Delaware First/Final Mile Freight Network Development

Working Paper 2: Addressing Delaware’s First/Final Mile Freight Needs and Issues

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WILMAPCO and DelDOT

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The objective of this network development effort is to create a greater understanding of Delaware's first/final mile connections that link businesses to state and national highway networks. A second objective is identifying freight transportation needs and issues on these connections so that DelDOT, WILMAPCO, and other planning stakeholders can address these issues in the future.

Ultimately, the project will help Delaware's transportation stakeholders make effective improvements and maintain first/final mile connections while balancing the needs of other transportation users.

Working Paper

This Working Paper is the second in a series of two that together inform the Study. This Working Paper provides results of a quantitative evaluation of potential first/final mile needs and issues, and a review of potential strategies Delaware could employ to address major needs and issues.

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Opinions

Unless otherwise indicated, the opinions herein are those of the authors and do not necessarily reflect the views of WILMAPCO or DelDOT.

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Acronyms / Abbreviations

BUILD	Better Utilizing Investments to Leverage Development
DelDOT	Delaware Department of Transportation
DOT	Department of Transportation
EPA	U.S. Environmental Protection Agency
ESAL	Equivalent Single Axle Load
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
GARVEE	Grant Anticipation Revenue Vehicle
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
INFRA	Infrastructure for Rebuilding America
ITS	Intelligent Transportation System
MPO	Metropolitan Planning Organization
NEPA	National Environmental Policy Act
NACTO	National Association of City Transportation Officials
NHPP	National Highway Performance Program
NHS	National Highway System
OSPC	Office of State Planning Coordination
PEL	Planning and Environmental Linkages
PMA	Protect-Manage-Accommodate
PNRS	Projects of National and Regional Significance
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
SCAG	Southern California Association of Governments
SIS	Statewide Intermodal System
SR	State Route
STP	Surface Transportation Program
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investment Generating Economic Recovery
TMP	Transportation Master Plan
USDOT	United States Department of Transportation
WILMAPCO	Wilmington Area Planning Council

1 Introduction

1.1 Project Background

The Wilmington Area Planning Council (WILMAPCO) and Delaware Department of Transportation (DelDOT), in partnership with other state and regional stakeholders, have undertaken this first/final mile network development project to help Delaware's transportation stakeholders effectively maintain and improve first/final mile freight transportation connections while balancing the needs of other transportation users including passenger traffic, bicyclists, and pedestrians.

This Working Paper is the second of two intermediate reports in this network development project and provides information on Delaware's first/final mile connections' performance needs and issues, and potential approaches to address these problems.

What is the first- and final-mile?

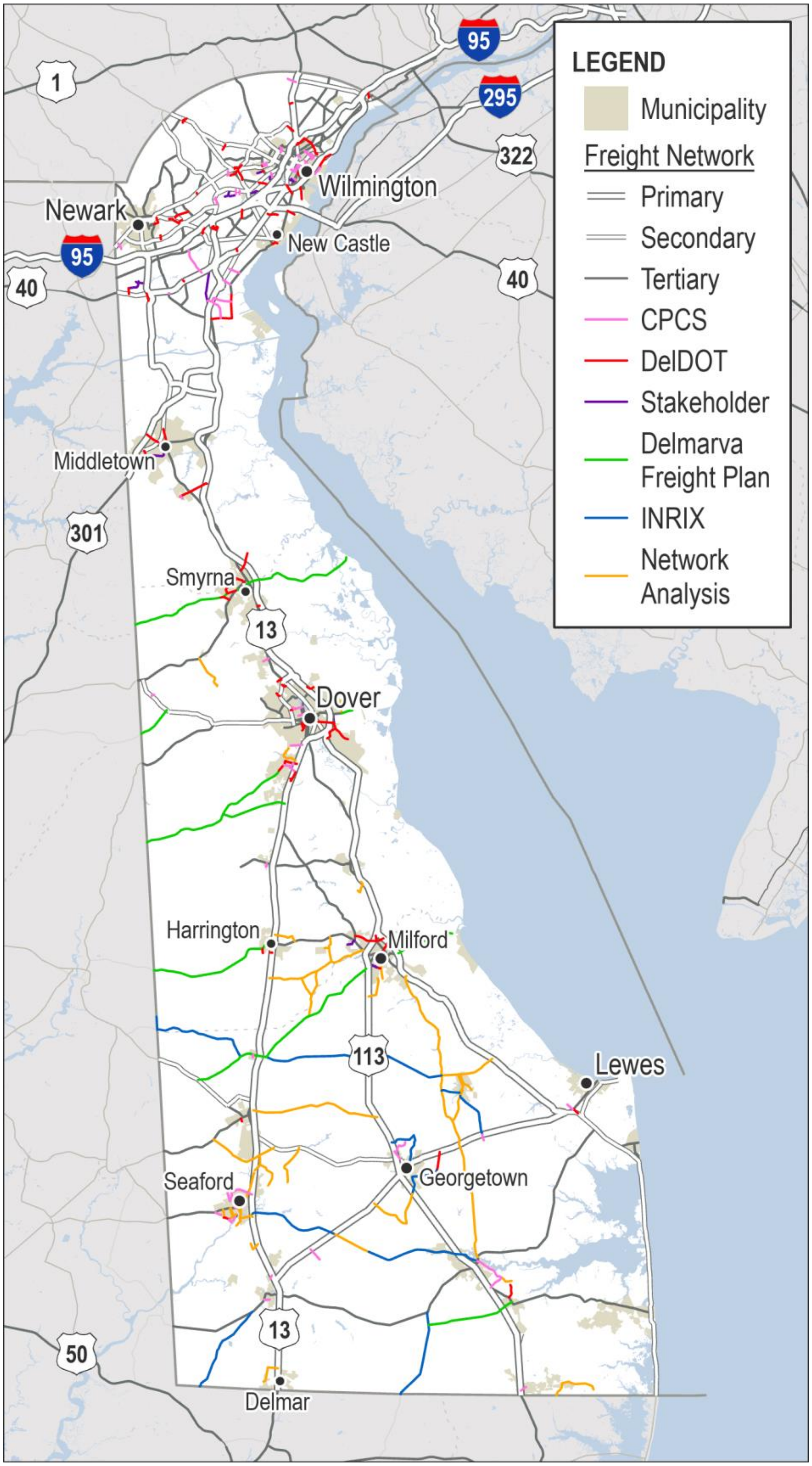
In the context of freight transportation, first- and final-mile connections are roadways that link truck trip origins or destinations with mainline routes of travel such as interstates or major regional highways. These connections are important elements of Delaware's freight network because they provide businesses with access to major highways, ports, airports, and intermodal terminals.

1.2 Delaware's First/Final Mile Network

An initial first/final mile network was identified as part of the development of Working Paper 1. Following the completion of Working Paper 1, WILMAPCO solicited stakeholder feedback about first/final mile needs and issues using the WikiMapping online map and comment platform. Within the WikiMapping system, government partners, industry stakeholders, and the general public were able to review the draft first/final mile network, provide corrections or additions to the network, and provide comments on the locations and characteristics of specific needs and issues. This stakeholder feedback is a critical input for the project because it helps identify needs and issues that the data cannot "see". For example, not all the desired performance data were available for this performance assessment. Prior first/final mile projects elsewhere in the United States have illustrated that stakeholder feedback on needs and issues is a critical complement to quantitative analysis. Based on the feedback received from the WikiMapping tool, the initial draft network underwent select revisions, and a revised network is shown in Figure 1. Different linework within the first/final mile map corresponds to identification methodology:

- **CPCS** corresponds to connections identified using business establishment and land use data.
- **DelDOT** shows connections previously identified by WILMAPCO and DelDOT.
- **Stakeholder** lists connections that were identified by stakeholders in the Wikimapping system.
- **Delmarva Freight Plan** connections were identified as key rural routes for agriculture in the Delmarva Freight Plan but were not identified as primary, secondary, or tertiary freight routes.
- **INRIX** reflects connections where INRIX truck GPS data identified truck flows moving on roads not previously classified as freight routes.
- **Network Analysis** connections were identified by ESRI's truck routing algorithms and provide connections to business establishments that did not have a clear route to the primary or secondary freight system identified during the "CPCS" analysis.

Figure 1: Delaware's First/Final Mile Network



1.3 Stakeholder Feedback Results

Different Wikimapping links were sent to two broad groups of stakeholders: (1) public agencies and industry stakeholders, and (2) the general public. This divided response format was used since responses can be seen and commented on by other users with the link, and the project team wanted to ensure that private industry stakeholders would be willing to share their needs, issues, and concerns.

Figure 2 summarizes the number and type of responses received from each group. Note that some Wikimapping comments mentioned multiple issues, and thus the number of mentions, corrections, and additions exceeds the number of comments received.

Figure 2: Wikimapping Application Feedback Summary

	Stakeholder Group	
	Industry and Public Agency	General Public
Unique Commenters	7	14
Comments Received	67	60
Substance of Comments		
Network Corrections or Additions	42	7
Land Use Mentions	20	13
Mobility Mentions	2	31
Safety Mentions	3	11
Condition Mentions	1	1

Government and industry stakeholders primarily provided corrections and additions to the first/final mile network, as well as general comments about land use conflicts. By comparison, public stakeholders primarily identified mobility and safety concerns.

While both Wikimapping surveys received a similar number of comments, there was a significant difference in the type of comments received. Public agencies and industry stakeholders provided more additions and corrections to the first/final mile network, as well as comments about land use conflicts. By comparison, the public provided more feedback on mobility and safety concerns. This difference can be explained by work focuses and perspectives: public agency staff, particularly planners, will have insight into broad land use problems or transportation network issues within their areas of practice, while residents know very specific needs and issues that personally affect them. Insight from specific comments is included in the following chapters of this Working Paper.

1.4 Performance Screening Methodology

During and after stakeholder feedback collection, CPCS worked with WILMAPCO and DelDOT to collect data for the performance screening. Data were assembled from a variety of sources and mapped onto the conflated road network linework. This data provides context for the performance of first/final mile connections and helps evaluate mobility, safety, and condition problems, as well as potential land use and institutional conflicts. Appendix A summarizes the results of this analysis and additional contextual information is also contained in a geospatial dataset that will be transferred to WILMAPCO.

Unfortunately, not all the data that CPCS requested for the evaluation process was available for use in this project. The following chapters provide information on missing data. Based on the lessons learned from this project's data collection and organization, some data-related recommendations are provided as well.

1.5 Categories of First/Final Mile Needs and Issues

This Working Paper is broken down into five major chapters that correspond to the broad types of first/final mile needs and issues present in Delaware and more broadly in the United States. The categories of problems are:

Institutional problems, which include difficulty coordinating freight investments across multiple levels of government, communicating the importance of freight transportation to local partners, and data availability issues.

Land Use problems, which relate to conflicts that arise because of freight routes passing through residential, commercial, or environmentally sensitive areas. Most commonly, land use conflicts relate to freight routes passing through residential areas, potentially exposing residents to undesirable noise, vibration, and air emissions.

Mobility problems, which refer to barriers to efficient or "smooth" freight movement, including traffic congestion, impediments to direct routing (such as low-clearance bridges forcing trucks to take longer, circuitous routes), tight turns, narrow lanes, shoulders, or passing lanes.

Safety problems, which refer to design characteristics or user behavior that increase the likelihood or severity of accidents, including poor sightlines at intersections, driver speeding, or co-location of truck routes and bicycle lanes.

Condition problems, which relate to the poor condition of pavement or bridges on freight routes, or accelerated deterioration of infrastructure as a result of frequent and heavy truck traffic.

2 Institutional Needs and Issues

Institutional needs and issues in Delaware that affect first/final mile issues include difficulty coordinating transportation planning between state and local stakeholders, which can create freight and land use conflicts, limited funding to support first/final mile investments, and limitations on freight-related data availability.

