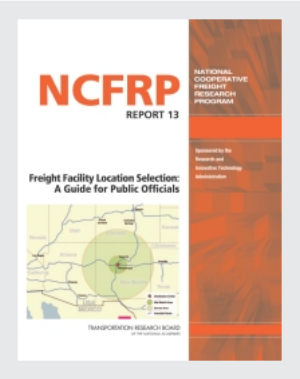

Freight Facility Location Selection: A Guide for Public Officials

DETAILS

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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

NCFRP REPORT 13

Freight Facility Location Selection: A Guide for Public Officials

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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

America's freight transportation system makes critical contributions to the nation's economy, security, and quality of life. The freight transportation system in the United States is a complex, decentralized, and dynamic network of private and public entities, involving all modes of transportation—trucking, rail, waterways, air, and pipelines. In recent years, the demand for freight transportation service has been increasing fueled by growth in international trade; however, bottlenecks or congestion points in the system are exposing the inadequacies of current infrastructure and operations to meet the growing demand for freight. Strategic operational and investment decisions by governments at all levels will be necessary to maintain freight system performance, and will in turn require sound technical guidance based on research.

The National Cooperative Freight Research Program (NCFRP) is a cooperative research program sponsored by the Research and Innovative Technology Administration (RITA) under Grant No. DTOS59-06-G-00039 and administered by the Transportation Research Board (TRB). The program was authorized in 2005 with the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). On September 6, 2006, a contract to begin work was executed between RITA and The National Academies. The NCFRP will carry out applied research on problems facing the freight industry that are not being adequately addressed by existing research programs.

Program guidance is provided by an Oversight Committee comprised of a representative cross section of freight stakeholders appointed by the National Research Council of The National Academies. The NCFRP Oversight Committee meets annually to formulate the research program by identifying the highest priority projects and defining funding levels and expected products. Research problem statements recommending research needs for consideration by the Oversight Committee are solicited annually, but may be submitted to TRB at any time. Each selected project is assigned to a panel, appointed by TRB, which provides technical guidance and counsel throughout the life of the project. Heavy emphasis is placed on including members representing the intended users of the research products.

The NCFRP will produce a series of research reports and other products such as guidebooks for practitioners. Primary emphasis will be placed on disseminating NCFRP results to the intended end-users of the research: freight shippers and carriers, service providers, suppliers, and public officials.

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FOREWORD

By William C. Rogers
Staff Officer
Transportation Research Board

NCFRP Report 13: Freight Facility Location Selection: A Guide for Public Officials describes the key criteria that the private sector considers when making decisions on where to build new logistics facilities. The location of freight facilities can have both positive and negative economic and social effects on local communities, regions, and states. By providing insight on location decisions for freight facilities, and suggesting best practices for transportation, land use, economic development, and regional partnerships, public sector agencies can benefit from a fuller understanding of the dynamics of freight movement and the factors affecting private sector location decisions. With this insight, public sector agencies may successfully plan for, attract, locate, and partner with freight-related activities in their jurisdictions.

Public officials at the state and local levels are frequently called on to consider the siting of freight intermodal terminals, inland ports, and warehouses and distribution centers. Decisions to pursue these facilities as economic development generators—as a supporting function for current and future businesses or in response to outside proposals—have a greater potential for success when the public sector understands the private sector financial and transportation drivers. A limited understanding of these critical site-selection drivers can lead public officials to expend time and resources on flawed strategies to attract facilities and react incorrectly to facility proposals. For instance, they may not understand the differences between international and domestic freight markets in the supply chain, the various functions they provide, or their respective support requirements. This can ultimately lead to inefficient transportation systems and failed economic development strategies. To formulate effective economic development strategies and react appropriately to proposals for the development of public or private freight facilities, public sector decision makers should have the benefit of a better understanding of these drivers and impacts.

Under NCFRP Project 23, CWS Consulting Group, with the assistance of HDR Engineering, Halcrow, Resource Systems Group, and Fitzgerald & Halliday, was asked to develop a guide to (1) inform public sector freight policy and decision makers about the key criteria that the private sector considers when determining where to locate new freight facilities, (2) inform the public sector about the complexity of the various facility types and the role they play in goods movement and supply chain management, and (3) enhance the potential for successful projects. A final report that provides background material used in the development of this Guide has been published as *NCFRP Web-Only Document 1: Background Research Material for Freight Facility Location Selection: A Guide for Public Officials (NCFRP Report 13)*, available at http://www.trb.org/Main/Blurbs/165743.aspx

Table of Contents

Preface

This guide for public sector officials is made possible by funding from the National Cooperative Freight Research Program (NCFRP) of the Transportation Research Board. The guide is a companion to, and results from, research contained in the final report for NCFRP Project 23: "Economic and Transportation Drivers for Siting Freight Intermodal and Warehouse Distribution Facilities," published as *NCFRP Web-Only Document 1* (http://www.trb.org/Main/Blurbs/165743.aspx).

The objective of this research is to develop a guide that:

1. informs public sector planners and decision makers about the key criteria that the private sector considers when siting logistics facilities,
2. informs the public sector about the complexity of the various facility types and the role they play in goods movement and supply chain management, and
3. enhances the potential for successful projects.

Both the technical report and this guide were developed by a project team consisting of:

- CWS Consulting Group, LLC
- HDR Engineering, Inc.
- Halcrow, Inc.
- Resource Systems Group, Inc.
- Fitzgerald & Halliday, Inc.

Special thanks to CWS Consulting Group, LLC, Halcrow, Inc., and Fitzgerald & Halliday, Inc. for photographs and graphics.

Chapter 1: Introduction and Background

What is the purpose of this guide?

In many ways freight movement may be considered the lifeblood of our economy. Over 60 million tons of freight move through the U.S. freight transportation system daily, representing roughly $40 billion in goods. Efficient movement of freight (i.e., mode selection, routing, and intermodal transfer) is necessary to make the best use of our transportation facilities, protect the environment, and reduce energy requirements, while keeping up with the ever-increasing demand for goods.

In many ways freight movement may be considered the lifeblood of our economy.

The freight environment continues to be a changing landscape. Trade is increasingly global, and manufacturing continues to move offshore. Fuel prices continue to fluctuate. Governments at all levels seek new ways of reducing carbon emissions, congestion, and pollution. These, and other factors, place increased importance on how we move raw materials and finished goods from place to place . . . from origin to ultimate destination. Greater emphasis on reliability and supply chain management increases the importance of efficient local and regional freight movement whether ultimate shipping destinations are across town or across the world.

The choices made about where these activities take place and the choices made by the carriers who serve these places, drive how transportation infrastructure is used. The location of freight facilities can have both positive and negative economic and social effects on local communities, regions, and states. Maximizing the benefits while minimizing the impacts are sensible goals for any public decision making.

Economic development, planning, and other government entities and elected officials at the local, regional, and state level recognize that trade and freight activity result in employment and investment opportunities and so have increasingly sought new strategies for attracting freight-related activities to their communities.

This guide for public officials has been prepared in concert with NCFRP Project 23: "Economic and Transportation Drivers for Siting Freight Intermodal and Warehouse Distribution Facilities," published as *NCFRP Web-Only Document 1* (http://www.trb.org/Main/Blurbs/165743.aspx), and explores both:

- Private sector supply chain and freight facilities, such as distribution centers and warehouses, and how market, cost competitiveness, and other factors shape private sector siting decisions and
- Transportation facilities (public and private) that manage freight carriage such as intermodal rail, transload, and ports.

The research for NCFRP Project 23 was conducted through a process of extensive review of existing literature, interviews with industry practitioners, and survey and analysis of actual freight facility location situations and processes. In addition to detailed information on freight facility siting factors, the final research report features a chapter of case studies illustrating freight issues and dynamics. Some excerpts from those case studies have been included in this guide as well, to better illustrate the material herein. A list of private sector corporations who participated in the interviews for NCFRP Project 23 is contained in Appendix A of this guide.

The purpose of this guide is to provide insight on location decisions for freight facilities and suggest best practices for transportation, land use, economic development, and regional partnerships to public sector agencies and officials considering and responding to freight facility development and location decisions. These agencies can benefit from a full understanding of the dynamics of freight movement and what factors affect private sector location decisions so that they may successfully plan for, attract, locate, and partner with freight-related activities in their jurisdictions.

Much specific freight-related terminology is used throughout this guide. Although an attempt has been made to define many terms, it may also be helpful for the reader to refer to the glossary of freight terms contained in Appendix B.

Who should use this guide?

This guide has been prepared for use by public officials at all levels. Economic development, planning, and other government entities and elected officials at the local, regional, and state level recognize that trade and freight activity result in employment and investment opportunities and so have increasingly sought new strategies for attracting freight-related activities to their communities. How transportation and freight facility requirements interact with other economic factors to influence location decisions made by the private sector is typically somewhat less understood by the public sector.

This guide condenses and focuses research findings of NCFRP Project 23 with the specific aim of providing local officials with the background and understanding with which to explore, attract, and prepare for expanded industrial and freight facility development in their jurisdictions as well as providing a practical manual for understanding freight issues and dynamics.

Economic development agencies have sometimes seen transportation infrastructure as a key driver to many such location decisions. Some may have read about intermodal site success stories, such as Columbus Inland Port in Ohio or Alliance Industrial Park in Texas, and their ability to attract new business. Less understood, perhaps, is how the combination of transportation, economic, and other location drivers makes them successful attractors of business and investment.

How to use this guide

The ensuing chapters of this guide discuss in more detail the requirements for both a good project and a good process in the planning and development of freight facilities (either public or private). This guide for public officials consists of six chapters.

Chapter 1: Introduction and Background provides brief background as to the purpose and use of this guide, as well as an overview of types of freight facilities and their role in freight distribution.

Chapter 2: Evaluating Freight Facility Impacts and Benefits provides an overview of some of the key factors that go into decision making in terms of costs and benefits to states, regions, or localities.

Chapter 3: The Critical Roles of Groundwork and Collaboration discusses how the public sector can prepare the way through successful application of planning methods and tools and can create a collaborative atmosphere to bring about a win-win outcome.

Chapter 4: How the Location Selection Process Works provides an overview of how the location selection process for freight facilities is conducted by the private sector.

Chapter 5: How Candidate Sites Are Evaluated contains a more detailed discussion of site assessment.

Chapter 6: The Changing Landscape (Complicating Factors) provides an overview of ever-changing global factors in the development of freight facilities as well as challenges to be faced in the project development and location process.

The reader is reminded that the associated research report, NCFRP Project 23: "Economic and Transportation Drivers for Siting Freight Intermodal and Warehouse Distribution Facilities," and published as *NCFRP Web-Only Document 1*, serves as the source for much of the material in this guide and may be consulted for more information. All of the source work and references from that document apply to this guide also.

What do we mean by freight facilities?

There are multiple types of facilities that interact with freight at different points along the supply chain (the supply chain starts with unprocessed raw materials and ends with the final customer using the finished goods). Though Tables 1a through 1g define the functions of various types of freight facilities, they essentially define freight facilities as "those which freight passes through (sometimes with a layover)." However, it is important to note to local officials that, in a larger sense, the term "freight facilities" can apply to a much larger universe of uses and could be more loosely defined as "facilities that attract and produce trips of freight-carrying vehicles" or "facilities that need materials and ship materials."

Since each of these types of freight facilities has a different purpose and different location needs, it is worthwhile to understand the functions housed in each, as well as the role that the facility performs. The following tables provide a summary of freight facility types and their roles in the supply chain.

...in a larger sense, the term "freight facilities" can apply to a much larger universe of uses... In this looser definition, facilities like truck stops, big box stores, rail yards, refineries, and manufacturing plants can all be considered freight facilities.

Table 1. Facility Types and Their Functions

1a. DISTRIBUTION CENTERS	Distribution Centers (DCs) take several forms, but all fill the role of storing and facilitating the movement of goods to their final destination.

- Most DCs are large, specialized facilities, often with refrigeration or air conditioning, where products (goods) are held and assembled into deliveries to retailers, wholesalers, or directly to consumers.
- Normally operated by a single company as a point in its supply chain, most DCs are linked to a geographic service region but some have specific purposes, such as the handling of urgent goods or imports.
- DCs perform staging, consolidation, and unitizing functions, can be involved in final stage manufacturing (such as packaging and labeling of goods), and may double as an operating terminal for an associated truck fleet.
- ***Warehouses*** are a less elaborate form of DC, focused simply on the storage of goods or merchandise. They may be multiuser facilities owned by a third party and leased by various supply chain customers (who may then view their portions as DCs), places for storage services offered by truck lines or household goods carriers, or inventory holding points for manufacturers or traders.
- A ***Cross-Dock Facility*** handles staging where inbound items are not received into stock, but are prepared for shipment to another location or for retail stores. Cross-docking supports lower costs through consolidated shipping and can create a pivot point for changing the specific destination of goods in transit. This facility breaks bulk items into smaller packs for delivery to warehouse/DCs or final destination.

1b. PORTS (SEA AND AIR)	Ports are key facilities for domestic shipping as well as the importing and exporting of goods, providing interface to rail and road.

- A ***Port*** serves as a point of entry and exit for incoming and outgoing shipments.
- Most commonly referring to air and seaports engaged in foreign and domestic trade, the term port also embraces points along rivers, canals, and lakes, as well as land gateways straddling national borders.
- Ports may have berths or hangars for vessels or aircraft, terminals and warehouses for the management of goods, staging and access areas, and customs facilities for the handling of foreign trade.
- Ports may specialize in certain types of cargo, such as containers, petroleum, bulk products, or automobiles, and they may also be military facilities.
- A ***Load Center*** is a seaport engaged in container trade that acts as a high-volume transfer point for goods moving long distances inland, and provides service to its regional hinterland.
- A ***Foreign Trade Zone (FTZ)*** is a geographic area in or adjacent to international ports where commercial merchandise receives the same Customs treatment it would if it were outside the commerce of the United States. An FTZ provides (a) cash flow timing benefits for warehoused products prior to distribution for sale and (b) significantly reduced import duties if value is added via refinement or sub-assembly processes prior to distribution for sale.
- An ***Inland Port*** is a physical site located away from traditional coastal or land borders with the purpose of facilitating and processing international trade and typically provides value-added services (such as assembly, kitting, or customization) as goods move through the supply chain. Inland ports may also feature FTZs.

