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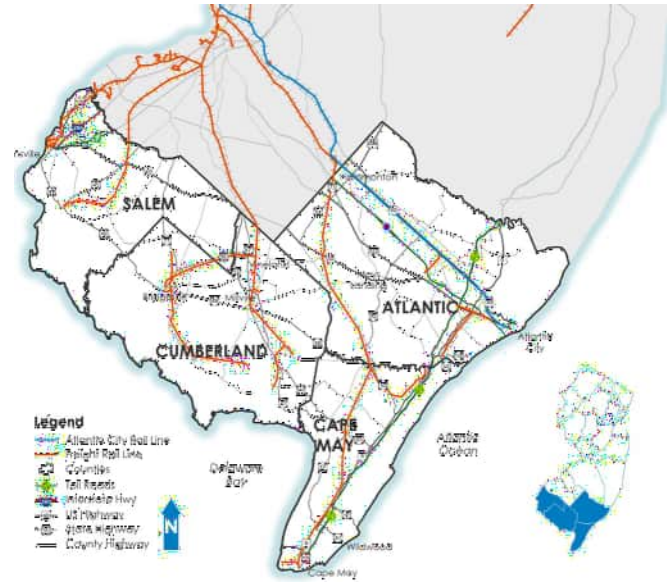

Regional Core Freight Dataset Technical Memo

SJTPO Regional Freight Plan Data Collection and Analysis

June 28, 2022

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1 Introduction

The South Jersey Transportation Planning Organization (SJTPO) is conducting this Regional Freight Plan Data Collection and Analysis project to better understand the movement of freight goods in southern New Jersey and to better integrate freight into its transportation planning process. SJTPO's overarching goal is to develop an optimal multimodal transportation network contributing to the region's economic development and its residents' wellbeing. This study will also help SJTPO to better represent the region's issues and needs in the New Jersey State Freight Plan.

This document summarizes the results of the first phase of the study, developing the regional core freight dataset. The next phase of the study will assess performance and condition of various freight infrastructure systems in the region including congestion, bottlenecks, and safety issues.

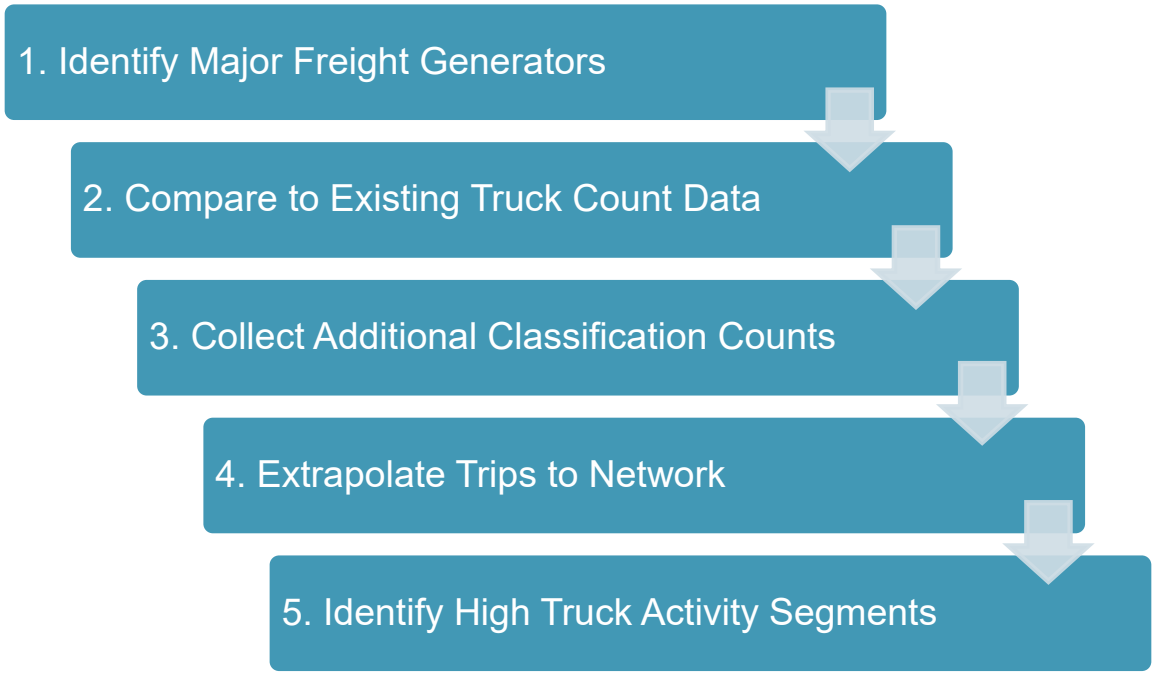
1.1 Regional Core Freight Dataset Approach

The first step in developing the Regional Core Freight Dataset is to identify the locations of major freight generators throughout the SJTPO area. Understanding these major sources of freight activity is critical for identifying key truck travel patterns and identifying roadway segments where truck volume and classification counts should be collected.

It is the opinion of the of the study team that no single data source can be trusted to tell the complete story of freight activity. For example, while truck probe GPS data can provide a high level of precision for specific freight business locations, it also has the potential to be misleading if it does not adequately represent all sectors of freight. Historically, freight sectors such as agriculture, mining, and logging have often relied on older vehicles that do not use the on-board navigation software that would be represented in many common truck probe data sets. To address this discrepancy, this study utilizes multiple different sources to identify those freight-generating activity centers.

The overarching goal of this task is to identify roadways within the SJTPO study area that are critical for the movement of freight. Additionally, this study seeks to identify roadways in the study area that have truck volumes exceeding 10 percent of total traffic. This is important for identifying roadways eligible for state freight funding. These goals were achieved using the multi-step process outlined in Figure 1-1. Each step of the process is described in more detail in the following sections.

Figure 1-1. Approach for Identifying Key Freight Corridors in SJTPO



2 Identify Major Freight Generators

The purpose of this analysis step is to identify locations within the SJTPO area that have high concentrations of freight activity. Since no single data source can provide a comprehensive picture of freight activity, a wide variety of data sources were used.

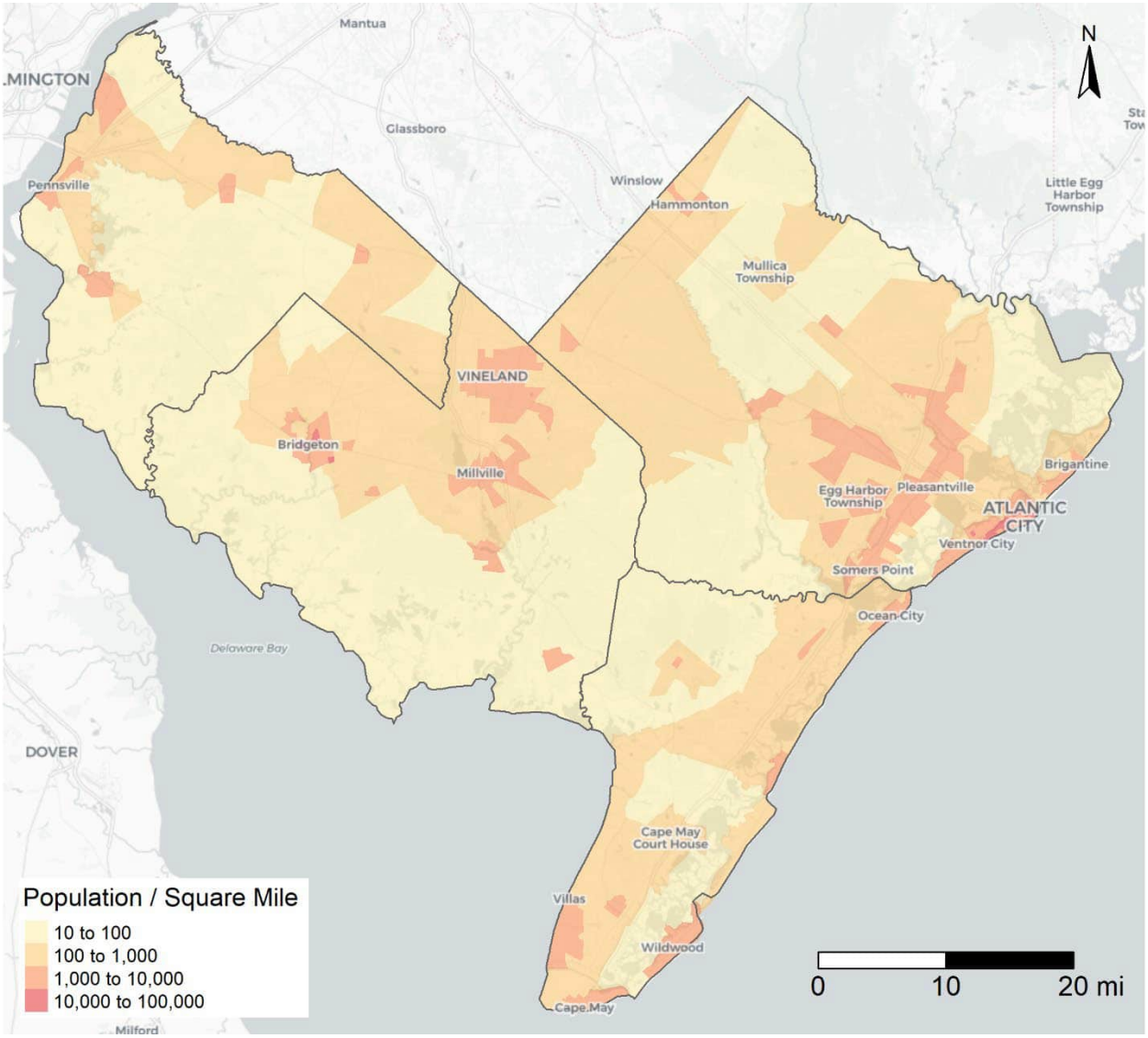
2.1 Population and Employment Data

Our first step in identifying areas of freight activity in the study area was to evaluate areas of population and freight-related employment concentration. Freight activity hotspots—particularly in sectors such as manufacturing—are typically correlated with the locations of population centers for the simple reason that proximity to infrastructure and workforce are necessary conditions for many freight-generating facilities.

2.1.1 Population

Figure 2-1 displays the population density for census block groups throughout the study area. The total population of the SJTPO area is approximately 574,000 according to the most recent 2019 American Community Survey (ACS) 5-year estimate data. The individual Census Designated Place (CDP) with the highest population in the study area is Vineland with a population of 60,000. The next highest population center is Atlantic City with a population of 38,000. However, the cluster of cities within 10 mile of Atlantic City contains a population well over 100,000. The most density populated areas are within Atlantic City with multiple block groups in excess of 10,000 population per square mile.

Figure 2-1. Population Density



Source: 2019 ACS 5-Year Population Estimates, Block Group

2.1.2 Employment

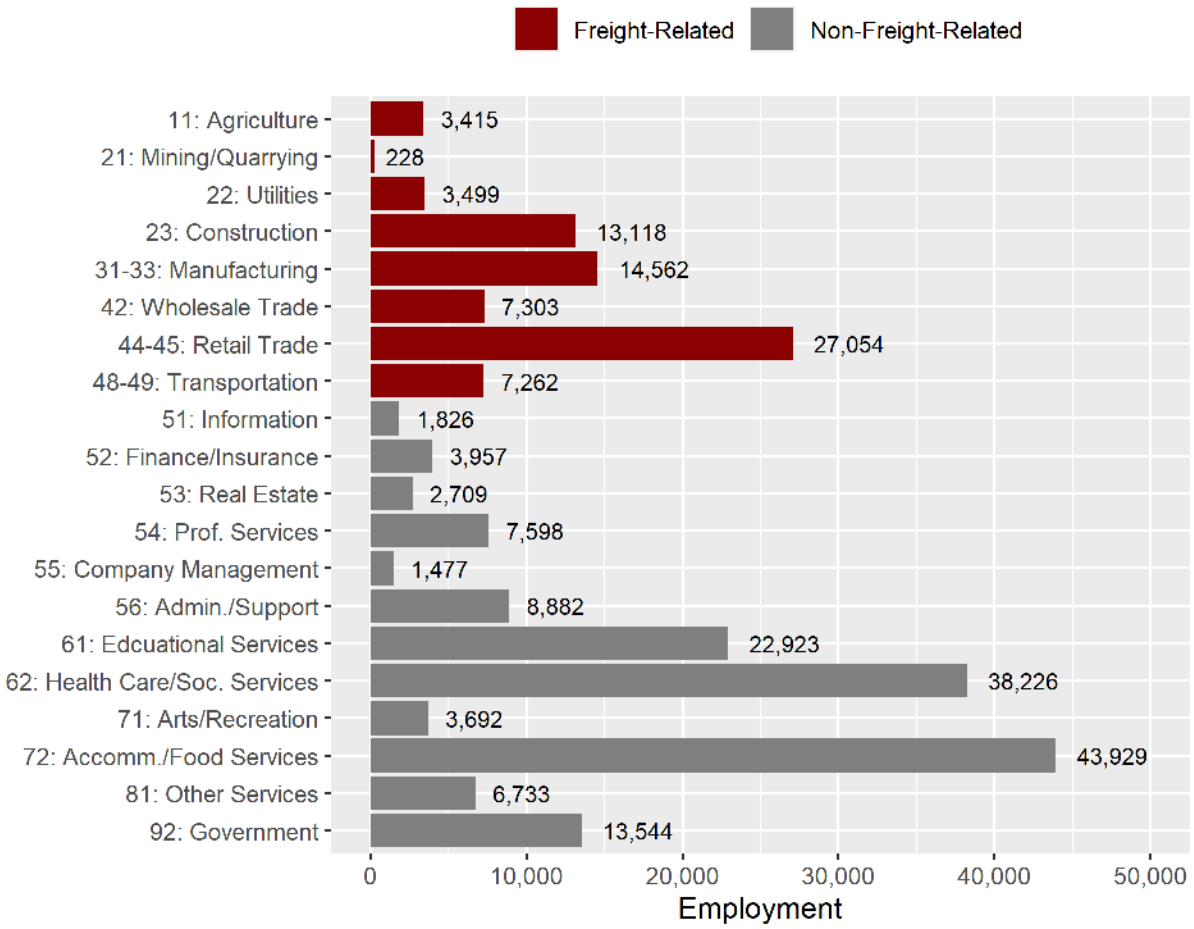
Our primary source for employment information comes from Longitudinal Employer-Household Dynamic (LEHD) data. The LEHD data is produced by the Center for Economic Studies at the U.S. Census Bureau and provides block and block group level estimates of employment by industry. For this study, block group level estimates of Workplace Area Characteristics were used to identify major freight employment areas.

