Sustainable Development of National Highways in India

NHAI: *Building a nation not just roads*

National Highway Authority of India (NHAI) Mandate

NHAI was set up as autonomous body under the National Highways Authority Act, 1988, established in 1995

Construct

- **Develop, maintain and manage** National Highways vested in it by the Government

Consult

- Develop and provide **consultancy and construction services**

Advise

- **Advise the Central Government** on all matters relating to Highways including implementation of environmental safeguards

Indian Road Network

- Total length of Road 62.16 lacs km
- Total Length of National Highway – 141,190 km
- National Highways constitute only **2% of total length of Road**, but carry **40% of the traffic**
- NHs carry **85 % of passenger & 70 % of freight traffic**
- NHAI is mandate for developing and maintenance of National Highways entrusted by MoRTH. The implementing agencies of MORTH are NHAI, NHAIDCL, BRO, NH-PWD *etc*
- **MoRTH entrusted majority of NHs with NHAI out of which successfully completed 71,310 km with Capital Cost about 7.5 Lac Crore**

Road Category	Length (km)
2 lane	28,885
4 lane	34,289
6 lane & above	8,136
Total	**71,310**

Infra growth to build roads and Increasing GDP

The scale of infrastructure development requires investments on a mammoth scale. As part of the National Monetisation Pipeline, the National Highway Authority of India (NHAI) has launched its Infrastructure Investment Trust (InvIT) to monetise road projects. In view of the long-term nature of the assets, units of InvIT were placed with international and domestic institutional investors. The initial portfolio comprising five roads raised ₹ ₹8,000 crore with 50% of investment from foreign investors.

Brownfield expansion and the improvement of highways serve an important purpose, but the game-changer in terms of reducing logistical costs is building access-controlled greenfield expressways connecting key cargo origin-destination centres. Consequently, five flagship expressways and 17 access-controlled corridors are being developed as part of Bharatmala Phase-1 at a total capital cost of ₹3.6 lakh crore.

Increase in employment and economy of the country.

Carbon Footprints of Highway Projects

- Transport sector is one of the leading contributors (14 %) to India's greenhouse gas (GHG) emissions.

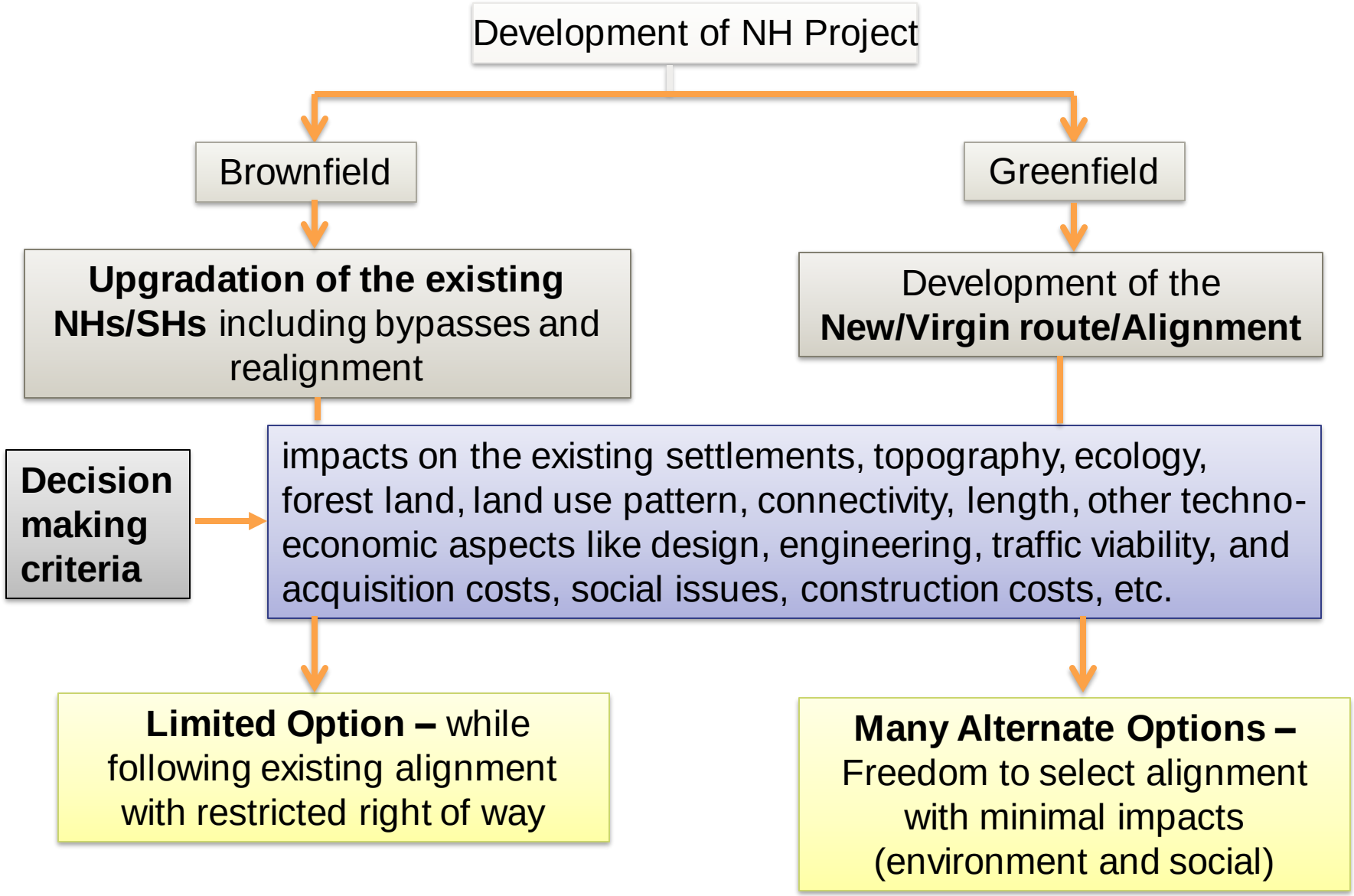
- The share of road transport in CO2 emissions is 12.32 %.

