HSR in India

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HSR and Indian Railways – Initiation

- Railway Budget 2007-08 first proposed High Speed Rail in India
  - Speeds of 300 to 350 kms per hour;
  - One each in the Northern, Western, Southern and Eastern regions of the country
  - Distances of up to 600 kms in two to three hours
  - Consideration of all alternatives including PPP for implementation

HSR and Indian Railways – Getting Started

- Feasibility study of five HSR corridors was on
  - Delhi – Chandigarh – Amritsar (450km)
  - Ahmedabad- Mumbai- Pune (650 km)
  - Hyderabad- Vijayawada- Chennai (644 km)
  - Chennai- Bangalore- Coimbatore – Ernakulam (649 km)
  - Howrah –Haldia (135 km)
- Delhi–Agra–Lucknow-Varanasi-Patna (991 km) HSR feasibility report would also be taken up as per Railway Budget 2009-10

HSR Corridors : Prefeasibility Studies I

Identified HSR Route	**Consortium that carried/will carry the Pre-feasibility/Feasibility study**	**Status of prefeasibility**
Pune – Mumbai – Ahmedabad *(Proposed in Railway Budget 2007-08)*	Pre-feasibility study: Systra, Italferr and RITES Feasibility study (to be carried out): Japan International Cooperation Agency (JICA)[1]	Draft final report submitted; Mumbai-Pune *(Dropped in Railway Budget 2013-14)*[2]
Delhi-Chandigarh-Amritsar *(Proposed in Railway Budget 2007-08)*	Invited Fresh Tender for Conducting Pre-feasibility Study (as on Nov 26th 2012) and Technical Evaluation of Offers from Consultants Completed and Financial Bids Being Finalised (as on 10th Jan 2013) Pre-feasibility study: Rail Vikas Nigam Limited (RVNL)[1]	Study to be carried out (as on Jan 2013) Necessary preparatory steps under process[1]
Hyderabad-Vijayawada-Chennai *(Proposed in Railway Budget 2007-08)*	Japanese consortium (Japan External Trade Organisation (Jetro) and Oriental Consultancy along with Parsons Brinkhoff) (out of 13 bidders like Korean, French, British and Spanish)	Japanese consortium conducting the study (As on Jan 2013)

HSR Corridors : Prefeasibility Studies II

Howrah-Haldia *(Proposed in Railway Budget 2007-08)*	Spanish consultant Ineco, PROINTEC, Ayesa	Draft final report submitted
Chennai – Bangalore – Coimbatore – Ernakulam *(Proposed in Railway Budget 2007-08)* Ernakulam – Thiruvananthapuram *(Proposed between 14th July and 30th October, 2011)*[3]	Consortium led by Jarts and Oriental Consultants	Study underway; [1]Positive interim report submitted
Delhi-Agra-Lucknow- Varanasi-Patna *(Proposed in Railway Budget 2009-10)*	UK-based consultant Mott McDonald	Draft final report submitted
Delhi-Jaipur *(Proposed in Railway Budget 2011-12)*[4] Jaipur-Ajmer-Jodhpur *(Proposed in Railway Budget 2012-13)*[2]	Yet to decide	Proposed

HSR Corridors : Prefeasibility Studies III

Thiruvananthpuram-Kasargod-Mangalore *(Proposed in 2009-10 budget speech of the LDF government (Kerala)*[1]; *State Cabinet approval on 10/02/2010)*[2]	Pre-feasibility study: Delhi Metro Rail Corporation (DMRC) Feasibility study: DMRC Submitted in Dec 2011	•Feasibility report submitted in Dec 2011 •Detailed Project Report in progress by DMRC •Presentation before Principal Secretary to PM on 20.01.2012

Source- http://www.keralacm.gov.in/images/stories/docs/All_Party_Meeting-13.2.12_1.pdf
[1] http://en.wikipedia.org/wiki/Thiruvananthapuram%E2%80%93Mangalore_high-speed_passenger_corridor
[2] http://khsrcl.com/downloads/Chapter%2014%20Implimentation%20Plan.pdf

ISSUES FOR HSR IN INDIA

Issues for HSR in India

- Upgrade Existing Right of Way v/s New Right of Way
- Route Fixation
  - Origin, Destination, Intermediate Stations
- Choice of Technology Partner, need for Standards
- Choice of Demonstration Route
  - Minimum Viable Route Length
- Location of Stations
  - City Centre v/s Periphery, Intermodal Connect
- Surface v/s Above Ground v/s Under Ground
- Choice of Gauge
- Interoperability beyond Core Networks

