

Executive Summary (English)

ES.1 INTRODUCTION

Bharatmala Pariyojana is a new umbrella program for the highways sector that focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Expressway, Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and Green-field expressways.

As part of this endeavour, NHAH has taken up the "CONSULTANCY SERVICES FOR PREPARATION OF DPR FOR DEVELOPMENT OF EXPRESSWAYS, ECONOMIC CORRIDORS AND INTER CORRIDORS UNDER BHARATMALA PARIYOJANA PHASE-II: Ahmednagar - Solapur - Akkalkot" in the states of Maharashtra". The total length of the project corridor is 234.500 kms. The present proposal involves Development of 6-lane (Greenfield) access controlled Corridor from Ahmednagar - Solapur - Akkalkot Section: Starts at Sarola Baddi Village (Design Ch. 290.000) and Ends near Umarge Village (Design Ch. 524.500) in the State of Maharashtra, Total Length - 234.500 km.

In order to fulfil the above task, the NHAH has entrusted M/s Aarvee Associates Architects Engineers & Consultants Pvt. Ltd. (herein after referred to as the "Consultant") to carry out the Environmental Impact Assessment study and to prepare Environmental Management plan for the aforesaid project.

According to new EIA Notification issued on 14th September, 2006 by the MoEF&CC, GoI and amended Notification on 22nd August 2013 on Highway projects, "New, expansion or modernization of any activity falling within categories of developmental and industrial activities shall be undertaken in any part of India only after it has been accorded environmental clearance by the MoEF&CC in accordance with the procedures specified in the Notification". Among categories listed in Schedule of Notification and amendments thereof, the proposed project stretch falls under Category-A of the Schedule. Hence, Environmental Clearance is required for this project. Accordingly, Form-1 was submitted to MoEF&CC and obtained the Terms of Reference (ToR), MoEF&CC vide file no. 10/9/2023-IA.III Proposal No. IA/MH/INFRA1/418904/2023, dated May 17, 2023 which is also attached as **Annexure -I**. Accordingly, the granted ToR by MoEF&CC, the EIA Study has been conducted and detailed in the report.

ES.2 PROJECT DESCRIPTION

ES.2.1 Location

The proposed project starts near to Sarola Baddi Village (Des 290.000) in Ahmednagar district and terminates at Umarge Village (Des. 524.50.000) of Solapur district in the State of Maharashtra. The proposed Greenfield corridor traverses through Ahmednagar, Beed, Osmanabad and Solapur districts in the state of Maharashtra. The index map is given in Figure ES 1.

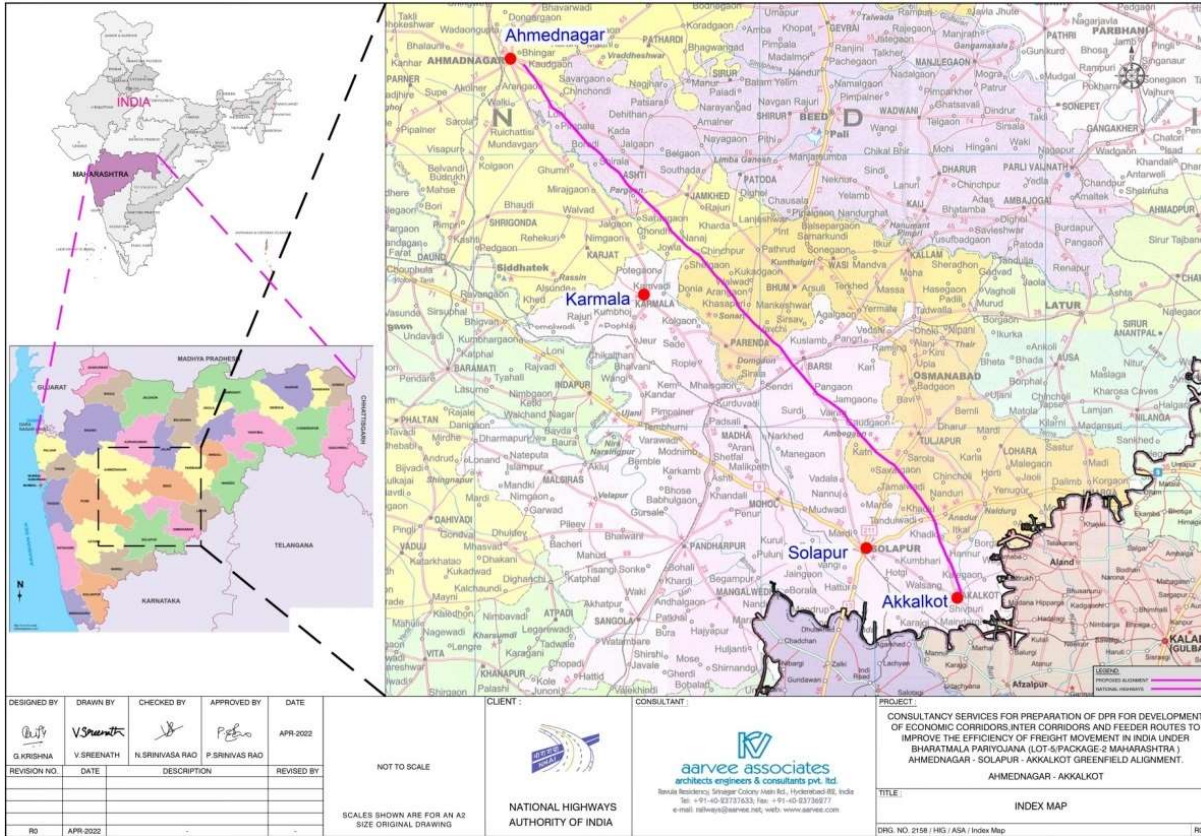


Figure ES.1: Index Map

ES.2.2 Description and Salient Features of the Proposed Project

The Salient features and engineering features of the project stretch are given in Table ES.1 and Table ES.2 respectively.

