NATIONAL HIGHWAYS AUTHORITY OF INDIA

Rehabilitation and Upgradation from existing 2-lane to 4-lane of Yedshi to Aurangabad section of NH-211 from Km 100.000 to Km 290.200 in the state of Maharashtra under NHDP Phase IV A & B

SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

AURANGABAD DISTRICT

(From Km 245.000 to Km 254.000 and From Km 260.00 to Km 290.200)

egis India
consulting engineers pvt. ltd.

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SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

1.0 INTRODUCTION

The Environmental Impact Assessment study has been conducted in accordance with the EIA Notification, 2006 of Ministry of Environment and Forests, Govt. of India for the present project to investigate and assess the principal environmental concerns associated with the proposed widening of Aurangabad to Yedshi section of NH-211 from Km 100.000 to Km 290.200. The scope of Environmental Impact Assessment (EIA) study covers Design & Preconstruction Phase, Construction Phase and the Operational Phase investigating and analyzing the potential impacts of the project on different components of environment including physical, ecological and socio-economic environment within the project influence area and providing measures to offset or minimize the adverse impact and enhance the positive impact as well as effective implementation and monitoring plan the environmental safeguard measures during different stages of the project.

2.0 PROJECT DESCRIPTION

The proposed project is widening and upgradation of the section of existing 2-lane NH-211 to standard 4-lane dual carriageway configuration from Km 100.000 near Terkhera village at the outskirt of Yedshi to Km 290.200 near Chilkalthana village at Aurangabad in the state of Maharashtra covering a total length of 190.200 Km. The project also includes bypasses and realignments in order to avoid mass displacement in heavily built up area, curve and geometric corrections.

The project stretch of NH-211 passes through many congested settlements where lot of local traffic gets mixed up with the through traffic. It is required to segregate the local traffic from through traffic, either by providing service roads or bypassing the settlements. The details of bypasses and realignments are given in **Table 1.0**

Table 1.0: Details of Bypasses and Major Realignments

S. No.	Bypass/Realignment	Existing Km	
		From	To
1	Chausala Bypass	140.900	145.850
2	Beed Bypass	172.950	183.040
3	Gevrai Bypass	205.715	211.418
4	Pachod Bypass	249.000	253.960
5	Shahgarh Realignment	217.188	222.350
6	Adul Realignment	271.188	274.890

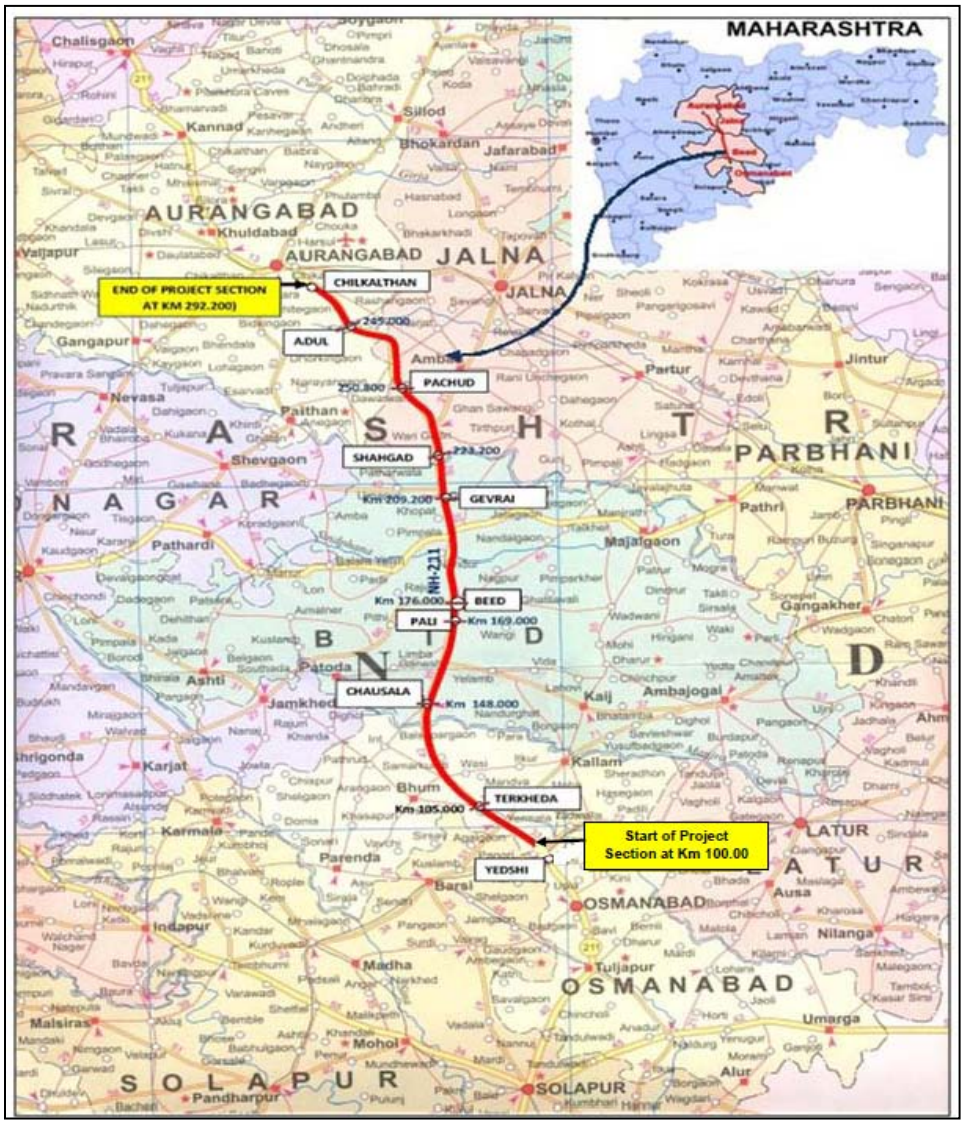
The project stretch passes through four districts in the state of Maharashtra viz. Osmanabad, Beed, Jalna and Aurangabad. The details are as follows:

S.No.	District	Project Stretch		Length (Km)
		From	To	
1	**Osmanabad**	Km 100.000 (near Terkhera village, outskirt of Yedshi town)	141.000 (Pargaon Basale village)	41.00

2	**Beed District**	Km 141.000 (Chausala town)	Km 221.000 (Near Khamgaon)	80.000
3	**Jalna**	Km 221.000 (Near Shahgarh) and again from Km 254.000 (Near Bhokarwadi)	Km 245.000 (Dogaon) 260.000 (Maliwadi)	24.000 6.00 Total =30 Kms
4	**Aurangabad**	245.000 (Near Pachod) Km 260.000 (Adgaon)	254.000 (End of Pachod Bypass) Km 290.200 (Chilkalthana)	39.200

The location plan of the project road is shown **Figure 1.0**.

Figure 1.0: Location Plan of the Project Road



2.1 Salient features of the Project

The salient features of the project are as follows:

A: General Information:

S.No.	Project Components	Details
1.	Location of Project	The project road section of NH-211 is the widening of 2-lane to 4-lane, which starts from Km 100.000 at Yedshi and ends at Km 290.200 at Aurangabad. The project includes the proposal of four new bypasses at Chausala, Beed, Gevrai and Pachod.
2.	Administrative locations	Districts: Osmanabad, Beed, Jalna and Aurangabad
3.	State	Maharashtra
4.	Length of the Project road	190.200 km
5.	Terrain	Entire project road is in plain terrain except at location between Km 159.000 to Km 162.000 is in hilly terrain.
6.	Major Settlement along the Project Stretch	Chausala, Beed, Gevrai, Shahagarh, Adul and Pachod within town limit.
7.	Rivers/ Streams/ Canals	The project mainly crosses five rivers namely Manjara, Sindfana, Bindusara, Dudha and Godavari river. Apart from these rivers, there are some natural streams/nallahs crosses the project road.
8.	Ponds/Tanks	Nil
9.	Forest area	Pockets of Reserved Forest are located along the existing RoW between Km 105.040 to Km 105.750 (RHS), Km 113.400 to Km 113.460 (LHS), Km 113.415 to Km 113.700 (RHS), Km 120.275 to Km 120.350 (RHS), Km 127.800 to Km 127.811 (LHS), Km 160.750 to Km 161.200 (RHS), Km 162.100 to Km 162.350 (RHS), Km 162.175 to Km 162.225 (LHS) and at Km 162.450 to Km 162.500 (LHS).

B: Project Features:

S. No.	Items	Existing	Proposed
1.	ROW	Generally existing ROW is 30 m	60 m
2.	Carriageway	2-lane carriageway of 7 m	7 m on either side of the median (4.5 m) with paved shoulder
3.	Design Speed	40/60 kmph	100 Kmph for the rural sections & 80 Kmph generally for settlement areas.
4.	Major Bridge	Osmanabad: 1 no. Beed: 3 nos. Jalna: 1 no.	**Retained and widened:** Osmanabad: 1 no. Beed: 1 no. **New Bridge:** Beed: 3 no.
5.	Minor Bridge	Osmanabad: 4 nos. Beed: 26 nos.	**Retained and widened:** Osmanabad: 4 nos.

S. No.	Items	Existing	Proposed
		Jalna: 5 nos. Aurangabad: 14 nos.	Beed: 10 nos. Jalna: 2 nos. Aurangabad: 7 nos. **New Bridge:** Beed: 17 nos. Jalna: 1 no. Aurangabad: 7 nos. **New Bridge at Service Road:** Beed: 3 nos. Jalna: 4 nos. Aurangabad: 1 no.
6.	Culverts	Osmanabad: 19 nos. Beed: 72 nos. Jalna: 20 nos. Aurangabad: 32 nos.	**Retained and widened:** Osmanabad: 16 nos. Beed: 48 nos. Jalna: 19 nos. Aurangabad: 23 nos. **New Culverts:** Osmanabad: 26 nos. Beed: 32 nos. Jalna: 11 nos. Aurangabad: 19 nos.
7.	ROB/RUB	Nil	**ROB** Beed: 1 no.
8.	Vehicular Underpasses	Nil	Osmanabad: 2 nos. Beed: 8 nos. Jalna: 2 nos. Aurangabad: 3 nos.
9.	Pedestrian / Cattle Underpasses	Nil	Osmanabad: 2 nos. Beed: 9 nos. Jalna: 1 no. Aurangabad: 6 nos.
10.	Flyover	Nil	Beed: 3 nos. Jalna: 2 nos.
11.	Busbays/shelters	Nil	Osmanabad: 6 nos. on both sides Beed: 13 nos. on both sides Jalna: 4 nos. on both sides Aurangabad: 5 nos. on both sides
12.	Truck Laybyes	Nil	Osmanabad: 1 location on both side Beed: 2 locations, one on LHS and other on RHS Aurangabad: 1 location on LHS
13.	Bypass / Major Realignments	Nil	Bypass: 4 nos. Major Realignment: 2 nos.
14.	Rest Area cum Wayside	Nil	Osmanabad: 7.920 Km

