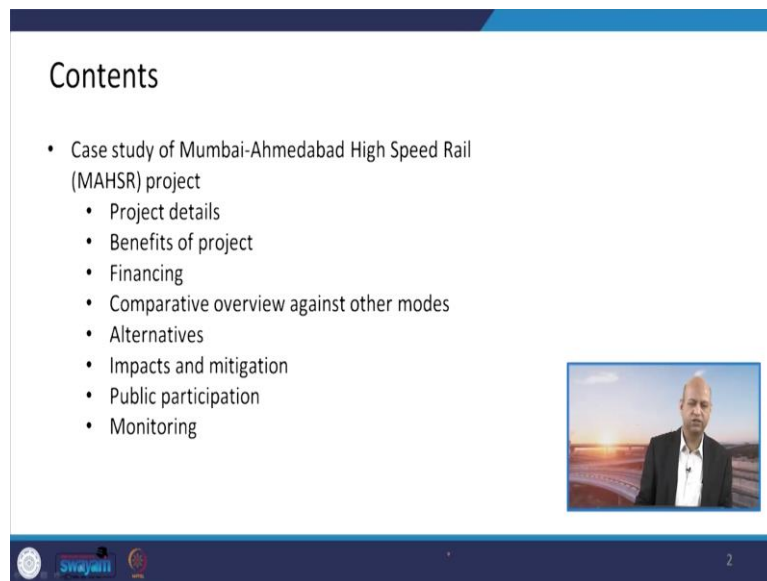


Sustainable Transportation Systems
Professor. Bhola Ram Gurjar
Department of Civil Engineering
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Lecture No. 17
EIA Case Study I

Hello, friends. So, by now, I am sure you are aware of several important features or aspects of EIA, that is environmental impact assessment. And we have also discussed several techniques methodologies processes of EIA, even including best practices across the world, which have been, implemented in several projects in different countries.

Today, we will discuss about one case study based on the EIA report that is Mumbai-Ahmedabad High Speed Rail project. So, we have taken several important features from the EIA report as well as other information sources and we will put forward, how this project got evolved? And what are important features? How they are addressing to those components, which are related to environmental impacts or environmental influences?

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So, first of all, we will discuss like project details in brief, what kind of project it was envisaged and how it is being implemented? Then, what are the benefits of the project? Why this project was proposed? What would be the benefits when this project will be completely operational?

And then finances because, every kind of infrastructure project needs huge financial resources to construct that, to implement that. So, what are the sources of finances for this project? And then the comparative overview against other modes means, if for example,

rather than this high speed railway, we would be having normal trains or the roads, highways etc., then viz-a-viz what is the difference, how in terms of speed, in terms of time saving, in terms of cost everything. So, those alternatives will be discussed.

Then we will see the impacts and mitigation means major impacts and the mitigation, how they were, reported in the EIA assessment report, and then public participation because that is one important aspect. In last lecture, you might have seen that, if we go for genuine public participation, then we get very good feedback and the project becomes more viable.

So, public participation in this particular project, how it has been carried out, that would also be discussed. And then the monitoring of the project, we will see what are the ways to get monitoring of this project means, whatever recommendation of EIA, then what are the monitoring process for those implementation of recommendations.

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Mumbai- Ahmedabad High Speed Railway (MAHSR) Project

- First proposed in the Indian Railways' 'VISION 2020' released by the Ministry of Railways, Govt. of India.
- High speed corridors allows speeds up to 350 kmph.
- To use Shinkansen trains from Japan
- Connects Mumbai to Ahmedabad through high speed rail line
- Completion expected by year 2028.

The slide includes two images: a green and white high-speed train with 'Ahmedabad - Mumbai' written on its side, and a man in a suit talking on a mobile phone.

Well, so, Mumbai-Ahmedabad Speed Railway project it was part of Indian Railways 'VISION 2020' document which was released by Ministry of Railways, government of India. And the high speed corridors allows speeds up to 350 kilometre per hour so, that way lot of time saving is there, if we travel through these kind of transportation modes. Now, it was decided that this Shinkansen trains of Japan which is popularly known as bullet trains, that technology will be used in our case also.

So, several technologies were compared and because of its good feedback and good record, this was selected. And then like, of course, as it is also visible by name that it connects Mumbai and Ahmedabad but, there are several in between stations which will also be

connected. And the completion of this project is expected by year 2028. So, because this is challenging project, huge project it takes time. Well, what is the importance of this Shinkansen train? Why this was selected?

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Shinkansen Train

- Shinkansen is popularly known as 'Bullet Train'.
- Famous for zero causality caused by train accident (in 50 years time with 10 billion passengers)
- Literal meaning of 'Shinkansen' is "New trunk/main line".





Image source: popularmechanics.com

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So, you can see, it is also known as bullet train. It is famous for zero casualty caused during its 50 years run, and 10 billion passengers it has catered, but still there is no casualty in any and there is no major accidents. There may be a little bit some very minor kind of thing, but there was no casualty across its time span till now. Plus, well this is the, I mean what is the meaning of Shinkansen? So, it is like new trunk, main line in Japanese this name is.

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EIA report of Mumbai- Ahmedabad High Speed Railway (MAHSR) Project

Project Proponent: **National High Speed Rail Corporation Limited (NHSRCL)**

Report of EIA prepared by-

- GPS Technologies Pvt. Ltd: S-EIA Report, collection and assessment of primary / secondary environmental data
- NHSRCL / RITES: Land Acquisition Plan and related details
- ARCADIS: Resettlement and Rehabilitation Action Plan

RITES: Rail India Technical and Economic Services
NHSRCL: National High-Speed Rail Corporation Limited



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Well, so, this National High Speed Rail Corporation this EIA report for this particular project was prepared by GPS Technologies Private Limited and collection of data, then assessment of primary and secondary environmental data, all these activities were taken care of by GPS Technologies Private Limited.

