

CONSTRUCTION ASPECTS OF BULLET TRAIN IN COMPARATIVE ANALYSIS WITH CONVENTIONAL TRAIN

Isha Kumbhar

Government Clg of Engineering ,Karad.

Abstract:

As one of India's most ambitious projects, a High-Speed Rail (HSR) line between Mumbai and Ahmadabad, gains traction, the country is poised to create history. On the Global HSR, take a major step forward in terms of development and join the league of industrialized nations.

Highway gridlock, airport delays, and unpleasant journeys will soon be a thing of the past. Our very own 'bullet' train, so named because of its bullet-like shape and speed, will be tearing through the landscape of west India, traversing the 508 kilometer trip between the two financial capitals in just over two hours. When compared to existing journey times of roughly nine hours (by bus) or six hours (by train), this will save a significant amount of time (by conventional railways).

Indian Railways is the world's fourth-largest railway system, transporting about 8,300 million passengers and 1,160 million tones of freight annually along with a 70,000-kilometer track network. The HSR project will completely transform this environment and will affect the way we Indians travel. The state-of-the-art high-speed trains, based on Japanese Shinkansen technology, will travel at 320 km/h, more than twice the speed of Indian Railways' fastest train, the Gatiman Express, which travels at 160 km/h, and we, as passengers, will get to experience one of the best HSR technologies available globally, providing the highest levels of safety, comfort, and reliability as we board this train.

A revamping of our 167-year-old railway infrastructure is a vital element of this journey as India makes tremendous advances on the path to prosperity and positions itself to join the coveted list of global superpowers. Indian Railways has planned a phased upgrade of its passenger and freight networks to achieve this goal. The National Rail Plan (NRP) for India envisions expanding the HSR system's reach and improving connections to all major cities. Further seven HSR lines have been identified as part of the National Infrastructure Pipeline (NIP), for which National High Speed Rail Corporation Limited has been tasked with preparing Detailed Project Reports (DPRs) (NHSRCL).

These include the following:

- 1. Delhi – Lucknow – Varanasi (865 km)*
- 2. Varanasi – Patna – Howrah (760 km)*
- 3. Delhi – Jaipur- Udaipur – Ahmedabad (886 km)*
- 4. Delhi – Chandigarh – Ludhiana - Jalandhar- Amritsar (459 km)*
- 5. Mumbai – Nasik – Nagpur (753 km)*
- 6. Mumbai – Pune - Hyderabad (711 km)*
- 7. Chennai – Bangalore – Mysore (435 km)*

NEED OF STUDY

- As this is first High Speed Rail Project in India which is also called as Bullet Train there are many challenges occurred differently than other countries
- The foundation of the whole construction is the tough job as the presence of expansive soil i.e. black cotton soil is present in the Mumbai Ahmadabad pathway.
- Secondly due to enormous speed which is of 320km/hr will be extended till 350km/hr the vibrations will cause up thrust and large amount of pressure will be created ,therefore to maintain the stability is the tedious task
- To avoid noise pollution the barriers are to be fixed of about three meters height which will be considered in the design parameters
- The construction aspects are different than that of conventional train as this project will be superior in as of many ways

SCOPE AND OBJECTIVE

- To investigate the construction and economic aspects
- To comprehend the construction work process
- To comprehend the operation of construction equipment

LITERATURE REVIEW

[1]According to P. R. Shukla, Minal Pathak, and colleagues (2015), high-speed rails may play a critical role in retaining and regaining the future share of the railway network. They also convey the unpredictability of intercity transport demand, the presence of several high-density corridors, and rising future incomes, making high-speed rails a comfortable platform in India's intercity transport evolution. The Government of India's recent policies and budget announcements reflect the country's growing emphasis on high-speed rails. The analysis emphasises the benefits of high-speed rail in terms of regional development, as well as other benefits such as improved lifestyle and time savings.

