

Anticipating 2025: Changing Technologies and Intermodal Linkages in Aerial, Highway, Marine, and Rail Transportation in the Northeast Corridor

The Insertion of BostWash within the Global and National Freight Frameworks

Jean-Paul Rodrigue

Department of Economics & Geography, Hofstra University, Hempstead, New York 11549, USA. E-mail: Jean-paul.Rodrigue@Hofstra.edu

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Abstract

A large urban agglomeration such as Boston – Washington is the origin, destination and point of transit of large quantities of freight. As the deindustrialization of the American economy endured, this freight is increasingly coming from international locations. Containerized traffic handled by North America's gateways has consequently increased as well as flows on long distance rail corridors. This paper investigates the main mechanisms in which the global, regional and local freight frameworks of the Boston – Washington corridor are inserted.

Keywords: Transport Corridor, Boston – Washington, Gateways, Freight Distribution.

Transportation, Gateways and Corridors

Gateways and Corridors

Gateways have become fundamental locations where the components of the global economy interact as they promote the continuity of circulation in a transportation system. They are an interface between different systems of circulation. Gateways reap advantage of a favorable physical location such as highway junctions, confluence of rivers, seaboard, and have been the object of a significant accumulation of transport infrastructures such as terminals and their links. A gateway generally commands the entrance to and the exit from its market area and commonly imply a shift from one mode to the other (such as maritime / land). In other words, a gateway is a pivotal point for the entrance and the exit of merchandise in a region, a country, or a continent. The emergence of intermodal transportation systems reinforces gateways as major locations of convergence and transshipment and has modified their geography with increased locational flexibility. While major terminals have expanded and relocated to more peripheral locations, namely port facilities, many distribution centers have relocated even further away along corridors.

The global transport system is subject to remarkable geographical changes even if many of its infrastructures are fixed. Flows, origins, destination and the modes used can change rather rapidly as new economic activities emergence (while other are shut down) and transport operators modify their services accordingly. What remains relatively constant are gateways, which can be seen as semi-obligatory points of passage, while a hub is a central location in a transport system with many inbound and outbound connections on the same mode. Gateways also tend to be most stable in time as they often have emerged at the convergence on inland transport systems while the importance of a hub can change if transport companies decide to use another hub, a strategy fairly common in the airline industry. Thus, gateways tend to be intermodal entities while hubs tend to perform transmodal (within a mode) operations.

Corridors as Transport Paradigms

The structure of a corridor is often taken for granted and simply relates to its linear orientation. Yet, corridors imply a much more complex reality than a simple linear correspondence. They are structures of accumulation where investments in economic activities are performed and also flow structures linked with an intense circulation of people, freight and information over specific segments. The later underlines that corridors are axis of transportation that has a significant role in shaping space. This role can be understood within three main paradigms (Rodrigue, 2004).

- Corridors as market areas. The first paradigm is the most traditional as far as geographical theory is concerned. The central places theory mainly considers cities as structurally independent entities that compete over overlapping market areas. Under the location and accessibility paradigm an urban region is considered as a hierarchy of services and functions and the corridor a structure organizing interactions within this hierarchy. Transport costs are considered a dominant factor in the organization of the spatial structure as the hinterland of each center is the outcome of the consumers' ability to access its range of goods and services. Because of higher levels of accessibility along the corridor, market areas are smaller and the extent of goods and services being offered are broader. Thus, differences in accessibility are the least significant along the corridor. This applies well to the consumption based functions of a corridor where each market area is serviced by a wide array of service activities.
- Corridors as specialization structures. The specialization and interdependency model considers that some cities can have a level of interaction and that transportation could be more than a factor of market accessibility, but also of regional specialization and of comparative advantages. Accessibility and economies of scale, both in production and consumption, are factors supporting the development of such entities where urban areas are increasingly specialized and interdependent. The main assumption is that the accessibility provided by the corridor reinforces territorial specialization and interdependency along its main axis, and consequently the reliance on a regional transport system. This applies well to the production based functions of the corridor.
- Corridors as logistically integrated axis. The distribution/flow model is one where a major gateway of an urban region acts as the main interface between global, national and regional systems. Under such a paradigm, three core structural elements are defining a regional corridor: 1) Gateways regulating freight, passengers and information flows. 2) Transport

corridors with a linear accumulation of transport infrastructures servicing a set of gateways. They provide for the physical capacity of distribution. 3) Flows, their spatial structure and the underlying activities of production, circulation and consumption.

