An Exploration of the Freight Village Concept and its Applicability to Ontario

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Executive Summary

This report examines the concept of the freight village and considers its applicability in the province of Ontario. On the whole, there has been a dramatic increase in the amount of freight transported around the world (global containerization has increased five-fold between 1992 to 2008) and the associated movements have had a considerable impact at metropolitan and even more localized levels as goods make their way through the supply chain.

There are a variety of reasons why more goods are flowing. Clearly, there has been a shift of manufacturing to Asia where it can be done more cheaply but reductions in transport costs from containerization have played a substantial role in making these flows possible. The rise of just-in-time production has led to lean inventories and larger numbers of discrete shipments. As supply chains have become more sophisticated there is more intermodal transport and more expertise dedicated in the form of 3rd and 4th party logistics to maximizing efficiency. There is more specialization and, as a result, more outsourcing is taking place. As Ontario metropolitan areas, particularly the Greater Toronto Hamilton Area, experience rapid population growth, the associated increase in the market for goods only reinforces the impacts of these broader trends.

In the movement of freight, it is natural for clusters of freight-related activities to spatially concentrate. Within a larger freight cluster there may be particular nodes that develop and which are highly freight-oriented. These are generally referred to as logistics centres and are associated with a variety of names and contexts. A freight village is a particular realization of a logistics centre.

Classifying Logistics Centres: A wide array of names have been used to refer to different versions of logistics centres. These include: distribution centre, dry port, inland port, load centre, logistics node, gateway, freight village and several others. The review of the literature in this regard suggests some confusion and a lack of standardized terms of reference. Reasons for this confusion include that intermodal logistics is a relatively new field and logistics itself has evolved rapidly with fast-changing technology. Also, the regional effect remains fundamental. Issues such as modal availability, market function and intensity, regulation and governance create unique circumstances by jurisdiction.

To assist in efforts to standardize and to create a common frame of reference, MITL has created an Intermodal Logistics Centre Hierarchy based on detailed review of the literature and on the idea that the term "logistics centre" is a useful, unifying term which can apply to a wide range of facilities. Among other aspects, this hierarchy helps clarify the role of freight villages. While the details are shown in Figure 2.1, the essence is that there are three distinct levels or clusters associated with logistics centres. It is important to note that with some case-specific exceptions, the higher order logistics centres will typically capture all the functions of the lower order facilities.

At the lower or first level is the warehousing and distribution cluster which includes basic elements in the supply chain such as warehouses, container yards and distribution centres. This level is heavily truck-oriented and is essentially unimodal. These are connection and redistribution points where goods change vehicles as opposed to changing modes. Within the cluster, warehouses are more oriented to

inventory and storage whereas distribution centres are more oriented to product flow with potentially some value added logistics services. The second level is named the Freight Distribution Cluster and includes intermodal terminals, inland ports and freight villages which will actually involve goods changing modes. The cluster captures the range from a basic intermodal facility to a comprehensive development which would also include the wide range of value added services potentially offered by a freight village. The third level is the gateway cluster and is generally reserved for international mainport terminals and, in rare cases, the freight operations of major international airports. It does not necessarily follow that a higher position on the hierarchy implies that more goods are passing through.

Elements of a Freight Village: Having positioned freight villages within the general hierarchy of logistics centres, it is important to dig deeper into what freight villages are and how they function. One useful definition suggests the following key aspects:

- a localized cluster of transport and logistics facilities which are co-located and co-ordinated for synergies;
- among the facilities is an intermodal terminal located near container storage, handling areas and warehouses linked to rail to reduce cargo handling costs and time and reduce the use of roads for containers;
- access to shared facilities, equipment and services (e.g. customs services, truck cleaning, post office, conference and training facilities and other services and amenities);
- centralized management and ownership structure for long term planning, investment, governance, environmental management and other issues.

Of these four main points, the latter two are most powerful in differentiating freight villages from other logistics centres on the hierarchy. The concept of "shared access" is fundamental to the point where a freight village acts as an incubator for small and medium size firms. A freight village can raise the likelihood that smaller firms utilize intermodal transport. The list of potential shared services is potentially very large and can range from those associated strictly with the movement of goods to those associated with serving either the employee base or a nearby residential population. For example, daycare and restaurants can be part of the mix in certain circumstances.

Centralized management is important because there is very much the concept that the whole is more than the sum of its parts. Certainly participating private entities inside the freight village will do their own planning and management to stay viable but the freight village itself has a strong identity and its own brand that must be strategically managed.

The locational elements of a freight village are important to outline. The typical freight village will be at or near the cross-roads of two or more major highways and rail connections have to be well-integrated within the facility and its extensive intermodal functionality. Ideally, the facility will be located close to a major metropolitan area which will also serve as a market or supplier of much of the goods that pass through. Access to the metro area also boosts access to human capital and shortens truck legs.

A freight village can be thought of as not only a locational nexus but also a focal point of high technology. Component warehousing and freight distribution functions have become highly advanced in recent years and more efficient. Greater storage capability is possible now over a smaller footprint which can lead to more opportunities for sharing and synergies.

There are other useful lenses through which to view the freight village concept. A higher order of freight village is one that is referred to as "integrated" meaning that modal changes occur on-site as part of a suite of logistics processes. The "non-integrated" version will not accomplish modal changes on-site. While an intermodal terminal will be nearby, it is not well-integrated with the rest of the development. The non-integrated case is likely to come about when a development progresses incrementally rather than having been master planned.

There is another useful binary classification: the logistics centre freight village and the community integrated freight village. For the former, largely industrial and logistics activities take place. For the latter, community-integrated commercial and possibly residential or recreational activities are included also. An example of the former is Interporto Bologna and an example of the latter is Alliance Texas. Both are discussed below. In the community-integrated version, it is probable that commercial areas will act as a buffer between industrial and residential uses.

There are two distinct conceptualizations of the freight village concept and it is likely fair to say that associated perceptions affect the way that the freight village concept is "sold" in the planning stages. One view portrays freight villages as simply a part of transportation infrastructure whereas the other sees the freight village as a promoter of business activity. A review of potential benefits and shortcomings sheds some light on which view is more convincing.

Potential Benefits of a Freight Village: On the benefits side, most have to do with synergies, efficiency, improved economies of scale and sharing. The freight village concept promotes synergies in logistics processes (e.g. haulage, storage and packaging) and synergies in infrastructure (e.g. connections to networks, transshipment equipment, railway sidings etc.) and an overall reduction in wasted movements since there is potential to internalize intermediate moves. With regard to economies of scale, a freight village leads to the assembly of a large amount of transport knowledge and know-how at one location. Potentially, this knowledge can be pooled in the management company to help benefit smaller tenants. Such pooling can also help on the marketing side since smaller companies can benefit from the overall message of the development. The concept can lead to fewer transportation links in the supply chain but those that remain are of a higher quality. This outcome can be attractive to prospective tenants as can the scale of warehousing capacity and modern equipment that can be achieved. There is potential to share investments in electronic and information infrastructure and other types of investments as well as to share in urban distribution processes. In the end, the implication is that risk is shared as well.

Potentially, a freight village can promote intermodal goods movements because all its associated value-added services combine in a package to make this transport option move attractive. In parallel, freight villages can then be seen as an approach to boost the competitiveness of inland regions.

Potential Shortcomings of a Freight Village: With regard to shortcomings, most of the criticisms of the freight village concept amount to issues surrounding co-ordination between actors. For public sector actors, there can be co-ordination difficulties between different levels of government and conflicting political interests. There can be risks of oversupply as every jurisdiction is anxious to pursue the latest trend. Due to the presence of large rail operators in North America, this latter risk may be less here than in Europe. On the private sector side, there is the reality that modern day supply chains are quite vertically-oriented whereas the freight village concept is inherently horizontal and, in its ideal form, at least partially depends on co-operation among firms. In many freight villages, firms have been observed to operate completely independently of other firms in the development. The net result is that many of the previously outlined benefits that would be expected to happen in theory can be difficult to achieve in reality. Concerns about co-operating for competitive reasons and also a dependence on government subsidies have also led to difficulties in the urban consolidation/distribution potential of freight villages. Some advanced German initiatives in this domain have lost momentum in recent years.

Examples of Freight Villages: Case studies of existing and planned freight villages add further insight to the analysis. European examples include Interporto Bologna and GVZ Bremen. Both are prototypical examples of the freight village concept. They function as public-private partnerships and they have an emphasis on road and rail as the two main modes, although the Bremen facility has marine and air nearby. Road and rail are the mainstay modes of many freight villages. Each of these two examples has in the range of 100 to 150 transport and logistics oriented firms and the actual built up areas of the developments are in the range of 500 acres although land is set aside for expansion. Local government played a large role in the development of both facilities.

Two U.S. examples of freight villages are Alliance Texas and the Raritan Center and like the European examples, there is a strong emphasis on road and rail. Alliance Texas is a primary example of a community-integrated freight village as extensive transportation, logistics and industrial land uses are complemented by residential, commercial and recreational developments. The overall development is managed by a private sector firm and the vast majority of funding has arrived from private sector sources although the development has always maintained a strong element of co-operation with the public sector. There was co-operation in the construction of Alliance Airport and the public sector assisted in developing transport connections to the development. Alliance Texas sprawls over 17,000 acres and houses 28,000 employees with the vast majority of these employees having little to do with the transportation and logistics sector. Key to being classified as a freight village is a large range of available public services such as: United States Customs, international trade and insurance and public services such as hospitals, a fire department and law enforcement.

Whereas, Alliance Texas is a greenfield development, the Raritan Centre is brownfield oriented. The development is a 2350 acre former military site which has evolved to exhibit similar community integrated characteristics as Alliance Texas. The overall development supports more than 15,000 employees from a range of sectors and nearly 400 firms associated with transportation and logistics. The primary modes are road and rail although planned improvements will permit access to the marine mode and short sea shipping. A short line rail operator purchased rail assets at the site and invested heavily. A primary outcome has been evolve the development away from a typical business park into a

freight village. New investments in rail sidings will seek to further enhance the rail infrastructure. It is worth noting that the overall development has been much more private sector oriented than other of the case studies.

Freight Villages in Ontario: Efforts to tie the freight village concept back to the Province of Ontario involve a high-level overview of existing freight clusters within the province. In particular, an analysis with the Canadian Business Patterns database is carried out at the census division level across sectors of the economy most associated with the generation and movement of goods. The primary data source is business count data with an estimate of the employee count by business and a detailed sectoral classification of the firm. As well as assessing the basic structure of freight clusters, the analysis has a temporal component which addresses how freight clusters have fared since the initial stages of the financial crisis in 2008.

For the census divisions in Ontario associated with the most significant freight clusters, an employment index was created across the most relevant sectors: support activities for transportation, manufacturing, warehousing and storage, wholesale trade and truck transportation. Rail, marine and air modes are associated with few firms and are not well represented in the source business count data. The results show that Peel Region, Toronto and York Region, even when considered separately, stand out from all other census divisions in the province. When taken together, which is quite reasonable since they are at the core of the same metropolitan area, the combined freight cluster is overwhelmingly larger than all other clusters in the province. When considered in the context of the clusters within the Greater Toronto Hamilton Area (GTHA) versus outside the GTHA, the GTHA accounts for over 80% of the magnitude of the employment index in warehousing and storage and over 70% in other sectors with the exception of truck transportation. For that sector, the GTHA accounts for about 60% of the employment index.

Among the three main GTHA census divisions, Peel distinctly stands out from the rest. It is the strongest division in all sectors covered that are directly related to transportation and is not weak in any of the other sectors covered. Among census divisions outside the "big three", it appears that an advantageous location relative to the core of the GTHA is an important factor in assessing the vitality of the freight cluster. On that basis, Halton Division appears more fully developed than Hamilton and Waterloo appears more fully developed than Middlesex division (London), for example. For many of these outlying clusters, there appears to be a high dependency on truck transportation as the primary mode defining each cluster.

In the aspect of the analysis which deals with changes since 2008, few of the census divisions are showing increases and many are showing declines in terms of business counts by sector and also employee index. It appears that Peel Region has been doing the best in showing growth since the onset of the recession and has a very large number of small trucking firms, which could be taken as a sign of vitality.

It is noted that there is no development in Ontario that can currently be defined as a freight village. One obvious constraint is that there are only three intermodal rail facilities in the province and they are all

located in the GTHA. The CP Vaughan development in the north of the GTHA comes closest in that there is a large intermodal facility and some logistics operations of a large private sector firm (Sears) are quite well integrated into the development. The CN Brampton intermodal terminal functions more in a non-integrated manner with surrounding logistics operations of large firms such as Canadian Tire. The CP site is viewed as having the best potential to perhaps evolve into a more extensive development that better captures some of the key tenets of freight village development such as the housing of smaller firms, pooling of resources, centralized management (apart from CP itself) and shared services.

Notable air freight clusters include Pearson Airport and Hamilton International Airport. The high value oriented nature of associated goods implies that the primary intermodal connection is with trucking. The Pearson cluster is highly developed but in too much of an ad hoc manner for it to be considered as a freight village. The Hamilton International Airport has considerable scope to evolve into a more advanced freight cluster and is already a very prominent handler of predominantly air courier cargo. Like the majority of freight clusters in Ontario, road access will form an important basis for the development of future logistics oriented activities at this site. However, evolution into a proper freight village without the rail mode is highly unlikely.

General Observations

This summary is concluded with a few observations about freight villages in general:

No One Model: Many logistics centres were planned as freight villages from the beginning, other facilities such as the Raritan Center and Pureland Industrial Complex in New Jersey show the possibility of evolving into a freight village by adding components of the concept such as intermodal terminals and supporting services. Furthermore, some areas that offer freight village components on nearby sites such as the Dallas Intermodal Terminal could eventually be considered freight villages in an unconventional sense of the concept.

Public Support is Important: Public sector support of freight villages and other logistics centres is an important factor in a project's success. This support can take many forms, from public private partnerships to purely public initiatives. In many cases of privately developed freight villages, the public sector has provided indirect assistance through infrastructure development, land discounts, and tax incentives. For urban consolidation and distribution elements to succeed, public support appears important. Past successes have been accomplished through direct subsidization of urban distribution schemes and supported by a number of indirect initiatives such as road tolls. However, private interest in these programs has been shown to wane without continued public support to offset the real and perceived additional costs for actors.

Private Sector Support is Fundamental: It has been found in general that privately oriented freight villages have performed better than their public counterparts and that public facilities tend to suffer from a lack of investment from private sector actors. As such, ensuring a high level of initial and continual private sector support is crucial for the success of any freight village project.

Private Sector Risk: Though support from the private sector is fundamental to the performance and success of freight village developments, private actors are unlikely to invest in any project that does not meet their criteria for profit generation. Because subsidies for the operations of freight villages are generally lower in North America compared to countries in the European Union, the minimum threshold for private sector interest is higher. The nature of such a threshold can be expressed through a list of preliminary critical needs for freight village development in North America to ensure a competitive entry into the marketplace.

Public Sector Risk: Freight villages and other publically sponsored logistics centres may not achieve their goals due to the market imperatives of attracting firms and selling land. Furthermore, a freight village risks requiring significant, long-term public subsidization unless interest from private sector players exists to take part in the project.

Market saturation is possible through the overextended development of logistics centres by over-eager public sector actors. This scenario is less likely in North America due to the tighter margins of major rail actors who would require high freight volumes. All public sector investments in freight villages and other logistics centres needs to be weighed against the very real risk of underperformance in the freight and logistics marketplace.

Attracting Compatible Firms: The realization of clustering and synergistic relationships between firms is a main goal of freight village development. However, the selection of firms to locate within a freight village must be done in accordance with their potential to cooperate. Some firms locate within a freight village and do not participate in any type of cooperation among firms or infrastructure. Furthermore, the management corporations of more publicly oriented freight villages may be under pressure to sell land to any firm that is interested, irrespective of that firm's business focus. Firms sited from incompatible sectors have little chance at achieving vertical or horizontal synergies. Overcoming these challenges requires a suitable governance structure representing a mix of public and private interests and proactive management of the facility.

Freight Villages as Generators of Business and Economic Development: While some may perceive freight villages as a promoter of intermodal transportation, the broader conceptualization of a freight village as an intermodal platform on which companies can generate business is more desirable from an economic development perspective. Furthermore, developing a freight village that hosts an array of services that are integrated into the community presents a more promising solution for promoting economic development than would a freight village focused solely on improving freight and logistics. It is not clear that freight villages, particularly the logistics-oriented variety, are significant job creators since increased productivity and synergies are often jobs-neutral at best.

Synergies: The whole can be greater than the sum of the parts. Clustering can promote synergies and economies of scale that create a multiplier effect for other firms in the facility and on the periphery. Co-locating major freight generators within a freight village can reduce intermediate moves, but the final delivery of goods to stores and end customers is still likely to be done overwhelmingly by road

transportation. Accordingly, there is the urban consolidation and distribution aspect of a freight village that seeks to increase the efficiency of urban goods movements.

Modal Shift: By offering high quality connections to intermodal infrastructure, freight villages can provide a platform to promote more efficient and cost effective intermodal transportation options. Furthermore, these improvements can achieve a 'network multiplier effect' by having more freight villages offering similar features at both ends of the supply chain. Freight villages can also improve the competitiveness of intermodal transportation at lower distances. This is accomplished by eliminating intermediate moves through the co-location of firms within a single cluster and producing higher volumes of freight by housing a number of freight generators on site.

Benefits for Smaller Enterprises: Small and Medium Enterprises (SMEs) stand to benefit from freight village development due to the potential for synergies and opportunities across a number of business areas. This can include joint investments in infrastructure, shared knowledge, and the ability to participate in opportunities to generate economies of scale, such as grouping shipments into larger block sizes with other firms or making use of the intermodal capacity of large freight generators to purchase cheaper blocks on intermodal shipments.

The Big Picture: In contemplating freight villages, the big picture needs to be carefully considered. A freight village is a complex and large undertaking where the elements of a compelling vision, master planning, financing, land assembly, extensive public and private co-operation and good timing have to come together all at once. There needs to be a strong latent or forecast demand to drive activity at the freight village and there needs to be a high comfort level that the large amounts of land required will be getting put to their highest and best use. The presence of an intermodal facility is one strong indication that a freight village development is such a use. Meanwhile, goods movement cannot be considered in isolation when issues such as residential sprawl and associated congestion effects threaten to undermine progress on the goods movement front.

Introduction

Though the ability to transport goods quickly, safely, economically, and reliably in urban areas has a major impact on the attractiveness, prosperity, and quality of life of cities and regions, it is a field that receives little attention in comparison to personal and public transportation. But with ongoing increases in globalized trade, the movement of freight and logistics and their impact on regional competitiveness is receiving more consideration at all levels of government and society. According to the World Bank, the performance of Canada's logistics network ranked 14th in the world, ahead of countries such as the United States and France, but behind Germany and Singapore (SCL Canada, 2011), suggesting room for improvement. Trade and logistics is especially important in Ontario, where over half of the province's GDP is derived from import and export trade activities (Government of Ontario, 2010). Consequently, supporting the efficient movement of this trade is crucial in maintaining a competitive and attractive environment for investment in a rapidly globalizing economy.

But from changing freight and logistics processes to broad regional trends in population, employment, and freight growth, significant challenges exist that stand to seriously restrict the flow of goods in the Greater Golden Horseshoe region. Ontario is not alone in facing these challenges, as many other regions around the world struggle to accommodate increasing trade flows. A promising solution that has emerged in international logistics for improving the efficiency of these networks is the creation of dedicated centres for the shipment of goods within and between urban areas called 'freight villages'.

These facilities present a land use solution to freight and logistics problems and have the potential to deliver important productivity, efficiency, and sustainability benefits.

1.1 Scope and Objectives

The objective of this study is to explore the freight village concept and assess its applicability to Ontario as a tool for developing freight supportive land uses and successfully managing the expected freight and trade demands that will impact the GTHA in the near future. This project will proceed according to the criteria for solutions that have the potential to improve sustainability, mitigate congestion, and support economic competitiveness and investment attraction of the GTHA and Southern of Ontario. The study was commissioned by the Ontario Ministry of Transportation and will inform future policy and planning decisions on goods movement. This project complements the Metrolinx urban freight study, which is dedicated to improving urban goods movement in the GTHA, and the Ontario-Quebec Continental Gateway and Trade Corridor Initiative.

1.2 Background and Context

Freight and logistics is quickly changing, and the regions that succeed in the future will be those that can adapt to trends in regional growth and fully leverage changes in freight and logistics processes to offer firms a competitive advantage. This section will frame the discussion of freight villages by providing a brief overview of the forces that shape modern freight and logistics.

1.2.1 Changing Freight and Logistics Processes

The transformation of transportation and logistics activities over the past five decades has been both astounding and all encompassing. From containerization and deregulation to supply chain management and intermodal transportation, these changes are having a profound effect on modern logistics.

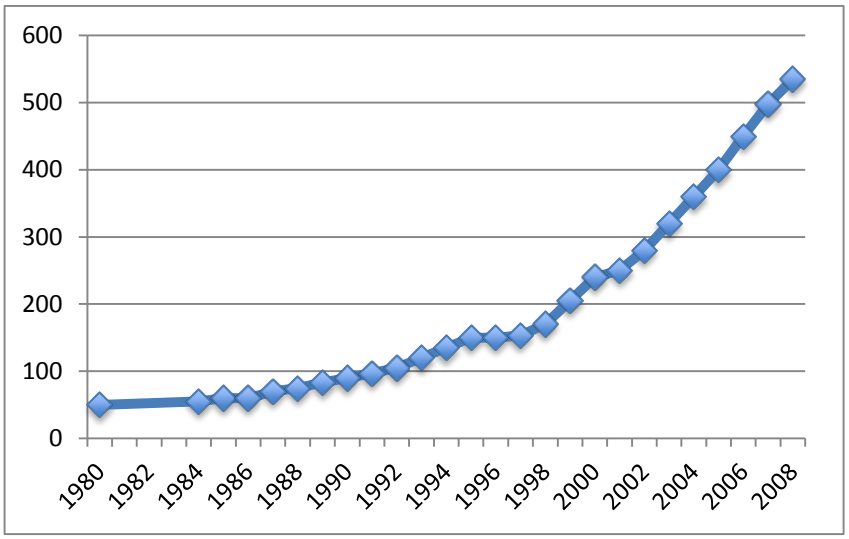
Containerization

Since the 1960s, the container shipping industry has improved the performance of international trade at a rapid pace (Figure 1.1). After the adoption of standard container sizes and lashing systems in 1965, world container traffic gradually grew to reach 100 million twenty-foot equivalent units, or TEUs in 1992. The pace of adoption rapidly accelerated throughout the 1990s, with volumes tripling in the course of a decade. By 1998 it was estimated that containers accounted for 13% of all seaborne trade by volume and 49% by value (Cullinane & Khanna, 2000). World container traffic volumes since 2002 have entered a period of peak growth, which Notteboom and Rodrigue (2009b) expected to reach approximately 535 million TEUs by the end of 2008. In Canada this can be seen in both West Coast container port traffic, which increased by 592% between 1990 and 2010, and East Coast port traffic, which grew by 83% (SCL Canada, 2011).

According to Rodrigue (1999), the adoption of containerized shipping owes more to cost reductions than increased speed. Containerization has set off a virtuous cycle of growing trade flows accommodated by ever-larger vessels, resulting in large economies of scale and a reduction in the cost per transported TEU

(Frémont & Franc, 2010). As of this year, Maersk Line has placed an order to build the largest containerships in the world with capacities of 18,000 TEU, 16% larger (2,500 containers) than today's biggest ships. The first ten are scheduled for delivery between 2013 and 2015 and Maersk holds an option for twenty more (Maersk, 2011). A result of ocean going freight reaching new levels of volume and cost savings per container is that interest and pressure among logistics actors has shifted inland to improving freight handling and distribution as a means to extend economies of scale (Roso, Woxenius, & Lumsden, 2009).

Figure 1.1 World Container Traffic, 1980-2008



(Notteboom & Rodrigue, 2009b)

Globalization

Supply chains are becoming increasingly globalized, which has led to a change and intensification in transportation requirements. New global trends in consumption and production have substantially altered distribution patterns and contributed to an overall increase in transportation demand and management requirements in the supply chain as products now move in complex international freight flows (Notteboom & Rodrigue, 2005). In Canada, the volumes of containerized trade at both coasts demonstrate a sharp increase in international trade since the early 1990s that is evident of a globalized supply chain.

Supply Chain Management and Just-In-Time Logistics

In an effort to be competitive at the global level, firms have begun to focus their attention towards streamlining production and distribution – a concept that has been termed supply chain management. As defined by Simchi-Levi et al. (2000, p. 1),

> "Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the

> right quantities, to the right locations, and at the right time, in order to minimize systemwide costs while satisfying service level requirements."

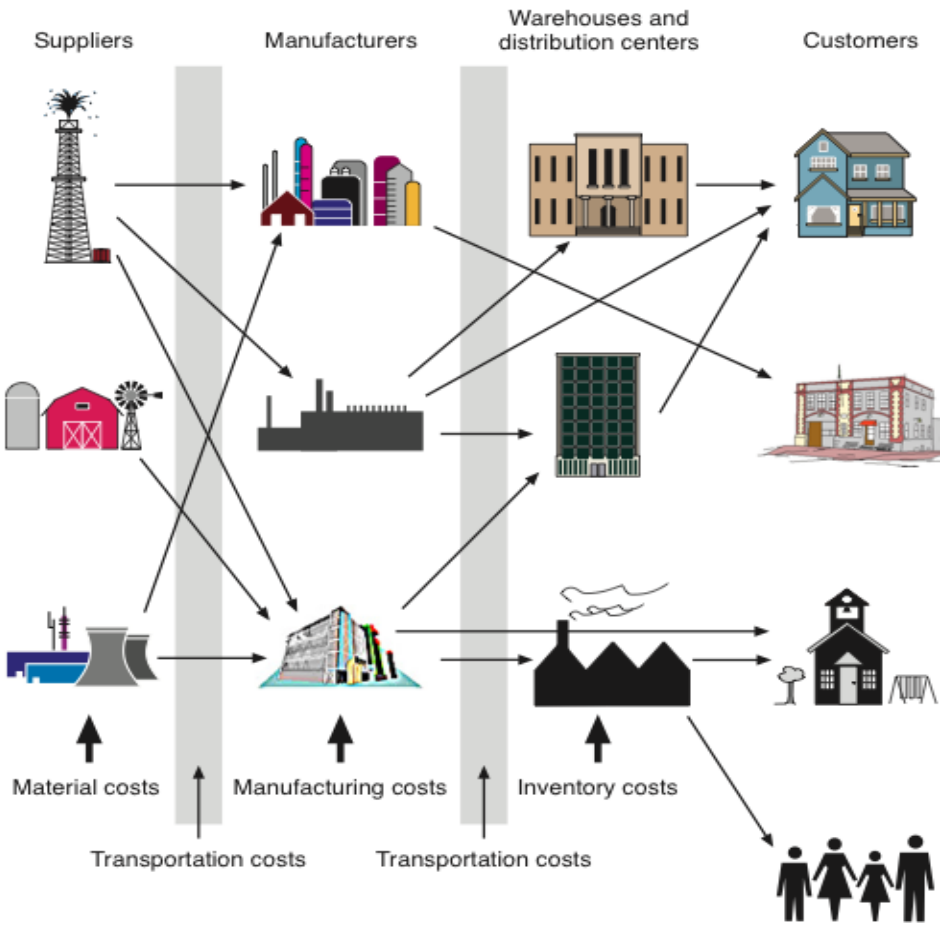
A key facet of supply chain management is the recognition that transportation can be a source of competitive advantage for companies. According to the literature, two of the most important aspects for achieving a competitive advantage are the minimization of transportation costs and the reduction of inventory.

First, in the typical supply chain, raw materials are procured, items are manufactured at one or more factories, transported to warehouses, and then shipped to retailers or customers (Figure 1.2). In a process such as this transportation costs can be seen to factor into the supply chain at multiple points. These are estimated to account for up to 20% of total production costs of manufacturing, and as much as 40-50% of the total logistics and transportation costs for firms (MTO, 2004; Meixell & Norbis, 2008; Wisetjindawat, 2010). Furthermore, the economies of scale seen at the maritime level through containerization have shifted focus to reducing the costs of inland transportation. For example, in the China-US trade link, up to 60% of total transportation costs comes from bringing a container from inland China to a gateway port such as Shanghai or Shenzhen (Notteboom & Rodrigue, 2005). As such, inland logistics is an important field of action. Eliminating "transportation-related waste that can add cost but no value" (Morash, 1999, p. 396) and finding other ways to control transportation costs at multiple points along the supply chain has become crucial to achieving a competitive advantage in the marketplace.

Second, the trend towards the reduction of inventory has led to the emergence of Just-In-Time (JIT) and Time-Definite delivery systems. This has shifted focus to improving transportation efficiencies and reliability, and minimizing the number of distribution facilities covering a geographic area, which now serve very large catchments if not entire nations (Leitner & Harrison, 2001; Rimienė & Grundey, 2007; SCL Canada, 2011). Consequently, the reduction in inventory has led to an increase in shipping costs, as it requires more frequent shipments and precise time scheduling in addition to the longer distances required to reach customers from centralized distribution facilities (Leitner & Harrison, 2001).

In Canada, the Supply Chain & Logistics Association of Canada, or SCL, has found that logistics and supply chain management activities are now considered a strategic part of business plans and have become integrated with day-to-day production processes. According to SCL (2011), data from 2005-2009 shows Canadian firms have responded to the challenge of integrating these complex global supply chains by improving their agility and reducing inventory levels. The importance of managing the supply chain is also reflected in new investments in distribution centres in Canada, which have increased by 106% over the last five years from $674 Million to $1.39 Billion. The majority of this (approximately 32%) has been in Ontario, which has seen a 123% increase in investment in distribution facilities to serve continental markets (SCL Canada, 2011). SCL (2011) identifies three core areas of action in this new paradigm that can generate benefits for business: logistic networks, distribution centres, and global transportation and visibility strategies, suggesting that all aspects of logistics and supply chain management will be increasingly important for businesses in the years to come.

Figure 1.2 Supply Chain Network



(Leitner & Harrison, 2001)

3rd Party Logistics

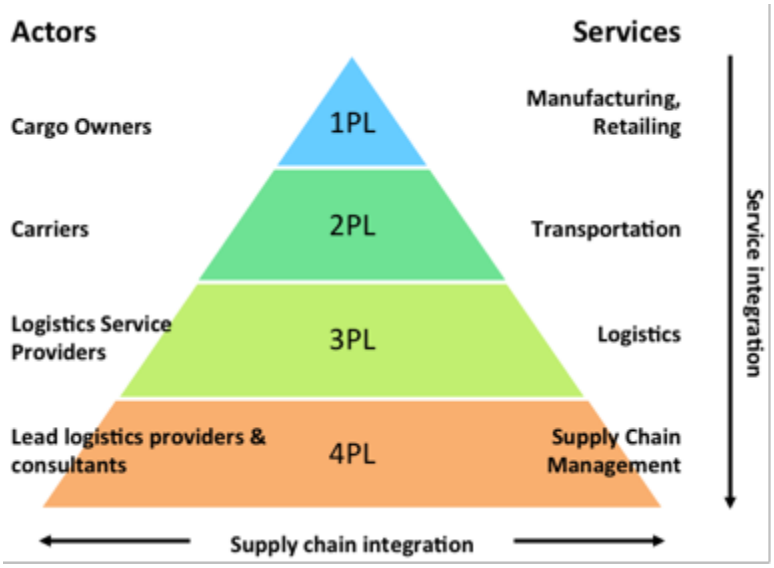
In addition to being a process, logistics has become an industry in its own right with the emergence of 3rd Party Logistics (3PL) firms and other Logistics Service Providers. According to Rodrigue (2011), a 3PL is a firm that adds value to the supply chains of cargo owners, directly or indirectly, by providing a range of logistics services beyond the mere carriage of goods. These firms have emerged in response to a market for logistics created by the trends mentioned above, such as supply chain management and JIT delivery systems. They offer a range of services and value-added features that are supply chain specific, such as time or cost, or increased reliability rather than services related to the physical characteristics of the goods themselves. 3PL firms currently control 40% of the global TEU in transit through maritime shipping and constitute an ever-growing segment of inland logistics service providers (Rodrigue, 2011).

However, Rodrigue (2011) explains that the lines between logistics service providers have become blurred as new types of operations and activities emerge in response to changing logistics needs, leading to what can be classified as 4th Party Logistics, or 4PL firms. Basic 3PL firms maintain their own fleets and perform operations as a third party, but 4PL firms are seen as supply chain managers that specialize

as forwarding, planning, and consulting logistics service providers, with the majority (85%) branding themselves as purely non-asset based (Rodrigue, 2011). The relationship between actors and logistics services is outlined below in Figure 1.3.

In Canada, the majority of 3PL firms are located within Ontario, which hosts 50.2% of 3PL employees and 64.2% of all employees working at 3PL headquarters (Rodrigue, 2011). Rodrigue (2011) argues this is reflective of both Ontario's commercial geography of gateways and corridors and the cross-border intensity of trade with the United States and other partners. The largest clustering of 3PLs in Ontario is found around Pearson International Airport, which accounts for more than $50 Billion in freight transiting value (Rodrigue, 2011).

Figure 1.3 Layers to Logistics Services



(Rodrigue, 2011)

Intermodal Transportation

According to Slack (2001), modern intermodal transportation is a concept that has grown out of 'multimodal' transportation processes practiced for centuries. Multimodal transportation is a term for the movement of both people and goods by more than one mode of transport, "But unlike multimodal transportation, which is characterized by essentially separate movements involving different transport modes," Slack writes, "intermodal transport is the integration of shipments *across* modes." (Slack, 2001, p. 142)

In the academic literature, there is confusion on the definition of intermodal transportation. Bontekoning et al. (2004) argue that research on intermodal transportation is currently immature with little coherence in research areas, collaboration among scholars, and consensus on definitions. For example, Tsamboulas and Kapros (2003, p. 142) define intermodal transportation as "a process in which at least two of the following conditions are fulfilled:

- Two or more different transport modes (lorry, train, barge, ship, plane) are deployed.
- The goods remain in one and the same transport load for the entire journey.

This definition appears to eliminate the possibility of moving goods between a single mode, such as truck-to-truck or rail-to-rail transshipment. However, other authors subtract this requirement, such as Notteboom and Rodrigue (2009a) who argue that the transloading, cross-docking, and warehousing of freight between a single mode constitutes intermodal transportation. Reaching consensus on the definition of intermodal transportation is beyond the scope of this research. For the purposes of this project, a more general interpretation of intermodal transportation will be used that allows for the inclusion of shipments between a single mode.

Despite these differences in definition, the fundamentals of intermodal transportation remain clear. Slack (2001) argues that there are two basic components in intermodal transport: first, the transferability of the items being transported, which is being made easier due to technology, mechanization of transfers, and the use of standardized shipping containers, and second, the provision of door-to-door service with single liabilities and through-bills of lading for national and international transportation.

Currently, the majority of freight movements in many jurisdictions are made by road. However, an increasing number freight actors are of the opinion that the road network will be unable to fulfill their goals in the future. In response, many predict a shift to barge and rail transport as part of an intermodal supply chain as a solution to emerging freight problems (Konings, 1996). Driven by the potential for increased efficiency through the massification of freight flows and the creation of economies of scale, this phenomenon has led to the diversification of freight transportation by making different modal options more attractive. However, intermodal transportation presents its own set of benefits and shortcomings and issues of competitiveness, which will be discussed further in Sections 4 and 5 respectively.

Deregulation and Privatization

Recent trends show that the level of integration in international freight and logistics is increasing rapidly. In the United States, regulations often prevented the ownership of multiple transportation modes in logistics, meaning the majority of distribution activities were performed by different entities ranging from shipping lines, agents, forwarders, and rail and trucking companies. Deregulation in these areas has led to many of these distribution functions that were once separate now being controlled by a single entity responsible for broader aspects of the supply chain. With the help of new Information Technologies, the increase in functional integration has removed many intermediate distribution functions, resulting in a more efficient and cost effective supply chain (Notteboom & Rodrigue, 2005).

In Europe, deregulation of the rail sector by the European Commission has permitted a similar process, with several actors able to create their own inland logistics facilities along rail corridors (Rodrigue & Notteboom, 2010). The privatization of national railways in the UK, Germany, and the Netherlands adds

to this phenomenon, creating a more open and inland terminal market for many actors (Rodrigue & Notteboom, 2010).

In Canada, deregulation of the railway industry in the 1970s allowed both Canadian National and Canadian Pacific Railways to focus their operations and abandon unprofitable segments of track. Later, the privatization of Canadian National Railway has also had a profound effect on its operations. Since 1995 it has aggressively expanded its trackage to become a more continental railway and has recently sought out innovative investments in its business operations, such as the CN Logistics Park outside of Calgary, AB.

Policies

Transportation and trade policies have also played a large role in changing freight and logistics processes. In the United States, one of the first steps was changing the direction of national transportation policies away from massive highway construction projects to a recognition of the interactions between various transport modes and users (Walter & Poist, 2004). To this end the Intermodal Surface Transportation Efficiency Act of 1991 and the Transportation Equity Act of 1998 provided federal funds to support intermodalism and transportation innovation (Walter & Poist, 2004).

In North America, trade policies such as the Canada-U.S. Free Trade Agreement, and more recently NAFTA, have resulted in an increase and shift in continental trade patterns between Canada, Mexico, and the United States (Leitner & Harrison, 2001; Walter & Poist, 2004). North America's Corridor Coalition, or NASCO, argues that although NAFTA went into effect in 1994, business infrastructure in North America is only now finally reorienting itself to take advantage of new continental trade opportunities (Conde, 2011). Infrastructure has also seen realignment towards a more continental perspective, such as the expansion of Canadian Pacific Railway who purchased track into the United States in 2001, and Canadian National Railway, whose rail operations now stretch into the southern United States and Mexico. Beyond NAFTA, other free trade agreements continue the process of globalization and open up new markets for North American goods around the world.

1.2.2 Trends in Regional Population, Employment, and Freight Growth

The movement of goods throughout the Greater Golden Horseshoe region has long been the foundation of Ontario's economic prosperity. But just as changing freight and logistics processes pose new challenges for the movement of goods in the GGH, trends in regional population, employment, and freight growth threaten to limit the economic potential of the region.

The biggest challenge to the movement of goods in the GGH is regional congestion. Recent analysis by the Organization for Economic Co-Operation and Development rates the Toronto region the second-worst for commute times among all metropolitan regions in the OECD, behind only Budapest, Hungary. The cost of this congestion to commuters was estimated at $3.3 Billion per year, with the overall cost to the economy estimated to total an additional $2.7 Billion annually in lost productivity (OECD, 2009). This has a direct impact on several crucial business sectors in Ontario, such as wholesale, retail, logistics, and food transportation, and poses a threat to the province's economic growth, competitiveness, and

prosperity. Congestion in the region's flow of goods is a complex problem that can be attributed to several factors, including population and employment growth, freight sprawl, freight modal imbalance, firm concentration, and terminal congestion, each of which is explored further below.

Population and Employment Growth

Many cities and regions around the world are faced with the pressures of increasing population growth, and Ontario is no different. The Greater Golden Horseshoe region of Ontario is projected to grow by an additional 3.7 million residents by the year 2031, accounting for 80% of all growth within the province (Government of Ontario, 2006). While this makes the GGH one of the most vibrant regions in North America, the challenges associated with this rapid pace of growth will have a profound impact on how goods are moved throughout the area.

Previous growth and settlement patterns have largely resulted in a sprawling region. Between 1971-1991, the majority of population growth in the Greater Toronto Area occurred largely outside of the traditional urban core, with the areas beyond Metro Toronto growing almost 200% compared to only 9.1% for the City of Toronto itself (Frisken, 2007). From 1991-2001, the pace of growth slowed, but was still at a rate of 35% outside of Toronto versus 9% in the city (Frisken, 2007, p. 312). Employment growth followed a similar trend, with office space in the suburban centres of North York, Scarborough, and the City of Mississauga growing by more than 250% from 1981-2004 (Charney, 2005). Employment rates followed, with the areas outside of Toronto growing by 33.7% between 1991-2001 compared to Metro Toronto, in which overall employment declined by 2.7% in the same period (Frisken, 2007).

But while new growth is an important driver for economic prosperity, the Greater Golden Horseshoe's rapid increase in population over the last several decades has proceeded essentially without any overall strategy for transportation or land-use planning (White, 2007). The result of this is a region suffering from high levels of air pollution, auto dependency, and transportation gridlock that has a profound effect on the efficient movement of both people and goods.

Freight Sprawl

The patterns of industry and logistics development largely mirror the trends of residential suburbanization. Many changes in transportation and technology have diminished the traditional role between a central location and a firm's success (Porter, 2000). Termed 'freight sprawl', many companies over the last several decades have reacted to urban congestion and taken advantage of changes in transportation to settle on large plots of greenfield land connected by new investments in highway infrastructure.

However, the trend towards relocation outside of congested and expensive urban areas is cyclical. According to Markus Hesse (2004), rising locational competition between logistics and industrial firms has contributed to an accelerated process of land consumption and further location dispersal from the traditional urbanized core. These changes have had a profound effect on transportation and logistics, which in turn further influences firm location choice. According to Thill and Lim (2010), many businesses engaged in international trade no longer feel bound to locate near a port or terminal anymore because

overland freight costs to ports have dropped to historic lows and attention has shifted to other supply chain management concerns.

Ontario has not been immune to freight sprawl. The GTHA has witnessed a cycle of relocation of industry from core areas to less congested/cheaper areas, with new transportation infrastructure improving accessibility but also leading to greater land consumption (MTO, 2004).

While some analyses have focused on freight and logistics challenges related to the flow of goods, the issue of freight sprawl identifies real estate and land-use issues as a fundamental aspect of freight flow dynamics. Like population and employment growth, the location of traffic-generating firms within supply chains and regional transportation networks can have a significant effect on regional congestion, making it an important area for consideration in the search for solutions to the challenges affecting freight and logistics.

Firm Concentration and Terminal Congestion

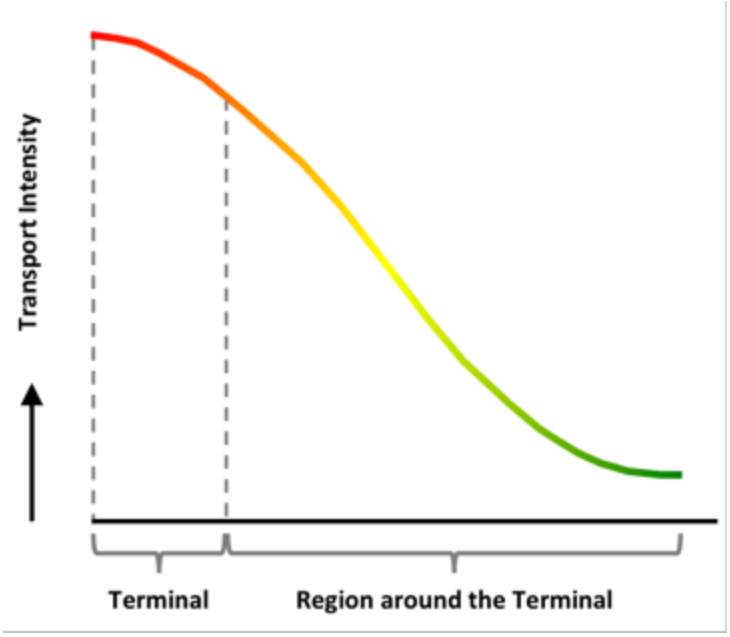
What seems to be a contradictory feature of freight sprawl, globalized supply chains, and international competition is that clusters, or geographic concentrations of interconnected companies are a striking feature of every local, regional, and national economy, especially in advanced nations such as Canada and the United States (Porter, 2000). In terms of freight sprawl, changes in information and transportation have diminished some of the importance of location in the era of globalization. However, while firms have relocated into suburban areas, they have agglomerated together in the creation of multi-nodal regions. New influences are driving the clustering of firms in what has become an increasingly complex, knowledge-based, and dynamic economy (Porter, 2000).

According to Notteboom and Rodrigue (2009a), governments in North America have rarely placed much attention to planning the locations of industrial and logistics areas beyond zoning regulations at the municipal level. As a result, this clustering is seen to have occurred according to a 'natural' process strongly conditioned by national and regional market accessibility. Generally, a variety of private real estate promoters, often in partnership with local or state or provincial governments, built logistics or industrial parks on an ad hoc basis where land was available, inexpensive, and close to a major highway. This has resulted in three major forms of North American logistics cluster dynamics: near major gateways and mainport terminals, around inland rail terminals, and along major highway corridors that can service a large metropolitan area or group of metropolitan areas (Notteboom & Rodrigue, 2009a).

This clustering has had a profound effect on freight and logistics. According to Slack (1999), one of the main features of contemporary freight traffic is the degree of concentration of freight movements at a relatively small number of logistics hubs or nodes. This has resulted in increasing congestion within the terminal itself, as growing volumes of container traffic and increased security measures have caused capacity problems at many traditional major freight nodes around the world (Walter & Poist, 2004). The congestion caused by high transport intensity within major terminals (Figure 1.4) is increasingly viewed as a major threat to the reliability of international transport chains (Walter & Poist, 2004; Frémont & Franc, 2010; Shafran & Strauss-Weider, 2003).

Furthermore, the intensity of transport movements in a small number of locations is causing terminal congestion to spill over into the surrounding region, compounding the problem of overall regional congestion attributed to population and employment growth. As local infrastructure struggles to accommodate the growing transport intensity of major terminals in addition to the needs of firms and population in its periphery, freight and logistics processes are increasingly being blamed for a host of negative externalities, such as air pollution, congestion, noise, traffic accidents, and an overall lower quality of life (Slack, 1999; Janic, 2007). Though many of these processes are affected by freight and logistics trends that are international and regional in nature, it is the terminal and its surrounding environs that have come to bear the brunt of the impacts associated with increasing trade.

Figure 1.4 Transport Intensity in the Vicinity of a Terminal



(Konings, 1996)

Modal Imbalance

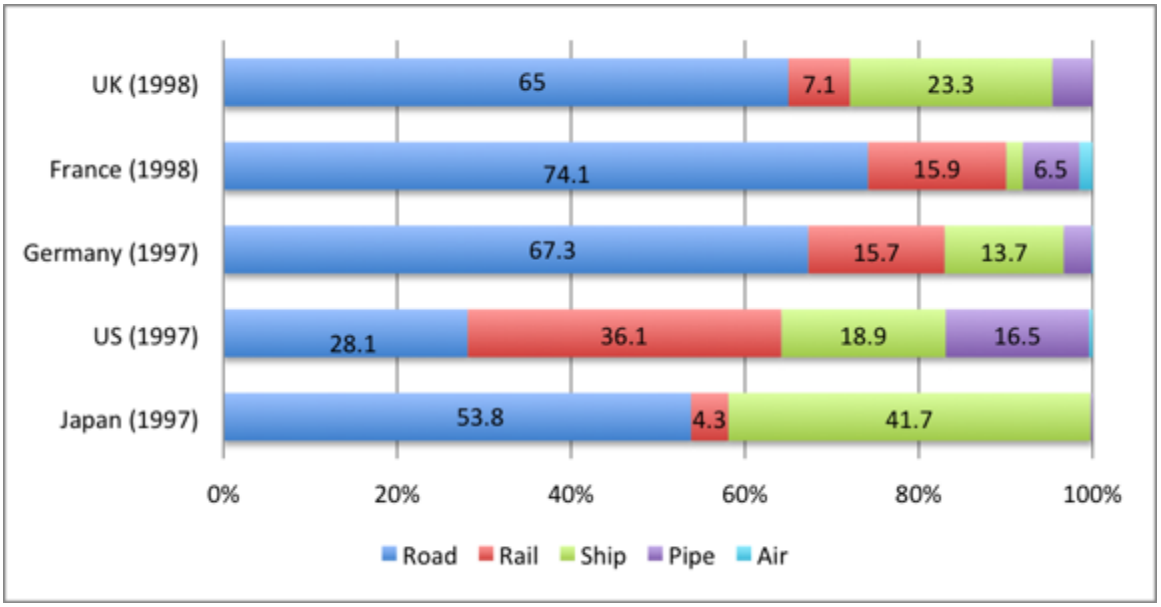
In many jurisdictions, trucking is the most dominant form of transportation for freight and logistics. An overview of domestic freight modal shares in 1997 and 1998 is provided in Figure 1.5 below. Changing freight and logistics processes have contributed to this trend, such as large increases in retail sales, airfreight logistics, and just-in-time business processes. These have resulted in a simultaneous increase in truck vehicle kilometres travelled (VKT), further contributing to the congestion and other negative externalities associated with increased freight movements (Weisbrod et al., 2002).

In Europe, road haulage is by far the most dominant form of freight transportation, with rail's share of freight across the European Union at 8% in the year 2000 (Vassallo & Fagan, 2005). This has led the European Commission and many EU Member States to promote rail and intermodal transportation in a number of ways, which will be discussed further in Section 5. However, in North America, although road transportation is strong, the mode share of rail has improved since 1997 to approximately 38% of all

freight movements in the United States (Vassallo & Fagan, 2005). According to Vassallo and Fagan (2005), 80% of this disparity between the United States and European Union can be attributed to inherent differences between systems, such as geography, shipment distance, and commodity mix. The remaining 20% is due to public policies such as the priority of passenger service, a lack of interoperability across borders, and incentives of the rail operators (Vassallo & Fagan, 2005).

In Ontario, trucking is the primary mode of goods movement to the United States, accounting for 59.2% of goods flows across the border by value (MTO, 2011). The share of rail to the US is much lower at 15.1%, though Ontario leads the nation in the value of exports and imports by rail, at 48% and 63% respectively (MTO, 2011).

Figure 1.5 Modal Share for Domestic Freight Transports in Many Countries (tonne-km)



(Wisetjindawat, 2010)

1.3 Overcoming Challenges

An efficient transportation system forms the backbone of a strong and competitive economy. Increasingly, the ability to transport goods quickly, safely, economically, and efficiently is now being seen as vital to a region's prosperity and its capacity to compete in a rapidly globalizing economy (Brewer, Button, & Hensher, 2001). However, the trends and challenges mentioned above have had a significant impact on freight and logistics processes that, while broad and international in nature, are increasingly being felt at the local, regional, and national levels. In order to maintain and enhance its place in the globalized economy, Ontario must recognize these changes and adapt to new realities in order to better facilitate the growing volumes of goods with origins and destinations all over the world.

The past several years have seen a significant increase in public sector interest in freight and logistics as its role as an important element in regional economic strength becomes clear. In Ontario, to overcome the obstacles presented by rapid population growth and suburban expansion, the Government of

Ontario has created a master plan for managing growth in the GGH region consisting of the Greenbelt (2005) and Places to Grow (2005) Acts, the Growth Plan for the Greater Golden Horseshoe (2006), and Metrolinx's Big Move (2008) regional transportation plan. The successful implementation of these plans is a fundamental precondition to overcoming the challenges facing the region. But while these have great potential to modify future population settlement and transportation patterns in the GGH, the region lacks a comprehensive long-term plan for ensuring a competitive, efficient, and sustainable flow of goods.

Reducing congestion at major freight terminals is particularly problematic, as traditional solutions face increasing difficulties. The emergence of significant regulatory constraints makes the construction of new terminals on greenfield sites unlikely, the expansion of existing major terminals is impossible in most cases due to previous settlement patterns, and the renovation of existing terminals can provide relief as a short-to-mid term solution only (Slack, 1999; Rodrigue & Notteboom, 2009; Rodrigue et al., 2010). Alternative solutions have emerged that focus on managing peak periods of demand, improving the operational efficiency of current sites (Hamzawi, 1992), or improving traffic flow by segregating truck traffic from passenger traffic through the use of exclusive truck facilities (Roorda, et. al, 2010).

However, another solution that has emerged as a way to shift modal balance and reduce regional and terminal congestion and other negative externalities associated to freight and logistics is the development of intermodal logistics centres called freight villages. Though they are known around the world by many different names, these facilities are designed to respond to, and take advantage of changing freight and logistics processes and promote intermodal transfers as close to the urban market as possible (Weisbrod et al., 2002; Wisetjindawat, 2010). Many of the trends and changes discussed above favour the emergence of these inland terminals, and the many examples in use around the world today present the concept as a promising land-use solution to the goods movement challenges faced in many jurisdictions.

1.4 Project Outline

The following report is organized into five sections. Section 2 will first explore the overall concept of logistics centres, followed by a discussion of freight villages as a subset of a broader logistics centre typology. Section 3 explores the freight village concept in greater detail with an overview of existing facilities. Section 4 will examine the benefits and shortcomings demonstrated by these facilities in practice, while Section 5 provides lessons for freight village development and best practices derived from the literature. Lastly, Section 6 applies this knowledge to assess the preliminary applicability of the freight village concept to Ontario.

2

Varieties of Logistics Centres

A new generation of intermodal logistics and distribution facilities has emerged around the world, facilitated by changes in freight and logistics processes, and in response to the challenges posed by regional population and freight growth. Loosely termed 'logistics centres', these facilities have become fundamental elements of local, national, and international transportation systems in regions with high volumes of trade.

However, in examining the academic literature on logistics centres, it is clear that this phenomenon has not yet received an agreed upon name (Meidutė, 2005; Rimienė & Grundey, 2007; Notteboom & Rodrigue, 2009a; Rodrigue et al., 2010). Many common, though imprecise terms have been identified to describe these centres, such as freight hub, freight gateway, inland port, inland terminal, dry port, and freight village. These definitions cover a wide variety of roles and scales, as some facilities are simple terminals with singular functions, while others are complex partnerships and legal entities that include logistics zones and a governance structure (Rodrigue et al., 2010). Table 2.1 provides a brief overview of the fragmentation in terminology and definitions in the literature, while a more comprehensive examination of these terms is provided in Appendix A and Tables A and B in Appendix B.

Table 2.1 Terms Used in Relation to Logistics Centres

Term	Author
Air Cargo Port	Leitner & Harrison (2001)
Bulk Terminal	Wiegmans, et al. (1999)
Container Yard	UNESCAP (2009)
Distribution Centre	Hesse (2004)
Distribution Centre	Notteboom & Rodrigue (2009)
Distribution Centre	Rimienė & Grundey (2007)
Distribution Terminal	Wiegmans, et al. (1999)
Dry Port	UNCTAD (1991)
Dry Port	Ng & Gujar (2009)
Dry Port	Roso, et al. (2009)
Dry Port	UNESCAP (2009)
Freight Village	Tsamboulas & Kapros (2003)
Freight Village	Rimienė & Grundey (2007)
Freight Village	Boile, et al. (2008)
Freight Village	UNESCAP (2009)
Gateway	Notteboom & Rodrigue (2009)
Hinterland Terminal	Wiegmans, et al. (1999)
Industrial Park	Boile, et al. (2008)
Inland Clearance Depot	UNECE (1998)
Inland Container Depot	Jaržemskis & Vasiliauskas (2007)
Inland Container Depot	UNESCAP (2009)
Inland Customs Depot	UNCTAD (1991)
Inland Freight Terminal	UNECE (1998)
Inland Port	UNECE (2001)
Inland Port	Rodrigue, et al. (2010)
Inland Terminal	UNCTAD (1982)
Intermodal and Multimodal Industrial Park	Boile, et al. (2008)
Intermodal Freight Centre	Cardebring & Warnecke (1995)
Intermodal Rail-Road Terminal	Roso & Lumsden (2009)
Intermodal Terminal	UNESCAP (2009)
Load Centre	Notteboom & Rodrigue (2009)
Logistics Centre	EUROPLATFORMS (2004)
Logistics Centre	Meidutė (2005)
Logistics Centre	Rimienė & Grundey (2007)
Logistics Node	Rimienė & Grundey (2007)
Maritime Feeder Inland Port	Leitner & Harrison (2001)
Nodal Centres for Goods	Tsamboulas & Dimitropoulos (1999)
Satellite Terminal	Notteboom & Rodrigue (2009)
Satellite Terminal	Slack (1999)
Seaport	Dooms & Macharis (2003)
Trade and Transportation Centre Inland Port	Leitner & Harrison (2001)
Transfer Terminal	Wiegmans, et al. (1999)
Transmodal Terminal	Notteboom & Rodrigue (2009)
Transport Terminal	Rimienė & Grundey (2007)
Urban Consolidation Centre	BESTUFS (2005)
Urban Distribution Centre	de Cerreño, et al. (2008)
Warehouse	Rimienė & Grundey (2007)

The variation in the literature highlights the confusion surrounding the concepts and definitions of these logistics centres, and brings to question their usefulness as terms to guide further study. For example, as explained by Roso et al. (2009), the term 'dry port' is often used to refer to a terminal where various cargo handling and added value activities are performed, directly connected to a major seaport with rail or barge shuttle services. But according to Rodrigue et al. (2010) this makes dry ports an issue of contention, as 'dry' appears to exclude other inland terminals served by barge. Even between countries, similar facilities are named differently. What Tsamboulas and Dimitropoulos (1999) refer to as nodal centres for goods are called freight villages in the United Kingdom, Platformes Multimodales/Logistiques in France, Interporti in Italy, and Gueterverkehrszentren (GVZ) in Germany. The term 'logistics centre' itself is subject to confusion, with some authors referring to it as a concept covering the "broadest meaning" of a centre for companies participating in activities related to transportation and logistics (Meidutė, 2005, p. 106), while others view logistics centres as functional equivalents of freight villages in Europe, Japan, Singapore, China, and the USA (EUROPLATFORMS, n.d., 2004; Rimienė & Grundey, 2007).