2.1 Strategic Context

2.1.1 Freight Facility Site Selection

Freight facilities such as modal transfer facilities (e.g. ports, intermodal terminals), distribution and centers and warehouses, and freight-reliant industries (e.g. manufacturing facilities and plants) have particular needs when it comes to site selection.

The most significant considerations for these types of facility location decisions tend to be factors such as access to key markets, proximity to the transportation network, availability of labor/workforce, and total cost environment (to include factors like taxes, utilities, etc.).[1]

In practical terms, this often means the ideal sites are located in an exurban environment (i.e. on the urban periphery). Such locations achieve proximity to the local workforce and development environment (e.g. utilities, road infrastructure), while also satisfying a desire for low-cost land that is not as highly sought-after by other competing land uses. Specifically, ideal freight facility development sites are often located close to interstate highways or other major highway corridors, in areas with other industrial or non-residential land uses, thereby providing maximal flexibility and minimal impedance concerning factors such as noise, odor, light, traffic, and hours of operation.

2.1.2 Causes of Freight Conflicts

Although freight industries typically seek out locations associated with minimal conflict, such conflicts can nevertheless emerge over time due to a variety of factors:

- **Growth and urban encroachment**: Many types of freight facilities are relatively immobile, requiring significant investments in fixed capital. Once these investments are made, it can be difficult and expensive for these facilities to relocate, even as population growth and suburban expansion impede on traditional freight lands. Over time, some former freight lands may be redeveloped for the new highest and best land use, while others may remain fixed in place. In addition, freight areas may be surrounded by residential developments.

- **Uncoordinated land use planning**: Another source of conflict is uncoordinated land use planning. Where regulations and official plans do not prescribe allowable uses, freight facilities and non-freight land uses may be developed near one another, leading to potential conflicts.

[1] For a briefing on freight facility site selection considerations, see NCFRP Report 13: Freight Facility Location Selection: A Guide for Public Officials. National Academy of Sciences, 2011.

- **Competition for land**: In growing metropolitan areas where greenfield land is at a premium (whether due to planning restrictions or market forces), freight and non-freight developers may compete for the same parcels of land. This may also put place similar pressures on brownfield developments. As an example, an e-commerce fulfillment center may need to be located close enough to the urban core to enable rapid express deliveries, and thereby may compete for the same land as a commercial plaza or housing development.

2.1.3 Strategic Lens on Freight Conflicts

Policymakers and agencies must carefully balance a range of competing interests when conflicts emerge and make decisions in the best interest of all of their constituents. In such a context, absolutes are rarely helpful or productive.

On the one hand, freight facilities may not be able to operate on a competitive commercial basis if heavy restrictions or impedances are imposed to assuage non-freight interests. Over time, such facilities may relocate or invest out-of-state or in other jurisdictions, removing a large source of employment, GDP, and tax revenues (not to mention spinoff economic activity).

On the other hand, a community's full economic potential and maximum quality of life may not be achieved if freight impacts such as noise, traffic, and safety go unaddressed.

A strategic lens, such as the PMA (Protect-Manage-Accommodate) framework shown below, can help agencies contextualize and prioritize freight conflicts.

Figure 3: Strategic Lens for Contextualizing Freight Conflicts

	Protect	Manage	Accommodate
Definition	**Protect** freight industries from unreasonable conflicts	**Manage** conflicts in tactical and targeted ways	**Accommodate** freight needs to prevent major issues
Context	Areas where freight industries are dominant. Freight facilities of high strategic importance	Areas where freight and non-freight industries are both significant uses	Areas where non-freight industries and residential communities are dominant
Examples	• Freight clusters • Ports, airports, intermodal terminals	• Mixed-use areas • Freight clusters transitioning to mixed-use	• Central business district • "Stranded" freight facilities (legacy facilities enveloped by communities)

Source: CPCS

Such a framework need not be interpreted rigidly, but it can lend a strategic angle to thinking about emergent freight conflicts systematically.

- **Protect:** Where possible, it is desirable to separate major freight clusters and strategically important facilities to protect them from potential sources of conflict. The focus is then on accommodating non-freight needs where reasonable, while prioritizing support for the competitiveness and productivity of the region's commercial and industrial base, which thereby drives regional economic growth and prosperity. This can require considerable advance planning.

- **Manage:** Where protecting freight industries is not achievable or desirable, managing conflicts is the next best option. A balanced approach reflects the reality that freight industries may impose negative externalities on communities (such as traffic, noise, etc.), but may also constitute significant businesses employing many of the people in those same communities. If done well, conflicts can be managed by finding tactical, targeted, and creative solutions rather than merely striving for compromise between competing stakeholders.

- **Accommodate:** In situations where non-freight interests are dominant, it is important to not forget about freight altogether. Indeed, the beneficiaries of efficient freight and goods movement are not only transportation/logistics companies and large shippers, but also freight receivers such as homes, businesses, and restaurants, which rely on trucks for deliveries of everyday goods. Ensuring the safety and mobility of all road users, including goods movement vehicles, is to everyone's benefit – even in situations where freight is not front and center among policy objectives.

2.1.4 Application

Frameworks such as the one above can be applied to a wide range of transportation and land use challenges. This study focuses on a subset of these challenges that applies to the first- and last-mile road network specifically.

2.2 Institutional Contributors to Conflicts

Freight conflicts can be caused or exacerbated by institutional issues within the public sector. Some of these challenges, which make solutions more difficult to implement, include:

- Land use and transportation planning responsibilities are entrusted to different agencies with different knowledge and priorities, resulting in the potential for new freight and land use conflicts in the future.
- First/final mile routes may be owned by multiple government agencies, making it difficult to coordinate or fund needed improvements.
- Data related to understanding first/final mile needs and issues may be fragmented across multiple agencies and levels of government, making the identification of needs and issues more difficult.

A notable institutional challenge in Delaware is the fragmentation of land use and transportation planning across multiple levels of government. Both the Delmarva and Delaware state freight plans stress the importance of state-level leadership or support for balancing economic growth and development opportunities with critical freight infrastructure and freight-oriented land use preservation. However, since Delaware is a Home Rule state, land use decisions are made at the county and municipal levels. This has created challenges for DelDOT and Metropolitan Planning Organizations (MPOs), including WILMAPCO, to preserve freight land use and ensure compatibility in specific areas. Figure 4 illustrates the share of the first/final mile network maintained by DelDOT, municipalities, and other parties. 92% of the first/final mile network is state-maintained, whereas 84% of Delaware's total road network is state-maintained.[2]

[2] *Innovation in Motion*. 2019. Delaware Department of Transportation.

Figure 4: Maintenance Responsibility of First/Final Mile Roads

State	Municipal	Other
321.8 Miles 92%	21.8 Miles 6%	3.6 Miles 2%

Source: CPCS analysis of Delaware Road Inventory data

2.3 Funding Solutions

Many first/final mile improvements require the construction or modification of physical infrastructure, which can often be a capital-intensive task.

The box below profiles funding challenges in Delaware, that are also common to many parts of the country. The remainder of this section describes national- and state-level programs that might be used to help Delaware address its first/final mile needs and issues.

Funding Challenges in Delaware

Innovation in Motion, the Delaware Long Range Transportation Plan, notes that Delaware is experiencing downward pressure on its transportation revenue sources, and that additional revenue may be needed in the future to keep up with current infrastructure standards, build resilience for climate change, and buffer against potential federal shortfalls in highway funding. Challenges such as these could make funding first/final mile improvements more difficult in the future, particularly for any connections that are not owned or maintained by DelDOT.

2.3.1 Federal Freight Funding

The Federal Highway Administration (FHWA) administers multiple programs that may be relevant to funding first/final mile improvements in Delaware. Specifically, the Federal funding programs available for federal highways, freight intermodal connectors, and some types of first/final mile connections include:

- **National Highway Performance Program (NHPP) –** Provides support for the condition, performance, and construction of the National Highway System (NHS).
- **Surface Transportation Program (STP) –** Provides flexible funding that may be used to preserve and improve the conditions and performance on any Federal-aid highway, including freight projects.
- **Highway Safety Improvement Program –** Achieve a significant reduction in traffic fatalities and serious injuries on public roads, including non-state-owned public roads and roads on Tribal lands.
- **Congestion Mitigation and Air Quality Improvement Program –** Funding source to reduce congestion and improve air quality. Available to State and local governments for transportation projects in nonattainment and maintenance areas.
- **Projects of National and Regional Significance (PNRS): Section 1120 –** Program that provides grants to States to improve the safe, secure, and efficient movement of people and goods through the U.S. to improve the national economy.

There also are several Federal financing tools that can be applied to freight connections. These tools include:

- **Transportation Infrastructure Finance and Innovation Act (TIFIA) –** Provides Federal credit assistance to eligible surface transportation projects, including highway, transit, intercity passenger rail, some types of freight rail, and intermodal freight transfer facilities. The program leverages substantial private co-investment by providing projects with supplemental or subordinate debt.
- **Rebuilding American Infrastructure with Sustainability and Equity (RAISE) –** Discretionary grant program that is the successor to the Better Utilizing Investments to Leverage Development (BUILD) and Transportation Investment Generating Economic Recovery (TIGER) programs. USDOT intends to award $1 billion in discretionary grants in the fiscal year 2021 for multimodal transportation projects that meet criteria, including safety, environmental sustainability, quality of life, economic competitiveness, state of good repair, innovation, and partnership. The department also intends to prioritize projects that demonstrate improvements to racial equity, reduce climate change and create good-paying jobs. An equal amount of funding is intended for urban and rural areas. This program allows regional and local governments to compete directly for funding.
- **Infrastructure for Rebuilding America (INFRA) –** Discretionary grant program to fund transportation projects of national and regional significance. The USDOT reserves 10% of available funds for small projects (grants of at least $5 million, compared to large project grants of at least $25 million). Additionally, at least 25% of funding must be used for rural projects. USDOT is particularly interested in shovel-ready projects, produce good-paying jobs, improve safety, and use transformative technology. For the first time in 2021, USDOT is interested in projects that address climate change and environmental justice.
- **Grant Anticipation Revenue Vehicles (GARVEE) –** Financing instrument that allows States to issue debt backed by future Federal-aid highway revenues. Eligibility for freight projects is constrained by the underlying Federal-aid programs that will be used for debt service.

2.3.2 State-Level Approaches to Funding First/Final Mile Investments

In addition to different federal freight funding programs, Delaware could develop new funding programs or leverage existing ones to improve first/final mile connections. Delaware already has one such program – the Transportation Infrastructure Investment Fund (TIIF), which was created in 2019. This fund focuses on transportation investments that support new economic development, including projects that construct, maintain, or enhance road infrastructure. However, many states have programs tailored to addressing freight needs for existing users, or varied programs to support economic development.

Some other states have also taken the initiative to develop their own funding programs that either support freight transportation explicitly or as part of broader transportation improvement efforts. Many of these programs are closely tied to economic development initiatives. Some examples include:

- Pennsylvania's **Multimodal Transportation Fund**, which is available for port, rail, and freight improvements (as well as broader economic and safety improvements).
- Minnesota's **Transportation Economic Development** program, which provides funding awards to state highway projects that provide measurable economic benefits, including retention of existing businesses. This program also awards competitive points to projects that address previously identified mobility, safety, and condition concerns for truck movement, including high-crash areas, areas with frequent flooding, and geometric barriers to trucks.
- Wisconsin's **Transportation Economic Assistance** program, which provides matching state grants to government partners for projects that either attract new employers or support retention of existing business and industry. $3.4 million is available each year. Wisconsin also operates a **state infrastructure bank** program that is used to fund access improvements for vehicle traffic

near commercial or industrial sites, as well as road modifications to accommodate truck movements.

2.4 Improving Delaware's Freight-Related Transportation Data

The data-driven analysis conducted during the development of this Working Paper illuminated some data deficiencies that, if addressed, could improve future evaluations of first/final mile needs and issues, or general analysis of transportation performance in Delaware.