Issues for HSR in India

- Land Acquisition, Environmental Clearances
- Pricing
- PPP or Contract, Viability Gap Funding
- Part of Railways v/s Independent Organization
- Regulation

New Right of Way for HSR v/s Upgrade Existing Right of Way

- Should we upgrade the existing railway lines to make it suitable for semi high-speed trains with an operating speed of 160 kmph to 200 kmph or new HSR with an operating speed of 250 kmph to 350 kmph?*
- For HSR with new ROW, the existing rail network does not get disturbed. For upgraded ROW HSR, few faster trains will get much precedence over the other trains, resulting in low throughput of permanent way.
- But the investment for new ROW HSR is much higher than the upgraded ROW HSR.
- Mumbai – Delhi route is the pilot test for upgraded HSR as freight trains will be shifted to Western Dedicated Freight Corridor
- New lines built for high-speed cost about Rs 70-100 crore per km, compared with Rs 6 -7 crore per Km of normal rail track.[1]

*Note - International Union of Railways (UIC) defined high speed lines as lines that are either specially built for speeds equal to greater than 250 kmph or specially upgraded for speeds of the order of 200 kmph (UIC, n.d)

Source- [1] http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_7.pdf

Route Fixation
Origin, Destination, Intermediate Stations

- High speed trains cannot have stoppage at each and every intermediate station & the High-speed rail lines cannot reach every station enroute.
- But the demand for including growing cities and political demand to include more stations enroute is not ruled out.
- Service model consisting non stop trains, fewer stop trains and few stop trains as in Japan may be worthy of consideration.

Choice of Demonstration Route: Minimum Viable Route Length

- Studies recommend HSR for intercity travel of 300 km to 800 km
- In case of HSR, the travel time reduction would be substantial (compared to conventional rail and road mode) only if the distance involved is at least 300 km.
- Any HSR project for demonstration should be at least 300 km.
- Given the large share of PRS in the passenger segment, Chennai – Bangalore (350 km) or Ahmedabad – Mumbai may be an ideal (500 km) stretch for demonstration.

Location of Stations
City Centre v/s Periphery, Intermodal Connect

- The HSR stations may be positioned either in
  - the existing railway stations
  - city centers which don't have existing railway station
  - periphery of cities which don't have existing railway stations
  - periphery of cities which have existing railway stations
- Wherever the stations are, seamless Intermodal connect is vital for good patronage of HSR
- Taiwan High-Speed Rail (THSR)
  - Intermediate stations lying outside the city are being served
  - free shuttle buses, local trains and metros are offered to meet the need of different passengers.

Surface v/s Above Ground v/s Under Ground

- ROW at surface – land acquisitions, crossover with roads and fencing is a major problem
- ROW above ground – Problem of land acquisitions, crossover with roads and fencing is minimal but costly compared to surface. Aesthetics and existing structures could be an issue.
- ROW under ground - Problem of land acquisitions crossover with roads and fencing is nil. Aesthetics is not an issue. Existing Structures could be an issue but can be resolved. Costlier than above ground

Choice of Gauge and Interoperability of Trains beyond Core Networks

- The entire HSR world over is of standard gauge. The rolling stock for HSR is available for standard gauge.
- The conventional trains in India run on broad gauge tracks.
- If India adopts standard gauge for HSR, how is the interoperability of rolling stock ensured?
- If India adopts broad gauge, what would be the scope for choices of rolling stock?
- Japan and Spain offer lessons.

Interoperability of Trains v/s Tracks – Global Experience

- Exclusive exploitation – High Speed Trains run on HSR tracks and Conventional Trains run on Conventional Tracks. Eg Japanese Shinkansen, conventional lines narrow gauge and HSR standard gauge
- Mixed High Speed - High Speed Trains run on HSR tracks and upgraded sections of Conventional Tracks. Conventional Trains run on Conventional Tracks. Eg TGV of France, Mini Shinkansen and Spain. Spain uses specific adaptive technology for rolling stock (TALGO trains).

