HIGH SPEED RAIL AND PPP PERSPECTIVE

Ravij Seth
Indian Railway Institute of Transport Management
Lucknow

INTRODUCTION

- In the 19th Century and early 20th Century, railway trains had a vital role in transport of passengers and goods.
- High-speed rail has enabled train services to be faster and more convenient than the motor car and aircraft.
- The development of the high-speed train system is considered as one of many strategies to reduce global warming and bring under control our resource consumption to preserve the Earth

- The pioneer in development of high speed trains has been the Japanese Railways, the first was 1964 between Tokyo and Tokaido at the time of the Tokyo Olympics.
- France took the lead in Europe in 1981 with the TGV (Train à Grande Vitesse)
- Vitesse), followed by Germany in 1991, Spain in 1992 and the rest of Europe in the last decade and a half.
- The USA was a late entrant to the HS club in late 2000, the latest members now being Korea and Taiwan.
- China has also jumped onto the high speed bandwagon.
- Indian Railways is, perhaps, the only major railway system in the world which does not have a high speed train.

DEFINITION

- The **International Union of Railways (UIC)** defines a high speed train as one that runs at over 250 kmph on dedicated tracks, or at over 200 kmph on upgraded conventional tracks.
- A “high speed line” is thus a new line designed to permit trains to operate at speeds above 250 kmph throughout the whole journey, or at least over a significant part of the journey.
- Alternatively, it could also be an upgraded conventional line, suitable for carrying traffic above 200 kmph.

- The French hold the world train speed record of 574.8 kmph.
- Japan introduced the technology of magnetic levitation train (maglev) in which a speed of 581 kmph was achieved in trials.
- the only maglev train in commercial service is the German designed Transrapid Shanghai to Pudong international airport link in China, operating at a maximum speed of 430 kmph.
- Currently, there are high speed networks of 9000 km under operation in the world.
- Networks of about 8000 km are under construction and similar lengths are under design/planning.

BENEFITS OF HIGH SPEED TRAIN SYSTEM

- Lower energy consumption per passenger kilometre
- Land usage for a given capacity compared to motorways
- HSR has proved to be the safest mode of transport
- Significant saving in journey time
- Decongestion of Metro

WHEN IT IS VIABLE ?

- Best suited for journey of 2-3 hours (250-900 kms) for which train can beat both air and car.
- It must have a decent backbone suburban/light rail transit system as prevalent in Europe and Japan.

INFRASTRUCTURE REQUIREMENTS

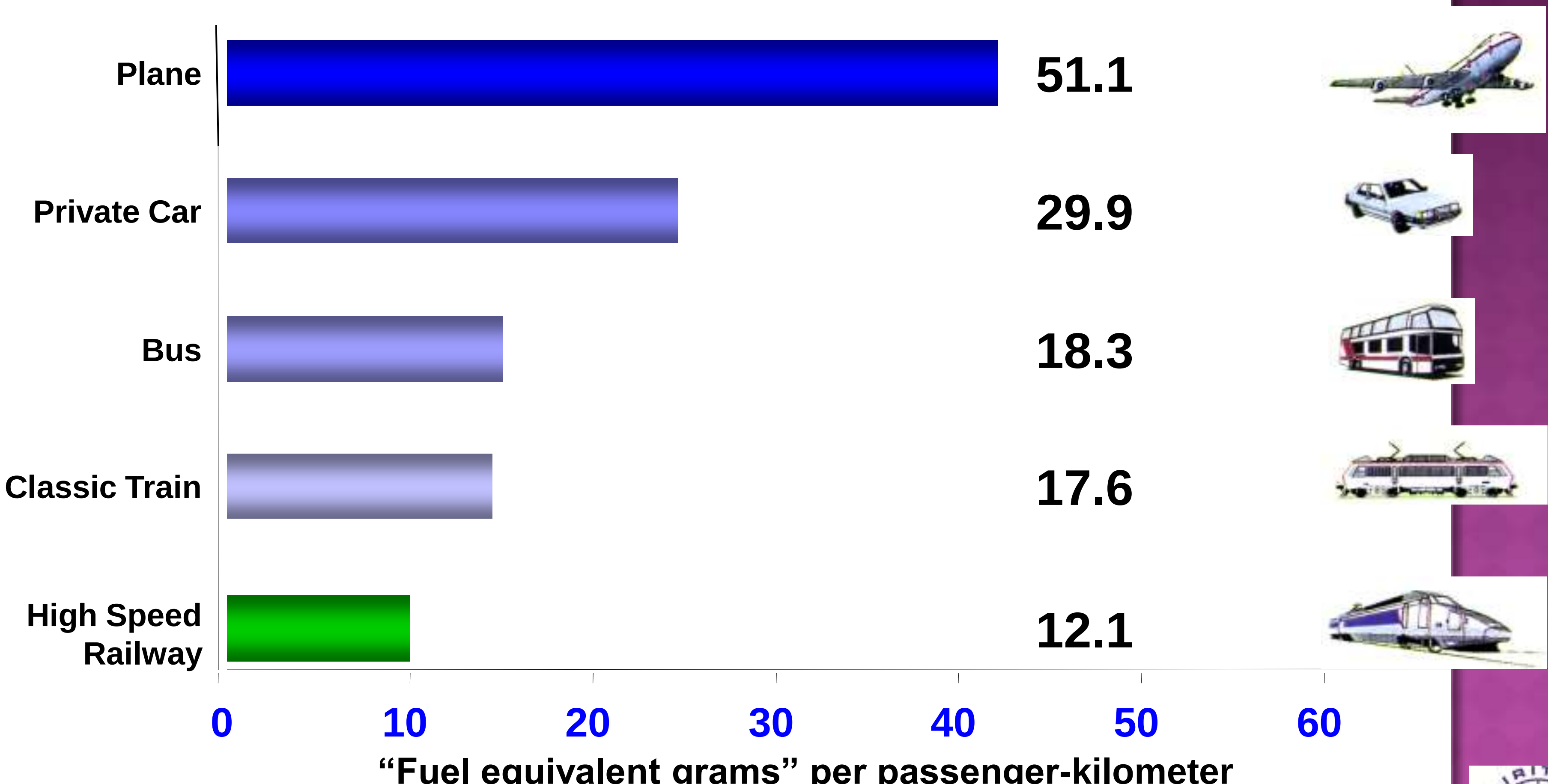
Parameter	V= 200 kmph		V= 300 kmph	
	Minimum	Ideal	Minimum	Ideal
Curve Radius	2500 m	3500 m	5500	7000 m
Center to Center of lines	4m	3.8 m	4.5 m	5.0 m
Max. Cant	150	170	150	170
Max. Gradient with Passenger Traffic only	35mm/m	40mm/m	35mm/m	40mm/m
Track Super Structure : (Typical Ballasted track) Rail type: Usually 60kg/m, welded Type and number of ties: Concrete monobloc or bi-bloc, 1,666 per km Fastening types: Elastic, many types Turnouts: Depending on the functionality of the line, they can have movable or fixed crossings				
Signaling, communications and other equipment: above 200km/h, a full on-board signaling system				
Rolling Stock Configuration :Train Set				
Traction: Electrification: Single phase. :25kV, 50 or 60Hz or 15kV, 16 2/3Hz.				

