THE HIGH-SPEED RAIL DEVELOPMENT IN THE NORTHEAST MEGAREGION OF THE UNITED STATES: A CONCEPTUAL ANALYSIS

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Abstract
This paper examines the high-speed rail (HSR) development issues in the Northeast Megaregion of the United States (U.S.). Due to chronic underinvestment and a myriad of other factors, the only operational HSR in the U.S., i.e., Amtrak's Acela Express, is lagging behind the Japanese Shinkansen and other advanced HSR systems in the world in its operating performance and relative modal importance. This study adopts both regional and international perspectives to address this issue. The regional perspective conducts the passenger rail transportation deficiency analysis on the Northeast Corridor (NEC). The international perspective introduces the Japanese railway privatization process and its consequences. Based on empirical research, this paper proposes a set of improvement strategies and draws conclusions.
Keywords: Northeast Megaregion, High-Speed rail, Amtrak, Shinkansen, Japan.

1. INTRODUCTION

Megapolitan region or megaregion consists of networks of interconnected, interpenetrated metropolitan/micropolitan areas with close economic, infrastructural, ecological, environmental, and cultural linkages. However, this construct has not been examined in any depth, except by proponents in the America 2050 movement (Ross, 2009). The research on megaregion is recently surging because it has become the hot spot of global economic competition. Many pressing planning issues are megapolitan in nature, transcending individual city, county, or even metropolitan boundaries (Carbonell and Yaro, 2005; Lang and Dhavale, 2005; Regional Plan Association, 2007; Ross, 2009). It is expected that by 2030, for the first time in history, two out of three people will live in urban areas, especially in the megaregions (Amekudzi, Thomas-Mobley and Ross, 2007). Global cities or world cities are all interconnected and located in megaregions, forming integral components of the so-called network society (Castells, 1996; Derudder, Witlox and Taylor, 2007; Taylor, Catalano and Walker, 2002; Taylor and Lang, 2005).

In spite of different delineation criteria, it is generally agreed that the United States (U.S.) has about ten megaregions. For example, the Virginia Polytechnic Institute and State University (Virginia Tech) Team has identified the following ten megaregions in the U.S.: Northeast, Midwest, Piedmont, Peninsula, Gulf

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Coast, I-35 Corridor, Valley of the Sun, Cascadia, Norcal, and Southland (Lang and Dhavale, 2005). These megaregions are America's economic engines and deserve a new American Spatial Development Perspective, similar to the European Spatial Development Perspective, which is a set of policy directives and strategies adopted by the European Union in 1999 (Faludi, 2002).

Of these ten megaregions, the Northeast Megaregion, which was coined as "megalopolis" by Gottmann (1961) and "liquid city" by Short (2007), is the largest agglomeration of people and economic activities in the Northeast U.S. stretching from southern Maine to northern Virginia, including such large cities as Boston, New York (Central City), Philadelphia, Baltimore, and Washington, D.C. (Regional Plan Association, 2007). This megaregion has 1.5%, 18%, and 20% of the country's land, population, and gross domestic products (GDP), respectively, demonstrating its predominant status.

Schwieterman and Scheidt (2007) estimate that 65.7% of the proposed HSR mileages in the U.S. are located in megaregions (Ross, 2008), suggesting the importance of a megaregion as a proper geographic unit for high-speed rail (HSR) analysis. The ten new HSR corridors designated by the Obama Administration all traverse the U.S. megaregions (Federal Railroad Administration, 2009). Within the Northeast Megaregion, HSR will become a promising transportation mode upon further improvements and upgrading in the future. Hagler and Todorovich (2009) indicate that HSR Regional service, for which Acela Express of the National Railroad Passenger Corporation (Amtrak) qualifies, provides a relief for highway and air operating in these markets, as demonstrated by Amtrak's current 64 percent market share for air and rail trips (14 percent of total intercity trips) that begin and end in New York and Washington, D.C. The New York to Washington, D.C. market is the top pair to deploy HSR in the U.S. based on the six criteria they developed (metropolitan size, distance, transit connections, economic productivity, congestion, and megaregion). In its 1996 plan entitled "A Region at Risk: The Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area," the Regional Plan Association (RPA) had already called for building the intercity high-speed rail system to fill existing gaps in the regional system and make traveling throughout the entire New York region by rail (Calthorpe and Fulton, 2001).

Following this introduction, this paper contains four parts. First, it describes and examines the Northeast Megaregion's intercity passenger rail transportation system from both demand side and supply side. Second, the paper performs a deficiency analysis on the major transportation issues and challenges this megaregion is currently facing. Third, the paper comes up with a broad framework of implementation strategies under the acronym PROMISE (Partnership, Reform, Optimization, Multimodalism, Interconnection, Sustainability, and Effectiveness), which lays a good foundation for further studies and refinements. This framework integrates a regional perspective focusing on the Northeast Megaregion

and an international perspective assessing the transferability of the Japanese Tokaido Shinkansen development experience to the U.S. together. Finally, it draws conclusions and summarizes research findings.

