

FHWA Freight and Land Use Handbook

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Executive Summary

Nationally, there is a growing awareness among local governments, Metropolitan Planning Organizations (MPO), and state departments of transportation (DOT) that land use and freight planning activities should be more closely coordinated. However, many agencies find it challenging to coordinate freight transportation and land use planning activities to ensure that transportation facilities are compatible with adjacent land uses, or that land use decisions are consistent with freight mobility and operational needs. These agencies are working to understand how land use issues impact freight movements (and vice versa), the types of stakeholders that should be involved in land use and freight planning activities, and the types of tools, techniques, and strategies used by other local, regional, and state agencies across the country to deal with these issues.

The goal of this *Freight and Land Use* handbook is to provide transportation and land use planning practitioners in the public and private sectors with the tools and resources to properly assess the impacts of land use decisions on freight movements, as well as the impacts of freight development and growth on land use planning goals. The handbook identifies freight-related land use issues, key considerations, and available resources. Throughout the handbook, examples and case studies from a range of urban and rural areas across the country are used to demonstrate the effectiveness of these techniques.

LINKING FREIGHT AND LAND USE PLANNING

Freight generating land uses, such as agriculture, natural resources and mining, construction, warehousing, manufacturing, logistics, and port and harbor operations, can bring tremendous positive benefits to a region. Some of the benefits of freight generating land uses include: direct and indirect employment associated with freight activity; business and income tax benefits to local, regional, and state economies; contribution to state and local economic output; and lower costs for goods and services. Freight generating industries also can produce negative impacts on a region's air quality by producing vehicle emissions and on land uses near freight generating facilities by producing noise, vibration, odor, and light pollution.

Because freight volumes, and their attendant impacts, are anticipated to increase significantly in the future, growing by over 60 percent (nationally) over the next 25 years, it is important to plan appropriately to accommodate freight-generating industries while protecting the health, safety, and quality of life of residents. Transportation and land use planning cycles can be better coordinated to accommodate freight and reduce its impacts by adopting “Freight as a Good Neighbor” strategies, adopting sustainable freight land use policies and practices, and accounting for freight physical and operational needs and impact mitigation through zoning.

FREIGHT AS A GOOD NEIGHBOR

If freight planning and land-use decision-making activities are well integrated, both the public and private sector may benefit through reduced congestion, improved air quality and safety, enhanced community livability, improved operational efficiency, reduced transportation costs, and greater access to facilities and markets. The freight community can be considered “a good neighbor” when such a balance between economic activity and external impacts is achieved. Public agencies can encourage this balance through adoption of appropriate and coordinated land use policies, effective transportation systems and services, effective operations and management policies of transportation infrastructure and terminals, and continuous education and outreach programs to engage community and industry representatives.

- **Appropriate and Coordinated Land Use Policies.** Land use is 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 through regional visioning, which helps to coordinate plans among agencies in the region, and 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.
- **Effective Transportation Systems and Services.** Freight-exclusive transportation facilities such as truck lanes, direct highway connections to freight facilities, and the reduction of at-grade rail crossings are examples of strategies that improve transportation

system safety and limit the potential impacts of freight movement on the safety and quality of life of the public at large.

- **Effective Operations and Management Policies.** Impacts may be reduced by encouraging off-peak deliveries, promoting anti-idling technologies to reduce emissions impacts, creating “quiet zones” along freight rail lines that pass through residential areas, reduce, or mitigate airplane noise through airplane design, and airport site planning that is sensitive to neighboring land uses.
- **Education and Outreach.** Lack of awareness is a key reason that logistics needs are not often considered in planning and development decisions. By educating public officials and the public at large regarding freight benefits; providing technical assistance to officials to develop appropriate plans and codes; assisting freight-generating businesses to understand and mitigate existing or potential impacts; local, regional, and state governments can foster a common understanding of freight and land use issues among all stakeholders at the table.

FREIGHT LAND USE AND SUSTAINABILITY

The term “sustainability” represents a pattern of human activity that aims to use the planet’s resources in a manner that meets the needs of the world’s population now and in the future, while achieving a balance between environmental conservation, economic development, and livability (including consideration of social equity and justice). Sustainability is a concept that is increasingly entering discussions of freight movement and freight generating land uses. Therefore, the concept of sustainable freight is one that maximizes the positive features of freight movement (jobs, economic development, etc.) while minimizing the negative impacts to 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, brownfields redevelopment, and freight villages.

ACCOUNTING FOR THE IMPACTS AND NEEDS OF FREIGHT

Freight and community needs are not necessarily mutually exclusive. In fact, the needs of the private-sector freight community may align well with local and regional sustainable development strategies. Freight shippers and carriers have a variety of needs that are critical to efficient

and safe goods movement. Shipper and carrier land use needs vary by region and activity type, but generally include: adequate capacity and reliable performance of the transportation system; sites with access to the transportation networks; loading and staging areas; sufficient geometric design to accommodate trucks and/or rail equipment; policies and design to foster safety and security. Local, regional, and state agencies can take action to accommodate these needs and properly mitigate the impacts.

- **Local governments** can conduct traffic access and impact studies; perform site planning reviews; develop or analyze truck routes; review the comprehensive plan to ensure land set aside for industrial uses is adequate and appropriate; use overlay zones with form-based or performance-based criteria; enforce loading zone and parking regulations; involve the private sector in developing site design standards; and provide guidance to developers.
- **Regional agencies'** planning actions include: lead regional visioning and goods movement studies; create regional freight plans to define key freight mobility goals and land use priorities; create model ordinances and best practices for local governments' use; create corridor or subarea plans that consider freight needs and impacts; and work with rail, air, and waterborne freight planners to determine needs at regional terminals.
- **State governments** can help address freight needs by providing a vision for planning and guidance to regional and local governments. States can: consider freight issues in statewide long-range transportation plans; include freight mobility as a criterion in project selection processes; take freight needs into account in highway design; develop corridor and subarea plans to address congestion and safety issues; and work with local zoning authorities to ensure consistency with state planning goals and to minimize conflicts between adjacent land uses in separate local jurisdictions.
- **Private-Sector Freight Stakeholder** planning actions include: participating in and comment on local, regional, and state transportation plans and studies; participating on freight planning committees; and offering opportunities for public-sector officials to learn about business and operations.

CONCLUSION

Together, the topics covered in this handbook will introduce some of the main players, policies, programs, and strategies that form the basis of knowledge for integrating freight into the land use planning process. By providing a broad swath of viewpoints, the handbook should appeal to public and private-sector freight stakeholders from all sides of the issue; including industrial site developers, land use practitioners, local government officials, members of the public, or anyone else.

Though this handbook is comprehensive, it is a static document. Readers should remember that the freight industry is a rapidly and ever-changing industry, reflective of economic and demographic shifts as well as global supply chain developments. Public and private stakeholders, alike, need to continue to work towards understanding the regions within which they operate. States and regions are constantly identifying ways to increase their ability to compete regionally, nationally and globally. Private-sector companies are constantly trying to streamline and economize their operations, and develop innovative solutions to existing problems. This handbook provides a good understanding of the issues, needs, opportunities, and strategies that will serve as a starting point to better integrate freight and land use in an ongoing and permanent manner.

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1.0 Background on Freight and Land Use

1.1 Purpose and Content

The first step towards a more comprehensive inclusion of freight in the planning process is to ensure a common understanding of the stakeholders, roles and responsibilities, and trends involved in the process. Though public-sector agencies often have a firm grasp of the transportation planning and programming process, they do not always understand the private-sector decision-making process, or the land use and transportation needs of freight. Private-sector companies, though knowledgeable of their own needs and business priorities, often lack a full understanding of the public planning and programming process, or the ways that they can effectively be included in this process. The purpose of this section is to help practitioners to better understand the key concepts in land use and freight transportation. This section will be divided into four sections:

- **Why Freight Should Be Considered in the Transportation and Land Use Planning Processes?** summarizes the benefits of freight-generating businesses, as well as some of the key demographic, financial, economic, environmental, public policy, and industry changes that signify a need to include freight in the public planning process.
- **Transportation and Land Use Planning Processes** discusses the key steps and products of the transportation and land use planning processes, as well as the linkages between them.
- **Public-and Private-Sector Stakeholders, Roles, and Needs** discusses the types of public- and private-sector stakeholders that are involved with transportation and land use planning, as well as a discussion of some of the key freight issues that drive the decisions of each group.
- **Freight and Land Use Trends and Issues** discusses some of the key trends and challenges that will impact freight and land use decisions in the next 10 to 20 years.

1.2 Why Should Freight be Considered in the Transportation and Land Use Planning Process?

There are several compelling reasons to integrate freight into the land use and transportation planning discussion. For one, freight generating land uses can potentially bring great benefits to a region, by providing

jobs, tax dollars, and proximity of goods to growing populations and businesses. Another, freight volumes, and their attendant impacts, are anticipated to grow significantly in the future, growing by over 60 percent (nationally) over the next 25 years, as will be discussed later in this section. Planning for their inclusion now will enable them to fit seamlessly into the community fabric, allowing them to provide benefits to their region while minimizing adverse impacts to local residents and the environment.

WHAT ARE THE BENEFITS OF FREIGHT GENERATING LAND USES?

Freight generating land uses, such as agriculture, natural resources and mining, construction, warehousing, manufacturing, logistics, and port and harbor operations, can bring tremendous positive benefits to a region. Understanding the positive benefits can help justify the retention of industrial land uses in growing urban areas, or of the need to include private-sector stakeholders in the public planning process. Some of the benefits of freight generating land uses include:

Employment

Freight generating industries can provide direct employment (jobs working directly for the business) as well as indirect employment driven by the economic activity of the jobs. For example, in an economic impact study performed in 2009 at the Port of Seattle, the port reported direct employment of 111,317 individuals, 62,128 induced jobs, and indirect statewide employment of over 200,000 people in Washington State.¹

Tax Benefits

Freight generating land uses can bring tax benefits to a region. For example, a study conducted for the Southern California Association of Governments (SCAG) found that industries related to international trade and freight contributed \$28.3 billion in state and local taxes to Southern California in 2005.²

Contribution to State and Local Economic Output

Freight-related businesses can contribute billions of dollars to regional and statewide economies. For example, an economic analysis of the State

¹ The Port of Seattle 2009 Economic Impact Report.

² SCAG 2008 Regional Transportation Plan: Goods Movement Report.

Assessing and Addressing Freight's Environmental Impacts - USEPA SmartWay Program

The SmartWay Program is a public/private collaboration between the United States Environmental Protection Agency (USEPA) and the freight industry, which aims to assess and limit freight-related emissions and energy consumption. The program helps carriers identify opportunities to improve efficiency reduce energy costs, and demonstrate their efficiency to potential customers. The program helps shippers and logistics companies find efficient carriers, assess mode choice options, and reduce the carbon footprint of the transportation component of their supply chains.

Source: United States Environmental Protection Agency, available from: <http://www.epa.gov/smartwaylogistics/>.

of Kansas found that goods dependent industries led by agriculture, meat processing, and manufacturing, still accounted for almost 43 percent³ (or \$40 billion) of state economic output in 2006.⁴

Other Benefits

Other benefits are harder to measure, but nevertheless important to mention. For example, the presence of freight uses within heavily populated urban areas can offer closer proximity to goods and services for local businesses and citizens. In addition, freight movement is becoming cleaner and safer every day – with programs like the United States Environmental Protection Agency (USEPA) SmartWay Transport program working to increase the environmental efficiency of freight transportation on a national level.⁵ Potential benefits from freight will be most easily realized if freight generating land uses are developed in a manner that is consistent with regional land use and transportation goals. One way to accomplish this is to include freight stakeholders in the public planning process.

WHAT ARE THE DISBENEFITS OF FREIGHT GENERATING LAND USES?

Clearly, freight land uses can offer substantial economic, employment, fiscal, and other benefits to a region. Nonetheless, there are negative impacts associated with freight operations, particularly when they are concentrated within a small area. These disbenefits, which are discussed in greater detail in Section 3.0, include:

Air Quality Impacts

Most freight vehicles are powered by diesel fuel, as are many pieces of support equipment such as yard hostlers and cargo cranes. The combustion of diesel fuel for goods movement emits particulate matter, oxides of nitrogen, and sulfur dioxide, all of which contribute to air quality problems, especially in urban areas and around large freight generators. New regulations for several types of freight vehicles will reduce freight diesel emissions significantly, but this could take time since most freight vehicles have long-service lives.

³ This is larger than the national share (36 percent of overall output, or about \$5.1 trillion); nonetheless, these industries remain critical to many state and local economies.

⁴ Kansas Department of Transportation, Statewide Freight Plan, 2009.

⁵ <http://www.epa.gov/smartway/>.

Greenhouse Gas Emissions

Freight land uses also can be a significant source of greenhouse gas (GHG) emissions. GHG are heat trapping gases that accumulate in the earth's atmosphere, thereby contributing to the "greenhouse effect" and global warming. Carbon dioxide (CO₂) is the primary GHG produced by the transport sector. Although 60 percent of transportation-related GHG comes from passenger vehicles, much of the remainder is related to freight.

Environmental Justice

Environmental justice refers to the geographically equitable distribution of the benefits and burdens of government policies, programs, and investments, and to ensure the full and fair participation by all potentially affected communities in the transportation decision-making process. Many freight facilities are located in communities which have a large number of minority or lower-income residents, and which often receive significant environmental impacts from those facilities. Expanding freight operations or infrastructure in these communities requires taking strategies to reduce or mitigate impacts into consideration.⁶ What driving forces necessitate the integration of freight into the planning process?

CHANGES INDICATING THE IMPORTANCE OF PLANNING FOR FREIGHT

There are several other demographic changes underway that will change the land use consumption needs of freight generating businesses in coming years. Understanding these key driving forces helps to illustrate the necessity of incorporating freight into the public planning process. Some key changes include:

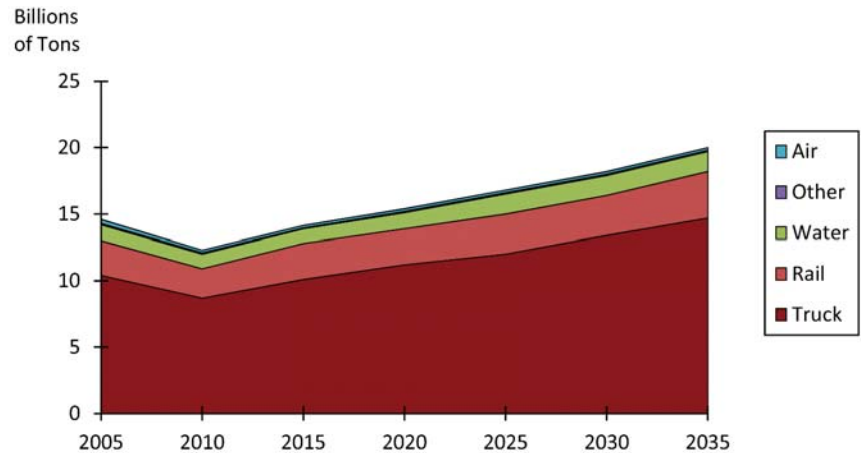
Freight Volumes are Growing Nationally

Though freight volumes, nationally, have dipped in the 2005-2009 years (corresponding with a national recession), economic projections show sustained growth in the 2010-2035 timeframe (as shown in Figure 1.1 below). This growth means that there will be additional capacity demands on the highway, rail, air cargo, and marine systems. This increased demand will have to compete with growing passenger vehicle miles traveled (VMT) on the same transportation infrastructure. In

⁶ "Envision Freight: A Roadmap to Freight Compatibility," Transportation Research Board, 2010, available from: <http://www.envisionfreight.com>.

addition, there will likely be the need for expanded freight land uses – in particular those closely tied to transportation such as rail yards and distribution centers.

Figure 1.1 National Multimodal Freight Tonnage 2005-2035



Source: IHS-Global Insight, Inc., 2007 TRANSEARCH data and economic projections.

Population Trends

As of 2007, 81 percent of the U.S. population lived in urban areas. The rate of urbanization is anticipated to grow steadily – in fact urban areas are expected to grow by an average annual rate of 1.1 percent through 2025, compared to -0.65 percent in rural areas.⁷ In terms of freight, larger urban populations will have two chief consequences: 1) Freight traffic will become more and more concentrated in cities, as freight movement will naturally increase in order to provide growing populations and business centers with the goods and services that they need to thrive; and 2) There will be additional demand for the facilities – such as ports, distribution centers, and intermodal rail yards – to serve that traffic. This growing need for land will have to compete with other regional land uses, including residential, commercial, public use, and open space.

The aging of the population also may impact these trends. There are essentially two ways through which the nation’s economy can grow and provide a rising standard of living: by adding workers, or by improving productivity. Given a generally aging population and declining birth rates, it may be difficult to expand output through adding workers.

⁷ United Nations Population Division, *World Urbanization Prospects: The 2007 Revision*, February 2008.

However, investing in freight transportation can improve long-term productivity in the economy by reducing the cost of moving goods. Therefore, investment in freight infrastructure – including public outlays for port improvements or intermodal hubs – may increasingly be seen as an effective tool for state and regional economic development.

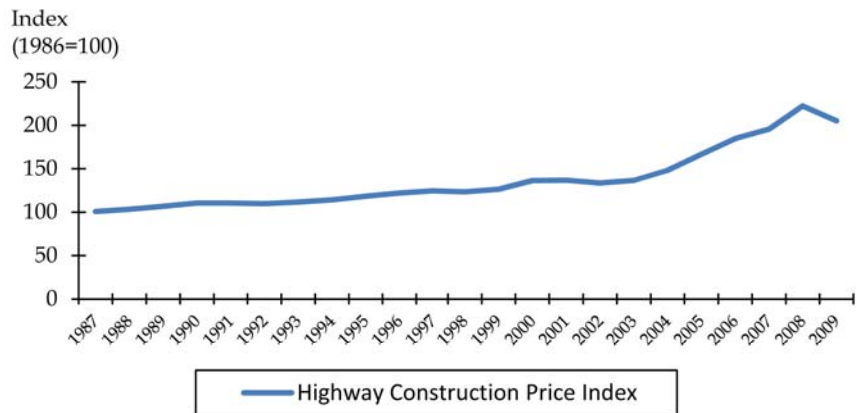
Climate Change, Sustainability, and Livability

Growing concern among policy-makers and the general public about climate change, livability, and sustainability also may impact land development as it relates to freight. For instance, community livability concerns and “Not In My Back Yard” (NIMBY) sentiments may hamper the ability of freight generating businesses and other entities (such as ports) to locate or expand in certain places. Industrial lands, ports, and rail yards in dense urban areas already are under significant pressure to be redeveloped into “higher value” commercial or residential uses. This is partially the result of a trend towards denser, urban living arrangements for both economic development and sustainability reasons.

Financial Challenges in Addressing Infrastructure Needs

This growth in freight flows will coincide with increasing challenges faced by Federal, state, and local governments in terms of funding infrastructure needs. As shown in Figure 1.2, the real costs of building streets and highways have been growing consistently over the last few decades, with a pronounced spike in the last decade. Meanwhile, revenues available for transportation projects have remained flat or even fallen when adjusted for inflation. Demand for construction materials in developing nations such as China will likely contribute to construction-cost inflation in the years ahead even as the growth in freight tonnage adds additional traffic to the system.

Figure 1.2 Producer Price Index for Highway and Street Construction
1987-2009



Source: Bureau of Labor Statistics.

1.3 Land Use and Transportation Planning Processes and Linkages

WHAT IS LAND USE PLANNING?

Land use planning can generally be described as a branch of public policy that seeks to regulate the use of land in an ethical and efficient manner. Land use planning is important to the public and private sectors because the process of land use planning determines how land will be used in the future, which can create opportunities and issues for businesses and citizens. Land use planning practice varies by state, region, and municipality. This variation is the result of several factors, including differences in the level of authority states grant to local governments and differing policy priorities among towns, cities, and regions.

WHO DOES LAND USE PLANNING?

Land use controls, such as zoning, are typically the responsibility of local governments, such as municipalities or counties. Therefore, most land use planning is conducted by city or county planning departments, and/or by regional bodies such as a council of governments. The level of authority exercised by these entities will vary depending on states' enabling legislation. Florida, for example, gives county governments the authority to develop their own land use and growth management plans. By contrast, counties in Texas have no authority over land use decisions.

Some state governments also participate in the land use planning process, for example by reviewing local plans to ensure their compatibility with statewide goals or plans of neighboring municipalities, sometimes through a statewide planning agency or commission. Delaware, New Jersey, Florida, Oregon, and Hawaii have all adopted such a statewide land use planning approach.

WHAT ARE THE KEY STEPS AND MAIN PRODUCTS OF LAND USE PLANNING?

Land use planning is comprised of several processes that guide how the land within a municipality will be used. The major components of the land use process include several different discrete products, including:

- Comprehensive/land use plan;
- Zoning code/land development regulations; and
- Land use permitting issues and process.

The comprehensive plan (also known as the master plan or general plan) serves as the overarching blueprint for future growth. It supplies a framework that the zoning code helps to implement through the use of development guidelines and regulations. The vision of the comprehensive plan and zoning code may be facilitated through permitting processes that offer specific approval to projects that fit within the framework of the plan and code. Each of these components are described in the following sections.

Figure 1.3 A Sample Land Use Plan Showing Proposed Land Use Designations and Locations



Source: “Connecting Cleveland: 2020 Citywide Plan,” City Planning Commission, City of Cleveland (Ohio).

The Comprehensive Plan

The comprehensive plan is the local government's development guidebook. It typically includes a general statement of goals and objectives, policies, and standards upon which future land use decisions are to be made.⁸ It will also include existing and proposed land uses, categorized into groups such as residential, commercial, and industrial uses.⁹ Throughout the plan development process, a strong public participation component is urged to ensure that citizens and businesses alike have a say in the plan content. Adoption of the comprehensive plan is a legislative act requiring approval by the local government or legislative body to become effective.

The land use information and guidelines in a comprehensive plan may or may not be legally binding, depending on state law. In some states, the comprehensive plan is generally more of a guide from which to create zoning and other land use regulations, or to document community wishes for future development. As a result, there can be inconsistencies between the comprehensive plan and other regulations such as zoning codes or land development regulations. At the other end of the spectrum, some states (for example Florida and Oregon) have granted comprehensive plans the force of law, and require local zoning enforcement to be consistent with plan objectives.¹⁰

The Zoning Code and Land Development Regulations

Zoning is a widely used method by local governments to control the physical development of land. The zoning code is a separate document from the comprehensive plan, and may or may not be consistent with the plan. The zoning code creates "zones" of land designated for residential, commercial, industrial, governmental, open space, or other land uses.

The zoning code is normally included within the local land development regulations (LDR). The LDRs govern all aspects of development – such as lot subdivision, wetlands protection, storm water management, signs,

⁸ Nolon, John and Salkin, Patricia, *Land Use in a Nutshell*.

⁹ Note that there are no standard requirements for comprehensive plan content or update procedures, due to the multiplicity of state laws and requirements. However, professional associations such as the American Planning Association do identify and develop best practices guidelines.

¹⁰ http://pcj.typepad.com/planning_commissioners_jo/2010/02/comprehensive-plan.html.

and parking – in addition to zoning. Some cities (for example Houston, Texas) do not have zoning. Instead, they rely on subdivision regulations (rules that set standards for the design of residential subdivisions, such as access road requirements and open space provisions) or land use ordinances to guide their development.

There are four basic types of zoning that cities may employ, as summarized below and shown in Figure 1.4:

- **Traditional or “Euclidean” zoning**¹¹ segregates land uses into specified geographic districts and provides dimensional standards and other rules to regulate development within each zone. This is the most widespread form of zoning in the U.S.
- **Form-Based zoning** seeks to regulate the form of different land uses/developments rather than their type. This type of zoning is often used when a municipality wishes to preserve or promote a certain development pattern, for instance in a downtown or historic area.
- **Performance zoning** regulates the acceptable intensity of different land uses, for instance by specifying the number of residential units per acre. In theory this can provide for more flexibility for both the city and developer by reducing land use conflicts.
- **Incentive zoning** is the practice of granting developers extra amenities they want (often by allowing higher density developments) in exchange for the provision of urban amenities such as green space, infrastructure enhancements, affordable housing, or public spaces.

Figure 1.4 Types of Zoning Codes

Traditional Zoning	Form-Based Zoning	Performance Zoning	Incentive Zoning
<ul style="list-style-type: none"> • Creates zones for each land use • Special permits for non-conforming uses 	<ul style="list-style-type: none"> • Regulates physical form rather than land use type • Promotes a certain look or ‘sense of place’ 	<ul style="list-style-type: none"> • Prescribes acceptable land use intensity • Allows flexibility for cities and developers 	<ul style="list-style-type: none"> • Reward-based system • Bonuses in exchange for urban amenities

Source: Cambridge Systematics, Inc., 2010.

¹¹ Euclidean zoning is named after the 1926 U.S. Supreme Court case which established the constitutionality of zoning (Village of Euclid, Ohio v. Ambler Realty Co.).

Different types of zoning can be used in conjunction with each other. For instance, a city may create a form-based overlay district on top of a traditional zoning code to achieve specific development outcomes. In addition, it is possible to make amendments to zoning ordinances, or to request a zoning variance or conditional use permit. For example, a developer may apply to change the zoned land use of a parcel from industrial to residential use, or may argue that a school should be allowed as a “conditional use” in a residential area.

Land Use Permitting Issues and Process

The permitting process is the final stage of land use planning implementation. There are a number of issues that may arise during the permitting process that will require review. For this reason, the permitting process can take years to complete. This is especially true for projects that may have significant environmental consequences, or those that encroach upon historic landmarks or scenic routes. Projects of this type will likely need to be reviewed by several different agencies (such as the planning committee, the landmarks board, and the Department of Conservation). The permitting stage also is where municipalities may be able to hold developers or landowners to other requirements – for example mandating minimum or maximum parking requirements in order for the project to gain approval. Since the specific requirements can vary on a city by city basis, it is important for a developer or private-sector business to have a clear idea of what is allowed, what is prohibited, and what the land use process is for variances within the municipality of interest.

WHAT IS TRANSPORTATION PLANNING?

The Federal Highway Administration (FHWA) defines transportation planning is: “A continuing, comprehensive, and cooperative process to encourage and promote the development of a multimodal transportation system to ensure safe and efficient movement of people and goods while balancing environmental and community needs.”¹² Transportation planning is important to the public and private sectors because it creates and maintains the safe, efficient transportation infrastructure that private citizens and businesses rely on for their day-to-day mobility.

Freight considerations within transportation planning practice include:

¹² <http://ops.fhwa.dot.gov/publications/cmpguidebook/appc.htm>.

- Developing an understanding of the freight volume, value, key commodities, and mode splits in a region;
- Establishing policies and programs to integrate freight within the overall transportation planning process and account for freight needs in project selection and prioritization; and
- Linking freight mobility to other community goals such as economic development and job growth.

WHO IS RESPONSIBLE FOR TRANSPORTATION PLANNING?

Transportation planning is carried out by several different government agencies:

- **State DOTs** are responsible for the overall statewide planning and implementation of transportation investments.
- **Metropolitan Planning Organizations (MPO)** are associations of regional decision-makers which every urbanized area above a certain population threshold must have by Federal law – are charged with planning and prioritizing transportation projects within their region.
- **County and local governments** design, build, and maintain local roads and streets that do not fall under the purview of the state DOT. Many larger cities have their own DOTs.
- **Transit operators** often conduct system planning studies, as well as participate in local transportation planning in conjunction with an MPO or other local agencies.
- **Other entities** – such as regional authorities, port authorities, or railroads – may be responsible for operating specific pieces of the transportation system, such as a toll road network.

The specific roles and responsibilities of all these players are described in more detail in Section 2.3.

What are the Key Steps and Main Products of Transportation Planning?

Figure 1.5 below highlights the transportation planning process at a high level. The regional vision and goals are incorporated into new strategies, which are then formalized in the Long-Range Plan (LRP) sometimes referred to as the Metropolitan Transportation Plan (MTP) or the Long-Range Transportation Plan (LRTP) and prioritized within the Transportation Improvement Program (TIP) or Statewide Transportation

Improvement Program (STIP). These are discussed separately in more detail later. Projects are then implemented and the performance of the system is monitored to provide ongoing feedback, which will then inform the ongoing development of the transportation system.¹³

Public participation is a key consideration throughout this process. In fact, DOTs and MPOs are required to develop and implement a documented public involvement plan that provides for meaningful participation and input from all stakeholders, including freight shippers and public review/comment at important decision points.¹⁴

FHWA provides numerous reference handbooks for transportation planning in general as well as for freight planning specifically.¹⁵

Figure 1.5 The Transportation Planning Process



Source: DOT/FHWA.

¹³ More detail on the process, products, and issues associated with transportation planning may be found at 23 CFR 450, Subparts A, B, and C.

¹⁴ 23 CFR 450.210, 23 CFR 450.316.

¹⁵ <http://www.fhwa.dot.gov/freightplanning/index.htm>.

This planning process revolves around several key factors that must be considered when evaluating transportation projects, services, and policy options. These planning factors are shown in Figure 1.6, along with their relationship to freight and/or land use.

Figure 1.6 Transportation Planning Factors and Relationship to Freight or Land Use



Source: Cambridge Systematics, Inc., with content from 23 CFR 450.206, 23 CFR 450.306, 2010.

Unified Planning Work Program (UPWP)

This document includes all of the studies and tasks that will be performed by the MPO. It covers a one-to two-year period and contains planning tasks, Federally funded studies, and state/local planning activities conducted regardless of how they are funded, funding sources for each project, a schedule of activities, and the agency responsible for each task/study. Note that the MPO does not necessarily conduct all of the studies contained in the UPWP; sometimes other local agencies (such as a transit provider) conduct the study, and may use their own sources of funding to conduct part or all of the study.