- The current CO2 emission level from road transport is **457 million tonnes** which is expected to reach **966 million tonnes by 2030**.

- The current CO2 emissions from National Highways stands at **140 million tonnes** which is expected to reach **300 million tonnes by year 2030**.

- Bulk of the carbon emissions are released during operations phase (i.e vehicular emission) ranging into 87% to 95%.

DEVELOPMENT STRATEGY



Greening of Highways: Vision & Mission

Create platform for research and innovation in green pathways sector including roads, rail-sides and waterways.

Make National Green Highways Mission self sustainable in next 10 years.

Sustained employment for 1 lakh people for next ten years (min 250 days/year)

Carbon Neutral National Highways for fulfilling India's COP-21 commitment of voluntary reduction in carbon emission by 2030

1. On pre merger cost base of INR 36,200 Cr. (ex –access and license fee)

Eight-fold Environmental and Socio-economic Benefits

- Reduction of Emission
- Reduced consumption of Time for Commuters
- Utilization of Fly Ash (1.2 Cr. Metric Cu. m.)
- Generation of Solar-Power (4 MW)
- Extensive plantation program of 2.6 Lakh trees
- Generation of Employment for about 10000 employees
- Greenbelt Development using Drip Irrigation Technique
- Rain-water Harvesting

Environmental Impact Score Instrument

Weightage percentage of Different Categories

Sl. No.	Environmental category/group	Weighted Percentage
1	Natural Environment	80
2.	Biological impacts	120
3.	Physical Impacts	50
4.	Social Environment	60
5.	Engineering	90
Total Score		**400**

S.No	Score out of 400	Score Limit (%)	Impact Category
1.	Less than 120	<30	Low
2.	120 to 200	30 – 50	Medium
3.	200 to 320	50-80	High
4.	More than 320	>80	Very High

Alternate Analysis (Worksheet)

Providing Carbon Sinks through Green Corridors

- Efforts to reduce carbon intensity of highway projects; are working but a large amount of residual emissions still exist.
- Hence, it is important to develop effective carbon sink for offsetting carbon emissions.
- MoRTH has promulgated Green Highways Policy – 2015. Under the aegis of the policy it is intended to develop uniform green corridors in the form of median and avenue plantation along existing as well as future highway projects.
- Median and avenue plantations along 1 km NH can help in sequestering up to 20 MT carbon annually.
- Uniform green corridors along 1 lakh km existing NH network, will have cumulative annual carbon sequestration capacity of 2.13 to 2.46 million tons