2. INTERCITY PASSENGER RAIL TRANSPORTATION OF THE NORTHEAST MEGAREGION

The Northeast Megaregion has the most developed intercity passenger rail transportation system in the U.S. The New York metropolitan area alone has over half of the U.S. rail passengers, and the New York-Northern New Jersey-Long Island, NY-NJ-CT-PA Consolidated Metropolitan Statistical Area (CMSA) had a journey-to-work transit modal share as high as 24.9% per the latest 2000 Census Transportation Planning Package (CTPP) data. The demand for and supply of the existing intercity passenger rail transportation in this corridor are described below.

2.1. Demand Analysis

Table 1 shows the trip purposes, 2-way trip lengths, and mode splits of the intercity travels between the New York metropolitan area and other metropolitan areas in 1995. The *1995 American Travel Survey* was the most recent long-distance travel survey conducted in the U.S.

TABLE 1 TRAVELS BETWEEN NEW YORK AND OTHER METROPOLITAN AREAS IN 1995

Categories	To/From Washington, D.C.		To/From Philadelphia		To/From Boston	
	Person Trips (1,000s)	Percentage (%)	Person Trips (1,000s)	Percentage (%)	Person Trips (1,000s)	Percentage (%)
By Trip Purposes						
Business	412	29.6%	170	16.4%	358	42.7%
Recreation	843	60.6%	773	74.5%	408	48.6%
Others	136	9.8%	95	9.2%	73	8.7%
Total	1391	100.0%	1038	100.0%	839	100.0%
By 2-Way Trip Lengths (Miles)						
< 300	35	2.5%	1017	98.0%	0	0.0%
300 – 499	1015	73.0%	21	2.0%	795	94.8%
500 – 999	331	23.8%	0	0.0%	44	5.2%
1000 – 1999	10	0.7%	0	0.0%	0	0.0%
Total	1391	100.0%	1038	100.0%	839	100.0%
By Modes						
Automobiles	796	57.2%	898	86.5%	326	38.9%
Airplanes	310	22.3%	4	0.4%	345	41.1%
Others	285	20.5%	136	13.1%	168	20.0%
Total	1391	100.0%	1038	100.0%	839	100.0%

Source: 1995 American Travel Survey.

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2.1.1. Total Person Trips

The New York-Washington, D.C. city pair had the largest number of intercity total person trips, followed by the New York-Philadelphia city pair and the New York-Boston city pair. Since New York and Washington, D.C. are the economic capital and political capital of the U.S., respectively, it is not surprising that they had the closest intercity linkages.

2.1.2 Trip Purposes

As to the trip purposes, most trips among the biggest cities in the Northeast Megaregion are recreation trips (including vacation trips), rather than commuting trips (part of other trips). Due to the immense geographic extent of this megaregion and the limitation of existing transportation technology, it is impossible to commute back and forth from one extreme to the other extreme of the megaregion within one single day. Commuting more likely takes place within one metropolitan area or between two adjacent metropolitan areas (Lang and Dhavale, 2005). This indicates that the geographic boundary of the Northeast Megaregion is delineated not based on commuting travel, instead, based on a combination of factors including economic linkages, goods movement, environmental cohesion, cultural and historical commonalities. Commuting travel only plays a minor role in delineating the Northeast Megaregion's geographic boundary.

2.1.3. Trip Lengths

Most intercity person trips between New York and Washington, D.C., and between New York and Boston had the average 2-way trip lengths between 300 and 500 miles. According to the Federal Railroad Administration (2009), for those metropolitan areas with moderate and high population density, high-speed rail has the comparative advantage for the intercity distance between 100 and 600 miles, which matches those city-pair distances very well. New York and Philadelphia are geographically very close, therefore, their intercity person trips are predominantly short trips most suitable for automobiles.

2.1.4. Mode Splits

In terms of mode splits, private automobiles were the principal intercity transportation means for the New York-Washington, D.C. city pair and the New York-Philadelphia city pair. I-95 is the major thoroughfare of this corridor with the largest traffic volume (about 300,000 average daily traffic) occurring near the New York City. For the New York-Boston city pair, it is noted that airplanes were the principal intercity transportation means. That the Amtrak Acela Express had a lower operating speed for the New York-Boston segment may partially contribute to the higher percentage of air trips due to modal

shift from rail to air. In Table 1, other modes include rail and bus. Amtrak rail trips account for about 14 percent of total intercity trips (including those by automobile) between Washington, D.C. and New York City (Congressional Budget Office, 2003), which is much lower than the modal shares of private automobiles and airplanes (except for the New York-Philadelphia segment).

According to Table 2, for vacation trips, automobile and air have much lower demand elasticities than bus and rail. This indicates that automobile and air are more popular modes for vacation trips. Since the Northeast Megaregion has a higher percentage of recreation trips, which more likely use automobiles and airplanes. Bus and rail are comparatively less important in this megaregion.

TABLE 2 - ELASTICITIES OF DEMAND OF INTERCITY PASSENGER SERVICE FOR VACATION TRIPS

Indicator	Automobile	Bus	Rail	Air
Cost	-0.45	-0.69	-1.20	-0.38
Travel Time	-0.39	-2.11	-1.58	-0.43

Source: Morrison, S.A. and Winston, C. (1985). An Econometric Analysis of the Demand for Intercity Transportation. *Research in Transportation Economics*, 2, pp. 213-237.