Data Stewardship Succession Planning

Several datasets could not be obtained because the individual believed to be responsible for that dataset was unreachable or unresponsive to queries. Often, staff turnover and personnel changes cause data assets to be lost for a variety of reasons. Even when the data is not lost, specific individuals carry hard-won institutional knowledge about how the data was generated, how it has evolved, and relative advantages and disadvantages. In turn, new staff may need training to update, distribute, and utilize existing datasets appropriately.

Capturing this knowledge and effectively imparting it to successive individuals improves an organization's ability to continue to generate value from its data assets. One of the simplest ways to roll forward accumulated knowledge is with a changelog: a listing that describes any modifications made to a dataset, and the dates on when they occurred. Inaugurating a changelog for important data assets requires little up-front investment but can pay off significantly down the road.

Longer-term investments in data stewardship succession planning may include developing onboarding modules to train new staff on specific datasets that are integral to their role. It may also include assigning ownership of each data asset to at least one individual and allocating time for that individual to maintain the dataset as part of their core job duties. The overall health and status of an organization's data assets may be assessed annually or periodically through organization-wide reviews or audits.

Adopting Data and Documentation Standards

On several occasions, a lack of data documentation made data interpretation challenging. There are two primary types of dataset documentation:

- **Metadata –** Strictly speaking, metadata is information about the dataset as a whole, such as author, publication date, or licensing information. The term "metadata" is also used more colloquially to refer to any contextual information or background that explains some aspect of a dataset.
- **Data Dictionary –** Data dictionaries explain the *individual attributes* of the observations in a dataset. They may list the allowed values for each attribute and provide a plain text description of those values if their meaning is not obvious.

Starting a data dictionary for important data assets is the easiest way to get started with data documentation. Adhering to existing standards, such as those created by the Federal Geographic Data Committee, can ensure an organization's data is easy to share and build upon. Over time, some organizations choose to invest in advanced data governance by implementing cross-department frameworks for making decisions about data and data management, like the State of Minnesota's Geospatial Advisory Council.

2.5 Incorporating Freight Knowledge into Existing Planning Work

This project generated a substantial amount of new information on Delaware's first/final mile needs and issues. Some of the problems identified by both stakeholders and the data can be considered "easy" fixes in that some solutions could be incorporated into existing infrastructure renewal or upgrade projects at little to no cost, or addressed quickly through local policy changes. For example, concerns about turning lanes or shoulders might be addressed as intersections or roadways are re-surfaced or expanded, and some land use conflicts could be mitigated through the designation of new truck routes.

Now that WILMAPCO and DelDOT have a large reference list of first/final mile needs and issues at hand, they should seek to ensure this list is reviewed whenever new project planning begins so that planning staff are aware of any potential freight problems that may need to be accommodated or addressed during a project's development. In the future, the database or reference list of freight problems could be expanded to include primary, secondary, and tertiary freight connections as well, giving DelDOT additional freight reference resources to incorporate into specific project planning. Incorporating freight considerations into the planning process early on will potentially help Delaware fix freight mobility, safety, and condition problems faster and more cost-effectively than identifying and developing freight-specific stand-alone projects.

Incorporating Freight into Project Prioritization Tasks

The Community Planning Association of Southwest Idaho (the Boise, ID MPO) provides an example of incorporating freight into existing planning processes. After the development of a regional freight plan, the MPO chose to incorporate the plan's information on freight flows into its existing processes: if a project was on an identified freight corridor it received a higher score in the regional prioritization process.

As well, the freight study included an analysis of truck-involved crash hotspots, congestion bottlenecks and other issues. Thus project proponents can refer back to a solution helping to address a top freight bottleneck or safety hotspot in the region.

Another example of this planning integration practice comes from Minnesota DOT, which conducted a district-by-district Manufacturers' Perspectives Study to assess business's freight transportation problems across the state. Upon completion of each study, District planning staff received a comprehensive list of the freight needs and issues identified in their regions, and these lists are reviewed when planning for new projects begins. This practice allows MnDOT to incorporate cost-effective freight solutions into previously programmed projects, and also strengthens relationships with local freight stakeholders, as MnDOT can demonstrate that it is acting upon their feedback

3 Land Use Conflict Needs and Issues

Freight and land use conflicts can have a significant impact on residents' health, safety, and general well-being, as well as impact the natural environment. Additionally, the presence of freight and land use conflicts often indicates the presence of other truck mobility and safety problems.

In Delaware, a key freight and land use concern identified in prior research, stakeholder feedback, and data analysis is the expansion of residential areas, and the creation of new freight and land use conflicts in suburban or exurban areas.

3.1 Introduction

Freight and land use conflicts often arise when freight routes pass through residential, commercial, or environmentally sensitive areas. Additionally, the overlap between first/final mile routes and potentially conflicting land uses can create or exacerbate many of the mobility and safety problems, which are noted in the following chapters. Freight and land use conflicts occur most frequently in and around developed areas. For example, conflicts can occur in long-standing neighborhoods surrounding urban industrial facilities, ports, or intermodal terminals where trucks may pass through residential neighborhoods to reach major highways. However, new conflicts are also emerging on the fringe of urban areas, as new residential development encroaches on formerly isolated industrial parcels, or as new warehousing or distribution center development generates large influxes of new truck traffic on local roads.

Freight and land use conflicts contribute to a negative public perception of freight, and may impact residents' health, safety, and quality of life.

Unlike the safety, mobility, and condition problems documented in the following chapters, many freight and land use problems are less likely to directly impact the cost of shipping. However, these problems can have major impacts on residents' safety and quality of life, and thus their perception of freight operations in their communities. Additionally, given their undesirable nature and potential negative effect on land values, the impacts of freight and land use conflicts may be disproportionately focused on low-income communities, including communities of color.

3.2 Delaware's Land Use Needs and Issues

Many of Delaware's previously mentioned freight-related land use conflicts are a result of the state's continued growth and development. For example, the continued development of new residential properties in Delaware can put pressure on formerly isolated industrial areas. At the same time, the development of new distribution centers and warehouses on the suburban fringe of cities and towns can also generate large volumes of truck traffic on local roads. Another major land use concern is sea level rise, which is a major threat to coastal elements of Delaware's road network.

This project took a broad view of freight and land use issues. These issues are grouped into two broad types of conflicts:

- **Social conflicts** – conflicts that mainly impact people and the built environment.
- **Environmental conflicts** – conflicts that mainly impact the natural environment.

Planning and Environmental Linkages

Planning and Environmental Linkages (PEL) is a transportation planning approach that considers the potential benefits and impacts of transportation projects on the environment, the community, and the economy. PEL practices and tools are promoted by Federal Highway Administration, and PEL engagement is intended to help accelerate project delivery by helping refine project alternatives early in the planning process.

The land use conflict screening in this chapter is intended to support a secondary project goal of conducting a PEL study. Specifically, this work identifies areas where first/final mile routes intersect with environmentally sensitive areas such as wetlands, waterways, or protected areas, and provides insight into sites where additional National Environmental Policy Act (NEPA) review would likely be required into order to implement infrastructure improvements.

This project also provided the opportunity for stakeholder feedback on the topic of environmental and social impacts of first/final mile truck movements through the Working Group and the Focus Group.

To identify potential freight and land use conflicts, this project screened first/final mile connections against 10 attributes provided by six data sources. These attributes and data sources are listed in Figure 5.

Figure 5: Freight and Land Use Conflict Attributes

Attribute	Data Source
Urban Region Designation	WILMAPCO - Unpublished
Population Per Square Mile	US Census Bureau American Community Survey
Land Use Types	Delaware 2017 Land Use Land Cover
Planning Investment Level	Office of State Planning Coordination
Environmental Justice Index	US Environmental Protection Agency
River Crossings	US Census Bureau Aerial and Linear Hydrography
Wetland Location	WILMAPCO - Unpublished
Natural Protected Area Location	WILMAPCO - Unpublished
Wellhead Protection Area Location	WILMAPCO - Unpublished
Sea Level Rise	WILMAPCO - Unpublished

Key findings from the screening of these attributes are summarized below. A greater summary of this analysis is available in Appendix A.

- **Continued development in rural and exurban areas will be a driver of future freight and land use conflict.** Most of Delaware's first/final mile connection mileage is located in rural areas or areas that are sparsely populated relative to the state as a whole. However, freight still has impacts on residents, with 70% of the first/final mile connection mileage is within 50 feet of residential dwellings. Furthermore, 23% of Delaware's first/final mile connections are in areas that the Delaware Office of Planning and State Coordination has identified as developing or likely to develop, and an additional 30% are located in areas considered "mature" urban areas.

- **First/final mile connections are disproportionately concentrated in lower-income and minority neighborhoods**. 52% of the mileage is located in Census blocks with low income and minority population environmental justice indices of 50 or higher, and 23% of connection miles are in Census block areas with indices of 70 or higher. This information suggests Delaware's first/final mile connections are concentrated slightly more heavily in communities that are relatively poorer or have higher shares of minority populations.

- **Environmental protection considerations are relevant to many connections.** Of note, there are 158 river or stream crossings documented for the first/final network, and 23 miles of first/final mile network lie within wellhead protection areas. Additional screening information on proximity to wetlands, environmental protection areas, and areas of sea level rise is available in Appendix A.

Visual Examples of Land Use Issues Identified

- **Noise and Livability:** Major truck thoroughfares can create high levels of noise, especially along sloping corridors where truck braking is an issue. Noise impacts can be further amplified if carrying across open spaces. A commenter suggested that truck noise is an issue on US-202 near the Lombardy Cemetery and noted that the sidewalk along this road leading to Independence Mall is narrow and unsafe.

Figure 6: US-202 near SR 141

Source: Google Street View

- **Continuity and Strategic Connectivity:** SR 7 / Bear Corbitt Road is an example of a corridor that changes typology drastically in a short space. The road passes under a highway bridge (SR 1 / US-13), where there is no interchange. South of the bridge, the corridor is a four-lane divided road with a wide center grass median, serving a growing freight area. North of the bridge, the corridor is a curving two-lane road with bike lanes, passing through a residential community. A commenter observed that there has been a significant increase in truck traffic on Bear Corbitt Road passing through the community, due to trucks accessing the growing warehouse district south of the bridge.

Figure 7: SR 7 / Bear Corbitt Road

South of US-13 | **North of US-13**

Source: Google Street View

- **Local Traffic:** When freight facilities and residential communities are located adjacent to one another, many types of conflicts can ensue – particularly when the freight facilities are reliant on community roads for access. Several commenters pointed to the example of the Twinco Romax facility in Newport which has two access roads, both of them residential local roads that are not suited for truck traffic. This creates concerns related to safety and damage to property and overhead wires.

- **Compatibility of Adjacent Land Uses:** Another example of land use compatibility conflicts is Hosier Street in Selbyville, where an agricultural food production plant is located directly adjacent to a school. A commenter observed that this leads to a variety of issues, including an environment where trucks, cars, and pedestrians comingle in close proximity.

Figure 8: Lindberg Avenue leading to a Freight Facility

Source: Google Street View

Figure 9: Hosier Street in Selbyville

Source: Google Street View

3.3 Potential Solutions

3.3.1 Strategic Truck Route Networks

Objective: Manage / Accommodate truck traffic

A strategic truck route network decreases negative community impacts by funneling trucks to specific routes that are best capable of handling them. Such a network can be voluntary/ suggestive, whereby an agency publishes a network of recommended routes (thereby relying on the mutual interest on the behalf of truck drivers in choosing safer and more appropriate access roads); or regulatory/enforced, whereby an agency will specifically define which roads trucks may use. In either case, first and final mile connectors are a critical component of any strategic truck network.

A drawback of stronger versions of this approach may be that funneling trucks onto a single route may not always be desirable. For example, in cases where there is no single road that is clearly most appropriate as a connector, such an approach may simply concentrate the freight impacts onto one corridor, rather than spreading them out. Additionally, it is important to consider redundancy and resiliency so that trucks have multiple options in the event of planned and unplanned road closures.