Interoperability of Trains v/s Tracks – Global Experience

- Mixed Conventional - High speed trains run on high speed tracks and conventional trains run on both high speed and conventional tracks.
- Fully mixed model – Both high-speed and conventional services can run(at their corresponding speeds) on each type of infrastructure. Eg German intercity trains (ICE) and the Rome–Florence line in Italy. High speed trains occasionally use upgraded conventional lines and freight trains use the spare capacity of high speed lines during night

Land Acquisition, Environmental Clearances

- The land required for new ROW for HSR is about 3.2 ha/km relatively lower than that of Highways (An average 6 laned road uses 9.3 ha/km)

Pricing and Revenues - I

- Prefeasibility report of Mumbai – Ahmedabad HSR estimated 12.0 million passengers in 2021 with pricing of Rs 7/km for first class and Rs 4.5/km for second class (75% of seats).
- Literature on HSR shows that for about 500 km, HSR is a successful commercial venturing if the passengers are in the range of 70 lakhs to 1 crore in the first year of operation.
- Construction cost may vary between Rs 37,700 crore to Rs 42,300 crore (economical conditions 2009) and rolling stock cost of Rs 5000 crore for Mumbai –Ahmedabad HSR.
- Economic Internal Rate of Return of the project on Pune – Mumbai – Ahmedabad Corridor works out to 12.8%.

Pricing and Revenues - II

- The first year return on investment will be about 0.34% as shown below

Stretch		No of passengers in 2021	Distance	Fare	Revenue	
Mumbai	Surat	9,25,285	285	1,461	1,35,14,94,403	
Mumbai	Vadodara	11,41,008	411	2,106	2,40,33,90,726	
Mumbai	Ahmedabad	26,20,703	531	2,721	7,13,19,15,627	
Surat	Ahmedabad	10,31,224	269	1,379	1,42,16,71,187	
Vadodara	Ahmedabad	41,80,829	118	605	2,52,83,56,338	
Surat	Vadodara	11,58,794	149	764	88,48,84,068	
Mumbai Airport	Surat	3,00,519	280	1,435	43,12,44,765	
Mumbai Airport	Vadodara	35,967	407	2,086	7,50,22,666	
Mumbai Airport	Ahmedabad	34,466	527	2,701	9,30,88,358	
	Total	1,14,28,795	2,977	15,257	16,32,10,68,138	Rs 1632 crore
				Operating cost in 2021	1385 crore	
				Operating surplus	247	
				Investment	Rs 72,000 crore	After adjusted for inflation
				First year return on investment	0.34	

PPP or Contract, Viablility Gap Funding

- Indian Railways wanted to implement the HSR project in Public Private Partnership mode
- The need for Viability Gap Funding is evident with the estimation of 0.34% return on investment in the first year of operation (2021)
- Given the nature of huge investments and poor return on investment……

SEMI-HIGH SPEED RAILS IN INDIA

Railway Plans Speed Boost for Premier Trains

- India has shelved the idea to go for HSR (as of now) and instead looking for options to go for the speed of 160-200 Kmph.
- IR purchased rolling stocks and locomotives like LHB and WAP5 which are fit for working at 160 kmph, but they have been working with merely 130 kmph; wasting potential speed of 30 kmph.
- Main reason for this is addressing safety concerns of handling trespassing and this requires an investment of about Rs 2-3 crores/km.

Source- http://www.railelectrica.com/rail-news/indian-railways-planning-for-semi-hsr-of-160-200-kmph/; Accessed on 12 Dec 2013

Some Steps Proposed

- Aims to increase speed to 160-200 kmph on the **existing track** by upgrading signal and brake system along with fencing the tracks.

Source- http://articles.timesofindia.indiatimes.com/2013-10-30/india/43526223_1_kmph-semi-high-speed-trains-passenger; Accessed on 12 Dec 2013

Issues Involved in Achieving Higher Average Speeds on Existing Network (Civil Engineering Perspective)

- Existence of sharper curves resulting in imposition of speed restriction.
- Vulnerable locations like level crossings, cattle crossings turnouts, SEJ's etc.
- Work sites with severe speed restrictions.
- Existing permanent speed restriction on various sections.
- Maintenance requirements of infrastructure.
- Alignment compulsions.
- Slower speeds at Entry/Exit of Yards and negotiation of Turnouts.