ENERGY CONSUMPTION

Energy Consumption	15 kWh/ 1000 GTKM	20 kWh/ 1000 GTKM	40 kWh/ 1000 GTKM
Speed	160	200	300

ENERGY EFFICIENCY

High Speed saves Energy Costs and reduces Greenhouse Gases

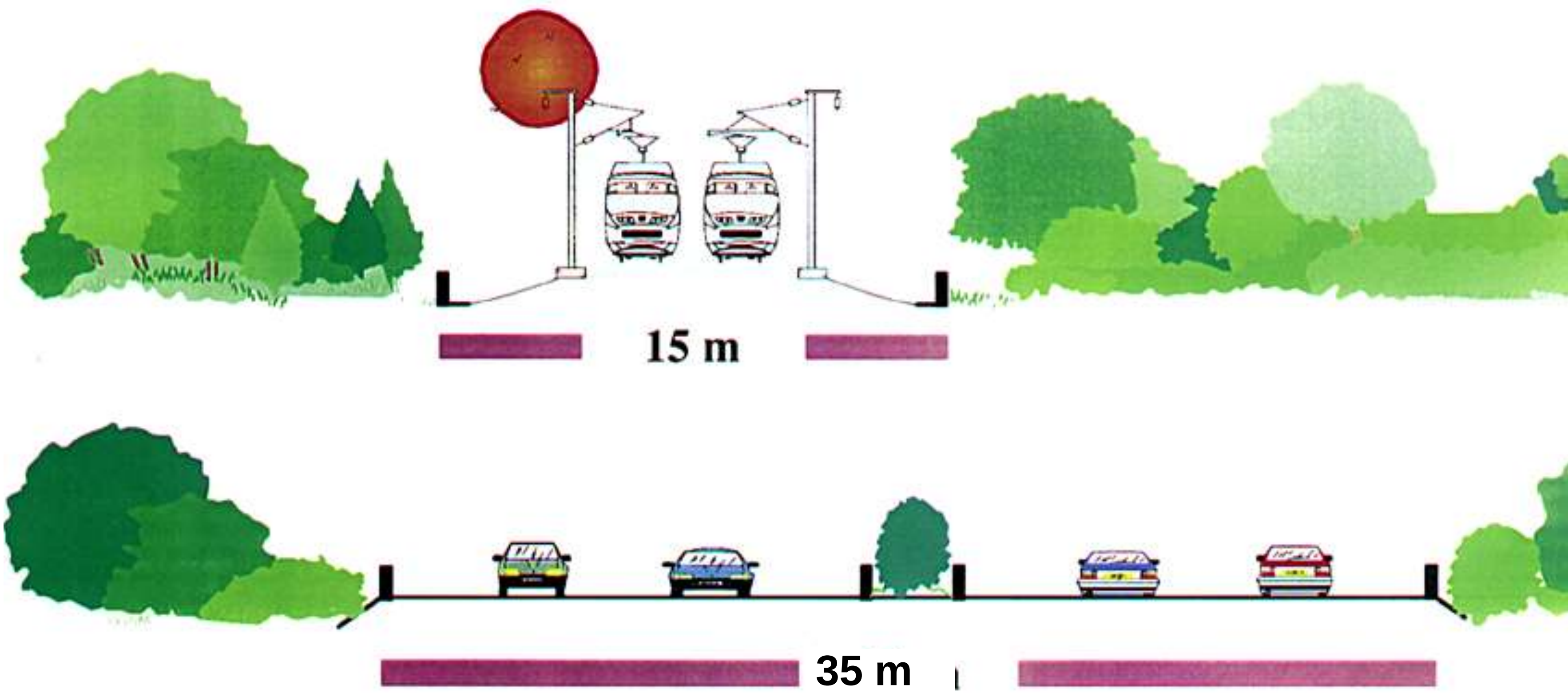


LAND REQUIREMENT

Land requirements are Smaller

A HSR-line allows more passengers than an six lane highway per hour

Elevated rail corridors reduce the hassle of Land Acquisition.



COST

- 60 percent civil incld station
- 20percent rolling stock
- 10percent land
- 10 system cost
- FRANCE &KOREA example of low civil cost-more grade & less structure cost(viaduct,tunnels)

COSTS OF HIGH SPEED RAILS

- **Cost of a new HSR corridor depend on a large number of parameters , such as**
  - topography through which the corridor passes ,
  - length of elevated tracks , tunnels , OHE, Signalling Arrangement
  - development of connections between stations and city centres,
  - type of rolling stocks ,etc.
  - Consequently, detailed studies on traffic forecasting, costs and benefits which examine all the positive and negative impacts of a project —including calculating the costs of doing nothing— are needed.
- **Average costs in Europe**
  - Construction of 1 km of new high speed line €12-30M
  - Maintenance of 1 km of new high speed line €70,000 per year
  - Cost of a high speed train (350 places) €20-25M
  - Maintenance of a high speed train €1M per year (2€/km - 500,000km / train & year)

COSTS OF HIGH SPEED RAILS

- As per International Standards, the approximate cost of constructing a HSR corridor (based on year 2008):