Case Study: New York City Truck Route Network

New York City Department of Transportation (NYC DOT) has established a set of roads that commercial vehicles must use in New York City. The network comprises two classes of roadways: Local Truck Routes and Through Truck Routes. Through routes are composed of major urban arterials and highways for trucks passing through a borough. Local routes are designated for trucks with an origin or destination within a borough. Trucks can use non-designated routes only for the purpose of accessing the start or end point of their trip, from the local truck route network. NYC DOT updates and publishes its truck route map online.

Source: New York City Department of Transportation, Trucks & Commercial Vehicles

3.3.2 Infrastructure Improvements

Objective: Manage truck traffic

In some cases, gaps in the transportation network may cause issues by channeling truck traffic to roads or intersections that are highly congested, less safe, or near sensitive land uses. In these situations, a review may be conducted to identify opportunities to build new physical infrastructure, such as connector roads, and resolve these gaps to better manage truck flow. While the new roads do not need to be *truck-only* access routes, building such infrastructure with truck freight mobility at the forefront can be of wider benefit, helping to direct trucks away from bottlenecks or otherwise sensitive locations.

Case Study: Finch West Goods Movement TMP in Toronto

The Finch West area of Toronto is a freight cluster transitioning to mixed use. A district with many truck freight facilities such as fuel terminals, manufacturing plants, and warehouses, the area is starting to intensify with a new light rail transit under construction, as well as proposals for bike lanes, improved pedestrian infrastructure, and new commercial and residential developments. Recognizing this challenge, the City of Toronto launched a goods movement Transportation Master Plan (TMP), which is currently underway. As a TMP, the study will have the authority to propose physical and operational infrastructure upgrades to help facilitate the movement of goods, ranging from signal-timing and intersection improvements, to new connector roads to improve circulation.

Source: City of Toronto, Finch West Goods Movement Plan

3.3.3 Truck Restrictions

Objective: Manage / Accommodate truck traffic

Truck restrictions work by prohibiting or restricting truck activity in certain locations, at certain times, or for certain types of vehicles. A wide variety of restrictions may be used depending on the jurisdiction. The key types of restrictions are shown below.

Figure 10: Types of Truck Restrictions

Type	Details
Route restrictions	Consider implementing truck prohibited road segments where truck activity occurs adjacent to sensitive land uses (e.g. schools, parks) and where an alternate route is available.
Time of day restrictions	Consider targeted time-of-day restrictions such as at nighttime near hospitals or seniors' residences, or during school hours beside schools.
Size and weight regulation	Consider prohibiting large trucks from routes where roadway geometrics are not supportive, and where an alternate more appropriate route is available. Restrictions could be based on

Type	Details
	vehicle dimensions, number of axles/tires, or vehicle weight/capacity.
Hazmat restrictions	Consider restrictions on where/when trucks carrying hazardous materials can operate.
Emissions controls	Consider idling regulations and engine compliance rules.
Commercial vehicle parking and loading zones	Consider designated loading zones and times for curbside loading and unloading; or restrictions to low emissions/zero-emissions vehicles in sensitive locations.

Figure 11: Examples of Truck Route Restrictions with Various Criteria

US-1 in New Jersey | **Glenwood Ave. in North Carolina**

Source: Google Street View

3.3.4 Environmental Justice Approaches

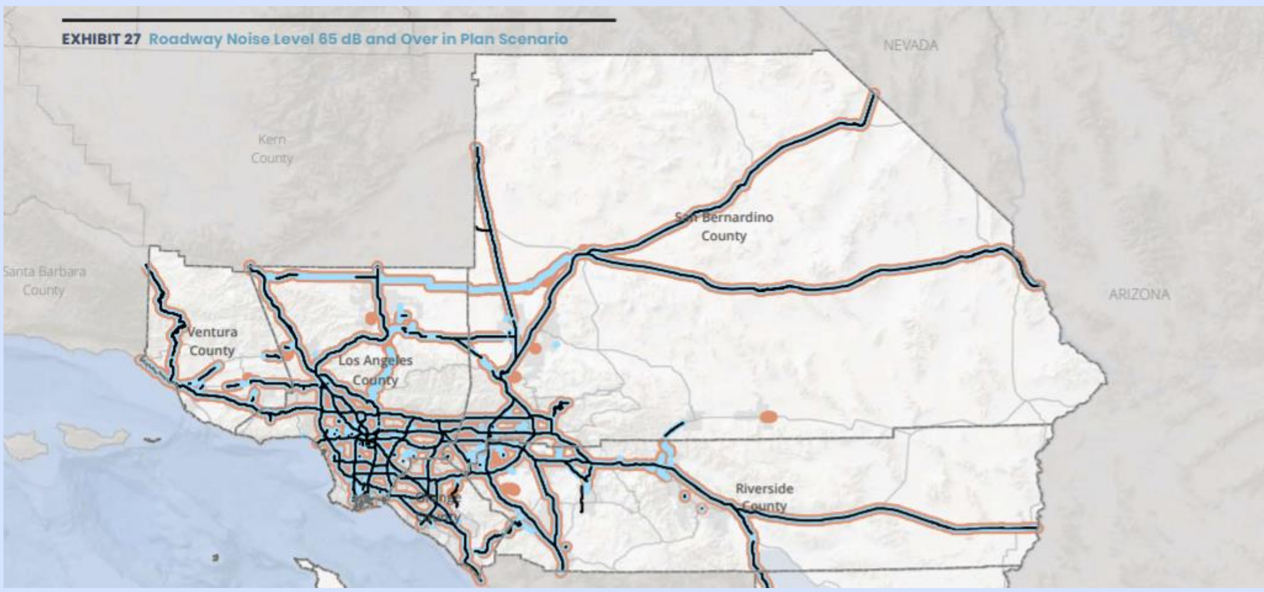
Objective: Manage truck traffic

Environmental justice, as it relates to freight, is the fair treatment and meaningful involvement of all people in the development, implementation, and enforcement of environmental laws, regulations, and policies directed towards the movement of goods. Therefore, an important step in moving towards environmental justice is the inclusion of all populations in the planning process, especially those that are typically underrepresented. In many situations, inviting community members to meetings outside of their neighborhoods will not be sufficient. Improved engagement with local communities can often be achieved by going to locations that local populations frequent such as grocery stores, community centers, or churches.

By including local community members in the planning process, the solutions to many environmental issues can more easily be identified. As an example, an industrial area located near a low-income neighborhood would have projects identified and prioritized that mitigate the impacts of first/final miles to match the needs of that community.

Case Study: Connect SoCal Environmental Justice Report

The Southern California Association of Governments (SCAG)'s 2020 Regional Transportation Plan, Connect SoCal, draws heavily on principles of environmental justice. The plan is designed to create region-wide benefits that are distributed equitably, while ensuring that any one group does not carry the burdens of development disproportionately. The plan's Environmental Justice Report defines 18 performance indicators, including roadway noise impacts, emissions impacts, and distribution of travel time impacts. As part of the program, SCAG also seeks out and considers the input of traditionally underrepresented groups and takes steps to propose mitigation measures or consider alternative approaches in cases where disproportionately high and adverse impacts on minority or low-income populations are identified.



Source: Southern California Association of Governments, Connect SoCal, Environmental Justice Technical Report, May 2020.

The concept of sustainable freight planning can be implemented in a manner that increases environmental justice in a regional context. Sustainable freight planning maximizes the positive features of freight movement (jobs, economic development, etc.) while minimizing the negative impacts on communities and the natural environment. Many local and regional government agencies are adopting sustainable land use strategies, including strategies to accommodate freight in urbanized areas and to develop freight clusters in a manner that reduces the environmental and community impacts. Examples of sustainable freight land use strategies include industrial preservation, brownfield redevelopment, and freight villages. These strategies improve the efficiency of goods movement across a region, thereby reducing the need to develop new freight facilities in underrepresented areas that already feature high levels of freight activity.

3.3.5 Siting Future Freight Facilities

Objective: Protect freight activity

WILMAPCO or DelDOT may want to designate and preserve specific locations for the development of future freight facilities, subject to their capacity to do so given Delaware's status as a Home Rule state. These locations can be identified within the context of existing land use designations and then specified based on factors such as capabilities of connecting roadways, proximity to residential land uses, and proximity to other sensitive receptors (e.g. schools, parks, hospitals). This will limit the impacts of the use of first/final mile connectors on adjacent non-industrial land uses, while allowing for community economic and employment benefits of freight facility growth.

Land use designations are generally planned and implemented at the local agency level, using the comprehensive plan, zoning code, and permitting system. However, many regional agencies, such as MPOs, can assist by developing regional visions and goals related to freight growth and by identifying freight clusters where freight can efficiently move into and out of without disturbing other types of land uses in the broader community. Other incentives to locate freight facilities in certain communities include tax relief programs to encourage industrial development and redevelopment consistent with regional goals.

Municipalities and regional agencies also may work with the private sector to reduce conflicts by establishing buffers between industrial and sensitive land uses, influencing location and design decisions through zoning tools, preserving existing industrial land uses, and promoting context-sensitive solutions for site and building design.

Finally, notifications can be used to advise residents, or prospective residents of developments in progress, of their proximity to freight facilities, corridors, or clusters.

4 Mobility Needs and Issues

First/final mile freight mobility problems include congestion, as well as geometric constraints on truck movement such as low bridges, tight streets, and tight turns. In both cases, mobility problems reduce the efficiency of freight transportation, and can contribute to increased first/final mile shipping costs. In Delaware, many mobility concerns relate to traffic congestion during tourist season and agricultural harvest times.

4.1 Introduction

Freight mobility is the ability to move efficiently through the transportation network. Mobility problems can be broken down into two general categories: geometric constraints and congestion. Geometric constraints are physical characteristics that make the passage of trucks challenging or impossible, and congestion is a reduction in speed associated with high traffic volumes or restricted vehicle throughput.

A consequence of many mobility problems is slower travel speed, or longer travel routing to avoid barriers. Slower travel and longer routings reduce the effective "speed" of freight movement, which means that smaller volumes of freight can be moved in any given amount of time. In turn, these lower capacities often translate into higher freight costs.

Mobility problems impact the efficient movement of freight, increasing travel times, decreasing freight throughput. Ultimately, these efficiency impacts can increase shipping costs.

Often, mobility problems do not "stand alone" – the presence of one problem on a first/final mile route means that other mobility, condition, or safety problems are likely to be present. Furthermore, many of the problems discussed here impact mobility as well as other performance topics. For example, narrow shoulders are a mobility concern for trucks, as well as a safety concern. Therefore, the mobility needs and issues here should be considered as context for the following safety and condition chapters.

4.2 Delaware's Mobility Needs and Issues

Prior mobility needs and issues documented in Working Paper 1 related to two major phenomena grounded in congestion concerns:

- **Tourism and seasonal traffic congestion**. The large influx of tourism during the summer months generates substantial passenger traffic, as well as additional truck traffic supporting service industry establishments in tourist centers. For example, in the prior Delmarva Freight Plan (2015), DelDOT estimated that traffic can more than double on some major routes during the tourist season. Continuing all-season community growth in Sussex and Dover Counties is likely to further exacerbate this congestion issue in the future. Previously, the Delaware Freight Hierarchy already identified the roads serving cores of tourist areas such as Rehoboth, Lewes, and Bethany as primary, secondary, and tertiary freight routes, and the first/final mile network does not include these particular connections.
- **Agricultural shipments in rural areas.** Seasonal movement of freight at harvest time can create congestion, similar to seasonal tourist traffic. Specific agricultural last-mile routes documented in the Delmarva Freight Plan were not included in the original Delaware Freight Hierarchy, but have been included in this project's first/final mile network.

To identify potential first/final mile truck mobility problems for this new effort, this project screened first/final mile connections against 14 attributes provided by seven data sources. These attributes and data sources are listed in Figure 12. In some cases, datasets only covered select parts of the state or select portions of the road network.