1c. INTERMODAL TERMINALS	Intermodal terminals, in the purest definition, include freight facilities that allow for the movement of truck trailers and marine, truck, or air containers between modes (e.g., road and rail, rail and maritime, road and air, etc.).

- These facilities handle transfer between ocean-going vessels and inland transport or between other modes to take advantage of the service, economic, or environmental efficiencies of one mode (e.g., rail) for concentrated volumes in long haul movement vs. the speed and reach of another (e.g., truck) for dispersed volumes in local pickup and delivery.
- Physical features may include rail sorting yards, container moving equipment (permanent or portable cranes), container and chassis storage facilities, warehouse or cross-dock facilities, and – depending upon the modes being interfaced – other support facilities for sea, road, or rail equipment.

1d. BULK OR TRANSLOAD TERMINAL	A receiving and distributing facility for lumber, grain, concrete, petroleum, aggregates, and other such bulk products is referred to as a bulk or transload facility.

- These facilities support the direct or indirect transfer of goods between the carrying equipment of different modes.
- They are technically another form of intermodal facility, but involve the transfer of the goods themselves rather than of the equipment that bears them (e.g., containers).
- Physical features may include storage areas and tanks, cranes or bulk transfer machinery, warehouses, railroad sidings, truck loading racks, and related elements.
- An ***Auto Terminal*** is a type of transload facility for finished motor vehicles moving between ocean-going vessels, railcars, and truck trailers. Vehicles are driven under their own power between carrier equipment, and thus the goods themselves are the objects of intermodal transfer. Such facilities typically require substantial amounts of parking and movement space for the storage and safe staging of vehicles and have particularly high security requirements.

1e. HUB TERMINALS	A hub terminal is a carrier-operated facility whose principal function is the intramodal re-sorting and re-consolidation of inbound into outbound load sets for continuation in intercity linehaul.

- Hubs are located at central points, marshalling volumes to and from city terminals within a region and between hubs in other regions.
- They are typically large-acreage facilities processing a high number of vehicles. In the case of national hubs (as are used in air freight), the land and building requirements are very extensive.
- In ***less than truckload (LTL)*** trucking, a hub is a cross-dock operation transferring goods from trailers at inbound dock doors to others at outbound doors.
- In small package trucking and mail, sort and conveyor machinery are used in the transfer. A comparable sorting system is used in air freight, except that aircraft and air containers take the place of trailers.
- In railroading, the terminal is called a ***classification yard***, with sets of inbound and outbound tracks, and includes the transfer of railcars from arriving to departing trains. For intermodal trains, the transfer can be of trailers and containers from railcars on one train to those on another, as well as the transfer of railcars between trains.
- Hubs may also serve a city terminal function for local freight, and may incorporate dispatch, driver services, equipment maintenance, and equipment storage.

1f. CITY TERMINALS	A city terminal is a carrier-operated facility whose chief functions are the intramodal (e.g., truck to truck) sorting and consolidation of load sets between intercity linehaul and local pickup and delivery, as well as the management of pickup and delivery services to customers.

- City terminals are end points handling distribution within a metropolitan area and between that area and its hub. Acreage and vehicle volumes for most facilities are moderate but correspond to market size.
- Carriers in big cities may have one major terminal or a few smaller ones.
- Less than truckload (LTL) carriage operations involve cross-dock transfers of goods between smaller city and larger linehaul trucks.
- For small package and mail, sorting equipment may be utilized.
- In air freight, the transfers are between trucks used for local distribution and air containers carried inside trucks.
- In railroading, the terminal is called a ***marshalling*** or ***industrial yard,*** and the transfer is of railcars between tracks for local and intercity road trains.
- Management by local dispatching of pickup and delivery to customers and of related equipment pools is a crucial role, and city terminals are sometimes called ***service centers***. Private truck fleets frequently perform this function out of their parent company's DCs, where the load assembly is performed as part of customer order fulfillment (and the principal service is limited to delivery, not pickup).
- Bulk truck fleets rarely use city terminals for load transfer and instead utilize them for customer service and the cleaning and maintenance of equipment between loads.
- Equipment storage and maintenance are common at city terminals, as are driver services and a limited amount of goods storage for customer and operating convenience.
- City terminals occasionally have a mixed character: some act as mini-hubs, staging loads between small town terminals and major hubs, and others located on airport property act as intermodal terminals, transferring containers to and from aircraft.
- A ***Drop Yard*** is a site used by carriers for equipment storage and load staging, but with no transfer of goods. A less elaborate form of city terminal and sometimes with lighter security requirements, a drop yard can be as simple as a fenced parking lot with, perhaps, an office trailer. Used by truckload carriers, they are handoff points between local and intercity drivers – ordinarily to improve scheduling efficiency – and are servicing points for customer equipment pools. Used by overseas shipping lines, railroads, and equipment owners, they are called ***container yards*** and are used for the storage and management of containers and chassis, as well as staging between vessels, trains, and groundside customers. Drop Yards may have local dispatching and some driver services, and may offer or support equipment maintenance.

1g. INTEGRATED LOGISTICS CENTER (ILC) OR "FREIGHT VILLAGE"	A relatively new freight facility type, Integrated Logistics Centers are industrial parks or mixed use developments specifically constructed around high performance freight servicing facilities.

- Known sometimes as "freight villages," there is frequently an intermodal or hub terminal at their heart.
- A full portfolio of activities relating to transport, logistics, and the distribution of goods, both for national and international transit, is often offered by various operators.
- Manufacturing and other industrial uses are then situated around the core transportation facilities. In this way, the transportation-related "village" makes highly efficient use of the core capabilities, such as regular rail or intermodal service.
- ILCs represent examples of "Smart Growth," as their economies of density and scope support efficient logistics within a concise community and environmental footprint.

Keys to freight facility development success

The keys to successful implementation of a freight facility, particularly one that has public sector involvement, usually include:

1. Understanding the supply chain, carriage requirements, and the flow of goods.
2. Providing good connections to transportation infrastructure and operating networks (road, rail, port, etc.).
3. Appreciating the competitive advantages and disadvantages among supply chains, among freight carriers, and among the facilities they use.
4. Examining how proposed developments can affect economic development and local conditions such as traffic flows, noise levels, or utility capacity.
5. Developing land use regulation that allows for development, efficient operation, and transportation connections while maintaining and promoting sustainability.
6. Building public willingness and support of these projects.

Successful development of a new or expanded freight facility depends on having a good project, one that meets the site selection needs of the private sector and is consistent with the goals of the public sector. Success also depends on having a good process, one in which the groundwork for success is in place and contingencies have at least been discussed and planned for. A successful outcome is also one in which there has been broad collaboration so that goals have been identified and consensus established. A good project and a good process together are essential if success is to be achieved. The best project can fail because of opposition or lack of community support, and the most collaborative environment will not yield success if the project does not meet a private sector demand.

Chapter 2: Evaluating Freight Facility Impacts and Benefits

Freight facilities change the flow of traffic, bring jobs, impact land use development patterns, and may or may not bring other development opportunities. They may represent desired investment in the community, actively sought by economic developers and planners alike. Alternatively, these facilities may be seen as a mixed blessing, with both wanted and unwanted consequences.

Public officials need to understand these potential changes before considering how to attract or plan for freight facilities. Only by understanding and evaluating these costs and benefits can public officials properly evaluate how freight facilities match community goals and prepare accordingly.

While cost reduction and productivity improvements drive most private freight facility location decisions, the public sector experiences the benefits and drawbacks of freight facilities differently. The transportation, economic, and societal effects of freight facilities will vary depending on the type of facility, the modes used at the facility, and the geographic perspective of stakeholders (local, regional, state, and national).

Significant research exists on the topic of economic impacts, benefits, and costs of freight and more detail can be found in NCFRP Project 23 final research report available as *NCFRP Web-Only Document 1* (http://www.trb.org/Main/Blurbs/165743.aspx) as well as U.S. Department of Transportation reports such as the *Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects* from 2006. Impacts thus fall into several different categories and not all of them will apply to each type of logistics center, but the principal broad categories are:

- Economic Effects – including construction impacts, direct economic activity, multiplier effects, and economic development/business attraction and

- Transportation Effects – including mode choice and traffic volumes, direct travel impacts, supply chain logistics impacts, environmental impacts, and safety/security impacts.

The following table illustrates a range of effects from several case studies of specific freight logistics facilities.

Table 2. Facility Impact by Case Study

FACILITY TYPE	CASE STUDY	DIRECT AND INDIRECT JOBS	FREIGHT VOLUME	TRANSPORTATION IMPACTS
Inland Port	Virginia Inland Port (Front Royal, VA)	17 direct jobs, over 8,000 indirect jobs	33,600 containers (2008)	5.4 million VMT reduction, $105,000 greenhouse gas emission savings
Intermodal Terminal	Rickenbacker Intermodal Terminal (Columbus, OH)	Approximately 150 direct jobs at Intermodal facility, projection of 20,000 jobs at freight industrial park	250,000 annual container movements	49 million fewer truck miles in Ohio in 10 years – $2 M in pavement maintenance savings, $2.45 million in accident reductions
Bulk or Transload Terminal	Savage Safe Handling (Auburn, ME)	100 direct jobs	500,000 tons per year – 5,000 railcars per year	$619,500 accident reduction, $506,000 pavement maintenance from using rail over truck
Distribution Center	Family Dollar (Marianna, FL)	515 direct jobs; catalyst to another 155 DC jobs	90 trucks/day – 32,000 trucks per year	16.2 million in truck VMT per year
Warehouse	Murphy Warehouses	20 direct jobs (per warehouse facility)	10,000+ carloads per year	1.3 million VMT reduced annually. 6,730 fewer greenhouse gas tons emitted
Integrated Logistics Center	Alliance Texas (Fort Worth, TX)	28,000 direct jobs; 63,388 indirect jobs	600,000 intermodal rail lifts per year	N/A
Hub Terminal	Old Dominion (Morristown, TN)	750 direct jobs	75 to 90 trucks per day	21.5 million to 25.9 million truck VMT per year

Note: VMT = vehicle miles traveled.

Private sector investment in buildings and equipment and permanent jobs at a facility represents very real local and regional economic gains that need to be balanced with the potential traffic or other impacts that might result from such a location decision. For example, a warehouse located in a specific area may result in potential jobs and employment, additional traffic servicing the warehouse with the inbound goods necessary for inventory, and the outbound transport of goods to receivers and final users.

The broader regional picture should also be considered. In keeping with the example above, the region or metropolitan area surrounding the new warehouse site might also experience increased traffic and job gains, but could also benefit from better access to goods through the distribution center.

Economic effects

Jobs and investment make up the primary economic benefit resulting from freight facility location decisions, and communities and companies often estimate jobs, income, wages, and property value as direct, indirect and induced effects of a facility. These impacts include both the short-term construction effects and long-term operations as well as the potential to attract other businesses near a freight facility.

These impacts must be considered and balanced with projected impacts to evaluate how desirable these facilities are to the community and region. Knowledge of the true costs and benefits also provides the public sector with a much better basis for negotiations for incentives, credits, impact fees, and other public-private partnerships.

Near-Term Construction Effects

Building the facility and proposed infrastructure as well as necessary transportation connections requires short-term construction activity with both direct effects and broader multiplier effects. If desired, these impacts can be measured using input-output models, such as IMPLAN or RIMS II, which allocate construction spending to relevant industry categories.

Direct Economic Activity at the Freight Facility

The direct impacts of the new freight facility include the number of people employed at the facility, their wages and salaries, changes in revenue (business output), and any developments directly related to the facility. Freight facilities also generate income to the community and state directly in the form of property tax, corporate income tax, sales tax, and the various permitting fees that accompany the activities at the site. In addition to this, the region and state also gain additional tax income through the income and purchasing activity of employees and vendors.

Multiplier Effects of the Freight Facility Operations

Impacts beyond the direct impact of the facility itself are called multiplier effects. For example, an employee at the new warehouse receives wages that he otherwise would not have received. Put another way, the salary paid by a freight company to an employee

is a direct impact. How that employee then spends this salary locally on groceries and housing is a multiplied, indirect impact. The impact of the facility thus expands into the community, state, and country.

Economic Development/Business Attraction

Freight facilities can be a catalyst for economic development through attracting other suppliers or vendors to form an industry cluster of activity. They may also spur new development or redevelopment of existing properties. The size and timing of economic development/business attraction effects can vary greatly by facility based on local land use and zoning policies, economic development incentives and marketing, transportation connectivity benefits, and so on. Effects include:

- Redevelopment – Economic and financial gains from redevelopment of existing underutilized land, including additional job creation and increases in property value.
- New Businesses – The economic and financial gain of locating new businesses on previously undeveloped land.
- Residential Properties – Including the addition of new houses and the impacts of increased population.

Transportation effects

Transportation impacts accrue from changes in the movement of goods and can impact the community and region in a variety of positive and negative ways. These include benefits from modal shifts (and removal of trucks from the roadways), increases or decreases in traffic, and pollution.

Mode Choice

Mode choice and traffic volume reflect changes in truck, rail, ship, and air volumes due to the selection of transportation mode. The primary impact tends to be to highways as most freight travels by truck for at least a portion of its trip. A facility that allows for lower cost or more efficient mode choice may either reduce truck traffic, or focus truck traffic at the point where modes connect.

Traffic

The location of the facility will change traffic patterns in the immediate surrounding area. This may result in increased truck traffic to/from the facility depending on highway access, local traffic patterns, and

access. Facilities that promote the use of modes other than truck may help keep longer distance trips on more efficient and cost-effective modes, thus reducing overall truck VMT (vehicle miles traveled) on local, regional, and national highways.