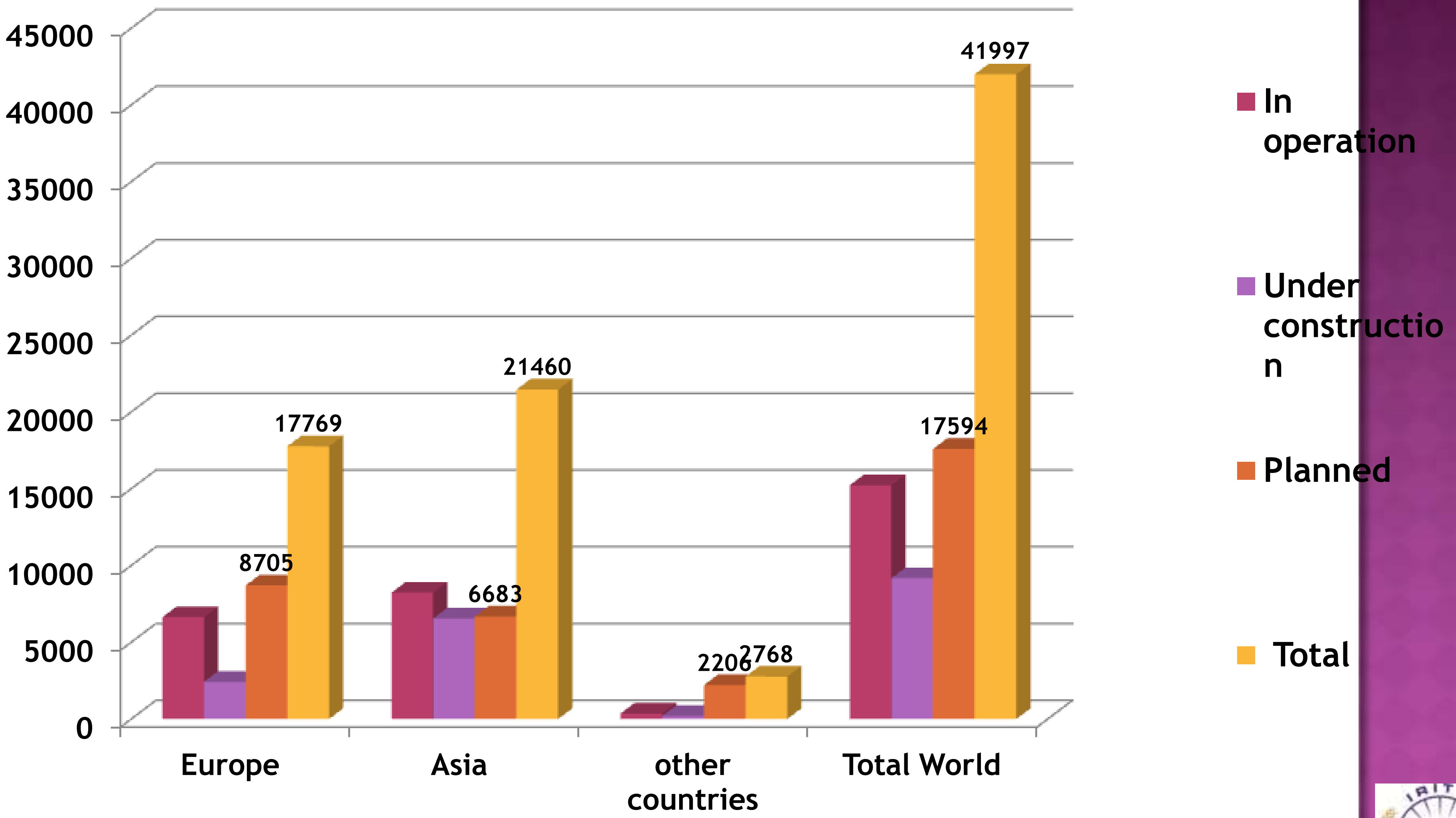
Item	Cost in Million € per KM
Infrastructure (Land , Station, maintenance facilities)	12
Track (Formation ,tunnels, etc)	3.5
Electrification	2.0
Safety & Signaling	2.5
Total	20
Rolling Stocks	4 per coach or 80,000 Euro per seat.

COSTS OF HIGH SPEED RAILS

- **Cost of Not Taking Decision**
  - Social and environmental costs, -appear to be intangible in nature, but have much higher costs, are neither being considered nor quantified.
  - These costs favour HSR on electric traction, when compared with road, air and diesel traction .

Hence, HSR shall be considered as a system and a change in perception is required for deciding investment pattern.