Metropolitan Transportation Plan (MTP)

In metropolitan areas, the MTP is the regional transportation system investment plan. According to Federal regulations, this will include both long-range and short-range strategies/actions that lead to the development of an integrated intermodal transportation system that facilitates the efficient movement of people and goods. It is important to note that the MTP must be fiscally constrained, in the sense that the projects contained therein must have a realistic chance of being funded with expected revenue streams; in other words, the plan cannot just be a ‘wish list.’ The MTP has a time horizon of at least 20 years, and is updated every 4 to 5 years depending on the region’s air quality attainment status. The plan addresses:

- Policies, strategies, and projects for the future;
- A systems-level approach by considering roadways, transit, nonmotorized transportation, and intermodal connections;
- Projected demand for transportation services over 20 years;
- Regional land use, development, housing, and employment goals and plans;
- Cost estimates and reasonably available financial sources for operation, maintenance, and capital investments; and
- Ways to preserve existing roads and facilities and make efficient use of the existing system.¹⁶

¹⁶ “The Transportation Planning Process: Key Issues.” Publication of the Transportation Planning Capacity Building Program, FHWA, and FTA. Updated September 2007.

Transportation Improvement Program (TIP)

The TIP is the four-year transportation program for the urbanized area. This is the region's way of allocating limited transportation resources among various needs of the MPO region. The TIP implements the region's transportation plan. Often, MPOs will use performance-based criteria to select projects that support plan goals and community priorities. This list of projects is updated at least every four years, is approved by the MPO and governor, and is incorporated directly into the Statewide Transportation Improvement Program (STIP).

The Long-Range Statewide Transportation Plan (LRTP or LRSTP)

This is a state-level plan developed by the DOT, which varies from state to state in the level of detail. Some plans are policy plans which focus on statewide goals, while others are project-specific. Most of the statewide plans address similar topics as the MTP, but on a statewide scale. Namely:

- Policies and strategies, and/or future projects;
- Projected demand for transportation services over 20 or more years;
- Statewide and regional land use, development, housing, natural environmental resource and employment goals, and plans; and
- Ways to make more efficient use of the existing system.

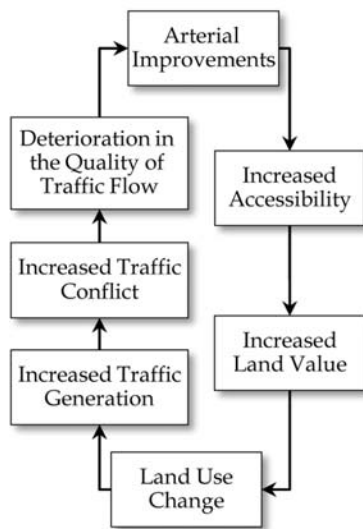
While not required, cost estimates and reasonably available financial sources for operation, maintenance, and capital investments are encouraged.

Statewide Transportation Improvement Program (STIP)

The STIP is a consolidated list of transportation projects covering four years at the state level. The state prioritizes projects from rural, small urban, and urbanized areas of the state. TIPs from MPOs are incorporated directly without change into the STIP. The STIP is approved by the U.S. DOT (FHWA and FTA). STIP approval must be granted before projects can move from planning to implementation.¹⁷

¹⁷ "The Transportation Planning Process: Key Issues." Publication of the Transportation Planning Capacity Building Program, FHWA and FTA. Updated September 2007.

Figure 1.7 The Transportation Land Use Cycle



Source: Stover and Koepke, 2002.

Other Plans and Studies

There are many other types of studies or plans that may be interconnected with freight planning in a state or region. For instance, safety plans typically have commercial vehicle safety as one critical component. States and regions will sometimes create corridor plans to address congestion and mobility issues on specific pieces of infrastructure, many of which are key freight corridors. Many states and some larger metropolitan areas also develop stand alone freight plans to better articulate goods movement issues and connect them to the wider transportation planning and policy program.

WHY IS IT IMPORTANT TO LINK THE TRANSPORTATION AND LAND USE PLANNING PROCESSES?

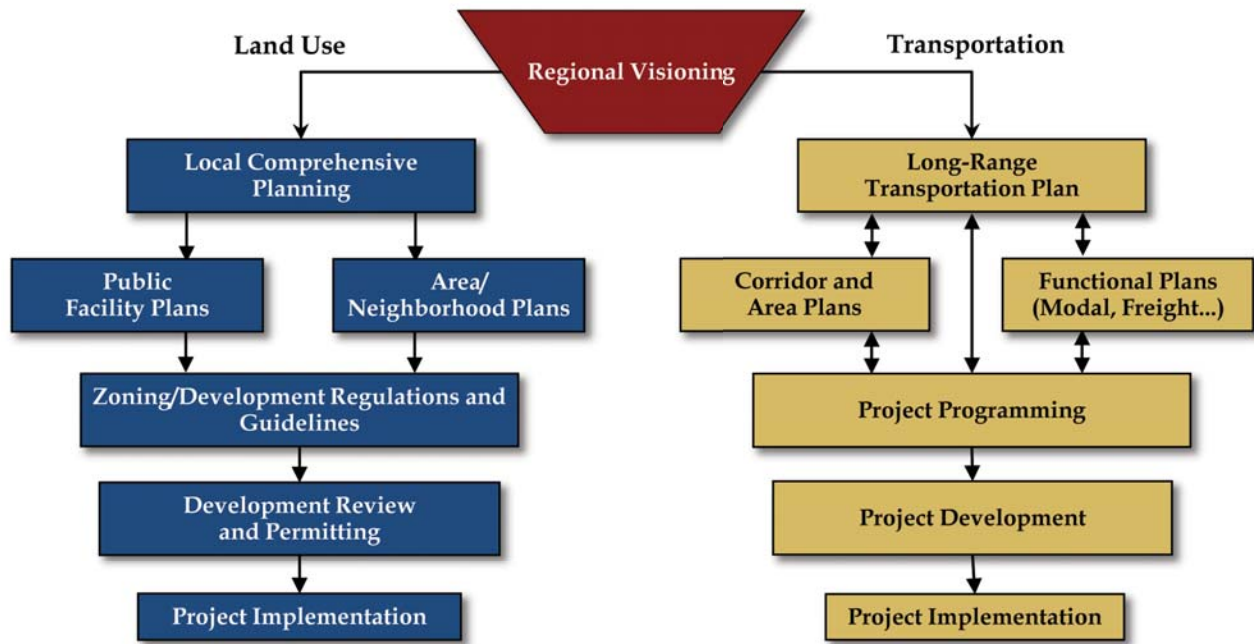
Transportation and land use planning processes in many regions are separate processes, and are completed by a range of stakeholders on different timelines. Nonetheless, the way in which land is developed will dictate, to a large extent, the transportation modes and volumes of traffic using our transportation infrastructure (as illustrated in Figure 1.7). For example, some types of land uses, including residential land use, will attract a small number of trucks at irregular intervals – i.e., the occasional delivery or service truck. Other land uses, including manufacturers, will rely on a steady stream of large trucks to deliver raw materials and remove manufactured product.

In addition, failure to consider land uses when doing freight planning (and vice versa), runs the risk of introducing conflicts between types of land uses, or competing passenger and freight uses for the transportation system. This conflict can, essentially, run counter to a region’s goals – decreasing safety, reducing mobility, and making the region an unattractive place for business attraction/retention. Indeed, industrial developers prefer to locate in communities with transportation and land use vision and a coordinated permitting process.¹⁸

As a result, it is important that land use and transportation planning decisions complement, not contradict, one another. Creating overlap and links between the transportation and land use processes is necessary to ensure that complementary land use and transportation decisions are made. Figure 1.8 shows the parallel land use and transportation planning processes, and key links between the two.

¹⁸ NCFRP 23 Preliminary Draft Report.

Figure 1.8 Relationships Between Transportation and Land Use Planning Processes



Source: Cambridge Systematics, Inc., 2010.

One key link between these processes involves the “Protect the Environment” planning factor (listed in Figure 1.6) and the requirement that state and regional transportation plans be consistent with state and local environmental goals, growth and development priorities, and economic development strategies. This planning factor provides for a particularly strong link between freight and land use planning since freight operations can contribute substantially to all of these goals.

Some methods already exist to strengthen the ties between transportation and land use planning. Federal law outlines land use considerations that need to be made when transportation stakeholders, elected officials, and the public make decisions regarding the maintenance, operations, and expansion of transportation systems.¹⁹ For instance, it is required that transportation improvements be coordinated with planned growth and economic development patterns. This is critical to ensuring that local, regional, statewide, and national transportation systems are not built in a vacuum but with the needs of communities, the environment, and the economy in mind.

Other ways in which the transportation and land use planning cycles can be better coordinated include:

¹⁹ Title 23, Code of Federal Regulations, Section 450.

What are the Primary Functions of an MPO?

- *Establish and manage a fair and impartial setting for effective regional decision-making in the metropolitan area.*
- *Use data and planning methods to generate and evaluate alternatives. Planning studies and evaluations are included in the UPWP.*
- *Develop a long range (20-year) transportation plan for the metropolitan area that fosters 1) mobility and access for people and goods, 2) efficient system performance and preservation, and 3) good quality of life.*
- *Develop a short-range (four-year) transportation improvements program (TIP) based on the long-range transportation plan.*
- *Involve the general public and other affected constituencies in the four essential functions listed above.*

- Ensuring that transportation strategies are adopted into the comprehensive plan;
- Adopting transportation policies into the zoning ordinance as development standards;
- Transportation agency review of site plans for developments that require highway access or that have an impact on traffic operations;
- Outreach to the public on planning outcomes;
- Partnership efforts with local agencies;
- Transportation project selection criteria that is consistent with Comprehensive Plan goals; and
- Financial incentives for local action to support the regional vision.

In addition, public-sector transportation agencies can provide technical assistance to public-sector land planners and developers to guide successful integration of transportation facilities. Additional strategies by which to better integrate freight and transportation planning processes will be discussed in later stages of this handbook.

1.4 Public- and Private-Sector Stakeholders, Roles, and Needs

A variety of public- and private-sector stakeholders are involved in the transportation and land use planning process. This section will introduce some of the key participants in each process, at the local, regional, and state level.

WHO ARE THE KEY PUBLIC-SECTOR PARTICIPANTS IN TRANSPORTATION AND LAND USE PLANNING?

There are several key participants in the land use planning process, including local decision-makers (members of local legislative bodies, planning boards, and zoning boards), professional planners, lawyers and judges, code enforcement officers, engineers, architects, other related boards, and members of the public.²⁰ However, those responsible for the process and implementing the laws and plans are public-sector employees. Primarily, this involves a variety of agencies that exist at the local, regional, and state level.

²⁰ Babcock, Richard. *The Zoning Game: Municipal Practices and Policies*.

The *transportation planning* process is governed by a variety of agencies, including state DOT, MPO, local, and county governments. No single agency has control over the entire transportation system. For example, most county or city streets are designed, operated, maintained, and owned by counties or local governments. Transit systems are maintained by transit operators. MPOs are responsible for managing the planning process and stakeholder involvement in the process for surface transportation modes and facilitating intermodal connections in cooperation with their planning partners. Other agencies, such as regional authorities for airports, ports, toll roads, ferries, or major bridges or transit agencies may help to influence policy and planning of the transit and road system. The state DOT is responsible for statewide planning activities, as well as interstate highways and other state-owned roadways. The responsibilities and roles of each of these entities are explained on the following pages of this handbook. Much of the background information below is taken from FHWA’s and FTA’s “The Transportation Planning Process: Key Issues” briefing book.²¹

The key local, regional, and state-level participants involved in transportation and land use planning are illustrated in Figure 1.9 below:

Figure 1.9 State, Regional, and Local Transportation and Land Use Planning Entities



Source: Cambridge Systematics, Inc., 2011.

²¹ “The Transportation Planning Process: Key Issues.” Publication of the Transportation Planning Capacity Building Program, FHWA, and FTA. Updated September 2007.

What are the Primary Planning Functions of a DOT?

- *To develop and update a long-range transportation plan for the state;*
- *To develop a statewide transportation improvement program (STIP) based on the state's long-range transportation plan. For metropolitan areas, the STIP incorporates the TIP developed by the MPO;*
- *To involve the general public and all of the other affected constituencies in the essential functions listed above; and*
- *Responsibility for the design, construction, operation, and maintenance of multimodal state facilities.*

Local Legislative Bodies

Local governments, including counties, cities, townships, or other administrative entities may derive land use planning authority from state enabling legislation, home rule provisions, the state constitution, and/or municipal charter. In many cases, state statutes give local legislative bodies the authority to decide to keep or distribute planning powers, such as the land use process, to planning or zoning boards. Therefore, each local government may differ with regards to what board is responsible for what actions, and how boards/agencies interact with one another.

Metropolitan Planning Organizations (MPO)

An MPO is a transportation policy-making body made up of representatives from local government and transportation agencies. Federal regulations require the establishment of MPOs in urbanized areas with populations greater than 50,000. MPOs were created to ensure that existing and future expenditures for transportation projects and programs were based on a continuing, cooperative, and comprehensive planning process. Therefore, they have responsibility to bring together local jurisdictions and transportation authorities to make coordinated transportation decisions in the metropolitan area. In addition to MPOs that are established as standalone entities, MPOs can be found within Councils of Governments (COG) and other types of regional agencies. Some single county MPOs can also be found within county planning commissions or housed within city governments.

The MPO is responsible for the development of the metropolitan transportation plan (MTP). Both the governor and the MPO are required to approve the TIP. Generally, MPOs will not take the lead in implementing transportation projects, but will provide an overall coordination role in planning and programming funds for projects and operations. A state DOT, local entity or authority typically implements the projects.

There is no required structure for an MPO as a decision-making policy body. A typical MPO may be composed of a policy or executive board, a technical and citizen's advisory committee, and a director and staff. Many MPOs in regions with considerable freight activities have freight subcommittees that include railroads, ports, airports, trucking organizations, state representatives and other stakeholders. MPO staff assists the MPO board by preparing documents, fostering interagency coordination, facilitating public input and feedback, and managing the planning process. The MPO staff also performs technical analysis such as freight studies, modeling, and scenario planning to inform the decision-making process.

State Planning Agencies

State-level involvement in the land use planning process varies by state. Several state governments, such as Delaware, Florida, Hawaii, and Oregon have become very involved in local land use planning processes, often requiring local governments to submit land use plans to state or regional agencies for review. A number of other states (such as New Jersey) have implemented state-level planning practices that have impacts on local land use.

States resource and regulatory agencies manage most regulatory and permitting activities, such as:

- Sewage facilities;
- Water supply facilities;
- Energy generation;
- Surface water quality;
- Air quality;
- Mining;
- Municipal, residential, and hazardous waste facilities; and
- Storm water management.

State Departments of Transportation (DOT)

State DOTs play three key transportation roles at the statewide level:

- Planning, or the process of establishing overall goals and priorities for transportation to shape policy and investment decisions and identifying projects that satisfy those goals;
- Project programming, which is the process of funding and prioritizing transportation investments; and
- Project implementation, or the construction, operation, and maintenance of multimodal transportation infrastructure.

State DOTs carry out these roles in all U.S. States, Puerto Rico, and the District of Columbia. State DOTs may work with airports, railroads, tolling authorities, ports, local agencies, and special districts that own,

operate, or maintain different portions of the transportation network.²² The state DOT is responsible for maintaining the state transportation system other than county and locally owned roads and for planning activities outside of metropolitan areas (outside of MPO boundaries) as well as interstate highways and other state-owned roadways.

State DOTs and MPOs work together closely. For instance, the DOT is typically part of the MPO policy board. A DOT will often involve the MPOs as a key stakeholder in any statewide transportation planning effort, in order to ensure that statewide transportation strategies are consistent with those of the MPOs. Outside of MPO boundaries, DOTs work with local and tribal governments, other public organizations, the private-sector, and the Federal land management agencies, bicycle and pedestrian advocates, the disabled and environmental agencies in the development of the long-range statewide transportation plan and the STIP.²³

PUBLIC-SECTOR FREIGHT STAKEHOLDERS – KEY ISSUES

The public sector stakeholders summarized in the preceding section may feel conflicted about industrial land uses. On the one hand, they recognize that the businesses provide jobs, tax benefits, and economic activity to their region, as well as providing goods and services to the local population. On the other hand, the public sector is sometimes concerned that the externalities associated with the freight distribution system degrades amenities highly valued by nearby residents. Increasing truck and train traffic often generates opposition from local residents due to noise, exhaust and perceived safety and congestion impacts. Residents near ports, distribution centers, and other freight generating land uses are often impacted by light pollution from 24-hour operations and, in the case of new construction of freight facilities, may face degraded views or increased truck presence. For property owners these concerns go beyond simple quality of life issues – they directly impact property values and the desirability of certain neighborhoods or regions. Learning to manage these different benefits and drawbacks to industrial land uses, and communicating them to the public, can be very challenging to public-sector officials. Some of the key public-sector freight and land use issues

²² “The Transportation Planning Process: Key Issues.” Publication of the Transportation Planning Capacity Building Program, FHWA and FTA. Updated September 2007.

²³ “The Transportation Planning Process: Key Issues.” Publication of the Transportation Planning Capacity Building Program, FHWA and FTA. Updated September 2007.

are summarized in Table 1.1 below. They are grouped into three general categories, 1) Potential negative effects, 2) Potential positive effects, and 3) Other planning considerations.

Table 1.1 Public-Sector Critical Freight and Land Use Issues

General Issue Category	Issue
Potential negative effects of freight and industrial land uses that public-sector agencies may have to address	• Noise/vibration
	• Light pollution
	• Air and water quality concerns
	• Greenhouse gas emissions
	• Proliferation of invasive plant and animal species ^a
	• Odors
	• Property value
	• Eyesore issues, such as unsightly equipment storage ^a
	• Roadway congestion/pavement maintenance
	• Safety issues related to at-grade rail/road crossings, handling of hazardous materials ^a , truck safety
Potential positive effects of freight and industrial land uses that may provide justification for their inclusion in the planning discussion	• Parking availability
	• Economic development
	• Job creation and retention
	• Tax benefits
	• Closer access to goods and services
	• Access to employment opportunities
Other planning considerations that may influence the treatment of freight and industrial land uses in the planning and programming process	• Potential air quality benefits from reduced truck travel because of colocation of industries and their markets
	• Quality of life concerns
	• Environmental justice
	• Livable communities
	• Smart growth vision for the area
	• Brownfield ^b and greyfield ^c remediation and redevelopment ^a
	• Urban renewal efforts
• Sustainability	

^a NCFRP Report 24 – Protecting and Preserving Freight Infrastructure and Routes, 2011.

^b A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.²⁴

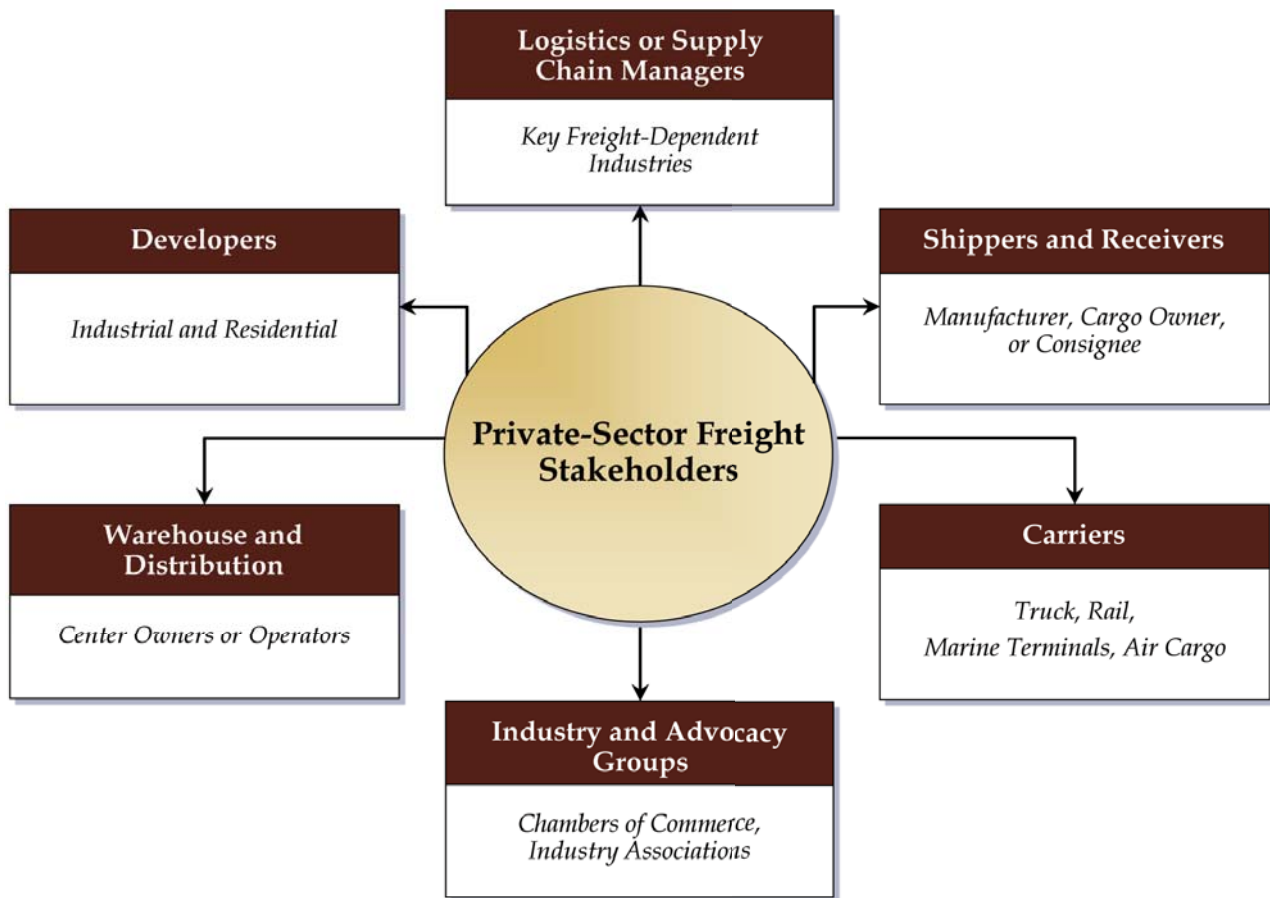
^c Greyfields are underutilized commercial parcels (such as distressed malls) that may be returned to more productive use through targeted land use and development initiatives. They are described further in Section 2.4.

²⁴ U.S. Environmental Protection Agency, “Brownfields and Land Remediation,” available from: <http://www.epa.gov/brownfields/index.html>.

WHO ARE THE KEY PRIVATE-SECTOR PLAYERS THAT SHOULD BE INVOLVED AND KNOWLEDGE ABOUT THE TRANSPORTATION AND LAND USE PLANNING PROCESSES?

Private-sector freight stakeholders do not generally take a lead role in public planning decisions. Nonetheless, it is critical to engage them early and often in transportation and land use decision-making. In addition, the advent of Public Private Partnerships (PPP) and increasingly complex transportation projects means that they are being invited more frequently as partners into the planning process. This is especially the case when considering freight generating land uses, since freight uses are generally owned and controlled by the private sector. Collaborative planning between the public and private sector can result in greater understanding, better design, and more effective integration of freight into the land use and transportation planning process.

Figure 1.10 Private-Sector Freight Stakeholder Types



Source: Cambridge Systematics, Inc., 2010.

Logistics or Supply Chain Managers from Key Industries

Companies' supply chain managers are responsible for maximizing the efficiency of a company's supply chain, including monitoring the quality, cost, and quantity of goods movement and storage activities. As such they are tuned in to the freight and land use needs of their business or industry. Since these needs will vary by industry, planners should analyze the economic makeup of their community, identify the companies involved in key freight-dependent local businesses, and then consult with the supply chain and logistics managers of those firms to gain a better understanding of their needs and concerns.

Shippers (Beneficial Cargo Owners and Consignees)

Shippers are the companies or individuals who own or consign for the goods being moved over the transportation system. An example would be a manufacturing company which must ship its finished product, either to an end user or to a warehouse for further distribution to markets. Some shippers take control for planning and execution of the logistics and freight movement responsibilities for their goods, while others may give responsibility to a Third-Party Logistics providers (3PL). Therefore, though shippers are very important private-sector stakeholders, they sometimes are less knowledgeable about system performance issues than the carriers or 3PLs.

Carriers with Yards or Terminals

Truck, ocean, air, and rail freight carriers operate yards or terminals where loads are assembled and equipment such as truck tractors, trailers, containers, and railcars are positioned to meet the business needs of the carrier. Railroads operate both classification yards (where loaded railcars are divided and reassembled into different trains according to their destinations) and intermodal yards (which serve as the interface between railroads and trucks). Both types require considerable acreage. Rail yards frequently have miles of receiving, forwarding, and classification tracks; intermodal yards also require truck parking and trailer storage facilities. Trucking firms use terminals to store equipment and reposition fleets to meet changing demand conditions. In communities with water ports, private marine terminal operators often handle the day-to-day operations of terminals. Airports also have cargo terminals that may be operated by large carriers such as FedEx.

Industry Associations and Advocacy Groups

Advocacy and professional organizations that represent freight-dependent industries can range from chambers of commerce (which typically represent the entire local business community) to advocacy groups focused on a particular industry (such as a farm bureau or business association) or transportation mode (such as a state trucking association). Association members often range from small “Mom and Pop” businesses to international corporations which have a presence in a local area or an interest in an aspect of local industry or infrastructure. These organizations typically are well aware of the needs of their members and often collect data from them to inform their advocacy efforts. Planning agencies may already have contacts at local chambers of commerce, if they are consulted on other (not necessarily freight-related) matters. These contacts can be leveraged to find other important stakeholders.

Warehouse and Distribution Center Operators and Third-Party Logistics Firms

Warehouses and distribution centers are the locations where goods from multiple suppliers are consolidated or stored for eventual delivery to customers or retail outlets. For example, a warehouse can be used as an intermediate storage point between a manufacturer and its suppliers, or between the manufacturer and its industrial customers. Distribution centers also often provide services to shippers such as multimodal transportation, cargo tracking, customs clearance, and packing/labeling.²⁵ Firms that provide these types of services are known as Third-Party Logistics providers (3PL); they specialize in integrating all or part of their client companies’ supply chains into a single tailored solution that can be scaled up or down according to market conditions. Warehouse operators and 3PLs therefore understand freight issues such as bottlenecks, street geometrics, and land supply which may be of value to land use and transportation planners.

Industrial and Commercial Site Developers

Developers understand the economic and logistics factors and trends that shape the demand for industrial and commercial properties. They also have a firm understanding of the location and site attribute requirements that their clients need. Industrial developments usually require large

²⁵ Lu, Chin-Shan and Yang, Ching-Chiao. ‘Evaluating Key Logistics Capabilities for International Distribution Center Operators in Taiwan.’ *Transportation Journal*, September 22, 2006.

tracts of land with good access to the highway network. For some industries, rail access is becoming increasingly important. For these reasons, most private developers will be aware of key freight issues in the region.

PRIVATE-SECTOR FREIGHT STAKEHOLDERS – KEY ISSUES

Private-sector freight stakeholders (like the ones summarized in the preceding section) must balance the need to preserve their business and profits with their desire to stay near the markets that they serve. Increasingly, private-sector freight land uses are being impacted by encroaching non-freight land uses and the associated increase in regulations, property values, and congestion on shared facilities. Many existing freight hubs, such as ports and warehouses, were initially located away from residences. In recent years, however, with urban populations growing and a renewed interest in living in central city areas, these freight generating land uses are sometimes hampered by regulations created to reduce the impact of freight activities on nearby residents. These regulations include limitations on operating hours as well as site design guidelines and performance standards. Site design guidelines outline acceptable landscaping, driveway access, signage, building setbacks, parking and other physical characteristics. Performance standards relate to noise, light, odor, vibration, or other aspects of operations that nearby residents find objectionable. In addition, as areas near freight facilities attract residents, property values tend to rise, affecting the ability of freight facilities to expand their operations. Growing residential populations near freight facilities can also lead to increased congestion on key truck routes.

All of these impacts can lead to reductions in the efficiency of freight operations. Local government site design guidelines and performance standards can increase the operating costs to facility operators, while congestion due to increasing residential traffic leads to decreased accessibility. The combination of these factors, along with growing property values that limit expansion opportunities, push freight facilities towards the less densely populated urban outskirts, where they may face less adequate transportation facilities and more lengthy trips.

Some of the key private-sector freight and land use issues are summarized in Table 1.2. They are grouped into two general categories, 1) Issues that impact the economic viability and functioning of freight land uses, and 2) Other planning and site location considerations.

Table 1.2 Private-Sector Critical Freight and Land Use Issues

General Issue Category	Issue
Issues that may impact the economic viability and functioning of freight land uses	• Increasing congestion on shared-use infrastructure leads to delays
	• Site design guidelines may be too restrictive for business needs
	• Industrial site access may be constrained or blocked as nearby land uses grow
	• Transportation system performance may degrade and harm business transportation if maintenance or upgrading of transportation facilities falls behind
	• Expansion constraints may limit ability of business to grow
	• Operating-hour limitations may be restrictive to allow efficient business functioning (e.g., nighttime deliveries)
	• Street geometric design (such as turning radii or features such as traffic circles) may restrict freight movement
	• Increasing pressure to redevelop industrial land into higher-value uses
	• Limited options to enhance logistics efficiency
	• Costs of implementing mitigation requirements
	• Citizen pressure and public resentment
Other factors that may influence industrial location and siting and may be affected by regional planning efforts ^a	• Permitting and regulation requirements
	• Local and state taxation and business environment
	• Ability to operate "24/7" or according to specific schedule requirements
	• Proximity to fast and reliable transportation choices (e.g., Interstates for truck access, main line rail access, employee transportation accessibility)
	• Proximity to customers, shippers, and/or receivers of goods
	• Other operating costs
	• Connectivity to other modes (rail, water, and/or air)
	• Availability of skilled workforce
	• Shovel-ready building sites

^a NCFRP Report 23: Economic and Transportation Drivers for Siting Freight Intermodal and Warehouse Distribution Facilities, Draft Final Report, 2011.

1.5 Freight and Land Use Trends and Issues

Certain national and global trends are worth noting because they are likely to impact the needs of freight-dependent industries in the coming years.

Economic and Logistics Trends: Globalization

Globalization has driven the increasing consolidation of warehouses and distribution centers over the last several years and this trend is expected to continue as companies constantly seek efficiencies to gain a competitive edge. This will lead to the development of large logistics centers (such as the Gardner Intermodal Terminal in Kansas) that serve as the key node for firms' entire distribution systems. This trend presents challenges and opportunities to many regions of the country, as these facilities could contribute to "freight sprawl" or be incorporated into industrial preservation or brownfields redevelopment initiatives.