The LEHD uses the North American Industry Classification System (NAICS) for industry categorization. This is a standard system used by many Federal statistical agencies and is useful for categorizing local and regional businesses for analysis. The NAICS system includes 20 primary (two-digit) categories ranging from agriculture to public administration. Consistent with the other national and regional freight studies, the following eight categories have been identified as “freight-related.” These industries account for the largest share of freight trip production and/or attraction.

- 11: Agriculture, Forestry, Fishing and Hunting
- 21: Mining, Quarrying, and Oil and Gas Extraction
- 22: Utilities
- 23: Construction
- 31-33: Manufacturing
- 42: Wholesale Trade
- 44-45: Retail Trade
- 48-49: Transportation and Warehousing

The SJTPO area supports more than 230,000 jobs. Of these, approximately 76,000 (33 percent) are within freight-related industries (Figure 2-2).

Figure 2-2. SJTPO Employment by Industry



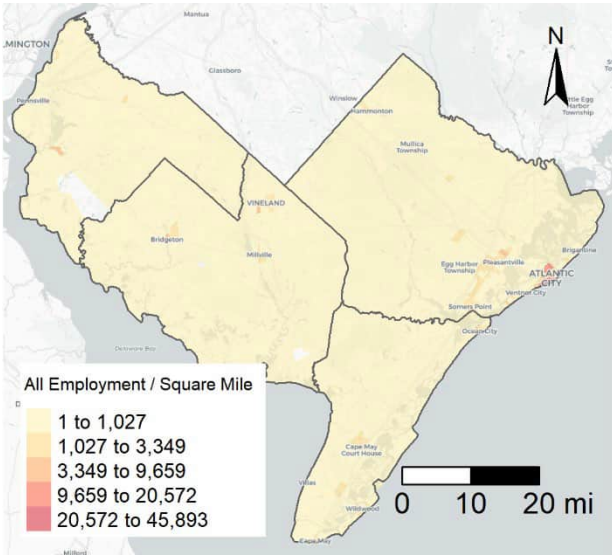
Source: 2018 LEHD Workplace Area Characteristics (WAC), All Jobs

Figure 2-3 displays a series of maps highlighting the distribution of employment density throughout the study area within the following four categories:

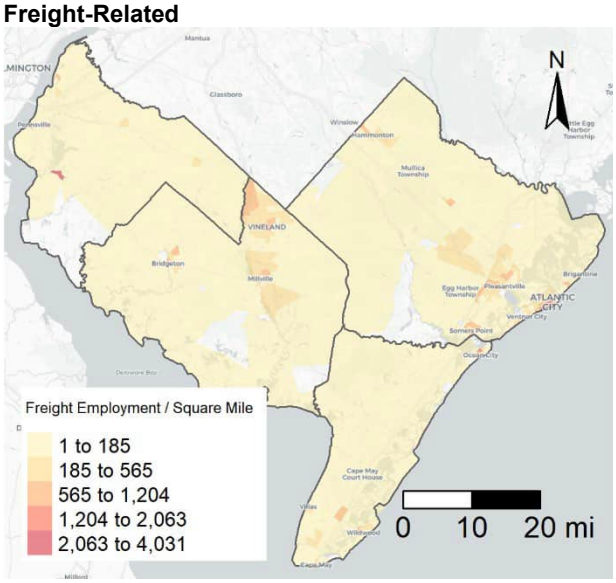
- **All Employment:** Looking at all employment in total, the single highest concentration by far is located in Atlantic City with up to 45,000 jobs per square mile in some areas.
- **Freight-Related Employment:** Narrowing this to only NAICS industries considered "freight-related" broadens this distribution to show many areas throughout the study area including Salem, Bridgeton, Vineland, Millville, Hammonton, Wildwood, Ocean City, Somers Point Pleasantville, and Atlantic City.
- **Agriculture, Forestry, Fishing and Hunting (Agriculture):** Agricultural employment is primarily concentrated in the areas around the Vineland, Bridgeton, and Millville.
- **Mining, Quarrying, and Oil and Gas Extraction (Mining/Quarrying**): Mining and Quarrying employment is primarily concentrated in a handful of areas between Vineland and Delaware Bay with some higher concentrations in Hammonton, Bridgeton, and Cape May Courthouse.

Figure 2-3. Employment Density

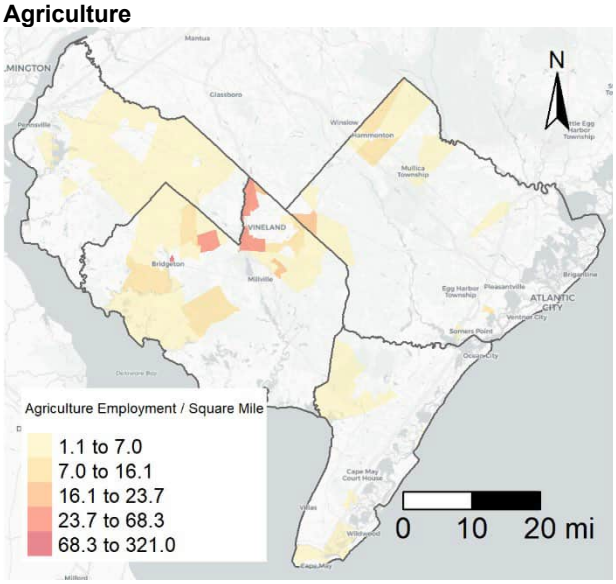
All



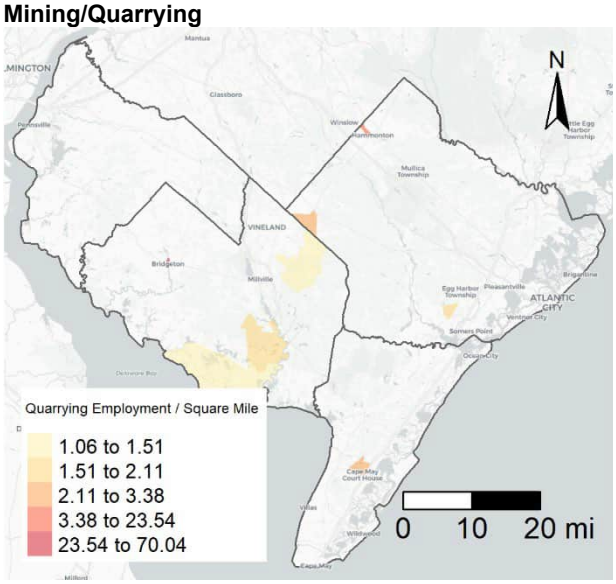
Freight-Related



Agriculture



Mining/Quarrying



Source: LEHD Workplace Area Characteristics, Block Group

2.2 Data Axle Business Information

Individual business information was procured from Data Axle Reference Solutions. This data set is continually updated and includes information on NAICS industry code, number of employees, and other details. Information was collected for all businesses falling within the following NAICS industries:

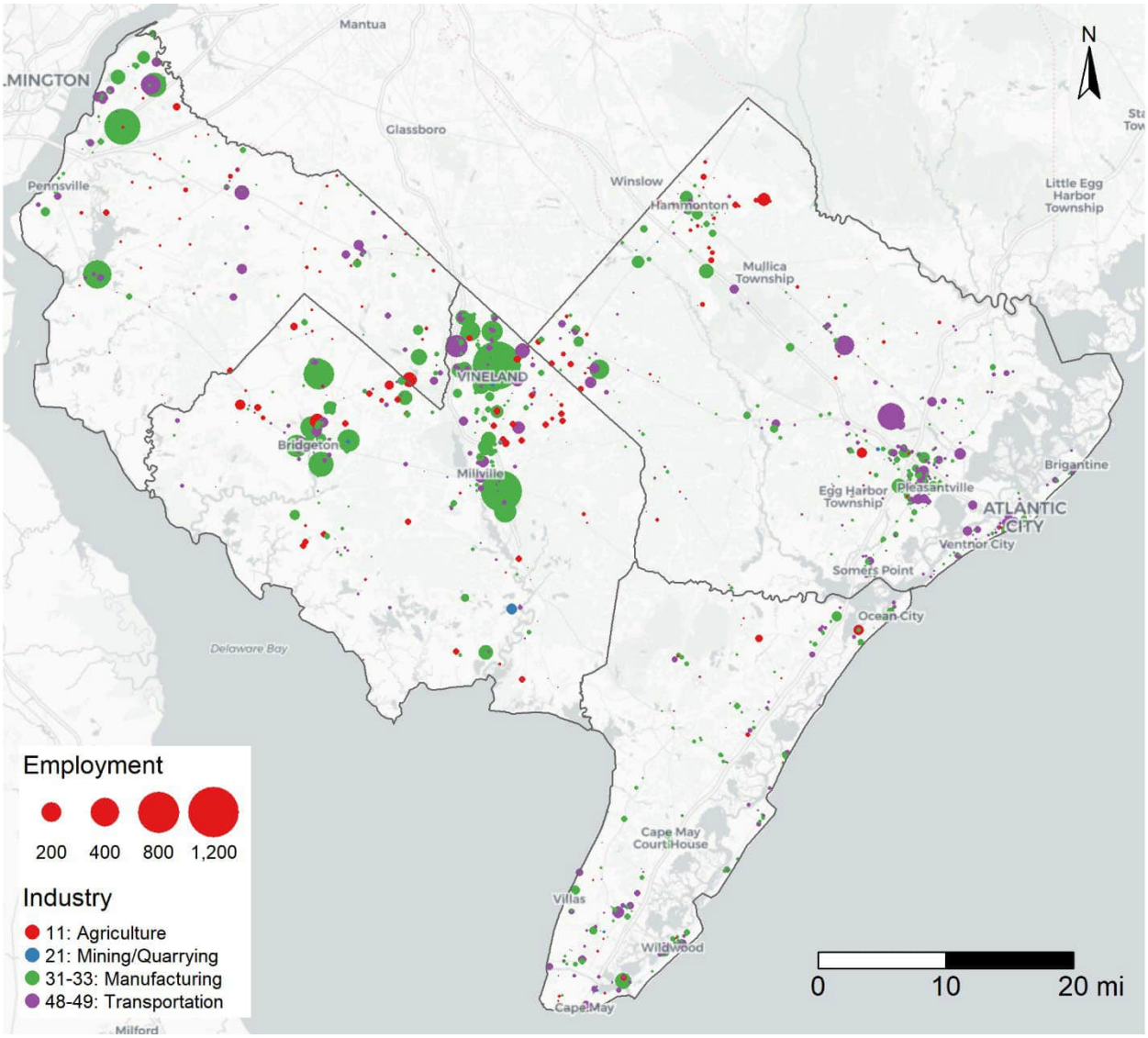
- 11: Agriculture, Forestry, Fishing and Hunting
- 21: Mining, Quarrying, and Oil and Gas Extraction
- 31-33: Manufacturing
- 48-49: Transportation and Warehousing

The locations of these businesses are shown in Figure 2-4 below. The locations are color-coded by industry and the point size is scaled to reflect the number of employees.

The figure highlights the cluster of manufacturing businesses located in the central SJTPO area around Vineland, Bridgeton, and Millville. Additional major manufacturing businesses are located in the western portion of SJTPO around Salem and across the river from Wilmington. Many transportation and warehousing businesses are clustered northwest of Atlantic City, near the Atlantic City International Airport. Businesses in both the agricultural and mining/quarrying industries are generally located more sporadically without strong clusters in individual regions.

In addition to helping to identify key freight industry clusters in the SJTPO area, the information was also used to help guide freight stakeholder outreach efforts.

Figure 2-4. Freight Business Locations



Source: Data Axle Reference Solutions for NAICS 11, 21, 31-33, and 48-49, collected July 2021

2.3 Truck Trip Generation Estimation

The employment information discussed in the previous two sections can also be used to develop estimates of freight activity and daily truck trip estimates. The project team's approach was to use freight trip generation and attraction formulas develop as part of *National Cooperative Freight Research Program (NCFRP) Research Report 37: Using Commodity Flow Survey Microdata and Other Establishment Data to Estimate the Generation of Freight, Freight Trips, and Service Trips: Guidebook*.[1] This guidebook provides a series of formulas that may be used to estimate average daily freight trip production and attraction based on the two-digit NAICS code and the number of employees within each industry. An example of the formula constants used for these estimates is provided in Table 2-1. This table represents the values to be used for an area that is similar to a blended average of New York City (NYC) and the Capital Region (CR) of Albany-Schenectady-Troy in New York State.

