# HIGH-SPEED RAIL:

# CALIFORNIA IN CONTEXT

Louis S. Thompson
Chairman, Peer Review Group
California High-Speed Rail Project
14684 Stoneridge Drive
Saratoga, CA 95070
lou.thompson@gmail.com
March 28, 2019

## Summary

California has been building a high-speed rail (HSR) system from San Francisco to Los Angeles ("Phase I"), with potential extensions to Anaheim/San Diego and to Sacramento ("Phase II"). The project is controversial because of its high (and rising) costs and the financial risks it poses to the state. This paper summarizes the experience of major high-speed rail systems in Europe and Asia and highlights the issues and choices facing the Legislature and Governor as they consider the future of the project. The paper argues that, by comparison with foreign experience, the project has suffered from: unstable and fragmented government(s) oversight; unreliable and insufficient funding; limited managerial capability; incomplete and inappropriate planning objectives; and, delays due to protracted litigation.

## High-Speed Rail Profiles

There is nothing new or exotic about high-speed rail.[1] Even some steam trains in the U.S. and Europe achieved speeds of 200 Km/hr by the end of the 19th century, though not in regular service. During the 1960s, experimental gas turbine trains exceeded 250 Km/hr and the United Aircraft Turbotrain actually carried passengers at 250 Km/hr for short distances, although the equipment was highly unreliable and expensive to maintain.[2] The PennCentral electric Metroliners were also capable of speeds above 250 Km/hr, but were constrained in practice to 200 Km/hr in revenue service in the mid-1960s. For the purposes of this paper, "real" high-speed rail passenger service began when the "Shinkansen" trains began to operate over the full 500 Km from Tokyo to Osaka in 1964 at sustained speeds of 210 Km/hr.

**Japan.** The first line of the Shinkansen system (Tokaido) from Tokyo to Osaka was built to carry the added traffic generated by the 1964 Tokyo Olympics as the existing Tokyo-Osaka line was saturated. Since commencing service, the Shinkansen system has been extended to 2849 Km connecting Tokyo to most of Japan's larger cities (see Table 1 for comparisons). The Shinkansen

---

[1] There is no agreed definition of "high-speed" rail. The original Japanese Shinkansen trains operated at 210 Km/hr (130 Mph) and the British HST operates at 125 Mph. Currently, train services faster than about 250 Km/hr (155 Mph) establish the boundary of "high-speed", though some trains in China have operated at 350 Km/hr (217 Mph). Experimental runs have reached 575 Km/hr in France. The high-speed parts of the planned CA HSR system are required to be designed for 220 Mph, though operation between San Francisco and San Jose will be limited to 177 Km/hr (110 Mph).

[2] See, e.g., https://en.wikipedia.org/wiki/UAC_TurboTrain accessed March 8, 2019

system is exclusive to HSR and is a different gauge from the rest of the Japanese system. The Shinkansens currently carry nearly 400 million passengers annually. Since 1964, the Shinkansens have carried over 11.5 billion passengers without suffering a single fatality due to a train accident. The image of the Shinkansen train speeding on the plain below a snow-covered Mt. Fujiyama has become an icon of modern Japan.

Table 2 shows the traffic levels on the world's high-speed lines. Since the completion of the build-out of the Shinkansen system in the early 1990s, traffic growth has been slow.

Not so well known is that the old Japanese National Railway collapsed under a mountain ($250 billion) of debt (only partly arising from Shinkansen construction) and operating losses. In 1987, the Government drastically restructured the system, creating six passenger companies, one freight company, one company that owned the high-speed infrastructure, and a "settlements" company into which much of the pre-existing debt and the non-rail assets were moved. Subsequently, four of the passenger companies have been profitable and were privatized. The high-speed infrastructure was sold to the four larger passenger companies at a price that earnings could support. Two of the passenger companies remain unprofitable and in government hands. The freight company slowly became marginally profitable and has been privatized. Taxpayers eventually had to absorb around $200 billion after all debt and assets were finally settled or sold.[3]

**France**. The French TGV (Train à Grande Vitesse) began in 1981 because the existing capacity of the Paris to Lyon line was saturated. A new line was built to carry much higher speed trains (originally 250 Km/hr, now up to 320 Km/hr on some lines). The system has been extended to cover most of France's major cities. Some services extend into Germany and Switzerland because the TGV trainsets are capable of operating on conventional lines as well as the exclusive high-speed lines. The ability to operate over both high-speed dedicated lines and conventional lines where new construction would be prohibitively costly was one of the important innovations of the TGV approach.

TGV services have always been financially and operationally integrated into the French national railway (SNCF) so it is not clear which of the TGV services cover their operating and capital costs. Studies (French law mandates retrospective economic studies of projects over a certain size) have found that the original TGV line from Paris to Lyon is fully

---

[3] Japan Times editorial, "Privatization of JNR, 39 years on," April 24, 2017.

profitable, including coverage of investment, and that a number of the other lines generate economic benefits in excess of their costs including investment, but these cannot be verified from public sources.[4] What is clear is that the SNCF overall generates large losses and is a major financial burden to the Government. There have been a number of attempts to restructure the system that failed due to political resistance, especially from the SNCF labor unions and SNCF continues to generate large losses.