Figure 12: Mobility Attributes and Data Sources

Attribute	Data Source
Shoulder Width	Delaware DOT Road Inventory
Number of Lanes	Delaware DOT Road Inventory
Road Width	Delaware DOT Road Inventory
Speed Limit	Delaware DOT Road Inventory
Average Truck Speed	WILMAPCO Congestion Management Data
Travel Time Index	WILMAPCO Congestion Management Data
Grade Crossing Train Frequency	Federal Railroad Administration
Grade Crossing Maximum Blockage Time	Federal Railroad Administration
Roundabout	Delaware DOT Roundabout Inventory
Bridge Vertical Clearance Over Road	WILMAPCO - Unpublished
Bridge Weight Restriction	WILMAPCO - Unpublished

Screenings of the attributes above found that:

- **Narrow lanes are not a concern**: 95% of Delaware's first/final mile connections have lane widths greater than 10 feet, so the system generally does not have mobility impediments associated with narrow lanes.
- **Narrow shoulders are a concern**: Nearly 9% of Delaware's first/final mile connections have between 0 and 1 feet of shoulder space.
- **Other data-screened mobility issues are not a statewide concern.** Other items included in the data screening were either (1) not problems, or (2) only relevant to very small portions of the network (<5% of mileage), and based on analysis and a lack of stakeholder comments, do not appear to be relevant mobility issues for the currently-identified first/final mile network.

Future Improvements for First/Final Mile Mobility Screening

During the development of this project, CPCS sought out additional data to aid in evaluating freight mobility. Two sources that were identified as useful and extant but were unavailable during the project were **roadway weight limits** and **intersection turning radius**. In the future, WILMAPCO, DelDOT, and their local partners should seek to collect and utilize this data to further improve future screening of truck-related transportation needs and issues. Stakeholder provided feedback on select intersections with truck turning problems, but these insights are only available for a few intersections in the state.

Visual Examples of Mobility Issues Identified

- **Signalization:** I-495 South Off-Ramp at Terminal Avenue – There is a single lane off-ramp with no signalization at the intersection. This can lead to queuing and delays when trucks are waiting to turn left heading towards the port. Trucks have slower acceleration than cars, making it harder to complete turns when entering non-signalized intersections.

Figure 13: I-49 South Off-Ramp at Terminal Avenue

Source: Google Street View

- **Access:** The entrance to the North Point Logistics distribution center is designed to be a right-in-right-out configuration. However, in likelihood, the vast majority of trucks accessing the center are going to/from SR 1/US-13 to the west. As a consequence, trucks have been observed using the access point as an eastbound entrance, presumably to save time.

Figure 14: SR 72 East of SR 1, Entrance to Distribution Center

Source: Google Earth

- **Roadway Configuration:** Trucks require more space to complete left and right turns compared to automobiles. Truck turning issues can pose maneuverability problems for truck drivers, disrupt overall traffic flow, and potentially create safety issues. An example of a roadway configuration issue identified by commenters was the left turn from northbound SR 30 to westbound SR 24, where an odd angle and concrete island make left turns difficult for trucks.

Figure 15: Intersection of SR 24 and SR 30

Source: Google Earth

4.3 Potential Solutions

4.3.1 Truck-Only Roads

Truck-only roads, or truck-only lanes, involve the dedication of all or part of a roadway for use by commercial vehicles. In some cases, eligible uses may be broader (for example to include buses), but general-purpose vehicles are disallowed. These solutions can improve truck mobility in strategic locations.

One challenge of truck-only roads or lanes is that they are typically in the highest demand in congested areas, where competition from non-freight vehicles is highest. However, it is in these same situations that the impetus to reduce congestion by maximizing the use of the full roadway is highest as well. These two factors can offset each other, meaning careful analysis of the benefits is merited (see the below case study for an example of a truck-only road in Boston).

4.3.2 Truck Corridor Improvements

Even without restricting road space to trucks-only, there are a variety of improvements that can be made to transportation corridors that focus on improving the efficient flow of freight. The improvements for consideration can span a range of domains such as geometric design, operations, and information technology. One option is to package a suite of improvements together as a freight-supportive project, as in the case of SR-6 in the Atlanta area (see case study below). Alternatively, another option is to require that projects evaluate opportunities for improvements that would benefit truck mobility, if the corridor under consideration is designated as a first/final mile connector. In many cases, improvements that would benefit truck mobility would also benefit mobility for all vehicles overall.

Case Study: South Boston Bypass

As part of the redevelopment of the South Boston Waterfront, grade-separated, limited-access truck-only roads were constructed to ensure continued reliable freight access to the commercial district, even as rail tracks were removed for redevelopment. The South Boston Bypass, a 1.5-mile haul road, was converted from an underutilized rail line and constructed to allow unimpeded travel for trucks and buses from the South Boston Expressway, bypassing residential neighborhoods. However, in recent years there have been increasing pressures to open access to the corridor to all vehicles, in order to decrease overall traffic congestion on other routes. MassDOT has performed several pilot projects (6-months and 1-year) in recent years in order to evaluate the traffic impacts of opening up the corridor to general purpose traffic. This case study illustrates some of the challenges of dedicating roads and lanes to commercial vehicles.

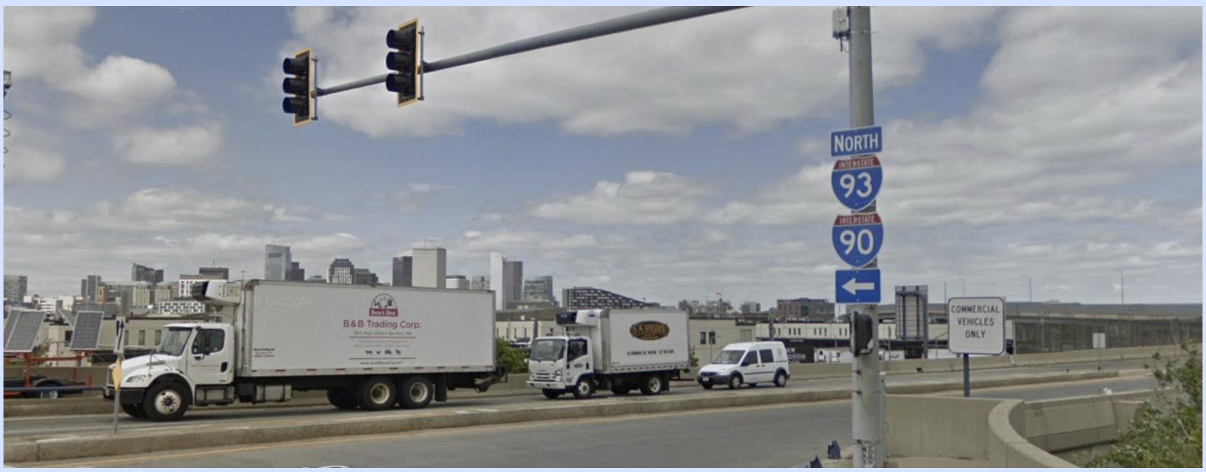


Image Source: Google Street View (2016)

Case Study: State Route 6 "Truck Friendly" Lanes in Georgia

Georgia's SR-6 / US-278 (partly designated as Thornton Road) is a key freight corridor which provides access from I-20 to Norfolk Southern's Whitaker Yard intermodal terminal near Austell, GA (among other freight-dependent facilities such as distribution centers). This road receives high truck volumes in addition to significant commuter traffic. Georgia's state freight plan has identified this road for corridor improvements termed "truck friendly" lanes. Specific elements of the project include widening existing shoulders, improving key intersections, increasing overhead signage, Intelligent Transportation System (ITS) technologies to manipulate green times to maximize freight vehicle progression, and ITS integration with the intermodal terminal (information on travel times).

Image Source: Google Earth

4.3.3 Signal Improvements

An important freight mobility consideration is left turns at intersections. Trucks have slower acceleration times than passenger vehicles, meaning that a traditional advanced green signal duration may be insufficient to accommodate more than one truck in succession, leading to delays for all vehicles. Observation of truck flow data can provide an indication of intersections along first/last mile connector roads where truck left turns are common, and identify which intersections could be candidates for extended advanced green signal improvements.

Truck signal priority is another measure that can improve freight mobility at intersections. Since trucks have slower acceleration and deceleration times, it can be more efficient to have trucks clear the intersection without stopping, as opposed to stopping and starting at red lights. While truck signal priority is most significantly a safety measure for high-speed roads and on downhill approaches (see Chapter 5), it can also be implemented at uphill approaches or level-grade intersections to improve overall traffic flow and enhance freight mobility.

4.3.4 Solutions to Address Seasonal Mobility Issues

There are two potential solutions for WILMAPCO to consider in addressing congestion generated by seasonal tourist traffic patterns:

- Disseminate information to road users about potential delays due to tourism and seasonal congestion factors with as much specificity as possible.
- For locations with the most congestion, identify specific alternative routes for either freight traffic or tourism traffic during peak seasons to separate the truck and passenger vehicles to the greatest extent possible. This can be achieved through a combination of designated truck routes and/or seasonal restrictions.

The issues associated with agricultural first/final mile traffic tend to be focused on pavement conditions. The pavement conditions along this portion of the first/final mile network should be examined and slated for potential improvement on a more frequent basis, relative to other rural roads. These roads should also be examined for potential geometric improvements that are compatible with the level of truck and other traffic during peak agricultural production seasons.

5 Safety Needs and Issues

Compared to land use and mobility issues, Delaware's first/final mile safety problems were less-frequently mentioned in both the literature and stakeholder feedback. Generally, safety problems are focused on specific portions of the road network with a high crash rate, or where residents perceive that safety problems exist. Many of these truck-related safety problems can be addressed through infrastructure changes and investments, such as improved intersections or widened lanes.

5.1 Introduction

In addition to safety concerns that arise from the mobility problems listed in Chapter 4, there are stand-alone safety issues documented in prior first/final mile literature, such as concerns about lack of turn lanes or traffic signals, conflicts with parking, pedestrians, or bicyclists, and railroad grade crossing safety. Understanding these safety issues is particularly important because these issues are often more visible or more relevant to the public and can have significant impacts on the health and safety of other road users.

5.2 Delaware's Safety Needs and Issues

The literature review conducted as part of Working Paper 1 did not identify safety issues unique to Delaware related to first/final mile connections. However, broader trends, such as the growing awareness of disparate freight-related negative impacts on frontline communities and the expansion of residential neighborhoods into formerly remote areas of freight activity, were noted as potentially relevant to first/final mile connections in Delaware.

To identify potential first/final mile truck safety problems, this project screened first/final mile connections against five attributes provided by four data sources. These attributes and data sources are listed in Figure 16.

Figure 16: First/Final Mile Safety Attributes and Data Sources

Attribute	Data Source
Truck-Involved Crashes and Crash Severity	WILMAPCO - Unpublished
Intersection Safety Ratings	WILMAPCO - Unpublished
Bike Route Information	Delaware Bike Council
Sidewalk Locations	DelDOT Unmotorized Inventory
Crosswalk Locations	DelDOT Unmotorized Inventory

Future Improvements for First/Final Mile Safety Screening

In addition to intersection risk assessments, Delaware has information on road segment risk assessments. However, this data was not available for project use. In the future, incorporating this roadway risk data will help further improve the understanding of first/final mile safety in Delaware.

Between 2014 and 2019, 1,122 crashes were observed on Delaware's first/final mile network. The majority of these crashes (75%) were property damage only. Figure summarizes the number and percentage of each type of crash recorded on Delaware's first/final mile network. Figure 17 summarizes the count and share of each type of crash.

