

**Development of Vadodara Mumbai Expressway (Phase-II)  
from km.26.320 to km.104.700 (km.390.864 of NH-8) of  
Main Expressway in the State of Maharashtra  
(MoEFCC F. No. 10-80/2016-IA-III)**

**EXECUTIVE SUMMARY IN ENGLISH  
(Draft EIA Report)**

Project Proponent

**NATIONAL HIGHWAYS AUTHORITY OF INDIA**

Ministry of Road Transport and Highways, Government of India

EIA Consultant

**Intercontinental Consultants and Technocrats Pvt. Ltd.**

A-8, Green Park, New Delhi-110016, India

Sl. No. in QCI's List '1' of

Accredited EIA Consultant (15<sup>th</sup> October 2019): **90**

NOVEMBER 2019

## EXECUTIVE SUMMARY

### E.1 INTRODUCTION

This EIA Report has been prepared in accordance with the Terms of Reference (ToR) issued by the Minister of Environment, Forest and Climate Change (MoEFCC) vide letter dated 9<sup>th</sup> December 2016.

### E.2 NEED OF THE PROJECT

The Mumbai–Ahmedabad Corridor is one of the important transport corridors of the country. On one side of this corridor is Mumbai which is the financial capital of the country and on the other side is Vadodara, an important commercial and business city. Many industries like, textile, gems & jewelries, petrochemical & fertilizer etc. have been established along this corridor. This corridor also serves SEZ areas and ports. NH-8 is of great significance for transportation in this corridor between Delhi to Mumbai.

NH8 has been widened to 6 lane but many of the sections have already reached nearly the capacity volume of 6 lane in the year 2015 with average journey speed of 50-60 km/hr. Further widening of NH-8 is not feasible. With rapid economic development taking place in the States of Gujarat and Maharashtra, there is a need to develop an expressway wherein the movement of large volumes of passenger and goods vehicles can take place at a fast pace.

Keeping in view of the importance of the National Highways for the economic development, the construction of about 379 km long proposed Vadodara Mumbai Expressway (VME) including SPUR is envisaged to fulfill this objective. The proposed VME has been divided into three phases for implementation. This EIA Report deals with development of VME Phase II from Km 26+582 to Km 104+700 of main expressway.

### E.3 PROJECT PROPONENT

National Highways Authority of India (NHAI), an autonomous agency of the Government of India is the project proponent.

### E.4 LOCATION OF THE PROJECT

The proposed project is the development of 8 lane access-controlled green-field Vadodara Mumbai Expressway (Phase-II). The expressway starts at proposed chainage 26+582 (at Koshimb village of Vasai Taluka) and ends at proposed chainage 104+700 [km 390+864 of new NH-48 (old NH-8)] at Ibhaddpada village of Talasari Taluka in the state of Maharashtra. Total length of expressway (Phase-II) is **78.118 km**. The proposed alignment is passing through 4 talukas (Vasai, Palghar, Dahanu and Talasari) of Palghar district in the state of Maharashtra.

## E.5 STUDY METHODOLOGY

The study methodology for the EIA employs a simplistic approach in which the critical environmental issues have been identified before initiation of the baseline study. Based on the identification, baseline data was collected during the study period from March to May 2017. This data has analyzed to predict and quantify the impacts and suggest best suited mitigation measure to mitigate the identified impacts.

## E.6 POLICY AND LEGAL FRAMEWORK

Various statutory clearances required to be obtained by the Project Proponent before start of construction of the proposed expressway is:

Type of Clearance	Required (Yes / No)	Remarks
Environment Clearance	Yes	Green field expressway (category "A" project)
CRZ Clearance	Yes	Alignment passes through the intertidal zones of Vaitaran River
Forest Clearance	Yes	Involves diversion of 191.5894 ha forest land
DTEPA Clearance	Yes	Alignment passes through Dahanu Taluka Eco Fragile Area for a length of 27.745 km
Consent to Establish	Yes	NOC from MPCB under Air Act & Water Act
NBWL Clearance	No	Alignment does not passes through any Protected Area or Eco-Sensitive Zone
ASI Clearance	No	No Protected Monument within 300m of the proposed expressway alignment

Apart from the above clearances, the contractor before starting the construction work has to obtain the various Clearances / NOCs from concerned authorities.