Inserting BostWash within the Freight Framework

Freight distribution is a physical activity where the transportation component is of prime importance. Paradoxically, because of its efficiency, freight transportation is almost invisible to the end consumer as the outcome (retailing) is seen, but not the process (distribution). Such a perspective often permeates public policy where the importance of freight transportation is often understated. This is particularly the case for the Boston – Washington corridor (BostWash) where a high concentration of financial and commercial activities, coupled with an enduring de-industrialization, tend to make freight issues mostly outside public concern. With a population nearing 75 million, accounting for about 27% of the U.S. population, but occupying only 6.2% of its landmass, the significance of the BostWash corridor is undisputable. The New York metropolitan statistical area alone, with its population of 21.2 million, accounts for 7.5% of the national population. High population densities, over 250 persons per square mile, on a conterminous segment of about 400 miles between Boston and Washington are also observed. This concentration of population, facilities and their associated circulation makes the corridor the most congested region in the United States.

Yet, the global economy to which BostWash significantly depend on is based on the backbone of freight distribution, relies on networks established to support its flows and on gateways that are regulating them. Networks, particularly those concerning maritime shipping and air transportation, are flexible entities that change with the ebb and flows of commerce while gateways are locations fixed within their own regional geography.

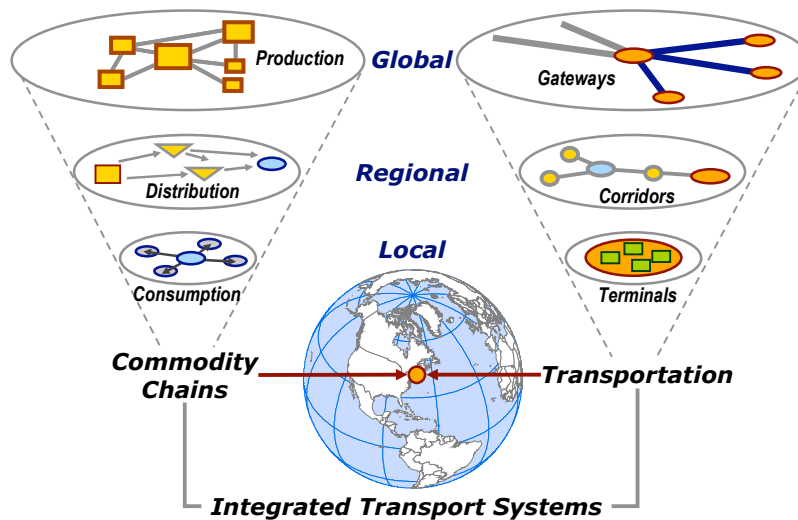


Figure 1 Freight Frameworks: From Global to Local

Transportation supporting commodity chains provide a framework to consider freight transportation. Gateways are thus the main tools of insertion within the freight framework, reconciling global, regional and local processes (Figure 1). The global level is mainly characterized by the function of

production, articulated by the concept of global production. The spatial fixity of gateways imposes the usage of transport corridors over which freight distribution is articulated. Freight terminals, for ports, airports and rail yards are hard pressed to cope since freight flows are taking place over longer distances. In the current setting, the same amount of freight is likely to require more modal and intermodal movements. The insertion of an urban region such as BostWash within the freight framework of production, distribution and consumption thus considers its major gateways, transport corridors and the terminals servicing them.

