

# Assessment of High-Speed Rail Technology as per Indian Scenario

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## ABSTRACT

India and Japan have signed a memorandum of understanding to set up a high speed rail (HSR) network costing of INR 976.36 billion between Mumbai and Ahmedabad rail corridor project. As of now, the top speed in India is 150 kmph, The Ministry of Railways proposed High Speed Rail's (HSR) in 2007- 2008 and have conducted pre-feasibility studies on various routes in the India. This paper is about high-speed rail technology in Indian Scenario, while documenting the progress of proposed High Speed Rail (HSR) routes for India, the paper also draws lessons from international HSR experience in Europe and Asia. For the development of HSR network in India, there are a variety of issues. This paper examines with regards to history of high speed rails, world scenario, route locations, choice of technology partner and need for standards, location of stations, speed, pricing, revenues, stakeholders and funding. We have gone through the various papers from International and national level related to HSR, which is also summarise in the paper.

**Keywords:** High Speed Rail (HSR), Maglev System, Revenue, Stakeholders, Feasibility, Indian Scenario,

## INTRODUCTION

High-speed rail (HSR) transport is a type of rail transport that runs faster than a standard Rail's, using an steel wheel running or Maglev system of specialized rolling stock and designed tracks. There are many countries which run High Speed Rails(HSR), in the world in which Japan was the first country to introduce High Speed Rails in the world with a design speed of 200Km/h. New lines in the track system of 250 Km/h (160 mph) and existing lines in excess of 200 Km/h (120 mph) are widely considered to be high-speed. High-speed trains are mostly operated on standard gauge tracks with continuously welded rail, such as Russia have planned to develop a high speed railway network in broad gauge. The Shanghai Maglev High-speed rail opened in 2004 is the fastest maglev with operation design speed of 430Km/h tunnel based commercial transportation rial corridor project in the world. Many countries have built and developed high-speed rail infrastructure to connect major cities, Like China, Japan, Germany, Belgium, France, Spain, Uk, US, Arabian Courtiers etc. High Speed Rails From the Europe was he only country in the world which crosses international borders. David M. Levinson (2012), got benefitting the network as a whole when demand is insufficient to enable frequent point-to-point service, clearly serves the hub cities the most, as they gain from all the incoming flows which create additional demand, and thus greater service<sup>(1)</sup>. Professor John Preston (October 2009) has reported on the economic benefits and costs on HSR and the reports indicate that the capital costs of HSR are high but there are also substantial benefits<sup>(2)</sup>.

### History Overview of High Speed Rails:

The history of railways is a history of speed. Since the origin of railways in Europe during the Industrial Revolution at the beginning of the 19th Century, the speed of passengers trains was an essential argument to compete. Li ZHOU and Zhiyun SHEN has describe footmarks of technology development of high-speed trains around the world and try to explain the reason why China rapidly surpasses other contries in the development of highspeed trains<sup>(3)</sup>. List of currently working on High Speed Rail (HSR)<sup>(4)</sup>:

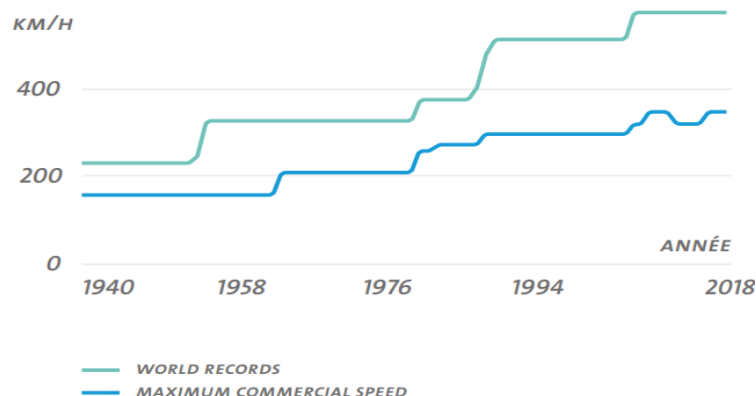
S.No	Country	Year of Operation Start	In Operation (KM)	Under Construction (KM)	Total Country (KM)
1	Japan	1930	2664	782	3446