## E.7 SALIENT FEATURES OF PROPOSED PROJECT

Proposed Project	Development of 8 lane access-controlled green-field Vadodara Mumbai Expressway (Phase-II).
Total length	78.118 km
Start Point	Proposed Km 26+582 at Koshimb village of Vasai Taluka
End Point	Proposed Km 104+700 at Ibhadpada village of Talasari Taluka
District and State	Palghar district in the State of Maharashtra
No. of affected villages	51
Proposed Right of Way	100 m / 120 m in general
No. of major bridges	8
No. of minor bridges	29

No. of culverts	133
Interchanges	2 (Km 50+594 & Km 78+648)
Fly-over	4 (Km 60+240, Km 73+054, Km 91+756 and Km 99+915)
Vehicular Underpass	8
Vehicular Overpass	3
Light Vehicular Underpasses	21
Small Vehicular / Cattle Underpasses	50
Way side Amenities	Type – A : 1 Type – B : 4
Toll Plaza	2 at chainage 50+594 and 78+638
Truck Parking	At 2 locations
Embankment	<ul style="list-style-type: none"> <li>▪ Total length of embankment - 70.617 km</li> <li>▪ Average height of embankment &gt; 3.5 m</li> </ul>
Drain	<ul style="list-style-type: none"> <li>▪ Lined drain has been proposed on both side</li> <li>▪ Total length of shoulder drain - 141.234 km</li> <li>▪ Total length of toe drain - 134.445 km</li> </ul>
Safety Measures	<ul style="list-style-type: none"> <li>▪ Thrie beam metal crash barriers</li> <li>▪ Advanced Traffic Management System (ATMS)</li> </ul>
Total Project Cost	Rs, 7,101 Cr.

## E.8 DESCRIPTION OF THE ENVIRONMENT

As per the EIA Guidance Manual for Highways (MoEF&CC, February 2010), a study area of 15 km radius from the proposed expressway was considered for secondary data collection. Primary data has been collected within 500 meters on either side of the proposed alignment. Baseline environment monitoring was carried out for the period of March to May, 2017.

### E.8.1 Physiography and Terrain

Geographically the proposed expressway lies between latitude 19°29'19.5"N, to 20° 9'2.4"N and between 72°52'58.8"E to 72°54'55.7"E longitude with elevation varies from about 3 m to 1113 m above MSL. The proposed expressway passes through mainly plain terrain except for a few stretches where it passes through rolling terrain.

### E.8.2 Seismicity

The project area is situated in the Zone III (having moderate seismic intensity) of the Seismic Map of India (as per IS: 1893, Part I, 2002) and therefore has a moderate risk of potential damage due to earthquake.

### E.8.3 Hydrology

The proposed alignment runs parallel to and / or very near to Rivers Vaitarna, Surya and Suseri between Km 30+000 and km 72+200. Vertical profile of the proposed expressway shall be governed by the HFL of these major rivers along the entire stretches. The river beds for the stretch between Km 26 to Km 45 seem to be made up of sandy / loamy soil whereas; rocks were visible in the beds of Surya river, Suseri river and Vadvali river. The proposed alignment crosses Vaitarna river at three locations. Vaitarna River experience tidal fluctuations in water levels at the proposed crossing points with the expressway. The maximum extent of tidal fluctuation generally observed was 3m, as informed by the local people. The Study area comes under Sub zone 5(a) for West Coast Region (Konkan Coasts) as per calcification of The Central Water Commission.

### E.8.4 Land Use

- **Land Use within PROW (100m-120m):** Agricultural and allied uses occupied largest part amounting 73.13% of the total area, followed by open scrub (13.41%), barren land (6.48%), reserved forest (2.71%), surface water bodies (2.12%), settlements (1.37%), mangrove forest (0.36%), open mixed forest (0.24%), mudflats (0.15%) and marshy land (0.04%)
- **Land Use within Study Area:** Total study area is 3027.325 ha. Agriculture land occupied major part (48.27%) of the total area, followed by reserved forest (31.39%), settlement (both urban and rural) (5.83%), surface water bodies (3.66%), marshy land (22.82%), open scrub (2.57%), open mixed jungle (1.83%), industrial (1.1%), mangrove forest (0.85%), salt pan (0.71%), barren land (0.64%), mudflats (0.34%).