Congestion

Congestion on roads, rails, air and sea can cause community conflict as well as delay in goods reaching their destinations. Congestion can also have direct financial impacts as it increases shipping costs and can lead to investment in infrastructure improvements to alleviate delays. Congestion can also have air quality impacts based on idling.

Environment, Emissions, and Energy

The pollution and energy usage that accompany freight facilities changes with the distance traveled and/or the modes used for transport. Changes in fuel consumption, emissions levels, noise and vibration are the most common environmental impacts.

- Air Quality – Fewer pollutants (NO_2, CO, CO_2, NO_X, SO_2, particulate matter, volatile organic compounds) are released into the atmosphere with fewer vehicle miles traveled, as emissions are a product primarily of mode and distance traveled. Shifts to a more efficient transportation mode (e.g., truck to rail via an intermodal terminal, or an increase in the distance on rail versus truck) also result in a change in emissions. In addition, newer intermodal facilities are often equipped with technology improvements to reduce truck idling, leading to further emissions reductions.
- Fuel Consumption (Energy Intensity) – While not a direct public cost or benefit, shorter trips and less congestion typically result in better fuel efficiency and lower levels of fuel consumption. Energy consumption per ton-mile varies by mode, with air having the highest consumption and maritime the lowest. Better overall fuel efficiency in the network can impact a community's energy profile and have broader, longer term societal benefits.

Safety and Security

The location and design of freight facilities can also have safety and security effects on the community or region. These include the traffic

Impacts

Transportation

- Traffic volumes by mode
- Direct travel costs
- Supply chain logistics
- Environment, emissions, and energy
- Safety and security

Economic

- Construction
- Direct economic activity at the facility
- Multiplier effects
- Economic development/business attraction

Costs

- Capital
- Infrastructure
- Operating and Maintenance

conflicts resulting in accidents due to changes in truck VMT, as well as criminal activities around the facility itself.

- Safety – Well-sited and designed facilities can reduce the number of trucks on the road and/or the distance they travel. This can be expected to lead to a reduction in accidents, measured as property damage, injury, and fatalities. The corollary is also true – poorly sited facilities can result in an increase in hazardous traffic conditions and conflicts with pedestrian or local auto traffic.
- Security – The value of freight can attract criminal activity, but security measures reduce this activity, thus reducing losses to shippers and receivers and providing a higher level of security in the community around the facility.

Other public sector costs

As described earlier, the costs of freight facilities are often borne primarily by the private sector owner of freight logistics facilities. However, supporting public infrastructure (roadways, utilities, and public services) represents direct costs to the community. Additionally, it is increasingly common for public-private partnerships to help fund facilities and connecting infrastructure. The three main categories of cost are:

- Capital – Those costs that occur when constructing the facility itself, including design and construction. These costs are typically incurred before the facility is operational.
- Infrastructure – Costs necessary to improve the road or rail network surrounding the facility in order to fully accommodate the increased volume of shipments.
- Public Services – The community and region may also incur additional annual costs for firefighting, public safety, police, public works, and related services as a result of additional freight activity.

While all of these measures may not be applicable to every freight facility, all of these costs and benefits should be considered in undertaking an assessment of the economic and transportation effects of freight facilities.

Chapter 3: The Critical Roles of Groundwork and Collaboration

Freight facility developers generally prefer to work with communities that understand the competitive landscape of the freight industry. These communities come to the table with an understanding of the company's goals, as well as how the company's and community's goals align. They are able to suggest proposals that help reduce initial investment or operating expense or at least to knowledgeably demonstrate the benefits of specific sites. This provides the most amenable environment for a win-win outcome. Such communities recognize that alignment of public and private sector goals yields benefits for both long into the future.

Freight facility developers generally prefer to work with communities that understand the competitive landscape of the freight industry.

Companies begin discussions with government and economic development organizations at various times depending on their stage in the location process. The more sure the company is about where they wish to be, the more likely it is that they will directly contact officials at the local level (county, city, or other) and begin feasibility discussions. If the search is regional (or at an early stage), then the company may decide instead to speak with state or regional officials.

Ideally, a community positioning itself for freight uses (i.e., industrial or freight facility development) will have developed a vision, economic development strategy, land use plan, transportation plan, and zoning regulations that explicitly permit and support these facilities in a variety of ways. This also means that such plans will have been developed in such a way that areas designated for freight uses are either not in conflict with other community uses and residential neighborhoods or that a certain amount of conflict has been recognized, identified, and mitigation proposed. This type of preparation may be referred to as **"laying the groundwork."**

Ideally, a community positioning itself for freight uses... will have developed a vision, economic development strategy, land use plan, transportation plan, and zoning regulations that explicitly permit and support these facilities in a variety of ways.

Communities and regions can also help significantly in the industrial or freight facility development process by proactively managing the interaction with both stakeholders at all levels and with the broader public. These activities can result in **"collaboration."** Government and appointed officials can work with local interests to keep everyone informed, involved, and coordinated. For example, they can ameliorate community concerns by ensuring that the community has a vision that is broadly based, has been developed in a collaborative way, and that calls for land use development that supports the necessary tax base. Such a vision and plans will also transparently acknowledge potential impacts and suggest ways to avoid or mitigate those impacts. Proactive planning will also serve to educate the public on the benefits that such development can bring to the community at large, and demonstrate how the community can work with the new development to reduce the impact on residents to the greatest extent possible.

The concepts of proactivity (planning, being proactive) and the building of collaboration – particularly with the public – deserve extra emphasis here. All local and regional planners want vital, attractive, and solvent communities. It is also true that this goal often requires very hard work in terms of solid strategic thinking and the courage to make controversial decisions or propose controversial alternatives. One key factor in reducing controversy is education of the public to the concept of "freight as a good neighbor." Freight is often seen as a "bad guy" contributing to noise, congestion, or unpleasant vistas. While there is no getting around the potential effects of freight uses, it is also true that freight facilities that are well-sited and well-planned can be a great benefit to a community in a variety of ways, from the development of an employment base to tax income potential. The more the public understands about the tradeoffs of land development, the more a community can be proactive in strategy, rather than reactive to controversy.

Proactive planning and targeting of specific freight facility development helps to provide a cost-benefit framework of tax base and jobs to ameliorate traffic and other land use development issues. There are many issues on which residents or others may oppose such

a development, not the least of which include NIMBY (not in my backyard) concerns. However, such opposition is less likely to develop traction if the community has already established a transparent process and a sense of trust, during which the public has become aware of the benefits and tradeoffs of freight facility development.

Companies view a community's or region's willingness to provide a clear path through the public review, permitting, and regulatory processes as an amenity or incentive. By providing the company with a reliable and transparent picture of what obligations the company needs to meet, which permits it needs to obtain, and a clear time frame for when these hurdles may be met, the company can more clearly define when the facility will be able to enter the supply chain and generate returns on investment.

Preparation for successful freight facility development begins with an understanding on the part of the community and local government of community vision and goals, and the logical steps that need to be taken to move the community in that direction. While clearly not all communities have written visions, even an unwritten vision makes itself clear in the ways that the community plans, or fails to do so, for its own development.

Laying the groundwork

Laying the groundwork for industrial and/or freight facility development may consist of any or all of the following:

- ☑ Prior development of community vision, goals, and comprehensive plan.
- ☑ Education and inclusion of community stakeholders.
- ☑ Initial third-party feasibility study on the appropriateness of the community for a freight facility.
- ☑ Amenable transportation network.
- ☑ Clearly defined economic development strategy.
- ☑ Clear and consistent zoning regulations and permitting requirements.
- ☑ Public utility capacity.
- ☑ Identification of private sector developers with interest and capability to construct freight facilities and infrastructure.
- ☑ An amenable tax environment.
- ☑ Public sector incentives.

A comprehensive plan... can be an indication that the community has taken responsible charge of its own direction... A good comprehensive plan will also have been developed collaboratively so that a broad range of stakeholders will have had meaningful input to the process.

Preparation for successful freight facility development begins with an understanding on the part of the community and local government of community vision and goals and the logical steps that need to be taken to move the community toward that development. A vision is not just words on paper, but clear understanding, developed in a collaborative process, of how the community sees itself in the future. This can relate to all types of characteristics, including quality of life, economic viability, sustainability, and infrastructure. While clearly not all communities have written visions, even an unwritten (or no) vision makes itself clear in the ways that the community plans, or fails to do so, for its own development.

A comprehensive plan, whether at the local, regional, or state level, can be an indication that the community has taken responsible charge of its own direction. Clearly, there are good comprehensive plans and not-so-good comprehensive plans. If well prepared, a comprehensive plan will define community goals for development, as well as the specific transportation, land use, and open space requirements and projects to bring about its goals. A good comprehensive plan will

Case Study

Land use regulation is a useful tool to guide freight facility development. Virginia Inland Port, located in Front Royal, VA (approximately 70 miles west of Washington, D.C.), began operations in 1989 and is generally recognized as America's first successful inland port. The port can also serve as a "lesson learned" opportunity, as current knowledge would suggest that if the port were to be developed today, the layout would be different to allow more strategic development of parcels. Also, land requirements might be expanded to 1,000 acres with greater emphasis on smart growth for supporting freight facilities. Strategic smart growth would entail planning to incorporate zoning and land use for supporting facilities [third-party logistics (3PL), distribution centers], and would buffer residential development from freight activity. Since Virginia Inland Port's actual development was sporadic, contiguous development didn't allow for efficient development of the growth and operations existing today. For example, a golf course development across from the facility hinders further industrial development and reflects the importance of planning considerations for future inland port developments.

also have been developed collaboratively so that a broad range of stakeholders will have had meaningful input to the process.

When a community is actively seeking or speaking with a potential freight facility or industrial developer, the greatest opportunity for success will come from extensive collaboration and communication at that stage. Planners, local elected officials, economic development agencies, regulatory agencies, transportation planners, and others need to be brought into the process so that they can express their concerns and have those concerns addressed. The same goes for the general public, most specifically those living, working, or commuting in proximity to the proposed facility.

In order for the comprehensive plan and vision to be implemented, a community must have sound land use regulations in place, including zoning regulations, building codes, transportation facility guidelines, and others. Those regulations impact how a company can implement its plans for a particular site and can also give some indication as to how compliance will impact the project development timeline. Knowledge that a community is already familiar with a facility type and has a process in place can be seen as a "location positive." For example, a community that already houses a bulk terminal will be familiar with the impacts that these might have upon the community and will have a clear process in place for permitting additional facilities using bulk freight. Other communities that do not have this experience might exhibit confusion and delay in responding to the company's permit applications if they do not have an understanding of a company's business needs. However, even a community without prior experience can ensure that it is well prepared for whatever type of development it desires.

Fire codes, land use regulations, traffic regulations, zoning, and hours of operation regulations can all significantly impact the feasibility of a freight facility location. The interpretation of codes and regulations by officials such as fire marshals can have a decisive effect on the ability of a facility to function as planned. Ideally, a community positioning itself for freight uses will have developed land use, transportation, and zoning plans that explicitly permit and

support these facilities and that, in some cases, allow for round-the-clock operation. As an aside, development of regulations that are amenable for desired development and that also support community goals and values can be a particular challenge when freight facilities are established at the edges of towns and the neighboring communities have differing views on which uses ought to be provided for and what standards to impose.

The availability of public utilities, such as water and sewer, can be a critical element in site selection. The amount of lead time to develop this infrastructure may end up being prohibitive if they are not already available. Public utility availability and costs are usually investigated through conversations with local economic development agencies and utility providers. Municipalities need to be aware of freight facilities' utility needs and of the capacity that exists to accommodate those utilities.

Public sector assistance in the forms of tax credits, grants, low-cost loans, training programs, utility discounts, and infrastructure development can address specific location shortcomings and is often used to close the gap between a location and its competition.

Many... view incentives as a means for building a critical partnership between company and community...

Public sector assistance and incentives

Public sector assistance in the forms of tax credits, grants, low-cost loans, training programs, utility discounts, and infrastructure development can address specific location shortcomings and is often used to close the gap between a location and its competition. Broadly speaking, incentives do not drive location decisions in the early stages of facility planning. Incentives do not substantially impact the overall feasibility of a site, nor can they ameliorate serious shortcomings. In short, they cannot make a "bad" location into a "good" one. Therefore, incentives are not an early decision factor, but may be a significant factor once the list is reduced to several candidate sites.

Companies and location consultants have a wide range of perspectives regarding the role and use of public incentives. Some companies view the incentives process as asking the community for handouts and

are not willing to ask for any assistance beyond that available as-of-right (e.g., benefits defined by legislation if companies achieve pre-set hiring or investment targets). Some may even forego incentive offers due to concerns over public perception or future "claw-back" provisions that require the company to return any benefits if agreed-upon benchmarks are not met.

However, many others view incentives as a means for building a critical partnership between company and community to reduce the one-time and operating costs of freight facilities to the point where success may be gained for both sides. Specific incentive programs can include:

- Tax concessions or exemptions.
- Loans and loan guarantees.
- Employee tax credits.
- Wage subsidies.
- Land subsidies or grants.
- Cash grants.
- Property tax abatements.
- Utility rate reductions.
- Infrastructure grants.
- Access improvements.
- Enterprise Zones.
- Foreign Trade Zones (FTZ).
- Tax Increment Financing (TIF).
- Inventory tax reduction.
- Expedited permitting and approvals.
- Customized training programs.

The public sector may also be able to offer information to freight facility developers by, for example, acting as a clearinghouse for information on back-haul and other freight-leveling opportunities. Some companies would find it helpful to obtain information on local freight movement the same way they can for electric, utilities, workforce, and soils. By coordinating this information, the community can ensure that local carriers and freight users run closer to capacity on a more regular basis, providing a strategic advantage. This type

of informed partnership, which the public sector can provide, may make a difference in the ultimate site selection.