2	Germany	1965	1334	428	1762
3	Italy	1970	923	395	1318
4	France	1967	2036	757	2793
5	China	2008	19000	12000	31000
6	Spain	1986	3100	1800	4900
7	Russia	2009	649	770	1762
8	South Korea	2004	412	562	974
9	Belgium	2002	209	0	209
10	Turkey	2003	1420	1506	2926
11	Taiwan	2007	345	0	345
12	United Kingdom	2009	113	204	307

### Overview Of Speed:

People are of different stages in money saving most of them prefer to travel fast and with low budget, as all of that they want to save time. High speed rail system can be of two types. Steel wheel running on steel rail system and Maglev system running with electromagnetic system by keeping rail wheel above the rail. In the first system the design speed is limited to 360 km/h with an upper limit of 400 km/h, Maglev system can offer commercial speed beyond 500 kmph but its exorbitant construction cost, huge energy consumption and sound produced during operation.

### Commercial speeds and speed records



### High Speed Rails In India:

India does not have any high speed rail lines or lines operating at over 200 km/h. A new High Speed Railway System(HSR) about 508km is currently under construction in INDIA between Mumbai and Ahmedabad at a top speed of 320 km/h along western coastal corridor area. It will be built in standard gauge using Shinkansen technology which is currently being used by Japan technology. In the year December 18<sup>th</sup> 2009 the Indian government has made a proposal with the Japan government for the construction of High speed rail project in India with a budget of ₹ 1,00,000 crore from Mumbai to Ahmedabad which is 80% being invested by the Japan government to build a High speed rail. It is expected to carry passengers between the two cities from Mumbai to Ahmedabad in just 3 hours, costing ticket prices are expected to be cheaper than the airways around ₹ 2,500 to ₹ 3000 per head. Kartik Hegadekatti the need and methodology for creating a High-Speed Railways (HSR) Network for India in the presence of an already well-established Rail Network<sup>(5)</sup>

In the Year 2014 the Bharatiya Janata Party (BJP) Leader Narendra Modi has said in an general elections that to build an DIAMOND QUADRILATERAL HIGH SPEED RAIL PROJECT which is going to connect the cities of Chennai,

Delhi, Kolkata, Ahmedabad and Mumbai with an High Speed Rail(HSR). The Mumbai-Ahmedabad high speed rail project has been started construction in the year 2017 and now the project is being expected to be completed by 2027. The construction of one kilometre of High Speed Railway track is going to cost ₹ 100 crore– ₹ 140 crore which is 10 to 14 times higher than the cost of standard railway. Now, the government is expecting to complete the project from Ahmedabad to Mumbai by 2027-2028. The foundation stone ceremony was held on 14 September 2017 when Japanese Prime Minister Shinzo Abe and the Prime Minister of India Narendra Modi flagged off the construction work in Ahmedabad. Raghuram G, Udaykumar D regards of route fixation, choice of technology partner and need for standards, location of stations, choice of grade level, choice of gauge and interoperability of trains beyond core networks, and pricing, revenues and funding<sup>(6)</sup>.