### E.8.5 Soil Quality

M/s Anacon Laboratories Pvt. Ltd., Nagpur (A NABL Accredited laboratory) was engaged for collection and analysis of Soil samples. Four (4) sampling locations of different land use (riverbed, agricultural, forest & plantation) within 500 meters on either side of the proposed alignment were collected for studying soil characteristics.

Station Code & Place	Land Use	Soil Quality
SQ1 Ghatim Village	River bed & Mangrove	Electrical conductivity is very high. Very low quantities of nitrogen, phosphorus and poor organic matter content indicate that the soils are poor in soil fertility
SQ2 Maswan village	Agricultural	Favorable organic matter content accompanied by medium levels of nitrogen and phosphorus, high levels of potassium and electrical conductivity within the required limits make the soils quite fertile.
SQ3	Forest	The organic matter being quite low shows that it is a

Station Code & Place	Land Use	Soil Quality
Rankol Village		degraded forest soil where there is very little addition of organic matter from the perennial trees. It should be covered with better plantation so that there is an increase in organic matter proportion of the soil & porosity and as a consequence the water infiltration and water holding capacity of soil improves
SQ4 Talote Village	Plantation	With nitrogen, phosphorus and potassium being in medium range, the soil can be categorized as fertile one. The sodium absorption ratio being well within the range does not show the problem of salinity. The only problem is that of low organic matter which has resulted in higher bulk density and will therefore influence the rate of water infiltration into the soil adversely.

### E.8.6 Climate

Past climatic data show that May is the hottest month with the mean daily maximum temperature around 34.4°C and January is recorded to be the coldest month with the mean daily minimum temperature of 17.3°C. The normal annual rainfall in the study area ranges from 1900 mm to 2600 mm and mean annual rainfall during the year 1981 to 2010 is 1874.6 mm.

A maximum temperature of 46.1°C and minimum temperature of 21.6°C was observed during the monitoring period (March to May 2017). Maximum Relative humidity during the monitoring period is found to be 81.4% while the average relative humidity was about 32%. The period was mostly dry with occasional rains totaling 27.4 mm.

### E.8.7 Ambient Air Quality

Five sampling stations were set up for monitoring ambient air quality within the study area. Monitoring locations were selected following the CPCB guidelines for ambient air quality monitoring so as to accord an overall idea of the ambient air quality scenario in the study area. The ambient air quality at the monitored locations does not exceed National Standards and well within the limits. No industrial sources of air emission are observed along the proposed alignment of the expressway. Air quality data of the study area generated through manual monitoring network has been utilized to calculate the monitoring date wise AQI of the study area and it can be concluded that 60% time of the monitoring period air quality of the area was satisfactory while 40% time of the monitoring period air quality of the area was good

### E.8.8 Ambient Noise Level

To assess the background noise levels in the study area ambient noise monitoring was conducted at five locations. Highest equivalent noise level during day time [57.8 dB(A)] and during night time [48.7 dB(A)] is observed at Pargaon village. The measured and

calculated values of the study area indicate that ambient noise levels slightly exceed the threshold limits. As the proposed expressway is non-existent as on date; it can be inferred that such noise levels originate from local activities i.e. “without project scenario”, which may escalate during the operation stage i.e. “with project scenario”

### E.8.9 Surface Water

Surface water samples (grab samples) were collected once in the month of May 2017 from 8 locations covering river, canal & pond and analyzed for physical, chemical and bacteriological parameters as per established standard methods and procedures. It is observed that the water of Vaitaran river is slightly alkaline, high values of BOD signify presence of decomposable and oxidizable organic matter in the water resulting increase of oxygen demand. Electrical Conductivity (EC) and Total Dissolved Solids (TDS) found to be very high in all three samples collected from Vaitaran River at different locations. Such high values of EC and TDS in Vaitaran River water indicate that the water is highly mineralized and salinity level is very high. This water is not suitable for irrigation under ordinary condition. Values of EC and TDS of the samples collected from Surya River, Jogani Nadi, Vadvali River, canal etc. indicate that the salinity level is low to medium and plants with moderate salt tolerance can be grown without special practices for salinity control.