These formulas for the linear freight trip production model were applied to the LEHD employment data discussed in section 2.1.2. The freight trip production formula uses the following general formula:

$$FTP = \alpha \times \mathrm{E}\beta$$

Table 2-1. Freight Trip Production Formulas, Linear Model

NYC and CR - FTP [shipments/day]							
NAICS	Description	α	β	Obs.	Employment		
					Mi	Mean	Max
23	Construction	-	0.092	20	6	39	201
31-33	**Manufacturing**	**5.321**	**0.063**	**96**	**1**	**51**	**350**
31	Food, Beverage, Tobacco, Textile, Apparel	-	0.117	18	2	43	150
32	Wood, Paper, Chemical, Plastics, Nonmetals	5.511	0.135	36	2	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	5.769	0.021	42	1	59	350
42	Wholesale Trade	6.455	-	68	2	22	200
44-45	**Retail Trade**	**2.314**	**0.242**	**63**	**1**	**15**	**94**
44	Motor Vehicle, Furniture, Electronics, Clothing	-	0.321	42	1	15	77
45	Sporting Goods, Hobby, Book, & Music Stores	3.956	0.179	21	2	15	94
48	Modal Transportation & Support Activities	8.500	-	8	9	53	151
72	Accommodation and Food	-	0.114	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**3.800**	**0.085**	**268**	**1**	**33**	**350**

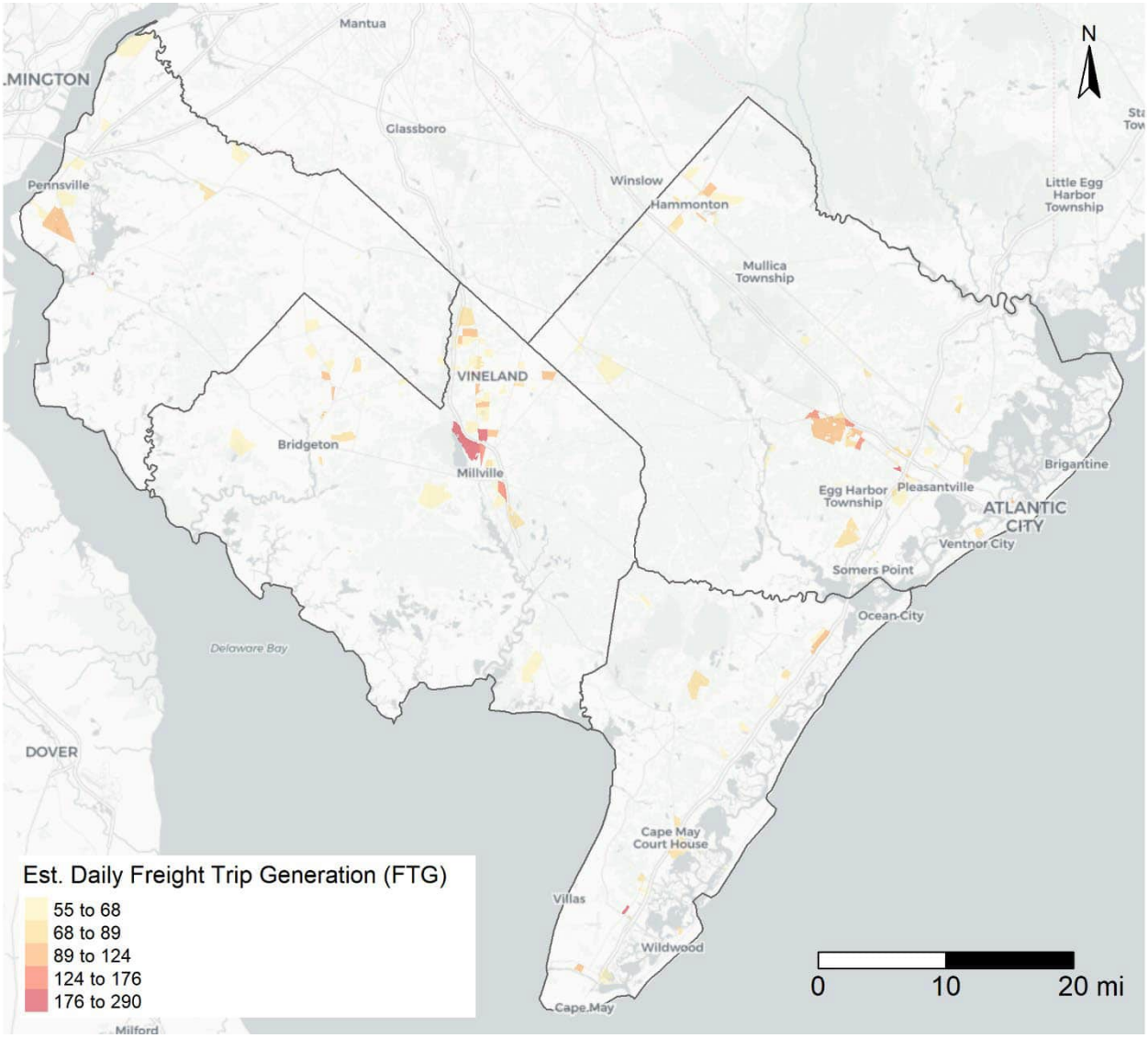
Source: NCFRP Report 37

Notably, the NCFRP Report 37 models do not include freight trip production estimates for either NAICS 11: Agriculture, Forestry, Fishing and Hunting or NAICS 21: Mining, Quarrying, and Oil and Gas Extraction. Therefore, while these formulas do provide useful tools for identifying freight activity hotspots, the industry specific data for NAICS codes 11 and 21 discussed in the previous sections is used in combination with the freight trip production estimates when identify potential data gaps.

[1] NCFRP Report 37: https://www.trb.org/NCFRP/Blurbs/175283.aspx

The results of this exercise are shown in Figure 2-5. This figure shows estimated daily freight trip generation (production and attraction) at the block group level in the SJTPO area. Key hotspot locations for freight trip generation include Millville, Vineland, areas south of Pennsville, and areas adjacent to US Highway 40 northwest of Pleasantville which include a Walmart Supercenter, a Home Depot, the Hamilton Mall, and other commercial establishments. These results will also be used later in this document to expand on the existing truck classification count locations in the trip extrapolation process.

Figure 2-5. Estimated Daily Freight Trip Generation



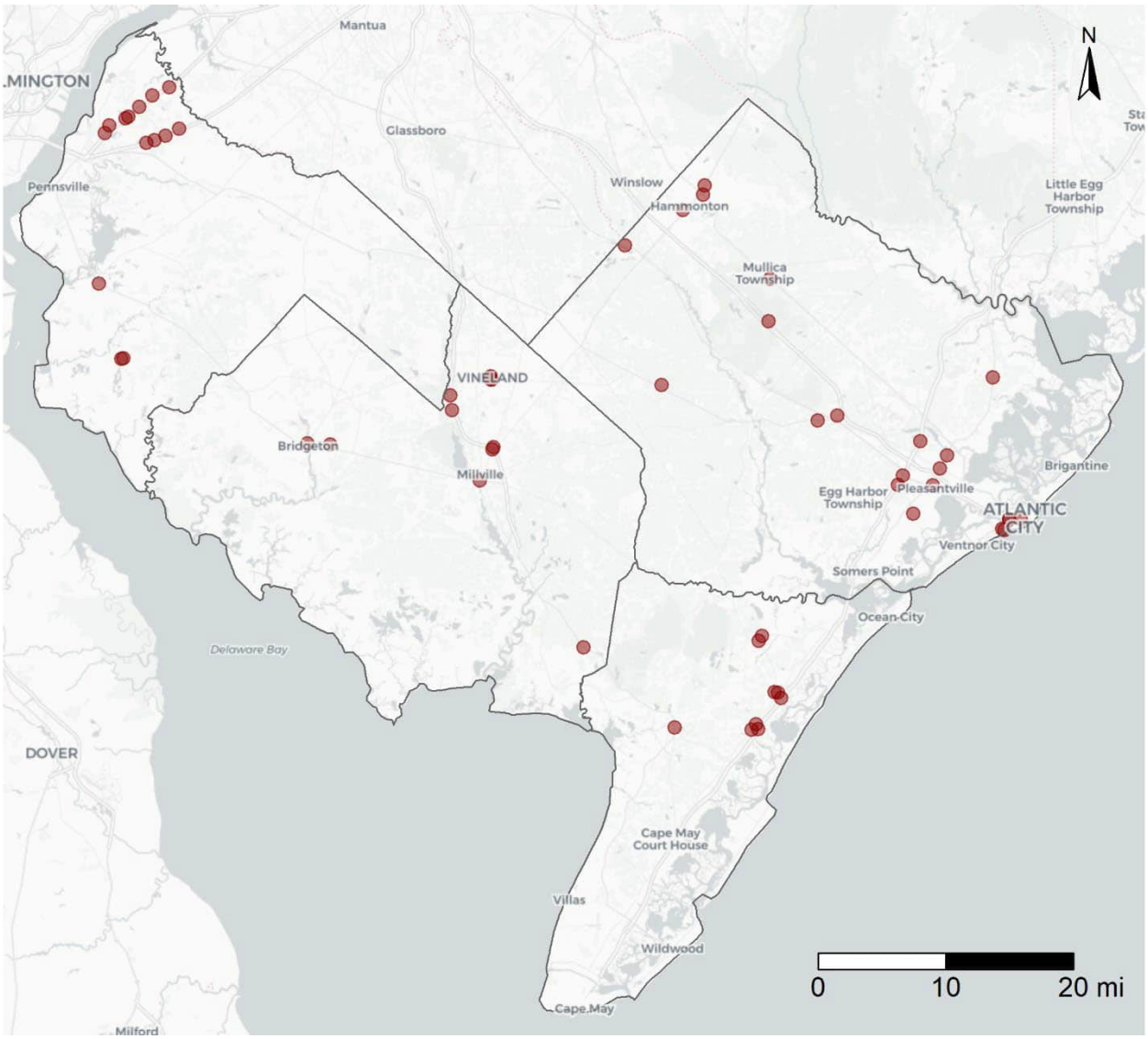
2.4 Stakeholder-Identified Locations

Engagement with a variety of stakeholder was conducted through this study. This included one-on-one teleconference interviews with twelve regional stakeholders including public entities such as counties and economic development associations as well as private freight industries including manufacturers and freight carriers. Among the

questions asked were those relating to the locations of high freight activity. Interview participants were asked to identify their most heavily used routes for transporting freight shipments both locally and for long-distance shipments. Additionally, they were asked to identify locations of frequently used multi-modal facilities used during shipment such as ports, airports, and rail yards.

Figure 2-6 shows the locations of comments identifying these high freight activity areas. Multiple respondents indicated portions of I-295 and the New Jersey Turnpike near the Delaware Memorial Bridge as key routes they take to depart from the SJTPO region. Other freight activity hotspots include Vineland, Atlantic City, portions of Highway 9 and the Garden State Parkway between Cape May Township and Ocean City, and multiple locations in and around Pleasantville.

Figure 2-6. Stakeholder Comment Locations Related to Areas of High Freight Activity



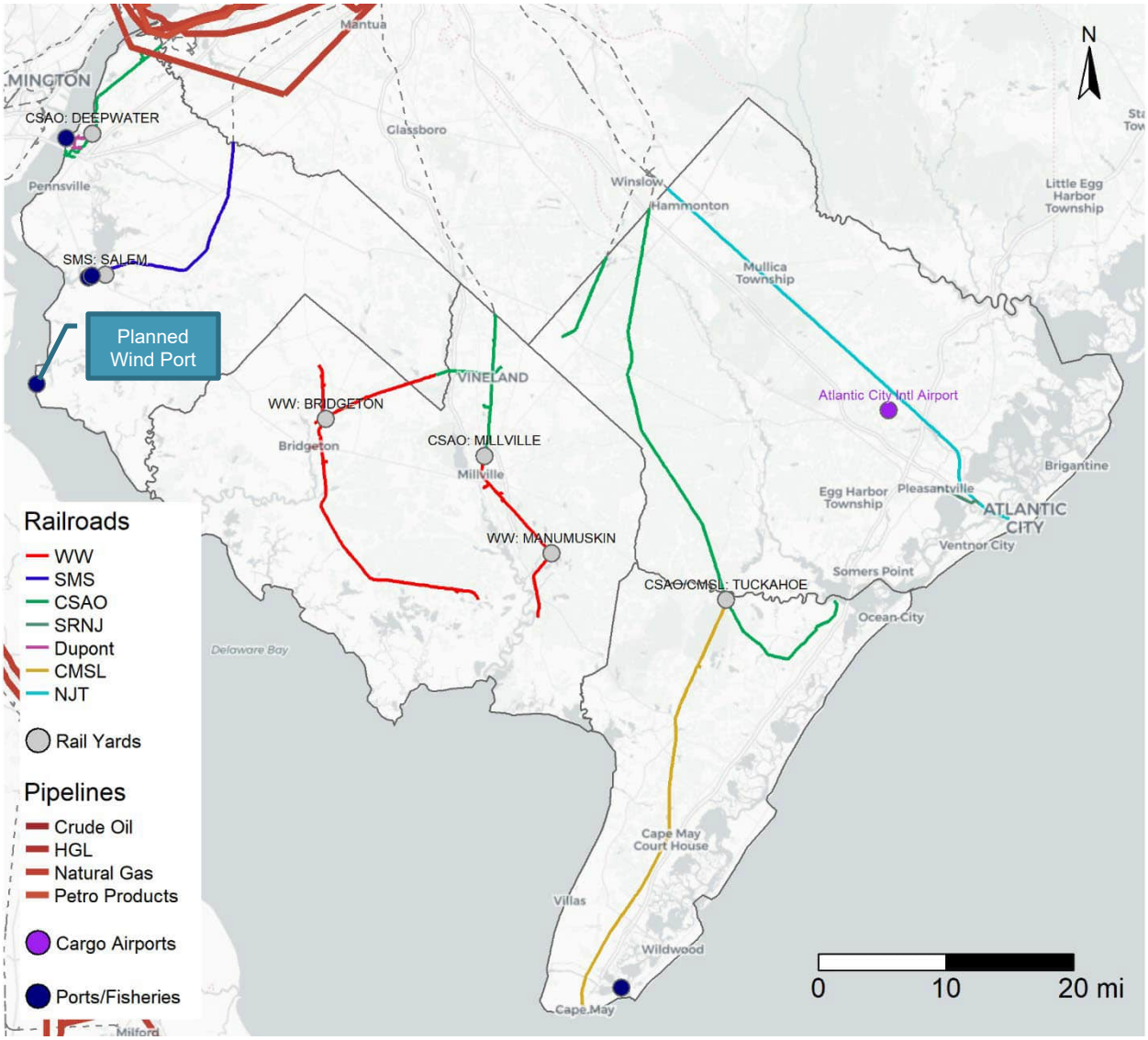
2.5 Multimodal Connection Points

Truck freight is the predominant mode of transport for the majority of freight movements in the country. Highways are also the component of the transportation network that public agencies such as SJTPO and counties have the most direct jurisdiction over. Therefore, the majority of this analysis has been focused on the truck freight mode. However, the connections of truck freight to other modes of freight transportation may also provide insights into locations of freight and truck activity. Multimodal connection points within the SJTPO area are shown in Figure 2-7 and described in more detail below.