Source- http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_5.pdf Accessed on 12 Dec 2013

Existence of Sharper Curves

- For the train to achieve full potential of 160 kmph of speed, the minimum radius of curve is 1325 m (1.3º). There are large numbers of curves sharper than 1.3° on existing network resulting in imposition of permanent speed restrictions. Available remedies to improve speed
  - Realignment of curves to restrict sharpness within permissible limits.
    - Again has a problem of complete deviation from existing track and financially not viable.
  - Introduction of tilting coaches' technology.

Source- http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_5.pdf Accessed on 12 Dec 2013

Vulnerable Locations Like Level Crossings, Locations of Cattle Crossings, Turnouts, SEJ's etc.

- All existing level crossings have to be planned to be replaced by suitable grade separator i.e. by ROBs/RUBs on a programmed basis.
- For high-speed operation, track will also have to be through and through fenced to avoid the menace of cattle, which could be a safety hazard.
- The existing vulnerable and high maintenance requiring components such as Turnouts, SEJs, Glued joint, Girder bridges have to be given necessary inputs for upgradation.
- All the turnouts should be replaced with thick web switches and weldable CMS crossings, which would reduce the maintenance efforts substantially.
- Superior technology of track circuiting should be adopted to avoid need of glued joint at station yards and signal locations in mid section.
- Existences of girder bridges, especially small spans i.e. up to 9.14 m, also add up to difficulties in maintenance and are better avoided for higher speeds.

Source- http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_5.pdf Accessed on 12 Dec 2013

Work Sites With Severe Speed Restrictions

- The worksites of TRR/TSR/Deep Screening/ Turnouts replacement/ Lifting / IMR rail replacement / Bridge attention/ Scattered replacement of sleepers at Main line or Turnouts/ Glued joint replacement etc need speed restrictions ranging from 20 to 45 Kmph.
- Time of about 12" per 200 Km is provided in timetabling for these planned works. All the trains have to accordingly absorb that much of extra time while on run. In the scenario of operation of 160 Kmph, the resultant time would still be higher and may go up to 18“ per 200 Km, which would be totally unacceptable.
- The work sites would have to be managed with higher speeds by utilizing modern technology to improve replacement cycle time and also making available adequate time for maintenance to avoid unscheduled maintenance requirements.
- One way to avoid need to negotiate speed restriction stretch could be by providing high-speed turnouts and taking the important high speed trains on TSL (Twin Single Line) working.
- The high-speed turnouts of 100 Kmph are available and can be utilized by augmenting the signaling systems. This would not only avoid restrictive speed restriction but also allow the works to be carried out in an uninterrupted manner.

Source- http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_5.pdf Accessed on 12 Dec 2013

Existing Permanent Speed Restriction on Various Sections

- The broad reasons for these speed restrictions are formation inadequacies, ballast deficiencies, rail/sleeper renewal, turnout replacement, bridge works, sharp curves, and turnouts on curves etc.
- Detailed analysis to establish feasibility on case to case basis to eliminate the permanent speed restrictions to make the track fit for 160 Kmph has the potential of improving average speeds and consequent reduction in point-to-point timings substantially.

Source- http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_5.pdf Accessed on 12 Dec 2013

Dedicated High Speed Corridor-Merits

- Building a new line gives the option of building a direct straight line between cities giving a shorter running distance again reducing journey time. [1]
- No interference of slow trains in the way of dedicated high speed rails.[1]
- Increase in rail capacity: Dedicated infrastructure for high-speed passenger lines frees up capacity on conventional lines, which can be used to accommodate additional freight and conventional passenger trains. In turn, this helps relieve congestion on the roads and drive down the related costs to society. [2]
- Safety- HSR has an unblemished record in safety. 4 billion passengers have been carried in Japan on HSR since 1964 without any fatal accident. In Europe, billions of passengers have travelled in Europe with practically no accident attributable to high speed trains. Traffic control systems and infrastructure of HSR are simpler to control compared to aircrafts. [2]
- Significant saving in journey time [2]

Source- [1]iricen.**indianrailway**s.gov.in/IRICEN1/events/fday2005/2-aky.doc
[2] Draft Report of Working Group on Railways Sector, set up by NTDPC; Accesed on 13 Dec 2013

Upgradation of Existing Tracks v/s Installation of New Lines

- New lines built for high-speed cost about Rs 70-100 crore per Km, compared with Rs 6 -7 crore per Km of normal rail track.[1]
- Upgradation of the existing track combined with advanced technology of rolling stock is the economical solution to achieve high speed. [1]
- The main advantage of improving conventional rail system is **lower cost** and **much less time required** in introducing a high-speed train. The cost of constructing a dedicated new high-speed line may be prohibitively high for a developing nation. [2]
- Further, building new tracks for HSR will have to use standard gauge instead of normal broad gauge which will be incompatible with normal tracks to run on in case of emergency.