### E.8.10 Ground Water

- **Depth of Ground Water:** In the study area, pre monsoon depth to water level (May-2011) ranging between 2 to 5 mbgl and 5 to 10 mbgl while post-monsoon depth to water level (Nov- 2011) ranging between 2 to 5 mbgl in major part of the study area. Mean water level range of 2 to 5 mbgl is observed in the Palghar, Dahanu and Talasari area.
- **Ground Water Category:** As per the CGWA classification, all the Talukas, through which the proposed expressway is passing, fall under safe category.
- **Ground Water Quality:** Ground water samples were collected once in the month of May 2017 from 5 locations comprising hand operated tube wells (hand-pumps) and analyzed for physical, chemical and bacteriological parameters as per established standard methods and procedures. The physico-chemical qualities of the ground water satisfy the acceptable limit as stipulated in Drinking Water Standards of India (IS 10500 : 2012) and suitable for human consumption.

### E.8.11 Ecology and Biodiversity

- **Quadrat Study of Flora:** Quadrat study of flora was carried in the month of October, 2017 at 15 locations between Koshimbe village to Talasari village. Overall 144 floral species were recorded during quadrat study out of which, 72 were tree species, 20 shrubs and 52 herb species. The study revealed the predominance of tree species like *Tectona grandis* *Terminalia tomentosa* *Phoenix dactylifera*,



*Bombax ceiba* and *Butea monosperma*. Fruit bearing trees are present in large numbers. Shannon's diversity index was 3.57 for trees 2.55 for shrubs and 3.28 for herbs. The value of Simpson index for diversity ranges between 0 and 1, the greater the value, the greater the sample diversity. In the present study the value was highest for trees 0.95 followed by herbs 0.94 and lowest 0.90 for shrubs.

- **Diversion of Forest Land:** The proposed project involves diversion of 191.5894 ha of forest land, which includes reserved forest (13.1%), mangrove forest (2%), protected forest (70.5%) and private forest (14.4%).
- **Mangrove** forest is found in patches along the Vaitarni River in the project area. The proposed expressway alignment crosses the Vaitarni River at 3 (three) locations and passes through the intertidal zones of Vaitarni River. Tentatively 3.8623 ha area of mangrove will be affected for the project.
- **Faunal Composition:** The fauna of project area is based on direct sighting during field survey, stakeholder consultation, review of Forest working plan of Dahanu Division, Wildlife Management plan of Tungeshwar Wildlife Sanctuary, DNH Wildlife Sanctuary and published literature. The fauna of the project area comprised of Schedule-I and threatened species such as *Panthera pardus*, *Felis chaus*, *Tragulus meminna*, *Axis axis*, *Sus scrofa*, *Antilope cervicapra*, *Muntiacus muntjak*, *Accipiter badius*, *Gyps bengalensis*, *Haliaeetus leucogaster* etc.
- **Protected Areas:** The proposed expressway does not pass through any Wildlife Sanctuary, National Park etc. it is located at a distance of 1.28 km from the boundary of Tungeshwar Wildlife Sanctuary and at a distance of 0.456 km from the notified Eco-Sensitive Zone boundary of Tungeshwar Wildlife Sanctuary i.e. outside the Eco-Sensitive Zone. Approx. 27.745 km stretch of the proposed expressway is traversing through Dahanu Taluka Ecologically Sensitive Area (proposed km 68+455 to Km 96+200).

#### E.8.12 Coastal Regulation Zone (CRZ)

The proposed expressway passes through the intertidal zone of Vaitarna River. CRZ map and report was prepared by the National Centre for Earth Science Studies (NCESS), Thiruvananthapuram in October 2015. NCESS has revised the CRZ map and report (**draft available, final awaited**) based on the recently approved Coastal Zone Management Plan (CZMP) of Thane and Palghar district by MoEFCC on 28.02.2019. Based on the **Draft Map** prepared by the NCESS, location and length in CRZ along the expressway is given in **Table E-1** and classification of CRZ area is given in **Table E-2**.