Communities can also provide tangible incentives without subsidy by shortening or expediting the permitting time frame. Communities that understand the company's process and drivers can smooth the permitting process and provide clarity of expectations for the company and the regulatory agencies, thus resulting in a better defined process and a shorter time to implementation. Through this approach, communities can provide a strategic advantage for their location.

Freight location decisions rarely respond to a "build it and they will come" approach on the part of the public sector unless the public sector has been diligent in doing its homework. But having needed infrastructure in place can be a strong incentive.

Income, sales, real estate, and property taxes can all significantly affect the cost environment for freight facilities. Chief among these are property taxes. Real estate taxes can be high on urban facilities on land that might otherwise be used for high-density development. Over time, higher real estate property taxes may drive these parcels into non-freight development and freight facilities will relocate to the urban fringe.

While incentives are often very useful tools, it should be noted that local strategies of building speculative infrastructure, public terminals, and warehouses are unlikely to be successful without a thorough understanding of how these directly address operating economics and forecasted market demand. Freight location decisions rarely respond to a "build it and they will come" approach on the part of the public sector unless the public sector has been diligent in doing its homework. But having needed infrastructure in place can be a strong incentive.

Best practices for the public sector

So, what can community leaders and officials do in terms of laying the groundwork and building a collaborative process to bring good freight facility development to their community in a win-win process?

The following lists represent some best practices for successfully engaging in this process.

Community representatives, whether they be elected officials, economic development professionals, or in the planning fields, can and must lead the dialogue on what role freight facilities will play in the economic life of the community. Public officials should take positive steps to examine how their community interacts with the freight network and lay the groundwork for mutually beneficial relationships in the future through the processes of learning; examining; and planning, communicating, and educating.

Learning:

- ☑ Becoming educated on the drivers of freight facility siting decisions can help communities effectively plan for such facilities. Understanding what drives a company to locate a new freight facility and how the process progresses allows for better conversations when the public and private sectors come to the table together.
- ☑ Obtaining a full understanding of a freight facility's potential impacts can lead to higher quality local planning and development decisions. Costs and benefits should be understood and shared among the parties.
- ☑ The world of freight movement is a dynamic place. Fuel costs, regulatory changes, and changing consumer tastes all influence the supply chain. Elected officials are best prepared to engage in freight facility discussions when they have the vision to anticipate change. Statewide or regional freight plans can incorporate these elements and use them in policy formation, and local communities can benefit from being familiar with these statewide or regional plans.

Obtaining a full understanding of a freight facility's potential impacts can lead to higher quality local planning and development decisions. Costs and benefits should be understood and shared among the parties.

Examining:

- ☑ The community's location on various transportation networks and freight flows will impact the kinds of businesses which will want to locate in the community. If the community is not along the key flow, it will not be a candidate for activity, while communities along key freight flows will experience increased pressures for freight facility development.
- ☑ Other key inputs such as labor force and overall cost environment will also impact the specific activities drawn to an area. This will differ by company, activity, and industry. Communities need to understand which facility types and functions match their own community strengths and provide a competitive advantage. Land use planners need to employ these insights in the ways they situate development and link that development to their locality's networks and resources as well as to their community's vision and goals.
- ☑ Making the effort to understand what the community has to offer in these key areas allows for more efficient and effective planning. This understanding can also influence private sector siting decisions and lead to improved opportunities for the community. Whether or not a community is even under consideration for a possible facility is often decided long before most local agencies learn of it. Thus, a community's ability to better position itself can expand its range of prospects. Economic development corporations can make a key contribution in sharpening the focus of public planning at both the regional and local levels.

...a community's ability to better position itself can expand its range of prospects.

Planning, Communicating, and Educating:

- ☑ Communities need to determine where freight and logistics oriented prospects fit into their business attraction program. Whether as a direct target or to support strategies for manufacturing, retail, and other activities, communities must develop freight attraction or support plans. A freight "cluster" may be a possibility if carefully planned. Metropolitan

Planning Organizations (MPOs) who want to influence instead of just react to the pattern of freight activity in their jurisdictions should make an attempt to integrate such components to their plans.

- ☑ Institutional silos between economic development, land planning, transportation planning, and even between regional governments must be overcome. Freight movement and facilities affect and are affected by all of these, and our public sector organizations need to collaborate in order for the big picture to be understood and for all stakeholders to be "on-board."
- ☑ Freight movement functions as a system. The infrastructure interacts with the operation, and private infrastructure interacts with public. Better outcomes result from collaboration. Despite the independent decision making of private and public organizations and the difficulty of institutional connections, the parties require interaction just like the system elements. Proactive communication is the first step to arriving at win-win proposals.
- ☑ Identifying areas appropriate for freight facilities in local plans and using zoning and policy tools can help protect a community's ability to support freight operations. Such insightful and multi-jurisdictional planning can also preserve community quality of life and avoid political headaches in the future.
- ☑ An understanding of the costs and benefits of freight facilities also lends public agencies the insight to build incentive, financing, and other credit programs that appropriately engage the private sector. They do so in a way that builds a long-term, mutually beneficial relationship between company and community, balancing gains and costs among the parties. Elected officials intent on bringing jobs to their districts can drive this process and ensure that it meets the needs of their constituents.
- ☑ Freight and logistics activities sustain community life (e.g., many popular consumer goods arrive by truck) and enable community growth, yet these benefits are generally not

Our public sector organizations need to collaborate in order for the big picture to be understood and for all stakeholders to be "on-board"... Better outcomes result from collaboration...

Freight and logistics activities sustain community life and enable community growth, yet these benefits are generally not recognized by citizens. Conversely, all citizens can relate to the hazards they attribute to truck traffic.

recognized by citizens. Conversely, all citizens can relate to the hazards they attribute to truck traffic. Communicating the vital contribution of freight to our economy and educating other stakeholders and the general public is an important part of building collaboration and garnering support. Communicating the specific value of proposed projects is essential to attracting and preserving community or political support and protecting timelines for development.

Each community's specific situation will be different. Nonetheless, the guiding principles or best practices noted in this chapter represent a useful framework for self-examination and action toward building a successful freight facility strategy.

Chapter 4: How the Location Selection Process Works

Communities that want to attract freight facilities should examine themselves as corporate site selectors do before engaging in a full-scale business recruitment process. If a community is going to successfully compete in attracting a freight facility, it is to its advantage to understand what needs a company is seeking to satisfy and what kind of criteria they will use to select a site. What are the key things a planner, economic development strategist, or elected official should know to develop potential or develop competitive advantage for a good freight facility project?

- ☑ Freight facilities will only consider locations that fulfill the primary objective of moving goods in the most efficient manner from point of origin to destination. This trumps most other considerations.
- ☑ Companies and carriers rarely base location decisions on personal relationships, government incentives, or regional promotions. These factors are only a consideration after a location meets the required criteria for the business to be successful.
- ☑ Local officials can make their communities more attractive to freight facilities by providing a hospitable climate through appropriate zoning, compatible land use, transportation infrastructure, and community support.
- ☑ When companies evaluate sites, some criteria are far more important than others. The ability to access key markets, availability of efficient transportation, sufficient qualified labor, and total costs are considered key criteria.
- ☑ Proximity and/or access to markets is the most important driving factor that determines the region or community in which a freight facility will locate.

Proximity and/or access to markets is the most important driving factor that determines the region or community where a freight facility will locate.

- ☑ Freight location decisions rarely respond to a "build it and they will come" approach by the public sector, yet it is also true that having the necessary support infrastructure in place can be a great incentive if the location is a good one and other factors are positive.

This chapter will broadly describe how companies decide where to place freight facilities – beginning with the early planning stages up through final site selection. Chapter 5 will provide a more in-depth look at 11 key criteria typically used to evaluate candidate sites. (Chapter 3 has already discussed the importance of the groundwork communities can undertake and the collaboration they can build to greatly increase the potential for success for freight facility development in their communities.)

Location screening is methodical and iterative....

Site selection: the big picture

Companies will first internally examine their current and future needs and then develop a planning framework to determine how best to externally address these needs. Location planning is methodical and iterative, usually involving a team of individuals within a company.

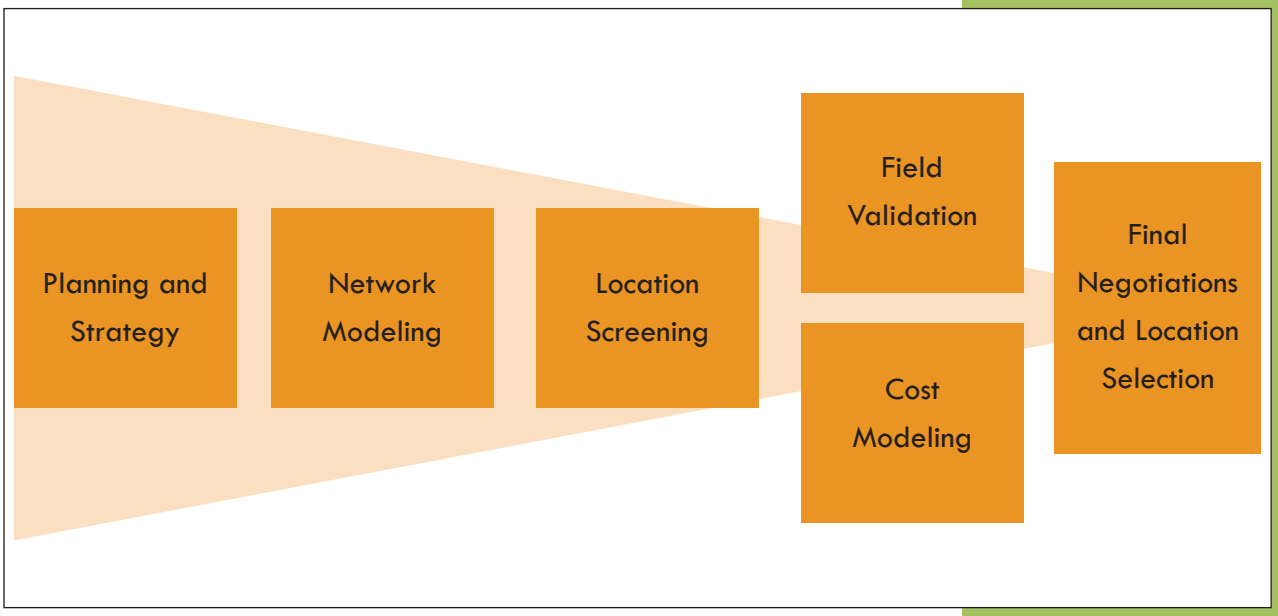
Site selection decisions typically involve at least the following four steps:

1. Defining the company's business strategy and the success parameters for the new (or relocated) facility.
2. Developing the site selection criteria, usually phased in such a way as to allow a progressive evaluation from broad to specific, region to community.
3. Examining the communities and sites directly through on-site visits.
4. Involving three to four sites and communities in detailed discussions and negotiations.

As noted above, location planning is methodical and iterative. Factors will vary in importance throughout the process. For example, access

to specific markets, costs, and population trends may drive the early stages. A secondary screening may involve examining highway and rail networks to determine areas with service advantages. The third screening may evaluate total costs of operation for the final candidate sites. The final stage may then involve more site-specific issues such as specific facilities and the labor available in a particular community.

Stages of site selection



While these steps are shown above as a sequence, stages often overlap and recycle in an iterative manner. For example, some organizations combine the network modeling and location screening stages. Others develop the financial model early in the project to determine overall feasibility and then refine it based upon new knowledge throughout the process. Sometimes location selection needs to cycle back to a previous stage.

Planning and strategy

The location selection process for any freight facility begins with the identification of a need. This need may arise from the desire to serve a new market, to merge facilities acquired from another company, or to respond to a change in market conditions.

Why seek a new site?
EXPAND: To service a new market
CONTRACT: To downsize into a smaller facility, fewer facilities, or merge networks
CHANGE: To adjust for changing market or network conditions

Distribution facilities are inextricably linked to distribution networks. A change at one node in the network may have implications up and down the entire supply chain. As a result, companies will usually begin site selection planning by revisiting the goals and business context for their distribution network as a whole. As part of this process, a company may ask itself a series of questions, such as:

- *Who are our customers? Where are they, and what do they want?*
- *How much of the supply chain do we wish to control ourselves, and how much of it do we wish to contract to a vendor or set of vendors?*
- *Is our goal to optimize cost or reduce time to market? How can the company best balance its customer service goals?*

- *What kinds of people do we need, and what do we need them to do? How does this balance with our capital needs?*
- *How might any of the above change over time? When might that change occur? How might this impact our decisions?*
- *How will we evaluate and adjust our decisions as time goes by? How often will we do this?*

Any form of advance planning involves a calculated risk. Unforeseen business events, market changes, and other outside factors introduce the risk of significant error into any planning process, and the margin of variance increases the further out the target year. Nonetheless, any network or facility plan usually adheres to the following rules of thumb:

FACILITY CHARACTERISTICS	PLANNING HORIZON
Significant infrastructure investment (such as a port or intermodal facility)	20+ years
Capital or machinery intensive investment	7-10+ years
Commodity-based or non-capital intensive	3-5 years

Once the company selects a planning time frame, the sales, operations, and/or supply chain staff can forecast or project the remaining strategic considerations:

- Sales or through-freight volume by type.
- Demand points or markets to be served.
- Product sourcing.
- Product categories.
- Number of end (or source) points to be serviced by the facility.
- Freight pricing (including variability by mode).
- Facility ownership or leasing options.
- Any likely exit plan for the facility.

The time frame and forecast of these strategic considerations establish the overall needs to be satisfied by the new facility or network. The location planning team will use this information to set overall parameters for the project.

During the planning and strategy phase a list of criteria will be developed.