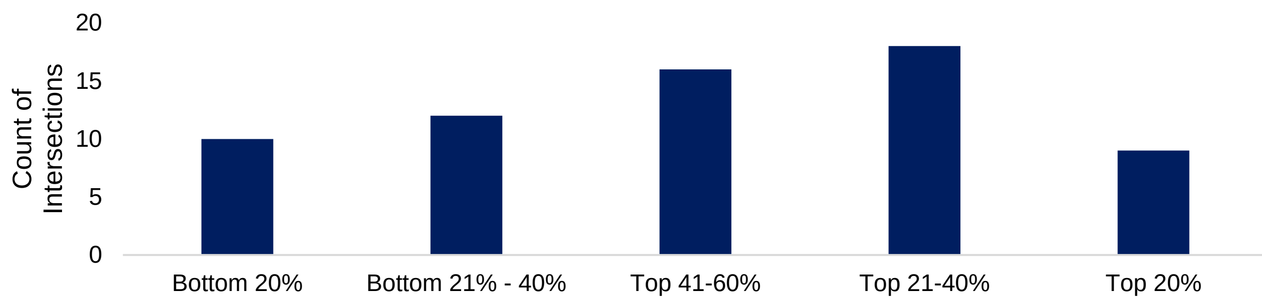
Figure 17: Count of First/Final Mile Road Crashes by Severity

Property Damage Only	Injury	Fatality
846 crashes 75%	266 crashes 24%	10 crashes 1%

Source: CPCS analysis of WILMAPCO data

In addition to this crash history information, some crash or safety hazard risk factors were examined. Delaware has conducted a risk assessment for intersections based on a ten-year average of vehicle crashes and other risk factors. 65 first/final mile intersections were represented in this dataset, which is broken into quintiles based on crash frequency. Figure 18 illustrates the distribution of risk ratings for the 65 first/final mile intersections that had been assessed.

Figure 18: First/Final Mile Intersections' Risk Rating



Source: CPCS analysis of WILMAPCO data

Other risk factors include the presence of other transportation users. There are 814 pedestrian crosswalks on Delaware's first/final mile network, and sidewalks parallel at least one side of 57.2 miles on this network. Based on data from the DelDOT Delaware Bike Council, 215 miles of first/final mile connections (about 62% of the state total) have some form of designed bicycling facilities, and 228 intersections between the first/final mile network and other transportation assets have some form of bike infrastructure or designation.

Visual Examples of Safety Issues Identified

- **Signalization:** Some intersections accessing freight facilities may be candidates for signalization to improve safety. One commenter proposed the example of Matassino Road in Wilmington Manor, which serves as an access corridor to a variety of facilities off of Boulden Boulevard.
- **Bicycles and Pedestrians:** Wrangle Hill Road (SR 72) is an example of a corridor that is important as a freight access corridor to newly developed distribution centers, but also as a transportation corridor for nearby neighborhoods and schools (including an elementary school located along a 1-mile stretch from a new distribution center to the highway). The corridor has narrow bicycle lanes and no sidewalks, and a commenter has noted that the road does not feel safe for pedestrians or cyclists given the increasing truck volumes.

Figure 19: Boulden Boulevard at Matassino Road

Source: Google Street View

Figure 20: Wrangle Hill Road (SR 72)

Source: Google Street View

- **Turning Radius:** In urban environments and city centers, narrow lanes and tight corners can be difficult for freight vehicles to maneuver. One example of such a location is the corner of Main Street and State Street in Millsboro. A commenter observed that this is a common trouble spot for turning trucks, as the corner is very tight for right turns, and the presence of parked vehicles right up to the intersection often makes maneuvering difficult.

Turning challenges can arise not just at intersections, but also along corridors with curves. One commenter suggested that the roadway geometry along Savannah Road in Sussex County creates problems when two trucks pass each other in opposite directions.

Figure 21: Intersection of Main Street and State Street in Millsboro

Source: Google Street View

Figure 22: Savannah Road in Sussex County

Source: Google Street View

5.3 Potential Solutions

5.3.1 Lane Width for Trucks

The National Association of City Transportation Officials (NACTO) recommends[3] typical lane widths of 10 feet for general purpose travel lanes, noting that wider travel lanes of 11 to 13 feet have traditionally been favored to create a more forgiving buffer for drivers, but that narrower streets promote slower driving speeds, which in turn reduce the severity of crashes. Indeed, there appears to be increased momentum nationwide for road diets, traffic calming, and other safety and public realm improvements that are intended to reduce speeding and other unsafe driving behavior while improving safety for vulnerable road users.

NACTO also acknowledges the importance of designing to accommodate transit and freight vehicles, which are wider than passenger vehicles and have different needs and impacts. NACTO recommends a wider curb lane of 11 feet for streets in urban areas where trucks and buses operate.

A key factor in road width decisions is the transportation context. For example, the City of Portland, which completed a comprehensive design guidebook for truck movements and other large vehicles, identifies a width of 12 feet as recommended for freight districts and major truck freight corridors, while truck access streets within non-freight areas have a preferred width of 11 feet, with an outside lane width of 11 to 12 feet.[4]

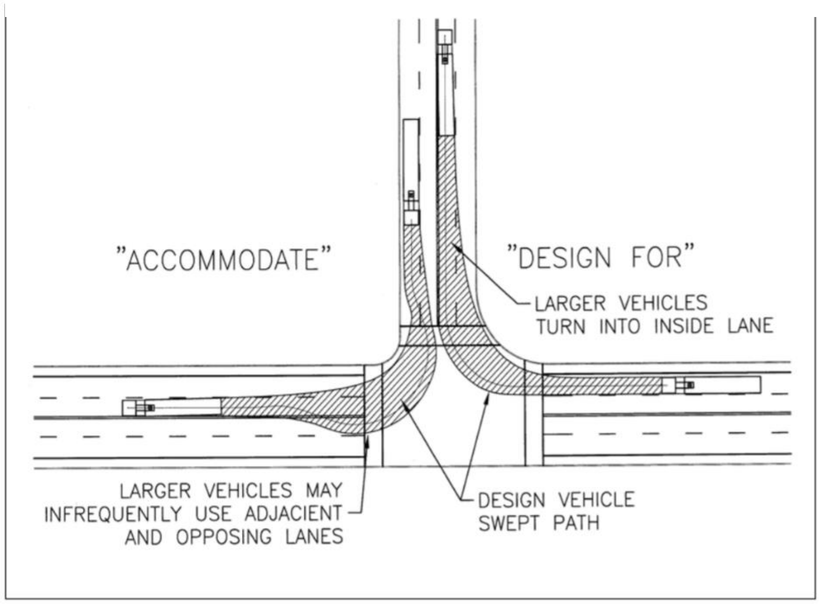
Truck-friendly lanes that are wider than the standard 12 feet can further reduce the potential of sideswipe crashes that occur on first/final mile roads. This is typically most useful for the far right lane of traffic. It is most useful for travel lanes that also feature a high level of passenger car, bicycle, and/or pedestrian traffic if separation of uses is not available.

[3] NACTO, Urban Street Design Guide, Lane Width (link)
[4] City of Portland, "Designing for Truck Movements and Other Large Vehicles in Portland," 2008.

5.3.2 Turning Radius for Trucks

Intersection turning radius is a key design question for road safety and truck mobility. As with lane widths, the context is very important as there is typically a tradeoff between the needs of trucks and other road users, including pedestrians and cyclists. Specifically, wider turning radii are safer for trucks, whereas tight turning radii with short crosswalk distances are preferable for pedestrians.

Figure 23: Design Considerations for Truck Circulation at Corners



Source: City of Portland, 2008

Figure 23 illustrates the relevance of designing for trucks versus designing to accommodate them. In freight districts or on key freight corridors, designing for commercial vehicles may improve safety by providing trucks enough maneuvering room to complete a right turn without encroaching into the travel lanes of opposing traffic or mounting curbs and sidewalks. However, in city centers and main street areas, wide corners may not be feasible or desirable. In such a case, truck movements can be accommodated through flexible use of road space, such as enabling the occasional use of adjacent and opposing lanes. Design elements – such as prohibiting parking/stopping close to the intersection and avoiding center medians or curbs at the crosswalk – can reduce the risk of inadvertently creating safety and congestion risks due to challenging truck turning movements.

5.3.3 Bicycle Lanes

Bicycles and trucks may come into conflict for a variety of reasons, including recognition that a truck driver's field of vision is limited, especially when making right turns at intersections. Shared bicycle lanes may be acceptable in low-speed urban contexts, in which case curb lanes should be wide to accommodate both types of road users. However, shared lanes are generally discouraged in freight districts or on truck-heavy corridors. In these cases, other design concepts such as physical separation through raised curbs or bollards, grade-separation, or alternate bicycle/truck routes may be considered to improve safety for all road users.

5.3.4 Median Barriers

Median barriers can be an effective design feature for wide multi-lane roadways with high speeds and high truck volumes. These barriers can reduce the number and severity of truck-involved collisions, particularly head-on collisions resulting from lane drift.

5.3.5 Traffic Signal Improvements

Freight or truck signal priority provides additional green time to enable trucks to pass through intersections without stopping – a safety measure intended to reduce the risk of serious collisions resulting from the potential for trucks to run red lights, given that trucks have longer deceleration times compared to passenger vehicles. Truck signal priority is particularly important on high-speed corridors or roadways with a downhill approach to the intersection. Detection equipment that can identify heavy vehicles can be used to extend green signals in such cases. Alternatively, roads known to be important freight corridors can be preprogrammed to have extended yellow signals to accommodate trucks.

5.3.6 Access Points

A review of truck trip-generating business establishments along freight corridors can serve to identify access points and any associated safety or mobility issues. Inadequate access may be resolved by moving the location of access points, adding turning lanes, installing signalized intersections, widening the curb radius, or restricting the direction of permissible turning movements. These challenges typically come to the fore in situations where roadways are widened or traffic levels rapidly increase.

5.3.7 Truck Route Designations or Prohibitions

Truck route designations or prohibitions (profiled in previous chapters) can be solutions to safety problems, by redirecting trucks away from unsafe corridors towards safer corridors. Analysis of truck crash hotspots using crash data or emerging sensor-based data (which can additionally illuminate incidences of near-misses) can be used to assess the relative safety of road corridors and intersections.

5.3.8 Other Improvements

Areas with high truck-pedestrian crash rates can be candidates for improvements, such as the addition of signalized intersections or crosswalks (for mid-block crash hotspots) or intersection reconfigurations or signalization modifications (for hotspots at signalized intersections).

Another consideration is the development of truck aprons for roundabouts and slip lanes on first/final mile roads, such that truck movements can be accommodated without interfering with the movements of passenger vehicles, bicycles, or pedestrians.

6 Condition Needs and Issues

Condition concerns were the least-frequently mentioned first/final mile problems not only in Delaware, but also in much of the national literature review conducted for Working Paper 1. Many condition needs and issues do not require additional attention, as they can be addressed within existing pavement replacement programs operated by DelDOT and its local partners.

6.1 Introduction

Condition problems are important to consider because poor-quality or rough roads can damage freight and increase vehicle maintenance costs. At the same time, the operation of trucks on under-engineered first/final mile connections can prematurely degrade pavements and bridges, creating a need for more frequent maintenance.

6.2 Delaware's Condition Needs and Issues

As noted in Working Paper 1 condition, like safety, is generally less frequently mentioned in national literature on first/final mile needs and issues. In Delaware, condition was not mentioned often in prior discussions of first/final mile issues and was primarily discussed regarding poor pavement and bridge condition of rural areas, and the general need for maintenance on first/final mile connections. This was validated through this project's outreach, as condition needs and issues were the least frequently mentioned type of first/final mile problem in the Wikimapping comments.

Visual Examples of Condition Problems Identified

- **Flooding:** Poor roadway drainage can lead to flooding and pavement deterioration, causing increased wear and tear and safety problems for trucking fleets. One commenter identified a location where these issues are acute, pointing out that Pyles Lane near Pigeon Point Road in a heavily industrial port-adjacent area is prone to frequent flooding due to inadequate drainage conditions.

Figure 24: Pyles Lane at Pigeon Point Road

Source: Google Street View

- **Debris:** A commenter observed that sand and gravel are tracked onto Federal School Lane by trucks accessing the gravel pit. Due to runoff/drainage conditions, the sand and gravel coat the road and clog the gutters, turning to mud when it rains. The road is also an access corridor for the Chadwyck neighborhood, leading to sand, gravel, and mud being tracked into the residential neighborhood by subsequent vehicles.