In summary, in the Northeast Megaregion, unless the intercity passenger rail service, especially high-speed rail, can be improved and made more attractive, and highway/aviation system can be upgraded, the future highway and air traffic congestion will be getting worse with the further increase in population and travel demand.

2.2. Supply Analysis

The Northeast Corridor (NEC) is the busiest passenger rail line in the Northeast Megaregion and the U.S. in terms of both ridership (10,897,852 total riders on Acela Express, Northeast Regional and Northeast Corridor Special Trains combined in FY 2008) and service frequency. The total NEC length between Boston and Washington, D.C. is about 456 miles, of which 363 miles (almost 80%) of tracks are currently owned by Amtrak, with the remaining tracks being owned by states of New York, Connecticut, and Massachusetts (Cambridge Systematics, Inc., 2008; Amtrak, 2008). See Figure 1 for details.

At present, seven operators use the NEC: Amtrak, New Jersey Transit (NJT), Southeastern Pennsylvania Transportation Authority (SEPTA), Massachusetts Bay Transportation Authority (MBTA), Metro-North Railroad, CSX , Norfolk Southern. Of these seven operators, CSX , Norfolk Southern are freight rail operators. Those non-railroad owners access the tracks through paying trackage rights fees.

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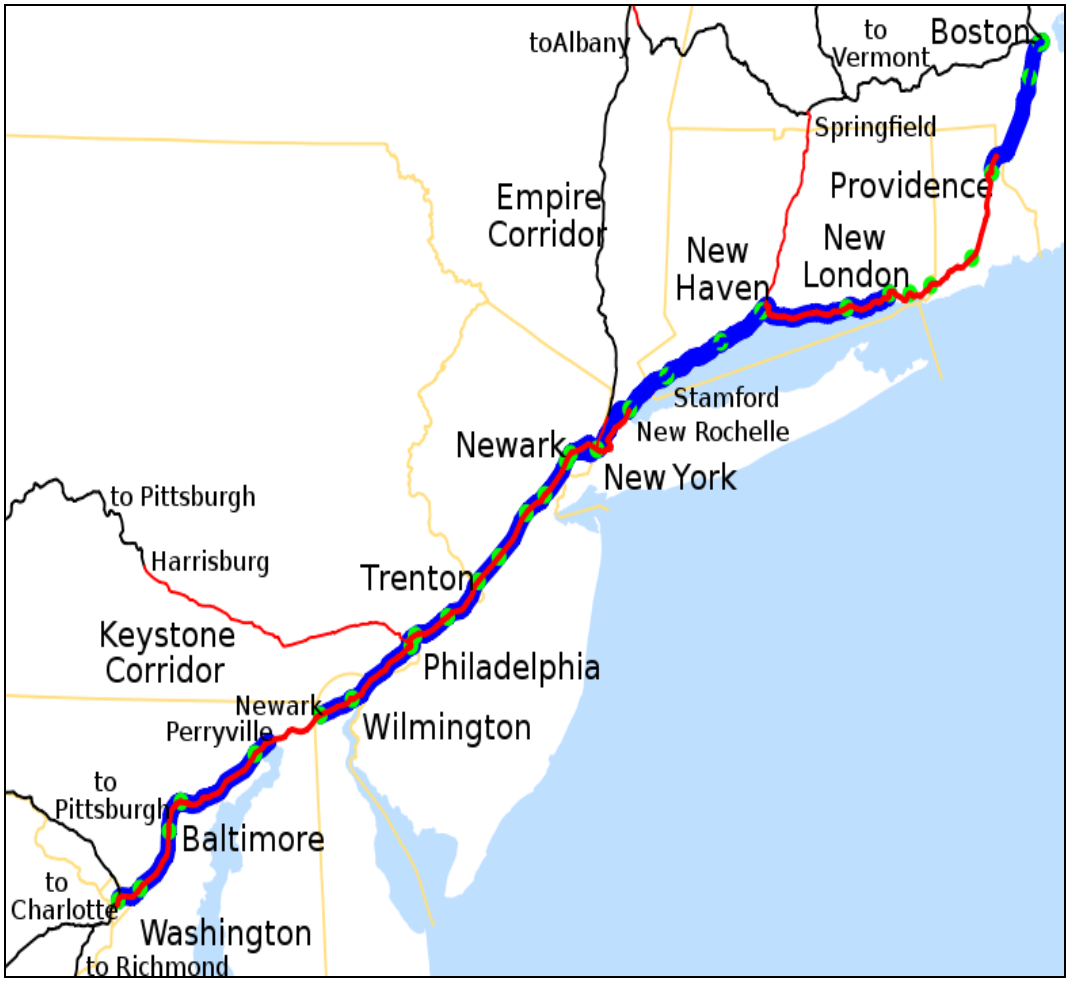

FIGURE 1 - RAILROAD OWNERSHIP OF THE NORTHEAST CORRIDOR MAINLINE
[Note: In Figure 1, Red - Amtrak ownership; Blue - NEC commuter services and NEC commuter rail agency ownership; Black - off-NEC Amtrak lines not owned by Amtrak; Green - stations on the NEC (Amtrak only)]

The rail route in the NEC is fully electrified and serves a densely urbanized string of cities from Washington, D.C., in the south through Baltimore, Wilmington, Philadelphia, Trenton, Newark, New York, New Haven, and Providence to Boston in the north. The busiest passenger rail station is Penn Station in New York, the central hub of the Northeast Corridor. The top 20 Amtrak station pairs in the NEC are listed in Table 3.