This raises many questions: Why is there so much variation in the literature? What do these terms mean? To what extent are they interchangeable? And what type of facility would best suit the needs of policymakers and planners interested in the benefits these facilities can provide? Answering these questions is essential as the issue of problem definition plays a fundamental role in any research undertaking by scholars in academia and the public and private sectors. To address these issues, the following sections will work towards a definition of logistics centres and the development of a logistics centre typology. But in order to proceed, the next section will explain three primary reasons for the confusion of terms encountered in the research: the relative immaturity of the field of study, the variety of functions performed due to the evolution of global logistics, and different regional geographical considerations.

The Study of Logistics Centres

The first reason is the age of the phenomenon itself. Advanced research of intermodal logistics is a relatively new area of study, and as such has some inherent drawbacks. According to Rimienė and Grundey, (2007, p. 92) "logistics researchers have made little effort to build a unified logistics centre conception." They contend that the history of theory development and empirical research on a unified logistics centre concept is quite poor in comparison to other disciplines, which can be attributed to the ongoing evolution of freight and logistics (discussed below) and the rather short history of supply chain management theory (Rimienė & Grundey, 2007). As a result, appraisals of logistics centres in the academic literature are lacking, with Tsamboulas and Dimitropolous (1999, p. 382) arguing that a distinctive characteristic of the field has been "the apparent absence of standard methodologies or decision criteria."

This immaturity extends beyond logistics centres themselves to the research of intermodal transportation as well. As discussed earlier, Bontekoning et al. (2004) argue that the lack of collaboration between researchers, coherence in research areas, and consensus on definitions has been a major stumbling block in progressing this area of scholarship towards a more mature and scientific

independent field of research. A consequence of these issues is the fragmented development of terminology and definitions used to describe the intermodal logistics centre phenomenon.

Evolution of the Logistics Centre Concept

Second, while the literature presents a range of definitions, the variation in these terms and the centres in which they describe can be seen as a response to the evolution of globalized trade (Kondratowicz, 2003; Rimienė & Grundey, 2007). During the late 1950s, the management of physical distribution began to materialize as an important business activity (Rimienė & Grundey, 2007). By the 1960s, the first dedicated logistics centres appeared in France, led by public-sector initiatives in cooperation with local authorities, chambers of commerce, and industry (Kapros, Panou, & Tsamboulas, 2005). In the late 1960s and 1970s, Germany and Italy added their own, this time including the concept of extended inland rail services and intermodal terminals. Since the 1980s and 1990s, the number of logistics centres multiplied in France, Germany, and Italy, and spread to the Netherlands, Belgium, and Great Britain (Kapros, Panou, & Tsamboulas, 2005).

Over this period of time, the concept of these centres has changed according to what Bolten (1997) has identified as three distinct phases of logistics centre evolution, with modern logistics centres playing a much broader and important role in facilitating globalized trade (Table 2.2). According to Bolten (1997), traditional warehouse operators have evolved into the 3- and 4PL logistics service providers mentioned previously, taking on a much broader role in the logistics system. Enabled by changing freight and logistics processes and supported by rapidly developing technology, new concepts and practices of customer service and inventory management are radically altering the way these logistics service providers manage the supply chain (Bolten, 1997; UNESCAP, 2002; Rimienė & Grundey, 2007).

Regional Geographic and Semantic Considerations

Lastly, confusion in the definition of logistics centres can be attributed to national, regional, and local characteristics. Though the concepts and functions of these facilities vary from country to country and also among authors in the field, each logistics centre can be seen as a product of inland realities. This is a result of the geographic setting of each facility and the preferences of actors and stakeholders, all of which play a large part in shaping the design and functions of these facilities in their respective economic hinterlands (Rodrigue et al., 2010). According to Notteboom and Rodrigue (2009a, p. 2), each logistics centre "remains the outcome of the considerations of a transport geography pertaining to modal availability and efficiency, market function and intensity, the regulatory framework, and governance." As such, they conclude that there is no single strategy in the design or function of these centres as the "regional effect remains fundamental."

In summary, the multiplicity of terms and definitions presented in Table 2.1 above can be seen as products of the immaturity of the research field, the evolution of logistics centres in response to changing freight and logistics processes since the 1950s, and regional and semantic considerations. However, the goal of this project is to explore the potential for freight villages as solutions to the goods movement challenges faced in the Greater Golden Horseshoe. To that end, what specifically constitutes

a freight village, and what characteristics delineate freight villages from the other types of logistics centres covered in the literature? These questions will be answered below through the development of a standardized typology and hierarchy of logistics centres.

Table 2.2 The Evolution of Logistics Centres

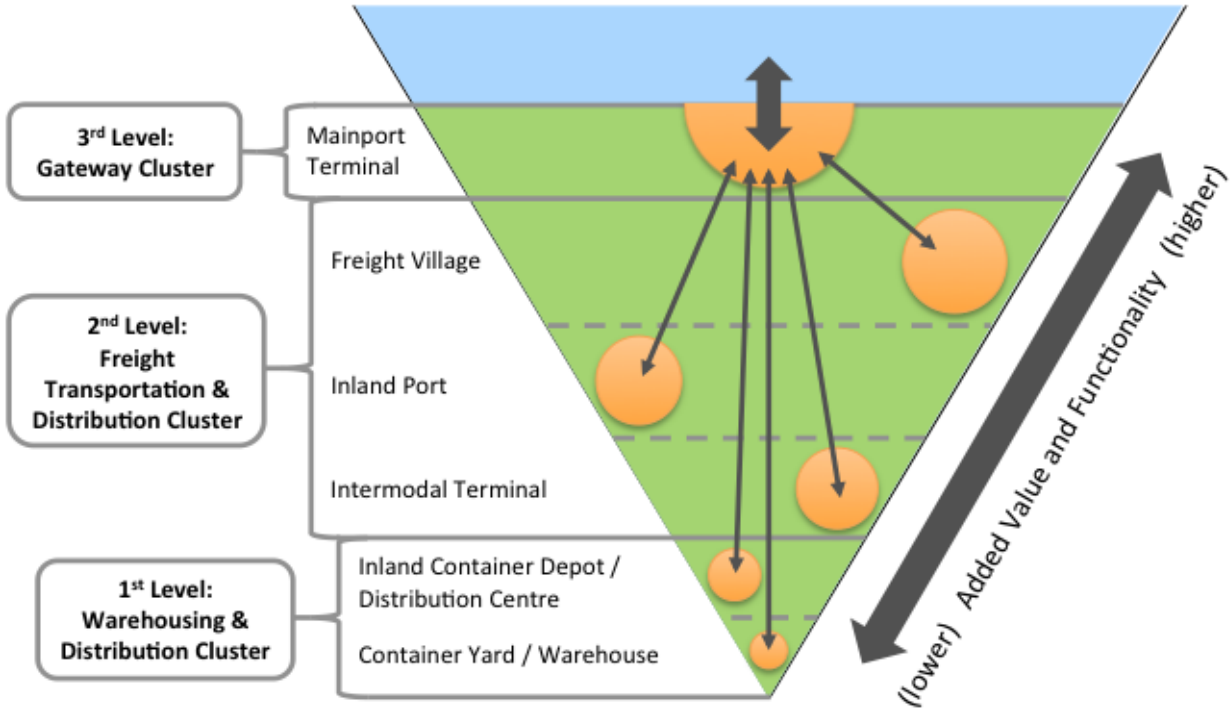
Stage A 1960s – 1970s Traditional Warehousing Services	Stage B 1980s – early 1990s Expanded Warehousing Services	Stage C Mid 1990s – present Logistics Services Provider / Third-Party Services
		Materials management Distribution services (national/global)
	Bonding	Import clearance Bonding Inbound transportation
Receiving	Receiving	Receiving
	Cross-docking	Cross-docking
Storage	Storage	Storage Inventory management and control Shipment scheduling
Order processing Reporting Picking	Order processing EDI Reporting Picking	Order processing EDI reporting Picking
Order assembly (Re) Packaging	Order assembly (Re) Packaging Stretch-shrink-wrapping	(Product) Subassembly Order assembly (Re) Packaging Stretch-shrink-wrapping
Palletizing/unitizing Label/mark/stencil	Palletizing/unitizing Label/mark/stencil	Palletizing/unitizing Label/mark/stencil
Shipping Documentation	Shipping Documentation Outbound Transportation	Shipping Documentation Outbound transportation Export documentation FTZ* Operation JIT/ECR/QR* services Freight rate negotiation Carriers/route selection Freight claims handling Freight audit/payment Safety audits/reviews Regulatory compliance review Performance measurement Returns from customers Customer invoicing

Abbreviations*: EDI – Electronic Data Interchange, FTZ – Free Trade Zone, JIT – Just-In-Time, ECR – Efficient Customer Response, QR – Quick Response

2.1 Development of a Standardized Logistics Centre Typology and Hierarchy

Some authors have attempted to categorize the variety of logistics centres according to different criteria. However, many of these approaches are isolated from one another and appear limited in their scope, level of analysis, and applicability. In order to address the lack of standardized definitions in the research, MITL has developed a unified typology and hierarchy of intermodal logistics centres by utilizing the variety of definitions and classifications in the literature. This classification combines and expands on the work of other authors in the field, with emphasis on Wiegmans et al. (1999), Leitner and Harrison (2001), Meidutė (2005), Rimienė & Grundey (2007), Notteboom and Rodrigue (2009a), and the United Nations ESCAP typology (UNESCAP, 2009). The result of this work is a hierarchy of intermodal logistics centres according to each facility's size, influence, and function in regional freight and logistics and value added activities (Figure 2.1). This hierarchy collapses the five sizes in Wiegmans et al. (1999) and the four levels presented in Notteboom and Rodrigue (2009a) into three broad levels based on the scope of activities in Rimienė & Grundey (2007). For a more detailed analysis of these approaches and the development of a standardized typology of logistics centres refer to Appendix B.

Figure 2.1 MITL Preliminary Logistics Centre Hierarchy



It should be noted that all authors providing these classifications make clear that the subdivision of terminal types does not cover all terminals unambiguously. Many take on characteristics of two or more terminal types according to regional geographic and semantic considerations discussed above. This approach presents a practical logistics centre typology and hierarchy that serves to simplify and differentiate between the varieties of facilities seen in the literature. In general, as these facilities move

up the scale in functionality and value added services they can be understood to incorporate and expand on many of the features of the logistics centres below them in the hierarchy.

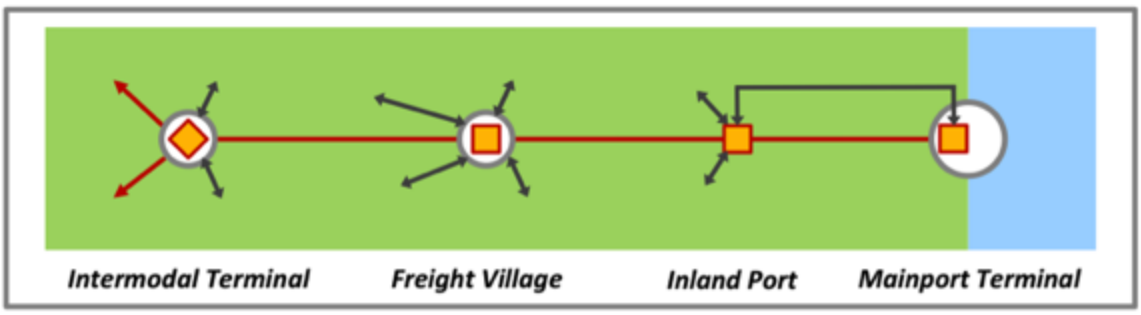
1st Level: Warehousing and Distribution Cluster

The 1st level represents the smallest scope of activities by intermodal logistics centres. Warehousing and Distribution Centres perform a variety of logistics functions and serve as important elements of the supply chain. Warehouses are typically a place for inventory, storage, and serve as a connection between producer and customer (Rimienė & Grundey, 2007), while Distribution Centres prioritize product flow and rapid delivery over storage, and some have evolved to offer ancillary value added logistics services (Bolten, 1997; Hesse, 2004; Rimienė & Grundey, 2007). Also included are the UNESCAP's basic Container Yards that help facilitate containerized trade, and Inland Container Depots that offer a greater set of services tailored to containerized trade over container yards.

2nd Level: Freight Distribution Cluster

The 2nd level represents the freight distribution cluster, which has been expanded from Notteboom and Rodrigue in accordance with the definitions of these facilities by other authors. It now encompasses Freight Villages, Inland Ports, and Intermodal Terminals, and loosely covers the XL, L, and M size terminals in Wiegmans et al. (1999). The activities performed by these facilities range from the simple transfer of goods from one mode to anther at an intermodal terminal, to the broad range of intermodal transportation options, wide geographic coverage, and comprehensive value added services offered by freight villages. If the updated 'freight distribution cluster' is applied to Notteboom and Rodrigue's (2009a) intermodal rail terminals presented in Appendix B, we can get a clearer picture of each facility's role. All that is required is an update of terminology to match that of the MITL typology. In this case, the Transmodal Terminal is now referred to as an Intermodal Terminal, the broad activities of the Load Centre now a Freight Village, and the Satellite Terminal now defined as an Inland Port (Figure 2.2)

Figure 2.2 Revised Freight Distribution Cluster



3rd Level: Gateway Cluster

The 3rd level defines the largest scope of activities contained within major international mainport terminals such as traditional seaports and to a lesser extent, the freight operations of airports described as XXL and XL terminals by Wiegmans et al. (1999) and Gateways by Notteboom and Rodrigue (2009a).

These facilities are responsible for immense amounts of trade as the primary interface between maritime and inland freight and logistics, and act as nodal centres for logistics activities, producing large amounts of logistics activity inside the facility and beyond as many firms choose to locate within its periphery.

2.2 Conclusion

As a relatively new area of study, the lack of consensus on definitions provides an opportunity to propose a standardized typology and hierarchy of intermodal logistics centres. The categories identified herein should not be considered exclusive, as many facilities can take on the roles of one or more different types according to their local, regional, and national geographic and semantic considerations. Furthermore, it is expected that the role of some facilities is likely to change over time as freight and logistics continues to evolve. Nevertheless, the establishment of this typology and hierarchy allows this project to more accurately conceive and define the type of facility chosen for further analysis. The discussion will now turn to a more in depth conceptualization of freight villages and an overview of select examples.

3

Freight Villages

Given the development of a typology and hierarchy of the different types of logistics centres, some important questions remain: What is a freight village? Are these facilities the best to accomplish this project's goals for solutions to the goods movement challenges facing the Greater Golden Horseshoe? More specifically, do freight villages have the potential to mitigate congestion, improve environmental sustainability, and enhance the investment attraction of the region? To answer these questions, this section will conceptualize and define freight villages and provide an overview of freight villages in use throughout both Europe and North America.

3.1 The Freight Village Concept

As discussed, there exists some confusion in the literature regarding the definition of freight villages, with some authors referring to them as functional equivalents of a specific definition of logistics centre (Meidutė, 2005; Rimienė & Grundey, 2007). Even EUROPLATFORMS, the European Association of Freight Villages representing 57 facilities and approximately 1,200 transport operators in the European Union has referred to freight villages as logistics centres in some reports, suggesting this specific interpretation is interchangeable (EUROPLATFORMS, 2004). However, for the purposes of this report, the term freight village will be distinguished from logistics centres as a subset in a broader logistics centre hierarchy and typology.

In spite of the terminology, freight villages can be seen to share a common conceptual background: by design they should contribute to intermodal transport, promote regional economic activity, and improve land use and local goods distribution (Meidutė, 2005; Roso, 2008). According to EUROPLATFORMS, the freight village concept is based on three important guiding elements:

1. *Territorial planning alongside infrastructure rationalization*: The dedication of specific areas to transport, logistics, and goods distribution implies land use planning and the rationalization of infrastructure to optimize site utilization, protect the environment, and to build infrastructure according to tenant needs.
2. *Transport quality*: High service quality is one of the most important elements in removing transportation-related wastes and attaining a competitive advantage. This is accomplished through specialization, offering the best logistics, transport, and storage solutions according to tenant needs.
3. *Intermodality development*: Road transport is dominant in Europe and North America. The promotion of intermodal transportation chains is seen as a central goal of logistics centre development and a fundamental element of future freight and logistics processes.

A number of definitions can be found in the literature for what specifically constitutes a freight village. For example, the European Commission defines a freight village as a geographical grouping of independent companies and bodies dealing with freight transport and accompanying services, which includes at least one terminal as well as the technical and administrative services for the infrastructure itself (Interporto Bologna SpA, 2005). One of the most useful and comprehensive definitions comes from the United Nations ESCAP (2009):

Freight Village (FV)
A freight village is an area of land that is devoted to a number of transport and logistics facilities, activities and services, which are not just co-located but also coordinated to encourage maximum synergy and efficiency. By 2005, there were 40 of these complexes in Europe, and since then there has been an emerging trend for their establishment in the US and in Australia. Central to a freight village is an intermodal terminal that is connected to major freight corridors and a nearby seaport. This enables flexible, quick movement of containerized and de- containerized cargo between wharf, warehouse and ultimate destination by both road and rail. The juxtaposition of the intermodal terminal with facilities such as container storage (full and empty) and handling areas, and warehouses that are linked to rail, is intended to significantly reduce cargo handling costs and time, and reduce the use of roads for container transportation. The second distinguishing feature of a freight village is shared access to other facilities, equipment and services. While some of the operators use their own facilities and services and others hire facilities and pay for services from other providers, some facilities such as customs and quarantine services, a truck cleaning area, post office and conference and training rooms would be used on a common access basis by all companies involved in the activities. As well as providing opportunities for sharing operational facilities, some freight villages cater for the social needs of people working there by including bus services, parking facilities, and amenities such as cafes and canteens, and recreation and child care facilities. Facilities such as these could be provided if not initially, perhaps as the freight village attracts enough operators to warrant their use. A centralized management and ownership structure is the third distinguishing feature of a freight village. This is

similar to the strategic management role of a port authority/corporation. Centralized management has responsibility for planning the long-term investment and growth of the village as well as the short-term maintenance of the village infrastructure. It is responsible for establishing corporate governance and administrative arrangements for the village, including those related to quality control, safety, and risk and environmental management. As part of the strategic oversight of the village, the manager would lead village members in designing and implementing ways of attracting business to the village.

While this definition provides a broad overview of what constitutes a freight village, the theoretical basis of these facilities can go much further. Some authors provide a more detailed conceptualization of the roles, functions, and actors involved in their development, which will be discussed below.

3.1.1 Types of Freight Villages

Some authors have proposed additional typologies of freight villages to aid in further classifying their role in freight and logistics. According to the Freight Village 2000 survey and report commissioned by EUROPLATFORMS and other stakeholders in the European Union (FV-2000, 1999), two types of freight villages can be distinguished among the 14 freight villages studied:

- *Integrated Freight Village*: Accomplishes modal changes on-site, in addition to providing a range of services in which transportation is only a single element of global logistics performance. This is the ideal-type of freight village.
- *Non-Integrated Freight Village*: Inside which modal changes are not accomplished. Freight can change vehicle (i.e. truck-to-truck or rail-to-rail transshipment) but not transport mode (i.e. rail-to-truck). Modal changes occur at an intermodal terminal nearby. These usually exist in the peripheries of large urban areas and perform as consolidation / deconsolidation centres for urban distribution.

In Task 1 of the NYMTC Freight Village study, de Cerreño et al. (2008) make a distinction between two different types of freight villages according to the mix of features offered on site and the facility's role within the community:

- *Logistics Centre Freight Village*: in which industrial and logistics activities take place.
- *Community Integrated Freight Village*: where community-integrated commercial activities of various types may co-exist with purely industrial and logistics activities.

They note that although logistics centre freight villages also provide support services, they are generally aimed at the workers within the facilities as well as those passing through. However, while these present an additional level of analysis and specificity to the freight village concept, this project formulates a general conceptualization of freight villages based on the two broad functions and roles of these facilities presented in 3.1.2 below.

3.1.2 Roles and Functions of a Freight Village

A freight village is much more than just a terminal. As the top logistics facility in the freight distribution cluster of the functional and value added hierarchy, freight villages build on and incorporate the

functions of the other types of logistics centres covered in the typology. In terms of functions, a freight village provides a host of auxiliary services such as warehouses, groupage activities, customs, maintenance workshops, insurance, banking, offices, and other services (Tsamboulas & Dimitropoulos, 1999). Weisbrod et al. (2002, p. 4-5) see freight villages as "a cluster of quality industrial-intermodal-distribution-logistics buildings located within a secure perimeter where a range of support services are provided" and a location that allows for "synergistic relationships among companies engaged in warehousing, light manufacturing, value-added assembly, and other operations." BESTUFS (2007a), the Best Urban Freight Solutions project initiated by the European Commission notes that the main functions of freight villages are transportation-related activities (such as forwarding, warehousing, and additional logistic services), a connection to a minimum of two transport modes, the settlement of different economically interdependent companies, and a governance structure that can best exploit potential synergies among tenants. Additionally, some freight villages can even include urban consolidation and distribution functions when located close to urban areas.

These points highlight the two different ways of thinking about freight village functionality. The first conceptualization is of freight villages as transportation infrastructure, while the second views freight villages as promoters of business and economic activity.

Freight Village as Intermodal Infrastructure

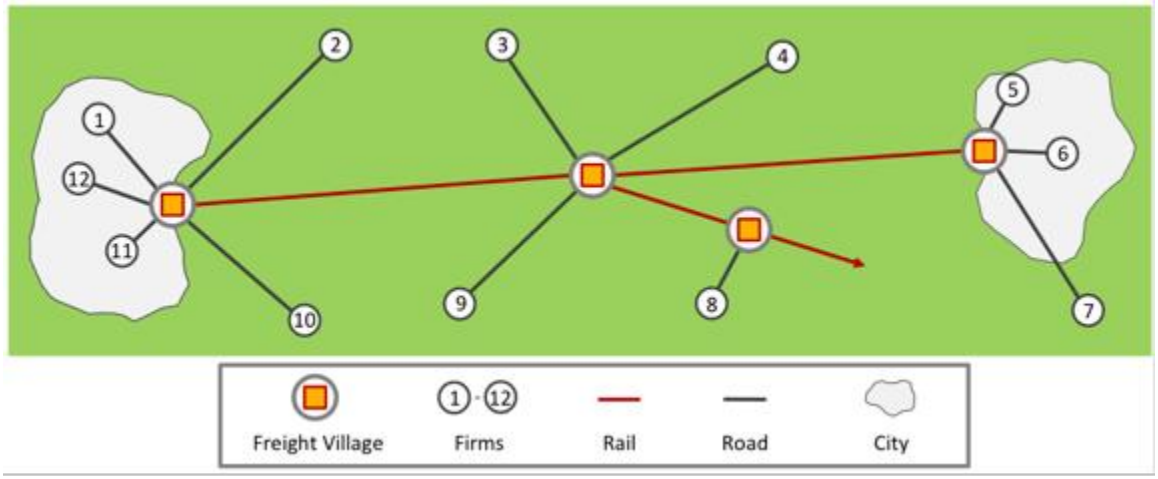
One of the main functions of a freight village is that of promoting intermodal transportation. Tsamboulas and Dimitropoulos (1999) viewed intermodal terminals as principal components of freight villages, and later Tsamboulas and Kapros (2003) referred to freight villages as an 'integrator' of various modes of transport with the goal of promoting intermodal transfers. The UN ESCAP (2009) definition refers to a freight village as an "intermodal terminal" and EUROPLATFORMS (2004) views such a terminal as important for "encouraging intermodal transport". From these definitions it is clear that a major goal of freight villages is to promote intermodal transportation activity by providing facilities dedicated to easing the transfer of goods between different modes.

This conceptualization exposes two additional scales of functionality for freight villages as intermodal infrastructure. The first concerns the regional scale that views freight villages as intermodal terminals promoting more efficient freight and logistics transportation between urban areas, while the second deals with freight and logistics within urban areas, in which freight villages function as centres for urban distribution.

Regional Intermodal Transportation: One of the main functions of freight villages as intermodal terminals is the promotion of modal shift from road to rail and improved inter-regional intermodal networks between urban areas. This essentially creates a hub-and-spoke network for freight transportation. While a single freight village facility may be able to influence mode shift on its own, the concept of a freight village works best when it is interconnected to additional freight villages or other types of intermodal logistics centres. This results in a 'network effect' of intermodal transportation, which argues that when more manufacturers, customers, suppliers, and shippers are located within a freight village or intermodal logistics centre, firms will be more likely to take advantage of intermodal

transportation options to move goods. A hypothetical inter-regional network relationship is illustrated in Figure 3.1.

Figure 3.1 Regional Road and Freight Village Networks



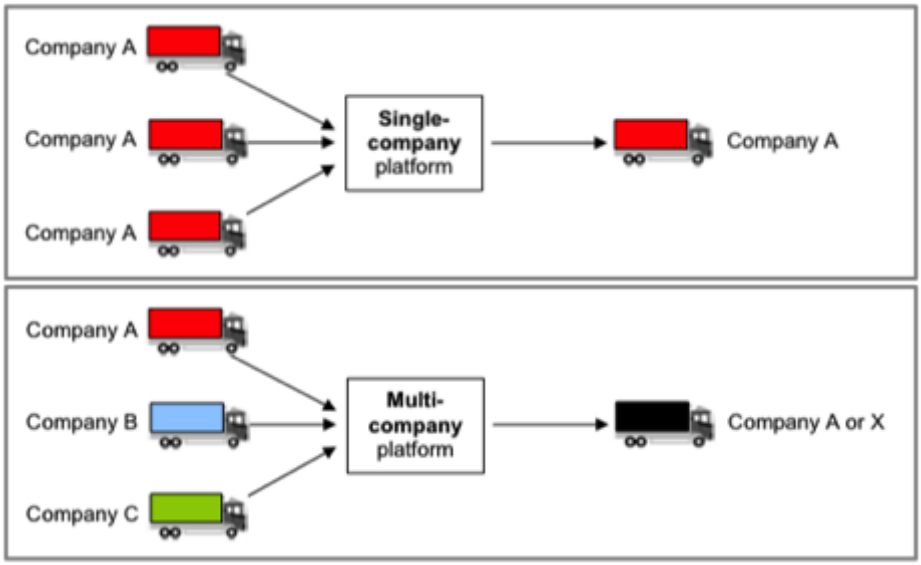
Urban Consolidation and Distribution: The second role of a freight village is that of reducing transport processes within cities and urban areas. BESTUFS (2007a) reports that as of 2007, more than 80% of road freight trips in European urban areas are of distances below 80 kilometres. Urban freight transport involves the delivery and collection of goods in towns and city centres and includes activities such as handling and storage of goods, the management of inventory, waste handling and removal, and home delivery services (BESTUFS, 2007b). This type of goods movement has a major impact on the economic power, quality of life, accessibility, and attractiveness of a region, but minimizing the negative externalities associated to urban goods movement is difficult. Because urban activities require a constant supply of goods and the disposal of waste, there is little scope for reducing goods flows to and from cities. However, previous research has shown that the distribution of urban goods is not organized efficiently and there is considerable room for reducing urban goods traffic (BESTUFS, 2007a).

According to Regan and Golob (2005), the issue of urban consolidation and distribution first received significant attention during the 1970s when it was observed that while inter-urban freight movements had become much more efficient, significant diseconomies characterized the movement of truck freight within urban areas. This has led to increased research into a field that, like logistics centres, is encountered with a variety of terms such as ‘city logistics’, ‘urban distribution centres’, ‘urban consolidation centres’, and ‘freight platforms’. Though much attention is paid to passenger movements in urban areas, the OECD (2003) views urban freight consolidation and distribution as one of the most important techniques for improving the sustainability of cities and urban regions.

The goals of the urban consolidation and distribution conceptualization of a freight village are for the optimization of logistics operations, urban traffic reduction, encouraging modal shift, and multi-company consolidation within the urban periphery. Other goals include the reduction of local air pollution, traffic noise, and the consumption of urban space for transport infrastructure and the general improvement of the urban environment (Visser et al., 1999). With a focus on distribution efficiency and

its urban orientation, centres for urban consolidation and distribution provide an interface between the transshipment of long-distance traffic to short-distance (urban) traffic where consignments can be optimized for local delivery (BESTUFS, 2007a). BESTUFS (2007a) classifies urban consolidation and distribution operations according to single- or multi-company urban freight platforms (Figure 3.2).

Figure 3.2 Single-Company and Multi-Company Platform

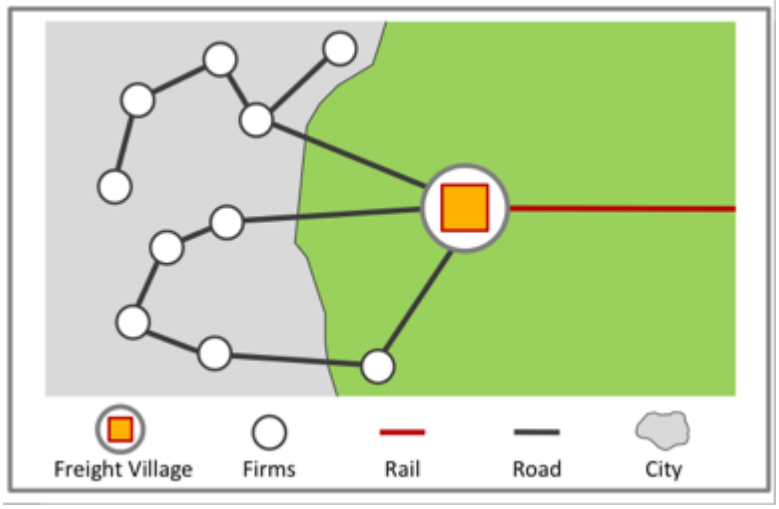


(BESTUFS, 2007a)

Single-company schemes are essentially proprietary systems of consolidation and distribution that many companies already perform as part of their management of the supply chain. Multi-company arrangements function in a similar fashion, but typically involves either the largest carrier with room to spare on loads or a 3rd party logistics service provider contracted by a number of companies to conduct deliveries on behalf of all parties. These types schemes are dependent on fostering strong horizontal cooperation relationships among actors, which will be discussed further below.

The intra- and inter-company cooperation created through these types of systems is presented as a solution to some of the negative externalities associated with changing freight and logistics processes and trends regional population and freight growth. By bundling various trips of one or several carriers into single linked trips with better capacity utilization or smaller or low-emissions vehicles, congestion, noise, and pollution in the city can be reduced, time gained, and deliveries made more reliable (BESTUFS, 2007a). Though in many cases urban distribution centres can function as standalone facilities lower in the hierarchy of logistics centres, many freight villages incorporate this function into their operations. When urban distribution is connected with an intermodal terminal, it allows a freight village to extend its influence to become a truly comprehensive multi-company regional consolidation and distribution node strengthened by high quality transportation options (Figure 3.3).

Figure 3.3 Freight Village Urban Distribution Function



Freight Village as a Generator of Business and Economic Development

The second role of a freight village concerns its economic development potential. Meidutė (2005) notes in her literature review that in Japan, Singapore, China, the United States, and some European countries freight villages are interpreted as not only parts of intermodal infrastructure, but important generators of business. Under this view, intermodal transportation services are not perceived as the main function of a freight village, but as a platform from which to create and secure beneficial business conditions and a competitive advantage for the companies within (Meidutė, 2005).

This is accomplished through two interrelated processes. The first is by promoting the 'clustering' or agglomeration of businesses and transportation and logistics firms within a single site or area. The second is the realization of synergistic and cooperative relationships between firms as a result of this clustering. Both of these are discussed further below.

Clustering: One of the main reasons behind the creation of a freight village is to realize synergies between manufacturing, industrial, and logistics firms and promote more efficient and effective freight and logistics processes. There are two ways this can be achieved. The first type of synergy offered by freight villages is the opportunity to facilitate the agglomeration or clustering of firms. At the theoretical level, Porter (2000, p. 21) defines this phenomenon as "a system of interconnected firms and institutions whose whole is more than the sum of its parts". Notteboom and Rodrigue (2005) have found that freight and logistics companies frequently locate close to one another, as they are attracted by the same location factors such as the proximity of markets and the availability of intermodal transport and support facilities. The geographic concentration of these companies in turn creates synergies and economies of scale that make the chosen location even more attractive and further encourages the concentration of companies in a particular area (Notteboom & Rodrigue, 2005).

Porter (2000, p. 21) argues that these clusters benefit companies in three broad ways:

a) Increasing the current (static) productivity of constituent firms or industries

b) Increasing the capacity of cluster participants for innovation and productivity growth
c) Stimulating new business formation that supports innovation and expands the cluster

According to Porter (2000), the clustering of firms produces concentrations of highly specialized skills and knowledge, institutions, rivals, related businesses, and sophisticated customers in a particular location. "Proximity in geographic, cultural, and institutional terms allows special access, special relationships, better information, powerful incentives, and other advantages in productivity and productivity growth that are difficult to tap from a distance." (Porter, 2000, p. 32)

While Porter's cluster theory operates at the local, national, and regional levels, realizing the benefits of this type of relationship at the facility level is an important aspect of the freight village concept. According to McCalla et al. (2001), the establishment of these and other logistics centres is based on the assumption that in locating different firms of the same sector close to each other, linkages and agglomeration benefits are expected. The co-location possibilities present in such a development provide an opportunity to realize synergies between firms and infrastructure that can increase productivity, innovation, and economic growth, and to promote more efficient and effective freight and logistics processes. These synergies are discussed further below.

Synergies: There are two major types of inter-firm relationships that both contribute to the success of clusters and emerge as a result of agglomeration: vertical and horizontal. These types of relationships are not insulated, as Sheffi (2010) argues that most clusters or agglomerations of firms naturally include both. It should be noted that vertical and horizontal cooperation form pillars of the field of organizational science, making an in-depth exploration of each beyond the scope of this project. This section provides only a brief overview of the broad themes in vertical and horizontal cooperation among freight and logistics actors.

Vertical relationships are links between trading partners. According to Sheffi (2010), all firms today rely on vertical relationships of various types such as materials and parts suppliers on the procurement side and distributors, customers, and other service providers on the sales side. Sheffi (2010) argues that the management of these relationships is of prime importance, especially now as more firms have increasingly moved away from vertical integration to outsource a number of functions and stages of production.

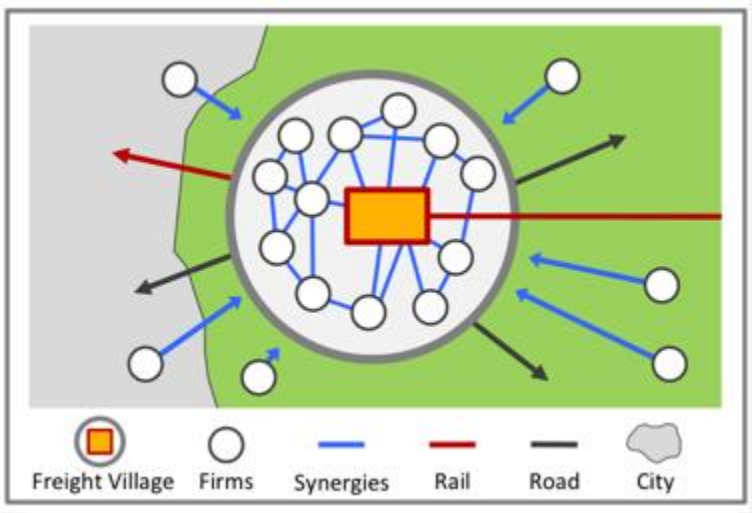
One of the basic ways vertical synergies can be achieved in freight and logistics is through potential benefits to the supply chain of firms. This stems from the literature on supply chain management that aims to install beneficial partnerships and seamless linkages among multiple parties acting at different levels of the supply chain to minimize 'waste' (Cruijssen et al., 2007). The most common and best-studied type of vertical cooperation in logistics involves shippers hiring 3PL and 4PL firms to perform part or all of their materials management and product distribution functions. A freight village can benefit vertical relationships between firms by providing an opportunity to reduce the number of warehouses or depots in a city, country, or region, and minimize wasted transportation movements in the supply chain (Morash, 1999; Simchi-Levi, Kaminski, & Simchi-Levi, 2000; Leitner & Harrison, 2001; Meidutė, 2005; Rimienė & Grundey, 2007).

A second type of synergy that can be realized through freight villages is that of horizontal cooperation. While traditional vertical cooperation in logistics typically involves firms operating at different levels of the supply chain, according to the European Commission, horizontal cooperation in logistics is defined as concerted practices between companies operating at the same level(s) in the market (Cruijssen et al., 2007). Examples of this include automobile manufacturing plants in Detroit, Michigan, or film studios in Hollywood, California, that both compete with each other and cooperate along dimensions that benefit them (Sheffi, 2010).

This type of relationship between freight and logistics actors forms the basis of the urban consolidation and distribution aspect of freight village activities, wherein companies that may have traditionally competed against one another cooperate to realize cost savings and increased productivity. This is achieved through optimizing vehicle capacity utilization, reducing empty trips, sharing expertise, and cutting the costs of non-core activities to increase the competitiveness of their logistics networks. These activities are common in the maritime and air freight industries and have been well studied. However, inland horizontal cooperation in logistics is in its infancy, though arrangements are gaining momentum in Western Europe, where a study by Cruijssen et al. (2007) found more than 30 formal logistics partnerships between 3PL firms and other logistics service providers.

A freight village can capitalize on these synergistic relationships by taking a master-planned approach to facility development and management that concentrates business and transportation activities from a single company or between several companies within a single site. Figure 3.4 highlights the hypothetical synergistic benefits that can be attributed to firm co-location and cooperation within a freight village, in addition to the benefits that can accrue to firms located in the periphery of the facility.

Figure 3.4 Synergistic Benefits of a Freight Village



3.1.3 Freight Village Features

In essence, freight villages are called freight villages because of the range of features present at the site. These features can be spit into two categories that make up the ‘freight’ and ‘village’ roots of the term.

The 'freight' side consists of traditional infrastructure dedicated to freight and logistics, while the 'village' element of the term corresponds to an array of supplementary services located alongside the freight infrastructure to facilitate and expedite freight and logistics processes within the site. Based on a review of freight villages in operation around the world, MITL has prepared a 'menu of elements' of the most common freight village features below, broken down into these two categorizations. A more comprehensive table of freight village features is included in Appendix C.

Infrastructure

The two most important freight features of a freight village are its warehouses and intermodal terminal. Warehouses are where the transport operators conduct their business. EUROPLATFORMS (2004) argues that there are different types of warehouses depending on the activities of its tenants and the freight it handles:

- General warehouses for storage
- Large warehouses for logistics activities
- Warehouses with rail-road interchange
- Warehouses with raised docking bays
- Climate-controlled warehouses

This view of warehousing coincides with freight villages as intermodal infrastructure, but warehouses also perform an important role in generating business and facilitating a competitive advantage through supply chain management. According to Weisbrod et al. (2002), these warehouses tend to be highly automated and information integrated to meet Just-In-Time delivery needs, with rapid cross-docking to keep inventory lean, and are also clustered, which allows for the development of a 'synergistic relationship' between companies.

The intermodal aspect essentially views a freight village as traditional intermodal terminals, composed of one or more tracks linked to main railway arteries and a large area used for dealing with all loading and unloading operations. Other intermodal facilities might include an on-site seaport or airport, or direct rail shuttle links these facilities within the freight village periphery (Boile et al., 2008). In an extensive review of global freight villages, Boile et al. (2008) found a number of other infrastructure features beyond warehousing and the intermodal terminal, such as:

- Distribution / consolidation centres
- Transshipment facilities
- Storage areas
- Vehicle maintenance / repair garages

Services

Beyond freight infrastructure, the village element of a freight village corresponds to the services necessary to satisfy and respond to the requirements of its tenants. Some of the basic logistics services usually found within a freight village are:

- Loading / unloading primary modes
- Transferring to secondary modes
- Storage
- Freight forwarding

- Cross-docking / merging in transit
- Freight consolidation / deconsolidation
- Distribution / final delivery
- Warehousing
- Hazardous materials services
- Security environments
- Cold storage areas
- 24-hour accessibility

While many of these are offered by the freight village management company as features of the facility, others are performed by the manufacturing, industry, and logistics firms located on site. However, what separates a freight village from traditional intermodal terminals and other logistics centres is the provision of on site complimentary services to support freight and logistics activities. These include:

- Banks
- Insurance offices
- Post Office
- Customs offices
- Office space for rent
- Land for further development

While this infrastructure is primarily related to freight and logistics, other services seen in the literature seem to fit into the broader 'community integrated' model of a freight village outlined by de Cerreño et al. (2008), which blurs the borders of the facility and integrates it into the broader community. These can include:

- Residential development
- Restaurant
- Supermarket
- Hotel
- Conference centre
- Hospital
- School
- Daycare
- Other commercial development

As outlined earlier by Bolten (1997), the evolution of logistics centres has meant that these facilities have increased their scope of activities to perform a variety of value-added services to freight. However, it is not the freight village itself that performs these activities, but rather the companies located within. The nature of a freight village is that it offers an attractive environment for 3PLs, 4PLs, and other logistics service providers to conduct a broad range of logistics activities made possible by the host of transportation, services, and tenants located on site. According to Rodrigue (2011), these can be classified into four categories that range from the standard services of basic 3PLs to the integrated services that can be classified as 4PL activities, reproduced in Table 3.1. Another important service that can be offered is reverse-logistics that can minimize wasted empty movements (FV-2000, 1999). Services dedicated to containerized trade are also becoming important. This can include stuffing / de-stuffing, storage, inspection, cleaning, and repair. Due to global trade imbalances, the repositioning of empty containers has emerged as a key challenge for transport companies (Frémont & Franc, 2010).

Table 3.1 Services Offered by Third and Fourth-Party Logistics Providers

3PL >			< 4PL
Standard	**Advanced**	**Complete**	**Integrated**
Transportation services Carrier selection Rate negotiation Fleet management Warehousing Cross docking Pick-and-pack Distribution (direct to store / home) Dispatching Delivery documentation Shipment consolidation	Vendor managed inventories Stock accounting Customs clearance and documentation Assembly Packaging Labeling Managing product returns Financing Retail delivery, setup, and on site training Inventory tracking	Order planning and processing Information and Communications Technologies (ICT) management Single invoice Landed duty paid cost (per piece) Payment collection Real time inventory updates Just-In-Time (JIT) inventory management	Production planning Sourcing Routing transit times (air vs. ocean) Supply chain consulting Complete real time supply chain monitoring and adjustment

(Rodrigue, 2011)

Free Trade Zone / Foreign Trade Zone

In addition to the infrastructure and services mentioned above, many freight villages and other logistics centres are now incorporating customs districts or Free Trade Zones (FTZs) to contribute to the efficiency of international trade and enhance the competitive advantage of tenants. FTZs eliminate or reduce costs or obstacles in international trade by enabling a logistics centre to act as an international mainport terminal, at least from a customs perspective.

For manufacturing, goods can be produced inside a FTZ with the waste left behind, and duty is paid only on the saleable product after final assembly (UNESCAP, 2002). Incoming and outgoing cargo can be transported without the need to clear customs at traditional gateway terminals. This can reduce customs turnaround times and generates additional value-added benefits, such as being able to perform inspections, quality control, or transformations of the cargo, which can then be 'exported' under another (lower duty) customs category. Payment can even be postponed until the cargo clears the FTZ (Rodrigue et al., 2010).

A different type of initiative that has emerged in Canada is that of a 'Foreign Trade Zone'. According to the Government of Canada (2009), the Foreign Trade Zone program provides three incentives:

- *The Duty Deferral Program:* Postpones or refunds duties and taxes that would otherwise have to be paid on imported goods.
    - **Customs Bonded Warehouse:** Can be applied to any part of your business. Benefits include not paying duties and taxes until the goods enter the Canadian marketplace, no

payment of duties and taxes on goods for export, the ability to import goods in bulk and distribute on an as-needed basis, and the storage of goods for up to four years.
    - **Duties Relief Program:** Firms may not have to pay duties on imports that are stored, processed, or used to manufacture other products so long as the produced goods or products are then exported.
    - **Drawback:** This option allows firms to recover duties already paid on imported goods that are later exported.
- *The Export Distribution Centre Program:* GST/HST exemptions for imported or domestic purchases of goods for firms that add 'limited value' to these goods and re-export them. Goods must be worth a minimum of $1,000.
- *The Exporters of Processing Services Program:* Relieves participants of the obligation to pay GSH/HST on imported goods that are subsequently exported. This program imposes no minimum level of export sales to meet eligibility or the amount of value that must be added.

The Government of Canada (2009) argues that together the benefits of these programs are comparable to those offered by other Foreign or Free Trade Zones around the world. However, the key difference is that unlike traditional FTZs that are featured within a dedicated location, Canada's Foreign Trade Zone-equivalent programs can be used anywhere in Canada, as participating businesses can designate their current operations as a Foreign Trade Zone.

3.1.4 Freight Village Actors

Understanding the main stakeholders, their roles, and the scope of their activities will be important in coordinating actors, deciding suitable action, and directing investments for improving freight and logistics processes. Frémont and Franc (2010) explain that there are three general types of stakeholders in the development of logistics centres: economic agents, which are directly involved in organizing transport operations; public authorities at all levels of government; and community groups, which are most often expressed through associations, lobbying groups, or the media.

Kapros et al. (2005) expand on this and apply it directly to the development of freight villages, arguing that although there are numerous stakeholders involved, most of them can be grouped into five main categories:

1. *Owners or Managers:* The ultimate project owner, which can be a company representing one (mainly the provider of the facilities) or an array of financiers (public or private). The owner is responsible for all managerial issues from conception to construction, through the subsequent operation.
2. *Potential Users:* Represent the various transport companies, forwarders, logistics service providers, and shippers that would use the new service.
3. *Other Transport Actors:* Represents the railways, port authorities, and other relevant transport companies (public or private) that might be influenced by the new service.

4. *Local Authorities:* Represent the complex interests of the surrounding municipalities. These interests are fiscal, financial (if the state provides part of the capital), political, technical, and environmental.
5. *Special Interest Groups:* A broad category with diverse and possibly conflicting interests. Relative to freight villages, this category is likely to include a) professional chambers of industry, commerce, and engineering; b) social organizations; and c) interest groups, such as those for environmental protection.

The urban consolidation and distribution function of freight villages is also seen to have its own classification of actors. According to Wisetjindawat (2010), these consist of shippers, receivers, carriers, and administrators at the local level. Shippers and receivers embody the supply and demand for products, carriers respond to the demand for the transportation of products between shippers and receivers, and administrators control the functioning of the whole system through incentives and disincentives related to freight transport.

3.2 Examples of Freight Villages

This section provides an overview of some of the current examples and relevant future projects covered in the literature. The current cases selected for further analysis consist of four freight villages currently in operation: two European examples – Interporto Bologna in Italy, GVZ Bremen in Germany, and two from the United States – AllianceTexas in Fort Worth, Texas, and the Raritan Center in New Jersey.

Future projects relevant to this discussion include the ongoing development of KC SmartPort and the CenterPoint-KCS facility in Kansas City, Missouri, CentrePort Canada in Winnipeg, Manitoba, the Port of Alberta in Edmonton, and the CN Calgary Logistics Park. Some of these facilities are in the early stages of planning while others such as CenterPoint-KCS are currently operational. Each of these examples does not yet constitute a freight village according to the typology of logistics centres established in this report. However, they are included in this project to highlight the foundations for the successful development of these types of facilities and recent examples of logistics centres in Canada. Not every freight village has been planned as such, and these examples serve to highlight some projects in the early stages of development that may eventually evolve into a freight village.

An additional overview of all of the different freight villages and other logistics centres encountered in the literature is provided in Appendix D. Furthermore, supplementary outlines of other freight villages not covered in this section are included in Appendix F.

3.2.1 Current Freight Villages

Interporto Bologna

Freight Village Overview

Size (Acres):	1,055	Modes:	Road, Rail
Employees:	1,500	Transp. & Log. Firms:	100

General Information

Interporto Bologna represents one of the earliest and best examples of a freight village in operation around the world. The project is the result of many public goals such as promoting intermodal rail transport to reduce heavy truck traffic in the city, improving urban goods distribution, and promoting environmentally sustainable economic development. Since its inception in 1971, the Bologna freight village has emerged as one of the busiest logistics platforms in all of Europe, helped to influence a shift in freight mode share, and created a competitive and productive environment to conduct business.

Development History

The Bologna freight village was the second such facility to be developed in Europe after Roissy-SOGARIS in France. The project began as Autoporto Bologna SpA, a partnership between local and provincial governments, the Bologna Chamber of Commerce, and Italian road haulage associations with the goal relieving the city of heavy truck traffic through a promotion of intermodality. Contact was made with the Italian rail company Ferrovie dello Stato in 1973 to bring rail service and the management company changed its name to Interporto Bologna SpA to reflect its new orientation. Construction of the freight village began in 1974 and phase one was completed within ten years (Boile et al., 2008).

Site Features

Interporto Bologna is strategically located in suburban Bologna at a site 12km from the city centre directly served by Italy's highway network and rail routes that carry 75% of all goods exchanged in the country (Wisetjindawat, 2010). This site was chosen for the possibility of disposing of a large area located next to a railway line and highway network, and its proximity to a wider area that has been established as a commercial district, which now houses more than 600 firms as of 2010 (Wisetjindawat, 2010). The location of Interporto Bologna is shown in Figure 3.5.

The site features a number of large warehouses with raised docking bays and office facilities, public warehouses for storage, intermodal terminals, and supporting services. A breakdown of space at the freight village and a layout of the site is included in Figure 3.6. Roughly 500 acres of the 1,055-acre site are currently built out with the remainder held for future expansion. An interesting feature of Interporto Bologna is the attention paid by its management company to the aesthetics of the facility. A site visit by de Cerreño et a. (2008) found 20 acres of landscaping and green areas outside of the freight village so that the facility is more acceptable to nearby neighbourhoods.

Figure 3.5 Location of Interporto Bologna

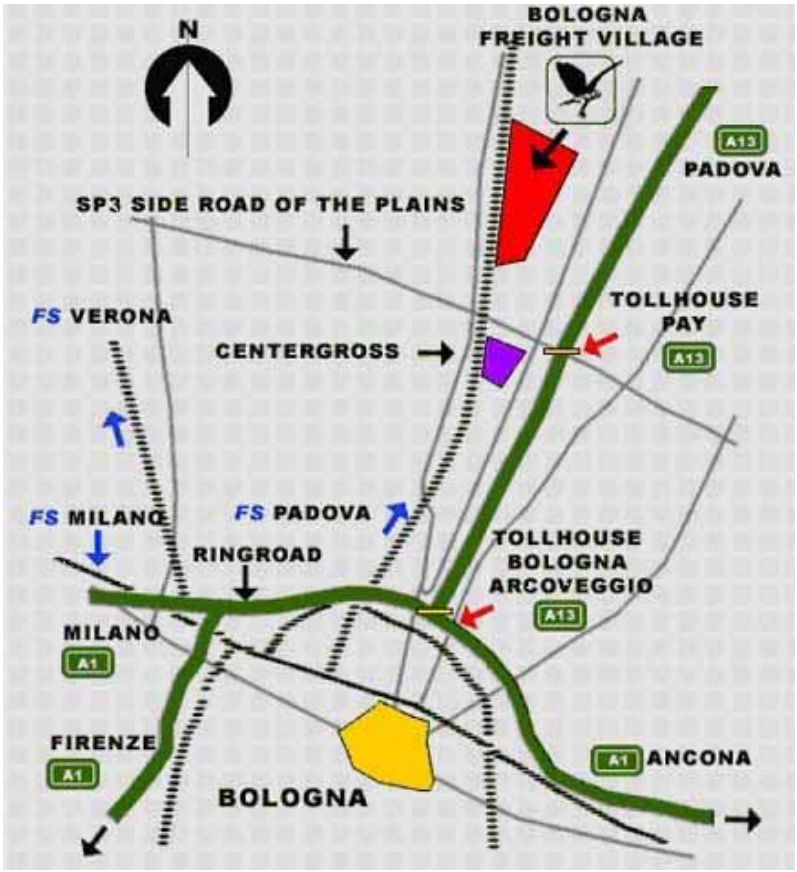
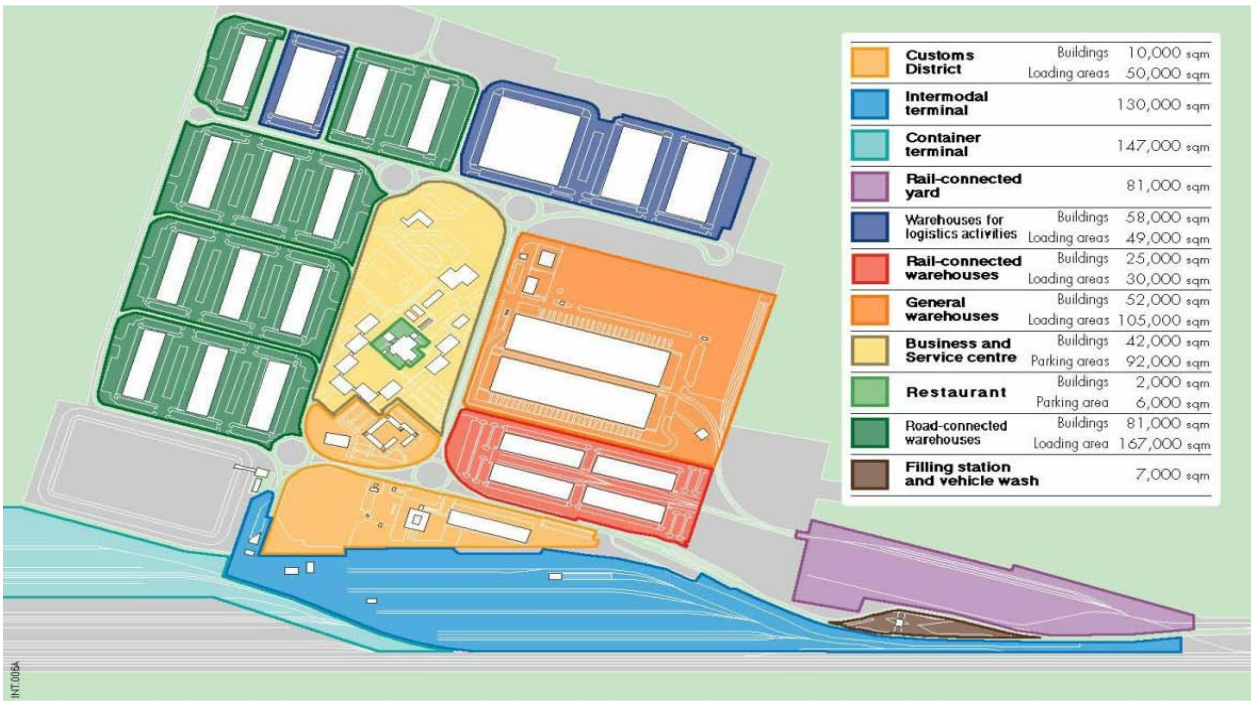


Figure 3.6 Site Layout at Interporto Bologna



Services

Services offered to the companies operating in the freight village include customs, gate access control and security, post office and banks, areas for parking and loading/unloading operations, a filling station and vehicle washing facilities, restaurants, container maintenance and repair, public transit, and telecommunications. Additional solutions are offered for transport companies, such as a tracking and tracing service offered free of charge for small and medium operators that cannot invest in IT (Boile et al., 2008).

Funding and Management

Interporto Bologna is a public private partnership managed by Interporto Bologna SpA, a joint-stock company with twenty shareholders in the public and private sectors. The majority of stock (52%) is owned by public entities with the remainder held by private companies. Of the public entities, the municipality and province hold approximately 35 and 17.5 per cent of the shares respectively. The remaining private actors consist of the local Chamber of Commerce, banks, insurance companies, industrial associations, and local transport associations (Interporto Bologna SpA, 2005).

The management company is run by a board of directors made up of 4 members from the municipality of Bologna, 2 from the Province of Bologna, and 1 each from the Chamber of Commerce, Bank institutes, Trenitalia SpA, Association Indistriali Bologna, and the Association of Bolognese Road Transport (Interporto Bologna SpA, 2005). The management company has engaged in a number of entrepreneurial activities, such as terminal management and promotion, real estate, a shunting operator, and lending their expertise to the development of other freight villages throughout Italy.

There is no breakdown of funding in the literature, though as a public private partnership, it is expected that the public sector has borne a large share of the costs of developing the project. Based on the successes at Interporto Bologna, Italy has formulated a number of laws to promote further freight village development. However, because phase one of the project was completed in the 1980s, no federal funding was awarded to the project. However, after the passage of Law no. 240 in 1990, Interporto Bologna received federal funding to complete phase two of the site (Boile et al., 2008).

Companies at Interporto Bologna

One hundred companies operate at Interporto Bologna as of 2005. The main breakdown of sectors includes couriers, logistics and distribution, transport and air forwarding, carriers, clearing agents, freight forwarders, craft unions, public warehouses, the Italian railroads, and freight village services. Table 3.2 lists the biggest sectors along with average warehouse size.

As freight and logistics in Bologna has changed, the companies at the freight village have evolved. During the last 5 to 7 years, a majority of the transport operators and couriers at the site have moved from a 2PL to 3PL model to become logistics service providers, taking advantage of the available land and services offered by the freight village (Boile et al., 2008).