TGV traffic (Table 2) grew rapidly at the outset but, as in Japan, has been essentially stable since completion of the system. In fact, TGV traffic actually shrank over the past ten years. The TGVs have carried 2.4 billion passengers without a passenger fatality due to an operating crash.

**Germany**. Deutsche Bahn (DB) took a more evolutionary approach to high-speed rail. Though pieces of new, high-speed lines have been built, the system was developed based on a mixture of high-speed lines along with up-graded medium speed and conventional lines. The rolling stock (Intercity Express, or ICE) can operate system-wide, with some ICE trains operating from Germany into Switzerland, Austria, Belgium and the Netherlands. ICE trains began operating in 1991 and have carried about 1.5

[4] See, e.g., Chapulut and Taroux 2010

billion passengers (Table 2) since then. There has been one crash involving 101 fatalities in 1998.[5]

Despite the growth of ICE traffic, DB as a corporation has had a troubled financial history, especially since the reunification of Germany in 1991. DB now has debts of more than €20 billion and a recent Court of Auditors report called for a searching review of DB's organization and objectives.[6]

**China.** Compared with Japan, France and Germany, the experience in China can only be called astounding. After starting construction in 2005, China Railways has built an HSR system of 21,635 Km, nearly 2.8 times that of Japan, France and Germany combined and essentially equal to all of the other high-speed lines in the world. After only 10 years of development, high-speed traffic on China Railways is 2.6 times that of Japan, France and Germany combined – and it is still growing rapidly. (Figure 1). More remarkable is the fact that, while the E.U. and Japanese systems are essentially complete, China Railways intends to add another 9000 Km of high-speed line by the end of 2020 and an additional 8000 Km by the end of 2025 (for a total of 38,000 Km). At current ridership densities, this indicates

[5] See https://en.wikipedia.org/wiki/Eschede_derailment
[6] Briginshaw, 2019

that in 2025 China Railways could see more than three billion high-speed passengers annually – about 8 times that of Japan and 15 times that of France and Germany combined.

China had a number of objectives in initiating its HSR program in addition to improving passenger service, *per se*. Probably most important, the entire Chinese network was saturated, with a total traffic density (passenger-Km plus freight tonne-km per line Km) that was more than three times the U.S. and almost 15 times that of the western E.U. rail networks. One perhaps counterintuitive objective for building new high-speed passenger lines was to get rail passenger traffic out of the way of vitally needed freight on the conventional lines, especially because the Chinese highway network is still not fully developed: rail plays a larger role in China than in the U.S. and a much larger role than in the E.U. Another objective was to create much stronger economic linkages between the more developed Eastern and coastal regions and the underdeveloped regions in Western China. The central government also used the HSR construction program for economic stimulus, especially in the less developed areas.[7]

[7] Financial "Leakage" may also have been an objective: the former Rail Minister is now in jail for accepting bribes arising from the massive construction program.

The financial and economic performance of the program offers good and bad news.  Although reliable data are always difficult to obtain in China (especially for the railway because rail traffic has national security implications), World Bank studies indicate that some of the more densely used high-speed lines have covered their costs, including debt service, and have generated financial rates of return between 6% and 9% for the more profitable 350 Km/hr lines and less than 1% for the 250 Km/hr lines.[8]  The difference is partly due to higher demand on the higher-speed lines and more significantly due to political and regulatory suppression of prices on the lower speed lines.

Even though some of the better performing lines are profitable, the overall picture is not nearly as bright.  The investment cost of the system has been in the range of $500 billion so far and it will obviously increase as more lines are built. The system has been built by "Joint Ventures" between China Railways and local governments, with each contributing half.  Although the source of the finance was supposed to be half debt and half "equity", it is likely that most of the equity was actually borrowed from a state controlled bank.  Since much of the debt cannot be repaid from earnings of the system, it will inevitably need to be repaid or refinanced by the national and local

---

[8] Lawrence, et al, 2018

governments, and some observers believe that the local governments will simply be unable to repay their debts.[9]

Since most of China's corporations are state owned, China's debt to GDP ratio including state enterprises has been estimated at 282 percent, making China the second most indebted country in the world.[10] Debts associated with the HSR program have undoubtedly been a significant contributor to this dilemma. Ansar, et al, also conclude that Chinese rail projects (not all of them HSR) have had an average budget overrun of over 40 percent and have tended to take longer than scheduled though, to be fair, Chinese rail construction schedules tend to be about 1/3 faster than in the E.U. and the U.S.

