



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: VII Month of publication: July 2017

DOI:

www.ijraset.com

Call: ☎ 08813907089

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Speed V/S Safety of High Speed Rails in India

Mr. Nikhar K Pandya

Lecturer, Civil Engineering Department , BBIT , V V Nagar, Gujarat, India

Abstract: As we all know, day by day especially in india, the population is rising tremendously while the public facilities are the same over the years. Food, clothing and shelter are the basic necessities for the people which are affected due to over population. But nowadays in 21st century, Transportation plays a vital role in the development of the country. India is a developing country, so the transportation system should be on the upfront for the people. Railways are the lifeline of india, this sentence will be remembered while listening to the word railways. The first railway was laid by the britishers in india around 1850's. After that, india is maintaining the rails over the country by itself after gaining the independence.

Japan and many other countries are focusing much on the high speed rails. Japan is practicing on Maglev trains which runs approximately 500kmph. While in india, average speed of fastest train is 160kmph of Gatimaan express. By thinking about the speed of the trains, the second thought which comes in mind is about the safety of railways. Mobility plays a key role in our economy and society. People want to reach their destinations safely, comfortably and quickly, and goods need to be shipped cost-effectively over shorter or longer distances. The impact of mobility is visible in environmental pollution, accidents and traffic congestion. The safety of railways plays a very vital role in the development of the country. It reinstates the transportation system in the country. India is planning for Bullet trains which will run at speed of 300kmph. The project of bullet train is on the initial stage. India is a country of villages. So, the main motive of developing the railways should benefit the whole including the villages. There should be awareness to the people regarding the transportation system which will in return beneficial for them. I had referred some research papers regarding the railways which made me to think regarding the high speed rails and the safety as a common subject. Safety Is a major aspect for all the people as it is of utmost importance. So how to increase the safety in railways along with the advancement in the speed of the trains.

Keywords— HSR, ROW

I. INTRODUCTION

As we know that in india in 2017, the total number of trains running everyday is approximately : Goods : 7461 and passengers : 12617 [source : Wikipedia.org]. Average distance covered by one locomotive is 560 km, and Local train passengers carried per day : 11,126,027(1.1 crore). So, as we can conclude from this figures that the trains running in india is much more than any other countries and population is also on the rise day by day. The average speed of express trains in india is 80 kmph till today. In comparison with other countries such as USA, Germany, Japan , etc the average speed is very much lower. So, the Indian Railways are far more behind in comparison with the other countries, and in terms of population , india is rising towards the peak..

A. What is High-Speed Rail?

High-speed rail is a 'malleable' term. The high speed Rails comprises of some characteristics which are listed as below:

- 1) Trains which are designed for sustained operation at or above 200 kmph (125 mph)
- 2) Trains which provides service between population centers or urbanized areas, with limited interim stop
- 3) Trains that are typically use semi-permanently connected sets of power cars, locomotives
- 4) Rights-of-way (ROWs) that are grade-separated; that have limited, if any, level crossings with roads or other railroads; and that have access barrier
- 5) Trains that have dedicated-use ROWs, particularly outside of terminal
- 6) Trains that most often use overhead, constantly tensioned catenary to supply power to locomotives and power car
- 7) Systems that uses some type of automatic train control (ATC) or positive train control (PTC) with line-side and cab signals.



Figure 1. High Speed Train [Source : Phys.org]

B. History of HSR

High-speed railways began around year 1933 when Europe and the U.S.A. created the streamline trains, which runs at 80 mph (130 km/h) were the fastest transportation option in the world. World War II stopped the development of any other railways, when the countries geared all resources towards the war. Italy had to stop its development of the ETR 200, a train that reached 126 mph (203 km/h) and had routes from Milan to Florence at the beginning of the World War II.

After the war, high-speed trains became important once again, especially in countries where a lot of railway tracks were destroyed during the war. Japan built a high-speed train in 1957, and now decades later the design has been improved to achieve the speed of 135 mph (217 km/h). It provided services between Tokyo and Osaka. Due to the train design and speed, the nicknamed “bullet train” was born. Today, there are train systems that can travel over 200 mph (320 km/h) due to aerodynamics, lighter trains and longer turns. Maglev or magnetic levitation is one of the many changes in the technology that high-speed rails use. China was criticized for using maglev over other technologies, on the grounds that maglev requires new tracks which are highly expensive. Spain, Germany, the United Kingdom and France currently have the largest high speed train networks in Europe.[1]

Particularly vulnerable areas in rail tracks are

- 1) Grade crossings which offers easy access to terrorists leading to derailment of trains
- 2) Stretches of track with compromised visibility (e.g., adjacent to tunnels or significant curves)\HSR stations with high volumes of other rail traffic
- 3) Signaling and communications systems that could be subjected to cyber attacks
- 4) Elevated viaducts
- 5) Tunnel
- 6) Sections of Right of Way (ROW) adjacent to major structures (e.g., overpasses) that could be Comprised .