Source-[1]http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=ppt_presentation:2_7.pdf;
[2] iricen.indianrailways.gov.in/IRICEN1/events/fday2005/2-aky.doc; Accessed on 13 Dec 2013

Upgrade Locomotives and Coaches

- Improve coaches, which can support 160 km/h, with stainless steel bodies and crash-worthy designs, incorporating passenger and crew protection, and fire-retardant materials. [1]
- Equip coaches with electro-pneumatic brake systems to enhance safe operations at 160–180 km/h.[1]
- Develop locomotives with output of 9000 to 12000 hp for hauling of 24-26 coach long passenger trains to 160–200 km/h.[1]
- Indian Railways has asked IIT Kharagpur to conduct research to obtain the technological know-how to increase the maximum attainable speed to 200 km/h. The project, which will be conducted in the Railway Research Centre of IIT Kharagpur, has four main goals; improving speed, improving carrying capacity (heavy haul), use of advanced material, advanced signalling and maintenance for better safety. The research is expected to be completed by the end of 2015.[2]

Source- [1] Indian Railways 2020 Vision - Government of India Ministry of Railways (Railway Board) December, 2009
[2] http://articles.timesofindia.indiatimes.com/2012-09-13/news/33815902_1_indian-railways-railway-board-iit-kharagpur; Accessed on 13 Dec 2013

Issues With Upgrading Track Scheme

- High speed trains and heavy freight trains have different demands on track standards concerning horizontal alignment, cant, gradients and vertical curves. The primary problem with the existing railways is that they can have tight curves.
- Running on existing railway, the new fast trains have to be scheduled in around the conventional trains. This can be a tricky thing, especially on a busy network; fast trains can easily become stuck behind slow running ones, resulting in delays.
- Safety is also a paramount consideration. After heavy rains the track may sag slightly and loose some alignment, only a real problem at speed.
- Maintenance of track for high-speed trains will require track geometry to be maintained within very tight limits. On mixed traffic routes, both high-speed passenger trains and heavy axle load freight trains operate on the same track and these heavy axle loads can be up to 25T. This poses problem for the Civil engineer in that these heavy axle loads can accelerate the deterioration of the track.

Source- iricen.indianrailways.gov.in/IRICEN1/events/fday2005/2-aky.doc, Accessed on 13 Dec 2013

Track structures for high speed routes

Track	Track structures for speeds upto 160 kmph	Track structures for speeds 160 to 200 kmph
1	2	3
Rails	60 kg & 90 UTS	71 kg & 90 UTS
Sleepers	Mono block PRC sleeper	Mono block PRC sleepers
Minimum curve radius[1]	630-1325 m	1325-1800 m
Sleeper density	1660 No. per km	1660 No. per km
Fastenings	ERC clip mark III with rubber pad 6 mm Thick & Linear-steel or GFN	Same as col 2
Points and crossings	Thick web, head hardered Switches and cast Manganese Crossings on PRC sleepers	Same as col 2
Ballast cushion	250/300 mm depth with 150 mm sub ballast	Hard stone ballast with 300 mm cushion over 150 mm sub-ballast
Formation	Stable with penetration of ballast	Well compacted and stable
Miscellaneous	Existing track may serve the purpose	Constraints to be removed

Source-http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=623:2introduction_of_150kmph_trains.pdf
[1] http://en.wikipedia.org/wiki/Minimum_railway_curve_radius ; Accessed on 16 Dec 2013

HSRC

- **High Speed Rail Corporation of India Limited (HSRC)** has been formed on the directions of the Ministry of Railways, Government of India, for development and implementation of high speed rail projects.**This Special Purpose Vehicle has been incorporated on 25 July 2012 as a subsidiary of Rail Vikas Nigam Limited (RVNL)**, which is a Mini-Ratna public sector enterprise of the Government of India. **[1]**
- Railways Minister Mallikarjun Kharge on **29 October 2013** launched the HSRC, a subsidiary of RVNL. The subsidiary has been set up to boost the speed of the passenger trains up to 200 Km/hr. He mentioned in his speech**[2]** that HSRC in the coming future would have a separate Managing Director. For now the current Chairman and Managing Director of RVNL will take care of the subsidiary.