Global Supply Chains and the BostWash Corridor

Global Supply Chains and Production Networks

In a context of intense global competition and diminishing profit margins, logistics offer additional opportunities to improve the efficiency of production through distribution strategies. In this context, Global Production Networks (GPNs) are accounting for an emerging and active branch of investigation of the various paradigms of globalization. While the term globalization implies many issues depending on the perspective considered, economic interdependencies in trade, production and consumption – core elements of GPNs – are a major factor accounting for its dynamics. Global production networks have various structures according to the nature of their production and the markets they service.

GPNs are bound to the interactions of supply and demand, as they reconcile the material needs of the consumers (let it be an individual or a corporation) to have the right product, in the right quantity, at the right price, at the right location and at the right time, and the capacity of production and distribution systems to accommodate such needs. The embeddedness they reflect is thus multidimensional, as markets, production and distribution become more linked in a complex web of flows. The development of GPNs has led to a substantial growth of flows of commodities, parts and finished goods, hinting at mobility requirements that must be accommodated. In such a context, global freight transport systems have faced additional demands in absolute terms, but also in terms of the average distance goods are carried over. By keeping the quantity transported constant, but increasing its distance, additional transport demand is implied, literally through a multiplying effect as more distributional capacity gets tied with the same quantity of physical flows.

The manufacturing function of many corporations has been hollowed out by the process of globalization, in which manufacturing accounts for one of the least added value activity, particularly if it takes place within a subcontracting framework. This has been true for the United States, notably its major urban agglomerations where the economy has become dominantly service oriented. In a global economy and globalized consumption market, an important share of the added value of a product concerns the R&D, branding and design on the concept segment (creating a product). On the logistics segment, distribution, marketing and sales / after sales services (such as customer support) are among the activities generating the most added value. In spite of acute deindustrialization, many American corporations still command substantial added value.

Continental Gateways

Conventionally, geographical factors linked to the site and situation of “hard” terminals (especially for maritime terminals) were bounded with the location of gateways. Around these facilities agglomerated many freight handling and distribution activities. The emergence of intermodal transportation systems reinforces gateways as major locations of convergence and transshipment and has modified their geography with increased locational flexibility. While major terminals have expanded and relocated to more peripheral locations, namely port facilities, many distribution centers have relocated even further away along corridors.

Trade and physical flow imbalances are clearly reflected at major American modal gateways (Figure 2). Almost all the gateways—land, maritime and air alike—are characterized by traffic imbalances where inbound traffic far exceeds outbound traffic. This is particularly the case for maritime gateways linked with long distance international trade with Europe and more specifically Asia. The West Coast is notably revealing and is the most imbalanced both in the concentration and the direction of the traffic. Inbound traffic accounts for about 80% of all the traffic handled by ports. The ports of Los Angeles and Long Beach handled 75% of the total freight dollar value brought in through the West Coast. NAFTA land trade gateways tend to be more balanced, but still reflect a negative flow to the advantage of Canada and Mexico. A similar pattern is observed for air gateways. What also characterizes North American gateways is their high level of concentration in a limited number of gateway systems; a set of modal gateways within a relatively defined region that acts as a functional system linking that region to international trade.