S. No.	Items	Existing	Proposed
	Amenities		Beed: 34.934 Km Jalna: 19.460 Km Aurangabad: 11.400 Km
15.	Toll Plaza	Nil	Osmanabad: 1 no. Beed: 1 no. Jalna: 1 no.
16.	High Mast Light	Nil	Toll Plazas, Major junctions, Flyovers, Truck laybyes, start and end of Bypasses locations.
17.	Street Light	Nil	Osmanabad: 2 locations Beed: 14 locations Jalna: 5 locations Aurangabad: 6 locations
18.	Service Road	Nil	Osmanabad: 7.920 Km Beed: 34.934 Km Jalna: 19.460 Km Aurangabad: 11.400 Km
19.	Cost of the Proposed Project	**Rs. 1596.7 crores.**	

2.2 Project Intervention

The proposed project of widening of Aurangabad-yedshi section of NH-211 comes under the purview Environmental Impact Assessment (EIA) Notification 2006 and requires Environmental Clearance from Ministry of Environment and Forests (MoEF).

2.3 DESCRIPTION OF THE ENVIRONMENT

As defined in the scope of works, baseline data on various physical, biological and social aspects has been collected, analyzed and compiled in order to get the picture of the existing environment condition in the project area.

2.3 Physical Environment

2.3.1 Physiography

The project area is located in the Marathwada region of Maharashtra state. The geographical extension of the project road section is between longitude 75°25'34" East to 75°5'29" East and Latitude 19°50'46" North to 18°19' North. The project stretch traverses mainly in plain terrain except for the small Ghat section between Km 160.000 and Km 165.000 which is hilly terrain. The elevation of the project stretch at Tarkhed Village near Yedshi is 693 m above mean sea level whereas the end of the project near end of Beed Bypass at Aurangabad at Km 290.200 lies on an altitude of 574 m above mean sea level. The topography shows varying slope mainly from west to east side however at local level slopes are governed by the local natural landscape having interspersed hills/hillocks around the project corridor.

2.3.2 Geology and Soil

The rocks met in the study area are of mainly igneous rock constituted of basalt and associates lavas and tuffs except for few pockets along Godavari river, Kundka river and Manjara river where sedimentary (unconsolidated) rocks of alluvial origin.

The soil of the project area is predominantly black soil and is classified mainly as Vertisols constituted of deep black and medium black soils and Inceptisols constituted of shallow black soil. The Black soils derived from basalt rock. Medium to heavy in texture alkaline in reaction. Low lying areas are rich and fertile. Chemically the soils are below normal and alkaline in reaction. The soils in general, are rich in calcium and Magnesium carbonates and are deficient in nitrogen and phosphorus. This chemical composition is mainly responsible for cracking of the soil during summer.

2.3.3 Seismicity

The entire stretch of the project road falls under the seismic ***zone III*** as defined by the Indian Standard (IS) 2002 seismic zoning classification system, i.e. a zone of relative stability. The horizontal seismic coefficient for zone III is 0.04 measured on a scale from II to V where zone II is most stable and Zone V is considered to be least stable.

2.3.4 Land Use Pattern

Land use along the Project Highway is predominantly agriculture followed by built up area. The majority of built-up areas are rural (9.10%). Around 8.97% of the area along right of way (ROW) is barren land. The industrial set-ups have occupied for about 0.81% of total area along the ROW. The forest area amounts for only 1.6% of the total project length. There are number of settlements all along the road. The settlements are for Residential, Commercial, Schools, Hospitals, Petrol stations etc. Forest patches are situated along the existing ROW at few locations. The highway encounters a number of water bodies in the form of rivers and streams.

2.3.5 Climatology

The climate of the project area is, in general, dry and moderately extreme. The average day temperature ranges from 27.7 ºC to 38.0 ºC while it falls from 26.9 ºC to 20.0 ºC during night. Similarly summer and winter temperature also varies greatly. The highest during summer day being about 43.3^0 C while the lowest during winter nights about 6.0^0 C. Relative humidity is extremely low for major part of the year (between 35 to 50%) while it is highest (85%) during monsoon.

The rainy season is considered from middle of June to the end of September which is followed by a sultry period from about the end of September to the middle of November.

The winter season commences from the middle of November and ends by the end of the January followed by a dry hot summer from February to middle of June. Summers are in general full of gusty winds.

The normal average annual rainfall is about 900 mm. It has decreased considerable in the recent years. The major amount of South West Monsoon precipitation is received on the West Coast of India due to the Sahyadris and only a small amount escapes through high hills which are received by the Deccan Plateau. The region thus falls in the rain shadow of the Sahyadris.