Table 3.2 Sectors at Interporto Bologna as of 2008

Sector	Number of Tenants	Avg. Size of Warehouse (m^2)
Couriers	26	38,000 (409,000ft^2)
Logistics Operators	18	11,000 (118,400 ft^2)
Freight Forwarders	18	1,700 (18,300 ft^2)
Transport Agents	8	500 (5,380 ft^2)
Customs and Services	N/A	20,000 (215,280 ft^2)

(Boile et al., 2008)

Transport Movements and Commodities

Interporto Bologna handled approximately 4.5 million tons of goods in 2005, a little over half of which (2.3 million) was road-based. The remaining 2.1 million tons were handled by rail by almost 6,000 trains (Interporto Bologna SpA, 2005). Nevertheless, an investigation by Boile et a. (2008) found that rail/road cross-docking facilities have a low utilization rate. Approximately 25% of all goods that pass through Interporto Bologna are distributed to the Bologna metropolitan area. The remaining 75% is destined for the rest of Italy and Europe (BESTUFS, 2007b).

Urban distribution is also a major part of the transport activities carried out at the freight village. Interporto Bologna has benefitted from policy objectives at the City of Bologna to promote urban goods distribution, such as a ban on heavy vehicle traffic in urban areas and programs to reduce congestion, pollution, and delivery times, and promote alternate-fuel vehicles (BESTUFS, 2007b).

Commodities handled for retailers at the freight village include packaged food, beverages, tobacco, textiles and paper products, while the intermodal terminals handle base metals, mineral products, plaster, cement, ceramics, machinery and mechanical appliances, polypropylene, and miscellaneous manufactured goods. Interporto Bologna does not handle fresh produce due to a lack of cold storage warehouses (Boile et al., 2008).

Outcomes

Thanks to its strategic location, generous transportation connections, and strong public private partnership, Interporto Bologna exists as one of the purest examples of freight village development in the European Union. Interporto Bologna SpA (2005) estimates that the high share of rail freight at the facility has reduced the number of trucks circulating on Bologna's roads by 55,000. The freight village has also been good for business. According to Interporto Bolgona SpA (2005), combining major transport and logistics service companies into a single area has contributed to improving the quality of services provided and has allowed local companies to better compete at the national and international levels.

GVZ Bremen

Freight Village Overview

Size (Acres):	895	Modes:	Road, Rail, Water, Nearby Air
Employees:	8,000	Transp. & Log. Firms:	150

General Information

Established in 1985, GVZ Bremen is the oldest freight village developed in Germany after nearly a decade of feasibility studies (de Cerreño et al., 2008). In addition to being the first, GVZ Bremen is also the biggest and highest rated in terms of performance when compared to other facilities in Germany. The project was initiated by a desire to reduce heavy truck traffic and increase intermodality. Though it has taken more than a decade to build the project to its current size, GVZ Bremen remains one of the best examples of a freight village in the European Union.

Site Features

GVZ Bremen is a tri-modal facility featuring rich rail links with Deutsche Bahn on site, connections to 2 major highways, and an inland waterway siding, with air transport capability through an international airport located 7km from the site (Wisetjindawat, 2010). An additional link to the deep-water port of Neustädter Hafen is approximately 2km away and the distance to Bremen's city centre is 8km (Boile et al., 2008).

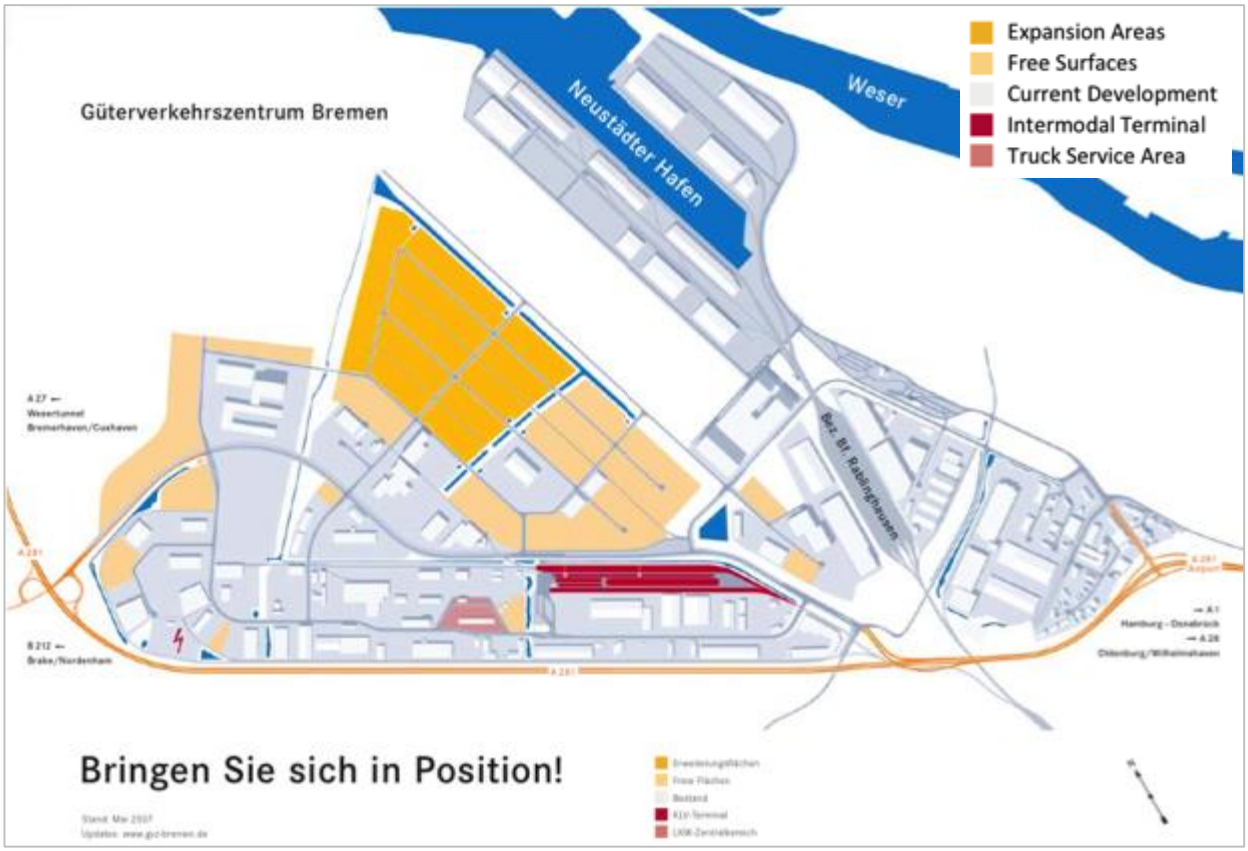
The overall size of the site is 895 acres, though currently only around half of that is currently developed. An additional 490 acres have been set aside for future development (GVZ Bremen, n.d.). The site features a number of high-bay warehouses, an integrated intermodal terminal, the largest high-bay warehouse in Europe, a container terminal, and a number of supporting services. As of 2010, GVZ Bremen hosts 150 different companies engaged in twenty different types of industrial and value added/distribution activities. These companies operate out of 1.2 million square metres of space and employ approximately 8,000 employees (Wirtschaftsforderung Bremen GmbH, n.d.; Wisetjindawat, 2010). The layout of GVZ Bremen is included in Figure 3.7 below.

GVZ Bremen functions as an important terminal in a much larger network of freight villages and other logistics centres. A map showing the location of GVZ Bremen in relation to other logistics centres in the area is provided in Figure 3.8.

Services

In addition to the basic transportation and logistics infrastructure mentioned above, supporting services at GVZ Bremen include a truck terminal, gas stations, truck maintenance centre, customs facilities, and restaurants (Wisetjindawat, 2010). These services help GVZ Bremen to support and encourage the flow of goods at the freight village.

Figure 3.7 Site Layout of GVZ Bremen



Transport Movements and Commodities

The main commodities handled at GVZ Bremen include automobiles and auto parts, aerospace, food and beverages, and commodities from the energy and chemical sector. Special attention is paid to logistics-intensive production and manufacturing, break-bulk logistics, and wholesale companies in the food and beverage industries (Wisetjindawat, 2010).

Programs to improve urban goods distribution have also been created at GVZ Bremen, with the management company promoting voluntary cooperation among different carriers and facility service providers. Nine participating companies consolidated their deliveries into environmentally friendly trucks, though the service was halted after government subsidies for the program were removed (de Cerreño et al., 2008).

Figure 3.8 GVZ Bremen

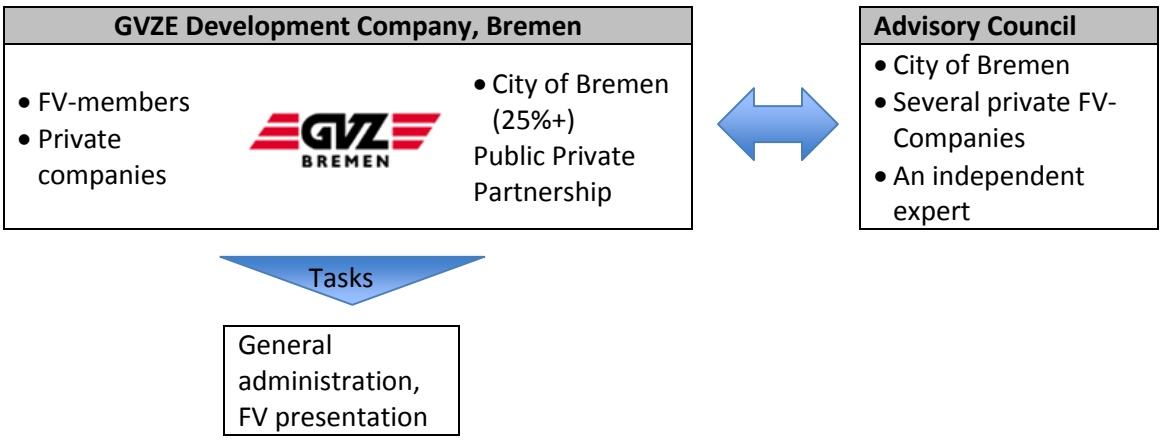
Funding and Management

GVZ Bremen has been developed as a public private partnership. The original infrastructure for the freight village was developed by the City of Bremen, which also acquired any additional property required beyond their original holdings. The project is the result of more than $200 million (US) of investment over 10 years. Approximately $37 million of this total has come from the City of Bremen, with the balance coming from private investment in facilities and machinery (Weisbrod et al., 2002). The public sector continues to support the project at the national level through policies to promote intermodal transportation (Wisetjindawat, 2010).

GVZ Bremen is managed through GVZE, which is a private, limited company under German law. This offers the advantages of limited liability and flexibility of membership and administration (Wisetjindawat, 2010). GVZE acts like a cooperative in that all companies located at the facility must be corporate members of the freight village, with each member having one vote at company meetings. Exceptions based on the level of investment do exist, such as Deutsche Bahn and the State of Bremen, who hold six votes each. Cooperative action among members has included the joint purchase of raw materials and supplies, and the exchange of equipment and labour as circumstances require. (Weisbrod et al., 2002)

The share structure of the company is a public private partnership in which the City of Bremen holds a share of at least 25% and is in charge of appointments to the board. The remaining shares are split among many private companies (Wisetjindawat, 2010). The freight village is also managed by an advisory council, the makeup of which includes three representatives of the State of Bremen, four from the companies located at the facility, one from the Deutsche Bahn railway, and one independent expert. This board makes decisions on new establishments, services, public relations, and infrastructure projects (Weisbrod, Swiger, Muller, Rugg, & Murphy, 2002). The management structure of GVZ Bremen is shown in Figure 3.9:

Figure 3.9 Organization Structure of GVZ Bremen



Outcomes

GVZ Bremen is viewed as a very successful freight village. Boile et al. report that synergies and voluntary cooperation among companies located within the freight village have been developed and the rail share of traffic into and out of the facility is very high, with most sites within the facility having their own rail link. Furthermore, Weisbrod et al. (2002) report that the facility has been able to reduce its truck trips to central Bremen by almost 15% by rationalizing the pickup and delivery of freight among all its members. The freight village has been good for promoting business, and has been ranked number one among German freight villages and number 2 in Europe in terms of productivity (Wirtschaftsforderung Bremen GmbH, n.d.). These successes make GVZ Bremen one of the best examples of a freight village throughout the world.

Alliance Texas

Freight Village Overview

Size (Acres):	17,000	Modes:	Road, Rail, Air
Employees:	28,000	Trans & Log. Firms:	170+

General Information

AllianceTexas is a master-planned and mixed-use community located in Forth Worth, Texas, of which freight and logistics is only one of many parts. The project began with the conversion of cattle pasture into a new freight and industrial airport to relieve airfreight congestion in the Dallas Fort Worth region. However, it quickly became evident that this focus was too narrow and in response, AllianceTexas has since evolved into what can be described as a 'freight city'. The project has been called a model of public private partnership and provides an example of how industrial, commercial, institutional, and residential activities can be located in close proximity to one another without conflict.

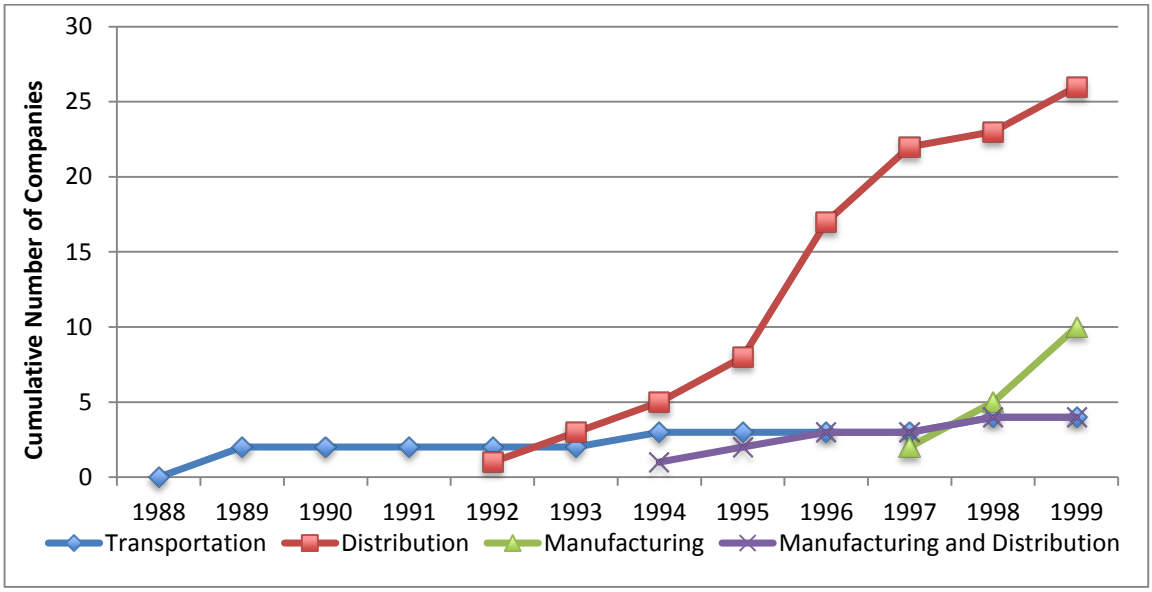
Development History

The freight aspect of AllianceTexas is anchored by the Alliance Global Logistics Hub and Alliance Airport, which opened in 1989 and bills itself as the first purely industrial airport in the western hemisphere (de Cerreño et al., 2008). To launch the project, Alliance's management company Hillwood aggressively pursued American Airlines to construct a $482 Million maintenance facility at the airport with the creation of 2,000 jobs (Leitner & Harrison, 2001). FedEx is currently responsible for much of the air cargo that flows through the airport.

The site began its evolution into a freight village through the construction of State Highway 170 and additional investments from BNSF railway, first through the construction of an automobile loading facility in 1989 and then the construction of a 735-acre intermodal terminal (Leitner & Harrison, 2001). This allowed rail to quickly become the dominant mode at the site, reaching 700,000 TEU lifts within a decade (Rahimi, Asef-Vaziri, & Harrison, 2008).

Over time, the makeup of companies at AllianceTexas has shifted and the history of its development can shed light on the evolution of such an area into a freight village. Early on in Alliance's development, there was a clear desire to build on the cluster theory of manufacturing and logistics. As shown in Figure 3.10 below, the first companies to locate at Alliance since its groundbreaking in 1988 were in the transportation and distribution sectors. It was not until 1994 that Alliance's first major manufacturing tenant (Nokia) arrived, which in turn spawned complimentary industries in plastics and high-tech electronics to support the production of mobile phones. Since that time distribution firms have spiked alongside a number of manufacturing firms utilizing them for their transportation and logistics needs (Leitner & Harrison, 2001).

Figure 3.10 The Development Life Cycle at AllianceTexas



(Leitner & Harrison, 2001)

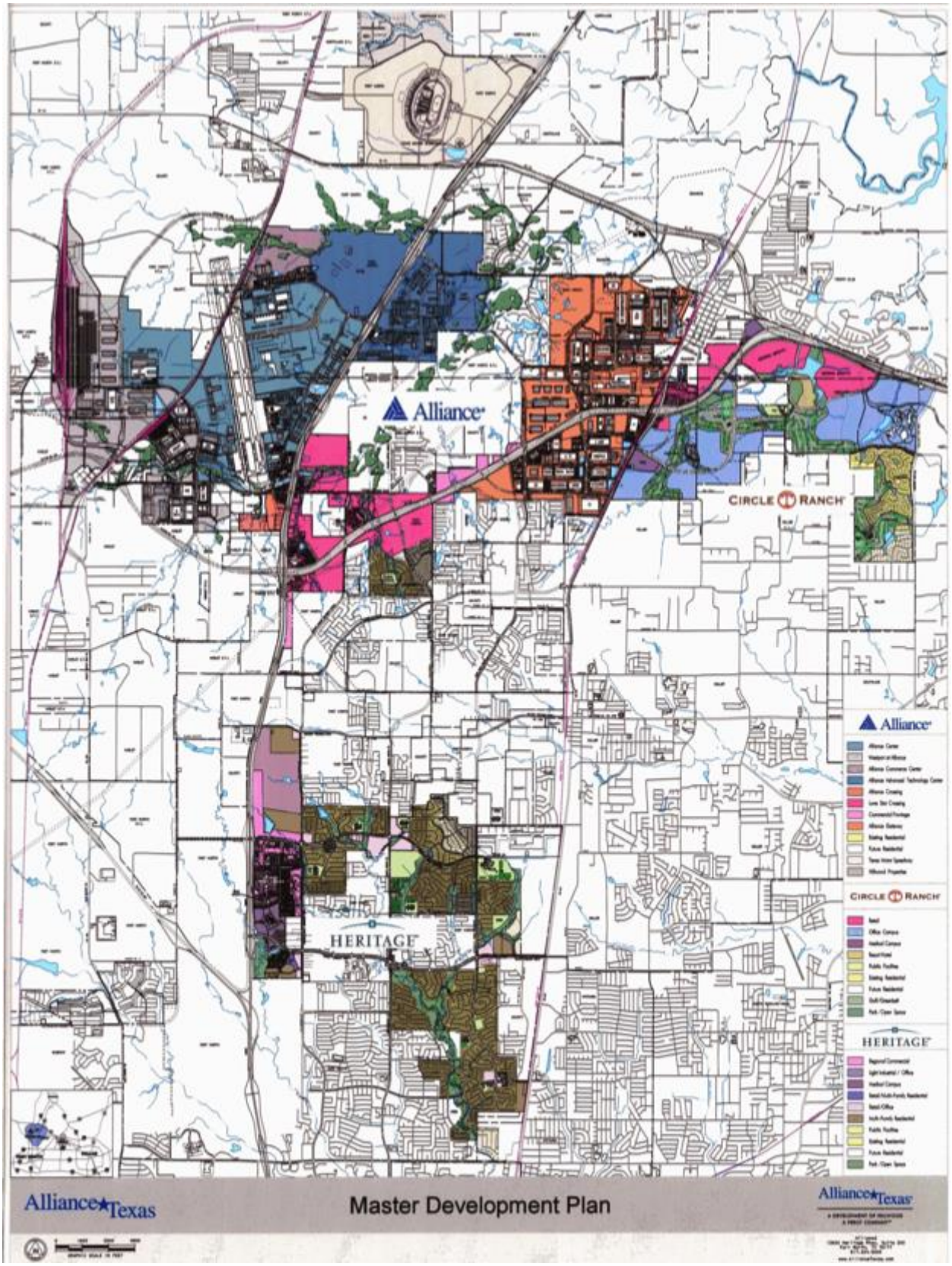
Site Features

While Hillwood was initially focused on industrial activity, Alliance has continued to evolve over time into a diversified mixed-use community. While AllianceTexas is referred to as a freight village, freight and logistics makes up only a portion of the site. Of the 17,000 acres at Alliance, 9,600 acres reserved for freight and industrial development, approximately 2,000 of which had been developed by 2001 (Leitner & Harrison, 2001). The remainder is divided into the Heritage and Circle T Ranch residential areas with over 6,200 homes, the Alliance Town Center shopping complex, two golf courses, institutional uses such as schools, hospitals, and acres of parkland (Leitner & Harrison, 2001; de Cerreño et al., 2008). This high level of community integration is rare among freight villages around the world, but provides a model for integrating many competing land uses into one area. The master layout of AllianceTexas is included in Figure 3.11 below.

Services

What sets Alliance apart from other logistics centres and determines its status as a freight village is its supporting services. This includes the Hillwood group who maintains an active role in managing, investing, and promoting the area, and various services like the United States Customs office, international trade and insurance services, a fire department and police substation, and schools, hospitals, recreation, and employment services. According to Leitner and Harrison (2001), these supporting services help to facilitate smooth operations at Alliance and key international trade components. Another important feature of AllianceTexas is its status as a foreign trade zone and complimentary tax incentives, such as the Triple Freeport Inventory Tax Exemption program. This allows companies at Alliance to not have to pay an inventory tax on goods that move in and out of the state within 175 days (AllianceTexas, 2009).

Figure 3.11 AllianceTexas Master Development Plan



Funding and Management

AllianceTexas is owned, funded, and managed by Hillwood, A Perot Company. Total investment in the project reached $7.2 Million in 2011, with more than 95% coming from private-sector sources. However, the project has always maintained a strong element of cooperation with the public sector. For example, the construction of the Alliance Airport was a partnership between Hillwood, the Federal Aviation Administration, and the City of Forth Worth. Public private partnerships have also been used to construct a new highway to the site (de Cerreño et al., 2008). Tax increment financing has been used to fund these improvement projects, with the most recent being at Alliance Town Center (Weeks, 2011).

Companies at AllianceTexas

AllianceTexas has attracted a wide range of companies to its site. In 2010 alone, Hillwood completed nearly three million square feet in lease transactions, with significant expansions by General Mills and renewals by anchor tenants such as Texas Instruments/Exel Logistics and LG Electronics, and a new lease from Motorola (Weeks, 2011).

Outside of the industrial and logistics area, Alliance Town Center has become home to many leading retailers such as JCPenney, Best Buy, and Michaels Stores. This has resulted in considerable diversification of business sectors at Alliance. Table 3.2 highlights the number of tenants at the site as of 1999 according to eight main areas. Recent estimates put the total number of companies at AllianceTexas around 257 (Weeks, 2011), with more than 170 transportation and logistics firms as of 2008 (de Cerreño et al., 2008).

Table 3.3 Sectors at AllianceTexas as of 1999

Sector	Number of Tenants
Distribution	26
Retail	19
Manufacturing	10
Office	10
Support	8
Manufacturing and Distribution	4
Transportation	4
Sales	3

(Leitner & Harrison, 2001)

Attracting a variety of sectors and companies has led to a considerable amount of jobs at Alliance. Table 3.2 shows the top employers at the site as of 2002. Since that time, many other companies have taken up residence at Alliance, including the new lease by Motorola mentioned previously and new users such as Hyundai, Trans-Trade, Lego, and ATC Logistics & Electronics, which alone added an additional 2,600 jobs in 2009 (ENR Texas & Louisiana, 2010). Current reports estimate that the total number of jobs at AllianceTexas is approximately 28,000 (Weeks, 2011).

Table 3.4 Major Employers at AllianceTexas

Company Name	Employees
Nokia	2,800
American Airlines	2,350
Fidelity	1,400
Southwestern Bell Telephone	1,069
Fed Ex	863
Burlington Northern Santa Fe	495
Gulfstream Aerospace	450
Perlos	445
Randalls Food Markets	442
AdvancePCS	425
AT&T	420
DaimlerChrysler	400
Texas Instruments	256
General Motors	250
Mitsubishi Motor Sales	250
Kraft Foods	238
Tech Data	238
Michaels Stores	231
JC Penney	225
InteSys	200

(Leitner & Harrison, 2001)

Outcomes

Hillwood notes that AllianceTexas has generated more than $2 Billion in annual economic impact with its cumulative impact to the North Texas Region at approximately $38.5 Billion in 2011 (Weeks, 2011). The FTZ has been ranked the top general-purpose foreign trade zone in the United States with more than $5.4 Billion in foreign goods admitted to the US (ENR Texas & Louisiana, 2010).

Alliance has also generated substantial tax revenues to the public sector, with more than $20 Million contributed to Tarrant County and $21 Million to the City of Fort Worth (Weeks, 2011). When considering the economic impact of AllianceTexas, Hillwood gives considerable credit to its public partners for helping to create a healthy environment for investment and notes that the public sector has received a nearly 20-to-1 return on its investment in the project (Weeks, 2011).

Raritan Center

Freight Village Overview

Size (Acres):	2,350	Modes:	Road, Rail
Employees:	15,000+	Logistics Firms:	391

General Information

The Raritan Center presents a good example of a privately financed logistics centre that has gradually evolved to become a freight village. The project began by focusing on industrial uses, but has gradually expanded its business plan to include community-oriented activities. In the early-2000s, the Raritan Center's management focused on returning rail freight service to the site, which has since evolved the facility into a modern freight village with many complimentary services.

Development History

The Raritan Center began its operations after two brothers purchased a decommissioned army arsenal outside of New Jersey in 1964. The initial plan was to turn the area into an industrial park, though this focus expanded over time to add five hotels and a conference centre on the lands adjacent to the area's major highways. By 1984 the Raritan Center had become home to more than 8,000 employees in 9 million square feet of industrial space (Boile et al., 2008).

The site did not fully evolve into its current operations until after 2000 when the Raritan Central Railway purchased the rail lines within the Raritan Center. Prior to this, rail was not extensively used throughout the site. Improvements to 18 miles of track were made at a cost of $7 Million and an aggressive marketing campaign was launched to attract more tenants to the site. These initiatives resulted in shifting the operations of the Raritan Center from a traditional industrial park to a freight village. The next step in the project's development has been an expansion of rail distribution infrastructure such as warehouse sidings and the attraction of additional companies, such as a 695,000 square foot Trammell Crow food distribution centre in 2003. Plans are also underway to refurbish the Raritan Center's water frontage to promote short sea shipping and start a rail shuttle between Port Newark (Boile et al., 2008).

Site Features

The Raritan Center is a 2,350-acre brownfield site that was a former army arsenal. It is located at the nexus of several major highways including the New Jersey Turnpike, I-287, the Garden State Parkway, and major local roads. It also features connections to the Raritan River and has direct access to the Raritan Central Railway. The major Port of Newark and Liberty International Aiport are approximately 20 minutes away (Boile et al., 2008).

The site features many large warehouses and facilities used by tenants on site, though no specific breakdown could be found for this project. The refurbishment of the Raritan Center's rail services also included a new rail yard, a 95,000 square foot rail-to-truck intermodal dock, and a 90,000 square foot

food-grade rail-to-truck warehouse. The Raritan Central Railway short line connects to CSAO, NS, and CSX rail systems (Boile et al., 2008).

The site also features a number of non-freight related uses, such as five hotels, office buildings, and the New Jersey Exposition Center. However, industrial uses make up the bulk of the site with 13 million square feet of industrial space in over 100 buildings. No clear map of the Raritan Center could be found for this project, so an aerial view of the freight village is provided in Figure 3.12 below (Boile et al., 2008).

Figure 3.12 Aerial View of the Raritan Center

Services

Supporting services at the Raritan Center include restaurants, hair salons/spas, banks, shops and retailers, cafes, a day care, health and insurance services, and a US Postal Service branch. The large number of employees working at the site makes these services financially viable. These services help to make the Raritan Center a 'one-stop-shop' for a variety of complimentary services for freight and

logistics in addition to serving as a buffer between nearby neighbourhoods and an attraction for local residents (Boile et al., 2008).

Transport Movements and Commodities

Since the refurbishment of the Raritan Center's rail trackage, rail volumes have grown from 700 cars annually to about 7,000 per year in 2007. Since the inception of service, the Raritan Central Railway has handled approximately 24,000 carloads. The main rail commodities include plastics, steel, lumber, flour, canned goods, and building products (Boile et al., 2008).

Funding and Management

As opposed to some of the European examples in which public goals have played a large part, the Raritan Center presents the case of a bottom-up development by private sector actors with the objective of profit maximization. The private management of the Raritan Center has allowed the facility to quickly react to changing trends. For example, as suburban office parks grew in popularity, management was able to capitalize on their available land for new office space. As intermodal increases its market share, the Raritan Center's new investments in intermodal infrastructure can enable the freight village to attract a new class of tenants and businesses (Boile et al., 2008).

Companies at the Raritan Center

As of 2008, the Raritan Center was home to over 3,000 tenants. Some of the major companies at the freight village include Brooks Brothers Clothing, Fuji Photo Film USA, the Bank of New York, Costco, FedEx, Ingersoll-Rand, Lucent Technologies, Marriott International, Nabisco/Kraft Foods, the New York Times, Prudential, UPS, Verizon, and Whirlpool. Together these companies employ more than 15,000 people and provide a large market to support the many services found at the site (Boile et al., 2008).

Outcomes

The Raritan Center provides one of the best examples of an evolved freight village in the United States. Though the project can trace its beginnings to a small industrial park, the innovative steps taken by the facility's management has enabled it to stay on top of emerging trends and capitalize on their land holdings. Most recently this has culminated in the resumption of rail service, transforming the Raritan Center into a fully featured and profit-driven freight village based in market realities.

3.2.2 Future Freight Villages and Logistics Centres

Kansas City

The freight developments at Kansas City present an interesting case of a world-class intermodal terminal in the case of CenterPoint KCS and a high degree of organization and promotion by the KC SmartPort non-profit organization. Each is discussed further below.

CenterPoint KCS

Intermodal Terminal Overview

Size (Acres):	1,340	Modes:	Road, Rail
Employees:	N/A	Logistics Firms:	N/A

General Information

Bolstered by the ongoing development of Kansas City as a major destination in North America's continental economy, Kansas City Southern (KCS) and CenterPoint Properties created the CenterPoint KCS intermodal terminal in 2007. The project is a partnership between a property developer and rail operator that seeks to maximize revenue generation at the site.

Site Features

CenterPoint KCS is located on a 1,340-acre recently decommissioned military base. The site is approximately 25km away from Kansas City and is adjacent to a major interstate highway. The current layout of the site features a 370-acre intermodal facility and a 940-acre industrial park with buildings available that range from 50,000 to 1 million square feet. Additional features include a Foreign Trade Zone and Missouri Enhanced Enterprise Zone, which provides tax benefits to companies, though it is being phased out. A layout of the site is provided in Figure 3.13 below.

The facility advertises itself as a location within a two-day truck drive to 78% of the United States and the ability to generate substantial transportation savings such as the elimination of drayage costs by locating at the same site as an intermodal terminal. Ideal tenants are in the warehousing, distribution, and manufacturing industries. The progress of the project is organized into five separate development phases wherein facilities are incrementally provided to the market. As the project is early in its development, there is ample land left for future expansion.

Services

CenterPoint KCS is still in the early development stage and other than the basic intermodal and logistics infrastructure, no supporting services have been installed at the site. As such, this development can be classified as an intermodal terminal according to the typology of different logistics centres established in this project.

Figure 3.13 Layout of CenterPoint KCS

Kansas City SmartPort

Kansas City SmartPort is not a freight village, but a governance structure set up to help articulate and promote a network of logistics centres in and around the Kansas City Region. SmartPort is a non-profit economic development organization whose mission is two-fold:

- To expand the transportation and logistics industries in greater Kansas City
- To make it cheaper, faster, more efficient, and secure to move goods in and out of the region. The ultimate objective is to make the flow of freight flexible and seamless.

A joint effort by the Greater Kansas City Area Chamber of Commerce, the Kansas City Area Development Council, and the Mid-America Regional Council, SmartPort was created in June 2001. The organization has a broad mandate and currently covers 18 counties, 50 cities, two states, several rail terminals, logistics zones, and the largest number of FTZs in the United States (Rodrigue et a., 2010).

The creation of SmartPort is based on the findings of The Chamber's 1993 Intermodal Task Force, the 1995 Intermodal Freight Strategies Study and 1999 Mid-Continent Trade Way Study. These studies concluded that the freight and transportation industry had significant impact on the economy of the Kansas City region to the tune of over 40,000 regional jobs and wages and salaries in excess of US$900m annually. These estimates, along with large current and projected increases in international trade, suggested that a new organization was needed to promote the transport interests of the region (MITL, 2009; Rodrigue et al., 2010).

As can be expected with such a mandate, one of the keys to making this initiative work effectively is a high level of cooperation between different levels of government. While Kansas City is essentially on the border between the states of Kansas and Missouri, the two state governments were both strongly behind the initiative. Upon establishment of SmartPort, the federal government backed the company with grants. One recent grant from the Department of Commerce has helped to develop security technology to assist in the seamless movement of goods from a Mexican customs facility in Kansas City followed by direct movement and entry into Mexico. The objective of course is to expand local exports to Mexico. Another federal grant, implemented via SmartPort, assisted local businesses in establishing direct trade relationships with Mexican entities (MITL, 2009).

It is worth noting that SmartPort is quite representative of many different stakeholders. Its board of directors is composed of over twenty different people. There are representatives from transport-oriented firms from the private sector and from various public entities, including one from the CenterPoint KCS project. Overall, it appears to be a very strong organization from a governance perspective with the risk of conflicts of interest being minimal.

Economic Development

One of the goals of SmartPort is to play an active role in the economic development process for Kansas City as it leverages its organizational focus on transportation and logistics. In cooperation with the area development council, SmartPort is brought into projects to provide transportation solutions to prospects looking at the Kansas City area. In particular, some of the economic development strategies employed by SmartPort include:

- Identification of key sites using consulting firms
- Attracting corporate targets with logistics operations to Kansas City
- Providing resources and marketing information related to the logistics industry in Kansas City
- Partnering with the area development council in all marketing and promotional events to tailor a consistent logistics message
- Determination of the critical elements of a transportation system needed for new investments

- Development of relationships with other inland and ocean-based ports to promote coordination and cooperation
- Focusing attention on the needs for maintenance, improvements, and growth in the Kansas City's physical infrastructure.

Intelligent Transportation Systems

Since one of the main goals of SmartPort is to make freight movement seamless, there has been an initiative to design and implement intelligent transportation systems (ITS) to improve the security and efficiency of the transportation infrastructure. SmartPort and the Mid-America Regional Council develop ITS funding requests to the Federal government to help fulfill this objective. The goal is to build a secure, efficient, and integrated system that allows for increased freight traffic in and out of Kansas City utilizing a combination of rail, air, and truck transportation modes. In addition, the integration architecture is being designed to link with systems in Canada and Mexico. Surveys have been carried out to establish infrastructure elements that are most attractive to manufacturers, distributors, and transportation companies relevant to the Kansas City region (MITL, 2009).

Business Services

More companies in the Kansas City region are becoming involved in international business, whether it be importing or exporting. There are services in the region to assist and support this growth but key components related to the movement of the goods are under development. Such services include customs, inspections, financing, documentation, packaging, and labeling. SmartPort has focused on building these services into the Kansas City region and on improving existing services. Business service strategies that have been employed by SmartPort have included:

- Getting letters of support from political leaders in Kansas and Missouri
- Securing the support of the Mexican Consul General in Kansas City, and the Canadian Consul General in Chicago
- Meeting with Mexican and Canadian officials to present details of plans

Outcomes

According to Rodrigue et al. (2010), SmartPort is likely the most advanced initiative in North America for promoting economic development in the region. Though CenterPoint KCS is still in the early stages of development, the active management of the site by CenterPoint Properties and promotion of the Kansas City region by KC SmartPort will help to ensure a smooth path for the future of this and other logistics centres in the area. In terms of CenterPoint KCS becoming a freight village, the basic infrastructure and management components are already in place. If supporting services can be attracted to the site, this project can evolve into one of the best examples of a freight village in the United States. Nevertheless, while the ultimate success of both remains to be seen, together the CenterPoint KCS and KC SmartPort initiatives present a promising framework for integrated freight and transportation development that other cities would do well to learn from.

CentrePort Canada

Freight Village Overview

Size (Acres):	20,000	Modes:	Road, Rail, Air, Link to Water
Employees:	N/A	Logistics Firms:	N/A

General Information

CentrePort Canada is a 20,000-acre logistics centre under development in Winnipeg, Manitoba that was created by a public private partnership. The site is located next to the James Armstrong Richardson International Airport and offers companies the benefit of significant tax and cost savings through its designation as a Foreign Trade Zone.

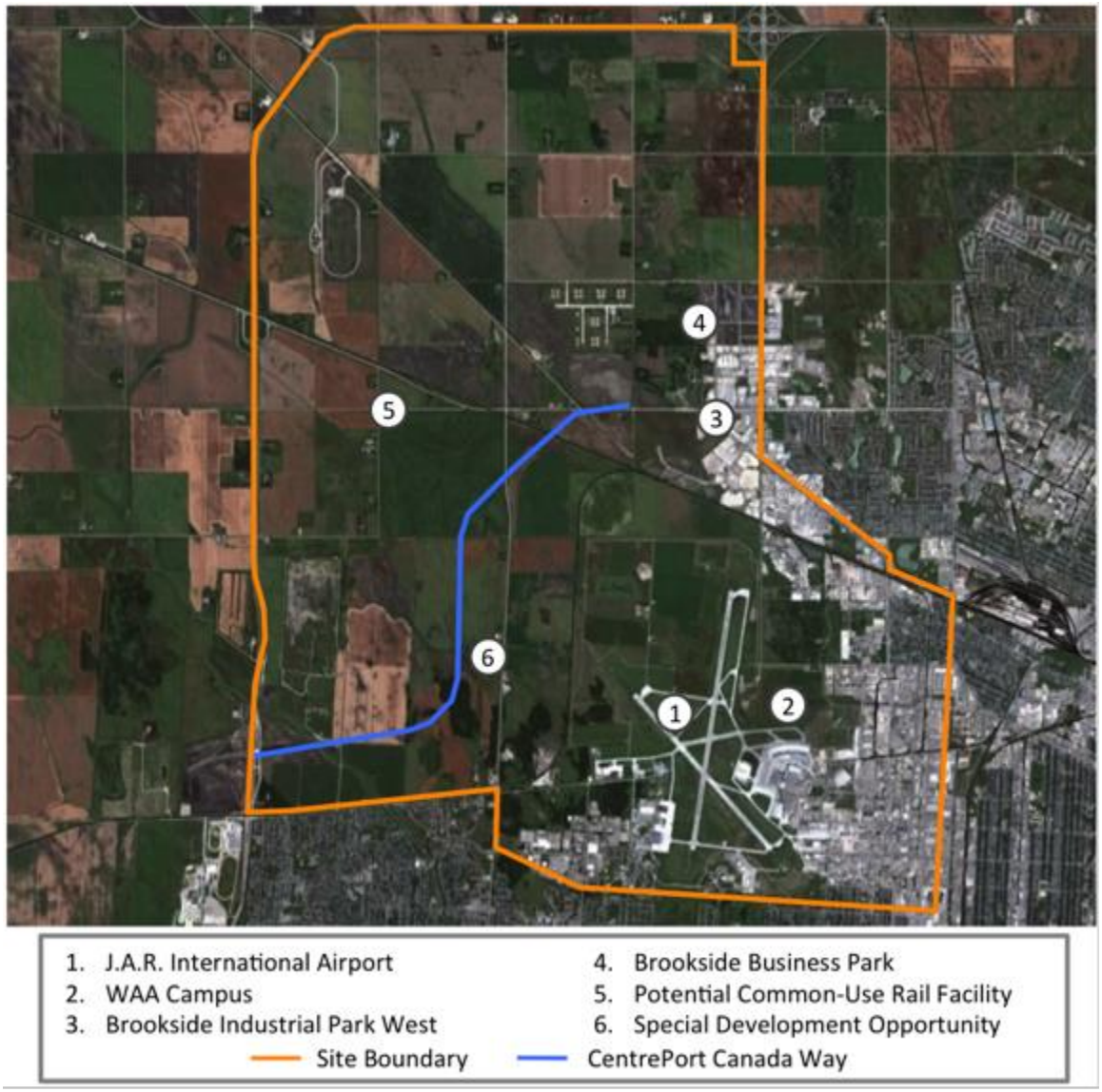
Site Features

The CentrePort site provides easy access to the James Armstrong Richardson International Airport, TransCanada and international highways, and three Class 1 rail carriers (CN, CPR, BNSF) within the city (CentrePort Canada, 2011). At 20,000 acres, CentrePort is among the largest areas dedicated to freight and industrial development in North America. Plans are currently underway for the development of a new shared-use intermodal rail terminal that will host all three rail carriers on site and provide a competitive environment for intermodal transportation. CentrePort currently houses more than 135 businesses, many of which are from the transportation, logistics, warehousing, and manufacturing sectors (CentrePort Canada, 2010). An overview of the CentrePort Canada site is provided in Figure 3.14 below.

The 20,000-acre site is defined in legislation by the CentrePort Canada Act. According to correspondence with a representative of CentrePort, the site is not assembled as one continuous development, with land ownership controlled by several parties. Though the CentrePort corporation is responsible for managing the entire area, it is only directly responsible for approximately 900 acres of the site. The remaining land is controlled by private landowners such as CB Richard Ellis and DTZ Barnicke, who own several industrial parks within the CentrePort area. However, the CentrePort management corporation is currently finalizing a draft land use plan and special planning area for the entire area.

Of the 20,000 acres, the majority is greenfield land and has yet to be developed. Currently, 2,000 acres of land are ready for new development and 645,000 sq. ft. of industrial space is available in existing warehouse facilities (CentrePort Canada, 2011). CentrePort also features Canada's first and only Foreign Trade Zone, offering businesses single-window access to programs that can help companies manage imported inventories, such as duty deferral, sales tax relief, and customs bonded warehouse status. However, as discussed in Section 3.1.3, the overall effect of FTZs as an attraction to a site in Canada is likely limited.

Figure 3.14 CentrePort Canada



Services

Though Port Alberta is still in the early development stage, planning documents make no mention of complimentary services, though the airport likely offers some basic customs features. This means that CentrePort can be considered an intermodal terminal until the site evolves to accommodate the level of development required to be considered a freight village.

Commodities

While early in its development lifecycle, CentrePort has already attracted a number of general freight and industrial firms on site. Furthermore, a new project has been announced that will see the shipment

of high-quality Manitoba agricultural products to Chongquing, China, such as soybeans, green peas, and canola meal (CentrePort Canada, n.d.).

Management

CentrePort was created by the CentrePort Canada Act in 2008, which established a private-sector led corporation with the authority to develop, market, and promote investment at the site (CentrePort Canada, 2010). The corporation is managed by a 15-member board of directors drawn primarily from private sector companies and associations, such as the Business Council of Manitoba, the Manitoba Trucking Association, the Winnipeg and Manitoba Chambers of Commerce, Richardson International, ACDEG Group, the Winnipeg Airports Authority, and the University of Manitoba. The City of Manitoba, Rural Municipality of Rosser, Province of Manitoba, and the Government of Canada each maintain one seat each.

While ownership of the site varies, the CentrePort management corporation works closely with landowners to market the site and is in the midst of finalizing a draft land use plan and special planning area for the entire 20,000-acres. Though CentrePort is led primarily by the private sector, the project is a public private partnership in the sense that the public has representatives on the board of directors, and through public sector support of infrastructure projects that are fundamental to the development of the area, such as the federal and provincially funded CentrePort Canada Way and local and provincially funded water and wastewater servicing.

Funding

The public sector is providing financial assistance to CentrePort in the form of infrastructure investments that are fundamental to improving the attractiveness of the site. For example, the City of Winnipeg and the Province of Manitoba have made a joint investment of $17 Million to provide water and wastewater servicing for 1,100 acres of industrial land within the site. Also under construction is CentrePort Canada Way, a $212.5 Million divided expressway funded by the Government of Manitoba and Federal Government of Canada that will connect these lands to local, national, and international highway networks (CentrePort Canada, 2011).

One of the most interesting aspects of the CentrePort project is its development as a Tax Increment Financing (TIF) area. This will allow the public sector to collect a return on its investment in infrastructure to the site through the tax revenue that would have otherwise not been generated. According to CentrePort CEO Diane Gray, the designation of CentrePort as a TIF area highlights the strength of the partnership between public and private actors, with the government showing a high level of support and enthusiasm for the project and its long-term success (CentrePort Canada, 2010).

Outcomes

Because CentrePort Canada is still under development, its effect on freight and logistics is not yet known. However, given the progress and organization of the project to date, CentrePort is likely to evolve favourably.

Port Alberta

Freight Village Overview

Size (Acres):	3,000	Modes:	Road, Rail, Air
Employees:	N/A	Logistics Firms:	N/A

General Information

Currently in the early stages of construction, Port Alberta is envisioned as a multi-modal logistics centre located on the Edmonton International Airport grounds. The main goals of the project are to attract warehousing and freight consolidation activities and customs services and build on the natural competitive advantage of the airport's location in global freight flows and a thriving industrial region with superior transportation infrastructure.

Site Features

Edmonton International Airport is a major airport with two runways and unrestricted operations. Current tenants at the site include 11 major airlines, 8 integrated express freight carriers, 3 independent cargo handlers, and over 40 freight forwarders and customs brokers (Edmonton Airports, 2006). The idea is to expand the current AirLINKS cargo park with a new AirLINKS West park on approximately 1,400 acres of available greenfield land. This would bring the total of developable land within the airport to 3,000 acres. A development plan for Port Alberta in Figure 3.15 highlights these areas. The home of Port Alberta is located at AirLINKS West the top-left of the figure (Edmonton Airports, 2006).

According to the Port Alberta website, the full build-out of the project will combine air, rail, and road transportation at a single point. However, rail access to the site has not been built, although lines run to the industrial park to the east of the Airport. Construction at the site has begun with a 13,000m^2 new cargo apron completed in 2007 and a development plan for the remaining 3,000 acres was completed in 2008 (Edmonton Airports, 2011).

Services

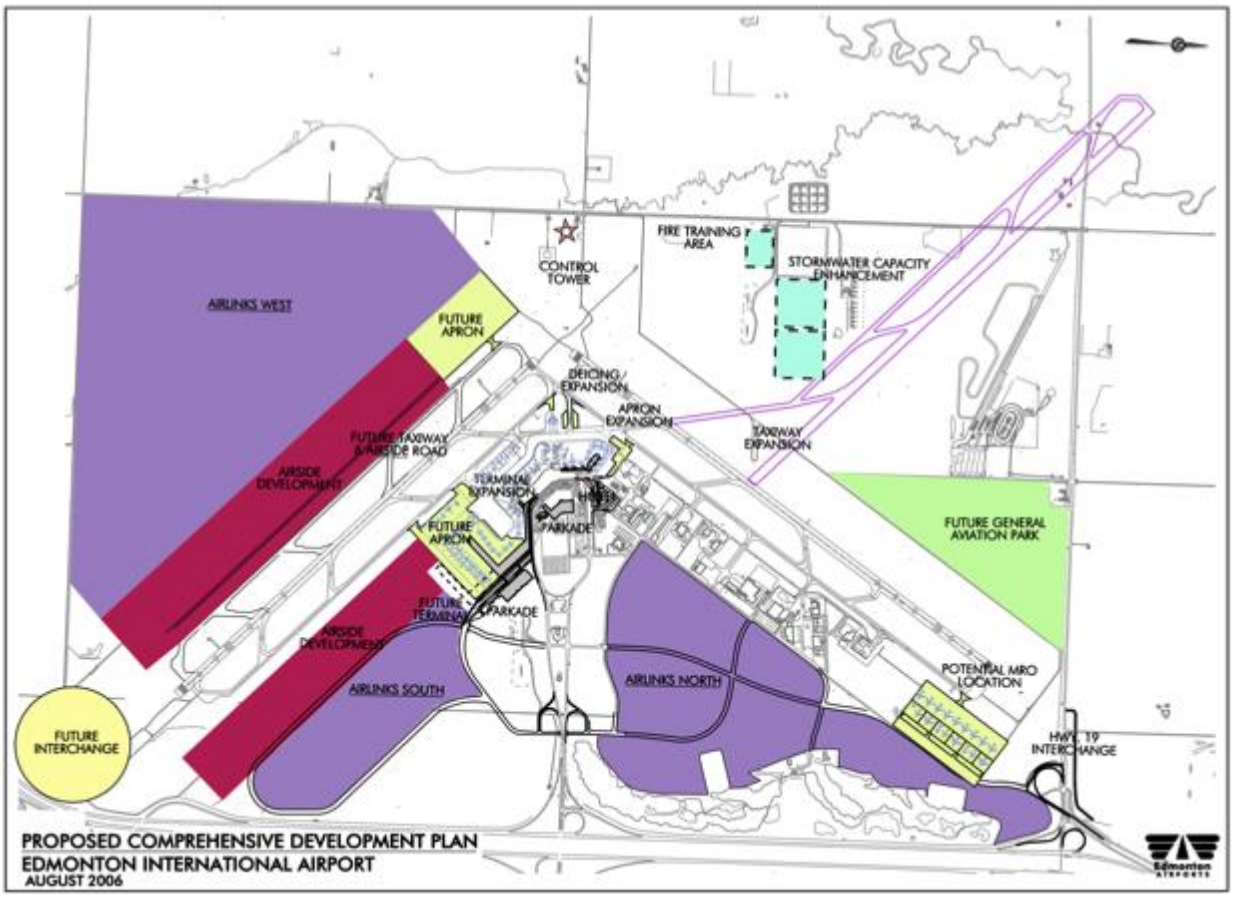
Though Port Alberta is still in the early development stage, planning documents make no mention of complimentary services. Because the plans for Port Alberta do not contain provisions for services supporting freight and logistics, it cannot yet be considered a freight village. Nevertheless, given its location at Edmonton International Airport, the attraction of the site may cause this to change in the future.

Outcomes

Given the available land and range of current and future transportation infrastructure at the site, Port Alberta seems likely to emerge as an important logistics centre in the Edmonton area. Though the

ultimate success of the project remains to be seen, Port Alberta has the foundations for an effective logistics center and the project provides a good framework for similar developments elsewhere.

Figure 3.15 Development Plan for Port Alberta



CN Calgary Logistics Park

Freight Village Overview

Size (Acres):	680	Modes:	Road, Rail
Employees:	N/A	Logistics Firms:	N/A

General Information

The CN Calgary Logistics Park builds on a new generation of intermodal terminals that have been established by rail operators in North America. These arrangements typically see rail companies act as landlords, developing the land around intermodal terminals for firms that can utilize the benefits of co-location. CN has expanded on this idea by acquiring a bigger site for development and announcing a $100 Million investment in the project (CN, 2010). The main advantages for firms locating in the park are the elimination of drayage and handling costs and direct access to CN's continental rail network, which features direct links to the ports of Vancouver and Prince Rupert, BC.

Site Features

The CN Calgary Logistics Park is located east of Calgary Airport with access to both the TransCanada Highway and Stoney Trail local highway. In addition to road access, the site will feature direct connections to CN's new intermodal terminal.

The project encompasses more than 680 acres of land with total warehousing capacity of over 2 million square feet. An overview of the site plan is provided in Figure 3.16 below. Planned features include a multi-commodity transload and warehouse facility, an automotive compound, and a liquid/bulk transload and distribution facility. The site has also been designated a Foreign Trade Zone, though as Section 3.1.3 discussed, the impact of FTZs in Canada is limited. The site is currently under construction, and has broken ground as of September 2011 (Shymanski, 2011).

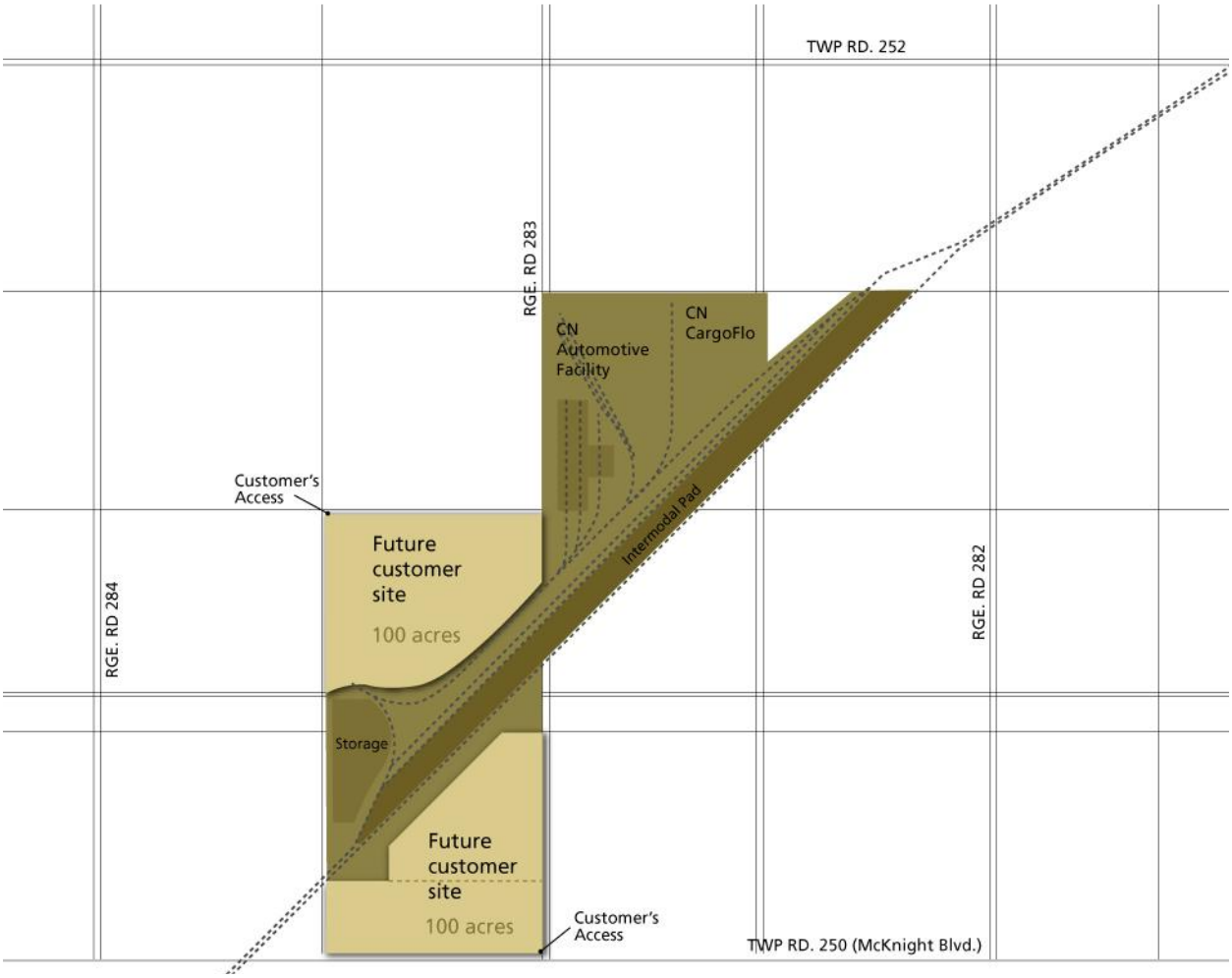
Services

Like Port Alberta, the CN Calgary Logistics Park is still in the early development stage and other than the basic intermodal and logistics infrastructure, planning documents make no mention of complimentary services. As such, the development is classified as an intermodal terminal according to the logistics centre typology established in this project.

Outcomes

The CN Calgary Logistics Park presents an interesting case of a new intermodal terminal being developed by private sector actors. The size of CN's investment into this facility is quite large and suggests that the market for logistics centres in Canada has firm foundations. As the project develops, a suitable mass of companies may emerge that can support the provision of supporting services that can transform this intermodal terminal into a full freight village.

Figure 3.16 CN Calgary Logistics Park



Appraisal of the Freight Village Concept

This section provides an appraisal of the freight village concept in practice, beginning with a brief discussion of the limitations of this field of research in Section 4.1 and differences between North American and European examples in Section 4.2. This is followed by an analysis of the examples and experiences with freight villages in the literature to provide an overview of the observed potential benefits and shortcomings of the concept in Sections 4.3 and 4.4 respectively.

4.1 Limitations of the Research

As mentioned previously, the immaturity of this field of research has meant that relatively few freight village appraisal studies are publicly available, and among those that are, Kapros et al. (2005) found that the methods used to assess these facilities are usually restricted to conventional financial or social appraisal methods that use descriptive terms and have quantification problems.

A major reason for this is a lack of standardized methodologies. According to Tsamboulas and Dimitropoulos (1999), although standards exist in several countries for the appraisal of 'link-type' infrastructure, such as roads and railways, there are no standardized methods for the appraisal of 'node-type' infrastructure, such as freight villages. Link-type projects tend to have clear 'project-specific' appraisal factors, but the success of node-type infrastructure is much more complex and depends on

many factors and 'sub-projects' due to the diversity of roles, features, and actors involved. Further complicating things, BESTUFS (2007a) argues that many factors attributed to the success of freight villages and other urban freight solutions are often intangible and less accessible to quantitative research methods. Kapros et al. (2005) attempt to address this by proposing a multi-criteria analysis of the Kilkis freight village in northern Greece, but ultimately conclude that the applicability of their approach is limited due to the peculiarities inherent in different freight villages around the world. As such, more qualitative methods must be employed.