Table ES-1: Salient features of proposed project stretch

S. No	Particulars	Details
1.	Location	The proposed project corridor Start near Sarola Baddi Village (Design Ch. 290.000) and Ends near Umarge Village (Design Ch. 524.500) in the State of Maharashtra, Total Length – 234.500 km.
2.	Latitude and longitude	Starting point: Lat 19° 5'39.18"N, Lon: 74°49'58.24"E and Ending point: Lat:15° 17'29'31.31"N, Long: 76°14'26.46"E
3.	Elevation above mean sea level	458 m - 649 m
4.	Terrain	Terrain is classified by the general slope of the country across the highway alignment. Based on this criterion, the entire project stretch traverses predominantly through plain terrain.
5.	Nearest railway stations	Ahmednagar Junction is at a distance of 11 km from the proposed alignment.
6.	Rivers/streams	The alignment is crossing Bori river, Streams of Chandini and Khasapuri dam and few streams.
7.	Hills/valleys	--
8.	Reserved forests/protected forest	The proposed project involves diversion of 10.445 ha of forest land. The project is passing through the forest area for a length of 1.8 kms.
9.	National parks/wildlife sanctuary /core biosphere reserve	It is passing near to Great Indian Bustard Sanctuary, Nannaj.

Table ES-2: Engineering features of the project stretch

S.No	Description	CP-8	CP-9	CP-10	CP-11	CP-12	CP-13	CP-14
1.	Right of Way (m)	60m						
2.	Design speed (km/hr)	100Kmph						
3.	Bridges							
4.	Major Bridge	4	2	7	2	3	0	1
5.	Minor Bridge	18	23	15	20	19	13	5
6.	Railway Over Bridge (ROB)	1	0	0	1	1	0	0
7.	Railway Under Bridge (RUB)	0	0	0	0	0	0	0
8.	No. of culverts	122	102	141	117	100	76	38
11.	Causeways	0	0	0	0	0	0	0
12.	LVUPs/SVUPs	11/Nil	09/Nil	19/Nil	09/Nil	11/Nil	06/Nil	05/Nil
13.	Vehicular underpasses/ Overpasses	03/Nil	06/04/	02 / Nil	07/03/23	03/ Nil	03 / 03	03/ 01
15.	Toll Plazas	02/Nil	02/Nil	Nil/8	2/Nil	1/Nil	1/Nil	1/ Nil
16.	Rest Areas	2	2	2	2	2	2	2
17.	Mini Nest Area	Nil	Nil	Nil	Nil	Nil	Nil	
18.	Bypasses	Nil	Nil	Nil	Nil	Nil	Nil	
20.	Land to be acquired (non forest)	278.69	306.89	294.03	308.92	248.4	220.13	110
21.	Land to be acquired (forest)	4.31	0.11	0.97	0.18	-	4.87	-

ES.2.3 Traffic Analysis

Traffic projections are important in order to assess the amount of vehicles running on the road in the future. It helps to estimate air and noise pollution in the nearby areas. Hence, mitigation measures can be taken to reduce the pollution levels. The project corridor is having tolling facility and projection of traffic is important for assessing the toll revenue that could accrue in the coming years. The passenger car unit (PCU) predicted for the 2025 varied between 25,205 to 32,667 and, for the year 2055 it varied between 97,958 to 151,183 for the proposed alignment.

ES.2.4 Construction period

The construction period is estimated to be for three (03) years - 36 months.

ES.2.5 Cost

Estimated cost for the construction of the proposed project stretch is around Rs. 7,219.49 cr.

ES.3 Analysis of Alternative

This chapter is an attempt to compare feasible alternatives to the proposed development in respect to site, technology, design, etc. The criteria adopted for the evaluation of the alternate route for construction of proposed alignment comprises engineering, economic, environmental and social considerations. The chapter discusses how environmental and social parameters were assigned due importance and were carefully considered in the analysis of alternatives. Three (03) alignment options were studied and compared in order to finalize the proposed alignment.

The alternative analysis was carried out using the **Impact Scoring Matrix** by comparing the three alternatives. The impacts scoring matrix was assessed by considering the impacts of the project on the physical environment such as natural resources and biological life and also includes the impacts on socio-economics as well as financial and economics (Refer

Chapter 4) From the assessment, it is evident that proposed alignment (Alt 1) is the preferred option due to following reasons and hence the same was selected by the NHAI:

- Least impact on forest area.
- Minimum impact on habitations
- Less number of structures affected
- Better connectivity to major towns
- Least distance so that lesser carbon footprint is generated

ES.4 Description of Environment

As per the EIA Guidance Manual for Highways (MoEF&CC, 2010), a study area of 10 Km radius from the project road was considered for secondary data collection. Primary data has been collected within 500 meters on either side of the proposed alignment. Secondary data were collected from published reports, research papers, working plans, consultations and discussions with govt. officials. Primary baseline environment monitoring was carried out for the period of one season from *April 2023 to June 2023* (summer season) by M/s. Vision Laboratories, Hyderabad, a NABL accredited (TC-5064) & MoEF&CC recognized laboratory.