Success Stories

- NHAI has completed the development of **six arterial corridors** in the country viz., **Golden Quadrilateral (4 corridors)**, **North – South Corridor** and **East – West Corridor**

- In addition to the development of arterial corridors, NHAI has completed **marquee projects** in the recent past, in **record time** with **superior design** to enable **efficient passenger and freight movement on key corridors along with environmental safeguards**

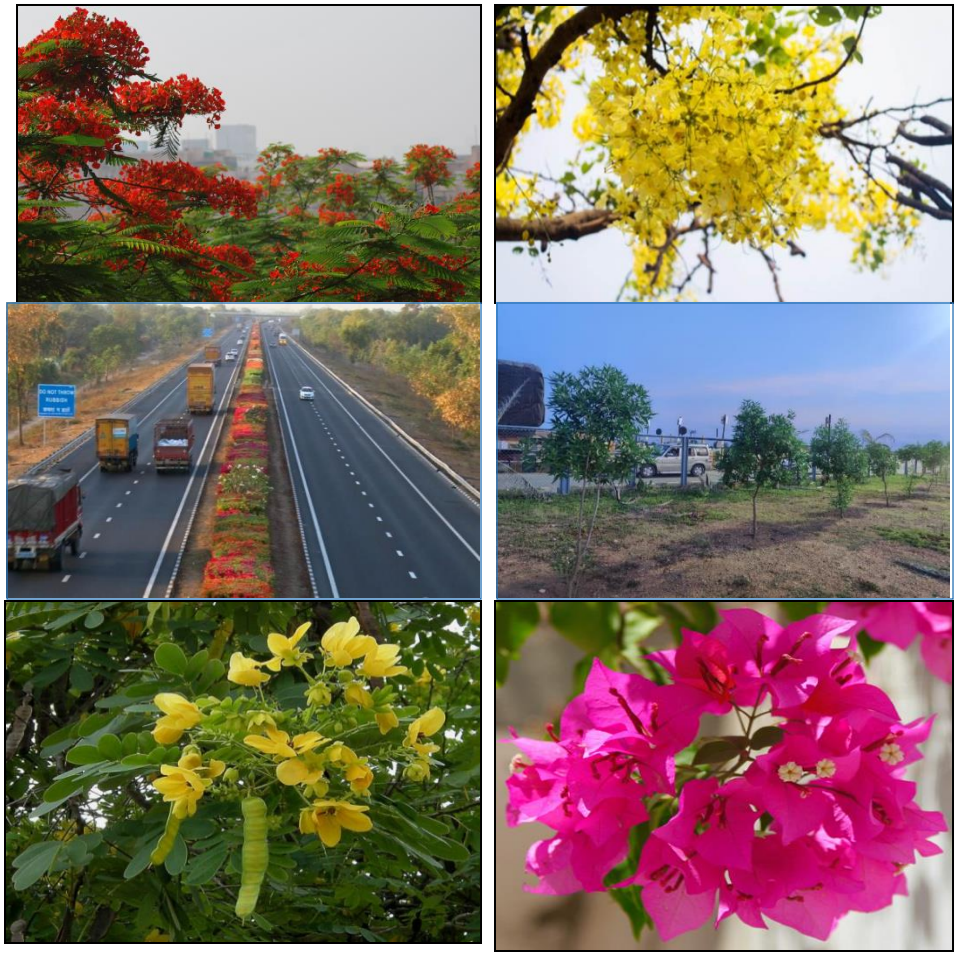
1. Eastern Peripheral Expressway
2. Delhi Meerut Expressway
3. Chambal Bridge
4. Narmada Bridge
5. Chenani – Nashri Tunnel
   – Delhi-Dehradun
6. New Brahmaputra Bridge
7. 2nd Vivekananda Bridge
8. Naini Bridge
9. Varanasi Ring Road Phase - 1
10. Srinagar Banihal Tunnel
11. Delhi Mumbai (Under Construction)
12. Delhi Katra (Under Construction)

ENVIRONMENTAL SAFEGUARDS….