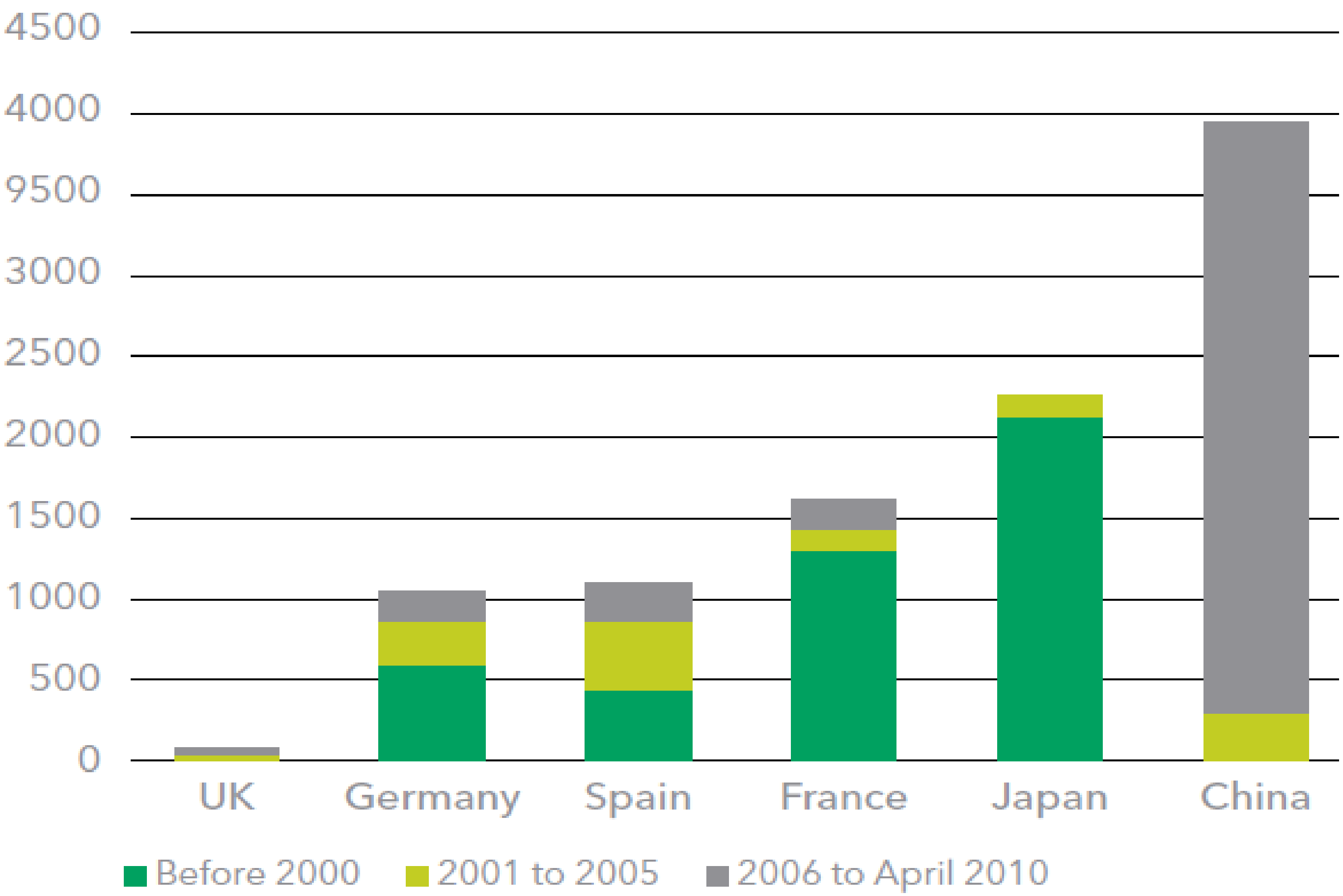
HIGH SPEED LINES IN WORLD



Source: UIC report Nov 2011; carbon foot print of high speed rail

HSR: INTERNATIONAL EXPERIENCE

High speed rail distance by country (km)



COUNTRIES HAVING HIGH SPEED RAIL

- Japan : 2118 Kms. In 1964, Ist Country to have HSR
- Germany :123 Kms in 1965, 2nd country to have HSR
- France :187 Kms in 1967, 3rd country to have HSR
- Italy :923 Kms in 1988, 4th country to have HSR
- Spain :265 Kms in 2002, 5th country to have HSR
- China :9300 Kms in 2002, 6th country to have HSR
- South Korea :340 Kms in 2004, 7th country to have HSR
- Taiwan :345 Kms in the year 2007
- Belgium :209 Kms
- NetherLand :139 Kms
- UK :130 Kms

JAPAN

First year of operation	1964
Length of track	2,663 kilometres
Top speed	305 km/h
Cost per kilometre	5.4 million euros for Tokyo-Osaka
Strategies employed	> Effective spreading of risk through PPPs, reflecting lowered expectations for government funding. > Strategic station placement adapting to high land prices. > Concentration on cities with highest population density.
Key benefits	> Huge reductions in travel times on main business arteries. > Tokyo-Osaka covers costs through revenue. > Revitalisation of small communities. > Establishing Japan as a world leader in technology.

CHALLENGES

- FINANCING
- TRACK GAUGE
- COMPETITION AND MARKET SHARE
- FREIGHT AND SHORT LINES
- SIGNALLING
- ECONOMIC IMPACT

FRANCE TRAIN À GRANDE VITESSE' (TGV)

First year of operation	1981
Length of track	1,548 km
Top speed	320 km/h
Cost per kilometre	17.2 million euros
Strategies employed	> The development and improvement of the regional rail services that serve the nodes with HST railway stations so that benefits can be spread more widely and overall accessibility be enhanced
Key benefits	> Four major provincial cities: Lyon, Marseille, Bordeaux and Lille accounts for the centrality of Paris in the network structure, which takes on the form of a star with the capital at its core

CHALLENGES

- FINANCING
- DISTRIBUTION OF HSR NETWORK
- TRAFFIC MANAGEMENT

REALISED BENEFITS

- TIME SAVINGS
- COMMERCIAL VIABILITY
- MEETING TRAFFIC DEMANDS

GERMANY

First year of operation	1991
Length of track	1,284 km
Top speed	305 km/h
Cost per kilometre	32 million euros
Strategies employed	> Emphasis on intermodal transit: HSR stations at airports, code-sharing with airlines > High speed rolling stock operating on conventional lines > Lower average speeds to suit a polycentric distribution pattern
Key benefits	> Improved reliability, particularly in the east > Eased transfer of capital back to Berlin > Modal shift from road/air travel > Significant growth in intermediate cities

CHALLENGES

- FINANCING High Rural population Density

- LOCAL ENVIRONMENTAL OBJECTIONS Noise/blight

- SIGNALLING Integration East and West Germany

REALISED BENEFITS

- HANNOVER – BERLIN

- COLOGNE – FRANKFURT

- IMPACT ON INTERMEDIATE TOWNS: MONTABAUR AND LIMBURG
- More on rolling stock composite type than on High Speed
- Network is more Web type than Hub and spoke type

SPAIN

First year of operation	1992
Length of track	2,057 km
Top speed	305 km/h
Cost per kilometre	12 million euros
Strategies employed	> Adoption of centralised, cross-platform signalling technology > Allowing freight on high-speed lines > Lower speed services on less-travelled routes
Key benefits	> Dramatic reduction in travel times > Large modal shift from air travel > Increased access to large economies from intermediate cities

Three types of passenger train services now operate on high-speed lines in Spain: Gauge Changer

- Since 1992, AVE trains with top speeds of 300-350 kilometres-per hour (km/h) have operated over long distances, only on high-speed lines.

- Since 2004, Avant trains with top speeds of 250 km/h have operated over shorter distances, again only on high-speed lines.

- Since 2006, dual gauge Alvia trains with top speeds of 250 km/h have operated over long distances on both high speed and conventional lines.

THE 'EUROSTAR NETWORK': LONDON TO PARIS AND BRUSSELS

First year of operation	1994
Length of track	531 kilometres (London - Paris – Brussels)
Top speed	300 km/h
Cost per kilometre	60 million euros
Strategies employed	> Unique bureaucratic model streamlines international travel. > Building close to motorways and pre existing track to minimise environmental degradation. > Shifting funding strategies in United Kingdom to match shifting economic situation. > Yield management pricing structure. > Competition expected to lower prices, improve service.
Key benefits	> Particularly acute reduction in travel time. Almost completely replaced other modes of travel on this corridor. > Regeneration of Lille.