In terms of its intercity linkage intensity, the following three levels can be identified:

- Level 1: New York-Philadelphia, and New York-Washington, D.C. This demonstrates New York's prominent central city status;

- Level 2: Philadelphia-Washington, New York-Albany, New York-Boston, New York-Baltimore, and New York-Wilmington; and
- Level 3: other intercity linkages.

As the only HSR in the U.S., Acela Express is Amtrak's rail service that uses high-speed tilting trains. Since its inception in December 2000, Acela Express has achieved a steady increase in its ridership and revenue generation, especially after the September 11 terrorist attacks. In 2007, Acela Express reached an annual passenger ridership of 3.19 million.

TABLE 3 - AMTRAK ANNUAL RIDERSHIP: TOP 20 STATION PAIRS IN THE NORTHEAST MEGAREGION

Station Pair	Amtrak Riders	Linkage Intensity
New York – Philadelphia	1,642,587	Level 1
New York – Washington D.C.	1,293,296	
Philadelphia – Washington D.C.	667,515	Level 2
New York – Albany	511,761	
New York – Boston	469,023	
New York – Baltimore	355,289	
New York – Wilmington	332,640	
Philadelphia – Newark	165,697	Level 3
New York – Providence	163,534	
Washington D.C. – Newark	149,475	
Washington D.C. – Metropark	144,315	
Washington D.C. – Wilmington	142,400	
Philadelphia – Baltimore	137,853	
Washington D.C. – Trenton	102,746	
Philadelphia – Harrisburg	97,201	
New York – New Haven	82,738	
Philadelphia – Boston	75,340	
Washington D.C. – Boston	71,794	
Metropark – Philadelphia	67,902	
New York – Hartford	62,264	

Source: University of Pennsylvania, 2005. *Reinventing Megalopolis: The Northeast Megaregion*. Philadelphia, PA: University of Pennsylvania.

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3. DEFICIENCY ANALYSIS

Even though the Northeast Megaregion has the most developed rail system in the U.S. and has achieved a modest increase in its ridership recently, it still has many deficiencies as listed below.

3.1. Low Modal Share

According to Congressional Budget Office (2003), Amtrak's role in transporting passengers, relative to other modes of travel, is much more prominent in the Northeast Corridor than in the rest of the country, due to its relatively high population density along the corridor. Nevertheless, Amtrak's modal share of total intercity trips in this corridor is still around 14%, much lower than those of automobiles and airplanes (except for the New York-Philadelphia segment). It is also much lower than 26.1% of rail modal share by passenger-kilometers in Japan (Okada, 2007).

3.2. Slow Operating Speed

Acela Express, classified as the high-speed rail in the NEC, travels at an average speed of 82.8 miles per hour (mph) from Washington, D.C. to New York, but only 67.9 mph from New York to Boston. Fewer, antiquated, and passenger/freight shared available tracks, and archaic/unreliable power systems between New York and New Haven cause significant delays and make the train to run only at 54 mph (University of Pennsylvania, 2005). As shown in Table 4, the slow operating speeds of Acela Express pale in comparison to the Japanese Shinkansen.

TABLE 4 - AMTRAK ACELA EXPRESS OPERATING PERFORMANCE IN THE NORTHEAST CORRIDOR

HSR Name	Segment	Mileage	Average Actual Speed	Travel Time
Acela Express (Southern Segment)	Washington, D.C. to New York	225	82.8 mph	2 hours 43 minutes
Acela Express (Northern Segment)	New York to Boston	231	67.9 mph	3 hours 24 minutes
Shinkansen (Nozomi)	Tokyo to Shin Osaka	320	132.4 mph	2 hours 25 minutes

Acela Express's slow speeds and high-priced fares have given people little choice but to use highway for shorter trips and air for longer distances, ultimately reducing demand for Amtrak and leaving both highways and airports more congested.

3.3. Complicated Railroad Ownership

Railroad ownership is perhaps one of the most important factors hampering the HSR operating performance in the Washington, D.C. - New York segment and the New York - Boston segment. The former is exclusively owned by Amtrak, whereas the latter is jointly owned by Amtrak, New York, Connecticut, and Massachusetts, which creates substantial coordination difficulties. As mentioned earlier, seven operators currently use the NEC.

All of the freight operations, plus conventional intercity rail and commuter rail services, have greatly impacted the Acela Express's performance. These freight railroads accounted for over 2.8 million of Amtrak's 3 million delay minutes in 2003. This situation is expected to be deteriorating in the future unless some drastic measures are taken. Therefore, a better coordination between Amtrak and the "host" freight railroads, and in particular, the construction of new rights-of-way for Acela Express HSR, is critically important, as elaborated later.