**Table E-1 Length of Expressway in CRZ (Tentative)**

Proposed Ch. Km		Length (Km)	Village	River
From	To			
28+300	28+500	0.200	Doliv	Vaitarna River



Proposed Ch. Km		Length (Km)	Village	River
From	To			
29+991	30+374	0.383		
30+540	30+854	0.314		
30+854	32+056	1.202	Wadhiv & Navghar	
35+325	36+020	0.695	Penand & Sonave	
44+828	45+264	0.436	Sakhare & Khamloli	
<b>Total</b>		<b>3.230</b>		

Source: Draft CRZ Map prepared by NCESS

Note: to be updated after finalization of CRZ Map & Report

**Table E-2 Break-up CRZ area with Classification (Tentative)**

Description	CRZ IA	CRZ IB	CRZ II	CRZ III	CRZ IV B	Grand Total
Doliv Village	0.1563	1.8691	3.7068	-	-	5.7322
Wadhiv Village	1.0347	0.5688	-	1.0306	-	2.6341
Navghar Village	1.1634	0.9162	-	1.2813	-	3.3609
Penand Village	0.1506	0.7004	-	2.7783	-	3.6293
Sonave Village	0.0058	0.8291	-	2.1091	-	2.944
Sakhare Village	-	0.919	-	1.031	-	1.95
Khamloli Village	-	0.3796	-	1.2172	-	1.5968
Vaitrarna River	-	-	-	-	10.9942	10.9942
<b>Grand Total</b>	<b>2.5108</b>	<b>6.1822</b>	<b>3.7068</b>	<b>9.4475</b>	<b>10.9942</b>	<b>32.8415</b>

Source: Draft CRZ Map prepared by NCESS

Note: to be updated after finalization of CRZ Map & Report

This may be changed/ updated in the Final CRZ map and report, which will be incorporated in this report upon receipt of the same. CRZ application can be submitted after Final CRZ Map & Report are available.

### E.8.13 Archaeological Sites:

There are no archaeological sites within 300 m on either side of the proposed expressway.

### E.8.14 SOCIO-ECONOMIC PROFILE

The proposed expressway passes through 51 villages in Palghar district, in the State of Maharashtra.

- **Total Population:** population composition of the villages is important to anticipate the extent of project impact. Population details of the 51 villages have been derived from primary census abstract 2011 and total population is 85,476, out of which 42,390 are male and 43,086 are female.

- **Tribal Population:** Total tribal population of 51 villages is 66,819 (Scheduled Cast – 1,123 and Scheduled Tribes – 65,696), which is 78.2% of the total population. As per Census of India, 2011, 100% population of Chandwad village is Scheduled Tribes. Out of 51 villages, maximum tribal population is observed in Vadavali village (5375 nos.) and in 24 villages, tribal population is more than 90%.
- **Literacy Rate:** Among 51 villages, highest literacy rate is observed in Nagaze village of Palghar Taluka (male – 92.02%, female – 78.88%). Lowest literacy rate among male observed in Dhaniwari village (44.01%) of Dahanu Taluka and among female observed in Ganeshbag village (18.52%) of Dahanu Taluka. In Dhaniwari and Ganeshbag village, tribal population is more than 99%. Overall literacy levels among tribals are lower than that of the general population.
- **Category wise Distribution of Main Workforce:** Agriculture does play an important sector in engaging the workforce in the project area. Majority of main workers are cultivators (42.8%) followed by agricultural labours (33.2%), other workers (22.0%) and only 2.0% population are engaged in household industry such as handloom, weaving, biri rolling, papad making, toy making, etc.

## E.9 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A summary of the anticipated environmental impacts during construction and operation phase along with recommended mitigation measures is summarized in **Table-E.3**:

**Table - E.3 Summary of Anticipated Impacts and Recommended Mitigation Measures**

Area	Impacts	Mitigation Measures
<b>Construction Phase:</b>		
Topography and geology	<ul style="list-style-type: none"> <li>▪ Disfiguration &amp; change in existing profile of the land due to borrow pits &amp; construction of realignments.</li> <li>▪ Disturbance on geological setting due to quarrying.</li> <li>▪ Uncontrolled digging of borrow pits resulting in water accumulation &amp; breeding of vector disease.</li> <li>▪ Establishment of construction camp</li> </ul>	<ul style="list-style-type: none"> <li>▪ Borrow pits shall be allowed at only pre-identified locations.</li> <li>▪ Borrow pits shall be restricted to 1 m depth followed by resurfacing of pits.</li> <li>▪ Road building materials shall be procured from approved and licensed quarries.</li> <li>▪ Suitable seismic design of the structures shall be adopted to mitigate the earthquake impacts.</li> </ul>
Soil	<ul style="list-style-type: none"> <li>▪ Disruption &amp; loss of productive top soil from agricultural fields</li> <li>▪ Soil erosion and contamination</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adequate measures like drainage, embankment consolidation &amp; slope stabilization shall be taken to avoid soil erosion.</li> <li>▪ Top soils (15 cm) of borrow pit sites shall be conserved and restored after excavation is</li> </ul>