- **Rail Yards:** Named rail yards were identified by reviewing the USDOT's North American Rail Lines spatial layer. This data is routinely updated to reflect current rail line conditions. The data used for this analysis was updated in January 2022. Six distinct named rail yards are included in the dataset: Deepwater, Salem, Bridgeton, Millville, Manumuskin, and Tuckahoe. Railroads in SJTPO include Winchester and Western (WW), Southern Railroad of New Jersey (SRNJ), Conrail Shared Assets Operations (CSAO), Cape May Seashore Lines (CMSL), and New Jersey Transit (NJT). A small amount of trackage in the CSAO Deepwater yard is listed as unknown ownership but is assumed to be owned by CSAO.
- **Water Ports:** Major docks and water port facilities were identified by reviewing the USDOT's Ports spatial layer available from the National Transportation Atlas Database (NTAD). These include
    - Two facilities in Salem involved in the shipment and receipt of multiple cargo types including conventional, containerized, and roll-on/roll-off cargo.
    - One facility just north of the Delaware Memorial Bridge involved in the shipment of acids and organic chemicals (Dupont Complex).
    - Multiple fisheries located in Cape May and Lower Township. While these facilities are not specifically noted in the USDOT databased, they were identified through stakeholder engagement and represent a major freight industry for the region.
    - While not yet included in the NTAD layer, a proposed wind port is planned for construction along Lower Alloways Creek, north of the nuclear power plant. This port would serve as a marshalling ground for construction of offshore wind energy infrastructure.
- **Airports:** Data on the locations of airports was downloaded from NTAD. Data on the monthly origins and destinations of passengers, freight, and mail shipped via airplane was downloaded from the Bureau of Transportation Statistics (BTS) T-100 dataset for years 2019, 2020, and 2021 (available through September). The data show that for this time period, the only airport within SJTPO that handled air cargo was the Atlantic City International Airport (ACY). However, this amount was small (15,870 lbs.) and only occurred in 2020. Negligible amounts of freight were handled at this airport in 2019 and 2021. The closest airport handling large volumes of freight is Philadelphia International Airport which handled over 1.2 billion pounds of freight in 2020.

- **Pipelines:** Pipeline infrastructure is extremely minimal within SJPTO. Data on pipeline and pipeline terminal locations for crude oil, hydrogen gas liquid, natural gas, and petroleum products pipeline types was downloaded from the U.S. Energy Information Administration. The data show only a small amount of natural gas and petroleum products pipelines located to the southwest of Bridgeport, and not major pipeline terminals in SJTPO. Note that for security reasons, the locations of the pipeline are highly generalized.

Figure 2-7. Multimodal Connection Points

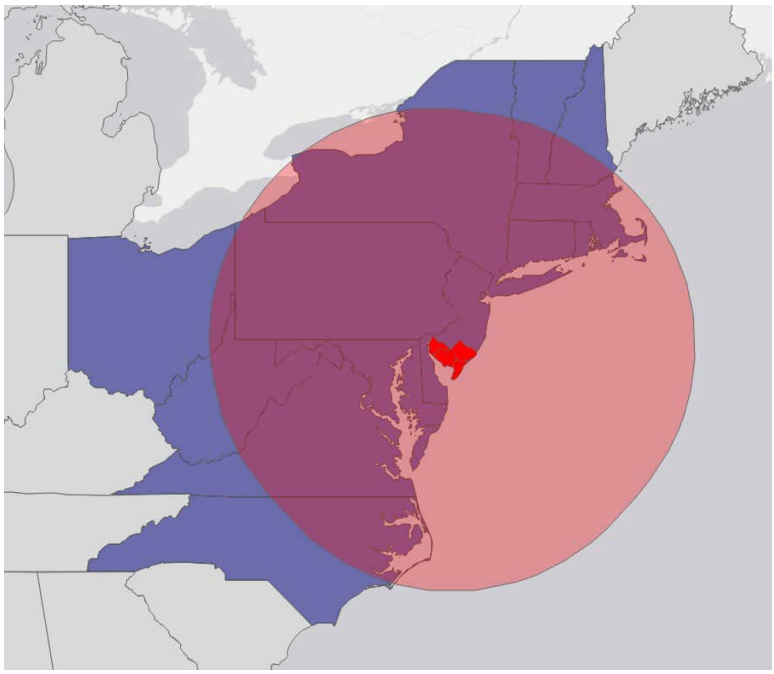


2.6 Truck Probe Activity

In early 2022, additional truck probe activity became available from the Regional Integrated Transportation Information System (RITIS) data platform. The data was purchased for the RITIS Trip Analytics platform by New Jersey DOT and was made available to the project team for analysis related to this study. The data includes processed INRIX truck trip data for April 2019, April 2020, and April – September 2021.

In total, these eight months of data include over 34 million individual records for truck trips either starting or ending within the State of New Jersey. The project team queried Origin-Destination matrix data from the RITIS Trip Analytics platform to identify all medium and heavy truck trips starting or ending their trip from Traffic Analysis Zones (TAZs) within the SJTPO study area and with a matching TAZ within any of the 15 states located within 300 miles of the SJTPO region (Figure 2-8). In total, this includes nearly three million individual truck trip records in the dataset for the SJTPO region. Note that the RITIS Trip Analytics Platform utilizes the 2010 Census TAZ delineations. These TAZ areas do not necessarily correlate with other local or regional delineation of TAZ areas.

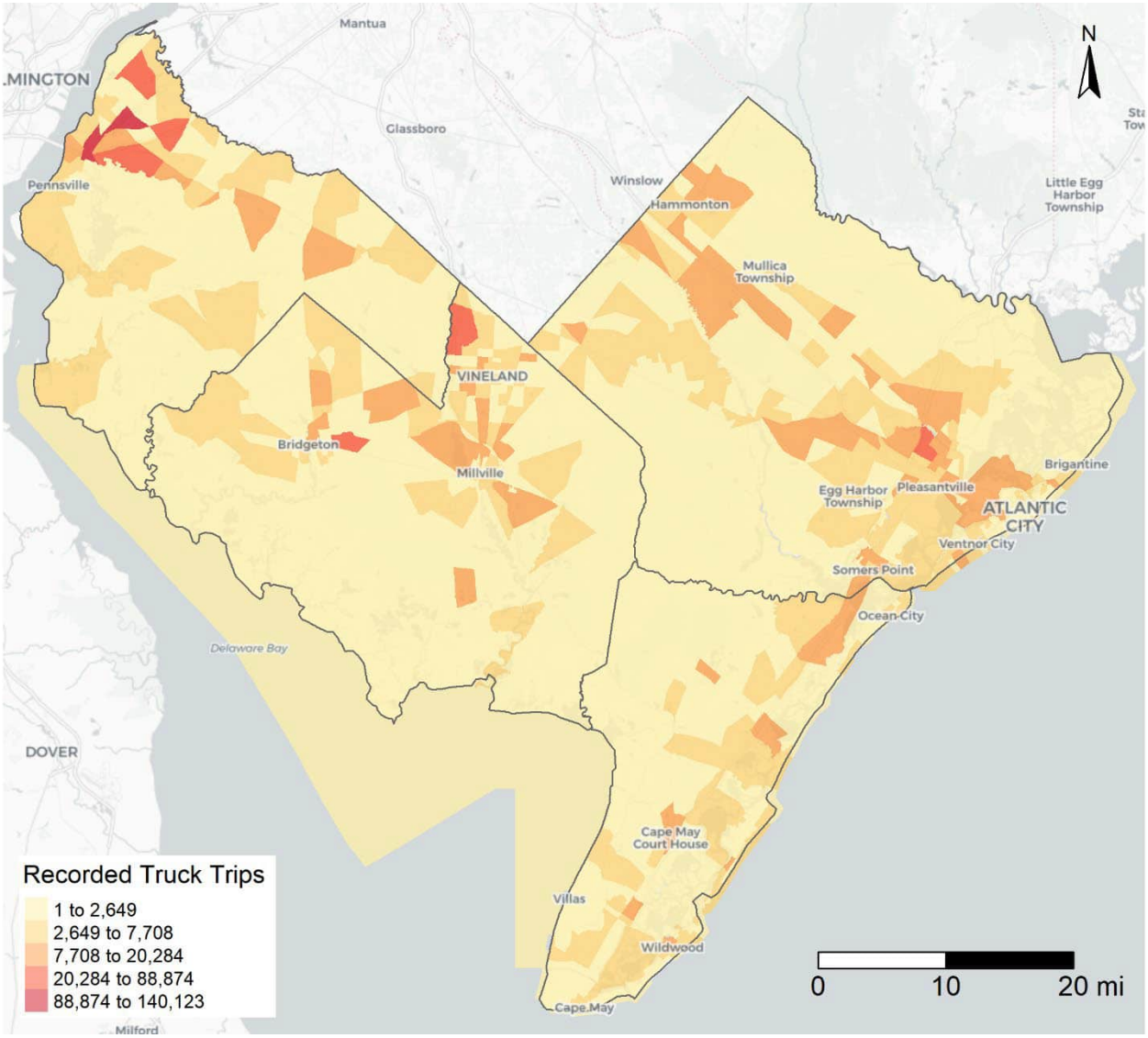
Figure 2-8. States within 300 Miles of SJTPO



The results of this exercise are shown in Figure 2-9. The TAZ with the highest levels of activity is located north of Pennsville adjacent to I-295 and the New Jersey Turnpike. This TAZ contains both a Flying J Travel Center and a Pilot Travel Center. Both of these facilities are used for overnight truck parking and explain the intense level of truck probe data in this TAZ. This TAZ alone account for nearly five percent of all trips starting or ending within the SJTPO area. Other areas of high truck probe activity are in the TAZs surrounding the two travel centers, Vineland, Bridgeton, Millville, and areas north of Pleasantville.

Not that this truck probe origin-destination data will be explored further in Tech Memo 2: Performance and Conditions.

Figure 2-9. SJTPO Truck Probe Activity by TAZ



3 Compare to Existing Truck Count Data

One of the key goals of this exercise is to develop a comprehensive freight roadway spatial network file to help SJTPO and other stakeholders better understand the magnitude of freight activity in the area. Specifically, this information seeks to help local stakeholders to determine whether individual roadway segments meet the criteria to be eligible for the New Jersey Department of Transportation (NJDOT) Local Freight Impact Fund (LFIF) program. NJDOT uses the following three criteria for determining eligibility:

1. Projects must be within the jurisdictional limits of the applicant's municipality and/or county unless filed jointly with an adjacent municipality and/or county.
2. Applicants must demonstrate that the project will provide access to a Port, Warehouse Distribution Center or any other Freight Node by providing a narrative and a map supporting their request.
3. Projects must have as a minimum 10% Large Truck Volume within the project limits. A traffic study must be submitted to support this information.

The identification of major freight generators completed in the previous sections will help to identify roadway segments that meet criteria 2. Roadways that serve the ports, rail yards, freight industry nodes, and areas with high truck probe activity should qualify under this measure.

This section seeks to address criteria 3 by reviewing available information on truck classification counts, collecting additional classification count data, and completing an interpolation process to estimate the truck percentages on intermediary roadway segments between the count locations. Additional details on the data sources and methodology of the process are described below.

3.1 Existing NJDOT Truck Counts

Vehicle classification counts are routinely conducted and recorded by the New Jersey Department of Transportation (NJDOT) to better understand the volume and types of vehicles traversing the State's roadways. This information is hosted on an interactive map available on the NJDOT websites (Figure 3-1). Each pink dot represents a 48-hour classification count location. NJDOT uses a vehicle classification system matching that of the Federal Highway Administration (FHWA). A breakdown of the various vehicle types under this classification scheme is shown in Figure 3-2. All vehicles Class 4 and above are considered "Trucks", while all vehicles Class 8 and above are considered "Combination Trucks".