C. Advantages of the High-Speed Rails in India

The high speed Rails itself defines the context of speed in railways. There are many advantages of HSR in railways. There is always a safety aspect considered in this HSR. No one can neglect the safety of people and the Railways while designing the HSR in Railways. As the conventional methods of railways are predominant in india , and it is very conservative in accepting any new changes in it. This move can be proved as vital in the indian railways. The advantages can be summarized out as below:

- 1) Less area required compared to airports.
- 2) Location of railways helps as located inside the city
- 3) Arrival time for passengers is reduced to minutes in comparison with hours in airports
- 4) The high-speed rail technology is also much better for the environment
- 5) The engines run on electricity, which is much cleaner source of energy
- 6) Less polluting emissions as trains reduce the need for cars or vehicles
- 7) Helps in dispersing the population more evenly throughout the country
- 8) The rails will help the economy by making more jobs accessible by migration

The HSR is a very helpful media for building good relationships between india and its neighbor countries.

All the above summarized advantages can be achieved within short span of time , because HSR will reduce the time travel considerably. So, it can be used in a very effective way.

D. Disadvantages of the High-Speed Rail in India

The building of the high-speed rail system in india has caused many issues. Nothing in this world comes only with the pros or the advantages , there are always some cons or disadvantages.

The disadvantages can be summarized out as below

- 1) The Railways create an immense debt in order to build extensive railway lines needed for HSR. So, Railways have to owe debts to the government or the banks.
- 2) The tickets are so expensive that most common people in india cannot afford them. India being a developing country, most of the population living in villages. More masses cant be benefitted.
- 3) People who buys tickets online, they need to use the outdated system that was not designed exclusively for the high-speed rail. So, it creates some difficulties for the people.
- 4) The trains runs on electricity which lowers down the air pollution, but there is no way to reduce the noise pollution which is created by HSR.
- 5) High-speed rail can be too expensive for many people , so they would choose the regular-speed rail.
- 6) The railway has not been changed much in the past, which is strange considering it is a very powerful operation.

As we all know, there is no country free from corruption . In India, whenever any project deals with the government there are chances of corruption . There has to be many investigations into the people working in governmental departments, as india fights against corruption.

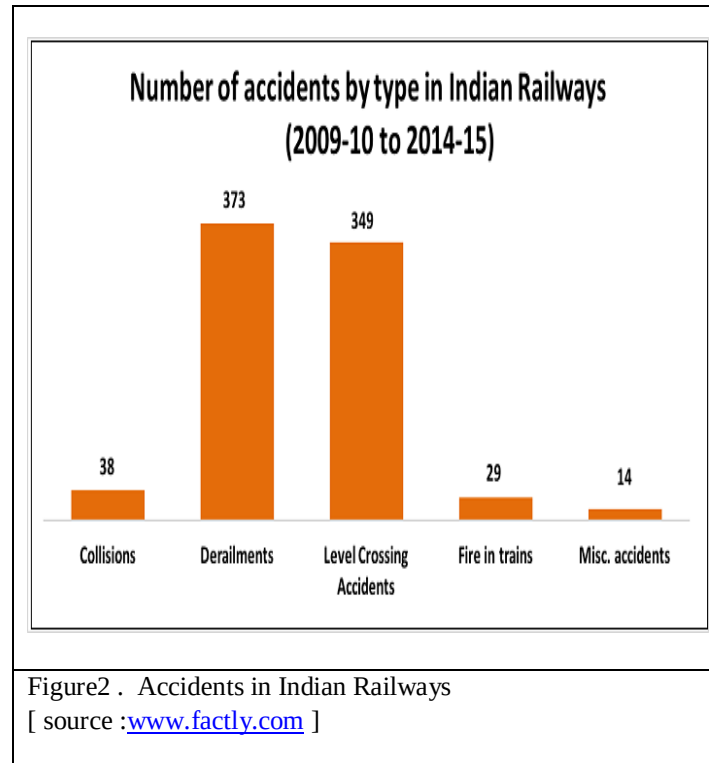
This indicates that people in both countries perceive high-speed rail as an effective mode of transportation