Economic and Logistics Trends: Fuel Price Volatility

Fuel (primarily diesel) is one of the major costs in the transportation industry. Fuel prices, therefore, can have an enormous impact on shippers and carriers alike. During the summer of 2008, the price of a barrel of oil peaked at a historic high of nearly \$150, before the onset of recession caused the price to drop back down significantly. This dramatically increased the cost of shipping goods. Many analysts predict continued fuel price volatility due to a number of factors, including growing demand from developing countries and the lengthy amount of time required to explore and develop new sources of oil. This could have numerous impacts on freight generating businesses. For instance, the 2008 spike generated interest among many shippers in more fuel efficient modes. There also is a chance that fuel price fluctuations will contribute to the slowing or reversal of the trend towards off-shoring many supply chain functions, and a return of activities such as production, packaging, and value-added activities to domestic or near-shore countries. This could lead directly to more clustering of freight-intensive land uses in some areas.

Economic and Logistics Trends: The Opening of the Panama Canal

The expansion of the Panama Canal to accommodate increasing trade volumes and larger container ships will be complete by 2014 and may affect supply chain patterns as companies reevaluate which maritime trade routes they use to get goods to market. For example, Canal expansion could make U.S. Gulf Coast ports more competitive with West Coast locations for receiving import cargoes from Asia. In fact, some companies have been hesitant to make big site location decisions until there is a clear picture of the effects of an expanded canal.

Land Use Trends: Encroachment

Urban encroachment is a growing problem for freight stakeholders as populations grow and cities expand into outlying areas that used to be industrial in nature. This is driving the conversion of industrial land into other uses (primarily residential) that may come into conflict with freight uses. It also is driving a number of development trends which, taken together, could have a negative impact on land availability for freight stakeholders in future.

Development of large logistics parks to meet the needs of globalization – the Gardner Intermodal Terminal, Gardner, Kansas

The Gardner Intermodal Terminal is a truck/rail intermodal terminal currently under development by the Burlington Northern Santa Fe (BNSF) Railway. The terminal is being built as a result of the railroad's need to accommodate its growing intermodal traffic and diversify away from Chicago, where rail traffic is becoming increasingly congested. It will be located in Gardner, Kansas (25 miles southwest of Kansas City) and will also include a logistics park that is being simultaneously built by a private developer.

The intermodal facility will include BNSF rail and truck facilities and will concentrate on the movement of freight from rail to truck. The logistics park includes ancillary warehouses that store and process freight. Both the intermodal terminal and the initial stages of warehouse development opened in fall 2009. The total size of the combined terminal and logistics park is approximately 1,000 acres, of which 418 are devoted to the BNSF intermodal facility. The rest of the acreage will be devoted to warehousing and distribution centers, primarily for large retailers like Target and Vanity Fair.

In all, the project is expected to result in 7.1-million square feet of new development. This does not include speculative development that is already occurring around the park.

Example: Regional impacts from declining industrial land in the urban region – The San Francisco Bay Area Metropolitan Transportation Commission’s (MTC) Goods Movement and Land Use Study

In a 2008 study, the MTC region found that if current land use development patterns continue, the existing industrial land supply in the urbanized region would be gone in 13 years. By 2035, goods movement business (including manufacturing, warehousing, transportation, etc.) with 87,100 jobs would have to relocate in outlying areas because of land shortages. The markets for many of these businesses, however, will remain concentrated in the central Bay Area.

Efforts to quantify the impacts of this trend revealed that over 8,400 daily truck trips shifted to new, mostly longer routings. These trips would add an additional 347,900 truck VMT to regional highways by 2035. This increase in truck VMT means increased wear and tear on regional highway surfaces, more trucks adding to congestion on already congested corridors, greater safety concerns, and increased emissions of criteria pollutants.

Source: http://www.mtc.ca.gov/planning/rgm/final/Final_Summary_Report.pdf.

Land Use Trends: Greenfield, Brownfield, and Greyfield Development

Greenfield development occurs as cities approve new residential and commercial development in previously unoccupied, vacant land. This is a normal response to population growth, but it does lead directly to encroachment issues when Greenfields on the periphery (where many freight uses tend to be located) end up being developed and occupied by new residents.

Brownfield development is the redevelopment of land that may be contaminated by one or more pollutants, for example as a result of previous industrial activity. Oftentimes these parcels are located in central cities, and municipalities thus see redeveloping them as a way to remove blight, revitalize downtowns, increase tax revenues, and relieve Greenfield development pressure. Such redevelopment usually involves converting the land to some other use (such as residential or commercial) and possibly subdividing it. This can result in encroachment on existing freight land uses and the reduction of available land for new or expanding freight businesses.

Greyfield development is similar in concept to Brownfield redevelopment, but typically deals with underutilized retail or commercial sites such as malls. These sites usually are not contaminated, but are instead suffering from disinvestment as retail tenants follow populations to areas of new development or redevelopment. These lands offer a relative rarity in urbanized areas: a large tract of land that has not yet been subdivided and may be suitable for freight generating activities, often without the complications of environmental remediation. However, cities may gravitate towards residential or commercial uses for these parcels, further limiting freight stakeholders’ options for expansion or relocation.

Green Trends: Smart Growth

In the planning and development realm, there has been increasing focus on ‘smart growth.’ Smart growth is a planning philosophy that seeks to restore vitality to areas suffering from disinvestment or ‘blight’ to provide neighborhoods with a mix of housing types, and create more pedestrian-oriented and transit friendly cities. While interest in these types of communities has certainly expanded in recent years, these growth patterns can have unintended consequences from a goods movement perspective. Compact growth patterns may end up pushing freight land uses to the periphery of cities, thus forcing trucks to take longer routes – with attendant increases in safety concerns, infrastructure

wear and tear, and emissions.²⁶ For example, smart growth design guidelines calling for pedestrian-scaled streets with traffic calming devices such as speed humps may not easily accommodate large freight vehicles. Bicycle lanes, if not carefully planned, may take curbside loading or commercial vehicle parking areas. Freight carriers may need to adapt (e.g., by using smaller vehicles) while design standards should have some flexibility (for instance, by making exceptions for key freight routes).

Green Trends: Conversion of Abandoned Rail Corridors to Recreational Trails

Another trend involves the conversion of abandoned rail corridors to multi-use trails for use by bicyclists and pedestrians. These ‘rails to trails’ conversions do provide important community amenities, but they may also restrict the already at-capacity rail freight network, hampering its ability to meet growing demand. Railbanking is a method by which corridors that would otherwise be abandoned can be preserved for future rail use through interim conversion to a trail. Established in 1983 as an amendment to Section 8(d) of the National Trails System Act, the railbanking statute allows a railroad to remove all of its equipment, with the exception of bridges, tunnels and culverts, from a corridor, and to turn the corridor over to any qualified private organization or public agency that has agreed to maintain it for future rail use.²⁷ They also may limit economic development opportunities for communities, particularly in rural areas where access to rail may be a key catalyst for local industries. Some states and communities have chosen to subsidize short-line rail operations for this reason.²⁸

Green Trends: Modal Shift from Truck to Rail

Many public and private stakeholders invest in infrastructure that supports rail intermodal services, with the goal of shifting some long-distance freight shipments from trucks alone to a combination of short-distance trucking and long-distance rail service. Mode shift from

²⁶ Metropolitan Transportation Commission, *Goods Movement/Land Use Study Update*, 2008.

²⁷ Rails to Trails Conservancy, *Secrets of Successful Rail-Trails*, 2009.

²⁸ The Surface Transportation Board (STB) defines a shortline railroad as a “Class III” carrier, with annual operating revenues of \$28 million or less, and all switching or terminal railroads. “Class II” carriers are also often included in the popular definition of shortline. “Class II” carriers have revenues of more than \$28 million, but less than \$346.8 million.

long-haul truck to rail can be driven by a number of factors, including rising fuel costs and the perception that trains are ‘greener’ than trucks. Indeed, trains enjoy a fuel efficiency advantage of about three to one over trucks, on a ton-mile basis.²⁹ Intermodal rail services are the fastest-growing business line for Class I railroads. This means there will be more demand in the future for intermodal yards like the Gardner facility in Kansas City. While these services may reduce fuel consumption and emissions for long-haul freight, there are a number of local impacts associated with intermodal terminals. Intermodal terminals generate many truck trips, because containers are transloaded from truck to rail or vice-versa. Trucks must transport the containers for the “last mile” to/from distribution centers or the customer’s door. As a result, there are many impacts such as increased truck traffic volumes, emissions, noise and light pollution, which could affect quality of life for residents living in close proximity to these facilities. Section 2.0 will address ways to plan for and mitigate these impacts.

²⁹ Federal Highway Administration, *Freight and Air Quality Handbook*, May 2010.

2.0 Freight as a Good Neighbor – Land Use, Transportation System, and Environmental Considerations

2.1 Purpose and Content

The previous section discussed some of the positive benefits of freight movements – including jobs, increased tax revenue, and supporting the demands of growing “just in time” consumer markets. Unfortunately, if not properly planned, freight movements and related land uses also have the potential to produce negative environmental impacts, including noise and light pollution, unwanted odors, vibrations, safety concerns, and impacts to regional air and water quality.

These impacts can be mitigated, to a great extent, by careful and smart regional planning, local land use and zoning, site and facility design, and operational considerations. However, these enhancements are only possible if they are implemented as part of a public transportation planning and land use planning, and zoning and permitting processes. If freight planning and land use decision-making activities are well integrated, both the public and private sector may benefit through reduced congestion, improved air quality and safety, enhanced community livability, improved operational efficiency, reduced transportation costs, and greater access to facilities and markets. The freight community can be considered “a good neighbor” when such a balance between economic activity and external impacts is achieved.

The purpose of this section is to review a range of strategies and tools that have been used successfully to ensure that freight land uses have a positive relationship with surrounding land uses. Throughout the section, “best practices” will be used to illustrate how other regional authorities and cities have successfully implemented freight uses into their land use fabric. Since land use and zoning rules, and responsibilities of public agencies regarding them vary widely from place to place, “best practices” were drawn from agencies of all sizes, and reflect freight and community needs in urban, rural, and suburban areas alike. A number of “critical success factors” are identified in each case, which are intended to provide key lessons learned and guidance to a variety of stakeholder and agency types.

SECTION ORGANIZATION

This section will provide regional and local-level tools, strategies and resources to ensure that freight is a good neighbor. These tools, strategies, and resources will be focused in five areas:

- **Appropriate and Coordinated Land Use Policies** – identifies land use policies, including regional visioning and planning, local zoning and transportation policies, and site-specific policies and practices addressing context-sensitive design and access to industrial and freight transportation facilities.
- **Effective Transportation Systems and Services** – presents suggested ways of improving transportation systems. The development and maintenance of transportation systems that can effectively, efficiently, and safely accommodate freight and passenger traffic can help freight systems be better neighbors in a community or region.
- **Effective Operations and Management Policies** – provides examples of policies to operate and manage transportation systems in order to reduce peak-period demand, and therefore, reduce congestion, and in ways that produce fewer negative impacts to quality of life and the environment.
- **Education and Outreach** – describes how state and regional agencies, by educating themselves and providing technical assistance to local jurisdictions and other agencies and authorities, can effectively engage private stakeholders and develop effective land use and transportation policies.
- **Putting it All Together** – demonstrates, through a series of detailed case studies, how several government agencies throughout the country have tied each of the previous four sets of policies and practices into a successful program.

Table 2.1 Examples of Freight and Land Use Integration Strategies and Tools

Policy Area	Strategy/Tool	Case Study Examples	Goals
Appropriate and Coordinated Land Use Policies	Regional visioning and scenario planning	Pittsburgh Region "Power of 32"	Sets regional stakeholder goals and gain common understanding between different levels of government
	Incentives to reinvest in existing industrial space – e.g., tax credits	Connecticut Urban and Industrial Reinvestment Tax Credit Program	Offers tax credits as an incentive to (re)develop in urban and industrial areas, provided performance criteria are met
	Creating buffers around freight	Vancouver, Washington pedestrian bridge	Provides safe means for residents to traverse a freight facility
	Using zoning tools to preserve industry and limit freight impacts	Baltimore, Maryland Maritime Industrial Zone Overlay District (MIZOD) Layton City, Utah manufacturing (M) zoning code	Provides space for manufacturing where appropriate infrastructure and adjacent land uses exist, and protect industry from pressures to change use
	Promote context-sensitive site and building design features	Port of Seattle Central Waterfront Project mitigation	Reduces the noise and vibration, light, aesthetic, and local air quality impacts of freight facilities on neighboring land uses
Effective Transportation Systems and Services	Freight-exclusive facilities	I-5 Truck Lanes	Reduces the noise and vibration, light, aesthetic, and local air quality impacts of freight facilities on neighboring land uses
	Effective truck route networks	Arroyo Grande, California truck route network	Ensures truck routes avoid sensitive areas and link with truck routes in neighboring jurisdictions.
Effective Freight Operations and Management	Offering incentives for off-peak delivery	Boston downtown delivery hours	Spreads truck traffic times across a wider timeframe, as well as increase their efficiency because of decreased road congestion
Education and Outreach	Technical assistance to local jurisdictions	Atlanta, Georgia – Atlanta Regional Commission	Ensures that local land use policy-makers are informed of freight needs and can help codify freight and land use integration best practices

2.2 Appropriate and Coordinated Land Use Policies

As described in Section 1.0, agencies at all levels of government have responsibilities regarding transportation and land use planning. Through goods movement studies, corridor studies, modal plans, and other planning efforts, state and regional agencies collect and publish data on goods movement, on economic activity, and on changing land use patterns at the state and regional level. These agencies establish policy guidelines and offer technical assistance to local jurisdictions, which have zoning authority. Local comprehensive planning and zoning authorities have the responsibility of establishing areas for residential, institutional, commercial, industrial, and other types of zones their areas require while ensuring that the various types of land uses can coexist, and minimizing impacts on residents and businesses. One important way to make sure that freight is a good neighbor is to implement appropriate land use policies, and to coordinate those policies among various local initiatives and between agencies in neighboring

jurisdictions. The planning process, whether through regional transportation planning or local land use planning, can facilitate this interaction and problem solving. This section demonstrates how regional and local agencies can work together through the use of land use strategies, tools, policies, and practice, to include industrial and freight generating land uses, while minimizing their impact on other, sensitive land uses.

REGIONAL-LEVEL STRATEGIES AND TOOLS

Land use is generally planned and implemented at the local agency level, using the comprehensive plan, zoning code, and permitting system as reviewed in the previous section. However, many regional agencies, such as Metropolitan Planning Organizations (MPO) are recognizing the importance of linking freight transportation and land use planning, and are learning to find ways to guide or educate local jurisdictions without infringing on their sovereignty. As such, strategies and tools at the regional level involve guidance in locating major freight-generating uses (such as manufacturing centers, distribution centers, etc.) within the region, as well as gaining regional planning consensus, and suggesting regionwide policies and approaches. Some strategies and tools implemented by regional agencies include scenario planning, preferential zoning and tax relief programs.

Scenario Planning

Scenario planning is a collaborative visioning exercise which analyzes trends and alternative futures regarding forces such as health, transportation, livability issues, economic, environmental, and land use patterns, that affect the transportation needs of a community or region. The Federal Highway Administration (FHWA) encourages and supports scenario planning that is focused on transportation issues. From a freight perspective, changes in demographics (e.g., aging populations or changing population densities), advancements in alternative fuel technologies, fluctuations in fuel prices, climate change and associated policies, and economic variability can result in radical changes in global supply chains, influencing where raw materials are sourced, where goods are produced, and where and how they are transported to consumer markets.

Shifts in global supply chain patterns can have significant implications for local and regional governments in the United States. For example, in scenarios in which diesel fuel prices become volatile, advancements in alternative fuels or mode shift from truck to rail may accelerate. Such an outcome could result in changes in distribution networks, industry

Example of Regional Visioning Process Recognizing the Needs of Freight Land Uses – Pittsburgh, Pennsylvania region

The “Power of 32” is a regional visioning effort launched in May of 2009. The goal of the process is to allow every resident of the 4-state, 32-county region to participate in creating a shared vision for the region’s best future.

Representing the economic region centered on metropolitan Pittsburgh, the process recognizes and communicates the importance of freight land uses such as manufacturing, research and development, and fuel extraction to the region’s economy, and has taken steps to include freight-intensive land uses, and the transportation infrastructure supporting them, in the visioning process. The region’s vision includes strategies to help businesses find suitable development sites, including those with existing utilities, transportation facilities, and/or in existing industrial or commercial areas.

The effort also includes an extensive outreach and education program to communicate the importance of the region’s major industries to its economy, and to receive constructive feedback from stakeholders and the public. In addition, the group’s steering committee includes representatives of many of the region’s major shippers and receivers.

The Power of 32 effort is a good example of how statewide and regional agencies can work together to address multijurisdictional freight and land use issues. It is also a good example of how private sector freight stakeholders can participate in the process.

Source: <http://www.regionalvision.org/pressrelease.htm#>.

location decisions, and truck and rail travel patterns at the global, national and local levels. At the local level, land use policy scenarios that account for current trends versus “smart growth” scenarios could demonstrate the impact of land use policy decisions on economic development and land use conflict issues.

The specific issues addressed by a scenario planning process will depend on the priorities of the community, region, or study area engaging in the exercise. The engagement of freight stakeholders, including the public at large, is therefore required in order to develop a collaborative vision of a desired future, and principles that guide the development of the trend and alternative scenarios. FHWA published the Scenario Planning Guidebook which helps agencies understand and engage in the scenario planning process. The guidebook suggests six phases that agencies are likely to encounter when implementing scenario planning process. The phases are:

- **Phase 1: How Should We Get Started?** Scope the effort and engage partners.
- **Phase 2: Where Are We Now?** Establish baseline analysis. Identify factors and trends that affect the state, region, community or study area.
- **Phase 3: Who Are We and Where Do We Want to Go?** Establish future goals and aspirations based on values of the state, region, community or study area.
- **Phase 4: What Could the Future Look Like?** Create baseline and alternative scenarios.
- **Phase 5: What Impacts Will Scenarios Have?** Assess scenario impacts, influences, and effects.
- **Phase 6: How Will We Reach Our Desired Future?** Craft the comprehensive vision. Identify strategic actions and performance measures.³⁰

³⁰ FHWA Scenario Planning Guidebook, Federal Highway Administration, available from: <http://www.fhwa.dot.gov/planning/scenplan/guidebook/index.htm>.

Tax Relief Programs to Preserve Freight-Dependent Land Uses

Although the redevelopment of former industrial sites for residential and/or commercial land uses near many city and town centers is acting as a force to push freight development to the fringes of many metropolitan areas, regions and states are finding that preserving industrial areas can contribute to economic vitality and a variety of other regional objectives, such as limiting “freight sprawl” and associated impacts.³¹ Tax incentives are among the tools states, regions, and municipalities can use to encourage the preservation of industrial activity on existing industrial sites. Recognizing the public purpose provided by private rail services (such as job creation or retention, reduced congestion, reduced fuel consumption and emissions reductions), some states grant property tax relief for certain rail properties. The Federal Government offers tax credits (ranging from 10 to 20 percent) to businesses that rehabilitate existing and/or historic industrial buildings. Many states and municipalities offer additional incentives to encourage reinvestment in existing industrial buildings or parcels.

LOCAL POLICIES AND PRACTICES

Local policies and practices generally refer to issues within a municipality, including the existence of truck routes and the access to intermodal facilities. Municipalities and businesses can work together in a number of ways to reduce the conflict between freight and sensitive land uses within communities, such as neighborhoods, schools, playgrounds, or near other areas where freight movement may have a negative impact. Tools and strategies included in this section, therefore, are most likely instituted by the municipality. However, private-sector businesses have also been active in voluntary restrictions to mitigate the impacts of goods movement on the communities that surround them. The following sections highlight some of the “best practices” (including local government policies and business practices) to mitigate the conflicts between freight and sensitive land use at the local level.³²

³¹ Freight sprawl can result in increased truck vehicle miles traveled (VMT), introducing significant air quality, congestion, safety, pavement issues, and other implications. Local and regional planning agencies sometimes facilitate this process because uses such as residential, commercial, or tourism are seen as preferred ways to foster economic development and expand the tax base.

³² Many examples in this section came from NCHRP Report 320.

Example of a State Tax Relief Program – Urban and Industrial Reinvestment Tax Credit Program, State of Connecticut Department of Economic and Community Development

The Urban and Industrial Sites Reinvestment Tax Credit Program is an example of an economic development tool that a state may develop in order to steer investment to urban centers, economically distressed communities, and existing or former industrial sites. Under the Connecticut program, the State may provide up to \$100 million in tax credits over a 10-year period to support projects that create significant jobs and capital investment in these areas. The program’s expenditures are capped at \$500 million by statute. The amount of credits offered to applicants is determined upon the outcome of a comprehensive financial and economic impact review process, including the use of econometric modeling.

Eligible projects must demonstrate significant new economic activity, increased employment, additional tax revenues to the municipality and state, and (if applicable) a return of contaminated property to a viable business condition. Candidate projects must be located on an “urban site,” defined as 1) a designated enterprise zone, 2) an acknowledged distressed area, 3) a municipality with a population of more than 100,000; or in on an “industrial site,” defined as a site that has been subject to environmental contamination.

Many states offer similar incentive programs to encourage development in desirable areas, such as urban and former industrial sites where appropriate land use regulations and supporting infrastructure are established.

Source: <http://www.ct.gov/ecd/cwop/view.asp?a=1101&q=249842>.

Figure 2.1 Creating Buffers or Separation Between Industrial Land Uses and Other Land Uses



Example of Industrial Uses and Highway Access – Layton City, Utah

Layton City, Utah, provides an example of using zoning codes to ensure that freight facilities are located with appropriate access to infrastructure while avoiding sensitive land uses.

In its Municipal Code, Layton City describes characteristics about each of the zones in the zoning code, including industrial uses. It states: The “M” (Manufacturing/Industrial) zoning districts are intended to provide areas for manufacturing and industrial uses, where they will have the necessary services and facilities, and minimize obtrusions by adjoining uses and districts. These districts shall be located near rail lines and shall be near interstate highway interchanges for ease of transportation of goods. In order to minimize conflict among incompatible uses, most non-industrial uses are not allowed in the “M” zoning districts.

Source: <http://www.laytoncity.org>.

Creating Buffers or Separation Between Industrial Land Uses and Other Land Uses

One method to reduce the impact of freight on the rest of the environment is to minimize the interference of freight on communities’ quality of life. This can be achieved through the construction of physical barriers, freight routing, and others. Examples are discussed below.

- **Create walls around freight corridors or create pedestrian/bicycle paths to make crossing of freight facilities safer.** Pedestrian crossing of freight rail facilities and major highways is a safety concern, which governments and businesses can mitigate through the construction of walls to discourage pedestrian crossing of railways and highways. A better but more expensive option is to build pedestrian crossings over the facilities.
- **Build sound walls or berms around areas with freight activity.** Installing these can reduce noise and light pollution. These types of structures can be mandated in zoning codes for specific sites or can be required through agreements between the surrounding community and the facility. Trees or tall plants can also act as a good visual barrier to freight centers.
- **Include buffer zones around freight generating sites.** Creating a buffer zone between freight intensive activities and the rest of the community can insert space between two incompatible land uses. The buffer could take the form of open space, or make use of the concept of “stepping up” land uses, which refers to incremental increases in land use intensity over a given area. Intermediate land uses, such as retail or office, may be located between freight-intensive land use areas and sensitive areas such as residential areas and schools. The intermediate land uses should be less sensitive to industrial and freight activity, and impose fewer impacts on sensitive areas. The use of buffers in this manner reduces noise and air quality issues that increase with proximity to heavy industrial and freight-heavy facilities.

Figure 2.2 Creating Buffers between Industrial Land Uses and Other Land Uses



Upgrade Rail Crossings with New Technologies

The public and private sectors are developing and deploying technologies to reduce hazards at at-grade rail crossings. These new technologies include installation of median barriers (raised islands with markers mounted atop), four-quadrant crossing gates, and intelligent signal monitoring systems, which provide notification when the grade crossing mechanisms have failed.³³

Utilize Zoning Powers

Zoning can be used to guide the development of industrial land uses, such as new freight warehouses or intermodal facilities, near major highway access points. It is recommended to locate new warehousing facilities close to major truck routes, such as interstates. The closer these freight generators are to major highway infrastructure, the fewer miles trucks will need to move on local roads before moving onto highways. The same can be said for intermodal facilities. Airports, rail/truck terminals, and seaports should have proximate and adequate freeway access to avoid truck movements on local roads. While facilities generating large volumes of freight should be located away from

³³ Luczak, M., "Beating Back the 'beat-the-train' Brigade," *Railway Age*, July 1999, available: <http://www.railwayage.com/jul99/beat-the-train.html>.

Example of Construction of a Bike/Pedestrian Bridge at a Major Railyard – Vancouver, Washington

Washington State DOT (WSDOT) provides an example of how an investment in a pedestrian bridge can effectively connect neighborhoods, and provide safe travel for residents over a busy freight facility.

At one of the busiest railyards in the Pacific Northwest, located in Vancouver, Washington, WSDOT is improving pedestrian and bike safety by constructing an overpass over tracks near the railyard. In addition to providing a safe separation of pedestrian and bicycle traffic from the railyard freight activity, this crossing will improve connectivity between neighborhoods in this Portland suburb.

Source: http://www.wsdot.wa.gov/projects/rail/pnwrc_vancouver/.

sensitive land uses, some industrial and retail activities which generate smaller volumes of freight activity may be allowable or even desired within multiple-use communities. Tools such as zoning overlay districts and preferential zoning can establish parameters to accommodate those activities while minimizing external impacts on surrounding areas.

- **Zoning overlay districts.** Zoning overlays allow for the requirement of fewer or more restrictions on land use types within a zone or a district. Zoning overlay districts are typically designed to promote or discourage a particular type of land use or activity. Zoning overlay districts are often applied to historic neighborhoods in order to preserve scale and design features, or in special industrial areas to preserve endangered or incubate emerging industrial activities. Two examples of zoning tools used in overlay districts include form-based and performance zoning. Rather than segregating all industrial land uses, form-based and performance zoning may be used as tools to accommodate suitable retail and light industrial activities within or on close proximity to residential or multi-use communities.
 - **Form-based zoning.** Form-based zoning codes are methods for regulating development by building form rather than by land use. Form-based codes are typically employed in urban districts where mixed-use developments are encouraged, and address the physical and aesthetic relationship of a building to the streetscape and to surrounding buildings. Planners may use form-based codes to require retail and light industrial activities be housed in buildings that conform to neighborhood standards. The requirements may include maximum setbacks from the lot line, restrictions on driveways and curb cuts in front of a building, and establishment of loading areas on the rear façade of a building, away from the street, where possible. The desired form and design principles established in a form-based code are communicated with developers graphically using site plans and street section drawings to limit confusion or misinterpretation.
 - **Performance zoning.** While traditional zoning addresses land use types and form-based zoning addresses building form and design, performance zoning codes address the intensity of activity on a given parcel and the impacts of that activity on surrounding areas. Performance codes are more flexible regarding permitted land uses, provided impacts such as noise, odors, light pollution, water contaminants, and traffic generation remain within allowable thresholds. Theoretically, performance zoning could allow industrial land uses to be located almost anywhere in a community, as long as the impacts

to adjacent properties are not excessive. Communities which adopt performance standards will have to weigh the benefit of reducing the effort required to draft zoning codes and administer variance procedures under traditional zoning codes against the effort required to establish performance criteria frameworks and a system to monitor performance.

- **Preferential zoning.** It is possible to develop zoning regulations that encourage development that meets established planning goals. For instance, if regional stakeholders have determined that the provision/retention of freight-dependent land uses is an important goal, the planning authority can establish special zoning designations based on existing land use patterns and then offer rewards to developers who include desired freight amenities in their plans. These can include incentives such as floor-area-ratio (FAR) bonuses³⁴ or height limit bonuses.³⁵ Allowing a developer to build to a higher FAR or height will increase the value of the property for the developer.

Example of Zoning Overlay to Preserve Freight Activity and Reduce Land Use Conflicts –Maritime Industrial Zoning Overlay District (MIZOD) – Baltimore, Maryland

The City of Baltimore’s Maritime Industrial Zoning Overlay District (MIZOD) is an example of an effective zoning tool that preserves a limited and desirable resource (waterfront land) for industrial uses in the face of a mixed-use real estate boom that has applied considerable pressure to convert waterfront industrial properties to mixed-use.

The City enacted the MIZOD in 2004 to preserve maritime properties with deep water, rail and highway access in order to protect maritime-dependent uses and intermodal freight movement. The goal was to balance the needs of both mixed-use and maritime shipping, maximizing each to the extent possible without harming the other. The City categorized its waterfront into two general districts: Mixed-Use and Maritime Industrial. In the first, mixed-use would be allowed, enabled, and encouraged. In the second, the MIZOD would protect maritime uses by prohibiting conversion of land to non-industrial uses. Establishing clearly defined mixed-use and maritime industrial areas streamlined the development by avoiding costly and time-consuming delays associated with site-by-site decision-making regarding changes of use. It is also credited with protecting the integrity of the maritime area by avoiding the “leapfrogging” of mixed use into maritime areas.

The City publishes an annual report to tracks performance indicators such as number of businesses located in the district, number of new permits, property tax collected, cargo volumes, and a survey of firms within or dependent upon the City’s maritime industry. The 2010 MIZOD Annual Report concluded that MIZOD protection has allowed companies to feel confident in making significant capital investments in Baltimore, citing a series of recent and planned investments as evidence.

The Baltimore experience can serve as an example for other locales experiencing rapid land development and population growth, and other pressures on industrial land uses.

Source: <http://www.baltimorecity.gov/LinkClick.aspx?fileticket=riYFfe-1s44%3d&tabid=273&mid=639>.

³⁴ FAR refers to the ratio of the total floor area of a building to the total area of the parcel on which it sits. Limits on FAR (often built into zoning codes) thus regulate the intensity of development.