**Amtrak.** Amtrak's higher-speed passenger services in the Northeast Corridor (NEC) from Washington, DC to Boston, MA via New York City are much smaller than Japan, France, Germany and China. There are two types of service. "Acela" operates European style rolling stock, offers Business and First Class service only, and operates at speeds of up to 250 Km/hr over short portions of the 731 Km distance. "Regional" trains operate with electric locomotives hauling conventional coaches and

---

[9] See, e.g., Xiang, 2018
[10] Ansar, 2016, p 385

operate at speeds of up to 210 Km/hr over much of the distance. There are no Amtrak services outside the NEC that travel faster than 170 Km/hr, and most of Amtrak's services are much slower.

Amtrak reports show that the Acela and Regional trains earn a large surplus over their direct operating costs while essentially all of the conventional services fail to cover even their operating costs from passenger revenues.[11] Amtrak does not report NEC infrastructure costs separately, so it is not clear whether the NEC trains cover their full costs and actually make a "profit." What is clear is that Amtrak overall is unprofitable, costing taxpayers $50.2 billion ($80.7 billion in 2017 $) since its inception in 1971.[12]

The foreign experience supports at least a few overall conclusions about HSR services. HSR is a fully proven operational and technological fact. It has been built in a number of countries and has carried many billions of passengers in comfort and safety. Though the HSR services are often provided by loss-making national railway entities, continuing public support suggests that there is a consensus that the HSR services have been worth the effort: political pressures are

[11] See Amtrak Monthly Performance Report for 2018 at https://www.amtrak.com/about-amtrak/reports-documents.html
[12] Unpublished history of Amtrak appropriations furnished to the author by Federal Railroad Administration

usually to expand HSR service, never to reduce it. From this perspective, the issue in California is simply a matter of political will. Does the California polity attach the same values and costs to HSR that pertain in other countries?

## Comparing the Institutions

Each of the existing HSR service providers exists within its own institutional and ownership framework. The institutional framework is important because it influences how the participants measure and value benefits and costs. Table 3 summarizes the determining characteristics of the institutional structure of the major high-speed railways in the world.

Ownership of the **infrastructure** (track, electrification and signals) ranges from a fully private corporation (Japanese Shinkansens) through Public-Private Partnerships (PPPs) (Taiwan) and public corporations (Amtrak, China Railways and Korean Railways) to publicly owned agencies not in corporate form (most E.U. railways and the CA HSR Authority).

It is the policy of the E.U. Commission that infrastructure agencies should be separated from all **operators** and should allow all qualified operators (conventional passengers and freight as well as HSR) access to the infrastructure on equal terms.

Though France and Spain as yet have only single operators for all passenger services (all are publicly owned corporations). Italy, Germany, Belgium, Netherlands, Sweden and UK have open access with competing operators, some public and some privately owned. None of the Asian HSR railways have open access and none allow competition in any service. Amtrak allows multiple access for non-competing services (commuter and freight) on its NEC lines (and charges them an access fee) but does not allow competing HSR or conventional operators.

The CA HSR Authority expects to award an exclusive non-competitive HSR concession, but the concessionaire will have to operate jointly with Caltrain and Metrolink in the commuter areas. By not allowing competition in the HSR services, the CA HSR Authority would be required to oversee and regulate the quality, frequency and prices of the services offered in order to strike whatever balance is targeted between financial and economic benefits. This is an issue that the Authority and the legislature have yet to consider fully. In addition, in the joint operating areas, the multiple operators would have to confront a complex series of access priority and pricing that has never been fully resolved in the E.U.

## What About California High-Speed Rail?

No two railways are the same, and that holds when comparing the CA HSR proposal with other HSR systems. Every generalization has a *caveat* and that is nowhere more true than with HSR systems. With that said, there do appear to be a number of ways in which other systems have survived or flourished while the California system has floundered.

**Stable and unified government leadership.** The most important single factor in HSR success elsewhere has been that HSR systems have enjoyed the committed support and leadership of a unified government. The railway has been owned and led by the national government where HSR policy is developed and consistently followed. For example, in China, the World Bank concluded:

"Careful planning, consistently implemented, is required to deliver a large infrastructure program. In China, development of a well-analyzed Long-Term Plan provided a clear and consistent framework for action. Government provided strong support for the plan, especially (sic) and changes to the plan were minimal. This provided a strong framework upon which all parties could depend and focus on delivery."[13]

Although China has an unusual degree of central control, all of the other HSR systems (including Amtrak)[14] were instruments of national policy and not subject to conflicts between national and local government levels or within local authorities.

[13] Lawrence 2018, pg 65. This finding was connected to a review of the Chinese HSR program, but it clearly applies to all infrastructure programs.

[14] The NEC does include eight states and the District of Columbia, and it has a number of operators, but the fundamental leadership comes (when it does) from the U.S. Department of Transportation.

