Financial feasibility Study of the Indian Bullet train

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Abstract-The rationale for HSR investment is not different to any other public investment decision. Public funds should be allocated to this mode of transport if its net expected social benefit is higher than in the next best alternative. The exam of data on costs and demand shows that the case for investing in HSR is strongly dependent on the existing volume of traffic where the new lines are built, the expected time savings and generated traffic and the average willingness to pay of potential users, the release of capacity in congested roads, airports or conventional rail lines and the net reduction of external effects.

The present study aims at the rationale for the Investment decision to verify that whether the Investment in its true sense an 'Investment or In-waste-ment'. The study is a further study to the research paper, "Can the Indian Bullet train make the Indian economy run like a bullet" A Study, The earlier paper has already discussed some of the parameters such as the expected time savings, the average paying ability of the paying class, alternative modes of transport such as airways and the comparative cost benefit analysis, the present condition of the Indian Railways, and options regarding its modernization, the present study mainly aims at the additional cost involved in the project and its benefits. The various cost benefits such as employment generation, skill development with the basic objective of improving the standard of living of the average lower and middle class has already been discussed at length in the earlier paper, the 10

The Maharashtra and The Gujarat exchequer if there is a go ahead on the project.

Keywords:-Bullet train, Capital Budget, Cost benefit analysis

1. INTRODUCTION

1.1 General

India has undergone rapid economic growth in recent years, and along with this growth has come a sharp rise in the volume of people and goods being transported in the country. As for passenger transport, the Indian Ministry of Railway (MOR) prepared the "Indian Railways Vision 2020" in December 2009.

A various reports issued by an expert committee on modernization of India's national railways that was established by MOR designates the line between Mumbai and Ahmedabad (approximately 500 km long) as the first high-speed railway section to be planned and constructed (hereafter referred to as the "Project"). A pre-feasibility study for this line was done by RITES of India, Systra of France and others in FY 2009. Japan (Ministry of Land, Infrastructure, Transport and Tourism: MLIT) conducted a study on project feasibility for the line in FY 2012.

Against this backdrop, India and Japan issued a joint statement on May 29, 2013, that included a decision to conduct a joint study on the construction of HSR between Mumbai and Ahmedabad. The proposed High Speed Railway corridor between Ahmadabad and Mumbai (the Project) aimed at improving connectivity between the two business centres and make it more easily connected. In response, JICA and MOR of India signed a Memorandum of Understanding (MOU) for joint feasibility study on October 7, 2013. Included in the feasibility studies, are the assessment and mitigation of the social and resettlement impacts linked to the development of the proposed HSR and land acquisition therein.

The High Speed Railway Line (HSRL) will connect Mumbai, the capital city of the State of Maharashtra and the second most populous metropolitan area in India with Ahmedabad which is a metropolis in the State of Gujarat. The approximately 500 km long line will consist of High-speed Railway vision running along the Arabian Sea coast side and connecting with Surat and Vadodara en-route which are the second and third largest city in the State of Gujarat.

1.2 Objective of the study

- To understand Economical calculations behind the project.
- To study the various economical factors affecting the feasibility of project
- check economic feasibility of HSR between Mumbai and Ahmadabad

2. LITERATURE REVIEW

2.1 Principle for Technical specification for HSR

In Japan, conventional line: narrow gauge, HSR: standard gauge. ・We propose standard gauge for HSR in India (even though conventional line has broad gauge), as following reasons: ¬ Main stream of world HSR is standard gauge ¬ Capacity of the conventional line

would be limited for HSR ¬ Securing safety in different speeds of railway operations

Table 2.1 Design specification of HSR

ITEM	DESIGN SPECIFICATION
Gauge	1435mm
Number of line	Double track(one way)
Maximum design speed	350km/h
Maximum operation speed	320km/h
Distance between track centreline	4.3m
Width of formation level	11.3m

Table 2.2 Design specification of Bullet train

ITEM	DESIGN SPECIFICATION
Cross section of tunnel	63.4m²(Double track)
Maximum axle load	16ft
Feeder voltage	AC 2x2kV
Signalling system	Digital ATC
Train Radio	LCX(leaky coaxial cable)
Rolling stock	Maximum 16 cars(Number of passenger capacity-High speed type 1300/ double decker type 1600) Car body width:3.4m

2.2 Details of Bullet train

2.2.1 Train operation Plan

Basic Conditions for the Train Operation Plan Basic Concept the basic concept of the train operation plan is as follows.

(1) To set maximum operation speed at 320 km/h to shorten the traveling time. (Maximum design speed for the future is 350km/h) In view of the fact that the maximum operation speed of HSR currently engaged in revenue service constantly and stably in the world is 320 km/h, the maximum operation speed of the this project should be set at 320 km/h to shorten the traveling time.

(2) To adopt the average passenger load factor of 70% for setting operation plan. An average passenger load factor should be 70%, taking into account the fluctuation of the number of passengers. For reference, Passengers in Japan usualy can book seats on particular trains optionally when trains are set with an average passenger load factor of approximately 70% assumed.

(3) To set 2 types stop-patterns of train. In view of the diverse needs of passengers, a vriety of origin and destination and a need to shorten the travelling time, two types (rapid train and each stop train) should be planned: a rapid train that will only stop at major stations and a each stop train that will stop at every station. The stations where “rapid service trains” stop shall be determined based on an OD Table.

(4) To separate operation time zone and maintenance time zone. To ensure safety operation is the top pripority for HSR. The maintenance work for facilities should be carried out properly by separating the operation time zone and the maintenance time zone comlpetely. From the view point of securing safety operation and avoiding confusion of operation troubles, which may sometimes causes serious accident, it is recommended Bi-direction operation sould not be adopted when traffic density is fairly thick. The train operation time zone and the maintenance time zone is as follows - Train operation time zone: 6:00-24:00 (0:00) - Maintenance service time zone: 0:00-6:00 Route Length and Stations : shows the station names and locations proposed in this study.

Table no 2.2.1 Station names and Distance

Sr no	Name of station	Distance
1	Mumbai(BKC)	0 k 000
2	Thane	27 k 950
3	Virar	65 k 170
4	Boiser	104 k 260
5	Vaapi	167 k 940
6	Bilimora	216 k 580
7	Surat	264 k 580
8	Bharuch	323 k 110
9	Vododara	397 k 060
10	Anand/Nadiad	447 k 380
11	Ahmedabad	500 k 190
12	Sabarmati	505 k 750

2.3 Frequency feasibility of train

10-car train will be operated at the inauguration of business, and it enables to guarantee operation of two trains per hour, such as one rapid service train and one each stop train, during off-peak hours. Later on, as demand rises, the number of trains and the number of cars per train-set will be increased. When the number of cars per train-set is increased, the maximum number of cars per train-set will be adopted 16-car train-set for the following reasons. - Although technically train-sets composed of more than 16 cars could be adopted, the corresponding stations and rolling stock depots, which are designed to accommodate train-sets, require to be enlarged and modification of equipment/facilities - Even

the TokaidoShinkansen in Japan relies on 16-car train-set for passenger transport, despite that it claims the largest HSR passenger service in the world.

Despite that it is possible to introduce eight-car train sets at inauguration and convert them into 16-car train sets in the future by connecting each two eight-car train sets into one, this idea is not chosen for the following reasons. - The necessity of 16-car train-sets will become a reality 10 years from now, when it is desirable from the viewpoint of passenger service to introduce new 16-car train armored with the latest technologies. Furthermore, connecting two train-sets into one produces a coupling section in the new train-set that is unavailable and inefficient for passenger service.

Increasing the number of trains and the number of cars per train-set, the durable years (life) of cars should be taken into consideration. Therefore, 10-car train-sets and 16-car train-sets coexist for some time in the transient period. Since the result of demand forecast showed that there is no section with big difference in cross sectional traffic volume, Almost all trains are set to operate mainly from Mumbai to Sabarmati and the number of trains will meet the maximum cross sectional traffic volume.

The numbers of the trains in 2023, 2033, 2043 and 2053 based on the maximum cross sectional traffic volume between Mumbai and Sabarmati are as follows. The frequency of train operation during peak hours, which is a matter of great concern on the HSR, is reviewed Table shows the number of trains and the number of the cars in train configuration in 2023, 2033, 2043 and 2053

Table no 2.2.1 Train configuration,Number of trains and traffic volume

Year	2023	2033	2043	2053
Train configuration	10	10-16	16	16
Train capacity	750,	750, 1250	1250	1250
Traffic volume(day/one direction)	17900	31700	56800	92900
Number of trains(day/one direction)	35	51	64	105
Number of trains(train/hour/one direction) peak hour off peak	32	43	63	86

3. ECONOMIC FEASIBILTY REPORT

3.1 Financial Detail

- The Indian Government says Japan will loan India Rs. 79,000 cr. for 50 years at 0.1%
- No need to pay back for the first 15 years
- The project cost is about 98,000 cr. over 7 years, with 500 kilometre of railway lines laid
- The technology will be the **Shikansen** system from Japan.

In fact, shockingly, the bullet train budget is 2.4X the entire amount the government of India is going to spend on the Indian Railways in 2015-'16.

The Mumbai-Ahmedabad bullet train budget is also 2.3X the entire spend of the Centre on schools. The corresponding figure for health and highways is 3.3 and 2.3, respectively.

The argument is: Don't do it, there's other stuff that needs to be done. But it's not clear why we should take 8% loans to do that stuff while not taking 0.1% loans to do a bullet train.

The bullet train between Mumbai and Ahmedabad will cost Rs 97,636 crore and will be built over seven years. Hence, the entire Rs 98,000 crore (approximately) will not be spent in one year.

3.2 Exchange rate issue

The 79,000 cr. loan could actually be denominated in Rupees – we don't know if not. That means Japan will take the risk of an exchange rate drop; this may not be too much, considering the rupee has gone from Rs. 40 for a 100 yen in 2001 to just Rs. 55, which is an annual increase of just 2.1%.Also India's RBI has a $50 billion swap deal with Japan on the Yen-Rupee, and this could be used or enhanced to hedge out the difference in exchange rates.

3.3 The Economics

A loan of Rs. 79,000 cr. for a project spend of Rs. 98,000 cr. means the Railways has to put up equity of Rs. 19,000 cr. on its own.

Since the loan is at 0.1% per year, the return in terms of interest will be Rs. 79 cr. per year for this line.

We don't know what the operational expenditure will be for a line like this, but let's look at revenue. The lines in Japan can carry 13 trains per hour at 1,300 passengers each. Assuming the longer term situation is just one train per 30 minutes for about 18 hours per day, the rough plan is:

- 36 trips per day, in each direction – 72 trips
- Let's just say 1,000 passengers or so – and say the deal is for 72,000 passengers a day.

- For Rs. 3,000 per trip, that's about Rs. 21 cr. of revenue per day.
- For a year of about 250 days , that's about 5,000 cr. of revenue
- Assume they make 20% gross profit EBIT (after depreciation and opex) – that would give them Rs. 1,000 cr. of pre-interest profit per year.
- They can easily afford Rs. 79 cr. of interest**,** or, assuming another 2% depreciation on the Yen, 300 cr. of interest a year.
- That still leaves them with Rs. 900 cr. of profit for an investment of Rs. 19,000 cr. – where the ROI isn't great at 5%. But they can increase that by advertising charges, rentals etc.
- And much of this is flexible to things like 5% inflation (which in 15 years will double prices and profitability, but keep debt levels the same), increasing frequency of trains etc.

The principal amount per year, after the 15th year, will be about Rs. 2,000 cr. per year. That should be possible if they tweak profitability, and has larger benefits in the faster commute and better infrastructure anyhow.

Note: The assumptions above are simplistic and assume costs will be less than the revenue. We have made that assumption now, but it might turn out the costs are higher, and the tickets are priced beyond the reach of a regular traveller. That could change the outcome.

3.4 The other Aspect

Since the train is a luxury, it will need to generate serious employment or GDP – and will, in the years of building it, in the form of labor, steel, concrete (most of it will have to be elevated) and train equipment. We will however pay a good portion of that loan to the Japanese suppliers of certain equipment, technology or trains. That's inevitable, and the single big reason why they are giving us this cheap loan. But we'll also understand the technology ourselves, and it's possible that subsequent bullet trains are made entirely by Indian companies at costs much lower. Overall, infrastructure development of this sort is desirable.

Will the government be taking on **too much debt**? We have about Rs. 42 lakh crores of loans by the central government, which isn't much. This will add Rs. 79,000 cr. more (if it's taken by the government) – but at the low interest cost this adds very little to our interest bill. (We currently pay a massive amount of money as interest, as much as 8% on each loan) The loan won't kill us and this is precisely why we should be taking loans – to build excellent infrastructure.

This is not a private-public partnership so the execution will be done by the Railways. They'll need a corporatized structure like the Delhi Metro corporation, and we've seen that succeed. There's good enough reason to believe they might pull this off too.

Overall, the project is economically feasible, in our opinion, and it's not a "waste" of anything. India needs such loans so that that burden of building such projects can be reduced – and we should take full advantage of Japan's ultra-low interest rates while doing so. (And, in fact, push the yen-rupee hedge costs to them if possible) We wouldn't compare it to the cost of education or anything else – because this project can, by itself, yield enough return to pay for itself in the long term. (Education is a spend we don't see returns from – at least not directly – so it's most like a social spend that will help the country rather than an investment that directly returns money)

4. CONCLUSION

The Mumbai-Ahmedabad HSR costs around ₹98000crore. Estimates in the project report by the Indian Institute of Management, Ahmedabad show that at least 1 lakh passengers at fares of ₹2,000-₹3,000 would be required daily for the project to break even. The tariff is too high — air fares between the two cities are around ₹3,000. Subsidies appear inevitable. Subsidies for agriculture, education and healthcare are taboo, but subsidies for the rich seem unproblematic.

Should India spend over ₹ 98000crore for a 508-km HSR used by well-heeled passengers when over 90% of rail passengers in India travel by sleeper class or lower class for thousands of kilometers? Project supporters argue that one should not view these as either-or propositions. Unfortunately, one is only seeing expensive projects for the upper classes so far.

This business deal given by japan is quite reasonable as an investment but it is not useful for project like HSR Mumbai-Ahmedabad for Indian .The baggage of 900cr per year is quite huge on Indian economy. So today Indian economy is not strong to take such huge loan even if the interest is low for project like Mumbai-Ahmedabad HSR but may be in FUTURE ?.....

5. REFERENCES

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