3.4. Amtrak Resource Misallocation

According to University of Pennsylvania (2005), Amtrak does not effectively match offered capacity with ridership demand, which creates a resource misallocation issue. For the top 20 ridership station pairs, New York, Washington, D.C., and Philadelphia carry the largest number of passengers. However, Amtrak does not offer sufficient capacity for these cities in the peak hours. Instead, many rail trips are focused on very long distances, which cannot successfully compete against airplanes.

This resource misallocation issue has something to do with the federal financial subsidies which make Amtrak less sensitive to rail ridership and financial costs, as analyzed below.

3.5. Financial Deficits

Amtrak has received federal subsidies every year since it began providing service in 1971. Those subsidies, fluctuating over the years, represented a substantial share of the company's total revenues: about 21 percent in 2001 and 32 percent in 2002 (Congressional Budget Office, 2003). In FY 2008, Amtrak earned approximately $2.45 billion in total revenue (passenger related and others) and incurred about $3.41 billion in expenses (salaries, wages, benefits, and others). The annual federal appropriation on which Amtrak relies totaled $1.325 billion in FY 2008 (comprising $475 million in operating funds, and $850 million in capital, including $285 million for debt service). Therefore, federal subsidy accounted for over 35 percent of total revenues (Amtrak, 2008).

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3.6. Lack of an Effective Governing Mechanism

As of today, this megaregion does not have an effective governing mechanism to coordinate intersectoral (private-private, private-public) and multijurisdictional (city, county, state, federal) activities and garner steady political supports.

4. RECOMMENDED IMPROVEMENT STRATEGIES FOR THE NORTHEAST MEGAREGION

This paper offers a new way of thinking for improvement strategies: Partnership, Reform, Optimization, Multimodalism, Interconnection, Sustainability, and Effectiveness, or acronym PROMISE. These strategies are all interrelated, rather than separated. This broad framework needs to be further detailed and studied in the future.

4.1. Partnership

It is essential to build successful public-public and public-private partnerships for the HSR services in the Northeast Megaregion. Political leadership can be demonstrated at both national and subnational levels (Perl, 2002).

On the public-public partnership side, the critical step is to build a coalition among federal, state, local governments, and Amtrak to keep intercity rail operation alive and thriving. It is necessary to execute a multilateral compact to do this.

Through the Federal Railroad Administration (FRA), the federal government can play an instrumental role in coordinating interstate planning, funding, and design activities to better address HSR issues in this corridor (Mathur and Srinivasan, 2009).

Since HSR is not a standalone transportation mode, its planning has to be placed in the larger multimodal transportation planning framework. This paper recommends the federal government, in conjunction with the 12 state governments plus Washington, D.C., to establish the Northeast Megaregion Governing Council. Modeled after the I-95 Coalition and the Twin Cities Metropolitan Council, this Governing Council shall have an expanded authority in setting multimodal transportation development policies, coordinating local and state transportation planning activities, reviewing and approving land use policies, managing a revenue-sharing program among different states, engaging communities and the public in planning for future sustainable growth, and others. All 12 states and Washington, D.C. should be represented on the Council Board. The establishment of this super

megalopolitan planning organization requires the special authorization from the U.S. Congress and the administration.

In addition, the roles of Metropolitan Planning Organizations (MPOs) should be strengthened as well. As noted by Orfield and Luce (2009), because of difficulties in organizing entire megaregions, the best solution is perhaps for metropolitan-level bodies to work together to manage issues of common interest to these larger, more loosely connected economies. Designated by federal and state governments for regional transportation planning purposes, these MPOs are often the councils of local governments, which, unless well coordinated, tend to be decentralized, fractionalized, fragmented, or polycentric (Wikstrom, 1990).

On the public-private partnership side, the key is to tap into private funding sources and promote transit-oriented development activities in the vicinity of HSR rail stations. Even though private sector involvement has usually been portrayed as bringing additional investment dollars into the transportation system, it actually helps break down the barriers that pervade multijurisdictional investment situations (Ankner and Meyer, 2009). Citizen participation is important to the success of HSR projects as well. Even though referring to the light rail projects in the U.S., Black's suggestion (1993) that local governments and citizens should play more important roles in transportation planning is also applicable to the HSR planning of the Northeast Megaregion.

4.2. Reform

This author holds that Amtrak needs to be thoroughly reformed in order to be more efficient and responsive to consumer demands. Competition mechanism must be introduced. The Japanese railway privatization experience may offer a good international perspective.

4.2.1. Japanese Railway Privatization

The former state-owned Japanese National Railways (JNR) had a deteriorated financial crisis between the 1960s and the 1980s. By 1987, the JNR's debt reached ¥25 trillion (4.9% of the total national budget and 0.9% of GDP), which triggered the government-led railway privatization movement in the same year.