The CA HSR project could hardly be more different. It originated in a referendum that directly overrode control by the legislature, thus denying the project legislative agreement and commitment.[15] The sources of funding were federal American Recovery and Reinvestment Act of 2009 (ARRA) money along with key roles by FRA and FTA. State funding came from Prop 1A bonds, but had to be matched by other (undefined at the time) sources. Funding from Cap and Trade receipts was highly contentious and unstable year-to-year. Private money was promised but eventually proved unavailable, at least until after the project is in operation.

Unfortunately, also, California is an object lesson in the problems of project planning and management in the face of political fragmentation. California has now had three Governors since passage of Prop 1A, and each has had different appointees and priorities. The California state government has far less control over the actions of its local jurisdictions than do the national governments with HSR systems, so fully accepted decisions are hard to reach and even harder to implement. The

[15] The use of the proposition process was also unfortunate because the voters were presented with a "vision" that had not been subjected to the normal process of critical review, either in the state government or the legislature. As a result, when the project began to encounter problems, it became an orphan.

net result was oversight conflict that sometimes verged on chaos, making project planning and management very difficult.

**Reliable and adequate funding.** Multi-year mega-projects must be able to develop multi-year construction plans that do not have to be revised from one year to the next, and they must be able to package the work into efficient contract sizes. This can only be done when project financing is predictable, stable and adequate. Other HSR systems had suitable financing because of the size of their governments and the commitments the governments made to their railway projects. By contrast, the CA HSR program has never been fully funded and has never had a credible financing program for completing the project. Effective management under these circumstances is simply not possible.

**Managerial capability.** All of the HSR systems were planned, constructed and operated by an existing railway fully staffed with competent engineers and managers that were able to see the project through. The World Bank said of the Chinese projects:

> "Aspects of the project management system that contribute to this include: project management structure with clear responsibilities and delegation of authority, [and] managers that stay for the entire duration of the project…"[16]

[16] Lawrence 2018, p 65

By contrast, the CA HSR project had no existing institutional depth or background. It was almost totally staffed by consultants at the beginning and still relies more heavily on outside consultants than most HSR systems. Consultants bring expertise, of course, and they are subject to professional standards: at the same time, they should be led by a full complement of state employees who can speak for the state in planning and policy issues. This was certainly not the case in the early years of the project and continues to cause problems with contract oversight.[17] Overall, it is clear that a large part of the project's oversight problems have been caused by an inexperienced and undersized in-house staff that was unable to oversee a large number of outside consulting teams. This has improved somewhat over time, but it was missing in the all-important planning stages of the project and is still a problem.

**Valid planning objectives.** As discussed above, very few individual HSR lines[18] (and **none** of the HSR **systems**) are financially profitable if "profitable" means that revenues from customers must cover all costs including a return on investment. All of these systems were planned and are operated with a clear

---

[17] "Moreover, the Authority has in essence placed portions of its oversight of large contracts into the hands of outside consultants, for whom the State's best interests may not be the highest priority. In addition, CMSU [Contract Management Support Unit] – which is staffed by consultants rather than Authority employees – has performed only weak and inconsistent oversight." Auditor's report 2018, pp 2,3.

[18] Possible exceptions are Tokyo to Osaka and Paris to Lyon.

and explicit understanding that they serve both a market (commercial) and a public purpose: the customer pays for the market values (trip time, comfort, cost) and the public supports the public benefits (reduced emissions of pollution and $CO_2$, improved safety, regional and urban development, reduced noise, employment access). This is why many evaluations have concluded that the economic viability of HSR projects is often stronger than their financial viability and is why governments are willing to support them.

Unfortunately, the CA HSR project had to be planned and justified based on manifestly unrealistic promises because it was not possible for the promoters to be explicit (honest) about the eventual required role of public financing (unless it was "free" federal financing or private investment). As a result, the law contains a requirement that the system not be "subsidized" without defining the term. This caused two problems. First, if subsidy means revenues covering purely operating costs (energy, wages and maintenance) the odds of not needing a "subsidy" are good; but, if it means, for example, covering a portion of debt and repaying investment, then no system, including CA HSR, can meet the requirement. Without an explicit understanding of, and agreement on, the terminology, at least some part of the public political support will be lost when the performance of the system emerges and the opportunity for litigation over the issue of state support will be increased. Second, there is a direct tradeoff between financial viability and economic viability in the fare structure. When fares are driven upward by a need to cover financial "costs," the ability of the system to generate public benefits by, for example, shifting traffic from road and air to rail is reduced accordingly. Other HSR systems were (to various degrees) planned with public benefits in mind and the fare systems are reviewed with both the financial and the economic performance of the systems in mind.

