North Jersey
Transportation Planning Authority

FINAL CURRENT AND FUTURE CONDITIONS REPORT

NJTPA Freight System Performance Assessment

prepared by
Cambridge Systematics, Inc.

CAMBRIDGE SYSTEMATICS

with
Edwards and Kelcey, Inc.
A. Strauss-Weider, Inc.
Moffatt and Nichol Engineers, Inc.
R.L. Banks and Associates, Inc.

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ACCESS & MOBILITY 2030
REGIONAL TRANSPORTATION PLAN

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1.0 About This Report

1.1 North Jersey Transportation Planning Authority Inc.

The North Jersey Transportation Planning Authority Inc. (NJTPA) is the Federally designated Metropolitan Planning Organization (MPO) for a 13-county region covering northern New Jersey. Each year, the NJTPA oversees over $1 billion in transportation investments. It evaluates and approves proposed transportation improvement projects and provides a forum for interagency cooperation and public input into funding decisions. It also sponsors and conducts studies, assists county planning agencies and monitors compliance with national air quality goals. NJTPA is responsible for preparing the region's Transportation Improvement Plan (TIP) and Regional Transportation Plan (RTP), which are critical in setting transportation policy and allocating funding.

The NJTPA region is one of the nation's leading centers for the production, consumption, and movement of goods. It hosts some of the nation's busiest seaports, airports, rail facilities, highways, and warehouse/distribution centers. The economic benefits of the region's freight infrastructure – in terms of job creation, access to markets, and lower consumer prices – are seen everywhere. But the costs of accommodating regional freight movement – in terms of congestion and related effects – are also highly visible. Safe, secure, and efficient freight movement is vital to the New Jersey economy, and must be accommodated within the goals of regional mobility, environmental quality, and other public policy guidelines. In response, NJTPA has been active in leading a variety of freight planning initiatives, including a special freight component of its previous Regional Transportation Plan.

1.2 Freight System Performance Assessment Study

Now, in support of its upcoming Regional Transportation Plan (RTP) update, NJTPA has undertaken a comprehensive Freight System Performance Assessment Study (FSPAS). In preparing the FSPAS, NJTPA has utilized a wide range of existing studies and resources, and has benefited from the valuable input of:

- The NJTPA Board of Trustees. The Board includes representatives from each of its 13 counties (Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union, and Warren), the cities of Newark and Jersey City, a Governor's representative, the Commissioner of the New Jersey Department of Transportation (NJDOT), the Executive Directors of New Jersey Transit and the Port

Authority of New York and New Jersey (PANYNJ), and a Citizens' Representative appointed by the Governor.

- The NJTPA Freight Initiatives Committee (FIC). The FIC is comprised of public agencies and private stakeholders with an interest in freight issues, and meets regularly to provide input and guidance for ongoing NJTPA efforts.

- Public and private organizations and their staff, who provided supporting studies, data, expertise, and advice, both in writing and in person. These include: NJDOT; the New Jersey Institute of Technology; PANYNJ; New Jersey Transit; the New Jersey Turnpike Authority; the New Jersey Motor Truck Association; and other members of the region's freight community.

In preparing the FSPAS, NJTPA was supported by the consulting firm of Cambridge Systematics, Inc., in association with: A. Strauss-Weider, Inc.; Edwards and Kelcey, Inc.; R.L. Banks and Associates; Moffatt and Nichol Engineers; and Reebie Associates.

The FSPAS consists of the following major tasks:

- Creation of a Comprehensive Freight Database;

- Preparation of a report assessing *Current and Future Conditions* for the region's freight transportation system;

- Preparation of a report on *Regional Issues, Needs and Strategies* related to freight movement;

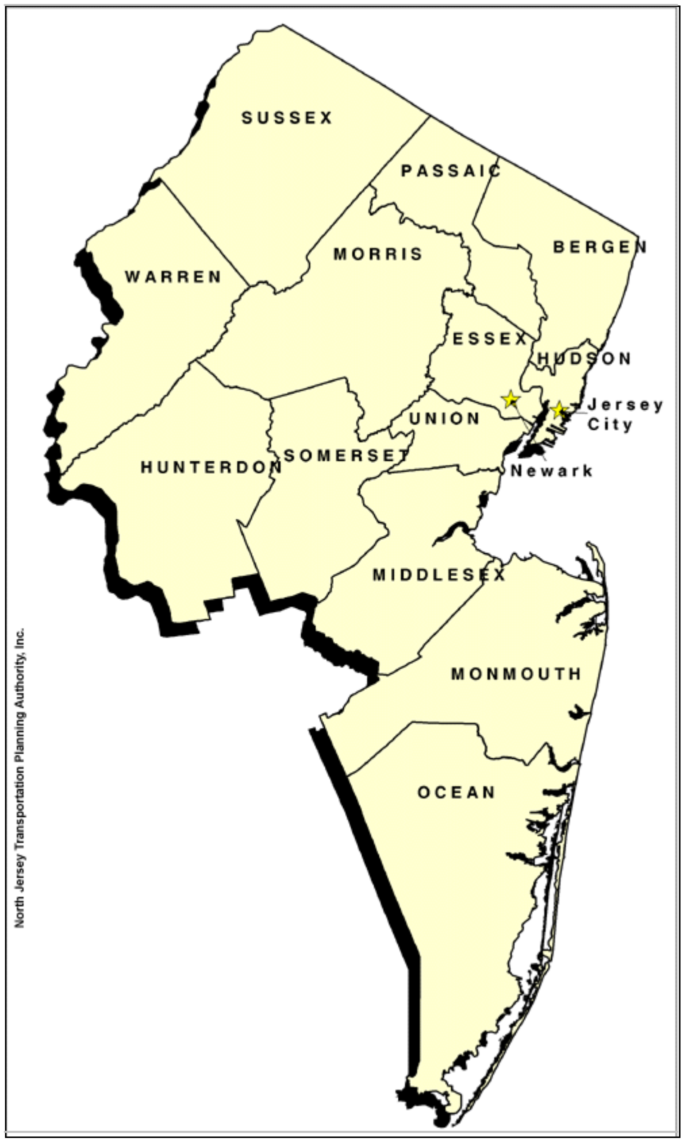
- Preparation of *Freight Impact Concept Reports* on potential projects and actions for freight; and

- Preparation of a freight component for the NJTPA's RTP Update.

■ 1.3 Current and Future Conditions Report

This Current and Future Conditions Report addresses highway, rail, marine, aviation, and warehouse/distribution components of the region's goods movement system, with the goals of: documenting current system conditions; presenting forecasts of future growth; evaluating future system conditions; and identifying critical issues as input to other work products under the FSPAS. As shown in Figure 1, the study area consists of the 13 counties within the NJTPA region. Current and future conditions for areas outside of this region have also been referenced, where such conditions influence conditions within the region. Where available, data covering the entire State of New Jersey are presented.

Figure 1. The NJTPA Region



This *Current and Future Conditions Report* is limited to the presentation of baseline data. Issues, needs, strategies, and recommendations are addressed in other FSPAS reports. This report is organized as follows:

- Section 1.0 – About This Report;
- Section 2.0 – Freight System Overview;
- Section 3.0 – Current System Conditions;
- Section 4.0 – Future System Conditions; and
- Section 5.0 – Conclusion.

2.0 Freight System Overview

2.1 Freight Movement and Its Key Drivers

"Freight movement" can be defined generally as the physical movement of materials, products, and/or property between two points. We refer to the first point as the origin (where freight is shipped) and the last as the destination (where freight is received). We refer to different transportation modes – air, water, truck, rail, or pipeline – over which freight can be moved. These transportation modes actually consist of point-to-point networks (waterways, highways, rail lines, and pipelines) and interchange points (where freight moves from one mode or one vehicle/vessel to another, such as airports, seaports, rail terminals, and warehouse/distribution centers). We can refer to the "intermodal" movement of freight when talking (broadly) about a freight trip involving more than one mode, or (more narrowly) about a freight trip using a specially designed shipping container designed to move readily between vessels, trucks and railcars. Freight movement is generally measured in terms of tonnage shipped, units shipped (number of containers, automobiles, etc.), value shipped, vehicles moved (railcars, trucks, vessels, etc.), vehicle miles of travel (VMT), and ton-miles (tonnage times miles of travel).

In practice, a single piece of freight – an apple, for example – can experience a very complex chain of logistics. It might be picked in Washington State, driven by a small truck to a packing house, consolidated into a larger intermodal shipping container and trucked to a rail terminal, moved by train to northern New Jersey, trucked from the rail terminal to a distribution center, taken out of the container and repacked into a smaller truck, and finally delivered to a local market. Even though the details of these individual movements are invisible to the person who actually buys the apple, that apple contributes to significant impacts over the local, regional, and national transportation system.

When talking about freight, it is important to distinguish between regional and through freight. By regional freight, we refer to freight that has an origin or destination (or both) within the NJTPA region. The movement of regional freight has significant direct local economic benefits: providing producers and intermediate processors with access to their markets; providing regional consumers with access to goods; creating jobs in the manufacturing, wholesaling, and/or retailing sectors; and providing jobs in the transportation sector. Through freight, on the other hand, is moving from one part of the U.S. or the world to another, and just passing through the NJTPA region. Through freight generates jobs primarily in the transportation sector – especially at seaports and airports – with less impact in other parts of the regional economy, unless there are opportunities for interchanging, handling, and processing this freight within the region.

Within the NJTPA region, the key drivers of freight movement are:

- **Consumer Demand in the NJTPA Region –** Freight movement is generated by the everyday economic activity of producing, processing, and consuming materials and goods. Millions of people buying millions of apples – and grapes, and everything else – generates a huge demand for freight movement.

- **Producer Demand in the NJTPA Region –** Production of raw materials, finished goods, and intermediate (partially completed) goods generates demand for freight movement, so that producer outputs can reach their markets.

- **Interchanging, Handling, and Processing Activities –** Interchanging, processing, or other handling of goods and materials – through the region's airports, seaports, rail terminals, warehouse/distribution centers, and "value added" manufacturing facilities – is an important part of accommodating freight demand generated by the NJTPA region's producers and consumers, as well as through traffic. The locations and functions of these facilities are critical in determining the mode(s) and the route(s) taken by a particular shipment of freight.

The region's demographics – its underlying base of producers, consumers, and intermediaries – are therefore a critical determinant of its freight movement characteristics. In large part, these demographics are responsible for what gets moved where, in what quantities, and by what modes. But the region's geography and position within the nation's overall transportation system have created a 'gateway' role for the region's interchange/handling/processing facilities, which is also highly significant in determining freight movement.

2.2 Regional Demographics

Tables 1 and 2 summarize some of the demographic measures that are important for understanding freight movement. These include: population; non-farm employment; value of manufacturer shipments; value of wholesale trade shipments; and value of retail sales. From Table 1, we see that the NJTPA region accounts for:

- 6,471,748 residents (75 percent of New Jersey's population) and 2,773,061 non-farm employees (77 percent of New Jersey's non-farm employment);

- $97 billion in annual manufacturer shipments (79 percent of New Jersey value);

- $188 billion in annual wholesaler shipments (83 percent of New Jersey value); and

- $60 billion in retail sales (75 percent of New Jersey sales).

Table 1. Demographic Characteristics of NJTPA Region

County	Population (2003 Estimated)	Private Non-Farm Employment (2001)	Manufacturers Shipments (1997), $1,000	Wholesale Trade (1997), $1,000	Retail Sales (1997), $1,000
Bergen	897,569	474,632	10,419,668	62,435,340	10,766,061
Essex	796,313	334,071	8,416,358	17,599,527	4,518,098
Hudson	607,419	223,542	4,220,836	11,271,459	3,842,879
Hunterdon	128,265	44,628	1,104,440	1,201,466	1,454,478
Middlesex	780,995	402,745	13,687,980	24,256,390	7,364,019
Monmouth	632,274	217,824	2,318,283	6,298,103	6,400,501
Morris	483,150	310,950	7,531,474	20,939,400	6,499,877
Ocean	546,081	113,947	939,795	937,157	4,728,321
Passaic	498,357	172,511	6,464,231	9,085,023	4,659,927
Somerset	311,600	180,012	5,148,393	18,285,267	3,305,796
Sussex	151,146	30,474	320,844	Not Available	953,563
Union	529,360	236,325	13,883,335	15,712,511	4,809,175
Warren	109,219	31,400	1,982,259	Not Available	862,193
NJTPA Region	**6,471,748**	**2,773,061**	**76,437,896**	**188,021,643**	**60,164,888**
New Jersey Total	**8,638,396**	**3,622,788**	**97,060,800**	**227,309,002**	**79,914,892**

Source: U.S. Census.

Table 2. County Rank by Manufacturing, Wholesale, and Retail Sales

County	Manufacturers Shipments (1997), $1,000	M/R	County	Wholesale Trade (1997), $1,000	W/R	County	Retail Sales (1997), $1,000
Union	13,883,335	2.89	Bergen	62,435,340	5.80	Bergen	10,766,061
Middlesex	13,687,980	1.86	Middlesex	24,256,390	3.29	Middlesex	7,364,019
Bergen	10,419,668	0.97	Morris	20,939,400	3.22	Morris	6,499,877
Essex	8,416,358	1.86	Somerset	18,285,267	5.53	Monmouth	6,400,501
Morris	7,531,474	1.16	Essex	17,599,527	3.90	Union	4,809,175
Passaic	6,464,231	1.39	Union	15,712,511	3.27	Ocean	4,728,321
Somerset	5,148,393	1.56	Hudson	11,271,459	2.93	Passaic	4,659,927
Hudson	4,220,836	1.10	Passaic	9,085,023	1.95	Essex	4,518,098
Monmouth	2,318,283	0.36	Monmouth	6,298,103	0.98	Hudson	3,842,879
Warren	1,982,259	2.30	Hunterdon	1,201,466	0.83	Somerset	3,305,796
Hunterdon	1,104,440	0.76	Ocean	937,157	0.20	Hunterdon	1,454,478
Ocean	939,795	0.20	Sussex	Not Reported		Sussex	953,563
Sussex	320,844	0.34	Warren	Not Reported		Warren	862,193
NJTPA Region	**76,437,896**	**1.27**	**NJTPA Region**	**188,021,643**	**3.13**	**NJTPA Region**	**60,164,888**
NJ Total	**97,060,800**	**1.21**	**NJ Total**	**227,309,002**	**2.84**	**NJ Total**	**79,914,892**

Source: U.S. Census.

The 13 counties comprising the NJTPA region are a huge economic engine and represent the majority of freight producing and consuming activities within the State of New Jersey. Each county has a unique mix of manufacturing, wholesale, and retail trades. This helps determine the volume and type of freight moving into and out of each county. As shown in Table 2, which ranks the counties by dollar amounts:

- The leading counties for manufacturing sales are Union, Middlesex, and Bergen. Manufacturing sales are lowest in Monmouth, Warren, Hunterdon, Ocean, and Sussex counties;
- The leading county for wholesale sales is Bergen, by a significant margin. Wholesale sales are lowest in Hunterdon and Ocean counties; and
- The leading counties for retail sales are Bergen, Middlesex, Morris, and Monmouth. Retail sales are lowest in Hunterdon, Sussex and Warren counties.

Table 2 also includes two columns labeled "M/R" (the ratio of manufacturing to retail sales) and "W/R" (the ratio of wholesale to retail sales). A figure higher than 1 shows that manufacturing or wholesale is more significant than retail; a figure lower than 1 shows that retail is more significant. We can use these ratios along with the absolute dollar values to get a sense of the relative importance of each trade sector to a county's economy.

From Table 2, we see that:

- **Bergen County** ranks third in manufacturing, first in wholesale, and first in retail trade. Manufacturing and retail trade are in balance, but wholesale trade is nearly six times as high as retail.
- **Essex County** ranks fourth in manufacturing, fifth in wholesale, and eighth in retail trade. Manufacturing is almost twice as significant as retail, while wholesale trade is nearly four times as significant as retail.
- **Hudson County** ranks eighth in manufacturing, seventh in wholesale, and ninth in retail trade. Manufacturing is in balance with retail, but wholesale trade is nearly three times as significant as retail.
- **Hunterdon County** ranks low in manufacturing, wholesale, and retail trade, consistent with its lower population. Manufacturing and wholesale are both less significant than retail trade.
- **Middlesex County** ranks second in manufacturing, second in wholesale, and second in retail trade. Manufacturing is almost twice as significant as retail, while wholesale trade is more than three times as significant as retail.
- **Monmouth County** ranks low in manufacturing and wholesale trade, but high (fourth) in retail trade. Manufacturing is substantially less significant than retail, while wholesale and retail sales are relatively balanced.

- **Morris County** ranks fifth in manufacturing, third in wholesale, and third in retail trade. Manufacturing is relatively balanced with retail, but wholesale trade is more than three times as significant as retail.

- **Ocean County** ranks low in manufacturing and wholesale trade but relatively high (sixth) in retail trade. Manufacturing and wholesale trade are substantially less significant than retail.

- **Passaic County** ranks sixth in manufacturing, eighth in wholesale, and seventh in retail trade. Manufacturing and wholesaling are more significant than retail.

- **Somerset County** ranks seventh in manufacturing, fourth in wholesale, and tenth in retail trade. Manufacturing is around 1.5 times as significant as retail, while wholesale trade is more than 5.5 times as significant as retail.

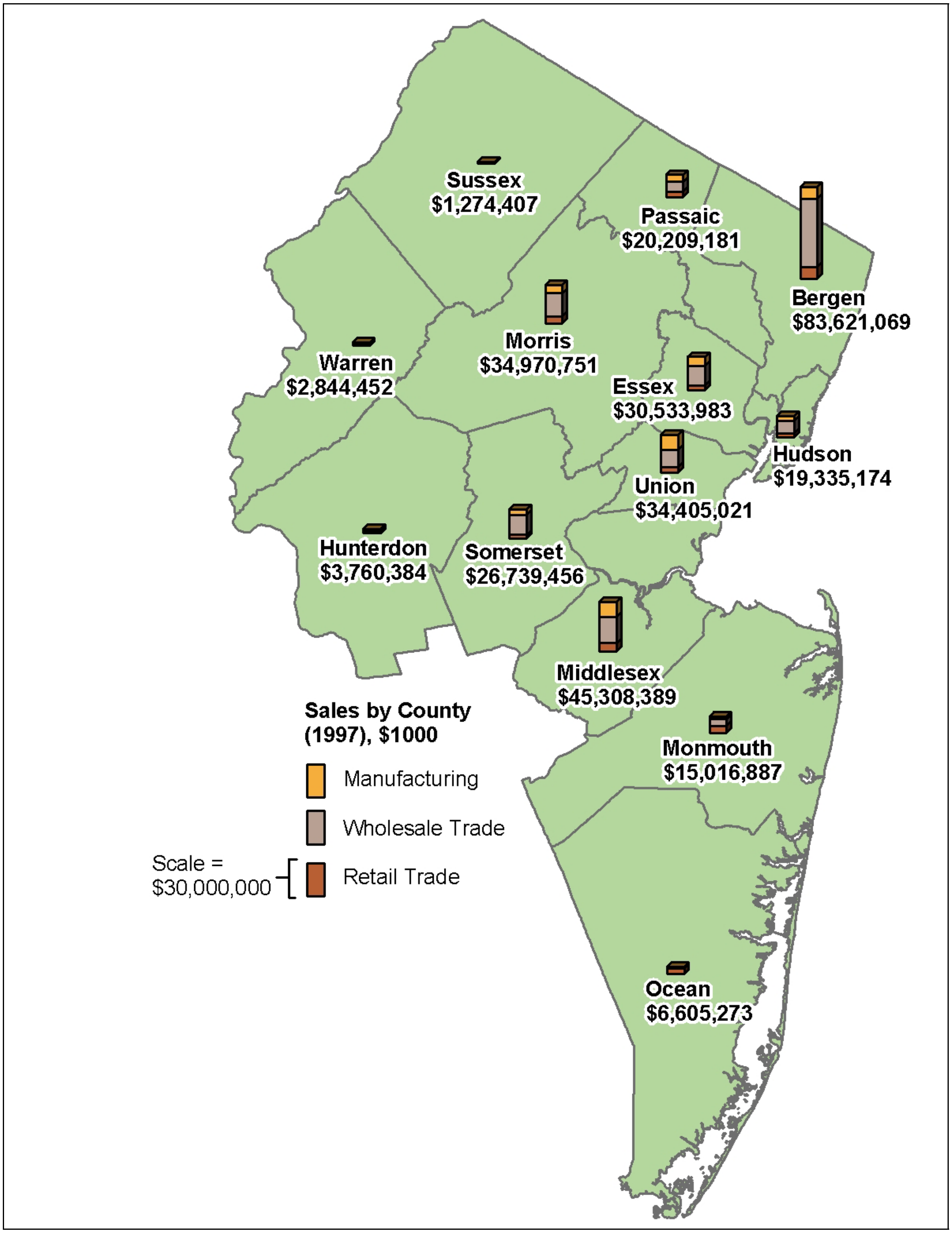
- **Sussex County** ranks low in manufacturing, wholesale trade (Census data for wholesaling is not available due to the small sample population), and retail trade, generally consistent with its small population. Manufacturing is substantially less significant than retail.

- **Union County** ranks first in manufacturing, sixth in wholesale, and fifth in retail trade. Manufacturing is almost three times as significant as retail, while wholesale trade is more than three times as significant as retail.

- **Warren County** ranks low in manufacturing, wholesale trade (Census data for wholesaling is not available due to the small sample population), and retail trade, generally consistent with its small population. Interestingly, manufacturing shipments are actually twice as high as retail sales.

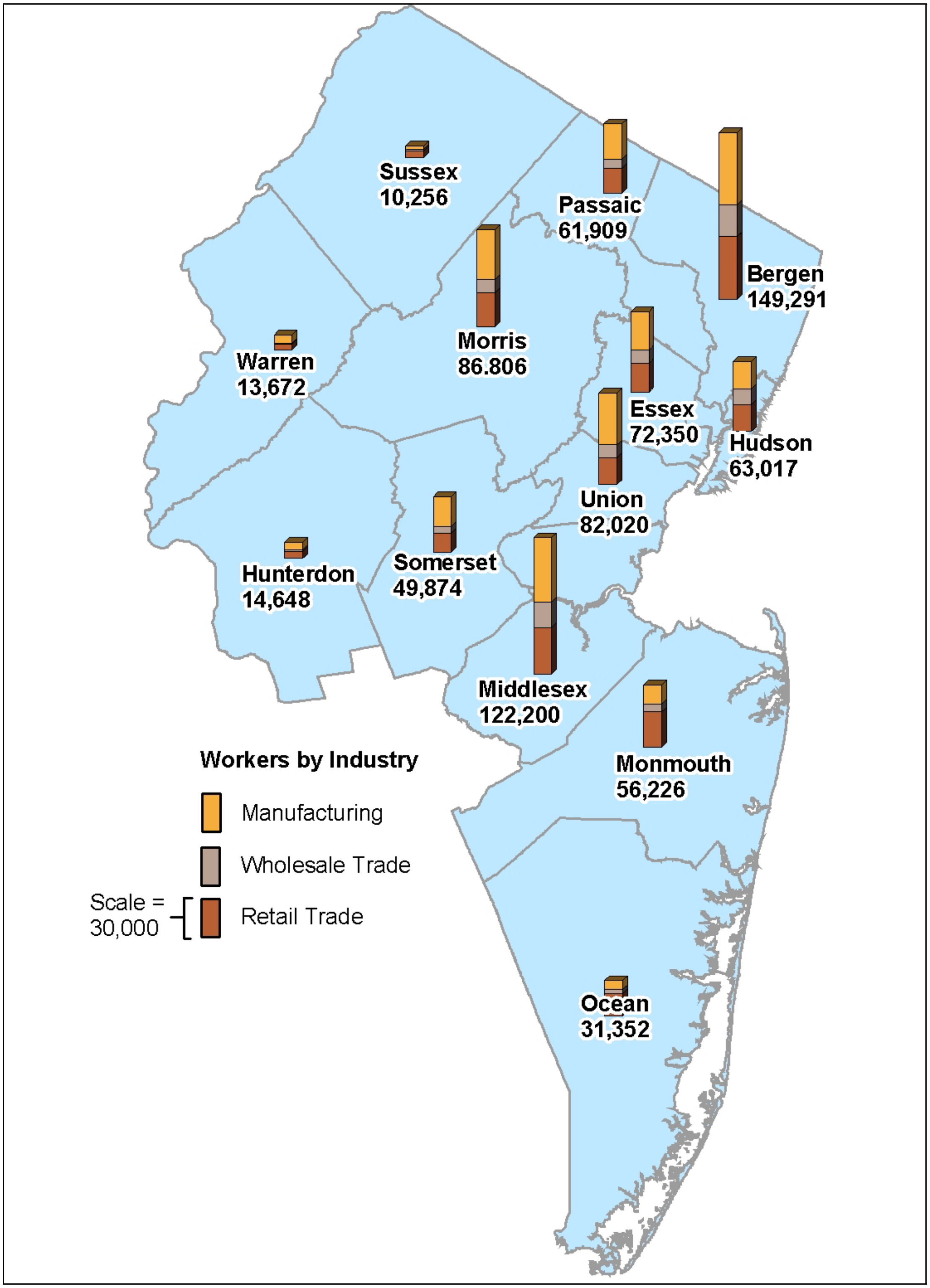
These sales figures are illustrated in Figure 2. Another useful metric is number of employees by county in each of these freight-generating sectors (manufacturing, wholesale, retail), as illustrated in Figure 3. Employment data suggests that: the highest activity would be in Bergen and Middlesex counties; there would be substantial activity in Hudson, Essex, Union, Passaic, Morris, Somerset and Monmouth counties; and there would be lower levels of activity in Sussex, Warren, Hunterdon, and Ocean counties. This is consistent with the sales data.

Figure 2. Sales in Manufacturing, Wholesale, and Retail Trades
1997



Source: U.S. Census.

Figure 3. Employment in Manufacturing, Wholesale, and Retail Trade
2000



Source: U.S. Census.

2.3 Regional Geography and "Gateway" Function

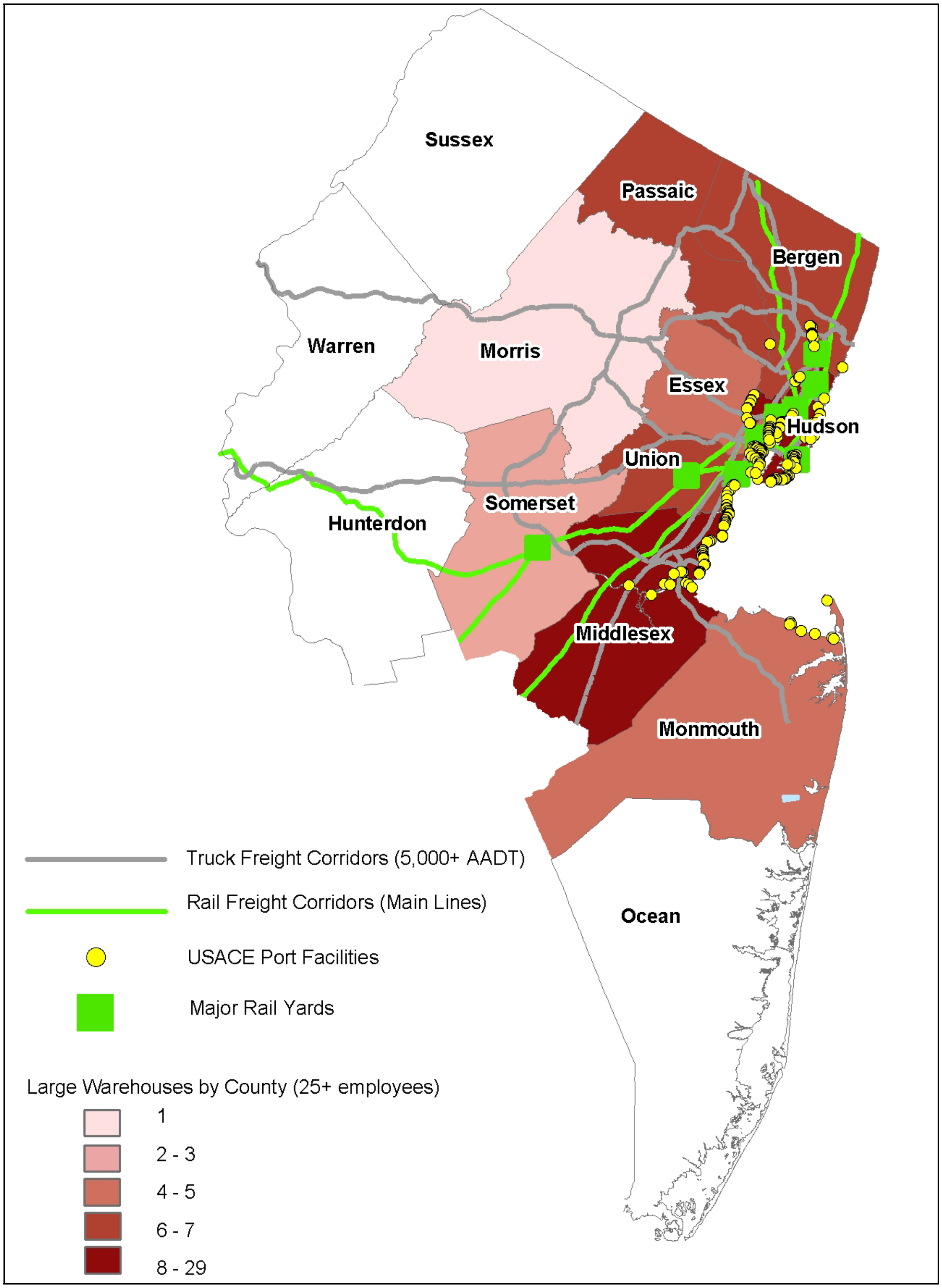
Due to its regional geography, and to transportation systems that have evolved in response, the NJTPA region serves as a freight gateway for an area far larger than its 13 constituent counties. Freight movement into, out of, and through the NJTPA region is significantly impacted by shipping decisions made halfway across the country, or halfway across the world. This gateway function offers unique service advantages for the region (in the form of access to highly developed infrastructure), but also imposes additional burdens (in the form of extra traffic and related impacts). Key gateway elements are illustrated in Figure 4, and include:

- **Seaports –** The region's seaports are perhaps its most visible gateways. Public and private marine terminals in the NJTPA region handle huge volumes of containerized and non-containerized commodities, in both domestic (to/from U.S. ports) and international trade lanes. Much of this freight has an origin or destination within the NJTPA region, but a substantial share is moving to/from other areas – New York City, New England, the Mid-Atlantic, the Midwest, etc. In some cases, the cargo "stops" along the way and generates regional jobs (in the form of value-added processing and finishing, or warehouse/distribution activity), while in other cases it simply passes through the region without any handling. Impacts are felt at marine terminals (which must handle additional traffic), and over the highway and rail systems that provide landside access to these terminals. Marine terminals (public and private) are located in Bergen, Essex, Hudson, Union, Middlesex, and Monmouth counties.

- **Airports –** Within the New York-North Jersey-Connecticut metropolitan statistical area, Newark Airport (EWR) is the leading gateway by tonnage for domestic air cargo, and the second-leading gateway (behind JFKIA) for international air cargo. As with seaports, much of this freight has an origin or destination in the NJTPA region, but a substantial share is associated with out-of-region origins and destinations. The biggest impact is actually on the highway side, as air cargo needs to be trucked longer distances to serve out-of-region customers. EWR is located in Union and Essex counties.

- **Railroads –** The U.S. freight railroad system was developed as a private for-profit system, and remains for the most part under private ownership today. Nobody planned the entire system – rather, it evolved according to the business opportunities afforded different railroad operators. Between 1860 and 1930, rail system mileage expanded rapidly. Northern New Jersey developed as a key point in the national rail network, where major east-west lines terminated. Since the 1930s, many rail companies have gone out of business or merged, and the survivors have substantially consolidated and rationalized their systems to reduce cost and improve profitability. Today, northern New Jersey continues to serve as the metropolitan area's gateway to the national rail system, for both east-west and north-south traffic. Impacts are felt on the rail system itself, as well as on truck routes accessing major railyards.

Figure 4. Regional Gateway Transportation Facilities



Sources: Federal Highway Administration, Federal Railroad Administration, U.S. Army Corps of Engineers, Federal Aviation Administration, and InfoUSA database.

- **Highways –** Northern New Jersey is the southernmost point by which vehicles can access New York City and points further east into New England. Major highways and bridge/tunnel crossings of New York harbor, the Hudson River, and the East River were developed to link the "west of Hudson" region with the rest of the U.S. highway system, via northern New Jersey. While much of the truck traffic on the NJTPA region's highways has an origin and/or destination in the region, a substantial share is related to traffic moving between New York City/New England and the rest of the country. Major bridge and tunnel crossings are located in Bergen, Hudson, and Union counties, and every NJTPA county except Ocean and Sussex is impacted by one or more high-volume truck corridors.

- **Warehouse and Distribution Facilities –** Historically, warehouse and distribution activities in the New York/New Jersey/Connecticut metropolitan area tended to be located in the urban centers, close to the population they served. But over time, the NJTPA region has evolved as the primary warehouse and distribution center for the New York/New Jersey region. Several factors – the growing need for larger facilities and better transportation access, increased urban congestion, and the shrinking pool of suitable urban land compared to the relatively low cost of developing in the region's "outer rings" – have resulted in the rapid expansion of warehouse/distribution clusters throughout the NJTPA region. These facilities attract trucks even in cases where the original shipper and the end user are both located outside the region (the tradeoff for the additional traffic, as we have noted, is substantial job creation and economic benefit for the host communities). Middlesex County hosts the largest concentration of large warehouse and distribution centers, followed by Hudson, Bergen, Essex, Union, Passaic, Morris, and Monmouth counties.

■ 2.4 Estimates of Freight Flows for the NJTPA Region

The interplay of multiple forces – county-level production and consumption, along with the provision gateway transportation services – creates a complex series of freight movements involving trucks, railroads, seaports, airports, and warehouse/distribution centers. We would like to know exactly how much traffic is moving via each mode, along what routes, and carrying what commodities. But while significant progress has been made in the past few years to collect and distribute freight data, there is no single data source – or combination of data sources – that tells us everything we might want to know.

To get a general picture of freight flows affecting the NJTPA region, the best available source is the TRANSEARCH database. TRANSEARCH is a commercial data product developed by Reebie Associates of Stamford, Connecticut, which provides estimates of domestic freight flows (by tonnage or vehicle equivalents) between any two origins and destinations (usually counties or states, but sometimes zip codes or census regions), by commodity type (using general commodity classification codes), and by mode (air, truck, rail, water, pipeline). (International transborder surface trade with Canada and Mexico can also be represented in the data, but international airport and marine terminal trade data must be appended from other sources.) The basic TRANSEARCH product is a set of origin-destination tables, which can optionally be assigned to highway and rail networks using national traffic models to provide approximate "flow" volumes. TRANSEARCH uses a variety of public data sources (the Federal Railroad Administration's Rail Waybill Sample, Federal Aviation Administration air cargo statistics, U.S. Army Corps of Engineers data on waterborne commerce, etc.) supplemented by proprietary trucking data.