Case Study

Murphy Warehouses operates nine warehouses in the Minneapolis-St. Paul region. When Murphy Warehouses requires another facility because of customer expansion or changes in warehouse and distribution demand, the following are key requirements for purchasing another existing facility:

- **Facility must have access to Interstate or major highway interchanges (within 3 miles).**
- **Facility must have on-site access to rail (reflecting Murphy's market strategy).**
- **Facility must be between 150,000 and 200,000 square feet.**
- **Real estate taxes in community must be reasonable.**
- **Preference toward energy-efficient facilities.**
- **Facility must be in good structural condition including docks, steel joists, roof, and floors.**
- **Stormwater can be handled on-site.**

Other considerations are: 1) the new site should have access to the markets served and located within the metropolitan area; 2) land prices and development costs to refurbish the existing facility would also factor into location decisions; and 3) any facilities considered would have to be sound real estate investments and sellable in the future.

Time to market and overall logistics costs are prime factors driving freight facility location decisions.

Network modeling and analysis

Time to market and overall logistics costs are prime factors driving freight facility location decisions. As a result, the first stage for locating a freight facility is to examine the interplay between location and freight costs. Transportation is a large consideration at this point in the analysis.

Companies use computerized network modeling programs or equivalent methodology to estimate total shipping cost and time to market for a range of scenarios. These approaches use customer or store locations, sourcing points, freight loads, fuel costs, facility operating costs, and transportation modal choices to develop

idealized distribution center networks. Modeling programs and other analyses may evaluate a variety of scenarios, examining the sensitivity of issues such as freight volume, population growth, customer change, sourcing, operations costs, and fuel costs.

Linkages and infrastructure in any modeling must be compared against real-world data to reflect actual conditions, which network models sometimes have difficulty incorporating. Congestion and traffic on roadways may compromise what appears to be an ideal network, as may policies that promote passenger traffic take precedence over freight on rail networks. Companies often need to make off-line corrections, as network models do not always incorporate on-the-ground issues.

The network models do not identify final sites, but only show recommended areas where freight facility nodes would yield the best performance. Companies typically use this information as a starting point and attempt to find sites within a reasonable radius of these recommendations. This radius may be larger (50 miles) or smaller (10 miles or less) depending on the nature of the network or facilities under consideration.

Communities poised with available information or a means to readily provide information may find themselves in a better position to compete for a facility.

Location screening

In this process, non-transportation factors such as workforce, regulatory environment, utilities, and the cost of real estate become important factors in the location search. The location planning team will typically construct either a grid or a weighting and ranking model that uses demographic, socioeconomic, workforce, tax, regulatory, utility, and other data to determine how each candidate community matches the company's goals relative to the other communities under consideration.

The location planning team, in addition to collecting available data from various public and private sources, may also submit a request for

information to individual community economic development agencies if the team needs more specialized information. Communities prepared with available information or a means to readily provide requested information may find themselves in a better position to compete for a facility.

The planning team typically constructs an evaluation matrix or model based on this data. By applying the evaluation criteria developed in the strategic planning phase, the team can objectively test how well each of the candidate communities or sites matches the company's needs. The team may test a variety of alternative scenarios to reflect changing priorities. The team also examines how the community or site location impacts operating and cost considerations as compared to the network model's ideal location. Communities that score well for the team's identified priorities and that can also adapt to alternative scenarios make the "short list" for further analysis.

Communities which score well for the team's identified priorities and which can also adapt to alternative scenarios make the "short list" for further analysis.

Field and site analysis

Once a community or region is placed on the short list, the location planning team will further evaluate specific sites or facilities within the area. At this stage, the location team may seek the assistance of local government or economic development officials to explore possible sites, find out about permitting and regulatory requirements, and learn more about transportation and utility infrastructure.

This communication will allow a better understanding of the actual operating environment in the community and can also serve to begin the negotiation process for land, facilities, and public assistance or incentives where appropriate.

At the same time, the company will enter into discussions with land or facility owners on selected properties to ascertain:

- Size, configuration, or permitting ability vis-à-vis company needs.
- The site or facility's ability to accommodate growth or otherwise adapt to future requirements.
- Ease of access to and distance from key transportation points (highway ramps, switching yards, intermodal facilities, etc.).
- Cross-dock, ceiling height, maximum floor weight, number of loading docks, rail access, and other materials movement requirements of pre-existing facilities.
- Utility capacity.
- Site engineering considerations.
- Environmental considerations.
- Potential rent, purchase, and operating costs.
- Safety and security.

This information, along with the financial analysis described below, allows the planning team to further refine the location recommendations.

Cost modeling

Companies will typically develop cost models during the site selection process to provide critical information as to how well each scenario and/or location will provide an economic payback (and over what period of time) for the proposed investment in the new location. The amount of time required for the company to recoup its initial investment and the rate of return must be compared against other operational investments the company might consider in order to prioritize such investments. Cost models typically include start-up and recurring costs and may also include exit costs.

Cost modeling allows for consideration of the impact of changing cost environments for fuel, labor, network service performance, revenues, and tax exposure. A location's flexibility of use and potential to accommodate future growth substantially increases the chances that an appropriate location or scenario will be selected. These analyses therefore result in a determination of both absolute and relative feasibility for the alternative locations under consideration.

Incentives, negotiations, and final selection

Initial steps will likely be made during specific site analysis towards identifying, negotiating, and securing incentives from local or regional governments to address any perceived shortcoming of the location or to help offset costs that negatively impact the project feasibility. These incentives can include tax incentives, cash grants, expedited permitting and approvals, and other inducements.

The project team will take extreme care to ensure that any action taken by the team, the company, or its partners is not construed as a firm commitment to any community under investigation, as any such premature commitment could eliminate the possibility of financial incentives and inducements.

At the completion of the cost model, site analysis and negotiations, and the negotiations for public incentives, the location planning team will present their findings and recommendations to corporate stakeholders. The company then decides on a course of action, completes negotiations, and implements the new location strategy.

Chapter 5: How Candidate Sites Are Evaluated

Equally important to knowing how companies make decisions is knowing the factors that drive those decisions. Throughout the stages outlined in the previous chapter, supply chain and operations personnel evaluate each option and location for:

- the ability to access key markets.
- interaction with the transportation network.
- modal choice.
- labor and workforce.
- total cost environment.
- utilities.
- availability of suitable facilities.
- permitting and regulation.
- tax environment.
- public assistance and incentives.
- climate and natural hazards.

Proximity and/or access to markets, especially supply chain networks, is the single most important factor in determining the location of a freight facility. Most of the other site selection factors are used to refine the site selection process to specific, sometimes competing, sites.

Companies typically state that the first five criteria in this list – access to markets, efficient transportation with modal choices, an ample and qualified workforce, and reasonable costs – are more critical than the others in the list. Furthermore, proximity and/or access to markets, especially supply chain networks, is the single most important factor in determining the location of a freight facility. Most of the other site selection factors are used to refine the site selection process to specific, sometimes competing, sites.

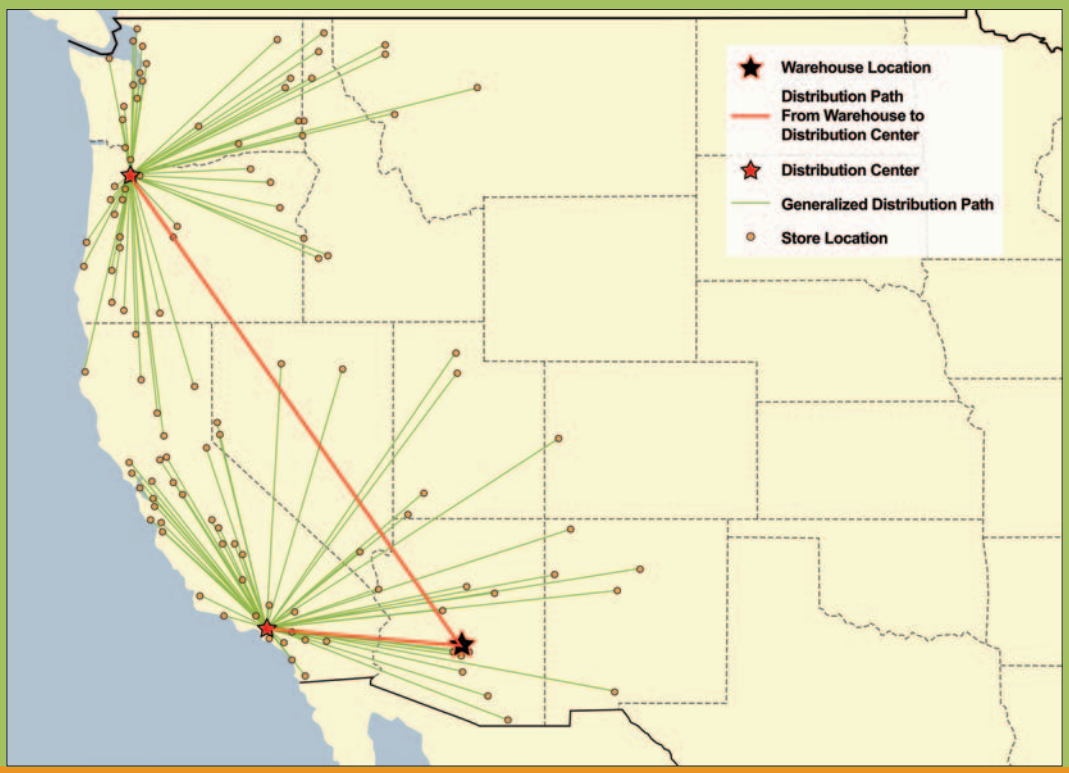
Ability to access key markets or customers

Freight facilities exist to facilitate the processing and movement of goods from an origin to a destination. The point of origin may be a source for raw materials, a manufacturing plant, or an intermediate point. The destination may be the ultimate consumer, a manufacturing plant, or a staging point along the way. Regardless, freight facilities typically choose locations that allow them to most directly and efficiently access these origin and destination points.

Access is expected to accomplish two things: 1) delivery service with speed, predictability, and precision that matches or exceeds the competitive standards in the market and 2) costs that are as low as possible.

Retail companies often establish their distribution networks on a concept of overlapping circles, each with a radius of approximately 500 miles. Beginning with the factory, this builds a supply chain that allows for a one-day drive to the regional distribution center, then the local distribution center, and finally to stores located in major consumption areas.

Distribution Networks



The ability to service a particular customer within a one-day drive is a common service expectation and location consideration. This requires both physical proximity to the customer and a location within the transportation network which permits ready movement to the customer's facilities. For a city terminal being operated for pickup and delivery by a truck fleet, customer proximity is substantially shorter and the density of customers in the region greater. These facilities are situated to minimize total miles within a few-hour service radius and require an investment in trucks as well as terminals.

Intermodal facilities and rail freight terminals are also located near major consumption zones but, due to their size and need for access to multiple customers, tend to be located at the outskirts of major metropolitan areas. Additionally, these facilities need to be located at points where they can generate large loads of freight for long-distance shipping.

For example, a rail freight terminal can require almost 100,000 carloads annually travelling at least 2,000 miles to be financially viable. Only the combination of volume and distance provides the competitive advantage over other modes. Intermodal facilities servicing containers and truck trailers have similar requirements. In such cases, the carrier will attempt to be near a market that either generates this volume or where they can collect freight from a relatively short distance to create the volume required.

Case Study

Rickenbacker Intermodal Facility is strategically located in the Columbus, Ohio, metropolitan area and is within a one day drive of more than 50% of the population of North America, and over 60% of US manufacturing production. The current rail operations at the facility include service by Norfolk Southern (NS) and CSX (two Class I Railroads—see note below). The facility is also located in close proximity to several major highways in the Columbus area: Interstates 270, 71, and 70 as well as highways 23 and 33.

Operated by NS, Rickenbacker Terminal opened in March 2008 and is located adjacent to Rickenbacker International Airport, approximately 15 miles south of Columbus. NS previously operated the Discovery Park intermodal facility nearby, but that facility had exceeded its capacity and a new site was deemed necessary to accommodate expected growth. Because it was operating above capacity, NS had to turn away domestic rail business, which at the time accounted for 20% of all traffic at the facility. This lack of capacity was detrimental to both NS and the Columbus region. Thus, a search for a new, larger location was undertaken, and NS selected the Rickenbacker site.

A Class I railroad is a major railroad with annual carrier operating revenues of $250 million or more. There are seven Class I railroads in the US and Canada: Burlington Northern Santa Fe (BNSF) Railway, Canadian National (CN), Canadian Pacific (CP), CSX, Kansas City Southern (KCS), Norfolk Southern (NS), and Union Pacific (UP).

Interaction with transportation networks

Besides proximity and access to customers and markets, a freight facility needs to efficiently connect to the transportation network. Depending on the facility type and the markets to be served, access to more than one mode of transportation may be required. Companies looking for locations will know what their transportation needs are along with the expected costs. Communities that successfully attract freight facilities are able to efficiently connect points of production or ports of entry to consumers. Freight facilities are located near key transportation channels such as:

- Areas or sites on major highways.
- Areas where multiple interstate highways converge.
- Railroad terminals at the edges of their network or at key consumption markets.
- Major sea and airports.

Communities that successfully attract freight facilities are able to efficiently connect points of production or ports of entry to consumers.