California HSR (indeed rail passenger systems in the U.S. in general) had to be planned and justified without being able to admit that much of the public investment would never be recovered from system revenues. At one level, this meant that the promoters had to promise (or hope for) a greater level of federal ("free," to the state, at least) support and private involvement than any existing federal or state programs could provide. In addition, it meant that the planning and start-up of the project were warped by a determined rush to claim the federal ARRA money even though, as the state auditor ultimately found, the rush eventually led to serious mistakes and extra costs.[19] The rush forced the Authority to accede to a federal requirement to commit to beginning in the Central Valley rather than in the Peninsula and the Los Angeles area with the result that the section will have far less utility than if the work had begun on the ends. Most important, the rush forced work to commence before a sufficient financing program was developed and agreed. All of these issues were laid out as early as a Legislative Analyst's Office (LAO) report dated May 10, 2011 and a letter from the PRG to the legislature dated July 1, 2011.[20]

**Protracted litigation.** Foreign high-speed systems are usually planned centrally. The government and/or the railway then hold discussions on the plans with local authorities, reach compromises when they can, and then the systems get built. In China, there is no (safe) way to protest the right-of-way acquisition. Since local authorities are often partners in the later HSR lines, there is little or no local opposition – and the lines get built. Japan and the E.U. countries are less authoritarian than China, of course, but the relative balance of power between national and regional/local means that national objectives tend to be implemented. Local interests are usually considered in the process of developing plans, but projects, once started, are not usually delayed by local political

[19] See Auditor's Report, pg. 2 and pg 17.
[20] See PRG website at www.cahsrprg.com/documents for listing of all PRG letters and reports.

opposition.  Opportunities for delay through litigation are severely constrained.

In the U.S., increasingly, and especially in California because of the added burden of the California Environmental Quality Act (CEQA), a decision to implement a program is only the beginning. Projects such as HSR then must navigate a thicket of planning and environmental steps, any one of which can cause significant delay.  The U.S. legal process gives local entities and private individuals an unusual ability to delay or even bring a project to a halt on arguments about limited "damages" or even on purely procedural grounds.  Almost anyone can delay or stop a project, essentially no one can make it move ahead.

This is not a hypothetical concern.  A $70 billion project delayed for a year during 2 percent inflation adds $1.4 billion to the cost of the project -- far more than legal costs or likely damages.  The concerns are often valid and real, and they clearly deserve a day in court.  Unfortunately, courts move far too slowly considering the costs that delay adds and, of course, one objective of HSR is environmental benefits that are being delayed by litigation.  Other countries do a far better job of resolving this problem than the U.S. and California.

**Summary**

Overall, in the light of the challenges faced by the HSR Authority by comparison with other HSR systems, it is not surprising that the project has been unstable, over budget and well behind schedule.  This leaves two questions: 1) could these problems have been foreseen and alleviated at the beginning of the project?; and 2) given the current state of the project, is there any prospect that they can be fixed now?

**Sources:**

Ansar, Atif, Bent Flyvbjerg, Alexander Budzier, and David Lunn, "Does infrastructure investment lead to economic growth or economic fragility? Evidence from China" Oxford Review of Economic Policy, Volume 32, Number 3, 2016, pp. 360-390.

Auditor of the State of California, "California High-Speed Authority. Its Flawed Decision Making and Poor Contract Management Have Contributed to Billions in Cost Overruns and Delays in the System's Construction," November 2018

Briginshaw, David, "German Court of Auditors proposes radical DB reform," International Railway Journal, Jan 21, 2019

Chapulut, Jean-Noël and Jean Pierre Taroux, "Trente Ans de TGV, Comparaison de Previsions et de Réalisations," Transports, No. 462, Juillet-Août 2010, pp 229-239

Lawrence, Martha, Richard Bullock and Liu Ziming, "China's High Speed rail Development," World Bank Group, December 2018. Pre-print furnished to the author.

Songuo, Xiang, "A Great Shift Unseen Over the Last Forty Years," China Change, December 28, 2018.

Table 1

## Profile of Higher Speed Railways

| Country | Km of Higher Speed Line: > 250 Km/hr | Km of Higher Speed Line: 160 to 250 Km/hr | Km of Higher Speed Line: Total | 2017 HSR Passengers (000) | 2017 HSR Passenger-Km (000,000) | Average Trip Length (Km) |
|---|---|---|---|---|---|---|
| **Japan (4 JRs)** | 2,849 | | 2,849 | 377,441 | 101,247 | 268 |
| **China** | 10,480 | 11,155 | 21,635 | 1,517,800 | 577,635 | 381 |
| **Taiwan (THSRC)** | 350 | | 350 | 60,570 | 11,103 | 183 |
| **Korea (KTX)** | 149 | | 657 | 59,669 | 14,869 | 249 |
| | | | | | | |
| **France (RFF/SNCF)** | 2,166 | | 2,166 | 108,721 | 58,280 | 536 |
| **Germany (DB)** | 1,104 | 1,511 | 2,615 | 86,732 | 28,502 | 329 |
| **Italy (FS)** | 909 | 1,718 | 2,049 | 23,882 | 5,513 | 231 |
| **Spain (ADIF/RENFE)** | 2,482 | 713 | 1,255 | 22,955 | 6,514 | 284 |
| **Sweden*** | - | na | na | 9,918 | 3,604 | 363 |
| **Belgium (SNCB)** | 108 | | 108 | 6,400 | 1,500 | 234 |
| **Netherlands** | | 120 | 120 | 4,098 | 413 | 101 |
| **UK**** | | 10,869 | 10,869 | 10,300 | 4,825 | 468 |
| | | | | | | |
| **U.S. (Acela)** | | 596 | 596 | 3,442 | 1,048 | 305 |
| **U.S. (NEC Regional)** | | 596 | 596 | 8,570 | 2,142 | 250 |
| **CAHSRA (Phase I)** | 741 | 97 | 837 | 42,000 | 16,002 | 381 |
| | 21,338 | | 46,702 | | | |