[2]Sunil Kumar Sharma and Anil Kumar (2014)This paper provides a detailed comparison of worldwide railways. India has risen to first place in terms of passengers per km travelled, but it lags far behind other countries in terms of cutting-edge technology. The Vision 2020 proposed by India's Ministry of Railways focuses solely on the adoption of technology and HST, but we continue to lag behind in infrastructure R&D. As a result, we deal with other countries and import their products.

[3]India J. Priyadarshini and M. Selladurai Associate Professor. 'Doctoral Research Scholar PG Department of Commerce. AJK College of Arts & Science. Coimbatore, Tamil Nadu, Indiait's India is a developing nation and it has not ready to bear the whole responsible of high speed railways. For those foreign countries like Japan, China, and France are ready to assist India in the high speed railway project. JICA (Japan International Cooperation Agency) has already funded the 80 per cent of the finance on Mumbai-Ahmedabad highspeed railway scheme and also Japan helping India in the technical orientation too. Mumbai- Ahmedabad is the first high speed rail project, and it's a best choice covering 500 km distance.

[4]According to Vijay Kumar Dutt (2016), the scenario of bullet rails will allow the original potential of young India and will be a mile stone in our journey towards emerging progress by reducing journey time across the country in an environmentally friendly way. He believes that by improving R&D in this field, where India has the greatest presence in the world, we will be able to become a complete exporter of innovative rail technology to the rest of the world. With advanced safety, technology transfer, skill development, and a massive influx of resources, bullet trains would provide a significant boost to Indian Railways.

[5]S. Ramesh and K. Joseph Raj (2014) investigate the financial requirements of the Indian Railways to modernize the rail industry's infrastructure. It could include the installation of an automated signaling system to prevent crashes. However, the Rajdhani and Shatabdi trains are India's fastest and most luxurious trains. According to them, another major issue with Indian Railways is the high accident rate, which includes derailment, collisions, and many people being run over by trains. However, the implementation of bullet trains must be studied to avoid these conditions. They were given some suggestions, which should be taken into account during the construction of a high-speed bullet train.

[6]According to Shubham Sharma, Annu (2015), India needs to reevaluate its entire railway system before beginning construction on a high-speed rail network. A comprehensive plan for upgrading the existing system is urgently required. These could include updating railway tracks, traction and power systems, rolling stock, signalling and braking systems, passenger safety, passenger information systems, cleanliness and maintenance, disaster management, and, most importantly, time management. A dedicated track separated from the existing crowded grid with all of the new advancements would be the only solution to the Indian railway's structure.

[7]G Raghuram and Prashanth D Udayakumar (2016) consider the issues involved in developing a high-speed rail network in India. Given that India is a developing country, the primary concern is whether the funds for such a project could be better spent elsewhere, such as upgrading conventional rail. However, the Japanese funding, amounting to 80% of the project cost, may not be available for other purposes.

Comparison between HSR and Conventional Railways

- High Speed Rail, which operates at a maximum commercial speed of 320km/h in the world, was established by combining technologies that differ from those used in conventional lines. More precise technologies should be introduced to achieve safe high-speed operation because rolling stock vibrates more and, in the event of an accident, the damage will be massive due to its high speed.
- It is written that a high-speed rail system is made up of subsystems that are very different from a conventional line. From the beginning of its development, High Speed Rail technology has been developed to achieve much faster speed operation than conventional lines. A variety of modern technologies, such as the structure and maintenance methodology of track, rolling stock, electrification system and Automatic Train Control (ATC), etc. have been adopted
- In terms of track, there have been instances of track irregularity caused by high lateral force generated by high speed operation, and technical development in track maintenance to deal with such a problem of high lateral force has been created. As of right now,
- In terms of track, there have been instances of track irregularity caused by high lateral force generated by high speed operation, and technical development in track maintenance to deal with such a problem of high lateral force has been created.
- When compared to a conventional line, the ballast-less track has a much stricter maintenance standard have been implemented in order to achieve safe high-speed operation. In terms of rolling stock, technological advancements in terms of high-speed running resistance include, adhesion coefficient, running stability, pantograph power collection, bearing metal, wind When the train enters the tunnel, there is pressure, and trains in opposite directions pass by. Braking distance, for example, has been developed. Aerodynamically shaped rolling stock and a complex body structure has been created.
- In the field of electricity, there has been the development of technologies such as a centenary structure that can withstand high speed and frequent operation, as well as the enforcement of its material, the compounding of centenary, and the installation of vibration reduction equipment to reduce the vibration caused by high speed operation. HSR's dependability has been improved. To achieve safe high-speed operation, for example, Automatic Train Control (ATC) has been created and installed, which displays signal on the indicator in the rail car (cab signal) and interlocks brake with cab signal because there is no margin for error.

Aspects	Bullet Train	Conventional Train
Time of travel	Less time	More time
Cost of travel	Moderate	Less
Safety	More	Moderate
Speed	250 to 350 km/hr.	160km/hr
Stops	Less no of stoppages	More no of stoppages

With its various features, HSR is required as a measure to archive several goals and demands outlined in Railway Vision 2020. The following are the six main items that HSR will satisfy:

1. **HSR's top priority is safety.**
2. **Large Capacity**
3. **Extreme Frequency**
4. **Expansion of the Network**
5. **Excellent Energy Efficiency**
6. **Solid Infrastructure and a High-Speed Rail System in the Event of a Natural Disaster**

(1) Security

As stated in Railway Vision 2020, the HSR System must strive to eliminate train accidents, derailments, collisions, and fires. HSR requires a high level of safety.

Since the Shinkansen opened in Japan in 1964, high-speed rail (HSR) has been established as a very safe mode of transportation, primarily in East Asia and Europe.

In India, high-speed rail (HSR) is required for a safe transportation network.

(2) Extensive Capacity/Frequency

Passenger transport activity in India is rapidly increasing, driven by rapid population growth, economic growth, urbanisation, and motorization.

BPKM=Billion Passenger Kilometers *Estimated by various Ministries and the Planning Commission. Estimates are on the higher side when compared to many other estimates.

CONSTRUCTION ASPECTS

Why Trains?

Trains have been a popular mode of transportation since the nineteenth century. In 1804 the first steam train was built. People initially believed that the speed of the trains would render them unconscious. However, trains advanced over time and are now one of the best and most reasonably priced modes of long-distance transportation.

Why need bullet train?

Traveling by air is becoming less expensive by the day. As a result, the demand for air travel has increased significantly.

On the other hand, some passenger trains are frequently overcrowded. This is true for some, but not all, of the routes. As a result, it is necessary to transport a large number of people in an environmentally friendly manner.

It is critical for trains to run smoothly in order to transport heavy freight from one location to another. Coal was used to power the steam locomotives in the early years. However, there are now electric power plants that assist in the operation of these trains. Trains' popularity declined dramatically after the invention of aeroplanes and automobiles. This is due to the fact that with the invention of these people, they were able to reach their destinations at a much faster rate. However, passenger trains now have a new market. They primarily transport people within and around major cities. These routes are set in stone, and there are no traffic jams. As a result, both underground subway trains and above-ground commuter trains have become more popular.

Normal Train

The trains that run on the ballasted tracks and have a **speed of around 160 kmph** and in some case a **speed of 200 kmph** is the normal trains.

- **Infrastructure**

The normal trains are the ones that have changed the background of the transportation. This happened when locomotive was launched in England for the first time in the year 1797. The locomotive is that part of the train that helps the other train parts to move. It was just after that the railroads started being constructed.

- **Operation**

Moreover, both the freight cars as well as the passenger cars were connected to the steam. The operation of the **steam locomotives depended completely on the burning coal**. This was used to heat the water in the boiler. When the water vaporized then the steam came out through the valves. This would help the piston move back and forth. The piston motion was then transferred to the train wheels and this powered the movement of the train.