❖Tree Plantation

- Development of green belts along the highways to be done in accordance with The Indian Roads Congress (IRC) Special Publication, **IRC:SP:21-2009- "Guidelines on Landscaping and Tree Plantation"** and MoRTH "Green Highway (Plantation, Transplantation, Beautification and Maintenance), Policy 2015"

  - **Extensive greenbelt development** has been undertaken comprising of about 2.6 Lakh plants which includes both avenue plantation and plantation in median along the entire expressway. Major Species planted are as follows:-
  - Avenue Plantation - Amaltas, Jacaranda, Gulmohar, Cassia, Sheesham, Neem, Mango, Peepal and Jamun
  - Median Plantation – Bougainvillea, *Tecoma stans*, Hibiscus and *Cassia glauca*



ENVIRONMENTAL SAFEGUARDS….

❖Energy Conservation

- Eastern Peripheral Expressway is the first Expressway in the country where solar power has been used on the entire Expressway of 135 Kms.
- There are eight solar power plants on this Expressway with a capacity of 4000 KW (4 Megawatt).
- Solar power has also been provided for lighting of the underpasses.
- Solar pumps have been used for watering of the plants.

Utilization of Fly Ash

Numerous benefits of incorporating fly ash as construction material have been demonstrated through extensive research and countless highway projects.

Eastern Peripheral Expressway utilized about **1.2 Cr. Cum** of fly-ash generated from nearby thermal plants of Dadri , Badarpur, Pali and Panipat.

Rain-water Harvesting

The objectives of constructing Rain water harvesting pits on roadsides are:

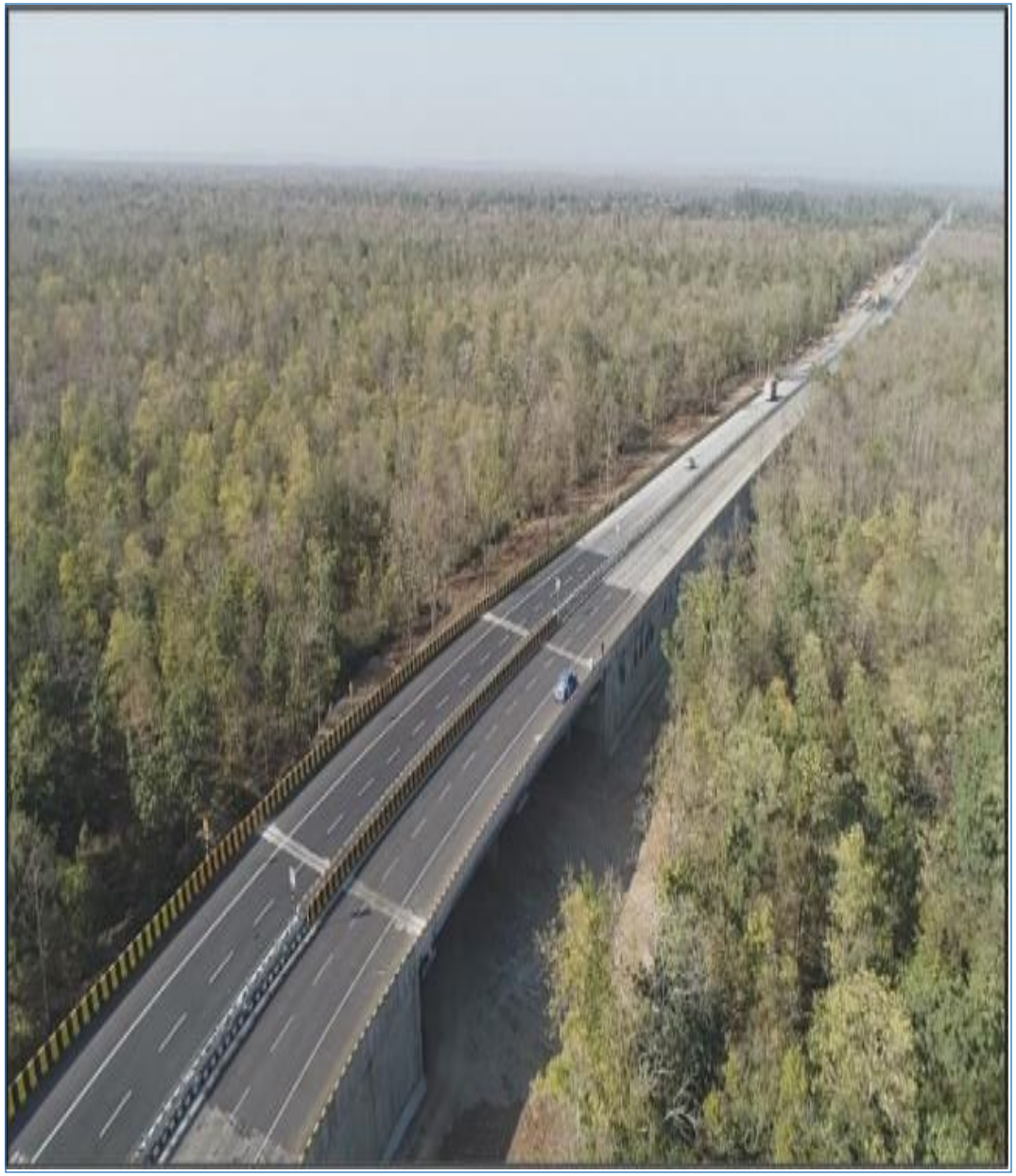
- To harvest the run-off rainwater falling on the Expressway.
- To utilize the rain water to recharge the underground aquifers .
- To prevent water stagnation on the surface of the Expressway , thus helping to ease traffic and avoid accidents
- To improve the quality of underground water in the region.