Then RITES, that is Rail India Technical and Economic Services and this National High Speed Rail Corporation Limited, NHSCCL this abbreviation of National High Speed Rail Corporation Limited. So, they were involved in land acquisition because they are the, basic promoters of this particular project.

So, the land acquisition plan and related other activities or details, so, RITES and NHRCL were responsible for that. Then one other organisation was responsible for like resettlement and rehabilitation action plan, that responsibility was taken by this ARCADIS, which is again very famous organisation management related organisation.

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The slide is titled "National High-Speed Rail Corporation Limited (NHSRCL)". It contains three bullet points: "NHSRCL was incorporated on 12th February 2016 under the Companies Act, 2013.", "Finance, construct, maintain and manage the high-speed Rail Corridor in India. modelled as 'Special Purpose Vehicle' in the joint sector", and "Equity participation by Central Government through Ministry of Railways and two State Governments viz. Government of Gujarat and Government of Maharashtra." To the right of the text is the NHSRCL logo, which features a stylized train and the text "NHSRCL National High Speed Rail Corporation Ltd.". Below the logo is a small video inset showing a man in a suit speaking. At the bottom of the slide, there are logos for "Swayam" and "6".

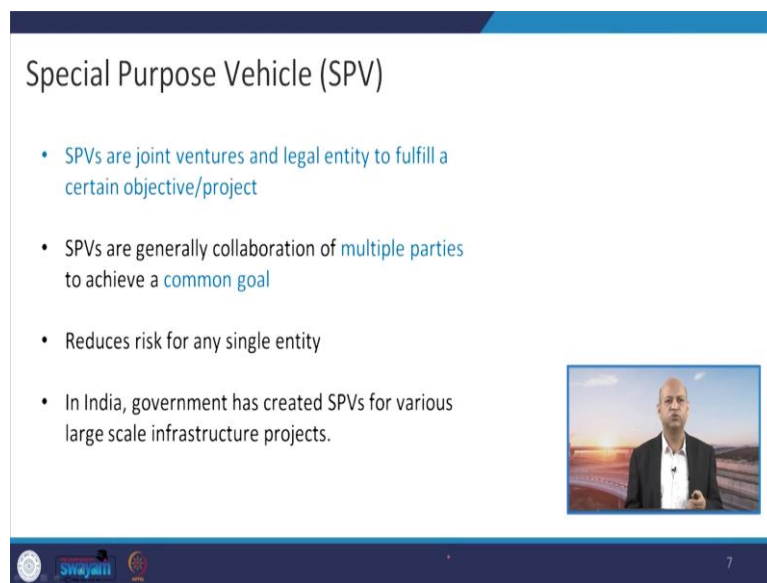
And in if you see this timeline when it was envisaged so, this particular corporation that is National High Speed Rail Corporation Limited, it was incorporated in 2016 under the Companies Act 2013 that is act provision where this was incorporated. Then, how this lot of money would be required for running this particular project to execute this project.

So, the financial matters or construction or maintaining, or management activities, all these were taken care of by a special purpose vehicle, SPV. This is way of doing things when you have multimodal projects or big projects, large infrastructure projects. So, this is special

purpose vehicles are the way, it is a kind of joint activity or joint venture by several organisations.

So, this is the project of central government through Ministry of Railways, and this state governments of Gujarat and Maharashtra are also involved. So, that way this SPV was created to join hands to make these three central government and to state governments join hands to execute this project.

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The slide is titled "Special Purpose Vehicle (SPV)" and contains the following bullet points:

- SPVs are joint ventures and legal entity to fulfill a certain objective/project
- SPVs are generally collaboration of multiple parties to achieve a common goal
- Reduces risk for any single entity
- In India, government has created SPVs for various large scale infrastructure projects.

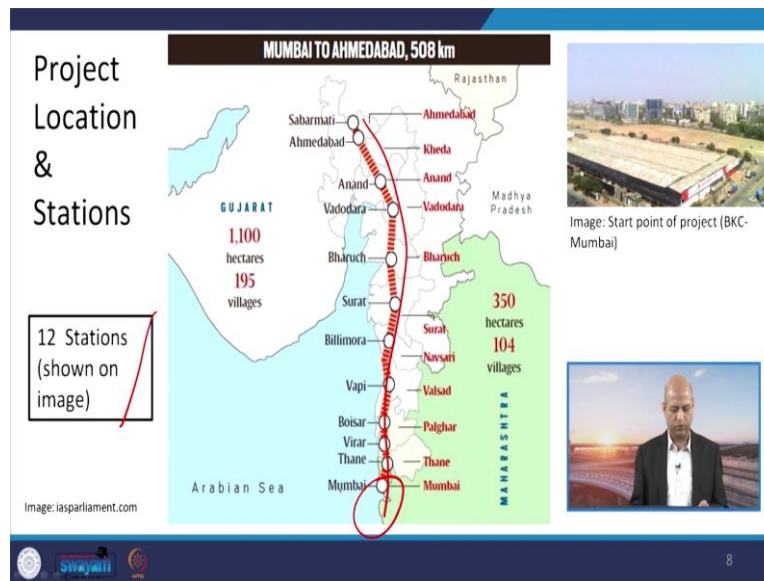
There is a small video inset on the right side of the slide showing a man in a suit speaking. At the bottom of the slide, there are logos for "Swayam" and "7".