- **Working Process**

The steam engines were then replaced by new technology. It was during this time that the diesel engines came into existence. After that, there were certain engines that started running on electricity. These were the ones that actually replaced the diesel engines at a later stage.

- **Infrastructure**

Speed trains or bullet trains are trains that travel at speeds of 250 kmph or higher. Speed limits may also be reduced for safety reasons. These bullet trains can be found in 16 different countries. China has the world's longest high-speed train track, measuring 27000 kilometres. Other countries, such as Germany and France, have 1000-kilometer-long tracks dedicated to high-speed trains.

- **Tracks**

There are some tracks built specifically for bullet trains. Other tracks have also been upgraded to allow for the operation of high-speed trains. Tracks built specifically for high-speed trains should have a speed limit of at least 250 km/hr.

Why trains are still necessary?

On the other hand, on tracks that have been upgraded for high speed trains, a speed limit of 200 km/hr is to be maintained. The bullet trains have been observed to run on conventional tracks in the majority of cases. These tracks, on the other hand, are made of much stronger materials. On these tracks, the train must have a total of two engines or power cars. These are located on both ends. Certain pantographs are mounted on the roofs, and these provide power to the trains. A larger portion of the regular routine alignments are also kept straight, which facilitates high speed. While most countries have dedicated tracks for these bullet trains, they can also travel on other modes of transportation.

Technology used

Magnetic levitation is used in bullet trains. These electromagnets tend to levitate these bullet trains a very short distance above the railway tracks. These trains also generate thrust, and it is this thrust that allows the trains to move. These trains also have better controls because neither the brakes nor the acceleration are affected by friction between the tracks. Furthermore, building trains is not an easy task.

REFERENCES

- [1] P. R. Shukla, Minal Pathak, Shivika Mittal, and Subash Dhar (2015), *Scenarios and Roadmap for Intercity Transport in India: The Role of High Speed Rail, Promoting Low Carbon Transport in India, UNEP with Indian Institute of Management, Ahmedabad, September 2015*
- [2] S. Ramesh, K. Joseph Raj (2014), *A study of Indian railways networks and approaches to implement the bullet trains in Indian scenario, International Journal of Electrical, Electronics and Computer Systems, ISSN (Online): 2347-2820, Volume -2, Issue-10 2014*
- [3] Shubham Sharma, Annu (2015), *Future of High Speed Trains in India and Its Comparative Study with Japan, France, Germany and South Korea, IOSR Journal of Mechanical and Civil Engineering, ISSN: 2278-1684, Volume 12, Issue 5 Ver. III (Sep. - Oct. 2015), PP 19-23*
- [4] Srinand Jha (2014) *Article, In future, Delhi to Chennai in 6 hrs by Train, Hindustan Times, New Delhi, November 14, 2014*
- [5] Sunil Kumar Sharma, Anil Kumar (2014), *A Comparative Study of Indian and Worldwide Railways, National Conference on "Recent Advances in Mechanical Engineering" RAME - 2014, ISSN 2278 - 0149 www.ijmerr.com, Special Issue, Vol. 1, No. 1,*
- [6] ISSN 2278 – 0149 www.ijmerr.com *Special Issue, Vol. 1, No. 1, January 2014 "Comparative Study of Indian Railways and Worldwide Railways"*
- [7] *National Conference on "Recent Advances in Mechanical Engineering" RAME – 2013 © 2014 IJMERR. All Rights Reserved Int. J. Mech. Eng. & Rob. Res. 2014 Centre*
- [8] *International Journal of Trend in Research and Development, Volume 3(3), ISSN: 2394-9333 www.ijtrd.com A Study on High Speed Rails in India J. Priyadharshini and M. Selladurai 'Associate Professor. 'Doctoral Research Scholar PG Department of Commerce. AJK College of Arts & Science. Coimbatore, Tamil Nadu, India's a critical assignment in developing the high speed rail network in India*
- [9] <https://www.nhsrcl.in/en/project/mahsr-project-operational-plans> (25/01/2022 8:15am) NHSRCL INSTITUTE