[1] http://pib.nic.in/newsite/erelease.aspx?relid=56514, [2] http://www.business-standard.com/article/companies/railway-sets-up-high-speed-rail-corporation-113102900987_1.html, Accessed on: 09 Dec, 2013

Objectives[1] of HSRC:

- To undertake feasibility studies and techno-economic investigations and prepare 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 High Speed Rail Systems on existing as well as new rail corridors.
- To enter into and carry on all businesses related to High Speed Rail Systems and other rail based traffic as may be approved by Government of India or RVNL or any other Authority created by the Government for such activities.

[1] http://hsrc.in/Objectives.html , Accessed on: 09 Dec, 2013

HSRC (cont.)

- For feasibility Study of **Mumbai - Ahmedabad High Speed Corridor**, an MOU has been signed between JICA and Ministry of Railways on 07.10.2013 for conducting a joint feasibility study for Mumbai - Ahmedabad high speed rail system. Railway Board has decided to associate High Speed Rail Corporation of India Ltd (HSRC) in this study. An inter Ministerial Joint Monitoring Committee including representatives of HSRC will monitor the Study.[1]
- Railway Board has assigned Rail Vikas Nigam Ltd, the parent body of HSRC, to conduct Pre-feasibility Study of **Delhi - Chandigarh - Amritsar High Speed Corridor**. Necessary preparatory steps are under process.[1]

[1] http://hsrc.in/projects2.html , Accessed on: 09 Dec, 2013

HSRA

- A separate entity, **High Speed Rail Authority of India (HSRA),** has been set up[1] to operationalise bullet trains in the country **as part of12th Five Year Plan (2012–17).**
- A public-private-partnership mode of investment and execution is envisaged for such expensive 250–350 km/h high-speed rail projects.
- Chairman Railway Board, Arunendra Kumar, on the day of launching HSRC noted that HSRC and HSRA will have different functions. The authority will be responsible for policy formation and corporation would be the implementation agency.[2]

[1] http://onrails.in/content/proposed-bullet-trainhigh-speed-rail-network-india.html
[2]http://smartinvestor.business-standard.com/market/story-207486-storydet-Railway_sets_up_High_Speed_Rail_Corporation.htm#.UqVyiOLpzM0 , Accessed on: 09 Dec, 2013

Mumbai-Ahmedabad HSR Project Development

- Proposed in Railway Budget 2007-08 initially as Pune-Mumbai-Ahmedabad.
- Pre-feasibility test completed in December, 2010 by French consulting firm Systra along with Rail India Technical and Economic Service (RITES) and Italy's ITALFERR.
- The decision to carry out its feasibility study was taken in September 2013.
- The Pune-Mumbai section was dropped from the pilot phase implementation plan due to cost constraints.
- The Mumbai-Ahmedabad HSR was prioritized for development based on intercity traffic projections and relatively higher per capita income in Gujarat and Maharashtra states.
- A Memorandum of Understanding (MoU) was signed between the Ministry of Railways, Government of India and the French National Railway (SNCF) in February 2013, under which both the parties agreed to jointly carry out 'operations and development' feasibility of the Mumbai-Ahmedabad HSR project. SNCF agreed to fund the study with support from the French Ministry of Finance.

Source-http://www.railway-technology.com/projects/mumbai-ahmedabad-high-speed-link/ ; Accessed on 11 Dec 2013

Mumbai-Ahmedabad HSR Project Development

- During the Indian Prime Minister's visit to Japan in May 2013, the Prime Ministers of both countries decided to co-finance a detailed joint feasibility study for the Mumbai-Ahmedabad HSR. The Japan Internal Cooperation Agency (JICA) was given the go-ahead for the study in September 2013.
- The detailed study, which examines the possibility of operating trains with a high speed of 300 km/h as well as the funding pattern, alignment, patronage, possible halts and fare structure, is expected to be completed in 18 months.

Source-http://www.railway-technology.com/projects/mumbai-ahmedabad-high-speed-link/
Accessed on 11 Dec 2013

Delhi-Chandigarh-Amritsar

- Technical evaluation of offers from consultants completed and financial bids being finalized by the Ministry of Railways. [1]
- Railway Board has assigned RVNL to conduct this study. Necessary steps are under process. [2]

Source-[1]http://www.indiapublicsector.com/2013/10/a-new-psu-hsrc-is-formally-launched-to.html
[2]hsrc.in/projects.html; Accessed on 11 Dec 2013

Hyderabad-Dornakal-Vijayawada-Chennai

- Japan External Trade Organisation (Jetro) and Oriental Consultancy along with Parsons Brinkhoff India has bagged the contract to conduct the pre-feasibility study on the proposed 664 km long Hyderabad-Vijayawada-Chennai route for running the high speed train.[1]
- Japanese consortium is currently conducting the study.[2]

Source-[1] http://articles.economictimes.indiatimes.com/2011-12-08/news/30490592_1_delhi-chandigarh-amritsar-pune-mumbai-ahmedabad-howrah-haldia
[2] Singh, 2011 and Punnathara, 2012 ; Accessed on 11 Dec 2013

Howrah-Haldia

- Pre-feasibility studies are being conducted by Spanish companies Ineco, Prointec and Ayesa-inception report, interim reports I &II, and draft final report have been submitted.[1]
- The study was completed earlier in 2012 and the report stated that it is feasible to build an elevated corridor from Kolkata (Howrah) to Haldia. [2]

Source-[1] http://ecor.railnet.gov.in/DOCUMENTS/IRJ.IR.High.Speed.Plans.pdf
[2] http://articles.timesofindia.indiatimes.com/2012-08-10/kolkata/33136573_1_pune-mumbai-ahmedabad-high-speed-trains-haldia-kolkata; Accessed on 11 Dec 2013

Chennai-Bangalore-Coimbatore-Ernakulam- Thiruvananthapuram

- The pre-feasibility study for the proposed Chennai to Ernakulam High Speed Rail Corridor will now be extended to cover Thiruvananthapuram also. [1]
- The pre-feasibility study was to be done for the following sections and separate reports comprising of all the aspects may be considered and reproduced for (a) section between Chennai-Bangalore; Chennai-Bangalore-Coimbatore-Ernakulam via Mysore and Chennai-Bangalore-Coimbatore-Ernakulam with a branch line to Mysore. [1]
- Pre-feasibility study underway by consortium led by JARTS and Oriental Consultants. [2]
- Japanese study team submitted a positive interim report to Railway Ministry in Oct 2012. [2]
- The Indian Railways gave the go ahead for conducting a feasibility study on the Chennai-Bangalore-Coimbatore-Ernakulam-Thiruvananthapuram route. [2]
- There was a plan to either include Mysore in the main route or to create a branch line to that city. [2]
- With the Railways' move, the Karnataka State government decided not to commission a separate feasibility study on implementing a high-speed train between Bangalore and Mysore. [2]
- The pre-feasibility study was to be tabled in Parliament and the final feasibility study was to begin in April 2012. [2]

Source-[1] http://www.thehindubusinessline.com/todays-paper/tp-others/tp-states/chennaiernakulam-high-speed-rail-corridor-to-be-extended/article2583370.ece
[2]http://indianrailways.informe.com/forum/message121169.html; Accessed on 13 Dec 2013

Delhi-Agra-Lucknow-Varanasi-Patna

- Study in progress by Mott McDonald, Britain-inception report, interim reports I & II, and draft final report submitted to ministry of railways. [1]
- This project has passed the first barrier with the rail ministry accepting a survey report and giving it the go-ahead, said a senior officer of North Central Railway. [2]

Source –[1] http://ecor.railnet.gov.in/DOCUMENTS/IRJ.IR.High.Speed.Plans.pdf
[2]http://www.hindustantimes.com/india-news/patna/patna-delhi-journey-in-4-hours-yes-yeh-ho-sakta-hai/article1-1072938.aspx; Accessed on 11 Dec 2013

Delhi-Jaipur-Ajmer-Jodhpur

- Delhi-Jaipur high speed corridor was proposed initially in Railway Budget 2011-12. [1]
- In Railway Budget 2012-13, addition of Ajmer and Jodhpur were announced by then Railway Minister Dinesh Trivedi. [1][3]
- The 591-km-long Delhi-Jaipur-Ajmer-Jodhpur route is slated to be taken up for pre-feasibility study for introducing bullet trains, which run at a speed of 350 km per hour, and an announcement to this effect is likely to be made on March 14.[2]
- Pre-feasibility studies on six high speed corridors already completed; study on Delhi-Jaipur-Ajmer-Jodhpur to be taken up in 2012-13. [3]

Source-[1] http://articles.timesofindia.indiatimes.com/2012-03-15/rail-budget/31197657_1_world-class-railway-bullet-train-railway-board
[2]http://www.indiatvnews.com/print/news/high-speed-trains-from-delhi-to-jodhpur-mumbai-in-rly-budget-1495-90.html;
[3]Highlights of railway budget 2012-13, Accessed on 14 Dec 2013

Thiruvananthapuram-Mangalore

- The Kerala State Industrial Development Corporation (KSIDC) was appointed as the nodal agency to develop the project. The Delhi Metro Rail Corporation (DMRC) conducted the pre-feasibility study of the project. [1]
- The pre-feasibility report recommended that the project should be extended by another 42 km to Mangalore instead of the original proposal for the northern terminus to be at Kasargod, as the projected traffic load tapered to a thin margin between Kozhikode and Kasargod.[2]
- The proposed Thiruvananthapuram-Kasaragod high-speed rail corridor is likely to be extended to Udupi. Karnataka government has written to Kerala officials in charge of the project suggesting such an extension.[3]
- In September 2011, a special purpose vehicle, the Kerala High Speed Rail Corporation Ltd. (KHSRC) was formed to implement the project.[4]
- The Ministry of Railways has stated that the project is feasible and has expressed full support for the project except for giving any financial support to the project. The construction will be taken up by Indian Railways.[1]
- The project is estimiated to cost Rs 1.20 lakh crore.[5] 80% of the cost will be funded by JICA and the remaining 20% by the State and Central governments.
- The proposed stations are Thiruvananthapuram, Kollam, Chengannur, Kottayam, Kochi, Thrissur, Valancheri, Kozhikode, Kannur, Kasargod and Mangalore.[6]

Source-[1] http://en.wikipedia.org/wiki/Thiruvananthapuram%E2%80%93Mangalore_high-speed_passenger_corridor

[2] "DMRC survey not final: Collector". Deccan Chronicle. 2012. Retrieved 2012.

[3] http://articles.timesofindia.indiatimes.com/2012-07-07/kochi/32577054_1_rail-corridor-high-speed-rail-high-speed

[4] "Kerala's High Speed Dilemma". Yentha.com. 8 August 2012. Retrieved 2012.

[5] T Ramavarman, TNN Jul 7, 2012, 05.27AM IST (2012-07-07). "High-speed rail corridor may go up to Udupi". The Times of India. Retrieved 2013-03-11.

[6] "Thiruvananthapuram: Work on high speed rail corridor to begin in 2014“. Ibnlive.in.com. 2012-08-10. Retrieved 2013-03-11.

Accessed on 14 Dec 2013

Agitations Threaten to Derail Kerala High-speed Corridor

- The Rs 1.20-lakh crore Thiruvananthapuram-Mangalore high-speed passenger corridor project has received two major blows in the form of mounting protests and the rupee decline.
- The Anti-High Speed Rail Corridor Committee recently submitted a petition before the Parliamentary Committee on Travel, Tourism and Transport against the project. The response to the petition is awaited.
- The estimate of the project was prepared when the rupee was at 55 against the US dollar, but because of depreciation, the project would now incur an additional cost of about Rs 27,000 crore.
- Agitators claim that around 60,000 houses would be brought down and 2.5 lakh people displaced if the project is implemented.

Source- http://www.newindianexpress.com/nation/Agitations-threaten-to-derail-Kerala-high-speed-corridor/2013/09/05/article1768706.ece; Accessed on 15 Dec 2013

Route Map

Source- http://www.khsrcl.in/route.aspx ; Accessed on 15 Dec 2013

Route

From	To	Travel Time from Trivandrum	Travel Time from previous station	Travel Time (Non-stop)
		(in minutes)	(in minutes)	(in minutes)
Trivandrum	Quilon	15	15	
Trivandrum	Kottayam	37	22	
Trivandrum	Kochi	53	16	42
Trivandrum	Thrissur	72	19	
Trivandrum	Kozhikode	98	26	79
Trivandrum	Kannur	119	21	96
Trivandrum	Kasaragod	142	23	115
Trivandrum	Mangalore	156	14	124
		Total time	156	

Source- http://www.khsrcl.in/route.aspx ; Accessed on 15 Dec 2013