³⁵ Height limits are another way agencies regulate development intensity, in this case by specifying the allowable building heights for a property in a particular zone.

Preserve and Maintain Existing Industrial Land Uses

Some regions have found that dedicated, preserved space in which to foster manufacturing and industrial land uses is a good way to support the development of freight generating land uses. In addition, by designating this space as industrial land and explicitly discouraging other land uses (such as residential or commercial), it is easier to build infrastructure and policies to support freight land uses. This can include infrastructure considerations – such as buffers or wide turning radii – but can also include supportive policies, for example relaxing any time-of-day restrictions in freight districts that may apply in surrounding residential communities. Supporting brownfield redevelopment for industrial use is another strategy that municipalities can consider. This can be accomplished through incentives and assistance in order to foster freight intensive activities in suitable locations, as well as to maintain some freight generating land uses within the urban core. Brownfield development is discussed in greater detail in Section 3.0.

Promote Context-Sensitive Solutions (CSS)

CSS is an approach used in transportation planning to achieve consensus among project stakeholders, and to ensure that a transportation project (solution) is in keeping with the context of a community's identity. CSS requires the continuous involvement of stakeholders in the process of establishing an understanding of the context, documenting problems and issues, identifying and evaluating alternatives, and selecting a solution. CSS can be an effective process for freight-related transportation projects, as it calls for solutions that are sensitive to surrounding land uses, and it can solve the “freight doesn't vote” problem by bringing private-sector freight stakeholders such as shippers, receivers, and motor carriers into the planning process with community residents and leaders. The outcome of CSS when applied to freight projects should be a solution that addresses the needs of the community, and which has the support of businesses and residents. Examples of building and site design features that could be part of context-sensitive applications are listed below:

- **Orient loading facilities to minimize aesthetic, noise, and pollution impacts on residents**, including creating loading bays that are sufficiently large to allow easy truck entrance, egress, and maneuvering.
- **Consider creating a buffer around all freight generating land uses** to preserve land for expansion and prevent encroachment of incompatible uses. Another option is to allow only those other land uses that are compatible with freight activities.

- **Establish staging areas for freight delivery.** Many stores and other facilities receiving shipments do not have staging areas or freight loading docks. Trucks making deliveries must park along the curb or in a parking lot, which can impede traffic flow and cause congestion on the streets around the store. One solution calls for municipalities and other zoning authorities to require on-site, and, preferably, off-street staging areas for facilities and businesses that regularly receive freight shipments. In some cases there may not be sufficient space for on-site loading docks or parking areas. The establishment of common loading areas in multiple-tenant facilities, and/or regulations to effectively manage curbside truck parking may be more suitable solutions.
- **Reduce light spillage from freight facilities.** Often, freight yards or businesses use heavy lighting for security, signage, or other reasons. However, lighting can have negative impacts on neighbors surrounding the facility, as the light might be a nuisance during sleeping hours or at other times of the day. This is referred to as “light pollution.” When selecting lighting for a facility, it is important to select fixtures, locations, and lighting orientations that minimize light spilling onto adjacent properties.³⁶ Freight locations located near highways or roadways should make sure that glare is reduced, so that drivers are not distracted by the glare produced by these lights. Glare can be reduced by locating the lights at an angle that minimizes disturbance to drivers.
- **Employ “Green Port” Technologies.** Ports have historically been hotspots for air pollution and GHG emissions, as a result of the high density of truck, marine, and rail traffic at these facilities. As a result, much can be gained in terms of air pollution reduction at these facilities. This includes the following:
 - Installing electric gantry cranes;
 - Using modern generator set, or “GenSet” locomotives, which do not consume as much fuel as a diesel locomotive engine, for yard operations or drayage activities; and
 - Improving efficiency of flow through the port through the implementation of appointment systems, virtual container yards, peak-hour truck reduction programs and others.
 - Installing electric plug-in, or “cold-ironing” at ship berths so that ships do not need to idle their engines to power the ship while in port.

Figure 2.3 Flat-lens Lighting Fixtures
Direct light downward, reducing light pollution and glare



Example of Truck Lanes – Interstate 5, California

Caltrans, through its implementation of truck lanes on Interstate 5 and other highways, provides an example of managing traffic through freight-only transportation facilities.

Caltrans has developed truck lanes on segments of Interstate 5 to facilitate the rapid movement of freight and passenger traffic in a safer, separated configuration. Caltrans and other DOTs throughout the country are examining the feasibility of developing truck lanes and/or truck-only toll (TOT) lanes.

Source: <http://www.dot.ca.gov/hq/traffops/trucks/ops-guide/truck-lanes.htm>.

³⁶ http://www.todaysfacilitymanager.com/tfm_07_02_sustainable.php.

Example of Truck Route Language in the General Plan - Arroyo Grande, California

The City of Arroyo Grande, a small city with nearly 16,000 residents on California's Central Coast, illustrates how a municipal truck route network should be coordinated with neighboring jurisdictions, and avoid areas containing sensitive land uses.

The City includes language in the circulation element of its General Plan that seeks to keep truck movements away from residential areas. The plan states "Truck routes should coordinate with County and adjoining cities designated routes and avoid traversing residential areas." (CT3-4.1)

Source: <http://www.arroyo grande.org/>.

2.3 Effective Transportation Systems and Services

In addition to pursuing “good neighbor” land use policies, developing and maintaining effective transportation systems and services is an important element of supporting the freight community and mitigating potential adverse effects of freight. Freight-exclusive transportation facilities such as truck lanes, direct highway connections to freight facilities, and the reduction of at-grade rail crossings are examples of strategies that improve transportation system safety and limit the potential impacts of freight movement on the safety and quality of life of the public at large.

FREIGHT-EXCLUSIVE FACILITIES

Many of the issues and challenges associated with freight transport revolve around safety and quality of life concerns that arise when freight vehicles come into contact with passenger modes. At the regional level, motorists and businesses are often concerned with the safety, congestion, and air quality impacts of commercial motor vehicle traffic on major freeways and arterials. Although it is usually recognized that freight movements are essential to commerce and economic growth, there is often pressure to find policies which reduce these negative externalities.

One way to mitigate these problems is to establish infrastructure solely dedicated to freight movements. The most common example is truck-only lanes, which are typically implemented as a regionwide network of managed lanes dedicated to trucks. This can reduce freight delays (trucks no longer have to contend with passenger cars for road space) while simultaneously minimizing conflicts between trucks and passenger cars. It can also focus truck traffic on one or more specified corridors – as opposed to having trucks impacting multiple routes in a region.

Truck-only lanes are typically planned as tolled facilities (truck-only toll, or TOT lanes), because it is often politically infeasible to raise taxes or use bonding authority to pay for transport infrastructure that is perceived to only benefit the freight industry. This raises the possibility of making the TOT lanes self-financed through user fees or using private capital through a public-private partnership (PPP) arrangement. However, there are some practical considerations which must be evaluated when looking at TOT implementation:

- **Tradeoff between limiting access and generating demand.** From an operational standpoint, the most efficient TOT-lane configuration would feature limited access points, for example between a port and a major transcontinental Interstate link. However, research suggests that average truck trip distances in many regions are shorter than might be expected, as freight trucks often need to access warehouses and distribution centers nearby other freight generators such as ports or intermodal yards. In this instance, providing access points at just a few locations would discourage truckers making local trips from using the facility. More access points may generate additional local demand, but this could come at the expense of operating speeds/efficiency while also increasing project capital costs.³⁷
- **Time-of-day distribution of truck traffic.** Peak truck travel patterns differ from peak commuter travel patterns largely because truckers strive to avoid the most congested periods of the day. As a result truck volumes often peak in the mid-morning (after the morning rush) and again in the mid-afternoon (before the evening peak), and long-haul trucks are much more likely to operate at night than passenger vehicles. This means that travel-time savings associated with TOT lanes may be minimal – which reduces demand – unless the roadway in question is congested for most of the day.³⁸
- **Tradeoff between toll rates and demand.** Ideally, toll rates would be set in a way that maximizes toll revenues, achieves an acceptable level of service and a high-utilization rate, and diverts a significant number of trucks from local roads to the TOT lanes. In practice it is difficult to achieve all four of these objectives at the same time, since they may work at cross-purposes. For instance, if tolls are set higher than the travel-time savings that truckers would realize by using the facility, they would be unlikely to use the TOT lanes, thus reducing demand and toll revenues without removing many trucks from congested free lanes.³⁹ Trucker utilization of TOT lanes also is affected by the value and time-sensitivity of the cargo.

³⁷ Fischer, Michael J., Ahanotu, D.N., and Waliszewski, J.M. *Planning Truck-Only Lanes: Emerging Lessons from the Southern California Experience*. Transportation Research Record No. 1833.

³⁸ Ibid.

³⁹ Chu, Hsing-Chung. *Implementing Truck-Only Toll Lanes at the State, Regional, and Corridor Levels: Development of a Planning Methodology*. Doctoral dissertation, Georgia Institute of Technology, 2007.

Replace At-Grade Rail Crossings

Rail tracks running near neighborhoods often create safety issues for pedestrians, bicyclists, and motorists looking to cross from one side of the tracks to the other. While expensive, replacing at-grade rail crossings with above or below-grade crossings for these modes will reduce conflicts with freight trains. These may also mitigate the divisive impact of a rail line on the community, allowing for more integration between neighborhoods on both sides of the tracks. Removing an at-grade crossing can reduce noise (no whistle blowing required) and may increase the effectiveness of freight rail operations. If removing at-grade crossings is not an option, upgrading rail crossings with new technologies, such as four quadrant crossing gates and intelligent signal monitoring system, can help make existing at-grade rail crossings safer.

2.4 Effective Operations and Management Policies

In addition to providing a safe and effective transportation system, there are a number of strategies that can be implemented to improve the operations of the transportation system to reduce freight impacts. Such operations strategies include incentivizing off-peak deliveries to reduce freight contributions to congestion during peak travel periods, creating “quiet” or “no whistle” zones along rail lines to reduce noise pollution in residential areas, and installing “hush kits” to reduce airplane noise impacts.

INCENTIVES FOR OFF-PEAK DELIVERY

One way to minimize the freight contribution to traffic congestion in a region is to provide incentives that encourage delivery during off-peak-periods such as nights and weekends. Since one 70-foot long tractor-trailer occupies space on the road equivalent to 1.5 to 8 passenger cars depending upon the type and condition of the roadway,⁴⁰ any reduction in peak-hour truck volumes can yield significant congestion relief benefits. It can also reduce the environmental impacts of goods movement since the time trucks spend idling in traffic typically translates into wasted fuel and increased emissions.

⁴⁰ *Highway Capacity Manual 2000*, Transportation Research Board.

Successful implementation of off-peak delivery incentives requires freight carriers and receivers to come to an agreement about delivery times. Modeling simulation research suggests that the businesses that are most receptive to off-peak deliveries are those that would likely be open during off-peak hours anyway, such as restaurants, bars, convenience stores, 24-hour supermarkets and big-box retailers, and medical facilities.⁴¹ The same research also found that off-peak delivery activity is driven mainly by receivers' preferences. This is because the freight transportation industry is fragmented and intensely competitive, which makes it hard for carriers to unilaterally impose delivery times on their customers. The model found a positive correlation between tax deductions given to receivers and off-peak delivery participation rates among both carriers and receivers. This suggests that incentives targeted towards the receivers of freight may have the largest impacts on congestion relief. Such incentives might be paired with discounted truck tolls on nights and weekends, which might encourage carriers to engage in off-peak deliveries where feasible.

At the local level, agencies, ports, and freight carriers can work together to adjust the times during which freight movements occur within municipalities. There are a number of options, which have different benefits and drawbacks:

- **Encourage off-peak delivery/pick-up times for major freight generators.** Major freight generators, such as seaports, can reduce peak-hour traffic congestion by incentivizing goods pick-up/delivery during off-peak hours. For example, the Ports of Los Angeles and Long Beach created a program called PierPASS, which provides incentives for shippers to move cargo at night and on weekends, rather than during congested daytime hours. This leads to reduced queues at the Port, which reduces truck idling and therefore has a positive impact on the air quality of surrounding communities. One drawback of this strategy is that off-peak hours usually are night hours, or quiet hours. If the freight facility or port is located in or near a residential area, this strategy may result in increased noise pollution near the facility.
- **Use an appointment system to schedule delivery of goods to freight pick-up or drop-off facilities.** At facilities where numerous trucks are scheduled to deliver or pick up goods every day, it may be beneficial to create an appointment system to clear traffic. For

*Example of Restricted
Downtown Core
Delivery Hours – Boston,
Massachusetts*

The City of Boston offers an example of a management policy that can reduce congestion and limit competition between trucks and automobiles for curb space.

Boston prohibits commercial vehicles from using certain downtown streets within the Downtown Crossing area (a high business and commercial area) between 11:00 a.m. and 6:00 p.m. This helps to reduce congestion during the evening peak period of 3:00 p.m. to 6:00 p.m. Exceptions are made for trucks with time-sensitive cargoes, including trucks from Brinks, FedEx, and the U.S. Postal Service.

Source: <http://www.downtowncrossing.org/visit/vehicle.php>.

⁴¹ Silas, Michael S. 'A Simulation-Optimization Formulation for Design of Off-Peak Delivery Policies.' Rensselaer Polytechnic Institute, presentation dated September 18, 2007. Retrieved April 12, 2010 from http://www.nymtc.org/download_file.cfm?filename=Silas-2007-09-21.pdf.

example, if 5:00 p.m. is a very congested time when all carriers would like to pickup goods, an appointment system would require goods to be picked up at the discretion of the business or factory – this would enable the business to spread out the times at which goods are picked up, which can improve operations and lower the number of trucks around the factory at one time. This, in turn, can reduce negative externalities for surrounding communities and traffic. Any appointment system should be developed in coordination with the trucking industry, as it will likely impact company’s logistics patterns, labor needs, and scheduling.

- **Implement restricted delivery hours in the downtown core or create surcharges for peak-hour delivery.** This strategy can reduce congestion and potential conflicts between residents and goods movement activities in the downtown core during peak travel times. In some cases (mostly smaller deliveries), this strategy can be coupled with the use of unattended delivery systems (such as electronic drop boxes or off-site collection locations) to minimize the impacts on labor or business opening hours.
- **Implement restricted delivery hours in residential zones.** This strategy can reduce congestion in residential zones during peak personal travel hours or “quiet” hours. The main reason to do this would be to reduce the noise impact from freight movement on neighborhood residents during the least desirable periods for noise. This strategy is not applicable everywhere, as the shifting of truck travel from one period of the day, from nighttime to daytime, for example, may result in negative impacts on traffic congestion, by pushing more trucks onto the road during peak daytime traffic hours.
- **Modify rail hours of operation to minimize noise/vibrations during “quiet” hours.** Trains can create noise pollution due to contact with the rails and their horns. For residences in close proximity to the railroad, vibrations may be another impact felt by residents. One strategy is for railroads to voluntarily move goods only during daytime hours when most residents are not asleep or at home, thus reducing conflicts. This is likely only a potential strategy for smaller, regional “shortline” railroads. Some shortlines, such as the Morristown and Erie (M&E) Railway, have done this.⁴²

⁴² NCFRP 320.

PROMOTE THE APPLICATION OF ANTI-IDLING TECHNOLOGIES FOR TRUCKS

Idling trucks are recognized as a significant source of localized pollution in neighborhoods around the country. A heavy-duty diesel truck engine can burn one gallon of diesel for every hour the engine idles, and emit tons of CO₂ and particulates over the course of a year. In many states and locales, truck idling is prohibited for periods longer than a few minutes. One method to reduce truck idling is to use on-board anti-idling technologies such as engine control modules, automatic shut-down/turn-on systems, direct-fired heaters, auxiliary power units, or generator sets. These technologies reduce or eliminate the need to idle the engine, although each has different capabilities (engine control and automatic shut-down/turn-on systems to not address cab comfort or power source needs, for example), and costs to install. Electrified parking spaces can provide electrical power and cab heating or air conditioning while trucks are parked at spaces equipped with the technology. Through the SmartWay Program, the U.S. Environmental Protection Agency (EPA) has partnered with trucking companies throughout the country to upgrade truck fleets with power units, generator sets, and other emissions-reduction technologies. Government agencies may find it worthwhile to direct motor carrier and locomotive fleet operators to programs like SmartWay for assistance in determining their emissions reduction needs and opportunities.⁴³

CREATE “NO-WHISTLE ZONES” OR “QUIET ZONES” FOR RAIL

While it is a Federal requirement for trains to blow their horns at at-grade intersections, there are some instances where alternate safety measures can be put in place that waive this requirement. The required measures are site-specific and vary per intersection, but can include measures such as four quadrant gates or public education. Communities can apply for “quiet zone designations,” but are responsible for all costs to make their crossings qualify.⁴⁴

⁴³ More information regarding the U.S. EPA SmartWay Program is available from: <http://www.epa.gov/smartwaylogistics/>.

⁴⁴ http://www.google.com/search?hl=en&rlz=1T4ADFA_enUS361US367&q=fr+quiet+zone+&aq=f&aqi=&aql=&oq=&gs_rfai=.

REDUCE OR MITIGATE AIRPLANE NOISE

Aircraft, especially older ones, create lots of noise for surrounding communities. As a result, airlines have retrofitted many of their older planes with hush kits, which reduce the noise produced by aircraft. Newer airplanes are designed with larger fan blades, which turn at a slower speed and emit less noise. Installation of sound-protective walls between airports and adjacent sensitive land uses can reduce the spillage of noise associated with on-airport activities into surrounding areas. In addition, strategies that manage approach and on-the-ground operations, including suggested limits on use of reverse thrust upon landing, limitations on power used while taxiing, and reconfigurations of runways or taxiways (where possible) to direct activity away from residential areas may be implemented to reduce noise impacts. The ability to implement these and other noise-reducing strategies at airports depends upon airport size, space availability, the location and configuration of sensitive land uses near the airport and along approach paths, and day-to-day weather and runway conditions.⁴⁵

2.5 Education and Outreach

Lack of awareness is a key reason that logistics needs are not often considered in planning and development decisions. Local and regional authorities can therefore make sure that its staff members are well educated in freight and land use issues, and can develop and deliver training targeted towards planning and zoning board officials and professional planners that educates them on logistics and freight needs with regard to transportation and land use planning. This can help provide the institutional push to integrate freight into the planning process. Through improving the understanding of material flows, receiving technical assistance and engaging and educating community groups and residents, and industry representatives, dialog about community needs and freight impacts can be undertaken in an educated manner, in which the benefits of freight and the community impacts are understood by everyone at the table.

⁴⁵ ACRP Report 15: Aircraft Noise: A Toolkit for Managing Community Expectations, available from: http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_015.pdf.

STAKEHOLDER ENGAGEMENT

Freight-dependent businesses may be engaged in zoning and land use planning processes, however, they may not fully understand the transportation implications of zoning and land use decisions. Therefore, it is important for local and regional authorities to “go to them” by actively reaching out to the freight generators. For example, a regional body could host a “Freight Forum” bringing stakeholders and local planning agencies together periodically or on a regular recurring basis to discuss freight-related land use needs and issues.

ENGAGE COMMUNITY GROUPS AND RESIDENTS

The communities who are impacted by freight have legitimate concerns about the noise, vibrations, light, air quality and other impacts they experience. While many communities may find freight an undesirable neighbor, there are strategies that industry groups, possibly with the assistance of government, can implement to engage the community and become a welcome neighbor.

- **Create a neighborhood investment fund.** Freight generating industries or freight carriers themselves can volunteer to give back to their surrounding communities by setting up neighborhood investment funds. These funds can help facilitate local economic development, which improves the lives of those in surrounding communities by adding jobs and improving services. This also can work as a public relations tool for the freight company, as direct investment in the community can lead to better relations with neighbors and local officials.
- **Hire locally.** Another strategy that helps to make the economic benefits of freight uses very evident to nearby communities is to develop an on-site workforce composed largely of community residents. This also can serve to improve private-sector relations with the community and officials.
- **Create complaint hotlines and open communication with neighbors and the community.** It is important to create a way for neighbors and the community to express their concerns, so that they can be addressed as appropriate by the business. Businesses can add such information to their web sites, while the government also can take complaints, if citizens feel more comfortable going to the local jurisdiction for complaints.

TECHNICAL ASSISTANCE TO LOCAL JURISDICTIONS

Oftentimes, inadequate consideration for freight in local land use and development decisions stems from a lack of freight provisions in local comprehensive planning efforts and associated zoning codes and land development regulations (LDR). As a result, freight and logistics needs end up as an afterthought in the planning and development review process. This can result in development projects getting approved even if the plans do not include sufficient provisions for efficient freight operations. For example, a freight and land use study in Atlanta found examples of large new mixed-use (residential and commercial) centers with no loading zones, off-street truck parking, or rear access for trucks. This could easily lead to conflicts between freight and passenger vehicles, not to mention pedestrians. The same study found instances of new residential development immediately adjacent to truck and rail terminals (see Figure 2.4).⁴⁶

Figure 2.4 Residential Development Adjacent to Freight-Generating Land Use



Source: Atlanta Regional Commission.

State DOTs and MPOs can help resolve this problem by educating their own staff members, and other divisions and departments, and by offering technical assistance to local governments.

⁴⁶ Mays, Caroline A. 'Integrating Freight and Land Use in the Atlanta Region.' Presentation given November 9, 2008 to FHWA Talking Freight Seminars.

This assistance should cover several key areas, including:

- **Providing data and modeling tools that quantify freight needs and impacts.** Often, state and regional agencies, through transportation planning activities and special studies such as corridor and subregional freight studies, have developed detailed freight data and regional modeling tools and products that local jurisdictions may not have the capability to develop or use on their own. By sharing these data, local jurisdictions may achieve a fuller understanding of freight activity occurring in their areas, weigh the costs and benefits of freight activity to the area's economy and quality of life, and make appropriate policy decisions.
- **Assisting local jurisdictions in developing coordinated comprehensive plans that consider freight.** Because agencies at all levels of government (local, regional, state, and Federal) are engaged in transportation, economic development, land use, and many other subjects of comprehensive plans, the task of ensuring that planning activities are coordinated with other agencies' and neighboring jurisdictions' activities can be daunting for local government planners. State and MPO agencies can assist by being engaged in local planning activities occurring within their jurisdictions, participating on advisory committees, and by cataloguing published planning documents for reference.
- **Model zoning/land development regulations.** Since freight is often not considered in local zoning ordinances or LDRs, a regional authority can help by developing model land development and zoning codes for use and adaptation by local agencies. These codes may include provisions for:
 - Buffer zones between incompatible land uses;
 - Protecting undeveloped land near freight facilities from encroachment through zoning, easements, or outright purchase of the land (this has the benefit of providing future expansion opportunities for freight businesses); or
 - Directing warehouse and distribution center development towards sites with multimodal access options.
- **Develop “logistics supportive design guidelines.”** Ultimately all development occurs at the site level, so it is important that freight-friendly design requirements are built into the site design and development review process. Regional agencies can provide site layout and building design guidelines that address logistics needs such as loading zones, street geometry, truck routes, and access points. This helps ensure that logistics needs are met for individual projects.

Example of Offering Technical Assistance to Local Jurisdictions and Stakeholders – A Lesson from the Atlanta Regional Commission – Atlanta, Georgia

The Atlanta Regional Commission (ARC), the MPO for the Atlanta, Georgia region, offers a Community Choices Resource Center, which provides tools and guidance to communities to help them wrestle with land use decisions and (re)development plans. This service is a proven example of how a regional agency can assist local governments in making smart land use policy decisions.

Through the Community Choices Program, ARC provides a broad range of tools, staff resources, and technical assistance to help local governments design communities that work for them. The goal is to assist local governments with making good, long-term decisions about where, when and how they should grow in order to achieve the unique and individual vision of each community. ARC has assisted over seven local governments to implement their growth and land use visions.

Source: <http://www.atlantaregional.com/local-government/planning-assistance>.

2.6 Putting it All Together

This section highlights, through three detailed case studies, specific examples of how issues in Sections 2.1 through 2.4 have been addressed and mitigated in three different metropolitan regions. Each case study is presented according to the following outline:

- **Issue Background** – insight into the key problem and causes of the issue addressed by the case study plan or initiative.
- **Approach and Resolution** – a summary explanation of the procedure, findings and recommendations each case study plan or initiative identified.
- **Critical Success Factors** – key points or “takeaways” that planners in other jurisdictions should learn from the case study subjects’ experiences.

Table 2.2 Key Issues Illustrated within the Best Practice Review

Case Study	Key Issues Addressed
Chicago Industrial Corridor Program	<ul style="list-style-type: none"> • The importance of preserving industrial and freight-related land uses • Retaining manufacturing in the urban core
Atlanta Regional Freight Mobility Plan	<ul style="list-style-type: none"> • Encroachment of residential development onto freight/industrial land uses • Site design to mitigate freight/industrial noise, light, and dirt
Seattle's Urban Mobility Plan	<ul style="list-style-type: none"> • The use of restricted delivery hours in the urban core • Provisions of off-street loading areas and reservation of on-street parking for trucks

CASE STUDY: CITY OF CHICAGO’S INDUSTRIAL CORRIDOR PROGRAM AND THE METROPOLIS FREIGHT PLAN: DELIVERING THE GOODS

Issue Background

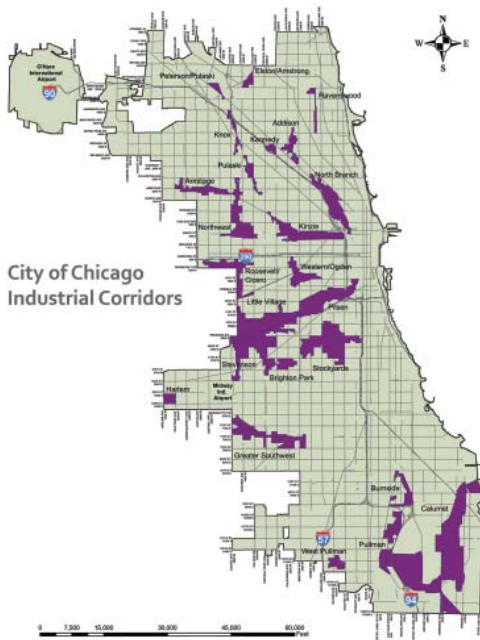
Since its founding in 1833, Chicago has been a major transportation hub – growing from a small trade link between the Great Lakes and the Mississippi region – to the point where it now sees the convergence of over 500 freight trains a day, as well as thousands of trucks and a vibrant air cargo industry. Chicago’s residential housing market has been putting increasing pressure on many of the city’s prime industrial sites, especially those located near downtown. Many sites previously devoted to transportation and industry are now being converted into residential lofts and condominiums – leading to tension between uses

and diminishing the city’s manufacturing employment base. These factors led to two different actions by two different groups:

The City of Chicago created an Industrial Corridor Program in the early 1990s to protect and guide industrial land use development along specific corridors. Part of this included the creation of “Planned Manufacturing Districts (PMD).” The latter is a special zoning designation for a defined geographic area that limits the types of development to industrial activity, as well as other compatible land uses. The Industrial Corridors and the PMD are shown in Figure 2.5.

In 2004, Chicago Metropolis 2020 created The Metropolis Freight Plan: Delivering the Goods in 2004. Chicago Metropolis 2020, since renamed Metropolis Strategies, is not the region’s MPO, rather it is an organization composed of civic and business leaders, collaborating in an effort to secure the region’s economic competitiveness.⁴⁷ Starting with the Industrial Corridor Program activities, this plan goes further to suggest a series of steps that Chicago Metropolis 2020 believes are needed to prevent future freight gridlock and to secure the economic benefits of growing freight traffic.

Figure 2.5 Chicago’s Designated Industrial Corridors and Planned Manufacturing Districts



Source: City of Chicago.

⁴⁷ “Metropolis Strategies” available from: <http://www.metropolisstrategies.org>.

Approach and Resolution

The City of Chicago established Planned Manufacturing District (PMD) zones in 1991 to preserve the city's industrial economy. The zones protect industry from encroachment of incompatible land uses by disallowing residential and other sensitive uses within the PMD zones. The City established "buffer" subzones near the edges of some of the PMD zones that allow for a variety of commercial and institutional uses to smooth the transition between industrial and sensitive land uses. Chicago's zoning code also includes performance criteria specific to the conditions within each PMD zone that limit the levels of noise, vibration, smoke and particulate matter, toxic matter, noxious odorous matter, fire and explosive hazards, and glare or heat emitted from properties within the zones.⁴⁸

The City of Chicago's Industrial Corridor Program is designed to support Chicago's industrial environment by bringing company and community interests together to plan and implement improvements in dedicated industrial areas. Corridors are identified by a series of characteristics, including their accessibility to goods dependent industries and transit, the existence of compatible uses within the corridor. By mid-2004, the City of Chicago had delineated 24 industrial corridors, and 35 were designated by 2011.⁴⁹ The industrial corridors program has helped to organize and "legitimize" the industrial clusters throughout the City as neighborhoods or districts. The corridors have served as mechanisms through which appropriate redevelopment and improvement programs have been implemented.⁵⁰

In 2004, this concept was expanded upon by Chicago Metropolis 2020, which completed the Metropolis Freight Plan: Delivering the Goods. This report began with a close study of the Industrial Corridor and Planned Manufacturing District program. It then went further, to complete an in-depth interview/discussion period, held with a wide range of industry professionals involved in freight, logistics managers, drayage carriers, commercial real estate developers, academics, transportation advocacy groups, county planning departments, municipal government, and law

⁴⁸ Zoning Ordinance, City of Chicago, available from: <http://forum49.chicago.il.us/local/docs/Pre2004ZoningLaw/section6.html>.

⁴⁹ <http://www.cityofchicago.org>.

⁵⁰ <http://www.cityofchicago.org/city/en/depts/dcd.html>.

enforcement. Finally, it included a truck modeling effort, including different scenarios of truck-only infrastructure, including a truck bypass of the downtown core. Outcomes from this effort include the identification of a need for more intermodal facilities in the region, as well as the establishment of local truck routes to connect freight-generating facilities to the main freeway facilities efficiently to reduce VMT and associated impacts. It also called for improved coordination between land use authorities and transportation agencies throughout the metropolitan region.