CHALLENGES

- INTEROPERABILITY ENVIRONMENTAL OBJECTIONS
- FINANCING OF HS1 OPERATOR ORGANISATION
- LAND ACQUISITION & FINANCING
- SAFETY ,TRAINING SIGNALLING & COMPETITION

REALISED BENEFITS

- TECHNICAL SUCCESS & PUNCTUALITY
- COMMERCIAL SUCCESS &
- TRAFFIC AND JOURNEY TIME BENEFITS
- ENVIRONMENT & LILLE AND REGENERATION

CHINA

First year of operation	2003
Length of track	4,500 kilometres
Top speed	350 km/h
Cost per kilometre	21.4 million euros
Strategies employed	> Centralised planning and regulation. > High maximum speeds for long distances. > Strong emphasis on technology indigenisation.
Key benefits	> Freeing capacity for freight transport on conventional lines. > Dramatic reduction in journey times.

CHALLENGES

- FINANCING
- SIGNALLING
- COMPETITIVENESS

REALISED BENEFITS

- IMPROVEMENTS IN JOURNEY TIMES
- RELIABILITY
- EXISTENCE OF A CENTRALISED INSTITUTION FOR PLANNING, INVESTMENT AND REGULATION OF RAIL POLICY

TAIWAN HIGH SPEED RAIL CORRIDOR TAIPEI TO KAOHSIUNG (345 KMS.)

- Elevated: 251 Km., U/G: 61 Kms., At Grade: 33 Km
- Construction period: Dec .2000 to Jan 2007
- App. Cost in Rupees 261 Cr. Per Km.
- Awarded to Taiwan High Speed Rail Consortium with their bid of no Govt. money needed. However, the fund came to this company in the form of Syndicated loan from group of 25 domestic banks. These were the Govt. deposits with the banks. Ultimately, the government share in the company is of the order of 84%
- Standard Car ticket 1490 NT$ for 345 Kms.(Rs. 8.29/Km.)
- Business Car Ticket 1950 NTS for 345 Kms.(Rs. 10.85)/Km.
- Initially 40000 passenger per day
- Present traffic 1.2 lakhs per day and up to 1.9 lakh on some days
- Line is operationally viable

RAILWAY ELECTRIFICATION & INDIA PERSPECTIVE FOR HSR WITH PPP

THE TIME LINE

- Started 3rd Feb, 1925, **Bombay VT and Kurla Harbor on** 1500 V direct electric traction
- Post Independence, the electrification of Howrah - Burdwan section of Eastern Railway completed in 1958.
- The **first trunk route Howrah to Delhi** completed in **1976**.
- The **second trunk** route was **Bombay - Delhi** via Western Railway.
- Over all about **65.2%** of the freight and about **50.5%** of passenger traffic is hauled by electric traction on Indian Railways.

PRESENT SCENARIO

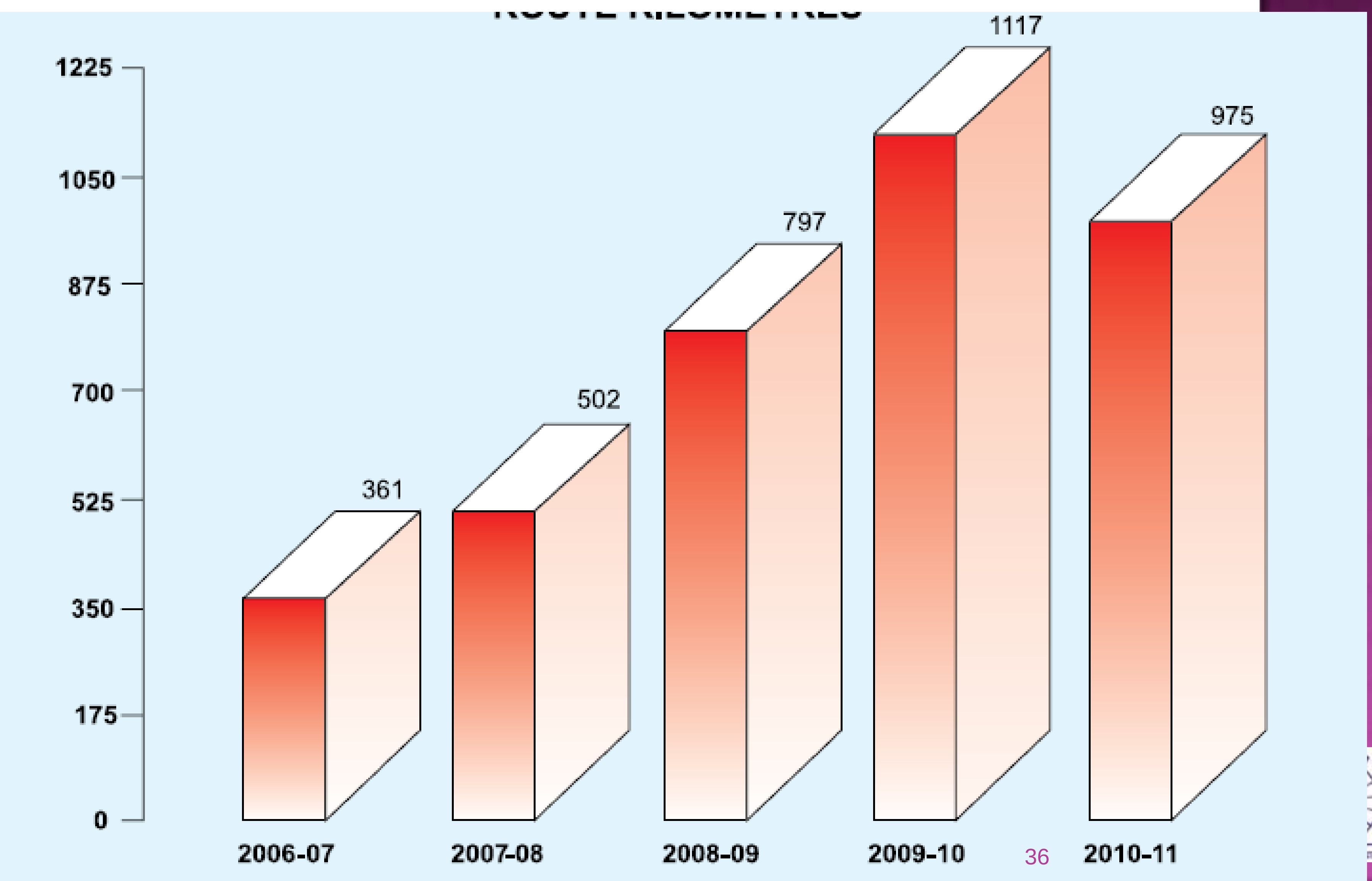
22,224 route kms of tracks under the electric traction on **31 st March,2012**.