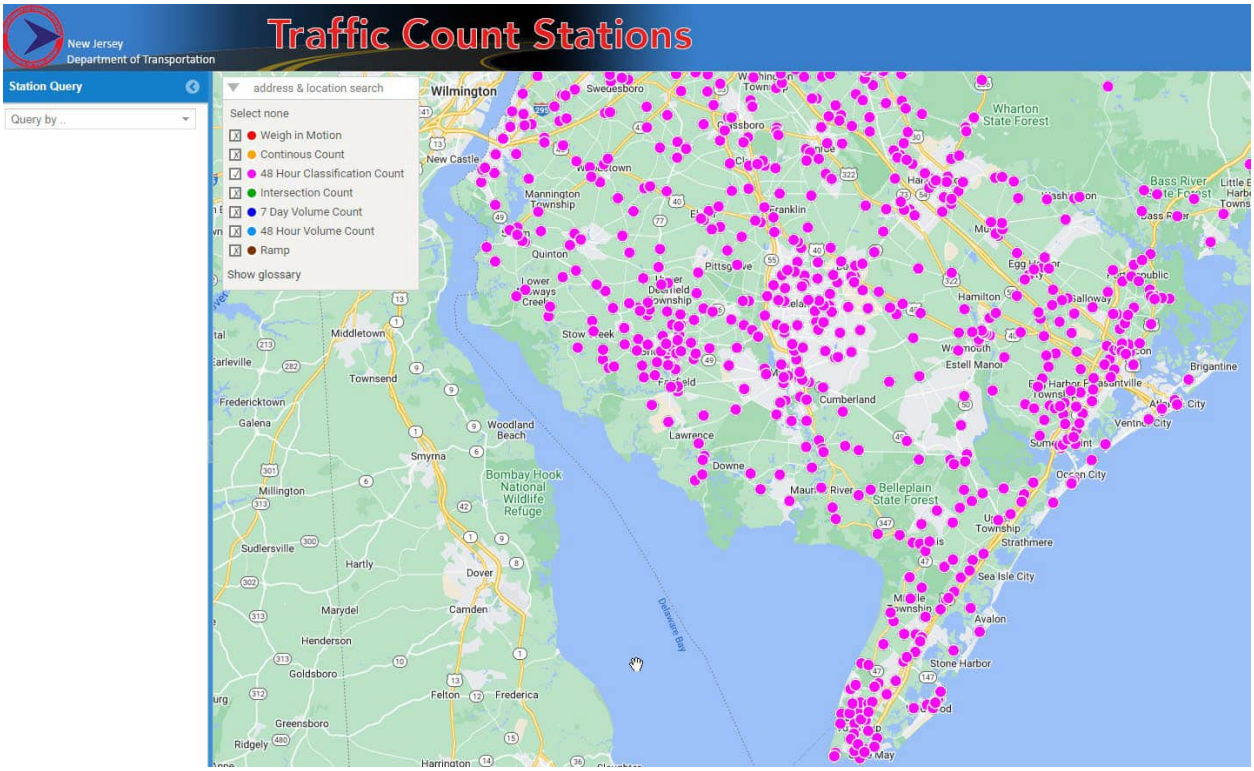
One key challenge in using this data is that while information on total annualized average daily traffic volumes (AADT) is available in downloadable spatial file from the NJDOT website, similar information on truck volumes is not available. Instead, the data can only be access via the interactive map by clicking on each location and then clicking on the PDF symbol to access the raw results of the classification count.[2] The study team

[2] Example Classification Count PDF: https://www.njtms.org/map/tms_reports/reports/DV03S_120106_8-20-2018.pdf

developed data analysis scripts to download the PDFs for each location and process the PDF text to identify the information for both truck volumes and combination truck volumes. This process was successfully completed for approximately 90 percent of the 48-hour classification count locations. The remaining locations were reviewed manually to complete the data collection process.

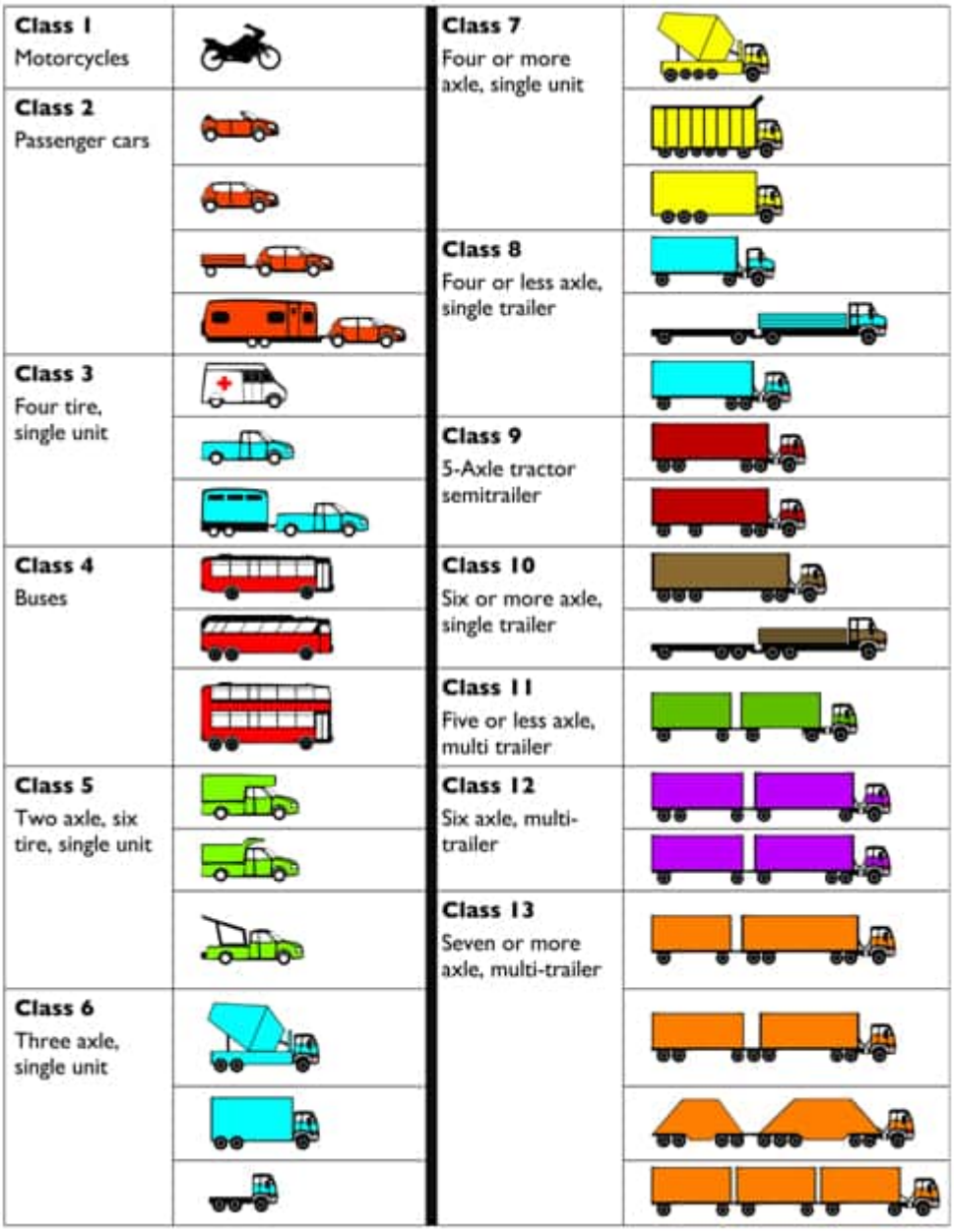
This process resulted in 426 unique classification count locations in the SJTPO study area.

Figure 3-1. NJDOT Traffic Count Station Map



Source: https://www.njtms.org/map/

Figure 3-2. FHWA Vehicle Classification Chart

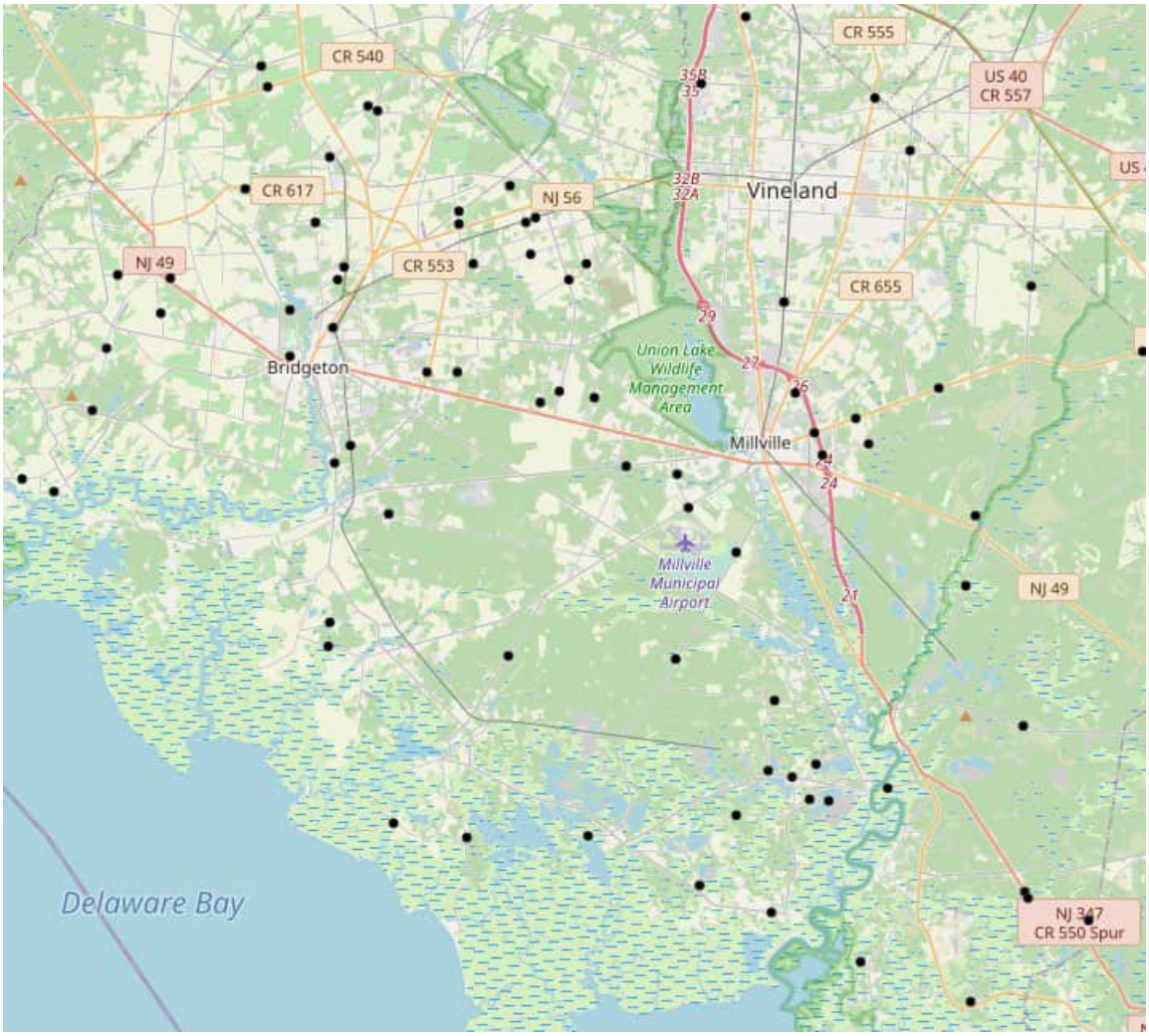


Source: FHWA Traffic Monitoring Guide (https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm)

3.2 Cumberland County Truck Study Counts

Cumberland County recently completed additional vehicle classification counts as part of a pair of Truck Route Identification Studies. The two studies were focused on the eastern and western portions of the county, respectively. In total, the study provided an additional 79 classification count locations to the dataset (Figure 3-3). The format of the classification count data matched that collected by NJDOT.

Figure 3-3. Cumberland County Truck Study Classification Count Locations

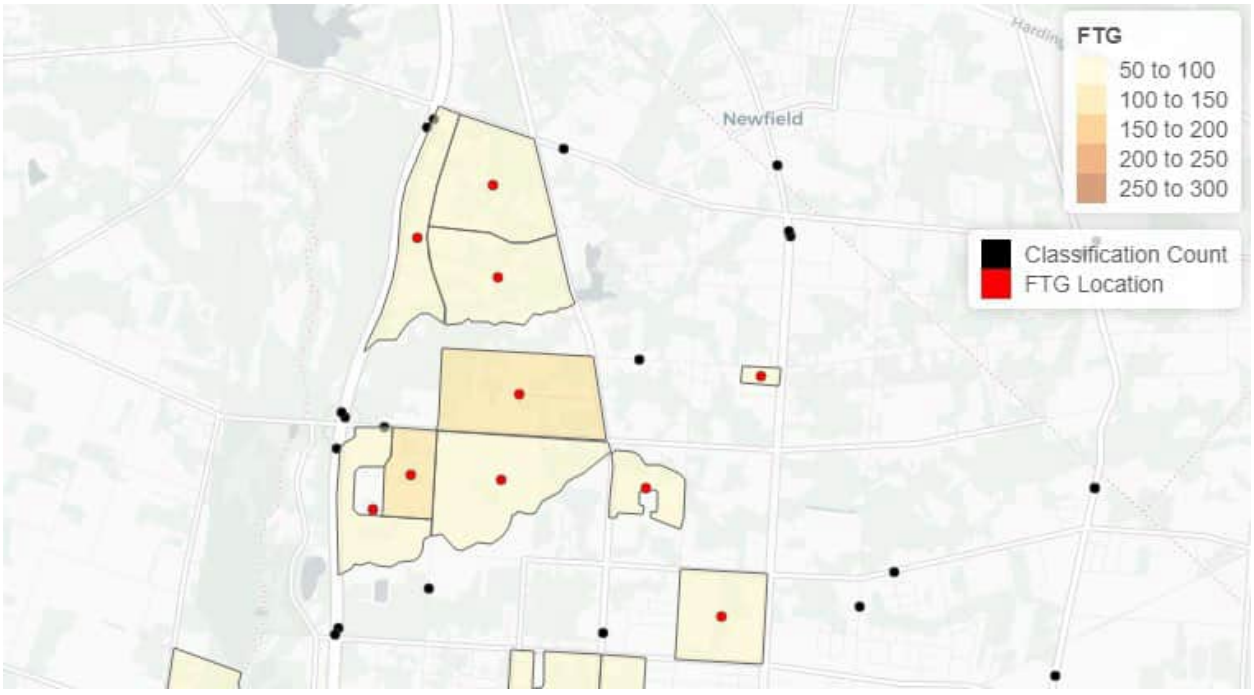


3.3 Freight Trip Generation Estimates

The process of estimating freight activity based on the industry type and number of employees within an area discussed in previous sections is used here to develop additional estimated classification count points in the SJTPO Region. While the freight trip generation values are considered only high-level estimates compared to the actual data represented by the classification counts, they are a useful tool for distributing trips along the network to areas which do not have real world data, but which are expected to have a large share of truck activity.