Critical Success Factors

Two key lessons emerge from these two actions:

- **Preservation and maintenance of manufacturing and industrial land uses in urban areas.** Both actions began with the assumption that it is critically important for cities to maintain a mix of land uses in order to support a full range of employment opportunities for residents. It also is vital that manufacturing and industrial land uses be maintained in their current locations in dense urban areas so that the jobs they provide can be reached by public transit systems and so that their freight transportation needs can be met on existing facilities.
- **Zoning as a tool.** The City of Chicago used several tools at its disposal, in this case zoning and land use planning, to maintain the viability of its manufacturing sector and attract new industrial development. By designating 35 industrial corridors, and 15 Planned Manufacturing Districts this land is preserved in a manner that means it will not be encroached upon by residential or commercial land uses.

In all, these two efforts are an example of incremental freight and land use integration. They offer: 1) key lessons to any growing urban region, in particular those experiencing residential redevelopment pressures on industrial land, 2) guidelines by which to retain goods movement industries within the urban center, instead of pressuring them to relocate towards the urban fringe, and 3) a compelling argument for cities to understand the hidden costs of these changes, both in terms of job loss and new infrastructure needs.

CASE STUDY: ATLANTA REGIONAL FREIGHT MOBILITY PLAN

Issue Background

According to the Atlanta Regional Freight Mobility Plan, the population of the Atlanta region is expected to reach almost seven million people by

2030. The region is one of the fastest growing metropolitan areas in the nation. This growth has and will continue to put development pressure on areas with existing infrastructure. Key freight corridors with access to the interstate and major arterials also are becoming prime space for high-density office and residential or mixed-use developments. As a result, the incidence of adjacent but incompatible land uses is growing (e.g., residential subdivisions bordering warehouse facilities). As property values increase within the urban core, distribution and logistics firms locate facilities at more remote sites at the metropolitan fringe, a phenomenon that has come to be known as “freight sprawl.”

Approach and Resolution

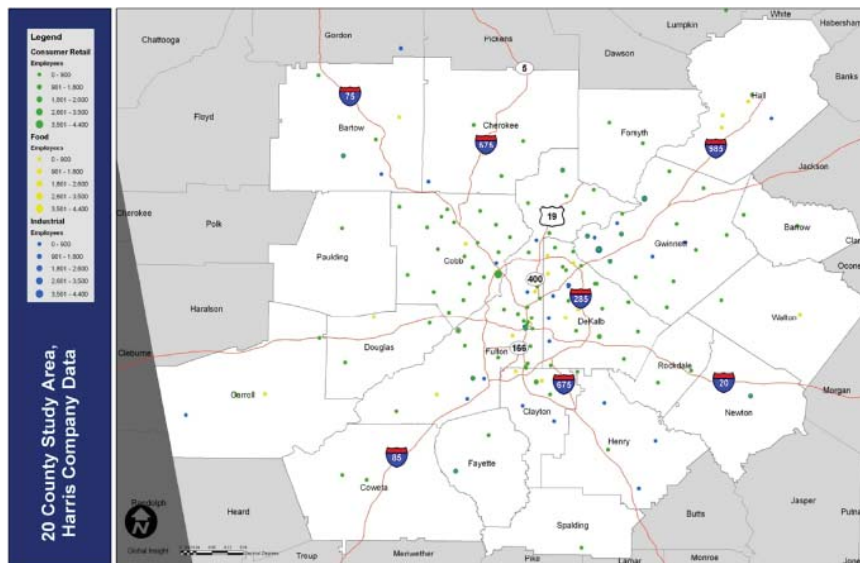
The Atlanta Regional Commission (ARC) identified the connection of land use and transportation as a key element of developing the ARC Regional Freight Mobility Plan. The Plan is intended to provide guidance for accommodating freight facilities and reduce the sprawl of freight activities (illustrated in Figure 2.6) by developing goods and trade-related distribution facilities within existing transportation corridors and zones. This can also help ensure a balance between the movement of people and the movement of goods across key corridors in the region. The goals of integrated freight-land use planning are to:

- Preserve the region’s quality of life by seeking “peaceful coexistence” of freight and non-freight land uses;
- Preserve and enhance efficient and safe access and mobility for freight transportation purposes; and
- Support smart transportation planning and projects.⁵¹

The ARC study examined planning documents completed by various agencies in the region, interviewed stakeholders, and conducted a review of literature produced in other regions to identify freight and land use issues and strategies that are in use, or could be used, to mitigate conflicts.

⁵¹ Atlanta Regional Commission, Atlanta Regional Freight Mobility Plan, February 2008.

Figure 2.6 Geographic Distribution of Warehousing/Distribution Centers in the Atlanta Region



Source: Atlanta Regional Freight Mobility Plan, Atlanta Regional Commission.

Critical Success Factors

The Freight Mobility Plan discovered the following issues and opportunities:

- Recognizing corridor-level impacts of freight.** The study found that corridor-level impacts of freight-related development is fairly minimal, and that the focus of freight planning activities tends to rest in resolving local traffic concerns and accommodating future traffic volumes rather than management of mobility and access. Many planning documents and processes do not fully understand logistics and supply chain systems and the needs of different freight system users, and they apply one-size-fits-all solutions to freight issues that may not address unique activities or impacts, and may result in the potential for poorly coordinated land use planning. As the region grows, so too will the need for freight infrastructure to support the population. Current trends indicate that freight facilities will locate in areas with relatively inexpensive land capable of accommodating facilities with large footprints, and with access to high-speed/high-capacity transportation networks. A proactive approach is needed to plan to accommodate the needs of the industry, to keep freight mobile and the population mobile.
- Recognizing freight's contribution to a region's economy.** The plan recognizes that freight-supportive land use planning is critical to sustaining the Atlanta Region's economic vitality, mobility, and quality of life in the future. The plan advised ARC and its planning

partners to evaluate in future Metropolitan Transportation Plans (MTP) and Regional Development Plan (RDP) updates and pursue the following objectives:

- Preserve freight mobility as the region continues to develop;
- Coordinate freight and non-freight land uses and mobility needs;
- Ensure adequate segregation and protection of different land uses; and
- Build goods movement and logistics needs into land development and site design.⁵²

CASE STUDY: CITY OF SEATTLE URBAN MOBILITY PLAN

Issue Background

Seattle's Urban Mobility Plan (UMP) was undertaken in order to chart a course for the City as it undergoes rapid population and employment growth in the coming decades. The goal of the plan was to ensure that Seattle's Center City would continue to grow in size, economic vitality, and accessibility through improving the efficiency of infrastructure, while also making it more inviting, and accommodating to users. The Plan specifically recognizes the importance of goods movement to support industry, facilitate port activities, and attract businesses.

Approach and Resolution

The UMP includes a section detailing best practices in freight movement, which identifies practices in use or under consideration by other cities to keep freight moving in congested multiuse areas. Many of the examples profiled in this review are European cities, since they often deal with tighter geometric requirements that U.S. cities and have been considering this issue for many years. Recent developments include:⁵³

- **Low emission zones** – where vehicles can only enter a designated Low Emission Zone (LEZ) if they meeting specific emissions criteria set by the local government (currently in use in Sweden, Amsterdam, and London).
- **Combined-use lanes** – where lanes are designated for different uses throughout the day – for example certain time periods allow through-traffic, truck stopping, or parking (currently is being used on Barcelona's Balms Street arterial).

⁵² Ibid.

⁵³ Briefing Book, Seattle Urban Mobility Plan, January 2008.

- **Preferential zoning or property tax relief for properties used in urban goods movement** – which offers incentive to incorporate goods movement into new development plans, exists in several Canadian cities.
- **Unattended delivery systems** – that allow deliveries to be made when offices are closed or recipients are not at home, so trucks do not need to return goods to the depot for later delivery. This may be in the form of a drop box, or a convenience store.
- **Retail delivery stations** – micro-warehouses are used to receive large truckloads of goods. The goods are later transported to individual businesses by pallet truck, small carts, etc. This reduces the amount of large truck trips in the urban core (currently in use in Brussels).

In addition, the UMP reviewed a wide variety of other freight and land use coordination methods from around the U.S., including restricted delivery hours, incentives for off-peak deliveries, and combined use or freight-exclusive lanes.

The UMP also identified a set of policies and practices that Seattle could use to best manage urban freight operations in a manner that both optimizes street operations and ensures safety. These proposed policies and practices are summarized in Table 2.3.⁵⁴

Table 2.3 City of Seattle Policies to Manage Urban Freight Operations

Key Issues Addressed
Reserve some on-street parking for commercial vehicles.
Reserve some on-street parking for commercial vehicles.
Require permits for all over-dimension trucks.
Require new developments to provide off-street truck loading areas.
Retain alleys for truck deliveries and garbage/recycling collection.
Provide signage for truck drivers to identify appropriate routes and note prohibitions.
Provide businesses with information regarding route closures and detours early enough for them to adjust routes or delivery schedules if required.
Provide real-time information about incidents that will disrupt traffic operations.

⁵⁴ Ibid.

Critical Success Factors

- **Establish space for freight.** By requiring new developments to provide off-street truck loading areas, and reserving some on-street parking for commercial vehicles, Seattle is implementing a management policy that will offer commercial vehicles a “place to work” while loading and unloading. This limits illegal and unsafe parking that may have occurred otherwise.
- **Share travel information.** By providing appropriate signage for truck drivers, and making information on route closures and incidents available to the freight community, businesses can take appropriate measures to “plan accordingly” and avoid undesirable routes and congested areas. When incidents occur, trucks and passenger vehicles may divert to other routes, but not all routes are suitable alternatives for trucks. By having truck route and detour information available, trucks can take appropriate actions to avoid sensitive areas.

3.0 Freight Land Use and Sustainability

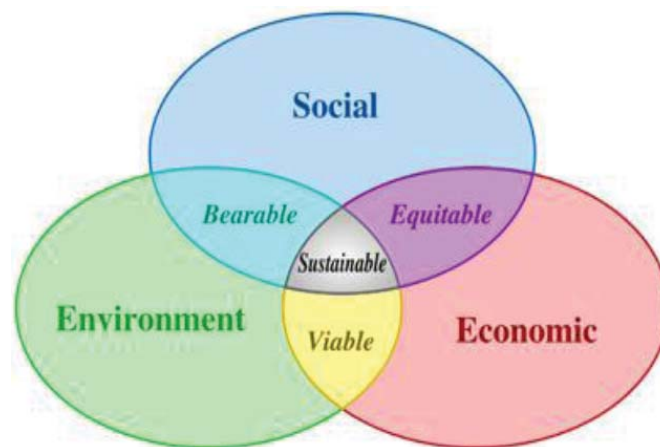
3.1 Purpose and Content

The term “sustainability” represents a pattern of human activity that aims to use the planet’s resources in a manner that meets the needs of the world’s population now and in the future, while achieving a balance between environmental conservation, economic development, and livability (including consideration of social equity and justice). The United States Department of Transportation has elevated discussions of sustainability in its “Livability Initiative,” which is tasked to improve the relationship between infrastructure and community needs across the nation. Specifically, the U.S. DOT defines sustainability and livability as the following:

“Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design, maximizing and expanding new technologies such as ITS and the use of quiet pavements, using Travel Demand Management approaches to system planning and operations, etc.”⁵⁵

Sustainability is achieved at the intersection of social, economic, and environmental factors (see Figure 3.1).

Figure 3.1 Relationship of the Three Dimensions of Sustainability



Source: FHWA Sustainable Highways Program.

⁵⁵ <http://www.fhwa.dot.gov/livability/>.

For example a project that results in economic development while also benefitting local communities and the environment. If only two out of three overlap, (for instance social and economic), it may result in a situation that is “equitable,” but does not necessarily consider the needs of the environment. Likewise, a situation that balances the social needs with environmental needs may be “bearable,” but may not result in optimal economic gains. Sustainability is a concept that is achieving an increasingly high level of public awareness and interest, and is beginning to shape government transportation and land use policies, particularly through actions such as FHWA’s Livability Initiative.

The private sector is also addressing sustainability concepts, with increasing effort being placed on creating efficiencies within logistics supply chains. Though some of this is in response to consumer and government demands, it is also driven internally, by the recognition that increased efficiency often results in cost savings – from reduced fuel consumption, reduced vehicle miles traveled (VMT) and other opportunities.

This section discusses the linkages between land use planning and policies on a variety of different aspects of sustainability, including economic development, environmental sustainability and social factors (including livability, equity and justice). For example, in some growing urban areas, local and regional “smart growth” land use policies can result in the relocation of industrial and freight land uses to regional fringe areas, which can result in negative environmental and transportation impacts (increased truck VMT and efficiency) that can run counter to the goals of smart growth. This section also discusses how freight land uses can be integrated into existing land use plans in a manner that maximizes the benefits of freight, while minimizing the negative impacts to communities and the natural environment. Guidance about how to avoid or mitigate the unintended consequences of land use decisions on freight movements is provided.

SECTION ORGANIZATION

This section is divided into the following three sections:

- **Freight and Land Use Sustainability Issues and Implications –** Provides an overview of issues related to freight land uses and the three dimensions of sustainability and identifies the conflicts that can result from land use decisions leading to “freight sprawl” and its impacts on environmental, economic, and social sustainability issues.

FHWA Livability Initiative

According to FHWA, livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. Six guiding principles of livability include:

- *Develop safe, reliable and economical transportation choices;*
- *Promote equitable, affordable housing;*
- *Enhance economic competitiveness;*
- *Target Federal funding toward existing communities;*
- *Coordinate policies and leverage investment; and*
- *Invest in healthy, safe, and walkable neighborhoods – rural, urban, and suburban.*

Source: <http://www.fhwa.dot.gov/livability>.

- **Sustainable Freight Land Use Strategies** – Presents strategies to preserve and restore freight facilities in urban areas and small towns. Examples of freight land use strategies that some areas are exploring and implementing, which uphold the principles of environmental, economic, and social sustainability are discussed in this section.
- **Summary and Conclusions** – Reviews the key findings from this section and discusses elements that will be incorporated into final section of this guidebook.

3.2 Freight and Land Use Sustainability Issues and Implications

Freight transportation and land use systems have impacts on all three dimensions of sustainability – social, environmental, and economic. Issues such as emissions reductions and climate change impacts, job creation and preservation, and community impacts of freight are some of the current issues relevant to freight land use sustainability. This section provides an introduction to the freight and land use issues relevant to each aspect of sustainability and lists the sustainability implications of freight land use trends and decisions.

In many communities, “traditional” land use policies, many of which have been in place for decades, encourage sprawling development on greenfields and disinvestment from traditional urban core areas and small towns. High-property values and/or “not-in-my-back-yard” (NIMBY) sentiments regarding freight have often led to the reclamation of existing industrial and freight land uses (particularly where the land is vacant or underutilized) for residential or recreational uses, and an exclusion of new freight land uses in growing communities. Combined with economic factors such as real estate values, these practices have, in many places, encouraged freight land uses to locate, or relocate, farther and farther away from population centers where the goods are consumed, resulting in a phenomenon known as “freight sprawl.”

While removing freight land uses from populated areas ensures that there will be fewer freight impacts on communities that abut freight facilities, there are many impacts that such policies introduce or exacerbate, though likely unintentionally. In addition, poor planning for freight facilities located in urbanized areas can result in negative impacts on nearby residents, some of these communities could be low-income or minority populations which brings up environmental justice issues. The potential ramifications of land use policies which exclude freight impact all three aspects of sustainability environmental sustainability, economic development, and social factors.

ENVIRONMENTAL SUSTAINABILITY AND IMPLICATIONS

Measures to improve the environmental aspect of freight sustainability seek to diminish the environmental footprint of freight operations. Among other impacts, the movement of freight contributes to regional and local air and water pollution – in particular along high-volume freight facilities, corridors, and at large freight generating land uses. The buildings and infrastructure of freight facilities and operations can disrupt habitat and can contribute to the loss of green and open space. Therefore, efforts to reduce the impacts of freight often focus on the reduction of freight-related emissions, by good site design and practices that minimize the impacts and runoff from freight facilities, by creating more fuel-efficient freight vehicles and facilities, and by recognizing and addressing climate change impacts.

Freight movement and freight facilities can impact the natural environment in many different ways. The movement of freight contributes to regional and local air pollution – both from runoff from freight land uses and from particles emitted in the combustion process. The buildings and infrastructure of freight facilities and operations can disrupt habitat and can contribute to the loss of greenspace and open space. Other potential environmental impacts of freight land use decisions include:

- “Freight sprawl” can result in greater VMT and related congestion and emissions impacts, as trucks must travel greater distances between port and rail terminals in older industrial areas, and distribution centers and warehouses located farther into the exurban and rural areas. This phenomenon may also result in longer return trips to customers located either in the metropolitan area or other exurban locations.
- Poorly planned freight hubs and systems create congestion, causing delays and increasing costs for fuel and time. In addition, poorly planned freight systems create congestion that affects other users of the transportation system, increasing delays, fuel use, and costs.
- The emissions from the movement of freight (PM, Ozone, Carbon Dioxide, and others) directly impact the natural environment, human health, and property. In addition, these emissions also contribute to regional and atmospheric changes that can exacerbate acid rain, ozone depletion, damage to crops, plants, and property, and contribute to global warming concerns. Sprawling land development can result in longer trips (increased VMT) and hence, more PM and GHG emissions.

- Expanding or relocating freight facilities may require a conversion of land from greenspace to industrial facilities. Greenspace can prevent soil erosion and absorb rainwater, and help to improve drainage and avoid flooding. Trees and shrubs can absorb pollution and reduce the urban heat island effect, and provide a buffer zone that can help reduce noise pollution. In addition, greenspace serves as a valuable recreational space to play, gather, and rest. It has also been shown to raise property values and protect the livability and vitality of communities.
- Land uses associated with freight facilities and corridors have the potential to negatively impact water supply in several ways. If done improperly, without adherence to environmental regulations, fueling, maintenance, cleaning, and other routine operational activities can lead to pollutants in surrounding surface and ground waters and soils.
- The land uses associated with freight facilities and movement often consists of large amounts of impervious surfaces which can lead to increased non-point source storm water runoff into surrounding waterways. Though new buildings are typically required to meet specifications regarding runoff and ground cover, many existing facilities may not meet those requirements.

Emissions Reductions

Emissions from the movement of freight can have serious impacts on public health, as well as on the natural environment. From the public health perspective, the presence of emissions have been linked to health conditions, including: reduced lung function, asthma and other respiratory illnesses, increased risk of cancer, and premature death (especially in vulnerable groups such as children and the elderly). Diesel exhaust from freight vehicles is a primary source of several health-harming emissions, including:

- **Particulate Matter (PM)** is divided into two subcategories: PM_{10} (particles between 2 and 10 microns in diameter); and $PM_{2.5}$ (particles less than 2.5 microns in diameter). Freight is a significant source of PM. In fact, the transport sector is responsible for over one-half of all PM_{10} emissions,⁵⁶ and freight sources comprise 51 percent of that total (not including off-road diesel equipment, some of which is used for freight applications).

⁵⁶ U.S. EPA 2005 National Emissions Inventory.

- **Oxides of nitrogen (NO_x) emissions**, which, when combined with Volatile Organic Compounds (VOC), light, and heat, produces Ozone.
- **Ozone** is a pollutant that is a significant health risk, especially for children with asthma and the elderly. It is also the main contributor to urban smog.

In addition to these public health impacts, freight emissions comprise close to one-third of U.S. transportation greenhouse gas (GHG) emissions, and have grown by more than 50 percent since 1990.⁵⁷ Efforts to reduce the emission of harmful pollutants and GHGs into the atmosphere include:

- Transportation demand management strategies to reduce the amount of vehicle miles traveled (VMT) by offering and incentivizing the use of alternative transportation modes.
- Transportation system management to improve the efficiency of transportation system operations, reduce congestion and bottlenecks (which can cause emissions “hot spots” from the high concentration of idling vehicles).
- Advanced vehicle and fuel technologies to reduce exhaust and evaporative emissions from truck, locomotive, and marine engines.
- Regulatory measures, such as the U.S. DOT and Environmental Protection Agency (EPA) proposed “Greenhouse Gas and Fuel Efficiency Standard”⁵⁸ for trucks and buses, the first national standards aimed at GHG emissions. If implemented, the standards could result in significant fuel and cost savings over the life of a truck or bus vehicle.

Understanding and Responding to Climate Change Impacts

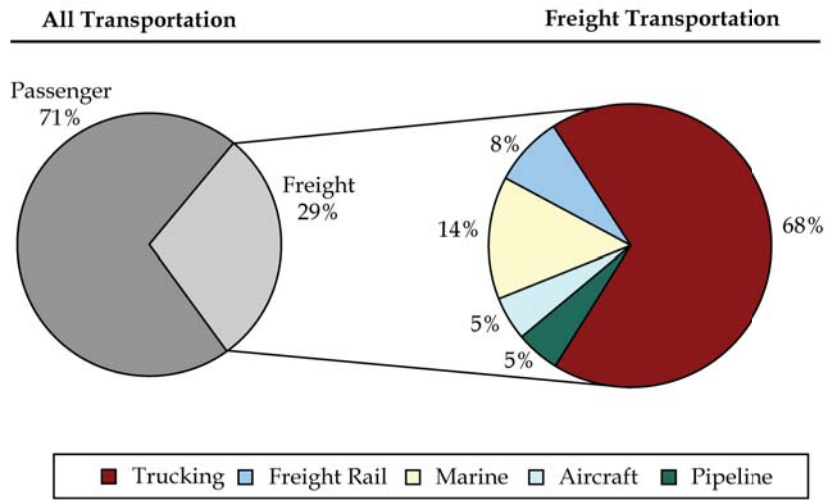
The emissions from the movement of freight contribute to regional and atmospheric changes that can exacerbate acid rain, result in damage to crops, plants, and property, and contribute to global warming concerns. Although there is little documentation of the specific effects of freight movement on climate change, much work has been done on the transportation-sector’s contribution as a whole to global warming, including freight.

⁵⁷ Federal Highway Administration. Freight and Air Quality Handbook, May 2010.

⁵⁸ <http://www.epa.gov>.

Recent estimates (Figure 3.2) suggest that direct transportation emissions are responsible for 29 percent of total U.S. GHG emissions. Of that total, approximately one-third comes from freight sources,⁵⁹ through key emissions, including Carbon dioxide (CO₂), Hydroflourocarbons (HFC), Nitrous oxide (N₂O) and Methane (CH₄). CO₂ alone accounts for 95 percent of total transportation-related GHG emissions.⁶⁰

Figure 3.2 U.S. Transportation-Sector GHG Emissions by Mode



Source: Cambridge Systematics, Inc. Analysis of U.S. EPA Emissions Data Program.

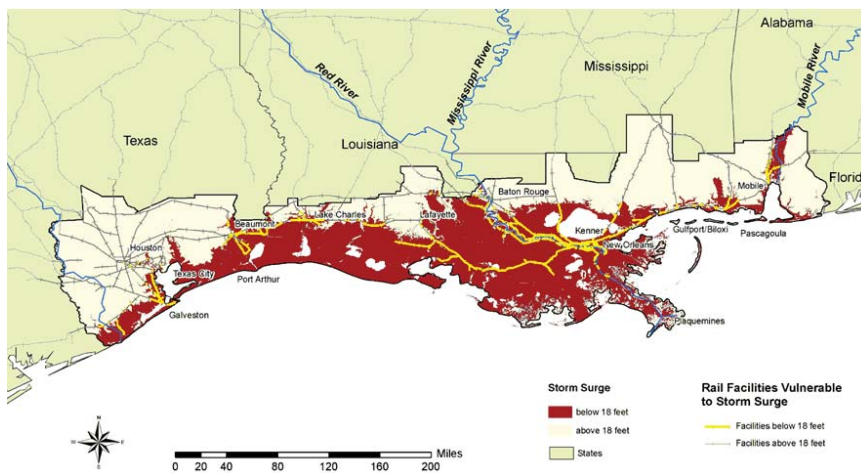
In the long run, climate change may have significant impacts on the freight transportation system as well. Increased precipitation, accelerated relative sea-level rise, and increased intensity of storms, including hurricanes, can negatively affect freight systems by exposing them to higher frequencies of flooding, potential rises in road and rail buckling due to heat, potential increases in subgrade erosion in flooded areas, and increased delays due to inclement weather. Erratic and severe weather affect the ability to move goods and to assure adequate safety in moving freight through the system. Beyond controlling emissions to reduce transportation’s contribution to climate change, the transportation sector will increasingly need to adapt to its effects by designing infrastructure to survive more severe climate conditions, achieving strategic redundancy in the transportation system to allow for the use of alternate routings when weather events or other emergencies

⁵⁹ Cambridge Systematics analysis of the U.S. EPA emissions data.

⁶⁰ Most human-produced CO₂ is the product of fossil fuel combustion.

compromise components of the system, and including disaster and climate change in scenario and emergency planning activities at the state, regional, and local levels.⁶¹ As shown in Figure 3.3, some transportation agencies are taking inventory of freight transportation facilities that are vulnerable to climate change impacts such as rising sea levels and storm surge brought on by hurricanes and tropical storms.

Figure 3.3 Impact of Sea-Level Rise and Storm Surge on Rail Facilities in the Gulf Coast Region



Source: U.S. DOT, USGS, 2008.

ECONOMIC DEVELOPMENT ISSUES AND IMPLICATIONS

The economic component of sustainability strives to achieve an economic model in which the actions taken in the present will not diminish the prospects of future generations to enjoy the levels of consumption, wealth, utility, or welfare enjoyed in the present.⁶² As noted during the TRB Conference Proceedings Report 37 on Integrating Sustainability into the Transportation Planning Process, “this is the crux of sustainable development – how to have economic growth without environmental

⁶¹ “Climate Change Impacts,” U.S. Department of Transportation, available from: <http://climate.dot.gov/impacts-adaptations/forcasts.html>.

⁶² “Sustainability,” The New Pelgrave Dictionary of Economics, available from: http://www.dictionaryofeconomics.com/article?id=pde2008_S000482&edition=current&q=sustainability&topicid=&result_number=1.

decay.”⁶³ In the short term, jobs and growth tend to be the most important drivers of decisions at the local, state, and Federal level, and economic development plans attempt to ensure that a state, region, or city’s economy remains robust and diverse and that prosperity enjoyed today continues into the future. The challenge is ensuring that sustainability objectives are injected into real-world decision-making and the planning process. While economic growth initiatives to attract new business are included in many economic development plans, preserving existing economic activity also is an important part of an economic development strategy. Industrial preservation programs, an example of which is discussed later in this section, seek to maintain the viability of industrial land uses in the face of pressures to remove those land uses – such as rising land values and encroachment by other types of land uses. Implications of freight land use decisions impacting economic sustainability include:

- Freight is a tremendously important aspect of any region’s economy. The 2004 *Metropolitan Transportation Commission (MTC) Regional Goods Movement Study*, for example, found that goods movement industries play a critical role in the economy, and that 37 percent of San Francisco Bay Area economic output is in manufacturing, freight transportation, and warehouse and distribution businesses.⁶⁴ These are the sectors employed in the production and movement of products, part, and raw materials. The retreat of freight land uses from population centers could reverse economic development by reducing economic activity in several sectors (such as manufacturing and distribution), and weakening an area’s economic diversity. The economic impact would extend to social impacts, as the retreat of industrial facilities would remove employment opportunities for area residents and potentially affect access to products.
- When a former industrial facility is redeveloped into a residential or recreational facility, the new residents may experience substantial impacts, such as pollutant emissions, noise and light pollution, etc., from the remaining freight activity. Additional encroachments may change the character of the neighborhood from industrial to residential and threaten the viability of the remaining industrial uses.

⁶³ Thomas B. Deen Keynote Address, TRB Conference Proceedings Report 37 on Integrating Sustainability into the transportation planning process. <http://onlinepubs.trb.org/onlinepubs/conf/CP37.pdf>.

⁶⁴ Regional Goods Movement Study for the San Francisco Bay Area, MTC (2004).

SOCIAL ISSUES AND IMPLICATIONS

The social dimension of sustainability takes on the need to address human needs fairly and efficiently.⁶⁵ This relates to livability and human rights issues and achieving better standards of living for disadvantaged populations while enhancing the quality of life of all populations. With respect to freight and land use, social issues can be apparent in negative freight facility and transportation impacts on residential areas, including those that impact disadvantaged populations. The location of freight facilities may also negatively affect workers' access to jobs, especially for workers who do not have access to a personal vehicle and must rely on public transit. Accessibility within communities for delivering products is also important to livability (safety, etc.) and availability of essential products at reasonable costs. Sustainable freight land use practices that address these issues are presented later in this section.

Externalities associated with the goods movement industry can negatively impact nearby residents. Increasing truck and train traffic can bring noise, increased air pollution, truck parking and safety concerns, and congestion impacts. Residents near ports, distribution centers, manufacturing facilities and other freight generating land uses can be impacted by light and noise pollution from 24-hour operations. Community impacts can overlap with social issues, including environmental justice⁶⁶ and equity concerns because communities with large proportions of disadvantaged populations tend to suffer disproportionate negative environmental impacts. Some of the potential community and social impacts of freight land use decisions include:

- Community safety-related impacts from truck movements can include injuries, and crashes, hazardous materials incidents, and security concerns. According to the Federal Motor Carrier Safety Administration (FMCSA), there were 3,380 fatalities from large truck crashes in 2009.⁶⁷

⁶⁵ "Policy Guide on Planning for Sustainability," American Planning Association, available from: <http://www.planning.org/policy/guides/pdf/sustainability.pdf>.

⁶⁶ In 1994, Executive Order 12898 defined Environmental Justice (EJ) as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income."

⁶⁷ "2009: Historic Truck Crash Declines," Federal Motor Carrier Safety Administration, 2010.