Rain water harvesting pits have been provided as per IRC guidelines on every 500 metres on either sides of the Expressway.

Drip Irrigation Technique

Eastern Peripheral Expressway is the first Expressway in the country which utilizes drip irrigation technique for watering plants in the median and avenue plantation on both sides.

Combined Structure for Elephant at Chila Motichur in RNP, NH-58, Haridwar-Dehradun- Section



Underpass around Pench National Park, Maharashtra

Elevated Corridor around Pench National Park,Maharashtra

Elevated Corridor Pench National Park, Maharashtra

Elevated Corridor in Pench National Park, Madhya Pradesh

Elevated Corridor in Pench National Park,Madhya Pradesh; Camera Trap Image

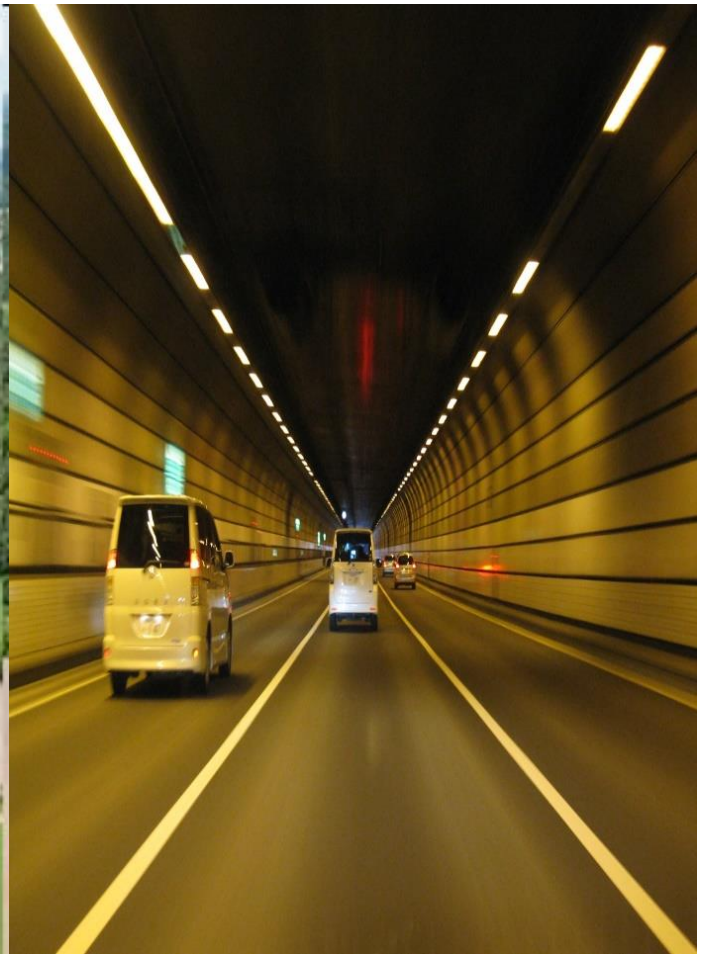
Sound and Noise barrier installations on animal crossings in Pench National Park, Madhya Pradesh