2.3.6 *Ambient Air Quality*

To study the baseline ambient air quality scenario within the project corridor the ambient air quality was monitored at eight locations in the month of October-November 2012. The ambient air quality in the project area was studies with respect to Particulate Matter having size <10µ (PM_{10}), Particulate Matter having size <2.5 µ ($PM_{2.5}$), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx), Carbon Monoxide (CO) and Hydrocarbons (HC). The average concentration of the PM10 exceeded the prescribed limit at Chausala, Shahad and Chilkalthana, whereas the concentration of PM2.5 was recorded within prescribed limit at all the locations. The concentration of other parameters was found well within the prescribed limit. The ambient air quality along the project area is presented in **Table 2.0**

Table 2.0: Ambient Air Quality at Different Locations along Project Corridor

Location	Chainage (Km)	Concentration of Air Quality Parameters					
		PM_{10} (µg /m^3)	$PM_{2.5}$ (µg /m^3)	SO_2 (µg /m^3)	NOx (µg /m^3)	CO (mg /m^3)	HC (ppm)
Osmanabad District:							
Terkheda Village	105.000	24.6	12.3	< 4.0	14.7	1.3	6.9
Beed District:							
Chausala	148.000	148.0	37.8	< 4.0	15.3	1.2	13.7
Beed	176.000	71.4	27.3	< 4.0	14.6	1.2	14.7
Gevrai	209.200	56.2	27.6	< 4.0	14.4	1.3	18.9
Jalna District:							
Shahgarh	223.200	115.8	36.3	< 4.0	14.2	1.2	20.4
Aurangabad District:							
Pachod	250.800	49.4	23.2	< 4.0	15.2	1.2	10.5
Adul	273.500	66.9	28.3	< 4.0	14.9	1.3	15.6
Chilkalthana	292.200	189.4	45.4	< 4.0	14.2	1.4	8.1
Standards		**100**	**60**	**80**	**80**	**2.0**	**-**

Source: Primary Data collected at site

2.3.7 *Water Resources*

The project area is mainly drained by five major rivers namely, Godavari, Sindfana, Manjara and Bindusara and Dudhna Rivers. Apart from these a number of local streams streams/natural nallah cross the project section ad different locations. These are seasonal in nature and carry water mainly during rainy season. Godavari River marks the southern boundary of Aurangabad district and northern boundary of Beed district. Similarly the Manjara River marks the southern boundary of Beed district and northern boundary of Osmanabad district. Most of these rivers and streams flow mainly from west to east direction. The Bindusara River flows in east to west direction. Few irrigation canals are also cross the project section. There is a dam situated adjacent to the ROW of the project section between Km 166.700 to Km 167.200.

The ground water table varies between 5 m to 20m below ground level in the project area. A number of tube wells, open wells and hand pumps are located along the project roads within corridor of impact. These are used for drinking, domestic and commercial purposes.

Water samples from Surface water source and ground water source at different locations were monitored along the project in the month of October 2012. At all locations the water quality are within the standards.

2.3.8 Noise Levels

The noise level monitored along the highway along all the major settlements exceeded the maximum permissible noise level for Residential/Commercial areas. The daytime equivalent noise level varied between 53.0 Leq dB(A) and 70.0 Leq dB(A). The nighttime equivalent noise level varied between 42.0 Leq dB(A) and 66.0 Leq dB(A) along project section of NH-211. The congested urban built-up area experience high noise level due to commercial activities of the area and traffic congestion.

2.4 Ecological Resources

2.4.1 Forest

Generally open shrubs are present apart from the agriculture fields along the project stretch. The area along the existing ROW of the project stretch is dotted with few Reserve forests pockets at seven locations. Plantation has been done in these forest area and the predominant species in the forest stretch are Eucalyptus, Neem and Babool. The proposed widening will require diversion of about 2.157 Ha of these forest lands.

2.4.2 Ecological Sensitive Area

The project does not pass through any ecological sensitive area such as National Parks, Wildlife Sanctuary, Tiger Reserve or any notified Ecological Sensitive area. Neither such ecological sensitive feature exists within 10 km radius of the proposed project.

2.4.3 Flora/Roadside Plantation

A total number of 27,380 trees are located within the proposed right of Way (ROW) along the project road and hence are likely to be affected due to widening of the road. Common tree species found along the project road are Sheesham, Siris, Neem, Eucalyptus, Babool, etc. Old trees of Banyan and Peepal are sparsely present and some of them are very close to the existing pavement.

2.4.4 Fauna

Domesticated animals constitute the faunal density in the area surrounding the project road. These are cows, buffaloes, goat, etc. Common birds like crow, parrot, sparrow etc. are seen here. No endangered flora and fauna species are reported within the proposed project corridor.

No wild animals are recorded in the close vicinity of the project stretch except for the forest area of the ghat section. As reported by the forest Department, the forest in the upper reaches animal like black buck, porcupine, rabbits, spotted deers, Neel gai are spotted. There is no natural habitat of these animals along the highway section. The present highway is in operation since long and the wild animals rarely visit towards the roadside.