E. Improving Safety and Security

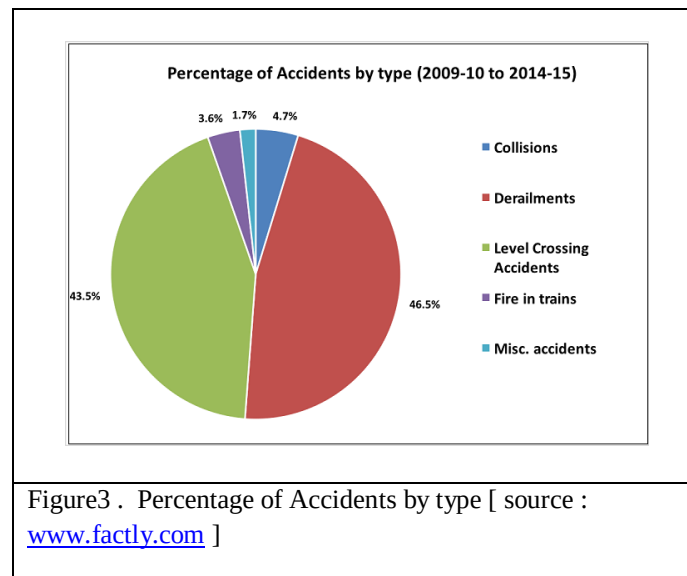
The safety criteria's and security criteria's need to be improved day by day. The average speed of trains in india is 80 kmph which will increase to 160-200kmph in the high speed trains. So, the safety and security protocols which are followed right now needs to be modified. The speed of train is inversely proportional to the fatalities . so, there is a chance of increase of rail fatalities due to the increase in speed of trains.

Each time there is a train accident, the issue of safety in Indian Railways comes to the fore. The recent train accident in Uttar Pradesh (india) has again triggered a debate on safety. As india is a densely populated country, most of the trains are overcrowded so there should be extra security and safety criteria's need to be added.

By far, the highest number of accidents are because of derailments & accidents at level crossings. Nine out of ten railway accidents during 2009-10 and 2014-15 have been due to derailments of trains and accidents at level crossings. The other type of accidents includes collisions, terrorist attacks etc. But their number is relatively low.



As shown in above figure, the number of accidents are indicated. The Derailments and Level crossing accidents are major accidents which are caused in railways. Now, in High Speed Trains these numbers may increase as speed can be correlated with the derailments and crossing accidents.



In terms of percentage of accidents , the Derailments leads of all which can be seen in above figure.

F. Smart and Competitive Railway System

- 1) **Increasing Efficiency and Competitiveness:** Railways faces tough competition from the roads, which offers attractive, cost-efficient, flexible, reliable, convenient door-to-door transport of freight and passengers across the country and abroad. Interoperability is a key challenge in improving the free flow of rail traffic throughout the continent and developing an efficient and attractive rail system throughout the country.

- 2) Reducing environmental impacts: While comparing favorably with other transport modes in terms of lower environmental impacts, there are key challenges to be met in reducing hindrance from rail noise and vibration, particularly in urban areas, and to further reducing greenhouse gas emissions.
- 3) Maintaining safety and security: The safety and security is a major concern In india, because of its population. So, it should be increased to optimum level to decrease the accidents which are caused by railways.

G. Optimal Networks for Train Integration Management

Innovative solutions and techniques have been developed to increase the capacity of the European railway network, and to improve train logistics and scheduling. The same techniques can be used in india to smartly manage the system. These improvements contribute to reducing delays for passengers and freight, thus increasing customer satisfaction and ensuring the railway network provide a dependable, resilient and green alternative to other transport modes. As shown in figure 4, complex rail crossings can be managed error free by using the optimal networks.



Figure 4. Railway Track

[Source : www.transport-research.info]

ON-TIME has developed advanced railway timetabling and capacity estimation methods for use in europe, leading to more efficient use of capacity, improved train punctuality and reduced energy consumption.

A traffic management system was developed that includes methods and tools for real time traffic monitoring and prediction. Augmented Usage of Track by Optimization of Maintenance, Allocation and Inspection of Railway Networks Adoption of advanced automation, inspection, maintenance and planning techniques will result in up to 40% of reduction in maintenance downtime on rail networks. Reducing maintenance downtime could substantially increase the capacity utilization to meet the ever-increasing demand on rail networks.

To increase the efficiency of track monitoring, track failure prediction algorithms were developed to estimate time remaining before track failure, and integrated into a monitoring planning and scheduling tool.

H. Addressing Environmental Challenges

Railways transport energy efficiency comes mainly from the low rolling resistance of locomotives, railcars and wagons running on dedicated tracks, and it is controlled, regulated driving pattern. Rail can therefore offers significant environmental advantages to the transportation system.