Typical View of Elevated & AUP around RTR

Elevated Corridor

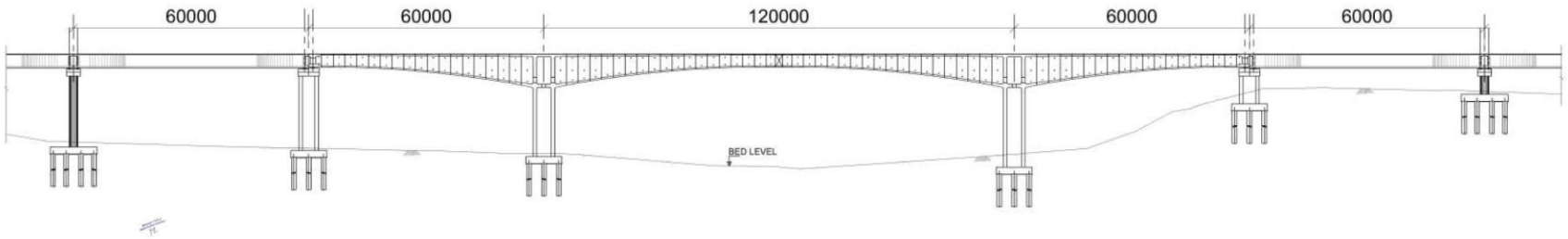
Animal Under Pass Section

Under Ground Box Structure (Cut & Cover) buffer of RTR



Details of Structures in NCS & its ESZ

Proposed Mitigations	Chainage (Km)	Length (m)	Vertical Clearance (m)	Span arrangement	Structure Proposal
Bridge	Ch.346.680 to Ch.347+400	2700	5.5	6x60+1x20+4x60	Precast Box Girder for approach spans & balanced cantilever Structure for Centre Span with segmental box Girder

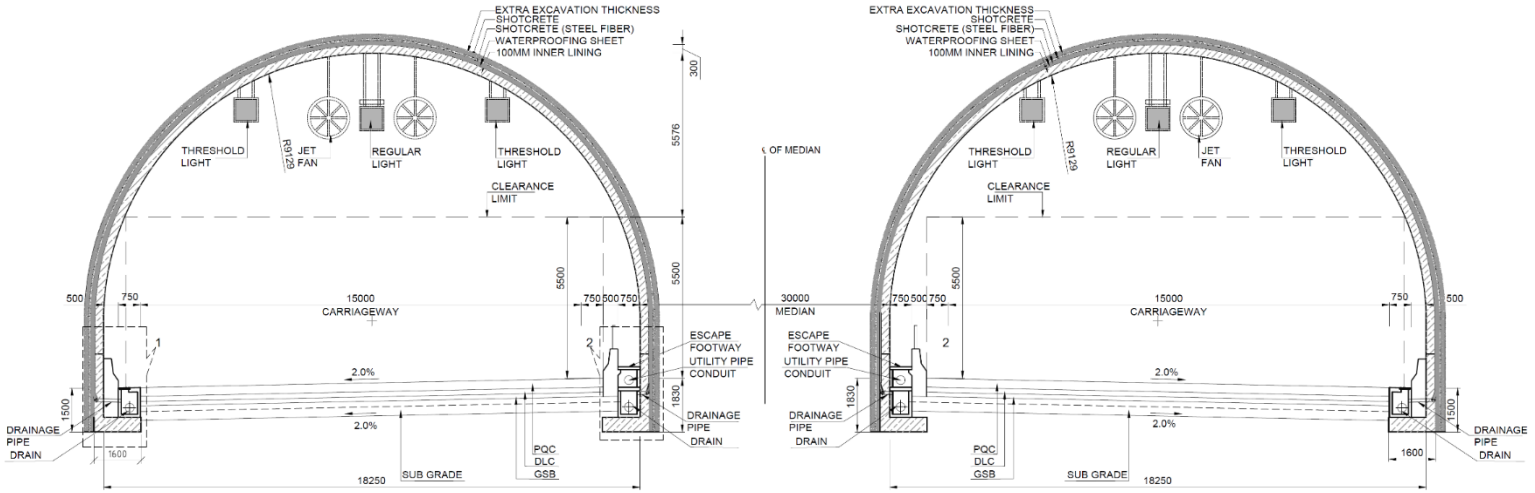


CROSS SECTION OF BALANCE CANTILEVER SPAN AT CHAMBAL RIVER

Structure	Number	Total Opening size (m)	Structure	Number	Total Opening size (m)
Major Bridge	13	2380	LVUP	12	144
Minor Bridge	41	1218	VUP	3	62.5
Box Culvert	100	350	Interchange	3	180
SVUP	13	94	ROB	1	130
			Viaduct	1	210