2.5 Social Environment

2.5.1 Demographic Profile

The combined population as per 2001 Census of the project districts, i.e., Osmanabad, Beed, Jalna and Aurangabad constitute about 8.44% of total population of the state. Aurangabad district has maximum population followed by Beed district, Jalna district and Osmanabad district, respectively. The population density is lower in all the districts with respect to the State's population density. The sex ratio reflects the socio-economic and demographic characteristics of the population. It is an important indicator of migration and gender equity (in a developing country context) since it helps to point out the employment opportunity in the districts. There are 922 females for every thousand males in Maharashtra State, while the sex ratios of Osmanabad are 930, Beed are 927, Jalna are 952 and Aurangabad are 919. The sex ratio is slightly higher in all the concerned districts than that of State's sex ratio of 922 female per thousand males except for Aurangabad district which has a ratio of 919 female per thousand males which is lower than the state's ratio.

2.5.2 Growth Rates

During the decade 1991-2001, the population growth in the State was 22.57% (annual compound growth rate 2.07%), which is less than the growth rate registered during the previous decade (1981-91) at 25.73%. The district of Osmanabad, Beed, Jalna and Aurangabad registered a growth rate of 15.35%, 18.54%, 18.17% & 21.20% respectively during the year 1991-01. It has been noted that the growth rate of the project districts has decreased from the previous decade

2.6 Economic Development

2.6.1 Agriculture

Agriculture remains the main occupation of the people of all the four districts and about 80% of the population depends on agriculture for its livelihood. There are two major agricultural seasons in the project area, Kharif and Rabi. Jowar, Bajara, Cotton and Pulses are the main crops cultivated during the Kharif season and in Rabi season, the major crops cultivated include jowar, wheat, gram, safflower, oil seeds, etc. Among the cash crops sugarcane and cotton are grown widely in the project area. The other crops like groundnut and sunflower, etc. are also cultivated in the area. Horticultural crops like sweet lime, orange, grapes, and mango are also grown commercially along the project area and a number of orchards are spread all along the project stretch.

2.6.2 Industries

The area along the project stretch is mainly dotted with a number of Sugar Factories and cotton processing units. Seventeen numbers of major/minor industries have been identified along the project corridor

2.6.3 Historical Monument/Archeological Site

No notified Archeological site or historical monument recorded within 10 km of the existing ROW of the project stretch on either side.

3.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Since the project is widening and strengthening of already existing road, the potential for the negative impacts is relatively small as compare to new alignment. Most of the negative environmental impacts are related to construction works which are inevitable. The impacts during construction phase are mainly temporary or short term, whereas the impacts during operation stage will have long term effects. Most of these negative environmental effects can be 'design out' at an early stage through proper engineering designs, which will emphasize the contractors to follow environmentally friendly construction methodology and by applying proper environmental safeguard measures at site.

3.1 Impacts during Pre-construction Phase

The environmental impacts associated with the pre construction stages mainly include impacts due to design and location of the project as well as site preparation for construction. The main issues involve in the preconstruction stage are acquisition of land and properties, tree felling, diversion of forest land, acquisition of common property resources, relocation of public utilities etc. Most of the impacts of preconstruction stage are permanent in nature. The anticipated impacts associated with the preconstruction stage and their mitigation measures have been presented in the **Table 3.0**.

Table 3.0: Anticipated Environmental Impacts due to the Proposed Project and their Mitigation Measures during Pre-construction Stage

S. No.	Environmental Components/ Issues	Impacts	Mitigation Measures
1.	Acquisition of Land	A total area of 824.565 Ha of land (175.625 Ha in Osmanabad Dist., 369.267 Ha in Beed Dist., 112.398 Ha in Jalna District and 167.274 Ha in Aurangabad Dist.) will be required for acquisition to accommodate proposed widening beyond existing ROW as well as the proposed bypasses.	• The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement framework for the project. • Early identification of entitlement for Compensation to Compensate the Losses. • The Compensation will be paid in accordance with the NHAI Act and Policy and NPRR, Govt of India • The Compensation rate will be decided by the Competent Authority of the State Government appointed by the NHAI. • All the affected people will be compensated as per NPRR before
2.	Acquisition of Properties	Total Number of 1392 structures (199 in Osmanabad, 663 in Beed, 303 in Jalna and 227 in Aurangabad district) will be required to be acquired either partially or fully. Out of 1392 affected structures, 659 are residential property, 659 are commercial and 50 are Commercial cum residential properties. Apart from this total number of 134 community properties will be affected.	
3.	Resettlement and Rehabilitation of People	A total population of 9415 persons will be affected due to proposed widening. Out of which, district wise affected persons	

S. No.	Environmental Components/ Issues	Impacts	Mitigation Measures
		are: a) Osmanabad District: 1292 persons b) Beed District: 4409 persons c) Jalna District: 2171 persons d) Aurangabad District: 1493 persons	commencement of Construction works
4.	Roadside Trees	Felling of 27,380 number of trees will be required due to the proposed widening. Out of the affected trees, district wise impact will be as follows: a) Osmanabad District: 10,160 nos. b) Beed District: 10,493 nos. c) Jalna District: 3,912 nos. d) Aurangabad District: 2,815 nos.	• All efforts will be made to preserve trees by restricting tree cutting within the formation width. • Special attention will be given for protecting giant trees, and locally important trees (having cultural importance). • Compensatory plantation will be carried out in the ratio of as per Forest (Conservation) Act and as per NHAI Plantation Strategy within the proposed ROW.
5.	Acquisition of Forest Area	Diversion of 2.157 Ha of Reserve forest area is envisaged from different Reserved Forest Pockets located in Terkheda, Golegaon, Washi, Izora, Kolwadi villages District wise Affected Forest Area are as follows: a) Osmanabad District: 1.366 Ha. b) Beed District: 0.791Ha. c) Jalna District: Nil. d) Aurangabad District: Nil.	• The forest area acquisition has been avoided by selecting widening option on one side of the forest stretch or by making suitable adjustment in the alignment depending upon the technical feasibility. • The Forest Clearance will be obtained as per Forest (Conservation) Act and the compensation will be paid in accordance with the assessment of losses and cost of compensatory afforestation by the Forest Department as per Forest Conservation Rules.
6.	Impact on Religious/Cultural Features	Altogether 48 religious structures will be affected due to proposed widening and ROW.	Relocation of religious structures will be ensured. The relocation site will be decided with the consultation with local population and the related community users. Preference of the local community