The New Jersey Department of Transportation recently acquired a TRANSEARCH dataset covering the State of New Jersey for year 2003. Normally, use of the data is restricted to its purchaser under terms of the license agreement; however, with the permission of NJDOT and under supplemental license with Reebie Associates, this dataset has also been made available to NJTPA for use in the FSPAS.

TRANSEARCH provides estimates of domestic truck, rail, air, and water (out-of-region only) tonnage. It includes international (cross-border) truck and rail tonnage, but counts it as domestic traffic from or to its first or last point in the U.S. It does not provide estimates of international airborne, international waterborne, or in-region waterborne tonnage. To develop a fuller picture of freight movement in the NJTPA region, we have combined TRANSEARCH with other available data:

- PANYNJ international/domestic air cargo tonnage and PANYNJ international container and auto import/export tonnage.

- U.S. Army Corps of Engineers (USACE) international and domestic waterborne tonnage. To fill in gaps in the TRANSEARCH and PANYNJ data (in-region waterborne traffic and import/export of commodities other than containers or automobiles), USACE data was used where possible. Reasonably good county-level assignments of certain movements (containers, autos, crude petroleum, and domestic coastwise traffic) could be made. However, county-level estimates for other international commodities and for in-region traffic – which represents around one-third of all estimated NJTPA waterborne tonnage – could not be made based on available data.

Table 3 shows estimated freight tonnages by mode for the NJTPA region, classified by modes of transport and general origin-destination patterns. **Originating** traffic has an origin point somewhere in the NJTPA region, and may be going to a destination which is international, outside the NJTPA region, or inside the NJTPA region. **Terminating** traffic has a destination point somewhere in the NJTPA region, and may be coming from an origin which is international, outside the NJTPA region, or inside the NJTPA region. **Through** tonnage is defined as tonnage passing through an NJTPA county; it may be moving to or from a different NJTPA county, or to or from a county (or state) external to the NJTPA region. All data is for year 2003 except the rail data (for which year 2001 is the most current available) and USACE-sourced waterborne data (which has been factored up from year 2002). It is important to remember that each time a piece of freight changes modes or goes through a warehouse, it counts as a "new" trip.

Table 3. Approximate NJTPA Regional Freight Tonnage

	Truck (2003)	Rail (2001)	Water (Approx. 2003)	Air (2003)	Total
Originating in any NJTPA County	**164,458,387**	**8,365,016**	**32,444,828**	**430,051**	**205,698,282**
To International (estimated)	a	a	7,836,359	69,800	7,906,159
To Outside Region	107,512,317	8,317,484	24,608,469	360,251	140,798,521
To Another NJTPA County	56,946,070	47,532	a	a	56,993,602
Terminating in any NJTPA County	**144,778,511**	**16,327,506**	**58,042,572**	**477,545**	**219,626,134**
From International (estimated)	a	a	45,281,031	121,442	45,402,473
From Outside Region	87,832,441	16,279,974	12,761,541	356,103	117,230,059
From Another NJTPA County	56,946,070	47,532	a	a	56,993,602
Originating/Terminating, Other (estimated)	**0**	**0**	**20,065,160**	**56,521**	**20,121,681**
Subtotal of Originating/Terminating	**309,236,898**	**24,692,522**	**110,552,560**	**964,117**	**445,446,097**
International (estimated)	0	0	53,117,390	191,242	53,308,632
Domestic (estimated)	309,236,898	24,692,522	57,435,170	772,875	392,137,465
Traffic "passing through" any NJTPA county *that is not generated by another NJTPA county; traffic through multiple counties is counted only once*	***111,938,944***	a	a	a	a

Sources: TRANSEARCH 2003, TRANSEARCH 2001, PANYNJ 2003, USACE 2002.

[a] No data available.

The key data presented in Table 3 can be summarized as follows:

- The tonnage originating and terminating entirely within the NJTPA region is estimated at over 445 million tons.
  - Trucks represented 69 percent of originating and terminating tonnage; rail represented 6 percent; water represented 25 percent; and air represented less than 1 percent.
  - Around 12 percent of originating and terminating tonnage is international by air or water; and around 30 percent is traffic moving entirely within the NJTPA region by truck or water. The remaining 58 percent is tonnage moving between the NJTPA region and the rest of the U.S. by truck, rail, air, or water.
  - Trucks provide point-to-point service between shippers and receivers, and also serve as feeders and distributors for rail, water, and air cargo facilities – so it is not surprising that they handle more than two-thirds of the region's total freight tonnage. Almost 40 percent of truck tonnage is associated with trips entirely within the NJTPA region, underscoring its importance for the local movement of goods. More truck tonnage is originated (164 million tons) than terminated (145 million

tons). This reflects the fact that the region is a net importer and warehouser of international goods, which turn into originated truck trips for receivers within and outside the region. Generally, the region is thought to consume more goods than it produces – which would normally generate more terminated truck tonnage than originated truck tonnage – but the region's role as a major gateway actually produces the opposite effect.

  - More rail traffic is terminated in the region (16 million tons) than is originated (8 million tons). This reflects the fact that the region is a net consumer of rail-carried commodities. Rail tonnage is substantially lower than truck tonnage, but rail is critically important for long-haul movement of carload and intermodal goods.
  - Waterborne trade has a huge impact on the region. Interestingly, it appears that international (shipped between the U.S. and other countries) and domestic (shipped within the U.S.) tonnages are relatively in balance – while most of the attention tends to focus on international commodities, water is extremely important for domestic moves, both within the region and to/from other coastal origins and destinations. For international tonnage, imports heavily outweigh exports (45 million tons terminated versus 8 million tons originated), while the opposite holds for domestic tonnage (13 million tons confirmed terminated versus 25 million tons confirmed originated). To some extent, this reflects the receipt of international cargos and their subsequent reshipment to domestic receivers. Much of this waterborne traffic has a linked landside (truck or rail) trip.
  - Air cargo in the NJTPA region is focused on domestic service, and while it accounts for a small share of tonnage, that tonnage tends to be high-value time-sensitive goods. Tonnage is a poor way to measure the significance of air cargo to the region's shippers, receivers, and overall economy.

- In addition, almost 300 million truck tons pass through one or more NJTPA counties annually. Much of this tonnage actually passes through more than one NJTPA county, and if you sum the impact for each individual county, the total through tonnage is nearly 1.2 billion. However, most of this tonnage is actually associated with traffic that has an origin or destination elsewhere in the NJTPA region, and is passing through another NJTPA county on its journey. Around 112 million tons – roughly a third of the 300 million through tons – are associated with "external through" movements between non-NJTPA origins and non-NJTPA destinations. If you add the NJTPA originating truck tons, NJTPA terminating truck tons, and external through truck tons, the total is over 400 million, with external through tons representing around a quarter of this total. This highlights the region's role as a primary trucking gateway for New York/New England, Southeast Pennsylvania, and South Jersey.

Tables 4 through 8 and Figures 5 through 11 provide additional detail on commodity flows by mode in each of the NJTPA counties, as available. Due to limitations of the source data, county-level approximations for water tonnage cannot be reliably estimated.

Table 4. Originating NJTPA Tonnage by Mode and County
2003

Origin County	Truck Tons	Rail Tons (2001)	Water Tons (Approximated)
Bergen	16,611,372	38,122	a
Essex	21,134,902	961,264	a
Hudson	26,740,899	3,958,637	a
Hunterdon	1,922,682	–	a
Middlesex	29,033,590	757,219	a
Monmouth	4,177,926	9,946	a
Morris	8,235,408	3,460	a
Ocean	6,191,329	–	a
Passaic	9,610,913	17,986	a
Somerset	6,278,233	20,822	a
Sussex	773,199	–	a
Union	31,970,251	2,581,857	a
Warren	1,777,683	15,704	a
NJTPA Total	**164,458,387**	**8,365,017**	**32,444,828**

Sources: TRANSEARCH 2003, TRANSEARCH 2001, PANYNJ 2003, USACE 2002.

[a] Not available.

Table 5. Terminating NJTPA Tonnage by Mode and County
2003

Destination County	Truck Tons	Rail Tons (2001)	Water Tons (Approximated)
Bergen	16,203,344	737,971	a
Essex	10,858,544	1,843,973	a
Hudson	15,544,942	6,480,640	a
Hunterdon	6,425,248	105,534	a
Middlesex	20,569,966	2,845,756	a
Monmouth	6,957,354	90,398	a
Morris	14,556,767	167,536	a
Ocean	7,168,208	61,244	a
Passaic	9,279,257	325,604	a
Somerset	11,600,763	273,650	a
Sussex	4,922,598	43,950	a
Union	15,205,081	3,154,391	a
Warren	5,486,442	196,860	a
Total	**144,778,512**	**16,327,507**	**58,042,570**

Sources: TRANSEARCH 2003, TRANSEARCH 2001, PANYNJ 2003, USACE 2002.

[a] Not available.

Table 6. Originating/Terminating Truck Tons by Commodity
2003

STCC	Commodity Class	Originating Truck Tons	Terminating Truck Tons	Total
50	Warehouse/Distribution	59,032,791	46,421,137	105,453,929
29	Petroleum and Coal	32,724,947	15,069,091	47,794,038
32	Clay, Concrete, Glass, Stone	14,363,374	15,045,513	29,408,887
20	Food and Kindred Products	10,143,318	16,342,345	26,485,663
28	Chemicals and Allied Products	11,585,924	9,653,206	21,239,131
14	Non-metallic Minerals	6,827,489	12,770,165	19,597,654
33	Primary Metal Products	5,857,805	4,912,152	10,769,957
26	Pulp, Paper and Allied Products	4,096,729	3,194,665	7,291,394
24	Lumber/Wood	1,649,175	5,037,060	6,686,235
34	Fabricated Metal Products	3,490,759	2,525,955	6,016,714
37	Transportation Equipment	2,499,058	2,340,698	4,839,755
1	Farm	273,414	4,434,642	4,708,056
	All Other	11,913,604	7,031,881	18,945,485
	Total	**164,458,387**	**144,778,512**	**309,236,899**

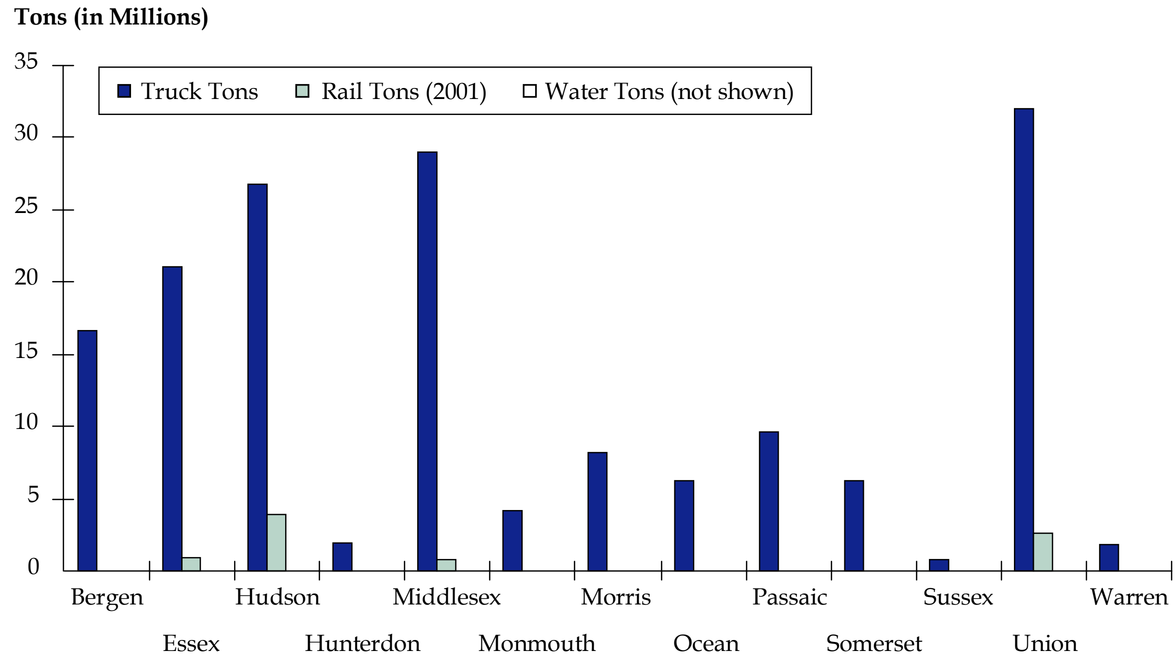
Source: Reebie Associates, TRANSEARCH 2003.

Table 7. Originating/Terminating Rail Tons by Commodity
2001

SCTG	Commodity Class	Originated Non-Intermodal	Originated Intermodal	Terminated Non-Intermodal	Terminated Intermodal	Total
439	Mix Freight/Container	170,722	4,605,874	142,422	5,429,838	10,348,856
410	Wastes	1,210,677	48,140	356,339	31,568	1,646,725
361	Motor Vehicles	330,458	300	864,658	–	1,195,416
72	Vegetables, Fruits, Nuts	7,612	840	930,552	31,212	970,216
263	Plywood and Veneer	–	6,741	785,735	29,851	822,327
74	Fats, Oils, Seeds	121,322	11,338	606,283	9,982	748,925
241	Plastics and Rubber	47,810	14,615	640,530	5,439	708,394
193	Gaseous Hydrocarbons	308,766	3,432	392,738	1,680	706,616
274	Paper and Paperboard	28,522	10,737	608,748	39,704	687,711
202	Inorganic Chemicals	61,504	8,626	416,858	11,185	498,173
204	Organic Chemicals	104,103	3,054	247,492	1,824	356,473
239	Other Chemicals	111,686	15,468	202,868	22,713	352,735
81	Beer	9,952	–	334,922	2,592	347,466
	All Other	680,146	442,571	3,096,101	1,083,672	5,302,490
	Total	**3,193,280**	**5,171,736**	**9,626,246**	**6,701,260**	**24,692,523**

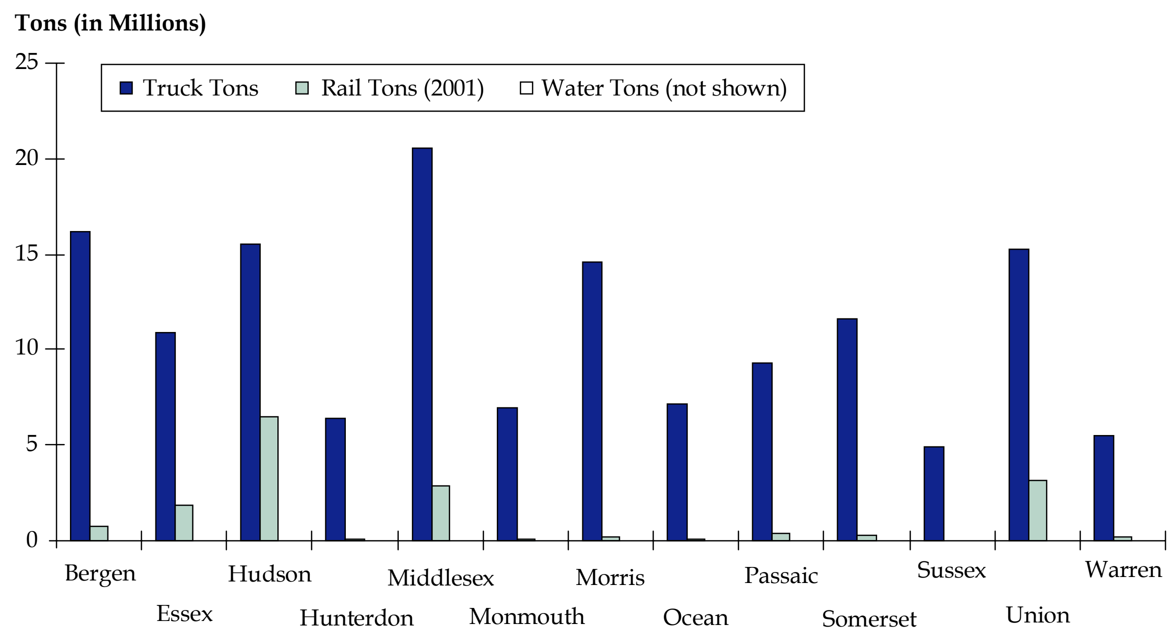
Source: Reebie Associates, TRANSEARCH 2001.

Figure 5. Originating NJTPA Tonnage by Mode and County (2003)



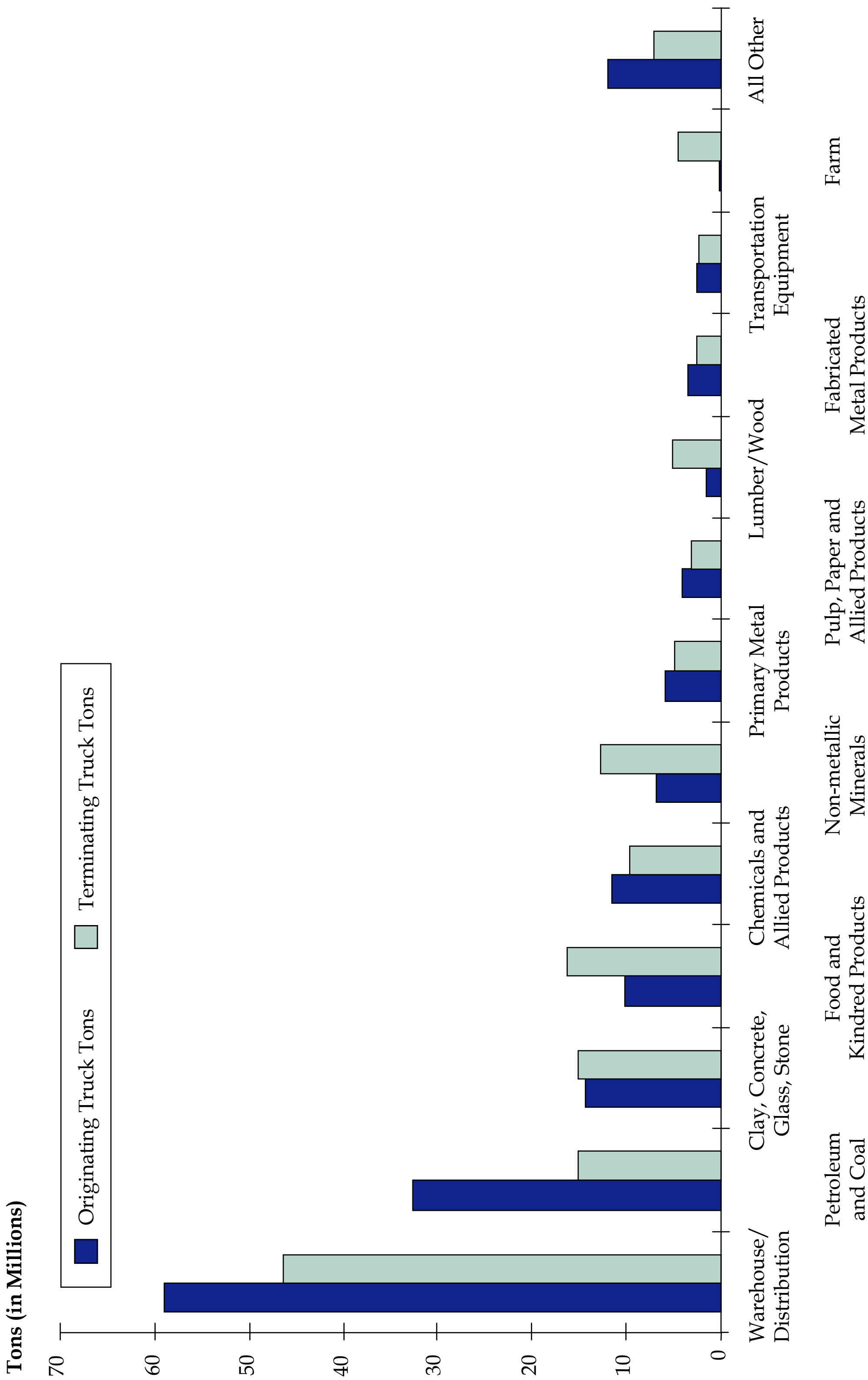
Sources: TRANSEARCH 2003, TRANSEARCH 2001, PANYNJ 2003, USACE 2002.

Figure 6. Terminating NJTPA Tonnage by Mode and County
2003



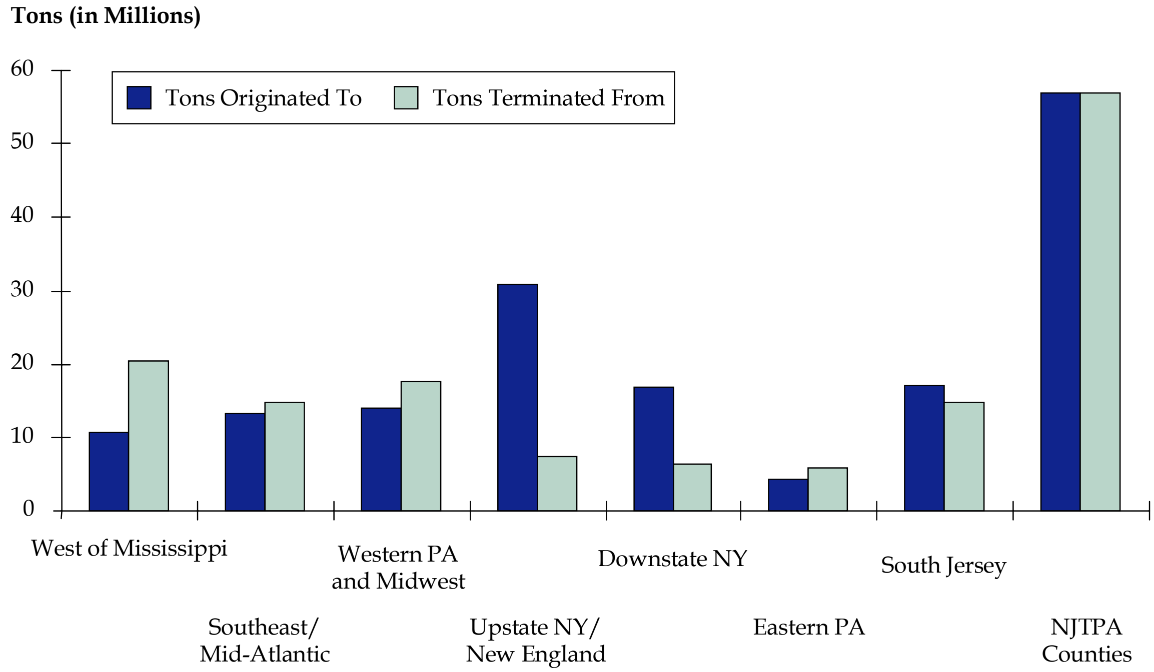
Sources: TRANSEARCH 2003, TRANSEARCH 2001, PANYNJ 2003, USACE 2002.

Figure 7. Originating/Terminating Truck Tons by Commodity
2003



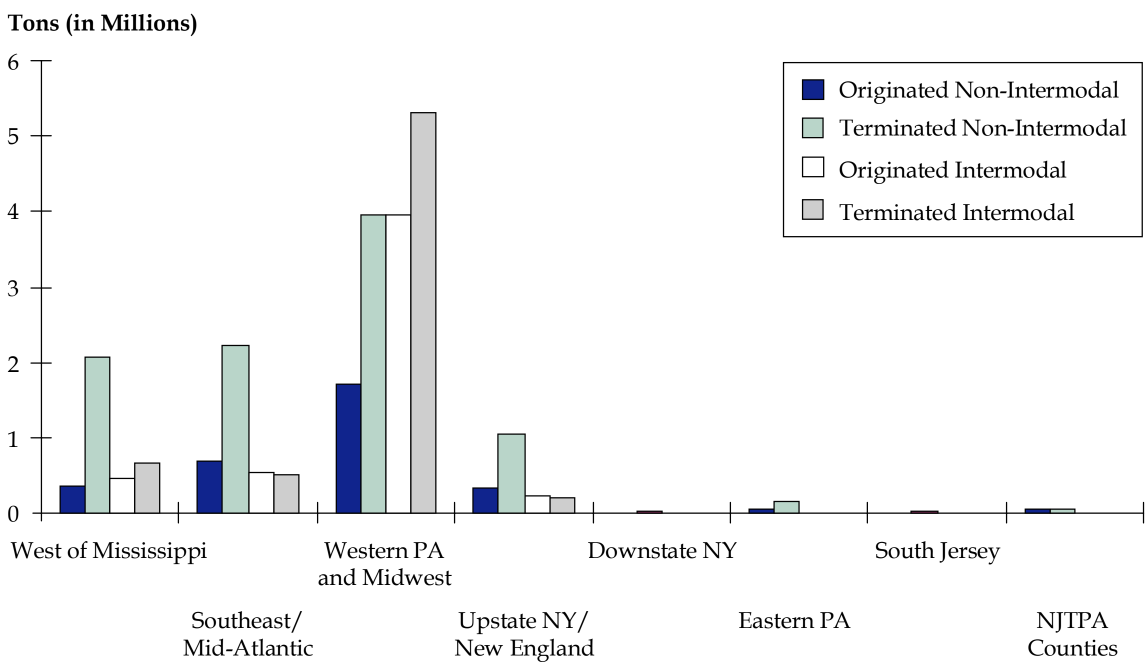
Source: Reebie Associates, Transearch 2003.

Figure 8. Originating/Terminating Truck Tons by External Region
2003



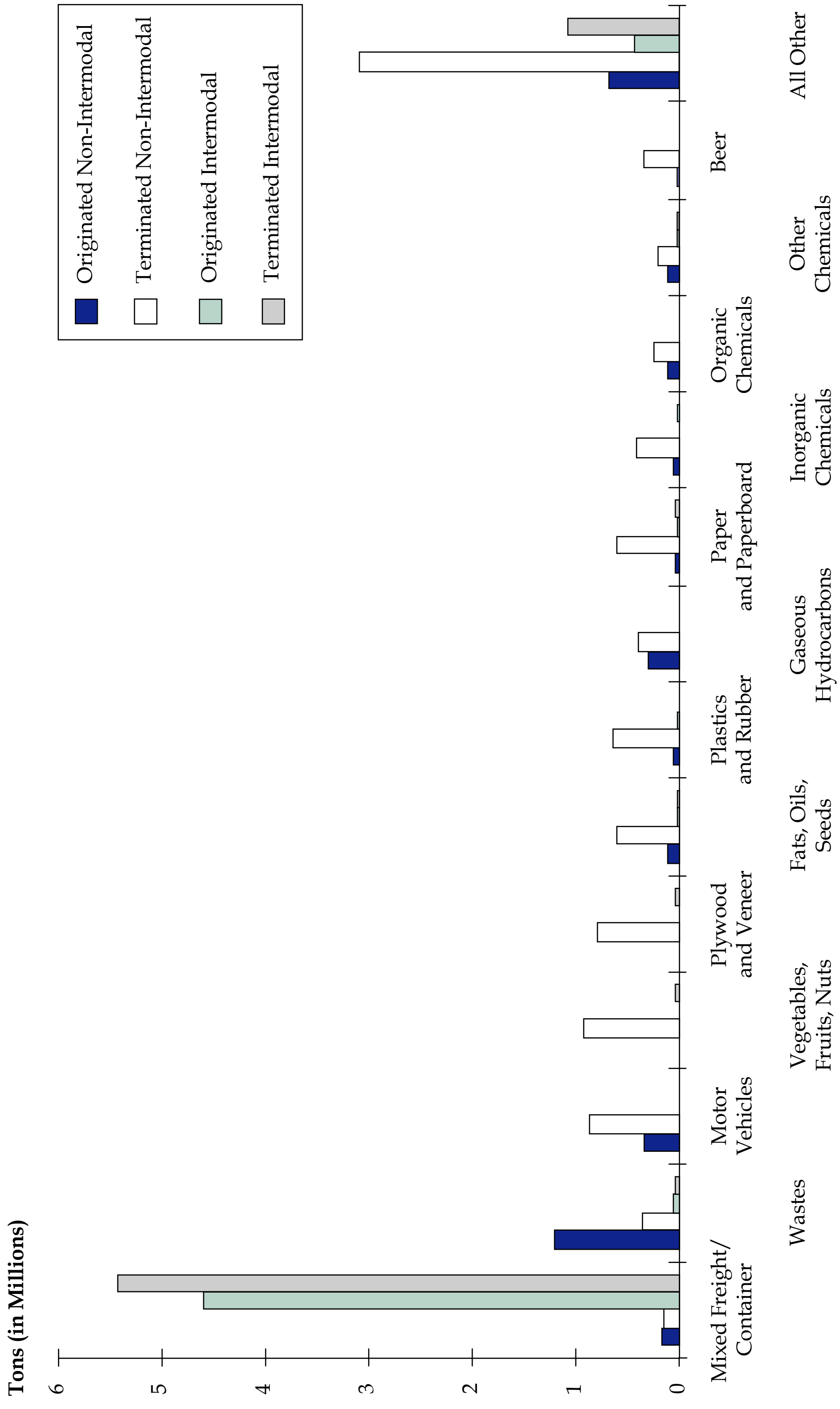
Source: Reebie Associates, TRANSEARCH 2003.

Figure 9. Originating/Terminating Rail Tons by External Region
2001



Source: Reebie Associates, TRANSEARCH 2001.

Figure 10. Originating/Terminating Rail Tons by Commodity
2001



Source: Reebie Associates, Transearch 2001.

Table 8. Originating/Terminating Waterborne Tons by Type
2003

Type	Originated	Terminated	Total
International	**7,836,359**	**45,281,030**	**53,117,389**
Containers and autos	5,671,783	12,828,387	18,500,170
Crude petroleum	70,000	12,068,000	12,138,000
Other (petroleum products, chemicals, primary materials, manufactured goods, food, etc.) – *approximated tons*	2,094,576	20,384,643	22,479,219
Coastwise (domestic out-of-region)	**24,608,469**	**12,761,540**	**37,370,009**
Petroleum products	22,270,749	7,635,800	29,906,549
Chemicals	158,914	1,540,611	1,699,525
Waste and Scrap	2,140,909	3,250,621	5,391,530
Other	37,897	334,509	372,406
Intra-port/in-region (around 80% petroleum products, 20% other commodities) – direction unknown, *approximated tons*	a	a	**20,065,160**
Total	**32,444,828**	**58,042,570**	**110,552,558**

Sources: TRANSEARCH 2003, PANYNJ 2003, USACE 2002.

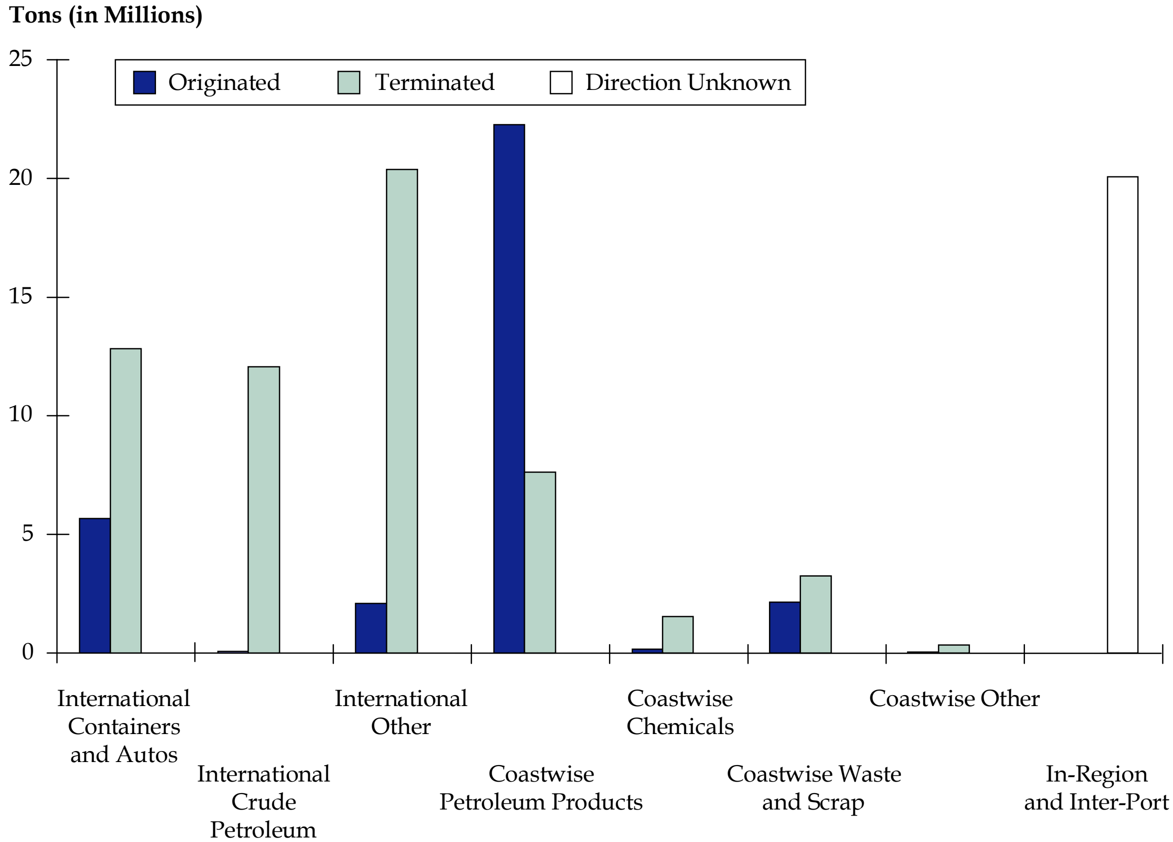
[a] Not available.

Tables 4 through 8 and Figures 5 through 11 present a tremendous amount of information and reward leisurely review. By way of summary, we would observe the following:

- For originating tonnage, there is a substantial difference between the five leading truck counties (Union, Middlesex, Hudson, Essex, and Bergen) and the other NJTPA counties. These five counties are key regional gateways and host marine terminals, railyards, and warehouse/distribution centers that generate substantial outgoing (e.g., originating) tonnage. Waterborne originations are significant for Hudson, Union, Middlesex, and Essex; rail originations are most significant for Hudson and Union counties.

- For terminating tonnage, the counties show less differentiation in terms of truck tonnage, due presumably to the fact that each of these counties consumes goods that must arrive by truck. Where we see major differences is terminating tonnage by water (at port facilities in Union, Hudson, Essex, and Middlesex counties) and by rail (at terminals in Hudson, Union, Essex, Bergen and Middlesex counties).

Figure 11. Originating/Terminating Waterborne Tons by Type
2003



Source: TRANSEARCH 2003, PANYNJ 2003, USACE 2002.

- For trucks, warehouse and distribution commodities represent the highest category of originating and terminating tonnage. Petroleum and coal moves also represent substantial tonnage. Other significant commodity categories include clay/concrete/glass/stone, food, chemicals, minerals, metal products, paper, lumber and wood, transportation equipment, and farm products. Looking at external regions, the highest truck tonnages are associated with originated traffic to the Downstate New York (including New York City and adjoining counties) and Upstate New York/New England regions; substantially more traffic is originated to these regions than is terminated from them. This imbalance is broadly attributable to "gateway" traffic (international cargo and warehouse/distribution) from NJTPA counties to these markets. Also interesting is the relatively high volume of long-haul truck traffic terminated from West of Mississippi, the Southeast/Mid-Atlantic, and the Western Pennsylvania/Midwest regions.

- Most NJTPA counties show substantially more through truck tonnage than originating or terminating truck tonnage. On average, around half of each county's through tonnage is related to trips with an origin or destination elsewhere in the NJTPA region, while the other half is related to purely external traffic. (It should be noted that the county-by-county estimates are based on TRANSEARCH network assignments, and may be showing too much through traffic on the New Jersey Turnpike and too little on I-78 and I-80.)

- For rail, we have distinguished between intermodal traffic (shipping containers on railcars) and non-intermodal traffic (all other rail services). Each represents around 12 million tons annually. Intermodal traffic shows a relatively surprising degree of balance – 7 million tons terminated versus 5 million tons originated – but non-intermodal is heavily weighted towards inbound traffic, with over 9 million tons terminated versus 3 million tons originated. The leading intermodal commodity is mixed freight in intermodal shipping containers. Non-intermodal traffic consists of a broad range of commodities – wastes, motor vehicles, foods, wood, plastics and rubber, paper, chemicals, and beer. Looking at external regions, there is very little tonnage associated with short-haul markets. Carload traffic is largely associated with Western Pennsylvania/Midwest (principally Illinois), Southeast/Mid-Atlantic (Florida), and West of Mississippi (principally Texas and California) markets. Intermodal traffic is dominated by the Western Pennsylvania/Midwest market, which is almost entirely attributable to Illinois, where the western Class I railroads (BNSF and UP) hand off traffic to CSX and NS; much of this "Illinois" traffic actually begins or ends on the west coast.

- For water, international containers and autos represent around 13 million tons of terminated traffic and nearly 6 million tons of originated traffic. These are the highest-value commodities handled by the region's marine terminals, but do not represent the majority of international tonnage – crude petroleum accounts for 12 million tons of terminated traffic, and other bulk commodities (petroleum products, chemicals, primary materials, etc.) account for an approximated 22 million tons. As previously noted, over 45 million tons are imported (terminated), versus less than 8 million tons exported (originated). On the domestic side, the most significant moves are coastwise (out-of-region) petroleum products, mostly originating from the region; this probably represents a combination refinery output and "transshipment" (waterborne cargo received at a facility and then shipped out again). The in-region/intra-port moves are grossly approximated at 20 million tons, highlighting the fact that water is an important element of in-region freight movement, especially for petroleum products.

3.0 Current System Conditions

3.1 Highway System

3.1.1 Role of Trucking in Regional Freight Transportation

Trucks are the 'glue' that holds the entire freight transportation system together. They move goods to and from: shippers and receivers; warehouse/distribution facilities; airports; seaports; and rail terminals. Unless a shipper or receiver is located directly on an airport, seaport, or rail line, he/she is absolutely dependent on trucking for the shipment and receipt of goods. Safe, efficient trucking services are therefore imperative – not only to provide door-to-door freight transportation, but also to ensure the effective operation of other freight modes and facilities.

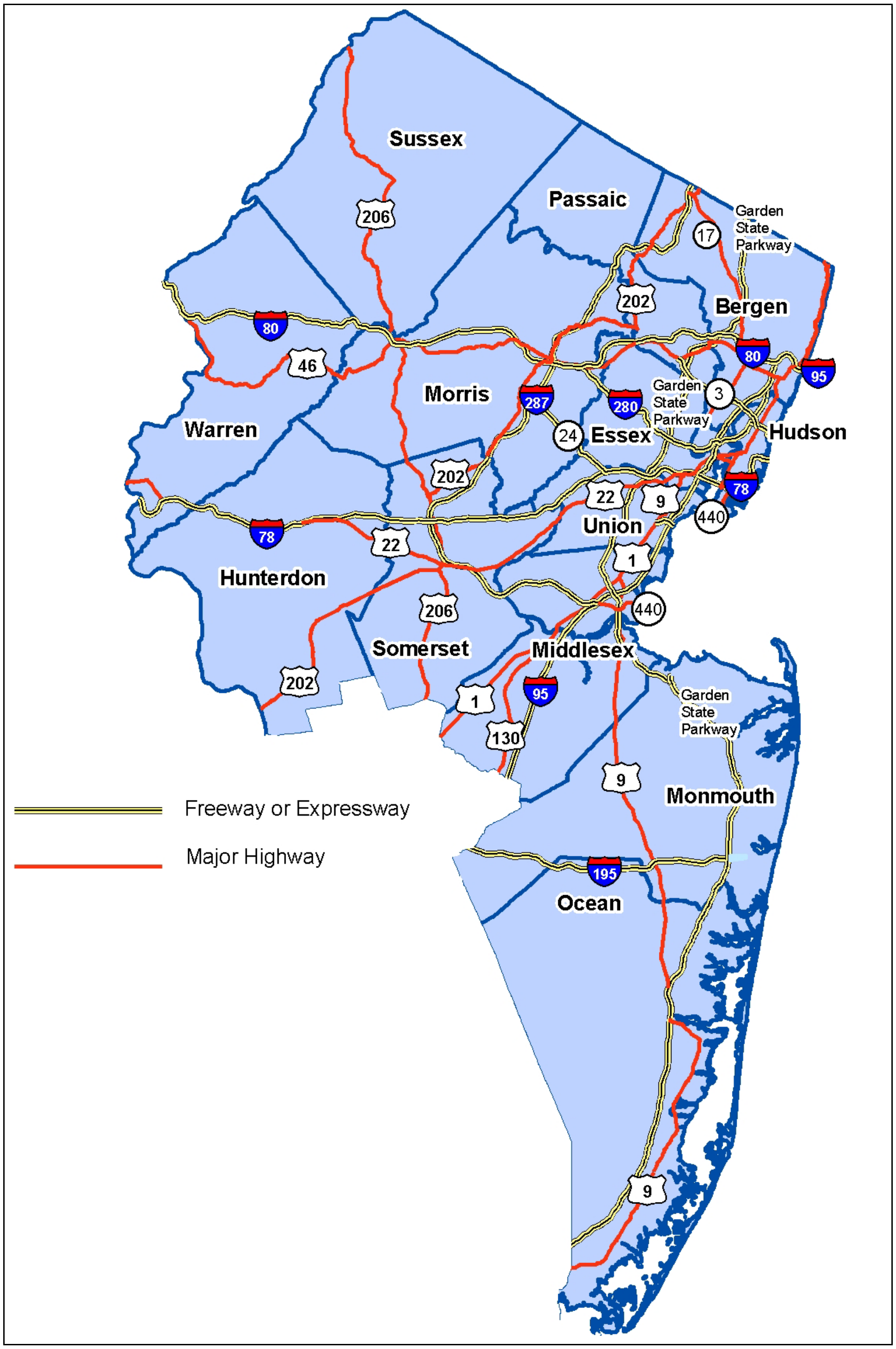
The NJTPA region's highway system consists of different elements, all of which are important:

- Major arterials (primarily interstate highways) accommodating longer-distance travel;
- Regional arterials (primarily state and county highways) accommodating shorter-distance travel, and linking local access roads with major arterials); and
- Last mile connectors (primarily county and local roads), which provide access to the front door of a shipper, receiver, or freight handling facility.

3.1.2 Truck Volumes

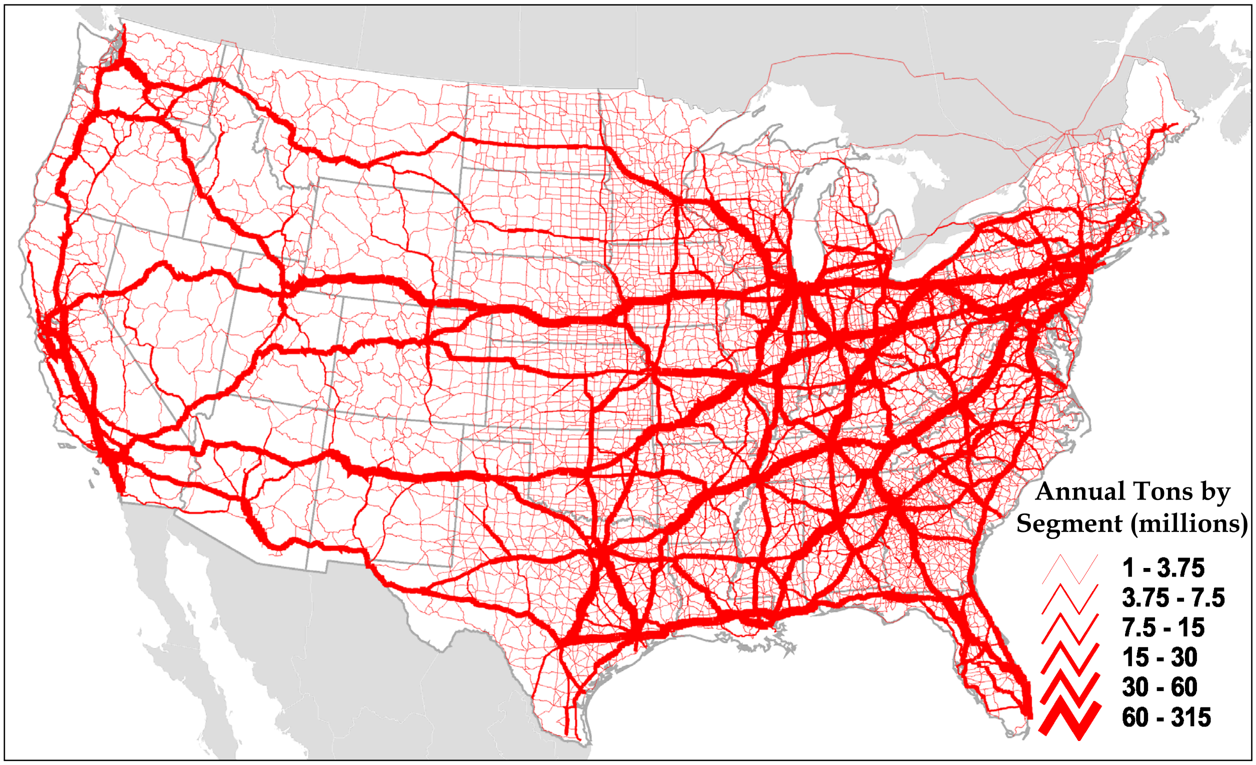
Figure 12 shows interstate highways, U.S. highways, and important state roads for moving freight in the NJTPA region. Figure 13 shows TRANSEARCH county-to-county truck tonnages for year 2000, assigned by model to the Oak Ridge National Laboratories national highway network. These model assignments are primarily intended to illustrate general flow characteristics, rather than specific volumes for any given highway segment, and are not calibrated to actual counts. Figure 14 shows an assessment of general levels of congestion over that same national highway network.

Figure 12. Major Interstate, U.S. and State Highways in the NJTPA Region



Source: Cambridge Systematics mapping of NJDOT data.

Figure 13. TRANSEARCH National Truck Tonnage Flows
2000



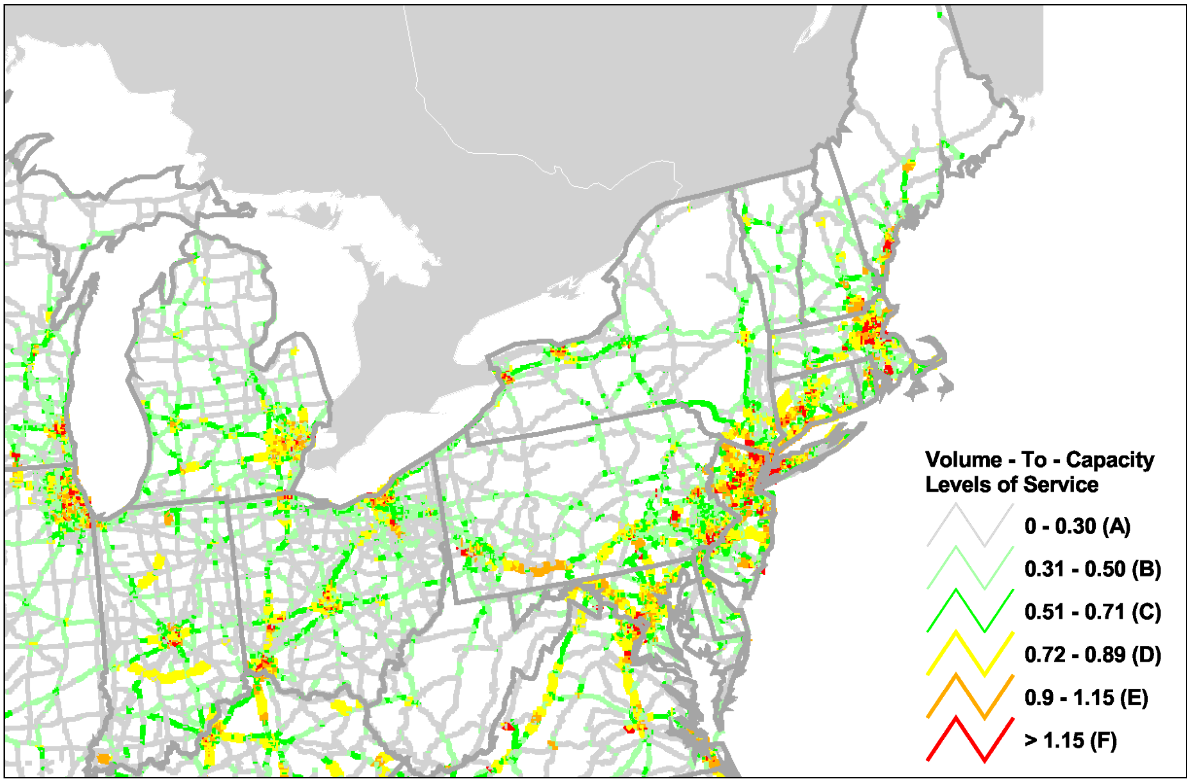
Source: Reebie Associates, U.S. DOT Freight Analysis Framework.

At a detail level, Figure 13 is somewhat frustrating to interpret. So much of northern New Jersey's highways fall into the highest volume categories – New Jersey Turnpike, I-95, I-78, I-80, and I-287 – that the lines become too thick to see what's happening on any of the other roads.

But this in itself serves to make perhaps the single most important point: namely, that the NJTPA region is a critical nexus for some of the nation's most heavily traveled truck routes, which traverse and radiate from multiple NJTPA counties, crossing and converging to create some of the highest truck volumes in the country.

According to an analysis performed for the U.S. DOT's Freight Analysis Framework project (Figure 14), much of the NJTPA region's interstate and state highway system already performs at an unacceptable (E or F) or near-unacceptable (D) level of service during the peak periods. Every NJTPA county has some portion of its infrastructure operating at LOS D, and most must contend with LOS E and LOS F segments. The high volume of truck activity depicted in Figure 6 is a contributor to these conditions.

Figure 14. U.S. DOT Estimated Peak-Hour Levels of Service
2000



Source: Battelle, U.S. DOT Freight Analysis Framework (Highway Performance Monitoring System volumes mapped against estimated segment capacity).

These national-level maps help in making general observations, but for purposes of this FSPAS we wanted to be more specific about the numbers and impacts of trucks on specific parts of the NJTPA highway system. To accomplish this, we used a truck model recently developed for the NJDOT's Portway Extensions and Congestion Management Study. The Portway Extensions model used the New Jersey Regional Transportation Model and the Portway Phase I models as platforms, and added major refinements: highly detailed truck origin-destination tables, network modifications, and new freight forecasts. The Portway Extensions model was originally designed to evaluate container truck movements, but for this project, we expanded it to cover all types of trucks as well as non-truck vehicle types. The model outputs were calibrated to plus or minus 10 percent for all vehicle classes using available counts, including counts performed specifically for the Portway Extensions project.

As shown on Figure 15, the model reported that the highest volume truck segments (greater than 180 per hour per direction) in the NJTPA region are the:

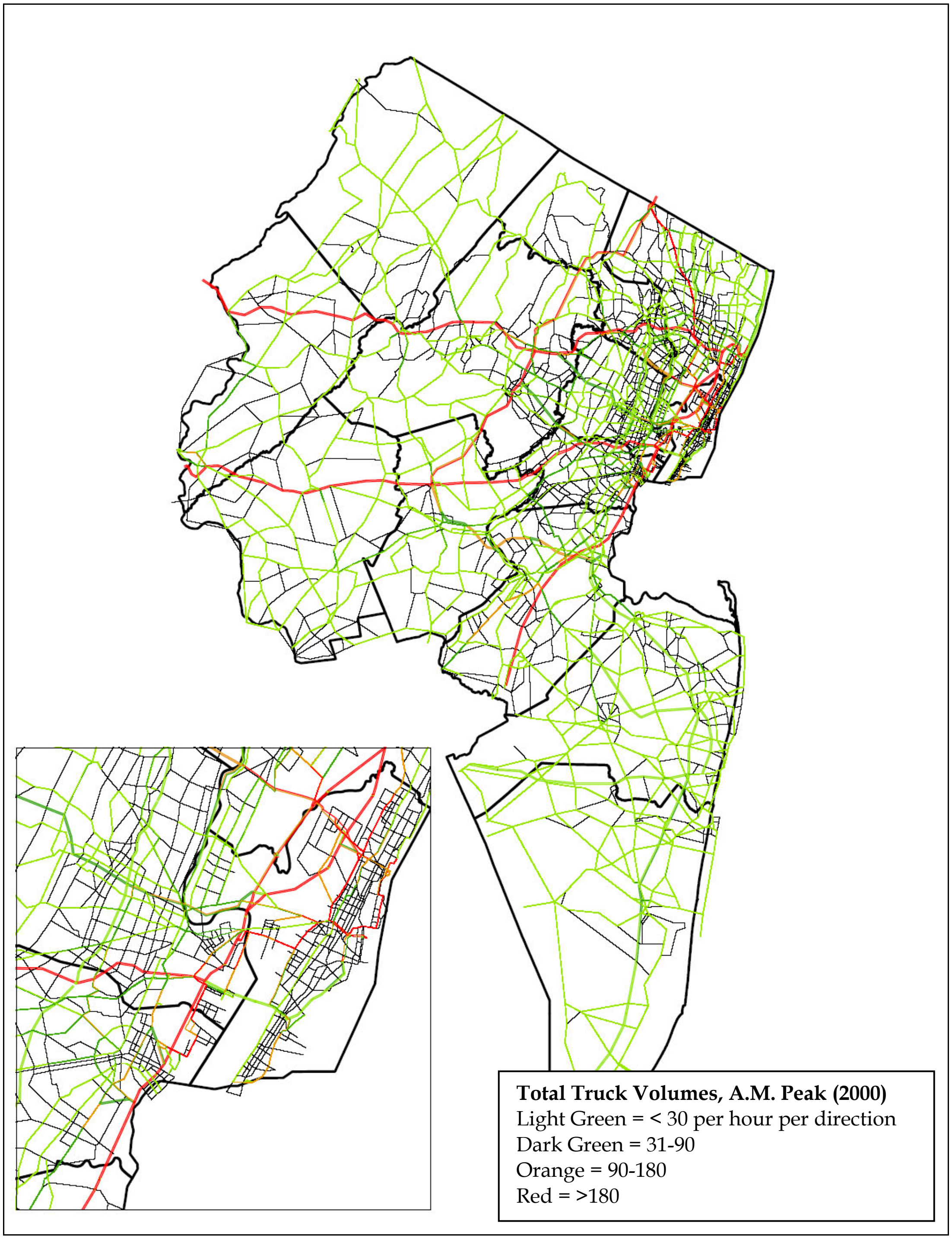
- New Jersey Turnpike below the George Washington Bridge (Bergen, Hudson, Essex, Union, Middlesex);
- I-78 west of the New Jersey Turnpike (Essex, Union, Somerset, Hunterdon, Warren);
- I-80 west of the George Washington Bridge (Bergen, Passaic, Morris, Warren);
- I-287 from I-80 to the New York state line (Somerset, Morris, Passaic, Bergen);
- NJ 3/NJ 495 (Hudson and Bergen);
- NJ 17 (Bergen); and
- NJ 440 (Hudson).

Other significant truck volume segments (91 to 180 per hour per direction) include segments of:

- I-280 (Hudson and Essex);
- U.S. 1 and 9 (Middlesex, Union, Essex, Hudson, Bergen);
- U.S. 46 (Bergen, Passaic, Morris);
- U.S. 202 (Passaic);
- NJ 3 (Bergen and Passaic);
- NJ 4 (Bergen);
- NJ 7 (Hudson);
- NJ 24 (Union);
- NJ 63 (Hudson);
- NJ 82 (Union); and
- Doremus Avenue (Essex).

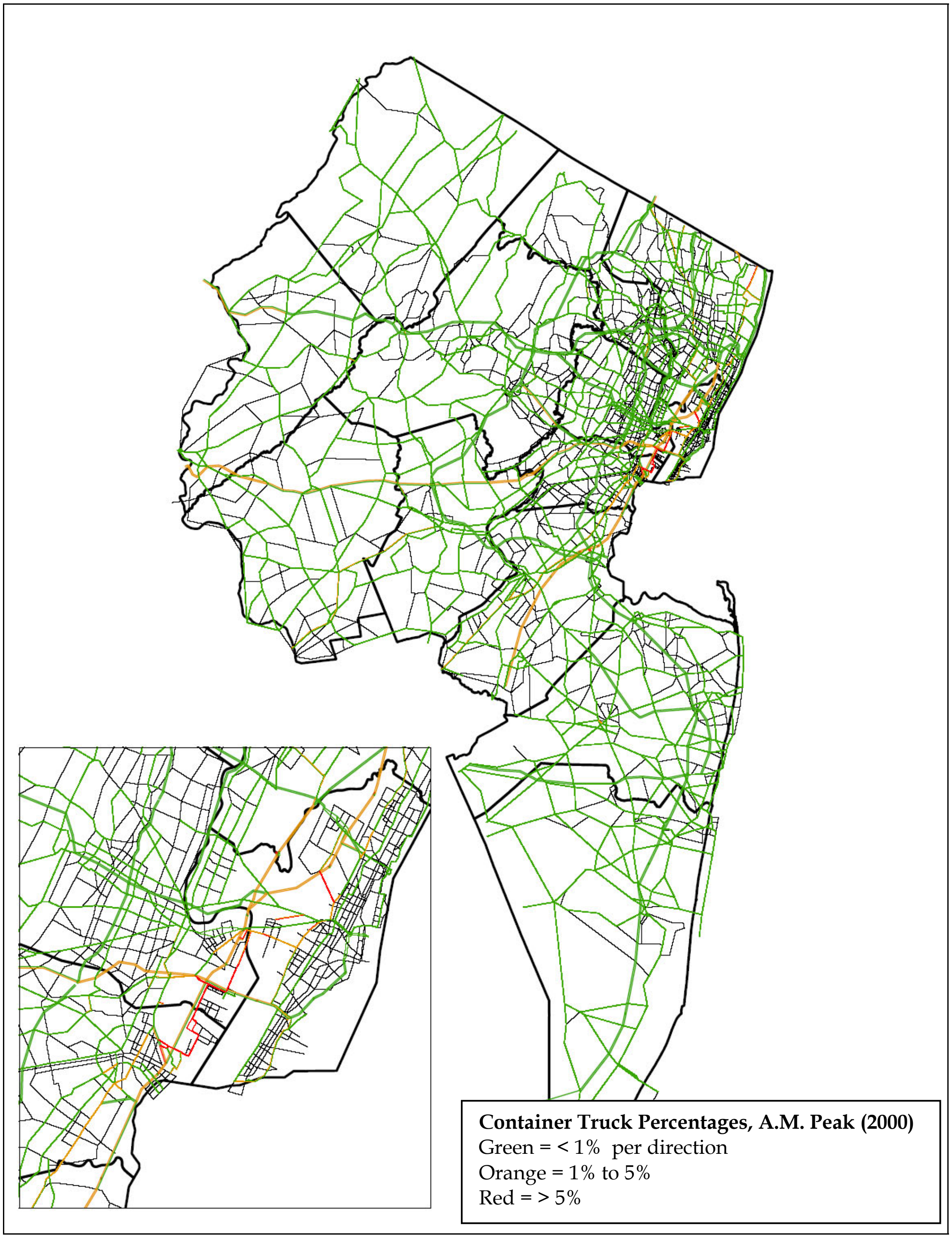
Figures 16 and 17 illustrate the relative percentages of truck traffic on the region's highway network during the a.m. peak. These maps tell a somewhat different story than Figure 16, because they show segments where trucks may be lower in volume but still represent a significant share of total traffic. Figure 16 shows only container truck percentages, while Figure 17 shows all non-container truck percentages.

Figure 15. Modeled A.M. Peak Truck Volumes
2000



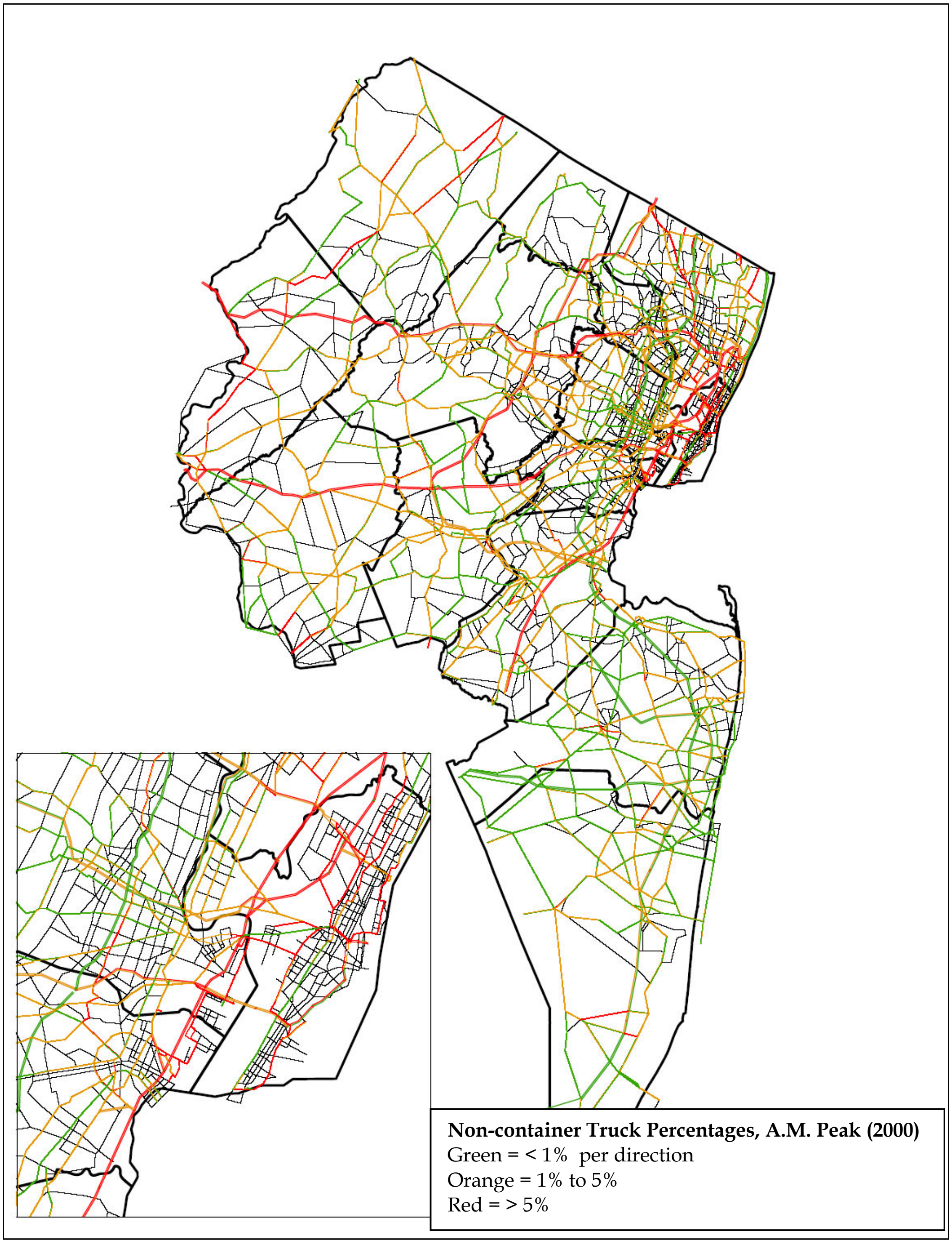
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 16. Modeled A.M. Peak Container Truck Percentages
2000



Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 17. Modeled A.M. Peak Non-Container Truck Percentages
2000



Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 16 should help address a misconception that has arisen in some circles: namely, that container trucks (and the facilities that generate them, including seaports and intermodal rail terminals) are to blame for all of the region's congestion, and that you can somehow "fix" the roads by limiting the growth of ports and railyards. In fact, there are very few corridors in the region where the container truck percentage in the a.m. peak exceeds 5 percent.

- Most of the New Jersey Turnpike, I-78, and NJ 17;
- Most of the local roads in the vicinity of Port Newark/Elizabeth; and
- Various sections of: I-80 (Warren); U.S. 1 and 9 (Hudson, Bergen, Essex, Union, Middlesex); U.S. 202 (Somerset, Hunterdon); and NJ 24 (Morris).

In contrast, Figure 17 shows that far more segments of the region's highway network experience 5 percent or more non-container truck traffic in the a.m. peak. Generally, these segments include not only the high-volume truck segments, but also a substantial number of local and regional roads. Every county in the NJTPA region experiences high truck percentages on some of its roads. This is not surprising – every county produces and consumes goods, and generates the demand for truck movement as a result. The fact is that for the most part, these local-serving trucks are not container trucks, but rather a mix of other truck types. Figure 18 should help to address another common misconception: namely, that non-industrial areas do not have to care about accommodating truck movements. They do – on both their local service roads and their major through-traffic arterials.

There is a relationship between container and non-container trucks, in that many container trips begin or end at warehouses, where the contents are transferred to/from other trucks (often smaller trucks). This "multiplier" effect has not been quantified, but even if it is large, it would still account for a small percentage of total truck trips – for the a.m. peak, the model shows: 2,600 container truck trips; 4,200 large (more than six axles) truck trips; and 102,300 other (smaller) truck trips over the model network.

These model results refer only to the a.m. peak. Results for the p.m. peak showed slightly lower truck percentages, due to a combination of higher auto traffic and truck avoidance. In most parts of the country, for major interstate highways, truck volumes tend to be relatively constant throughout the day and evening. As a result, trucks can be a much higher percentage of traffic in the evening/overnight hours; however, this does not usually result in congestion, because the cars are mostly out of the way.

The Portway Extensions model incorporates hundreds of partial-day and full-day truck counts from NJDOT, PANYNJ, and others at various locations throughout the region. The counts were taken at different periods, employed different methodologies, and have different degrees of reliability; therefore it is difficult to interpret the counts in an "apples-to-apples" manner. The available count information has been incorporated into the NJTPA Comprehensive Freight Database, where it can be used to support more detailed investigations of critical corridors.

3.1.3 Highway System Performance

Figure 18 illustrates the a.m. peak level of service (the volume/capacity ratio from all vehicle types) on the NJTPA region's highway network. It seems to confirm common-sense experience: many highway segments in the NJTPA region are operating at poor to unacceptable levels of service (greater than 0.95) today, and many other segments are operating at fair to marginal levels (0.75 to 0.95). Moreover, while conditions are the "most red" in the inner core counties, no county is immune.

While Figure 15 showed the highest truck volumes on major interstate highways, on regional connectors, and in the vicinity of Port Newark/Elizabeth, Figure 18 shows that:

- Some of these high-volume truck segments are not actually performing at poor to unacceptable levels of service, at least not yet; and

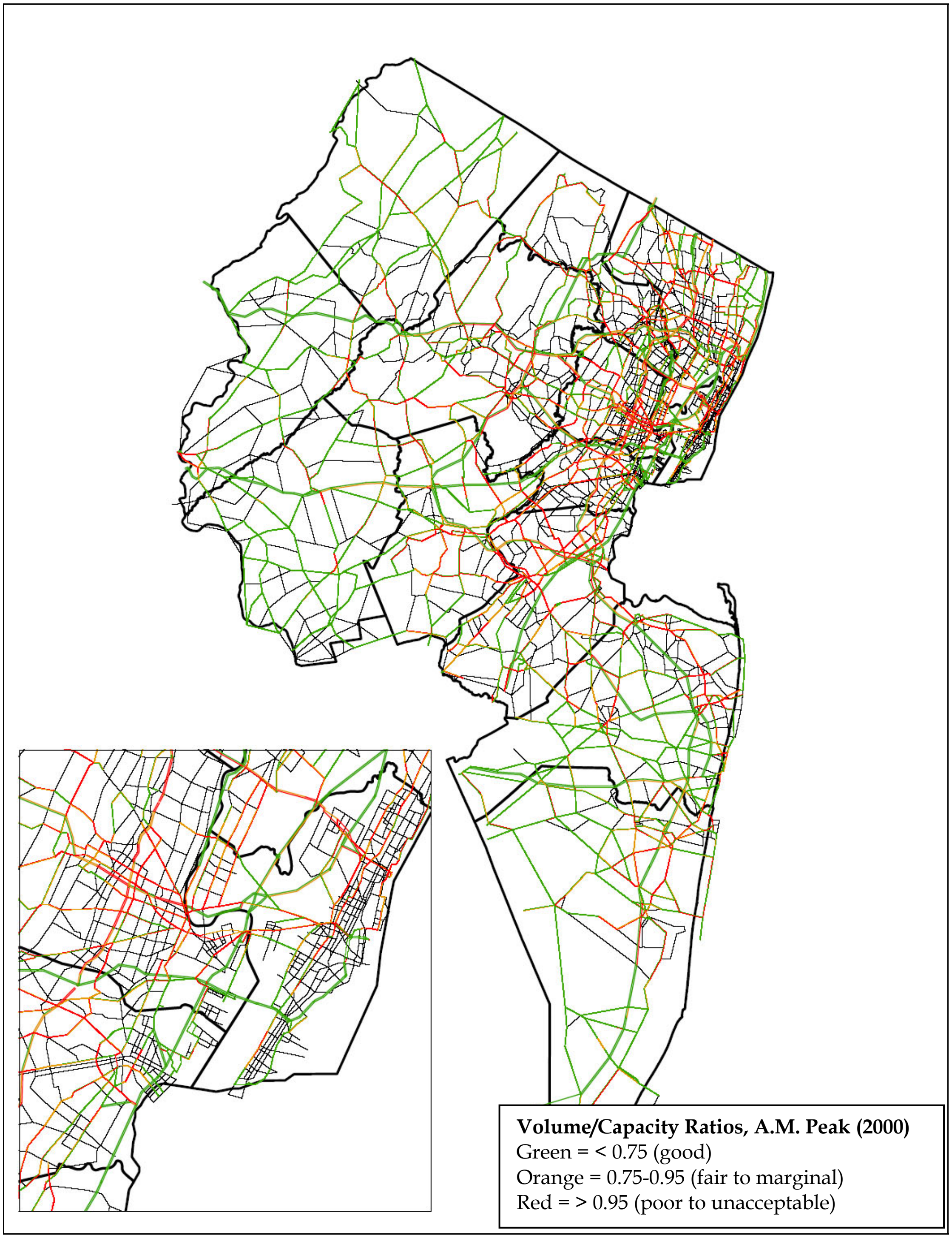
- Many of the segments showing unacceptable levels of service are not high-volume truck segments. Their performance is primarily due to the high levels of peak-period auto traffic they have to carry.

To highlight the areas where truck impacts are most critical, we asked the model to select highway segments that currently operate with a volume/capacity ration of 0.95 or worse, **and** also experience high percentages of truck traffic (5 percent or more for container trucks or for non-container trucks). The output is shown in Figure 19. It highlighted a number of extended segments, including I-287 between I-78 and I-80, NJ 17 though Bergen County, U.S. 1 and 9 at multiple points, NJ 440 through Jersey City and Bayonne, and many local roads serving the industrial areas in the vicinity of Port Newark/Elizabeth. It also highlighted problems at some critical interchanges, including I-80/I-280, I-78/I-287, I-78/New Jersey Turnpike, I-495/NJ 3/New Jersey Turnpike.

The criteria used to develop Figure 19 were very restrictive, and ultimately excluded many known or potential problem areas. Also, being based on volume/capacity ratios, it does not take into account operational impacts, safety issues, and other critical factors. We believe that truck accessibility and impact issues are important wherever there are high truck volumes (as shown in Figure 15) or high truck percentages (as shown in Figures 16 and 17).

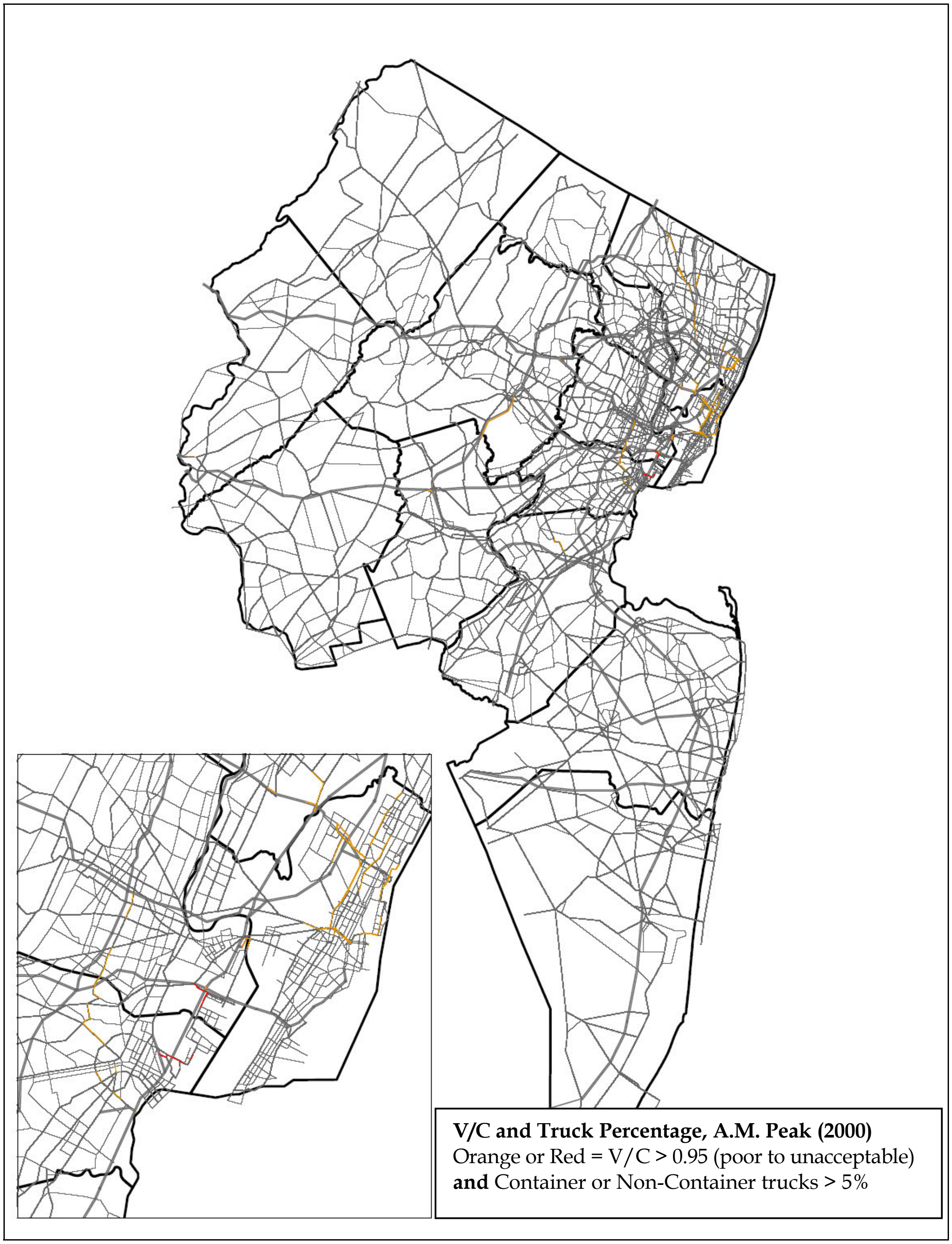
Accident locations (all types) involving trucks are mapped on Figure 20. Accident locations are highly clustered in the industrial areas of Hudson, Bergen, Essex, and Union counties, and along major regional access roads (New Jersey Turnpike, I-78, I-80, I-287). They also appear on local roads in each of the NJTPA region's counties – you can almost trace out a county's road system just from the accident data. It is interesting to compare Figure 15 (which shows a limited number of high-volume truck corridors traversing Hudson, Bergen, Essex and Union) with Figure 20 (which shows accident locations over a very broad geographic area), suggesting that many of these accidents are on lower-volume local streets. This highlights the need to look beyond pure volume data and volume/capacity ratios when evaluating truck issues.

Figure 18. Modeled A.M. Peak Level of Service
2000



Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

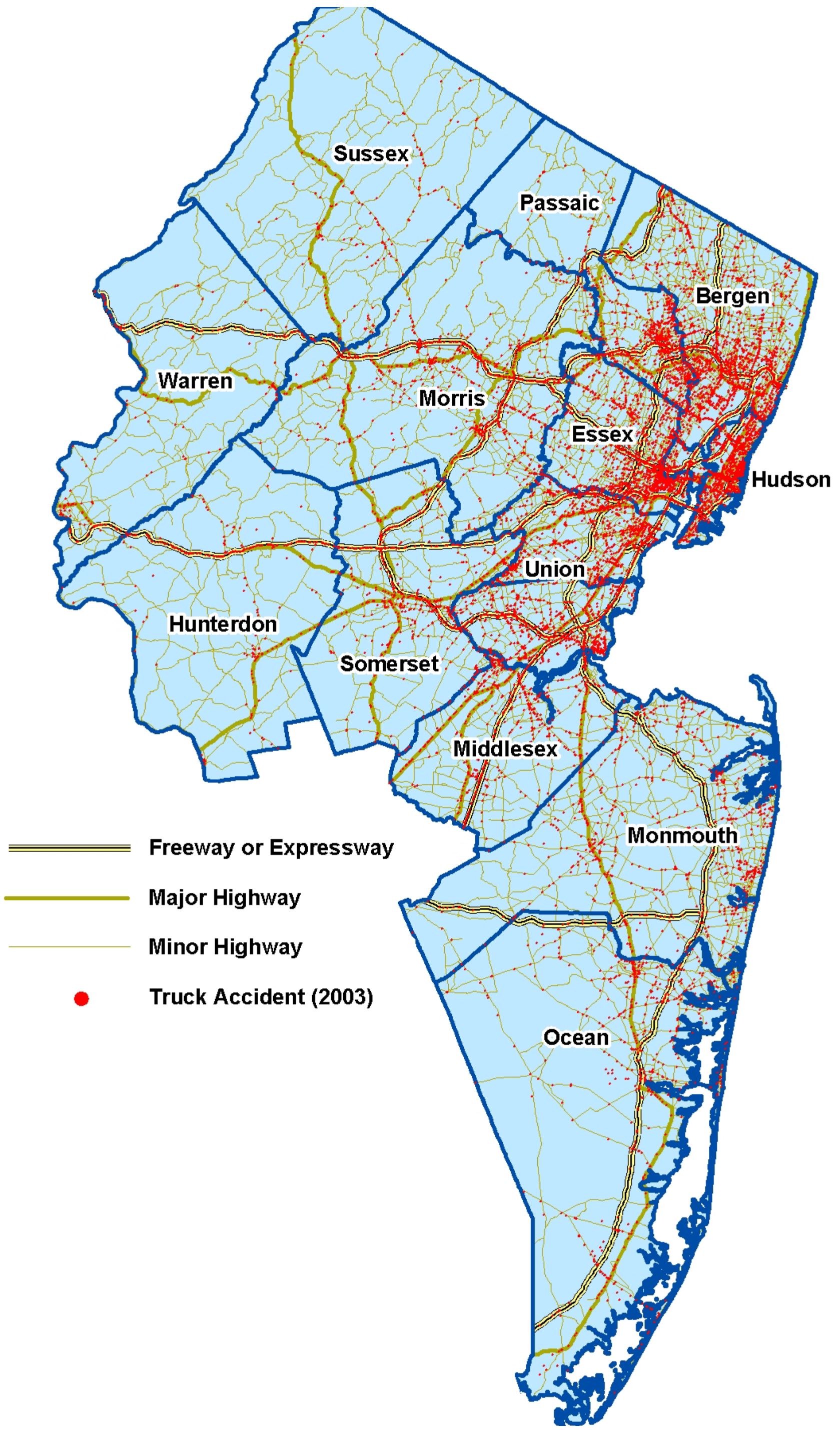
Figure 19. Modeled A.M. Peak Level of Service *and* Truck Percentages
2000



V/C and Truck Percentage, A.M. Peak (2000)
Orange or Red = V/C > 0.95 (poor to unacceptable)
and Container or Non-Container trucks > 5%

Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 20. Truck Accident Locations
2003



Source: NJDOT.

3.2 Rail System

3.2.1 Role of Railroads in Regional Freight Transportation

While rail is not as flexible a mode as truck – roads go everywhere, and rails do not – rail excels at many different types of freight moves. By its nature, rail offers a lower per-mile transportation cost than trucking, but with higher terminal handling costs, so that economies of scale and increased competitiveness with trucking are generally realized over longer distances.

Unlike the highways, which are publicly owned, the nation's freight rail system is – with limited exceptions – a privately owned system, operated on a for-profit basis, and accountable to its shareholders. With very high costs to maintain and operate its private system, and faced with strong competition from over-the-road trucking, railroads have evolved their business strategies in response to changing conditions and market demands:

- **System Rationalization –** As noted earlier, the railroad industry as a whole has reduced the number of miles it operates over, pruning lower-profit lines and services and allowing it to focus on higher-profit lines. Railroads have merged to consolidate their services and improve their operating economies. And increasingly, larger railroads are focusing on "hub-to-hub" service strategies that aim to concentrate as much traffic as possible on selected corridors, leaving smaller railroads (regionals, shortlines, and switching railroads) or trucks responsible for "last mile" pickup and delivery.

- **Diversification of Commodities and Services –** Historically, rail focused on heavy, lower-value commodities moving in bulk – such as coal, stone, lumber, and chemicals – where per-mile transportation cost is critical, and speed and reliability of delivery are often less important. In recent years, however, the rail industry has evolved to serve higher-value shipments – such as intermodal shipping containers, truck trailers, and automobiles – where speed and reliability of delivery are significant factors. Many railroads have instituted premium scheduled services, and some are exploring strategies to become more competitive with trucking over shorter distances.

- **Partnership with Other Modes –** Throughout its history, rail has been a key partner for the nation's seaports, primarily for shipment of bulk materials such as coal, petroleum, or chemicals. With the rapid expansion of international container markets beginning in the 1970s (and continuing today), railroads have become key partners for moving containers to and from seaports, offering double-stack container (DST) and container-on-flatcar (COFC) services. They have also become key partners for the trucking industry, handling a variety of domestic intermodal traffic in the form of trailers (trailer-on-flatcar) and truck chassis ("piggyback") services.

Generally speaking, the nation's rail network carries four classes of commercial traffic:

- **Unit Train –** Unit train traffic typically consists of a single type of bulk commodity (coal, clay, etc.) moving in long train sets between large shippers and large receivers.

- **Carload, "Loose Car", or "Merchandise" Traffic –** Carload traffic can consist of a wide range of different commodities, traveling in several different kinds of railcars: hopper cars (for dry products), tank cars (for liquid products), flatcars, boxcars, etc. Carload trains can be short or long, but generally consist of traffic moving between multiple shippers and multiple receivers, so there is more railcar handling involved than for unit trains.

- **Intermodal –** Intermodal traffic, in railroad vocabulary, is the movement of containers, trailers, or truck bodies on either a standard flatcar or a dedicated "well car." Intermodal trains are for the most part dedicated for that purpose, and may be offered as premium scheduled services. Containers may be stacked one on top of the other (double-stack), or singly on a railcar. Typically, these are long trains.

- **Autorack –** Finished automobiles can be moved in special "bi-level" or "tri-level" car carriers. Dedicated autorack trains can provide premium services, similar to intermodal.

Figure 21. Examples of Unit, Carload, and Intermodal Trains

Source: Reebie Associates and Cambridge Systematics, *AASHTO Freight Rail Bottom-Line Report.*

In some cases, rail moves materials directly between shippers and receivers, if both are served by rail lines. More often, rail is part of an intermodal trip chain, where cargo is delivered to or picked up from a rail terminal by truck, or where a rail terminal is located directly at a marine terminal. Rail does not interact with air cargo (which tends to be low-weight, high-value, time-sensitive and requires door-to-door delivery), but is closely integrated with all other freight modes.

Within the NJTPA region, the freight railroads are critically important for a number of reasons: they provide needed services to the region's shippers and receivers; they provide critical connections to the region's marine terminals; they provide an alternative to trucking, reducing pressure on the region's highways; and they share, in some cases, infrastructure with passenger railroads.

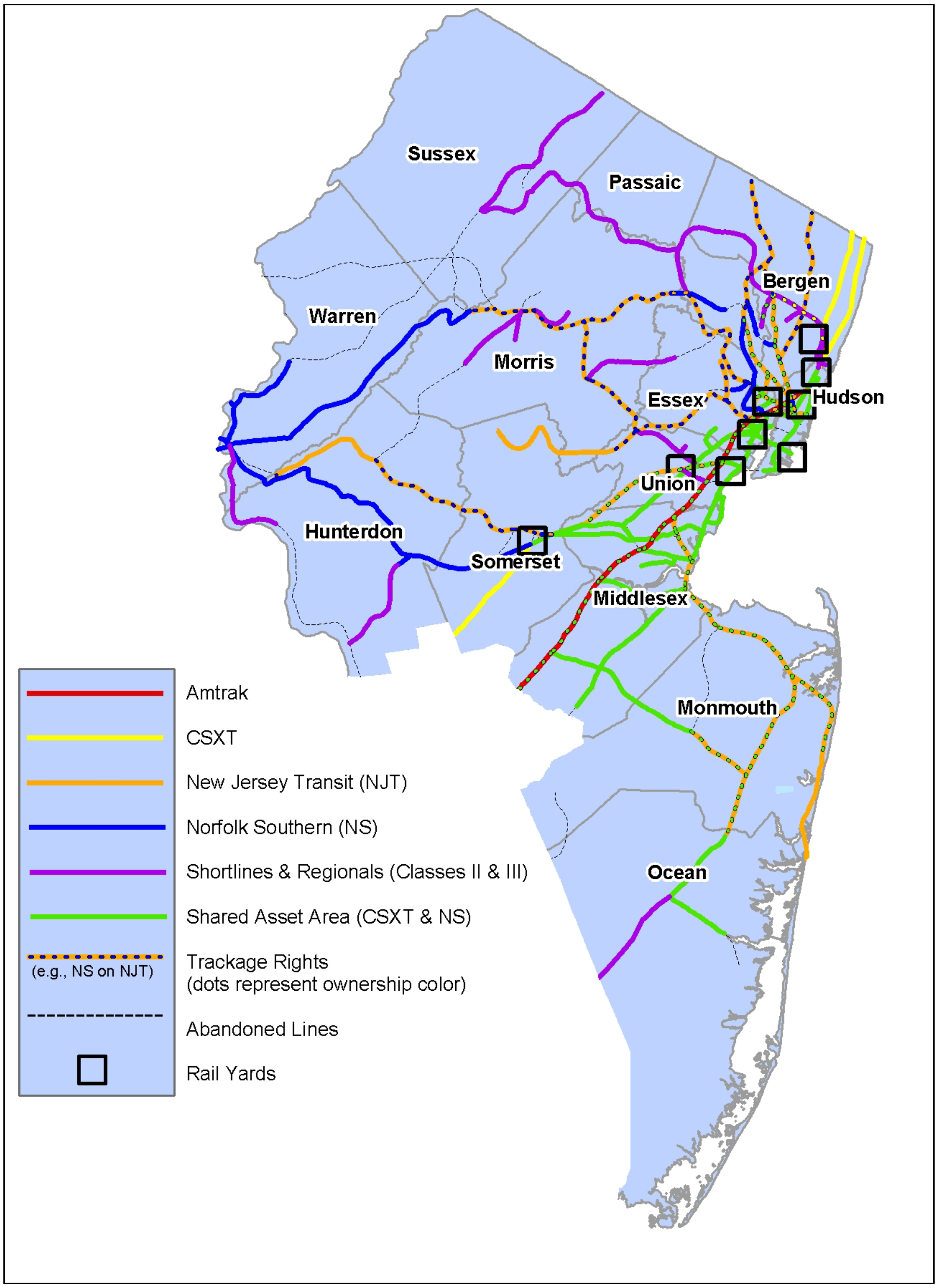
The NJTPA region's rail system consists of different elements, all of which are important:

- Mainlines, accommodating higher-volume, higher-speed traffic;
- Branches, secondary tracks, running tracks and industrial tracks, accommodating lower-volume, lower-speed traffic and last mile connections to industrial customers;
- Intermodal terminals for the exchange of shipping containers between rail and trucks, or between rail and marine terminals;
- "Transload" or "transflow" yards for the exchange of non-containerized commodities between rail and trucks, or between rail and marine terminals; and
- Classification yards for breaking longer trains into shorter trains, and vice versa.

The NJTPA region's rail system (see Figure 22) has evolved from multiple railroad systems over the past 100 years. Today, it is operated by many different freight railroads, including:

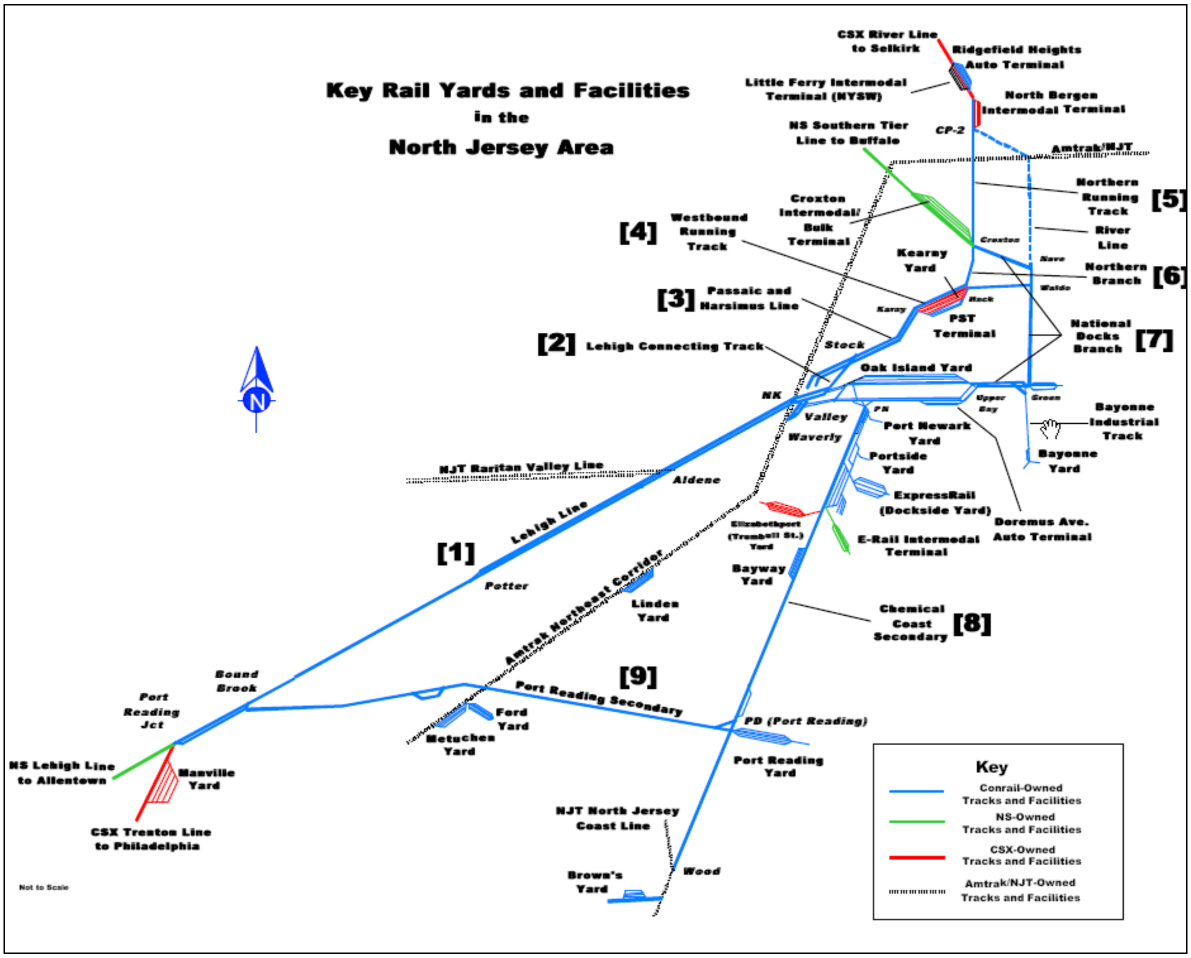
- Two national Class I railroads – Norfolk Southern (NS) and CSX – which operate major systems in the region. Within the region, the NS shares trackage with New Jersey Transit, and the NS also operates over Amtrak's Northeast Corridor. A third Class I – the Canadian Pacific (CP) – also offers limited service, but does not own track.
- Conrail, a subsidiary of NS and CSX, which serves as a terminal railroad for NS and CSX within the North Jersey Shared Assets Area (NJSSA). The NJSAA includes main lines of NS and CSX that link the region with the national rail system, secondary freight and passenger lines (including the Northeast Corridor), and lines owned and operated by shortline railroad companies providing service to local rail customers. The NJSSA was formed as a result of the 1999 acquisition by and division of Conrail routes between NS and CSX. The purchasers chose to establish shared assets areas in three locations in order to permit access to rail customers by both NS and CSX. NS and CSX also have the right to serve customers in those areas directly.
- Eight shortlines, including the: Black River and Western RR (BRW&BDRV); East Jersey Railroad (EJR); Morristown and Erie Railway (Maine); New York Cross Harbor RR (NYCH); New York and Greenwood Lake Railway (NYGL); New York Susquehanna and Western RR (NYS&W); Port Jersey Railroad (PJRR); and Raritan Central Railway.

Figure 22. The NJTPA Region's Major Rail Lines and Railyards



Source: Federal Railroad Administration.

Figure 23. Major Rail Facilities in the North Jersey Shared Asset Area



Source: R.L. Banks Associates, Inc.

North Jersey Shared Assets Area

As shown in Figures 22 and 23, much of the region's critical rail infrastructure is contained within the NJSSA. This includes a number of critical mainlines and branchlines:

- The **Lehigh Line** serves multiple functions. It accesses NS's main route into and out of the region (to/from Allentown, Pennsylvania); it provides access to CSX's Manville Yard and Trenton Line; it accommodates New Jersey Transit traffic between NJT's Raritan Valley Line and the Northeast Corridor; and it provides critical access to the huge Oak Island Yard;
- The **CSX River Line** is CSX's main route into and out of the region (to/from Selkirk, New York, near Albany);
- The **NS Southern Tier Line** (to/from Buffalo) is a less-used NS mainline;

- The **Chemical Coast Secondary** provides vital service to waterfront industries, Port Newark/Elizabeth, and multiple railyards;
- The **Port Reading Secondary** links the Lehigh Line and Chemical Coast and provides industrial access;
- The **Lehigh Connecting Track, Passaic and Harrimus (P&H) Line, Westbound Running Track, Northern Branch**, and **Northern Running Track** provide access between Lehigh Line/Oak Island Yard and the River Line and Southern Tier, as well as the important Croxton and Kearney intermodal yards;
- The **National Docks Branch** links the Southern Tier and Oak Island Yard and provides industrial access; and
- The **Greenville Branch** extending east from Oak Island Yard across Newark Bay and the **Bayonne Industrial Track** provide industrial access onto the Bayonne Peninsula.

The NJSAA also includes most of the region's critical railyards, including:

- Conrail's Oak Island Yard, which is the major merchandise (carload) freight classification yard for railroads serving the region;
- NS's Croxton Yard (primarily international containers moving from/to the west coast via landbridge services, along with bulk traffic) and E-Rail (primarily domestic intermodal traffic);
- CSX's Kearney Yard (primarily international containers moving from/to the west coast via landbridge services), North Bergen Intermodal Terminal (primarily domestic intermodal traffic), Ridgefield Heights Auto Terminal (auto handling), Elizabethport/Trumbull Street Yard (bulk transfer for industrial customers), and Manville Yard (bulk and merchandise traffic);
- Conrail's ExpressRail, Portside Yard, Port Newark Yard, and Doremus Avenue Auto Terminal, which provide on-dock and near-dock rail service for the marine terminal complex at Port Newark/Elizabeth, and primarily handle containers and autos;
- Conrail's Bayway Yard, Port Reading Yard, Brown's Yard, Ford Yard, Metuchen Yard, and Linden Yard, which provide bulk and merchandise service for various industrial customers;
- Conrail's Greenville Yard, which is leased to the New York Cross Harbor Rail Road, which has used the yard to serve a rail float operation to Brooklyn; and
- The NYS&W's Little Ferry Intermodal Terminal, which primarily handles domestic intermodal traffic.

Beyond the NJSSA

There are three primary freight rail routes linking North Jersey with the national rail system, including the CSX River Line, the CSX Trenton Line, and the NS Lehigh Line. A fourth freight route is the NS Southern Tier Route. Those four routes are described in detail below. The fifth rail route is Amtrak's Northeast Corridor between Boston, New York and Washington, D.C. The Amtrak route hosts freight trains serving on-line customers but almost no through freight. Due to the heavy volume of intercity and commuter passenger trains, the Northeast Corridor is not a viable option to host significant through freight service and is not addressed further.

- **River Line – CSX Transportation –** The River Line connects the NJSAA with New York's Hudson River Valley via Selkirk Yard and Albany. The line features a single track with several extremely long passing sidings and maximum train speeds that range between 30 and 50 miles per hour. Train movements over the line are signaled through Centralized Traffic Control (CTC) with controlled sidings.

- **Trenton Line – CSX Transportation –** The Trenton Line connects CSX NJSAA operations with Philadelphia, Pennsylvania. Infrastructure configuration varies considerably, with some sections of single, double, and triple main track. The single-track segment of the Trenton Line contains of only one passing siding in the 22 miles between Port Reading Junction and CP Wing. Train movements are controlled by a mixture of (Automatic Block Signals) ABS and CTC. Maximum authorized freight train speeds range between 25 and 50 miles per hour.

- **Lehigh Line – Norfolk Southern Railway –** The Lehigh Line between Port Reading Junction and Allentown, Pennsylvania connects the NJSAA operations of NS to the carrier's major east-west artery through Pennsylvania and points west. The line features a mixture of both single and double main track sections between Port Reading Junction and the New Jersey/Pennsylvania border; the line enjoys all double main track between the New Jersey/Pennsylvania border and Bethlehem, Pennsylvania. Train movements are controlled by CTC with controlled sidings, as well as ABS only in some places. Maximum authorized freight train speeds range between 10 and 30 miles per hour.

- **Southern Tier Route – Norfolk Southern Railway and NJT –** The Southern Tier Route between southern New York and Buffalo, New York includes NS freight train operation via trackage rights over portions of the NJT Main Line and NJT Bergen County Line between the NJSAA and Suffern, where the NJT Main Line connects with the NS Southern Tier Line which extends to Buffalo. The NS portion consists entirely of single track with passing sidings. The line is controlled by a mixture of ABS and CTC with extremely long passing sidings. Maximum authorized speeds range between 10 and 50 miles per hour. NS trains entering the Shared Assets Area must travel on portions of New Jersey Transit's Bergen County Line and Main Line as they enter Croxton Yard; similarly, trains exiting the Shared Assets Area must operate over New Jersey Transit before reentering NS rails at Suffern, New York.

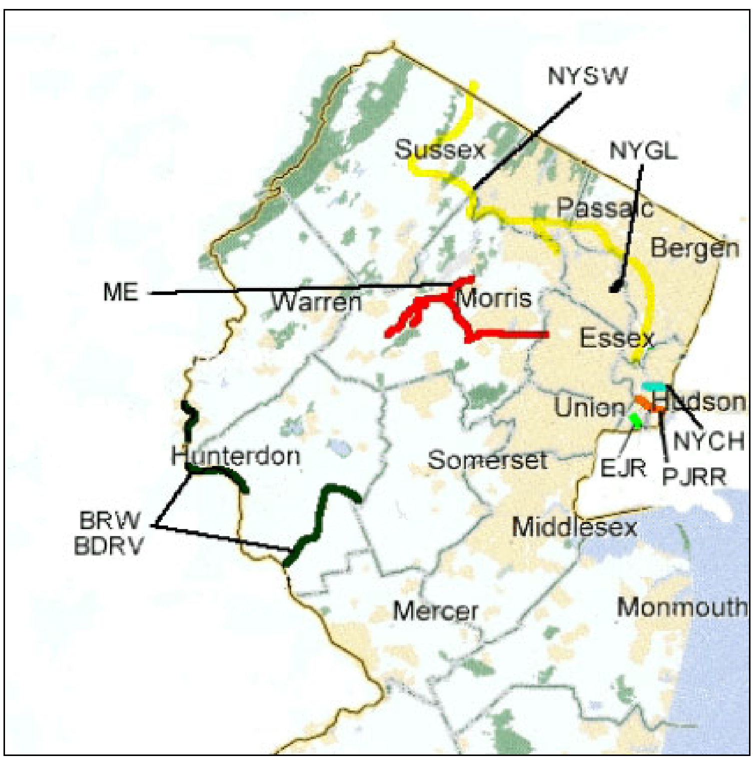
As previously mentioned, NS trains either entering or exiting the NJSAA must access New Jersey Transit's Bergen County Line via trackage rights between Croxton Yard and Ridgewood Junction. The Bergen County Line is predominantly double main track with maximum authorized freight train speeds of 30 to 50 miles per hour. The line is signaled by a mixture of ABS Rules and CTC.

Connecting New Jersey Transit's Bergen County Line at Ridgewood Junction with NS at Suffern, the Main Line also is the continued route of NS trackage rights trains both inbound to and outbound from the NJSAA. The Main Line features both single and double main track on which maximum freight speeds range between 40 and 50 miles per hour. The line is governed by a mixture of ABS and CTC.

Shortline Railroads

Five shortline railroads – the Port Jersey Railroad (PJRR), East Jersey Railroad (EJR), New York Cross Harbor Railroad (NYCH), New York Susquehanna & Western Rail Road (NYSW), and Raritan Central Railway – operate in the shared asset area. Three others – the Morristown and Erie Railway (Maine), the Black River and Western RR (BRW&BDRV), and the New York and Greenwood Lake Railway (NYGL) – are outside the NJSSA.

Figure 24. Shortline Railroads in the NJTPA Region



Source: New Jersey Shortline Railroad Association.

3.2.2 Rail Volumes

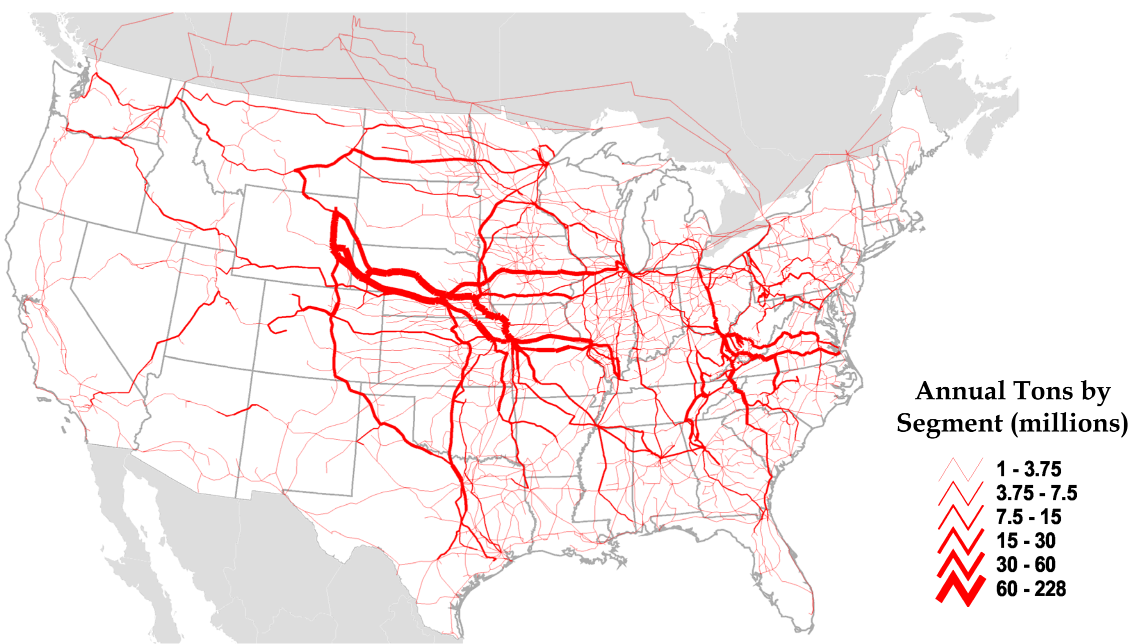
Figures 25, 26 and 27 illustrate the various flows associated with unit trains, carload trains, and intermodal/auto trains. These graphics were developed by Reebie Associates and Cambridge Systematics for *AASHTO's Freight Rail Bottom-Line Report*, based on model assignments of FRA's Waybill Sample to the national rail network. These assignments are indicative of general region-to-region flows, and may not reflect actual line-by-line volumes, but support the following observations:

- Unit train traffic is not highly significant for the NJTPA region. Very little appears to pass through or terminate in the region. Nationally, the largest unit train flows are associated with Powder River Basin coal (coming out of Wyoming), Appalachian coal (moving into Norfolk), and Midwest grain.

- Carload traffic is significant for the NJTPA region. North-south flows (Florida, Atlanta, Gulf) and east-west flows (Chicago and Great Lakes) converge in the area.

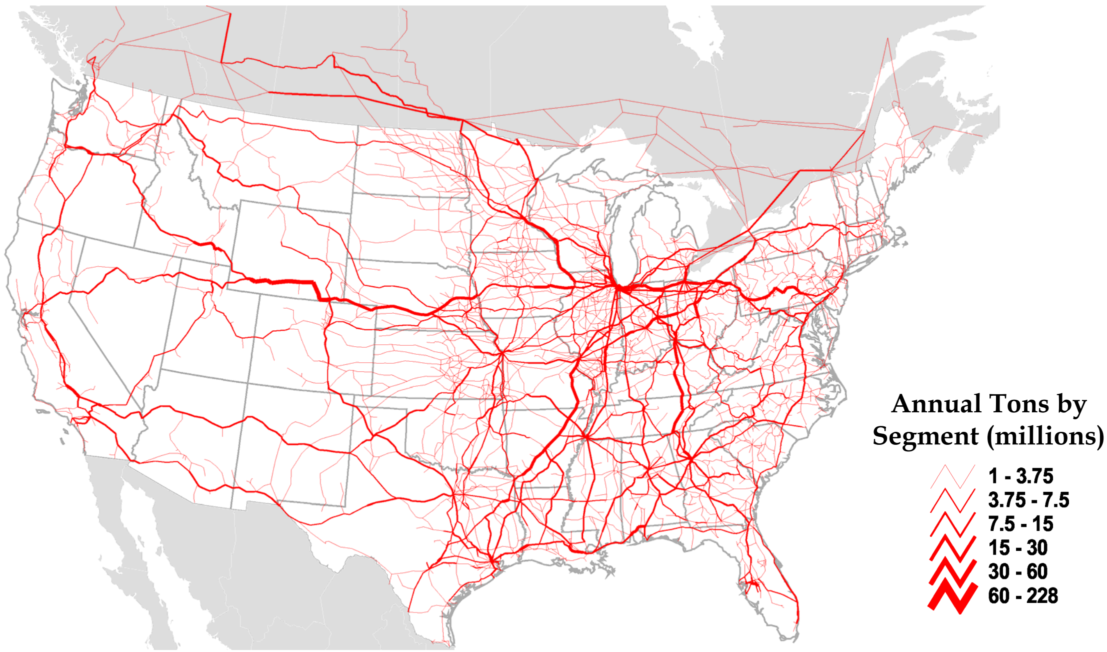
- Intermodal/auto traffic is significant for the NJTPA region. Northern New Jersey is the eastern terminus of the nation's most heavily used intermodal routes, with service via Chicago from Los Angeles/Long Beach, Oakland, Portland, and Seattle/Tacoma. Much of this is "landbridge" traffic – international containers that come through west coast seaports, and are loaded onto rail for shipment to markets in the northeast. As shown previously in Table 3, intermodal represents around 12 million tons annually, while non-intermodal represents around 13 million tons annually.

Figure 25. Unit Train Commodity Tonnage Flows
Year 2000



Source: Reebie Associates and Cambridge Systematics, *AASHTO Freight Rail Bottom-Line Report.*

Figure 26. Carload Commodity Tonnage Flows
Year 2000



Source: Reebie Associates and Cambridge Systematics, *AASHTO Freight Rail Bottom-Line Report.*

Figure 27. Intermodal/Auto Tonnage Flows
Year 2000

Source: Reebie Associates and Cambridge Systematics, *AASHTO Freight Rail Bottom-Line Report.*

As shown in Figure 28, according to FRA year 2000 data, the highest-tonnage lines in the region are the CSX River Line and the shared asset portion of the Lehigh Line. The NS portion of the Lehigh Line and the CSX Trenton Line, which join the shared asset portion of the Lehigh Line at Manville, are the next highest tonnage lines.

3.2.3 Rail System Performance

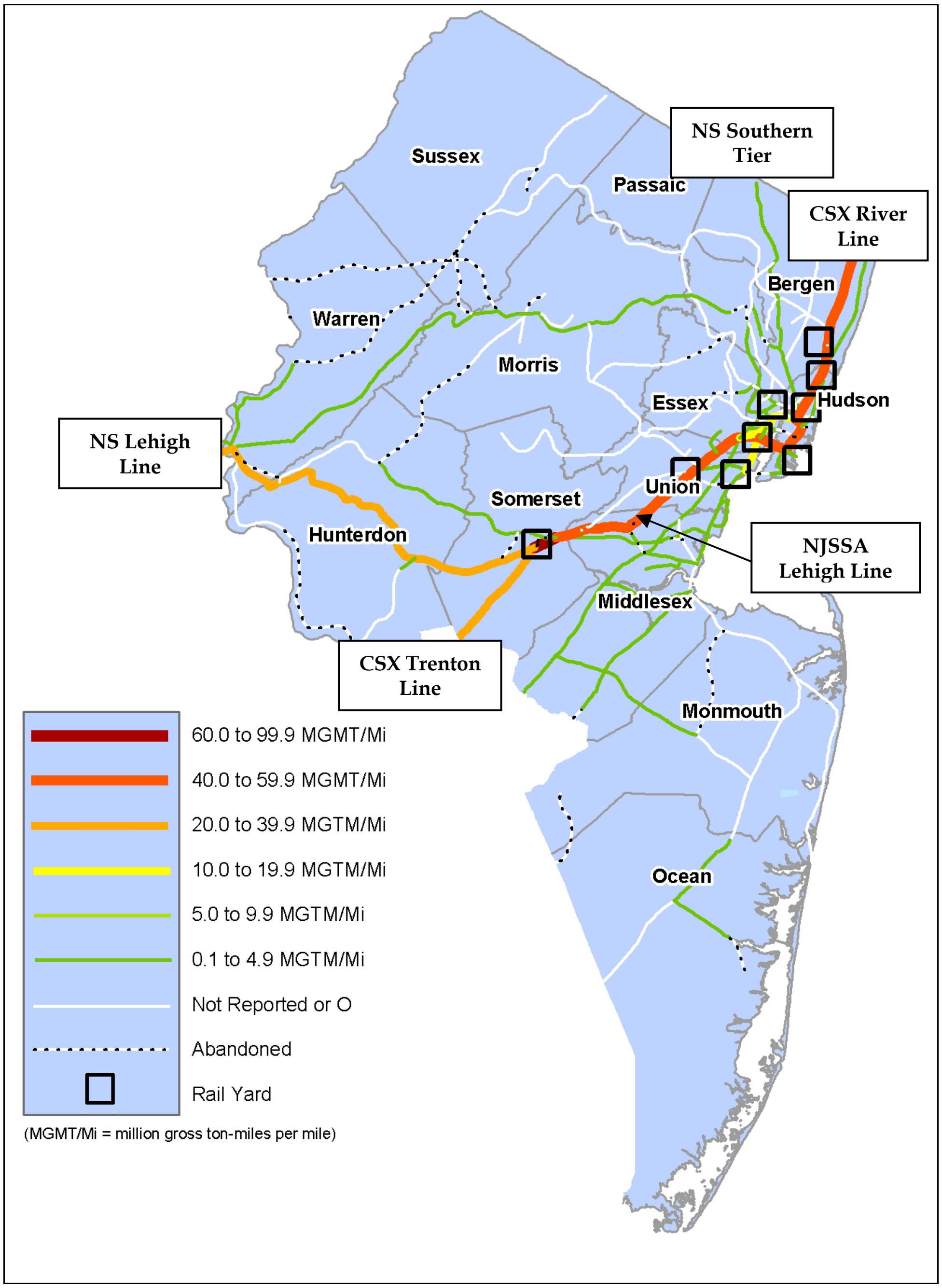
The rail component of the Freight System Performance Assessment Study was undertaken in the context of widespread recognition that: 1) international and domestic freight volumes are expected to grow significantly in coming years and 2) that the rail share of that freight growth is likely to strain the capacity of some or many components of the North Jersey rail network. The second point has been recognized in several earlier examinations of the rail system. A Working Group including representatives of railroads, governments and the Port Authority of New York and New Jersey (PANYNJ) undertook an analysis of likely capacity needs and developed an extensive list of proposed capacity improvements. In 2001, the PANYNJ engaged R.L. Banks & Associates, Inc, to conduct an independent assessment of the rail line capacity within the Port area and to identify imminent shortfalls and remedies as well as to review the Working Group's proposed improvements. In February 2002, CSX made a presentation addressing "Rail Freight Operations in New Jersey" to NJTPA, in which it identified rail capacity needs.

Mainlines, Branchlines, and Secondaries

In this task, various sources were used to develop estimates of train volumes on key rail network segments, and to quantify capacity in broad terms. Train movement information developed in the course of RLBA's 2001 study on behalf of the Port Authority was updated through contact with the major railroads and/or other sources. Trains were categorized as through trains (intermodal, carload or automotive), local switching or passenger (New Jersey Transit service, which contributes 60 trains per weekday to Lehigh Line traffic volumes). Traffic was assigned to the appropriate main line segments within the study area. Because railroads vary their train operating plans and patterns from time to time, these capacity and demand estimates are best viewed as general indicators. The work did not cover all lines in the NJTPA region, but did address the most critical high-volume segments within the shared asset area.

From Table 9, the general finding is that peak-day demand slightly exceeds capacity on the **P&H Line** and the **Chemical Coast Line**, and matches capacity on the double-tracked segment of the **Lehigh Line** (over which New Jersey Transit operates). These lines can be considered to be operating at their peak, with little capability of absorbing additional traffic unless improvements are made. In fact, a significant program of improvements has been proposed, and the effect of these improvements in light of forecasted growth in rail traffic is discussed in Section 3.0 of this report.

Figure 28. Rail Traffic Density by Line
Year 2000



Source: Federal Railroad Administration.

Table 9. Estimated Capacity and Demand of Major Rail Lines

2003	NS Lehigh Line[a]	CSX Trenton Line[a]	NJSSA Lehigh Line	P&H Line	Northern Running Track	National Docks	Chemical Coast	Port Reading Secondary	CSX River Line[a]
Average Daily Freight Trains	18	13	32	23	23	16	17	3	22
Average Daily Total Trains	18	13	94	25	25	16	17	3	22
Peak-Day Trains	23	16	100	29	29	20	21	4	28
Existing Capacity 2003	30-40	30	41 (single-track portion) 80-100 (double-track portion)	26	42	36	20	15	30

Source: R.L. Banks Associates, Inc.

[a] Includes through trains only.

Railyards

Estimates of railyard volumes were not developed as part of this study. This information is not readily available, although some estimates have been published by the PANYNJ, and by the *NYMTC Regional Freight Facilities Inventory*, the *Comprehensive Port Improvement Plan* technical documents, and the *Portway Extensions and CMS Study*. Good information on the capacities of these railyards is even more difficult to find. What we know from current activity and can reasonably surmise from past experience is the following:

- The PANYNJ's ExpressRail facility has grown rapidly – from 28,000 container "lifts" in its inaugural year (1991) to more than 200,000 lifts in year 2001. In 2003, ExpressRail (at Port Elizabeth) and a companion interim facility serving Port Newark handled a combined total of more than 230,000 lifts. The PANYNJ is currently expanding the ExpressRail terminal to accommodate up to 1,000,000 lifts per year, and is also upgrading other port-serving yards.

- NS Croxton handled an estimated 155,000 intermodal units in year 1998. No estimates of capacity are available.

- CSX Kearny handled an estimated 340,000 intermodal units in 1999, versus an estimated capacity of 300,000 lifts. The adjoining APL South Kearny Yard, since incorporated into the CSX facility, handled an estimated 120,000 intermodal units in 1998. Total capacity of the combined facility is not available.

- Combined operations at intermodal railyards handling primarily domestic intermodal traffic – E-Rail, North Bergen, and Little Ferry – totaled around 225,000 lifts in 1998/1999.

- The Oak Island Yard handled around 900 railcars per day in 1999, versus an estimated capacity of 1,400 per day. However, capacity constraints and the need for eventual expansion of this facility have been under discussion.

- The Doremus Avenue yard handled around 420,000 automobiles in 1999, while the Ridgefield Heights yard handled around 160,000 automobiles in 1999.

Community Impacts

An efficient rail system keeps helps reduce the amount of freight that has to be moved by truck. Maintaining current levels of rail traffic, and growing these levels in the future – through both long-haul and shorter-haul services – is important in managing regional congestion. However, the provision of rail services to achieve these regional benefits can also have local impacts – in the form of at-grade crossings, noise, vibration, and other effects. To the extent practical, these effects need to be addressed and offset, so that the benefits of rail freight can be achieved without the downside costs. New Jersey Transit has compiled a list of at-grade crossings for possible attention (see Table 10).

Table 10. Selected At-Grade Highway-Rail Crossing Locations

Line and Owner	Crossing Location and Milepost
Trenton Line (CSX)	Sunnymead Road (54.30); Route 601 (47.39); Hollow Road (45.29); Spring Hill (44.57); Province Line (44.20); Route 518 – Lambertville-Hopewell Road (42.03)
Lehigh Line (Shared Asset)	Rahway Avenue (20.05); Inman Avenue (23.18); Tingley Road (23.69); Front Street (26.32); Clinton Street (27.43); New Brunswick (27.96); New Market Rd (29.01); Prospect Avenue (29.14); South Avenue (30.06); Cedar Avenue (31.41)
Lehigh Line (NS)	Thirteenth Street (37.03); Roycefield Road (39.48); Valley Road (39.79); Auten Road (40.50); Beekmans Lane (41.35); Woodfern Road (45.78); Main Street (48.61); Rockafellow (49.66); Flemington Road (54.13); Hamden Road (57.01); Landsdown Road (57.74); Pittstown (60.77); Kennedy Road (71.95); Lee Avenue (73.67)
National Docks (Conrail)	Chapel Avenue (3.27)
Northern Branch (Conrail)	St. Pauls Avenue
River Line (CSX)	69th Street (2.58) – to be eliminated by HBLRT MOS-3; Bergen Turnpike (5.95); Mount Vernon Street (6.59); Pedestrian – Bogota (8.xx); New Bridge Road (10.92); Clinton Avenue (11.67); Main Street (11.91); Church Street (12.06); Central Avenue (12.15); Columbia Avenue (12.54); Madison Avenue (12.84); New Milford Avenue (13.12); Haworth Avenue (14.27); Durie Avenue (14.85); Old Hook Road (15.37); LaRoche Avenue (16.10); Harriet Avenue (16.22); Lafeyette Avenue (16.35); Blanche Avenue (17.12); Broadway (17.35); Clinton Avenue (18.25)
Port Reading Secondary	Main Street (0.47); Bakelite Road (1.69); Washington Avenue (4.61); New Brunswick Avenue (5.31); Clinton Avenue (5.66); Helen Street (6.62); South St (6.89); St. George Avenue (13.84); Rahway Avenue (14.89); Blair Road (15.71)
Chemical Coast	Railroad Avenue (11.xx); First Avenue (Private) (16.8x)

3.3 Marine Terminals

3.3.1 Role of Marine Terminals in Regional Freight Transportation

The Port of New York and New Jersey (PONYNJ) district, which encompasses publicly owned Port Authority of New York and New Jersey (PANYNJ) facilities as well as privately owned marine terminals in both New Jersey and New York, is the second-largest marine transportation hub in the U.S., trailing only the ports of Los Angeles/Long Beach. Marine transportation has been enormously important in the region's history – from the founding of New York as a colonial port, to the emergence of New York and New Jersey as a center of industrial production, to its evolution as a focus of world trade and commerce – and continues to play a leading role in the region's freight transportation system.

The region's marine terminals are designed to handle a wide range of commodities, including:

- **Containers –** Intermodal shipping containers can contain basically anything, but typically are used for high-value goods that need to be transferred to/from truck or rail with maximum speed, security, and visibility. Containers are typically "stuffed" at their origin point, trucked or railed to a marine container terminal, moved internally within the terminal by yard equipment, and loaded onto vessels using specially designed cranes; the process is reversed at the receiving port. Container terminals are highly specialized and expensive to develop; they must offer wharf-side cranes, extensive storage, large truck gates, and equipment maintenance facilities, and often feature on-dock rail terminals and consolidation/transfer warehouses (for "stripping" containers that are overweight or whose contents need to be separated for different receivers, or for the reverse "stuffing" process). Containers come in a variety of lengths – 20 feet, 40 feet, 45 feet, and even up to 53 feet (for domestic over-the-road containers only) – and the volume of containerized traffic can be measured in terms of **boxes** or **lifts** (the number of containers handled), **TEUs** (20-foot equivalent units), or cargo tonnage. The first containers (starting in 1956) were handled on ships carrying mixed cargo, but today they are handled mostly on purpose-designed container ships generally capable of handling between 2,000 and 8,000 TEUs. From an economic perspective, we care mostly about the tonnage of commodities inside the box; from a transportation perspective, we care mostly about the box itself, since that is what we need to physically move. This distinction becomes important when considering the fact that the PONYNJ imports about twice as much containerized tonnage as it exports, and the empty boxes either have to be shipped somewhere (with nothing inside to pay their way) or left to pile up in the region.

- **Automobiles and Motor Vehicles –** The modern automobile terminal is an integrated facility for shipping/receiving, storing, and processing motor vehicles. Typically, vehicles are driven onto and off of large vessels designed specifically for vehicle handling – these "Pure Car Carriers" are basically large floating parking structures. At the receiving terminal, vehicles may undergo value-added processing – dealer prep, installation of options, etc. – that generates local jobs above and beyond the transportation of the vehicle itself.

- **Break-Bulk and Neo-Bulk –** These are non-containerized cargos that move in packaged units. Break-bulk usually refers to cargo (boxes of fruit, pallets of lumber, bags of cocoa, etc.) that can be handled by traditional stevedoring equipment. Neo-bulk usually refers to cargo moving in larger, heavier units that require specialized handling equipment, such as rolled steel or paper, "super sacks" of clay, or large machines such as generators. Generally, break bulk and neo-bulk are carried on smaller vessels capable of handling multiple cargo types, often with ship-mounted cranes. Break-bulk and neo-bulk terminals typically employ wharf-side cranes that are smaller than container cranes, and almost always offer on-terminal warehousing for cargos requiring weather protection, climate control, and/or extended storage.

- **Dry Bulk –** These are dry commodities that are shipped loose in a vessel hold, without packaging. Typical dry bulk commodities include coal, sand, salt, cement, grain, etc. In small quantities, these commodities may move in break-bulk or neo-bulk form, but in larger quantities they tend to move as dry bulk, in specialized vessels. Dry bulk can be stored in enclosed silos or sheds or domes, covered piles, or open piles.

- **Liquid Bulk –** These are liquid commodities that are shipped loose in a vessel hold, without packaging. Typical liquid bulk commodities include crude petroleum, petroleum products, chemicals, molasses, and oils. In small quantities, these commodities may move in break-bulk or neo-bulk form, but in larger quantities they tend to move as dry bulk, in specialized vessels. Liquid bulk is typically stored in enclosed tanks.

Maritime terminology tends to be fairly flexible, but the term "general cargo" is often used to refer to some combination of containers, autos, break-bulk, and neo-bulk cargo, while "bulk cargo" is often used to refer to some combination of liquid and dry bulk cargo.

The New York and New Jersey waterfronts have evolved substantially over the last several hundred years. The first ports were break-bulk ports, where cargo was passed hand-to-hand. This was a slow process, requiring ships to be tied up for extended periods. As a result, the dominant type of marine terminal design was a "finger pier" – a wide pier extending into the water, with vessel berths on either side, and often a warehouse structure in the middle.

With time, the relative importance of break-bulk shipping has declined. Specialized terminals for handling of liquid bulk, dry bulk, autos, and containers have been developed. These terminals employ fast methods of loading and unloading, requiring vessels to dock for relatively short periods, but also requiring substantial amounts of on-terminal storage and efficient landside access by highway and rail. To provide the needed acreage, areas between historic finger piers were filled in, and new terminals were developed in "greenfield" areas, where required land resources and transportation connections could be more easily provided than in developed urban areas.

Perhaps the most significant step in this evolutionary process has been the rise of containerization. From the shipment of the first container in 1956 (from Port Newark), the container has become the dominant means of transporting high-value goods across international and domestic waterways. The reason is that it works – it allows for fast, reliable, seamless, cost-effective transport across both natural boundaries and jurisdictional barriers. The availability of container transport has revolutionized business practices, allowing national supply chains (the receipt of materials for processing into finished goods) and distribution chains (the shipment of finished goods to market) to be transformed into international supply and distribution chains. This in turn has revolutionized retailing, supporting the growth of huge "big box" importers such as Wal-Mart and Home Depot.

Today, millions of containers are shipped each year to and from the U.S. west coast, Gulf coast, and east coast. The PONYNJ is by far the leading container port on the U.S. east coast, and more than 85 percent of PONYNJ containers are shipped through PANYNJ marine terminals in the NJTPA region:

- **Port Newark –** Port Newark Container Terminal and American Stevedoring (which moves containers on barges to and from the Red Hook Container Terminal in Brooklyn);
- **Port Elizabeth –** APM (comprising the former Maersk and SeaLand operations) and Maher Terminals; and
- **Bayonne Peninsula –** Global Marine Terminal.

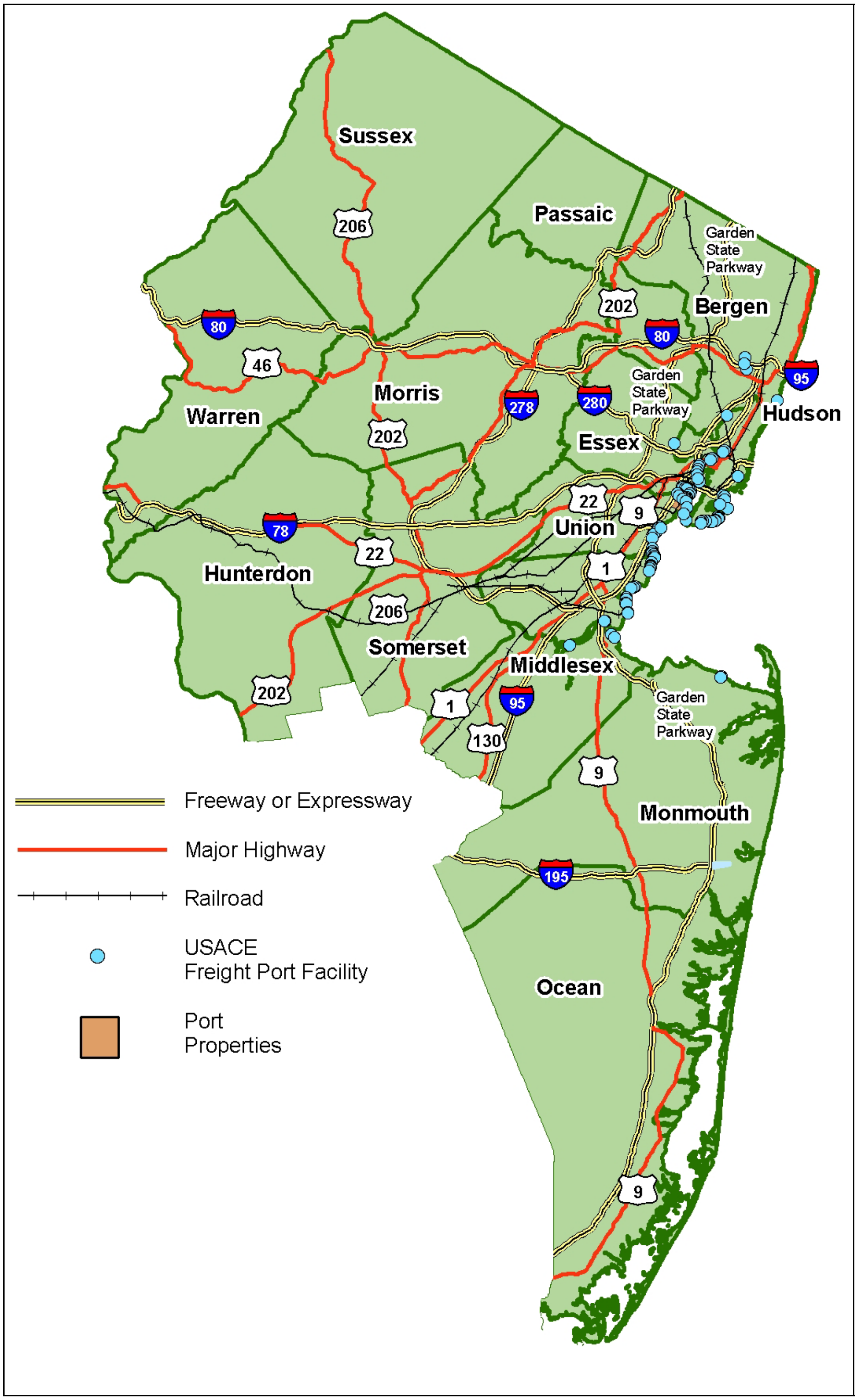
The PANYNJ is also one of the nation's leading automobile handling ports. All of the PANYNJ's major auto handling facilities are located in the NJTPA region:

- **Port Newark –** FAPS (originally known as Foreign Auto Preparation Services), Toyota Motor Logistics Center;
- **Port Elizabeth –** DAS (Distribution and Auto Storage); and
- **Bayonne Peninsula –** NEAT (Northeast Auto Terminal) and BMW.

In addition to these PANYNJ facilities, the NJTPA region hosts privately owned freight handling marine terminal facilities, as identified by the USACE. The locations of these facilities are illustrated in Figures 29 and 30. Other important public facilities in the New York/New Jersey region (not shown) include the Howland Hook Marine Terminal on Staten Island, the Red Hook Marine Terminal in Brooklyn, and the South Brooklyn Marine Terminal.

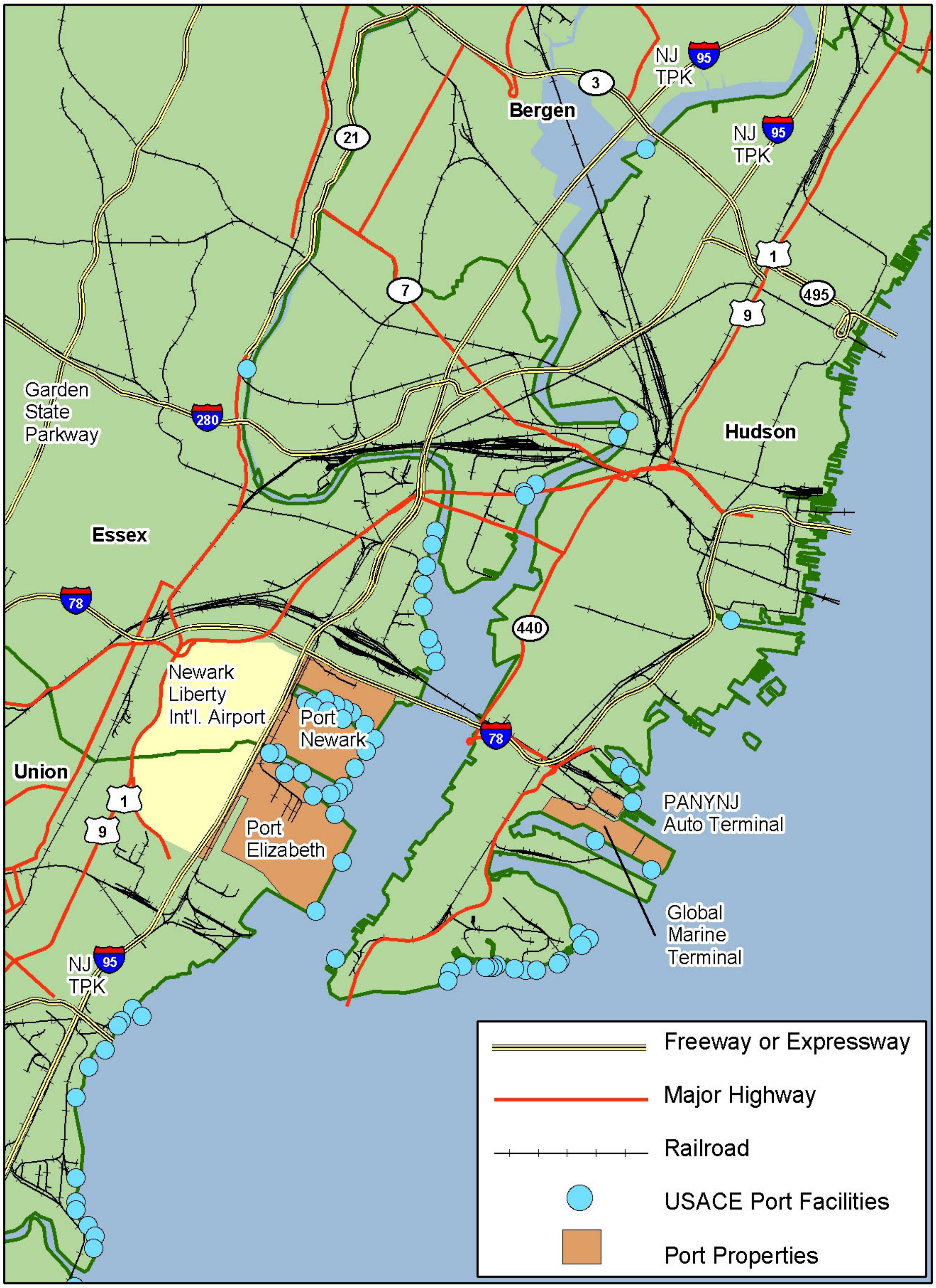
These terminals are supported by an extensive network of highways, rail lines, and navigation channels, all of which are in the process of being improved. Some of the highway and rail improvements have been discussed in previous sections. Channel deepening projects scheduled for completion by 2005 are illustrated in Figure 31, and a project for further deepening of major channels (to 50 feet) is anticipated.

Figure 29. Location of Freight-Handling Marine Terminals in NJTPA Region



Source: U.S. Army Corps of Engineers.

Figure 30. Location of PANYNJ Marine Terminals in NJTPA Region



Source: U.S. Army Corps of Engineers and PANYNJ.

Figure 31. PONYNJ Navigation Channel Improvement Projects

Source: PANYNJ.

3.3.2 Marine Terminal Volumes

Historic and current data on marine freight traffic for the PONYNJ as a whole is readily available from a number of sources, including the American Association of Port Authorities (AAPA), USACE, and PANYNJ. However, the data can be "apples and oranges" depending on the year, the included geography, and the type of cargo being examined. Table 11 provides a portwide breakdown of marine freight tonnage for year 2002 by commodity type, including tonnage of all types. Figure 32 illustrates portwide time-series data for one subset of this tonnage (international import and export tonnage); Figure 33 illustrates portwide time-series data for another subset (international import and export containers).

Table 11. PONYNJ Waterborne Tonnage

Year 2002 (Thousands)

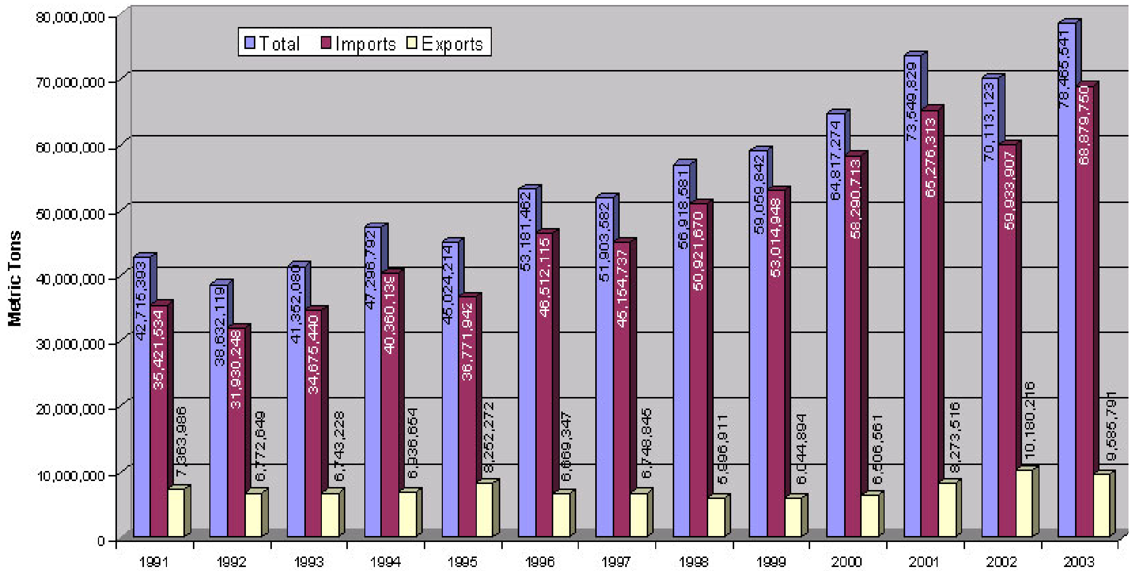
	International		Domestic Coastwise			
	Originating	Terminating	Originating	Terminating	Internal	Total
Petroleum Products	869	23,608	19,645	8,173	24,359	76,654
Crude Petroleum	70	12,068	68	504	558	13,268
All Manufactured Equipment	1,364	6,040	519	238	349	8,510
Other Chemicals	1,175	2,342	348	1,633	664	6,162
Other Agricultural Products	635	4,381	–	955	1	5,972
Soil, Sand, Gravel, Rock, Stone	9	1,917	596	564	2,453	5,539
Lime, Cement and Glass	78	2,346	–	327	411	3,162
Iron Ore and Scrap	1,215	37	81	50	743	2,126
Primary Non-Ferrous Metal Products	1,064	988	–	–	–	2,052
Pulp and Waste Paper	1,986	30	–	–	–	2,016
Coal	1	809	–	1,182	–	1,992
Paper Products	356	708	–	–	–	1,064
Vegetable Products	107	921	–	–	6	1,034
Other Non-Metallic Minerals	28	875	–	–	–	903
Primary Iron and Steel Products	173	337	–	–	–	510
Forest Products	183	320	–	–	4	507
Waste and Scrap	–	–	82	–	420	502
Fish	34	254	–	–	–	288
Processed Grain and Animal Feed	111	132	–	–	–	243
Grain	21	99	–	–	–	120
Primary Wood Products	21	94	–	–	–	115
Oilseeds	15	84	–	–	–	99
Non-Ferrous Ores and Scrap	72	18	–	–	–	90
Sulphur, Clay and Salt	23	56	–	–	–	79
Fertilizers	16	21	–	–	–	37
Slag	2	–	–	–	–	2
Unknown or Not Elsewhere Classified	525	932	–	–	–	1,457
Total	**10,153**	**59,419**	**21,339**	**13,626**	**29,968**	**134,505**

Source: USACE, 2002.

In total, the PONYNJ handled over 134 million tons of commodities in year 2002. Almost 60,000,000 was international import; over 10,000,000 was international export; over 21 million was domestic shipments; nearly 14 million was domestic receipts; and almost 30 million was internal traffic. Petroleum products accounted for more than half of total tonnage – it was around one-third of imports, and dominated coastwise and internal movements. Crude petroleum, manufactured products, and agricultural products were the other leading import commodities.

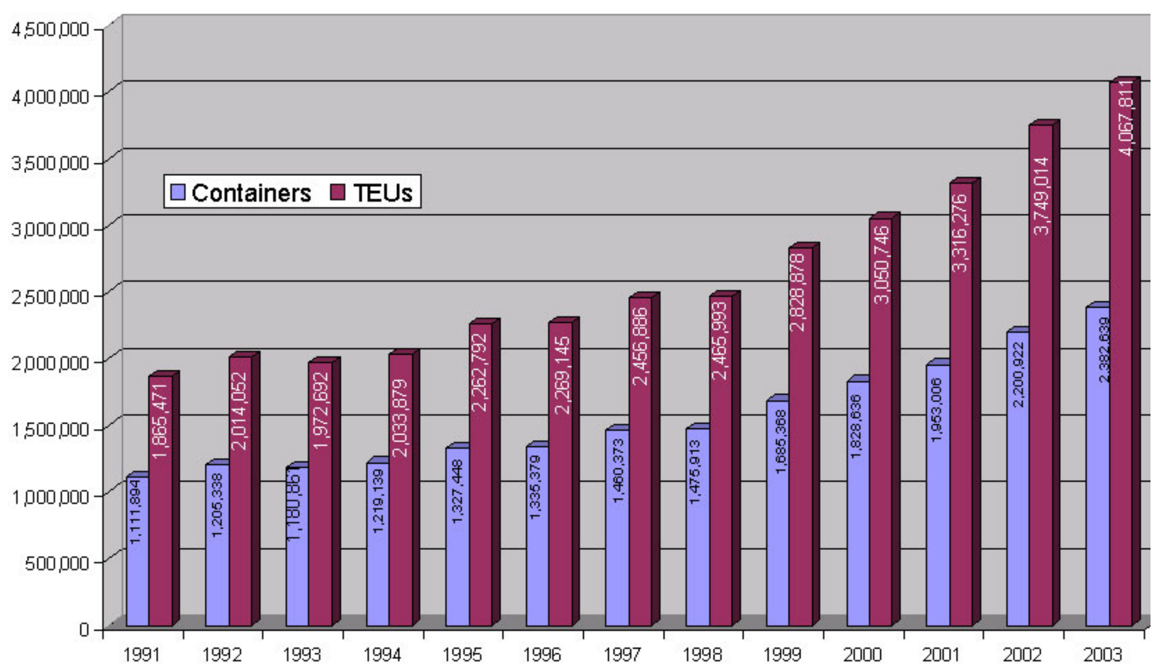
As shown in Figures 32 and 33, PONYNJ international cargo tonnage and container volumes have grown steadily and substantially since 1991, with both setting record highs in year 2003.

Figure 32. PONYNJ International Bulk and General Cargo
1991-2003



Source: PANYNJ.

Figure 33. PONYNJ International Containers and TEUs
1991-2003



Source: PANYNJ.

Determining how much of this tonnage is associated with the NJTPA region is not a trivial task. Excluding inactive facilities and active mooring facilities for passenger boats, fishing boats, and service craft, the USACE database identifies more than 180 freight-handling marine terminals in the entire PONYNJ, of which 75 are located within the NJTPA region. Our estimate of NJTPA waterborne tonnage was summarized in Table 8 previously, and is shown with additional detail in Table 12. International container and auto data is sourced from PANYNJ; domestic coastwise data is sourced from TRANSEARCH; and the remainder has been approximated from USACE data.

Table 12. Estimated NJTPA Waterborne Traffic
2003

	International		Domestic Coastwise			
	Originating	**Terminating**	**Originating**	**Terminating**	**Internal**	**Total**
International Containers (Tons)	5,601,026	11,843,630				17,444,655
International Containers (TEUs)	1,788,090	1,511,327				3,299,417
International Autos (Tons)	70,757	984,758				1,055,515
International Autos (Units)	42,883	596,823				639,706
Crude Petroleum	70,000	12,068,000				12,768,000
Petroleum Products			22,270,749	7,635,800		29,906,549
Chemicals			158,914	1,540,611		1,699,525
Waste and Scrap			2,140,909	3,250,621		5,391,530
Other			37,897	334,509		372,406
Unknown – *approximated only*	*2,094,576*	*20,384,643*			*20,065,160*	*42,544,319*
NJTPA Tonnage Estimate (2003)	**7,836,359**	**45,281,030**	**24,608,469**	**12,761,540**	**20,065,160**	**110,552,558**

Sources: TRANSEARCH 2003, PANYNJ 2003, USACE, 2002.

PONYNJ is the nation's second leading container port complex, behind only the Ports of Los Angeles and Long Beach. While containers appear to represent less than 20 percent of the NJTPA region's waterborne tonnage, they represent a considerably higher share of value and marine terminal revenues; in addition, they are highly visible when they turn into truck trips or "mountains" of empty containers. An important question is: where are all these containers coming from and going to? An analysis of 1998/1999 data by PANYNJ and Moffatt and Nichol, as reported in the Portway Extensions study, found the following distribution:

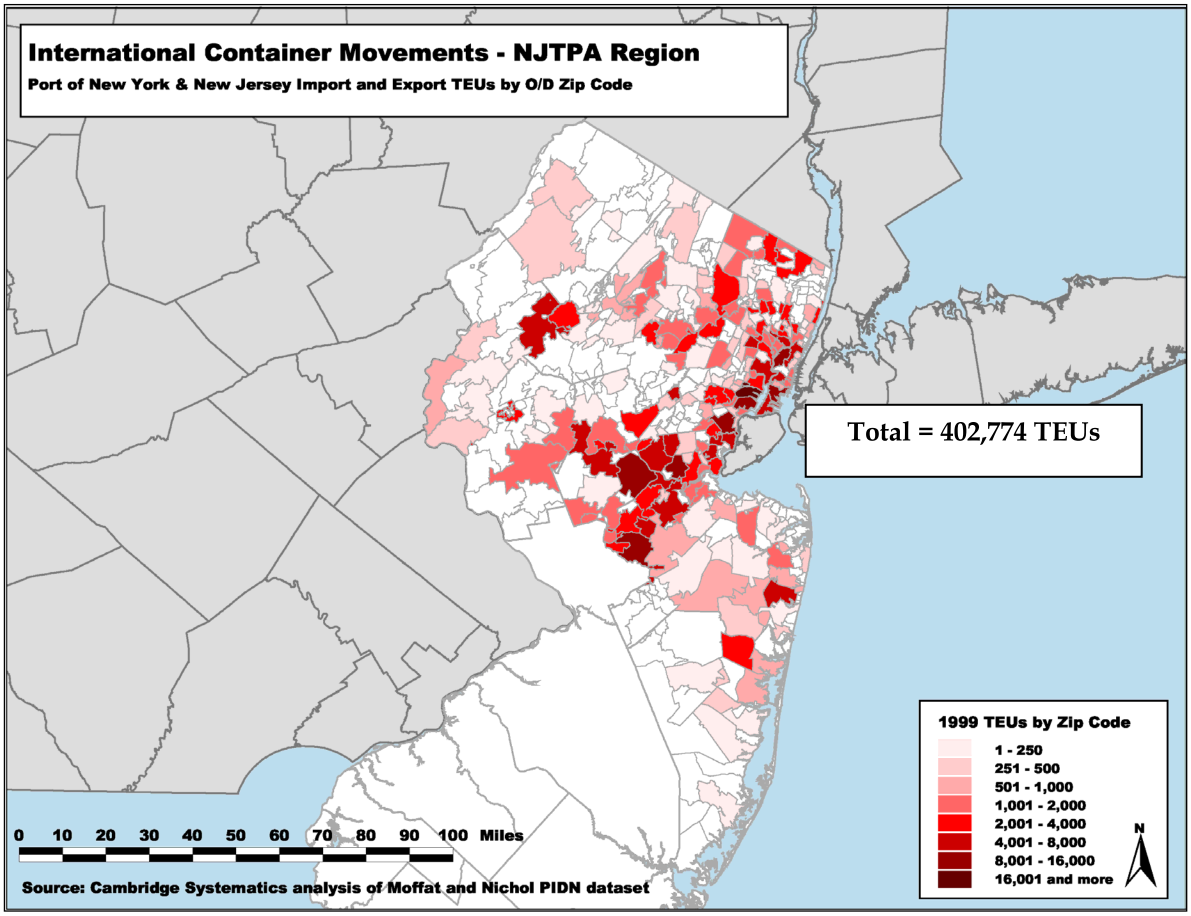
- Thirty-three percent of PANYNJ containers had an origin or destination within 75 miles of the Port;
- Fifty-two percent had an origin or destination between 75 and 400 miles, mostly in a series of "Dense Trade Clusters" (Worcester/Framingham, Hanover, Reading and Camden, Pittsburgh, Hartford and Springfield, Rochester, Albany, Buffalo, and Syracuse); and
- Fifteen percent had an origin or destination beyond 400 miles.

The existence of these dense trade clusters suggested the possibility of developing dedicated transportation corridors to and from the PANYNJ. The PANYNJ has developed a "Port Inland Distribution Network" concept which emphasizes serving dense trade clusters by non-highway modes, using rail and barge services. Several of the rail services are in place, and the PANYNJ has implemented barge service to the Port of Albany. The Port of Bridgeport is close to starting up a barge service to PANYNJ.

For Asian cargo entering the U.S., west coast ports have been the preferred gateways. Substantial numbers of containers are moved from west coast ports to the NJTPA region by rail, in "landbridge" services. In fact, the number of international containers moved to and from the NJTPA region through other U.S. ports is actually greater than the number of international containers moved to and from the NJTPA region through the PANYNJ.

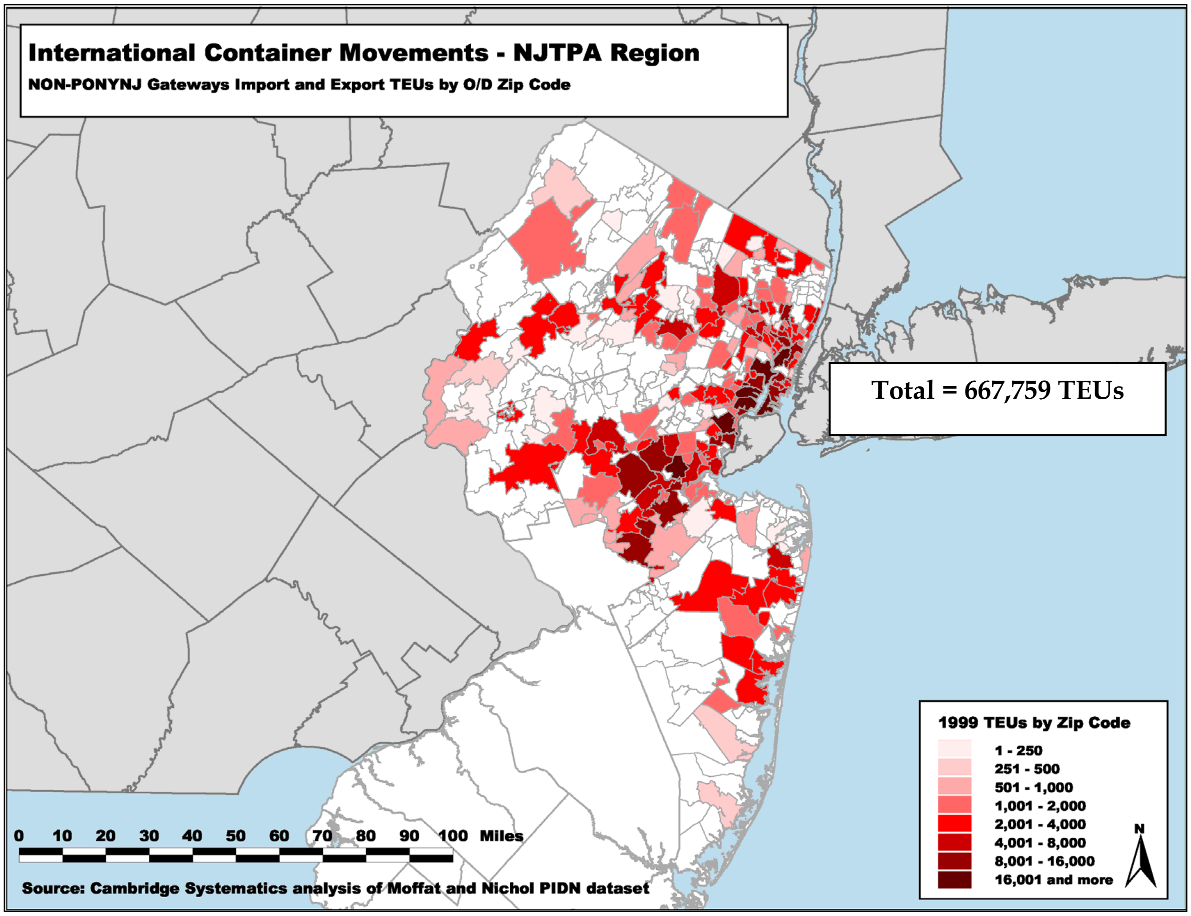
Figure 34. International Containers Imported to/Exported from NJTPA Counties via PONYNJ Marine Terminals

1998/1999



Source: PANYNJ and Moffatt and Nichol, mapped by Cambridge Systematics.

Figure 35. International Containers Imported to/Exported from NJTPA Counties via non-PONYNJ Gateways
1998/1999



Source: PANYNJ and Moffatt and Nichol, mapped by Cambridge Systematics.

3.3.3 Marine Terminal Performance

Over the past decade, container terminal capacity has been one of the most-studied freight questions in the region. All of the various studies have agreed that capacity is a function of a terminal's physical and operational characteristics, in which the physical characteristics (acres of storage, number of berths and cranes, size of the gate, etc.) create a maximum bound for how much the terminal can physically handle, while the operational characteristics (amount of container stacking, amount of yard equipment and labor, hours of operation, amount of time that containers remain on terminal, crane and gate processing efficiency, etc.) how much of this maximum bound can be achieved in practice.

Beyond a certain point, it becomes increasingly difficult and costly to squeeze more capacity out of a terminal; the question of how far an operator wants to push the terminal depends largely on the profitability of doing so. Capacity is almost always presented as a static engineering measure, but it might be better characterized as a dynamic business measure – a measure of how much throughput a terminal operator can profitably handle, given his/her physical and operational assets and costs.

Throughout the 1990s, we saw west coast ports push more through their terminals than was previously thought possible in the U.S., and since then we have seen east coast ports make comparable gains. As a result, recent estimates of container terminal capacity for the PONYNJ properly assume more intensive operation and greater utilization of physical assets, and show more available capacity, than older estimates did.

The two most important recent studies of port capacity were done under the *PONYNJ Comprehensive Port Improvement Plan* (CPIP) and the U.S. Army Corps of Engineers' *Harbor Navigation Study and Limited Reevaluation Report*. The CPIP analysis estimates places current PONYNJ container capacity at around 8 million TEUs annually, while the USACE estimates year 2010 capacity (with ongoing/anticipated improvements) at 7.9 million TEUs.

Recent estimates by Moffatt & Nichol are consistent with the above, indicating capacity to be in the 4.7 million lift (8 million TEU) range, after completion of the existing port redevelopment effort and a relatively short "learning curve" period. Overall, the consensus is that the PONYNJ has sufficient capacity to handle its existing container volumes (4,067,811 TEUs in 2003) and accommodate some measure of future growth, pending completion of currently planned improvements.

Automobile terminal capacity has also been studied, but to a lesser extent. Generally, studies have indicated the need to add auto terminal acreage and/or improve facility throughput to accommodate future volumes, but have found existing capacity adequate to current levels of demand.

Capacity for other types of cargo has not been comprehensively studied. Many, if not most, of the non-container/non-auto terminals are privately owned and operated. Growth rates for non-container/non-auto terminals have been relatively low – in the 1 percent to 2 percent per year range – so there has been less stress on terminal infrastructure, compared to containers, which have grown at a rate of 7.5 percent per year since 1993.

3.4 Air Cargo

3.4.1 Role of Air Cargo in Regional Freight Transportation

Air cargo is primarily focused on the movement of high-value, light-weight, time-sensitive commodities – perishables, equipment and instruments, high-end consumer goods, and printed information. Air cargo relies almost exclusively on trucking for its last-mile connections, and in some cases trucking can be used for longer segments of an "air cargo" trip. Air cargo is vital in providing the NJTPA region's shippers with access to domestic and international markets, and in providing its consumers with access to a wide range of goods and services.

Air cargo is typically handled in several ways:

- All-cargo airlines;
- Integrated carriers, who manage and coordinate both air and truck fleets; and
- Passenger carriers, who carry cargo in the aircraft hold (also known as "belly cargo").

Newark Liberty International Airport (EWR) is the hub of air cargo activity for the NJTPA region and the overnight/small package center for the larger bistate area. Operated by the Port Authority of New York and New Jersey, EWR is also one of the largest hubs of air cargo activity in the world. The airport focuses primarily on domestic cargo movement through integrated carriers, such as FedEx, UPS, and the U.S. Postal Service. With the increasing amount of international aircraft activity at EWR, international cargo activity has also developed. However, John F. Kennedy International Airport (JFK) in New York remains the leading international cargo facility in the bistate region.

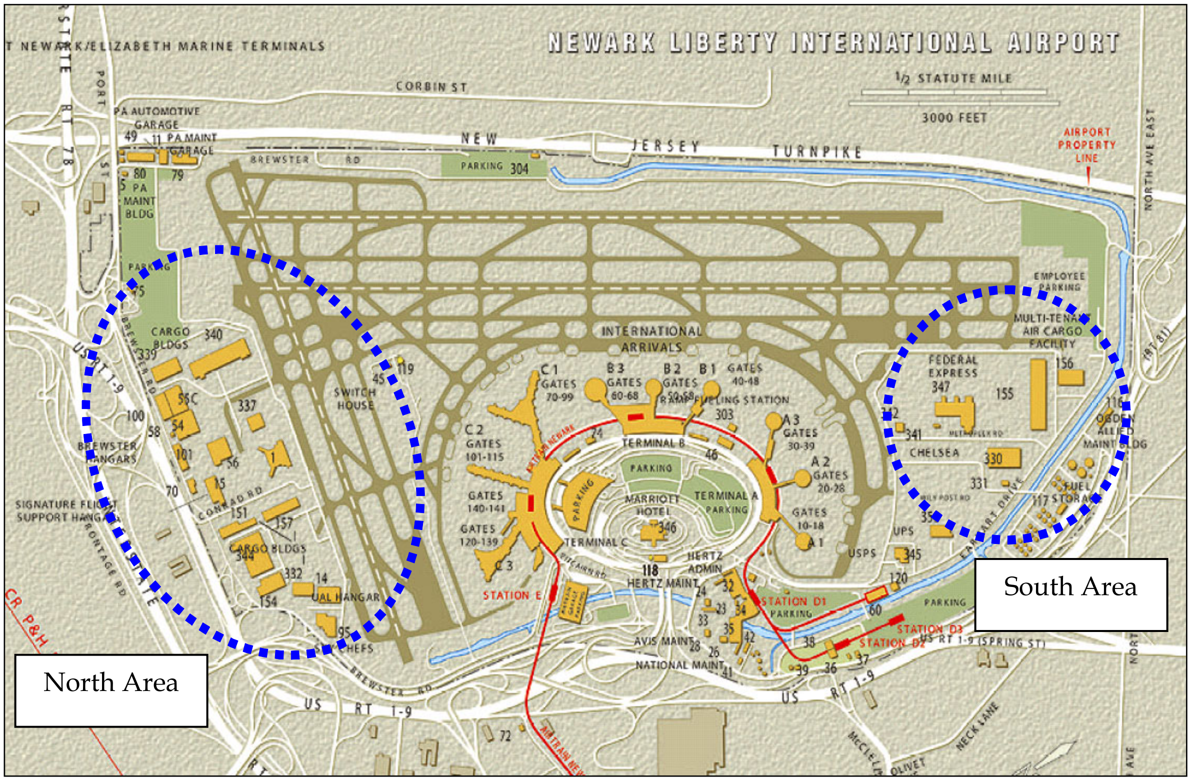
The air cargo-related facilities in the NJTPA region consist of:

- On-airport facilities at EWR;
- Air cargo facilities in the immediate vicinity of the airport (also known as "through the fence" operations); and
- Air cargo forwarder facilities, which are generally located within a 30-minute drive time to the airport.

EWR has 290 acres and nearly 1.4 million square feet of space devoted to cargo activity on the north (Essex County) and south (Union County) sides of the airport, including:

- The FedEx Cargo Complex (South Area), which was completed in 1995 and includes three buildings. This complex, known as the Newark Regional Hub, is a key national facility for FedEx and services the entire bistate area.

Figure 36. Air Cargo Facilities at Newark Liberty Airport



Source: PANYNJ.

- The UPS package handling and distribution center (South Area) was completed in 1987. The facility occupies 28 acres.
- The USPS Facility (South Area). This $2.6 million, 36,000-square-foot Postal facility opened in 1983.
- The Airis International Air Cargo Center (North Area). Built on the site of the former North Terminal, the Center consists of two buildings containing 192,000 square feet, which opened in 1998, and 76,000 square feet, which opened in 1999.
- The United Airlines Cargo Facility (North Area). This facility contains 42,000 square feet of cargo area and 7,300 square feet of office space. The building was completed in 2001.
- The Continental Air Cargo Facility (North Area). This 110,000-square-foot facility was completed in 2001.
- The Port Authority Multi-Tenant Cargo Building, which was completed in the North Area in 2003.

Additional air cargo-related operations exist in the area immediately adjacent to the airport on the south side in Elizabeth, New Jersey. This location balances easy access to the airport with far less expensive lease rates. With on-airport space increasingly constrained, the Elizabeth area provides needed capacity to allow the continued growth of cargo activity at the airport.

3.4.2 Air Cargo Volumes

EWR cargo volumes peaked at around 1.2 million from 1997 to 2000. In 2000, EWR was ranked 18th in the world in terms of cargo activity. Memphis, Tennessee ranked first in the world and handled almost 2.5 million tons of air cargo in 2000. Memphis is the key hub for FedEx. JFK was ranked 6th and handled 1.8 million tons.

Air cargo activity declined in 2001 concurrent with the recession and the events of September 11. EWR dropped to less than 900,000 tons in 2001, but has recovered business since then, with 937,010 tons in 2002 and 964,117 tons in 2003. In 2003, EWR ranked 21st among world cargo airports. Memphis continued as the leading cargo facility, handling nearly 3.4 million tons. JFK also dropped in rank to 11th, handling 1.6 million tons.

3.4.3 Air Cargo Facilities Performance

Generally, air cargo facilities at Newark Liberty Airport are considered adequate for current levels of demand; from review of available information and discussions with PANYNJ and industry stakeholders, we are not aware of any significant capacity issues.

3.5 Warehouse and Distribution Facilities

3.5.1 Role of Warehouse and Distribution Facilities

Warehouses and distribution centers are an often overlooked element of the freight transportation system. Nevertheless, these facilities play a key role in goods distribution and the NJTPA region.

Warehouses and distribution centers (DCs) are defined as structures that are primarily used for the receipt, temporary storage, possible modification/customization, and distribution of goods that are en route from production sites to where they are consumed. Warehouses and DCs are often sites where value is added to the products moving through them. Examples of value added activities include final assembly and customization of products and preparing products for the sales floor (including packaging and tagging).

Warehousing operations vary considerably in size, ranging from just a few thousand square feet to buildings that are over 1 million square feet. Warehouses may contain temperature-controlled space, which is essential for maintaining perishable food.

Warehouses and DCs can be located at or adjacent to airports and ports to support cargo operations. Warehouses may also have rail sidings for the receipt or shipping of products. The vast majority of the freight moving from warehouses and distribution centers tends to be handled by trucks.

Warehouses and distribution centers in the NJTPA region serve the area, the surrounding states, and North America. The region has one of the highest concentrations of warehousing and distribution center space in North America and is considered a key location for this activity in the U.S.

Figure 37 shows the location of the largest warehouse and distribution facilities in the region, as reported by the InfoUSA database. The largest warehouse concentrations are located in Bergen, Hudson, Essex, Union, and Middlesex counties. However, other counties also host substantial warehouse and distribution center activity. By following the warehouse locations, it is possible to trace out the alignments of many of the region's major freight roads – the Turnpike, I-80, I-78, I-287, U.S. 1, U.S. 9, U.S. 17, etc.

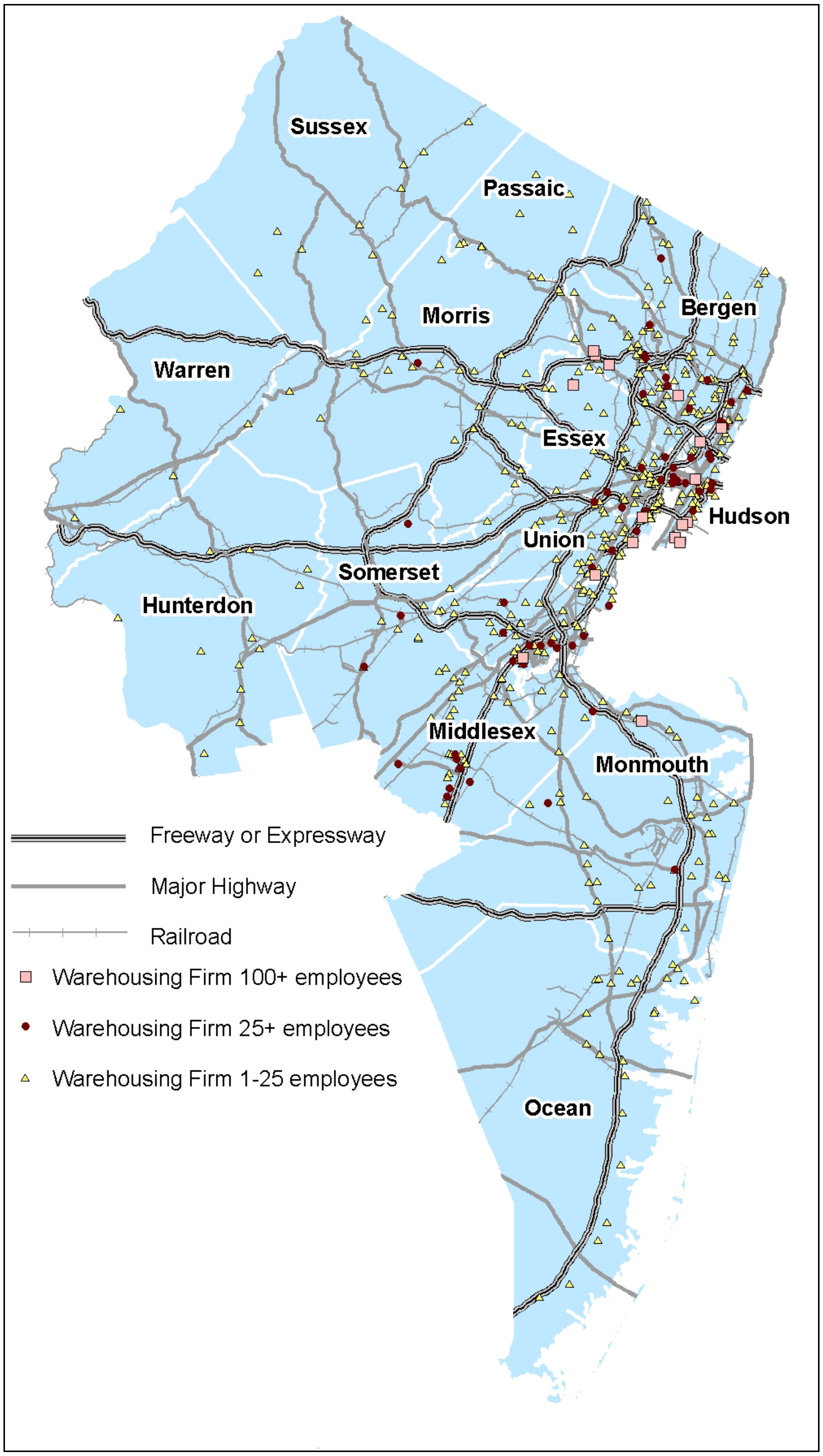
It should be noted that this data does not include private warehouses operated by wholesalers and retailers (Barnes and Noble, etc.), which have a substantial presence in the region.

3.5.2 Warehouse and Distribution Facilities Volumes

The northern and central New Jersey region contains over 778 million square feet of industrial property, with an additional 5 million square feet currently under construction. Much of this space – an estimated 670,000,000 square feet in the NJTPA counties – consists of warehouses and distribution centers. It is estimated that nearly 422,000 people work in New Jersey warehouses and distribution centers, making this activity one of the leading job generators in the State.

Since the third quarter of 1998, the NJTPA region has added 70 million square feet of space, primarily consisting of warehouses and distribution centers. The availability rate has decreased, dropping from over 10 percent to less than 7 percent despite all of the new construction. The average asking lease rate has generally increased throughout the region. Older industrial structures are being demolished or converted to other uses. The new construction, increasingly oriented towards warehousing and distribution, has provided the region with state-of-the-art capacity.

Figure 37. Location of Major Warehouse and Distribution Facilities



Source: InfoUSA.

Table 13. Current Industrial Square Footage
Second Quarter 2004

Market	County	Existing Space	Available Space	Under Construction	Average Asking Lease Rates
Hudson Waterfront	Hudson	65,628,292	5,906,546	300,000	$6.33
Central Bergen	Bergen	34,713,247	2,048,082		$7.01
Fairfield Market	Essex	18,630,932	1,658,153		$7.25
Meadowlands	Hudson/Bergen	100,598,341	9,556,842	249,760	$6.47
Morris Region	Morris	41,899,557	3,226,266	210,000	$6.87
Newark	Essex	50,146,927	2,056,024		$4.87
North East Bergen	Bergen	7,244,733	391,216		$7.56
North West Bergen	Bergen	19,418,918	1,534,095		$6.93
Route 23 North	Passaic	396,300	128,005		$4.21
I-280 Corridor	Essex	3,558,290	14,233		$–
46/23/3 Interchange	Passaic	57,296,903	3,437,814		$5.90
Suburban Essex	Essex	14,014,421	490,505		$5.38
Brunswick/Exit 9	Middlesex	24,877,356	1,268,745	43,776	$4.73
Carteret/Avenel	Union/Middlesex	18,549,486	1,372,662		$5.18
Central Union	Union	24,679,670	1,159,944		$6.39
Exit 8A	Middlesex	49,974,989	4,897,549	101,266	$4.96
Hunterdon	Hunterdon	2,843,335	966,734	57,400	$3.37
Linden/Elizabeth	Union	3,404,656	2,883,851	22,000	$4.71
Monmouth	Monmouth	23,941,970	454,897	286,301	$10.03
Princeton	Mercer/Somerset	8,791,388	703,311		$5.66
Route 287/Exit 10	Middlesex	97,654,625	5,273,350	1,184,500	$4.77
Route 78 East	Union/Somerset	9,313,791	325,983		$5.01
Somerset	Somerset	35,669,520	1,926,154		$6.54
Trenton/I-295	Mercer	15,282,416	1,314,288		$5.49
Total North/Central New Jersey		**778,530,063**	**52,995,249**	**5,455,003**	**$5.82**

Source: CB Richard Ellis.

4.0 Future System Conditions

4.1 Growth Forecasts

Year 2025 forecasts were initially developed for each component of the freight transportation system examined in Section 2.0 – highways, rail, seaports, airports, and warehouse and distribution – to allow us to make some judgments about the adequacy of future freight infrastructure and operations, and to highlight areas where improvement and attention is most critical. The forecasts were drawn from:

- The Federal Highway Administration's *Freight Analysis Framework* (truck and rail);
- The New York/New Jersey *Comprehensive Port Improvement Plan* (CPIP) and U.S. Army Corps of Engineers *Harbor Navigation Study* (marine terminals);
- The PANYNJ *Port Inland Distribution Network* (PIDN) study (marine terminal-generated truck and rail);
- The *NJDOT Portway Extensions and CMS* (marine terminal-generated truck and rail based on CPIP marine terminal forecasts, plus regional travel demand forecasts for all vehicle types within the Portway Extensions model); and
- Industry and facility trendlines interpreted and extrapolated by the FSPAS team (air and warehouse) based on anticipated future conditions.

Within the NJTPA region, there are several different forecasts available for marine terminals. We have developed two alternative forecasts: one based on CPIP and one based on the Harbor Navigation Study. These are intended as what-if scenarios.

- CPIP assigns a certain amount of international container arrivals to over-the-wharf handling at the region's marine terminals, and the remainder to rail and truck arrivals from other U.S. gateways. This is our **Forecast Scenario 1**.
- The USACE forecasts assign more containers to the marine terminals, and is silent on the issue of rail handling. We assumed that total international container arrivals would be the same as under CPIP, and reduced the volumes from other U.S. gateways by an equivalent amount. This is our **Forecast Scenario 2**.

The two scenarios produce different results for international container handling through the region's marine terminals, as well as different results for truck and rail volumes and routings generated by international container handling. Additionally, the landside handling of international containers is expected to change over time – favoring substitution of rail and barge for truck – under the PANYNJ's Port Inland Distribution Network (PIDN) initiative. Forecast Scenario 1 reflects initial PIDN projections (PIDN Version 1) while Scenario 2 reflects revised projections (PIDN Version 2) with reduced truck substitution.

Apart from this difference in the treatment of international containerized freight, the two forecast scenarios are identical. Marine traffic other than international containers was forecast using total tonnage trendline estimates developed for the *NYMTC Regional Freight Plan*. Highway forecast growth rates were taken from those incorporated in the Portway Extensions model, which integrated several different forecast sources (point-source facility forecasts, TRANSEARCH and U.S. DOT Freight Analysis Framework, and legacy models). Rail forecast growth rates were developed using the U.S. DOT's Freight Analysis Framework projections. Growth in air cargo is a significant uncertainty, but a planning-level forecast estimate was developed by this consultant team based on trendlines and reasonably foreseeable activity. Growth in warehousing is expected to be proportional to overall growth in container-related truck trips, consistent with the approach taken for the Portway Extensions project.