Figure 25: Federal School Lane near Gravel Pit

Source: Google Street View

6.3 Potential Solutions

Pavement solutions related to first/final mile connectors focus on preventing problematic pavement conditions from arising, identifying problematic locations that have already occurred, and prioritizing pavement condition improvements.

The locations of first/final mile connectors should be specified in asset management programs such that the Equivalent Single Axle Load (ESAL) estimates for these roadways can be adjusted to account for the higher percentages of trucks that occur on these roadways. This adjustment is particularly important on first/final mile roadways that are functionally classified as local roads and not part of the NHS in Delaware. By using accurate ESAL estimates for these roadways, scheduled maintenance has the potential to occur more frequently which will prevent road damage from occurring on these truck-intensive roadways. Additionally, appropriate pavement types can be more readily applied when there is an accurate estimate of the truck percentage on the road.

Proper road designation and enforcement also prevent road damage from occurring. Heavy trucks can be routed towards roadways with appropriate pavement types, while more local roads can use lighter materials more appropriate for passenger vehicle traffic. Any truck-only designated roads or designated truck routes should have pavement types that match the number of trucks that are utilizing the road.

To identify pavement issues outside of the formal asset management process, WILMAPCO can employ a combination of road inspections and outreach. Road inspections can occur on the first/final mile network on a biennial basis to ensure that these roadways are in good condition. Additionally, WILMAPCO can set up a program that allows truck drivers to report locations of poor pavement conditions through interfaces with truck fleet managers. The prioritization of pavement improvements within asset management programs should also include specific mechanisms for prioritizing truck damage on the local roads that serve as first/final mile connectors.

7 Next Steps

7.1 Next Steps

Once Working Paper 2 is complete, CPCS will prepare materials for and facilitate focus group meeting 2. The goal of this meeting will be to collect feedback from the focus group on the findings of Working Paper 2. In turn, this feedback will be used to further refine recommendations presented in the draft report.

Using findings from this Working Paper and the performance evaluation, CPCS will also create a preliminary list of prioritized first/final mile connection needs and issues. This preliminary prioritization is intended to help the work group understand which needs and issues may benefit from more immediate attention but will not be included in the draft and final reports.

After focus group meeting 2, CPCS will create a draft report that synthesizes findings from Working Papers 1 and 2, as well as feedback from the two focus group meetings and all prior work group meetings. Once complete, a draft report will be circulated for work group review, and a work group meeting will be convened to discuss the draft and provide feedback. A revised final report will be created based on feedback received from the work group.

Appendix A Summary of Data Analysis

This Appendix provides a summary of the results of the first/final mile need and issue screening process.

Land Use Needs and Issues

To identify potential freight and land use conflicts, this project screened first/final mile connections against 10 attributes provided by six data sources.

Figure 26: Freight and Land Use Conflict Attributes

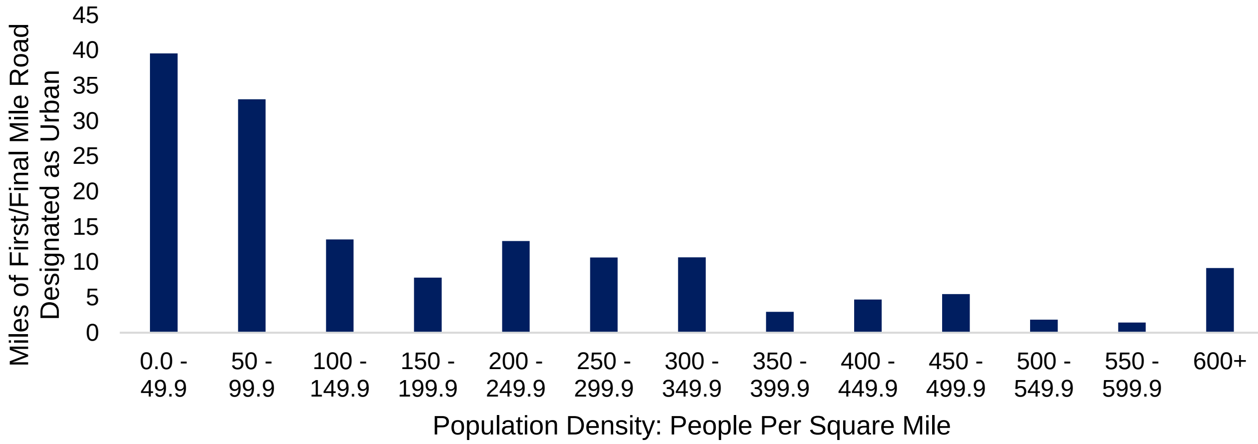
Attribute	Data Source
Urban Region Designation	WILMAPCO - Unpublished
Population Per Square Mile	US Census Bureau American Community Survey
Land Use Types	Delaware 2017 Land Use Land Cover
Planning Investment Level	Office of State Planning Coordination
Environmental Justice Index	US Environmental Protection Agency
River Crossings	US Census Bureau Aerial and Linear Hydrography
Wetland Location	WILMAPCO - Unpublished
Natural Protected Area Location	WILMAPCO - Unpublished
Wellhead Protection Area Location	WILMAPCO - Unpublished
Sea Level Rise	WILMAPCO - Unpublished

Urban Areas and Population Density:

About 44% or 154 miles, of the identified first/final mile connection mileage is located within areas designated as urban. The size of this share is heavily influenced by the long-distance rural first/final mile connections identified in Kent and Sussex Counties within the Delmarva Freight Plan.

Even in areas designated as "urban," it appears that most of Delaware's first/final mile connections lie within relatively sparsely-populated areas. For example, 136 miles, or 88%, of "urban" connections are located in areas with a population density less than Delaware's statewide density of 460.8 people per square mile. Only 2.8 miles of connections had a population density higher than that of New Castle County.

Figure 27: Population Density of Delaware's Urban First/Final Mile Connections



Source: CPCS analysis of US Census Bureau American Community Survey Data

This data suggests that Delaware's current first/final mile connections are most heavily concentrated in lower-population and rural areas. Urban first/final mile connections' mileage skew towards low-population areas is likely due to several factors:

- Many existing urban freight routes are already classified as secondary or tertiary freight routes and therefore are excluded from this first/final mile analysis.
- Freight routes in urbanized areas are concentrated in industrial areas, where the localized population is lower.

Delaware's urban first/final mile road connections appear to be concentrated in areas with relatively low population density.

This finding aligns with the needs and issues documented in Working Paper 1 – particularly the multiple concerns about the impact of continued suburban development on formerly-rural freight routes, or the new development of warehouses and distribution centers in exurban areas. This concern was also echoed by comments within the Wikimapping application, where both public commenters and agency and industry users noted some areas of ongoing development for potential future conflict.

Land Uses:

The 2017 Delaware Land Use Land Cover dataset provides information about the general types of land use in Delaware. This information was used to help illuminate potential types of conflicts across the state.

Figure 28: First/Final Mile Connection Mileage with Potential Land Use Conflicts Within 50 Feet

Single Family Dwellings	Multi-Family Dwellings	Commercial	Mixed Urban or Built-Up Land
241.7 miles 69%	**10.7 miles** 3%	**98.7 miles** 28%	**76.9 miles** 22%

Source: CPCS analysis of WILMAPCO data

As before, there is a relatively high share of connection milage with some adjacency to residential properties, but there is relatively little mileage adjacent to potentially denser development like multi-family dwellings. This further supports the idea that many of Delaware's first/final mile and land use conflicts are likely to be found in areas of new development, in suburbs or the urban fringe.

Development Levels:

The Delaware Office of State Planning Coordination (OSPC) has created strategies for policies and spending. Specifically, strategies created in 2020 identify goals and policies for land use and infrastructure investment. As part of this strategy development work, OPSC has identified four "investment levels" to depict growth strategies for varying areas of the state. Levels 1, 2, and 3 are defined as "urban" or "urbanizing growth", while Level 4 is considered more rural. Additionally, some areas are marked as "out of play" for private development, and a small amount of first/final mile mileage falls into this category.

Figure 29: Mileage of First/Final Mile Segments by OPSC Development Level

Level 1	Level 2	Level 3	Level 4
Mature areas with infrastructure and services. Ex: Dover, Wilmington, and Seaford.	Urbanizing Areas near Level 1, with newer or planned infrastructure.	Less-established but experiencing development pressures. Long-range growth areas.	Rural areas, including agricultural and natural resource areas.
107.5 Miles 30%	**42.1 Miles** 12%	**39.4 Miles** 11%	**156.8 Miles** 45%

Source: CPCS analysis of Delaware OPSC data

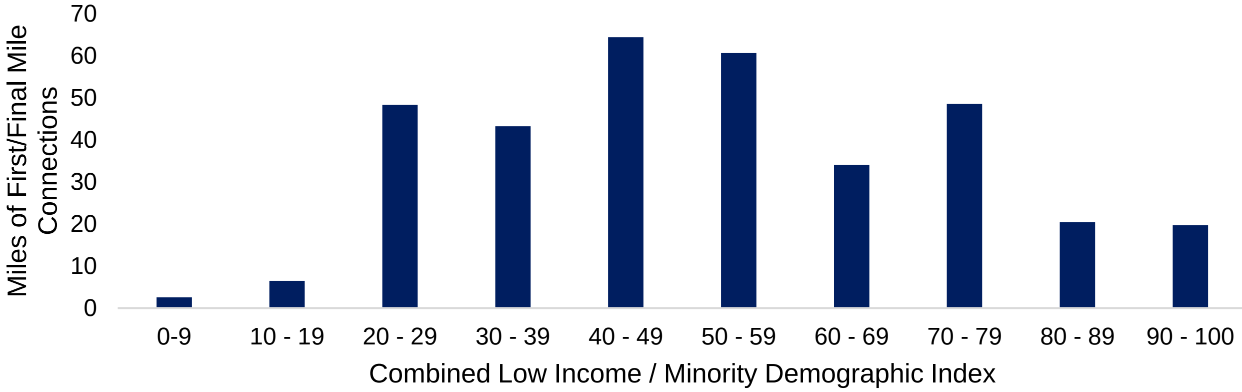
23% of Delaware's First/Final Mile connections are in urbanizing or developing areas.

Environmental Justice

As noted in Working Paper 1, there are multiple potential negative impacts of freight transportation and industrial activity, such as air emissions, noise, light pollution, and vibration. These negative impacts, their corresponding impact on land value, and other longstanding factors like institutional racism mean that low-income communities and communities of color have often been disproportionately affected by the negative impacts of industrial activity and corresponding freight transportation. Therefore, future efforts to improve first/final mile connections must consider historic and potential future impacts on frontline communities.

The US Environmental Protection Agency's (EPA) environmental justice screening data was used to understand potential impacts on low-income communities of color and highlight potential areas that would require additional environmental review or community engagement. Specifically, this project uses the EPA's environmental justice demographic index, which is based on the average of two demographic factors in each Census block group: percentage of the population that is low income, and percentage of the population that is classified as a minority group. This index reflects Delaware's overall demographic makeup, with an index value of 50 representing an income and minority population make-up similar to the state as a whole, values less than 50 reflecting higher income or less minority population share, and values greater than 50 reflecting lower income and higher minority population share. Delaware's first/final mile connections are more concentrated in areas with lower income and greater minority shares of the population. Among first/final mile connections, 52% of the mileage was in Census blocks with indices of 50 or higher, and 80 miles of connections are in Census block areas with indices of 70 or higher.

Figure 30: Environmental Justice Demographic Index



Source: CPCS analysis of US Environmental Protection Agency data

Delaware's first/final mile connections are concentrated slightly more heavily in communities that are relatively poorer or have higher shares of minority populations.

Intersections and Proximity to Other Environmental Features:

In addition to the land use screenings above, CPCS conducted a review to identify potential environmental land use conflicts. This screening supports the project's PEL objective, as it helps WILMAPCO and DelDOT understand which first/final mile connections are likely to require further environmental review as part of further planning or project development. Of note, there are 158 river or stream crossings documented for the first/final network, and 23 miles of first/final mile network lie within wellhead protection areas.