4.2 Differences Between Freight Villages in Europe and the United States

Another important issue concerns the differences inherent in the concept between the United States and European Union. In general, freight villages can take on two different conceptualizations depending on the philosophies that have underlined their development. In the European Union, freight villages have been framed through the lens of public sector intervention in the marketplace for a variety of reasons. Freight villages typically fit into a broader package of incentives and disincentives, such as subsidies for intermodal transportation. Goals for freight village development typically include the promotion of intermodal transportation, employment, and economic development, increasing the sustainability of freight transport and urban development, mitigating congestion, and reducing emissions. This can be seen in the intertwined public private partnerships that formed the basis of the first freight village, Roissy-SOGARIS in France, and later at Interporto Bologna in Italy and GVZ Bremen in Germany.

In the United States, the market has driven the development of freight villages and other logistics centres. For example, intermodal transportation has flourished in North America without the use of major governmental subsidies. In response, many rail carriers have started to develop their own small scale logistics centres around intermodal terminals, such as the CN Calgary Logistics Park discussed above and Canadian Pacific Railway's Vaughn and Calgary Intermodal Terminals that are discussed further in Section 6. However, these have generally been smaller scale intermodal terminals according to the typology of logistics centres developed in Section 2. Nevertheless, some freight villages have also been developed without the level of public involvement seen in Europe, such as the examples of the Raritan Center in New Jersey and 17,000-acre AllianceTexas 'freight city' outside of Forth Worth, Texas. In each case, the main goals of the project are for revenue generation rather than any overarching public benefit. Nevertheless, the public sector has maintained some involvement in many projects, albeit through smaller-scale and less market-intrusive means such as infrastructure provision.

Furthermore, the types of freight villages that have emerged in each jurisdiction also exhibit some important differences. Based on an assessment of the European and US models of freight village development according to Figure 4.1 and Tables 4.1 and 4.2 below and the examples of freight villages in Appendix D, some interesting trends can be identified. Figure 4.1 shows that compared to the United States, Europe has more freight villages in total. However, their size tends to be smaller. While the United States has fewer overall, their size is much larger than that of their European counterparts. When intermodal terminals are added to these totals in Figure 4.2, a similar trend emerges, with European logistics centres being higher in number, but smaller in size and US centres larger, but less

frequent. This reflects the fact that market realities tend to form the basis of many developments in the United States, making the size and scale of potential development much more important for revenue generation. Sizes in Figures 4.1 and 4.2 are taken from Appendix D and are for entire site totals, not the size of current development. Logistics centres other than Intermodal terminals were not included in Figure 4.2 due to a lack of information. Examples from Asia are also included in Figures 4.1 and 4.2 for the sake of global comparison.

Figure 4.1 Size Differences among Global Freight Villages

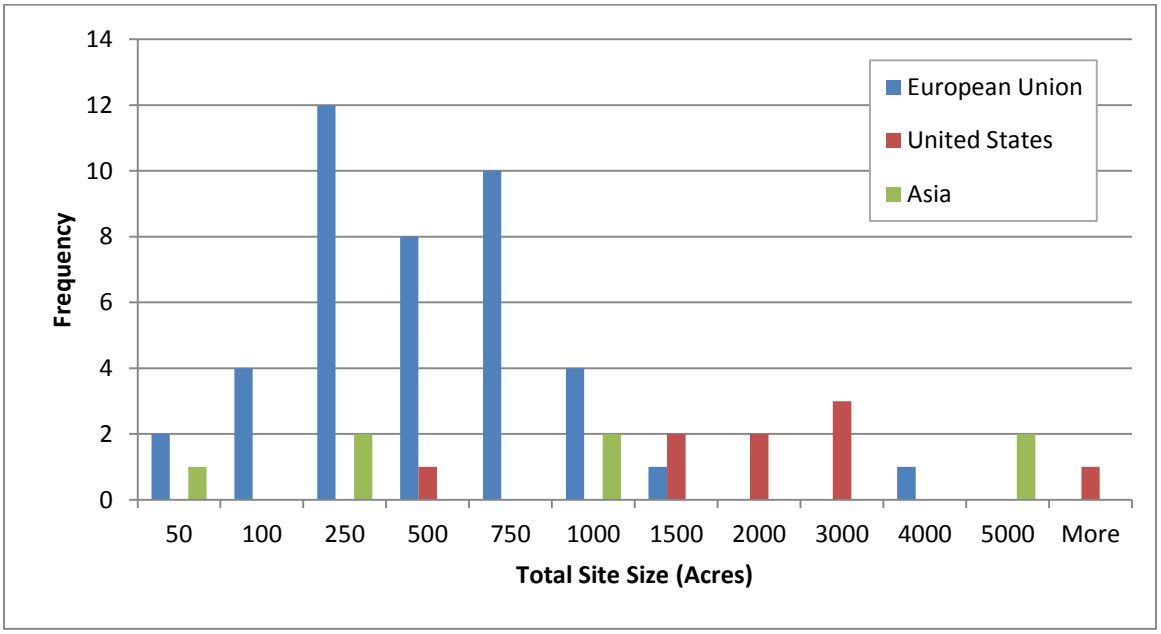
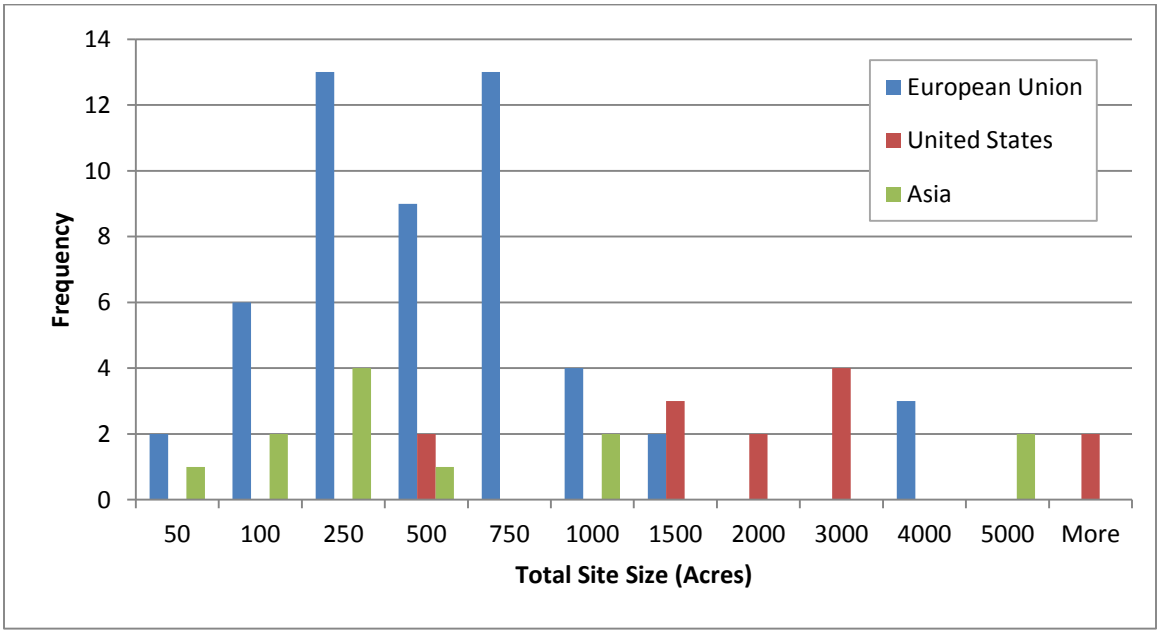


Figure 4.2 Size Differences among Global Freight Villages and Intermodal Centres



Tables 4.1 and 4.2 further illustrate the differences in freight villages between European and US examples. The European freight villages in Table 4.1 highlight a broad range of public and private objectives in their development. Each features a high degree of initial public involvement at different levels of government and maintains an active public role through their joint management by public private partnership. Each facility is also smaller than many examples in the United States, and subsequently features a smaller level of employment.

In the United States, the examples in Table 4.2 cite general transportation and logistics efficiencies as their primary goals. Public involvement is generally limited to infrastructure provision by local governments rather than the large-scale involvement of several levels of government in Europe. Nevertheless, some forms of public private partnership are emerging for the two projects currently under development, though the supplementary overviews of these facilities in Appendix F show that these partnerships are still to a lesser degree than their European counterparts. As mentioned, US freight villages tend to be larger than their European counterparts, and as such feature employment levels proportional to this size.

However, some important characteristics are also common between US and EU examples. All feature road and rail access and an element of industrial development for on site freight generation, and, other than the two examples in the United States currently under development, each maintains support services that are complimentary to freight and logistics (CenterPoint Intermodal Center has been revised to no longer be considered a freight village according to Boile et al. (2008)). However, even here differences in support services exist, with US examples featuring a number of services that are attractive to the broader public such as hotels, retail, supermarkets, and hospitals. European freight villages typically feature services that are freight-oriented.

These differences are important in delineating the types of freight villages seen in both jurisdictions, and subsequently the type of facility that is relevant to market and governance realities in Ontario. This project tries to make distinctions between the US and EU experience with freight villages wherever possible. The reader should take these differences into account to frame the discussion of the concept in the coming sections.

Table 4.1 Freight Villages in Europe

	Roissy-SOGARIS, France	NTC, Denmark	GVZ Bremen, Germany	Berlin-Brandenburg Region, Germany	Interporto Bologna, Italy
Objectives	- Mitigate congestion - Promote intermodal - Support businesses	-Relocate freight facilities out of cities -Improve environment -Improve safety -Support business	- Relocate freight facilities out of cities - Mitigate congestion - Promote intermodal - Consolidate industry - Resolve conflicting land use - Promote regional development	- Mitigate congestion - Promote intermodal - Promote regional development	-Consolidate industry
Size (acres)	133	494	895	GVZ Wustermark – 520 GVZ Großbeeren – 759 GVZ Freienbrink – 321	494
Mode	Intermodal, rail, road, nearby airport	Intermodal, rail, road, sea	Intermodal, rail, road, water, nearby airport	Intermodal, rail, road	Intermodal, rail, road
Operation and Management	SOGARIS (80% public and 20% private)	The NTC, Ltd.	GVZE Bremen	GVZE	Interporto Bologna SPA (52% public and 48% private)
Institutional Form	Public private partnership	Public private partnership	Public private partnership	Public private partnership	Public private partnership
Public Involvement	Regional and local government	Central, regional, and local government	Central and regional government	Central and regional government	Central, regional, and local government
Tenants	100	15	114	n/a	81
Employees	2,500 (Boile, et al., 2008)	n/a	n/a	4,800 (Hesse, 2004)	1,500 (Boile et al., 2008)
Industrial Activity	Yes	Yes	Yes	Yes	Yes
Services	Customs office, post office, health care, public transit, restaurant, cafeteria, security, gas station	Post office, customs service, bank, showers	Parking, customs services, gas station	Bank, restaurant, bar	Customs, post office, public transit, bank, bar, restaurant

(de Cerreño et al., 2008)

Table 4.2 Freight Villages in North America

	CenterPoint Intermodal Center*	AllianceTexas	Raritan Center	Pureland Industrial Complex	Winter Haven ILC (Under Developmnent)	Compact Intermodal Center (Proposed)
Objectives	- Promote intermodal	n/a	- Access to shipping routes	n/a	- Reduce transportation costs - Improve reliability	n/a
Size (acres)	2,200	17,000	2,350	3,000	1,250	260
Mode	Intermodal, rail, road	Intermodal, rail, road, air	Intermodal, rail, road	Intermodal, rail, road	Intermodal, rail, road	Intermodal, rail, road
Operation and Management	CenterPoint Properties	Hillwood, a Perot Company	Federal Business Centers, Summit Associates, Inc., Raritan Central Railway	The Pureland Group, DP Partners, other smaller developers	CSL Real Property, Inc., City of Winter Haven	n/a
Institutional Form	Private	Private	Private	Private	Public private partnership	Public Private Partnership
Public Involvement	Local government	Local government	n/a	n/a	Local government	n/a
Tenants	n/a	170	3,000	150	n/a	n/a
Employees	8,000 (Boile et al., 2008)	27,773 (Boile et al., 2008)	15,000 (Boile et al., 2008)	n/a	8,500 projected (de Cerreño et al., 2008)	n/a
Industrial Activity	Yes	Yes	Yes	Yes	Yes	Yes
Services	n/a	Office, residential, hospital, education, retail, mall, entertainment, hotel, etc.	NJ Convention Center, post office, medical centre, bank, hotel, restaurant, daycare	Offices, hotels, restaurants, supermarket	n/a	Planned to be available

*Originally described as a freight village by de Cerreño et al. (2008) in Task 1 of the NYMTC study, but revised later as an intermodal/multimodal industrial park by Boile et al. (2008) in Task 3.

(de Cerreño et al., 2008)

4.3 Observed Potential Benefits of the Concept

Freight villages have the potential to generate some important benefits that can alleviate some of the challenges posed by changing freight and logistics processes. Kapros et al. (2005) argue that freight villages can produce 'internal' effects such as increased productivity and synergies among tenants of the facility, and 'external' or network effects, such as congestion mitigation, modal shift, land-use reorganization, economic growth and employment, lower energy consumption, and environmental benefits. Wisetjindawat (2010) agrees, noting that cooperative freight distribution systems can have important environmental, social, and economic benefits, such as lower emissions, reduced congestion, and more opportunities for achieving a competitive advantage.

In a quantitative assessment and prioritization of all major logistics centres in the Central European, Adriatic, Danubian, South-Eastern European space (CADSES), Nathanail (2007) found that outside of 'special logistics areas' within major international gateway terminals, freight villages generate the highest levels of performance among logistics centres for improving competitiveness and investment attraction, contributing to intermodal transportation, and quality of life impacts such as pollution and congestion. Among the CADSES, the highest performance was seen in Western Europe, but Nathanail (2007) concludes that freight villages are of great importance throughout the entire region.

In one of the best analyses of a freight village, the multi-criteria approach used by Kapros et al. (2005) considered the Kilkis freight village's attractiveness for private financing, contribution to the national and local economies, environmental quality, ability to affect land-use change, and complementarity with other policy plans. Though the model uses limited data, the results show that for all categories considered, the freight village had a positive impact and "the creation of a freight village in the region is more preferable than the do-nothing alternative." (Kapros et al., 2005, p. 63) Though the specific criteria used may not be widely applicable to all cases, the model presents a useful tool to assist in the appraisal of freight village investments.

The benefits of freight villages reported in the literature include outcomes such as increased productivity, intermodality, and urban consolidation, congestion mitigation, and other important impacts, which are discussed further below.

Benefits to Actors

BESTUFS (2007a) argues that freight villages and other logistics centres can benefit both public and private aims. The public can expect to see fewer emissions through more efficient urban deliveries and less trips, a shift of long-distance transportation from road to rail, a further reduction in congestion as intermediate trips between destinations are minimized, and the stimulation of economic growth by improving logistics infrastructure. Benefits to private sector operators and transport companies are mainly focused on increasing efficiency through better warehouse space, bundling consignments, utilizing intermodal transport, economic gains through value-added services, cooperating with other actors, and attracting new customers (BESTUFS, 2007a). Because many of the benefits to public and private actors are connected with other categories of benefits, they will be discussed further below.

Synergies

One of the main aspects of the conceptualization of freight villages as generators of business and economic development is the promotion of clustering and co-location of firms for easier vertical and horizontal cooperation and the realization of synergistic relationships between these firms in freight and logistics. According to BESTUFS (2007a), some of the direct logistics synergies that can be expected in a freight village can include:

- Synergies in logistics processes such as long distance haulage, storage, packaging, and commissioning
- Synergies in infrastructure such as connections to transport networks, transshipment equipment, environmental investments, and railway sidings for better internal economies of scale.
- Reduction in wasted movements through the provision of internal services such as customs, public transport, security services, waste disposal services, information services, and training and consulting
- The creation of external economies of scale into the surrounding periphery by assembling transportation know-how within a single site

Jaržemskis (2007) highlights additional synergistic benefits can be realized through freight villages (Table 4.3). It is these types of synergistic relationships that form the foundation of freight villages as solutions to the challenges facing modern freight and logistics. While BESTUFS (2007a) and Jaržemskis (2007) provide a general overview, the literature shows that the synergies created by freight villages have led to broader impacts on productivity, intermodality, congestion, and environmental sustainability.

Table 4.3 Synergistic Benefits of Freight Villages for Firms

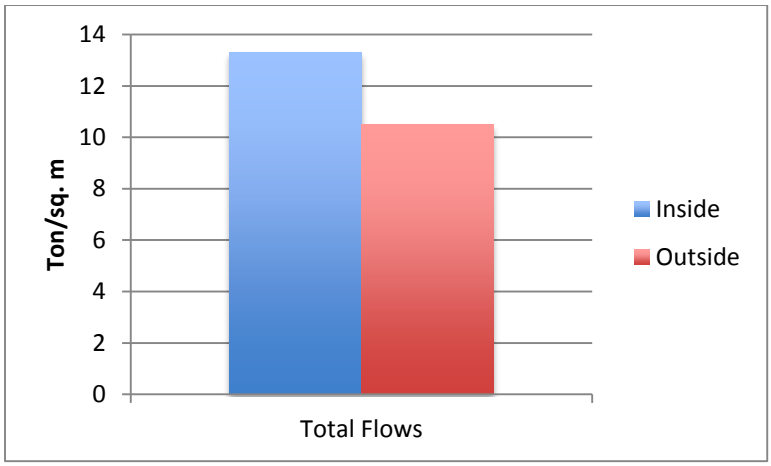
Area	Benefit
IT Solutions	Many transport and warehousing companies are small and cannot afford specialized IT software for operations management. Freight villages make possible shared investments in these types of electronic and information infrastructure at a lower cost.
New Transport Flows	Warehousing capacity and modern equipment can attract world-class companies and have a positive impact on the growth of domestic freight movements.
Supply Chain Management	Individual transportation and warehousing firms are not attractive to world-class manufacturing and trading firms due to low levels of service and warehouse capacity. Operating in a freight village can significantly improve service quality and freight capacity issues.
Additional Services	The localized freight activities at a freight village stand to be attractive to external service providers and entrepreneurs who can improve on-site amenities
Cost Sharing	Pooling investments in transportation, warehousing, IT, knowledge, and other infrastructure provides a cost-effective way for companies to gain a competitive advantage.
Economies of Scale	A decrease in the number of transportation links in the supply chain alongside an increase in their quality can provide firms operating within a freight village a competitive and reliability advantage and allow them to secure long-term tenders for manufacturing, freight, and logistics operations.
Quality	As a freight village becomes established and successful, operating within one stands to be

	seen as a seal of quality for firms that can be an effective marketing element.
Knowledge	Larger transport firms have the possibility to retain the best managers who control their operations and activities. In a freight village, this expertise can be pooled in the management company, which allows smaller firms to benefit.
Joint Marketing	Companies within a freight village can offer joint marketing, which can be an advantage for smaller firms.

Productivity and Investment Benefits

Freight villages have been shown to facilitate important productivity benefits. In the case of Interporto Bologna, it has been reported that transport and logistics companies operating within the freight village have noticed increased productivity in warehouses of up to 30% and improved service quality (Boile et al., 2008). The Freight Village 2000 study (FV-2000, 1999) surveyed 98 European transport companies from countries all over the European Union, 49 per cent of which were located within a freight village, and the remaining 51 per cent outside. In comparing these companies, the study concluded that those located within a freight village presented higher overall productivity rates compared to those outside. In terms of tons moved, productivity per square metre of each warehouse inside a freight village is higher than the productivity per square metre of each warehouse outside (Figure 4.3).

Figure 4.3 1997 Average Productivity of Firms Inside and Outside a Freight Village



(FV-2000, 1999)

For economic investment and risk, as Jaržemskis (2007) highlighted in Table 4.3, freight villages offer an advantage for users in sharing the total acquisition and operating costs of common facilities, equipment, and services, avoiding large and uncertain investments in building their own private freight facilities that would exhibit low or possibly unattainable returns (BESTUFS, 2007a). Freight villages can also generate savings in transport time, an increasingly useful benefit when road haulage can incur higher costs in congested areas. Konings (1996) argues that locating within or nearby a logistics centre such as a freight village and utilizing the infrastructure and services within has a beneficial effect on costs, transit times, and the reliability of intermodal transport techniques. Tsamboulas and Dimitropoulos (1999) agree, finding that freight villages influence the rationalization of goods flows and improve transportation system efficiency. Freight villages stand to lower the cost of doing business for many industrial and

logistics companies, giving them more opportunity to free up significant amounts of capital from transportation and logistics-related overhead that can then be invested in other beneficial ways.

Economic Development and Employment

Freight villages are also credited with generating employment and economic investment. Appendix D provides an overview of the employment totals for freight villages and other logistics centres in the literature. For example, Interporto Bologna is responsible for 8.6% of direct employment in the transportation sector, hosting approximately 100 firms and 1,800 employees (Interporto Bologna SpA, 2005). The development of three intermodal logistics centres in the Berlin-Brandenburg region of Germany has resulted in the attraction of more than 85 enterprises and the creation of approximately 4,800 jobs (Hesse, 2004).

In the United States, freight villages and other logistics centres are also seen as magnets for employment and investment. AllianceTexas employs over 28,000 workers at 257 companies and has had a cumulative economic impact of $38.5 Billion to the North Texas Region since opening more than twenty years ago (Weeks, 2011). Walter and Poist (2004) highlight that the Port of Huntsville in Alabama has generated nearly 28,000 jobs. Other logistics centres have also had a positive impact on employment, such as the new Dallas Logistics Hub, which is expected to create over 60,000 jobs and have a total economic impact of $5.4 Billion when completed in approximately 30 years (Area Development Magazine, 2008). CenterPoint Intermodal Center outside of Chicago has also had a clear impact on job creation. The facility was built on a former military site where 8,000 people used to work until it was decommissioned in 1976. However, the development of the project has seen the creation of roughly 8,000 to 12,000 new jobs and $27 Million in annual property tax revenues (de Cerreño et al., 2008). The Gateway Commerce Centre near St. Louis, Missouri has created 2,000 jobs and attracted more than $200 Million in new investment by companies such as Dial Corporation, Procter & Gamble, and Hershey Foods (Area Development Magazine, 2008).

Containerized freight is also contributing to a shift in logistics employment. According to the American Association of Railroads, in contrast to 2002 when rail companies shed 4,700 jobs, rail freight carriers are expected to hire more than 80,000 new workers by the year 2014, the largest numbers of which are to be in major logistics hubs (Area Development Magazine, 2008). Containerization is also changing the types of firms at logistics centres. In an interview with the Federal Reserve Bank of Atlanta's Econ South journal, a respondent noted that "The reason you want containers is because that's when you get a Wal-Mart distribution centre, a Target distribution centre … That's the kind of stuff that goes in containers. And that leads to even more jobs." (English, 2008)

One of the most promising developments for employment is in the provision of value added logistics services. Global supply chain expert Rob Beynon of InterVISTAS Consulting in Vancouver argues that containerization has brought expanded opportunities in logistics, noting there is now "more money to be made in handling and managing freight as opposed to just moving it." (Ross, 2010) Rimienė and Grundey (2007) note that the average distribution employs 100 workers, but trends towards expanding value added operations are expected to require hiring more employees.

A study of the community impacts of logistics centres commissioned by the federal Department of Transport and Regional Services in Australia concluded that value added services combined with an intermodal terminal can have a significant impact on local employment compared to 'pure' intermodal terminals that offer only container handling services (Table 4.4). Hosting both an intermodal terminal and a variety of value added services, freight villages appear to be the best candidate among logistics centres for creating employment and economic development.

Table 4.4 Community Impact of Intermodal Logistics Centres

Pure Terminal	Low level of local economic benefit
Exchange containers between transport modes Storage for full and empty containers	
Value Adding Intermodal Terminal	High level of local economic benefit
Bonded facilities Warehousing Container repairs and cleaning Truck and trailer parking and repair Office locations for customs, insurance, banking	

(Meyrick and Associates, 2006)

Intermodal Transportation

Intermodal transportation in itself is also seen to bring about its own benefits for freight and logistics companies, which Frémont and Franc (2010) outline according to the actors involved (Table 4.5). Capitalizing on these benefits is one of the main goals behind the creation of a freight village, and the literature demonstrates that these facilities can have a positive impact on the development and utilization of intermodal transportation. By design the goal of a freight village is to make intermodal transportation more attractive for companies. BESTUFS (2007a) argues that this is because a freight village allows the additional services necessary to increase the quality of intermodal transport and attract new customers to be offered at relatively low cost. By facilitating the implementation of efficient transshipment equipment, these logistics centres can help to support the shift of long distance transport from road to rail.

In the literature, freight villages appear to translate into higher rates of intermodal utilization. Among the 98 companies surveyed, the Freight Village 2000 study (1999) found that in addition to productivity benefits, the synergistic opportunities in logistics and transportation provided by freight villages have resulted in companies moving higher overall volumes of freight by intermodal transportation (Figure 4.4). Furthermore, in distinguishing between companies located within an 'integrated' freight village inside which modal changes are accomplished versus those in 'non-integrated' freight village that perform intermodal transshipment at an intermodal terminal nearby, the study found higher overall rates of productivity for companies located in a freight village with a host of intermodal transportation connections on site (Figure 4.5).

Furthermore, there are overall regional benefits to intermodal transportation related to increased accessibility. A study by Thill and Lim (2010) found that the emergence of a network of inland

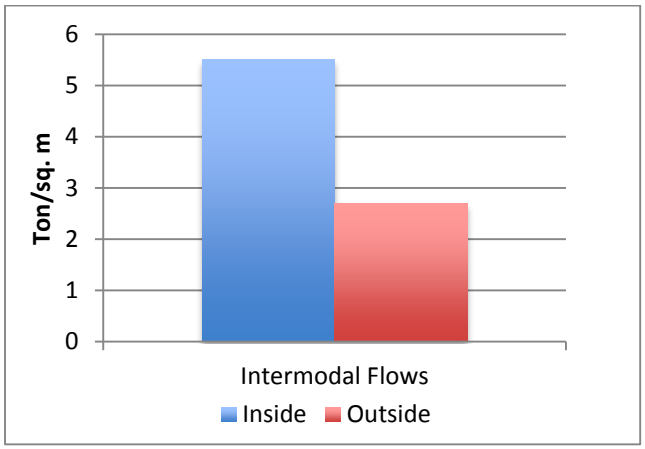
intermodal logistics centres can enhance the overall accessibility of shippers to domestic and international markets. Inland logistics centres and intermodal infrastructure essentially provide a platform for regions that are geographically disadvantaged to compete in domestic and international markets. According to their model, the impact of intermodal terminals provides an increase in accessibility in the range of 3 to 8 per cent. While not large, Thill and Lim (2010) note that this effect is sufficient to place some regions in a position where they can now be competitive in international trade.

Table 4.5 The Benefits of Intermodal Transport for Different Actors

<table>
<tr><th></th><th>Costs</th><th>Traffic Flow</th><th>The Environment</th></tr>
<tr><td colspan="4">Economic Agents</td></tr>
<tr><td>Shippers</td><td>Reducing inland transport prices</td><td>Need for reliable transport chains</td><td rowspan="2">Showing interest in taking into account sustainable development</td></tr>
<tr><td>Shipping lines</td><td rowspan="2">Competing with other transport organizers to attract freight from shippers</td><td rowspan="2">Offering reliable transport chains</td></tr>
<tr><td>Forwarders</td><td rowspan="2">Anticipating a possible inclusion of environmental costs in transport costs</td></tr>
<tr><td>Freight handlers</td><td>Same as above if the freight handler is also a transport organizer</td><td>Reliability of the operation of maritime terminals</td></tr>
<tr><td colspan="4">Public Authorities</td></tr>
<tr><td>Port management</td><td>Interport competition</td><td>Interport competition</td><td rowspan="2">Promoting sustainable development</td></tr>
<tr><td>National, regional, and municipal governments</td><td>Economic development and jobs</td><td>Regional planning</td></tr>
<tr><td colspan="4">Public Opinion</td></tr>
<tr><td></td><td>Economic development and jobs</td><td colspan="2">Low tolerance for environmental externalities</td></tr>
<tr><td></td><td></td><td colspan="2">NIMBY syndrome</td></tr>
</table>

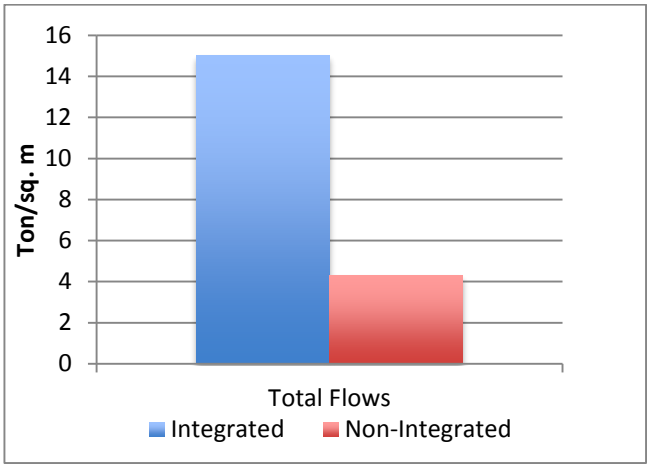
(Frémont & Franc, 2010)

Figure 4.4 1997 Average Intermodal Productivity Inside and Outside a Freight Village



(FV-2000, 1999)

Figure 4.5 Integrated and Non-Integrated Freight Village Productivity



(FV-2000, 1999)

Congestion Mitigation and Traffic Management

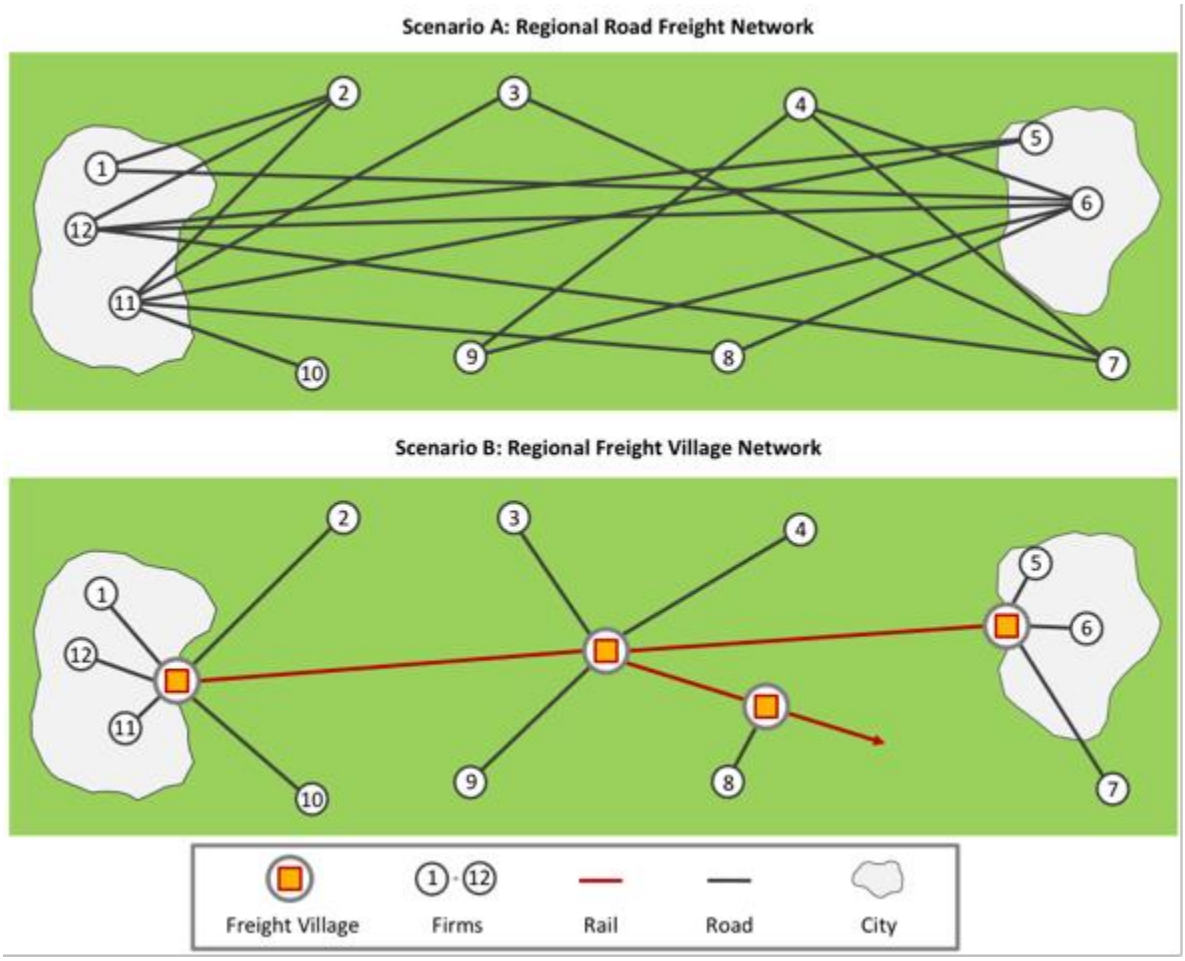
Freight villages can reduce congestion at both the regional and local levels through increased intermodal transportation, improved urban distribution, and a minimization of intermediate trips through co-location. For intermodal transportation, shifting freight from road to rail can reduce vehicle kilometres travelled and have a positive impact on regional congestion. Figure 4.6 compares freight movements in a traditional road network versus a regional network of inland intermodal freight villages connected by rail to highlight the regional congestion mitigation potential of the freight village concept.

In a study of inland ports in Sweden, Roso (2007) estimates that one train from the main gateway port to the Boras inland port removes 35 trucks from the road. With 2 trains per day on average, this results in a reduction of approximately 2,000 road-kilometres travelled every day. Furthermore, Boile et al. (2008) report that at Interporto Bologna it is estimated that a direct rail service connection to the port of Ravenna running three trains per day has resulted in 8,500 less truck movements per year.

Co-location can minimize intermediate trips between companies and the intermodal terminal. By locating on the same site as the intermodal infrastructure, these firms can virtually eliminate drayage costs and extra transport time. This can also extend to having manufacturers, suppliers, and customers on the same site. This clustering of complimentary activities can lower congestion at the local level by avoiding trips that would otherwise occur on the local road network.

In terms of urban consolidation and distribution, facilities dedicated to the consolidation, deconsolidation, and transshipment goods can result in less truck trips and more efficient urban deliveries. In the Sustainable Urban and Regional Freight Flows (SURFF) pilot program commissioned by the European Union, seven urban distribution test sites indicated that the utilization of load consolidation and better route planning led to a 20% reduction in VKT (Regan & Golob, 2005). Similar results were found in a model of cooperative freight systems by Taniguchi and Van Der Heijden (2000), in which shared urban deliveries resulted in an overall decrease in truck distances travelled.

Figure 4.6 Regional Road versus Freight Village Network



In practice, urban distribution can have a meaningful effect on urban truck trips. Germany presents a case in which large-scale policy decisions were made after reunification to promote the consolidation of goods for urban deliveries through shared distribution subcentres called GVS or 'City-Logistik' schemes in about 80 German cities (Wisetjindawat, 2010). As reported in a study by Visser et al. (1999), initial results of the GVS scheme showed promise. A dedicated urban distribution centre in Freiburg, Germany housing 12 different transport companies resulted in a 33% reduction in the number of urban truck trips and a 50% reduction in the overall number of trucks upon its opening in 1993, while another facility in Kassel housing 10 transport companies reduced the number of trucks required from 10 to 2 and the number of trips from 15 to 4 per day in 1994. A summary of this study's findings is reproduced in Appendix G.

De Cerreño et al. (2008) report that the opening of the first GVS in the Berlin-Brandenburg region resulted in a savings of 6,000 truck trips every year. Additionally, Wisetjindawat (2010) reports that Kassel's City Logistik has doubled the load factors of trucks, increased the delivery weight per stop by 15 per cent, and lowered goods vehicle kilometres towards the inner city and within the inner city by 40% and 60% respectively.

The GVS urban distribution function of the GVZ Bremen freight village was also successful. Commodities from nine participating companies were delivered to the freight village and consolidated into environmentally friendly trucks for urban delivery. This program resulted in a reduction of 70 daily truck trips with a savings of 291 gallons of diesel fuel per month (de Cerreño et al., 2008). However, as the potential shortcomings section discusses, many of the GVS schemes described here have ceased due to a lack of continued interest by public and private sector actors.

Similar results were achieved in Fukuoka City, Japan, where 36 freight transport operators launched a scheme for cooperative city logistics in partnership with local, national, and regional governments. After developing a shared facility for collection and distribution, installing parking metres that were to be used exclusively by freight vehicles, and increasing the enforcement of parking regulations, the scheme resulted in a reduction of the number of freight vehicles by 65% and vehicle kilometres travelled in the area by 87% (OECD, 2003).

The mitigation of congestion within terminals is also important. Effective and efficient operations within terminals require a congestion-free flow of containers between modes and tenants inside the terminal and in its periphery, and also customs clearance procedures and value-added operations that can be performed with minimal delays (Frémont & Franc, 2010). According to Slack (1999), congestion at main gateway terminals can be avoided by offloading functions to other logistics centres. He defines four functions of modern freight terminals:

1. *Mode Change*: the primary mode transfer between land-sea, rail-truck, land-air, etc. Carried out at major terminals due to specific site or equipment requirements.
2. *Assembly*: preparation of freight in preparation for its transfer. Characterized by the receipt of individual shipments and their consolidation into unitized loads such as containers, or deconsolidation into smaller loads.
3. *Storage*: storing freight awaiting pick-up and delivery. Important because the capacities of modes differ. Requires an extensive supply of space and sufficient amount of load units to minimize dwell times.
4. *Distribution*: the logistical control of product flows to customers.

Of these, only the initial primary transfer needs to take place at major mainport terminals while the remaining three are free to be performed off-site at less-congested logistics centres. This presents a significant opportunity for a freight village to absorb gateway functions and reduce some capacity-related terminal congestion, offering complimentary and potentially large gains in freight and logistics performance for both types of facilities (Slack, 1999).

A related issue is the potential to eliminate intermediate moves between intermodal infrastructure and firms located on site. Many existing freight clusters are inefficiently organized with many chokepoints in transportation connections between firms, such as using local road networks to reach customers, suppliers, and transportation options such as intermodal terminals. By co-locating and agglomerating firms inside a freight village with high quality connections to intermodal infrastructure, a freight village

can significantly cut down on intermediate movements between freight actors and remove a significant number of truck trips from local and regional roadways.

Environmental Benefits

In the European Union, transportation is the only major sector of the economy responsible for an ever-growing share of total CO_2 emissions. This has been a major reason behind the push at local, national, and international levels in the EU for improvements in freight and the promotion of intermodal transportation (Frémont & Franc, 2010). Similarly, the share of greenhouse gas emissions attributed to road transportation has steadily risen in Ontario, and as of 2008 makes up the largest share (25%) of all emissions by sector (MTO, 2011). As such, increasing sustainability through a reduction in harmful emissions from the freight and logistics is an important aspect of this research project.

Congestion is directly related to harmful carbon emissions in freight transportation, and reductions in freight traffic flows can be seen to directly benefit the environmental impact of goods movement at the regional and local levels. Many of the environmental benefits of freight villages are tied to its ability to reduce congestion, though additional benefits have also reported.

The opportunity to consolidate urban deliveries is one of the most promising ways to reduce the number of trips and energy consumed by freight transportation. Aside from congestion, the SURFF pilot program also indicated that modifying transport, warehousing, and logistics processes usually decreased carbon dioxide emissions and other negative environmental impacts (Regan & Golob, 2005). The evaluation model produced by Taniguchi and Van Der Heijden (2000) found that the reduction in truck distances travelled through cooperative freight systems also reduced carbon dioxide emissions.

The promotion of intermodal transportation has an impact as well. In terms of transportation emissions, in most cases road transport is responsible for more carbon emissions than intermodal transport. According to Frémont & Franc (2010), transportation in the European Union on waterways is more energy efficient per ton transported than rail by a factor of 2 to 1, which itself is more energy efficient than road transport by a factor of 2.6 to 1. To return to the example of the Boras inland port, the elimination of approximately 35 truck movements per train was also estimated to save approximately 1,300kg of CO^2, which adds up to a considerable reduction over 2 trains every day (Roso, 2007). In summary, Wisetjindawat (2010) concludes that when combined with urban distribution and consolidation functions, intermodal freight villages stand to reduce harmful emissions within the urban area and greatly increase the mode share of more environmentally friendly transportation options.

In general, freight villages are seen as a good model for sustainable freight development. The FV-2000 study (1999) concluded that freight villages by nature are more sustainable because they allow for less warehouse dispersal around a country or region as well as a concentration of transportation in proximity to major consumer centres and a variety of transportation modes.

4.4 Observed Potential Shortcomings

Although freight villages can play an important role in generating synergies, promoting regional intermodal transportation and urban distribution, and economic, employment, congestion, and environmental impacts, some important shortcomings in each of these categories has been observed in the literature.

Actors

The Freight Village 2000 report (1999) cited difficulties in coordinating actors among one of the biggest obstacles to freight village development:

- Lack of coordination between policy making bodies at central, regional, and local levels
- Lack of coordination between different transport ministries within one country
- Bureaucracy and conflicting political interests slow development
- National transport policies are often perceived as being in favour of road transport
- Intermodality requires long-term investment while political decisions change frequently

Relations among actors can also lead to conflicts of interest, which, if not resolved by either market forces or regulation, can cause several risks to emerge. The most prevalent is the risk of over-supply, wherein many actors have the goal of establishing logistics centres within their jurisdictions. This is a particular problem at the public level where local and regional actors have the propensity to 'latch on' to the latest development or job creation scheme, of which evidence exists in India and the Rhine region of Western Europe (Rodrigue et al., 2010). However, Rodrigue et al. (2010) argue that this risk is less in North America due to the presence of large private rail operators who are likely to be involved in any major logistics centre development and will ensure a suitable basis for market competitiveness.

Synergies

Cruijssen et al. (2007) note that the literature on horizontal cooperation in freight and logistics typically pays little attention to the impediments towards closer relationships between firms. However, they report that as many as 70% of all strategic alliances fail for one reason or another. Horizontal cooperation is often an uncertain undertaking in which it is difficult for partners to plan the required activities and measure the realized outputs of their relationship. Furthermore, a large degree of relational risk is involved, with many relationships spoiled by opportunism. Some of the most common impediments to horizontal cooperation among companies in freight and logistics according to a literature review by Cruijssen et al. (2007) are:

Partners

- Difference in interests, opportunistic behaviour
- Difficulty in finding partners with whom to cooperate
- Difficulty in finding a trusted party or person to lead the cooperation
- Difficulty to distinguish oneself towards customers
- High coordination costs due to differences in operating procedures

- Risk of losing clientele to competitors or partners

Determining and Dividing the Gains

- Difficulty in determining the benefits, monetary and otherwise
- Difficulty in establishing a fair allocation of the shared workload
- Difficulty in establishing a fair allocation of the benefits

Negotiation

- Disagreement over the domain of decisions
- Unequal bargaining positions due to size differences or other factors

Coordination and Information and Communication Technologies (ICT)

- High indispensable ICT costs
- High additional coordinating and controlling costs
- Loss of control

Speaking specifically to the experiences with horizontal cooperation at logistics centres in Europe, Hesse (2007, p. 2) argues that "the strong vertical links in supply chain management may hinder the development of significant linkages among firms" which can impact the project's expected economic benefits. Furthermore, Boile et al. (2008) report that in some successful freight villages, companies are just locating themselves within the facility and operating without any attempt to increase cooperation. Although the facilitation of synergies between firms in freight and logistics is a primary goal of any freight village development, policy and planning actors should take these impediments into account and be skeptical of the potential for horizontal cooperation among firms in practice.

Employment and Economic Development

In terms of jobs and economic growth, Hesse (2007) argues that the assessment of logistics industries as 'growth machines' is far from proven. He explains first that this assumption cannot be confirmed by overall employment statistics, and second, even if there is statistical growth, it might be derived by "pseudo-correlation: many of such related developments represent either a consequence of outsourcing or spin-offs from industry, wholesale, and retail, or they are simply the result of spatial shifts, the movement of facilities from one place to another; in both cases, the net-effects appear to be limited." (Hesse, 2007, p. 2)

Furthermore, the impact of logistics on local and regional employment is mixed. Hesse (2007) argues that because logistics centres are dedicated to making processes more efficient, and consequently less costly and labour-intensive, overall employment growth due to logistics has been stagnant. In terms of the types of jobs created, he also finds that while logistics activities can generate a small share of highly qualified labour, the majority of employment at a logistics centre is entry-level or temporary. Seen in this light, the experience at some freight villages appears to be 'jobs-neutral'.

Though the literature on unsuccessful freight villages is limited, one project that has failed to live up to expectations is the Global TransPark facility near Kinston, North Carolina. Significant public subsidies

were provided to the project for infrastructure provision based on the 55,000 jobs it was anticipated to provide. However, Walter and Poist (2004) report that after opening the project had produced only 600 jobs, leading some to proclaim it as a 'boondoggle' and putting future public subsidies in jeopardy. As such, investments in freight village developments as policy tools for the creation of employment and economic development should be weighed against the very real risk of underperformance in the free market.

Urban Consolidation and Distribution Conceptualization

While urban consolidation for shared deliveries seems like a promising solution for reducing the negative externalities associated with urban goods movement, these benefits have often proven difficult to realize. Similar to the impediments to horizontal cooperation noted earlier by Cruijssen et al. (2007), BESTUFS (2007a) gives an overview of the challenges encountered in setting up multi-company urban consolidation centres:

- Lack of economic interest (interruption of the transport chain at the urban distribution centre causes additional costs that are not offset by corresponding gains in efficiency)
- Lack of willingness to cooperate because of fierce competition (fear of disclosing competitive information about order quantities, products, customers, know-how, etc., fear of losing customers to competitors)
- Reluctance to relinquish control over merchandise and the transport chain, particularly the responsibility for the goods transported
- Loss of direct contact between the end customer or receiver and the delivering company (the act of delivering offers an opportunity for the transport company to promote itself and establish a customer relationship)
- Many companies give much higher priority to customer service and competitive advantage than to reduced transport costs
- Reduced need for multi-company consolidation because of the general concentration process in the transport business (for large retail companies with their own distribution network the benefit of multi-company consolidation is rather small)

In practice, the results of these facilities is mixed. Though initial results reported by Visser et al. (1999) showed promise, the 'City-Logistik' GVS initiative in Germany has largely come to be seen as a failure and the majority of the projects have been suspended (Wisetjindawat, 2010). Boile et al. (2008) report that the goal of reorganizing the German freight transportation sector has proven difficult because wholesalers and distributors preferred to have proprietary dedicated warehousing and distribution facilities, and also because some facilities were launched in locations outside of optimal freight flow directions that inevitably led to longer distances to customers.

In order to succeed, an urban consolidation and distribution centre for shared deliveries requires initial and continued interest, acceptance, and cooperation from private sector participants (Wisetjindawat, 2010). This presents a large obstacle, as while public actors and development companies often attempt

to present only the positive side of the initiative, private companies are generally reluctant to restructure their business patterns through public policy interventions (Boile et al., 2008).

But the biggest factor affecting the implementation of these centres is increased costs. Wisetjindawat (2010) argues that initial set up costs for urban distribution facilities are relatively high, necessitating heavy public investments to make participation attractive to private sector actors. The operation of urban consolidation is also costly, with approximately one-third of all distribution costs imposed by the act of transshipment (BESTUFS, 2007a). In many cases, this erases any benefit that could be realized and reinforces the attractiveness of proprietary deliveries. Despite the appeal of initial goals, Regan and Golob (2005) conclude that the urban consolidation centres envisioned in the 1970s have failed to materialize primarily because it was judged that development and operating costs exceed what carriers would be willing to pay.

Intermodal Transportation Conceptualization

The regional conceptualization of freight villages stresses the promotion of intermodal transportation, but it too also suffers from a number of important shortcomings. The Freight Village 2000 report (1999) highlighted some obstacles to the development of intermodalism, such as:

- Economic conditions (low profitability for intermodal operations)
- Lack of homogenous systems for different modes and different countries
- Low flexibility in rail operations and lack of coordination between transport modes
- Low frequency, and too high tariffs (compared to road transport)
- Low reliability

In Europe, some aspects of intermodal transportation have not met expectations. Janic (2007) cites a low containerization rate, deterioration in service quality for intermodal transport, and improvements in the efficiency and quality of road transport as reasons for low intermodal mode share.

But another major factor is the competitiveness of intermodal transportation versus road transport. Intermodal is generally only seen to offer 'economies of distance' for long haul freight. This topic is explored further in Section 5.1 below. Roso (2008) argues that other obstacles prevent buyers from using rail as a major mean of transportation, such as a lack of flexibility both in time and space requirements, and a high rate of damaged goods. Furthermore, she outlines 'soft' variables that contribute to rail's low mode share, such as feelings, a general resistance to change, or lack of know-how rather than decisions based in fact.

Lastly, while Thill and Lim (2010, p. 546) argued that intermodal transport can increase the accessibility of regions to compete in national and international markets, they note that intermodalism should not be seen as a "silver bullet capable of erasing the logistical disadvantages of geographic peripherality". The ease at which firms can move goods varies sharply across regions, and even with quality intermodal transportation options, some regions are destined to be at a logistical disadvantage due to the 'tyranny of geography' (Thill & Lim, 2010).

Congestion and the Environment

Minimizing regional and terminal congestion is one of the main goals behind public investment in a freight village. But as Hesse (2004; 2007) argues, while these logistics centres have the potential to support more efficient long-distance operations, this is generally at the expense of increased local transportation. A major reason behind this is intermodal transport. According to Konings (1996), intermodal transportation has the tendency to actually create congestion through increased localized transport intensity in and around intermodal terminals. He argues that the growth of intermodal transport naturally entails the growth of road transport activity around terminals as the initial and final segments of most freight still need to be handled by road haulage. As a result, Konings (1996) cautions that despite its promise for long distance haulage, intermodal transportation can fall victim to its own success and find itself unable to meet market expectations. While the goal of reducing regional and terminal congestion is important, the focus on intermodal transportation as a fundamental element of freight villages has the potential to simply alter patterns of congestion and can even make local congestion worse.

Furthermore, despite heavy investments in intermodal infrastructure, companies may still gravitate towards road transport. Hesse (2004) has found that although one of the main goals behind the development of three intermodal logistics centres in the Berlin-Brandenburg region was the promotion of mode shift from road to rail, the operation of these facilities is still heavily biased towards road transport. Hesse (2004) attributes this as a response to competition and low freight rates that favour the market position of road haulage firms.

In addition to these issues, Hesse (2007) also calls into question the environmental sustainability of new freight and logistics sites. Like traditional mainport terminals, Hesse argues that new logistics centres are extensive consumers of land with distinct infrastructure requirements, such as convenient access to a number of high quality transportation modes. Furthermore, to accommodate its activities, these facilities typically depend on locations separate from other land uses and sites that are 'robust' enough to handle the negative externalities associated with 24-hour freight operations, 7 days a week.

Value for Money

Questions have also been raised as to the cost versus benefit of freight villages. For example, though the three freight villages in the Berlin-Brandenburg region attracted 85 companies and created approximately 4,800 jobs, the development of these centres has required continued federal and EU-subsidies, which as of 2002 totaled €86.7 Million (Hesse, 2004). A similar example is the Global TransPark facility mentioned above that has been called a 'boondoggle' due to its ability to generate 600 jobs when funding from the public sector was premised on the expectation of 55,000.

The lack of research and empirical data on the impacts of freight villages has led Boile et al. (2008) to conclude that there is no clear answer to the question whether the mentioned benefits outweigh the costs. No studies referenced in this literature review provide an economical evaluation or quantification of freight village benefits weighed against the costs of investment. In general, to ensure value for

money, actors involved in freight village development should ensure that those who stand to benefit the most bear a share of the total costs proportional to these impacts.

Land Use Impacts

There is no definitive answer to whether freight villages have produced a meaningful impact on altering freight land use patterns. Because freight and logistics is inherently market driven, the ultimate success of any freight village project depends on market demand. In the case of the Berlin-Brandenburg intermodal logistics centres discussed by Hesse (2004), he notes that although these facilities offered highly accessible locations for businesses, the sites were not fully built-out and development continued to occur at locations outside of these areas. Furthermore, because the publicly owned logistics centre must find buyers for its properties to generate a return on investment, they are inclined to accept any firm that buys a lot (Hesse, 2004). This highlights a conflict of interest, wherein the logic of filling the facility contrasts with the goals of maximizing the benefits of co-location and clustering by attracting only the firms that have the potential to cooperate and can best utilize the features of the facility. In general, these examples highlight the very real possibility that a freight village will not perform its stated goals.

Lessons for Freight Village Development

Based on a review of the examples and experiences encountered in the literature, several lessons for the development of freight villages can be derived. Section 5.1 considers issues relating to the competitiveness and attractiveness of these facilities, including cost, time, and flexibility considerations, border concerns, public versus private initiatives, and long-term life cycle issues. Section 5.2 explores the target market for freight villages according to recent studies of freight and logistics operators in North America. Section 5.3 examines location and site design issues such as size, amenities, and infrastructure, while Section 5.4 surveys the literature on the range of funding and managing arrangements in the development of freight villages between public and private actors. Section 5.6 discusses policy tools for the implementation of freight villages.

5.1 Competitiveness and Attractiveness

Mainport terminals function as a complex interface between two systems of circulation (maritime and inland), and inland intermodal logistics centres such as freight villages perform a similar task by transferring cargo from one mode to another. However, Rodrigue et al. (2010) note that mainport terminals differ from inland logistics centres in a fundamental way: while a port is an obligatory node for the maritime/land interface, the inland logistics centre is only one option among many for inland freight distribution. Freight villages will only be a suitable option so long as market competitiveness and

favourable commercial conditions are maintained, such as the cost of intermodal transportation, time, reliability, and flexibility considerations, the attractiveness of urban distribution, and regional border concerns.

5.1.1 Cost, Time, and Reliability Considerations for Intermodal Transportation

Increasing the utilization of intermodal transportation is a main goal of freight village development. However, in order to be successful, intermodal transportation must operate according to market realities. The ability of transport operators to move freight at the lowest possible cost with high levels of reliability and regular service is an essential condition to gaining or maintaining an advantage in a competitive marketplace (Frémont & Franc, 2010). This subsection outlines the cost, time, and reliability considerations for intermodal transportation followed by a discussion of improving on these limitations in the future.

Cost Considerations

Interviews with transport operators conducted by Frémont and Franc (2010) concluded that prices for intermodal transport must be 10-20% lower than road transport to be an incentive for a modal shift. This suggests that if intermodal transportation is to be adopted and succeed, it must demonstrate that it can offer a competitive advantage to companies at prices lower than road transport alternatives. There are four prerequisites for enabling the market competitiveness of intermodal transportation versus traditional road haulage: distance, volume, frequency, and trip type.

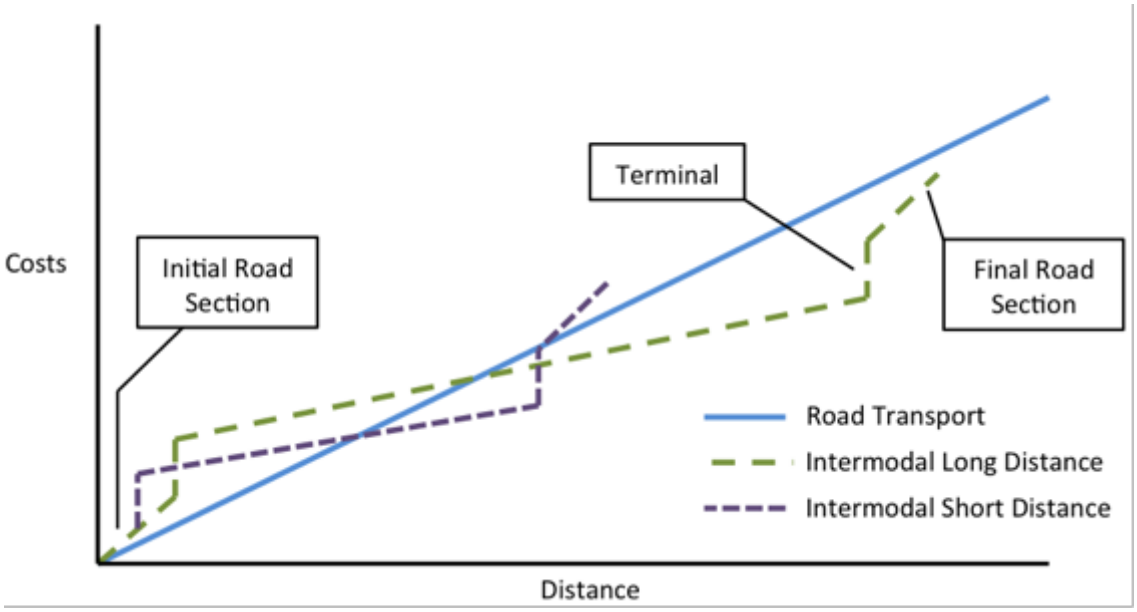
The long-distance viability of intermodal transportation is well known and backed by many academics such as Konings (1996), Janic (2007), and Roso (2008). Frémont & Franc (2010) argue that many traditional seaports have capitalized on intermodal transportation to extend the economies of scale achieved at sea by very large vessels. According to Roso (2008), these ports are now using high capacity rail shuttles to inland logistics centres as a way to 'extend' the gate of the port, attract new customers, and enlarge their respective regional hinterlands.