Figure 5. Wind mill adjacent to railway tracks
[Source : www.transport-research.info]

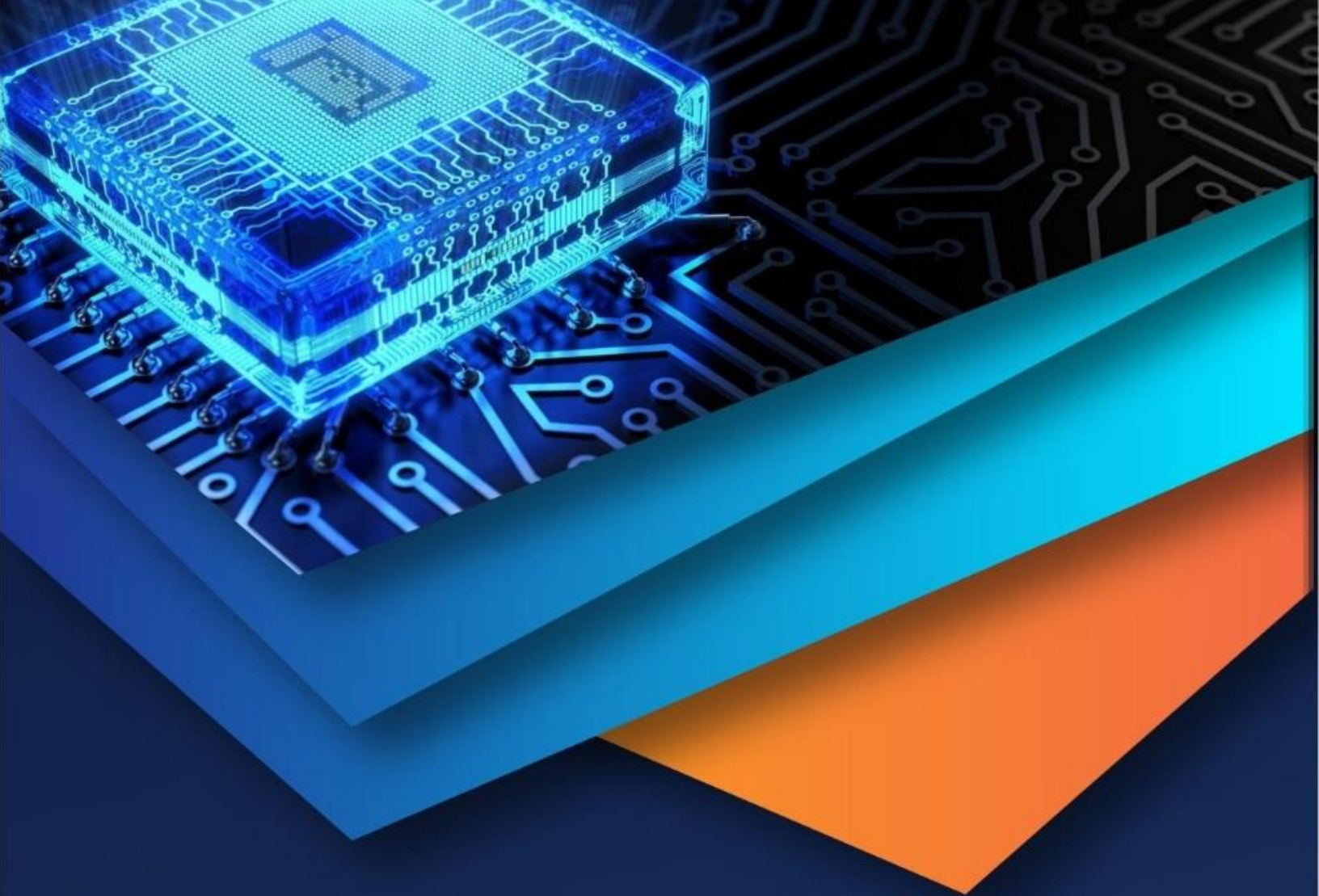
II. CONCLUSION

The High speed Rail has many advantages as well as disadvantages , while the safety criterias need to be fulfilled to the utmost level. So, there should be a perfect balance between the Comfort level which is the speed of rails and the safety as well as security of the property and the people. This paper is a review of the various provisions which should be kept in mind while proposal of high speed rails especially in india.

After looking at the various advantages and disadvantages of high speed rails, it clearly depends on the requirements of the people whether to opt for high speed rail or not. Innovations in high speed rails which are seen in the paper can be implemented for the betterment of rails. This paper will serve as a basis where the high speed rails are going to be established. High speed Rails v/s Safety in Railways in India is surely a topic of discussion required especially in india.

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