Area	Impacts	Mitigation Measures
		<p>over.</p> <ul style="list-style-type: none"> <li>▪ Accidental spills of lubricants/oil and molten asphalt shall be avoided by adherence to good practices.</li> <li>▪ Oil Interceptor shall be provided for wash down, refueling areas</li> <li>▪ Vehicle parking area of the construction camp will be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats.</li> </ul>
Land use	<ul style="list-style-type: none"> <li>▪ Changes in existing land use pattern of the PROW for construction of the expressway</li> <li>▪ Loss of agricultural land, forest land etc. due to land acquisition</li> </ul>	<ul style="list-style-type: none"> <li>▪ Earth material generated from excavation shall be reused during site development.</li> <li>▪ Construction debris will be disposed of in suitable pre-identified dumping areas.</li> <li>▪ Dumping areas will be biologically reclaimed.</li> <li>▪ Construction camp will be provided to avoid indiscriminate settlement of construction workers.</li> <li>▪ Construction activities shall be kept confined to PROW only</li> </ul>
Drainage & Hydrology	<ul style="list-style-type: none"> <li>▪ The drainage network along the expressway is subject to adverse impacts due to construction of embankment</li> <li>▪ 2 Ponds shall be fully affected and 2 ponds are likely to be partially affected due to the proposed alignment</li> </ul>	<ul style="list-style-type: none"> <li>▪ To minimize the impact drainage &amp; hydrological flow, 8 major bridges, 29 minor bridges, 133 culverts are proposed to be constructed along the expressway</li> <li>▪ Free flow of water in river / stream has been ensured in all bridge location</li> <li>▪ All bridges have been designed for a return period of 100 years and culverts have been designed for a return period of 50 years</li> <li>▪ Silt fencing shall be provided between expressway and water bodies to avoid any siltation due to runoff from construction area</li> <li>▪ Shoulder and toe drains has been proposed along the expressway on both side</li> </ul>
Water use	<ul style="list-style-type: none"> <li>▪ Impact on the local water sources due to use of construction water.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minimum use of water from existing sources for construction purpose</li> <li>▪ The contractor shall arrange water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.</li> <li>▪ If new tube-wells are to be bored, due to the non-availability of water required for construction, prior sanctions and approvals by the Ground Water Department has to be obtained by the Contractor</li> </ul>

Area	Impacts	Mitigation Measures
Water quality	<ul style="list-style-type: none"> <li>▪ Increase of sediment load in the run off from construction sites and increase in turbidity in receiving water bodies.</li> <li>▪ Water pollution due to generation of wastewater from construction camps</li> <li>▪ Water pollution due to use of fly ash in the embankment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wastage of water during the construction should be minimized</li> <li>▪ Silt fencing will be provided to reduce sediment load</li> <li>▪ Oil interceptor to stop and separate the floating oils</li> <li>▪ Packaged Wastewater Treatment Plant has been recommended for the construction camp</li> <li>▪ All the construction activities will be carried out during dry seasons only.</li> <li>▪ In line with specifications of IRC:SP:58, method of construction of Fly Ash embankments is proposed by alternate layers of fly ash and soil i.e. Sandwich Type Construction</li> <li>▪ Rainwater Harvesting Structures has been proposed at toll plaza and way side amenities</li> <li>▪ The fuel storage and vehicle cleaning area shall be stationed at least 500m away from the nearest water body</li> <li>▪ Apart from provision of the mitigation measures, water quality shall be monitored during construction and operation phases as per environmental monitoring program to understand the effectiveness of mitigation measures suggested</li> </ul>
Air quality	<ul style="list-style-type: none"> <li>▪ Deterioration of air quality due to fugitive dusts emission from construction activities and vehicular movement along unpaved roads.</li> <li>▪ Deterioration of air quality due to gaseous emissions from construction equipment &amp; vehicular traffic.</li> <li>▪ Deterioration of air quality due to emission from hot mix plants and stone crusher.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Construction materials will be stored in enclosed spaces to prevent fugitive emissions.</li> <li>▪ Truck carrying soil, sand and stone will be duly covered to avoid spilling.</li> <li>▪ Dust suppression measures such as regular water sprinkling on haul &amp; unpaved roads particularly near habitation</li> <li>▪ Hot Mix Plant with Pollution Control Measures having Fabric Filter with multiple wet scrubber shall be installed and elevators at loading section shall be fully covered</li> <li>▪ A combination of dry and wet type control system is suggested for stone crusher to minimize the impact on air quality</li> <li>▪ Hot mix plants &amp; stone crusher shall be located at least 500 m away from inhabited areas &amp; sensitive receptors</li> </ul>