There is substantial interaction and overlap among the various modal forecasts, because movements in one mode – such as water – generate corresponding movements in other modes. The integration of forecast elements is summarized in Table 14.

Table 14. Forecast Elements and Sources

Mode	Type	Forecast Source
Waterborne	International Container	Adjusted CPIP and USACE forecast scenarios
	Other Freight	Trendline (from NYMTC Regional Freight Plan)
Highway	International Container	Adjusted CPIP and USACE forecasts and PIDN mode shares
	Other Freight	Portway Extensions Model
	Background Non-Freight	Portway Extensions Model
Rail	International Container	Adjusted CPIP and USACE forecasts and PIDN mode shares
	Other Freight	U.S. DOT Freight Analysis Framework
Air	All Freight	Trendline and planning-level assessment
Warehouse	All Freight	Consistent with growth in container-related truck trips

Working with different modes, base years, forecast sources, units, and analytical tools necessarily introduces some level of inconsistency, but we have worked to try and synthesize an overall multimodal forecast that coordinates the various elements, corresponds generally to current and anticipated conditions based on available information, and serves as a useful platform for "big picture" freight system evaluation.

In particular, it should be noted that Forecast Scenario 1 is actually based on a modified version of the CPIP forecast ("2025 high") that was developed for the Portway Extensions project in cooperation with the CPIP planning team. The modified forecast is accelerated by five years versus CPIP's base forecast, and also assumes expansion of Global/MOTBY, which CPIP did not. To develop Forecast Scenario 2, the USACE forecast growth rate was substituted for the CPIP growth rate, and all other assumptions were kept constant; this was necessary to allow the team to adjust the Portway Extensions highway model (which was based on the modified CPIP forecast) to test the alternative USACE forecast. Furthermore, we have tried to isolate growth expected in the NJTPA region rather than port-wide. As a result, the total maritime volumes in Forecast Scenarios 1 and 2 do not correspond exactly to published CPIP and USACE forecasts.

The forecasts were initially developed for year 2025 due to the availability of previous forecasts using that horizon, and were linearly extrapolated to year 2030 for consistency with NJTPA planning requirements. Forecasts of container traffic by water and by rail are presented in TEUs, and can be converted to tons if desired using the rule of thumb of 7 tons per TEU. Forecasts of highway traffic are presented in vehicle miles of travel (VMT) rather than tons or TEUs, to allow for meaningful comparisons with auto traffic.

Finally, the forecasts presented in Table 15, it must be emphasized, are unconstrained – that is, they represent the amount of traffic that could be anticipated based on demand, assuming that sufficient capacity is available to realize that demand.

Table 15. Unconstrained Freight Forecasts for NJTPA Region

Mode	Type	Annual Growth	Base Year Volume (NJTPA Region)	Year 2025 Forecast	Year 2030 Extrapolated
Marine (PANYNJ and private terminals)	Int'l Container, Scenario 1	3.5%	2,798,578 TEUs (2001)	6,398,107	7,600,933
	Int'l Container, Scenario 2	4.6%	2,798,578 TEUs (2001)	8,236,786	10,314,037
	Other Freight (approx.)	1.4%	93,107,904 tons (2003)	126,421,680	135,522,478
Rail (ExpressRail and private terminals)	All Container, Scenario 1	5.6%	1,827,734 TEUs (2003)	6,015,930	7,886,628
	All Container, Scenario 2	3.9%	1,827,734 TEUs (2003)	4,177,251	5,173,524
	Non-Container	2.4%	12,819,526 tons (2003)	21,826,764	24,632,927
Highway (a.m. peak over Portway Extension model network)	All Container, Scenario 1	3.0%	34,785 VMT (2000)	72,669	84,206
	All Container, Scenario 2	3.2%	34,785 VMT (2000)	76,344	89.341
	Other Trucks (average)	2.1%	328,864 VMT (2000)	551,409	611,456
	Non-Truck (average)	1.3%	10,545,579 VMT (2000)	14,678,449	15,682,023
Air	All Freight Inc. Air-Truck	2.5%	964,117 tons (2003)	1,659,796	1,877,907
Warehouse	Warehouse Space	2.8%	671,218,968 sq. ft. (2004)	1,198,725,181	1,376,211,561

Sources: Comprehensive Port Improvement Plan, USACE Harbor Navigation Study, NJDOT Portway Extensions, U.S. DOT Freight Analysis Framework, NYMTC Regional Freight Plan, and Cambridge Systematics/Edwards and Kelcey/A. Strauss-Weider/Moffatt and Nichol.

4.2 Implications for Future Highway Conditions

4.2.1 Highway

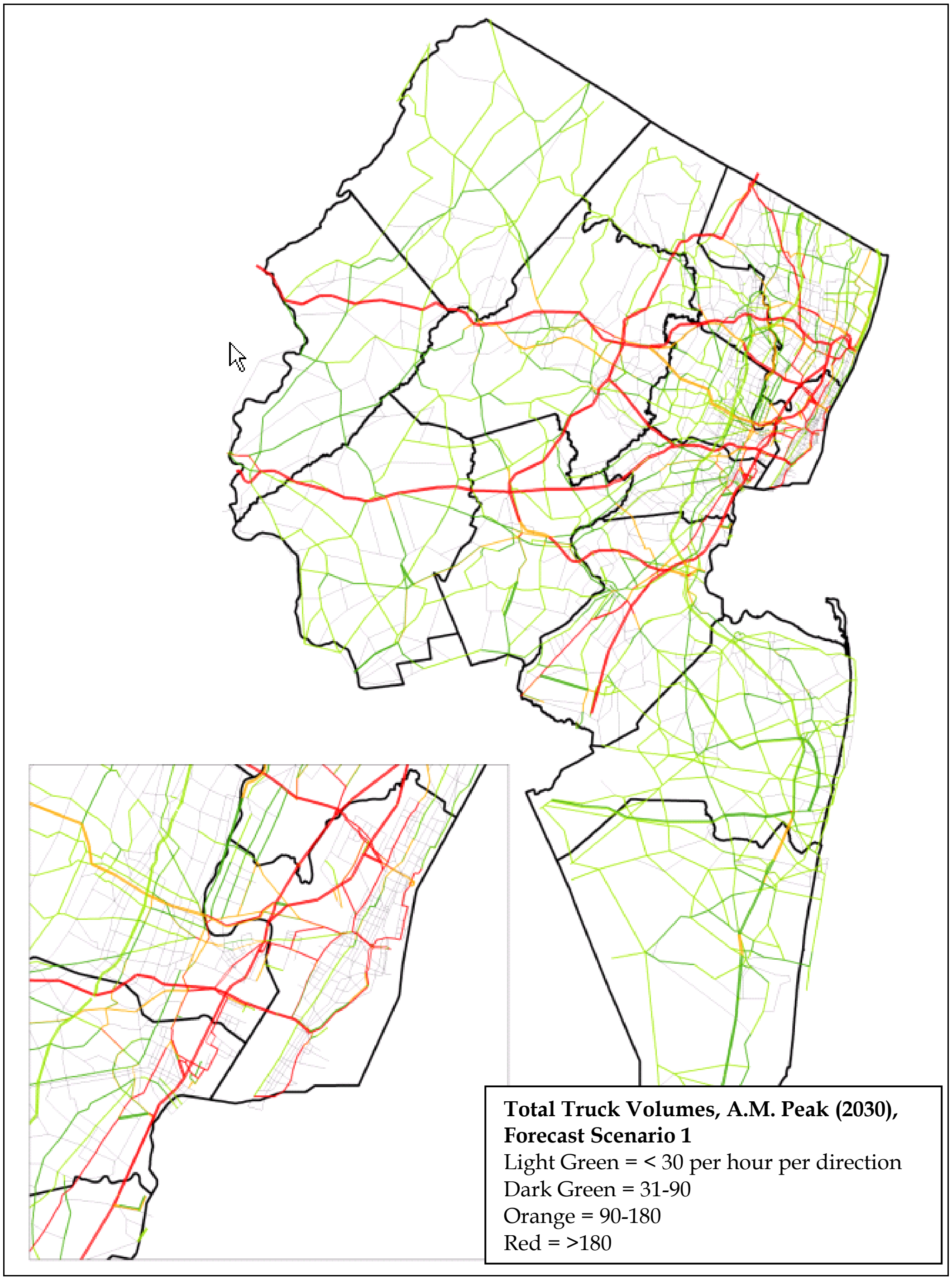
As indicated on Table 15, the highest growth rates for highway VMT will be realized by container trucks – 3.0 percent annual growth under Scenario 1, and 3.2 percent under Scenario 2. The differences between the two scenarios are fairly modest, because in both scenarios, the same number of containers are arriving in and departing from the NJTPA region – the difference is how many come through PONYNJ versus other gateways, and what share is assumed to be divertable to non-truck (rail or barge) modes for movement to/from the region. Overall, container truck VMT under both scenarios will lag growth in international waterborne containers, because of the mitigating impact of PIDN improvements, which would substitute rail and barge services for a substantial share of port-serving container truck trips. The Scenario 1 forecasts were developed initially as part of Portway Extensions, using a fairly aggressive PIDN forecast; the Scenario 2 forecasts were developed specifically for this study and use the most current PIDN forecast, which is somewhat less aggressive. This results in slightly less diversion of truck traffic to rail and barge for Scenario 2, and produces slightly higher container truck VMT growth.

Container trucks are enormously important to the region's economy, but actually represent a relatively small share of peak-hour VMT. For base year 2000, container trucks represent around 35,000 VMT in the a.m. peak; other truck types (combination, single-unit/van, and non-commercial) represent around 329,000 VMT; and non-truck traffic (all other vehicle classes) represents over 10,500,000 VMT. Growth in non-container trucks (2.1 percent annually) and in non-truck traffic (1.3 percent annually) will generate the greatest impacts on the region's highway system. The differences between Scenario 1 and Scenario 2 are not highly significant from a highway perspective.

Interestingly, the model suggests that overall truck VMT will grow substantially faster than non-truck VMT, which is very consistent with national forecasts. This is largely a function of changing freight logistics and utilization patterns at the national level – per capita, we are moving more goods, through more facilities, over longer distances.

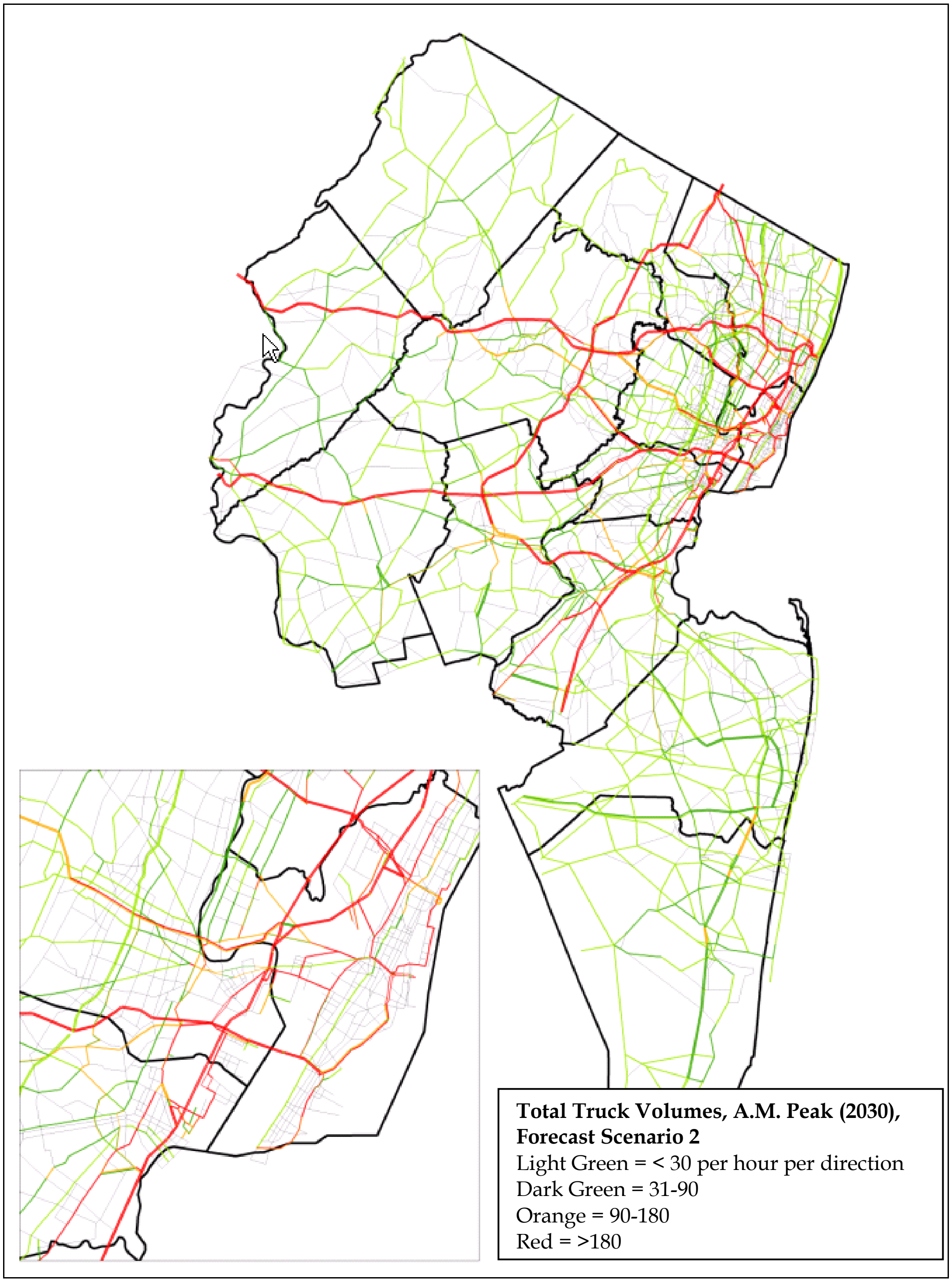
We assigned the year 2030 projected traffic onto the year Portway Extensions highway network without improvements, and without allowing traffic (freight or non-freight) to shift out of the peak periods or change modes. The year 2030 highway network included several highway improvements in the vicinity of Port Newark/Elizabeth (the NJDOT "Portway Phase I" program) but no other regional projects. The intent was to describe a "worst case scenario." Review of Figures 38 through 47 suggests that we were more successful than we'd hoped to be – basically, a huge portion of the NJTPA highway system shifts into the "unacceptable" level of service category, and the contributions of trucking to this shift are substantially increased compared to base year 2000. There are some interesting differences in the location of impacts between the two forecast scenarios, but the overall message is consistent and clear.

Figure 38. Modeled A.M. Peak Truck Volumes
2030, Scenario 1



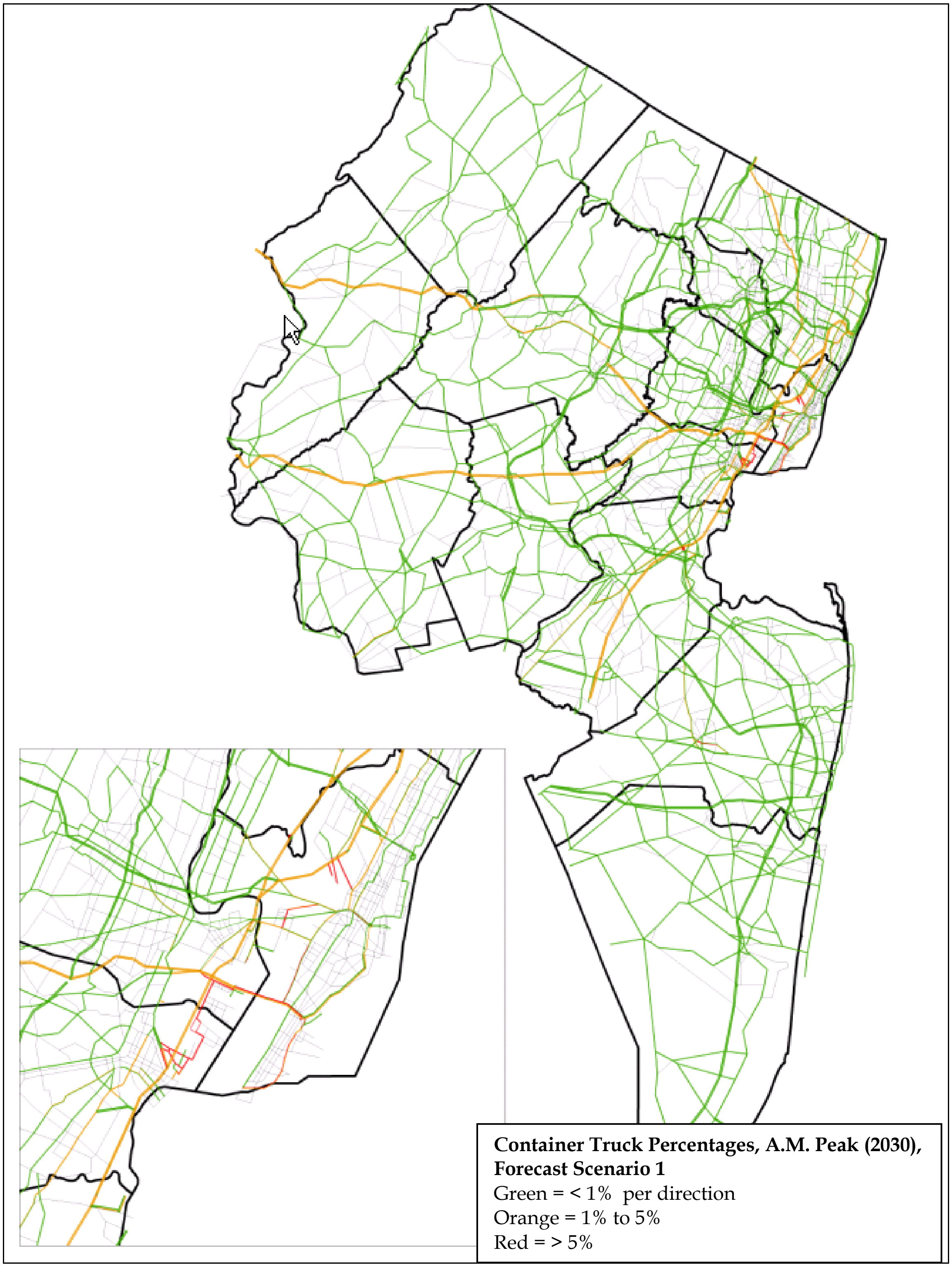
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 39. Modeled A.M. Peak Truck Volumes
2030, Scenario 2



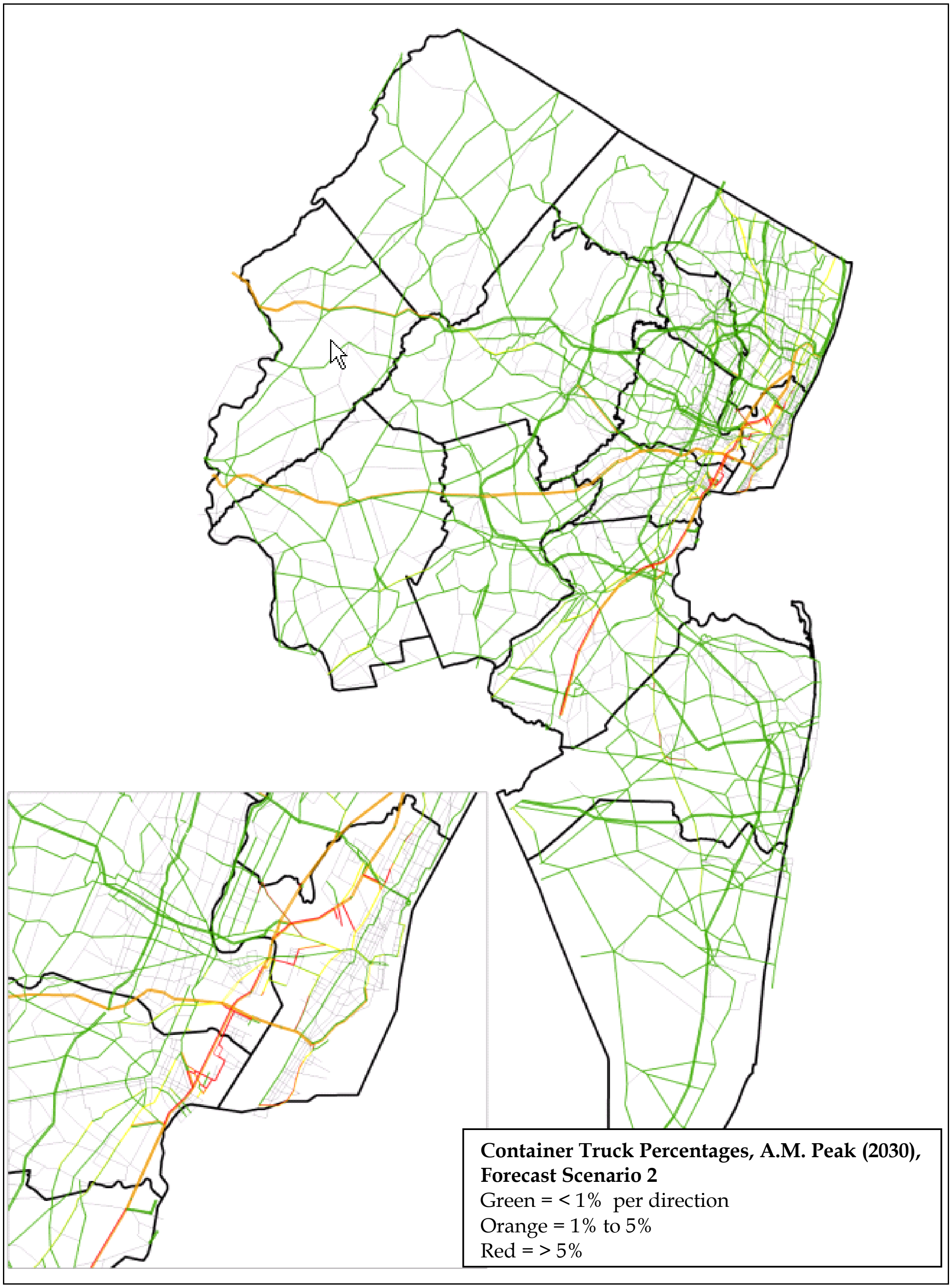
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 40. Modeled A.M. Peak Container Truck Percentages
2030, Scenario 1



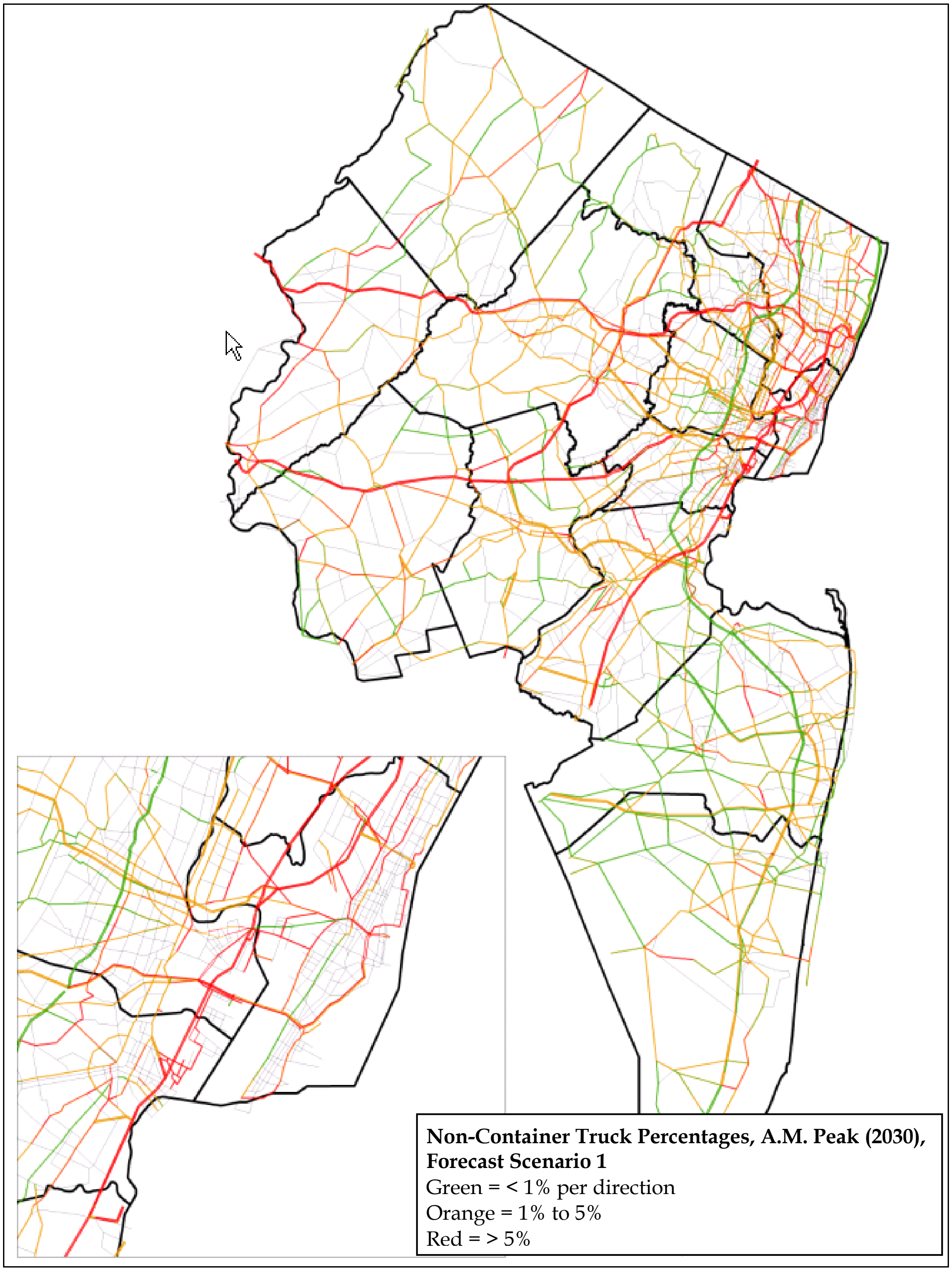
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 41. Modeled A.M. Peak Container Truck Percentages
2030, Scenario 2



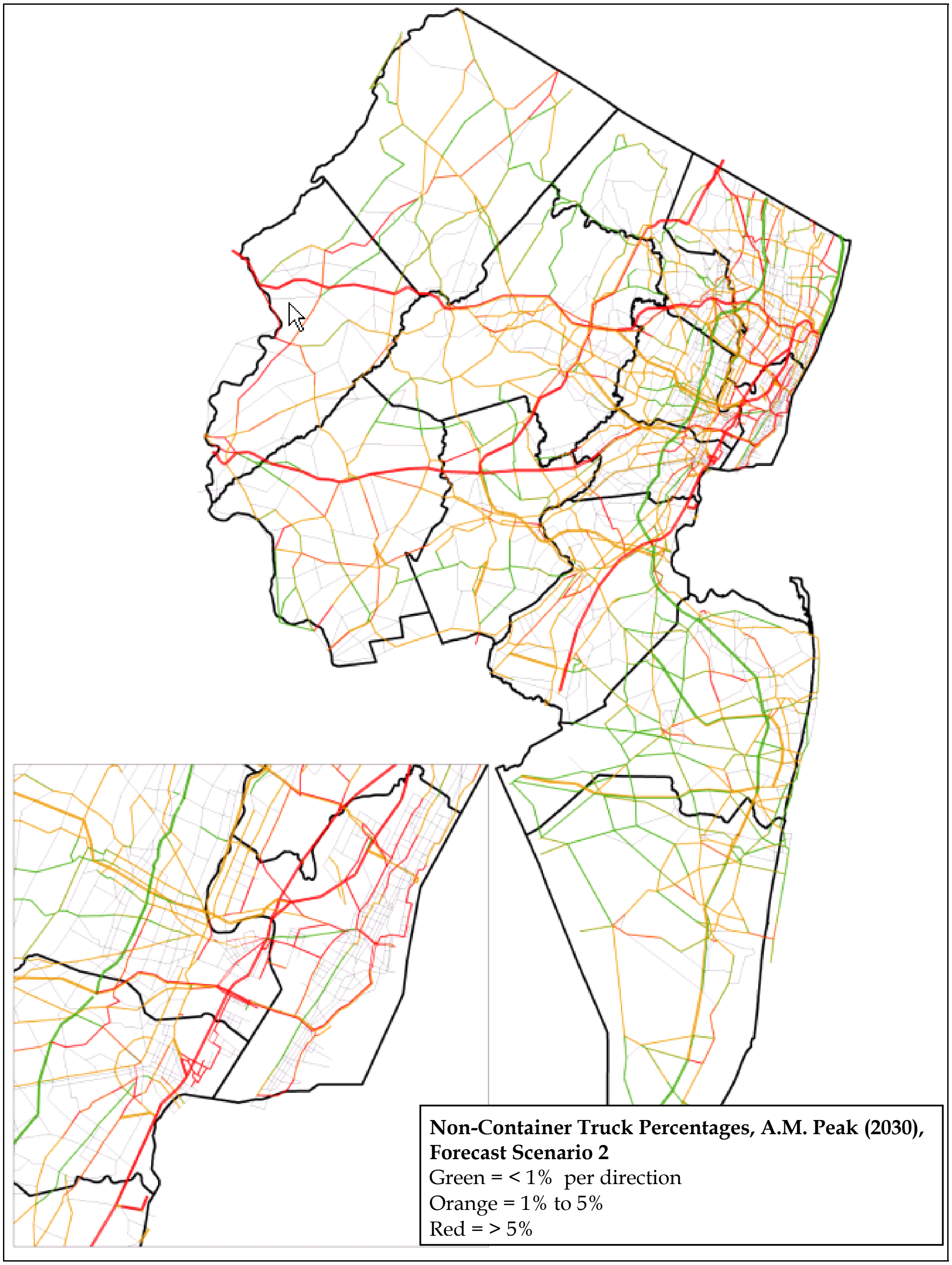
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 42. Modeled A.M. Peak Non-Container Truck Percentages
2030, Scenario 1



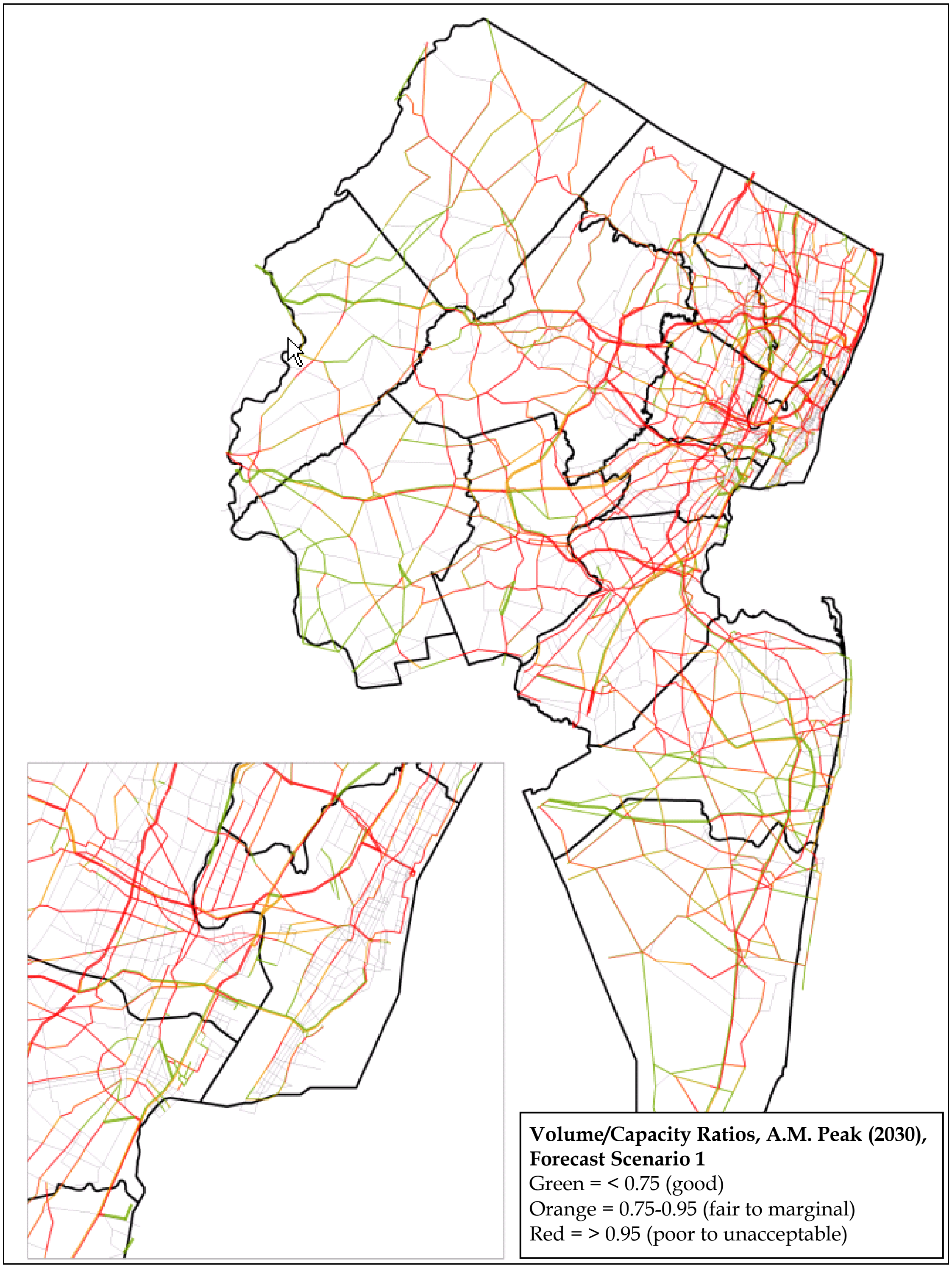
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 43. Modeled A.M. Peak Non-Container Truck Percentages
2030, Scenario 2