An example of this process is shown in Figure 3-4 for the Vineland Industrial Park area near N Mill Road and W Garden Road. Multiple census blocks within this area have estimated daily truck trips of 50 or more. For the incorporation of this data into the study, the block centroids were used as proxy classification count locations. The freight trip generation data does not distinguish between truck vehicle types. To approximate a value for the combination unit truck type, the surrounding classification count locations within a two-mile radius were used to estimate the ratio of combination trucks to all trucks. The freight trip generation estimates also do not produce any estimate of all-vehicle average daily traffic. Therefore, the average daily traffic values at the freight trip generation centroids were set to zero for the next analysis steps.

Figure 3-4. Freight Trip Generation (FTG) Point Locations

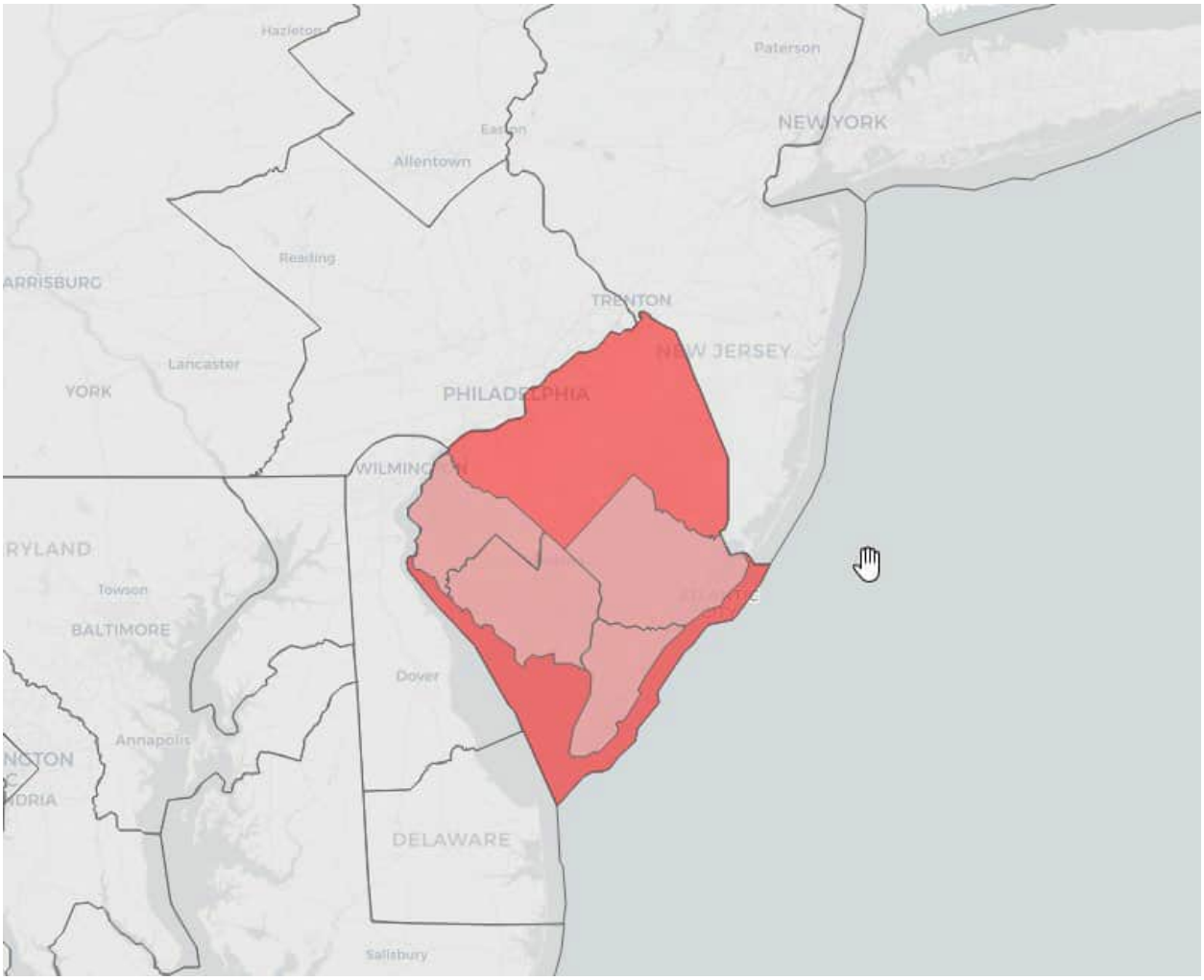


3.4 Freight Analysis Framework Estimates

The Freight Analysis Framework Version 5 (FAF5) is a data product developed in coordination between the Bureau of Transportation Statistics (BRS) and the Federal Highway Administration (FHWA). It combines data from the 2017 Commodity Flow Survey (CFS) with international trade data from the Census Bureau to incorporate data from agriculture, extraction, utility, construction, service, and other industry sectors. FAF data is release every five years, typically following the release of the CFS data. The most recent FAF data is Version 5 which was released in late 2021 with additional data products being release in the Spring of 2022.

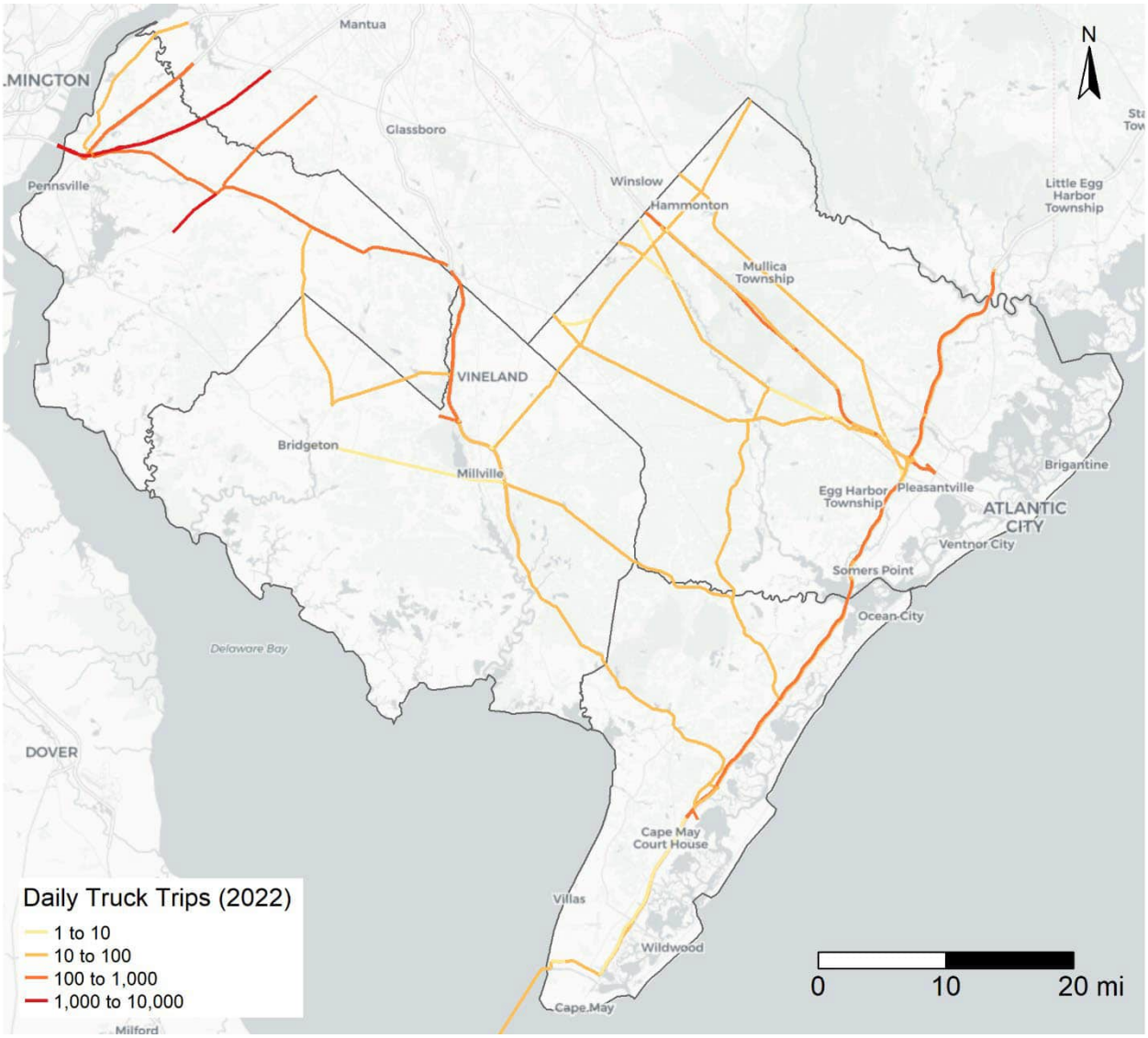
The primary product developed under FAF5 is the estimation of freight flows by industry and mode between and within each of the designated FAF areas. SJTPO falls entirely within the Philadelphia-Reading-Camden, PA-NJ-DE-MD FAF Area (NJ Part) as shown in Figure 3-5. The Philadelphia-Reading-Camden FAF area continues with a Pennsylvania counterpart. The remainder of New Jersey is included within the New York-Newark, NY-NJ-CT-PA FAF Area (NJ Part).

Figure 3-5. FAF5 Philadelphia-Reading-Camden, PA-NJ-DE-MD FAF Area (NJ Part)



A secondary data product released as part of the FAF5 dataset is the Estimates of Truck Flow on the nation's highway networks. This data is prepared as part of a multi-step process by which the FAF region origin-destination flow data is disaggregated to smaller geographies, the truck mode component is filtered out, the truck tonnage estimates are converted to estimated daily trucks, and these trucks are then assigned to specific routes on the roadway network. Note that the FAF model network primarily consists of higher classification roadways on the National Highway System such as Interstate, US, and Major State Highways. The estimated truck flows on highways within SJTPO is shown in Figure 3-6. This data is also further disaggregated into vehicle type (e.g., single unit trucks, combination unit trucks) and by commodity type including categories such as farm products; stone, sand, gravel, and ores; chemicals; and manufactured goods.

Figure 3-6. FAF5 Estimated Daily Truck Volumes



For this analysis, the all truck and combination unit truck flow estimates on each roadway segment were used to supplement the classification count data described in the previous sections. Individual points were created by taking the midpoint of each FAF5 network segment. Since many of the higher classification roadways included in this data set were not included in the classification count data, it helps to fill in the gaps to develop a more complete picture of freight activity in the region. Further evaluation of the FAF5 truck flows will be included in subsequent Tech Memos.

3.5 Additional Truck Count Data

The locations of the existing classification count data were compared against multiple datasets to identify potential candidate roadways for additional classification count data collection. First, the count locations were compared against the major freight generator information discussed in the previous sections. Roadway segments with no existing count data that were in proximity to major freight generators were flagged for potential consideration. Additionally, the study team conducted a preliminary routing interpolation process to estimate the truck volumes and percentages in between the point locations. Roadway segments with high estimated truck volumes or an estimated truck percentage greater than 10 were also flagged for potential consideration.