Sources: UIC, International Railway Statistics 2017, Table 10 and Table 50
China data from the World Bank.
Amtrak, Monthly Performance Summary, Sept 2018
CAHSRA Business Plans and data furnished by CA HSRA to PRG

* Sweden data mostly represent X2000 (tilting) trains on 200 Km/hr lines.

** Km for the entire network, Passengers for Eurostar only.

Table 2

## HSR Passenger Traffic*

| | JRs (Shinkansen) | | | SNCF | | | DB AG | | | China Railways | | | Amtrak NEC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Japan* | | | *France* | | | *Germany* | | | *China* | | | Acela/Metroliners | | | NEC Regional | | |
| | Passengers (000) | Pass-Km (000,000) | Avg Trip Length (Km) | Passengers (000) | Pass-Km (000,000) | Avg Trip Length (Km) | Passengers (000) | Pass-Km (000,000) | Avg Trip Length (Km) | Passengers (000) | Pass-Km (000,000) | Avg Trip Length (Km) | Pass (000) | Pass-Km (000,000) | Avg Trip Length (Km) | Pass (000) | Pass-Km (000,000) | Avg Trip Length (Km) |
| 1964 | 11,018 | 3,912 | 355 | | | | | | | | | | | | | | | |
| 1965 | 30,967 | 10,651 | 344 | | | | | | | | | | | | | | | |
| 1966 | 43,784 | 14,489 | 331 | | | | | | | | | | | | | | | |
| 1967 | 55,250 | 17,991 | 326 | | | | | | | | | | | | | | | |
| 1968 | 65,903 | 21,027 | 319 | | | | | | | | | | | | | | | |
| 1969 | 71,574 | 22,816 | 319 | | | | | | | | | | | | | | | |
| 1970 | 84,627 | 27,890 | 330 | | | | | | | | | | | | | | | |
| 1971 | 85,354 | 26,795 | 314 | | | | | | | | | | | | | | | |
| 1972 | 109,854 | 33,835 | 308 | | | | | | | | | | | | | | | |
| 1973 | 128,080 | 38,990 | 304 | | | | | | | | | | | | | | | |
| 1974 | 133,195 | 40,671 | 305 | | | | | | | | | | | | | | | |
| 1975 | 157,218 | 53,318 | 339 | | | | | | | | | | | | | | | |
| 1976 | 143,000 | 48,149 | 337 | | | | | | | | | | | | | | | |
| 1977 | 127,000 | 42,187 | 332 | | | | | | | | | | | | | | | |
| 1978 | 124,000 | 41,074 | 331 | | | | | | | | | | | | | | | |
| 1979 | 124,000 | 40,986 | 331 | | | | | | | | | | | | | | | |
| 1980 | 126,000 | 41,790 | 332 | | | | | | | | | | | | | | | |
| 1981 | 126,000 | 41,717 | 331 | 1,260 | 700 | 556 | | | | | | | | | | | | |
| 1982 | 143,000 | 46,105 | 322 | 6,080 | 3,600 | 592 | | | | | | | | | | | | |
| 1983 | 161,000 | 50,440 | 313 | 9,200 | 5,700 | 620 | | | | | | | | | | | | |
| 1984 | 164,000 | 50,826 | 310 | 13,770 | 8,300 | 603 | | | | | | | | | | | | |
| 1985 | 180,000 | 55,423 | 308 | 15,380 | 9,300 | 605 | | | | | | | | | | | | |
| 1986 | 183,012 | 55,943 | 306 | 15,370 | 9,400 | 612 | | | | | | | | | | | | |
| 1987 | 206,822 | 57,414 | 278 | 16,970 | 10,400 | 613 | | | | | | | | | | | | |
| 1988 | 227,759 | 64,351 | 283 | 18,100 | 11,200 | 619 | | | | | | | | | | | | |
| 1989 | 236,536 | 65,965 | 279 | 19,160 | 12,200 | 637 | | | | | | | | | | | | |
| 1990 | 260,057 | 72,173 | 278 | 29,930 | 14,900 | 498 | | | | | | | | | | | | |
| 1991 | 275,104 | 74,221 | 270 | 37,000 | 17,900 | 484 | 5,100 | 2,000 | 392 | | | | | | | | | |
| 1992 | 276,531 | 73,061 | 264 | 39,300 | 19,000 | 483 | 10,200 | 5,200 | 510 | | | | | | | | | |
| 1993 | 275,855 | 72,563 | 263 | 40,120 | 18,900 | 471 | 14,600 | 7,000 | 479 | | | | | | | | | |
| 1994 | 262,985 | 68,248 | 260 | 43,910 | 20,500 | 467 | 21,300 | 8,200 | 385 | | | | 2,024 | na | na | 5,509 | na | na |