- The (re)location of freight facilities from urban corridors can result in negative transportation impacts. For example, it may increase the vehicle miles traveled by trucks which have to dray freight between terminals such as ports, airports, and intermodal terminals and distribution centers or receivers. If these facilities are located far apart, trucks have to travel longer distances. In addition, locating facilities away from urban corridors could result in a smaller local labor pool and potentially long commutes for employees traveling from urban areas or small towns farther away. In addition, the lack of transit service may make it difficult for employees who lack access to a personal vehicle.
- Environmental Justice (EJ) refers to equitable distribution of benefits and burdens of government policies, programs, and investments, and the avoidance of disproportionate burdens on low-income and minority populations. Often, freight facilities are located near communities whose populations are predominantly low-income and/or minority. While freight facilities provide employment opportunities and local tax revenue, the external impacts on nearby communities should be reduced or mitigated.
- Expanding freight operations or infrastructure in these communities requires taking strategies to reduce or mitigate impacts into consideration.⁶⁸
- Rail safety concerns tend to be concentrated around at-grade crossings (where the potential exists for vehicular/train interactions) as well as the issue of rail carrying HazMat material. Pipelines carrying oil and other potentially hazardous material traverse through residential areas, creating a situation that is generally safe, but has the potential for catastrophic incident.
- Congestion is a recurrent problem in many regions throughout the nation. Apart from the economic cost of time lost to delay, there can also be public health consequences. Traffic congestion has been linked to negative health effects caused primarily by stress – hypertension, headaches, and weakened immune system.
- Air pollution from transportation sources presents a health risk as well. Emissions of nitrogen oxides and volatile organic compounds (VOC) in diesel fuel transform into ozone, which contributes to the

⁶⁸ “Envision Freight: A Roadmap to Freight Compatibility,” Transportation Research Board, 2010, available from: <http://www.envisionfreight.com>.

buildup of greenhouse gases (GHG) in the atmosphere and could contribute to climate change. Particulate matter from road dust and engine exhaust can be a contributing cause for asthma.

- Noise pollution is described by the EPA as “unwanted or disturbing sound.” In terms of freight movement, noise pollution complaints generally focus on truck sounds (including braking, loading, and engine sounds), train whistles, horns and movement, the sound of air cargo planes, or the sounds that tend to accompany industrial land uses. Noise pollution can have major consequences to people’s health. Problems can include annoyance, sleep disturbance, reduced productivity, hearing loss and tinnitus, cardiovascular disease, and effects on the immune system, among others. Noise induced Hearing Loss (NIHL) is the most common health impact,⁶⁹ though research has shown that there are numerous other negative impacts on public health.
- Light pollution has been linked to such adverse health outcomes as headaches, carcinoma and other cancers, sleep deprivation and associated health effects such as decreased mental capacity, a compromised immune system, depression, hypertension, and weight gain. Light pollution can also have environmental consequences such as disrupting delicate ecosystems by confusing animal navigation or changing predator-prey relationships. It can also waste energy if not being used for an active and necessary purpose.⁷⁰

⁶⁹ <http://www.epa.gov/air/noise.html>.

⁷⁰ Chepesiuk, P., “Missing the Dark: Health Effects of Light Pollution,” *Environmental Health Perspectives*, National Institute of Health, January 2009.

Example of Addressing Air Quality Impacts in a Region – The San Pedro Bay Ports Clean Air Action Plan (CAAP) – Los Angeles and Long Beach, California

The San Pedro Bay Ports Clean Air Action Plan (CAAP) is an emissions reduction plan adopted by the ports of Los Angeles and Long Beach to improve air quality in the Los Angeles basin by implementing strategies to reduce port-related emissions from ships, trains, trucks, terminal equipment, and harbor craft. Although the San Pedro Bay ports are a significant source of diesel emissions in the region, the Federal and state governments have no authority over many port emissions sources (such as foreign-flagged vessels), so the ports can employ emissions strategies that other entities cannot.

The CAAP is a collaborative program that has been endorsed and adopted by both ports. Getting both ports on-board was critical because port tenants need assurance that they would not be subject to different requirements at each port. The plan also has the support of the South Coast Air Quality Management District, EPA, and California Air Resources Board. The CAAP is a five-year plan, but it also has a long-term component that describes how five-year emissions reduction actions would be integrated into port operations over the long term, and their expected impact on emissions. The plan targets PM emissions, but SO_x and NO_x reductions are secondary goals.

The CAAP focuses on three implementation strategies:

- *Tenant Leases. Whenever new development occurs on port property, the port works with the tenant to put mitigation measures into the lease. When port tenants amend or renew their leases, the port must comply with the California Environmental Quality Act (CEQA) and the NEPA (if applicable). The CAAP serves as the guiding document for developing mitigation strategies during the Environmental Impact Statement (EIS) and the state-required Environmental Impact Report (EIR) phases of the project. The port then negotiates with the tenant to incorporate feasible mitigation measures into the lease. Measures that are not feasible for the tenant to undertake become the responsibility of the port. Examples of mitigation measures placed in a lease include requiring the use of shore power by ships berthed at the terminal and tenant adoption of clean yard equipment.*
- *Incentives. The ports provide monetary incentives to retrofit older trucks accessing the terminals with emissions control devices, or replace them with new, cleaner models. This approach has been effective since trucks often access multiple terminals and are outside of the control of any one tenant. There also are incentives to use ultra low sulfur diesel (ULSD) and to reduce vessel speeds when approaching the ports.*
- *Tariffs. The CAAP calls for tariff changes to encourage the adoption of emissions reduction strategies by vessels calling on the port, but to date these have not been implemented largely because of the economic downturn.*

Source: <http://ops.fhwa.dot.gov/publications/fhwahop10024/sect1.htm>.

3.3 Sustainable Freight Land Use Strategies

To offset sprawl, urban and small town disinvestment, and related impacts, many local and regional government agencies are adopting sustainable land use strategies, including strategies to accommodate freight in urbanized areas, and to develop freight facilities in clusters, to reduce the environmental and community impacts while providing benefits from freight transportation (cost of goods, accessibility of goods, accessibility of jobs) In addition to the “good neighbor” strategies such as efficient truck routing and facility design to avoid and minimize neighborhood impacts identified in Section 2.0, examples of sustainable freight land use strategies include industrial preservation, brownfields redevelopment, and freight villages.

INDUSTRIAL PRESERVATION

One sustainable practice is to implement strategies that preserve the viability of existing freight land uses. It is important for cities and towns to maintain a mix of land uses and to provide employment opportunities for residents and accessibility for goods movement. Industrial areas can be preserved by designating manufacturing or industrial districts. Such district designations ensure that there is a “place” for such land uses in the municipal code.

The designations can be accompanied with zoning codes that ensure that industrial land uses remain separated from incompatible land uses, and to restrict the encroachment of residential and other incompatible uses on the industrial districts. This could include form-based zoning or performance zoning,⁷¹ the latter which specifies the intensity of land uses that are acceptable. A good example of this is the City of Chicago,⁷² which has designated 35 industrial corridors, a designation that commits the City to maintain infrastructure and zoning that supports industrial activity along the corridors. As part of this, a special zoning designation called “Planned Manufacturing Districts (PMD)” was developed. PMD is a special zoning designation for a defined geographic area that limits the types of development that may occur in the area to industrial activity and other compatible land uses. Ten PMD sites have been identified along the 24 corridors.

Any industrial zoning code should also include provisions that require context sensitive solutions, such as lighting requirements, buffers, etc., (as recommended in Section 2.0) to limit the external impacts of freight and industrial land uses on adjacent land uses. Additionally, it is important to preserve freight access to multiple modes of transportation, for the sake of transportation system redundancy, freight transport efficiency, and modal balance. Therefore, freight land uses with a combination of highway, rail, water, and air access offer particularly strategic opportunities.

⁷¹ Detailed description of different types of zoning codes, including Zoning Overlay Districts, form-based zoning, and performance zoning is included in Chapter 3 of this Handbook, Section 3.1.

⁷² Chicago Metropolis 2020: The Metropolis 2020 Freight Plan: Delivering the Goods, 2004.

Example of Industrial Preservation – The Puget Sound Regional Council’s (PSRC) VISION 2040 – Seattle, Washington

Seattle, Washington: The PSRC VISION 2040 demonstrates how proactive land use planning can shape a desired future scenario for freight land uses and preserve the viability of those uses in an urban environment.

VISION 2040 is a regional strategy for accommodating an additional 1.7 million people and 1.2 million new jobs expected to be in the region by the year 2040. The plan is an integrated, long-range vision for maintaining a healthy region – promoting the well-being of people and communities, economic vitality, and a healthy environment. It contains an environmental framework, a numeric regional growth strategy, and six policy sections guided by overarching goals.

Recognizing that industrial land uses generate a significant share of the region’s employment, VISION 2040 designated 21 desired growth areas, including 8 industrial and manufacturing centers. The industrial and manufacturing centers are areas in which clusters of freight generating industries are located. One goal of VISION 2040 is to preserve the industrial and manufacturing centers, and to continue to provide adequate public services. VISION 2040 includes an implementation strategy, which will monitor the vital signs of each of the industrial and manufacturing centers (such as employment, number of facilities, etc.), comparing them to performance goals, and evaluating the success of the implementation program.

Source: <http://psrc.org/growth/vision2040/pub/vision2040-document/>.

BROWNFIELDS REDEVELOPMENT

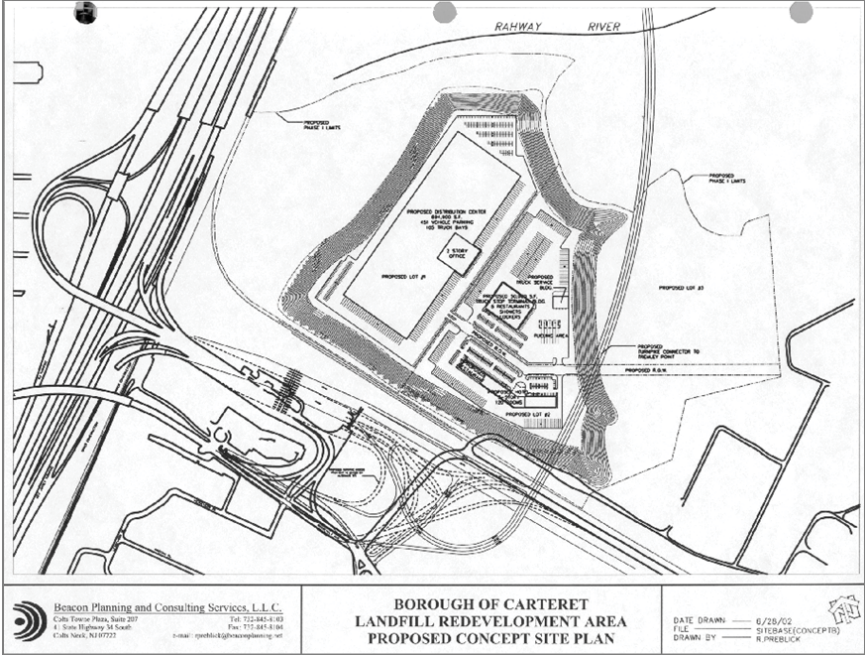
While much of the growth in freight land uses in recent decades has occurred at the fringe of metropolitan areas throughout the country, there are increasing pressures to develop or redevelop industrial and distribution land capacity near major seaports, intermodal terminals, and other freight hubs, which are often located in urban areas, to support growing international trade and domestic consumer demand. Brownfields, which are abandoned, vacant, or underutilized industrial parcels, represent opportunities for redevelopment to accommodate growth in freight land use demand. Many freight developers are recognizing the transportation costs associated with serving markets from distant facilities and desire locations closer to major freight terminals and consumer markets. Planners are recognizing the potential to restore urban and small town employment and opportunities to clean up contaminants that present health and environmental hazards and to restore sites to active use.

Developing or redeveloping brownfield sites for modern freight-supporting uses such as industrial or distribution centers does not come without challenges, since many brownfields may be desirable to residential developers, especially in waterfront locations or areas in close proximity to downtowns. It is important that planners recognize that in some cases, “highest and best use” does not mean luxury residential development, but that supporting freight facilities is of importance to a municipality, county, and region.

Because brownfields are former industrial sites, they are often linked or in very close proximity to freight rail and water port terminals, and are typically surrounded by other industrial land uses, minimizing the potential for impacts on residential neighborhoods. In addition, Brownfield sites usually provide an opportunity to redesign the area to meet current transportation needs. Brownfield redevelopment comes with many challenges, however, including the potentially high costs of remediating contaminated sites. Successful brownfields redevelopment strategies require comprehensive planning that includes land use, transportation and freight needs and impacts, streamlining of review and permitting processes, and the offering of incentives to offset the cost of remediation costs.⁷³

⁷³ “Brownfield Economic Redevelopment: Preparing Modern Intermodal Freight Infrastructure to Support Brownfield Economic Redevelopment,” North Jersey Transportation Planning Authority and the New Jersey Institute of Technology, 2003; “Brownfields and Land Revitalization,” U.S. EPA, available from http://epa.gov/brownfields/basic_info.htm#plan.

Figure 3.4 Conceptual Site Plan for the Redevelopment of a Brownfield Site into a New Distribution Center Facility



Source: North Jersey Transportation Planning Authority and New Jersey Institute of Technology, 2001.

FREIGHT VILLAGES

A freight village is a defined area, often master-planned, within which all activities relating to the transport, logistics and distribution of goods are carried out by various operators. Freight villages are effectively clusters of freight and logistics facilities where any number of supply chain activities (such as consolidation, value-added activities, and transloading) occur within the boundaries of the district. Often, freight villages include support services such as truck rest areas, banks, customs for international cargo, restaurants, and vehicle repair services. Freight villages come in many shapes, sizes and combinations of facility types, and can be applied in urban and suburban environments. The freight village concept originated in Europe in the 1960s, and includes examples in Barcelona, Paris, and The Netherlands. Alliance, Texas is a good example of an existing “freight village” in the United States. Several addition freight villages are also under consideration, including a potential freight village at Tremley Point in Linden, New Jersey and a possible Harlem River freight village in the Bronx in New York.

The sustainability benefits of freight villages include reduced truck VMT due to the close geographic proximity of different supply chain components (intermodal terminals, distribution centers, etc.) and associated benefits, employment opportunities and “spin-off” economic activity generated by the supporting land uses such as banks and restaurants. Freight villages that incorporate multimodal terminals can also encourage freight to use alternative modes.⁷⁴

Example of Brownfields Redevelopment – The North Jersey Transportation Planning Authority (NJTPA) and New Jersey Institute of Technology (NJIT) Brownfield Economic Redevelopment Study

The NJTPA and NJIT Brownfield Economic Redevelopment Study identified public sector initiatives that could help spur redevelopment of many abandoned and underutilized industrial sites in the region.

Recognizing that “freight sprawl” was having a noticeable impact on traffic congestion and quality of life in the northern New Jersey region, and anticipating a significant increase in port-related freight volumes traveling into the region (which would require more freight-supporting land-uses), the NJTPA and NJIT conducted a study to identify the potential for redeveloping brownfield industrial sites near the port terminals and the region’s population core. The study quantified the expected growth in container traffic and the associated demand for warehouse and distribution space, and gave specifications for the needs of modern facilities. An analysis of potential sites and government land use and environmental policies identified the potential for redeveloping brownfield sites in the region.

The study found that at least 2,500 acres of brownfield sites suitable for freight-related redevelopment existed within just 10 miles of the seaport, and thousands of additional acres existed up to 25 miles away. The sites ranged in size from a dozen to more than 100 acres, and many had desirable highway access and were located away from sensitive residential land uses.

The study showed that while some state policies encourage brownfield redevelopment (such as a fund that reimburses developers up to 75 percent of the site cleanup costs), there are many barriers to redeveloping brownfields, including a lack of coordination between government agencies at the state and local levels, conflicting requirements, delays caused by multiple reviews, and high costs for permitting and plan approvals. The study recommended policy changes and a number of transportation, environmental and planning recommendations to facilitate brownfield redevelopment.

The NJTPA and NJIT Brownfield Economic Redevelopment Study is an example of a regional visioning and planning tool to help the region identify the potential for reclaiming fallow industrial lands and to accommodate freight land uses in a more sustainable configuration.

Source: <http://www.njtpa.org/plan/Element/SmartGr/Brownfields/BERfinalreport.aspx>.

3.4 Summary and Conclusions

Sustainability is a concept that is increasingly entering discussions of freight movement and freight generating land uses. Sustainability is often defined as contributing to environmental sustainability, economic development, and environmental justice. Therefore, the concept of sustainable freight is one that maximizes the positive features of freight movement (jobs, economic development, etc.) while minimizing the negative impacts to communities and the natural environment. Though

⁷⁴ “Feasibility of Freight Villages in the NYMTC Region,” New York Metropolitan Transportation Council, available from: http://www.nymtc.org/project/freight_planning/freight_village.html.

there are many actions being taken at the state and Federal level to build sustainability into the planning process, challenges remain. This section has outlined some of the challenges, issues, and opportunities involved with achieving sustainability in the planning process. Section 4.0 will discuss, in more detail, some of the ways that these needs could be better integrated into the planning process, freight, land use, and sustainability impacts and needs of freight:

- The private sector is increasingly addressing sustainability concepts, with special focus on creating efficiencies within logistics supply chains. Though some of this is in response to consumer and government demands, it is also driven internally, by the recognition that increased efficiency often results in cost savings – from reduced fuel consumption, reduced truck VMT and other opportunities.
- The environmental component of sustainability includes impacts to the natural and human environment. The movement of freight contributes to regional and local air and water pollution, can disrupt habitat, and can contribute to the loss of green and open space. In addition, freight emissions comprise close to one-third of U.S. transportation GHG emissions, and have grown by more than 50 percent since 1990.⁷⁵ GHG emissions have been linked to environmental trends, including global warming, sea-level rise, and increasingly unpredictable weather patterns.
- Emissions from the movement of freight can have serious impacts on public health. The presence of emissions have been linked to health conditions, including: reduced lung function, asthma and other respiratory illnesses, increased risk of cancer, and premature death (especially in vulnerable groups such as children and the elderly).
- The economic component of sustainability strives to achieve an economic model in which the actions taken in the present will not diminish the prospects of future generations to enjoy the levels of consumption, wealth, utility, or welfare enjoyed in the present. This is a particular challenge, as many local and regional plans tend to focus on short-term economic development (job creation) and growth.

⁷⁵ Federal Highway Administration. Freight and Air Quality Handbook, May 2010.

- The social dimension of sustainability takes on the need to address human needs fairly and efficiently.⁷⁶ This dimension relates to livability and environmental justice issues and achieving better standards of living for disadvantaged populations while enhancing the quality of life of all populations. Important issues include ensuring the safety of the movement of freight, as well as minimizing the noise, light, and air pollution from freight land uses on their neighbors and providing access to affordable goods.

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. In addition to the “good neighbor” strategies such as efficient truck routing and facility design to avoid and minimize neighborhood impacts identified in Section 2.0, examples of sustainable freight land use strategies include industrial preservation, brownfields redevelopment, and freight villages.

⁷⁶ “Policy Guide on Planning for Sustainability,” American Planning Association, available from: <http://www.planning.org/policy/guides/pdf/sustainability.pdf>.

4.0 Accounting for the Impacts and Needs of Freight

4.1 Purpose and Content

While the private and public sectors try to respond to rapidly and ever-changing industry needs, the transportation planning community wants to better guide transportation investment to support economic and freight needs. States and regions are identifying ways to increase their ability to compete regionally, nationally, and globally. This includes coordinating investment to support new industries and understanding their changes in land use patterns and freight transportation needs. It is important for freight to be a “good neighbor” in its host communities, as described in the previous section, and land use and zoning policies also have to account for the needs of freight transportation. These needs include access, on-site circulation, building size and use needs, geometric requirements for trucks and/or railcars, adequate truck parking and loading areas or sidings and/or working tracks for railcars, and security provisions. Freight and community needs are not necessarily mutually exclusive. In fact, the needs of the private-sector freight community may align well with local and regional sustainable development strategies. Concepts such as industrial preservation, brownfield redevelopment, and freight villages, presented in Sections 2.0 and 3.0, could serve as “common ground” strategies through which the needs and aspirations of freight and planning agencies and stakeholders can be achieved. This section will provide an understanding of freight needs, land use and transportation planning practices, and opportunities to implement sustainable freight land use and transportation strategies.

SECTION ORGANIZATION

This section is divided into the following three sections:

- **Freight Carrier/Shipper Land Use Needs** – Identifies the site selection criteria and site design features that are required for safe and efficient freight operations.
- **Land Use and Transportation Planning Tools to Address Freight Needs and Impacts** – Examines the transportation and land use planning processes and identifies strategies and action steps aimed at engaging private-sector stakeholders and incorporating freight needs into the planning processes.

- **Putting It All Together** – Demonstrates, through a series of detailed case studies, how cities and Metropolitan Planning Organizations (MPO) have addressed freight needs and incorporated sustainable principles into their land use planning processes.

4.2 Freight Carrier/Shipper Land Use Needs for Efficient and Safe Goods Movement

Freight shippers and carriers have a variety of needs that, if not met, can have critical impacts on efficient and safe goods movement. This section focuses on the nexus between freight needs and land use planning and activities, which is followed by a discussion on how to take action at the local, regional, state, and private-sector level to address these needs through various methods and through integration into plans and processes. Shipper and carrier land use needs vary by region and activity type.

TRANSPORTATION AND LOGISTICS PHYSICAL AND OPERATIONAL NEEDS – CAPACITY AND RELIABILITY

The most fundamental physical requirements for conducting freight operations are adequate freight system capacity and maintenance. This includes both capacity and maintenance on general freight infrastructure (such as interstate highways and railways) as well as in terminals and logistics centers such as rail yards, seaports, airports, and distribution centers. In this discussion, capacity refers primarily to freight system congestion and proper maintenance to facilitate the movement of goods to improve speed and reliability and reduce costs. Low congestion and proper maintenance are critical to shippers and carriers, as these factors impact travel time and reliable operations, and therefore impact cost for both industries and consumers. In areas where congestion and deteriorating infrastructure are the norm, the reliability of the system is eroded and the costs of moving goods between locations will increase. As a result, it is necessary to provide adequate capacity and to adequately maintain the freight system for all applicable modes in order to improve freight efficiency.

SUITABLE LAND FOR FREIGHT ACTIVITIES

Land is an important resource required for all freight transportation activities. A lack of available industrial land can create overcrowded existing facilities or may encourage companies to search elsewhere for locating their business. It also is important that land is available at the right locations. For example, in port communities, some waterfront land

Example of Site Selection Criteria – Roanoke Region Intermodal Facility Roanoke, Virginia

In order to provide both east-west and north-south capacity for freight rail traffic and to improve multistate freight rail facilities, as a part of the Heartland Corridor initiative, Virginia committed to building a new intermodal facility in the Roanoke region. A report was prepared which reviewed 10 sites and made recommendations on where to locate the facility based on the following evaluation criteria:

(a) Proximity and easy access to a major highway (Interstate 81);

(b) Located on the Heartland Corridor's rail line to ensure a competitive time advantage for freight shipments;

(c) Sufficient land available (65 acres minimum if possible), an appropriate site configuration for freight transfer operations, and located on relatively flat topography;

(d) Does not create the need for additional grade separation bridges, particularly in congested urban areas;

(e) To the extent possible, seek to minimize associated roadway costs that might be required; and

(f) Well configured from a rail operating perspective to avoid degrading other rail traffic, result in more efficient rail intermodal operations and result in lower relative facility development or delivery costs.

This provides an idea of the types of variables that developers may take into consideration when selecting a site for a freight facility such as an intermodal facility.

Source: Roanoke Region Intermodal Facility Report, March 2008.

near urban centers should be protected for freight uses or port expansion (if feasible) in order to keep goods close to market and to reduce truck or rail travel time and emissions.

Some of the key desired characteristics of land for development include:

- Access to key markets within a given radius;
- Interaction with the transportation network, meaning efficient and logical connections to interstate highways, railroad terminals, and/or major seaports and airports;
- Workforce availability, skill, and cost;
- Cost environment, including freight and logistics costs, labor costs, utilities, facilities costs, and business, real estate and, in some states, personal property taxes;
- Availability of suitable facilities or developable sites;
- Cooperation from local, state, and Federal agencies regarding permitting and regulations;
- Availability of public assistance and incentives; and
- Perception of low or reduced risk of natural hazards or climate change impacts.⁷⁷

An inventory of land for development potential is critical information for private-sector stakeholders looking to develop, redevelop, expand, or relocate their facilities. In turn, it is important for local and regional governments to take the above freight selection criteria into account when selecting which land to make available for freight-dependent uses.

ADEQUATE LOADING AND STAGING ZONES, PARKING, AND ENFORCEMENT

Freight carriers rely on adequate loading zones and parking to support loading and unloading of goods at freight facilities. Generally, three types of freight facilities exist which have differing loading zone and parking requirements: urban business districts, warehouses and retail centers, and intermodal or marine terminals.

⁷⁷ NCFRP 23, Preliminary Draft Report.

Urban Business Districts

In urban environments in large cities and small town downtowns, where loading docks often do not exist, loading and unloading activities tend to occur curbside or in alleys. Management of the curbside loading/unloading freight activities are typically defined by local zoning or other ordinances. Commercial loading zones tend to be located in front of commercial buildings with designated signage for the loading zone. Curbside loading zones may be enforceable during certain periods of the day, corresponding with business hours or off-peak delivery periods. Alleys also are points of access to commercial facilities, refuse pick-up, and deliveries at the rear lots. Many alleys are narrower than a two-lane street and may not be wide enough to accommodate tractor-trailer combinations, or may only handle traffic in a one-way pattern, with little or no room to turn around or back into a loading dock or bay. An alley may therefore be “blocked” when a delivery or pick-up is in progress. Some key considerations for managing urban loading areas include:

- **Establish loading zones in areas that are as close to the receiving areas of shipping/receiving businesses as possible** to reduce delivery/pick-up time and disruptions to pedestrian and vehicular traffic that could result from moving goods to and from the truck.
- **Make sure commercial loading zones are designated as being available when demand is highest.** Whether deliveries on a particular street tend to occur during normal business hours or during certain off-peak-periods, the commercial loading zones should be made available to meet the demand. Depending upon the other land uses present in the neighborhood, there may be competing demands for curb space (i.e., shoppers and business patrons may need on-street parking during business hours, while residents may demand on-street parking overnight). Commercial loading zones should be established to meet freight needs while being sensitive to other demands for curbside space.
- **Enforcement of parking and loading rules should be strict.** To ensure that curbside and alley loading space is used effectively without impacts to traffic operations and safety, enforcement of parking and loading rules is critical. Enforcement of vehicle types allowed to park or stand in the loading zones, time limits, and metering discourages parking by passenger vehicles in these loading zones, and encourages trucks to occupy the space for the shortest period of time possible, ensuring that space is available for other trucks. When trucks are unable to find an appropriate place to load or unload, they may find alternative means of making their deliveries

Figure 4.1 Managed Curbside Loading Zone in New York City



or pickups by double-parking, blocking travel lanes or driveways, or parking in other configurations that disrupt traffic flows and could present unsafe conditions for passing traffic.

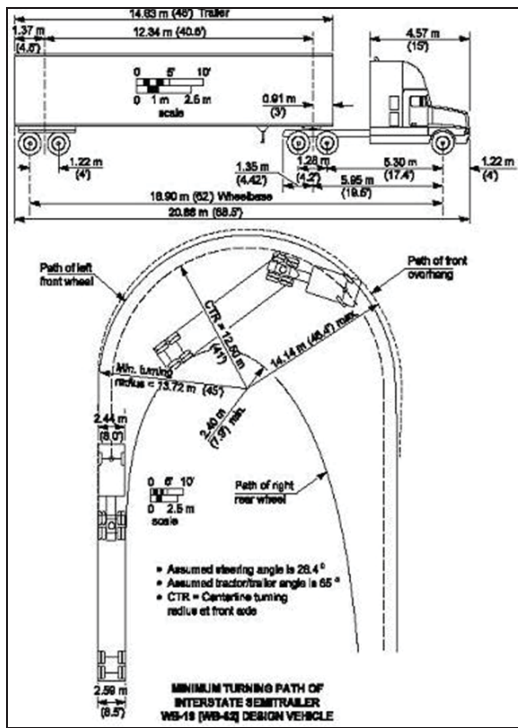
Suburban Retail Centers

In suburban retail centers, such as shopping centers, shopping malls, big box retailers, etc., there is typically more space available to provide adequate loading/unloading and parking areas for trucks. Often, however, retail center site plans are developed with the “customer experience” as the top priority, while freight access, loading areas, and truck parking areas are considered as an afterthought.

Key considerations for freight loading and parking at suburban retail facilities include:

- **Ensure adequate loading dock space for receiving deliveries and for staging outbound shipments.** Anticipated shipment volumes should be considered in the design process. If a possibility that more than one truck may have to pick up or deliver goods at the same time, multiple loading bays should be provided to serve them. Within the building, space for staging outbound shipments and receiving inbound shipments should be provided to expedite the process and to keep trucks at the loading docks for the shortest period of time possible.
- **Ensure adequate space for truck maneuvering.** Providing adequate space for the largest trucks that will serve the facility is a critical consideration that is sometimes ignored. It is important to consider the size of the trucks that will serve the facility. Will all deliveries be made by vans or small box trucks, or will 53-foot trailers need to be accommodated? A tractor-trailer combination with a 53-foot trailer can measure between 70 and 75 feet in length, and require large turning radii and space to move into align the vehicle with the loading bays and back-in or pull-out. The minimum turning radii for a 68.5-foot tractor-trailer combination is shown in Figure 4.2.

Figure 4.2 Minimum Turning Radius Requirement for Interstate Semitrailers



Source: <http://www.fhwa.dot.gov/programadmin/y2kgb2.htm>.

- **Limit interaction with passenger vehicles.** To the extent possible, opportunities to segregate freight traffic with passenger vehicle (customer) traffic on-site should be taken. Loading areas should be located at the rear of retail buildings, away from customer parking and entry points. Loading and customer parking areas may be accessed using separate driveways or access roads.
- **Provide space for trucks to park while awaiting loading or unloading.** If a truck arrives prior to its scheduled delivery window, and it cannot pull up to the loading dock due to the presence of other trucks or because the facility staff are not ready to receive the truck, it will need a place to park and await service. A designated parking area should be provided on-site for this purpose.

Warehouse and Distribution Centers

Warehouses, where goods are stored until demanded, and distribution centers, where goods are packaged, broken-down, or otherwise prepared for shipment to retailers or directly to consumers, are facilities designed for the receiving, handling, and shipment of freight. Warehouses and distribution centers may be located in urban, suburban, or rural

areas, and may be served directly by truck, rail or both. While most warehouses and distribution centers are designed and developed by companies that are experienced in industrial design and understand freight needs, there are several key considerations that public-sector officials should be sure to check for in site plan reviews.