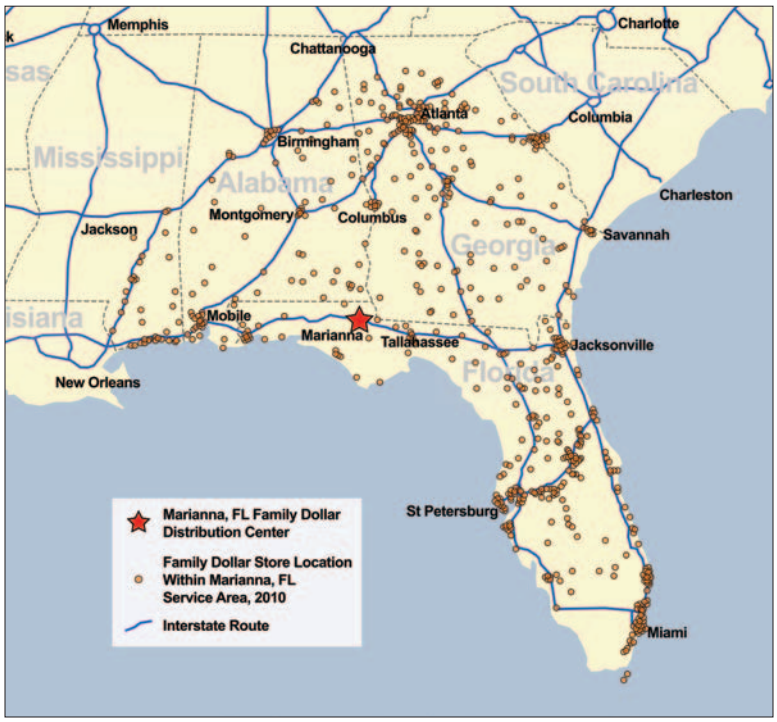
However, a site might be set in precisely the right position in the transportation network, but site or community issues can prevent or inhibit effective use of the site. Distribution centers usually need to operate on a 24-hour basis, yet a community may have regulations that restrict hours of operation or prohibit truck traffic on a strategically located route. Decisions about what mode to use for goods movement are unique to each shipper, receiver, and carrier but generally reflect direct transportation costs, reliability, and travel time. These factors can vary greatly by mode and region depending on transportation infrastructure, available freight carriers, size of the market, and quality of freight service.

... site or community issues can prevent or inhibit the effective use of the site.

How goods and materials are transported will vary widely depending on the type of company and the goods being shipped, but can include the following:

Road and Truck

Full-load and long-haul trucking require quick access to major highways. Additional time on local roads, with delays due to local congestion and traffic signals, adds to logistics costs and operational difficulties and may increase conflict with local communities. A site within ¼ mile of a highway and with no traffic signals will represent a significant annual logistics cost savings when compared to a site two miles from a highway. Similarly, the less impeded the access to a major artery and the better its connection to the metropolitan network, the better. Companies also consider whether the roads they will use have tolls. Tolls represent additional cost both in terms of direct fees and lost time on the road and can impact overall cost of operations.



Case Study

The Family Dollar distribution center in Marianna, Florida, is serviced entirely by trucks for both inbound and outbound goods. As a result, Interstate highway access was a critical aspect of siting this facility. The facility provides a direct three-lane access road to an existing interchange on Interstate 10. Route 276 runs through the site, providing a north-south connection. Based on the local traffic experiences of some of their other distribution center facilities (such as Charlotte, NC), Family Dollar learned that a direct ramp to the Interstate can be a large benefit by eliminating local traffic concerns.

Rail

Companies shipping bulk products or large volumes of goods over longer distances may choose to do so via rail. Increasingly, this also includes products shipped by intermodal container. The use of rail varies regionally as the shipping distance preferred by railways is somewhat shorter in the eastern United States than in the west, due to fewer miles between cities. Yet access to rail in the eastern United States can still play an important role in site selection.

Railroads seek to collect shipments at points on their network that will allow for efficient use of their equipment and infrastructure. As a result, they will typically not allow unrestricted access at all points on the network, but will instead encourage complementary uses at key nodes to allow for more efficient use. For example, a company shipping consumer goods to the Pacific Northwest may attempt to co-run 60-foot boxcars with a lumber company, reload these cars with paper at the destination, and ship this back to the original site. Rail is also a natural solution in supply chains that combine a West Coast port of entry and East Coast consumption zones.

Access to the rail network is concentrated at terminal facilities. Terminal facilities themselves are located at key origin and destination points for freight and are constructed with the capability to move bulk freight, intermodal containers, liquids, and/or other materials between mainline rail and other forms of transportation.

These terminals are designed to allow for the most efficient interface with mainline rail. Such a facility might require a minimum volume of 150,000 to 200,000 lifts annually to approach financial and operating feasibility. As a result, railroads attempt to encourage the co-location of rail-based freight users at interchange points to both maximize efficiency and to generate critical freight mass. While the majority of freight in the United States is moved by truck today, access to rail is becoming more of a consideration as fuel prices rise.

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Case Study

Photo by Savage Safe Handling, Inc.

Access to a Class I railroad was considered the most important consideration in site selection by Savage Safe Handling, Inc., a full-service, bulk product transportation and chemical transloading/processing company that operates the largest rail-to-truck bulk transloading facilities in New England (Auburn, ME) and western Pennsylvania (New Stanton). In part, this decision to locate next to rail reflected the company's preference for fuel-efficient transportation and its interest in keeping transportation costs down.

Case Study

A corporate decision was made in the 1980s by Murphy Warehouses of the Minneapolis-St. Paul, MN, region to obtain and preserve facilities with rail connections. The company believes intermodal access to be a competitive advantage. Consequently, rail has become a locating requirement for facilities. Each of their six rail-served facilities is served by Class I railroads including: BNSF Railway, Canadian National (CN) Railways, Union Pacific (UP) Railroad, and Canadian Pacific (CP) Railways. Rail facilities can accommodate up to 18 rail cars indoors at a single facility. Smaller facilities can house 12, six, or four rail cars indoors, with the remaining two rail facilities operating outdoors.

Water

High bulk goods, liquids, and containers moving internationally require water access. Ports must provide the infrastructure to load and unload shipping and have the ability to transfer freight to other modes of transport. Additionally, the facility will likely require space for sorting, storing, and assembling shipments, and may also require customs and safety screening for international shipments.

Air

Freight carrier requirements for air transportation only truly come into play in site selection when high-value, quick response, low bulk items are considered. Medical devices, some biotech products, and some electronics are good candidates for air shipping. Air transport can also be a back-up access to high speed transportation for companies carrying very low inventories.

Interestingly, however, many freight users will include proximity to a hub airport as an evaluation criterion for freight facilities. While the company may not ship anything by air, it may still require air access to accommodate company management or partners who wish to visit the facility. There may not be specific discussions with airports during the site selection process, but the company may investigate the carriers using the airport and examine how active the facilities are.

Third-Party Shippers

Instead of co-locating or locating near specific freight infrastructure, some freight businesses will rely upon and perhaps locate near third-party shippers or third-party logistics (3PL) companies. For example, large retailers who ship most of their own merchandise through their distribution centers may also rely upon commercial carriers such as FedEx or UPS to ship small packages, such as jewelry, directly from central distribution to their stores.

Labor and workforce

Every freight facility is different, but labor skills, costs, and the overall workforce environment can play a key role in location selection. While some forms of freight facilities are highly automated or do not have high skill requirements, others involve assembly, manufacturing, value-added processing, or other operations where the availability of a trained talent pool may be a significant requirement.

Freight facilities can require a wide variety of employee talents, depending upon the exact nature of the facility. Skills required may include forklift operators, assemblers, truck drivers, machinists, mechanics, technicians, material handling specialists, and engineers in addition to unskilled labor.

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In evaluating locations, companies may first examine data from the Department of Labor and Department of Commerce regarding overall employment for a region or community. This information indicates the overall labor market health of the community and may also give indications as to the general level of labor costs.

For example, Family Dollar partially selected a distribution center site based on the workforce characteristics in and around Marianna, Florida. Family Dollar received over 6,000 applications for the 515 available jobs. Similarly, Old Dominion, a national trucking firm, chose a site in Morristown, Tennessee, over a Nashville site primarily because of the greater availability of workforce in Morristown. The Morristown area of Tennessee has a strong furniture manufacturing history, and, at the time that Old Dominion was considering developing a regional hub, furniture manufacturing was decreasing in the area and moving overseas. This left a large pool of former manufacturing employees who were available and trainable for employment at the new distribution center.

Companies may speak directly with peer companies in the local market to better understand local salary trends, best practices for attracting and retaining key talent, and to determine unionization trends. They may also examine the education infrastructure to determine overall

education levels of the population and the availability of follow-on training programs to fill specific requirements.

Some companies view the presence of a union as beneficial, as specific industries already expect to work with unionized labor. Unions may provide training, support to the local labor force, and also act as an easily identifiable party who can readily represent labor in negotiations. Other companies work actively to avoid unionization and will use their location as part of an overall strategy to lessen the risk of labor becoming organized.

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Total cost environment

Companies develop cost models to evaluate the relative costs of doing business in each candidate location or scenario. The models will assess the sensitivity of each scenario's relative feasibility to changes in factors such as fuel costs, product mix, labor costs, tax exposure, product sourcing, or other key inputs. The cost model may include any or all of the following:

$ Start-up costs

- Land or facility purchase (if applicable).
- Construction and fit-out costs.
- Recruiting, hiring, and training.
- Relocation expenses.
- Equipment and furniture purchases.
- Sales tax.

$ Recurring costs

- Ongoing inbound and outbound transportation costs.
- Transportation network service performance.
- Rent (if applicable).
- Building and equipment depreciation (if applicable).
- Maintenance, repairs, and other occupancy costs.
- Staffing and labor costs.
- Benefits and recurring training.

- Utilities.
- Property and income taxes.

$ Exit costs

The total cost of doing business in each location not only provides information to be balanced against other operational factors, but also informs the incentive negotiation process with the local government or economic development agency.

Availability and cost of suitable facilities

Companies will consider a great property at a good price, but only if the site satisfies other key strategic criteria.

Companies will consider a great property at a good price, but only if the site satisfies other key strategic criteria. For example, the availability of well-planned warehouse space at a regional airport might allow for a faster decision if that airport also has good highway and rail access and is at a location that allows unimpeded service to consumption areas. Conversely, the lack of suitable facilities on land zoned for industrial or commercial uses near key infrastructure access points can impede progress or remove a community from consideration. It is common for carriers siting city terminals to limit their search to existing industrial facilities because of the cost of new construction and fear of community resistance (which can result in delay costs). Properties of this sort may be handed from operator to operator as leases expire and lessors grow, consolidate, or fail.

The availability of suitable facilities can be a yes/no screening issue for some companies. As previously noted, because of their experience owning and operating many facilities, Murphy Warehouses has specific criteria for potential facilities to acquire, including a minimum size requirement of 150,000 square feet of warehousing.

The freight user will investigate the availability of buildings of a particular size envelope, layout, ceiling height, number of loading docks, floor loading limits, utility feeds, refrigerated space, purchase, rent and operating costs, and other attributes depending upon their specific requirements (e.g., warehouses with modern, automated material handling equipment are able to get more throughput from leases by adding capacity vertically – toward the ceiling – instead of horizontally, which adds to square footage and lease

costs). Alternatively, companies may search for land near specific transportation points or other partners. They will determine plot size, possible layouts, price, geology, soils, hydrology, and other requirements and seek parcels meeting these needs.

Companies will also investigate the availability of nearby operations to support their own freight activities. Operations such as bulk and transload facilities allow for consolidation and access to modes of transportation such as rail and port where the single users' activities are not sufficient to support service.

Connection points to the transportation network, rail terminals, intermodal facilities, ports, etc., are valuable as they provide choice as to how to move goods. Integrated logistics centers allow communities to provide adequate land and facilities at a point which also concentrates freight movement away from other community activity.

Initial data on regional costs may be obtained through reports from national real estate service providers. The company can then seek market and building specifics either from their own real estate service firm or through the local economic development agency.

Integrated logistics centers allow communities to provide adequate land and facilities at a point which also concentrates freight movement away from other community activity.

Case Study

In addition to facilities, the availability of low-cost land and large parcels impacts location decisions, particularly for large intermodal facilities such as the Rickenbacker facility (mentioned earlier) and Alliance Global Logistics, an 11,600-acre integrated logistics center in north Fort Worth, Texas. The logistics center features an industrial airport, an intermodal terminal, access to two Class I railroads, highway access, a foreign trade zone, and logistics and industrial companies.

In the case of Alliance, much of the area surrounding Fort Worth had been developed and the tract of land purchased for the logistics center was relatively inexpensive and not yet developed because the area was prone to unpleasant odors from prevailing winds and a long-defunct nearby livestock market. While the stockyards had long been gone, the stigma remained. This allowed for large parcels of inexpensive land to be purchased and utilized for industrial development.

Utilities

When making a location decision, a company will want to know that reliable and cost-effective electric, water, sewer, and other utility capacity exist. Some facilities are more dependent on utility capacity than others. Electric, water, and sewer capacity is less critical to warehouse, distribution center, and intermodal facility locations than it is for data center and manufacturing use. However, refrigerated and automated warehouses will have requirements with regards to the amount, cost, and reliability of power. This will also be the case for any freight facilities that incorporate manufacturing as part of the operation.

Some facilities, such as those using heavy lift capability or automated warehouses (which are highly reliant on computerized machinery), will pay even more attention to utilities and may even use access to uninterrupted power as a go/no-go issue when evaluating potential sites. Freight facilities often include assembly or light manufacturing operations in addition to freight movement. Utility requirements of these ancillary functions may impact location needs.

Permitting and regulation

Permitting and regulation impact how a company can implement its plans for a particular site and can also impact its timeline. Knowledge that a community is already familiar with industrial and freight facility types and has a process in place can be seen as a location positive. Content and interpretation of fire codes, land use regulations, traffic regulations, zoning, and hours of operation regulations can all impact the feasibility of a freight facility location.

Tax environment

Income, sales, real estate, and property taxes can all affect the cost environment for freight facilities.

Income, sales, real estate, and property taxes can all affect the cost environment for freight facilities. Real estate taxes can be high on urban facilities, especially if the land could be used for other high-density development such as upscale condos and retail. High

real estate property taxes may drive these parcels into non-freight development and push freight facilities into the urban fringe. High personal property taxes can also be a concern if inventory is taxed as personal property.

Public sector assistance and incentives

Public sector assistance in the form of tax credits, grants, low-cost loans, training programs, utility discounts, and infrastructure development is often used by a community to gain advantage over a competitor. When competing sites are rated relatively equal, incentives offered by the public sector may help close the deal.

When competing sites are rated relatively equal, incentives offered by the public sector may help close the deal.