However, there are questions of intermodal transportation's ability to be competitive versus traditional road transport over shorter distances. In the European Union, Janic (2007) notes that while the share of long-distance intermodal traffic from 900-1,000km has risen from an annual volume share from 5% to 9% from 1990 to 1999, the share in short-distance corridors between 200-600km has not improved and remains low at 2%. This is because intermodal transportation is often simply uncompetitive to direct road haulage in many situations. Konings (1996) explains that, in themselves, rail and barge transport are competitive to road transport, but this advantage is frequently cancelled out by the added costs of handling between modes and the initial and final road transport segments (Figure 5.1).

Though the terminal costs of shifting modes are high, this implies a point at which intermodal transportation becomes competitive to road haulage. As a result, the competitiveness of intermodality is based on what Anderson (2008) refers to as 'minimum competitive distance' and Janic (2007) terms 'economies of distance'. According to Janic (2007), for both road and intermodal transport, the sum of their internal and external costs decreases more than proportionally as door-to-door distance increases.

Based on this, Janic (2007) expands on Konings (1996) and calculates a break-even distance for intermodal transportation versus road transport in the European Union of 1,050 kilometres, taking into account higher costs due to low volumes and demand at this distance.

Figure 5.1 Cost Structure of Unimodal vs. Intermodal Transport



(Konings, 1996)

However, intermodal transportation differs from road transport in an important way. In addition to economies of distance, intermodal transportation can offer economies of scale wherein average costs decrease as the volume of loads rises while for road transport these costs remain constant (Janic, 2007). Janic (2007) argues that because of its ability to carry larger volumes of goods, intermodal transportation has the potential to neutralize the effects of higher costs at distances less than 1,050km by increasing service frequencies in medium-distance markets of around 600-900km with high demand. Having more frequent high volume trains at shorter distances reduces the break-even point, allowing intermodal transport to bridge the gap in competitiveness between road haulage and capture a larger market share (Figure 5.2).

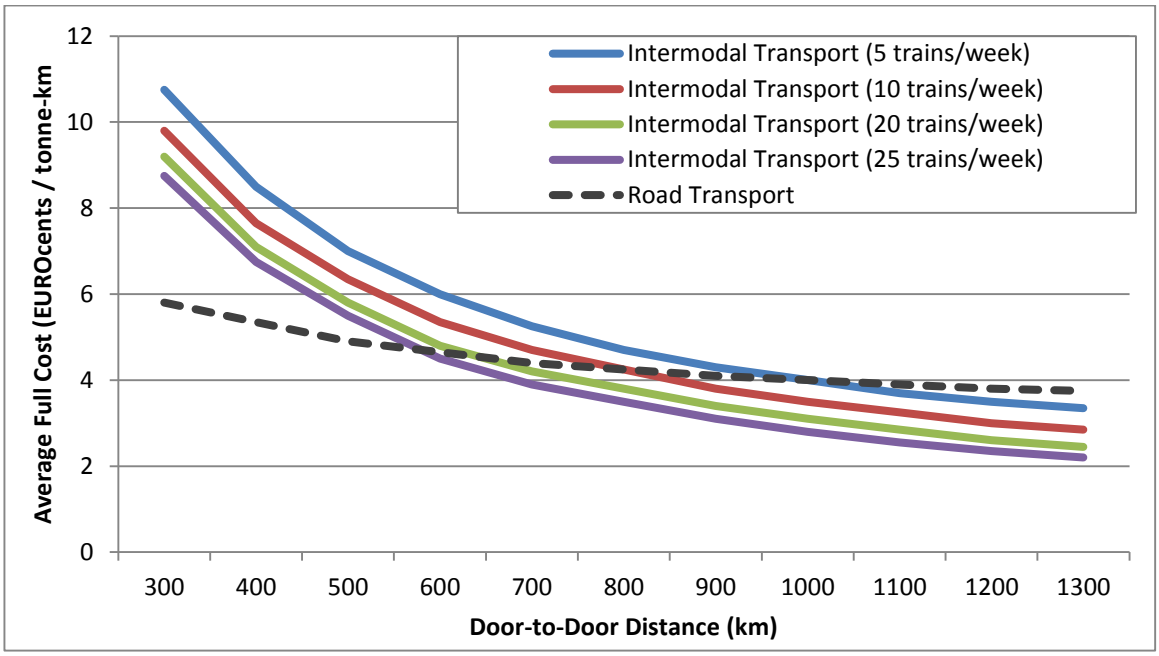
Intermodal transportation in North America differs from that in Europe in its potential to increase economies of scale and lower overall costs. Frémont & Franc (2010) note that while the biggest European block trains have a capacity of 80-95 TEUs, double-stack trains in North America have a capacity of up to 400 TEU, which offers significantly more capacity to extend cost savings related to volume. This suggests that the break-even distance for intermodal transportation in North America can be achieved at lower distances than those outlined by Janic (2007) for the European Union if double-stack trains are utilized to carry higher volumes of goods.

While this implies substantial cost savings when large freight volumes are shipped, it also means that freight villages need to attract large amounts of freight if they are to be successful. According to

BESTUFS (2007a), the type of volumes required to enable these savings and make an intermodal freight village successful can be expected if:

- The region of the freight village is widely integrated into national and international markets
- High regional freight volumes exist that are compatible with freight village operations
- The freight village is directly linked to a main railway route
- A large number of freight forwarders are established on site

Figure 5.2 Average Full Costs of Intermodal and Road Networks



(Janic, 2007)

Trip type also plays a role in the competitiveness of intermodal transportation and can give it an edge over road haulage under certain scenarios. Frémont and Franc (2010) argue that intermodal transportation is more competitive for moving containerized trade when the road alternative consists of 'return-trip' rather than 'one-way' transport, as the return journey entails the wasted movements of hauling an empty trailer and container back to the terminal. This has led the repositioning of empty containers to become a key challenge for road transport companies. When combined with volume, service quality, flexibility, reliability, and extra services performed at the terminal, the trip type and intermediate transportation advantages of intermodal transportation can be a significant factor in its economic competitiveness versus competing long-distance road haulage options (Frémont & Franc, 2010).

Freight villages can benefit the competitiveness of intermodal transportation by locating freight generators on site that can guarantee specific volumes and frequencies of intermodal container traffic. This in turn can increase the ability to offer intermodal shipments at lower distances and allow smaller firms to purchase blocks of space on intermodal trains that are required to meet the needs of the larger

tenants on site. Additionally, the co-location of firms within a freight village can also affect the competitiveness of intermodal transportation. By locating on the same site as the intermodal terminal, firms can minimize initial and final transportation segments and can even make use of internal tractor transportation systems to eliminate the need for trucking between the terminal and warehouses.

Time and Reliability

Aside from issues of cost at lower distances, Konings (1996) sees current intermodal transportation options as uncompetitive to road transport based on time considerations. Anderson (2008) agrees, noting that there is an inherent speed penalty for intermodal freight service because it naturally involves one or more transshipments between truck and rail. Furthermore, because containers need to be consolidated into trains with common destinations, a container may have to wait at the terminal until a suitable train is formed. Though this can be offset to some extent by avoiding road congestion, Anderson (2008) argues that in general, intermodal is a slower mode than trucking.

But another significant factor, and to some actors the most essential factor in the competitiveness of intermodal transportation is that of reliability. A survey of supply chain preferences by Rodrigue (2011) found that respondents value reliability (43%) above both cost (38%) and time (12%) considerations. This suggests that even if intermodal options are cheaper than road transport alternatives, they will not be used if products cannot be guaranteed reliable delivery times. But more importantly it also shows that reliability can mitigate transit time issues if goods move in a predictable way. This has become fundamentally important with the emergence of JIT logistics and supply chain management techniques that minimize stock while promoting high levels of customer service.

Anderson (2008) argues that timeliness is more important than speed in lean logistical systems, and as long as a shipment arrives within a narrow time window its speed of travel is not important. However, he also notes that intermodal transportation in Canada involves bigger time risks than trucking as even on the most heavily used intermodal corridors, trains leave only once every 24 hours because the cost competitiveness of these operations depends on large volumes (Anderson, 2008).

Improving the Competitiveness of Intermodal Transportation

Nevertheless, both Konings (1996) and Anderson (2008) argue that the competitiveness of intermodal transportation will gradually improve over time. Anderson (2008) notes that trends in the economy such as rising fuel costs stand to affect trucking more than its intermodal counterpart, driving up the price of road transport at a stronger slope. He argues that a similar scenario is likely with regards to labour costs, as intermodal transportation is generally a labour-conserving mode and less sensitive to run-ups in transportation sector wages. A recent analysis suggests that increases of 25% in both fuel and labour costs along with the internalization of other external costs such as pollution and uncompensated infrastructure damage would result in a reduction of about 33% in the minimum competitive distance of intermodal transportation (Anderson, 2008).

Konings (1996) argues that intermodal will benefit from rising costs and lower service reliability for road transport attributed to increasing congestion at both the major terminal and regional levels (Figures 5.3

and 5.4). Additionally, he argues that intermodal transportation can further improve its competitiveness versus road transport by minimizing handling costs and making terminal operations more efficient. Konings (1996) calls for the development of freight village-style location and cooperation synergies between firms at intermodal logistics centres and efficient internal tractor transportation systems and technologies that can reduce terminal dwell times and congestion, and improve freight handling between modes and firms. He refers to these as integrated centres for the transshipment, storage, collection, and distribution of goods (TCSD) which can be seen as functional equivalents to freight villages, suggesting the possibility of intermodal network multiplier effects that lower costs even further when these types of facilities exist at both ends of the transport and supply chain (TSCD2 in Figure 5.3 and 5.4).

Figure 5.3 Cost Components Now and in the Future

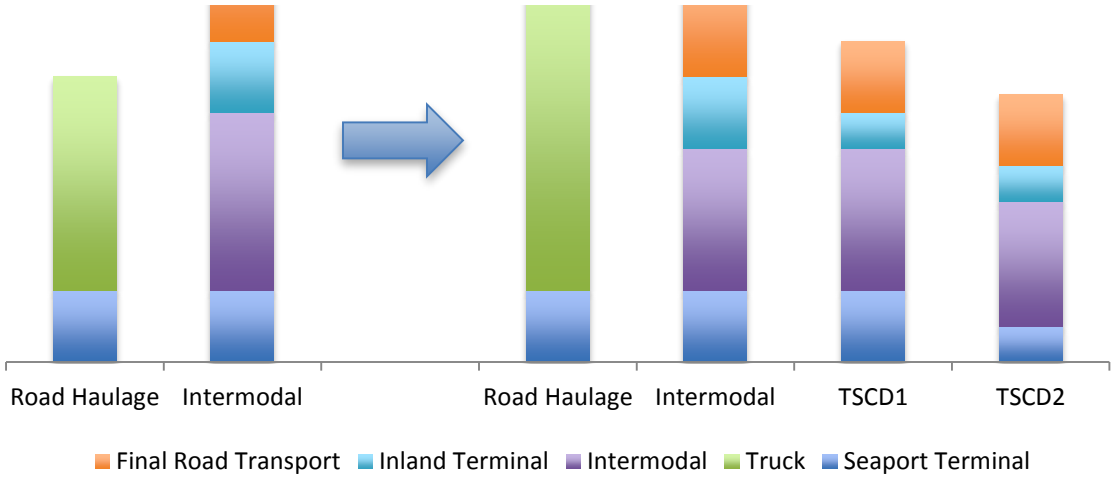
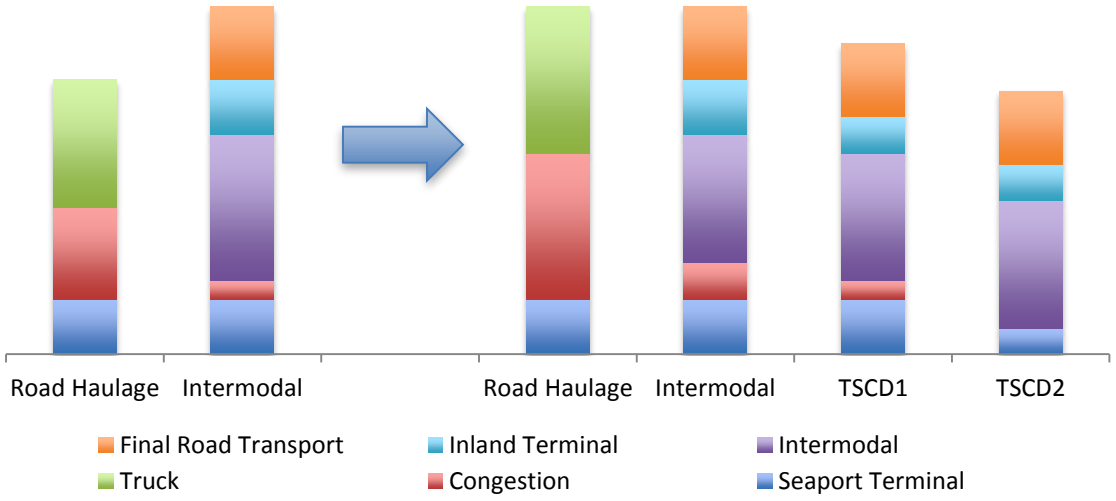


Figure 5.4 Transit Times Now and in the Future



TSCD1: TSCD facilities at one end of the transport chain
TSCD2: TSCD facilities at both ends of the transport chain

(Konings, 1996)

In general, intermodal transportation will be in the interest of companies if it is more reliable and less costly than road transport. But these factors on their own may not be enough to prompt actors in the transport chain to shift their preferences away from road transport. Frémont and Franc (2010) argue that in order to further induce a modal shift it is necessary to offer additional services that road transport does not or cannot provide. This presents a unique opportunity for freight villages that offer a host of transportation and value-added services.

These value added services can even turn perceived intermodal time handicaps into an asset. Frémont and Franc (2010) cite the example of agreements between customs in France and intermodal transportation operators for a FTZ arrangement that allows firms the right to store import containers at inland temporary storage areas for up to 45 days after their departure from the Port of Le Havre, costing the shipper between €20-30 per container. The client can then have this container delivered to their warehouse, which if it is a bonded warehouse, gives them an additional 20 days before it becomes necessary to declare their freight. In addition to the 5 days of free storage at Le Havre, this gives firms a 70-day deadline for customs clearance, providing incredible flexibility in their supply chains. In practice this means a company can wait until the products to be sold are on display in an outlet before making any payments. According to Frémont and Franc (2010, p. 555), "When end-consumers pay at the supermarket checkout, they pay almost at the same time as the distributor pays the customs charges."

Rodrigue (2011) cites an additional example of a terminal in Europe with high turnaround times on containerized freight. Initially thought of as inefficient, upon further investigation Rodrigue (2011) found that companies using the terminal were instead attracted to this turnaround time as a way to gain a competitive advantage. Firms were utilizing the facility's option for more than a week of temporary storage included in terminal costs and were in turn using the terminal as a buffer in their supply chain and a low-cost replacement for proprietary warehousing operations (Rodrigue, 2011). These two examples highlight some of the creative ways freight villages and other logistics centres can leverage their services to turn what may be considered a time and reliability handicap for intermodal transportation into an asset, increase the attractiveness of intermodal transportation options, and enhance the supply chain competitiveness and advantage of firms.

Intermodal transportation is likely to never be able to compete with road transport in terms of flexibility. But by offering high quality connections to intermodal transport and by facilitating cluster and transportation-related synergies between modes and companies, freight villages can provide a platform to promote more efficient and cost-effective intermodal transport. Furthermore, as more freight villages develop offering similar features, these efficiency improvements can be multiplied at both ends of the supply chain and the broader transportation network.

5.1.2 Urban Consolidation and Distribution

The urban consolidation and distribution function of freight villages also relies on large volumes of goods flows in order to be successful. However, as discussed previously, many of the initial centres dedicated only to transshipment and urban deliveries such as those in Germany have failed to live up to expectations. Regan and Golob (2005) attribute this to the fact that many of the early shared urban

freight facilities were designed so that freight companies could consolidate smaller shipments into larger ones. However, this may no longer be the case, as functioning only for distribution may not meet the changing needs of freight and logistics actors given recent trends. They argue that a sharp reduction in average shipment sizes fueled by the growth in just-in-time manufacturing and distribution systems, dynamic management of inventories, and e-commerce initiatives suggest that "today's shared urban freight facilities will be deconsolidation centres where large deliveries are transferred to smaller vehicles for the final leg of their trips." (Regan & Golob, 2005, p. 2)

In order to maintain the market competitiveness and attractiveness of the urban aspect of freight villages, the lessons learned from dedicated urban distribution projects should be taken into account and facilities should perform according to demonstrated market needs. A secondary issue relates to supportive public policies for urban distribution, which will be discussed further below.

5.1.3 Border Concerns

Another key area in the competitiveness of supply chains and international trade in Ontario concerns the border with the United States. Exports accounted for 51% of the provincial economy in 2004, with 92% of these destined for the United States (MTO, 2004). However, there are significant and often unpredictable delays at border crossings, and inadequate infrastructure is seen as a major contributor to this problem (MTO, 2004; Taylor et al., 2004). This has led some to express concern that these delays can reduce Ontario's economic competitiveness and lead to the relocation of industry to the US, particularly in the automotive sector (MTO, 2004).

Furthermore, because trade patterns are oriented towards the cross-border flow of goods, Ontario firms shipping to the US incur extra costs attributed to border crossings that can affect their ability to compete in continental trade. While NAFTA has removed many barriers to trade in North America, the relationship between Canada, the United States, and Mexico still entails significant costs associated to customs. Taylor et al. (2004) estimate that border and other trade-related policies are costing the US and Canadian economies US$10.3 Billion every year, while a study by KPMG in 2002 found that the US-Canada border was costing a small sample of Canadian trucking companies $350 Million per year (Taylor et al., 2004).

As a result, Canadian firms competing in the US or Mexican marketplace are at a natural competitive disadvantage for cross-border continental trade and logistics compared to our continental partners. For freight villages, this necessitates increasing the competitiveness of operations and services even further to overcome this obstacle if Ontario is to maintain and improve its position in the North American logistics marketplace.

Border concerns can also benefit the adoption of intermodal transportation. Rail offers a much higher density for cross-border movements than trucking, which can relieve some of the constraint of moving large volumes of goods through a limited number of chokepoints (Anderson, 2008). Additionally, as intermodal is generally less labour-intensive than road transport, delays associated with the clearance of people as opposed to goods should also be much lower (Anderson, 2008). Furthermore, because containers and other freight cars are generally sealed prior to crossing the border, this can create a

market for inland border clearance and inspection services for shippers eager to avoid congestion at major crossings.

5.1.4 Public and Private Freight Villages

In conceptualizing freight village development along a public to private continuum, the literature appears to show that more privately oriented freight villages have generally been more successful than their publicly oriented counterparts. Boile et al. (2008) conclude that private initiatives without direct public policy support have gained substantial momentum, while BESTUFS (2007a) has found that freight villages that are owned by public authorities are often less successful than their private counterparts. BESTUFS (2007a) attributes this to a general lack of investment in public facilities.

This relationship has been modeled to a degree in the work of Tsamboulas and Kapros (2003), who found that the amount of private funding was directly tied to the rate of return that could be expected after the development of a freight village in Greece. According to their financial evaluation, a mixture of 30% public and 28% private funds with the rest covered by loans exhibits a rate of return of 8%, which constitutes an interesting investment for private financers. When there are only public funds covering 30% and private funds covering the remaining 70%, the rate of return increases to 11% (Tsamboulas & Kapros, 2003).

Hesse (2007) argues that the higher performance of private logistics centres is a result of fundamental differences in goals between public and private actors. Freight villages initiated by the public sector are inherently policy-oriented while their private counterparts are driven by profit. As a result, he concludes that the presence of strong private interests is fundamental to freight village success unless long-term public subsidization is to be required.

5.1.5 Public Policies

The examples in Section 3 highlight some of the policy tools used to facilitate the development of these and other logistics centres, such as project initiation, infrastructure provision, and public private partnerships. Interporto Bologna and GVZ Bremen have been the result of strong ongoing partnerships between public and private actors, while AllianceTexas has benefitted from new public investments in roads to the facility. Other private logistics centres in the United States have enjoyed contributions from the public sector through infrastructure development, land discounts, and tax incentives (Leitner & Harrison, 2001). However, these policy initiatives can play a large role in the competitiveness of many logistics centres. In some cases, without the initial and sometimes continued support of the public sector, many facilities would not be able to be competitive in the marketplace. For example, the success of freight villages in Europe can be partly attributed to substantial disincentives to road transport and the continued subsidization of intermodal transportation.

Public policies can also have a significant impact on the success of urban distribution activities. The case of the City-Logistik scheme in Germany highlights the importance of continued public support for regional and urban goods movement, as the OECD (2003) attributes its failure to a lack of public policy support that contributed to the diminishing commercial interest of the private sector. BESTUFS (2007a)

and the OECD (2003) note that while some urban distribution projects have proven themselves viable in the marketplace, many more could only succeed with direct activity by the public sector through subsidization and the establishment of supportive policy and planning frameworks such as a truck ban in the city centre, time access windows, or the utilization of reserved parking or loading space for transport companies participating in the program.

A major issue in the public support of logistics centres is an approximation of costs versus benefit. But as discussed in Section 4.4, the literature provides no clear answers to the fundamental questions surrounding public support of logistics centres, such as how much public money is required to make a freight village successful or if the benefits of public investments outweigh the costs. The issues of funding and policy tools used in the development of logistics centres are large enough to warrant their own sections for discussion and are explored further in 5.4 and 5.5 respectively.

5.1.6 Long-Term Life Cycle

Leitner and Harrison (2001) argue that logistics centres and freight villages can also be seen to fit within development cycles (Table 5.1). According to this understanding, these facilities have a limited functional life span according to five stages of development in which a variety of actors participate in their siting, design, establishment, growth, maturity, and even to mitigate their eventual decline.

Table 5.1 Development Life Cycle Stage Description

Stage	Name	Description
I	Preparation	• Evaluation criteria fulfilled • Proponents begin to attract companies and local support
II	Establishment	• Modes established or planned • Anchor tenants arrive
III	Expansion	• More sectors begin to locate on site • Planned modal investment takes place • Cluster theory materializes
IV	Stabilization	• Companies invest in expansion of current facilities • Non-trade services (like housing) established • Slowdown in new arrivals
V	Reduction	• Companies begin to leave because of better options elsewhere • New private-sector trends materialize forcing change in operations

(Leitner & Harrison, 2001)

Rodrigue et al. (2010) argue that another dimension of this concerns market competition with other facilities, as a successful idea often leads to many imitators and attempts at differentiation. This can be the case in the conflicts of interest among actors mentioned previously in which public and private actors can see freight villages and other logistics centres as a new trend for personal or political gain and risk saturating the market with an oversupply of facilities. Because a freight village is only one option for inland freight distribution, competition or changes in the marketplace can substantially alter their

business model and shift their position in the development cycle into maturity, decline, or even obsolescence.

As a region becomes subject to increasing competition for freight movements, this can cause the viability of several logistics centres to be called into question. While the market itself is typically good at clearing excess supply among producers, Rodrigue et al. (2010) note that logistics centres are another issue entirely because many have various forms of subsidies or direct public involvement which can be highly contentious if a market rationalization were to take place.

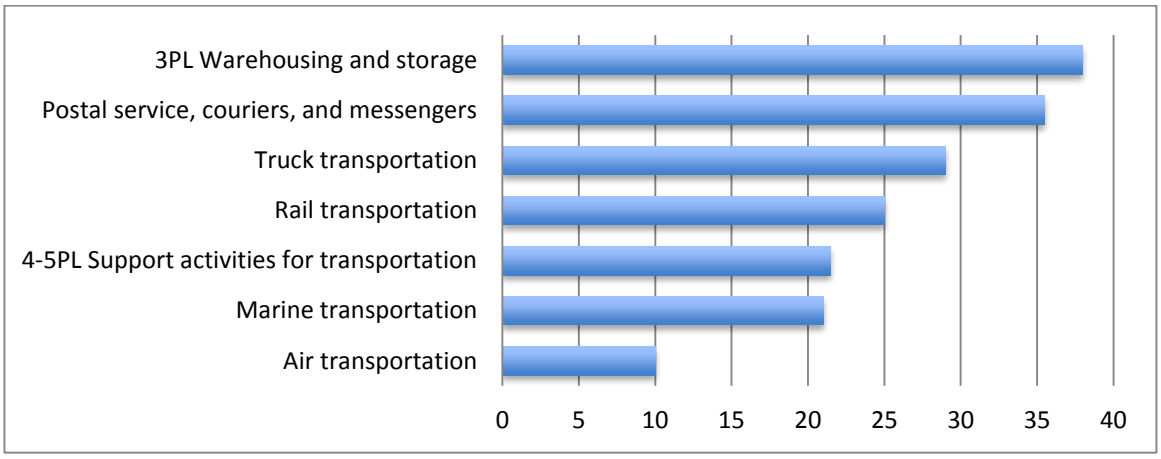
5.2 Target Market

While a freight village provides its own set of basic features, it can also be thought of as a platform for conducting business and an enabler of further gains in productivity and efficiency in response to the changing trends in freight and logistics processes. But in order for a freight village to be successful, industrial and logistics companies have to be attracted to the benefits it can offer. Potential customers evaluate whether the integrated transport chain offered by freight villages produce a competitive advantage through cost savings, enhanced reliability, decreased transit times, and improved service quality (Konings, 1996; Tsamboulas & Kapros, 2003; Meidutė, 2007).

The target markets for freight village developments are companies that make the highest demands of their transport facilities and supply chains and view cost, service, and quality factors as significant elements of their business processes. These are typically companies engaged in a high degree of supply chain management and Just-In-Time logistics that prioritize service cost and quality considerations (Konings, 1996). One of the biggest target markets for freight village development is that of 3PL firms and other logistics service providers. As seen in the case of Interporto Bolonga, locating in a freight village has enabled most of the transport operators on site to become logistics service providers, moving from a 2PL to 3PL model. Jaržemskis (2007) argues that freight villages offer the perfect platform for these companies to conduct their business and innovate in the supply chain. Furthermore, their influence in freight and logistics processes is growing, and their needs are changing. The Supply Chain & Logistics Association of Canada (SCL Canada, 2011) reports that an increasing trend in logistics outsourcing to 3PL and 4PL firms is the use of long-term initiatives with dedicated facilities, personnel, processes, and technologies. These types of arrangements are perfect candidates for freight village development.

Research from SCL Canada (2011) also shows that these companies are leading the way in logistics innovation. Relative to other transportation and logistics providers, Canadian 3PL firms are increasingly adopting innovative methods and processes to retain their competitive advantage (Figure 5.5). This suggests that 3PL firms in addition to other transportation service providers value opportunities to increase their productivity through new methods and as such should be approached as key tenants of any freight village development to realize potential supply chain and logistics benefits.

Figure 5.5 Introduction of New or Improved Logistics Methods by Logistics and Transportation Service Providers, 2007-2009 (% of Firms)



(SCL Canada, 2011)

Attracting freight generators to the site is also a fundamental element of success, as transportation companies naturally need items to transport. Generally, freight generation can come from a variety of sources, such as manufacturing and light industry. Demand from these firms is likely to be on the basis of cost considerations, co-location, and clustering to achieve the synergies and productivity benefits outlined earlier. This can include the direct benefits of cooperation with complimentary industries, suppliers, and services, but can also include impacts on productivity such as the presence of competitors. But because the variety of industries is so broad, innovation and cooperation should be encouraged among similar companies or complimentary sectors by a facility's managing corporation to promote the maximum potential for synergies and clustering possible inside a freight village.

However, studies of industry demand for these types of facilities in North America are limited. As reported by Walter and Poist (2004), other than the often-proprietary feasibility studies for individual cities, there is little published market or demand information regarding the development of logistics centres. Furthermore, those that are available present a mixed response. An early study by Stank and Roath in 1998 found only moderate support for a proposed inland port in the Midwestern United States. Demand for transportation services such as intermodal facilities and containerization capabilities were ranked the highest in importance, logistics and information services such as import/export document services, duty/tariff payments, and customs were ranked second, followed by warehousing and distribution services. Stank and Roath (1998) ultimately concluded that a full-service intermodal logistics centre such as a freight village was not justified for the region, though providing specific transportation facilities and services may be feasible given market demand.

For the urban consolidation and distribution function of freight villages, a study by Regan and Golob (2005) found low levels of interest for shared distribution facilities among 700 trucking companies in California. Only 18.7% of respondents indicated that they would have use for such a facility, with another 8.3% possibly interested, while 71.9% replied 'no' and another 1.1% did not know. However, they note that many of the companies surveyed were private fleets or delivery services with regular

schedules that would have little use for shared urban distribution functionality. Of the 27% that would or might be interested, they conclude that demand is higher among for-hire carriers, carriers providing general truckload, van, refrigerated, hazardous, or high value goods, and highest for 3PL firms, smaller companies with less than five vehicles that could benefit by not maintaining a proprietary terminal, and long-haul carriers with average lengths of loaded movements over 500 miles (Regan & Golob, 2005). Among positive respondents, providing information technologies was a significant indicator of their interest in such a facility and appears to be an important area for future logistics centre development (Regan & Golob, 2005).

Walter and Poist (2004) offer their own insights using a proposed inland port development in Des Moines, Iowa. They ultimately conclude that such a facility would only be of interest to internationally-oriented shippers, not those whose business is primarily domestic. Of the internationally-oriented firms, their highest levels of interest were for an internet website, a port of entry for customs, a transportation centre, an intermodal transportation facility, an information clearinghouse, and a location for federal and state trade agencies. The domestically oriented firms prioritized similar features, but would elevate federal and state transport agencies ahead of trade agencies and changed listing priorities on the website (Walter & Poist, 2004). They conclude that in general the most desirable features for an inland port in Iowa appear to be information and facilities-based, however in this case there does not seem to be sufficient demand for an inland port at this time.

In response, Walter and Poist (2004) provide two recommendations for future inland port developments: First, inland port developers must be aware of the inherent risk in a project that has only moderate levels of interest and support in the local marketplace. This is particularly important for actors involved in the types of facilities Rodrigue et al. (2010) note can be overdeveloped as a new 'trend' in political policymaking and can be insulated from market realities at great cost to the public through increasing subsidization.

The second is that an educational and promotional program will be needed to generate additional interest in an inland port. This point highlights the difficulties inherent in measuring current levels of support for a concept in which many respondents have no prior experience or cannot foresee future value opportunities. Regan and Golob (2005) noted that the 27% of respondents who replied that they would or might have use for such a facility is not an insignificant number, especially considering that these types of facilities do not yet exist in the United States. Interest in the services and functional transportation integration provided by inland ports, freight villages, and other types of logistics centres will more than likely be limited until these types of facilities can prove their attractiveness to companies through better education of industry actors or the development of pilot projects.

But perhaps the biggest factor affecting the development of freight villages is that of cost and proving their market viability. According to BESTUFS (2007a), demonstrating the ability of a freight village to generate profitability to industry and transport companies can result from a variety of factors:

- Cost and availability of land
- Suitable space with efficient transportation infrastructure

- Efficient intermodal transportation connections
- A location nearby other transport companies to facilitate cooperation
- Availability and cost of educated or specialized labour
- Benefits from additional services provided directly on site
- Benefits from proximity to major markets and customers

BESTUFS (2007a) argues that industry and transport companies form the foundations of successful freight village, as when these companies are in place, the rest of the service sector (such as logistics, customs, postal services, hotels, etc.) will naturally be attracted to the site. This suggests that the developers of a freight village should focus on the fundamentals of providing a site in which industry and transport companies can obtain a competitive advantage. Upon achieving this, other services will be drawn to the facility, and the creation of a new freight and logistics cluster and its associated benefits can emerge.

BESTUFS (2007a) concludes that the market it can service, the functions it performs, and the actors involved will go a long way towards anchoring the commercial viability of freight village developments. Likewise, as highlighted earlier by Konings (1996), developing more intermodal logistics centres at different ends of the supply chain can lead to network multiplier effects that benefit the continued growth of intermodal transportation and logistics centres for local, regional, and national freight and logistics processes.

5.3 Site Location and Design

5.3.1 Transportation

By definition an integral need at a freight village is transportation assets. One of the first studies examining the key factors influencing the location of logistics centres found that the most important of these is the proximity of the facility to arterial roads, freeways, and services (Regan & Golob, 2005). But because the scope of activities for freight villages is much larger, different transportation requirements can be expected. According to EUROPLATFORMS (2004), assuring fluidity between transport connections and coordinating transport modes is one of the primary tasks of a freight village. As a result, most freight villages are situated in hub points for transportation and distribution activities, which means being near main road, rail, and sea connections.

Road: Because trucking is responsible for a large share of freight transport and the initial and final segments of intermodal transport are most often made by road, proximity and access to major highways and arterial roads is a prerequisite for freight village development. In examining freight villages in Europe, Weisbrod et al. (2002) found that each facility was located at the crossroads of at least two major highways.

Rail: Connections to rail infrastructure are fundamental to developing intermodal transportation. Weisbrod et al. (2002) found that the extent of rail integration within freight villages in Europe can vary, with some offering a full range of intermodal services and

warehouse sidings, while at others rail connections are not integrated with the facility and consequently utilization remains low.

Air: Connections to airports vary in the literature. Bronstone et al. (2000) question the importance of air as integral parts of logistics centres, as these examples appear to the most limited. Of the freight villages examined by Weisbrod et al., (2002) some facilities were within a few minutes of international airports, others had no business relationship with any airfreight facilities. Other freight villages in the literature offer complete integration with air, such as AllianceTexas, which maintains its own private 100% cargo airport on site (Leitner & Harrison, 2001).

Sea: Some of the freight villages studied by Boile et al. (2008) are located at locations with access to inland waterways to promote short sea shipping. Beyond this, mainport terminals generally act as the major interface between maritime freight transported by container ship and inland transportation networks. However, many of the freight villages examined by Weisbrod et al. (2002) maintained connections to mainport sea terminals through rail shuttle service.

Appendix D provides an overview of the transportation assets at freight villages around the world. Based on the examples covered in this project, every freight village maintains road access and the vast majority of freight villages feature on-site rail connections typical of an integrated freight village. Only four facilities are considered non-integrated with rail nearby. Air and water is less common, with some featuring on site seaports and airports, though many more utilize these transportation assets through other locations in the vicinity. While transportation infrastructure is viewed as a critical need necessary for the successful development of a freight village, alone they are not sufficient and must be combined with the following critical areas if success is to be ensured.

5.3.2 Location

Location is a fundamentally important factor in the success of any freight village facility. Operating with fewer strategically located facilities is part of a trend in supply chain management to rationalize business activities (SCL Canada, 2011). According to EUROPLATFORMS (2004), being able to optimize or reduce the delivery time to customers and destinations in the supply chain is one of the elements that can make an important difference when a transport or industrial operator is selecting a site. The goal of any freight village or logistics centre is to select a site that offers the lowest possible transportation costs with the easiest access to the greatest number of customers (Rimienė & Grundey, 2007).

Finding a suitable location involves balancing competing interests. In order to accomplish its goals, a freight village would ideally be located close to a city and its commercial centres. Leitner and Harrison (2001) view a location within close proximity to a large population base that can provide workers and buyers for the companies locating their operations at the facility as a critical need for successful logistics centre development. Such a location benefits both the intermodal and urban aspects of freight village functionality by enabling shorter legs for distribution trips and longer rail distances for intermodal transport (BESTUFS, 2007a). Furthermore, Harder (1999) argues that investments in intermodal rail terminals near large metropolitan areas have higher rates of expected financial return. But a central

location typically involves high land prices and conflicts with neighbouring residential areas that are sensitive to the negative externalities generated by the facility (BESTUFS, 2007a). In practice, a study of freight villages in Europe, including GVZ Bremen and Interporto Bologna by Weisbrod et al. (2002) found that each was situated within ten miles of their respective major cities. In general, BESTUFS (2007a) believes that sites closer to urban centres would only be possible with considerable public subsidy.

Freight villages also require a site with sufficient land to house its operations. While size will be discussed further below, Leitner and Harrison (2001) report that many freight villages and other logistics centres in the United States are located at recently decommissioned air force bases such as March GlobalPort in California and KellyUSA in Texas, though some such as AllianceTexas materialized at greenfield locations. In the case of air force base developments, these areas present convenient locations for logistics centres as much of the required infrastructure is already available, such as large buildings, utility services, and telecommunications. Additionally, these sites already have significant investments in transportation infrastructure, such as runways that can be converted from military use, rail sidings, and good access to the road network. Typically, European freight villages are smaller and constructed on brown or greenfield sites with similar locational requirements. In Europe, it appears that Europort Vatry in France is the only logistics centre located on a military base.

The location of a freight village within supply chains and goods flows matters as well, both from a demand and optimization perspective. Demand, in the form of existing freight movements or transport companies, must exist if a freight village is to survive. Leitner and Harrison (2001) argue that if a location does not have this asset base it will be difficult for any logistics centre to operate successfully at that site. Finding an optimal location of a freight village according to goods flows is also important. This requires obtaining data and informing site selection with knowledge of regional trade movements, as this will have a substantial influence on the traffic generated by the facility and its ability to have a positive impact on reliability, efficient, congestion mitigation and other environmental benefits. In general, if the selected site cannot perform optimally according to goods flows, the potential for gains in efficiency will be lost.

5.3.3 Size

Freight villages come in a variety of sizes. As illustrated in Sections 3 and 4, European examples are typically smaller, ranging from 125 acres in Paris up to 740 acres in Toulouse. Many have large areas set aside for future development, such as GVZ Bremen, which currently occupies 300 acres but offers an additional 490 acres for future development. Freight villages in the United States typically offer much larger sites for development. For example, the Raritan Center in New Jersey is 2,350 acres. AllianceTexas presents one of the biggest, situated on approximately 17,000 acres of land, though freight uses make up a portion of this total. As previously noted, many of the freight villages in the United States have been developed on decommissioned air force bases. These sites typically afford their owners a large amount of land on which to develop a range of industrial uses.

It should be noted that in many cases not all land is allocated for business use. Typically some is devoted to landscaping and other natural uses to provide a buffer between neighbouring alternative

land uses. At the Eurocentre in Toulouse for example, 10% of the total land area is designated natural and park space (Weisbrod et al., 2002). Though this project classifies it as an intermodal terminal rather than a freight village, CenterPoint Properties in the United States has donated 83 acres of the CenterPoint Intermodal Center site to the Forest Service, 60 acres to a wetlands conservation project, and another 10 acres to the City of Elwood for future use (Brick, 2002).

Other measures of size beyond simple acreage include levels of employment and the number of transportation firms operating at the site. Though the data is insufficient to provide a more in-depth analysis, Appendix D provides an overview of this information for the different types of logistics centres around the world. Despite goods flows also offering a good measure of freight village size, this information was only reported for some facilities in Europe. This information is found in Appendix E.

5.3.4 Site Features and Layout

Two of the main aspects of a freight village are its intermodal terminal and land for companies to operate within the same site. To illustrate this, consider the difference between an integrated versus non-integrated freight village. The Freight Village 2000 study (1999) made the distinction between integrated freight villages, where the intermodal transfer was handled on site, and non-integrated freight villages, where the intermodal terminal was located offsite nearby. In the non-integrated freight village, or really any stand-alone intermodal terminal in a freight cluster, containers must be transported to a nearby intermodal yard using the local road system.

In the case of the integrated example, companies on site benefit by lowering or eliminating the cost of dray and handling for containers by minimizing the distance between the warehouse and terminal. Utilizing on-site access rather than local public roads also makes weight restrictions less of a factor. Though integrated and non-integrated freight villages can be found all over the world, the literature suggests that an integrated freight village is the ideal-type of development, as it leads to higher overall productivity and intermodal utilization than their non-integrated counterparts (FV-2000, 1999).

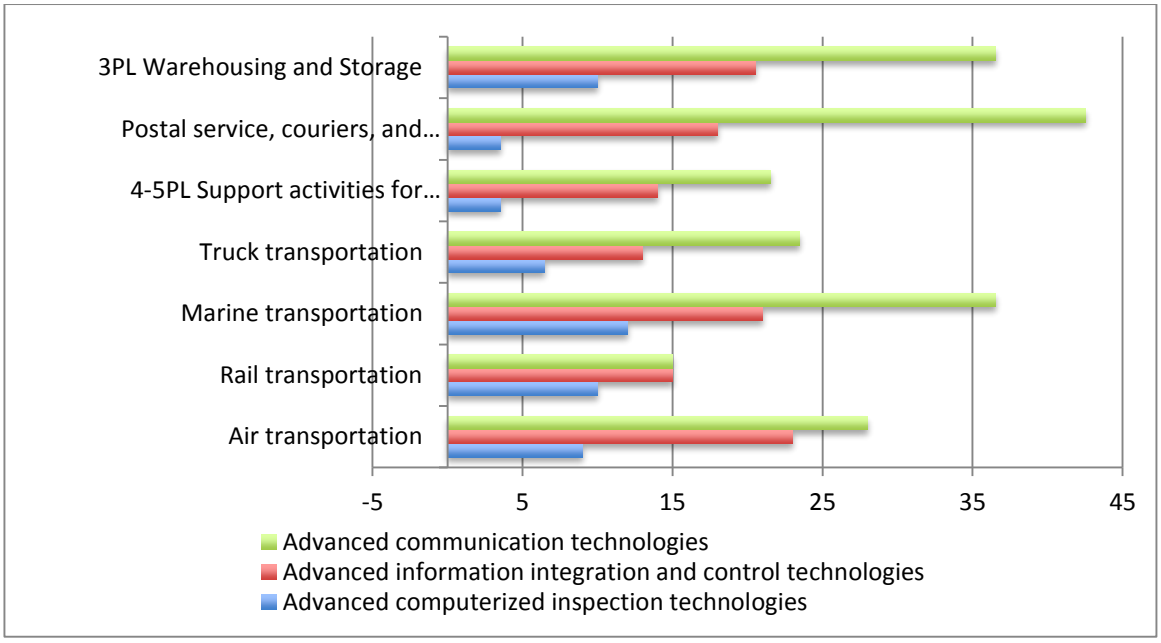
Other features at a freight village can attract companies to the site. According to SCL Canada (2011), Canadian firms have become increasingly interested in site features that can lower costs and increase productivity, such as:

> *Number of doors*: Additional doors increase flexibility and enable shipping and receiving to be carried out simultaneously. Single item pallets can enter while pallets containing customer-specific orders are being shipped.
>
> *Height / building clearance*: Warehouses are typically built with 18-20-ft clearance, but some clients are now looking for facilities with up to 80-ft of clearance. With the rising cost of land, the smaller cost of increasing building height is compensated by greater storage space for a smaller footprint. However, these facilities require specialized equipment to operate.

Another important area is advanced information and communication technology. As the research by Walter and Poist (2004) highlights, transportation and logistics firms rank the provision of IT high on

their list of features desired at a freight village. Earlier it was mentioned that 3PL firms and other transportation and logistics service providers are among the most innovative types of firms and would be ideal candidates for taking advantage of the features a freight village offers. These types of firms are also the most progressive in terms of the adoption of advanced communication, information, and inspection technologies (Figure 5.6). As Jaržemskis (2007) argues, freight villages can offer the opportunity to share the risks and financing involved in these types of technological investments. When considering the adoption rates of advanced technologies in transportation and logistics, it is evident that this is an area of increasing importance for attracting innovative firms to locate within freight village developments.

Figure 5.6 Advanced Technologies Adoption by Logistics and Transportation Service Providers (% of Firms)



(SCL Canada, 2011)

International trade and customs services are also an area of increasing importance. Leitner and Harrison (2001) view the status as a Free or Foreign Trade Zone, having United States Customs officials on-site, or at least a commitment to obtain these services as critical elements to the successful development of a freight village. This is especially important given the higher rate of interest in the development of a freight village among internationally-oriented transportation and logistics actors seen in the survey by Walter and Poist (2004).

Boile et al. (2008) argue that though the Logistics Centre and Community Integrated Freight Villages discussed earlier in Section 3 are similar in most respects, the community orientation of the latter may prove to be particularly important and lucrative for economic development. They explain that it is the commercial activities in the Community Integrated Freight Village that ensure economic development benefits for the region and local communities and create a buffer between industrial and freight activities and the surrounding neighbourhood, making their location more acceptable to adjacent

communities (Boile et al., 2008). This suggests freight village developers should place a high value on services related to both freight and the wider community if wider acceptance, integration, and development are to be achieved.

In terms of actual site layout, the literature offers a few lessons. In a study of conventional versus advanced layouts of intermodal rail-road freight terminals in the European Union, Ballis and Golias (2002) found that advanced layouts offer distinct differences in productivity over their conventional counterparts. Advanced terminals are those that arrange their transshipment areas in a rectangle formation, compared to a conventional terminal that resembles a long rectangle with a length equal to that of one transshipment lane. Advanced systems also take a different approach to container stacking, conventional terminals make extensive use of wagons as temporary storage points, while advanced terminals minimize their use as much as possible to better utilize rolling stock. Ballis and Golias (2002) find that advanced terminals offer greater efficiency and flexibility in their operations, produce similar throughput to conventional terminals with less handling equipment required, and generate cost savings due to a smaller number of personnel.

5.3.5 Site Management

Lastly, a suitable governance structure and strong management plan is a critical need for ensuring the success of any freight village or logistics centre development. Leitner and Harrison (2001) argue that a freight village development cannot achieve success without capital funding, marketing, and cooperation between the public and private sectors. There are many different ways this can function, which will be discussed further in the next section.

5.4 Funding, Operations, and Management

According to Rodrigue et al. (2010), the financing and management of logistics centres ranges from solely private initiatives to projects highly influenced by public policies and finance, with a whole range of public private partnership arrangements in between. In the European Union, there is considerable emphasis on joint venture public private partnership arrangements as the most widespread and ideal investment and management structure for freight village facilities (FV-2000, 1999; Tsamboulas & Kapros, 2003; EUROPLATFORMS, 2004; Kapros, Panou, & Tsamboulas, 2005; Regan & Golob, 2005; Jaržemskis, 2007; Meidutė, 2007; Wisetjindawat, 2010). Public private partnerships are also becoming increasingly important in the urban distribution aspect of freight villages. A survey of stakeholders by BESTUFS (2008) ranked the importance of PPPs as very high for the current and future development of successful urban goods distribution schemes in the European Union, while the OECD (2003) views PPPs as necessary for effective action in improving urban goods movement.

However, many freight villages and other logistics centres consist of purely private developments, such as the AllianceTexas facility financed by Hillwood and CenterPoint, at which more than $1 Billion in investment was provided by CenterPoint Property. In Canada, smaller facilities such as CPR's Calgary and Vaughan Intermodal Terminals (discussed further in Section 6) and CN's Calagary Logistics Park have been privately financed. Some examples exist in Europe as well, such as Switzerland's Embraport and

LGZ Hochrhein that have been developed, constructed, and managed by a private company in response to market needs. Embraport profits from its good rail, road, and air connections and its location in major Swiss supply chains while Hochrhein successfully hosts many private and semi-private companies on a redeveloped brownfield site (BESTUFS, 2007a). Other examples such as the Raritan Center in New Jersey demonstrate how other types of private logistics centres can evolve over time to become freight villages.

Nevertheless, there is a strong case for the development of freight villages as public private partnerships. By their very nature, freight villages entail a mixture of public and private goals and outcomes. As mentioned previously, a freight village can be seen as both intermodal infrastructure and a generator of business. Kapros et al. (2005) view freight villages as a combination of public facilities and businesses while Tsamboulas and Kapros (2003) argue that freight villages present a dual nature as infrastructure, which is in the domain of public interest, and business-oriented transport services, which refers to market and private interests. This can make their funding, development, and management as public private partnerships very attractive. But despite their different beginnings, both top-down public private partnerships and bottom-up private developments perform similar functions as warehousing and logistics facilities (Boile et al., 2008). While Section 5.1 highlighted that projects with a high degree of private interest and financing were generally more successful than their more public counterparts, these examples highlight that there is no specific formula for freight village development.

5.4.1 Funding

According to Meidutė (2007), there are four general funding schemes for the development of a freight village:

- Combination of private investments, bank loans, and public institution or public limited company funds
- Combination of private investments and bank loans
- Combination of private investments and public institution or public limited company funds
- Fully private investments

For private actors, the benefits of a freight village are tied to the profitability of the project (Kapros et al., 2005) along with other benefits attributed to economies of scale and co-location (Rodrigue et al., 2010) that can provide a return on investment. As the cases show, there are examples in which fully private freight villages have been developed and succeeded. But as mentioned, many freight villages are conceived as public private partnerships using a mixture of public and private funds.

The choice of the public private partnership model and the involvement of the public sector is based on financial, infrastructure, and planning reasons. The rationale behind these investments is that of providing a public good, such as transportation infrastructure, productivity effects, and larger-scale regional policy and planning objectives. This can include increasing regional economic competitiveness, attracting industry, reducing congestion and pollution, improving sustainability, and reorganizing freight distribution to better fit local characteristics such as urban density (FV-2000, 1999; Tsamboulas &

Kapros, 2003; Kapros et al., 2005; BESTUFS, 2007a; Rodrigue et al., 2010). To help make these plans a reality, Wisetjindawat (2010) argues that the public sector should be involved from the very beginning by providing initial funding for research work and pilot studies.

Even in cases with purely private financing, the public sector can play an important role in freight village development through indirect means such as infrastructure development. This support can take various forms, such as providing land at low costs, securing appropriate areas, or direct subsidies (BESTUFS, 2007a). Examples of this are provided in Section 5.5.1 below.

However, a bigger reason for the involvement of the public sector seems to be in mitigating investment risk. According to EUROPLATFORMS (2004), developing a freight village involves a massive investment for the creation of intermodal and other infrastructures, large warehousing space, and other services. The location implies certain costs as well. Regan and Golob (2005) argue that the high cost of land negates developing freight facilities near the urban core. Because of these high investment costs, freight villages should be seen as long-term enterprises that, at least initially, do not represent a truly tempting business for private investors. This makes financial support from the public sector indispensible in freight village development, at least in the initial investment phase (EUROPLATFORMS, 2004; Regan & Golob, 2005).

5.4.2 Management

As mentioned previously, a suitable governance structure and strong management plan is a necessary critical need at a freight village. Meidutė argues that management by a single and neutral legal body is vital if synergy and commercial cooperation are to be ensured (Meidutė, 2007). If a freight village is deemed viable for private investment, a legal entity is formed, funding is secured, and an ownership and management structure is adopted among partners. For privately developed freight villages, this can be between a mixture of private actors according to their investment and role in the facility. In a typical public private partnership arrangement, share capital is owned by public and private partners in different percentages, though in most cases the majority of shares are held by public authorities (EUROPLATFORMS, 2004). The shareholder structure of freight villages represented by EUROPLATFORMS (2004) is generally divided between:

- National and local public authorities
- National and local railway companies
- Local transport associations
- Chambers of Commerce
- Banks
- Insurance companies
- Industrial associations

The management company acquires the necessary land, constructs, operates, and manages the facility, and negotiates agreements with companies interested in establishing themselves on site (Meidutė, 2007). As explained by Kapros et al. (2005), the management company remains the owner of the entire

site and is responsible for leasing or renting space and commercially exploiting services, while in other cases the managing enterprise sells space within the site and retains ownership of common facilities and equipment. Furthermore, if private investors are involved, funds mainly derive from companies located in the freight village who become involved in its ownership and operations (Kapros et al., 2005). According to EUROPLATFORMS (2004), the responsibilities of the management company can be broken down into six categories:

1. *Defining infrastructure necessities:* Road, rail and port connections
2. *Defining the Freight Village layout:* Considering customs infrastructure, postal/bank/insurance services, offices, intermodal terminals, warehouses
3. *Business plan:* Management of a freight village also implies investment and development planning regarding its layout
4. *Creating the general infrastructures, warehouses, and integrated services:* The management company is responsible for the construction of all the infrastructures, once layout planning and the business plan have been completed
5. *Land leasing to transport operators / Warehouse and office leasing / Sale of warehouses and offices:* The management company is responsible for all the procedures regarding the leasing or selling activities, and both the commercial/marketing and legal procedures
6. *Administrative, financial, commercial, and operations management of the Freight Village:* Upkeep and management of common property

5.4.3 Issues

With many public private partnership projects, costs and benefits can be unclear, and long-term success is never guaranteed. As reported earlier, in terms of value for money, there is no clear answer to the question whether the mentioned benefits outweigh the costs, and also those who stand to benefit the most are not necessarily those who bear these costs (BESTUFS, 2007a; Boile et al., 2008).

Furthermore, ensuring a successful relationship between public and private actors is not an easy task. The key to success for most public private partnerships is cultivating a cooperative relationship among public and private actors. Wisetjindawat (2010) cautions that for PPP freight villages, the enthusiasm of private sector partners operating in the project is crucial to its success. This requires developing a common understanding of the benefits of sustainable transport among the private sector partners because the benefits of reduced cost are not always obvious and can cause the private sector to lose interest over time.

As mentioned earlier, Boile et al. (2008) found that private freight villages or those with a high degree of private sector financing and interest have tended to perform better than their public counterparts. This suggests that the existence of a lead private investor and interest from other private sector actors stands to reduce financial risk for all stakeholders involved while providing the leadership and incentive to follow a long-term strategy for freight village success.

5.5 Implementation

While the literature has shown that there are a number of different ways freight villages can be developed, from purely private and public initiatives, to public private partnerships, there are several ways the public sector can help to facilitate the development of these and other logistics centres. Below is an overview of direct and indirect policy tools used in the development of logistics centres and policy tools that can aid in the success of urban consolidation and distribution. This is followed by a discussion of the role of government and the appropriateness of market intervention.

5.5.1 Policy Tools

Many different policy tools have been used by the public sector to influence the development of freight villages. These range from direct policy tools with the primary goal of market intervention for freight village development, to less direct means of promoting an environment conducive to freight villages. As discussed in Section 4.2, there exists a great difference in the scale of public policies employed between examples of freight village development in the European Union and United States. This section explores relevant policy tools used in both jurisdictions below.

Direct Policy Tools

Direct Market Intervention: Market intervention by the public sector has been used to create freight villages in the past. In this case, the public sector acts by itself to develop a freight village site. Several cases of freight village development in Germany and Denmark have been the result of direct policy intervention by public sector actors (de Cerreño et al., 2008). For example, Hesse (2004) reports that after reunification in Germany, governments in Germany developed a plan for three integrated logistics centres in the Berlin-Brandenburg region. In each case, the public sector procured the lands for development, supplied multimodal infrastructure, and attracted tenants to the sites through cheap land costs and zoning regulations for industrial and commercial use, allowing for 24-hour operations (Hesse, 2004).

Public Private Partnership: Aside from direct market intervention, common among the examples of freight villages and other logistics centres in the European Union is joint development by public and private sector actors. As discussed in Section 3, Interporto Bologna was developed as a joint venture between the Italian Government and the Italian national rail companies and continues as a PPP through the creation of a joint-stock management company. Similarly, the GVZ Bremen freight village was developed as a public private partnership between the State of Bremen and Deutsche Bahn, a German national rail carrier. The Roissy-SOGARIS freight village outside of Paris, France was created by four regional governments that maintain a dominant position in the management and operations of the facility with 80% of the shares. The remainder is held by a variety of private firms (de Cerreño et al., 2008).

Public private partnerships are also increasingly being used in the United States, as seen in the examples of the Compact Intermodal Center and Winter Haven ILC covered in Appendix F. However, the scale of public involvement in these initiatives is generally less than that seen in European examples.

Indirect Policy Tools

Infrastructure: The public provision of infrastructure is one of the most common methods used by governments around the world for contributing to the development of freight villages and other logistics centres. For example, while CenterPoint Property provided $1 Billion for the development of the CenterPoint Intermodal Terminal, the State of Illinois was also actively involved in the project by providing $75 Million for road, water, and sewer facilities for the site (de Cerreño et al., 2008). The Global TransPark facility near Kinston, North Carolina was provided $80 Million in grants and loans from federal and state government sources to construct a runway for airfreight operations. At the same facility, local infrastructure was provided to the site by a $5 per year increase in vehicle license fees in the 13-county surrounding area (Walter & Poist, 2004). AllianceTexas also benefitted from the construction of State Highway 170 to the site by the Texas Department of Transportation (de Cerreño et al., 2008).

In Canada, CentrePort has benefitted from the public sector's support of the project through infrastructure, such as the joint investment of $17 Million by the City of Winnipeg and the Province of Manitoba to provide water and wastewater servicing, and the construction of the new CentrePort Canada Way expressway to the site at a cost of $212.5 Million, funded by the provincial and federal governments (CentrePort Canada, 2011).

Furthermore, aside from directly subsidizing intermodal transportation, governments in North America can contribute to improving the competitiveness of intermodal transport by funding required infrastructure, particularly changes to tunnels and bridges to allow for double-stacking that can greatly increase the volume and minimum competitive distance of intermodal options for shippers (Anderson, 2008).

Financing: Outside of incentives, infrastructure, public private partnership arrangements, and direct public involvement, some freight villages and logistics centres are financed to different degrees by the public sector. For example, freight villages in Italy have been directly financed by the public sector through the passage of law 240/90 in 1990 that saw the federal level of government embark on a comprehensive plan to develop a network of intermodal logistics centres across the country (Interporto Bologna SpA, 2005). Tax Increment Financing has also been used as a way for public sector actors to directly invest in the development of logistics centres and recover funds over time. This is currently employed at CentrePort in Winnipeg as discussed in Section 3, and the CenterPoint Intermodal Center near Chicago, which received $125 Million in tax incentives towards the project from the City of Elwood (de Cerreño et al., 2008).