| 1995 | 275,900 | 70,827 | 257 | 46,590 | 21,430 | 460 | 27,259 | 8,700 | 319 | | | | 2,001 | na | na | 5,872 | na | na |
| 1996 | 280,964 | 72,948 | 260 | 55,915 | 24,787 | 443 | 27,363 | 8,850 | 323 | | | | 2,011 | na | na | 5,665 | na | na |
| 1997 | 282,815 | 73,214 | 259 | 62,881 | 27,583 | 439 | 30,947 | 10,073 | 325 | | | | 2,081 | na | na | 5,548 | na | na |
| 1998 | 280,457 | 71,019 | 253 | 70,575 | 30,619 | 434 | 31,201 | 10,155 | 325 | | | | 2,135 | 496 | 232 | 5,786 | 1,516 | 262 |
| 1999 | 277,437 | 70,034 | 252 | 74,258 | 32,192 | 434 | 35,642 | 11,591 | 325 | | | | 2,241 | 522 | 233 | 5,803 | 1,522 | 262 |
| 2000 | 280,607 | 71,154 | 254 | 79,685 | 34,747 | 436 | 41,610 | 13,925 | 335 | | | | 2,408 | 570 | 237 | 6,113 | 1,527 | 250 |
| 2001 | 282,492 | 72,316 | 256 | 83,481 | 37,404 | 448 | 46,668 | 15,515 | 332 | | | | 2,652 | 666 | 251 | 6,020 | 1,625 | 270 |
| 2002 | 278,365 | 71,537 | 257 | 87,860 | 39,856 | 454 | 47,636 | 15,255 | 320 | | | | 3,214 | 912 | 284 | 5,760 | 1,537 | 267 |
| 2003 | 282,559 | 73,000 | 258 | 86,742 | 39,604 | 457 | 56,480 | 17,457 | 309 | | | | 2,937 | 819 | 279 | 5,975 | 1,554 | 260 |
| 2004 | 290,045 | 74,669 | 257 | 90,890 | 41,439 | 456 | 63,705 | 19,604 | 308 | | | | 2,967 | *831* | *280* | 6,405 | *1,601* | *250* |
| 2005 | 301,336 | 77,903 | 259 | 94,020 | 43,130 | 459 | 66,819 | 20,853 | 312 | | | | 2,453 | 679 | 277 | 7,116 | 1,677 | 236 |
| 2006 | 305,046 | 79,439 | 260 | 97,862 | 44,853 | 458 | 69,533 | 21,635 | 311 | | | | 2,668 | 759 | 284 | 6,755 | 1,623 | 240 |
| 2007 | 315,778 | 82,823 | 262 | 105,366 | 47,966 | 455 | 70,531 | 21,919 | 311 | | | | 3,191 | 929 | 291 | 6,837 | 1,655 | 242 |
| 2008 | 310,237 | 81,658 | 263 | 116,054 | 52,564 | 453 | 74,700 | 23,333 | 312 | 7,000 | 1,600 | 229 | 3,399 | 1,016 | 299 | 7,489 | 1,844 | 246 |
| 2009 | 288,836 | 76,309 | 264 | 114,395 | 51,864 | 453 | 73,709 | 22,561 | 306 | 47,000 | 16,200 | 345 | 3,020 | 919 | 304 | 6,921 | 1,702 | 246 |
| 2010 | 292,037 | 77,426 | 265 | 112,558 | 51,890 | 461 | 78,507 | 23,903 | 304 | 133,000 | 46,300 | 348 | 3,219 | 923 | 287 | 7,149 | 1,704 | 238 |
| 2011 | 297,125 | 79,532 | 268 | 111,533 | 52,044 | 467 | 76,100 | 23,306 | 306 | 286,000 | 105,800 | 370 | 3,379 | 1,047 | 310 | 7,515 | 1,879 | 250 |
| 2012 | 321,419 | 86,001 | 268 | 110,825 | 51,086 | 461 | 76,600 | 24,753 | 323 | 388,000 | 144,600 | 373 | 3,395 | 1,040 | 306 | 8,014 | 2,005 | 250 |
| 2013 | 333,474 | 89,177 | 267 | 109,796 | 50,786 | 463 | 78,770 | 25,178 | 320 | 530,000 | 214,100 | 404 | 3,343 | 1,018 | 304 | 8,044 | 1,982 | 246 |
| 2014 | 339,760 | 90,280 | 266 | 108,978 | 50,659 | 465 | 77,951 | 24,316 | 312 | 870,000 | 282,500 | 325 | 3,545 | 1,081 | 305 | 8,083 | 2,018 | 250 |
| 2015 | 350,465 | 94,313 | 269 | 103,230 | 49,980 | 484 | 79,451 | 25,280 | 318 | 1,137,000 | 386,300 | 340 | 3,474 | 1,058 | 305 | 8,215 | 2,074 | 252 |
| 2016 | 285,755 | 78,243 | 274 | 104,189 | 49,104 | 471 | 83,422 | 27,213 | 326 | 1,444,000 | 464,100 | 321 | 3,489 | 1,058 | 303 | 8,409 | 2,122 | 252 |
| 2017 | 377,441 | 101,247 | 268 | 108,721 | 58,280 | 536 | 86,732 | 28,502 | 329 | 1,713,000 | 660,000 | 385 | 3,442 | 1,048 | 305 | 8,570 | 2,142 | 250 |
| | 11,529,835 | | | 2,441,954 | | | 1,452,536 | | | 6,555,000 | | | | | | | | |