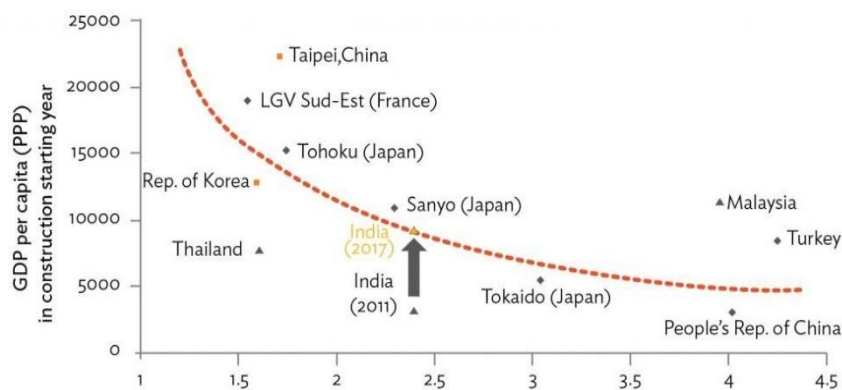
There are Seven corridors that have been identified by the High Speed Rail Corporation Of Indian (HSRC) for technical studies on setting up of high-speed rail corridors, they are:

- Mumbai-Ahmedabad (527 km)
- Delhi-Chandigarh-Amritsar (450 km)
- Hyderabad-Dornakal-Vijayawada-Chennai (664 km)
- Howrah-Haldia (135 km)
- Chennai-Bangalore-Coimbatore-Kochi (850 km)
- Delhi-Agra-Lucknow-Varanasi-Patna (991 km)
- Ernakulam – Trivandrum (194 km)



### High Speed Rail(HSR) Proposals

Indian Railways proposed five High Speed Rails(HSR) routes in the year 2007, in the Railway Budget. In the year 2010 one more route was proposed in the Railway Budget. In December 2009, the Vision 2020 the Ministry of Railways has planned the implementation of the four High Speed Rail (HSR) projects, one in the Northern and one in Western, Southern and Eastern regions of India. In the year 2012-2013 and 2014-2015 Railway Budgets, routes proposed by the Ministry to eight, due to the higher construction costs involved in the ghat section of the Mumbai and Ahmedabad route, the Mumbai-Pune link was dropped in a Railway Board decision in March 2013. In the year 2009-2010 in Kerala State Budget, the Thiruvananthapuram-Kasargod-Mangalore route was proposed and given that high population density of Kerala along its linear geography. In 2011, at the Kerala government's request, Thiruvananthapuram was added to the Chennai-Bangalore-Ernakulam route. Ashish Verma (Indian Institute of Science, India) and Varun Raturi (Indian Institute of Science, India) the impact of introduction of HSR is assessed in terms of social welfare by analysing the mode choice behaviour and strategic decision making of the operators, thus reflecting on the economic viability of the transport infrastructure investment<sup>(7)</sup>.



### Indian High Speed Rail Corporations

The Central Government formed the High Speed Rail Corporation of India Limited (HSRC), as an SPV and a subsidiary of Rail Vikas Nigam Limited (RVNL), for the development and implementation of High Speed Rails (HSR) projects. HSRC was incorporated on July 25, 2012 and launched on October 29, 2013, Its stated objectives are:

- To undertake feasibility studies and techno-economic investigations and prepares detailed project reports and bankability reports of selected corridors.
- To plan, design and freeze technical parameters including fixed assets, rolling stock and operations.
- To develop financing models, explore PPP options, coordinate with stake holders and funding agencies and obtain various Government approvals.
- Project development, project execution, construction, upgradation, manufacture, operation and maintenance of HSR systems on existing as well as new rail corridors.

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### CONCLUSION

The problem in developing a High-Speed Rail (HSR) network in India is very complex. India is a developing country; the primary concern is that whether the funds for a project like High-Speed Rails could be better utilised in other domains. The complexity of the project also arises due a variety of socio-economic implications like land acquisition, rehabilitation, and environmental concerns. In spite of such complexity, there are many positive benefits and externalities of the HSR which would be useful in India's overall aspirational development. The Mumbai-Ahmedabad route is a good choice for the first route, since it connects India's first and seventh most populous cities, with significant economic development in the 500 km corridor between two cities. In this Report we conclude that the HSR as per the Indian scenario and we found the impact of introduction of HSR is assessed in terms of social welfare by analysing the mode choice behaviour and strategic decision making of the operators, thus reflecting on the economic viability of the transport infrastructure investment.

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