And what were the importance of this SPV, why do we need? So, basically these SPVs are joint ventures as I said, and these are legal entities like a company or that kind of legal entity which has certain rights, responsibilities, everything. And to fulfil certain objectives and projects, so, these SPVs are created. And they are generally as I said, joint ventures or collaborations of multiple parties to achieve the common goal which has been set by these partners, partner organisations.

Well, why it is needed? Because sometimes for large projects, huge projects, single entity has huge risk. So, when there are so many partners, then risk is reduced, that is one advantage. And also, because when different governments or different organisations are involved in carrying out a project, then it is good that they join hands like a partnership.

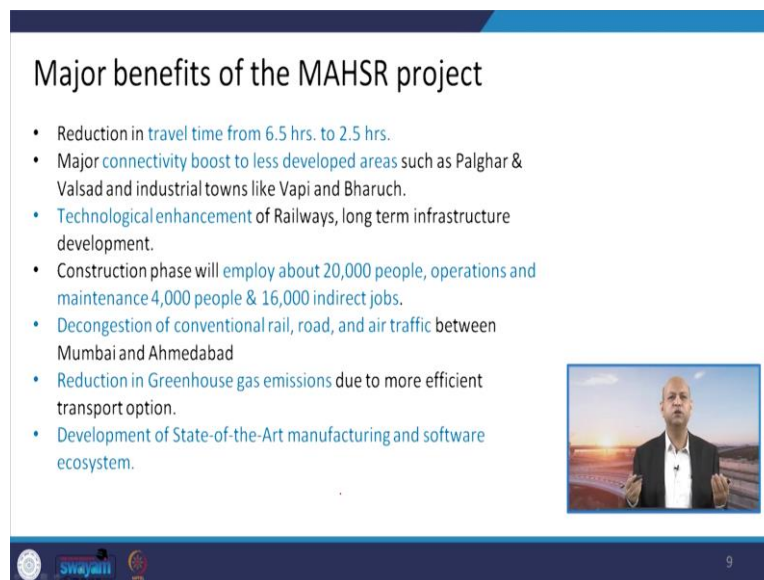
So, this SPV helped to execute that project in a smooth way. Otherwise, when one is owning one project, another one is only for giving some permissions etc., so, sometimes time is taken, lot of time is taken.

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Well, if you see this, this map this line, where this Mumbai to Ahmedabad 508-kilometre track will be there for this particular project and 12 stations which are shown here like Sabarmati, then Ahmedabad, Anand, Vadodara, Bharuch, Surat, so, that way it will reach Thane and then Mumbai. So, this is the basically route for this particular project.

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And if we, see the major benefits through this project then one major advantage is reduction of the time in significant way. For example, at present around 6.5 hours average is taken this travel time and this will be reduced to around 2 to 2.5 hours. And the connectivity will boost development activities of some underdeveloped areas like Palghar, Valsad and industrial towns like Vapi and Bharuch. So, they will have better connectivity.

Then technological enhancement, because this is the new technology for us and this will give way to learn many things and to implement in other sectors. So, several technological innovations will be implemented in this project. So, this is one more example or example of the advantage.

Then construction phase will employ around 20,000 people. So, employment generation is also there, a skill development is also there, we will see in another slide that not only the skill development of the employees, but those population which will be affected this project will take care of to enhance their skills to make them more employable.

Then operations and maintenance 4,000 people and 16,000 indirect jobs. So, many families will be benefited by this project. Then, it will also help in decongestion of other routes like railways, roads, air traffic because many people will travel through this particular mode of transport very quickly. So, the pressure on other modes will be released.

If you see in terms of like environmental benefits, then there is a lot of greenhouse gas emissions reduction, because when we are travelling through road, or through air, or through other means, then lot of greenhouse gas emissions are there which are responsible for climate change as you know.


So, with this particular efficient technology, there will be huge reduction in greenhouse gas emissions in total like if we calculate per passenger, per kilometre, then we will have very less amount of greenhouse gas emissions. And then of course, it will help in developing as I said new technologies and new innovations.

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Benefits over other modes of travel

Aspect	MAHSR	Railway/Road/Air
Land Use	2.8 ha/km Minimal change in land use pattern	9.3 ha/km Change at large scale (New roads will be required in future)
Travel Time	2 hr. Better connected to local transport	6-12 hr. (Rail) 1.25 hr (Air) Airports are not easily accessible in many cities
SHG (Greenhouse Gas) emission	10% annual reduction wrt no change 81400 Tons CO2 over 15 years	6 times by 20250 1.4 Metric Tons CO2/km by 2050
Fuel Consumption	Significant reduction due to mode change	Steep increase if no change

Possible benefits and after comparison w.r.t. other modes, this project can be said 'feasible to implement' (from development point of view)



MAHSR: Mumbai-Ahmedabad High Speed Rail

So, as I said, if we compare in terms of quantities, so, there is huge benefits in terms of land use or travel time and the reduction in greenhouse gases plus fuel consumption. So, there are lot of benefits in terms of these particular dimensions.

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The slide is titled "Financing of project" and contains the following information:

- Estimated cost of the MAHSR is INR 1.08 Lakh Crores.
- Government of Japan has agreed to provide a soft loan of 12 Billion USD at 0.1% interest.
- Repaid over 50 years and includes a 15-year grace period.
- The loan will be made available through Japan International Cooperation Agency (JICA).

A callout box titled "Grace period" defines it as:

- Term generally used in international landings.
- Time period in which, annual payments are not required

The slide also features a small video inset of a man speaking and a footer with logos and the number 11.

Now, the issue of finances, so, the estimated cost is very huge around 1.08 lakh crores. One crore is how much? 10 million. 1 million is 10 lakhs, one crore is 10 million. So, that way it is a huge cost which will be there for financing of the project, but this project will be funded by government of Japan through JICA, that is Japan International Cooperation Agency.