- Electrified Route **34.48%** of Railway Network/**40.27%** of the BG System
- Major Trunk Routes **The Golden Quadrilateral, Delhi - Chennai, Chennai - Bangalore, Ernakulam-Trivendram and Delhi - Amritsar.**
- During 11th Five year Plan Railway Electrification energized 4556 Route Kms
- Target for **12th Five year plan** (2012-17) is **6500 RKM.**
- Target for financial year **2012-13** has been kept as **1250 RKM.**

PLAN-WISE PROGRESS OF ELECTRIFICATION ON INDIAN RAILWAYS

Sl. No.	Year / Plan	Targets	Achievements
1.	1925-1956	---	529
2.	2nd Five Year Plan (1956-1961)	---	216
3.	3rd Five Year Plan (1961-1966)	---	1678
4.	Annual Plan 1966-1969	---	814
5.	4th Five Year Plan (1969-1974)	---	953
6.	5th Five Year Plan (1974-1978)	---	533
7.	Inter Plan 1978-1980	---	195
8.	6th Five Year Plan (1980-1985)	---	1522
9.	7th Five Year Plan (1985-1990)	2618	2812
10.	Inter Plan 1990-1992	1715	1557
11.	8th Five Year Plan (1992-1997)	2700	2708
12.	9th Five Year Plan (1997-2002)	2300	2484
13.	10 th Five Year Plan (2002-07)	1800	1810
14.	11th Five Year Plan (2007-12)*	4500	4556
	*** 168 RKM electrified MG line dismantled, 25KM Kolkata Metro added***		
	Gross		**22,224***

RAILWAY ELECTRIFICATION PROGRESSION



ADVANTAGES RAILWAY ELECTRIFICATION

- Energy Conservation through Railway Electrification
- Role of Electric Traction in Suburban Transport
- Haulage of Heavier Freight Trains and Longer Passenger Trains under Electric Traction
- Benefits of clearer environment
- Economy in Electrical Items
- Staff Reduction
- Closure of RE Stores Depots

TECHNOLOGY UPGRADATION

- Electric Rolling Stock
- Modernization of Equipment
- Supervisory Remote Control & Data Acquisition System (SCADA)
- 2 x 25 kV System Bina Katni Section
- Optical Fibre Communication
- Train Radio Communication

ELECTRIC TRACTION

- Remote Monitoring and Diagnostic System
- Locotrol and wireless MU couplers
- Regeneration of energy in locomotives in 3-phase MU consist
- Train Protection Warning System (TPWS)
- Provision of Vigilance Control Device (VCD) on electric locos
- Crew friendly cabs

TRAIN KMS. TYPES OF TRACTION (%)

Year	Passenger				Freight		
	Steam	Diesel@	Electric		Steam	Diesel	Electric
			Loco	EMU			
1950-51	93	-	2	5	99	-	1
1960-61	91	-	2	7	94	5	1
1970-71	77	7	7	9	46	39	15
1980-81	49	25	14	12	18	62	20
1990-91	21.8	42.4	22.6	13.2	3	60.6	34.4
2000-01	-	56.2	31.2	12.7	-	43.5	56.5
2007-08	-	51.6	36.5	13.5	-	38.1	61.9
2008-09	-	50.0	38.2	13.3	-	36.9	63.3
2009-10	-	50.0	38.4*	13.1*	-	36.7*	63.1
2010-11	**-**	**49.9**	**38.4**	**13.3**	**-**	**37.1**	**62.7**

@ Includes DHMU & DEMU

* revised.

GROSS TONNE KMS. TYPES OF TRACTION (%)

Year	Passenger				Freight		
	Steam	Diesel@	Electric		Steam	Diesel	Electric
			Loco	EMU			
1950-51	92.4	-	2.8	4.8	98.3	-	1.7
1960-61	91.9	-	2.7	5.4	90.5	8.1	1.4
1970-71	74.1	10.7	8.2	7.0	32.2	47.7	20.1
1980-81	41.2	33.0	17.2	8.6	9.0	67.0	24.0
1990-91	15.1	47.1	29.5	8.3	0.8	57.8	41.4
2000-01	-	52.8	40.2	7.0	-	40.2	59.8
2007-08	-	51.0	43.1	6.2	-	36.2	63.7
2008-09	-	48.2	44.1	6.4	-	34.7	65.3
2009-10	-	49.2*	44.9*	6.2*	-	36.4	63.6
2010-11	**-**	**49.3**	**44.9**	**6.1**	**-**	**35.7**	**64.3**

@ Includes DHMU & DEMU

* revised.

VISION2020 RAILWAY ELECTRIFICATION

- **33,000 kms of routes** (Additional electrification of 14,000 kms in 10 years).
- Inclusive of all Inter-Metro links and the other busy corridors.
- Electrification of 2000 kms in 2010-2012.
- Electrification of 12000 kms in 2012-2020.
- Total **14000 kms.**

INDIA & CHINA COMPARISON

	1990-91		2008-09	
	India	China	India	China
Route km	**62,367**	**57,899**	**63,273****	**77,966***
Electrified route km	**9,968**	**6,491**	**18,274****	**24,047***
Passengers carried: no. (million)	3,858	957	6,524**	1,458
Passenger-km (billion)	296	261	770**	773
Freight carried: tonne, million	341	1,507	794**	3,306
Net tonne-km (billion)	243	1,062	521**	2,512
Traffic density: passenger km/route (km)	7.1	4.5	14.6	9.3
Labour productivity: traffic units (passenger km+net tonne km)/no. of staff	326	673	927	1,982

* For year 2007 on CR ** For year 2007-08 on IR

Source: World Bank: Working Paper, March 2009 (for CR), Ministry of Railways, India, (for IR)

PRESENT PARADIGM

- Railway's Agency- Central Organisation for Railway Electrification- Ten Pan India Projects Units -30 years
- Works Contracts for Overhead Equipments , Signal and Telecom and Civil works and Copper and Steel Structure Purchase Contracts
- Off late Turnkey Contracts Varanasi Phaphamau Unchahar, Jhansi- Kanpur
- The Outlay Rs 800 crore /Cost of Electrification about Rs 80 lakh Material Copper and Steel constituting more than 50-60 %

PLAYERS IN RAILWAY ELECTRIFICATION IN INDIA

TATA Projects -Kondapuram–Guntakal,Khurja-Meerut–Saharanpur

Larsen &Toubro-Jhansi-Bina,Kota-Nagda,Egmore-Tambaram Line,Guntakal, Raichur,

KECInternationalLimited-Trivandrum–Kanyakumari,Kharagpur– Bhadrak,Renigunta-Nandalur, Ernakulam-Alleppy –Kayamkulam,

PREMCO Rail Engineers Limited

- Andal – Ukhra – Pandbeswar
- Rail Vikas Nigam Limited- Renigunta–Guntakal –Pune
-

LIMITATIONS/

- Large Setup , Express execution needed for benefits
- Funds limitation off late Provisioning from Capital Fund
- Turnkey/ EPC contracts Experience in handling the projects
- Manpower and Maintenance needs, Safety Sanctions
- Governmental Constraints
- Imperative for Public Private Partnership for Complete Set of Activity including maintenance

IMPERATIVES

- Completion of construction work-Projects are handed over for Operation & Maintenance to Operational Railways
- Requires skilled and trained Manpower
- Fresh recruitments-long drawn and lot of time & efforts
- Departmental Productivity/Related Concerns/ Time Lag in Coordination Departmental Lines
- A Way Forward-Public Private Partnership (PPP)

RAILWAY'S RECENT INITIATIVE

- R3i -Railway's Infrastructure by Industry Initiative
- R2Ci Railway to Coal, Iron Mines Infrastructure
- New Policy for Operationally Necessary/ Bankable Sanctioned Projects Stake Holders identifiable –Special Purpose Vehicle
- When not Identifiable- Build , Operate and Transfer Through Competitive Bidding and its mode Design, Build, Finance, Maintain and Transfer(DBFMT) Concession

PRESENT INITIATIVE PARADIGM

- New Policy Announcement and categorisation into six groups for State/Local Government, Industries Import/export Foreign Investor
- 1- Non Government Railway First/last mile connectivity Purely Private arrangement
- 2-Bankable sanctioned/Railway Projects New/Conversion of Line Operationally clear
- 3-Not possible to identify the partner BOT –DBFOT through competitive bidding –Line
- 4- Capacity Augmentation with Customer funding Line doubling/trebling freight rebate
- 5- Capacity Augmentation Annuity Model DFT
- 6 State Governments Under 1/2 proposition

PPP IN RAILWAYS

- Viramgam Mehsana Gauge Conversion Project 90 Km BOT (Annuity) DSCL

- Surendranagar-Pipapav Rail Project construction, operation & maintenance of the 271 km long Broad Gauge Rail line -cost of the Project is approx. Rs.373 crores

- Gandhidham-Palanpur Railway Project to convert existing meter gauge line between Gandhidham and Palanpur(301 km) Kutch Railway Corporation

- Bharuch Dahej Port SPV set up to convert existing 63 kilometre Narrow Gauge Railway Line Port of Dahej

- Madhepura Electric Loco Factory at an estimated cost of Rs 1,294 crore

- Marhowra Diesel Loco Factory at a cost of Rs 2,025 crore

- Port Connectivity & other RVNL projects, Investment in Rolling Stock by Container Operators

PPP IN RAILWAYS: EXPERIENCE SO FAR

- Indian Railways has experimented with various PPP schemes viz. Railway lines connecting Ports, Privatization of container trains, dedicated parcel trains, wagon investment scheme, luxury trains, tourist lodges etc.

- IR has entered into some of these PPP projects directly and some through its public sector agencies like Rail Vikas Nigam Ltd, IRCTC etc.

- Each of these PPP initiatives has a different structure and form.

- In some cases, IR has followed the route of licensing and investment partnership.

- The experience of Indian Railways with PPP has been far from satisfactory.

- Railway projects are typically capital intensive and therefore require horizon time frame of 30 to 35 years, giving best returns only in the second half of their life.
- Railway PPP is ideally suited for investors with long-term liquidity preference.
- Indian Railways has yet to come up with project de-risking strategy using the 'Viability Gap Funding' scheme enunciated by GoI.
- Railway PPP policy is designed to suit typically the strategic investors who use the project line for transportation of their cargo. Unfortunately, not many such strategic partners have come forward to take up the offer.

THE WAY FORWARD

- Indian Railways appears to be serious about development of rail infrastructure through PPP.
- Several new areas viz. R**edevelopment/ development of World-class stations, high-speed passenger corridors, multimodal logistics parks, dedicated freight corridors, rolling-stock manufacturing units, multi-functional complexes at stations, port connectivity** etc. have been identified.
- Interestingly, little private participation that has taken place or proposed so far; relates to only contribution in terms of project management expertise, finances and business development.
- Operations and maintenance of the railway projects is another field, which is palpably attractive for the private participation.
- Indian Railways also needs to find ways to avoid treating PPP projects as an extension of railway department and start viewing them as a potential business venture in partnership.
- Finally, echoing the aspirations of the potential partners, IR should seriously consider setting up nodal agency to fast-track its PPP initiatives.

INCREASING URBANIZATION

Explosion in Inter City Travel

India's urban population - 285 million reported in the 2001 census and 377 million in 2011 census.

McKinsey Global Institute (MGI) projects - 590 million by 2030 (40% of India's total projected population).

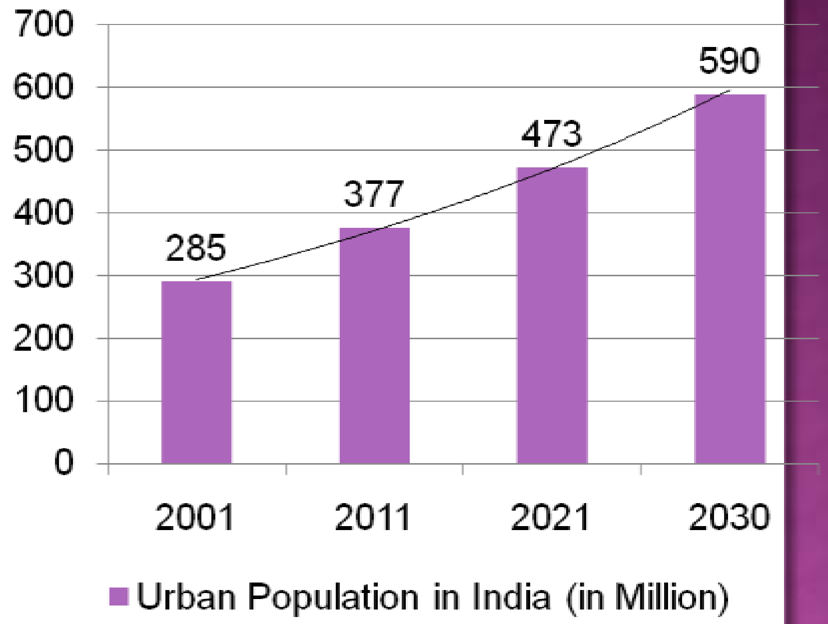
The rapid urbanization in the country has triggered a growing demand for inter city traffic between metropolitan cities and 2nd and 3rd tier cities.