Figure 31: Mileage of First/Final Mile Connections within Given Distances to Environmental Areas

Distance from Road:	50 Feet	100 Feet	500 Feet
Natural Protected Areas	28.1	35.6	56.5
Wetlands	21.3	27.9	89.3

Source: CPCS analysis of WILMAPCO data

Sea Level Rise:

While sea level rise is a significant concern for Delaware, it is of limited relevance to the first/final mile network developed in this project, as less than 1 percent of the identified network mileage was likely to be inundated with up to 3' of sea level rise. These at-risk connections were primarily concentrated in coastal New Castle County, and these issues were also documented in feedback from the Wikimapping application.

Figure 32: Mileage of First/Final Mile Connections Affected by Projected Sea Level Rise

1' Rise	2' Rise	3' Rise
4.8 miles 0.01%	9.6 miles 0.02%	12.0 miles 0.03%

Source: CPCS analysis of WILMAPCO data

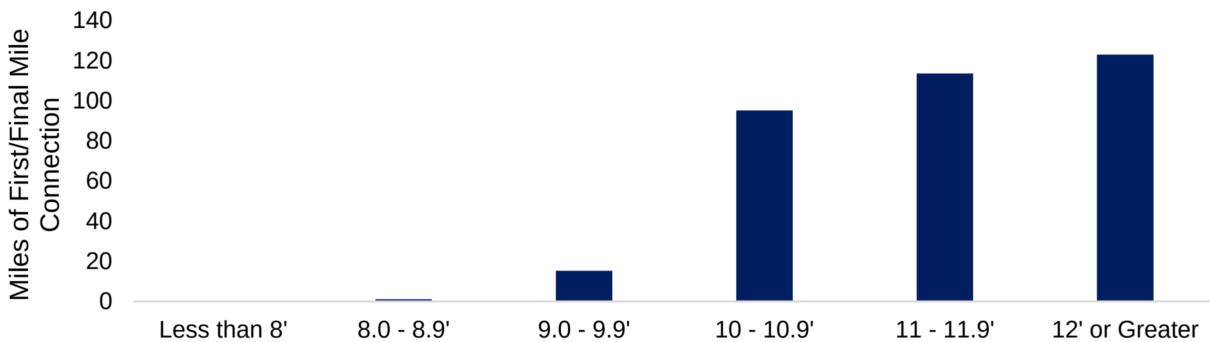
Relatively small portions of Delaware's first/final-mile network are at risk of temporary or permanent closure due to near-term sea level rise.

Mobility Needs and Issues

Roadway Widths

The standard semi-trailer dry van is roughly 8.5' wide, and narrow streets present a potential mobility barrier for trucks. Recommended lane widths for road design usually vary between 10 and 12 feet, depending on the road's location, speed, and intended use.[5] Based on this guidance, it appears that the majority of Delaware's first/final mile connections do not have mobility impediments associated with narrow lanes. Figure 33 illustrates how 95% of Delaware's first/final mile connections have lane widths of greater than 10 feet. Narrower lane widths are primarily concentrated in developed urban areas.

Figure 33: Delaware's First/Final Mile Lane Width



Source: CPCS analysis of Delaware Road Inventory data

In addition to lane width, shoulder width is an important mobility and safety consideration, as shoulders give truckers "room for error" in maneuvering their vehicles and accommodating other road users. Stakeholders noted issues with road and shoulder widths on both urban and rural roads. Specific concerns included narrow or tight ramps on limited-access highways, tight corners that cannot accommodate passing trucks, and stretches of road without adequate shoulders. This feedback has been assigned to specific road segments in the network dataset. Nearly 9% of Delaware's first/final mile connections have between 0 and 1 feet of shoulder width, while 70% of the first/final mile network has shoulders of 4' or greater.

Figure 34: Shoulder Widths of Delaware's First/Final Mile Connections

Left Shoulder Width (Feet)	Right Shoulder Width (Feet)										
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10
0-1	8.9%	0.1%	0.4%	0.3%	0.2%	0.4%	0.7%	0.1%	0.4%	0.7%	0.5%
1-2	0.1%	0.3%	0.8%	0.4%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%
2-3	0.3%	0.0%	4.2%	0.3%	0.4%	0.0%	0.1%	0.3%	0.1%	0.3%	0.2%
3-4	0.2%	0.0%	0.2%	2.6%	0.3%	0.1%	0.1%	0.2%	0.7%	0.1%	0.3%
4-5	0.2%	0.0%	0.2%	0.0%	10.4%	0.9%	0.3%	0.2%	0.1%	0.3%	0.1%
5-6	0.2%	0.0%	0.0%	0.3%	0.9%	5.6%	0.2%	0.2%	0.1%	0.2%	0.2%
6-7	0.1%	0.0%	0.1%	0.2%	0.1%	0.9%	2.9%	1.6%	0.2%	0.1%	0.2%
7-8	0.6%	0.0%	0.2%	0.1%	0.1%	0.1%	0.7%	3.5%	5.7%	1.1%	0.2%

[5] *AASHTO Green Book*.

	Right Shoulder Width (Feet)										
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10
8-9	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.9%	8.2%	5.2%	0.3%
9-10	0.2%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.2%	1.8%	11.1%	0.8%
>10	0.7%	0.0%	0.3%	0.1%	0.1%	0.3%	0.2%	0.2%	0.3%	1.4%	1.6%

Source: CPCS analysis of Delaware Road Inventory data

Bridge Clearances and Weight Limits

Low clearance bridges can be particularly problematic barriers to efficient truck movement, as they can serve as bottlenecks and require trucks to take substantial detours to avoid them. 16 bridges cross over the identified first/final mile network, and a small number of bridges are too low to safely accommodate standard-sized box dry van truck trailers.

Figure 35: Count of Low-Clearance Bridges on Delaware's First/Final Mile Network

Under 13'6" Maximum Truck Height without Oversize Permit in Delaware	**Under 14'6"** FHWA Recommended Bridge Clearance Over Road
3 bridges	7 bridges

Source: CPCS analysis of WILMAPCO data

These low-clearance bridges are all associated with major rail corridors in New Castle County and are located on Old Ogletown Road in Newark, a service road for Stanton Christiana Road, and James Street in Newport. However, all three of these low-clearance bridges have major freight corridors nearby, so they do not create much of a true bottleneck for truck movement.

In addition to these height limitations, bridge weight restrictions can also affect truck routes and mobility. The identified first/final mile road network crosses over 135 bridges, and only three rural bridges on the network have posted weight limits.

First/final mile bridge height and weight restrictions do not create substantial barriers for freight mobility in Delaware.

Other Mobility Considerations

The data analysis also examined other potential influences on mobility, including travel time index, travel time reliability, grade crossings, and train frequency. These factors were only relevant to very small portions of the network (<5% of mileage), and based on analysis and a lack of stakeholder comments, do not appear to be relevant mobility issues for the currently-identified first/final mile network.

Based on the initial analysis conducted and stakeholder comments, mobility concerns are generally limited for Delaware's first/final mile network and are focused on geometric mobility issues related to shoulders.

Safety Needs and Issues

To identify potential first/final mile truck safety problems, this project screened first/final mile connections against five attributes provided by four data sources. These attributes and data sources are listed in Figure 36.

Figure 36: First/Final Mile Safety Attributes and Data Sources

Attribute	Data Source
Truck-Involved Crashes and Crash Severity	WILMAPCO - Unpublished
Intersection Safety Ratings	WILMAPCO - Unpublished
Bike Route Information	Delaware Bike Council
Sidewalk Locations	DelDOT Unmotorized Inventory
Crosswalk Locations	DelDOT Unmotorized Inventory

First/Final Mile Truck-Related Crashes

Between 2014 and 2019, 1,122 crashes were observed on Delaware's first/final mile network. The majority of these crashes (75%) were property damage only. Figure summarizes the number and percentage of each type of crash recorded on Delaware's first/final mile network. Figure 37 summarizes the count and share of each type of crash.

Figure 37: Count of First/Final Mile Road Crashes by Severity

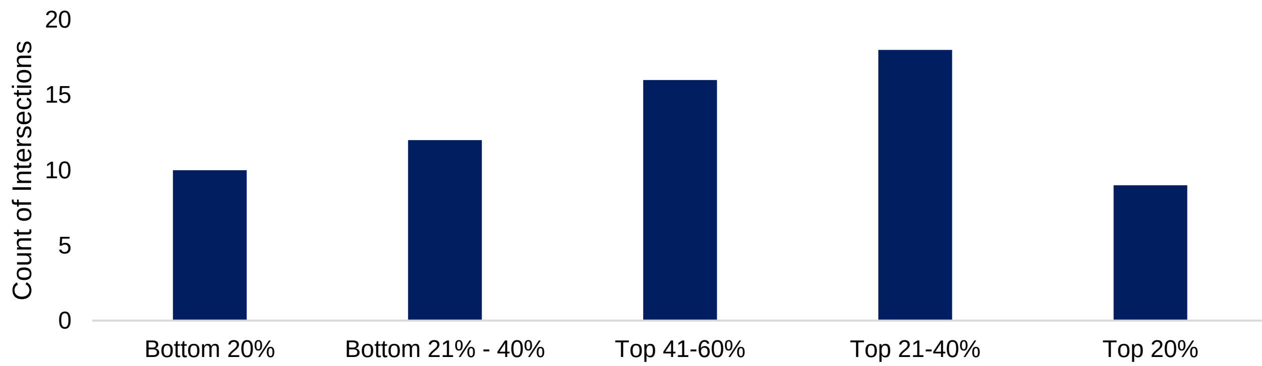
Property Damage Only	Injury	Fatality
846 **75%**	**266** **24%**	**10** **1%**

Source: CPCS analysis of WILMAPCO data

Intersection Risk Scores

Delaware has conducted a risk assessment for intersections based on a ten-year average of vehicle crashes and other risk factors. 65 first/final mile intersections were represented in this dataset, which is broken into quintiles based on crash frequency. Figure 38 illustrates the distribution of risk ratings for the 65 first/final mile intersections that had been assessed.

Figure 38: First/Final Mile Intersections' Risk Rating



Source: CPCS analysis of WILMAPCO data

Crosswalks and Sidewalks

Prior first/final mile research, such as the FHWA's Intermodal Connector Study, noted that the presence of crosswalks and sidewalks can be risk factors for first/final mile safety, as wide-turning trucks can occupy large portions of intersections or could be at risk of "hopping' the curb on narrow urban streets. Additionally, some of the general public feedback noted concerns about pedestrian safety in neighborhoods that surrounded freight routes, particularly in some communities in New Castle

County. Based on the review of data listed in Figure 38 there were 814 pedestrian crosswalks on Delaware's first/final mile network, and sidewalks parallel at least one side of 57.2 miles of this network.

Bicycle Facilities

Based on data from the DelDOT Delaware Bike Council, 215 miles of first/final mile connections (about 62% of the state total) have some form of designed bicycling facilities, and there are 228 intersections between the first/final mile network and other transportation assets with some form of bike infrastructure or designation.

7.2 Condition Needs and Issues

Two attributes from two data sources were mapped onto the first/final mile network to help identify potential condition problems.

Figure 39: Condition Attributes and Data Sources

Attribute	Data Source
Pavement Condition Rating	DelDOT Planning Section Road Inventory
Bridge Condition Rating	FHWA National Bridge Inventory

Pavement condition rating information is available for about 302 miles of the first/final mile network, with rating 1 being the worst, and rating 5 being the best. Based on this assessment, 75% of Delaware's first/final mile connections are rated "3" or higher, suggesting that poor condition is not a significant concern for the system overall.

Bridge condition ratings are available for 48 bridges on the first/final mile network, and Figure 40Figure lists the count of each bridge by condition rating.

Figure 40: Condition of Bridge's on Delaware's First/Final Mile Network

Poor	Fair	Good
2	27	19