And this will be repaid, this soft loan will be repaid over the 50 years and 15 years grace period is also there in case something happens and we are not able to repay. So, this 0.1 percent interest means soft loan is there. So, that is a kind of support from Japan, because Japan has this policy of supporting their friendly nations, promoting good technologies.

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Alternative consideration in project planning

3 alternatives were considered:

- Alternative 1- HSR with Viaduct / Bridges and Tunnels ✓
- Alternative 2- HSR with Embankment and Bridges and Tunnels ✓
- Alternative 3 – No-HSR - Business-as-Usual (BAU) ✓

BAU

- Business as usual condition is 'no change' situation.




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Then when this project was envisaged and different scenarios were compared. So, the alternatives were also compared, like alternative 1 was high speed rail with viaduct and bridges and tunnels or high speed rail with embankments like the tracks which will be seeing picture in next slide and bridges and tunnels.


And then alternative 3 means no high speed rail just only business as usual BAU scenario, so no change scenario and high speed rail with embankment and bridges and tunnels and high speed rail with viaduct that is above the ground, those kind of bridges etc.

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Viaduct Vs. Embankment Rail




Elevated rail section (viaduct)



Rail line on embankment

Image source: railwaymagazine.co.uk, researchgate.net



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So, this is elevated rail viaduct. So, elevated rail section and this rail line on embankment. So, this occupies lot of land, the land acquisition those kinds of issues are quite critical in our


country. As you know several projects have faced these kinds of problems when land acquisition is the prime part of that project.

So, in this only very small land is being used for pillars etc. Otherwise, and there is also like crossing, freeways are there for animals or other purposes, but for this lot of land acquisition must be there. So, investment needed more. So, that way we can compare that in means less amount of the land will be required in this particular proposal, in this particular alternative.

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Comparison among Alternatives

Aspect	Alternative-1 (with Viaduct)	Alternative-2 (with embankment)	BAU (Business as usual)
Length	508.17 km	508.17 km	538 km (Road)
Travel Time	2 hr. 07 min.	2 hr. 07 min.	8 hr. 52 min. (Car)
Travel Demand (by year 2023 per day)	40 thousand	40 thousand	38 thousand
Safety Level	High	High	Low
Cost	1080000 Million INR	709151 Million INR	N/A
Environment Impact	Minor damage but Thane creek not affected	Minor damage but Thane creek not affected	N/A
Land Use	2.8 hectare/km	3.2 hectare/km	7.5 hectare/km for conventional rail line



Well, if you compare different alternatives like alternative 1, which we have seen, the elevated one, then the embankment and BAU. So, lengths are same, but in this already existing the route is longer, 538 kilometre otherwise, it is around 508 kilometres. Journey time in both alternative it is same 2 hours around and this is 8 hours 52 minutes of course.

Then travel demand by the year 2023 per day that was estimated at that time 40,000, 40,000, 38,000 so, more people will use these kinds of alternatives. Safety level, very high safety level in this bullet train whereas in in comparison to the bullet train, the safety level is lower in the this BAU scenario or business as usual scenario.



Cost, no doubt where means technologies higher and so, many things, so, cost is higher. Environmental impact is we see then, business as usual means what whatever is going on that will go on, there will not any additional activities. So, environmental impact is not the case here, but in these alternatives, there will be some minor damage to the particular portions of that route, so, that will be taken care of.

And land use as earlier also we discussed only 2.8 hectare per kilometre is being used, whereas in this embankment related route, this was larger 3.2 hectares per kilometre and the present one is having longer route and other things, so, 7.5 hectares per kilometre for conventional rail line.

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Regulatory Requirements for lender (JICA) for impact assessment

- The MAHSR project is categorized as category A as per JICA's guidelines for environmental and social consideration (April 2010).
- These guidelines are like world bank guidelines for EIA.
- JICA (Japan International Cooperation Agency) is an international lender organization supported by Japan.
- Generally, provides loans on easy terms to countries having good terms with Japan.



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Well, regulatory requirements for lender means, whosoever funds the project they have their own conditions. There are certain terms and conditions which borrower has to fulfil. So, those guidelines from the regulatory requirements are there and that guideline also includes the EIA, very exhaustive EIA, very detailed EIA as World Bank also does.


So, similar JICA also has the guidelines for having the detailed EIA, so that one can know what are the real environmental impacts and how the mitigation measures will be taken to reduce those impacts.

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Regulatory clearance requirements for project implementation

Clearances related to:

- Diversion of forest land ✓
- Mangroves and wildlife (protected) areas
- Tree felling in various land types
- Coastal regulation zone
- Adverse environment impacts
- Occupational Health & Safety as well as Labor laws



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So, the diversion of forest land then there are some mangroves and wildlife protected areas which are in between the route, some tree felling cases are there at certain locations, then there are certain coastal regulation zones, adverse environmental impacts, occupational health and safety issues or labour laws, all these are the regulatory clearances required for this project implementation.


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Regulatory authorities for environment in consideration

- Ministry of Environment, Forest & Climate Change (MoEF&CC)
- Central/State Pollution Control Board (CPCB & SPCB)
- National/State Board for Wildlife (NBWL & SBWL)
- Forest Department (State- Gujarat & Maharashtra)
- National Green Tribunal (NGT) ✓
- National/State Coastal Zone Management Authority (NCZMA & SCZMA)
- Dahanu Taluka Environment Protection Authority (DTEPA)

DTEPA

Taluka level authority in Dahanu; created to protect natural habitat of tribal people in tribal district of Palghar.



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So, then, these are the agencies which are involved for all these regulatory requirements fulfilment, like MoEF Ministry of Environment and Forests and Climate Change, then Central and State Pollution Control Boards are there who are responsible for pollution levels and air quality or water quality and land and, then forest department is there, national green

tribunal is there. So, so, many environmental protection agencies, authorities or other legal agencies are there which have their own requirements which are to be fulfilled properly.

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Environmental Acts considered for assessment

- Environment (Protection) Act 1986
- Wildlife (Protection) Act 1972
- Air (Prevention and Control of Pollution) Act and Rules 1981
- Maharashtra Felling of Trees (Regulation) Act 1964
- Water (Prevention and Control of Pollution) Act and Rules 1974
- Maharashtra (Urban Areas) Protection and Preservation of Trees Act 1975
- The Indian Forest Act 1927
- The Wetlands (Conservation and Management) Rules 2010



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So, Environmental Acts considered for this assessment, what all these which are existing in our country like Environmental Protection Act 1986 and the Wildlife Protection Act of 1972, Maharashtra Felling of Trees Act 1964 that act is there. So, because Maharashtra government's land will be there. Similarly, Maharashtra Urban Areas Protection and Preservation of Trees Act 1975.

And then this Wetlands Conservation and Management Rules 2010, then Water Prevention Control Pollution Act, Air Pollution Control Act, Indian Forest Act, all these Acts have to be, all whatever provisions are there, one has to take care all those requirements.

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Environment attributes considered in MAHSR project

- Physiography & terrain
- Drainage
- Soil
- Geology & seismology
- Landscape
- Land use
- Ground subsidence
- Climate
- Climate change
- Water use/demand
- Water quality
- Water body
- Air quality
- Noise
- Vibration
- Ecology
- Protected areas
- Sensitive location
- CRZ (Coastal Regulation Zone)
- Forest & mangroves




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Well, so, the attributes of the environment which were considered to prepare this detailed EIA in this particular project of Mumbai-Ahmedabad High Speed Railway, so, these are like all physiography, geography, terrain, drainage, soil, geology and seismological aspects and then land use patterns or there are coastal regions also so, that is coastal regulation zone is also to be considered. Then ecology of every kind of section, air quality, noise all aspects have been taken care of.

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Landscape: Impact & mitigation measures

Impact	Mitigation
<ul style="list-style-type: none">• Construction of viaduct from Mumbai to Ahmedabad	<ul style="list-style-type: none">• Suitable (less impact to landscape) viaduct design was chosen
<ul style="list-style-type: none">• Bridges across the intersecting water bodies	<ul style="list-style-type: none">• Landscaping is effectively managed and minimize temporary visual impacts during construction
<ul style="list-style-type: none">• Permanent change in the vicinity of the proposed stations	<ul style="list-style-type: none">• Reduce the impact of the project and structures by additional tree planting wherever feasible to reflect the existing landscape character.• Landscaping at the station to improve aesthetics etc.



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Well, when we talk about impact and mitigation measures, so, if we see some examples like construction of viaduct from Mumbai to Ahmedabad, so it is suitable, because less impact to the landscape, it will not change landscape much more and that is why this elevation design



was chosen. And there is also no issue of land acquisition as I said, and that cost is reduced basically.

Then bridges across the intersecting water bodies, permanent change in the vicinity of the proposed stations that will be there of course, but as such in the field there will be less disturbance afterwards, during construction there will be of course disturbances and things will be taken care of.

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Deforestation: Impact & mitigation

Impact	Mitigation
<ul style="list-style-type: none">• Diversion of forest (138.3269ha. including 32.3902 ha. Of Mangrove).	<ul style="list-style-type: none">• Compensatory afforestation and planting of mangroves and trees shall be carried out as per regulatory requirement.
<ul style="list-style-type: none">• Removal of mangrove trees (24.3981ha.)	<ul style="list-style-type: none">• Construction of balancing culverts in coastal and mangrove areas, to maintain tidal water exchange.
<ul style="list-style-type: none">• 60000 trees are expected to be cut	



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Then deforestation like there are certain number of trees or mangrove trees. So, all these have to be removed, but in place of them there are provisions that some planting of additional mangroves will be done and the trees will be planted in the vicinity of those areas. So, that compensation properly will be done.

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Rise in Sea level: Impact of project & mitigation

Impact	Mitigation
<ul style="list-style-type: none">Impact of potential sea level rise on the alignment and station structures close to coastal area at BKC-Mumbai	<ul style="list-style-type: none">The structure and premises of proposed Station close to Mithi river designed taking into consideration of sea level rise of 1 m over a period of 100 years.

Annual global sea level rise is 3.6 mm per year in last decade




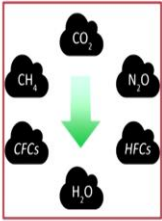
22

Rise of the sea level because as you know, because of global warming sea level is rising around 3.6 millimetre per year, is the average value of sea level rise. So, for designing of this project, this aspect has been taken care of and around this project can take care of even the sea level rise happens up to 1 metre. So, that kind of things have been included into design aspect, calculations.

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Energy consumption & GHG emissions: Mitigation measures

Impact	Mitigation
<ul style="list-style-type: none">Consumption of electrical energy for operation and at stationsAssociated indirect GHG emissions	<ul style="list-style-type: none">The Shinkansen HSR technology is relatively more efficient as compared to the conventional railway operation presently in use in IndiaEnergy star rated equipment and fixtures will be used to minimize the energy consumption (energy efficient motors and pumps, use of energy efficient lighting, energy efficient luminaires, adequate and illumination levels optimized as per tasks, and energy)offset to a large extent by the savings in GHG emissions due to expected modal shift from private vehicle road travel



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Then energy consumption and greenhouse gas emissions, as I said, because it will be run by electricity, some sources will be there of course, like fossil fuel based thermal power plants or it the electricity can be taken from other sources also, but in totality means because of the


speed, high efficient technology, the greenhouse gas reductions which we have seen in our table 10 % reduction of the greenhouse gases will be there.

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Dust & emissions during construction: Impact & mitigation

Impact	Mitigation
<ul style="list-style-type: none"> Gaseous emissions from construction vehicles 	<ul style="list-style-type: none"> All the vehicles shall have pollution Under Control (PUC) certificate
<ul style="list-style-type: none"> Fugitive dust emissions due to traffic movement 	<ul style="list-style-type: none"> Regular sprinkling of water on unpaved ways / access roads
<ul style="list-style-type: none"> Spillage and fugitive emissions arising out of construction materials 	<ul style="list-style-type: none"> The material shall be transported in covered An enclosure or barricading at such locations






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Dust and emissions during construction because construction activities cause lot of fugitive emissions etc. So, proper sprinkling of the water and those kind of ways are there they will be taken care of that way.

(Refer Slide Time: 23:16)

Noise during construction: Impact & mitigation measures

Impact	Mitigation
<ul style="list-style-type: none"> Noise emissions from construction equipment. 	<ul style="list-style-type: none"> Adequate enclosures around the stationary equipment.
<ul style="list-style-type: none"> Noise generated from the running of heavy vehicles deployed in the construction activities. 	<ul style="list-style-type: none"> Noise barriers of suitable specifications erected in locations of sensitive receptors. Equipment fitted with exhaust mufflers
	<ul style="list-style-type: none"> Personal protective equipment (PPE) shall be provided to the workers working near the high noise area.


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Noise because noise is there when machineries are being used or something blast, blast happens when some ways has to be cleared those kinds of things, and because of there are certain instruments which also create noise. So, these are related to occupational and health

issues. So, proper, personal protective equipments will be given to those who are the workers in, at that location.

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Vibration during construction: Impact & mitigation measures



Impact	Mitigation
<ul style="list-style-type: none"> Increase in ground vibration due to underground tunneling and potential impact on TCFS Noise propagation due to running of heavy construction vehicles at the construction sites 	<ul style="list-style-type: none"> Noise abatement measures shall be adopted in tunneling activity. Noise barriers of suitable specifications shall be erected in locations of sensitive receptors.



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Impact on safety & comfort of local community during construction & its mitigation

Impact	Mitigation
<ul style="list-style-type: none"> Vibration in the nearby area due to piling. Blasting operation may lead to temporary ground borne vibration. Running of heavy construction equipment. 	<ul style="list-style-type: none"> Night-time piling activity avoided near residential areas. Blasting carried out in the day-time only, with advance intimation to local communities.

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And it is also taken care of like, at certain times means, like night-time activities will be stopped if it is near eco sensitive zones and villages etc. So, the vibrations and all those noise related impacts have been taken care of with proper guidelines. So, like night-time piling activity will not be there, blasting carried out only in daytime, all those guidelines are there or provisions are there.

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Mitigation measures for Flora

- Verification with forest department officials and marking of trees which need to be cut (it minimizes the tree cutting during construction)
- Appropriate compensatory plantation using suitable native species or pollution tolerant species
- For trees to be felled in private land, compensation for trees based on fruit yield value, timber value given to the owners
- Minimizing clearing to only necessary amount of vegetation from the forest area.
- Compensatory mangrove plantation





Image: Flamingo near Thane creek
Source: timesofindia.com



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Then for flora, so, forest with forest officials and their expertise, whatever recommendations are there from their side, so, the minimization of the tree cutting during construction, so, that way routes have been designed properly and then appropriate number of trees will be planted in compensation wherever tree felling is there.

So, using suitable native species and pollution tolerant species, that is very important to focus upon because sometimes earlier people just used to have plantation of any kind of species and those species may not be native and because of those species, which are not native the native species got damaged.

So, this, in this particular project, it has been taken care of properly that only native species will be used and also those species will be promoted, which reduces pollution because there are natural plantation or plants or trees which have tendency to reduce certain pollution. So, these kind of things are there.

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Mitigation measures for Fauna

- No construction yard should be set up in the forest areas
- Heavy construction equipment/machineries should be kept away from the forest areas
- Soil compaction for embankment work should be done immediately to avoid erosion
- Immediate actions for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents
- Crossing structures (tunnels for animal movement) in place where the MAHSR line passes through the forest patches





Image: Mangrove area near Thane creek
Source: hindustantimes.com




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For fauna, so, again construction activities and some passes for those life forms and this you know, like cleaning up of oil spills, fuel, toxic chemicals immediately without leaving them, otherwise they can damage the sensitive ecosystems. So, all these things, crossing structures for tunnels, animals through tunnels etc., we have seen those kinds of structures in earlier lecture if you may recall. So, those kinds of structures will be there for animals etc., so that they can cross from one point to another, wherever some bridges or those kinds of things are there.

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Mitigation measures for water bodies/natural drainage

- No material to be dumped into natural drains or block, impede or alter drainage channels.
- Adequate cross drainage channels (longitudinal and median drains) should be provided at suitable locations for the smooth passage of the surface runoff to prevent flooding.
- Capacity of existing drainage works, cross drainage structures in the parallel section should be duly augmented.
- Suitable drainage at construction site and camp to avoid formation of stagnant pool of water that lead to soil erosion, water logging.



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Then if we see the water bodies and natural drainages, so, again no material will be dumped to block the drainages. So, those strict plants are there to execute and they will be taken at

proper place to dispose of them or maybe to use like nowadays waste to wealth, this philosophy is growing. So, nothing is waste if we can use in some other activity to through recycling or those kinds of things. So, this drainage and construction at construction site will be taken properly care of.



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Public Consultation

Public meeting were arranged at 10 places:

- Navsari ✓
- Surat
- Valsad/Dadra Nagar Haveli
- Palghar
- Mumbai/Thane
- Vadodara
- Anand
- Kheda
- Ahmedabad
- Baruch

Compensation and religious structures were key issues discussed by public



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Public consultation as I said, this is one important issue because public participation makes the project successful if they are happy. So, at 10 places public meetings were arranged like this Navsari, Surat, Valsad, Palghar, Mumbai, Thane, Anand, Kheda, Ahmedabad, Bharuch all these places and people were given proper information, so that there is no grievances or there is no issues which can later emerge.


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Grievance redressal mechanism

As project passes through many protected areas or tribal region, it makes project exposed to social acceptability issues such as interaction with:

- NGOs/activists for environment ✓
- Organizations for tribal rights ✓
- Local people whose land has been acquired

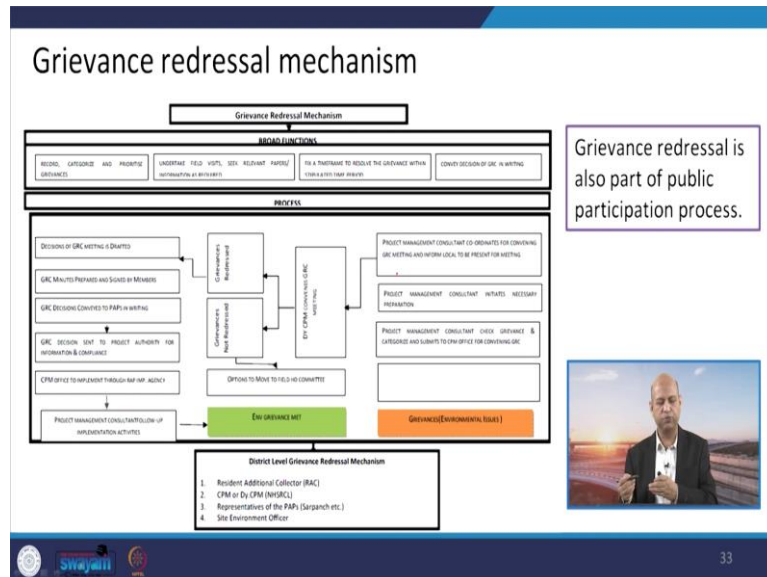
This makes grievance redressal very import for the project.



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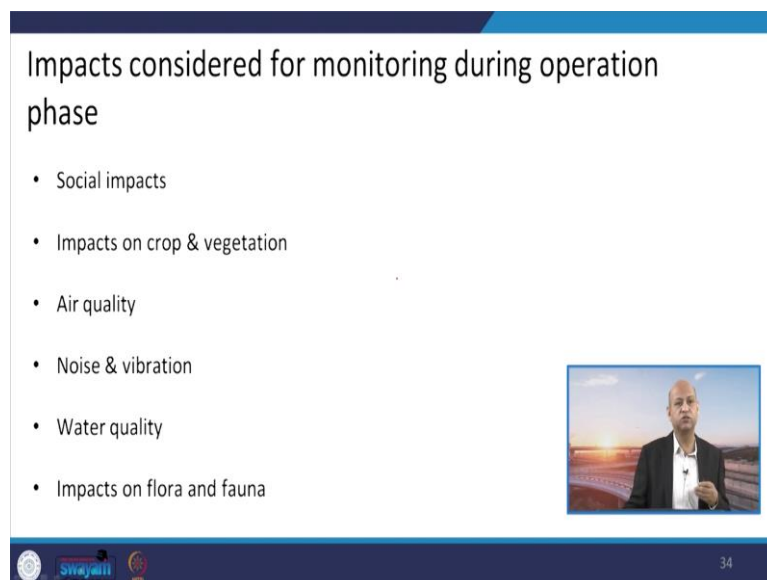
And also, there are issues, if grievances are there through NGOs or activists or some organisations which are working among, for tribal rights etcetera, local culture etc. So, their issues were also properly listened and they have to be taken care of.

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So, this particular mechanism which is shown in this flowchart has been several organisations and responsible agencies or people were put in together to redressal mechanism for grievances.

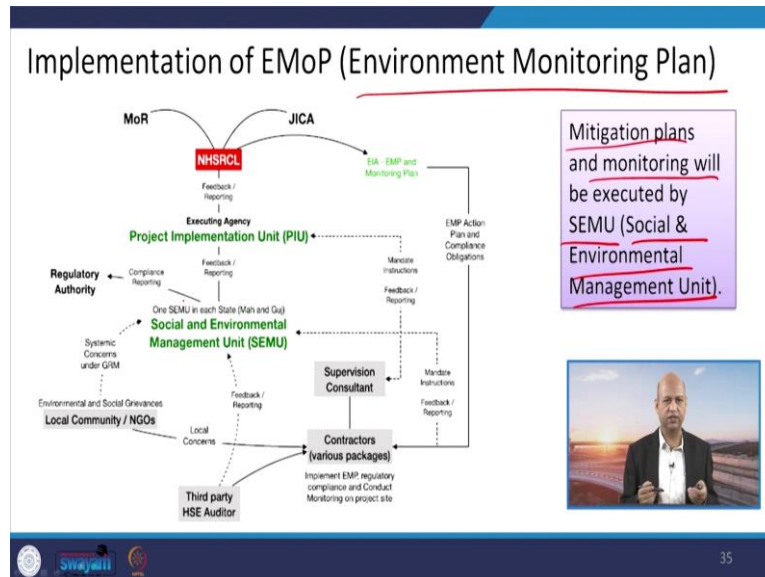
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So, the impacts, which were considered for monitoring during operation phase are like social impacts or impacts on crop and vegetation, air quality, noise and vibration, water quality impacts on flora and fauna. So, all these aspects, which are part of the detailed EIA for

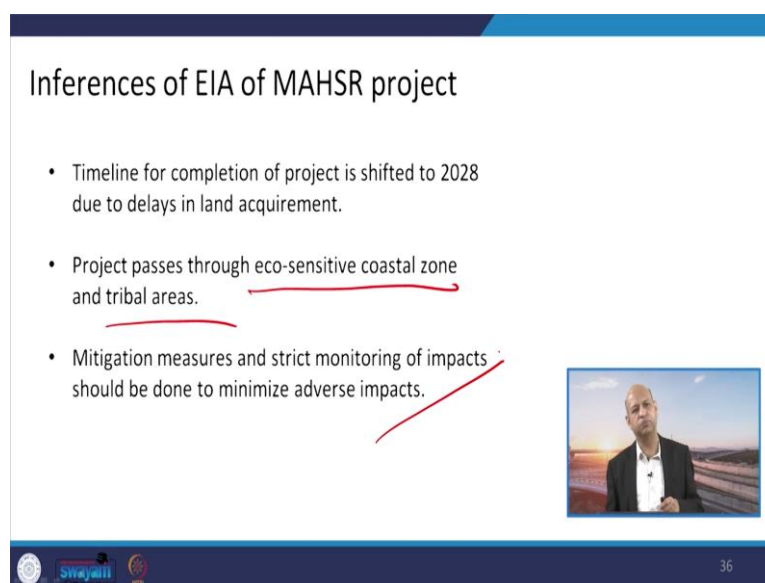
impact assessment and monitoring, continuous monitoring to see their condition or impacts of the project. So, they have been properly considered.

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And then environmental monitoring plan has been into place. So that this unit mitigation plans and monitoring will be executed by SEMU that is social environmental management unit. So, this unit was properly created and that is responsible for this implementation of environment monitoring plan, and they submit report time to time to the officers and they take care and the review process happens. So, again, these are different ways where they collect information and the report those kinds of mechanism is there.

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Inferences of this EIA for this particular project are that timeline for completion of project is shifted to 2028 because of this, exercise of detailed EIA, it was known that certain activities will take more than expected time, to address those issues properly, in terms of socio-economic impacts or environmental impacts, time is required. So, the timeline was shifted.

Then project passes through eco sensitive coastal zones and tribal areas, as we have seen, so, proper redressal of those issues are there, mitigation measures and strict monitoring impacts should be done to minimise adverse impacts. So, those recommendations or inferences have been properly taken care of.

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The slide is titled "Conclusion" and contains the following text:

- Binding & regulatory EIA process ensures
 - Impact assessment
 - Mitigation for impacts considered
 - Use of practices which are less adverse for environment
 - Monitoring of impacts and mitigations measures
 - Public participation during project
- In India, EIA process follows various steps which help in minimizing the adverse environmental impacts from developmental activities.

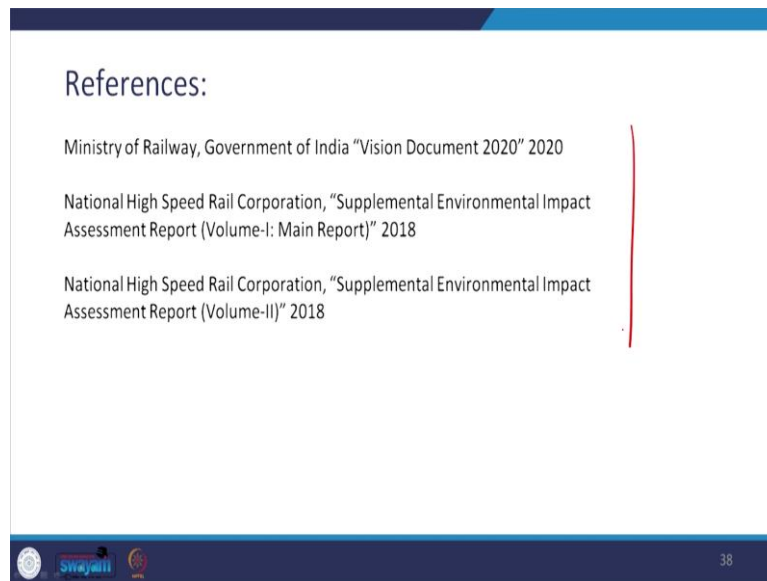
At the bottom right of the slide, there is a small video inset showing a man in a suit speaking. The slide also features logos for "Swayam" and "37" at the bottom.

So, in conclusion, we can say that, this process, this EIA process is needed for impact assessment, mitigation of impacts, which are considered and use of practices, which are less adverse to the environment, monitoring of the impacts and mitigation measures and public participation, all these issues are kind of binding in terms of legal terms.

So, these are the binding and they have to be properly taken care of. So, these kind of EIA, if we go in detail, and if we implement the recommendations, then project becomes more successful, because there is no agitation, there is no issues or complaints or grievances afterwards.

So, that is why such kind of proper EIA must be there, and we should, use them as best practices. So, this is one very good study from EIA perspective, which we have discussed today.

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These are the references where we have taken information so, you can go through those big reports, and you can have detailed information if you want to have more database report. So, thank you for your kind attention. And we will continue to have more case studies, not only for EIA, but for transportation systems so that we can learn about their success stories, or if there are problems like failure cases that also are the ways to learn those negative things. So, we will continue these case studies further. Thank you again.