- **Segregate truck and rail traffic.** If a facility is being served by truck and rail, it is important to separate the two modes to the extent possible. Trucks and railcars should be served in separate loading dock areas. In some facilities, railcars and trucks are served from the same loading areas (see Figure 4.3). Such an arrangement causes conflicts, since all of the truck trailers must be moved out of the way in order for railcars to be moved along the track paralleling the loading docks. If a truck access route crosses a rail spur or working tracks, trucks may be subjected to lengthy delays as trains are broken-down, built, or as individual railcars are being positioned. Keeping the truck and rail circulation and working areas separated eliminates the conflicts between the two modes and allows both to operate as efficiently and safely as possible.
- **Ensure adequate loading dock/rail shed space.** Sufficient loading docks for truck deliveries and rail sheds, which consist of spur tracks and loading docks where railcars can be loaded or unloaded, should be provided for truck-served and/or rail-served facilities. Anticipated facility throughput volumes for each mode should be considered in the design process to ensure that sufficient space for delivery of inbound freight, and pick-up of outbound freight can be handled efficiently, so that trucks and trains do not have to idle for long periods, waiting for dock or rail shed space to become available.
- **Ensure adequate space for maneuvering.** Providing adequate space for trucks to move into and out of the loading docks and to circulate through the facility's driveways and access routes is critical. Plan for sufficiently large turning radii and space to move into align the vehicle with the loading bays and back-in or pull-out. The minimum turning radii for a 68.5-foot tractor-trailer combination is shown in Figure 4.2.
- **Ensure adequate space for drilling railcars.** Space for railcars to be handled should also be provided if the facility is being served by rail. The activities of positioning, linking, and breaking-down blocks of railcars are referred to as "drilling." In addition to rail sheds for loading and unloading, working tracks where blocks of arriving railcars can be broken down, and where departing railcars can be linked and prepared for pickup should be provided at or as near to the facility as possible.

- **Provide space for trucks to park while awaiting loading or unloading.** Designated parking areas for trucks to park while awaiting their delivery window should be provided on-site.

Figure 4.3 When Truck and Rail Access Are Not Separated, Inefficiencies (Such as the Orphaned Railcar Shown, Center) Can Impact Operations



Source: Cambridge Systematics, Inc., 2008.

Intermodal and Bulk Transload Terminals

Intermodal terminals are facilities where containerized cargo is transloaded from truck to rail, or vice versa. Bulk transload terminals are facilities where bulk commodities such as aggregates, liquids, gases, and agricultural products, are transloaded from truck or pipeline to rail, or vice versa. These are controlled access facilities for large scale freight operations, which are intended to be accessible by large trucks and long-unit trains. Bulk transload terminals may only require a few acres of land, on which bulk materials are piled or stacked. Intermodal terminals may occupy dozens of acres, with staging areas for trucks or chassis, container storage areas, and working tracks served by cranes. Developers prefer long working tracks of 1,500-2,500 feet in length so that long-unit trains can be assembled and disassembled with few moves.

Marine Terminals

Wait times at such facilities can be long because of high volume during peak pick-up times, drayage movements within the facility, a thorough

security process or for other reasons. As a result of these waits, parking turnover rates can be low, which may require the facility to need a high number of parking spaces. Use of electronic data interchange, automatic vehicle identification and equipment tracking technologies can significantly reduce the wait times at the gate and improve the parking and loading area capacity.

GEOMETRIC SITE DESIGN OF THE FREIGHT SYSTEM

It is important for trucks to be able to move efficiently and safely between their origin and destination points. Many smart growth principles suggest that new neighborhoods be developed with narrow roads, which may have an impact on how effectively trucks move. Height restrictions on trucks vary by state, but usually range between 13.5 feet and 14 feet. The national maximum weight standards for interstate highways are 20,000 pounds for single axle, 34,000 pounds per tandem axle, and a gross vehicle weight not to exceed 80,000 pounds. On state and local roads and older bridges, weight limits could be much lower.⁷⁸ As a result, it is important that freight carriers are aware of height, size, and weight restrictions when moving through different neighborhoods. It also is important for local, regional, and state governments to take into account the size and height of trucks that move through its boundaries early in the planning process. Engaging in a Context Sensitive Solutions (CSS) approach, as described in Section 2.0, which seeks to arrive at solutions that meet the needs of all stakeholders is an approach that FHWA advocates.

Truck dimensions must also be taken into account in industrial, commercial, and freight facility site design. Roadways and driveways within these sites must allow for safe and efficient passage of trucks. Key considerations include:

- **Ensuring sufficient turning radii.** Internal roadways and driveways where trucks are intended to have access must be designed with the minimum turning radii shown previously in Figure 4.2.
- **Vertical clearance.** A minimum clearance of 12 feet, 6 inches should be provided for truck-served sites, with many design guidelines calling for clearances over 13 feet. Rail clearances vary depending upon the type of railcars served. Tanker and hopper cars require clearances as low as 15 feet, while double-stacked intermodal

⁷⁸ “Commercial Vehicle Size and Weight Program,” FHWA, available from: <http://ops.fhwa.dot.gov/freight/sw/overview/index.htm>.

containers require a 22-foot, 6-inch clearance. Bridges, tunnels, overhead utilities and signage, and tree limbs on a truck-served site should be designed to provide sufficient vertical clearance for safe truck movement.

- **Avoid “blind corners.”** Landscaping, building dimensions, and utility infrastructure can hinder visibility and create potentially dangerous situations when drivers in two or more vehicles are unable to see one another. Sites should be designed to ensure that drivers can see where they are headed and so they can identify potential hazards such as oncoming vehicles in advance.

TRUCK PARKING AND REST FACILITIES

The need for truck parking/rest area facilities differs from the earlier parking discussion. This paragraph refers to truck parking facilities along major truck routes and near major freight hubs such as air cargo airports, seaports, and clusters of warehousing/distribution centers and manufacturing facilities to allow truck operators to take breaks and rest while enroute between their origin and destination points. While the need for truck parking/rest area facilities is obvious in order to improve safety for truck operators and for those sharing the road with trucks, land must be made available along major routes to support the projected increase in trucks using highways. A lack of designated truck parking areas can lead to parking in unsafe areas such as highway shoulders, expressway ramps, and desolate parking lots. Parking demand can be met with publicly owned and operated, roadside parking and rest areas, or by off-freeway privately owned truck stops, which typically provide additional services such as restaurants, showers, tractor maintenance and repair services.

State DOT or other highway authorities are typically the lead agencies involved in on-highway truck parking and rest area planning and development, and should work with private stakeholders to confirm truck parking demand and identify opportunities to expand capacity where necessary. Off-highway, municipalities must work with regional and state governments and the private sector to identify opportunities to expand truck parking capacity by utilizing land around freeways and other strategic locations. Public-sector officials also may work with the private sector to incorporate space for truck parking/rest area into the design of industrial and commercial facilities. Some major national retailers, such as Wal-Mart, allow truck drivers to park in their store and distribution center parking areas at many of their stores and distribution centers. Such a parking area could be provided adjacent to the loading area, or in the general (customer) parking area during

Examples – Extending Hours of Operation at Freight Facilities

The U.S. Government Accountability Office (GAO) also suggested the extension of hours of operation at freight facilities to reduce peak hour congestion. Examples cited by GAO:

In New York City, some retail stores have extended hours of operation to receive deliveries after 9:00 p.m. and the City, in turn, has provided incentives to these businesses in the form of special approval of curbside parking for deliveries during off-peak hours.

The Off-Peak program and a fee concept together are implemented through PierPASS Inc. at the San Pedro Bay Ports. All international container terminals at the Los Angeles and Long Beach ports implemented five new shifts per week – Monday through Thursday nights, and during the daytime on Saturdays. In addition, a Traffic Mitigation Fee was created, and is required for cargo movement through the ports during peak hours (Monday through Friday, 3:00 a.m. to 6:00 p.m.). This fee is used as a congestion pricing mechanism providing an incentive to use the off-peak shifts.

The extension of hours of operation at freight facilities can reduce peak hour congestion, but requires the participation of shippers and receivers, who make the decisions regarding when deliveries are to be made. Motor carriers must make deliveries when their customers demand them. For off-peak delivery programs to be successful, those customers must be willing to have staff available or make arrangements to give motor carriers access to their facilities to make deliveries during these off-peak periods.

Source: GAO-08-287 “Freight Transportation: National Policy and Strategies.”

late night hours if the store is closed or experiencing light volumes of customer traffic. Implementing an arrangement for allowing trucks to park on-site may introduce liability and security issues that are unique to state and local laws and conditions, and which will have to be examined and addressed carefully.

One of the key challenges to developing new truck parking capacity is overcoming the impacts that truck parking facilities may have on adjacent residential areas. Because truck parking demand peaks during the overnight hours, the noise, light, and emissions impacts affect residential areas when peace and quiet are desired most. This challenge can often be overcome with smart site selection for truck stop and parking area development, and with implementation of design features to reduce spillover of light and noise. Many truck stops and truck parking facilities are equipped with idle-reduction equipment that allow truck drivers to run electronics and control the climate within their cabs without idling the engine. These technologies reduce fuel consumption and emissions while trucks are at rest. Vendors supply many of the nation’s truck stops and rest areas with stationary power hookups, some of which include Internet and entertainment hookups as well. Many truck stops offer recharging stations for trucks equipped with on-board power units. Agencies should work with motor carriers to take advantage of opportunities to equip fleets with on-board units, and with the agencies and companies that operate rest areas truck stops to make electrification and recharging hookups more widely available.⁷⁹

FLEXIBLE TIMELINES FOR DELIVERY/PICK-UP

Extending the business hours of operation of freight handling facilities creates the opportunity to shift trucks from most congested peak hours of traffic to off-peak hours. Peak-hour congestion results in increased travel times, decreases in the reliability of deliveries, and in turn disrupts delivery schedules and inventory control operating plans in warehousing and distribution facilities. Flexibility in delivery times gives carriers the opportunity to more efficiently utilize the existing highway infrastructure. Flexible delivery times for terminal operators allows for more efficient utilization of freight handling equipment. Receivers that can typically accommodate off-peak deliveries include restaurants, convenience stores, 24-hour big box retailers and grocers, and industrial

⁷⁹ The U.S. Department of Energy web site has a truck stop electrification locator to help planners and motor carriers identify truck stops equipped with electrification technologies, available at: <http://www.afdc.energy.gov/afdc/locator/tse/>.

facilities with two or three labor shifts. Many small businesses which have one labor shift during business hours are not always able or willing to arrange to have staff on-site to receive a delivery during off-peak hours. An off-peak delivery pilot program completed in New York City in 2010 showed that many small receivers were willing to receive deliveries off-peak with the help of small cash incentives or by providing drop-key or key-code access to trusted motor carriers so the deliveries could be made without the receiver's staff being on-site.⁸⁰

SAFETY AND SECURITY CONSIDERATIONS

It is important that safety and security of the public and of goods are taken into consideration when designing terminals and other facilities that ship or receive freight. Intermodal terminals, warehouses, distribution centers, and many industrial facilities are areas where trucks, trains, forklifts, cranes, and other moving pieces of equipment represent potential hazards to workers if precautions and appropriate protocols are not followed. Mishandling of hazardous materials could result in safety risks to the general public beyond the confines of the facility. Failure to secure facilities and goods from theft or vandalism could result in damage to property and harm to facility employees or the public at large. Important attributes to consider include:

- **Keeping unauthorized persons away from the freight activities.** Whether in a retail center where the public have access to portions of the facility, or in a freight terminal where the public are not generally permitted, it is important to ensure that people who are not authorized to be in a working freight area are not permitted to enter. Trespassers run the risk of being harmed if they are unfamiliar with the facility's configuration and potential hazards. Fencing, signage, cameras, and security personnel may be utilized, as appropriate, to protect the facility and discourage trespassing. Some large facilities may effectively separate one part of a community from another. Facility developers and local officials should work together early in the project development process to identify any opportunities to provide alternate means of access (pedestrian bridges over rail yards, pedestrian crossing signals at signalized driveways, etc.) where appropriate.

⁸⁰ New York City Department of Transportation, "NYC DOT Pilot Program finds economic savings, efficiencies for truck deliveries made during off-hours," Press Release # 10-028, July 1, 2010.

- **Ensuring that there is a designated space for each activity** occurring at the facility (processing, shipment consolidation, receiving, loading/unloading, transloading, etc.) to occur safely and without the interference of other activities. When multiple various activities compete for space, equipment, and personnel, product may be left in locations where they do not belong, increasing the risk of accident, misshipment, or damage. Furthermore, loading areas, access routes and driveways, and parking areas should meet geometric guidelines to limit potential conflicts.
- **Terminal/Facility operators must develop a plan with first responders.** Depending upon the size and nature of a facility's operation, the operators should work with first responders, port authorities, the Department of Homeland Security, the Federal Emergency Management Agency, and other applicable local, state, and Federal agencies to develop a plan of response to terrorism, natural or man-made disasters, or other situations that could threaten the security of the facility and/or the general public. The plan should include communications, evacuation, and incident management procedures.

ACCESS MANAGEMENT

Employing good access management techniques on infrastructure at the local level can help improve the efficiency and safety of the transportation and the freight system. Access management involves the proactive management of vehicular access points to land parcels adjacent to all manner of roadways. This presents an opportunity to link transportation and land use for the mutual benefit of freight operators, passenger vehicles and livability in the community. Access management includes the following techniques:

- **Access Intersection and Driveway Spacing** – Much of the congestion and delay on arterial highways results from traffic entering and exiting the highway from closely spaced driveways and intersections. Where possible, new commercial and industrial development should consider establishing a common driveway or access to a side street intersection with the arterial highway among several adjacent parcels. Increasing the distance between traffic signals improves the flow of traffic on major arterials, reduces congestion, and improves air quality and safety for heavily traveled corridors. It is important to ensure that parcels maintain reasonable access to the highway, and that access management concepts do not make access routes unreasonably long or complicated in such a way that the benefit is lost. The ideal spacing of intersections and driveways varies by functional class and speed limit

on the highway. According to AASHTO, for a primary arterial with a speed limit of 45-55 miles per hour, the minimum suggested signalized intersection spacing is ½ mile. Unsignalized driveways (right-in-right-out configuration) should be spaced no less than 860 feet to avoid impacts on highway throughput capacity.⁸¹

- **Safe Turning Lanes** – dedicated left- and right-turn, indirect left-turns and U-turns, and roundabouts keep through-traffic flowing, and can provide safe pockets for cars and trucks to await opportunities to make turns. Roundabouts represent an opportunity to reduce an intersection with many conflict points or a severe crash history (T-bone crashes) to one that operates with fewer conflict points and less severe crashes (sideswipes) if they occur. Roundabouts with small radii can be difficult for trucks to navigate. The design of these features should take truck dimensions (especially turning radii) into account. Trucks should be able to make a turn without “sweeping” the tractor or trailer into adjacent traffic lanes.
- **Right-of-Way Management** – For the sake of preserving the capability to widen highways, expand, or reactivate rail infrastructure, existing rights-of-way should be maintained. When rights-of-way are encroached upon, the prospect of developing new transportation infrastructure is made far more difficult.⁸²

The needs discussed above are some of the major items to be considered when planning the development of freight terminals, freight-dependent facilities such as stores and warehouses, on-site circulation and access routes, and general transportation infrastructure, such as bridges and highways. Other needs exist as well, but these highlight some of the major needs which can be positively impacted by public-sector policy and actions.

4.3 Tools and Actions to Address Freight Land Use Needs and Impacts

This section will review some of the key actions that can be taken at the local, regional, and state level to help meet the needs of freight stakeholders while also accounting for the needs of the community. Please refer back

⁸¹ “Driveway and Street Intersection Spacing,” Transportation Research Board Circular 456, March 1996, available from: http://www.accessmanagement.info/pdf/TRC_456_Driveway.pdf.

⁸² FHWA: http://www.ops.fhwa.dot.gov/access_mgmt/what_is_accsmtgmt.htm.

to Section 1.0 for further information on the role of various levels of government in the transportation planning process. With respect to land use, local governments are, for the most part, responsible for making land use decisions in response to private-sector development actions. Zoning requirements are established by the local government. Regional planning commissions help establish consensus-based regional visions for land use patterns. State agencies such as environmental regulatory and resource agencies perform permitting roles for specific developments, but generally have limited land use planning responsibilities.

LOCAL PLANNING ACTIONS

Local governments are responsible for comprehensive plans and zoning ordinances which can have a substantial impact on the effectiveness of freight movements at the site level and on the transportation infrastructure in general. In addition, local planning departments also can meet freight needs through additional freight stakeholder involvement and documents which clarify process and open communication between the groups. When reviewing the key freight needs discussed in Section 5.1, the following actions can be implemented at the local level to address key freight needs:

- **Traffic access and impact studies** gather and analyze information that will help determine the need for any improvements to interior, adjacent, and nearby road systems. New development sites can impact the surrounding roadway system by adding to existing traffic volumes or altering traffic patterns. In addition to designing appropriate access for proposed developments, planners and developers should strive to maintain a satisfactory level of transportation service and safety for all roadway users. Many municipalities or local planning agencies require a traffic access and impact study, which includes a trip generation estimate, prior to approving changes to zoning or proposed developments. In some instances, developers may be responsible for mitigating impacts to the adjacent transportation facility to meet the needs of the changed land use.
- **Perform site planning reviews** to make sure that new developments meet freight needs set forth by the community. For example, the Anchorage, Alaska MPO (highlighted as a case study in Section 4.3) has a committee of freight stakeholders who assist in site plan review and offer recommendations to better accommodate deliveries/freight. This type of review by an outside committee allows in-progress site plans to be checked to make sure that freight needs are met and that freight has the least possible negative impact on the community.

- **Analyze truck routes through the municipality** to ensure that key freight-dependent businesses are located near these truck routes and that the operational equipment, roadway maintenance and infrastructure along the truck route support large truck movement. For example, it is necessary to ensure that roads are in good condition and that bridges are high enough to accommodate both local and regional freight traffic moving through the area.
- **Review the comprehensive plan to ensure** that adequate land is set aside for industrial uses and potentially create a land use type which differentiates freight and intermodal uses from other industrial and commercial uses. Also review the comprehensive plan to ensure that current road design standards allow trucks to move efficiently through the municipality and to key loading and unloading areas.
- **Enforce loading zone and parking restrictions in front of busy freight** loading and unloading areas. Failure to do so will make loading and unloading in busy areas difficult for freight carriers and disrupt traffic.
- **Involve private-sector freight stakeholders** in developing site design standards to gather their input on how to best improve design standards and plans to ensure freight efficiency.
- **Develop freight stakeholder committees that allow freight stakeholders** to voice their concerns regarding land use policies and other infrastructure which impact the efficiency of freight movements.
- **Integrate access management principles** into the design of the local transportation infrastructure.
- **Provide guidance to developers and others** regarding expected regulations and highlight key items that they should be aware of and follow when developing a parcel of land. The guidance should include providing an inventory of appropriate developable or redevelopable industrial sites, information regarding available local tax incentives or financing mechanisms, and assistance interpreting and navigating through local permitting processes. In many cases, a municipality's economic development officer also may serve as a liaison to state and Federal regulatory and permitting agencies.⁸³

⁸³ NCFRP 23 Preliminary Draft Report.

- **Develop toolkits for industrial developers**, including zoning requirements, permitting processes, key steps to complete the permitting process, and contacts at the planning/zoning offices. This will clearly define the process up front and open the lines of communication between public sector and developers up front.
- **Use overlay zones** with form-based or performance-based criteria to accommodate the needs of freight, or of particular industry types, while ensuring sensitivity to surrounding land uses. Overlay zones, can specify requirements for setbacks, parking, driveway spacing, and a variety of other factors, and require that development conform to the underlying zone. In this capacity, overlay zones offer zoning authorities an opportunity to maintain consistency with the zoning map, while having the flexibility to apply special circumstances in areas where warranted.
- **Work with railroads and the Federal Railroad Administration to establish “quiet zones.”** Quiet zones are areas in which trains can pass through at-grade intersection crossings without blowing their whistle, provided there are specific safety precautions taken to protect motorists and pedestrians crossing the rail right-of-way.
- **Work with port planners to address “outside the gate” impacts.** As domestic and international waterborne cargoes continue to land at port facilities throughout the country, communities that host port terminals should be engaged with terminal owners, operators, whether they be public or private entities, to address impacts of truck and rail traffic that are going “out the gate” onto the local transportation system. Developing suggested routing schemes to desirable intermodal connectors that avoid local neighborhood streets, optimizing signal timings, encouraging use of rail, and consideration of around-the-clock gate operations can help alleviate some of the impacts on the local transportation system. These strategies will have to be weighed against any noise, light, and air quality impacts that around-the-clock operation may have on adjacent properties.⁸⁴

⁸⁴ NCHRP Synthesis 320 suggests that port operations can be limited to daytime hours (when most residents are away from home), though such a schedule could lead to adverse impacts on the transportation network, as daytime hours are when traffic volumes are highest. Potential operating schedules should be investigated and negotiated based upon considerations of both factors – effects on local residents and the transportation system – to determine the most desirable and least detrimental operating scheme.

REGIONAL PLANNING ACTIONS

Regional governments, while generally not working on specific site design and land use issues, can have a role in helping regions and municipalities meet freight needs. The following are actions that MPOs and other regional government agencies can take to help meet freight and community needs:

- **Lead regional visioning and goods movement studies** to help lay out a bigger picture which local governments in the region can turn to in order to incorporate freight concerns when developing their plans and regulations.
- **Create regional freight plans** to help define key freight mobility goals and land use priorities in terms of freight.
- **Create model land development ordinances and best practices** for use by local governments when creating plans, ordinances, and other regulations that may impact freight.
- **Create corridor or subarea plans** to address congestion or safety issues on certain highway and rail freight corridors, regions, and/or major intermodal facilities that experience high traffic and crash volumes.
- **Consider freight issues in development of metropolitan transportation plans and corridor studies.** Freight is recognized among the planning factors that guide the metropolitan transportation planning process.
- **Work with rail, air, and waterborne freight planners** to ensure that the region's ports, airports, and rail intermodal terminals are capable of handling current and future volumes of traffic safely and efficiently without significant adverse impacts on host communities or the region's transportation system. Attributes such as transportation network capacity and utilization, terminal capacity and operating characteristics, truck stop and parking availability on a corridor or regional level should be examined.

STATE PLANNING ACTIONS

State governments can help address freight needs in some of the same ways that regional governments can: by providing a vision for planning, by developing freight plans (statewide), and by providing model land development ordinance and best practices. Some states, including Florida and Oregon also have a limited active role in ensuring consistency among local land use plans relative to neighboring communities or state planning guidelines.

- **Consider freight issues in the development of the statewide long-range transportation plan.** Work with stakeholders across all modes to take inventory of the state’s transportation assets, including networks and nodes (terminals and other activity centers), identify needs, and develop a state policy on developing and maintaining freight infrastructure in the state.
- **Include criteria in project selection processes** that consider freight mobility as a criterion for project selection. For example, the Oregon Statewide Transportation Improvement Program (STIP) requires considering of freight mobility in the process of selecting projects.
- **Design state highways, interchanges, and other freight infrastructure** in such a way as to take freight needs into account and maintain mobility and safety.
- **Create corridor plans or subregional plans** to address congestion or safety issues on freight corridors and/or major intermodal facilities that experience high traffic and crash volumes.
- **Work with municipalities or other local zoning authorities to ensure consistency** with state planning goals and consistency among local land use plans to minimize conflicts between adjacent land uses in separate local jurisdictions.

Private-Sector Freight Stakeholder Actions

While the public sector can do many of the items listed above to meet freight needs, private-sector leaders, and stakeholders also need to take part in the planning process in order to make their needs heard. Several key actions that private-sector stakeholders should take to help meet freight needs:

- **Participate in committees and the development of freight plans** designed to improve freight operations in cities and states. Participation by private-sector stakeholders, including representatives from key regional businesses or industry groups, helps make sure that private-sector needs are considered. These committees may be organized by the MPO or local government agency.
- **Offer opportunities for public-sector officials to learn about business and operations.** This can come through presentations or by offering public-sector officials a site visit or a tour of the facility. Allowing public-sector officials to understand industry operations and to see the needs first-hand will help improve their understanding of the requirements that are to be addressed in plans and ordinances.

- **Participate in and comment** on metropolitan transportation plans, Long-Range Transportation Plans, corridor studies, comprehensive plans and other freight-related documents to make sure that private-sector comments are heard during the planning process. Public participation and consultation are key elements of the planning process.

Overall, it is important for both public-sector officials at all levels of government and private-sector representatives, such as chambers of commerce, rail and trucking associations, private rail or marine terminal operators, major shippers and receivers in the local area or region, and supply chain managers, to be engaged with one another and to understand each other's viewpoints. This will help lead to plans and visions that both support livable communities and address freight needs.

4.4 Putting It All Together

The following case studies provide examples of collaborative efforts involving numerous levels of government, public-sector entities, and the private sector freight community. In each case, stakeholders were able to successfully implement projects that account for the needs of freight while preserving environmental and community sustainability. Each case study is presented according to the following outline:

- **Issue Background** – insight into the root and causes of the issue addressed by the case study plan or initiative.
- **Approach and Resolution** – a summary explanation of the procedure, findings and recommendations each case study plan or initiative identified.
- **Critical Success Factors** – key points or “takeaways” that may offer useful insight to planners and government agencies in other jurisdictions.

Table 4.1 Key Issues Illustrated within the Best Practice Review

Case Study Program	Freight Needs Addressed	Critical Success Factors
AMATS (Anchorage, Alaska MPO) Private-Sector Involvement Strategies	<ul style="list-style-type: none"> • Freight site design needs • Site access and local circulation 	<ul style="list-style-type: none"> • Engage freight stakeholders • Educate agency staff • Demonstrate progress
NYMTC (New York City MPO) Freight Villages Study	<ul style="list-style-type: none"> • Site requirements • Site access and local circulation • Efficient regional transportation system 	<ul style="list-style-type: none"> • MPO leadership role in freight and land use visioning • Accounting for the site design needs of freight
CenterPoint Intermodal Center, Elwood, Illinois	<ul style="list-style-type: none"> • Brownfield redevelopment • Adequate buffers to prevent encroachment • Shared costs and shared benefits 	<ul style="list-style-type: none"> • Inclusion of multiple public and private stakeholders • Highlighted the positive benefits of industrial development • Shared resources and shared benefit
Kansas City Cross-Town Improvement Project (C-TIP)	<ul style="list-style-type: none"> • Clearly defined issue statements • Implementable solution 	<ul style="list-style-type: none"> • Inclusion of multiple public and private stakeholders • Identification of clear vision and goals

CASE STUDY: ANCHORAGE METROPOLITAN AREA TRANSPORTATION SOLUTIONS (AMATS) PRIVATE-SECTOR INVOLVEMENT STRATEGIES

Issue Background

Anchorage Metropolitan Area Transportation Solutions (AMATS) is the MPO for the City of Anchorage, Alaska. In addition to serving as the MPO, AMATS also is a municipal agency with zoning and land use authority. AMATS recognized that poorly planned industrial and retail sites did not account for the needs of freight, including provisions for adequate space for truck deliveries and circulation. The agency also recognized that government officials needed to better understand freight needs and incorporate them into the planning and site plan review processes.

Approach and Resolution

AMATS addressed these issues by engaging private-sector stakeholders. AMATS established a Freight Advisory Committee (FAC) to offer feedback on and enrich planning activities by providing the private-sector freight industry perspective, and to identify freight-related transportation and land use issues. AMATS also encourages FAC members to review and provide comments on-site plans for industrial and retail land uses. The FAC members offer advice on issues that affect the safety and efficiency of freight movements into,

out of, and within a proposed facility, including space requirements, turning radii, parking lot configurations, and landscaping that could create unsafe blind corners. Although the Municipality of Anchorage does not pin all site plan review requirements on freight needs, they appreciate the FACs involvement and advice, and have on several occasions requested that developers of industrial and commercial properties make changes to their site plans to improve truck access and safety accordingly. In one example, the Municipality, based upon FAC input, asked the developer of a retail property to reduce the amount landscaping which was intended to hide loading bays. While the shrubs and trees screened loading bays from customers' view, they also created a potentially dangerous blind spot and conflict between trucks entering and exiting the loading bays, and passenger vehicles traveling in the adjacent parking lot driveways. Upon hearing this concern, the developer made appropriate modifications to the site plan.

Through coordination with the FAC, AMATS has developed a collaborative relationship with private stakeholders. One FAC member invited local and state transportation planning staff to participate in a virtual reality simulation exercise. The exercise gave planners an opportunity to experience the sensation of driving a tractor-trailer through city streets and facility parking lots and loading zones. Through this exercise, public officials were able to better understand freight operations and transportation and land use requirements.

Critical Success Factors

- **Engage freight stakeholders.** AMATS has been able to develop a mutually rewarding collaborative relationship with freight stakeholders in Anchorage. The agency learned that getting the private-sector involved early in the planning process can help to improve transportation plans and site plans.
- **Educate agency staff.** The FAC has helped agency staff acquire a better understanding of freight issues through participation in meetings and by allowing staff to experience freight operations. Having staff who are educated in freight needs helps to ensure that those issues are addressed in transportation plans, project development, and site plans.
- **Demonstrate progress.** An important part of maintaining a relationship with private stakeholders is to ensure that their needs and issues are integrated into the creation, evaluation, and prioritization of strategies. If the private-sector stakeholders feel

that their participation does not result in change, they may lose faith and interest in the participation program. By incorporating FAC ideas into the planning and project development processes, and by implementing projects, stakeholders could see that their input was valued and resulting in improvements.