Total = 4768m

Details of Structures in Mukundra & its ESZ



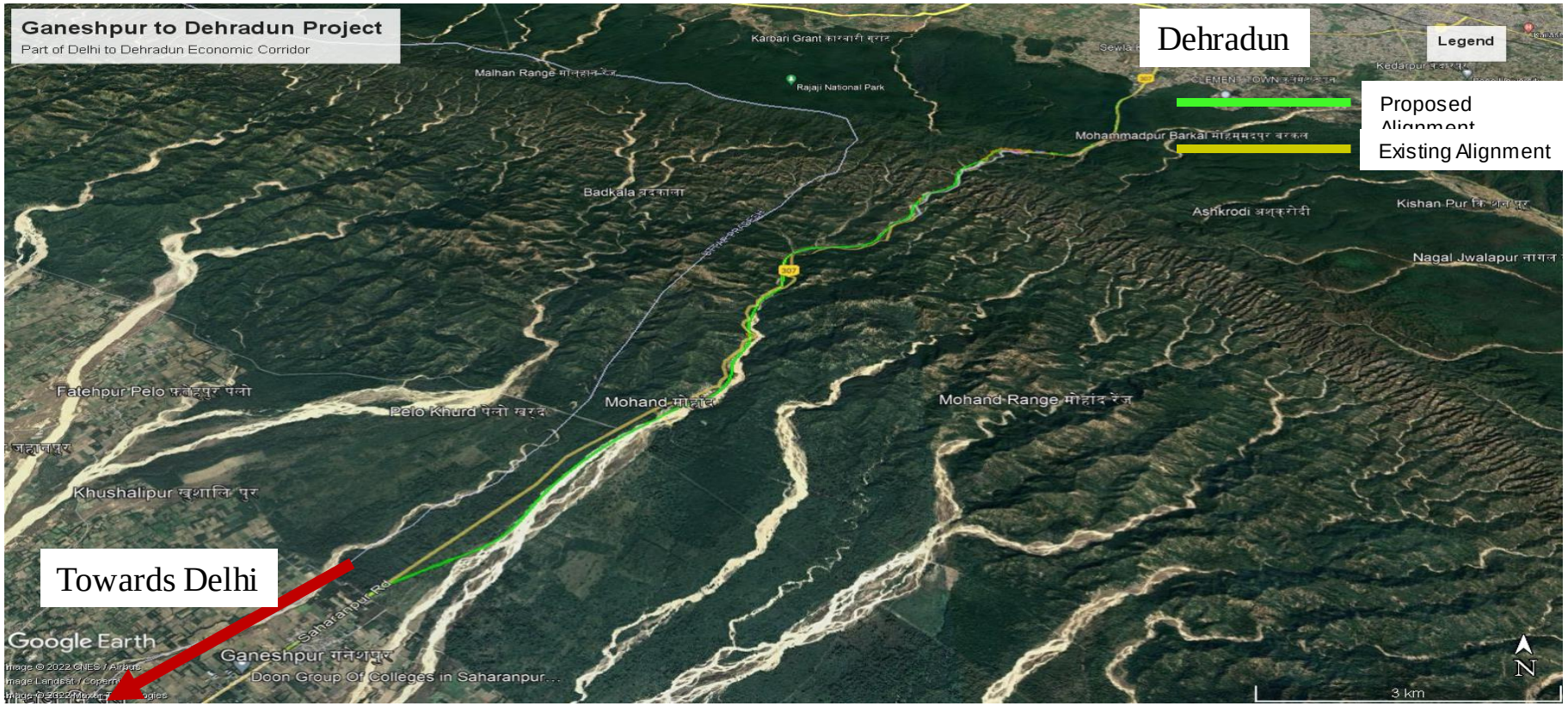
CROSS SECTION OF DUAL 4-LANE (8-LANE DIVIDED) TUNNEL