Climate and natural hazards

In order to understand business interruption risks, companies will collect data on the region's climate, natural hazards, and historic information on how these have impacted business closures in past years. Few areas are without some form of natural hazard risk, and companies will sometimes compile data on excessive heat, cold, rain, snowfall, earthquake, wildfire, tornado, hurricane, or other relevant data to develop appropriate mitigation (and recovery) plans.

Weighing site selection factors

The site selection process and factors apply to all forms of freight facilities in some fashion. Still, how these are applied varies depending on who will use the facility. For example, the availability of labor is a very important factor for a port facility whereas tax incentives generally are of less importance, especially as many ports are publicly owned. Likewise, the transportation network is critically important to a distribution center but permitting and regulations are far less important than they might be to a transload center that may process hazardous materials.

Table 3 below identifies the relative weight of various factors that will drive the site location decision for each type of freight facility. Public officials should note that factors over which they have some control – permitting and regulations, the tax environment, incentives and other forms of assistance – are generally a less important factor than access to markets, transportation networks, and a workforce when location decisions are being made.

Table 3. Site Selection Criteria by Facility Type

LOCATION CRITERIA	TYPE OF LOGISTICS FACILITY						
	Distribution Center	Port	Intermodal Terminal	Transload Terminal	ILC	Hub Terminal	City Terminal
Ability to Access Key Markets or Customers	●	◑	●	●	●	◑	●
Interaction with Transportation Network	●	●	●	●	●	●	●
Labor and Workforce	◑	●	◑	◑	◑	◑	◑
Total Cost Environment	◑	●	◑	◑	◑	●	◑
Availability and Cost of Suitable Facilities	○	○	○	◑	○	◑	●
Utilities	○	○	○	○	◑	○	○
Permitting and Regulation	○	○	◑	◑	○	○	○
Tax Environment	○	◑	○	○	○	○	○
Public Sector Assistance and Incentives	○	○	○	○	◑	○	○
Climate and Natural Hazards	○	◑	○	○	○	◑	○

Key

Priority of Criteria: ● Primary Factor ◑ Important Factor ○ Lesser Factor

Chapter 6: The Changing Landscape (Complicating Factors)

No matter how familiar a public sector planner or official may be with freight issues or supply chain dynamics, it is difficult to stay current with the trends, challenges, and opportunities that are constantly in flux in the marketplace. This refers not only to local, state, and national trends and issues but also to the global landscape. In addition, while the location selection process has been presented in this guide as if it always occurs in a consistent and orderly manner, such is not always the case.

This chapter highlights for public officials some of the aspects of that changing landscape that they need to consider, or of which they should at least be aware.

Changing role of the freight facility

Transportation and logistics are dynamic by their very nature. Freight is always in motion, and the means of accommodating this motion evolve constantly. Changes in modes, connections between modes, and the size, function, and location of those connections are all part of the changing landscape of freight movement.

There is an ever-increasing emphasis on "goods in motion," referring to the supply chain ideal of goods delivered at moment of need, straight from production. Freight facilities are increasingly used for modal transfer, consolidation, deconsolidation, and redirection – not storage. For example, distribution centers may in some cases need to be smaller in size but greater in number and located closer to markets. Orders filled from goods already on the way will result in smaller static inventories. Technologies to enable this approach will continue to improve.

Freight facilities have in some cases become a key link in goods production and have acquired the role of final stage manufacturing – conducting customized kitting, assembly, packaging, and labeling of goods for local use. This can reduce transportation costs, and can also provide the ability to include market level modifications and value added closer to the market, point of sale, and consumption.

As an example, some retail businesses note that as much as 65% of the inventory moving through the distribution center must be assembled as it moves through the facility. This can be very labor intensive, which influences the location requirements accordingly.

Changes in global sourcing

The trend towards freer trade and the corresponding global sourcing of products has arguably had the largest single impact on freight facilities and distribution networks in recent times. This has resulted in new growth at and near ports on both the West and East Coasts, and has forced the realization that locations in the hinterland have to be at some form of commercial crossroad in order to support intermodal distribution center concentrations.

The trend towards freer trade and the corresponding global sourcing of products has arguably had the largest single impact on freight facilities and distribution networks in recent times.

Previously, manufacturing in the Pacific Rim, coupled with major consumption zones on both American coasts and in the growing Sunbelt and Midwest, had forced a reconsideration of logistics networks. Manufacturing in Asia naturally resulted in additional port activity at Pacific ports, particularly in Los Angeles and Long Beach. Distribution networks were then designed to efficiently move these goods across the country and disperse them to the consumption centers of the United States.

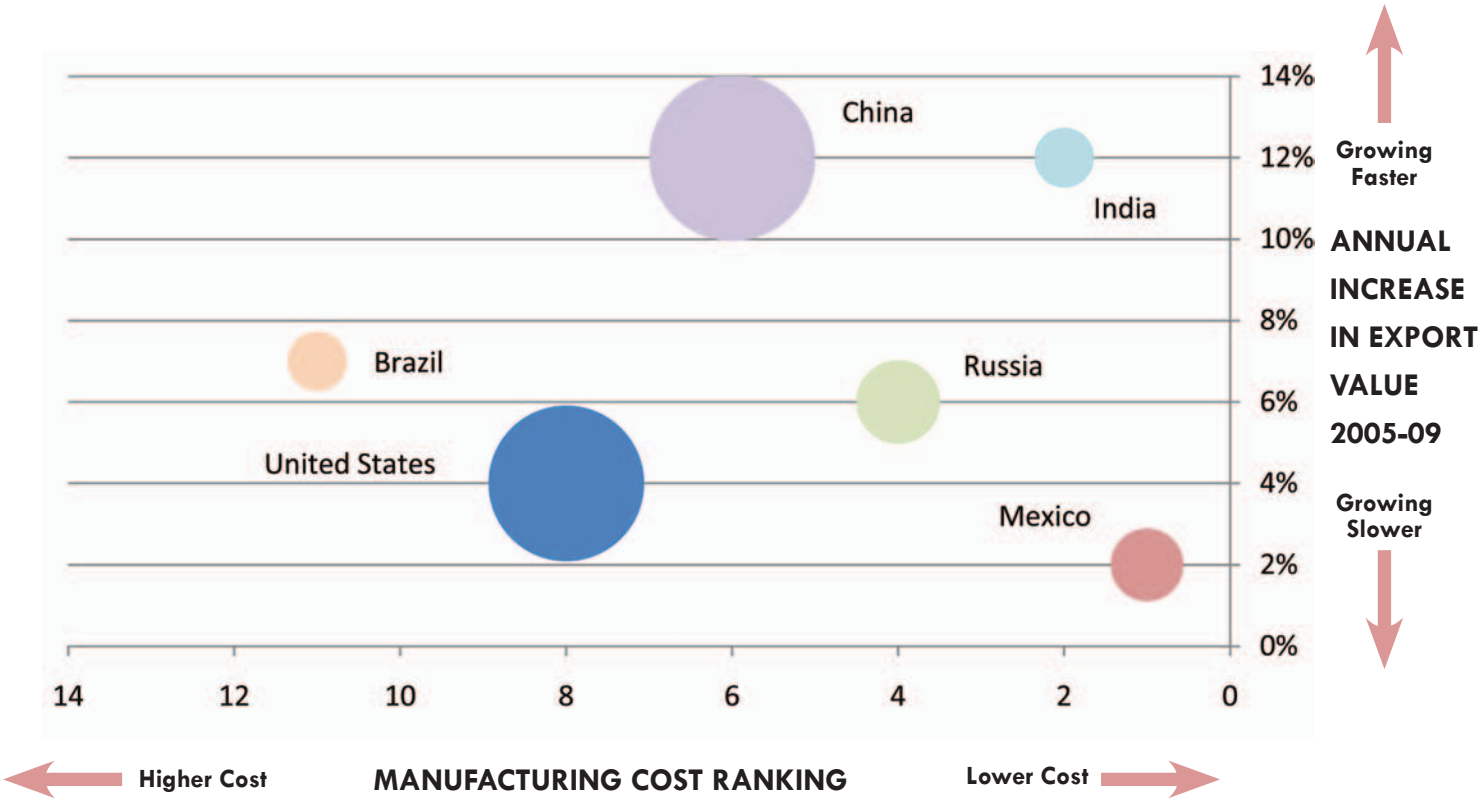
However, congestion at these ports and risk management by supply chain operators forced some traffic to come to North America from the opposite direction, by way of the Suez Canal, or to continue to the Atlantic Coast through the Panama Canal. This subsequently resulted in new expansion in Norfolk, VA, and Savannah, GA, which those facilities took particular steps to encourage. Growth of the Gulf and Atlantic ports is expected to continue. The completion of the Panama

Canal expansion in 2014 will allow fast, all-water routes to more major consumption zones.

Sourcing decisions in today's economic and political environment are in flux. Overseas production seems unlikely to diminish. In fact, it could be speculated that the American transformation to a "knowledge economy" necessarily results in knowledgeable workers who demand high-quality, low-cost products from global sources. Nevertheless, the growing concern regarding fuel and carbon costs (discussed below) could suggest "nearshoring" (production in lower cost areas of Mexico or Canada to reduce both labor and transportation costs) for certain products, along with a shortening of some supply chains. For the purposes of local officials and economic development managers who wish to understand more about freight issues, it is enough to have a basic understanding of the competing factors at work in the field and to understand that the global situation is constantly changing. In short, change in the status quo should be expected, and facility location and usage will shift to accommodate those changes.

Growth of the Gulf and Atlantic ports is expected to continue. The completion of the Panama Canal expansion in 2014 will allow fast, all-water routes to more major consumption zones.

Changes in International Trade



Source: AlixPartners U.S. Manufacturing-Outsourcing Cost Index, February 2010 and World Trade Organization, International Trade Statistics, 26 March 2010

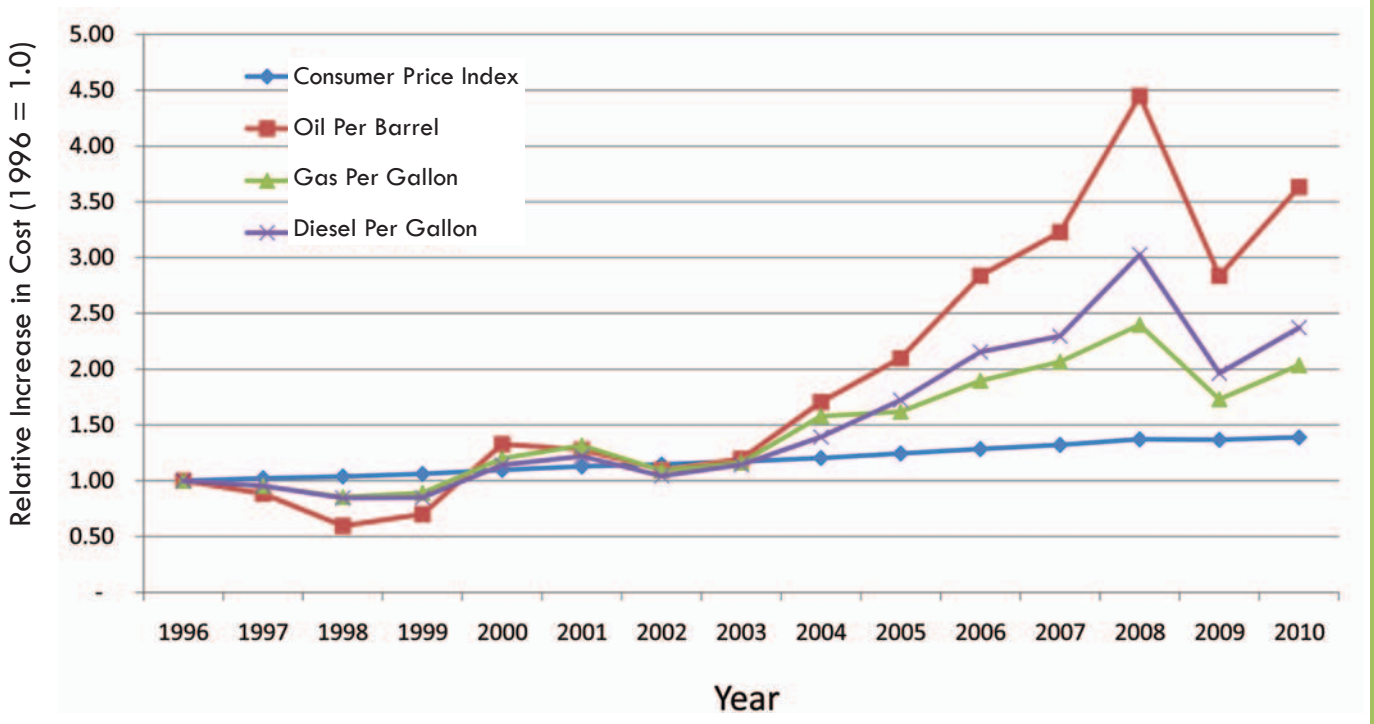
Fuel costs and environmental factors

Starting in the early 2000s, fuel costs grew significantly faster than the overall rate of inflation (as measured by the consumer price index). Gasoline and diesel prices peaked in the $4.50 per gallon range, and, in 2008, many truck-reliant freight businesses found that they had spent their entire annual fuel budgets by midyear.

At about the same time, consumers and state governments began to look more closely at how transportation was impacting the environment at large. In the case of consumers, a movement to understand the overall carbon footprint of specific consumer goods became more common. At the same time, governments, in an attempt to curb both pollution and congestion, began to look specifically at the impact of freight transportation (particularly truck trips) on local, regional, and state facilities.