S. No.	Environmental Components/ Issues	Impacts	Mitigation Measures
			using the structure will be addressed during relocation/ renovation of such affected features.
7.	Severance Problem	Severance Problem	A total number of 13 vehicular (Osmanabad: 2 nos., Beed: 8 nos., Jalna: 2 nos. and Aurangabad: 3 nos.) and 17 nos. Pedestrian/cattle underpasses (Osmanabad: 2 nos., Beed: 9 nos., Jalna: 1 no., Aurangabad: 6 nos.) have been provided for crossing the road for pedestrians, local traffic and cattle to avoid severance problem.
8.	Traffic Safety	Accident Hazards	The Adequate number of Vehicular underpasses, Pedestrian/cattle under passes, service roads, geometric corrections, scientifically designed bus stand, traffic signals, zebra crossings, junction improvements, bus bays and truck lay byes, traffic lightings and caution, regulatory and informative signboards have been provided in the project as per IRC codes. During operation there will be provision of highway patrolling, ambulance and recovery vans to deal with emergency situations.

3.2 Impact during Construction and Operation Stage

During construction period the major environmental issues will be related to dust generation, emission of gaseous emissions, borrow area and quarry operations, pollution due to operation of plants and equipments, contamination of land and soil, contamination of water bodies and public as well as workers health and safety. These anticipated impacts will mainly temporary and localised in nature and are likely to persist for short duration till the construction activities are over in a particular area. However there are some long term adverse impacts due to construction. These impacts however can be mitigated effectively through proper planning, scheduling and by application of environmental friendly construction practices. The likely impacts due to construction activities and operation of the project are explained along with the mitigation measures and institutional responsibility of implementation of environmental safeguards measures have been presented in the **Table 4.0**.

Table 4.0: **Matrix of Potential Environmental Impacts and Mitigation Measures during Construction and Operation Stage**

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
Loss of Top Soil	Excavation will be done only to the pegged area for constructing the road.	Throughout the stretch	Concessionaire	IC and PIU, NHAI
	Agricultural areas will be avoided for borrowing of materials, unless requested by the land owner.	Borrow Sites	Concessionaire	IC and PIU, NHAI
	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles of height not exceeding 2m.	Borrow sites, Quarry , Plant site and construction zone	Concessionaire	IC and PIU, NHAI
	The stored topsoil will be spread back to maintain the soil physico-chemical and biological Characteristics.	Borrow areas, Quarry, Plant site and construction zone	Concessionaire	IC and PIU, NHAI
Compaction of Soil	Construction vehicles, machinery and equipment will move, or be stationed in the designated area, to avoid compaction of soil.	Construction site and all ancillary sites	Concessionaire	IC and PIU, NHAI
	If operating from temporarily hired land, it will be ensured that the topsoil for agriculture remains preserved & not destroyed by storage, material handling or any other construction related activities.	Construction site and all ancillary sites	Concessionaire	IC and PIU, NHAI
Borrowing of Earth	No earth will be borrowed from within the RoW	Borrow Areas	Concessionaire	IC and PIU, NHAI
	Non-productive, barren lands, raised lands, river beds, waste lands are recommended for borrowing earth.			
	If new borrow areas are selected, it will be ensured that there is no loss of productive soil, and environmental considerations will be met with.			
	If vehicles carrying materials from borrow areas are pass through villages, the excavation and carrying of earth will be done during day time only.			
	The unpaved surfaces used for the haulage of borrow materials will be maintained properly			

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
	Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials.			
	To avoid any embankment slippages, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer			
	Borrow pits will be redeveloped by filling and providing 150 mm thick layer of preserved top-soil; or by creating a pond for fisheries, etc; or by levelling an elevated, raised earth mound and covering it with 150 mm thick preserved top-soil			
	Re-plantation of trees in borrow areas will be carried out			
Stone Quarry	The quarry material will be obtained from licensed sites only, which operate with proper environmental clearances, including clearances under the Air Act or if Concessionaire wants to open a new Quarry he shall take the entire requisite license from Dept. of Mines and Geology.	Quarry sites	Concessionaire	IC and PIU, NHAI
Soil Contamination from Fuel and lubricants	Impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform will be appropriately provided at construction camp, servicing area and liquid fuel and lubes at storage areas.	Construction Camp, Vehicle and Equipment Servicing Centre and Construction site	Concessionaire	IC and PIU, NHAI
Soil Contamination from Construction waste and spoils	All spoils will be disposed off as desired and the site will be fully cleaned before handing over.	Construction site throughout the project stretch	Concessionaire	IC and PIU, NHAI
	The non-usable bitumen spoils will be disposed off in a deep trench providing clay lining at the bottom and filled with soil at the top (for at least 0.5m)			
Community water Source	Any community water source as wells, tube-wells, etc., lost incidentally will be replaced immediately	Throughout the project stretch	Concessionaire	IC and PIU, NHAI
Drainage and run off	Earth, stones, wastes and spoils would be properly disposed off, to avoid blockage of any drainage channel.	Throughout the project stretch	Concessionaire	IC and PIU, NHAI
	All necessary precautions will be taken to construct temporary or permanent devices to prevent inundation or pond.			