Tax Incentives: Tax incentives can also be a powerful way for the public sector to influence the development of a site into a logistics centre or the attractiveness of a current facility to firms. As mentioned, CenterPoint Intermodal Center received $125 Million in tax incentives to develop on a former military arsenal. Another example is a site selected for the potential development of a freight village in the New York metropolitan area by Boile et al. (2010) that qualified for a number of financing and tax incentives, such as the SBA HUB Zone program, which provides contracting assistance to small businesses located within the zone, the New Market Tax Credit which provides financing for up to 20%

of project costs for projects over $5 Million, and the New York State Empire Zone which provides various tax incentives.

De Cerreño et al. (2008) note that many freight villages benefit from tax breaks and other tax initiatives that can factor into the attractiveness of a location. Bowen (2008) reports that over the past 25 years, a lower tax rate in Nevada has made it a more attractive place to warehouse and distribute goods than neighbouring California. Similarly, the Province of Manitoba offers a host of tax incentives for businesses, such as no small business income tax, a low corporate income tax rate, fuel tax reductions on domestic cargo and exemptions on international cargo flights, and manufacturing investment tax credits (Government of Manitoba, 2011). While not limited to a specific site, the combination of these and other incentives can provide an attractive package to firms to locate within a logistics centre. Taxes can also be used as disincentives that can influence the attractiveness of logistics centres. These will be discussed further below.

FTZ Status: The public sector can also use the designation of a location as a Free Trade Zone as a policy tool to increase the attractiveness of a site or facility for conducting business. Many freight villages and logistics centres in the United States use FTZ status as a way to attract customers by offering tax incentives, bonded warehouses, and customs and border clearance advantages by having customs agents on site.

As outlined earlier in Section 3, the Government of Canada advertises Foreign Trade Zones as its own equivalent version of this tax and trade incentive. However, the opportunity for public sector actors to extend these benefits to freight villages and logistics centres in Canada as a way to attract tenants appears limited, as regulations allow the creation of 'Foreign Trade Zones' anywhere in the country. While CentrePort Canada advertises itself as Canada's first Foreign Trade Zone, the ability for any company to designate their current site as a FTZ means the impact of this branding is likely to be limited to offering one-window access to tax and customs services.

Land Use Regulation and Planning Initiatives: The public sector can also have a large influence on the development of logistics centres through zoning and land use planning initiatives. The goal of these policy tools is for the creation of protected areas for development with detailed secondary plans.

One of the best examples in the United States is the creation of the Guild's Lake Industrial Sanctuary in Portland, Oregon. In 1996 it was recommended that specific boundaries be delineated for the creation of an industrial sanctuary. The goal of this project was to protect these lands and the sunken investments in freight infrastructure from competing land uses by creating a buffer between industrial and residential land uses. In 2001 the Guild's Lake Industrial Sanctuary Plan was released, providing the policy framework for retaining the existing uses while balancing the needs of these uses from the surrounding communities. This was accomplished through zoning code text amendments and the development of an Action Plan for providing direct access to interstate highways and the provision of rail service throughout the site. The resulting site is considered a prime scenario for the eventual development of a freight village (de Cerreño et al., 2008).

A similar scheme has been employed at CentrePort in Winnipeg, where 20,000 acres of land have been zoned for industrial and commercial land uses. Additionally, CentrePort's managing corporation is working with developers and landowners to create a draft land use plan and special planning area for the entire site to ensure the development of the site according to a rational and master-planned approach and the protection of industrial lands from competing land uses.

Political Initiation and Support: Many freight villages and other logistics centres have benefitted from a strong level of support from politicians and the public sector through project initiation and planning. Aside from major public initiatives like the freight villages of the Berlin-Brandenburg region mentioned above, public support has also been important for a number of smaller developments. For example, the active public participation in the development of the Compact Intermodal Centre in Hillsborough, New Jersey has allowed the public sector to shape the details of the project to make it more acceptable to residents. Somerset County and its consultant team hope for the development of a sustainable freight facility on a brownfield site with the goal of reducing any negative impacts on the surrounding communities (de Cerreño et al., 2008). The resulting political and popular support is considered a crucial element in the project's chances of success.

Like the Compact Intermodal Centre, the City of Winter Haven and CSX Transportation are collaborating to jointly develop the Winter Haven Intermodal Logistics Centre. The 1,250-acre project is being built on public lands and will feature a new intermodal terminal and warehousing facilities. The City of Winter Haven and State of Florida have shown support for the project for its potential to generate economic investment and approximately 8,500 jobs for the region (de Cerreño et al., 2008).

Transportation Regulation and Subsidies: A major contributor to the success of freight villages in the European Union is the public sector's support for intermodal transportation. Many European national governments subsidize intermodal transport in a variety of ways. For example, the dominant position of rail freight and intermodal transportation for goods movement in Sweden has been attributed to the strict regulation of road transport (28 tonne limit) and subsidies for piggyback intermodal operations (Wiegmans, Masurel, & Nijkamp, 1999).

The French Transport Ministry subsidizes cargo handling operations for containers that use intermodal transport. According to Frémont and Franc (2010), in 2007, this aid amounted to €12 per container per handling operation and can be extended to four operators and a maximum of €48 to increase the competitiveness of inland transportation. Another example is the Autonomous Port of Paris, which reduces property rent costs for shippers or forwarders according to the volume of freight they move using water-borne transport. This discount lowers 'last mile' transportation costs and increases the competitiveness of short sea shipping versus road and other transport modes (Frémont & Franc, 2010).

In rare cases, the public sector can also subsidize the operations of a freight village's intermodal infrastructure. For example, at the privately developed LGZ Hochrhein, 70% of the operating costs of the intermodal terminal are supported by the government, whose stated policy is to support the shift of freight from road to rail (BESTUFS, 2007a).

Transportation Taxes and Charges: Many jurisdictions have adopted disincentive policy tools to internalize the external costs of transportation and influence the adoption of intermodality. Aside from subsidy programs, the viability of intermodal transportation in the European Union is also heavily influenced by the combined charges, taxes, and regulations EU Member States. A study by the Real Cost Reduction of Door-to-Door Intermodal Transport group supported by the Commission of European Communities (RECORDIT, 2001) provides an analysis of the variety of charges incurred in European road and intermodal transportation. An overview of the categories of policy tools used in transportation in the EU is provided in Appendix H. In calculating the total cost of road and intermodal transportation along a number of corridors, the group found that after totaling fuel taxes, infrastructure fees, road tolls, and other charges imposed by European governments, the fees for intermodal transportation are low, with intermodal consistently receiving higher subsidies than road transport (RECORDIT, 2001). For example, in the corridor of Athens to Gothenburg, the sum of taxes and charges minus applicable subsidies amounts to a trip cost of €1,317 per semi trailer versus €638 for intermodal transport (RECORDIT, 2001).

Infrastructure charges have been used to benefit intermodal transportation and the success of an inland port project at Port Botany, near Sydney, Australia. Rather than directly subsidize rail intermodal transportation, the public sector chose to implement a $30 charge for both rail and road transportation at the inland port. However, the rail charge would be refunded to operators with the revenue from the remaining road levy used to finance rail infrastructure and support its competitiveness versus road transport (Roso, 2008).

Urban Consolidation and Distribution

A number of different public policies appear to play a fundamental role in the success of urban consolidation and distribution schemes. Generally, European governments have enacted a much more comprehensive system of incentives and disincentives to promote increased urban consolidation and distribution schemes. The city of Rome for example utilizes a central limited traffic cordon zone with 24 electronic entry gates and restricted access during peak hours on weekdays. Many other cities worldwide have initiated electronic cordon and tolling schemes for city centres that BESTUFS sees as a positive measure for increasing the viability of urban distribution activities and improving the efficiency of urban freight movements (BESTUFS, 2007a). Charges have also been used to shift transportation demand to off-peak times, such as the introduction of a fee for truck traffic at the Ports of Los Angeles and Long Beach in 2005. The Traffic Mitigation Fee is required for truck movements during peak hours and has resulted in a shift of truck traffic to nighttime and weekends instead, with an estimated 30-35% of typical day container transportation shifting to off-peak hours (Wisetjindawat, 2010).

A similar system was developed for the Enfield Inland Port in Australia, at which a ‘pay for slot’ auctioning system was devised to shift demand to off-peak hours. The system was designed so that peak hour slots would be the most expensive so that the arrival of trucks would be spread throughout the day. Furthermore, with no change on rail, a secondary goal was to increase the utilization of intermodal transportation (Roso, 2008).

Other policy tools include urban distribution zones, centralized collection and delivery points, vehicle restrictions and design requirements, and information-based tools such as real-time traffic information, delivery auctioning, and intelligent routing and scheduling (OECD, 2003; BESTUFS, 2007b). Appendix I presents an overview of several of these initiatives in use in the European Union.

5.5.2 Government Intervention

The rationale, justification, and scale of government intervention required is ultimately an issue of local circumstances. As discussed previously, many European freight villages are the result of strong public policies, while market forces have generally dictated the development of their counterparts in the United States. Ultimately the answer to these questions is best left to local authorities, though in the case of Ontario this will be discussed further in Section 6.

A related issue exists with respect to managing expectations and contrasting public goals with market realities. As Hesse (2007) explains, ambitious public plans have the potential to not achieve public goals, and the public sector risks failure in its freight village endeavours. In general, the power relations between public and private actors are shifting towards the private side in freight and logistics-related development. For example, infrastructure provision was traditionally an area of public decision-making, but it is now increasingly subject to private influence. As such, any freight village undertaking should include private sector interests from the start and view the interest and cooperation and interest of these actors as fundamental to the likelihood of success.

Furthermore, Hesse (2007) argues that the public sector should manage its goals for any freight village or logistics centre project. This can come by recognizing that road transport is currently the most competitive option for distribution and should be considered an important aspect of planning any changes to the freight system. However, Hesse (2007) does conclude that the market potential for logistics centres exists and that these facilities can play an important role in future freight and logistics processes because they offer solutions to overcoming capacity and acceptability constraints at other locations.

5.5.3 Overcoming Impediments

There are many impediments to freight village development, though they are not widely discussed in the research. The only research on the topic comes from Roso (2008), who interviewed stakeholders involved in the development of two inland ports in Australia. The impediments encountered can be classified according to five different criteria:

- *Regulations:* Such as the regulation of the rail or freight sectors.
- *Environment:* Bureaucracy and politics related to environmental issues. Can spark NIMBY responses
- *Land use:* Trade-off between the cost of land and accessibility to markets. Also related to environmental issues.
- *Infrastructure:* The sharing of rail infrastructure with passenger services has led to restrictions on freight movements. Also road and terminal congestion and infrastructure capacity issues.

Other impediments exist in navigating the web of actors and stakeholders involved in local and regional planning processes. For example, CenterPoint Property, the developers of the CenterPoint Intermodal Center estimate that it dealt with 50 different governmental entities to get the project off the ground (Brick, 2002). Some jurisdictions have overcome these challenges, such as the case of Kansas City in Section 3, wherein KC SmartPort was designed to coordinate the many different actors involved in promoting the region as a magnet for freight and logistics development. As for the other examples mentioned above, issues related to freight village development will have to be assessed on a project-by-project basis with a minimization of impediments for freight village and logistics centre development to occur.

5.5.4 Critical Needs for Success

As outlined earlier, the interest and involvement of private actors in freight village development has been shown to increase the performance and chances of success of these projects. Likewise, private actors interested in creating freight village or other logistics centres have assembled critical needs that they feel are necessary for the creation of a successful site.

For example, Leitner and Harrison (2001) and Rahimi et al. (2008) report that the Lynxs group, developers of the March GlobalPort in North Carolina and other air cargo operations in the United States considers existing supply the most critical need of a location. Before investing in a new air cargo operation, the Lynxs Group examines the Standard Industrial Classification (SIC) codes for goods frequently shipped in the region. The top twenty codes are examined to determine if adequate supply exists in the region and if a potential to increase this supply is evident. If so, the Lynxs Group will consider developing a new air cargo facility in the selected region (Leitner & Harrison, 2001; Rahimi et al., 2008).

Robinson (1999) provided a list of assets necessary for the development of a logistics centre derived from the work of Trade Point USA:

- *Intermodal Transportation Capacity:* Air, rail, highway, deep-water access
- *Demographic Advantage:* Close to a large percent of national population
- *Geographic Advantage:* Access to markets
- *Presence of Shippers:* Does demand already exist?
- *Information Technology Infrastructure:* Is the infrastructure in place?
- *Public/Private Cooperation:* Is there an established working relationship?
- *Councils:* Address concerns of interested parties
- *Aggressive Marketing:* Obtains community support and attracts business
- *Capable Program Management:* Leadership to move the project forward

According to Rahimi et a. (2008), the developers of AllianceTexas have assembled a list of seven required assets for the development of a freight village of a similar size and scope:

Critical Needs for AllianceTexas
1. Base population 3 million
2. Multiple modes
3. 5,000-10,000 acres
4. Tax and other incentives
5. Strong employment base
6. Telecommunications
7. Foreign Trade Zone Status

Rahimi et al. (2008) argue that strong financial backing should be added to this list, as Hillwood's substantial resources have allowed for multi-year promotional strategies. Based on these requirements, Hillwood believes that a freight village of the size and scale of AllianceTexas can only succeed in four or five areas of the country, such as the large population base and available land required (Rahimi et al., 2008).

From these examples, Leitner and Harrison (2001) identify five selected preliminary critical needs that can be considered prerequisites for the successful development of a viable freight village:

Modal Capabilities: By definition a critical part of a freight village is transportation assets, such as highway connectivity and proximity to rail, air, or waterway transport.

Existing Demand: Demand in the form of existing cargo shipped or motor carriers, logistics firms, or freight forwarders must exist for a freight village to survive. Without this asset base, it will be difficult for such a facility to successfully operate at its location.

Locational Advantages: Existing demand is related to the critical need for locational advantages, such as a large population base within close proximity that can provide consumers for goods and workers for the wide range of jobs available at a freight village and its freight and logistics cluster.

International Trade Facilitation: Facilitating international trade through Foreign Trade Zone status is seen as a critical element of freight villages and other large-scale logistics centres in the United States. Furthermore, sufficient telecommunications infrastructure to facilitate electronic information flows attached to this trade is required.

Management Plan: Lastly, a freight village cannot succeed without capital funding, marketing, and cooperation among public and private actors. This is accomplished through an appropriate and effective governance structure and management corporation according to the mix of actors involved in the development of a freight village. Related to this issue are partnerships between public and private actors to achieve common goals, such as utilizing public actors for land use and zoning changes that can benefit the operations of a freight village.

Applicability to Ontario

The purpose of this chapter is to consider the potential future role of freight villages in Ontario. Up until now, the discussion has focused on the concept of freight villages and associated experiences and practices from around the world. To assess the potential for Ontario, this chapter is composed of two distinct sections. The first section explores existing freight clusters in Ontario and pays some attention to how they got there in the first place. Some original analysis of the Canadian Business Patterns database, as it relates to freight, is carried out to assist in characterization of Ontario freight clusters. The second section seeks to assess the prospects for freight villages in Ontario and offers some observations to that effect as well as some possible policy directions. The discussion in this chapter is intended to be locationally higher level in nature although some specifics of certain freight clusters are described.

6.1 Freight Clusters

The purpose of this section is to give an overview of Ontario's freight clusters. The rationale of the section is that vibrant freight clusters which generate substantial movements of goods are arguably the single most important pre-requisite for the development of a freight village. Other pre-requisites for a proper freight village include the need for an intermodal facility to serve as the anchor and sufficient land for freight-oriented development in the vicinity.

Bearing these pre-requisites in mind, the discussion in this section proceeds as follows. Initially, there are brief overviews of firm location factors at the macro and micro levels since these matters have much to do with the development of freight clusters. The next step is an introduction to a freight-oriented analysis of the Canadian Business Patterns data for major census divisions in Ontario to assess issues such as whether demand is adequate. These census division units, and the data applying to them, act as a proxy for freight clusters. Intertwined with the reporting of the results of the analysis are descriptions of the various freight clusters both in and outside the GTHA.

6.1.1 Freight Cluster Location Factors

It is important to remember that all forms of goods movement are derived demands and in general, the amount of such movements is strongly related to the state of the economy. Substantial freight clusters will come about if there are large metropolitan markets nearby or if a location is a very strategic place for goods to change modes. Halifax is a good example of the latter. In the case of Ontario, the development of freight clusters has had more to do with the former than the latter. The large metropolitan population is certainly a magnet for freight clustering but from the rail perspective the GTHA serves as a natural focus for the north-south lines that extend as far as the Gulf coast and the east-west lines that cross all of Canada.

There is an extensive literature on why industrial clusters in general are located where they are and a lot of the reason comes down to agglomeration economies in which firms derive various benefits from locating closely to one another (e.g. Combes et al., 2011; Delgado et al., 2010). Access to large pools of human capital and access to suppliers and markets are examples of specific factors. Large metropolitan areas are the only places that can really provide the scale that is necessary for many agglomeration economies to be realized and there are only a few cases scattered across the country that provide that requisite scale.

In Ontario, the GTHA stands alone in metropolitan stature. It accounts for over half of provincial GDP and this high share reflects itself in freight activity. Like many other forms of economic activity, it appears that goods movement entities benefit from urban agglomeration economies. As subsequent results will show, to a large extent, other urban centres in Ontario are left on the outside looking in as it relates to capturing a large share of provincial freight activity. It is difficult to defy the laws of agglomeration economies just as it is difficult to defy the laws of gravity.

Having briefly described forces that operate at the macro-level, consider some of the forces at work at the micro-level which determine where, within a metropolitan area, freight clusters are likely to locate. In Central Ontario, the location pattern of firms is consistent with the freight decentralization trend witnessed in both North America and the European Union (Hesse, 2008). Growth in transportation and warehousing businesses has been skewed towards the outlying areas of the GTHA (Jakubicek & Woudsma, 2010). Because many municipalities lack brownfield sites that are suitable for industrial development, most development has occurred on greenfield sites, except where these lands are protected or critical to tourism and agriculture (MTO, 2004).

Generally firms are seen to choose a location based on a set of competing demands – namely the desire to locate closer to customers for quick cut-off times, but also as far away as possible from congestion and high land values (Hesse, 2008). Jakubicek and Woudsma (2010) explored this issue for the GTHA, and identified 'push out' and 'retain' factors for businesses. These issues can be grouped into four major categories: direct and indirect costs to business, which covers land costs, taxes, and the regulatory environment; land use and availability, such as proximity to customers, suppliers, and competitors; transportation and logistics issues such as connections to different modes, site features such as dock doors, truck accessibility, and 24-hour operations; and the availability of skilled and unskilled labour.

Table 6.1 Location Factors - Relationship between Importance and Satisfaction

	Low Satisfaction Factor	High Satisfaction Factor
Low Importance	*Neutral Effect* • Long combination vehicle accessibility • Sea port access	*Slightly Retain* • Proximity to similar businesses • Highway visibility • Airport access • Rail intermodal access • Availability of unskilled workers
Neutral Importance	• Public transit availability	• Truck staging area
High Importance	*Push Out Factors* • Land costs/tax rates • Availability of Skilled Workers • Business regulatory environment • Land available for expansion • Number of dock doors	*Retain Factors* • Access to major suppliers • Ability to operate 24/7 • Proximity to highways • Trailer parking • Access to major customers

(Jakubicek & Woudsma, 2010)

Two secondary trends in firm location are the growth of 3PL and other logistics service providers, and the development of larger centralized distribution centres rather than a more widely distributed system. As 'Canada's Logistics Hub', the GTHA houses more 3- and 4PL firms and national distribution centres than any other location in Canada (MTO, 2004; Rodrigue, 2011). For these firms, land costs and availability tend to be more significant in locational decisions than proximity to markets. This allows distribution centres and other logistics facilities to be located outside of core areas, so long as the distance can be overcome by good transportation options.

The Supply Chain & Logistics Association of Canada (2011) reports that logistics companies are increasingly interested in the number of doors and height clearance of potential facilities. These types of criteria would tend to favour newer, outlying areas. Overall, freight villages would appear to address many of the 'push out' and 'retain' factors identified by Jakubicek and Woudsma (2010) by providing:

- A larger site with more infrastructure and services at a lower cost and the availability of land for expansion
- Better access to major suppliers, markets, and competitors through co-location and a site near the urban core
- Logistics provisions such as purpose-built warehousing space with large doors, good truck access, 24/7 operations

- Transportation factors such as accessibility to highways and other modes of transportation

A Ministry of Transportation report incorporated stakeholder interviews with trucking companies to argue that while congestion can influence the general location of industry, it will not alter the tendency to locate in close proximity to highways. It was noted that even locating relatively far from the GTHA is not a disadvantage as long as the metropolitan market is easily reached (MTO, 2004). The same study notes some issues that arise from the focus on highway locations:

- *General shortage of capacity on roads*: The heavy use of the 400-series highway system and local municipal access roads by both freight and passenger vehicles has resulted in general road congestion and capacity issues.
- *Lack of access to rail services*: Stakeholders noted inadequate access to intermodal facilities in the GTHA due to congestion in the terminal periphery and capacity issues.
- *High costs of congestion to freight carriers*: Road-based carriers are generally paid by distance and find it difficult to maintain profit margins as delays increase. Furthermore, congestion delays vary significantly from one day to the next, which has a profound effect on reliability and Just-In-Time logistics.

6.1.2 Freight-oriented Analysis of Canadian Business Patterns Data in Ontario

Data and Assumptions

The Canadian Business Patterns data, available from Statistics Canada, provides a useful tool for assessing the vibrancy of freight clusters within the province. The data are categorical business counts obtained via the Canadian Business Register. Firms that have payrolls are very well covered in Canadian Business Patterns but the data do represent a large number of firms which are described as "indeterminate." It is safe to assume that these are all very small and in the neighbourhood of one or two employees. These are not taken into account in the current analysis. All other firms are assigned one of eight employee count categories: 1-4, 5-9, 10-19, 20-49, 50-99, 100-199, 200-499 and 500+.

The data are not spatially detailed but they are very sectorally detailed. Consider the spatial theme first. For the purposes of this analysis, MITL obtained data based at the census division level of aggregation. The main significance of using this level is that the main GTA clusters are broken into Toronto, Peel, York, Halton and Durham whereas in the census agglomeration version, these are all grouped under Toronto. The census agglomeration version is a better choice for representing outlying clusters in that, for example, data would be available for London rather than the Middlesex census division.

On the sectoral side, classifications are based on the North American Industrial Classification System (NAICS), which divides firms into over 900 different categories and provides the capability for higher-level groupings as well. Sectoral detail can have its disadvantages as well since firms are capable of changing sector from one time period to the next. There are certainly many instances where firms operate in several six-digit NAICS categories which can cause classification problems. The particular assignment for a firm is based on the six-digit category which provides the highest revenues and of course that category can change for a firm as business conditions change.

Business counts in and of themselves are not terribly useful in that a 1 person firm is given as much weight as a 1000 person firm. Meanwhile, categorical employment categories are not very easy to compare from case to case since a whole range of numeric values need to be considered. For these reasons, it makes sense to define an "employee index" to enable comparisons. For a given census division, the employee index for a certain sector is obtained by multiplying the business count by the category midpoint for each class and then summing the result across all eight classes. In this way, the result is one number per census division/sector combination.

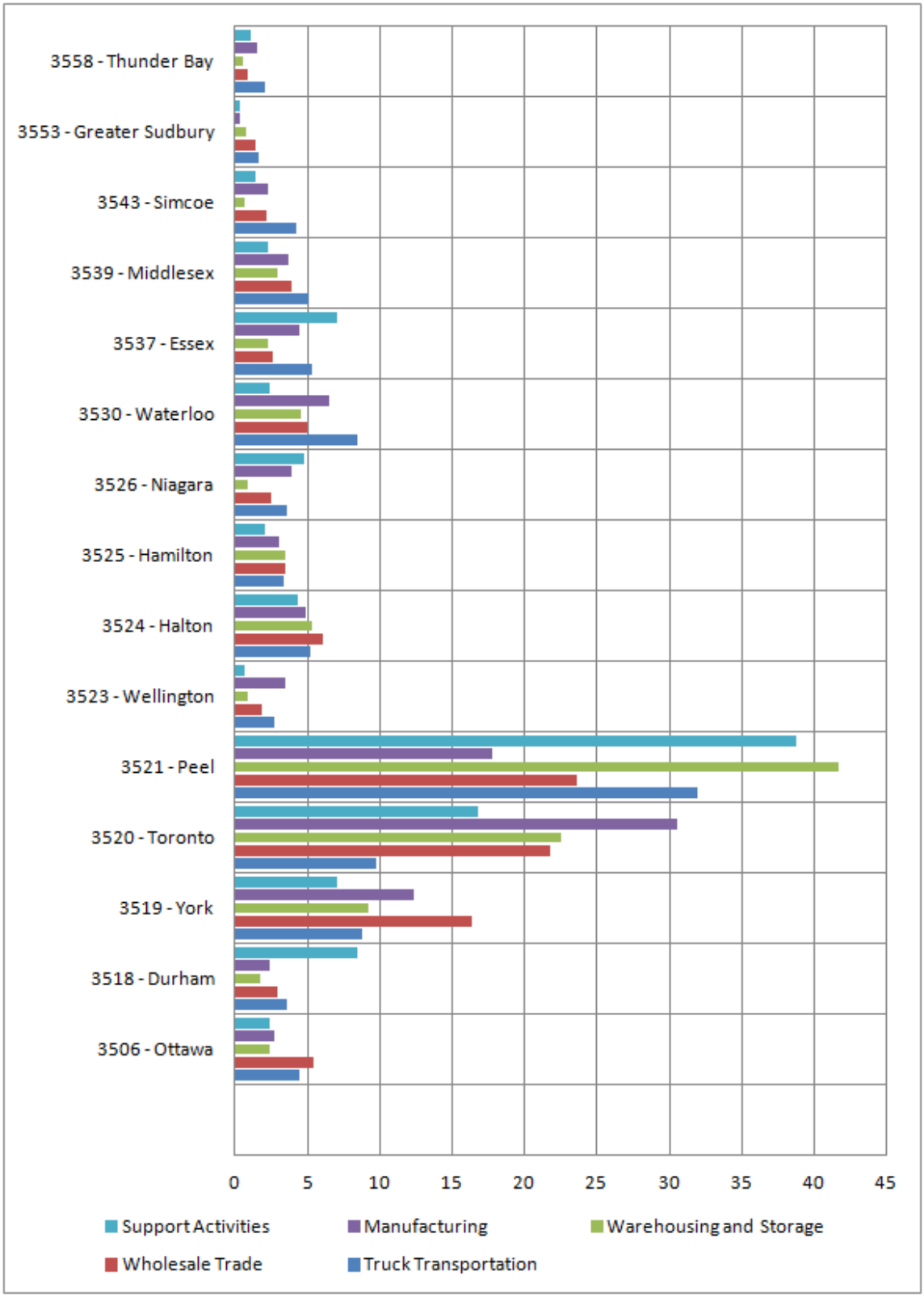
There are some caveats to be borne in mind with this approach. The most obvious is that these will not be the actual employment counts for the sector but rather will be estimates. The actual total of employees for a firm in the 200-499 category is not known. We choose to make the simple assumption that it is 350. It is possible to make large errors for any given firm with many employees. There are a few firms that employ 5,000 or more people but we choose to assume that any firm in the largest (500+) category is 1,000 employees. This assumption will overestimate for most large firms but will underestimate a few. Overall, use of the Canadian Business Patterns in this manner will provide particularly useful estimates for small and medium enterprises which one could argue are an important aspect of vibrancy in freight clusters. In the rail sector, the data will be ineffective because CN and CP dominate employment as very large firms.

It is important to note that Statistics Canada discourages use of the Canadian Business Patterns data for longitudinal or time series forms of analysis. They suggest that over time, there are too many changes in their classification that can take place. Nevertheless, data have been obtained over several time periods and some tentative steps will be taken in the analysis to do some comparisons over time. The reader should consider the results bearing some of the assumptions and risks in mind. There are few comprehensive data sources in Canada that capture employees in great sectoral detail at their place of work so it is important to extract the most out of these data.

Results

In the charts below, an overview of results across the primary Ontario census divisions is presented. In Figure 6.1, a 2011 percent distribution of the employment index is given for five important sectors that are associated with freight clusters. One category needing further clarification is "support activities" which actually relates to NAICS code 488, which is support activities for transportation. This category has actually been filtered to remove certain six digit codes associated with marine. This category may be an imperfect surrogate for 3PL, and 4PL activity although neither is specifically identified in the NAICS codes. The other categories are fairly self-explanatory. It is important to keep in mind that these are percentage distributions and that some sectors are much larger than others on an absolute basis. The results described here have been developed on a relative basis.

Figure 6.1 Percent Distribution of Employment Index by Key Sector (2011)



It is interesting to note that Peel is leading Toronto in every category except for manufacturing. Peel is relatively strongest in all the categories that are directly related to transportation but is certainly not weak in any of the sectors. Peel, Toronto and York distinctly stand out from all the others and are the regions closest to the heart of the metropolitan areas. While Durham, Halton and Hamilton are part of the GTHA, they are not on the same level as freight clusters based on these results. Outside of the "big three" census divisions, the ranking for general prominence across the five categories would be 1) Halton, 2) Waterloo, and 3) Middlesex with Hamilton and Essex close behind.

Certain divisions show spikes in certain sectors but the above ranking is based on the sectors taken together. For Hamilton, it is interesting to note that when the effect of large employers is removed, as it is in this analysis, that this division does not particularly stand out for manufacturing. Halton, which has similar access to the QEW but is nearer to the heart of the metropolitan area, would appear to have a more diversified manufacturing base.

Figure 6.2: Percent Distribution of Employment Index (2011) - GTHA versus Non-GTHA

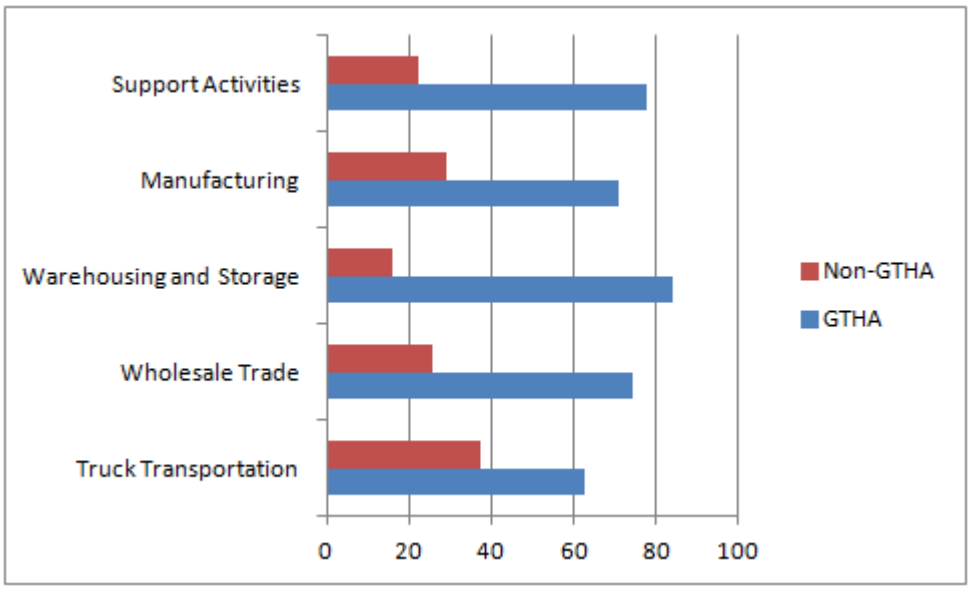


Figure 6.2 is showing the same information as Figure 6.1 but in a more aggregated way. The census divisions under study have been grouped based on whether or not they are in the GTHA. The results support the fact that a lot of the freight-related activity in Ontario is taking place in the GTHA. Based on the employee index, over 80% of warehousing and storage is intra-GTHA. Of course, if smaller Ontario census divisions that have been excluded from this analysis are added, this percentage would decline somewhat. Truck transportation appears to be the most decentralized of the sectors. While the trucking sector need not highly concentrate itself in the GTHA, it is true that good access to Hwy 401 is quite important for some of the divisions such as Waterloo, Middlesex and Essex.

Figure 6.3: Percent Distribution of Employment Index by Trucking Sector (2011)

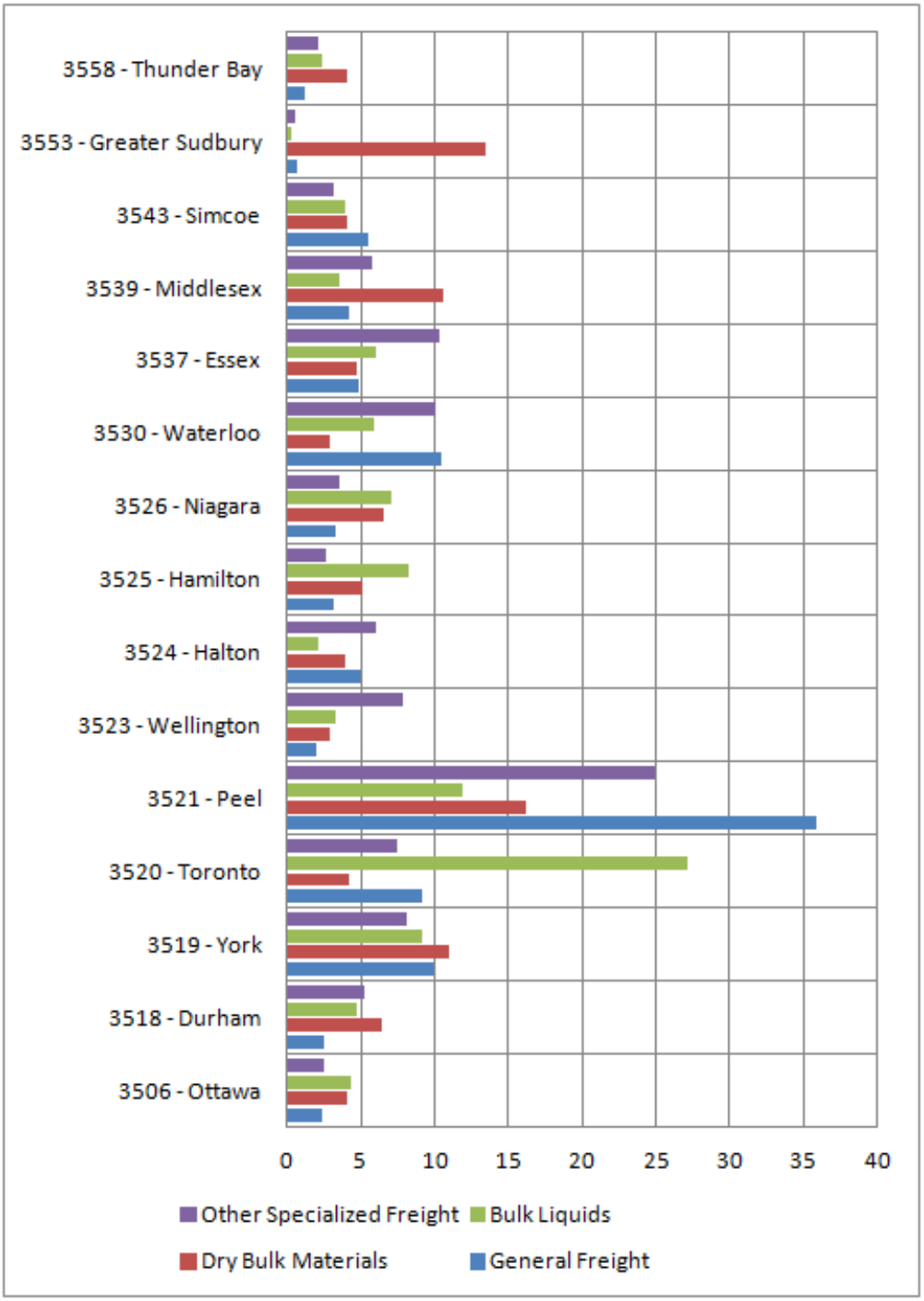
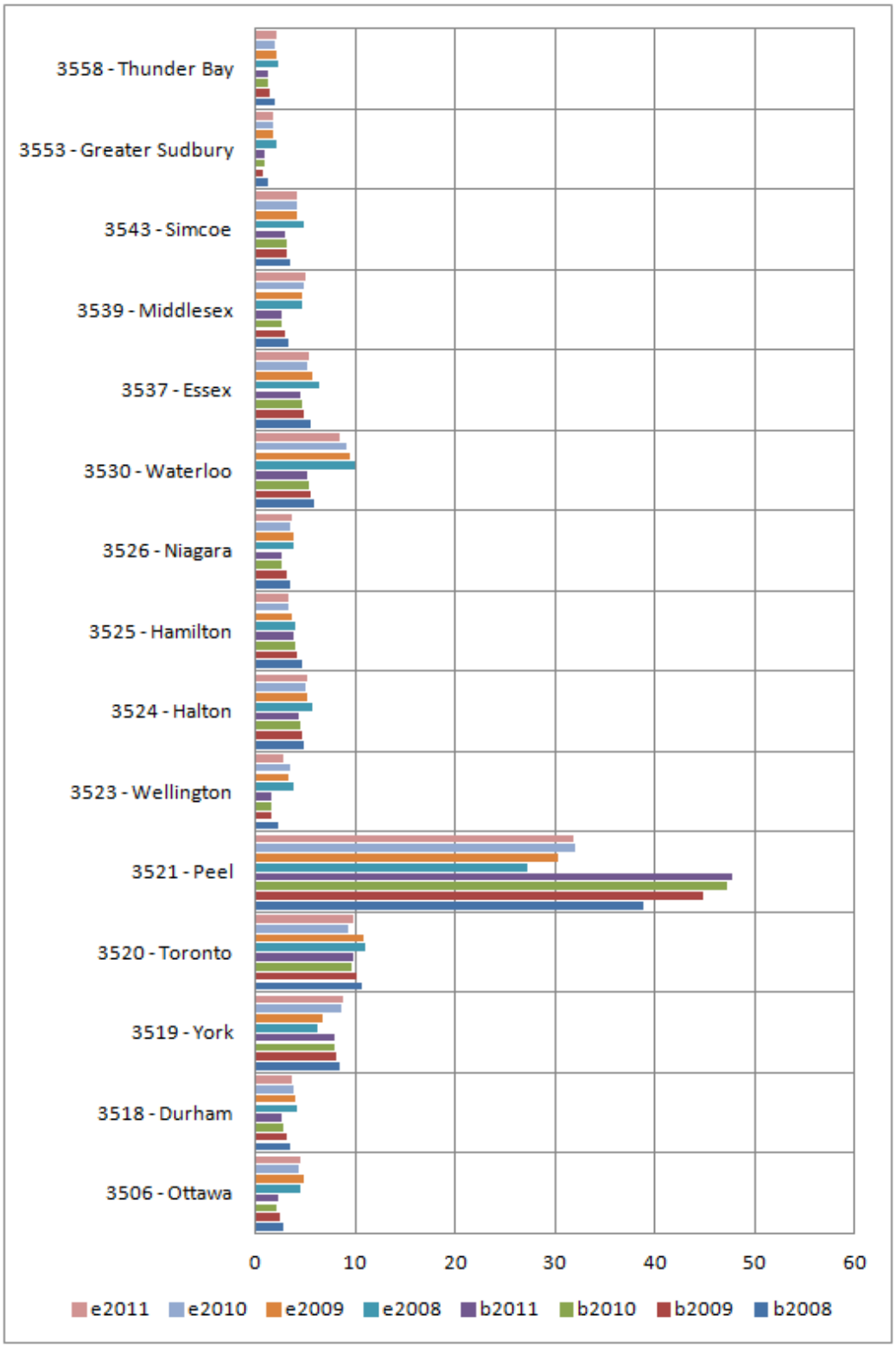


Figure 6.3 is set up in the same manner as Figure 6.1 but focuses on the distribution of particular trucking activities across the census divisions and illustrates that the NAICS system has a great deal of sectoral detail. It seems that a focus on trucking sectors reduces the degree to which York and Toronto regions stand out from the others. Peel, in contrast, continues to stand out. In General Freight, which is the largest of the sectors in absolute terms, the second place region has a score of about 10% while

Peel is over 35%. Interestingly, Waterloo's score in General Freight is higher than all other divisions except for Peel. The one trucking sector in which the Toronto division dominates is bulk liquids. This result likely derives from the fact that many of the main flammable liquids and liquid food products are originating from or destined to the core of the metropolitan area.

Finally, Figure 6.4 interjects a time series component into the process by considering overall distributional patterns in the trucking sector since 2008. This chart expresses the employee index and the business count data as percentage distribution across the time periods. "E2011" refers to the employee index and "B2011" refers to the business count. In terms of the employee index, few of the census divisions are showing increases and many are showing declines. The same pattern is apparent for business counts. Peel appears to have been overcoming the recession to some extent as it is showing positive growth in terms of trucking businesses and employee index. Note that the business count scores for Peel exceed its employee index scores. This result would indicate that Peel has relatively more small firms in the sector than other divisions which could be taken as a sign of vitality. York division is showing growth in the employee index but not in business count which would indicate that the average size of its businesses could be increasing. In short, the only region that appears to be showing any sort of dynamism in the recent harsh environment is Peel. The region that was already the strongest in freight has been getting relatively stronger.

Figure 6.4: Truck Transportation - Employment Index and Business Counts Percent Distributions (2008-2011)



6.1.3 Primary Freight Clusters in the Greater Toronto Hamilton Area

This subsection continues on with the data analysis but focuses on freight clusters within the GTHA. More attention is paid to absolute data in terms of business counts and jobs by sector. While the discussion so far has focused on freight clusters at the census division level, Table 6.2 below outlines some of the key freight nodes within these clusters and the typical weekday truck counts that are associated with these nodes. As well as being the biggest freight generators within Peel and York regions, this is a good list of the largest freight generators within the GTHA.

Table 6.2 Major Freight Clusters and Trip Generators in the GTHA

Region	Cluster	Selected Terminals/Facilities	Truck Count per Weekday
Peel	Pearson Airport/Northeast & Gateway Business Parks, Mississauga	Lester B. Pearson International Airport	21,770
		FedEx Airport Operations	
		SCM Maritz Dr.	
		SCM Courtneypark	
	CN Intermodal Area Business Park, Brampton	CN Brampton Intermodal Terminal	2,256
		Canadian Tire Billes Distribution Centre	
		Canadian Tire Brampton Distribution Centre	
York	Vaughan Business Centre	CN MacMillan Yard	Greater than 243
		Several CN Facilities (CargoFlo, Metal Distribution, AutoPort, Worldwide Distribution)	
	Highway 50 Corridor	CP Vaughan Intermodal Terminal	Greater than 1,619
		Consolidated FastFrate	
		Sears	

(Transport Canada, 2010) – unpublished work

In terms of relating these key clusters to the concept of a freight village, note that the Peel region cluster, and Ontario's existing freight clusters in general, have developed in an unplanned manner according to free market forces. The major clusters of both Peel and York resemble the basic concepts of a freight village. They host a variety of transportation, and manufacturing and wholesaling firms within a defined area and with access to multiple modes of transportation infrastructure. However, these clusters are not organized efficiently and exhibit a reliance on trucking for the majority of goods movement trips as is seen in Table 6.2.

One defining aspect of two facilities in Table 6.2 is that they are intermodal facilities and as such have a key basic ingredient of a freight village. According to the Ministry of Transportation, in 2004 there were approximately 4,000 intermodal movements in Central Ontario each day carrying a range of commodities such as food, lumber, auto parts, clothing, alcoholic beverages, metals, and furniture (MTO, 2004). The majority of trips, presumably associated with final/initial truck legs, were short-

distance. Locations in Peel and York regions and the City of Toronto accounted for three-quarters of all such activity (MTO, 2004).

As highlighted in Section 4.4, an interesting side effect of intermodal transportation is that it often results in no substantial reduction in vehicles on the road, and thus does little to ease regional congestion. This conclusion was also reached in the case of intermodal terminals in Ontario (MTO, 2004). The benefits of intermodal are most associated with the long distance component of a shipment as opposed to the short segments at either end. In areas like the GTHA, which are already congested, intermodal's development has not improved matters in this respect.

In general, intermodal has been the fastest growing goods movement segment. However, recent data (Transport Canada, 2011) indicates that intermodal has suffered some setback in Eastern Canada (including Ontario) along with rail movements in general. Eastern loadings were 14 million tonnes in 2010 versus 15.4 million tonnes in 2008. For 2010, intermodal represented 12.3% of rail tonnage for eastern car loadings.

Ontario intermodal terminals have recently been developed as expanded logistics centres which incorporate tenants on-site. This outcome can be seen in the CP Vaughan Intermodal Terminal which incorporates a 900,000 sq. ft. distribution centre on site used by Sears, its subsidiary SLH Transport (discussed further below) and Consolidated FastFrate. This trend has also been seen outside Ontario in the CP Calgary Intermodal Terminal that houses Sears and SLH Transport in addition to Canadian Tire and Consolidated FastFrate distribution centres, and in CN's Calgary Logistics Park (discussed earlier) that will incorporate an automotive storage area and warehousing and distribution facilities.

CN Brampton Intermodal Terminal Freight Cluster

The 195-acre CN Brampton Intermodal Terminal is Canada's largest intermodal facility. The surrounding freight cluster includes 18 facilities that move over 100 trucks per weekday. Cumulatively, the area generates 4,000 trucks per weekday, the largest generator of which is the intermodal terminal itself (Transport Canada, 2010). The terminal receives and ships containers from all of continental North America, with international traffic accounting for 69% of inbound and 43% of outbound container traffic, though many distribution centres in the terminal's periphery more than double this volume (Transport Canada, 2010).

The freight cluster around the CN Brampton Intermodal Terminal exhibits elements of the freight village concept. Many of the businesses in the periphery of the terminal interact with the facility regularly, including numerous transportation companies that ship large volumes both within Ontario and outside the province. However, the level of functional integration between the intermodal terminal and surrounding businesses is low and the organization of freight and logistics activities in the area is inefficient. Stakeholders report that the facility suffers from capacity constraints and in particular a lack of container storage space. While the site has been expanded to add two additional container yards, the terminal is land constrained and the potential for growth is small (Transport Canada, 2010). Furthermore, incompatible land uses surround the terminal site, such as the Goreway Station gas-fired power plant. An overview of the CN Brampton Intermodal Terminal is provided in Figure 6.5 below.

Figure 6.5: The CN Intermodal Freight Cluster

Based on the Transport Canada (2010) report, CN trucks use a separate gate to enter the facility and account for 30% of all truck traffic. The remaining 70% of the terminal's traffic must use Intermodal Drive to the south of the terminal (Given recent improvements at CN Brampton, these ratios may have evolved). This arrangement causes terminal congestion and frequent delays as trucks wait for service. Although the Canadian Tire and Costco distribution centres are located next to the terminal, both must use their own trucks and the Intermodal Drive entrance to collect their freight. This negates many of the benefits of locating near an intermodal terminal and increases congestion.

By not integrating major freight generators on site, the terminal is constrained by its capacity to serve peak periods of truck traffic. In an ideal scenario, major freight generators such as the Canadian Tire

distribution centre would not only be co-located near the terminal, but be functionally integrated with it to reduce intermediate movements and shift demand away from local roads. Overall, this cluster has many elements of a freight village but does not function smoothly as one.

Because this facility was planned as a singular site, the potential to increase the efficiency of freight movements in this cluster is limited by capacity issues at terminal entrances and constraints in container handling for truck-based shippers. In the example of the Costco and Canadian Tire distribution centres, not integrating these major freight generators into the intermodal terminal contributes to further terminal congestion and blocks access for other users.

Nevertheless, CN has released news in May 2011 that it is investing heavily in the facility. In particular, new track is being installed to increase rail capacity by nearly 15%, five new cranes are being added in 2011 and the labour force at the facility is being increased by 10%. More ground space is being created for international containers by staging CN containers off-site. This last statement highlights that space is at a premium on the actual intermodal site.

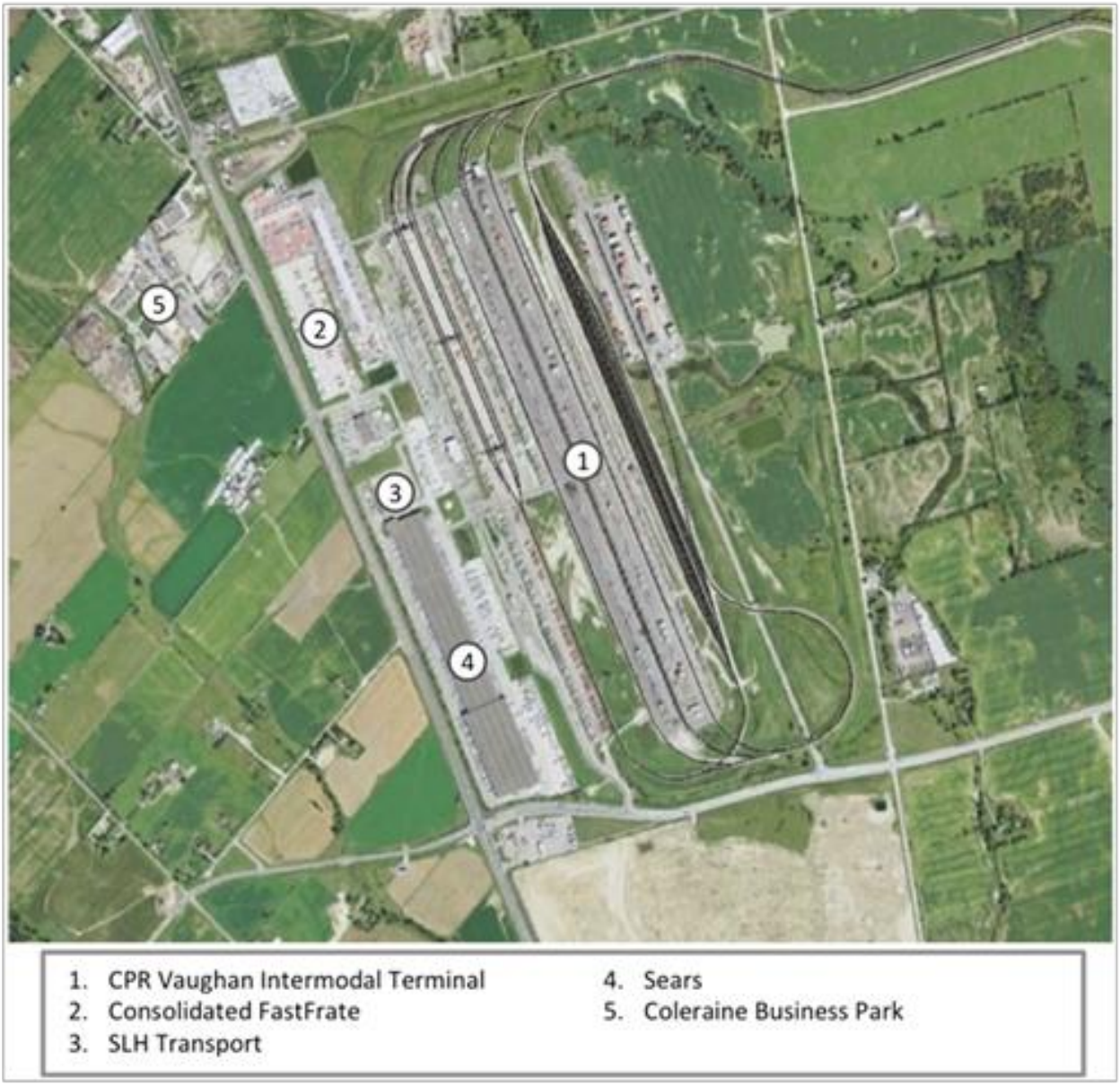
CP Vaughan Intermodal Terminal Freight Cluster

The CP Vaughan Intermodal Terminal in York region opened in 1991 with a capacity of 110,000 units per year, and has since been expanded twice to reach an expected capacity of 350,000 units per year (MTO, 2004). Until 1991, CP's intermodal traffic was handled at the Obico facility in Toronto's west end and in two satellite yards near the downtown. The Vaughan terminal is CP's largest and handles more than 1,600 trucks per day. Most freight is general freight from west coast ports, all of which is containerized. International traffic accounts for 60% of inbound and 40% of outbound traffic (Transport Canada, 2010).

This terminal exists as a good example of an 'intermodal terminal' logistics centre according to the hierarchy developed for this project, featuring the co-location and integration of Sears and its subsidiary SLH Transport and Consolidated FastFrate on site, in addition to the nearby Coleraine business park (Figure 6.6). These are key elements of the freight village concept. Future plans for the site include an extension of the 427 highway and additional capacity along Highway 50 (Transport Canada, 2010). Hwy 427 terminates less than 5km from the southern boundary of the development. CP itself notes that an extension of Hwy 427 to connect directly to the intermodal development represents the "key to unlock full multimodal potential" of the site (CP, 2008). CP further notes that the intermodal terminal is highly dependent on the highway mode. It would appear that there is a lot of potential for the development of a freight village at this site and for the improvement of transportation connections to the 400 series of highways.

Unlike the CN Brampton Intermodal Terminal, this site features stronger linkages between onsite tenants and the intermodal terminal that can significantly reduce intermediate transfers. However, the potential to expand these efficiencies beyond the existing boundary of the site is limited due to municipal access roads that would bisect the enlarged terminal. This would create a situation similar to that seen at the Brampton terminal in which space and transportation bottlenecks restrict traffic flow and negate the use of an internal container transportation system on site.

Figure 6.6: The CP Vaughan Intermodal Development



With ample land around the terminal for expansion, CPR's Vaughan Intermodal Terminal has the most potential to explore the 'add-a-freight village' concept. In terms of assembling land, costs may become an issue. The very existence of the terminal has driven up the price of surrounding land. Consultation of the MLS database reveals that the current going rate is between $300K and $400K per acre. Note that the complex straddles the border between York and Peel. The terminal itself is located within York region, but the Coleraine Business Park is in Peel. The issue of divided regional and municipal jurisdiction needs further consideration in the context of 'add-a-freight village'. More inter-regional co-ordination will be required in matters relating to future construction of the site and management of area municipal roads but both regions will have access to its own municipal revenue stream as a by-product of any future development.

Pearson Airport Cluster

The most noteworthy aspect of the Pearson Cluster, of course, is its reliance on the air mode. Pearson is the foremost air-based cluster in Canada but overall Canada plays a minor role in air cargo compared to the United States. Of the total North American market (Canada and the US) the Canadian domestic market is about 2% and transborder flows between Canada and the United States are about 1.4%. These transborder flows are much more northbound than southbound. In considering North American movements between Europe, Asia and Latin America, Canada accounts for about 5% of each market (Boeing Corporation, 2010).

In 2007, Pearson handled approximately 500,000 tonnes of air cargo. As is well known, it is normally specific types of high-value cargo that are moved by air. Some of the main cargoes at Pearson Airport include: electrical machinery, pharmaceutical products, aircraft parts, optical/medical instruments and precious stones. While such specialized cargo is hardly bulk goods, it is useful to point out the typical Boeing 747-8 Freighter can carry up to 140 tonnes a distance of 8,130km. This is several times more than the largest trucks on the roads. Pearson handles several large freighter flights of this nature each week (GTAA, 2008).

The domestic Canadian air cargo market is expected to grow 2.9% per year until 2029 which is roughly in line with expected GDP growth. However the growth in transborder air cargo between Canada and the United States is expected to exceed Canadian GDP growth (Boeing Corporation, 2010).

As seen in Table 6.2, the Pearson cluster is a very large traffic generator and functions in more of an ad-hoc manner than would a well-functioning freight cluster. There is a low level of functional integration between firms. The whole area is so heavily built out that there is little than can be done to modify the area in accordance with sounder freight village principles. In adhering to such principles, there would ideally be more co-location of air freight focused participants in the cluster, to reduce intermediate moves and better segregation of commercial and passenger traffic in the area.

Figure 6.7 gives some idea of the scale of the Pearson cluster and also how it has evolved in a 12 year period from 1995 to 2007. The green areas represent zones that were not built up in 1995 but were by 2007. Most of the growth that has taken place since 1995 is west of Hwy 410 and is in Peel region. It is only the area east of Hwy 427 that is in the Toronto division. For the most part, the cluster was already quite well developed by 1995.