Both factors have had an impact on freight facility location selection and associated distribution networks. There is a general tradeoff between the cost of having more facilities and the cost of shipping

The Rising Cost of Fuel



Source: US Energy Information Administration, 2010 and Bureau of Labor Statistics 2010

goods longer distances. Put another way, it becomes more efficient to consolidate warehouse and distribution operations when fuel costs are low and the cost to ship goods long distance by truck is relatively inexpensive. However, higher fuel costs have pushed some freight-dependent companies to investigate more dispersed distribution networks, with larger numbers of smaller facilities. These facilities reduce distances from the centers to the final delivery points, which are the most dispersed and truck dependent, and allow consolidated carriage inbound to the distribution centers by a relatively smaller number of long-haul trucks, or by rail. This method trims transportation costs while boosting facility expenses. During the fuel spike in 2008, supply chain designers began considering a larger number of smaller-footprint facilities situated close to big cities, preferably with high degrees of automation, offering short commutes for labor and short distances to product delivery.

The same set of behaviors also tends to reduce environmental impacts, because fuel efficiency and carbon efficiency are positively correlated. This is important as current trends are beginning to place more weight on green/carbon evaluation criteria.

According to one logistics manager, approximately one-third to one-half of his customers are requesting measurement of green and/or carbon footprint data. Rail companies such as BNSF and intermodal operators like JB Hunt now provide their clients with internet-based "carbon calculators" to estimate the impact of specific shipping decisions, underscoring the fuel consumption and carbon emission advantage of long-haul rail. While a different logistics professional described customer attitudes to greening as mostly "wait and see," the fact that an influential company like Wal-Mart now expects carbon reductions from its vendors would tend to indicate that the requirement is likely to spread.

The effect of carbon monetization on supply chain design would be identical to that of higher fuel prices. Monetization is essential, so that a carbon footprint can then be considered a "real cost."

Organizational factors and comprehensiveness

A complicating factor in the site selection approach described in preceding chapters is the fact that companies approach the location selection process with varying levels of sophistication, comprehensiveness, and collaboration. Also, in some cases the location process may be run by either the real estate department or the logistics department, with little input from other aspects of the company. Thus, sometimes rent and occupancy might take more precedence in the location selection, while in other cases, transportation costs and logistics may dominate the evaluation of locations.

Likewise, the presence of a specific third-party logistics (3PL) partner might dictate a location which otherwise does not meet objective strategic goals. Typically, logistics and supply chain departments may report through operations to the chief operating officer, and real estate may report through finance to the chief financial officer. Each division may have individual performance measurement criteria that do not adequately reflect overall corporate goals. Integration of the two chains of command may not occur until higher corporate levels compel an optimum result. These situations reflect corporate culture that is not fully aligned in terms of overall vision or goals.

Increasingly, the total operating costs of the supply chain force a review of the decision-making process, ensuring a more holistic approach in large companies.

Increasingly, the total operating costs of the supply chain force a review of the decision-making process, ensuring a more holistic approach in large companies. In these cases, competing goals and measures may be replaced with, for example, an initiative to minimize total land cost and preserve future options for change. Even so, many companies will still exhibit lack of coordination in their facility location process.

Computer model use and sophistication

Computer models such as ILOG and CAPS, which optimize logistics costs within performance criteria, interactively simulate transportation linkages across modes and can determine the sensitivity of operations

cost vis-à-vis changes in the operating environment. They are able to evaluate huge numbers of scenarios, allowing corporations to determine the ideal number, size, and location for distribution centers and cross-dock facilities.

However, while these models are precise and can allow for the manipulation of huge amounts of data, they are limited in that they can't accurately represent on-the-ground local details such as traffic congestion, inefficient highway interchanges, or delay related to transfer points between modes. Additionally, these models are largely static and cannot easily incorporate future changes to the network or its capacity. As an example, a one-hour drivetime analysis for a site on the outskirts of a major metropolitan area will usually show that a truck can travel just as far into and through the city as outward from the city. Anyone who uses this same roadway network during the morning or evening commute might suggest that travel will be easier in one direction and considerably more difficult in the other.

While computer models are powerful, useful, and increasing in sensitivity, they are not yet (nor are they likely to be) a practical substitute for local knowledge of actual conditions. Nevertheless, they are widely applied and tend to govern decisions in the initial planning stage, meaning that the large scale design of supply chains is determined by the factors they consider or omit, as well as the methods they employ.

Transportation network congestion

Network congestion for all modes impacts freight facility location decisions. Most modes have at least one identified trouble point. For example, containerized ocean shippers may view Southern California ports as an area of concern. Rail freight experiences difficulty in major urban areas, at the interface point between Class I railroads, or between Class I railroads and short line carriers. Truck carriers experience difficulty in any number of urban markets.

While all have experienced transportation network congestion and understand where it is, there is frequently an inability to use this information in a meaningful way in simulating distribution networks.

Another trend that may influence the operation of freight on rail and roadway networks is the increasing level of competition for capacity between freight and passenger movement on both road and rail infrastructure.

Competition with other types of development

Freight users in some cases are prohibited from locating in ideal freight locations either due to land use prohibitions or conflicts (real or anticipated) with surrounding uses. In many cases, land that had previously been used for freight movement has now been converted to commercial, retail, or even residential use. The remaining developable industrial land becomes subject to increased limitations due to conflict with the new land uses.

One example of this trend is the federal government's decision to expand military and associated operations at the Aberdeen Proving Ground and Ft. Meade in Maryland as a result of Base Realignment and Closure (BRAC) activity. In consequence, land which had previously been used or permitted as warehouse and industrial space along the key Interstate 95 East Coast distribution corridor will now be converted to office development instead of industrial or freight-related use. The opportunity to implement Urban Distribution Centers, with their clear advantages for fuel and carbon efficiency and truck VMT reduction, is dependent on suitable sites, most likely on brownfield properties with established, but perhaps dormant, industrial designation. The risk to such properties from land use conflicts could reduce supply chain performance by social as well as commercial and economic measures.

Appendix A: List of private sector interviewees

Company	Role	Industry Type
Becton Dickinson (retired)	Shipper	Medical Devices Manufacturer
BNSF	Carrier	West Class I Railroad
Boeing	Shipper	Aircraft Manufacturer
CSX (retired)	Consultant	East Class I Railroad, Consultant
Cushman & Wakefield	Realty	Warehouse Real Estate
Diamond Head Associates	Consultant	Simulation Modeling
Food Marketing Group	Consultant	Food Logistics
Grubb & Ellis	Realty	Warehouse Real Estate
Housatonic RR/HRR Logistics	Carrier	Short-Line Railroad, Bulk Terminal
IBM Networks	Consultant	Software Services
Jack Kuchta Inc	Consultant	Supply Chain Design Consultants
Johns Hopkins University - Enterprise Development	Consultant	Education, Former Transportation Official
Murphy Warehouse Company	Shipper	3PL
Saia	Carrier	Less-Than-Load
Staples	Shipper	Big Box Retailer
Terminal Corp	Panel Member	Trucking and Warehousing
TJX	Shipper	Big Box Retailer
Tompkins Associates	Consultant	Supply Chain Design Consultants
Transplace	Shipper	3PL
WATCO	Carrier	Short-Line Railroad
Whirlpool	Shipper	White Goods Manufacturer

Appendix B: Glossary of terms

Auto Terminal. A transload facility for finished motor vehicles moving variously between ocean-going vessels, railcars, and truck trailers.

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, and contrasts to an empty movement.

Barge. The cargo-carrying vehicle that inland water carriers primarily use. Basic barges have open tops, but there are covered barges for both dry and liquid cargoes.

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 non-uniform 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.

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.

Bulk Terminal. See "Transload Terminal."

Capacity. The physical facilities, personnel, and process available to meet the product or 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.

Carload. Quantity of freight (in tons) required to fill a railcar; amount normally required to qualify for a carload rate.

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

City Terminal. A carrier operating facility whose chief functions are the intramodal sorting and consolidation of load sets between intercity linehaul and local pickup and delivery and the management of pickup and delivery services to customers.

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

Class I Railroad. A major railroad with annual carrier operating revenues of $250 million or more. There are seven Class I railroads in the US and Canada: Burlington Northern Santa Fe (BNSF), Canadian National (CN), Canadian Pacific (CP), CSX, Kansas City Southern (KCS), Norfolk Southern (NS), and Union Pacific (UP).

Classification Yard. A railroad terminal area where railcars are grouped together to form train units.

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

Common Carrier. Any carrier engaged in the interstate transportation of persons/property on a regular schedule at published rates, whose services are for hire to the general public.

Container. A "box," typically ten- to forty-feet long, which is used primarily for ocean freight shipment. Containers are designed to be moved with common handling equipment, functioning as the transfer unit between modes rather than the cargo itself. For travel to and from ports, containers are loaded onto truck chassis or on railroad flatcars.

Container Yard. See "Drop Yard."

Containerization. A shipment method in which commodities are placed in containers, and after initial loading, the commodities are not rehandled in shipment until they are unloaded at destination.

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

Contract Carrier. Carrier engaged in interstate transportation of persons/property by motor vehicle on a for-hire basis, under contract with one or a limited number of customers to meet specific needs.

Cross-Dock Facility. A staging facility where inbound items are not received into stock, but are prepared for shipment to another location or for retail stores.

Distribution Center (DC). A 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 air, 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 Yard. A type of distribution center to which an equipment operator deposits a trailer or boxcar at a facility at which it is to be loaded or unloaded.

Durable Goods. Generally, any goods whose continuous serviceability is likely to exceed three years.

Flatbed. A trailer without sides used for hauling machinery or other bulky items.

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 Village. See "Integrated Logistics Center."

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

Hub. A common connection point in a network, as in a "hub and spoke" configuration, which is common in the airline and trucking industries.

Hub Terminal. Carrier operating facility whose principal function is the intramodal re-sorting and reconsolidation of inbound into outbound load sets for continuation in intercity linehaul.

Inbound Logistics. The movement of materials from shippers and vendors into production processes or storage facilities.

Industrial Yard. A railroad city terminal allowing the transfer of railcars between tracks for local and intercity trains.

Inland Port. A physical site located away from traditional coastal or land borders with the purpose of facilitating and processing international trade through various transportation modes and typically offering value-added services as goods move through the supply chain.

Integrated Logistics Center (ILC). A clustering of activities related to transport, logistics, and the distribution of goods for domestic and/or international use. Activities are carried out by a collection of various operators. Also known as a "freight village."

Interline Freight. Freight moving from point of origin to point of destination over the lines of two or more transportation companies.

Intermodal Transportation. Transporting freight by using two or more transportation modes such as truck and rail or truck and oceangoing vessel.

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

Inventory. The number of units and/or value of the stock of goods (raw materials, in-process, finished goods) a company holds.

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 feeds production lines with products delivered "just-in-time."

Lead-Time. The total time that elapses between an order's placement and its receipt. It includes the time required for order transmittal, order processing, order preparation, and transit.

Less-Than-Containerload/Less-Than-Truckload (LCL/LTL). A container or trailer loaded with cargo from more than one shipper; loads that do not by themselves meet the container load or truckload requirements.

Level of Service (LOS). A qualitative assessment of a road's operating conditions. For local government comprehensive planning purposes, level of service is 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.

Line Haul. The intercity movement of freight over the road/rail from origin terminal or market to destination terminal or market, often over long distances.

Load Center. A seaport engaged in container trade that acts as a high volume transfer point for goods moving long distances inland, and provides service to its regional hinterland.

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.

Marshalling Yard. See "Industrial Yard."

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

Outbound Logistics. The process related to the movement and storage of products from the end of the production line to the end user.

Piggyback. A rail/truck service. 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. Trailers that are staged at facilities for preloading purposes.

Port (sea and air). A place serving as a harbor, airport, or point of entry and exit for incoming and outgoing shipments.

Post-Panamax. Refers to ships that are too large to pass through the Panama Canal, such as contemporary supertankers and the largest container ships.

Private Carrier. A carrier that provides transportation service to the firm that owns or leases the vehicle which is typically a shipper or receiver of goods.

Private Warehouse. A company-owned warehouse.

Pull Logistics System. "Just in time" logistics system driven by customer demand and enabled by telecommunications and information systems rather than by manufacturing process and inventory stockpiling.

Push Logistics System. Inventory-based logistics system characterized by regularly scheduled flows of products and high inventory levels.

Rail Siding. A very short branch off a main railway line with only one point of access. Sidings allow faster trains to pass slower ones and facilitate maintenance or loading off the main track.

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

Reverse Logistics. A specialized segment of logistics focusing on the movement and management of products and resources after 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.

Radio Frequency (RFID). A form of wireless communication that lets users relay information via electronic energy waves from a terminal to a base station, which is linked in turn to a host computer. The terminals can be placed at a fixed station, mounted on a forklift truck, or carried in the worker's hand. The base station contains a transmitter and receiver for communication with the terminals. When combined with a bar-code system for identifying inventory items, a radio-frequency system can relay data instantly, thus updating inventory records in "real time."

Seasonality. Repetitive pattern of demand from year to year (or other repeating time interval) with some periods considerably higher than others. Seasonality explains the fluctuation in demand for various recreational products, which are used during different seasons.

Service Center. See "City Terminal."

Shipper. Party that tenders goods for transportation. Often used loosely to mean any buyer of freight transportation services, whether shipping or receiving goods.

Shipping Manifest. A document that lists the pieces in a shipment.

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.

Switching and Terminal Railroad. Railroad that provides pickup 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 may previously have been performed in-house by the customer.

Throughput. A warehousing output measure that considers the volume (weight and number of units) of items stored during a given time period.

Ton-mile. A measure of output for freight transportation; reflects weight of shipment and the distance it is hauled; a multiplication of tons hauled by the distance traveled.

Transit time. The total time that elapses between a shipment's pickup and delivery.

Transload Terminal. A receiving and distributing facility for lumber, concrete, petroleum aggregates, and other such bulk products.

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

Truckload (TL). Quantity of freight required to fill a truck, or at a minimum, the amount required to qualify for a truckload rate.

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

Unit Train. A train of a specified number of railcars handling a single commodity type which remain as a unit for a designated destination or until a change in routing is made.

Vehicle Miles Traveled (VMT). A unit to measure vehicle travel made by a private vehicle, such as an automobile, van, pickup truck, or motorcycle. Generally used as an overall measure of regional travel efficiency or volume.

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

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation