Global Rail and Energy Workshop

Session 4:

Role of rail in India's development objectives

Prashant Mishra
General Manager (Elect.)
National High Speed Rail Corporation Ltd
NHSRCL

Presentation Outline

- **Mumbai- Ahmedabad HSR (MAHSR) Project overview**
- **India’s other High Speed Rail studies**
- **MAHSR Benefits**
- **“Make in India” Objectives**
- **MAHSR other related issues**

Mumbai- Ahmedabad High Speed Rail (MAHSR) Brief

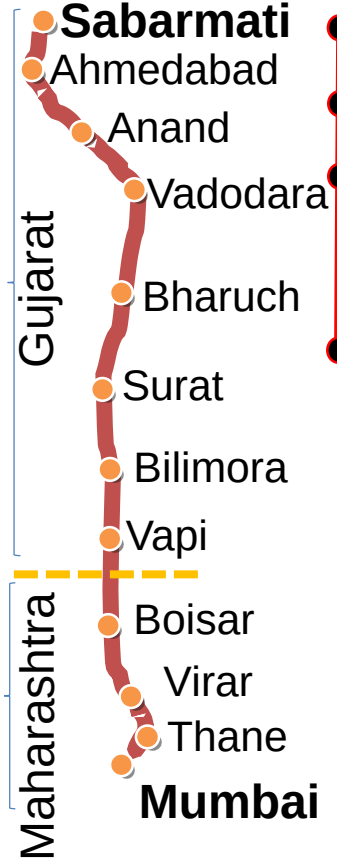
- MAHSR **Project** is the **first HSR project** in India.
- **National High Speed Rail Corporation Limited** (NHSRCL), a Government company, Incorporated in 2016,
  - is implementing the Project.
  - Jointly owned by Government of India and participating State Governments (i.e Gujarat & Maharashtra)
  - It will later operate and maintain MAHSR

•**Funding-** by Japanese loan – nearly 81% of the project cost, 0.1% interest, 15 years moratorium and 50 year return period

•Project to be implemented in **short time span of 6 years**.

Overview of Project

Total Length: 508.09 Km



- **460.3 Km** Viaducts (**90.6%**)
- **9.22 Km** Bridges (**1.8%**)
- **25.87 Km** Tunneling (**5.1%**)
  (Longest Tunnel: 21 Km with 7 Km undersea)
- **12.9 Km** Cut/Fill (**2.5%**)

Stations: 12 (8 in Gujarat & 4 in Maharashtra)

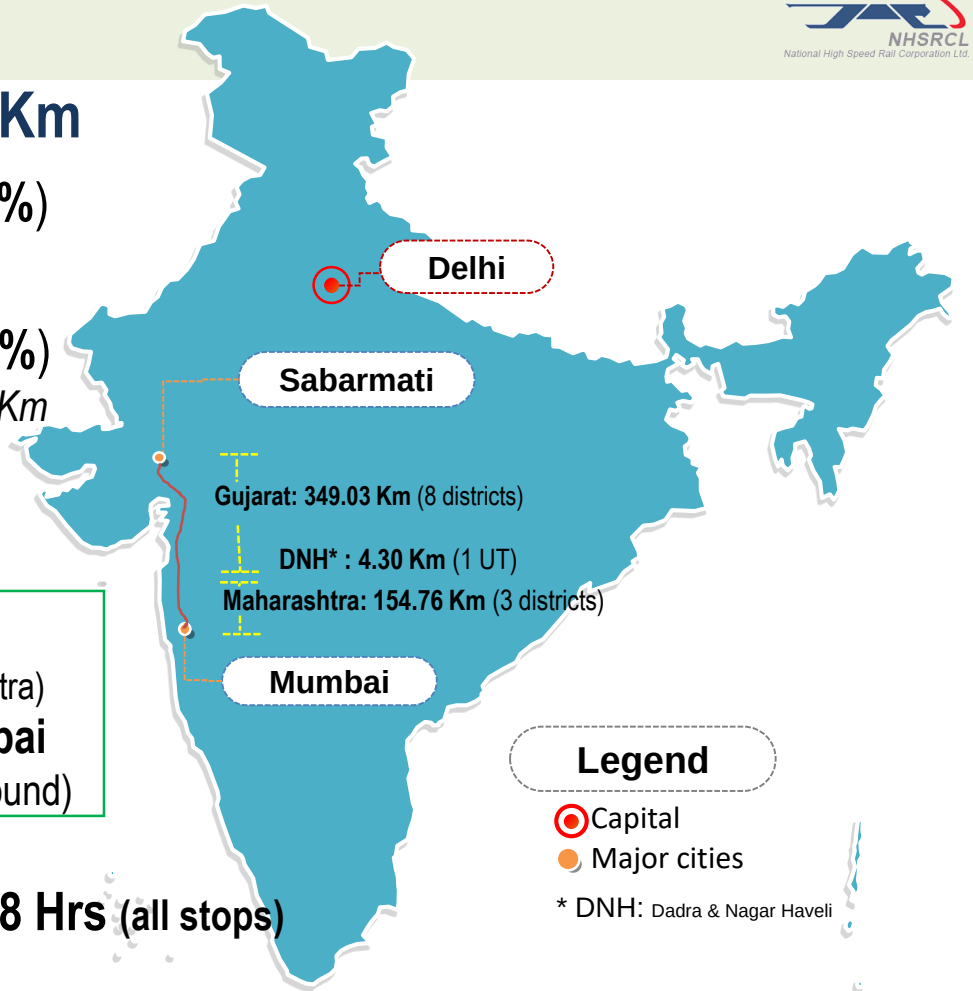
All elevated except Mumbai (underground)

Travel Time:

2.07 Hrs (limited Stops) **2.58 Hrs** (all stops)

COST: INR 1,080 Billion

(including all escalation, Interest during Construction, taxes/duties)



Salient features of Project

Total Length	**508.09 Km** *(Maharashtra 154.76 Km, Gujarat 349.03 Km, Dadar & Nagar Haveli (UT) 4.30 Km)*
Gauge	**Standard Gauge**
Speed	Design: **350 Kmph**, Operating: 320 Kmph
Travel time	**2.07 hrs** (limited stops) , 2.58 hrs (all stops)
Stations	**12 numbers** [**Maharashtra 4 nos** *(Mumbai, Thane, Virar, Boisar),* **Gujarat 8 nos** *(Vapi, Bilimora, Surat, Bharuch, Vadodara, Anand, Ahmedabad, Sabarmati)*]. ***All elevated except Mumbai (underground).***
Alignment	**460.3 Km** *Viaducts*, **25.87 Km** *Tunneling*, **12.9 Km** *Embankment/cutting* and **9.22 Km** *Bridges*.
Longest Tunnel	**21 Km** with 7 Km under sea.
Longest Bridge	**River Vaitarna**, 1,950 m.
Estimated Completion Cost	**INR 1080 Billion** *(including all escalation, Interest during Construction, taxes/duties)*

Salient features of Project

TRAIN OPERATION PLAN (Source: Feasibility Study)

	Year	2023	2033	2043	2053
Train Configuration		**10**	**10/16**	**16**	**16**
Number of Rakes		**24**	**24 +11**	**44**	**71**
Number of Trains (per day/one-direction)		**35**	**51**	**64**	**105**
Train Capacity		**750**	**750/1250**	**1250**	**1250**
Traffic Volume (day/one direction)		**17,900**	**31,700**	**56,800**	**92,900**
Number of Trains (per day/hour/one-direction)	**Peak Hour:**	**3**	**4**	**6**	**8**
	Off peak:	**2**	**3**	**3**	**6**

Operational Control Centre: **Sabarmati**

Maintenance Depot/Workshop (Rolling Stock): **Thane, Sabarmati**

Salient features of Project

- **Power supply**: 12 Traction substations, 2 Depot substations and 16 Distribution sub stations (12 Stations, 2 Depots & 2 Tunnel)
- **OHE**: 2X25 KV, Heavy Compound Catenary System
- **Signalling**: DS- ATC similar to Shinkansen
- State of the art **High Speed Railway Training Institute** at **Vadodara**
- **Annual Energy consumption (2024)** (Trains, Stations etc)- 1100 million units

Yearly Estimated load -MAHSR (MVA)

TRACTION SUBSTATION(TSS)				*DISTRIBUTION SUBSTATION (DSS)*	
SN	Location	Load		Location	Load
		2023	2053		
1	Mumbai	8.4	42	Mumbai	20
2	Thane/Depot	5.7	35	Thane creek /drainage post-1	0.35
3	Thane	19.1	63	Thane creek /drainage post -2	0.15
4	Virar	19.1	71	Thane Station	7.4
5	Boisar	19.1	64	Thane Depot	10
6	Vapi	19.1	70	Virar Station	7.8
7	Bilimora	19.1	80	Boisar station	7.8
8	Surat	19.1	78	Vapi Station	7.8
9	Bharuch	19.1	67	Bilimora Station	7.8
10	Vadodara	19.1	74	Surat Station	7.8
11	Anand	19.1	76	Bharuch Station	7.8
12	Mahmedabad	19.1	63	Vadodara Stn	7.8
13	Ahmedabad	8.7	45	Anand Station	7.8
14	Sabarmati/Depot	5.7	35	Ahmedabad Stn	7.8
15				Sabarmati Stn	8.4
16				Sabarmati/Depot	20.9

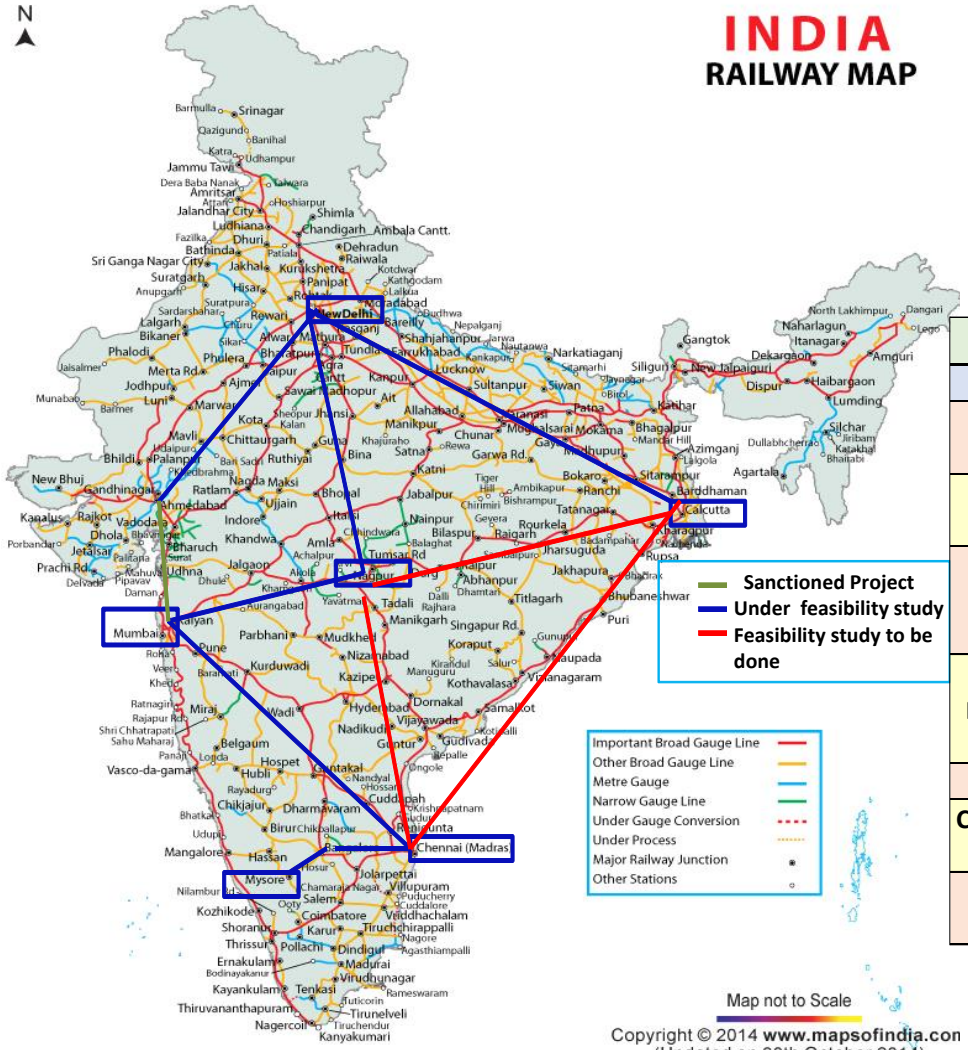
Status of the Project

- Ground Breaking by Hon'ble PMs of Japan & India - 14.09.17
- **Technical Standards of MAHSR**:-
  - Schedule of Dimensions (SOD)- Finalised
  - Manual of Specification & Standards(MSS) - Finalised
- Design of Horizontal alignment completed.
  - LiDAR, DGPS, Hydraulic, Utility Shifting Survey & Geotechnical Investigation completed
  - Most of **Bid documents** are in the final stages and all Bids would be floated in the next three months.
  - **Land acquisition** is different districts is in various stages and expected to be completed in 2019

Status of the Project

- **Power supply –**
  - Power requirements for all 14 TSSs and 16 DSSs finalised
  - Applications for all substations submitted in Jan 2018
  - Survey works completed, payments against estimates being made
- **Training Institute Hostel and slab track being constructed** in Vadodara.
- Training Institute with all equipment, simulators, 128 m HSR track would be ready by 2020

INDIA
RAILWAY MAP



India's High Speed Rail (HSR)- Feasibility studies

Section	*Route*	*Status*
Delhi-Mumbai	Delhi – Gurgaon – Jaipur – Ajmer - Udaipur – Ahmedabad	To be completed in 2018
Delhi-Kolkata	Delhi – Lucknow – Varanasi – Patna - Dhanbad – Asansol - Kolkata	Report under review
Mumbai- Chennai	Mumbai – Pune – Kolhapur (Spur line to Goa)-Belgaum – Hubli – Dharvad – Bangalore - Tirupati - Chennai	To be completed in 2018
Mumbai – Kolkata	Mumbai – Thane – Nasik – Aurangabad – Akola – Amravati - Nagpur	To be completed in 2018
Delhi – Chennai	Delhi - Nagpur	To be completed in 2019
Chennai-Bengaluru-Mysuru	Options under discussion	To be completed in 2019
Kolkata- Chennai		Study agency being finalised

Mumbai –Ahmedabad High Speed Rail Project Benefits

1. **Reduction in train travel time from approx. 8 hrs to 2 hrs.**
2. **Connectivity and ease of travel**:
    - Initially 3 trains per hour per day (in each directions, during peak hours) which will increase to 8 trains per hour per day (in each directions, during peak hours)
    - Initially on the commissioning of the Project, daily users are expected to be 36000 persons/day (both directions) which will increase 156000 /day (both directions) by 2053.

3. **Safety**:

- Based on Shinkansen design, which has a record of “0 passenger fatalities” in more than 50 years of operation.
- Equipped with Disaster Prevention System.
- Dedicated railway track with no level crossings.

Mumbai –Ahmedabad High Speed Rail Project Benefits

4. Eco friendly: CO_2 emission per km travelled is one- fourth of an aeroplane and two- seventh of a car. *(UIC report)*

5. Energy saving: Energy consumption per km travelled is one- third of an aeroplane and one fifth of a car *(UIC report)*

6. Transit oriented Development (TOD) and urbanisation-

- Enhanced labour mobility, Real Estate Development and growth in service sector
- Project will facilitate development of semi urban areas i.e. Virar, Boisar, Vapi, Bilimora etc.

7. Comfortable with amenities for Divyang Passengers, women:

- Comfortable, Silent ride.
- Rotating seats, Special seats for Divyang Passengers.
- Vacuum toilets, exclusive toilets for Divyang passengers and women

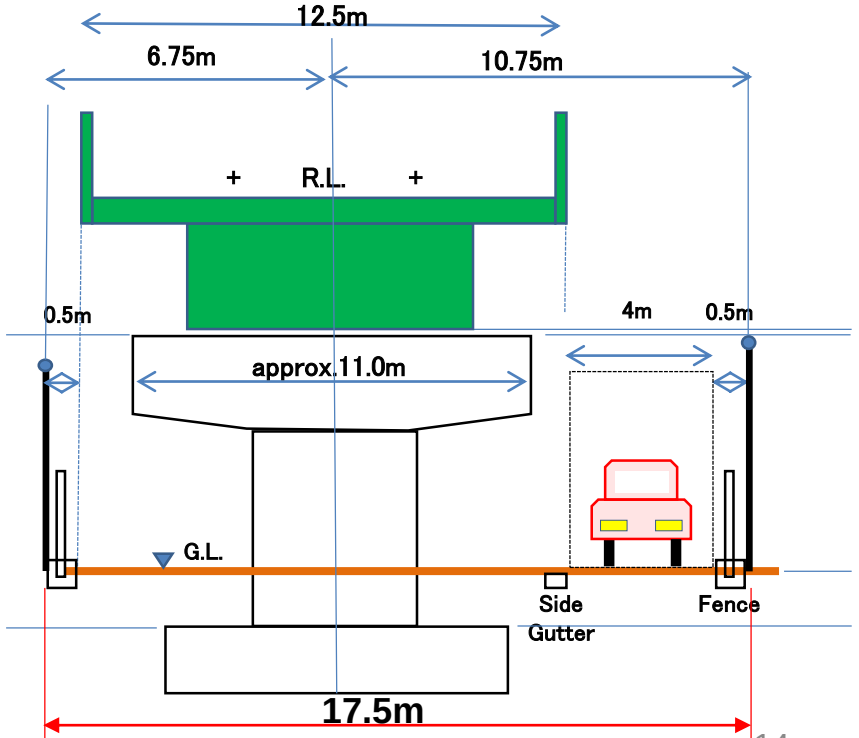
"Make in India" –Plans

- As per the agreement between Governments, the MAHSR Project has "Make in India (MII)" & "Transfer of technology" objectives.
- **Potential items & sub-systems for "make in India" in four Sub groups- Track, Civil, Electrical & S&T, Rolling Stock have been jointly agreed** under guidance of Department of Industrial Policy & Promotion (DIPP), Japan External Trade Organisation (JETRO) .
- Most of the Civil Work material, large number of Power supply Equipment, some track equipment and six of the 24 trains would be "made in India"

Minimizing land Acquisition- saves time

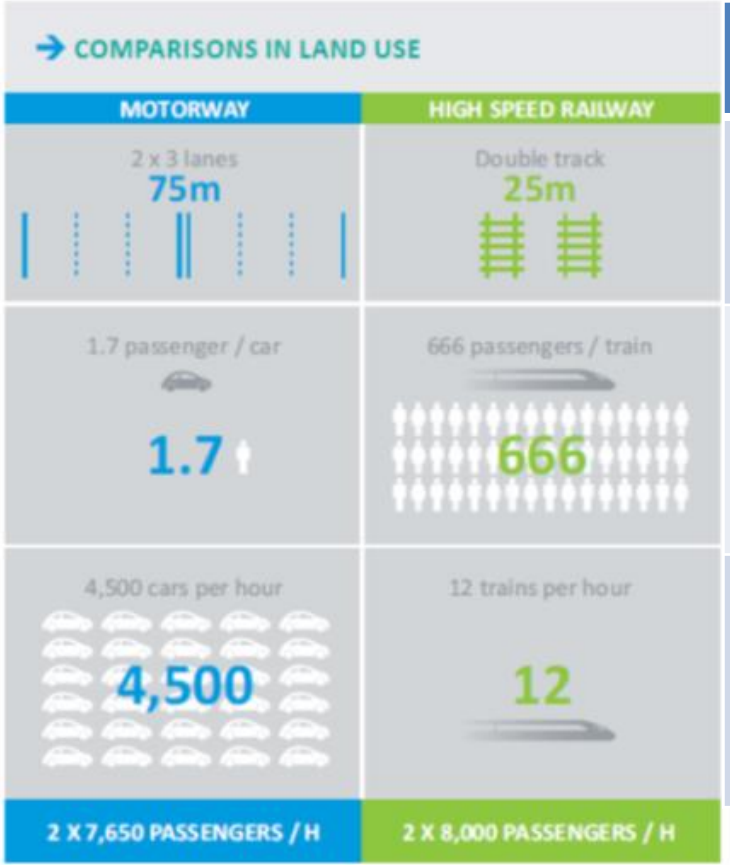
More than 90% of the alignment has been changed to **viaduct structures** although the **feasibility report** had **proposed** more than **60%** on **embankment.** This

- **Reduces requirement of land (17.5 m width against 36 m)**
- **Ensures no obstruction to natural flow of waters**
- **provides crossing at all places, sufficient clearance of 5.5m (highest for roads) is available over existing road network**
- **Greatly improves safety and security perception against external interference**



(Typical Cross-section of HSR main-line for the purpose of Land Acquisition)

Land Use better than other HSR



MAHSR
Double track **17.5 m**
• **Initially 750 passengers /train** *(2023)* • **increases to 1250 pass/train** *(2053)*
Peak 16 trains/ hour in both directions *(2053)*

Source: UIC *(Land Use comparison)*

Energy options in MAHSR

- **Increased energy efficiency needs no elaboration-** UIC reports* and worldwide experiences confirm that HSR has lower energy intensity compared to conventional trains.
- MAHSR has the potential to reduce emission by sourcing electricity from renewable sources (Solar) mainly because:
  - Large solar plants planned in Gujarat & Maharashtra encourage this possibility for non traction Railway loads
  - Possibilities to source part of power demand from renewables is being examined.
- NHSRCL being a deemed transmission & distribution licensee allows economical power procurement.

**UIC: High speed, energy consumption and emissions (Dec, 2010)*

MAHSR and Air transport

- Too early and MAHSR is only one segment
- Other than reduced time travel time from home to destination, MAHSR would be preferred over air travel because:
  - it would be more reliable operating in all weather conditions. Air services get disrupted due to inclement weather.
  - not being dependent on imported fuel, unlike Airlines which do not have any control over the cost or supply of fuel and planes too..
  - It’s ability to serve multiple city-pairs, both direct and overlapping e.g Thane, Vadodara, Surat etc unlike air lines.
  - Being more eco friendly
  - India has a long “rail travel culture” and history.

THANK YOU