Area	Impacts	Mitigation Measures
		<ul style="list-style-type: none"> <li>▪ Air quality shall be monitored during construction and operation phases as per environmental monitoring program to understand the effectiveness of mitigation measures suggested</li> </ul>
Noise level	<ul style="list-style-type: none"> <li>▪ Increase in noise level due to construction activities like operation of construction equipment &amp; vehicular traffic.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Construction camp and temporary labour sheds will be located away from the immediate vicinity of the construction sites and major road traffic.</li> <li>▪ PPEs will be provided to construction personnel exposed to high noise levels as preventive measure.</li> <li>▪ Low noise construction equipment will be used.</li> <li>▪ Stationary construction equipment will be placed 113 m away from inhabited areas.</li> <li>▪ Stationary construction equipment will be placed 200 m away from the silence zones</li> <li>▪ Construction activities carried out near residential area will be scheduled to the daytime only so that minimum disturbances are caused to people.</li> <li>▪ Noise barrier will be constructed in silence zone, interchanges (300m on each side on outer edge), fly-overs (200m on each side on outer edge), truck parking (500m on one side on outer edge), way side amenity - type A (500m on one side on outer edge) and way side amenity - type B (150m on one side on outer edge)</li> <li>▪ Noise level shall be monitored during construction and operation phases as per environmental monitoring program to understand the effectiveness of mitigation measures suggested</li> </ul>
Floral, Fauna and Forest	<ul style="list-style-type: none"> <li>▪ As per joint measurement survey of 34 villages, approximately 43,392 trees are falling within the proposed ROW in non-forest land</li> <li>▪ Tentative number of trees to be felled in the forest area is 25,703.</li> <li>▪ Proposed project involves</li> </ul>	<ul style="list-style-type: none"> <li>▪ 90,899 no. of trees and 49,408 no. of hedges have been proposed to be planted under greenbelt development plan</li> <li>▪ Plantation suggested under Compensatory afforestation for diversion of 191.5894 ha forestland shall be 1,91,589 plants. However, this shall be finalized by the Forest Department</li> <li>▪ To compensate the loss of horticultural trees in the area, budget of <b>Rs. 2.5 Crore</b></li> </ul>