The Japanese government divided JNR into six geographic regions, intended to reinforce regional governance and foster interregional competition. See Figure 2 for the service territories of these six private JRs (Japan Railways). The passenger rail was divided into three regions on the main island of Honshu - JR East, JR Central, and JR West. Three additional passenger railroads were created on

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each of the three smaller islands - JR Hokkaido, JR Shikoku, and JR Kyushu. The rationale of this division is to ensure that 95% of all passenger rail trips would begin and end within the service territory of one regional company. Each regional railway company is vertically integrated, meaning its infrastructure, rolling stocks, and operations are owned by one company. It should be noted that Japan Freight Railway Company was created as an independent company. This company is vertically separated, i.e., not owning infrastructure. It has to pay trackage rights fee to access the tracks.

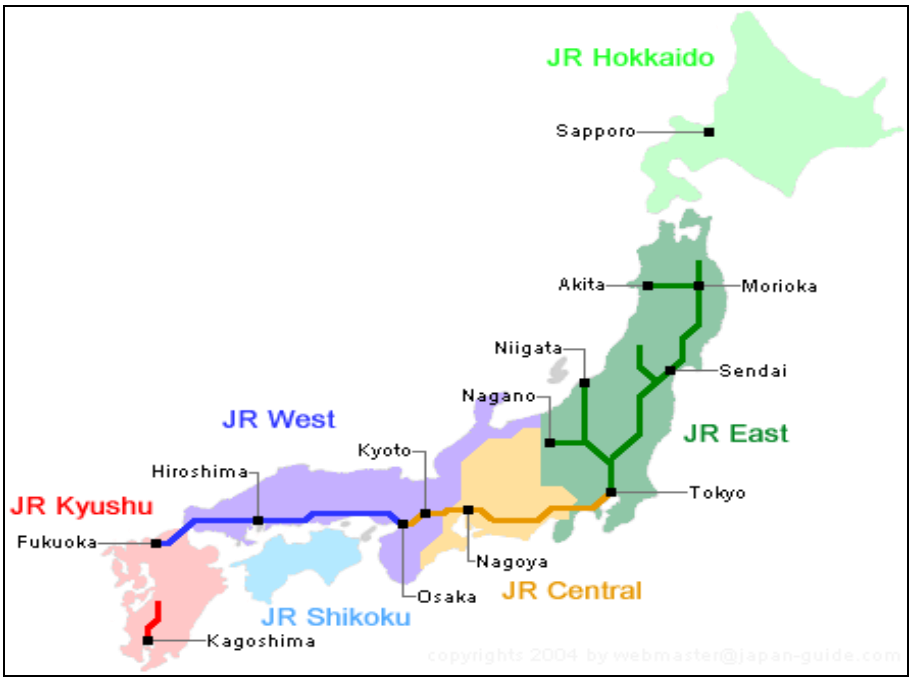

FIGURE 2 - SERVICE TERRITORIES OF THE JAPANESE RAILWAY COMPANIES

Each JR is a joint-stock company with different stockholders. For example, Central Japan Railway Company (JR Central) is 60% owned by private investors, with the rest being owned by the Japanese government. See Figure 3 for its corporate governance model.

As one of the most important JRs, JR Central operates the earliest Shinkansen bullet train in Japan - the Tokaido Shinkansen. The Tokaido, meaning "east coast road", has been the main road of Japan since Mediaeval times (Ito, Nagashima, and Hons, 1980). Fully funded by the Japanese government, the 515.4-km long Tokaido Shinkansen was built in order to increase capacity in the corridor served by the old Tokaido main line. It opened for operation on October 1, 1964, just in time for the 1964 Tokyo Summer Olympics. This is the most heavily travelled high-speed rail route in the world, with 4.8 billion cumulative passengers recorded by March 2009. As shown in Figure 4, this HSR line links the following four most important cities in Japan: Tokyo, Nagoya, Kyoto, and Osaka.

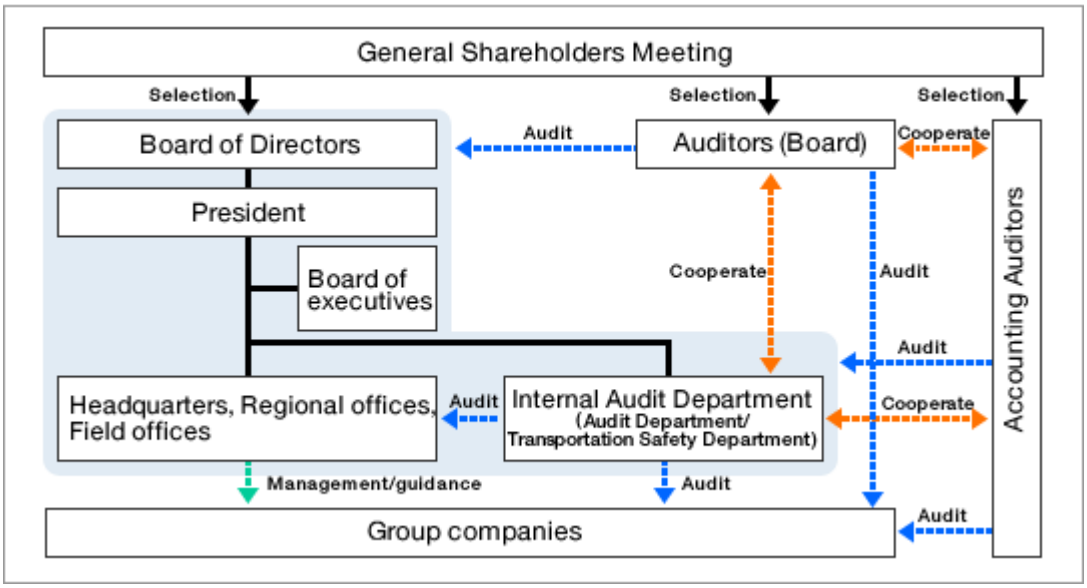

FIGURE 3 - JR CENTRAL CORPORATE GOVERNANCE MODEL
Source: http://english.jr-central.co.jp/company/company/about/governance.html