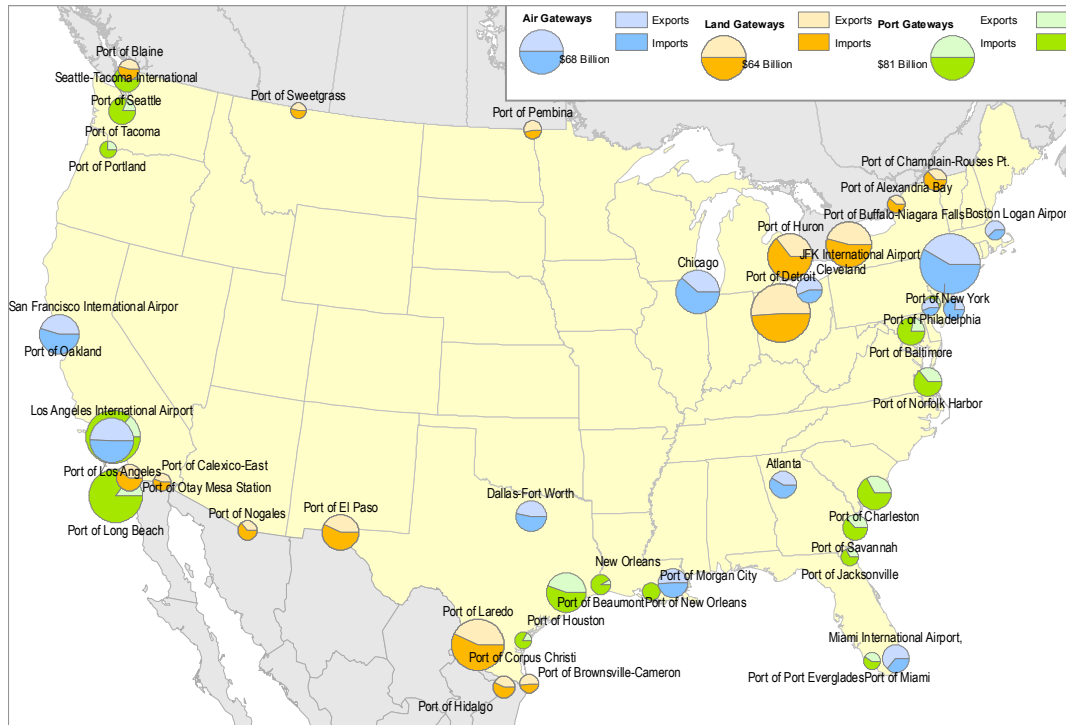


Figure 2 Major US Modal Gateways, 2004

A closer look at the three most important gateways reveal that they account for a third (34.2%) of all American trade in terms of value. The Asia effect can be seen geographically over its impacts on imbalances handled by gateways. While the land gateway of Detroit has a slightly imbalanced trade structure, this figure goes to 2 to 1 for New York / New Jersey and close to 3 to 1 for Southern California. Like the majority of American gateways, BostWash copes with systematic negative freight imbalances where imports far exceed exports.

Continental Integration

A North American lattice of trade corridors where freight distribution is coordinated by major metropolitan freight centers (MFC) has emerged in the recent decades (Figure 3). While MFCs are significant markets, they also command distribution within the market areas they service as well as along the corridors they are connected to. They thus have a significant concentration of logistics and intermodal activities at specific locations. The ongoing accumulation of these activities has led in many cases to the creation of “central freight districts” which are clusters of freight distribution activities, mainly retail-oriented. The extent of the market area of a MFC is mainly a function of the average length of domestic truck freight haul, which is around 550 miles (880 km). Like many segments of the North American economy and territory, globalization and integration processes, namely NAFTA, have impacted on the nature and function of continental production, consumption and distribution. For international trade, the gateways of this system are major container ports along coastal areas from which long distance trade corridors are accessed. About 55% of the North American trade took place within NAFTA in 2005, mainly through land gateways (ports of entry) that are gateways in the sense that they are obligatory points of transit commanding access to the United States. For truck and rail flows, virtually no intermodal activities take place at land gateways, although several distribution centers nearby borders and along corridors.



Figure 3 North American Corridors and Metropolitan Freight Centers

Land gateways are dominantly servicing an import function, expanded under NAFTA trade, and connected to corridors of continental freight circulation. These include three main longitudinal (north, central and south) and four latitudinal (west coast, central, NAFTA and east coast) axes. The NAFTA Corridor links the two largest land gateways of North America, Detroit, Michigan and Laredo, Texas. It dominantly relies upon trucking as about 65% of the value of the NAFTA trade is serviced by this mode. However, it is far from being a continuous corridor as northbound flows of Mexican imports and the southbound flows of Canadian imports dwindle as the distance from their respective borders increases. The equilibrium point is around the Tennessee / Kentucky range, past which the respective flows are very small. About a third of the volume involves auto parts produced in Southern Ontario and in the Maquiladoras of Mexico, which are used for low-cost car manufacturing in the Southeast states. It is however over longitudinal corridors that traffic has expanded the most, which reflects the booming transpacific trade carried over transcontinental rail corridors to East Coast markets.