	Covered Ramp-01		Tunnel Portion		Covered Ramp-02	
Start/End point	421+380	422+200	422+200	425+750	425+750	426+250
Length (m)	596		3550		450	
Total length (km)	4.596					

Structure	Number	Total Opening size (m)	Structure	Number	Total Opening size (m)
Major Bridge	3	295m	LVUP	4	48m
Minor Bridge	4	65 m	VUP	1	30m
Box Culvert	26	104 m	Interchange	2	169m
SVUP	6	54m	ROB	1	205m

Total = 970 m

Project Site of Ganeshpur – Dehradun



Development Plan of Ganeshpur – Dehradun

- **Total Length :** 19.785 Km (16.160 Km in UP + 3.625 Km in UK)
- **Elevated Corridor Length:** 12 Km (Longest Animal Corridor in Asia)
- **Length of Tunnel:** 340 m (160m in UP + 180m in UK)
- **Elephant Under Pass:** 2 nos. of length 200m each(in UK)
- **Animal Passes:** 6 Nos. of length 12m to 20m each (3 Nos. in UP + 3 Nos. in UK)

- Video

Elevated Corridor- Ganeshpur to Dehradun

Tunnel under Construction; Ganeshpur - Dehradun

Guidelines for Rehabilitation of Dumpsites, Quarries, and Borrow Areas

Guidelines for identification of Debris Disposal Sites

The locations of the debris disposal sites have to be selected carefully keeping in mind various factors like residential areas, forest areas, water bodies etc.

Guidelines for Rehabilitation of Dumpsites, Quarries, and Borrow Areas

The guidelines give the best practices on restoring the dumpsites, quarries and borrow areas like covering with topsoil and using for plantation or for growing agricultural produce etc.

Leveling & spreading of preserved topsoil after excavation

Cultivation at re-developed borrow area

Utilization of Fly Ash

Construction of embankment using Fly Ash

- Numerous benefits of incorporating fly-ash as construction material have been demonstrated through extensive research and countless highway projects.
- **Eastern Peripheral Expressway** utilized about 1.2 cr. cum. of fly-ash generated from nearby thermal plants of Dadri, Badarpur, Pali and Panipat.

Utilization of Fly Ash

Use of Fly ash and earth work after water sprinkling to control of dust and air pollution

Borrow Area redeveloped into Irrigation Pond for Community Use

Bank Protection of Water Bodies

Solar power plants on Eastern Peripheral Expressway with a capacity of 4000 KW (4 Megawatt).

In conclusion….

•NHAI in partnership with scientific institutions and statutory bodies has been conducting Monitoring and Evaluation studies to assess the efficacy of wildlife mitigation measures along its Highways and Expressways.

•The underpasses, overpasses (eco-duct), elevated corridor, tunnel, viaduct etc designed and constructed by NHAI have been used by over 4300 wild animal species including 133 times by Tigers in and around a single landscape of animal i.e. Pench National Park. In addition thousands of large (elephant) and small species including reptiles are using such type of structure in various landscape of animals in entire country from hilly to plain area.

• Important to state that the said structures are being used by wild animal species 24 by 7 and are under intense monitoring at many locations using camera traps installed by the Wildlife Institute of India.

•Further, development of site and species specific offsite mitigation measures with their maintenance along the national highway enhance the conservation of Wildlife Habitat.

In conclusion….

• saving of fuels not only enhance the economy of the country but also minimize the large extant of carbon foot print.

•Use of waste plastics for construction of 530km of service roads and national highways

•The reduction in travel time not only boost the economy but simultaneously increase in comfort and safety.

•Creation of huge carbon sink along national highways, vacant land, clover leaf, under elevated corridor, rehabilitated borrow area, bank of water body etc. apart from the statutory compensation.

• development of 75 Amrit Sarovar in each district around 50,000 in the country as a water conservation resources.

•NHLML is 100% owned subsidiary of NHAI. NHLML is mandate to develop ecofriendly infrastructure i.e. about 200 ropeways in entire country and 34 numbers of multi model logistic park

•The synergies developed between NHAI, scientific institutions and other line agencies including NGOs and NGIs are providing 'win-win' outcomes for all concerned.

Thank You.....