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
Contamination of water from construction and allied activities	All necessary precautions will be taken to construct temporary or permanent devices to prevent water pollution due to increased siltation and turbidity.	Throughout the project stretch and allied sites including Construction camp and labour camp	Concessionaire	IC and PIU, NHAI
	All wastes arising from the project will be disposed off, as per SPCB norms, so as not to block the flow of water.			
	Wastes must be collected, stored and taken to approve disposal site.			
Sanitation and waste disposal in construction camps	Garbage tanks and sanitation facilities will be provided at camps	Construction Camp	Concessionaire	IC and PIU, NHAI
	The construction camps will be located away from water sources.			
	Efforts will be made to provide good sanitary and sewage disposal facilities at camp to avoid epidemics			
	The workplace will have proper medical approval by local medical, health or municipal authorities.			
Use of water for construction	The Concessionaire will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.		Concessionaire	IC and PIU, NHAI
	If a new tube-well is to be bored, prior sanction and approval by the Ground Water Department will be obtained			
	Wastage of water during construction will be minimized.			
Emissions from Vehicles and Equipments	All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms.	Plant sites	Concessionaire	IC and PIU, NHAI
	The asphalt plants, crushers and the batching plants will be sited at least 0.50 km in the downwind direction from the nearest human settlement.			
Dust Generation	The hot-mix plants, crushers and batching plants will be sited at least 0.5 km downwind from the nearest habitation. The hot mix plant will be fitted with dust suppression system.	Plant sites and Construction site	Concessionaire	IC and PIU, NHAI
	Water will be sprayed in the lime/cement and earth mixing sites, asphalt mixing site and temporary service and access roads.			

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
	After compacting, water will be sprayed on the earthwork regularly to prevent dust.			
	Vehicles delivering material will be covered.			
	Vehicles and machinery will be regularly checked to conform to the CPCB and NAAQ Standards			
	Mixing equipment will be well sealed and equipped with dust control removal devices			
	Workers at mixing sites will wear masks to reduce the chances of exposure to RSPM			
	Regular monitoring of RSPM/SPM/CO/Pb/HC will be carried out as mentioned in the Environmental Monitoring Plan			
Noise Generation from Construction vehicles and Machinery	The plants and equipment used for construction will strictly conform to CPCB noise standards.	Plant sites and Construction site	Concessionaire	IC, PIU, NHAI, State Pollution Control Board, Tamil Nadu
	Vehicles and equipments used will be fitted with silencer and maintained accordingly.			
	Noise standards of industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts.			
	Noise to be monitored (for 24 hrs.) as per monitoring plan			
Noise from Blasting Operation	Blasting as per Indian Explosives Act will be adopted.	Quarry site	Concessionaire	IC, PIU, NHAI, State Pollution Control Board, Tamil Nadu
	People living near such blasting sites will have prior information of operational hours.			
	Workers at blasting sites will be provided with earplugs			
Loss or Damage to Vegetation	Apart from trees earmarked for felling, no additional tree clearing within the RoW will be carried out.	Throughout the stretch	Concessionaire	IC, PIU, NHAI and Forest Dept.
	Area of tree plantation cleared will be replaced according to compensatory Afforestation Policy under Forest Conservation Act-1980.			
	Re plantation of tree species along new ROW.			
	Plantation of shrubs and under trees in the median.			
	Effort will be made to save giant trees with girth size more than 2.5 m.			

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
Compaction of Vegetation	Construction vehicles, machinery and equipment will move or be stationed in the designated area only (RoW or CoI, as applicable), to prevent compaction of vegetation outside the RoW	Throughout the stretch	Concessionaire	IC, PIU, NHAI
	While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses is avoided.	Throughout the stretch		
Occupational Health & Safety	Adequate drainage, sanitation and waste disposal will be provided at workplaces.	Throughout the stretch	Concessionaire	IC, PIU, NHAI
	Proper drainage will be maintained around sites to avoid water logging leading to various diseases.			
	Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc.			
	A health care system will be maintained at construction camp for routine check up of workers and avoidance of spread of any communicable disease			
Traffic Safety	To ensure safe construction in the temporary accesses during construction, lighting devices and safety signal devices will be installed.	At Concreting and plant sites	Concessionaire	IC, PIU, NHAI
	Traffic rules and regulations will be strictly adhered to.			
	Safety of workers undertaking various operations during construction will be ensured by providing helmets, masks, safety goggles, etc			
	The electrical equipment will be checked regularly			
	At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctor will be provided.			
	Road safety education will be imparted to drivers running construction vehicles.			
	Adequate signage, barriers and persons with flags during construction to control the traffic will be provided.			