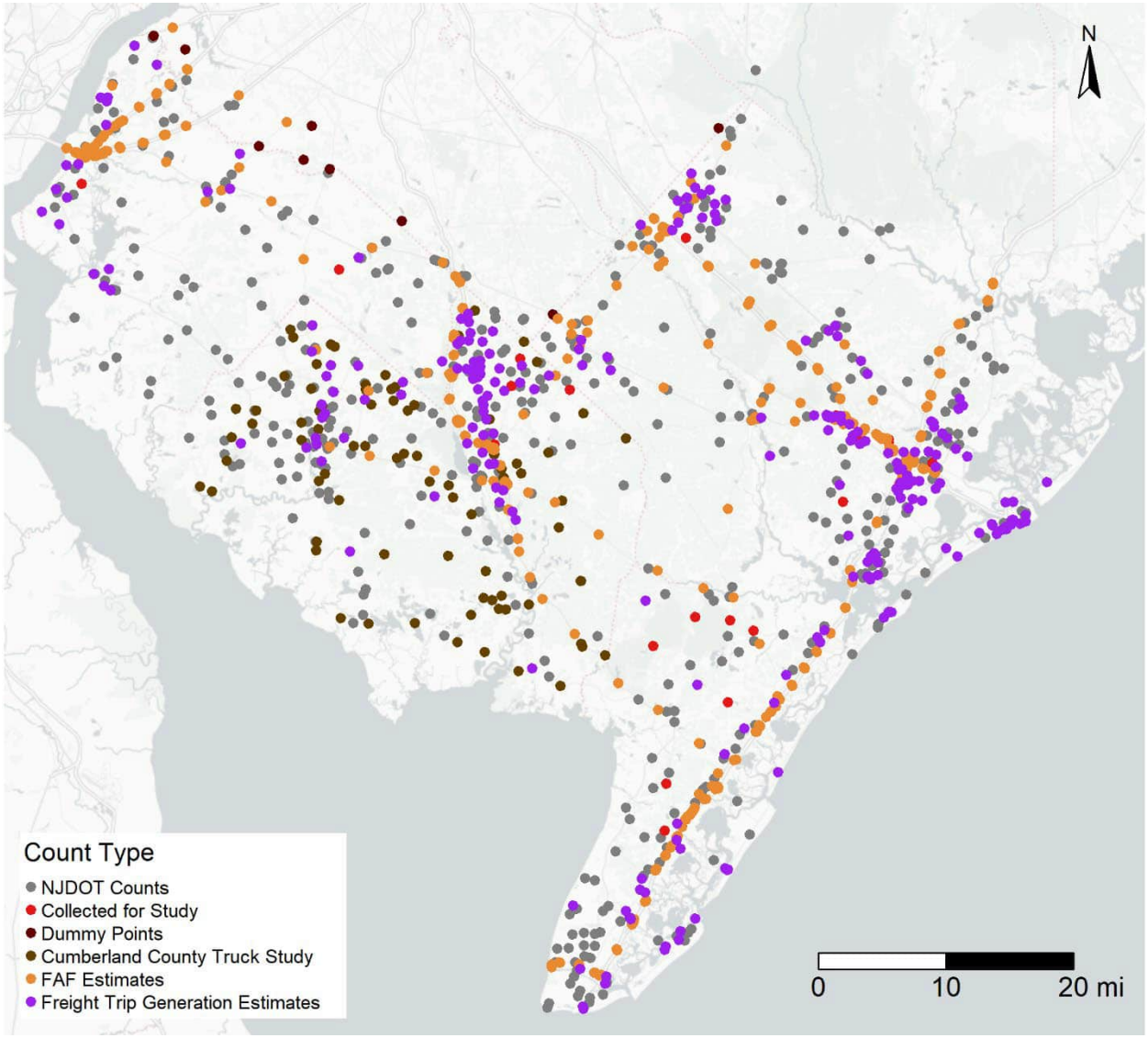
The proposed classification count locations were reviewed with staff from Salem, Cumberland, Cape May, and Atlantic Counties and staff from the City of Vineland. Through a combination of the data analysis and the local knowledge of county and city staff, additional classification count locations were identified. In total, 21 additional classification count locations were identified and collected by the study team in January 2022.

The locations of the classification count data points included in the analysis are shown in Figure 3-7.:

- Existing NJDOT classification count data is shown in gray
- Cumberland County Truck Study classification counts are shown in brown
- Additional classification counts collected as part of this study are shown in red
- FAF truck flow estimates are shown in orange
- Freight trip generation estimates are shown in purple
- “Dummy” points shown in black are duplicate locations placed on the periphery of the county boundaries to reflect actual conditions more accurately during the routing extrapolation phase of the study. The placement of these points results in the truck counts at the peripheral points being split evenly rather than all of the trucks being distributed to points within the SJTPO area.

Through a combination of these multiple data sources, the study area has thorough coverage of local, regional, state, and interstate highways in the region for use in the trip interpolation and extrapolation process described in the subsequent section.

Figure 3-7. Final Truck Classification Count Locations



4 Extrapolate Trips to Network

A unique approach undertaken by this study was the extrapolation of truck counts from the point locations to the surrounding highway network. This was accomplished through a combination of the HERE Routing API[3] and scripted geospatial processing. The following steps were taken:

1. For each individual classification count location, identify the 50 nearest adjacent count locations.
2. Use the HERE Routing API to map a route between the original point and the adjacent points and create a spatial line feature of this route.
3. Truncate the resulting routing spatial features to eliminate any routes that extend beyond one of the count locations. An example of this can be seen in Figure 4-1: Site 120622 would have been identified as one of the adjacent location connecting to site 8-4-431. However, the routing between these two points would have passed through side 552-1. Therefore, the route to 120622 was removed.
4. Filter out unrealistic routing results by eliminating routing shapes where the network distance of the route exceeds three times the straight-line distance between the start and end points. For example, this will eliminate routings from one side of a divided highway to the other.
5. Calculate the proportion of the truck trips estimated to travel to each of the adjacent point based on the volume of trucks at the adjacent locations. For example, if an originating point had two connecting points and their truck volumes were 60 trucks per day and 40 trucks per day, the process would estimate that 60 percent of trucks from the originating site would travel to the first site and the remaining 40 percent of trucks would travel to the second site. In this way, count locations with high truck volumes are likely to attract trips from other surrounding points while count locations with low truck volumes are less likely to attract trips.
6. Merge the results of the overlapping routings to combine the estimated truck volumes on individual segments.

This exercise was completed for all classification points in the data set and trip extrapolations were calculated separately for all average daily traffic (ADT), truck ADT, and combination truck ADT. The last step of this analysis was to calculate the percentage of trucks on each route by dividing the composite truck ADT value by the total ADT value.

The following figures highlight the results of this analysis on three adjacent count location on May's Landing Road east of Millville. Each site is labelled with its associated NJDOT site identification number. The extrapolation of trips from site 8-4-431 is relatively straightforward. Only three adjacent locations are identified within the immediate area. Of these, the sites at 552-1 and 8-6-116 on May's Landing Road have higher truck counts than the site at 160623. Therefore, the majority of trips from this site are expected to

[3] HERE Routing API v8 Documentation: https://developer.here.com/documentation/routing-api/dev_guide/index.html

continue along May's Landing Road. However, a small percentage of trucks are estimated to traverse north along New Panther Road to reach the site at 160623. Since New Panther Road does not currently have a classification count, this process provided additional information not included in the point data alone.

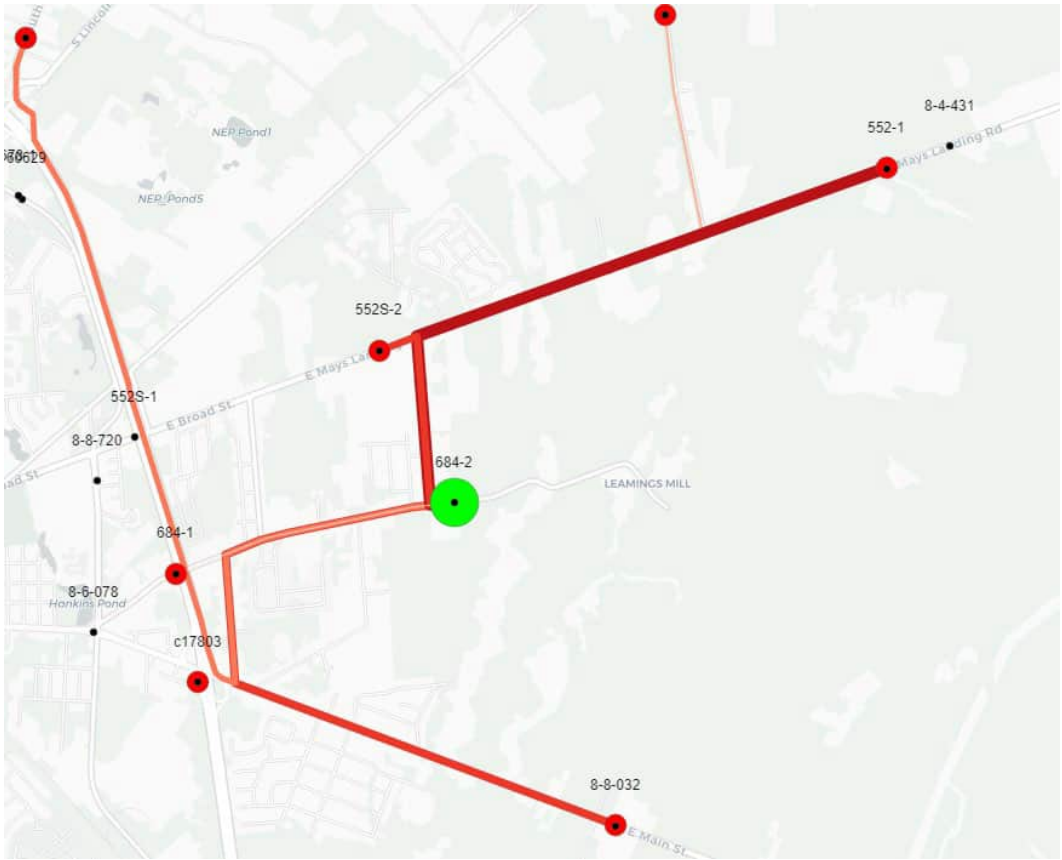
The extrapolation of trips from site 552-1 (Figure 4-2) is only somewhat more complicated than the previous example because it has four connecting count locations. However, as before, the majority of truck trips are expected to remain on May's Landing Road.

The extrapolation of trips from site 684-2 (Figure 4-3) is the most complex of these examples due to multiple adjacent count locations with similar traffic volume levels. Approximately 32 percent of the truck trips from this site are estimated to travel to site 552-1, 20 percent are estimated to travel to site 552S-2, 22 percent are estimated to travel to site 8-8-032, and 16 percenter are estimated to travel to site 4 in the northwestern area of the figure. The remaining 10 percent of trips are estimated to travel to other sites on the figure.

Figure 4-1. Extrapolation: Site 8-4-431

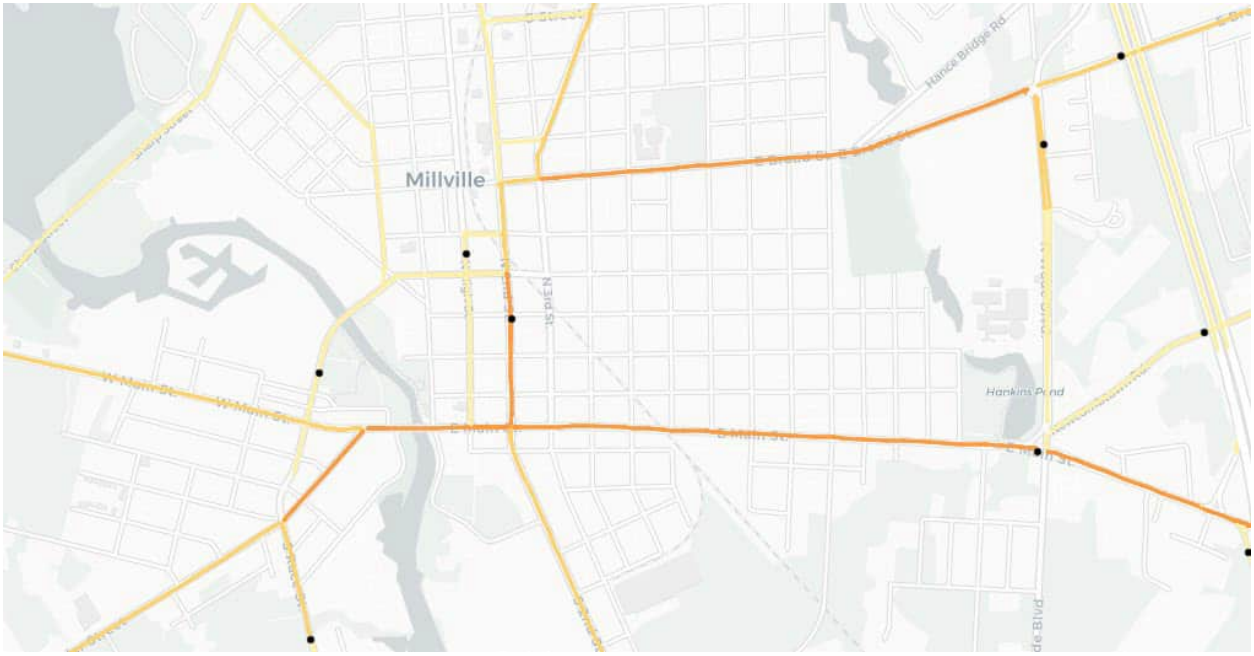
Figure 4-2. Extrapolation: Site 552-1

Figure 4-3. Extrapolation: Site 684-2



One key advantage of this methodology is that the allocation of trips to the network can help to fill in the information gaps between existing classification count locations. Figure 4-4 below highlights an example of this in Millville. Multiple segments of Main Street and Broad Street do not have existing classification counts but this methodology indicates the likelihood of higher truck volumes on these segments. Note this information represents only an estimated value based on this analysis methodology and should be used only as a guide. Prior to submitting funding applications to the NJDOT Local Freight Impact Fund or other uses, physical classification counts must be recorded to confirm actual truck volumes and percentages.