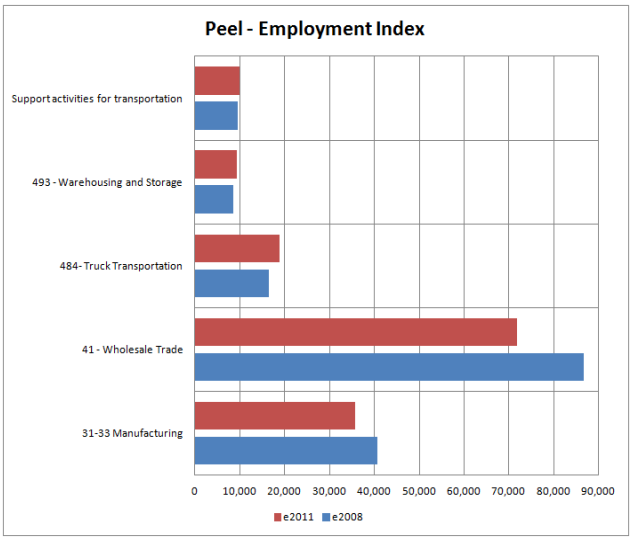
Figure 6.7: Evolution of the Pearson Freight Cluster (1995-2007)

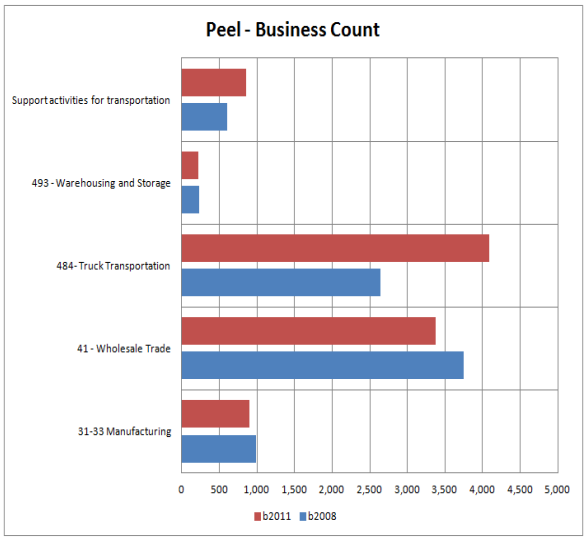
Source: McMaster University Map Library, Ortho Images and Google Maps

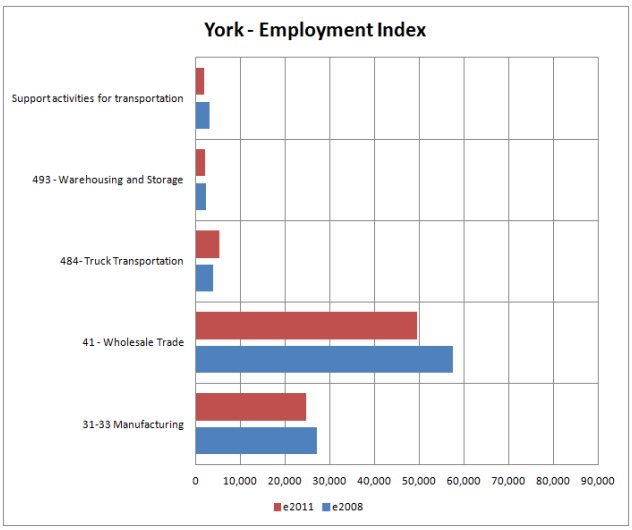
Peel, York, and Toronto

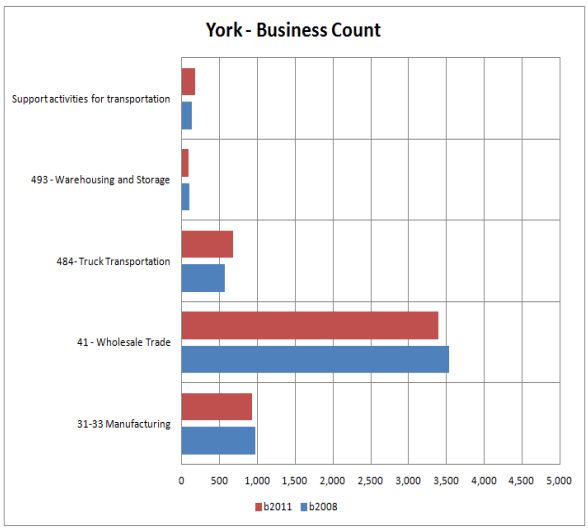
Considering the regions at large as opposed to the largest nodes within, Figures 6.8 gives some idea of the magnitudes of the overall freight clusters and trends since the 2008 financial crisis and subsequent recession and as before are based on Canadian Business Patterns. For the given region, the employment index for 2008 and 2011 are on the left and business counts for the two times periods are on the right. Figure 6.8 makes it clear that employee counts in wholesale trade and manufacturing are much larger than in sectors related more purely to transportation. Along with a large metropolitan population mass to act as a market, these two sectors have a lot to do with the amount of goods moving around in the vicinity.

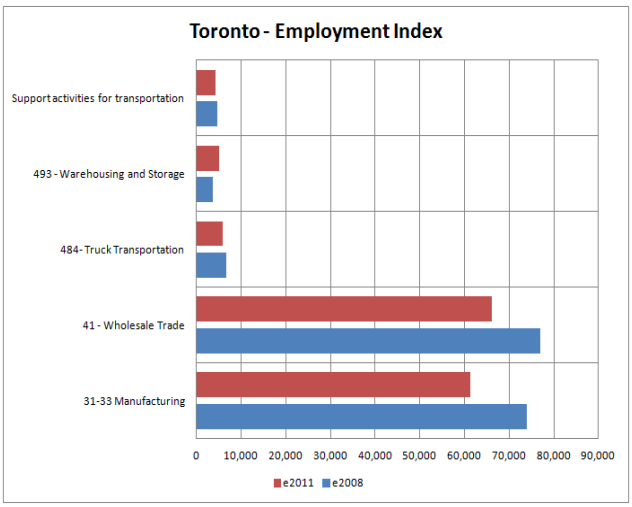
Figure 6.8: Employment Index and Business Counts by Sector (Peel, York, Toronto)

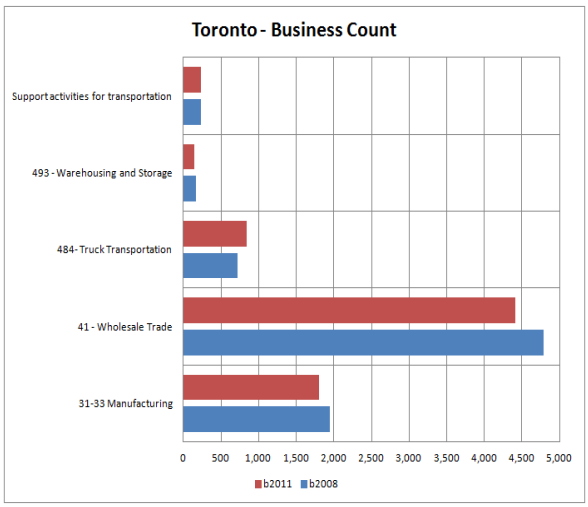












In comparing two of the regions, Peel is larger than York across all sectors shown. In the past three years, both regions appear to be down in employment terms with respect to wholesaling and manufacturing but both regions are showing comparative strength in the transportation sectors. Meanwhile, the Toronto census division stands out for the size of its manufacturing sector while wholesaling is on the same scale as Peel. Both of these sectors are showing some employment declines since 2008 while warehousing and storage appears to be showing some growth. The Toronto data also show very clearly that manufacturing firms are generally much larger than their wholesaling counterparts.

Despite being the anchor of the overall metropolitan region, most of the largest freight generators are outside the boundaries of Toronto proper. The CP Obico Intermodal terminal in Etobicoke is one exception. Also the Ontario Food Terminal receives and generates a fairly large amount of truck traffic. Most industrial facilities in Toronto are to the north and are clustered on both sides of Hwy 401.

Halton, Hamilton and Durham

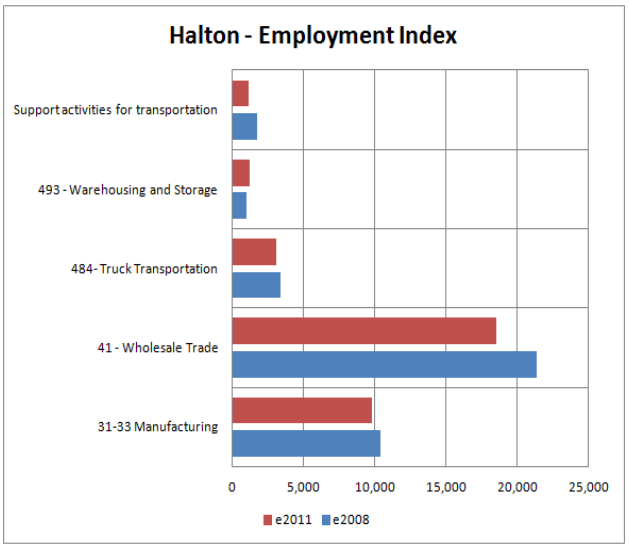
Halton, Hamilton and Durham are the three outlying census divisions associated with the GTHA and in general, associated freight clusters do not approach the size of those found in the core divisions of the GTHA. Accordingly, Figure 6.9 is scaled differently than Figure 6.8 to best show the smaller cluster components. Freight clusters in Halton are quite road-oriented with ones in Oakville and Burlington being focused on the QEW while the cluster in Milton is focused on Hwy 401. The QEW also plays a significant role in the primary Hamilton freight cluster which extends from Hamilton Harbour through to Stoney Creek. This latter cluster is notable because the modes of rail, road and marine converge. There are no intermodal facilities in these census divisions which is significant in considering potential for a proper freight village.

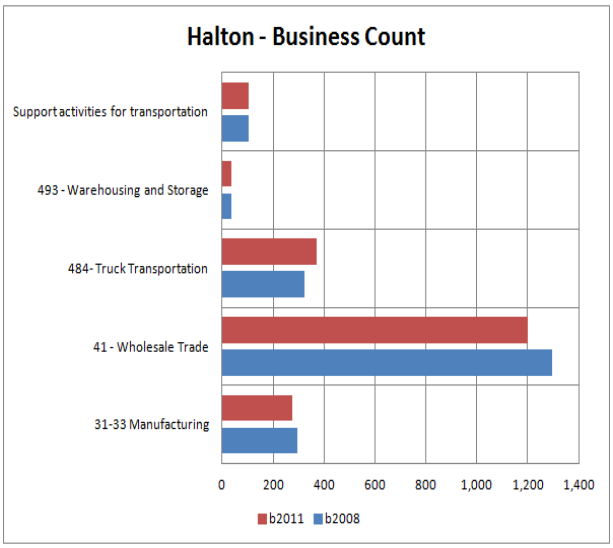
In terms of key freight infrastructure, the Port of Hamilton is the largest Canadian Port on the Great Lakes and processed 8.2 million tonnes in 2009 (Transport Canada, 2011). Hamilton also possesses the only significant airport of the three census divisions and it is one of the largest cargo airports in Canada. It processed about 100,000 tonnes in 2007 (GTAA, 2008) with most of the cargo being domestic and courier-oriented. With its location on the Niagara escarpment, the airport functions as a separate cluster. For manufacturing totals, it is worth bearing in mind that Hamilton has some large employers, such as those in the steel industry, and as these are not well-captured with the employment index.

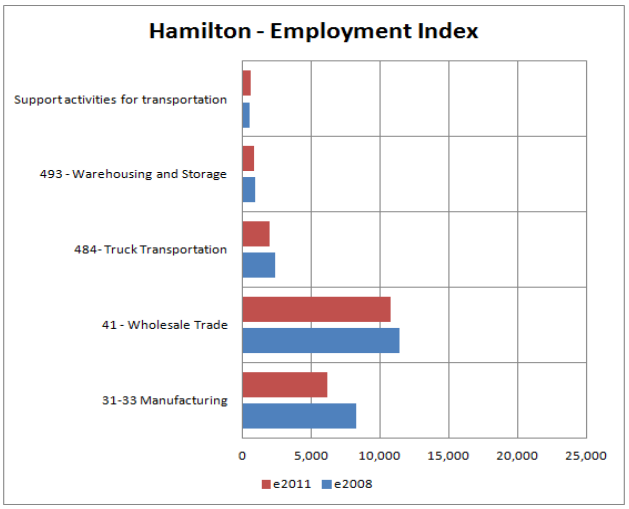
In Durham, clusters are planned in the vicinity of Hwy 7 but for now the main two clusters are the Pickering South Industrial Park and the GM Oshawa Industrial park which are both located in close proximity to Hwy 401 and thus are very much highway oriented developments.

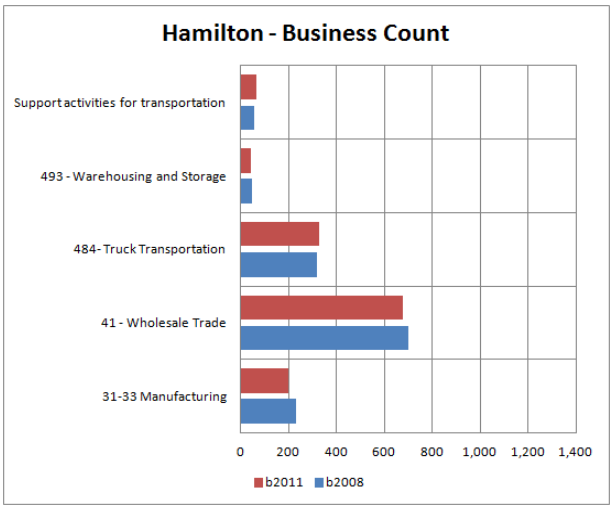
In terms of overall freight vibrancy, Figure 6.9 indicates that Halton is leading based largely on its preferred access to the core of the GTHA. Most notably Halton has a much larger wholesaling sector than Hamilton and Durham. Generally, the regions are each showing moderate declines across the sectors since 2008 with the one exception being perhaps a moderate increase in Halton's warehousing and storage. Durham's employment index stands out for support activities to transportation although not by business count.

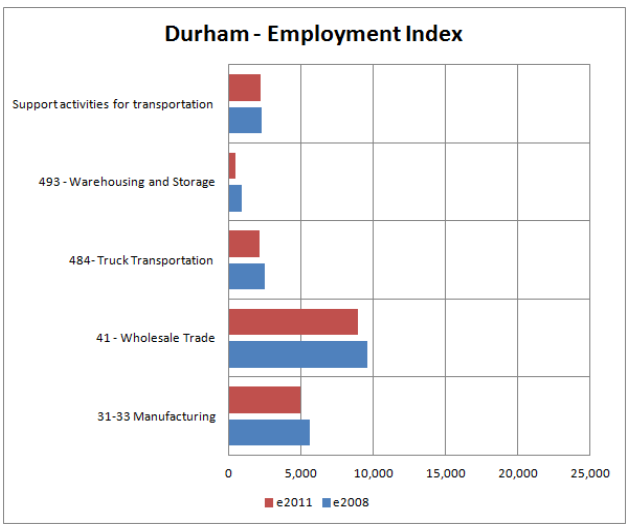
Figure 6.9: Employment Index and Business Counts by Sector (Halton, Hamilton, Durham)











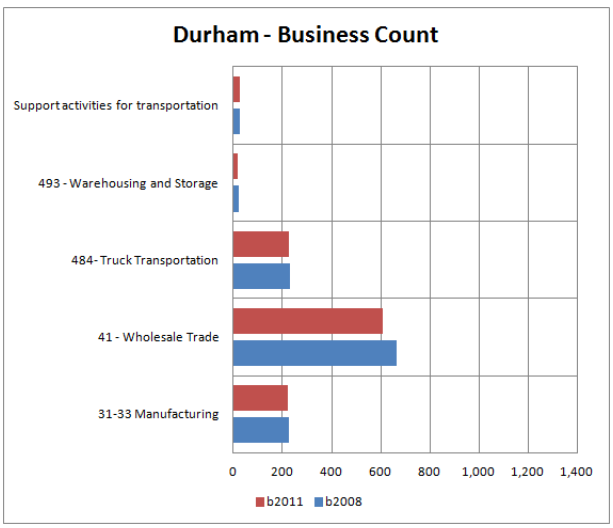
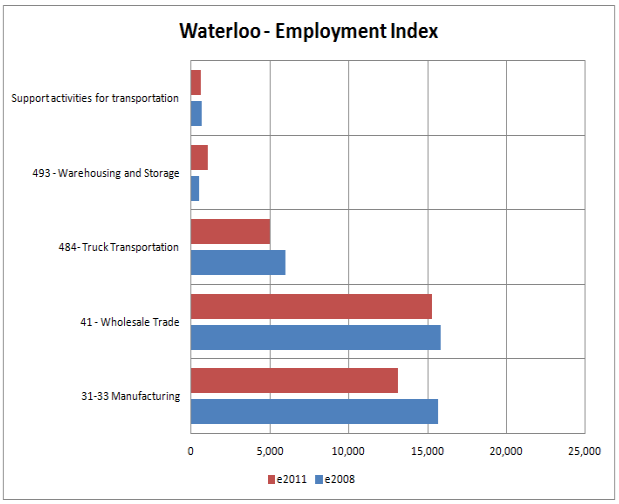
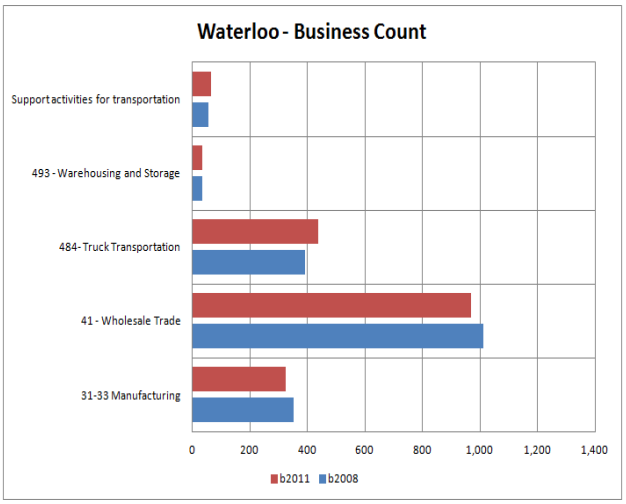
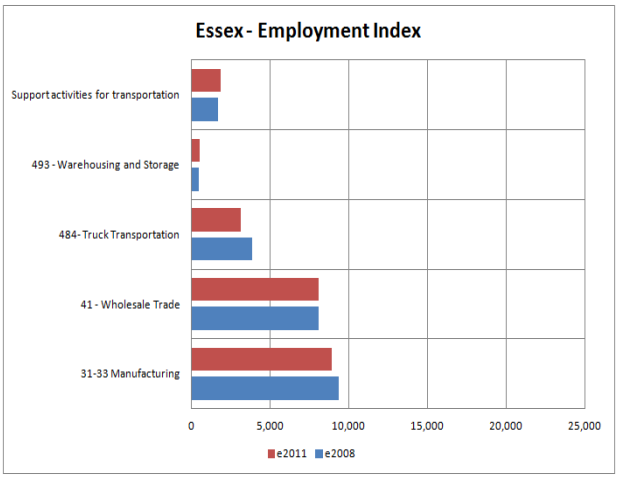
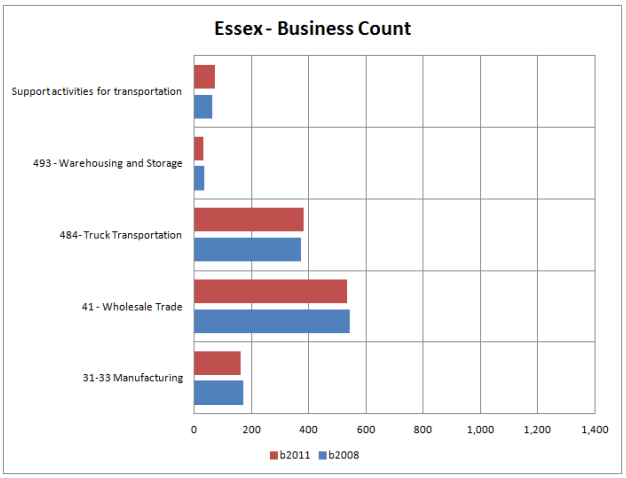


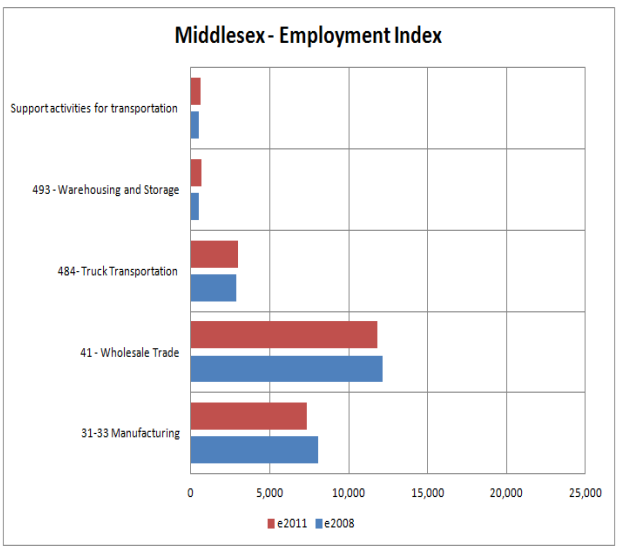
Figure 6.10: Employment Index and Business Counts by Sector (Waterloo, Essex, Middlesex)

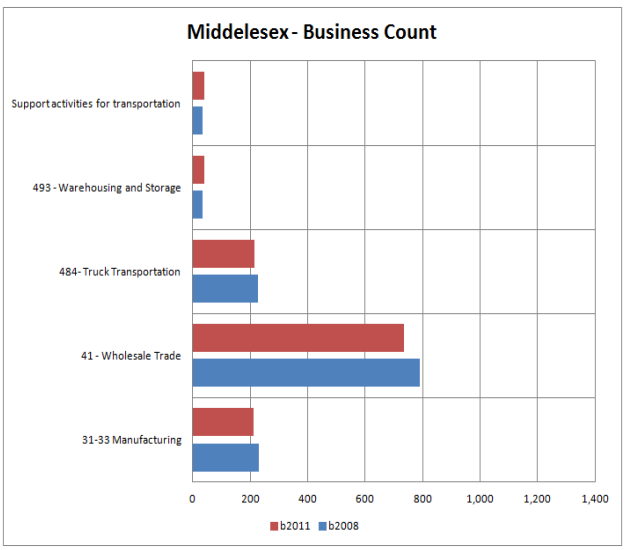












6.1.4 Primary Freight Clusters outside Greater Toronto Hamilton Area

As has been shown, the GTHA is quite dominant from a freight perspective in Ontario and there are some fair-sized clusters outside the region but again nothing approaching the size of the main GTHA clusters. This section will focus on the divisions of Waterloo, Middlesex and Essex which cover the southwestern reaches of the Hwy 401 corridor and are the largest of the non-GTHA freight clusters.

Other divisions such as Ottawa, Niagara, Wellington, Simcoe, Sudbury and Thunder Bay are compared with their counterparts in the earlier graphs of this chapter. With regard to notable freight facilities in this latter list of census divisions, Niagara has the Welland Canal, Thunder Bay has a substantial port and Ottawa has an International Airport that moves in the order of 20,000 tonnes of cargo per year (GTAA, 2008) and which ranks third among airports in Ontario.

Waterloo, Essex and Middlesex

Of Waterloo, Middlesex and Essex, the Waterloo freight cluster is the largest. The main urban areas in Waterloo are the combination of Waterloo, Kitchener and Cambridge. While the main urban areas in Middlesex and Essex are London and Windsor respectively. In each case, Hwy 401 has much to do with the development of the clusters. As is the case with Halton, Hamilton, and Durham there are no intermodal facilities in these divisions although there are other types of rail facilities. For Essex, the nearest intermodal facilities are in Michigan. Each region has an airport although the Waterloo facility in particular is passenger-oriented. The airports in both Windsor and London are aggressively marketing themselves as important air freight centres although at present they lag far behind Hamilton, for example. For 2008 it is estimated that Windsor International Airport processed 300 tonnes while London International Airport processed about 160 tonnes (Lufthansa Consulting, 2009). These figures are both less than 1% of the volume of Hamilton International Airport.

Figure 6-10 above demonstrates the size advantage of the Waterloo cluster which again is at least partially a consequence of better access to the GTHA. All three divisions are generally showing modest declines since 2008 thought not substantial. The freight clusters appear to be stable for the most part. Essex is showing a strong advantage over the other two in support activities for transportation. Wholesale trade is relatively more important to Middlesex than it is to the other two divisions. Overall, these divisions are comparable in size to the lesser three divisions within the GTHA but not to the main three.

Despite efforts to develop the regions as air hubs, the evidence suggests that these regions are heavily highway-oriented as freight clusters. The levels of freight demand are inadequate at present to form a sound basis for a freight village and the absence of a rail-based intermodal facility is significant. Essex region is hampered by a relatively small local market and the fact that mode changes are more logically carried out on the U.S. side of the border. Waterloo's superior positioning relative to the GTHA gives it an advantage over Essex and Middlesex for potential higher-order freight facilities.

6.2 The Potential for Freight Villages in Ontario

The purpose of this final section of the chapter is to sum up what has been learned about freight villages throughout this study and to consider the potential linkages to freight clusters in Ontario. Already, lessons have been learned about the movement of goods in Ontario, particularly the GTHA. The future of freight villages in Ontario will be tied into those lessons.

6.2.1 Classification of Existing Freight Clusters

At the outset, it is useful to distinguish between a "freight cluster" and a "freight village" as both terms have been used extensively. A freight cluster is a more generic term that can be used to describe some locus, large or small, of freight-oriented activity. In general, one would tend to think of a freight cluster as something bigger than a freight village although in some cases they could coincide. The more that a freight village can internalize a freight cluster the more efficient that freight cluster will be. A freight cluster captured entirely within a freight village will operate more efficiently and generate less congestion than a comparable ad hoc freight cluster over a presumably larger area.

In summing up this report, a good place to start is Figure 2.1 which sought to develop a standardized logistics centre hierarchy based on a thorough review of the literature. Since some confusion and contradiction was discovered in the literature, the original effort in Figure 2.1 was undertaken. The 3rd Level Gateway cluster can instantly be eliminated as a possibility in Ontario largely because there will never be a major seaport in Ontario. The likes of Rotterdam and Hong Kong are quite distinct from anything that can be found here in the province. This third level can also relate to a world-class freight airport and certainly Pearson Airport is the closest but does not process the required amount of cargo. Pearson takes on a secondary role to major airport gateways in the United States. The first and second levels of the hierarchy are relevant to Ontario but only the GTHA fits some of the criteria for the second level.

Beginning with the GTHA, the CP and CN intermodal developments are the most obvious second level facilities. These would include the CN Brampton facility and the two CP facilities Vaughan and Obico. These facilities are the closest in Ontario to being a freight village, which is the highest level member of the second level. However, these facilities were originally conceptualized as pure intermodal facilities and have a focus on the movement of containers. As a result, they fall into the lower reaches of the second level. Previous patterns of land development in these areas mean that they cannot be considered freight villages based on the master-planned developments covered in this project. They likely do not technically qualify as inland ports either because they are not designed to handle non-containerized freight as a proper inland port would. The basic idea of an inland port is that it does everything a seaport does except at an inland location.

There are numerous facilities throughout Ontario which qualify for the first level on the hierarchy. One of the key requirements for reaching the second level is an intermodal connection. However, most warehouse and distribution facilities in Ontario are truck-based. The Ontario Food Terminal is an interesting example of a truck-oriented piece of supply chain infrastructure that works quite well. Every

year in the neighbourhood of 25 to 30 thousand trucks deliver produce and approximately 300,000 distinct buyers per year get the produce to market (OFTB, 2009). But it is all truck based. Meanwhile, the various freight clusters in places like Halton, Hamilton, Waterloo, London and Windsor are essentially first-level road based as well.

6.2.2 Observations by Geography

Certainly, there are several municipalities in Ontario that market themselves as gateways and in some sense of the word many are. Based on the hierarchy developed in this report though, there is not a single place in Ontario that qualifies. Even reaching the second level of the hierarchy is uncommon. Intermodal terminals in Ontario are quite rare and the choices for new locations are limited by land constraints and geographic realities of freight distribution. In most contexts, there is no compelling reason for a change of mode to take place. Windsor and Niagara for example are certainly important border "gateways" to and from the United States but goods will tend to flow through these regions without changing modes.

Peel Region is one of the leading freight clusters in Canada. Peel anchors a freight cluster that is actually much larger and extends into the York and Toronto census divisions. These observations are certainly backed by the results from the analysis of Canadian Business Patterns data. On the surface, one might think that all required ingredients would be in place for a freight village. Certainly, its status as a vibrant freight cluster is a very important ingredient. In reality though, there are some very significant challenges including: lack of available land, high land costs, mixed and incompatible land use issues and a heavy reliance on trucking. Essentially, no aspect of the entire cluster was ever planned as a proper freight village and it is not an easy thing to undo or modify what has been done. This latter statement applies most to the CN Brampton facility and CP Obico, which function quite well on the whole but not as freight villages. There is limited scope to modify them from here although CN is currently performing upgrades to the Brampton facility.

The CP Vaughan intermodal facility nearly straddles the boundary between Peel and York but is located within York. This facility is the only example in Ontario of a rail-based intermodal terminal which theoretically has ample room for expansion in that the surroundings are mostly not built up. Also, the facility is within a few kilometres of the 400 series of highways which enhances the opportunity to develop something which at least approaches the ideal of a freight village. There is the possibility that the linkage between the development and the highway could be achieved via truck lanes as the IBI Group (2011) notes that such a tool has potential in the case of a big freight generator such as an intermodal facility.

Some of the freight clusters in Ontario benefit from good proximity or access to the heart of the GTHA. Halton and Waterloo are two that emerge based on the results of the Canadian Business Patterns analysis. Waterloo has very good access to the 401 while Halton has access to the QEW, Hwy 401, Hwy 403 and Hwy 407. Hamilton has fairly good highway access but it really stands out for having the largest Port in the vicinity and also the largest airport outside Toronto for the handling of air cargo.

The Raritan Centre in New Jersey (Section 3.2.1) offers an interesting template for how the Hamilton QEW cluster, with its access to road, rail and marine and a strong historical industrial base, could further evolve. Meanwhile, CentrePort in Winnipeg and Port Alberta, with their emphasis on an airport as a focal point, suggest how things might evolve for Hamilton International Airport. Recent highway improvements help as would the development of a mid-Niagara Peninsula expressway. The scenario does lack rail nearby but in practice, strong road access is most important for air-oriented clusters.

6.2.3 Lessons Already Learned

The examples of the CN Brampton and CP Vaughan intermodal terminals expose four important lessons for the development of freight villages in Ontario: timing, master planning, land assembly, and financing. These lessons may well influence future policy directions in the area.

Timing

Successful freight villages require timing, vision and conviction because the most successful often function on a large scale. In the absence of a bold vision, there is strong potential for incompatible land uses to encroach on a smaller development over time. In the case of CN Brampton, some of the nearby land uses are appropriate but a lack of planning reduces the quality of the connections and overall efficiency. Ideally, all lands for the development of warehousing, logistics, and industrial facilities and the intermodal infrastructure would be acquired simultaneously. Of course this is easier said than done and entails significant risk for public and private sector actors.

Master Planning

The ability to master plan areas for freight and logistics is fundamental to the successful development of an efficient and effective freight village. A large site is required that can accommodate the development of freight and industrial land uses and supporting services and take into consideration the future needs of these developments. Ideally, distribution centres are co-located and functionally integrated with the main intermodal terminal. Use of local roads is minimized and productive synergies are maximized. Along with master planning of the facility itself, there is a pivotal role for government in ensuring that a freight village is served by appropriate transportation connections (especially by road). This type of master-planned facility avoids many of the issues seen in the cases of the Pearson Airport and CN Brampton freight clusters.

Land Assembly

The public sector can play an important role in assembling land for large-scale potential freight villages and to assist in dealing with fragmented private ownership. Ideally, freight villages are master-planned sites over a large area. In the United States, retired military bases have been redeveloped as freight villages which offer large sites, good accessibility, and a buffer from competing land uses. But this scenario is unlikely for the GTHA. Alliance Texas was based on a very large private purchase of land at a favourable time. The planned CN Calgary Logistics Park is similar in the sense of private acquisition of a large area. A more likely model for the GTHA is possibly the European model of public-private

partnership for land assembly. This has been the arrangement for CentrePort Winnipeg which admittedly involves cheaper land prices than in the GTHA.

Financing

There is an opportunity for the public sector to provide financing for freight village development. The CP Vaughan Intermodal Terminal has ample room to grow and would appear to be a likely candidate. In an interview with MITL, a representative of CP noted the inability of his firm to finance a large expansion around the current facility. Direct public financial contributions can assemble the necessary land and mitigate the risk involved in such a large investment. Such an investment might well be in the public interest through mitigation of regional and local congestion, reduction of sprawled residential developments in the area, increased sustainability, and enhanced investment and employment.

Other Ontario Research

In terms of lessons learned, it is worth mentioning some key aspects of goods oriented research completed by Metrolinx (2011). Metrolinx's Urban Freight Study compliments the work of the Continental Gateway Initiative by concentrating on urban goods movement challenges to freight trips that begin and/or end in the GTHA. The study identified several challenges to freight and logistics in the region, one of which is land use conflicts between freight and residential activities. Previous residential settlement patterns in the GTHA have largely overlooked the needs of industry and freight-related development. This has exposed several incompatibilities between land use types and has put further pressure on industrial and freight-related activities and the surrounding transportation network.

This study identified four solutions that align with the objectives of freight villages:

> *Develop freight-supportive land use guidelines*: Support the Province's Growth Plan for the Greater Golden Horseshoe by developing land use guidelines that promote clustering of freight uses and the creation of buffers between freight uses and other developments.
>
> *Improve access to existing intermodal facilities*: The development of improved connections from air, rail, and marine intermodal facilities to the GTHA freeway network would reduce modal transfer delays, making intermodal shipping more competitive and reducing industry's reliance on long-distance trucking. Better freeway connections could also be complemented by co-locating intermodal terminals and consolidation facilities, which would reduce the need for trucks to travel on public roads between these facilities.
>
> *Plan and protect complimentary land uses near major freight hubs*: Steps to preserve lands for industrial and freight uses around major intermodal transfer facilities such as ports, airports, and rail yards can reduce the impact of goods movement by keeping major freight origins and destinations close together.
>
> *Support the development of innovative freight hubs*: Add freight consolidation centres in locations that are relatively accessible and offer inexpensive storage space, thereby reducing traffic demands and land needs in higher-density locations. A second approach is to develop

'freight villages' that include intermodal facilities, consolidation services, logistics-intensive manufacturing, and support services. Another option is to establish localized package drop-off stations that serve inbound and outbound courier activities.

Metrolinx (2011) also discussed potential to consolidate local shipments at either the shipping or receiving end of the trip. A freight village is the type of development which could promote this type of co-operation. However, the role of the urban distribution aspect of a freight village is much less developed than its intermodal counterpart. There have been suggestions for transshipment centres located outside of congested areas that consolidate deliveries to downtown areas or clusters of offices or buildings (MTO, 2004). However, as was seen in Section 4.4, earlier urban distribution initiatives in Germany have lost momentum due to a lack of incentives from the public sector.

6.2.4 Policy Directions

A lot of detailed work remains to determine whether a freight village concept might be appropriate in targeted instances for the province of Ontario. In this section, some brief policy-oriented observations are made that may offer some direction for future inquiry:

- In considering the logistics centre hierarchy in Figure 2.1, it is fair to say that the higher the position on the hierarchy, the greater the need for government involvement. Many freight villages around the world, and now increasingly in Canada, are based on public-private partnerships to bring these more complex developments to fruition. Meanwhile, for the lowest level on the hierarchy, the warehousing and distribution cluster, developments are most easily and effectively developed as private sector initiatives. This may leave only a small number of potential developments that would require deeper public involvement.

- The analysis of the Canadian Business Patterns data from 2008 to 2011 is useful for clarifying priorities. On the one hand it shows clearly that the core regions of the GTHA are overwhelmingly important as the dominant freight clusters in the province. The data have also shown that, with few exceptions, there is little in the way of dynamic growth occurring in the clusters. So for many of the freight clusters in the province, which are small to start with, there is little or even negative growth in the challenging current environment. For now, perhaps the ideal policy prescription for slow growth clusters outside the GTHA is to monitor closely.

- In considering the strengths and limitations of freight villages, it is important to remember that the movement of goods is a derived demand. It does not really have a life of its own but rather is constrained by the levels of economic growth (or shrinkage in more recent times). In 2004, MTO forecasted freight movements to increase by approximately 80% in Central Ontario over the 20 years to follow. In the first few years after this forecast, the projected growth has not come to pass as the economic recovery has been rather sluggish. For example, in terms of railway car loadings in the eastern region (of which Ontario is a major part) the figures show a decrease of 3.5% from 117.4 million tonnes in 2008 to 113.3 in 2010 (Transport Canada, 2011).

In developing policy on freight villages and other topics, it will be important to periodically recalibrate forecasts in light of new information.

- Congestion is an important yardstick in the evaluation of freight villages since properly planned freight villages have the potential to internalize many more freight movements. Clustering, increased accessibility to multiple modes of transportation and concentrated land uses lead to an overall reduced footprint for freight activities. A freight village can slow ad hoc industrial shifts to outlying, perhaps unduly fragmented, greenfield sites. Overall, freight villages are most attractive in congested locales as opposed to uncongested as the former have the types of issues that freight villages best address.

- While freight villages have the potential to reduce congestion via fewer external freight movements, consider that freight village traffic efficiencies can easily be overshadowed through residential sprawl and its considerable potential to generate large amounts of non-commercial traffic. A proper policy perspective should thus focus on more than goods movement in isolation.

- Future improvements in goods movement efficiencies should be directed at achieving broader planning and economic objectives. In some cases, the most effective allocation of resources, both public and private, may be towards efficient movement in existing developed areas and brownfields, so that industry is not encouraged to move to outlying greenfield areas (MTO, 2004). Also, freight supportive land use guidelines have the potential to lead to plans, zoning by-laws, and development approval processes that promote the clustering of freight uses and the creation of buffers between these uses and other developments (Metrolinx, 2011).

- There is a need to identify lands that are highly strategic for freight movements and to consider very seriously what the highest and best use of these lands is. In some cases, there will be a strong argument that the best use is freight-oriented. The lands surrounding CP Vaughan are an obvious example. At present there is opportunity for further freight-oriented development at or near this location. The 'add-a-freight village' model employed by the Raritan Center in New Jersey may be applicable as a way to increase the efficiency of this and other targeted major freight clusters. In some cases, brownfield sites of sufficient scale and in appropriate strategic locations may be a possibility (e.g. Oshawa, Hamilton) for such development.

- Once a highly strategic facility like an intermodal terminal is fully surrounded by sub-optimal developments from a freight perspective, there are no second chances. This has essentially been the experience at CN Brampton and was also one of the reasons that CP required another facility to complement CP Obico which had no further room for expansion.

- For freight villages to succeed there needs to be some strong latent demand to tap. In the absence of this demand, a freight village in isolation will not override the trend. Consider that the GTHA has developed as one of the foremost freight clusters in Canada without possessing a freight village. Of course, saying that something is not a necessity does not mean that it cannot

make things better or more efficient. It may be that freight villages will evolve into an important competitive advantage for those regions that have them.

- Freight villages have been dually characterized as generators of economic activity versus a more passive role as part of transport infrastructure. With respect to job creation, governments may have more powerful tools at their disposal (e.g. general taxation policies) which are outside the realm of freight villages. If anything, many of the potential economic benefits of freight villages are jobs-neutral and have more to do with greater operational efficiencies which enhance profitability. Nevertheless, the view of a freight village as part of effective transport infrastructure though should not be trivialized as effective infrastructure is a very worthy objective, particularly in congested contexts.

- There is some evidence from around the world that government involvement can enhance freight-oriented outcomes by helping to develop on a large scale when appropriate. There may be the potential for government to see a "bigger picture" which takes a wider range of social costs and benefits into account than private sector actors. Otherwise, government should strike a balance so that the private sector is not overly constrained in its activities. Policies such as tax incentives or infrastructure grants can be used to shape private sector behaviours in sympathy with high-priority policy objectives. Another important role for government is to assist in the aspect of providing high quality transportation connections to strategic freight-oriented developments. In the case of a freight village, access roads with truck lanes might be a viable tool.

- Rail operators, transportation and logistics service providers, and industry are receptive to the types of clustering and productivity benefits that are a fundamental element of freight village development. This receptiveness to the concept highlights an opportunity for the public sector to expand on the potential of these developments.

- Freight villages offer a solution for warehousing and distribution operations that are increasingly turning towards larger, regionally oriented facilities, and 3- and 4PL firms looking to innovate in the supply chain. Potential benefits are good accessibility, high-quality connections, and the ability for firms to share investments in infrastructure, services, and expertise.

- There is the potential that large prospective anchor tenants, who are seeking to compete effectively, will make substantial new investments in distribution centres in a non-freight village context and will thus not be able to participate in later freight village initiatives. This example relates back to the matter of timing.

- European freight village examples in particular highlight the importance of co-operation between participating organizations in areas such as revenue sharing, agreed service standards and coordinated marketing. It is possible that this type of co-operation is less likely in the competitive North American context, particularly since modern supply chains have strong vertical integration.

- Increased use of intermodal has its challenges (MTO, 2004; Metrolinx, 2011). As the rail companies have rationalized, many branch lines that could have carried traffic have been eliminated. Meanwhile, many industrial and distribution activities have taken on a strong road orientation without much thought for rail and intermodal facilities. Given these realities, and irrespective of whether pure freight village concepts are pursued, it will be important to maintain and improve road access to intermodal facilities and improve efficiencies within such facilities.

6.2.5 Potential Future Research

This report has conducted considerable research on what a freight village is and what has been learned about the concept from experiences around the world. Meanwhile, this chapter has examined Ontario freight clusters at a fairly high level and has paid attention to how these clusters have fared in the recent difficult economic times. It has offered some general conclusions about how the freight village concept might apply in this province in some fairly specific cases. One significant finding is that most freight clusters in Ontario are not well-suited to be developed as freight villages or at least there is not much urgency to do so. In many of these cases, the private sector can likely determine most of what needs to be done although indirect policy measures may assist.

In terms of future work, there is a need to get more detailed about what can be done in Ontario for specific cases. For the most part, this research would involve examining specific, targeted instances (e.g. CP Vaughan) in considerably more detail. Issues such as localized goods flows and land availability would need to be addressed in more depth. In addition, the implications and compatibility of a freight village with Ontario's overall planning context would need to be examined. This is particularly relevant in the Greater Golden Horseshoe Region where there are growth planning targets for population and employment densification.

There is the opportunity to do specific research on lesser freight clusters around the province to determine possible courses of action and degrees of government involvement. The potential growth district around Hamilton International Airport is an interesting case which has some current critical mass and some potential to grow. This type of work need not be strictly focused on "pure" freight villages but could also examine the possibility of access improvements to existing intermodal clusters, particularly those in the GTHA which suffer most from congestion problems.

As part of getting more detailed about what can be done in Ontario, additional research could be carried out to develop a model business case for development of a freight village within the province. The model could be based on a public-private partnership and would seek answers to the following questions: what elements need to be evaluated, how could risk be measured and what is required to solicit private sector involvement?

Subsequent work can be less a literature review and more an attempt to leverage the best of available data sources to draw sound conclusions about specific cases. There is an opportunity to go deeper with the Canadian Business Patterns to consider more time periods and perhaps some key freight clusters outside Ontario. Since certain modes operate on a spatial scale that exceeds the scale of Ontario, this

approach would offer improved perspective for specific Ontario cases. To a similar end, data such as Canadian Business Patterns or Canadian input-output transactions tables could offer more detail on specific sectoral interaction patterns which support freight clusters. Goods movement clusters are tied into manufacturing and wholesaling so more detailed characterization of these two sectors for specific freight clusters would be helpful.

A specific data source which may prove useful in the assessment of freight village potential is a commodity-based origin-destination survey. Such work is in its early stages at the Centre for Urban Freight Analysis at the University of Toronto and is being supported by Metrolinx. One interesting question that may be answerable with the survey results is the potential to internalize freight flows. Are there many instances of substantial trucking movements between intermodal terminals and specific but distant firm locations and what would be the impact of relocating such firms so that they are integrated into a proper freight village? There is a possibility that new survey work tailored to the specific requirements of freight villages might be required but nevertheless, it will be wise to ensure that planned and imminent survey work, such as that taking place at the University of Toronto, properly addresses the needs of the freight village concept in Ontario.

The above are suggestions which will further advance our understanding of freight villages and their potential in Ontario. There is much to be done to explore this topic for the benefit of Ontario and other jurisdictions. In general, there are few case studies of logistics centres and in particular, very little work has been done to measure the quantifiable incremental benefits of different types of logistics centres.

Appendix

APPENDIX A Terms Used in Relation to Logistics Centres

Boile, et al. (2008)	Freight Village	Industrial activity facilities that include multimodal access and freight transfer facilities, and commercial support activities. (i.e. banks, restaurants, truck driver facilities, etc.)
Boile, et al. (2008)	Industrial Park	Differ from intermodal and multimodal industrial parks in that they lack the key features of dedicated freight transfer facilities and multimodal access. They include industrial development and, typically, commercial activity.
Boile, et al. (2008)	Intermodal and Multimodal Industrial Park	Intermodal industrial parks include all the functions of a freight village, with the exception of commercial support activities. Multimodal parks have access to multiple modes to support industrial activities, but do not have connections between these modes.
Cardebring & Warnecke (1995)	Intermodal Freight Centre	A concentration of economically independent companies working in freight transport and supplementing services in a designated area where a change of transport units between traffic modes can take place.
de Cerreño, et al. (2008)	Urban Distribution Centre	Offers a means for reducing truck traffic in congested urban areas through communication, cooperation, and coordination among the various stakeholders. Using public warehousing and distribution facilities, shipments are deconsolidated and consolidated.
Dooms & Macharis (2003)	Seaport	Large scale traditional ports that generate large amounts of economic activity and employment. Ports are typically located outside of urban areas with hinterlands stretch beyond national borders.
Hesse (2004)	Distribution Centre	A physical facility used to complete the process of product line adjustment in the exchange channel. Primary emphasis is placed upon product flow in contrast to storage. Modern functions comprise receiving, storage, pick operations, value added activities, shipping, return processing, and information management.
Jaržemskis & Vasiliauskas (2007)	Inland Container Depot	A common user facility with public authority status, equipped with fixed installations and offering services for handling and temporary storage of import / export stuffed and empty containers.
Meidutė (2005)	Logistics Centre	No clear definition exists in the literature, though it is apparent that there are two different conceptualizations of logistics centres: logistics centres as transportation infrastructure, and logistics centres as generators of business.
Ng & Gujar (2009)	Dry Port	Dry port can be understood as an inland setting with cargo-handling facilities to allow several functions to be carried out, for example, consolidation and distribution, temporary storage, custom clearance, connection between transport modes, allowing agglomeration of institutions (both private and public) which facilitates the interactions between different stakeholders along the supply chain.
Rodrigue, et al. (2010)	Inland Port	Defined by three main criteria: containerization of domestic and maritime freight flows, a dedicated high capacity link to a port terminal, and massification – the creation of economies of scale by handling larger volumes at a lower unit cost.
Roso & Lumsden (2009)	Intermodal Rail-Road Terminal	A place equipped for the transshipment and storage of intermodal loading units (ILUs) between road and rail. There are intermodal terminals in a great variety of shapes and sizes and a number of value-added services such as stuffing and stripping, storing and repair of ILUs might be offered.
Roso, et al. (2009)	Dry Port	A dry port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardized units as if directly to a seaport.

Slack (1999)	Satellite Terminal	Smaller facilities connected to major freight terminals dedicated to performing freight assembly, storage, logistical control, and distribution functions. Only the actual transfer of cargo between two modes is performed at the major terminal, alleviating terminal congestion.
Tsamboulas & Dimitropoulos (1999)	Nodal Centres for Goods	Intermodal terminals where the transshipment of goods from one mode to the other takes place, in addition to auxiliary facilities such as warehouses, groupage activities, customs, maintenance workshops, banks, insurance offices and other services. Functional equivalent to a Freight Village.
Tsamboulas & Kapros (2003)	Freight Village	A Freight Village is mainly an intermodal terminal, constituting the node where the transshipment of goods from one mode to the other takes place. It is part of an integrated transport chain comprising terminals and rail/barge/maritime transport segments as well as the initial and final segments done in most (if not all) cases by road transport. Developed to offer 'common' services to various transport and logistics companies located within its site, as well as to other external users.
UNCTAD (1982)	Inland Terminal	An inland terminal to which shipping lines issue their own bills of lading for import cargoes, assuming full responsibility of costs and conditions, and from which shipping companies issue their own bills of lading for export cargoes.
UNCTAD (1991)	Dry Port	A customs clearance depot located inland away from seaport(s).
UNCTAD (1991)	Inland Customs Depot	A common-user inland facility, other than a port or airport, with public authority status, equipped with fixed installations and offering services for handling and temporary storage of any kind of goods (including container) carried under Custom transit by any applicable mode of inland surface transport, placed under Customs control and with Customs and other agencies competent to clear goods for home use, warehousing, temporary admission, re-export, temporary storage for onward transit, and outright export.
UNECE (1998)	Inland Clearance Depot	A terminal located in the hinterland of a gateway port and serving as a dry port for customs examination and clearance of cargoes, thereby eliminating customs formalities at the seaport.
UNECE (1998)	Inland Freight Terminal	Any facility, other than a port of an airport, operated on a common-user basis, at which cargo in international trade is received or dispatched.
UNECE (2001)	Inland Port	A port that is located inland, generally far from seaport terminals, and that supplies regions with an intermodal terminal or a merging point for traffic modes – rail, air and truck routes – involved in distributing merchandise that comes from seaports; an inland port usually provides international logistics and distribution services, including freight forwarding, customs, brokerages, integrated logistics and information systems.

APPENDIX B The Development of a Logistics Centre Typology and Hierarchy

A. Logistics Centre Typologies

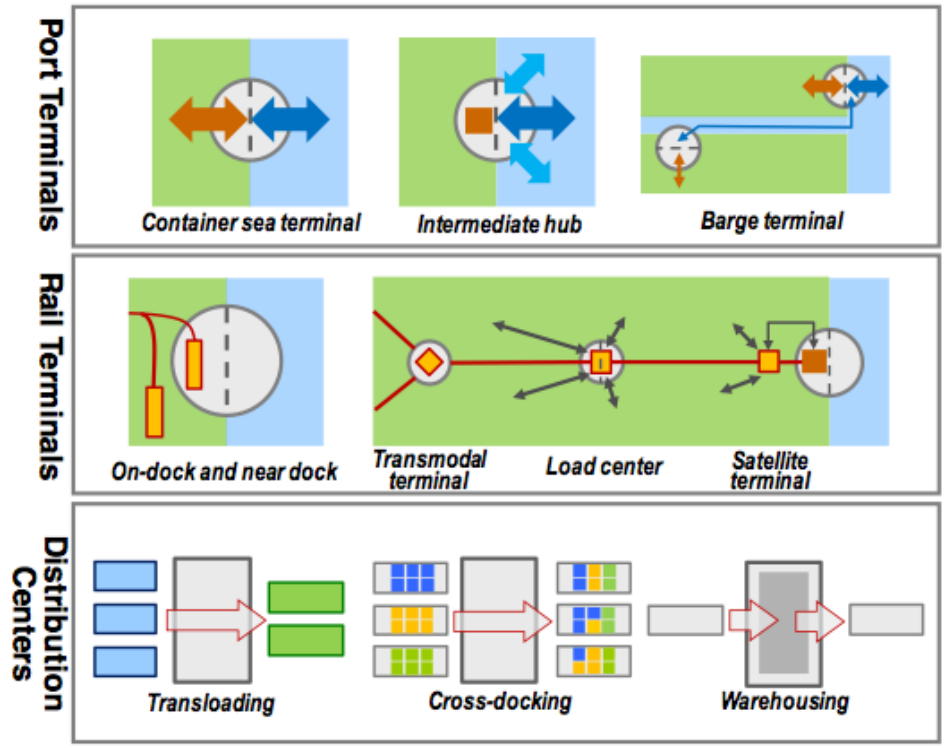
As seen in Table 1 and Appendix A of this report, there is some confusion in the literature surrounding the terminology and definitions of intermodal logistics centres. Some authors have attempted to categorize the variety of logistics centres according to different criteria. Below we provide a working version of the paper "Varieties of Logistics Centres" by Higgins et al. (2012). To begin, we provide a concise discussion of these approaches, with a more detailed outline presented in Table A. The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, 2009) has developed a comprehensive typology of five different types of intermodal logistics centres according to their design, function, and role, ranging from the simple functions of a container yard to the broad activities performed at a freight village.

Based on a review of different terms used in the literature, Rimiene and Grundey (2007) propose a classification of six different types of logistics centres based on their function and scope of activities in freight and logistics, ranging from the singular function of warehousing to the conceptualization of 'logistics nodes' as integrators of different transport modes with large freight flows and extensive regional influence.

Working under the rubric of inland ports, Leitner and Harrison (2001) classify the development of logistics centres into different categories according to their primary mode of transportation. This includes inland waterway ports, airfreight facilities, the relief of maritime ports through road and rail shuttles for inland consolidation, and sites that host a range of road and rail connections and add value to goods. Notteboom and Rodrigue (2009a) take a similar approach, arguing that there are three major types of intermodal terminals, each with their own locational and equipment requirements. These consist of port terminals, rail terminals, which have a subdivision of three types of inland ports (satellite terminals, load centres, and transmodal terminals), and distribution centres that perform transloading, cross-docking, and warehousing operations (Figure A).

Wiegmans et al. (1999) provide an alternate classification of terminal types based on the volume of freight flows and the corresponding network characteristics. This typology ranges from bulk terminals that handle large volumes of global freight to hinterland terminals that consolidate small shipments into bigger freight flows. These are also organized according to four types of freight bundling flows and network organizations, such as the point-to-point bundling model, the hub-and-spoke network, the line network, and the trunk line with collection and distribution.

FIGURE A Types of Intermodal Terminals



(Notteboom & Rodrigue, 2009a)

B. Logistics Centre Hierarchies

Some authors have then applied the terminology to the development of hierarchical classifications of logistics centres according to different criteria. For example, Wiegmans et al. (1999) classify five different types of freight terminal based on geographical coverage, volume, and terminal capacity, ranging from the intensive operations of a 'XXL or Mainport Terminal' such as a major seaport to the small-scale operations at a 'S or Local Terminal'. A detailed overview of this hierarchy is provided in Table B.

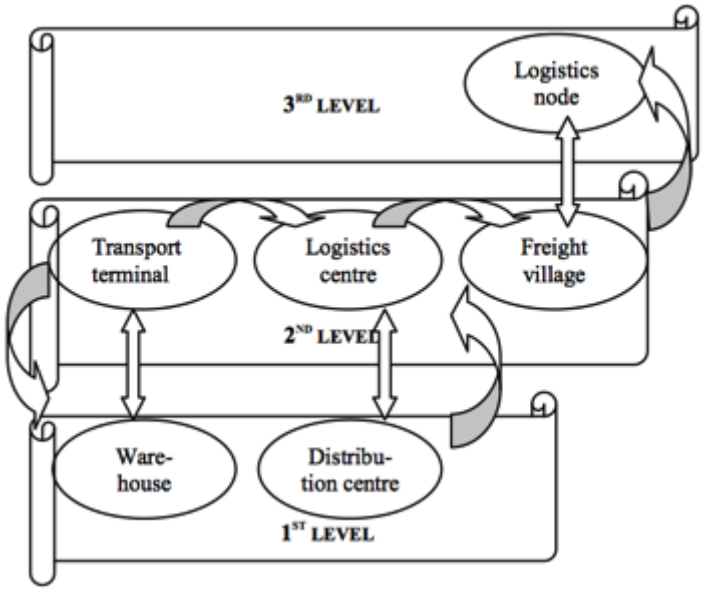
After a comprehensive literature review of various definitions of logistics centres, Rimienė and Grundey (2007) produced a 3-level hierarchy of their classification of logistics facilities according to their role in the supply chain and similarities to one another (Figure B): According to Rimienė and Grundey (2007), the 1st level indicates the smallest scope of activities, with the highest scope defined by the 3rd level. The intersection arrows between different levels show that the names of connected facilities can transfer between levels depending on the individual activities of each centre, and the definition employed by individual authors. The closest connections in definition are represented by unidirectional arrows (Rimienė & Grundey, 2007).