Environmental Issue/Attributes	Mitigation Measures	Location	Institutional Responsibility	
			Implementation	Supervision
	If any valuable or invaluable articles such as fabrics, coins, artefacts, structures, or other archaeological relics are discovered, the excavation will be stopped and Archaeology Department, Assam. will be intimated.			
	Construction camps blasting sites and all allied construction activities will be located at least 500 m away from the cultural property.			
Operation Phase				
Contamination of Surface Water	Contingency Plans will be developed for clean up of oil spills, fuel and toxic chemicals for mitigating contamination of Surface Water due to Traffic Movement & Accidents	Throughout the project stretch	PIU, NHAI	PIU, NHAI
Air Quality Deterioration	Provision of Vegetative Screens		PIU, NHAI,	PIU, NHAI,
	Truck parking, lay-byes to be provided in suitable areas		PIU, NHAI	PIU, NHAI
	Regular Monitoring			
Noise Pollution	Noise attenuating Tree Species to be planted along the road	Settlement areas	PIU, NHAI	PIU, NHAI
	Posting of signs prohibiting the use of horns at settlement areas.			
Accident Hazard and Safety	Provision of elaborate system of sign boards and road markings along the whole stretch	Throughout the Project Stretch	PIU, NHAI	PIU, NHAI and State Police and Traffic Department
	Provision of suitable lighting arrangement at required locations			
	Development of Emergency Response and Contingency Plan for accidents			

It can be inferred from the above discussion that the project has temporary adverse environmental impacts during construction period which can be controlled through good construction practices and implementation of above mentioned environmental safeguard measures which have already been addressed in the EIA study. Some permanent impact is envisaged due to the project which is related to land acquisition and acquisition of structures, which is unavoidable. However the impact has been minimized by suitable selection of alignment, provision of bypasses and restricting ROW in built-up sections to the minimum. Moreover the affected persons will be adequately compensated as per NPRR Policy and National Highway Act and Policy. A Resettlement Action Plan has also been formulated for ensuring implementation of Resettlement and rehabilitation plan in effective manner.

During Operation stage overall the project will have positive impacts and with the provisions of traffic safety measures, provisions of public convenience, tree plantation, longitudinal drains, wider road etc. will improve the general environmental conditions along the project corridor.

4.0 ENVIRONMENTAL MONITORING PROGRAMME

Monitoring of environmental quality during construction and operation stages reflects the success of implementation of the mitigation measures. Also it provides a chance to review the suggested measure and improve upon the measures. The environmental monitoring plan covering various performance indicators, frequency and institutional arrangements for the project in the construction and operation stages has been formulated for the project. Monitoring of Environmental performance indicators will be undertaken by the project authority.

5.0 ANALYSIS OF ALTERNATIVES

An analysis of “With” and “Without” Project scenario reveals that the positive impacts outnumbered the negative impacts due to the proposed development. The negative impacts are envisaged only during the construction period which will be temporary in nature and of short duration. Further mitigation measures will be adopted to limit the impacts during the construction phase. The proposed expansion will add in infrastructure development and will act as a catalyst to boost the economic progress. It was revealed during discussions with various stakeholders that safety is a major concern along the existing highway section. The safety aspect will be enhanced considerably with the provision of service lanes, pedestrian crossings, street lights, additional systematically designed bust stands, rest areas, bus bays and truck lay byes, service roads which are the significant part of the project. The will ensure smooth traffic, it is envisaged that commercial establishments will revive their business and this will inturn boost the economic development.

6.0 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan (EMP) is the key to ensure effective implementation of environmental safeguard measures during different stage of the project. The desired results from the environmental mitigation measures proposed in the project may not be obtained without proper planning of the implementation of mitigation measures. The project specific EMP has been formulated for mitigating of offsetting the anticipated adverse impacts arising out of the project activities. Environmental Management Plan includes EMP Implementation Framework, supervision monitoring and reporting requirements.

During Preconstruction stage the responsibility of the implementation of mitigation measures is mainly Project Implementation Unit of NHAI which is the project proponent for the project. During Construction the primary responsibility of implementing environmental safeguards measures is with Concessionaire which will design, construct and own the project till concession period. The NHAI will be overall responsible for EMP implementation.

A budgetary cost estimated for environmental management activities is Rs. 22.27 Crores which includes various mitigation costs during preconstruction, construction and operation stages, environmental enhancement measures, environmental monitoring cost and activities of Corporate Social Responsibility.

7.0 CONCLUSIONS

The proposed expansion will add in infrastructure development and will act as a catalyst to boost the economic progress of the state. After the widening and extensive provisions of road safety measures such as provision of service roads, pedestrian/cattle underpasses, vehicular underpasses, bus bays, truck laybyes, guard rails, footpath, street lighting, etc. the existing road will ensure smooth flow of traffic thereby will increase the public safety and comfort. Benefits of the project will be the reduction in air pollution due to better service levels of the road, reduction in travel time and accidents, better connectivity. This will definitely encourage the economic along the project stretch, thereby improvement of socio-economic condition of the area along the project corridor.

With best management practices and a proper environmental management & monitoring plan in place during construction and operation stages, the proposed project is not expected to cause any significant adverse effect on the surrounding environment.