* High-speed as defined by the railway.  For DB this would include some traffic <250 Km/hr

Source: UIC, International Railway Statistics 2017, Table 10 and Table 50.  Data for China furnished by World Bank

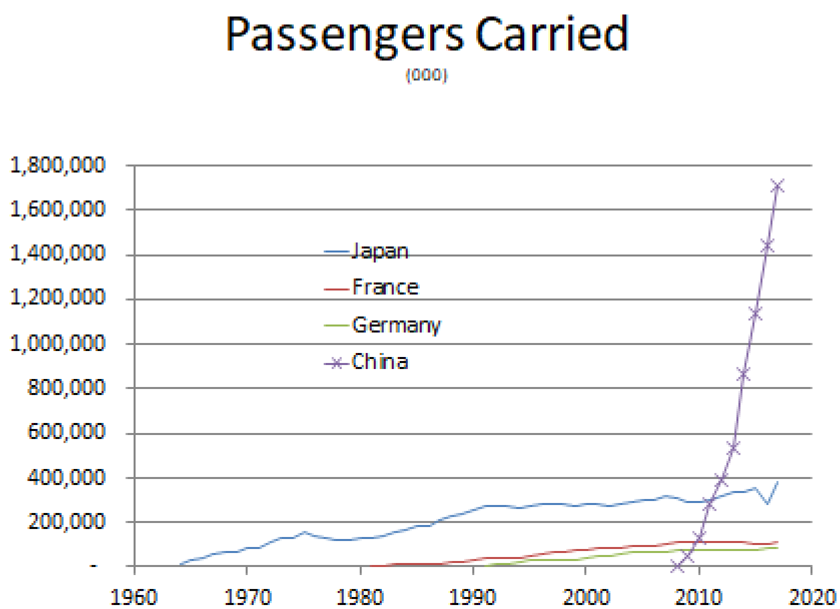
Table 3

## Organization and Ownership of Higher Speed Railways

| Country | Ownership of Infrastructure | Multiple HSR Access? | Multiple Access by Non-HSR Operators | Private Operators for HSR? | Access Regime |
|---|---|---|---|---|---|
| **Japan (4 JRs)** | Private Corp | No | No | Yes | Closed |
| **China** | Public Corp | No | No | No | Closed |
| **Taiwan (THSRC)** | PPP | No | No | PPP | Closed |
| **Korea (KTX)** | Public Corp | No | No | No | Closed |
| | | | | | |
| **France (RFF/SNCF)** | Public Agency | No | Yes | No | "Open" |
| **Germany (DB)** | Public Agency | Yes | Yes | Yes | Open |
| **Italy (FS)** | Public Agency | Yes | Yes | Yes | Open |
| **Spain (ADIF/RENFE)** | Public Agency | No | Yes | No | "Open" |
| **Sweden*** | Public Agency | No | Yes | Not Yet | Open |
| **Belgium (SNCB)** | Public Agency | Yes | Yes | Yes | Open |
| **Netherlands** | Public Agency | Yes | Yes | Yes | Open |
| **UK** | Public Agency | Yes | Yes | Yes | Open |
| | | | | | |
| **U.S. (Acela)** | Public Corp | No | Yes | No | Limited |
| **U.S. (NEC Regional)** | Public Corp | No | Yes | No | Open |
| **CAHSRA (Phase I)**** | Public Agency | No? | Yes | Yes | Limited |

Source: Author's research

Figure 1



Passengers Carried
(000)
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
1960
1970
1980
1990
2000
2010
2020
Japan
France
Germany
China