Freight Distribution Clusters

Due to their operational requirements, which are space intensive, distribution centers (DC) have migrated to more affordable locations at the periphery of metropolitan areas. Even if many DCs are unrelated and linked to different supply chains, they tend to agglomerate in clusters nearby major road facilities. Market accessibility is the main driving force of this process. Freight clusters emerged in suburban (or exurban) settings to accommodate two market accessibility factors and their distribution requirements. The first is proximity, either to customers or to the major transport

terminals from which DCs draw their supply. The second is intermediacy where a DC must find a location within corridors of freight circulation that enables a reliable and constant supply. Since a DC is just one link in a sequence, being efficiently connected to the upstream segment can be as important as being connected downstream, notably when global sourcing is concerned. As globalization took place, proximity evolved at a wider scale, mainly from the metropolitan area to a regional system of cities, which tend to be organized along corridors. Supply chains that are time dependent tend to rely more on an intermediacy strategy (notably large retailers) while those that are less time dependent are more prone to proximity.

The setting of large distribution centers, often part of distribution clusters, has been a dominant trend, particularly among major retailers such as Wal-Mart, Target and Home Depot. When intermediacy is important, which particularly concerns supply chains of foreign goods, freight clusters tend to locate in small intermediary locations. For instance, the vicinities of Albany (NY) and Allentown (PA) have experienced the setting of several large distribution centers for retailers. These locations are along long distance highway corridors enabling to service the Eastern Seaboard market, particularly the New York metropolitan area, within a 48 hours envelope (order / delivery). Central New York is at the nexus of two important axis between Montreal and New York and between Buffalo and Boston. Eastern Pennsylvania has the advantage of being serviced in less than a day from the major rail terminals of Chicago from which transcontinental containerized rail traffic bound from the Pacific Coast arrives.

Gateways, Corridors and Competitiveness

A Paradoxical Competitive Setting

In the current economic setting that characterizes North America, the freight transport system cannot be considered as a tool of industrial competition with the global economy. It has become a tool of freight distribution, logistics, industrial reorganization and market penetration for foreign goods. The efficiency of containerized international transportation has given a net advantage for foreign producers over a wide array of goods. The reorganization of freight distribution went in three major phases. The first concerned a relocation of manufacturing activities to lower costs locations within the United States in an initial attempt to cope with increasing global competition, particularly in the car industry. Aging industrial clusters, such as in the Midwest, saw serious declines in output and employment mainly due to high labor costs. The second stage took shape around the setting of NAFTA and permitted a further rationalization of manufacturing with Canadian and Mexican comparative advantages in numerous sectors of activity. It created a set of logistical relationships around border regions and new latitudinal corridors of freight distribution. Cross-border traffic surged as the North American market increasingly became perceived by freight forwarders as a single entity. The third stage is now in full motion and involves entirely new commodity chains using global comparative advantages to a much fuller extent. The logistical relationships involve a maritime / land interface involving containerized maritime shipping and long distance intermodal rail operations. All these stages have been linked with a growing quantity of freight being moved as well as its average distance.

Gateways and Hinterland Competition

As a growing share of the consumption of vast markets such as BostWash is being supplied by international sources new systems of inland freight distribution are being established. Many ports see growth opportunities and potential to capture added value activities, particularly at inland freight distribution clusters. Such expectations are however clashing with acute congestion since there is limited potential to increase the capacity of existing road systems along the BostWash corridor. There is thus competition between ports over the hinterland they service, but this competition takes increasingly the shape of the reliability of these services. To do so, modal shift and freight diversion strategies are contemplated. Modal shift implies that freight entering or exiting the port terminals would use a mode other than road, particularly rail. Freight diversion, which goes concomitantly with modal shift, involves the setting of inland terminals where freight converges.