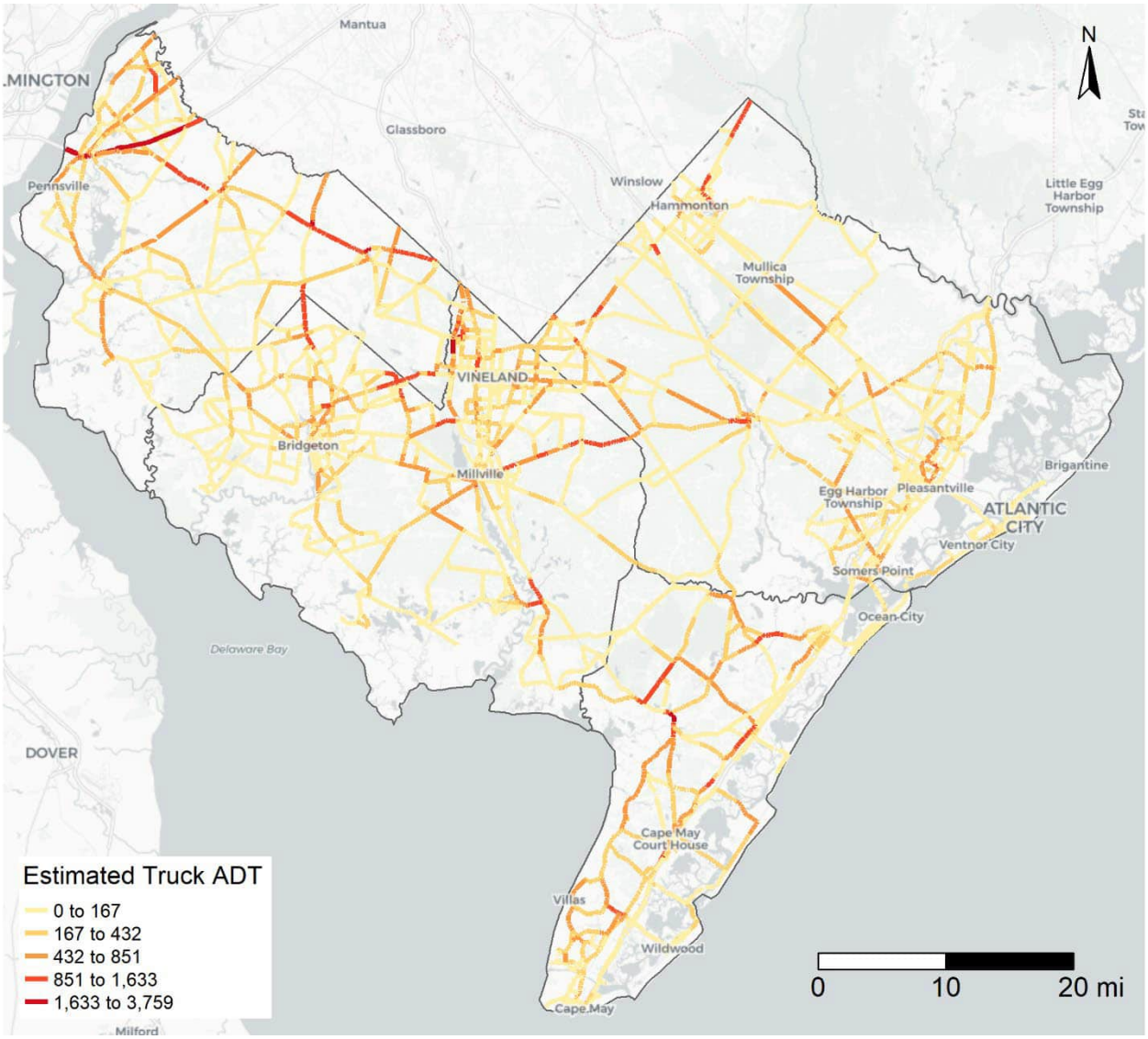
Figure 4-4. Example of Filling in Gaps Between Known Counts (Millville)



The final estimated truck ADT, combination truck ADT, and truck percentages on roadway segments throughout SJTPO are shown on the following pages. This data will also be presented in an interactive online map format to be discussed in later technical documentation.

Figure 4-5 highlights the estimated distribution of Truck ADT on roadway segments in SJTPO. The figure shows many areas of high truck activity in Vineland, Bridgeton, and Millville as well as other corridors near Cape May Township and Pennsville. Key truck freight corridors include US 40 (Harding Highway), NJ 49 (North Broadway/Shell Road), NJ 77, US 206, and NJ 47.

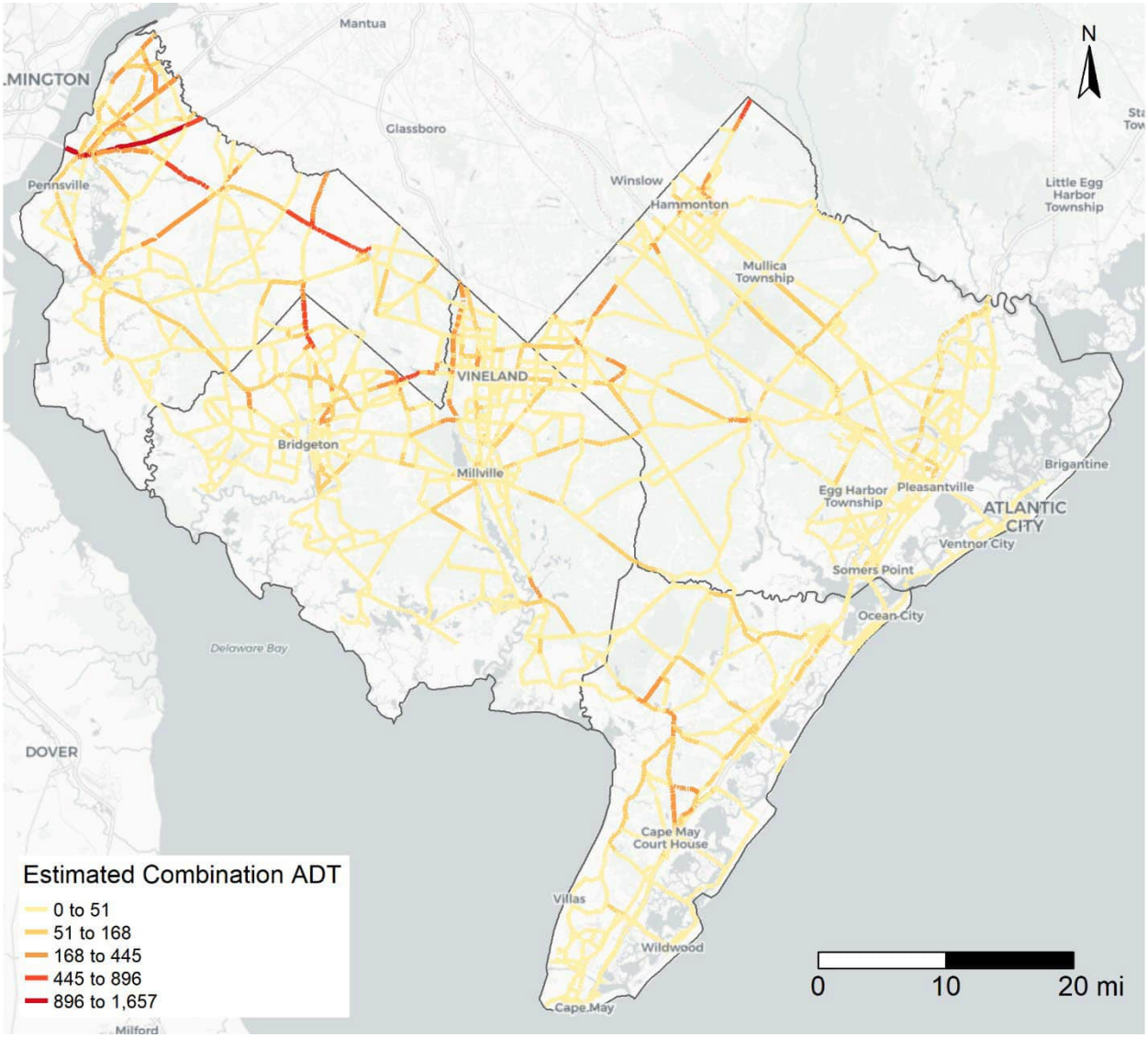
Figure 4-5. Final Estimated Truck ADT



Source: HDR analysis of NJDOT truck classification counts, freight trip generation estimates using the NCFRP Report 37 methodology applied to LEHD data and FAF5 truck flow network assignments.

Figure 4-6 highlights similar information for the larger single and multiple combination tractor trailers in the SJTPO region. Many of the roadways highlighted in the previous figure are also highlighted here. However, the combination truck traffic tends to be more heavily concentrated onto a smaller selection of roadway segments. In particular, US 40 (Harding Highway), NJ77, and US 206 all have fairly high concentrations of these larger freight vehicles.

Figure 4-6. Final Estimated Combination Truck ADT

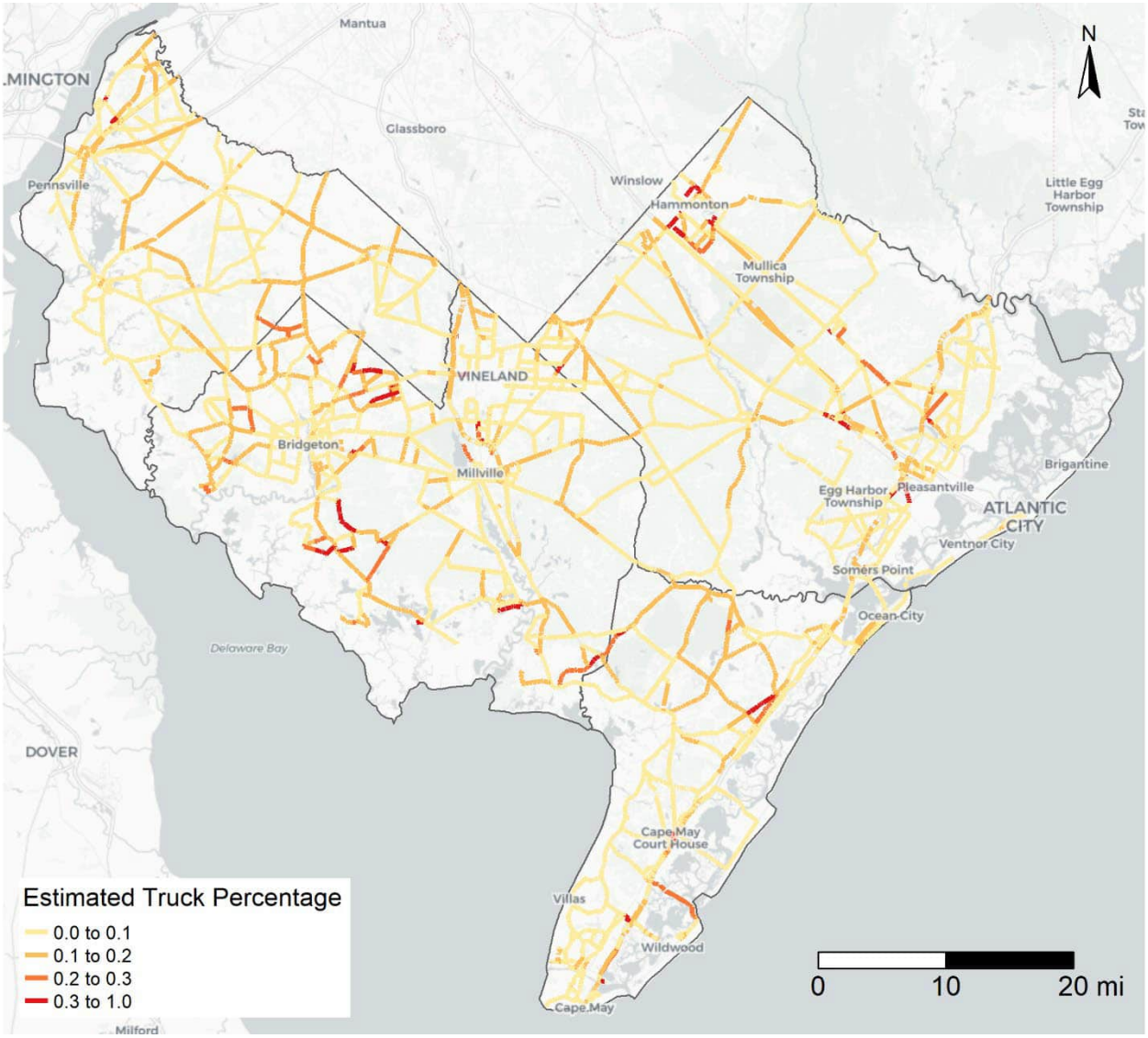


Source: HDR analysis of NJDOT truck classification counts, freight trip generation estimates using the NCFRP Report 37 methodology applied to LEHD data and FAF5 truck flow network assignments.

Lastly, Figure 4-7 highlights the estimated truck percentage on roadway segments in SJTPO. While there is some overlap between the previous figures and this figure, higher truck percentages are more likely to occur on local and county roads that have relatively lower total traffic volumes. Note however, that the classification count points developed through the freight trip generation estimates do not include estimates of average daily traffic. Because of this, roadways on or near these points may show an ADT value of zero. To avoid the appearance of artificially high truck percentages, Figure 4-7 excludes roadway segments that resulted in positive truck volumes and zero ADT volumes.

As noted earlier, this information will be made available in an interactive online map format that will make it easier to identify the individual roadway segments that meet the 10 percent truck criteria for the NJDOT Local Freight Impact Fund eligibility. The maps will also show the location of existing classification counts and the locations of major freight generators discussed in previous sections.

Figure 4-7. Final Estimated Truck Percentage



5 Next Steps

The next phase of this study will focus on the evaluation and assessment of freight performance measures. Specifically, the study will review available truck probe data sets available from the Trip Analytics and Massive Data Downloader tools available from the RITIS tool suite. The study will also evaluate freight mobility barriers such as bridges with low vertical underclearance and low permissible loads as well as evaluate safety issues related to truck crashes including both crash type and severity.

Finally, all of the data analysis products displayed for these technical memos will be displayed in an online StoryMap format including both descriptive text narration and interactive maps of the materials being presented. The StoryMap will be developed using the ArcGIS Online (AGOL) platform and will be hosted on SJTPO's AGOL servers.