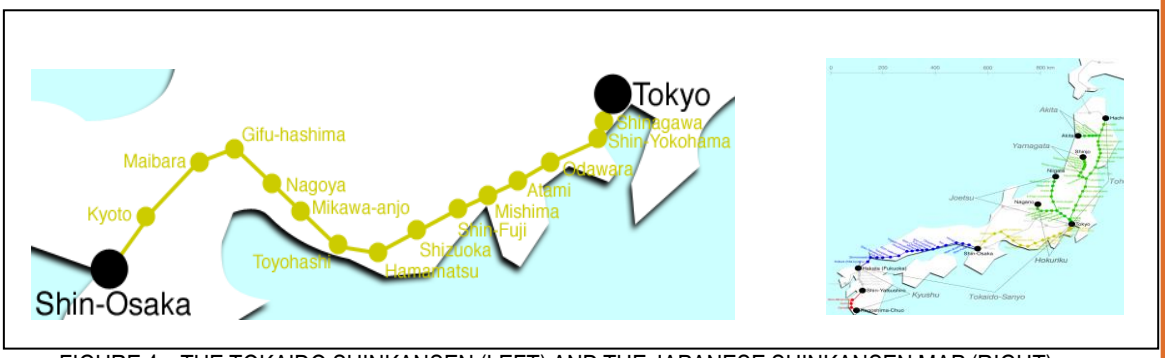

FIGURE 4 - THE TOKAIDO SHINKANSEN (LEFT) AND THE JAPANESE SHINKANSEN MAP (RIGHT)

The Japanese railway privatization was certainly not perfect. For example, the vertical integration of all JRs somewhat restricted competition, and its network opening to third parties was also limited (Obermauer, 2001). Nevertheless, it did yield some positive results.

According to Imashiro (1997), since the new JRs became reality on April 1, 1987, their operating balances soon improved dramatically compared to the JNR days. In their first year of operation, the combined operating profits totaled ¥340 billion, rising to ¥900 billion in 1992. Imashiro cited four contributing factors: 1) the steady growth in transport demand resulting from the economic boom at that time; 2) the release from the huge burden of the old JNR debt; 3) the positive business efforts of the JRs themselves; and 4) the reduced labor costs. As a result, the JRs have managed to avoid fare increases for a long time after privatization. Mizutani and Nakamura (1996) estimated that the effect of privatization on productivity increase was about 29%.

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As to JR Central, it is also able to cover its operating costs from operating revenues and does not receive operating subsidies from the government. See Table 5 for details. In particular, the Tokaido Shinkansen line is the most financially viable in terms of covering its operating costs. Significant commercial revenue is also derived from non-rail businesses the railroads operate along side their track, such as offices, department stores, housing, and recreational facilities.

TABLE 5 - FINANCIAL PERFORMANCE OF JR CENTRAL

Financial Performance	2006		2007		2008	
	Millions of Yen	Millions of US Dollars	Millions of Yen	Millions of US Dollars	Millions of Yen	Millions of US Dollars
Operating Revenue	1,467,650	16,158.83	1,491,269	16,418.87	1,559,467	17,169.73
Operating Cost	1,063,895	11,713.48	1,088,782	11,987.49	1,125,004	12,386.29
Surplus/Deficit	403,754	4,445.33	402,487	4,431.38	434,462	4,783.43

Source: http://english.jr-central.co.jp/company/company/achievement/finance/highlights.html. Note: 1 Japanese Yen = 0.01101 US dollar on 12/31/2008.

4.2.2. Amtrak Reform Strategies

In the U.S., rail captures only 0.1% of domestic intercity passenger travel (measured by passenger-kilometers) but 36% of the domestic intercity freight market (measured by metric ton-kilometers). In contrast, Japan's railways carried 22.98 billion passengers (25.5% of total) (404.59 billion passenger-kilometers, 29% of total) of domestic passenger transportation in fiscal year 2008. In the same year, its railways only carried 46.2 million tons (0.9% of total) (22.26 billion ton-kilometers, 4% of total) of domestic freight transportation (Source: http://www.stat.go.jp/english/data/handbook/c09cont.htm). Japan's rail dominance, especially the Shinkansen, in intercity passenger transportation has been greatly influenced by the unique Japanese geography characterized by mountaineous terrains and a narrow strip of plain area between mountains and the Pacific Ocean. Nevertheless, the Japanese railway privatization experience is still applicable and transferable to Amtrak because competition enhancement is exactly what Amtrak urgently needs right now. This author recommends the following reform measures for Amtrak:

- Under the Amtrak umbrella, create three semi-autonomous operations divisions or service sectors for NEC Mainline: Amtrak North (conventional rail operations between New York and Boston), Amtrak South (conventional rail operations between Washington, D.C. and New

York), and Amtrak Acela Express for the entire NEC. Each division should have its own governing board and management, which make locally-responsive operating decisions. For the HSR operation, it would perhaps be more efficient for Amtrak Acela Express to run throughout the entire NEC, which is similar to the Tokaido Shinkansen operation model. The Tokaido Shinkansen is operated by JR Central only, even though the line traverses the service territories of JR East, JR Central, and JR West. Vranich (2004) also concludes that America's passenger trains have great potential if we pursue privatization, franchising, and devolvement of services to more responsive regional and state transportation agencies;

- Foster competition among commuter rail and freight rail operators accessing the NEC tracks through an open bidding process, and allow for direct on-track competition of these operators against Amtrak. Trackage rights fees should be set to be flexible in response to travel demand and rail traffic congestion; and
- Introduce the networking franchising option by having private carriers gradually take over the Amtrak business. The federal government needs to develop contracts specifying its minimum expectations from private operators, as well as identifying the terms by which public resources would be made available to deliver those standards (Perl, 2002).

4.3. Optimization

In order to optimize intercity rail transit performance, the existing Acela Express HSR has to be upgraded and improved in the following aspects:

- In the short run, Amtrak needs to reduce travel times and increase service frequency, rather than directly jump to the very expensive 200 mph HSR standard (Hilkevitch, 2009);
- In the long run, it is necessary to better coordinate Amtrak and host freight railroads to allow or build new rights-of-way for exclusive HSR use. Initially, the existing tracks need to be upgraded. This will significantly reduce congestion at the critical choke points, and increase efficiency along the entire line. To accelerate its construction schedule, it is necessary to streamline the planning process and implement the phased construction similar to Japan's Shinkansen construction model;
- The latest advanced HSR techniques need to be introduced in a stepwise way, including vehicle designs, signal controls, power transmission, track design, and others.

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4.4. Multimodalism

The multimodal planning approach calls for considering all feasible transportation modes and different components, such as supply management, demand management, and land use management (Meyer and Miller, 2001).

Even though HSR is at the core of future transportation improvements, other modes (highway and aviation) are also important, as mentioned earlier. Furthermore, it is critical for the megaregion that its transit system, highways, and bridges are maintained in a state of good repair, which lays the foundation on which all multimodal transportation improvements are made (New York Metropolitan Transportation Council, 1999).

4.5. Interconnection

A good interconnection among different modes will maximize overall transportation system effectiveness and minimize travel times. The following key areas need to be strengthened in particular: airports, seaports, bus and rail stations, park-and-ride lots. The reduction of transfer time and nodal congestion are at the core of a good intermodal connection (University of Pennsylvania, 2005).

4.6. Sustainability

The Northeast Megaregion transportation should be so designed and improved to better attain sustainable development goals ranging from preservation of open space and green infrastructure to transit-oriented development, provision of affordable housing options, social equity, and many others.

The transportation planning process needs to include detailed environmental impact studies to mitigate any unnecessary environmental impacts. Sustainability calls for achieving 3 Es: economic efficiency, social equity, and environmental preservation.

4.7. Effectiveness

This calls for developing a set of adequate performance indicators to measure the effectiveness of HSR and other transportation modes in addressing the severe transportation issues confronting this megaregion.

5. CONCLUSION

As the most important megaregion in the U.S., the Northeast Megaregion is facing tremendous transportation challenges, including severe highway and air traffic congestion. To meet these

challenges, it is necessary and urgent to improve and upgrade the existing Amtrak Acela Express to a higher level. Only a good HSR system with a competitive operating speed can attract existing motorists and air passengers and increase transit modal share, which has beneficial externalities in building a sustainable transportation system.

The supply/demand relationship analysis within the Northeast Megaregion and an international comparison with the Tokaido Shinkansen in Japan help identify many intercity passenger rail deficiencies in the corridor. In response, this paper proposes a set of PROMISE strategies.

On the political fronts, it is essential to build effective partnerships (public-public, and public-private) and reform the Amtrak's existing corporate governance model. Continuing political and funding supports would keep intercity passenger rail alive and thriving. A more effective federal leadership will better coordinate multistate and interjurisdictional issues associated with HSR development. More importantly, competition should be introduced into corporate culture in order to improve rail operating efficiency and reduce financial costs.

On the technical fronts, providing exclusive rights-of-way and introducing the latest HSR techniques are critical measures for improving and upgrading Amtrak Acela Express services in the NEC. Aside from HSR, other modes (especially highway and aviation) need to be improved concurrently. The multimodal planning approach helps interconnect different modes and build an integrated transportation system in a seamless way.

In summary, the Northeast Megaregion deserves a new HSR system that helps realize the sustainable development goals: economic efficiency, social equity, and environmental preservation.

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