ES.4.1 Site and its environs

The reconnaissance survey and subsequent field studies were carried out in the study area which falls in Ahmednagar, Beed, Osmanabad, Solapur in Maharashtra state.

ES.4.2 Air Environment

ES.4.2.1 Climatology

As a part of the EIA study, an automatic weather station at Dongaon has been installed and monitored for the months of April - June 2023. The micro-meteorological parameters observed are Temperature, Wind speed, Wind direction and Rainfall. The summary of meteorological conditions observed is presented in Table ES.3.

Table ES-3: On-site meteorological conditions

Parameter	Dongaon	
	Max	Min
Temperature, °C	46	22.4
Wind Speed, m/sec	60.0	21.9
Wind Direction, degrees	54	
Rainfall (mm)	West North-West and Calm: 1.45%	
	0.46	

Micro-meteorological station gives climatological condition of the study area by recording temperature, wind direction, wind speed and rainfall data. The station was installed at Dongaon and data recorded for Summer Season for three months (April 2022 to June 2023). Micro-meteorological location details are given in Table ES.4.

Table ES-4: Micro-meteorological location

Location Code	Location	Latitude and Longitude
MM	Dongaon	18°43'5.00"N 75°11'19.60"E

Eight (08) ambient air quality monitoring stations were identified & monitored.

- **PM10:** values were observed in the range of 24.1 - 43.6 µg/m³ as against the CPCB standard of 100 µg/m³ for residential / industrial / rural / areas other than ecologically sensitive areas.
- **PM2.5:** values were found in the range of 13.4 - 24.9 µg/m³ as against the CPCB standard of 60 µg/m³ for residential/industrial/rural/areas other than ecologically sensitive areas.
- **SO2:** values were observed in the range of <4 - 5.7 µg/m³ and is well below the CPCB prescribed limits.
- **NOX:** values were observed in the range of 10.6 - 20.5 µg/m³ and is well below the CPCB prescribed limits.
- **CO:** The concentration of CO was observed below 1.0 mg/m³ all monitoring stations as against the CPCB standard of 4 mg/m³.

ES.4.3 Noise Environment

The field monitoring was carried out at Twenty two (22) noise monitoring locations. The day noise levels were recorded between 6 am to 10 pm and night noise levels were recorded between 10 pm and 6 am at all locations. Leq day and Leq night calculated for various locations in the area are presented below which has been compared with the standards prescribed by CPCB for various zones. The Noise quality result presented in below table, shows that Leq Day time varies from **38.7 - 52 dB (A)** and Leq Night-time varies from **31.4 - 42.6 dB(A)**.

ES.4.4 Water Environment

Surface Water Quality

During the preliminary assessment, sixteen (16) surface water sampling locations were identified, and samples were collected for assessing the water quality for physico-chemical and biological parameters.

- pH values are varying between 7.18 to 8.46 which are well within the Class C limits of 6.5-8.5 in all surface water samples.
- Total Hardness (TH) values are varying between 140-770 mg/L.
- Total Dissolved Solids (TDS) concentrations are varying from 317 mg/L to 1473 mg/L which are well below the Class C limit concentration of 1500 mg/L.
- BOD concentrations are varying from <3.0 mg/L to 20 mg/L. Most of the Samples analysed are showing BOD values higher than the Class C limit of 3 mg/L. Higher BOD values may be due to the intrusion of domestic wastewater into the surface water body.
- Dissolved Oxygen (DO) in the samples are varying from 4 mg/L to 5.2 mg/L which are above the minimum requirement of 4 mg/L, shows sustainability of aquatic life in the lakes/ponds/streams.

Ground Water Quality

Seventeen (17) sampling locations were identified (bore wells/dug wells). Ground water samples collected from various sources were analysed for physico-chemical and biological parameters.

- pH values are varying between 6.98 to 8.16.
- Total Hardness (TH) values are observed to be varying between 80 mg/L – 1,800 mg/L. Desirable and permissible limit of Total Hardness are 200 mg/L & 600 mg/L respectively. All samples are showing TH values well below the permissible limit except at the locations of GW4 and GW7 which are above the permissible limit of 600 mg/L.
- Nitrates values are observed to be varying between 6.2 – 29.6 mg/L. Desirable limit of Nitrates are 45 mg/L. All samples are showing Nitrates values well below the acceptable limit.
- Flouride values are observed to be varying between 0.4 – 2.3 mg/L. Desirable and permissible limit of Flourides are 1 mg/L & 1.5 mg/L Apart from GW7 & GW17, all sample values are well below the permissible limit.

The ground water quality in the study area is satisfactory as compared with BIS: 10500 standards.

ES.4.5 Land Environment

The land use of the proposed project area is found to be mostly i.e, 74.3 % agriculture area and Barren land accounts to 18.25%. The remaining minor portion is falling in forest area and others with 4.45 % and 3.0 % respectively.

Soil Quality: The soil of the Solapur and Ahmednagar districts is mainly Sandy loam to silty loam in nature. The soil characteristics were analyzed at Twelve (12) locations.

- pH values vary from 6.98 to 7.65.
- EC of the analysed samples vary between 95 μ S/cm to 156 μ S/cm.
- The NPK values are in the range of 216-385 mg/kg, 19-35 mg/kg & 85-168 Kg/Ha respectively.
- Organic carbon in the samples varies from 0.64 to 0.71%.
- The micro-nutrients assessed in the soil are Iron and Lead and they range between 1.2-4.2 mg/kg, and <1 mg/kg.

ES.4.6 Biological Environment

The proposed highways section of 234.5 km traverses through plain and rolling terrain with fertile agriculture lands, grasslands, and rocky surfaces. The natural greenery in this region is mainly attributed by the grasslands and scrub kind of forests as water holding capacity of soil is very low thus dryness prevails in the soil.

There are no dense forests are found in the project area. It was seen that the natural habitats or green patches in the project area is found in the form of open scrub vegetation which have very sparse tree such as *Azadirachta indica*, *Acacia nilotica*, *Prosopis cineraria*, *Butea monosperma*, which are also having restricted growth whereas in shrubs *Calotropis procera*, *Lantana camara*, *Zizipus sps* etc have been observed.

In context of faunal species, during the survey, a general profile of different animals was seen in the area. However, endangered species was not encountered but presence of some RET faunal species is reported in secondary literature and Forest department. Among Sch-1

Mammals, Leopard, Black buck, Wolf, Rusty Spotted Cat and Four-horned Antelope are found in the project area whereas in Great Indian Bustard, Black Indian Peafowl as well as several species of the Accipitridae family such as Birds Shikra, Black-shouldered Kite, Eagle, Lesser Florican are found which are enlisted in Sch-1 species of WPA 1972. Similarly, in Reptiles Indian Monitor Lizard is also Sch-1 species of WPA 1972 which is found in the project area. Black buck is reported to have a wide distribution and movement in the project area.

Ecological Sensitivity

The proposed project road is not passing within any any eco-sensitive / protected areas. As per the MoEF&CC ESZ Notification, the proposed alignment is passing 600m away from designated ESZ zone of Gangewadi Great Indian Bustard Sanctuary and 24km away from Rehekuri Blackbuck Sanctuary Boundary. Hence, no direct impact is envisaged on any major wildlife. However, the movement of Blackbuck deer is reported in a wide range of the area therefore project embankment will disturb the moment of Blackbuck and other wildlife species across the area. The project is passing through forest area for a length of 1.8 kms and the proposed project involves diversion of 10.445 ha of forest area.

ES.4.7 Socio-Economic Environment

The project road runs through the districts of Solapur, Ahmednagar, Beed and Osmanabad districts of Maharashtra. The proposed road connects major town of Beed, Osmanabad, Barshi etc. Brief socio-demographic profile of the project districts is given in below Table ES 5.

Table ES5: Census data of Solapur & Ahmednagar of Maharashtra

S.No	Particulars	Solapur	Ahmednagar	Beed	Osmanabad
1	Geographical Area (Sq. Km)	14895	17048	10693	7569
2	Population as per 2011 Census				
(a)	Total Population	4317756	4543159	2585049	1657576
(b)	Male Population	2227852	2342825	1349106	861535
(c)	Female Population	2089904	2200334	1235943	796041
3	Sex Ratio	938	939	916	924
(a)	Rural	922	938	912	922
(b)	Urban	972	942	933	934

ES.5 IMPACTS DURING DESIGN, CONSTRUCTION AND OPERATION PHASES

This chapter assesses the nature, type and magnitude of the potential impacts likely on physical, biological and cultural environmental components along the project corridor and also discusses suitable mitigation. For the assessment of impacts, the baseline information was collected based on primary surveys and secondary data.

ES.5.1 Design Phase

ES.5.1.1 Impacts due to Project Design

The design phase involves the siting of the final right-of-way footprint and all aspects of structural design and within design mitigations. This phase also provides several important mitigation opportunities including both site-scale avoidance of sensitive habitats and structural modifications to the highway design that may reduce impacts of fragmentation or

off-site effects. Accordingly, the following measures were considered during the design phase:

ES.5.1.2 Biological Environment

All the ecological sensitivity and biological environment of the project area has been taken into consideration and thus most of the negative impacts of the project on the ecological environment and sensitivity has been removed by changing the route to avoid the passing inside the protected area such as GIB WLS as well as by providing cross structures to facilitate the movement of the wildlife.

ES.5.1.3 Water Environment

- The proposed project alignment is abutting 24 river/stream along the proposed alignment. At all these locations **828 nos.** of cross drainage structures in the form of major/minor bridges & culverts, are proposed to avoid obstruction to the movement of water flow.
- Nineteen (19) major bridges and One hundred thirteen (113) minor bridges are proposed, No major and minor bridges will be dismantled and reconstructed. In the case of culverts, 696 culverts (new) are proposed.

ES.5.1.4 Social Environment

- The project may affect 2,650 PAFs (approx.) which is lesser than other alternatives.
- The finalization of project alignment also considered avoiding of graveyards, temples, cold storage warehouses etc., wherever possible to avoid disturbs to the public utilities.
- Shifting of alignment away from the existing utilities such power grid lines were carried out in co-ordination with Utility owners.

ES.5.2 Construction Phase

ES.5.2.1 Physical Environment

Pre-Construction, Construction and Operation Stage

Impact

An increase in daytime temperature near the road surface due to increased pavement surface, which in turn might lead to formation of heat islands especially near the inhabited sections. This increase in the daytime temperature assumes significant especially in close vicinity of proposed highway.

Mitigation

Although the impact is significant but reversible in nature and shall be compensated by avenue tree plantation alongside the proposed highway as per IRC SP-21:2009 to compensate the micro-climatic impacts.

ES.5.2.2 Physiography

The impacts on physiography may include de-stabilisation of slopes due to cut and fill operations. 119 Minor Bridges and 696 Culverts are proposed along the project stretch to avoid any impact on local hydrology.

ES.5.2.3 Geology and Seismology

The entire stretch of the project traverses through Seismic Zone III (Moderate damage Risk zone). The project does not have any direct impact on the geological or seismic stability of the area.

ES.5.2.4 Borrow Areas/Stone Quarries/Sand Quarries

The proposed project corridor requires raw materials from borrow areas, metal quarries and sand quarries. Total 14 nos. borrow areas, 15 nos. metal quarries and 1 nos. sand quarries have been identified for the entire project stretch.

Mitigation measures:

- To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Site Engineer.
- Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials.
- To ensure that the spills, which might result from the transport of borrow and quarry materials do not impact the settlements.
- Quarries and borrow pits will be back filled with rejected construction wastes and will be given a vegetative cover.
- Appropriate plant species for the planting programme should be selected in consultation with ecological consultant and local forest department.

ES.5.2.5 Utilization of Fly Ash

It is estimated that **18,552,097.00Cum** of flyash will be utilised for the construction of embankments. This may be procured from NTPC Solapur, MSPGCL - Parali Thermal Power Plant.

ES.5.2.5 Surplus Earth/Muck/Construction & Demolition Waste

The quantity of surplus earth/muck generated during the construction phase is about **87,40,021Cum** for the proposed road project. An amount of **Rs.15,032.83 lakhs** are provided in the EMP for the disposal of the same.

ES.5.2.6 Soil Erosion

Impact

Elevated sections of the highway, high embankments along the bridges and the bridge approaches would be vulnerable to erosion and need to be provided proper slope protection measures to prevent erosion. Construction of new bridges involves excavation of riverbed and banks for the construction of the foundations and piers. If the residual spoil is not properly disposed off, increased sedimentation downstream of the bridge is likely.

Mitigation

Adequate slope protection measures are proposed as part of engineering design. Silt fencing shall be provided to prevent eroded material from entering watercourses. Though during construction period, drainage alteration and downstream erosion / siltation is anticipated, however, cross drainage structure based on hydrology study shall compensate the drainage alteration in the surrounding area.

ES.5.2.7 Impact on Water Resources and Water Quality

To prevent accumulation of water by the roadside, adequate cross drainage (CD) structures in the form of bridges/culverts/causeways with adequate discharge, along the road capacity will be constructed. During reconstruction of old cross drainage structures and construction of new ones, diversion is required to aid uninterrupted movement of traffic. Material will not be put in the drainage to avoid blockage and prevent the erosion. This will help in protecting the aquatic ecology.

Proposed Cross Drainage Structures:

Thirteen (19) major bridges and fifty-four (113) minor bridges are proposed. In the case of culverts, 696 culverts (new) are proposed.

ES.5.2.8 Impact on Air Quality

Fugitive dust emission during construction phase due to movement of trucks on haulage roads, excavation activities, loading and unloading activities is estimated based on US EPA reference documents. Notable inputs for the model include 28 precipitation days with precipitation > 0.254 mm, 12% silt and 8% moisture content. 95% EMP efficiency is assumed. Total reduction of 85,512 Tonnes/year of PM10 is anticipated with 95% EMP efficiency for fugitive dust emissions from haulage roads, excavation and loading & unloading activities during construction phase of the project.

Mitigation Measures:

- Hot mix plants shall be located away from the inhabited areas, residential settlements and water bodies.
- Trucks and tippers carrying earth for filling, sand, gravel or stone will be duly covered with tarpaulin sheets to avoid spilling.
- Dust level at the construction sites shall be controlled by sprinkling water on haulage roads thrice in a day.
- Construction material, machinery and equipment will be maintained in a good working condition and shall be handled with due precaution and only by trained professionals.

ES.5.2.9 Impact on Noise

For predicting the noise levels during the construction phase, three scenarios carried out i.e., Residential, Commercial and noise levels at structures (Major bridges). The input values for the above table was utilized and output was predicted at distance of 50 m from the center of the proposed alignment using the Roadway Construction Noise Model (RCNM). The predicted values are 77.6 dB(A), 77.6 dB(A) and 80.1 dB(A) for Residential, Commercial and noise levels at structures respectively. Some of the instruments considered for the modelling study are Concrete batch plant, concrete mixer truck, crane, backhoe, vibrator pile driver, pavement scarafier, paver etc.

Mitigation Measures:

- The required mitigation measures include location of construction equipment at least 250 m away from inhabited areas.
- Construction workers will have to be provided with protection devices like earplugs.
- Maintenance of equipment in good condition, proper design of engine enclosures.

ES.5.3 Impact on Biological Environment

The proposed alignment is passing through 10.445 ha of reserve forest which is envisaged to be diverted for this project as per Forest (Conservation) Act, 1980. This will disturb the natural habitat and its dependent wildlife. In forest areas the passing of the road will fragment the habitat.

Trees and vegetation of the RoW shall be cleared for the road. About **9,795 trees** are likely to be felled. The felling of trees will disturb the habitat and shall have impact on Fauna depending on them for various purposes.

Degree of erosion will also be increased with the removal of vegetation. Road development activity is not likely to disturb the aquatic habitat depending on the extent and design of the project and also if activity and handling are uncontrolled.

Movement of Blackbuck deer is reported in a wide range of the area therefore project embankment will disturb the moment of Blackbuck and other wildlife species across the area.

Mitigation Measures

- Clearing of the RoW and propagation of the road structure will be carried carefully.
- The loss of trees and ecosystem shall have to be compensated through Green Belt Development along both sides and median of the road (88,000 nos. of Avenue plantation and 1,17,216 nos. of median plantation). Also, compensatory plantations in accordance with the principles of the Forest (Conservation) Act and Forest Policy will be done inline of the Forest land diverted.
- The camps shall have proper toilets with sanitary disposal of wastes.
- Smoking, hunting & fishing by the labour and other staff in the wild are prohibited.
- No labour camps shall be permitted in the vicinity of any water body.
- Construction material or debris etc. will not be stored near the water bodies.
- Silt fencing has also been proposed to ensure that siltation and hence turbidity doesn't increase.
- The contractor shall regularly service the construction vehicles & machinery and maintain these in good condition.
- Adequate structures for the crossing of the wildlife such as, Black Buck, will be provided throughout the project length.

ES.5.4 Social Environment

ES.5.4.1 Impacts on Human Use Values

Construction of newly proposed Greenfield highway with 6 lanes complying with National Highway norms may lead to a change in the land use pattern of areas adjacent to the road. The existing land adjacent to the road stretch at present is predominantly agricultural land and barren land.

Total land required for the project is around 1770.50 ha involving approx. 2650 Project Affected Families (PAFs).

Mitigation Measures:

- Approx. 2,600 workers shall be employed during the construction phase of the project for three years and local people shall be given priority. It shall provide at least 50 nos. of permanent employees.
- The project shall generate total 2,847,000 mandays of work during construction phase and 1,82,500 mandays of work during operation phase.
- The compensation for the project affected and project affected families shall be provided as per the RFCTLARR Act, 2013
- It is expected in next 10 years at least 80 to 100 agro-based industries and manufacturing industries shall be developed along the proposed stretch.
- Major settlement has been avoided to reduce adverse impact on the local communities.
- Construction activities shall be limited to the corridor only.
- Care shall be taken to ensure that the construction workers camp do not disturb the surrounding land use.
- Existing access/entrances to the highway shall be duly maintained.
- The bypass alternatives that are best from engineering, environmental and social aspects are selected for this project.
- Construction camp shall be located away from the major settlement; eco sensitive areas; Not located at water hole of down stream consumers; Away from potential unstable areas; Away from flash flood level; Away from any drainage lines (at least 10m); In low impact areas where road works induced damage is minimal; With kitchen refuse disposed of to designated locations ; With washing up – dishes, clothes – done at locations well away from the water hole.
- The project road will provide economic boost to the local population through facilitation of easy transportation of materials to the commercial centres.
- As a result, villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local 'haats' and middlemen.
- Improved quality of life is expected for the population in the project influence area.

ES.5.4.2 Impact on Archaeological sites/Artefacts

As per "The Ancient Monuments and Archaeological Sites and Remains Act, 1958", as amended in 2010", the construction activities should be 200 m away from the ASI site. There are no ancient or historical monuments and archaeological sites are coming within 200m vicinity along the proposed project corridor, but a Salabat Khan Tomb is about 590 m away from the proposed corridor.

Mitigation Measures:

- The Contractor will not disturb the found artefacts further until an assessment by competent professionals is made and actions consistent with the requirements of ASI are taken.
- The Contractor, on behalf of the NHAI, will coordinate with the Archaeology Department to designate an on-site representative during the entire duration of the project.

- All workers will undergo a briefing with the Archaeology Department to ensure safeguarding of artefacts/heritage resource and cultural/religious practices.

ES.5.4.3 Impacts from Construction Workers Camp

Local labourers shall be employed for the construction activities to the maximum possible number to minimize the production of domestic waste generation. As far this project is concerned, the number of persons to be employed during the peak construction period would be around 2,600 nos respectively. Potential impacts from construction workers camps also include poaching of edible animals and birds in the locality, despite prohibitions.

Mitigation Measures:

- The contractor and safety manager will be responsible for providing adequate knowledge to workers regarding the protection of fauna.
- Workers will be trained regarding nature protection and the need to avoid cutting down trees during construction.
- Contractors will be responsible for supplying appropriate fuel in the work camps to prevent firewood collection.
- Labourers residing in the camps shall be provided with safe drinking water, adequate sanitation facilities, kerosene/gas and all other amenities as per the prevailing Labour laws. Domestic waste generated will be treated as per IS: 2470 norms.

ES.5.5 Impacts during Operation Phase

ES.5.5.1 Impact on Land Use

Road development may lead to establishment of petty shops and other commercial pursuits by the local people. Local statutory bodies will strictly enforce land use. In addition, the project proponent should prevent development of squatters' settlements and encroachments on the vacant portions of the RoW of the road.

ES.5.5.2 Impact on Air Quality

Air quality analysis along the project stretch was done using CALRoads (US EPA preferred/recommended model). CALRoads is an air quality model used to predict pollutant concentration near roads.

Inputs for the CALINE model include micro-meteorological data from Dongaon (18°43'5.00"N; 75°11'19.60"E) station (temperature, wind direction, wind speed & rainfall), roughness coefficient, ambient concentration, emission coefficient, traffic volumes and emission factors. The assessment of air quality was performed for the project stretch considering worst case scenario for number of vehicles expected on 2059 (ultimate year). The parameters considered in this model are CO and PM.

Carbon Monoxide (CO):

The predicted values of CO for year 2059 are varying from place to place. The maximum concentration of CO predicted for the year 2059 is 1.10 ppm (1.26 mg/m³). CO values are varying between 0.01 ppm to 0.16 ppm (0.01 mg/m³ to 0.18 mg/m³) in most of the surrounding areas of proposed road stretch.

Particulate Matter (PM):

The predicted values of PM₁₀ for year 2059 are varying from place to place. The maximum concentration of PM₁₀ predicted for the year 2059 is 80.70 µg/m³ for 24 hours. PM₁₀ values are varying between 20 to 30 µg/m³ in most of the surrounding areas of the proposed

project stretch. When compared with the National Ambient Air Quality Standard (NAAQS) of 100 µg/m³ for 24 hours, predicted values for the year 2059 are well below the prescribed standard limit near the project corridor.

In order to minimize the impact, it is already suggested in EMP to go for two rows/three of avenue plantation (88,000 nos.) on either side of the proposed project road and two rows of median plantation (1,17,216 nos.). This will further reduce the concentration of CO and PM.

ES.5.5.3 Impact on Noise Quality

The future noise levels are predicted using FHWA (Federal Highway Administration) noise modelling technique and suitable mitigation measures are taken for reducing noise levels. The noise levels are predicted for ten stretches for different years (2025, 2030, 2035, 2040, 2045, 2050 and 2055) with project scenario at 500 m distance from the either side of the carriageway. It is clearly indicated that for all the predicted years, the day noise is exceeding the stipulated CPCB standards (65 dB(A) for commercial area) for stretch I to Stretch IX. The noise level at nighttime is crossing the limit of 55 dB(A) for all years (2029, 2034, 2039, 2044, 2049, 2054 and 2059) for all the stretches. The greenbelt development has been proposed with two/three rows of avenue plantation (88,000 nos.) on either side of the proposed project road and two rows of median plantation (1,17,216 nos.) shall further reduce the noise levels.

ES.5.5.4 Impact on Water Environment

Groundwater:

No adverse impacts are anticipated during operation phase. Around 352 nos. of RHW pits are proposed on either side of the road with oil and grease removal tank at an interval of 500 m. A budget provision of 70.4 lakhs is made for the same in EMP.

Surface water:

During the operation period, no significant surface water pollution is expected.

ES.5.6 Biological Environment

Roads are considered as the major cause of the pollution due to the vehicular movement. This affects the biotic components in the surrounding. The noise caused by the vehicular movements shall disturb and frighten the fauna & their habitats. This alignment is passing 600m away from the ESZ zone of Great Indian Bustard Wildlife Sanctuary and 23 km from the Rehekuri Blackbuck Sanctuary Black Buck Wildlife Sanctuary. An equivalent area of diverted land is to be afforested outside the notified forest, else, twice of the diverted area recognized as the degraded forest land or wasteland under forest must be afforested. This can be finalized with the Forest department during the forest clearance process.

Mitigation Measures

The Greenbelt Development and compensatory plantation will replenish the loss of greenery. This will also recreate the habitat for the small animals and avifauna. Therefore, the plantation/compensatory afforestation along the proposed highway and other areas shall act as new habitat for these faunal species and after a period the negative impact due to the road construction shall be mitigated with more aesthetic advantages.

There will be proper embankment with crash barriers & other barricades to stop the wild & domesticated animals to enter or cross the road. Entry and exit at the highway shall only be allowed through interchanges.

Regular watering and safety to the plants have to be provided till they get self-sustainable. Also, regular watering shall be ensured in the dry/summer seasons to save the plants from permanent wilting.

Turfing of grass on the embankment shall be ensured to stabilize the slope and checking of the erosion.

Though the project corridor is passing away from designated ESZ zone of Gangewadi Great Indian Bustard Sanctuary and more than 15 km distance from the Rehekuri Blackbuck Sanctuary Boundary, there are animal/pedestrian underpasses and culverts proposed along the stretch passing close it. These include 59 nos. of Animal/ pedestrian underpass with vertical clearance of 4.5 m, 80 nos. of Box culverts with vertical clearance of 3m and 10 nos. of LVUP/UP cum culverts with 5.5m to 7.7m vertical clearance.

In the forest stretch of 1.8 Kms, four (04) nos. of box culverts are proposed with a vertical clearance of 5m. The details of these structures are provided in the Annexure-V.

ES.6 Environmental Monitoring Programme

The environmental monitoring programme is devised to ensure that the envisaged purpose of the environment management plan is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations and
- To provide feedback on adequacy of Environmental Impact Assessment

Construction Phase

During construction stage environmental monitoring will be carried out for air quality (8 Locations), noise (22 Locations), water quality (28 Locations), soil quality (12 Locations) for period of 3 years.

Operation Phase

Even though the environmental hazards during the operation phase of the project are minimal, the environmental monitoring will be carried out for air quality(8 Locations), noise (22 Locations), water quality (28 Locations), soil quality (12 Locations) for period of 1 year .The results of air quality, water quality, soil quality and noise quality will be submitted to management quarterly during construction phase and semi-annually during operation phase.

ES.7 Disaster Management, Risk Assessment & Mitigation Procedures

Risk assessment is a process that seeks to estimate the likelihood of occurrence of adverse effects as a result of major road mishaps, gas tanker explosions, fire hazards, floods, cyclones, earthquakes etc. at Highway projects. Fatality rate on Indian highways is very high mainly due to road accidents. The other adverse impacts due to gas tanker explosions, fire hazards, floods, cyclones, earthquakes etc. are nominal. Elimination of the risk (avoidance of accidents) is given prime importance and NHAI has introduced road safety provisions during the design of highway with the help of Road Safety Manual. Some of these are listed below:

- Safety barriers/delineators hard shoulders on main roads
- Traffic signs and pavement markings
- Underpasses and other grade separators at junctions
- Removal of junctions and direct access points on main roads
- Improved median openings with stacking lanes
- Separate provisions and direct access point
- Service roads in towns and villages for segregating local and highways traffic.

The contractors shall conduct Risk Assessment for all works to decide on priorities and to set objectives for eliminating hazards and reducing risks. The detailed plan is provided in the chapter 8.

ES.8 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Based on the detailed evaluation of the likely impacts on various environmental parameters, an environmental management plan is prepared. The mitigation measures for minimization of adverse impacts, green belt development/plantation programme have been incorporated in the chapter on environmental management plan. Post-project monitoring and analysis shall be carried out as described in this report. The frequency, methodology of sampling and testing for various pollutants specified by CPCB will be followed. This plan also specifies the organizational requirements and institutional strengthening necessary for sound environmental management of the project. The major components of the EMP are:

- EMP implementing agency
- Monitoring of the EMP implementation
- Training on environmental management
- Budget for EMP implementation

Environmental Management Cell (EMC) of NHA will supervise and implement the mitigation measures as documented in the EMP. This EMC must also be adequately empowered to discharge the responsibilities as outlined in the EMP. To ensure smooth implementation of EMP, the project proponent will have to collaborate with various government agencies like Public Works Department, Revenue Department, State Pollution Control Board, State Forest Department, Police Department and other allied departments.

ES.9 Summary and Conclusion

The proposed development of 6-lane (Greenfield) access-controlled corridor (Ahmednagar – Solapur - Akkalkot Section) which starts from Sarola Baddi Village on (Design Ch. 290.000) and ends near Umarge Village (Design Ch. 524.500) in the State of Maharashtra can harmonize with the surrounding environment with the following direct and indirect benefits.

Environmental improvement measure adopted in the project are:

- **Reduction in Length:** The proposed stretch is part of **Surat - Nashik - Ahmednagar - Solapur - Akkalkot - KN/TS border - Kurnool - Chennai greenfield alignment under ECONOMIC CORRIDOR of BHARATMALA PARIYOJANA** which will reduce the existing travel length by nearly 320km. However, the present project (Ahmednagar-Solapur) will reduce the distances by **89.5 km**, and this shall reduce the fuel consumption and thereby reducing the vehicular emission. It shall save upto 3.15 hours of time.

- **Contribution to Climate change:** Based on the reduction in travel length in the proposed stretch from Surat-Ahmednagar, the GHG emission reduction has been estimated for the Year 2025 to 2055 as **237 tonnes/yr to 1034 tonnes/yr**. The proposed project shall reduce the traffic and improve the condition of existing traffic flow by removing all bottlenecks at various locations connecting Ahmednagar and Akkalkot which in turn reduces the vehicular emission.
- **Accident Cost Savings:** It is possible to predict the reduction in accidents on account of road improvements. The accidents costs collected from IRC-SP-30 (the values are in the year 1990 and escalated with 5% to get the values in the year 2018)

Accidents Cost Collected

Accident Cost (Rs.)	1990	2018
Fatal	2,10,000	8,23,227
Serious injury	32,000	1,25,444
Minor injury	1,100	4,312
Damages to car	4,700	18,425
Damages to 2-wheeler	1,100	4,312
Damages to bus	15,800	61,938
Damages to truck	18,100	70,954

Source IRC SP-30

- **Avenue Plantation:** Around 88,000 nos. of trees as avenue plantation need to be planted. Budget allocation for the avenue plantation is 1,584 lakhs.
- **Median Plantation:** The number of median plantations proposed are around 117216 Nos. The budget allocation in EMP for the median plantation is 469 lakhs.
- **Rain Water Harvesting (RWH):** Around 352 nos. of RHW pits are proposed on either side of the road with oil and grease removal tank at an interval of 500 m. A budget provision of 70.4 lakhs is made for the same in EMP.
- **Employment Opportunity:** Approx. 2,600 workers shall be employed during the construction phase of the project for three years and local people shall be given priority. It shall provide at least 50 nos. of permanent employees. The project shall generate total 2,847,000 mandays of work during construction phase and 1,82,500 mandays of work during operation phase.
- **Muck/Debris/C&D Waste Disposal:** The quantity of muck/surplus earth generated from the project is 3960000 cum. An estimated amount of Rs. 6851 lakhs provision is made in the EMP for the safe disposal of the muck.
- **Fly Ash Utilization:** Fly Ash requirement for the project is estimated to be around 18552097 cum, which is assessed duly adopting the Fly Ash Notification, 2016. A budget provision of 38959.4 lakhs is made for the same in EMP.
- Total budget for the implementation of **EMP** during construction & operation phases of the project is estimated to be **Rs.585.35 Crores** including Muck Disposal and Flyash utilization and, **Rs. 44.79 Crores excluding muck disposal and flyash utilization cost.**