There is thus a hinterland access strategy in the making along the BostWash corridor. Unlike Europe, the North American East Coast does not offer significant axis of fluvial circulation (the St. Lawrence Seaway is limited). The Port Authority of New York and New Jersey has developed an ambitious plan to siphon off some traffic through a web of inland hubs connected to the mother port by barge and rail (Figure 4). The Port Inland Distribution Network (PIDN) plan would free up valuable terminal space, ease mounting congestion and provide environmental benefits. It would also provide reliable, scheduled service for containers no longer subject to the saturated highway system and the potential disruptions that congestion may create.



Figure 4 Port Inland Distribution Network of the Port Authority of New York and New Jersey, 2007

The PIDN services a set of freight clusters within a 50-mile radius of a number of potential feeder locations which are either barge or rail terminals. For instance, in 1991 the port of New York / New Jersey inaugurated a direct ship-to-rail and rail-to-ship transshipment facility, a function which grew at a phenomenal rate (much faster than the port traffic growth) from 43,000 containers handled in 1992 to more than 338,000 in 2006. It is expected that by 2010, intermodal rail share would climb to 25-30% of transshipped containers, resulting in improved economic and environmental benefits for

the locality. This initiative is not without challenges. For instance, the New York / Albany barge service was suspended, due to the lack of funding in February 2006, which corresponded to the end of subsidies provided to help jump start the service in 2003. Inland barge distribution remains a problematic endeavor for the Eastern Seaboard.

The port of Hampton Roads (Virginia Port Authority) has also initiated an inland freight service to a terminal named the Virginia Inland Port, located about 80 miles west of Washington. It can be serviced by an 18 hours train journey between the port and the inland terminal. The two most important container ports of the BostWash corridor are thus competing at their respective margins through modal shift and freight diversion. Port regionalization – the setting of inland terminals linked to port terminals by rail or barge services – thus appears to be used as a tool of port competition.

In an effort to capitalize on the growing traffic by offering a new corridor available to double stack rail train, Norfolk Southern expects by 2009 to complete a major rail project that will reduce the distance of container train trips between the middle East Coast and the Midwest. The “Heartland Corridor” will initially connect the new port terminal facilities of Maersk in Portsmouth, Virginia, with rail lines through West Virginia and end in Columbus, Ohio. At this point the corridor will link up with western rail networks or with the double-stack rail corridor to Chicago. Currently, double-stack trains heading towards the Port of Virginal must go through Harrisburg, Pennsylvania because of insufficient tunnel clearance. But the Heartland Corridor project will bypass this loop, cutting 250 miles and 36 hours off the present route from Virginia to the Midwest. This setting is thus likely to increase hinterland competition at the margin of the BostWash corridor and offer a new alternative to long distance transcontinental freight distribution.

Conclusion

Globalization and its associated changes in freight distribution have resulted in a context where urban regions such as BostWash are affected by a growing quantity of freight and tons-km in circulation. This imposes intense pressures on transport terminals and corridors to cope with demands that have increased in volume, but also over the distance freight is transported. The increasingly congested setting in which transportation operates within the BostWash corridor leaves few other alternatives than the usage of modal shift strategies, particularly from the major port terminal facilities.

Inferring how the current freight situation will unfold in the coming years remains challenging since many variables, ranging from energy prices, the value of the US dollar, to the comparative costs of Chinese labor, can have significant impacts on freight flows. Still, the last 50 years have seen the integration of BostWash within a freight framework relying on large volumes of containerized freight related to time-dependent distribution strategies. It underlined the strategic importance of gateways and corridors to service the region. This framework of global production and distribution is likely to continue shaping freight flows at the regional level in the coming years. The question remains about the modal balance, the location of major terminals and freight distribution centers and the related level of congestion that would characterize this framework.

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