In absence of HSR, passenger traffic of Airlines/ Car users is growing at 15-20%

INCREASING URBANIZATION

The major challenges faced are:

- **Major Urban centers are severely congested:**
  - **Dramatic growth in vehicle ownership in the past decade.**
  - **Accessing jobs, education - becoming increasingly time-consuming.**
  - **Billions of man-hours are lost with people stuck in traffic.**



TRAVEL TIME (TRIGGER FOR MODAL SHIFT)

Journey time for air travel involves travel to airport, away from city centers and waiting time at Airports. Distance between DELHI to CHANDIGARH is 245 Km.

Plane

Delhi (city centre) → Delhi Airport → Chandigarh Airport → (city centre)

.75 hr | **1.25 hrs at Terminal + 1 hr Flying time** | **30 min**

Total time: 3.5 hrs

High Speed Railway

Delhi (city centre) → Chandigarh (city centre)

Total time: 1 hr

APPROACH TO HIGH-SPEED RAIL IN INDIA

- The implementation of regional high-speed rail projects to provide services at 250–350 km/h, and planning for corridors connecting commercial, tourist and pilgrimage hubs.
- **Six corridors** have already been identified for technical studies on setting up of high-speed rail corridors
  - *Delhi-Chandigarh-Amritsar*
  - *Pune-Mumbai-Ahmedabad*
  - *Hyderabad-Dornakal-Vijayawada-Chennai*
  - *Howrah-Haldia*
  - *Chennai-Bangalore-Coimbatore-Trivandrum*
  - *Delhi-Agra-Lucknow-Varanasi-Patna.*
- In a feasibility study published in 1987, RDSO and JICA estimated the construction cost to be Rs 49 million per km, for a line dedicated to 250–300 km/h trains.
- RITES is currently performing a feasibility study. It is being estimated that dedicated high speed corridor will cost about 100 crore per km.

High-Speed Corridor	Route	Speed	Length (km)	Status
East India				
Howrah - Haldia High-Speed Passenger Corridor	Howrah-Haldia	250-300	135	Approved by Planning Commission & PMO
North India				
Delhi - Patna High-Speed Passenger Corridor	Delhi-Agra-Kanpur-Lucknow-Varanasi-Patna	200 - 350	991	Approved by Planning Commission & PMO
Delhi - Amritsar High-Speed Passenger Corridor	Delhi-Chandigarh-Amritsar		450	Approved by Planning Commission & PMO
Delhi - Jodhpur High-Speed Passenger Corridor[	Delhi-Jaipur-Ajmer-Jodhpur		591	Proposed
South India				
Chennai - Bangalore - Trivandrum HSR	Chennai-Bangalore-Trivandrum	350	649	Approved by Planning Commission & PMO
Hyderabad - Chennai High-Speed Passenger Corridor	Hyderabad-Dornakal-Vijayawada-Chennai		664	Approved by Planning Commission & PMO
Thiruvananthapuram - Mangalore High-Speed Passenger Corridor	Thiruvananthapuram - Mangalore	300	585	Approved by Planning Commission & PMO
Bangalore - Mysore High-Speed Passenger Corridor	Bangalore - Mysore	350	110	Proposed
West India				
Ahmedabad - Dwarka High-Speed Passenger Corridor	Ahmedabad - Rajkot - Jamnagar - Dwarka			
Mumbai/Navi Mumbai - Nagpur High-Speed Passenger Corridor	Mumbai/Navi Mumbai - Nashik - Akola -Nagpur			Proposed
Pune - Mumbai - Ahmedabad High-Speed Passenger Corridor	Pune-Mumbai-Ahmedabad	300 - 350	650	Approved by Planning Commission & PMO
Rajkot - Veraval High-Speed	Rajkot - Junagadh - Veraval	350		

- Mumbai-Ahmedabad route of 500 km, will cost Rs 370 billion (US$ 8.04 billion) to build and to make a profit, passengers will have to be charged Rs 5 per km (US$ 0.11/km).
- Indian Railway plans to set up a corporation called National High Speed Rail Corp (NHSR) that will exclusively deal with the proposed ambitious high speed rail corridor projects.
- It will handle tendering, pre-feasibility studies, awarding contracts and execution of the projects.
- All high-speed rail lines will be implemented through PPP mode on n a Design, Build, Finance, Operate and Transfer (DBFOT) basis.

PPP PROJECT STRUCTURING

The Project Structures proposed under PPP mode are:

OPTION I - Design, Build, Finance, Operate and Transfer (DBFOT) of the entire project by a single Private Developer, who will be responsible for construction , operations and maintenance, thus there will be no interface risk and all revenue risk can be transferred to the private developer.

OPTION II - Unbundling the project into different components, so as to make the project components attractive to private players from the perspective of affordability in terms of size and risk allocation.

PPP PROJECT STRUCTURING (CONTD.)

OPTION I

DBFOT of the entire project by a single Developer

key parameters

- Land provided by IR,
- VGF - 17% of Project Cost,
- Soft Loan - 20% of total Debt.
- Equity IRR – 16%

PPP PROJECT STRUCTURING (CONTD.)

OPTION II

A. Build and Transfer of Civil Works

- VGF - 40 % of project Cost,
- Annual Grant - Rs. 2,700 crore,
- Soft Loan - 20% of total Debt.
- Equity IRR – 16%

B. Build, Operate and Transfer of Systems, Stations, Trains and Depots

- VGF - 17% of Project Cost,
- Revenue share - 53% of fare box collections
- Soft Loan - 20% of total Debt.
- Equity IRR – 16%

FINANCIAL ANALYSIS

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Key Financial Indicators:

Pre-Tax Project FIRR
11.42%

SOCIO ECONOMIC ANALYSIS

Pre-Tax Project EIRR
12.80%

CONCLUSION

- Investment in HSR has revolutionized the nature of transportation.
- Reduced travel times on key routes have facilitated drastic shifts from congested and polluting road and air networks.
- Fulfillment of goals of environmental protection and curbing climate change.
- The decreased opportunity costs of travel on HSR have provided opportunities for growth in large, mid-sized and small cities.
- Business and commerce have benefitted from access to widened labour markets and more efficient freight transport on both HSR and less congested conventional rail.
- Assurance of Safe Operations.

THANK YOU !