CASE STUDY: NEW YORK METROPOLITAN TRANSPORTATION COUNCIL (NYMTC) FREIGHT VILLAGES STUDY

Issue Background

The New York Metropolitan Transportation Council (NYMTC) is the MPO for a 10-county portion of the New York City metropolitan area within New York State. Although the New York City region is a place where residents rely on transit services such as trains and subways for commuting and intercity trips, there are few alternatives to trucks and highways for freight shipments. Because the region consists of many islands and waterways, freight relies upon the region's highway bridges and tunnels to reach terminals, distribution centers, and customers located throughout the region and beyond. Freight activity contributes to chronic and severe congestion on the limited number of bridges connecting the region. The NYMTC region also is a mature region, with little land available for new freight land uses. Freight land uses have sprouted throughout neighboring regions in New Jersey and Pennsylvania resulting in longer movements and few opportunities to attract new economic activity to the NYMTC region.

Approach and Resolution

The 2004 NYMTC Regional Freight Plan recommended a feasibility study of freight villages in the region as a means to consolidate supply chain functions into several activity centers served by multiple modes. This strategy, in theory, would reduce truck VMT, achieve redundancy and mode balance through multimodalism, and introduce new freight activities and economic development to parts of the region. The Freight Villages Study, (under development in 2011), has taken the following work steps:

- Literature review to uncover freight village types and applications throughout the world, and to identify the features of a typical freight village;
- Through input from industrial developers, third-party logistics firms, and transportation service providers, the project developed a list of site evaluation criteria and weighted evaluation metrics pertinent to the NYMTC region;

- Selection of six candidate sites and an evaluation of those sites relative to freight village features and NYMTC goals; and
- Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of the six sites to determine the potential for development of each.

The site analysis was conducted by applying scores to each of the sites using four evaluation criteria areas:

1. Site suitability characteristics such as total and developable acreage, topography, potential for further expansion, utilities infrastructure, environmental characteristics, and security; existing facilities and activities that could be incorporated into the freight village activities;
2. Access and transportation characteristics, including road, rail, water and air access, and ease of commuting for employees;
3. Property conditions characteristics such as property ownership and cost, land use and zoning, running covenants that may restrict use, neighboring land uses and conflicts, recurring costs, attitude of neighboring communities, and pressures from existing property users; and
4. Location and interconnected business activities attributes, including centrality of the site in relation to important consuming areas, proximity to major retailers and logistics providers, location in relation to interstate and regional freight transshipment facilities, availability of local trucking and availability of a suitable local workforce.

The Freight Villages Study currently is finalizing the results of the site evaluations, and will make recommendations regarding how and where freight villages could be implemented in the NYMTC region.

Critical Success Factors

- **MPO leadership role in freight and land use visioning.** The Freight Villages Study represents a strategy by which an MPO can take a leadership role in visioning and planning for goods movement and related land uses. Through this study, the MPO and constituent agencies have achieved a better understanding of a potential alternative for freight land use and development that may help them reach their sustainability goals.
- **Account for the needs of freight stakeholders.** The Freight Villages Study evaluated potential applications of freight village development patterns while keeping in mind the needs of the freight industries that will be encouraged to operate in these environments. Working with

the industrial developers, third-party logistics firms, motor carriers, and railroads, the study conducted an evaluation of potential sites to account for attributes that are important to these stakeholders: site configuration and design, transportation system access, workforce and trucking availability, and accessibility to other freight facilities. The study recognized that the freight needs and regional sustainability needs should be met in order for sites to be feasible for freight village development.

CASE STUDY: CENTERPOINT INTERMODAL CENTER ELWOOD, ILLINOIS

Issue Background

The CenterPoint Intermodal Center in Elwood, Illinois, is a 2,500-acre intermodal facility used for the transfer, distribution, and warehousing of consumer materials and goods. Located about 50 miles southwest of Chicago, the site is a brownfield redevelopment project that includes a 775-acre intermodal transfer facility, as well as 8 million square feet of warehouse and distributions space.⁸⁵ The project included a wide range of public and private participation, in both the planning stages and to provide the roughly \$1 billion in public and private financing. Now nearing completion (in 2011), the project is one that highlights the benefits of freight movement while minimizing the impacts to communities and the natural environment.

Approach and Resolution

Many existing truck-rail intermodal centers are located in or close to urban areas. Over time, growing regional populations will often begin to encroach on the facilities, converting land that was once vacant to higher-value residential and commercial uses. This can lead to capacity constraints of the intermodal facility, as well as growing freight and land use conflicts, including congestion, noise, and safety concerns. The Chicago area illustrates some of these concerns. It is one of the major freight hubs in the United States, and also one of the most congested. As freight volumes and the local population have grown, conflicts (such as congestion) have inevitably arisen. By some estimates, railed freight can take one day to reach Chicago from the West Coast ports, and can then take another entire day to move through Chicago.⁸⁶

⁸⁵ <http://casestudies.uli.org/Profile.aspx?j=8307&p=1&c=6>.

⁸⁶ Jack Lanigan, Sr., John Zumerchik, Jean-Paul Rodriquez, Randall Guensler, and Michael O. Rodgers, "Shared Intermodal Terminals and Potential for Improving Efficiency of Rail-Rail Interchange," Transportation Research Board Annual Meeting, 2007, Paper #07-2563.

The goal of this project is to increase the speed and capacity of freight. However, project proponents decided, early on, to achieve these goals in a manner that benefitted local communities and the environment. Several factors illustrate this approach:

- **Choice of a brownfield redevelopment site.** The site itself was the Joliet Arsenal, an abandoned plant located strategically on the Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) mainlines and Interstates I-80 and I-55. However, the site also is a brownfield, and this project provided cleanup and remediation of an otherwise unused brownfield property.
- **Choice of a site with adequate buffers to protect from encroaching land uses.** As shown in Figure 4.4 below, the site is well-buffered from conflicting land uses. The buffers themselves are likely permanent entities, and include the Abraham Lincoln National Cemetery, and the Midewin National Tallgrass Prairie restoration project.
- **Shared costs and shared benefits.** Multiple partners, including CenterPoint, the railroads, the Illinois DOT, the Illinois Department of Commerce and Community Affairs (DCCA), are taking part in financing the project. This partnership is possible because the benefits to multiple stakeholders have been documented. For example, the railroads will benefit from capacity improvements and freight efficiency enhancements, while local governments will benefit from thousands of new jobs and millions of dollars in tax revenues.

Critical Success Factors

- **Inclusion of multiple levels of government, public agencies, and private industry.** During the planning phases, the project brought together “virtually all levels of governments, more than a dozen public agencies, and private industry.”⁸⁷ In fact, CenterPoint estimates that it dealt with 50⁸⁸ governmental entities throughout the planning and development cycle. Though time consuming, the inclusion of all these entities meant that issues were resolved as they arose, without ever resulting in loss of partners or build-up of animosity.

⁸⁷ Michael M. Mullen, “CenterPoint Intermodal Center,” *Economic Development Journal*, April 2005, p. 2.

⁸⁸ Michael Brick, “Village Says, ‘Yes, in My Backyard,’ to Rail Center,” July 17, 2002. *The New York Times*.

- **Highlighting the positive benefits of the development to the public.** The site is located in an area of high unemployment. Therefore, using the site as an engine of local economic development was critically important. It is estimated that this site will employ over 8,000⁸⁹ people once completed.
- **Shared resources and shared benefits.** The project was designed and is being implemented with shared public private financing. Therefore, there was “give and take” throughout the process so that all parties felt that they were receiving benefits. For example, though the Illinois DOT and the Illinois Department of Commerce and Community Affairs (DCCA) is funding the road improvements, CenterPoint is donating 60 acres of land to a wetlands conservation project and another 83 acres to the U.S. Forest Service. These types of arrangements have helped to prevent a buildup of public animosity towards a large-scale industrial development.

CASE STUDY: THE KANSAS CITY CROSS-TOWN IMPROVEMENT PROJECT (C-TIP)

Issue Background

The Cross-Town Improvement Project (C-TIP) was first conceived in the fall of 2004 and has since grown in both size and stature. The C-TIP is a technological solution to the problems arising from transferring goods from rail to truck in metropolitan regions. Whether it is truck-to-rail transfers near ports, or rail to truck to rail transfer near rail interchanges, the inefficiency of cross-town “rubber tire” interchanges can have negative impacts, including: congestion, loss of efficiency in the transportation network, safety concerns, energy consumption concerns, and impacts to the local environment.⁹⁰ Kansas City was chosen as a pilot study location because it is the second largest rail hub in the U.S. (after Chicago), yet is smaller and less expensive to implement (compared to a pilot study in Chicago).

The C-TIP concept is an intermodal move database that will coordinate cross-town traffic to reduce empty moves between terminals, track intermodal assets, and distribute information to truckers wirelessly.

⁸⁹ <http://www.centerpoint-prop.com/projects/article.aspx?id=151&mode=ALL>.

⁹⁰ “Cross Town Improvement Project” given by Randy Butler, U.S. Department of Transportation. The “Talking Freight” seminar, November 17, 2010.

Approach and Resolution

Several key steps highlight the approach that was taken to this project.

Work with stakeholders to define a problem. The approach to the project first focused on defining the problems that were to be solved. This was accomplished through discussions with public and private freight stakeholders. These discussions revealed several growing problems in the Kansas City region that are caused by cross-town drayage, such as:

- Growing freight volumes;
- Increasing port-related traffic;
- Growing congestion at key locations where “cross-towns” occur;
- Air quality degradation from an aging fleet and unnecessary truck miles traveled within urban areas; and
- Inefficiency of the port-related truck fleet.

Once the issues had been discussed among multiple public- and private-sector stakeholders, it was determined that the root cause of the issue was a lack of communication between the many parties involved in cross-town drayage.

Define a solution that is implementable. When completed, C-TIP will help to mitigate the number of trucks involved with cross-town “rubber tire” interchanges. This, in turn, will help to improve the efficiency of the region’s transportation network, as well as ensure the safety of its citizens. These benefits are illustrated in Figure 4.4 below.

Figure 4.4 The C-TIP Public Private Partnership Goal



Source: U.S. DOT's Federal Highway Administration (FHWA).

Critical Success Factors

- **Inclusion of multiple levels of government, public agencies, and private industry.** The key players throughout the pilot study are the U.S. DOT – FHWA, multiple Class I railroads (BNSF, UP, and Kansas City Southern (KCS)), trucking companies, state governments, Metropolitan Planning Organizations (MPO), economic development groups, and traffic management organizations.
- **Identification of a clear vision and goals.** The project began with a clear identification of the problem at hand (i.e., too many unproductive moves in a congested urban area), and then worked with stakeholders to envision an innovative, yet implementable, solution. The goal statement for C-TIP is now: “To develop and deploy an information sharing/transfer capability that enables the coordination of moves between parties to maximize loaded moves and minimize unproductive moves.”

4.5 Conclusion

As highlighted in these case studies, as well as throughout the rest of the handbook, land use patterns and land use decision-making can impact freight movements and industries in many ways – including impacts on regional truck vehicle miles traveled (VMT), intermodal accessibility and safety, land consumption, and access to jobs. If freight planning and land-use decision-making activities are well-integrated, both the public

and private sectors may benefit through reduced congestion, improved air quality, enhanced community livability, increased industrial-related jobs and activity; and improved operational efficiency, reduced transportation costs, and greater access to facilities and markets.

However, arriving at decisions that maximize the benefits of freight, while minimizing the impacts, can be very complex. On the public side, industrial development goals are too often overshadowed by other community goals, including smart growth strategies that seek to redevelop industrial lands into residential and commercial uses, and efforts to push freight facilities to the regional fringe. From the private-sector side, the slower pace and many stages of land use planning can seem complex, frustrating, and not inclusive to private-sector participation. As a result, many agencies are struggling to understand how land use issues impact freight movements (and vice versa), the types of stakeholders that should be involved in land use and freight planning activities, and the tools, techniques, and strategies used by agencies across the country to deal with these issues.

This handbook has provided some grounding, knowledge, and examples for public- and private-sector entities that are interested in understanding freight and land use integration issues. Topics highlighted within this handbook include:

- **Background on freight and land use issues**, including the key concepts and trends in land use and freight transportation, as well as the linkage between freight, land use, and economic development.
- **Key steps and products of the transportation and land use planning processes and the linkages between those processes**, including a discussion about the relevant public and private stakeholders, their roles and needs, the key freight and land use issues and trends affecting decision-making now and in the future.
- **Discussion of freight as a good neighbor**, including a range of strategies and tools that have been used successfully to ensure that freight land uses have a positive relationship with surrounding land uses, and have been used successfully to integrate freight uses into the community fabric.
- **Discussion of sustainability**, including the potential ramifications of poor land use planning and policies on an economic development, environmental sustainability, and social equity and justice.

- **Discussion of how freight and land use decisions can meet current freight demands, while encouraging desirable growth patterns in the future**, including guidance about how to avoid or mitigate the unintended consequences of land use decisions on freight movements.
- **Discussion of the impacts and needs of freight**, including the land use needs of freight-generating industries and facilities, including access, on-site circulation, dimensional requirements for trucks, adequate truck parking and loading areas, and security provisions.
- **Discussion of transportation and land use planning processes**, including strategies and action steps aimed at engaging private-sector stakeholders and incorporating freight needs into the planning processes.

Together, the topics covered in this handbook will introduce some of the main players, policies, programs and strategies that form the basis of knowledge for integrating freight into the land use planning process. By providing a broad swath of viewpoints, the handbook should appeal to public- and private-sector freight stakeholders from all sides of the issue – including industrial site developers, land use practitioners, local government officials, members of the public – or anyone else.

Though this handbook is comprehensive, it is a static document. Readers should remember that the freight industry is a rapidly and ever-changing industry, reflective of economic and demographic shifts as well as global supply chain developments. Public and private stakeholders, alike, need to continue to work towards understanding the regions within which they operate. States and regions are constantly identifying ways to increase their ability to compete regionally, nationally and globally. Private-sector companies are constantly trying to streamline and economize their operations, and develop innovative solutions to existing problems. This handbook provides a good understanding of the issues, needs, opportunities, and strategies that will serve as a starting point to better integrate freight and land use in an ongoing and permanent manner.

Appendix A Freight and Land Use Glossary

Access Management. A set of techniques that state and local governments can use to control access to highways, major arterials, and other roadways. The benefits of access management include improved movement of traffic, reduced crashes, and fewer vehicle conflicts.

Air Quality. Refers to the measure of air pollutants (including greenhouse gases and particulate matter) present in a given area. Poor air quality can have detrimental impacts to the environment and human health.

Average Annual Daily Truck Traffic (AADTT). The total volume of truck traffic on a highway segment for one year, divided by the number of days in the year.

Backhaul. The process of a transportation vehicle (typically a truck) returning from the original destination point to the point of origin. A backhaul can be with a full or partially loaded trailer.

Bottleneck. A section of a highway or rail network that experiences operational problems such as congestion. Bottlenecks may result from factors such as reduced roadway width or steep freeway grades that can slow trucks.

Boxcar. An enclosed railcar, typically 40 or more feet long, used for packaged freight and some bulk commodities.

Breakbulk Cargo. Cargo of nonuniform sizes, often transported on pallets, sacks, drums, or bags. These cargoes require labor-intensive loading and unloading processes. Examples of breakbulk cargo include coffee beans, logs, or pulp.

Brownfield. Real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties protects the environment, reduces blight, and takes development pressures off green spaces and working lands.

Bulk Cargo. Cargo that is unbound as loaded; it is without count in a loose unpackaged form. Examples of bulk cargo include coal, grain, and petroleum products.

Capacity. The physical facilities, personnel and process available to meet the product of service needs of the customers. Capacity generally refers to the maximum output or producing ability of a machine, a person, a process, a factory, a product, or a service. In regards to the transportation system, this term references the ability of the transportation infrastructure to accommodate traffic flow.

Cargo Ramp. A dedicated load/unload facility for cargo aircraft.

Carrier. A firm which transports goods or people via land, sea, or air.

Chassis. A trailer-type device with wheels constructed to accommodate containers, which are lifted on and off.

Class I Railroad. Railroad with annual operating revenue of at least \$272.0 million (2002).

Climate Change. Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (e.g., changes in ocean circulation); and
- Human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., deforestation, reforestation, urbanization, desertification, etc.).

Comprehensive Planning. A process through which a community's or region's long-term community development goals and policies relating to a full array of topics such as transportation, land use, utilities, cultural institutions, and housing, are determined.

Commodity. An item that is traded in commerce. The term usually implies an undifferentiated product competing primarily on price and availability.

Consignee. The party who is to receive a freight shipment, as specified on a bill of lading.

Container. A large, standard-sized metal box into which cargo is packed for shipment; containers are designed to be moved with common handling equipment, functioning as the transfer unit between modes rather than the cargo itself.

Containerized Cargo. Cargo that is transported in containers that can be transferred easily from one transportation mode to another.

Container on Flat Car (COFC). A method of transporting goods by rail, which accommodates international shipping containers on top of a flat railcar.

Context-Sensitive Solutions. A collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist.

Distribution Center (DC). The warehouse facility which holds inventory from manufacturing pending distribution to the appropriate stores.

Dock. A space used for receiving merchandise at a freight terminal.

Double-Stack. Railcar movement of containers stacked two high.

Drayage. Transporting of rail or ocean freight by truck to an intermediate or final destination; typically a charge for pickup/delivery of goods moving short distances (e.g., from marine terminal to warehouse).

Drop. A situation in which an equipment operator deposits a trailer or boxcar at a facility at which it is to be loaded or unloaded.

Encroachment. For the purpose of this handbook, “encroachment” refers to the development of incompatible land uses such as residential areas, parks, and schools in close proximity to existing industrial and freight-generating land uses. Encroachment presents land use conflicts and can exacerbate the impacts of freight on a community’s environment and quality of life.

Freight as a Good Neighbor. Refers to a wide range of site selection, site and building design, and operating strategies that limit the negative impacts (such as noise, light, emissions, etc.) on nearby communities.

Freight Exclusive Facilities. Transportation facilities, such as truck-only lanes, that accommodate freight traffic at the exclusion of passenger traffic.

Freight Forwarder. A person whose business is to act as an agent on behalf of a shipper. A freight forwarder frequently consolidates shipments from several shippers and coordinates booking reservations.

Freight Sprawl. A phenomenon in which freight-generating land uses are “pushed out” of urban areas and small towns due to forces such as rising land values, chronic congestion, and/or NIMBYism, and relocate to greenfields at the rural fringes of metropolitan areas.

Freight Village. A clustering of activities related to transport, logistics and the distribution of goods, for domestic and/or international are carried out by various operators.

Free Trade Zone (FTZ). An area or zone set aside at or near a port or airport, under the control of the U.S. Customs Service, for holding goods duty-free pending customs clearance.

Greenfield. Undeveloped rural land, usually natural or agricultural, which may be considered for new, urban development.

Greenhouse Gas (GHG). Gases that trap heat in the atmosphere. Some greenhouse gases such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are:

- **Carbon Dioxide (CO₂):** Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide also is removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH₄):** Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

- **Nitrous Oxide (N₂O):** Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- **Fluorinated Gases:** Hydroflourocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (“High GWP gases”).

Gross Vehicle Weight (GVW). The combined total weight of a vehicle and its freight.

Hazardous Material. A substance or material which the Department of Transportation has determined to be capable of posing a risk to health, safety, and property when stored or transported in commerce.

Hours of Service (HOS). A ruling that stipulates the amount of time a driver is allotted to work enforced by the Federal Motor Carrier Administration.

Industrial Preservation. A strategy or program of strategies to support and maintain the viability of existing industrial land and facilities, particularly in urban areas and small towns. Industrial preservation can be an objective within a larger smart growth or jobs preservation program.

Industrial Real Estate. Land and facilities used for the production, modification, storage, and distribution of goods. Examples of industrial real estate include manufacturing plants, warehousing, and distribution centers.

Intermodal Transportation. Transporting freight by using two or more transportation modes such as by truck and rail or truck and oceangoing vessel. For example, a shipment moved over 1,000 miles could travel by truck for one portion of the trip, and then transfer to rail at a designated terminal.

Intermodal Container Transfer Facility (ICTF). A location at which intermodal containers are transferred from one mode to another. A yard at a seaport, at which containers are transferred from rail to oceangoing ship or vice-versa is an example.

Intermodal Terminal. A location where links between different transportation modes and networks connect.

Just-in-Time (JIT). An inventory control system that controls material flow into assembly and manufacturing plants by coordinating demand and supply to the point where desired materials arrive just in time for use. An inventory reduction strategy that feed production lines with products delivered “just-in-time.”

Level of Service (LOS). A qualitative assessment of a road’s operating conditions. For local government comprehensive planning purposes, level of service means an indicator of the extent or degree of service provided by, or proposed to be provided by, a facility based on and related to the operational characteristics of the facility. Level of service indicates the capacity per unit of demand for each public facility.

Logistics. All activities involved in the management of product movement; delivering the right product from the right origin to the right destination, with the right quality and quantity, at the right schedule and price.

Logistics Supportive Design Guidelines. Site design guidelines, which can be built into an agency’s site design and development review process, accounting for the physical and operational needs of freight, including loading zones, street geometry, truck routes, and access points, etc.

Metropolitan Planning Organization (MPO). A Federally funded and mandated organization, composed of representatives from local government and transportation authorities, charged with establishing transportation policy and decision-making for a metropolitan area.

Model Zoning Regulations. A tool through which an MPO or a state agency can provide technical assistance to local jurisdictions, using sample regulatory language and examples, to develop zoning requirements aimed at achieving community development goals.

Node. A fixed point in a firm’s logistics system where goods come to rest; includes plants, warehouses, supply sources, and markets.

Not-In-My-Backyard (NIMBY). Refers to opposition, among community residents or other stakeholders, to development within their communities that may adversely impact the quality of life or environment. NIMBY sentiments may serve as a warning that

impacts are not properly addressed in the zoning, planning, or project development processes.

Off-Peak Delivery. A strategy to incentivize or otherwise encourage the delivery of goods at times other than peak traffic periods.

Post-Panamax. Refers to ships that are too large to fit in the Panama Canal, such as supertankers and the largest modern container ships.

Placard. A label required by the U.S. Department of Transportation that identifies a hazardous material shipment and the hazards present.

Piggyback. A rail/truck service in which a shipper loads a highway trailer, and a carrier drives it to a rail terminal and loads it on a flatcar; the railroad moves the trailer-on-flatcar combination to the destination terminal, where the carrier offloads the trailer and delivers it to the consignee.

Pool/Drop Trailers. Trailer that are staged at a facility for preloading purposes.

Port Authority. State or local government that owns, operates, or otherwise provides wharf, dock, and other terminal investments at ports.

Private Carrier. A carrier that provides transportation service to the firm that owns or leases the vehicles and does not charge a fee.

Preferential Zoning. Zoning regulations encouraging development that meets established planning goals. For instance, if regional stakeholders have determined that the provision/retention of freight-dependent land uses is an important goal, the planning authority can establish special zoning designations based on existing land use patterns and then offer rewards to developers who include desired freight amenities in their plans.

Quiet Zones. Designated areas in which trains are not required to sound their whistles while approaching grade crossings. Quiet zones are intended to reduce the noise impacts of rail operations, but require the installation of advance warning systems and gates, and possibly additional safety equipment depending upon location-specific conditions.

Regional Railroad. Railroad-defined as line-haul railroad operating at least 350 miles of track and/or earns revenue between \$40 million and \$272 million (2002).

Regional Visioning. An exercise through which an MPO or other regional planning agency establishes a “vision” scenario representing desired future growth patterns.

Reliability. Refers to the degree of certainty and predictability in travel times on the transportation system. Reliable transportation systems offer some assurance of attaining a given destination within a reasonable range of an expected time. An unreliable transportation system is subject to unexpected delays, increasing costs for system users.

Reverse Logistics. A specialized segment of logistics focusing on the movement and management of products and resources after the sale and after delivery to the customer. Includes product returns and repair for credit.

Receiving. The function encompassing the physical receipt of material, the inspection of the shipment for conformance with the purchase order (quantity and damage), the identification and delivery to destination, and the preparation of receiving reports.

Shipper. Party that tenders goods for transportation.

Short-line Railroad. Freight railroads which are not Class I or Regional Railroads, that operate less than 350 miles of track and earn less than \$40 million.

Short Sea Shipping. Also known as coastal or coastwise shipping, describes marine shipping operations between ports along a single coast or involving a short sea crossing.

Site Plan Review. An exercise through which site plans for proposed developments are reviewed by zoning officials to ensure compliance with zoning regulations and applicable comprehensive, land use or transportation plans.

Stakeholders. Public-sector agencies, community groups, and private sector businesses which have a direct role in, or are impacted by, transportation and land use planning and decision-making processes.

Stakeholder Committee. A forum in which stakeholders are invited to participate in the transportation and land use planning and decision-making processes.

Strategic Highway Network (STRAHNET). A network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity, and emergency capabilities for defense purposes.

Strategic Rail Corridor Network (STRACNET). An interconnected and continuous rail line network consisting of over 36,000 miles of track serving over 140 defense installations.

Sustainability. An objective calling for policies and strategies that meet society's present needs without compromising the ability of future generations to meet their own needs.

Switching and Terminal Railroad. Railroad that provides pick-up and delivery services to line-haul carriers.

Supply Chain. Starting with unprocessed raw materials and ending with final customer using the finished goods.

Third-Party Logistics (3PL) Provider. A specialist in logistics who may provide a variety of transportation, warehousing, and logistics-related services to buyers or sellers. These tasks were previously performed in-house by the customer.

Trailer on Flatcar (TOFC). Transport of trailers with their loads on specially designed rail cars.

Transloading. Transferring bulk shipments from the vehicle/container of one mode to that of another at a terminal interchange point.

Transportation Planning Process. The procedure through which an MPO or state identifies transportation needs, analyzes alternatives, develops projects, and mitigates environmental impacts, while engaging stakeholders.

Truck Climbing Lane. An highway lane provided where steep grades exist, allowing slower-moving vehicles such as trucks to travel with limited disruption to the flow of other traffic.

Truck-Only Toll (TOT) Lanes. On an expressway, a separated set of lanes dedicated to trucks, which allows trucks to avoid congestion in general purpose lanes during peak-periods. Use of the TOT lanes is voluntary, and a toll is charged to users.

Truck Parking. Facilities either on-highway (such as state-operated rest areas and service-plazas) or off-highway (private truck stops), which provide spaces for trucks to park and for drivers to rest.

Twenty-Foot Equivalent Unit (TEU). The 8-foot by 8-foot by 20-foot intermodal container is used as a basic measure in many statistics and is the standard measure used for containerized cargo.

Vehicle Miles of Travel (VMT). A unit to measure vehicle travel made by a private vehicle, such as an automobile, van, pickup truck, or motorcycle.

Warehouse. Storage place for products. Principal warehouse activities include receipt of product, storage, shipment, and order picking.

Zoning. Regulations established by local governments which designate “zones” and define the allowable land uses, density, ground cover, building types, and dimensions within them.

Sources

This glossary was assembled from a number of sources, including:

- “Freight Glossary and Acronyms,” Federal Highway Administration. (<http://ops.fhwa.dot.gov/freight/FPD/glossary/index.htm>).
- NCHRP Synthesis 320 – Integrating Freight Facilities and Operations with Community Goals (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_320.pdf), by Anne Strauss-Wieder, Inc., Anne Strauss-Wieder, 2003.
- U.S. EPA, <http://www.epa.gov>.
- Cambridge Systematics, Inc., 2010.

Appendix B Key Information Sources

1. NCHRP Synthesis 320 – Integrating Freight Facilities and Operations with Community Goals (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_320.pdf), by Anne Strauss-Wieder, Inc., Anne Strauss-Wieder, 2003.
2. NCHRP Report 423A – Land Use Impacts of Transportation: A Guidebook, 1999.
3. NCHRP Report 594 – Guidebook for Integrating Freight into Transportation Planning and Project Selection Processes (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_594.pdf), by Cambridge Systematics with Prime Focus LLC and Kevin Heanue, 2007.
4. NCFRP Report 23 – Economic and Transportation Drivers for Siting Freight Intermodal and Warehouse Distribution Facilities: Preliminary Draft Final Report, February 2011.
5. NCFRP Report 24 – Protecting and Preserving Freight Infrastructure and Routes, 2011.
6. Freight and Air Quality Handbook (<http://ops.fhwa.dot.gov/publications/fhwahop10024/index.htm>), FHWA Freight Management and Operations, May 2010.
7. The Transportation Planning Process: Key Issues (http://www.planning.dot.gov/documents/briefingbook/bbook_07.pdf). Transportation Planning Capacity Building Program, FHWA and FTA, September 2007.
8. Planning Truck-Only Lanes: Emerging Lessons from the Southern California Experience (<http://pubsindex.trb.org/view.aspx?id=682016>) by M. J. Fischer, D. N. Ahanotu, and J. M. Waliszewski, 2003.
9. An Interim Guidebook on the Congestion Management Process in Metropolitan Transportation (<http://ops.fhwa.dot.gov/publications/cmpguidebookindex.htm#contents>), FHWA Office of Operations, February 2008.
10. A Guidebook for Engaging the Private Sector in Freight Transportation Planning (<http://www.fhwa.dot.gov/freightplanning/guidebook/guidebookps00.cfm>), FHWA Office of Planning, June 2010.

11. Policy Guide on Planning for Sustainability (<http://www.planning.org/policy/guides/pdf/sustainability.pdf>), American Planning Association, April 2000.
12. Climate Change Impacts (<http://climate.dot.gov/impacts-adaptations/forecasts.html>), U.S. DOT.
13. Translating a Regional Vision into Action (http://commerce.uli.org/Content/NavigationMenu/MyCommunity/RegionalVisioningandCooperation/Regional_Plan_intoAction.pdf), Urban Land Institute Land Use Policy Forum, March 2005.

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16. Abstract The goal of this <i>Freight and Land Use Handbook</i> is to provide transportation and land use planning practitioners in the public and private sectors with the tools and resources to properly assess the impacts of land use decisions on freight movements, as well as the impacts of freight development and growth on land use planning goals. The handbook identifies freight-related land use issues, key considerations, and available resources. Throughout the handbook, examples and case studies from a range of urban and rural areas across the country are used to demonstrate the effectiveness of these techniques.			
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**U.S. Department of Transportation
Federal Highway Administration
Office of Freight Management and Operations
1200 New Jersey Avenue, SE
Washington, DC 20590**

**Phone: 202-366-0408
Fax: 202-366-3225
FreightFeedback@dot.gov**

<http://www.ops.fhwa.dot.gov/freight>

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