TABLE A Logistics Centre Typologies

Leitner & Harrison (2001)	
Inland Waterway Port	These ports are not a new concept in international and domestic freight movement. Provides one of the most efficient means for the transport of bulk cargo. This can be considered an inland port by virtue of its inland location and volume of goods transported.
Air Cargo Port	Air cargo ports exist in conjunction with passenger facilities but are becoming more common as dedicated cargo ports. Commonly used to ship high-value, time-sensitive goods. Some facilities incorporate customs, distribution facilities, and in some cases manufacturing centres.
Maritime Feeder Inland Port	The concept behind this class of inland port is to provide a deconsolidation point for cargo shipped to a congested maritime port. Typically located between 50 to 250 miles from the mainport to allow the mode shift of freight from road to rail and relieve congestion, though major inland links can include highways and inland waterways as well.
Trade and Transportation Centre Inland Port	This general class can be looked at as a location where border processing of trade is shifted inland and multiple modes of transportation are available. A distinguishing feature is the ability to be at locations where value is added to goods. Many sites are located at air force bases or large greenfield areas. Sites can range from a single facility where intermodal connections and manufacturing centres are located, to an entire city or region that facilitates international trade.
Notteboom & Rodrigue (2009a)	
Port Terminals	The most substantial intermodal terminals in terms of traffic and land consumption, providing an interface between the maritime and inland systems of circulation. Barging has also emerged to extend the economies of scale offered in maritime container shipping.
Rail Terminals	Connected to port terminals to form the inland intermodal chain. These can be broken down further into three types of facilities: • Satellite Terminals: Linked to maritime terminals through rail shuttle or drayage and perform activities that have become too expensive for the maritime terminal. • Load Centres: Standard intermodal rail terminals serving a regional market. When combined with other logistics activities such as freight distribution, they can take on the form of a freight village. • Transmodal Terminals: Shift containerized freight from one rail carrier or rail network to another during long distance transportation.
Distribution Centres	Represent a distinct category of intermodal terminals performing an array of value-added functions to freight, with operations mainly supported by trucking. These functions include: • Transfers: The contents of maritime containers are transferred into domestic containers or truckloads. • Cross-Docking: The contents of inbound loads are sorted and transloaded to their final destinations. • Warehousing: A standard function still performed by a majority of distribution centres that act as buffers and points of consolidation and deconsolidation in supply chains.
Rimienė & Grundey (2007)	
Logistics Node	Points that gather and connect different transport modes and give an opportunity to serve cargoes that flow from different directions. Nodes include major seaports and other large-scale terminals that are seen as complimentary to inland logistics centres.
Freight Village	Seen as synonymous with logistics centres, differing only in scale. Typically, only larger logistics centres are considered a freight village, offering a broader range of services, infrastructure, and integration to facilitate the flow of goods. Freight villages with

	considerable influence in regional trade flows can also be considered a logistics node.
Logistics Centre	A village planned and built to best manage all the activities involved in freight movement. Logistics centres are seen as promoters of local consolidation, intermodal transportation, and regional economic activity.
Transport Terminal	Points of concentration at which traffic between urban areas ends its journey, or is interchanged for further movement to its ultimate destination. Transport terminals can range from simple terminals providing transfer between two or three modes, to more extensive facilities providing a number of value-added services. The latter approach the scope of activities of a logistics centre or freight village.
Distribution Centre	A warehouse that emphasizes product flow rather than the storage of goods. Later conceptions of distribution centres focus on distribution centres as a place located at nodal points in the transportation system where consignments are grouped or split. These activities approach the definition of a transport terminal or logistics centre.
Warehouse	Can be as simple as an intermediate storage point between suppliers and manufacturers to smooth the relationship between time and demand, to a more complex facility for performing distribution, maintenance, and value-added services. The complex-type warehouse can be seen to be virtually synonymous with a distribution centre.
UNESCAP (2009)	
Freight Village	An area of land dedicated to a number of transport and logistics facilities, activities and services, which are not just co-located but also coordinated to encourage maximum synergy and efficiency. Distinguishing features include an intermodal terminal and shared access to facilities and services.
Dry Port	Provides all the services of a port except for the loading of cargo to and from seagoing ships. In comparison to container depots, it can accommodate all types of cargo, not just containers. Typically provides all of the features of the facilities above.
Intermodal Terminal	Enables containers to be transferred from road to rail or rail to road. Can be an efficient method for moving high volumes of freight from one inland location to another, and typically incorporates the services of the other terminals in the ESCAP typology.
Inland Container Depot	Adds to the functions of a container yard through customs clearance and inspection services. Performs the same role as a port container terminal in addition to break-bulk handling and other container services.
Container Yard	Dedicated to the temporary storage, cleaning, and repair of empty containers. Sometimes located near to a seaport to improve import / export container turnaround time.
Wiegmans et al. (1999)	
Bulk Terminal	This is the mainport with large volumes and global freight connections. Bulk refers to large volumes and not to bulk freight. Large flows arrive at the terminal and are split into smaller flows for further transport. These terminals are noted by grand storage areas, rapid loading and unloading, intensive use of IT, and intelligent terminal transport. Utilizes the point-to-point bundling model.
Transfer Terminal	Almost exclusively aimed at shipping continental freight. There is almost no collection and distribution in the region where the terminal is located. Freight arrives and departs in huge flows and the terminal is characterized by large areas that enable direct transshipment between trains and/or barges. Utilizes the hub-and-spoke network.
Distribution Terminal	At this terminal, added value is created in the form of an extra service provided by the terminal operator. From locations A, B and C, continental freight arrives at the terminal and is consolidated into shipments for customers X, Y, and Z. One or more terminal services are added by the terminal operator to the shipments at the terminal. Utilizes the line network.
Hinterland Terminal	Small continental cargo shipments are brought to the hinterland terminal and consolidated into bigger freight flows. These bigger freight flows are further transported by larger transport means, such as trains or barges. Utilizes the trunk line bundling model.

FIGURE B Logistics Centre Hierarchy



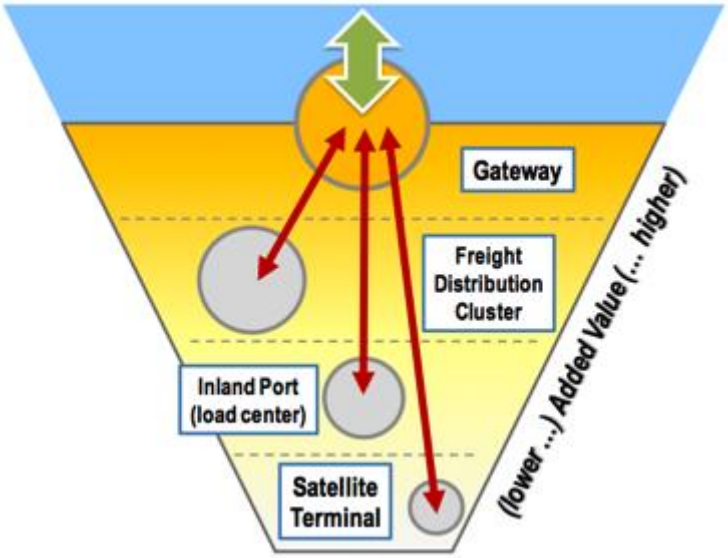
(Rimienė & Grundey, 2007, p. 89)

Notteboom and Rodrigue (2009a) have expanded on their categorization of logistics centres and utilize them to form a functional and added value hierarchy (Figure C). The categories in this example are grouped according to three levels ranging from the broad transportation and value added activities at a 'Gateway (Level 1)' terminal, to the specific function performed by a 'Satellite Terminal (Level 4)'. A more detailed overview is provided in Table B. According to Notteboom and Rodrigue (2009a), the functions of inland logistics zones and facilities ranges from simple cargo consolidation to advanced logistics services. Many locations have assumed not only a significant number of traditional cargo handling functions and services, but have also attracted many additional logistics services, acting as distribution centres, shipping agents, trucking companies, freight forwarders, container repair facilities and packing firms. This classification shows the clustering of inland terminals and logistics activities, and also the degree of specialization each offers with respect to different freight and logistics processes. These facilities have become excellent locations for consolidating a wide range of ancillary logistics services and a host of logistics companies.

Summary and Evaluation

The approaches outlined above make an attempt to distinguish between the different types of logistics centres according to varying criteria. But as these demonstrate, there exists no standardized approach to conceptualizing the different types of facilities encountered in the literature and their role in freight and logistics processes. Like the terminology outlined elsewhere in this report, these approaches appear to be limited in their scope, level of analysis, and applicability for further study due to the immaturity of the research field, the evolution of logistics, and the regional geographic and semantic considerations mentioned previously.

FIGURE C Freight Terminal Hierarchy and Added Value



(Notteboom & Rodrigue, 2009, p. 9)

Many of these examples exist in isolation from one another, discussing similar concepts but making no attempt to unify research in this area. Of these works, only Rimienė and Grundey (2007) have made an explicit attempt to integrate the terminology on logistics centres based on a literature review. However, their approach falls short in accommodating the various types of facilities mentioned by other authors and their distinct roles in freight and logistics.

Yet while the usefulness of these typologies and hierarchies to guide further study appears limited, they are useful for the development of a standardized approach in two ways. The first is that these examples demonstrate that although differences in logistics centres do exist, the concepts, characteristics, and relationships between terminal types are similar enough that functional classifications between terminal types can be delineated.

The second way these examples benefit the development of a standardized typology and hierarchy is through establishing the criteria for further analysis. In order to assemble a standardized typology, this paper will consider the definitions of logistics centres according to their design, function, primary mode of transportation, volume of freight flows, and role and scope of activities in freight and logistics. The results of the typology can then be applied to create a standardized hierarchy according to facility size (site, volume of freight, capacity), influence (geographic coverage), and scope of functionality and value added activities.

TABLE B Logistics Centre Hierarchies

Notteboom & Rodrigue (2009a)	
Gateway (Level 1)	World-class gateway terminals that function as an interface between regional and international transportation systems. Gateways contain the whole range of value added activities related to freight and logistics, though basic gateways focusing only on transshipment between maritime and inland transportation networks do exist.
Freight Distribution Cluster (Level 2)	Characterizes a complex of large inland terminals and freight distribution centres that cover a vast market area. Some can have as much value added activities as a gateway.
Inland Port (Level 3)	Often a single intermodal terminal coupled with an array of distribution activities. Commonly acts as a load centre for commodity chains.
Satellite Terminal (Level 4)	Performs a specific function such as transloading, often in the vicinity of a major gateway. Some satellite terminals are very significant at providing specialized freight distribution services.
Wiegmans, et al. (1999)	
XXL or Mainport Terminal	Abundant deep-sea, rail, truck, and barge connections throughout the world. Characterized by low costs, high volumes, high capacity utilization, IT-intensive operations, and heavyweight global logistics players involved. Usually a mainport will either be a major seaport or a large airport with worldwide connections.
XL or International Terminal	Characterized by deep-sea, rail, truck, and barge connections in a more continental level. Especially used as an international distribution centre.
L or National Terminal	Operated on the country level and has rail, barge, and truck connections. Used as a national distribution centre in Europe.
M or Regional Terminal	Characterized by low cost through low budget solutions, relatively low volumes and IT-components in operations, and smaller regional and national logistical players. Used as a regional distribution centre with truck and rail or barge connections.
S or Local Terminal	Only served by trucks that collect and distribute freight to and from their final destination. A simple connection with rail or barge is provided.

C. The Development of a Standardized Logistics Centre Typology and Hierarchy

Despite their limitations, the definitions and approaches in Section B establish useful criteria for analysis. These factors provide the framework for developing a unified typology and hierarchy of logistics centres that can account for much of the variation in the literature. This section develops a standardized logistics centre typology and applies it to the creation of a standardized hierarchy. This is followed by an overview of the consolidated definitions of logistics centres and a discussion of the limitations of the approach.

Standardized Logistics Centre Typology

In order to address the lack of standardized definitions in the research, this paper will first develop a unified typology of logistics centres by extracting common themes from the definitions, typologies, and hierarchies presented above and applying them to the criteria outlined in Section B. Using these criteria, the various definitions of logistics centres encountered in the literature can be broken down into six categories and three levels of activity as shown in Table C, with each term located relative to its definition and those above and below it. This classification combines and expands on other authors in the field, with particular emphasis on Wiegmans et al. (1999), Leitner and Harrison (2001), Meidutė

(2005), Rimienė and Grundey (2007), Notteboom and Rodrigue (2009a), and the United Nations ESCAP report (UNESCAP, 2009). This typology presents a practical logistics centre typology that serves to simplify and differentiate between the varieties of facilities seen in the literature.

Standardized Logistics Centre Hierarchy

The information from the above classification typology is then applied to form a hierarchy of logistics centres according to each facility's size, influence, and function in regional freight and logistics and value added activities (Figure D). This hierarchy collapses the five sizes in Wiegmans et al. (1999) and the four levels presented in Notteboom and Rodrigue (2009a) into three broad levels based on the scope of activities in Rimienė & Grundey (2007). Utilizing the classification above, the definitions provided by the authors cited are applied to form functional definitions of the eight consolidated types of intermodal logistics centres in Figure D. These categories are then expanded and defined below according to their cluster and terminal type. Examples of facilities in the literature according to this classification can also be seen in Appendix D.

FIGURE D Standardized Logistics Centre Hierarchy

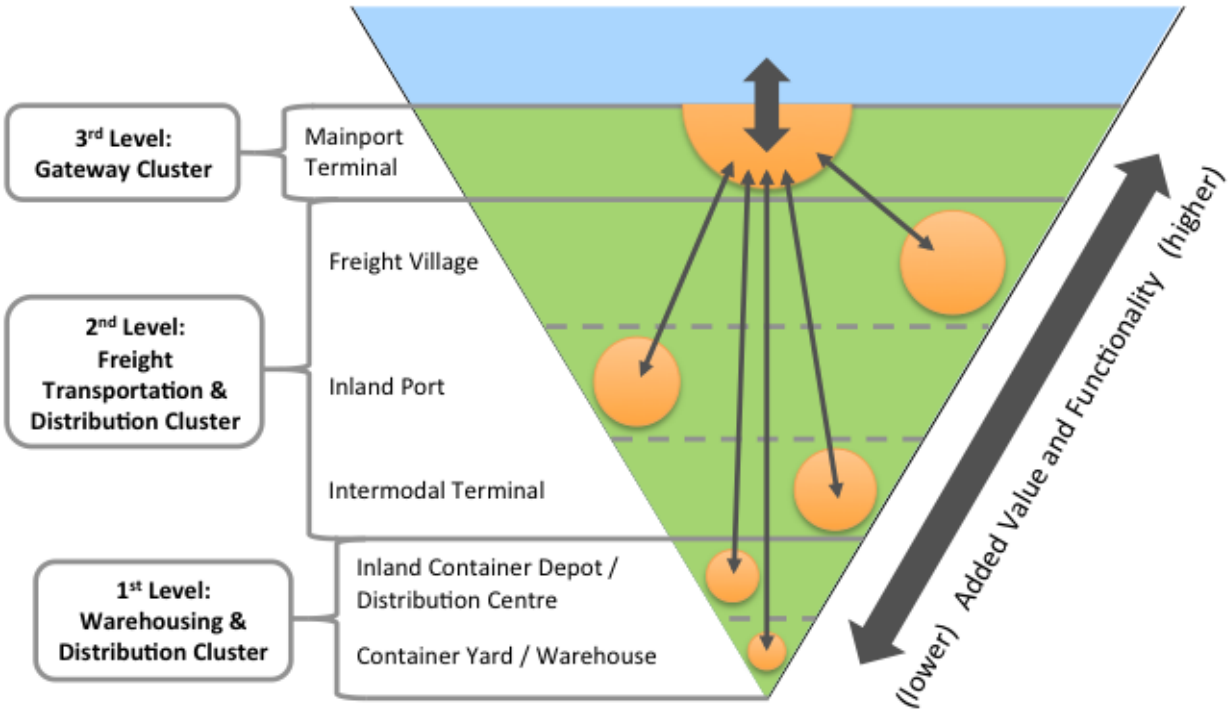


TABLE C Consolidated Logistics Centre Classification and Scope of Activities

Terminal Size[a]	Logistics Facilities Hierarchy[b]	Functional Hierarchy[c]	Facility Terminology	Consolidated Classification	Consolidated Scope of Activities
XXL	3rd Level	Gateway (1st Level)	Gateway (Notteboom & Rodrigue, 2009a)	Mainport Terminal	3rd Level (Gateway Cluster)
			Logistics Node (Rimienė & Grundey, 2007)		
			Seaport (Dooms & Macharis, 2003)		
			Air Cargo Port (Leitner & Harrison, 2001)		
XL			Bulk Terminal (Wiegmans et al. 1999)		
L	2nd Level	Freight Distribution Cluster (2nd Level)	Nodal Centres for Goods (Tsamboulas & Dimitropoulos, 1999)	Freight Village	2nd Level (Freight Transportation and Distribution Cluster)
			Freight Village (UNESCAP, 2009)		
			Freight Village (Rimienė & Grundey, 2007)		
			Freight Village (Tsamboulas & Kapros, 2003)		
			Freight Village (Boile et al. 2008)		
			Logistics Centre (EUROPLATFORMS, 2004)		
			Logistics Centre (Meidutė, 2005)		
			Logistics Centre (Rimienė & Grundey, 2007)		
			Trade and Transportation Centre Inland Port (Leitner & Harrison, 2001)		
		Inland Port (3rd Level)	Load Centre (Notteboom & Rodrigue, 2009a)	Inland Port	
			Inland Port (UNECE 2001)		
			Dry Port (Ng & Gujar, 2009)		
			Dry Port (Roso, et al. 2009)		
			Dry Port (UNESCAP, 2009)		
			Inland Port (Rodrigue et al. 2010)		
			Maritime Feeder Inland Port (Leitner & Harrison, 2001)		
M		Satellite Terminal (4th Level)	Satellite Terminal (Notteboom & Rodrigue, 2009a)	Intermodal Terminal	
			Satellite Terminal (Slack, 1999)		
			Inland Waterway Port (Leitner & Harrison, 2001)		
			Barge Terminal (Notteboom & Rodrigue, 2009a)		
			Transport Terminal (Rimienė & Grundey, 2007)		
			Intermodal and Multimodal Industrial Park (Boile et al. 2008)		
			Hinterland Terminal (Wiegmans et al. 1999)		
			Intermodal Rail-Road Terminal (Roso & Lumsden, 2009)		
			Intermodal Freight Centre (Cardebring & Warnecke, 1995)		
			Transfer Terminal (Wiegmans et al. 1999)		

S			Transmodal Terminal (Notteboom & Rodrigue, 2009a)		
			Intermodal Terminal (UNESCAP, 2009)		
	1st Level		Industrial Park (Boile et al. (2008)	Distribution Centre / Inland Container Depot	1st Level (Warehousing and Distribution Cluster)
			Distribution Centre (Notteboom & Rodrigue, 2009a)		
			Distribution Terminal (Wiegmans et al. 1999)		
			Distribution Centre (Rimienė & Grundey, 2007)		
			Urban Consolidation Centre (BESTUFS, 2005)		
			Urban Distribution Centre (de Cerreño et al. 2008)		
			Distribution Centre (Hesse, 2004)		
			Inland Container Depot (Jaržemskis & Vasiliauskas, 2007)		
			Inland Container Depot (UNESCAP, 2009)		
			Warehouse (Rimienė & Grundey, 2007)	Warehouse / Container Yard	
			Container Yard (UNESCAP, 2009)		

a: Wiegmans, Masurel, & Nijkamp, 1999; b: Rimienė & Grundey, 2007; c: Notteboom & Rodrigue, 2009a

1st Level: Warehousing and Distribution Cluster

The 1st level represents the smallest scope of activities by intermodal logistics centres. Warehousing and Distribution Centres perform a variety of logistics functions and serve as important basic elements in the supply chain. Also included are the UNESCAP's basic Container Yards that help facilitate containerized trade, and Inland Container Depots that offer a greater set of services tailored to containerized trade over container yards.

Warehouse: Warehouses are typically a place for inventory and storage and perform the basic function of acting as a buffer between suppliers, manufacturers, and customers to smooth time and demand constraints in the supply chain (Rimienė & Grundey, 2007). Some warehouses are more complex, performing distribution, maintenance, and value added activities and can approach the functional scale of distribution centres.

Distribution Centre: Distribution centres are a single large warehouse or cluster of warehouses dedicated to the rapid movement of goods. Basic functions include warehousing, shipping, receiving, transloading, and cross-docking, while some have evolved to add ancillary value added services such as order picking, returns processing, information management, labeling, barcoding, and other activities. Unlike a warehouse, the primary emphasis of a distribution centre is on product flow rather than the storage of goods. Some facilities are specifically designed to increase the efficiency of urban goods movement by providing a shared facility within an urban area at which different companies can consolidate and deconsolidate their shipments into fewer or smaller trucks for local delivery. Broader conceptions of distribution centres that host logistics and other firms, offer access to other modes, and perform a wide array of activities can begin to resemble other facilities higher in the hierarchy such as freight villages.

Container Yard: A container yard is a facility dedicated to performing the basic functions of storage, cleaning, and repair of empty containers. Like a warehouse, these facilities act as a buffer in the supply chain by ensuring a smooth supply of container to facilitate the movement of goods. These facilities can be located near a mainport terminal or other logistics centres as a way to improve service and handling turnaround times.

Inland Container Depot: Inland container depots offer a location for the handling and temporary storage of containerized trade. Similar to distribution centres, the focus of an inland container depot is on the movement of containers rather than storage. Unlike a container yard, an inland container depot performs some of the functions of a traditional seaport container terminal other than ship to shore transfer. This can include container handling and storage, break-bulk cargo handling and storage, and additional value added services such as basic customs clearance and inspection.

2nd Level: Freight Distribution Cluster

The 2nd level represents the freight distribution cluster, which has been expanded from Notteboom and Rodrigue (2009a) in accordance with the definitions of these facilities by other authors. It now encompasses Freight Villages, Inland Ports, and Intermodal Terminals, and loosely covers the XL, L, and

M size terminals in Wiegmans et al. (1999). The activities performed by these facilities range from the simple transfer of goods from one mode to anther at an intermodal terminal, to the broad range of intermodal transportation options, wide geographic coverage, and comprehensive value added services offered by freight villages.

Intermodal Terminal: An intermodal terminal is a facility dedicated to the transshipment and consolidation of intermodal freight into bigger flows for regional and continental trade. Intermodal terminals handle large freight flows and feature intermodal infrastructure for the transshipment of goods between rail, road, and other modes such as barge for further transportation to their final destinations. Some intermodal terminals can incorporate the value added and logistics functionality of a freight village with the exception of commercial support services and activities, while others perform singular functions as a terminal dedicated to transshipment between modes.

Inland Port: An inland port can be understood as an inland extension of a traditional seaport, connected to the mainport terminal by a high-capacity rail shuttle or barge link for short sea shipping. The scope of activities at an inland port can range from intermodal 'satellite' terminals dedicated to 'extending the gate' of mainport terminals by consolidating freight flows for further transport by barge or train or deconsolidating incoming freight for local distribution. Other inland ports can resemble freight villages by offering a variety of transport modes, warehousing and distribution activities, and value added services such as customs clearance and inspection.

Inland ports typically provide the range of additional services offered by inland container depots and container yards. But unlike these facilities, an inland port can accommodate all types of cargo in addition to containers and offers full customs-related services. By providing all of the services of a traditional seaport other than the actual loading and unloading of cargo from maritime vessels, inland ports can mitigate congestion at mainport terminals. This can include functions such as freight assembly, storage, and logistical control. Furthermore, as a consolidation and deconsolidation point for maritime freight flows, inland ports offer firms the benefits of massification for achieving economies of scale.

Freight Village: A freight village is a site or area hosting a cluster of industrial, intermodal, distribution, and logistics infrastructure and supporting services dedicated to facilitating the flow of goods. A central feature of a freight village is high quality connections to intermodal and other transportation infrastructure (road, rail, air, barge) that enables the fast and flexible transportation of freight. Some freight villages add urban consolidation and distribution functions to improve the efficiency of urban goods movement.

A distinguishing characteristic of a freight village is shared access to facilities, equipment, and services among firms located on site. This can include common intermodal infrastructure, customs and quarantine services, cleaning and repair areas, IT and telecommunications, security areas, and amenities such as restaurants and childcare facilities.

Because of the size of investment required, many freight villages are financed through partnerships between public and private actors, though examples of purely private facilities exist. Due to the

complexity of these arrangements, freight villages typically feature a joint management and ownership structure. This company is responsible for owning and operating common infrastructure as well as planning the long-term growth of the facility.

Though the size of their sites can vary significantly, freight villages are the largest inland facilities at the top of the logistics hierarchy due to the size of their influence and impact in freight and logistics. These logistics centres add the most value to the supply chain by offering a host of facilities, services, infrastructure, and activities related to freight and logistics that are both co-located and coordinated to encourage maximum efficiency between tenants on site. By combining major freight generators with multiple modes of transportation, logistics activities, and commercial support services at a location near major urban and regional markets, a freight village can have a large impact on a number of freight-related processes. The biggest freight villages with sufficient infrastructure and considerable influence in regional trade flows can approach the level of being considered a mainport terminal.

3rd Level: Gateway Cluster

The 3rd level defines the largest scope of activities contained within major international mainport terminals such as traditional seaports and the freight operations of airports described as XXL and XL terminals by Wiegmans et al. (1999) and Gateways by Notteboom and Rodrigue (2009a).

Mainport Terminals: As the primary interface between maritime and inland freight and logistics, mainport terminals act as nodal centres for logistics that produce large amounts of activity both inside the facility and within its periphery. This includes major seaports that transfer large volumes of freight from maritime to inland transportation systems and other large-scale terminals such as airports with worldwide connections and high trade and passenger flows. Large volumes of freight arrive at the terminal and are split into smaller shipments for further transport, though these flows have enough volume to fill an entire train, barge, or ship. This relationship is inversed for consolidating outgoing shipments.

As the largest logistics centres, mainport terminals require vast amounts of investment in infrastructure and consume an immense amount of land for terminal operations. These terminals have a large economic impact, generate high levels of employment, provide vast areas for storage, feature heavy duty infrastructure to facilitate rapid loading and unloading, utilize IT and other technologies extensively, and contain the whole range of value added activities related to freight and logistics. These facilities are complimentary to inland intermodal logistics centres and act as the main gateway between international supply chains.

Discussion

As a simplified and functional classification, the presented standardized typology and hierarchy of intermodal logistics centres accommodates the varieties of facilities seen in the literature. However, such an approach is not without its limitations. First, it should be noted that any subdivision of terminal types cannot cover the variation of logistics centres seen in practice unambiguously. The categories of logistics centres presented are not exclusive, as many examples take on characteristics of two or more

terminal types according to their function, operations, location, and other regional geographic and semantic considerations. This is represented in Table C by dotted lines that indicate connections between various classifications.

Secondly, this classification does not accommodate facilities that do not incorporate access to freight transfer infrastructure or engage in freight and logistics activates. A related issue is that this typology only considers logistics centre facilities. This excludes broader conceptualizations of freight and logistics centres as entire cities or regions that facilitate trade, as seen in the definition of a 'Trade and Transportation Centre' by Leitner and Harrison (2001).

A third limitation is that the ongoing evolution of freight and logistics and the centres that facilitate these activities means that the definitions of these facilities are likely to change over time. For example, some of the older definitions cited in Appendix A of this report are not included in this typology, such as those in UNCTAD (1982, 1991) and UNECE (1998). Though these provide some of the first descriptions of the logistics centre phenomenon, the defined roles and conceptualizations of these facilities have become too general and ambiguous compared to more recent definitions to be considered as a guide for further analysis.

Lastly, this typology relies on a more general interpretation of intermodal transportation to classify the varieties of facilities seen in the literature. For example, Boile et al. (2008) identify 'Industrial Parks' that are supported only by trucking as a freight and logistics facility. By employing the more general definition of intermodal by Notteboom and Rodrigue (2009a), this facility can be accommodated in the typology. However, based on a strict interpretation of intermodal as a transportation process employing at least two different modes as seen in Tsamboulas and Kapros (2003), these facilities would not be considered an intermodal logistics centre.

APPENDIX C Functions of Freight Villages

Broad Functions		
• On-site manufacturing/commercial firms • Warehousing and leasing • Cargo handling	• Container freight station • Distribution services • International cargo transfer • Cargo division	• E-commerce • Host/facilitate 3-4PL activities • Industry integration
Intermodal Facilities		
• Rail lines/rail sidings (single/multiple operators) • Seaport • Airport	• Container terminal • Combined Terminal • Rail link to nearby airport • Rail link to Port	• Rail terminal • Transshipment/Transload facilities
Transport Services		
• International logistics • Domestic logistics • Aviation services	• Load/unload ships/trains/trucks • Roll-on/Roll-off infrastructure • Cross-docking/merge-in-transit	• Final transportation to destination • JIT logistics
Traditional Logistics Services		
• Distribution • Freight forwarding	• Warehousing • Warehouse leasing	• Basic container handling • Storage
New Logistics Services		
• Transshipment • Container depot (load, unload, repair, inspect, clean)	• Air cargo ground handling • Consolidation for local distribution/long distance shipping	• Cargo deconsolidation for local distribution/long distance shipping • Fresh produce express parcels
Value Added Logistics Services		
• Free/Foreign Trade Zone (FTZ) • Barcoding • Online tracking • Quality Assurance and control • Picking • Packaging/repackaging • Pick-and-Pack • Labelling	• Wrapping • Assembly/reassembly • Postponement/delayed assembly • Palletizing • Processing • Customs clearance • Management of customs requirements • Sampling	• Surveying • Topping-up of cargo • Performance analysis • Allocation • Procurement • Management of customer returns • Facilitate electronic information flows between customers

Continued…

Additional Value Added Services		
• Supply chain management	• Supplier-managed inventory	• Call centre management
• Temperature controlled environments	• Vendor-managed inventory	• Commissioning
• Security environments	• Finished goods inventory	• 24-hour access/extended hours
• Hazardous materials services	• Stock replenishment	
• Raw material management	• Production line management	
Additional Features		
• New land for development	• Washing facilities	• Workforce recruitment/training/retention
• Repair garages	• Research and development facilities	
Public Services		
• Hospital/medical centre	• Road/traffic information	• Public weigh bridge
• School	• Customs office	
• Post Office	• Public transportation	
Private Services		
• Residential development	• Restaurant/Cafeteria	• Consulting services
• Commercial development	• Recreation/entertainment	• Accountants
• Office space	• Courier	• Fitness centre
• Insurance office	• Conference centre/exhibition hall	• Showers
• Bank	• Meeting rooms	• Bar/pub
• Supermarket	• Gas station	• Internet/telephones/fax services
• Hotel	• Forwarding agents	• Daycare

(Boile, Theofanis, & Strauss-Wieder, 2008)

APPENDIX D Examples of Logistics Centres in the Literature

Freight Villages

Country		General Characteristics			Modes			
		Size (Acres)	Employees	Transport & Logistic Firms	Road	Rail	Sea / Water	Air
Asia								
China	Shenzhen Pinghu Logistics (Boile et al., 2008)	4,015	-	-	X	X	(X)	(X)
	Huaihai Integrated Logistics Park (Boile et al., 2008)	890	-	-	X	(X)		
	Shanghai North-West ILP (Boile et al., 2008)	4,653	-	-	X	X		(X)
Korea	Busan New Port Distripark (Boile et al., 2008)	758	-	17	X	X	X	(X)
	Gamcheon Distripark (Boile et al., 2008)	-	-	-	X	X	X	(X)
	Gwangyang Port Distripark (Boile et al., 2008)	215	-	23	X	X	X	
Taiwan	Far Glory FTZ (Boile et al., 2008)	111	25,000	-	X		X	X
	Taisugar Logistics Park (Boile et al., 2008)	21	-	-	X		X	(X)
Europe								
Denmark	HTC Hoeje Taastrup Transport Centre (Boile et al., 2008)	371	-	3	X	X		
	NTC Nordic Transport Centre (Boile et al., 2008)	228	-	15	X	X	X	
	Skandinavisk Transport Centre (Boile et al., 2008)	321	-	-	X	X	(X)	(X)
	Taulov Transport Centre (Boile et al., 2008)	519	-	14	X	X	(X)	
France	Roissy-SOGARIS (Weisbrod et al., 2002; de Cerreño et al., 2008; Boile et al., 2008)	133	2,500	100	X	X		(X)
	Eurocentre Toulouse (Under Development) (Weisbrod et al., 2002)	740	-	-	X	X		(X)
Germany	GVZ Bremen (Weisbrod et al., 2002; Boile et al., 2008; Wisetjindawat, 2010)	895	8,000	150	X	X	X	(X)
	GVZ Dresden (Boile et al., 2008)	61	410	4	X	X	X	(X)
	GVZ Entwicklungsgesellschaft Bremen MBH (Boile et al., 2008)	524	3,000	-	X	X	(X)	(X)
	GVZ Freienbrink (de Cerreño et al., 2008)	321	-	-	X	X		
	GVZ Großbeeren (de Cerreño et al., 2008)	759	-	-	X	X		
	GVZ Hamburg (Boile et al., 2008)	138	450	6	X	X	X	(X)
	GVZ Kiel (Boile et al., 2008)	667	-	-	X	X	X	(X)
	GVZ Nuremberg (Boile et al., 2008)	833	5,500	260	X	X	X	(X)
	GVZ Osnabrück (Boile et al., 2008)	114	-	-	X	X	X	(X)
	GVZ Rostock (Boile et al., 2008)	373	-	-	X	X	(X)	(X)
	GVZ Wustermark (de Cerreño et al., 2008)	520	-	-	X			
Hungary	Budapest Intermodal Logistics Centre (Boile et al., 2008)	247	-	-	X	X	(X)	(X)

Italy	Interporto Bologna (Boile et al., 2008; Wisetjindawat, 2010)	1,055	1,500	81	X	X		
	Interporto Novara (Boile et al., 2008)	207	50	-	X	X		(X)
	Interporto Padova (Boile et al., 2008)	3,212	1,200	80	X	X		
	Interporto Parma (Boile et al., 2008)	618	1,300	60	X	X	(X)	(X)
	Interporto Rivalta Scrivia (Boile et al., 2008)	556	490	40	X	X	(X)	
	Interporto Rovigo (Boile et al., 2008)	395	30	4	X	X	X	
	Interporto Torino (Boile et al., 2008)	889	3,000	200	X	X		
	Interporto Quadrante Europa (Boile et al., 2008)	618	1,800	110	X	X		(X)
	Interporto Venezia (Boile et al., 2008)	59	250	-	X	X	X	
	Interporto Verona (Boile et al., 2008)	605	1,800	110	X	X		
Portugal	Terminal Multimodal Do Vale Do Tejo S.A. (Boile et al., 2008)	548	22	-	X	X	(X)	
Spain	Bilkakobo-Aparcabisa (Boile et al., 2008)	49	800	40	X	X		(X)
	Centro de Transportes Aduana de Burgos (Boile et al., 2008)	40	-	17	X	X		(X)
	Centro de Transportes de Coslada (Boile et al., 2008)	247	-	15	X	X		(X)
	Centro de Transportes de Irun (Boile et al., 2008)	99	2,100	107	X	(X)		(X)
	Centro de Transportes de Madrid (Boile et al., 2008)	84	8,000	150	X	(X)		(X)
	Centro di Transporte de Vitoria (Boile et al., 2008)	268	-	20	X	X		(X)
	ZAL Port de Barcelona (Weisbrod et al., 2002; Boile et al., 2008)	177	-	17	X	X	(X)	(X)
	Zona Franca de Barcelona (Boile et al., 2008)	130	-	7	X	(X)	(X)	(X)
	ZAL Gran Europa (Boile et al., 2008)	237	>1,000	100	X	X		(X)
	Ciudad del Transporte de Pamplona (Boile et al., 2008)	150	1,000	50	X	X		(X)
United Kingdom	DIRFT Logistics Park (Boile et al., 2008)	498	-	-	X	X	(X)	
	Keypoint: Swindon's Premier Logistics Park (Boile et al., 2008)	-	-	-	X	X		
	Kingmoor Park (Boile et al., 2008)	400	-	100	X	X		
	Wakefield Europort (Boile et al., 2008)	220	-	16	X	X		
North America								
Canada	CentrePort Canada (Under Development)	20,000	-	-	X	X	(X)	X
Mexico	ADNplus Industrial Multiport (Cancelled) (Leitner & Harrison, 2001)	1,100	-	-	X	X		X
United States	AllianceTexas (Leitner & Harrison, 2001; Walter & Poist, 2004; Boile et al., 2008)	17,000	28,000	170+	X	X		X
	Global TransPark (Leitner & Harrison, 2001; Walter & Poist, 2004)	15,700	-		X			X
	Greater Columbus Inland Port / Rickenbacker Intermodal Facility (Leitner & Harrison, 2001; Walter & Poist, 2004; Boile et al., 2008)	1,300	20,400*	-	X	X		X
	Guild's Lake Industrial Sanctuary (Under Development) (Boile et al., 2008)	1,625	-	-	X	X	(X)	
	Heller Industrial Park (Boile et al., 2008)	-	-	-	X	X		
	Mesquite Intermodal Facility / Skyline Business Park (Boile et al., 2008)	400	-	-	X	X		
	Port of Huntsville (Leitner & Harrison, 2001; Walter & Poist, 2004)	1,780	-	-	X	X		X

	Pureland Industrial Complex (Boile et al., 2008)	3,000	-	150	X	X		(X)
	Raritan Center (Boile et al., 2008)	2,350	15,000+	391	X	X		
	Winter Haven (Boile et al., 2008)	1,250	8,000*	-	X	X		

X = Featured on site; (X) = Located nearby; * = Anticipated employment upon build-out

Inland Ports

Country		General Characteristics			Modes			
		Size (Acres)	Employees	Transport & Logistic Firms	Road	Rail	Sea / Water	Air
Asia								
New Zealand	Metroport (Leitner & Harrison, 2001)	9	-	-	X	X		
Europe								
Belgium	TCT Belgium (Notteboom & Rodrigue, 2009a)	-	-	-	X		X	
France	Lyon Terminal (Rodrigue et al., 2010)	-	-	-	X	X	X	
Germany	Logport, Duisburg (Leitner & Harrison, 2001, UNESCAP, 2006, Rodrigue et al., 2010)	665	-	-	X	X	X	(X)
Nether-lands	Trimodal Container Terminal Venlo (Rodrigue et al., 2010)	-	-	-	X	X	X	
Spain	Zaragoza Maritime Terminal (Rodrigue et al., 2010)	-	-	-	X	X		
North America								
United States	Virginia Inland Port (Leitner & Harrison, 2001)	161	-	-	X	X		
	Alameda Corridor Inland Port Network (UNESCAP, 2006)	-	-	-	X	X		
	Savannah Inland Ports (Rodrigue et al., 2010)	-	-	-	X	(X)	(X)	

X = Featured on site; (X) = Located nearby

Intermodal Terminals

Country		General Characteristics			Modes			
		Size (Acres)	Employees	Transport & Logistic Firms	Road	Rail	Sea / Water	Air
Asia								
China	ATL Logistics Centre, Hong Kong (Boile et al., 2008)	214	-	-	X		X	(X)
	Beijing Airport Logistics Park (Boile et al., 2008)	378	-	169	X			X
	Nanjing Wangjiawan ILP (Boile et al., 2008)	183	-	-	X	X	(X)	
	Tradeport Hong Kong (Boile et al., 2008)	-	-	-	X		X	X
Malaysia	Northport Distripark-Port Klang (Boile et al., 2008)	73	-	-	X		X	
Singapore	Keppel Distripark (Boile et al., 2008)	57	-	-	X		X	
Europe								
France	Europort Vatry (Under Development) (Leitner & Harrison, 2001)	3,260	-	-	X	X		X
Germany	GVZ Herne-Emscher (Boile et al., 2008)	57	-	-	X	X	X	(X)
	GVZ Kassel (Boile et al., 2008)	185	-	15	X	(X)		(X)
	GVZ Koblenz (Boile et al., 2008)	544	4,000	-	X	X	X	(X)
	GVZ Weil am Rhein (Boile et al., 2008)	64	600+	-	X	X	X	(X)
	GVZ Frankfurt / Oder (ETTC) (Boile et al., 2008)	586	-	-	X	X	X	
Italy	Interporto Marche (Boile et al., 2008)	1,482	-	-	X	X		
Spain	Platforma Logistica de Zaragoza (Boile et al., 2008)	3,290	7,000	25+	X	X		X
United Kingdom	Birch Coppice Business Park (Boile et al., 2008)	400	-	-	X	X		
	Port of Tyne (Boile et al., 2008)	580	425+	68+	X	X	X	
North America								
Canada	CN Calgary Logistics Park (Under Development)	680	-	-	X	X		
	CPR Vaughan Intermodal Terminal	-	-	-	X	X		
	CPR Calgary Intermodal Terminal	-	-	-	X	X		
	Port Alberta (Under Development)	3,000	-	-	X	X		X
United States	California Integrated Logistics Center (Boile et al., 2008)	-	-	-	X	X	(X)	
	CentrePoint Chicago (Boile et al., 2008)	2,200	8,000	8,000-12,000	X	X		
	CentrePoint-KCS Intermodal Freight Gateway (Rodrigue et al., 2010)	1,340	-	-	X	X		
	Dallas Intermodal Terminal / Dallas Logistics Hub (Boile et al., 2008)	6,360	32,000	-	X	X		
	March GlobalPort (Leitner & Harrison, 2001)	350	-	-	X			X

X = Featured on site; (X) = Located nearby

Distribution Centres

Country		General Characteristics			Modes			
		Size (Acres)	Employees	Transport & Logistic Firms	Road	Rail	Sea / Water	Air
Asia								
Singapore	Alexandra Distripark (Boile et al., 2008)	62	-	-	X			
	Pasir Panjiang Distripark (Boile et al., 2008)	62	-	-	X		(X)	
Europe								
Denmark	Denmark Transport Centre (Boile et al., 2008)	156	900	40	X			
Spain	Centro de Transportes de Benavente (Boile et al., 2008)	53	800	20	X			
	Cimalsa (Boile et al., 2008)	109	2,000	32	X			
	Ciudad del Transporte de Zaragoza (Boile et al., 2008)	149	-	150	X			
North America								
Canada	Atlantic Gateway-Halifax Logistics Park (Boile et al., 2008)	125	-	-	X	(X)	(X)	(X)
United States	Hunts Point (Boile et al., 2008)	329	3,000	47	X			

X = Featured on site; (X) = Located nearby

APPENDIX E Freight Village Examples with Measures of Goods Flows

Country		General Characteristics			Mode				Freight Flows		
		Size (Acres)	Employ-ees	On-Site Transp. /Log. Firms	Road	Rail	Sea/ Water	Air	Est. Interm. Road/Rail Traffic	Est. Rail Traffic	Est. Road Traffic
Europe											
France	Roissy-SOGARIS	133	2,500	80	X	X		(X)	25,000 tons	-	2,500,000 tons
Hungary	Budapest Intermodal Logistics Centre	247	-	-	X	X	(X)	(X)	87,000 TEU (2005)	-	-
Italy	Interporto Bologna	1,055	1,500	81	X	X			3,906,000 tons (2002)	1,777,000 tons (2003)	2,250,000 tons (2003)
	Interporto Novara	207	50	-	X	X		(X)	-	-	436,000 TEU (2005)
	Interporto Parma	618	1,300	60	X	X	(X)	(X)	5,000,000 tons (2006)	1,600,000 tons (2006)	3,500,000 tons (2003)
	Interporto Rivalta Scrivia	556	490	40	X	X	(X)		1,500,000 tons	500,000 tons	1,000,000 tons
	Interporto Torino	889	3,000	200	X	X			-	-	3,000,000 tons (2003)
	Interporto Quadrante Europa	618	1,800	110	X	X		(X)	26,000,000 tons (2003)	6,000,000 tons (2003)	20,000,000 tons (2003)
	Interporto Verona	605	1,800	110	X	X			26,000,000 tons (2003)	6,000,000 tons (2003)	20,000,000 tons (2003)
Portugal	Terminal Multimodal Do Vale Do Tejo S.A.	548	22	-	X	X	(X)		1,000 tons (2003)	-	-
Spain	Bilkakobo-Aparcabisa	49	800	40	X	X		(X)	-	-	425,000 tons
	Centro de Transportes de Irun	99	2,100	107	X	(X)		(X)	-	-	2,800,000 tons

APPENDIX F Supplementary Examples of Freight Villages and other Logistics Centres

Freight Villages

Denmark	
Nodric Transport Centre (de Cerreño et al., 2008)	Established in 1989 on a 494-acre land about six miles from the City of Aalborg, NTC was initiated by the Port Authority, a public entity. The location on the outskirts of the city was chosen because the city's municipal plan required that freight facilities be moved outside the city in order to improve environmental quality and public safety. NTC's location provides good access for international and local markets through trimodal connections of road, sea and rail. More than a dozen transportation and other related companies are located in NTC, including warehouses, distribution centers, and intermodal container terminals. While no commercial or retail activities are located within the NTC, worker support services include a post office, customs services, a bank, and shower facilities.
France	
Roissy-SOGARIS (de Cerreño et al., 2008)	Begun with only a truck terminal and a goal of supporting business, Roissy-SOGARIS is now a 133-acre air freight Logistics Center Freight Village with a truck-rail intermodal facility, and access to several nearby highways (A86 and A6), and nearby Orly Airport. The LCFV accommodates almost 100 transportation, warehousing, and distribution- related companies, and a variety of worker support services (e.g. customs office, post office, health center, public transport, restaurant, gas station). Four *departement* (similar to counties in the United States) – Paris, Hauts-de-Seine, Seine Saint-Denis, and Val-de-Marne – own roughly 80 per cent of the shares, combined. The Société Anonyme de Gestion Immobilière (SAGI) owns almost 15% of the shares, while Caisse d'Epargne Group owns another 4%. The remainder is held by miscellaneous private companies.
Germany	
Berlin-Brandenburg Region (de Cerreño et al., 2008)	A system of three GVZs and 10 UDCs is under development in the Berlin-Brandenburg region. According to Bentzen et al. in de Cerreño et al. (2008), this is "a model of how Freight Villages can be integrated and can play a key role within complex environment for solving urban freight distribution." This system is being developed in an effort to reduce traffic congestion, promote rail and water intermodal alternative, and remove conflicting land uses. The three GVZs are located outside the metro region, to the West (Wustermark, 520 acres), to the South (Großbeeren, 759 acres) and to the East (Freienbrink, 321 acres). Complimenting these are 2 UDCs in operation with another 8 under development. The GVZs focus on long-haul freight operations, while the UDC activities center on local distribution of goods. This system is expected to solve "last mile" issues by reducing the number of truck trips for urban distribution. According a 2003 study, with the first UDC in operation, about 6,000 truck trips were saved every year.
United States	
Compact Intermodal Center (de Cerreño et al., 2008)	The Hillsborough Compact Intermodal Center is a proposed freight facility to be situated on several former warehouse sites, including a 165-acre former Veterans Administration Supply depot, an 80-acre Defense Logistics Agency, and a 10-acre former U.S Postal Service site. The approximately 260-acre proposed site would have access to exiting rail services provided by the New Jersey and Northern Railway. Somerset County and its consultant team have decided to focus on a freight facility that will be built with green technologies in terms of building materials and energy use (e.g. solar power). In addition, the facility may have

	Foreign Trade Zone status and provide intermodal transportation, industrial activities, and retail supporting services for on-site support and the community. If the Compact Intermodal Center is successful in developing all of these components, it would become another Community Integrated Freight Village according to de Cerreño et al. (2008). Of note, like Winter Haven, the Compact Intermodal Center is being developed with active public participation as the developers seek to reduce any negative impacts on the surrounding communities. The County expects that the public will respond positively to several features. First, because rail use will be encouraged, the facility may reduce regional truck traffic. Second, the community was already impressed with the attention to environmental mitigation (e.g. providing open space) and the use of green building technology applications. The supporting commercial services that will be located along the public roadway frontages and site access roadways will minimize conflicts between freight use and other land uses, serving as a buffer and generate jobs for the community.
Guild's Lake Industrial Sanctuary (de Cerreño et al., 2008)	Guild's Lake Industrial Sanctuary is an industrial park with multiple uncoordinated users, owners and tenants. While not a Freight Village and while there are a number of challenges (partly as a result of it not being actively managed in some way), the designation of the area as a "sanctuary" aimed at preserving industrial and freight uses from other land uses, helps inform this study. The Guild's Lake area in Portland, Oregon has been a center of industrial and freight uses since the 19th Century. Beginning in 1995, at the request of the Portland City Council, the Northwest Industrial Neighborhood Association (NINA) formed a taskforce to make recommendations regarding the area, and planning staff from the City of Portland worked closely with representatives from several community organizations on the issue. In 1996, the Northwest Industrial Sanctuary Working Group (SWG) was formed and recommended that specific boundaries be delineated for the industrial sanctuary and that buffer zones be created between the industrial and residential land uses. The Guild's Lake Industrial Sanctuary Plan was issued in 2001, providing the policy framework for retaining the existing uses and sunken investment in freight infrastructure, while balancing these uses with the needs of the surrounding communities. The Plan sets forth the required zoning code text amendments and City Council resolutions, as well as an Action Plan for proceeding. When built, the facility will provide direct access to US Route 30 and Interstate 505, rail service throughout the site, and direct rail access to the Port of Portland's 55-acre Terminal 2 facility. Its location on the Willamette River will provide waterfront operations as well.
Pureland Industrial Complex	Another example of an Industrial Park-turned Freight Village is the Pureland Industrial Complex in southern New Jersey. The 2,000-acre complex was developed by several private companies: the Pureland Group, DP Partners, and other small site developers. The largest industrial complex in southern New Jersey, Pureland is located near Exit 10 of I-295, in Gloucester County, 12 miles from Philadelphia, 15 minutes from Philadelphia International Airport, and 98 miles from New York City. Like Raritan Center, the addition of a rail intermodal facility helped transform this Industrial Park into a Freight Village. SMS Rail Lines, a shortline railroad with 4.5 miles of track within Pureland, has served Pureland Industrial Complex since 1994. SMS connects to national CSX, Norfolk Southern and Canadian Pacific rail freight service via the Conrail Shared Assets Area. In addition to direct access to a rail intermodal facility, Pureland also benefits from being approximately 20 minutes from maritime facilities in Philadelphia and southern New Jersey, and two hours

	from the Port of New York and New Jersey. Retail and office development has taken place on the property between the more industrial uses in the complex and the outside residential neighborhoods, and now serves as a buffer between the freight village and the neighboring communities. Retail businesses include fast food restaurants, groceries, bank, hotels, and recreation facilities.
Winter Haven Intermodal Logistics Center (de Cerreño et al., 2008)	The Winter Haven ILC is a Logistics Center Freight Village, currently under development in the state of Florida. CSX Transportation and the City of Winter Haven are collaborating to develop 1,250 acres of the City's Wastewater Treatment Plant #3 property into this facility. The proposed facility would include a truck, rail and warehousing hub for the transfer and storage of containerized consumer goods. At completion, Winter Haven is projected to generate 8,500 jobs. While the configuration of the facility is similar to a typical LCFV, whether it will evolve fully into a Freight Village is unclear. Concerns have been raised by nearby residents about illumination issues beyond the facility's boundaries, noise and air pollution, and the potential increase in traffic on residential streets. CSX reportedly offered some mitigation measures for these concerns by changing design and constructing alternative routes, along with several other modifications. However, the process continues and concerns are still being heard as CSX continues to reach out to community.

Intermodal Terminals

United States	
CenterPoint Intermodal Center (de Cerreño et al., 2008)	Built in 2000 to handle intermodal shipments moving through the Chicago area, CenterPoint Intermodal Center is located approximately 40 miles from Chicago. CenterPoint has multimodal access (rail and road), and a dedicated freight transfer facility on site. Tenants include transportation-related companies, as well as big box retail (their warehousing and distribution functions), among others. CenterPoint was developed and is actively managed by a private company – CenterPoint Property – rather than a public entity. With this said, the public sector was actively involved in the development of the facility. While the bulk of the investment for the facility – $1 billion – was provided by CenterPoint Property, the State of Illinois was also actively involved in the project's development, providing $75 million for road, water, and sewer facilities. In addition, $125 million was funded through tax-increment financing by the City of Elwood, Illinois. CenterPoint had a clear impact on job creation. CenterPoint was built on the former military site where 8,000 people used to work. However, the facility was decommissioned in 1976, turning the once active community into an economically depressed area. By turning this site into a modern logistics centre, roughly 8,000 – 12,000 new jobs were created, and $27 million in annual property tax revenues were generated.
Dallas Intermodal Terminal / Dallas Logistics Hub (de Cerreño et al., 2008)	The Dallas Intermodal Terminal/Dallas Logistics Hub is currently under development but is evolving much like Skyline Industrial Park. When the planned development is complete, all the neighboring facilities together will function as a Community Integrated Freight Village. The Dallas Logistics Hub is under development, situated adjacent to Union Pacific's Dallas Intermodal Terminal. In addition, there is a proposed intermodal terminal by BNSF and an air cargo facility at Lancaster Airport. According to the Allen Group, the 6,000-acre area will eventually accommodate distribution, manufacturing,

	office, and retail facilities.
Skyline Industrial Park (de Cerreño et al., 2008)	Skyline Industrial Park in Mesquite, TX, offers an interesting example of how an Industrial Park may be located closely to another type of freight facility to provide synergies that allow it to function more like a Freight Village. A 300-acre Industrial Park, Skyline Business Park was purposely developed next to Union Pacific Railroad's 100-acre intermodal yard. The facilities are also in close proximity to a wide range of amenities including restaurants, hotels, and a regional mall. While each facility was developed separately, together they function in many respects like a Community Integrated Freight Village, and demonstrate the potential for separate facilities, if strategically located, to begin to function as a Freight Village.

APPENDIX G GVS Urban Distribution Programs in Germany

City	Starting Date	Participants	Results
Augsburg	Nov 1994	6 transport companies	-83% trips
Basel	Sept 1994	12 transport companies + postal services	Positive
Berlin	Mid 1993	9 transport companies	-50% deliveries
Berlin	Jan 1995	5 transport companies	From 5 to 2 trucks
Bielefeld	May 1994	3 transport companies	-
Bremen	1992	9 companies	-70%
Dortmund	-	-	-
Duisburg	Feb 1995	7 transport companies	-
Düsseldorf	1992	3 transport companies	-
Freiburg	Oct 1993	12 transport companies	-33% trips, -51% trucks, -48% time
Gütersloh	Feb 1995	Transport companies and local authorities	-
Hamburg	Sept 1994	8 transport companies	From 8 to 4 trucks, -70% vehicle kilometres
Hannover	-	-	-
Kassel	Aug 1994	10 transport companies	From 10 to 2 trucks, from 15 to 4 trips per day
Koblenz	April 1994	5 transport companies	-30,000 km/year
Kuelen	July 1994	4 transport companies	-150 vehicle kilometres / day
Munich	May 1993	22 transport companies	-
Munich	Mid 1993	4 transport companies	From 4 to 1 truck
Munich	Sept 1994	3 transport companies	-
Neuss	1993	3 transport companies	Positive
Nuremberg	End 1994	3 transport companies	-
Stuttgart	1993	3 transport companies	-
Stuttgart	Jan 1994	2 transport companies	From 23 to 14 trucks
Ulm	Jan 1995	2-4 transport companies	-

(Visser, Van Binsbergen, & Nemoto, 1999)

APPENDIX H Different Types of Taxes and Charges in European Transportation

Taxes	
Registration Tax	The registration taxes are normally payable in advance of, or at the time of, registration of a vehicle. They are normally charged only once, at the time of first registration, but in some Member States, a new tax arises on each change of ownership. When buying a car the buyer will have to pay a percentage of the price of the car. Only few countries in the EU do not have this registration tax,
Circulation Tax	Charged on a periodic basis, mostly annual, and usually confers the right to use the public road network. The tax is charged according to various criteria, such as engine capacity, horsepower, fuel type, region of registration, and age of vehicle. The circulation tax has to be pad in the country where the transport company is located.
Insurance Taxes	Most European countries do not have an insurance tax for freight transport. It is an extra tax above the insurance fee, and in most cases charged in insurance for private cars. Freight trucks are often exempted from this insurance tax, if it exists.
Fuel Tax	Fuel tax is the excise duty on petrol and diesel. Usually it is a percentage of the fuel price (without VAT). The height per kilometer depends on the fuel usage. By September 2000 the high price of the petrol leads to a discussion about lowering the fuel tax, to prevent too high prices for the transport sector. According to some publications, 2/3 of tax revenues from road transport in EU Member States is accrued from excise duties.
Eco Tax	An Eco-tax means that for every product bought, a percentage is paid for the environmental damage generally occurred during the lifecycle of that product. In Germany the refrigerated freight transport sector objected to this policy measure because of their high energy usage and the limited opportunities to reduce it.
Charges	
Toll	Toll payments are used for direct infrastructure costs, like building costs, maintenance and repair costs. The toll has to be paid by the users of the infrastructure, both passenger cars and freight trucks.
Infrastructure Charge	Infrastructure charges consist of several elements. Most visible is the road charge for using infrastructure. For several years some Western-European countries have adjusted the so-called Eurovignette, to be paid by heavy load vehicles that would like to trade in those countries. Road pricing is another form of infrastructure charge.
Rail Infrastructure Charges	Rail transport is subject to charges in several European countries. Rail way companies pay a train- or wagon-related charge for making use of the tracks. In most cases this rail infrastructure user charge per kilometer is calculated by dividing a total annual amount by the total number of kilometres per year.
Harbour and Berth Dues	Vessels in inland shipping pay several charges when entering the harbour.
Terminal Charges	In harbours, inland shipping terminals and rail terminals forwarders must pay a charge for using the terminal. Government-owned terminals would obey a charge for an operator. The more an operator uses a terminal the more he pays.
Fuel Charge	Some European countries apply a charge on top of the fuel price (inclusive VAT), and the fuel tax, which is here defined as a fuel charge. Only a few European countries levy the fuel charge, and the difference between the fuel charge and the fuel tax can hardly be determined. In general the fuel charge is especially used for covering expenditures for internalizing environmental external costs for fuel emissions.

(RECORDIT, 2001)

APPENDIX I Classification of Public and Private Measures for Urban Goods Distribution

Policy measures and instruments	Public			Private	Public and Private	
	Licensing and regulations	*Pricing*	*Financial support*	*Voluntary cooperation*	*Technology improvement*	*Information systems*
Land use	Zoning for logistics activities or transport intensive retail	Land use pricing	Subsidies for land use prices	Concentrate businesses on one location	--	--
Logistics operation	Minimal load-factor	--	Subsidizing intermodal transport	Load exchange	New load-units	Cargo information systems
Networks	Truck routes, vehicle and time restrictions	Road pricing	New infrastructures for freight	--	Road construction	Real time traffic information
Terminals	Urban distribution centre	--	Terminal exploitation	Operation of terminals	Transshipment and storage	--
Loading / unloading	Loading time	Differentiated parking charges	Facility support	Sharing unloading facilities	Off-street unloading facilities	Reservation system of parking lots
Vehicles	Emission standards	Fuel taxes	Subsidies for low emission trucks	Share of vehicle fleet	Electric vehicles, handling equipment	Vehicle tracking systems

(Visser, Van Binsbergen, & Nemoto, 1999; BESTUFS, 2007b)

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