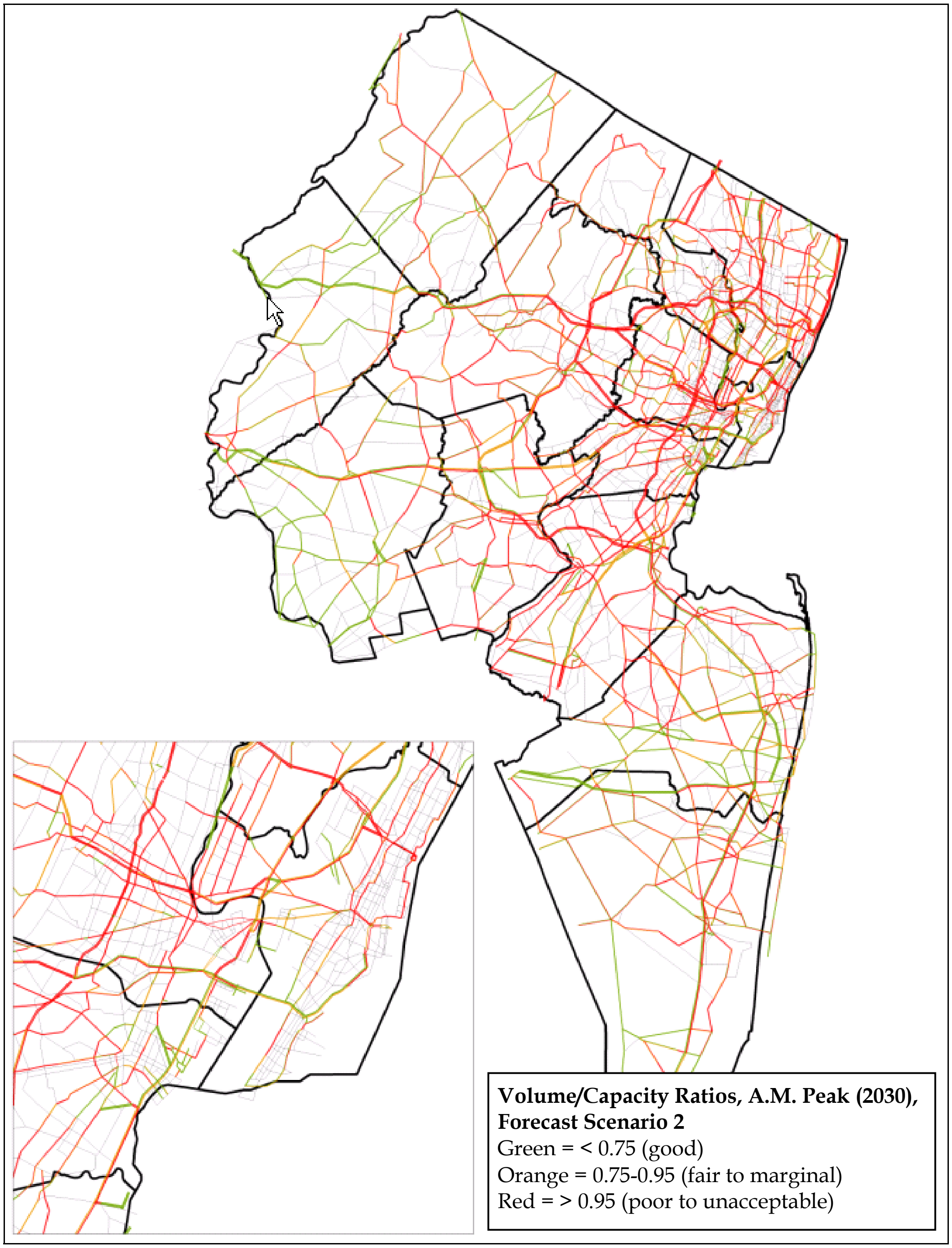
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 44. Modeled A.M. Peak Level of Service
2030, Scenario 1



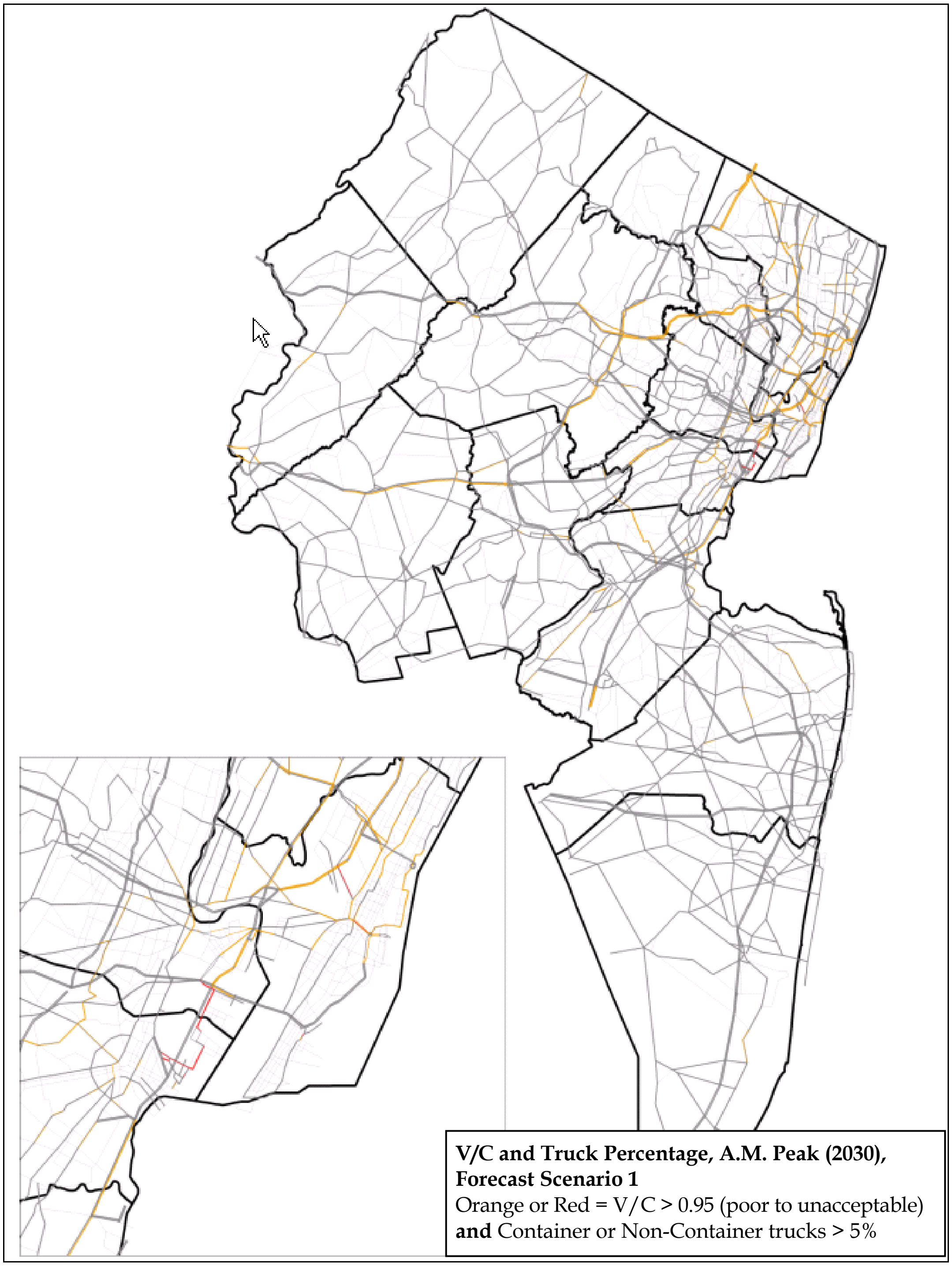
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 45. Modeled A.M. Peak Level of Service
2030, Scenario 2



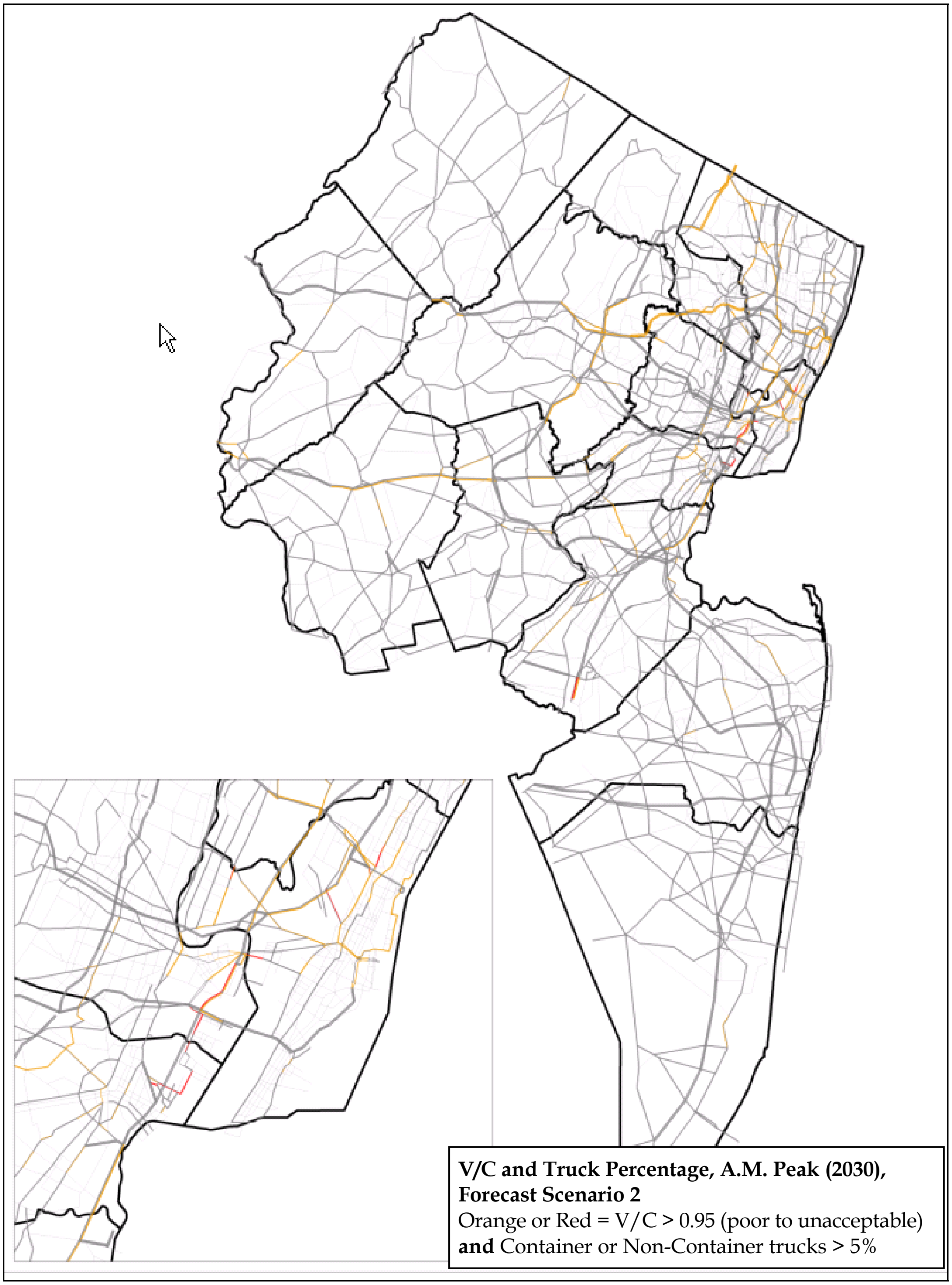
Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 46. Modeled A.M. Peak LOS and Truck Percentages
2030, Scenario 1



Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

Figure 47. Modeled A.M. Peak LOS *and* Truck Percentages
2030, Scenario 2



Source: NJDOT Portway Extensions Model, Edwards and Kelcey/Cambridge Systematics.

As shown on Figures 38 through 43, under both forecast scenarios there will be continued intensification of truck activity on existing high-volume truck segments (greater than 180 per hour per direction), while most of the moderate-volume truck segments in year 2000 will move into the high-volume category. Major corridors affected include: all of the New Jersey Turnpike, I-78, I-80, NJ 17, and NJ 24; most of I-287, U.S. 1 and 9, NJ 3/495, NJ 4, and NJ 440; and most of the waterfront industrial access roads in Hudson, Essex, and Union counties. Other major segments of concern include I-280, U.S. 22, U.S. 46, U.S. 202, NJ 7, NJ 10, NJ 18, NJ 21, NJ 31, NJ 63, NJ 82, CR 503, and CR 505 through Bergen County, and some truck-carrying portions of the GS Parkway in Ocean County.

At the network level, the model shows a significant increase in the number of segments, mileage of segments, and amount of VMT accruing on segments with an unacceptable level of service (volume-capacity ratio of 0.95 or worse), as mapped on Figures 44 and 45.

These results are based on forcing the model to accommodate a fixed projected level of peak-period demand. In practice, this worst case scenario is unlikely to occur – or can, at least, be made less likely to occur – based on the following strategies:

- **Highway Improvements –** Substantial improvements will be programmed and implemented throughout the region over the next 30 years. Both general-purpose and dedicated freight-only improvements will likely be needed. Bridges and tunnels, mainline corridors, regional/local routes, and last-mile connectors must be addressed.

- **Modal Diversion –** As highway conditions worsen, alternative modes – transit for passengers, rail and water for freight – will become increasingly competitive, and should help offset growth in highway demand to some degree.

- **Peak Shifting –** As peak-period highway capacity becomes increasingly scarce, both freight and passenger traffic will favor off-peak travel, when capacity is more available. Through freight already does this to some extent, but it will require substantial changes in business practices (namely, remaining open in nighttime hours for pickup and delivery) for the benefits to be felt. Running the region's container ports in the off-peak can help, but as previously noted, container trucks are a small portion of the region's truck VMT, and the effects of this beneficial policy are relatively small when factored over an entire network.

- **Passenger Displacement –** One of the most effective ways to provide freight capacity may be to get cars out of the way of the trucks. The more people on transit, the less congested the network will be. This requires coordinated planning of passenger and freight improvements across the entire multimodal spectrum.

Future intermodal system planning must address these and other possibilities to manage freight demand and provide freight capacity, so that the worst-case scenario depicted here can never materialize. Current initiatives – Portway Phase I, Portway Extensions, the International Intermodal Transportation Corridor, etc. – are a good start, but are only the beginning of what will be needed over the next 30 years. Successful delivery of highway system performance improvements for freight and passengers is – and must be – a core mission of transportation planning at all levels of government, both within the NJTPA region and throughout the State of New Jersey.

4.2.2 Rail System

Train volume forecasts (from U.S. DOT's Freight Analysis Framework and CPIP) contain an underlying assumption that rail's current modal share (versus truck or water) in key commodity lanes will remain constant into the future. That assumption is a two-edged sword – a decrease in market share would slow the projected train volume growth while a market share increase would cause faster growth and higher eventual volumes. Given the growth of rail intermodal over recent years, constraints on highway capacity, driver recruitment and retention problems, potentially high fuel prices if not fuel shortages, upward pressure on trucking costs, and diminishing highway capacity, it would seem that rail market share is more likely to increase than diminish. On the other hand, railroads will only carry the freight if it is profitable to do so, and their future operating ratios cannot be reliably predicted. We have therefore allowed for an increase in rail handling of PANYNJ containers as contemplated under PIDN, but otherwise have endorsed the constant market share forecasts for planning purposes – recognizing that reality could be very different based on business factors or public policy decisions.

Capacity Shortfalls and Recommended Infrastructure Improvements

Train volume growth of the magnitude indicated will place severe demands on rail line capacity both within and beyond the borders of the Shared Assets Area. Infrastructure improvements will be necessary to provide additional capacity if the indicated volumes are to be accommodated. This is true for both Forecast Scenario 1 and Forecast Scenario 2, although capacity shortfalls are somewhat greater under Forecast Scenario 1 (which assumes a higher number of intermodal landbridge trains).

Detailed examination of specific capacity improvements is beyond the scope of this Study but much work has been done in that regard and it is possible to review previously identified projects in light of the volume forecasts applied by this Study. In brief, the proposed freight capacity projects identified by the Working Group and the list of projects evaluated on behalf of the PANYNJ, which are essentially the same projects, collectively represent a reasonable approach to adding necessary capacity, and may be adopted as a long-range guide.

The "future capacity 2025" line in Table 16 reflects capacity after implementing these identified rail improvement projects, and after presumed operational changes to take advantage of these projects. The planned improvements address most of the anticipated shortfalls, with the exception of the Shared Asset Lehigh Line, the NS Lehigh Line, and the CSX River Line, which are anticipated to reach capacity. The forecasts were developed for a year 2025 horizon, but the same findings hold if extrapolated to year 2030.

Table 16. Estimated Through-Train Capacity and Demand
2025

	NS Lehigh Line[a]	CSX Trenton Line[a]	NJSSA Lehigh Line	P&H Line	Northern Running Track	National Docks	Chemical Coast	Port Reading Secondary	CSX River Line[a]
2003									
Average Daily Freight Trains	18	13	32	23	23	16	17	3	22
Average Daily Total Trains	18	13	94	25	25	16	17	3	22
Peak-Day Trains	23	16	100	29	29	20	21	4	28
Existing Capacity 2003	30-40	30	41 (single-track portion) **80-100 (double-track portion)**	26	42	36	20	15	30
2025 Forecast Scenario 1									
Average Daily Freight Trains	36	23	60	42	41	24	29	4	40
Average Daily Total Trains	36	23	120	42	41	24	29	4	40
Peak-Day Trains	45	29	135	53	51	30	36	5	50
2025 Forecast Scenario 2									
Average Daily Freight Trains	30	20	52	36	35	23	26	4	34
Average Daily Total Trains	30	20	112	36	35	23	26	4	34
Peak-Day Trains	38	25	125	45	44	29	33	5	43
Future Capacity 2025 with planned improvements	30-40	30	**80-100 (double-track portion)**	60-80	60-80	36	60-80	30	30

Source: R.L. Banks Associates, Inc.

Within the Shared Assets Area

The NJSSA Lehigh Line will face greatest pressure. It has a large freight traffic base at present that will grow significantly. It also hosts a large volume of NJT trains which, although held constant in the projected train counts, also could increase. Completion of the missing segment of double-track between Bound Brook and Potter will be necessary.

The P&H Line and the Northern Running Track, which together comprise the main route through the NJSAA, will need to be upgraded to full double-track and equipped with CTC signal control system on both main tracks, and the proposed “Waverly Loop” will provide greater connectivity.

The Chemical Coast Secondary, north segment, also should be brought to up to double main track, CTC signal – controlled configuration. Support trackage parallel to the main track should be retained in addition to the second main track rather than sacrificed by conversion to main track. These enhancements would improve the flow of trains in and out of the terminals and yards along this segment as well as easing conflicts between through trains and Conrail local switching assignments.

The Port Reading Secondary provides a currently little-utilized alternate route connecting NS and CSX main lines to the south and west with facilities along the Chemical Coast Secondary, Oak Island Yard and with North Bergen and Little Ferry via the River Line. The line is lightly used because it is slow speed, unsignalled, has only one short passing track, and connects with the already congested Chemical Coast Secondary. Those configuration and operational issues have kept the route undesirable and lightly used but the Study Team believes that it will become necessary to use the line as an alternative to the Lehigh Line, even after the latter is improved. An appropriate set of improvements to the Port Reading Secondary includes track upgrading, siding extension and CTC signal system installation. In addition, the southern portion of the Chemical Coast Secondary should receive a second track and a CTC signal system. Access to the west end of the upgraded Port Reading Secondary route would be enhanced by construction of the proposed connection between the Port Secondary and the CSX Trenton Line, allowing CSX to access the Port Reading Secondary without occupying the Lehigh Line. This set of improvements, which are assumed to follow improvement of the Chemical Coast Secondary north segment described above, would enable the Port Reading Secondary/Chemical Coast route to: 1) provide efficient connection between the NS and CSX main routes at Bound Brook and the many customers south of PN and 2) accommodate some traffic between Bound Brook, Oak Island or North Bergen and points north as an alternative to the Lehigh Line.

The above improvements are presented in one possible sequence of implementation but it is important to remember that actual, line-specific increases in train traffic and consumption of capacity should trigger improvements, not the passage of time or an overly rigid plan. Capacity needs also may be influenced by passenger operations on the Lehigh Line, the NJT Southern Tier Route lines and any lines which might come to host passenger service. Following implementation of these planned improvements, the only significant year 2025 capacity shortfall remaining within the shared asset area would be on the Lehigh Line, where peak-day traffic could exceed available capacity.

Outside the Shared Asset Area

Absent additional improvements not yet identified, the NS Lehigh Line and CSX River Line are anticipated to experience capacity shortfalls in year 2025. This is the case for both forecast scenarios, although the shortfalls are larger under Scenario 1, which places the greatest emphasis on bringing west coast containers into the NJTPA region via rail.

The Working Group and PANYNJ improvement packages focused on the NJSAA but the forecast volumes suggest that the main lines within the Study area but outside the NJSAA also should receive consideration. The three primary rail routes linking North Jersey with the national rail system, discussed above, are each expected to experience a doubling of freight volume by 2025. The CSX River Line and the NS Lehigh Line experience the greatest traffic today, and improvements leading to complete, or near complete, double-track

CTC-signaled configuration will become appropriate as traffic grows. (The River Line faces challenging topography that may limit the feasibility of adding track in some locations.) The CSX Trenton Line experiences significantly less traffic than the River and Lehigh Lines but it too is likely to require additional improvements such as addition or extension of passing sidings on its single-track portions. The NS Southern Tier route is lightly used due to topography, capacity, configuration, and relatively few on-line customers. At present, no significant change in use or volume can be foreseen and hence no improvements are contemplated but as traffic grows on the NS Lehigh Line, it could become desirable to increase use of the Southern Tier route.

Future Directions for Rail

At a minimum, one can conclude that it is essential to implement rail program improvements that are already well-advanced in planning. This will allow the region to meet forecasted needs on most of its critical rail infrastructure through the year 2025. On most lines, it allows for some excess capacity, which could accommodate higher-than-forecast rail traffic. This is the good news.

One can also conclude that by the year 2025 – or earlier, if rail grows faster than the constant-share forecasts – the region's major Class I mainlines (NS Lehigh and CSX River) will run out of capacity. This is bad news, especially if the region plans on relying on rail to maintain its current modal share beyond year 2025, or to handle an increased share of the region's transportation prior to 2025. Unless growth in the number of trains can be significantly reduced (by building longer trains, rather than holding train lengths constant as our analysis has done), major mainline improvements will be needed. To accomplish them, we may be looking at very expensive projects that could require substantial public sector participation and funding. At the same time, by taking an "Alameda Corridor" approach to public-private sector participation, the public might receive substantial benefits in the form of improved rail operations and service, reduced truck traffic, and the opportunity to provide environmental improvements (grade separations, noise/vibration reduction, etc.) in sensitive areas of the alignments. The important institutional issues – how does the public sector participate in funding major improvements to privately owned, for-profit infrastructure, what guarantees the achievement of public benefits, and who delivers needed "downstream" capacity in the rest of the system – remain to be addressed.

At the same time, given the anticipated shortfall in highway capacity, we should not be deterred from exploring strategies to increase utilization of rail services, above and beyond constant market share forecasts. One major opportunity is the exploration of short-haul rail corridors. This is not an approach that "steals" traffic from trucks or water – quite the opposite, it is a strategy that supports and reinforces trucking, maritime, and warehouse/distribution users. The concept is to move containers (or other unit cargo) from congested marine terminals to "inland depots" (which could be truck transfer terminals or industry clusters) using a dedicated short-haul train service. The service could benefit the marine terminal by moving containers off-terminal more quickly, freeing up storage space for other containers – effectively "building a larger terminal" without adding any square footage. The service could benefit truckers by allowing them to drop off and pick up maritime containers without traveling through the most congested parts of the region's highway system, saving them time and money and reducing the levels of traffic experienced by other highway system users.

4.2.3 Marine Terminals

We have evaluated two different marine container forecasts largely because of a continuing debate about which one represents most "accurate" picture. Without taking sides, we would argue that:

- **Both Forecasts Raise Questions –** Recent growth of PANYNJ container traffic has significantly outpaced the CPIP-based forecast, and shows no signs of slowing to CPIP rates. On the other hand, the USACE-based forecast, which is more in line with recent growth, anticipates that export TEUs will grow faster (and actually pass) import TEUs, which seems at odds with experience. We are generally comfortable that the two forecasts bracket a continuum of reasonable futures, but cannot guess which point on this continuum is most probable.

- **Despite Their Differences, Both Forecasts Have Essentially the Same Planning Implications –** Under both forecasts, a lot more containers are coming, and will generate more truck and rail traffic, and will need to be handled through more efficient marine terminal facilities. As previously discussed, the highway system implications and rail system implications of the two scenarios are more or less the same, with some localized differences that are important but relatively minor from a total network perspective. And as discussed below, the general findings regarding marine terminal capacity through the year 2025 are consistent to both scenarios. The key difference is not so much what as when – basically, how soon after 2025 we need to provide additional capacity that is not currently in the pipeline.

Future Portwide Container Capacity

The CPIP estimates current capacity at around 4.7 million lifts per year (just over 8 million TEUs per year, using a conversion factor of 1.7 TEUs per lift). Reports we have reviewed do not provide a future capacity estimate based on planned improvements.

The USACE estimates capacity at 7,901,260 TEUs in 2010; 8,366,040 TEUs in 2020; and 10,457,550 TEUs in 2030 and throughout subsequent years. This is the capacity available for all containerships; vessels requiring drafts greater than 45 feet would not be able to call at all facilities, so capacity actually available to those vessels would be somewhat lower. (Source: Table 4 of U.S. Army Corps of Engineers, Limited Reevaluation Report, Consolidated Implementation of the New York and New Jersey Harbor Deepening Project, January 2004, Economics Appendix). This assumes capacity enhancements are phased in over time.

Recent estimates by Moffatt & Nichol suggest that near-term capacity is estimated in the range of 4.5 to 5.0 million TEUs (lower than the CPIP estimate), but should rise to around

8.0 million TEUs after completion of the existing port redevelopment effort and a relatively short "learning curve" period.

Some of the ongoing and planned improvement projects include the following:

- Deepening of the Kill Van Kull and Newark Bay to 45 feet (scheduled completion 2004) and the Arthur Kill and Port Jersey Channel to 41 feet (scheduled completion in 2005); planned subsequent deepening of major channels to 50 feet (in contracting process); six berths deepened to more than 45 feet and four more planned for deepening;

- Seventy-five acres of new container storage from redevelopment of existing terminals and 340 acres of container yard redeveloped;

- Seven thousand two hundred linear feet of wharf reconstruction with 25 new container cranes (12 installed, 13 on order);

- Expansion of ExpressRail terminal and improvement of other rail facilities, including Staten Island Rail Road and Chemical Coast Connector (serving Howland Hook);

- Grade separations and other roadway improvements;

- Reconfiguration and optimization of Maher, APM, and PNCT terminals (Port Newark/ Elizabeth) and Howland Hook Marine Terminal; and

- Planned expansion of container terminal capacity at Global/MOTBY.

To accommodate rapid growth in container volumes over the past several years, the PANYNJ's marine terminal operators have also operated their facilities more intensively. They have achieved substantially greater operating efficiencies using more intensive storage, improved information and management systems, longer operating hours, etc.

The combination of these physical improvements and continued gains in operating efficiency will certainly provide substantially increased capacity without significant increases in the actual size of the port. Absent a future capacity estimate from the CPIP process, we rely on the USACE portwide estimate.

Future Portwide Container Demand

As indicated previously in Table 15, our forecast Scenario 1 (adapted from CPIP) is for a 3.5 percent annual growth rate in container traffic within the NJTPA region, while our forecast Scenario 2 (adapted from USACE) is for a 4.6 percent rate within the NJTPA region, from a base year of 2001.

For the port as a whole, CPIP offers a range of potential futures, depending on which Atlantic coast ports deepen their channels. Assuming the PANYNJ deepens to 50 feet as currently planned, the forecast range is 5.6 million to 6.2 million TEUs in 2020, and 8.5 million to 10.4 million TEUs in 2040. (The PANYNJ actually hit a record high 4,067,811 TEUs in 2003, so the maximum annual growth rate from a 2003 base is just 2.6 percent, which is substantially below historic growth rates). Whether you believe the forecast or not, the key point is that CPIP demand in year 2020 (6.2 million TEUs) does not exceed anticipated USACE capacity (8.4 million TEUs), and CPIP demand in year 2040 (10.4 million TEUs) does not exceed anticipated USACE capacity (8.5 million TEUs).

For the port as a whole, USACE offers point forecasts of 8,248,570 TEUs in 2020 (below the estimated capacity of 8.4 million TEUs) and 11,460,041 TEUs in 2030 (slightly more than the estimated capacity of 10.5 million TEUs).

Through 2025, both demand forecasts support the notion that there is sufficient portwide container capacity through year 2025. Beyond 2025, the CPIP demand forecasts suggest that additional capacity will not need to come on line until close to 2040, while the USACE demand forecasts suggest that additional capacity will need to be in place by 2030.

Table 17. Container Terminal Capacity and Demand in the PONYNJ Region

Baseline Study	CPIP-Based Assessment	Harbor Navigation Study-Based Assessment
Current Capacity	8.0 million TEUs	7.9 million TEUs (2010 with improvements)
Current Demand	4.1 million TEUs	4.1 million TEUs
2030 Capacity	8.0 million TEUs	10.5 million TEUs
2030 Demand	5.6 to 6.2 million TEUs (with 50-foot channels)	11.5 million TEUs (with 50-foot channels)

Source: Moffatt and Nichol/Cambridge Systematics.

Implications for Moving Forward

These findings are dramatically different from several port studies conducted in the 1990s, which as a rule found that the Port of New York and New Jersey was facing a dire and fairly imminent shortfall of terminal space. So what happened? Leaving the detailed answer to forensic planners, the short answer seems to be that "efficiency happened." Throughout the 1990s, west coast ports dramatically improved their throughput per acre through better operating practices and modest infrastructure improvements. The improvements were borne of necessity, because profitable cargo just kept showing up. At the same time, the PANYNJ marine terminals did not show comparable efficiency gains, and it was believed that operating differences between west coast and east coast ports would make such gains unlikely at PANYNJ. So to provide more capacity, the 1990s studies had to build more and bigger terminals. What we have actually seen, starting in the late 1990s and continuing through the present, is that lots of profitable cargo is showing up at PANYNJ – and of necessity, operational and modest physical improvements are being made to keep up. Seeing the PANYNJ terminals achieve west-coast levels of efficiency, the latest studies are supported in finding more "latent capacity" in these terminals than previously thought, reducing the near-term need for major capacity improvements. This underscores our previous assertion that capacity estimates should be viewed as dynamic business-driven measures, rather than rigid engineering yardsticks.

However – and this is a critical point – the CPIP and USACE studies do indicate that major capacity improvements will be needed, sometime in the 2025 to 2040 period. Additional terminal acreage will almost certainly be required, and there are several options for how to provide it. Traditionally, ports have expanded by landfilling or acquiring vacant or underutilized land, but landfilling is increasingly difficult to accomplish within environmental considerations, and suitable waterfront land is scarce. Fortunately there are other viable options:

- Build out of currently planned new terminals, such as the proposed terminal at MOTBY.
- Further intensification at existing container terminal complexes, with the gradual relocation of non-container uses or non-critical functions to offsite facilities. Underutilized properties identified by NJTPA as "freight opportunity sites" could be considered for supporting functions.
- Development of inland port facilities for the offsite collection and distribution of marine containers. As discussed in the rail section previously, the concept would be to move import containers from the waterfront to an inland port via rail as quickly as possible, and to hold export containers at an inland port until the last possible moment, in order to free up as much space as possible at the marine terminal itself.

There is no reason to wait for year 2025 to pursue these opportunities, should they arise. If they provide capacity improvements, it helps defer other investment needs. Other actions and strategies that should be pursued in the near term include:

- Supporting ongoing implementation of the PANYNJ's channel deepening, terminal improvement, and road/rail improvement programs.
- Supporting ongoing implementation of the PANYNJ's Port Inland Distribution Network strategy of promoting rail and barge as preferred modes for serving dense trade clusters within a 75- to 400-mile radius of the port.
- Supporting ongoing evaluation and implementation of port-serving highway and rail investments, including the Portway Phase I program, the Portway Extensions program, and the International Intermodal Transportation Corridor program.
- Consideration of an expanded role for marine transportation in substituting for in-region (less than 75 miles) and coastwise domestic ("short-sea") freight movements. Today, barges move tremendous amounts of petroleum and petroleum products throughout the region, and also shuttle containers between the Red Hook Container Terminal in Brooklyn and the American Stevedoring terminal at Port Newark. Every ton moved locally on a barge through Newark Bay or New York Harbor is a ton not moved by truck. There are practical limitations to what freight ferries and barges can

accomplish, based on the degree that they are time and cost-competitive with other modes, but the possibilities of a larger role are worth further exploration.

- Further study of the needs of non-container and private marine terminals within the NJTPA region.

4.2.4 Air Cargo

National air cargo forecasts are generally made in terms of revenue ton-miles (RTM) or revenue ton-kilometers (RTK). Because of the substantial truck substitution affecting domestic air cargo, it is likely that the mileage attribute will grow faster than the tonnage attribute. Projections made in terms of tonnage tend to show smaller anticipated growth. Assuming continued economic growth and consumer activity, it is anticipated that air cargo at EWR will grow between 2 and 3 percent annually (a midpoint estimate of 2.5 percent annually is shown in Table 16) in terms of tonnage during the planning period. The implications of handling this volume of tonnage at Newark Liberty Airport remain to be assessed, and will require further work with PANYNJ staff.

4.2.5 Warehouse and Distribution

The high level of new speculative construction (defined as no tenant prior to start of construction) would usually indicate that the real estate cycle for warehouses and DCs is peaking, particularly when much of the new construction and facility purchases are being made by real estate investors. However, the demand for warehouses and DCs does appear to be growing for the reasons previously articulated.

The outlook, therefore, is for continued strong demand for warehouses and DCs, assuming economic and international trade trends continue. Demand for both greenfields and underutilized properties should grow. Locations closer to the region's core are preferred. If not available or prohibitively priced, then demand will most likely be accommodated in locations further south on the New Jersey Turnpike and in Pennsylvania (particularly on the Interstate 78 and Interstate 81 corridors). Continued monitoring of availability and lease rates over the next year will indicate either a continuation of increased demand or a peaking of the demand cycle.

The big opportunity in warehouse and distribution, as previously noted, is economic development. Freight happens, and it is forecast to continue to happen, and the region will continue to see the traffic from it happening. The issue on the table is: what will the region do to make freight pay, to achieve an economic benefit that allows the region to address the negative impacts of freight movement while improving the region's overall employment, tax base, and quality of life?

As an overall strategy, one approach is to maximize the amount of warehouse and distribution center activity within the NJTPA region. That means a public policy that is supportive of, and attentive to, industry requirements – particularly their need for an efficient, reliable, cost-effective transportation system. Furthermore, in locating new development, primary consideration should be given to underutilized "freight opportunity sites" identified by NJTPA, as a means of returning these properties to productive use. Close-in sites and/or rail-served sites are preferred where possible, because they tend to reduce the amount of VMT associated with truck movements. Apart from freight opportunity sites, other prime industrial lands must be identified and kept available for that purpose.

5.0 Conclusion

While the two forecast scenarios developed for this study have somewhat different implications for the location, intensity, and/or timing of marine terminal, rail and highway activity, for the most part they tell exactly the same story – for the NJTPA region, there will be significantly increased demand on the region's highway, rail systems, marine terminals, airports, and warehouse/distribution facilities, occurring against a backdrop of growing passenger demand competing for limited transportation system capacity.

Other reports developed for the Freight System Performance Assessment Study utilize the information presented in this Current and Future Conditions Report address critical issues, needs, strategies, and recommendations for meeting these challenges.