Area	Impacts	Mitigation Measures
	<p>diversion of 191.5894 ha forest land</p> <ul style="list-style-type: none"> <li>▪ Loss of habitat of fauna due to felling of trees and diversion of forest land</li> </ul> <p><u>Note:</u> no. of trees to be felled will be updated after completion of Joint Survey with Forest Department in all ranges and completion of JMS in all villages and as per JMR</p>	<p>earmarked under Corporate Environmental Responsibility for fruit sapling distribution</p> <ul style="list-style-type: none"> <li>▪ To compensate the loss of medicinal plants, development of herbal garden is proposed. Total budget of <b>Rs. 60 Lakhs</b> proposed for development of herbal garden by Forest Department under CER.</li> <li>▪ Wildlife awareness &amp; environmental protection training shall be provided to the work force by the Contractor and a budget of <b>Rs. 12 lakh</b> has been proposed for training in the EMP Budget.</li> <li>▪ Cooking fuel (LPG) shall be provided to construction workers to avoid cutting / felling of trees for fuel wood.</li> <li>▪ Soil erosion shall be checked by adopting bio-engineering measures</li> <li>▪ The Contractor shall ensure that no open fire is done in construction camp as it may lead to fire to surrounding forest causing injury to wildlife</li> <li>▪ Noise will be kept under control by regular maintenance of equipment and vehicles.</li> <li>▪ Noisy activity shall be prohibited during night time</li> </ul>
Protected Area	<ul style="list-style-type: none"> <li>▪ The proposed expressway does not pass through any National Park, Wildlife Sanctuary, Conservation Reserve and Community Reserve; hence no direct impact is envisaged</li> <li>▪ Approx. 27.745 km stretch of the proposed expressway is traversing through Dahanu Taluka Ecologically Sensitive Area</li> <li>▪ Proposed expressway may cause obstruction in movement of wildlife. hence bridges, culverts and wildlife / cattle underpass are important structures in the design of the expressway</li> </ul>	<ul style="list-style-type: none"> <li>▪ The wildlife kills reported by Tungeshwar Wildlife Sanctuary shows that all the incidence of vehicle kill occurred towards south-east side from the start point of proposed expressway, which is about 1.8 km away from old NH-8. The Sanctuary is on further right side of old NH-8 and old NH-8 is acting as a barrier for the movement of wild animals. There is no report of wildlife killed in the stretch of old NH-8 parallel or closed to the proposed expressway.</li> <li>▪ Further, the density of forest is more towards western side of the proposed expressway in comparison to the eastern side. Therefore, the possibility of accident of wild animal in the proposed expressway is expected to be nominal. Further, fencing / wall has been proposed along the ROW boundary of the entire expressway.</li> <li>▪ 8 major bridges and 29 minor bridges, 133 culverts 51 cattle underpasses (size 7m x</li> </ul>



Area	Impacts	Mitigation Measures
		<p>4m) have been proposed along the expressway. In addition to above, the box culverts of size 6m x 4m and 5m x 4m will act as cattle underpass / animal crossings during summer season.</p> <ul style="list-style-type: none"> <li>▪ Monitoring of wild animals should be done during construction phase and any incidence of sighting should be immediately reported to Forest Department.</li> <li>▪ Measures recommended during Environment &amp; CRZ Clearance, DTEPA clearance and Forest Clearance shall be complied; progress report of implementation of EMP and recommendations by various authorities shall be submitted as per the schedule</li> </ul>
Solid Waste	<ul style="list-style-type: none"> <li>▪ Waste generated during construction may impact soil, agriculture and water quality</li> <li>▪ Waste generated from workers' camps may impact surface and ground water quality and agriculture</li> </ul>	<ul style="list-style-type: none"> <li>▪ Approx. 75 kg/day solid waste will be generated by the construction workers out of which estimated biodegradable waste is 30 kg/day and remaining 45 kg/day is non-biodegradable waste. There shall be "Refuse Containers" at site for the management of domestic waste generated by the construction workers and these containers shall be emptied at least once daily and shall be disposed of as per SWM Rules, 2016 in consultation with the local authority.</li> </ul>
Construction camp	<ul style="list-style-type: none"> <li>▪ Influx of construction workforce &amp; suppliers who are likely to construct temporary tents in the vicinity.</li> <li>▪ Likely sanitation &amp; health hazards &amp; other impacts on the surrounding environment due to inflow of construction labourers.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Temporary construction camps with adequate potable water supply, primary health facilities and fuel for cooking shall be provided</li> <li>▪ Packaged Wastewater Treatment Plant has been recommended for the construction camp</li> <li>▪ It will be ensured that the construction workers are provided fuel for cooking to avoid cutting of trees from the adjoining areas.</li> <li>▪ Contractor to provide a full-fledged dispensary. The number of beds shall be as per the requirement of the labour license</li> </ul>
Occupational health & safety	<ul style="list-style-type: none"> <li>▪ Health &amp; safety related problems to construction workers due to inadequate health &amp; safety measures.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adequate safety measures complying to the occupational safety manuals will be adopted to prevent accidents / hazards to the construction workers</li> <li>▪ Contractor shall conduct monthly health check-ups of all his laborers in his camps through registered medical practitioner</li> </ul>



Area	Impacts	Mitigation Measures
		<ul style="list-style-type: none"> <li>▪ Contractor to conduct workshop on HIV / AIDS for all his laborers at all his camps at least once in a quarter</li> </ul>
Road safety	<ul style="list-style-type: none"> <li>▪ Increase on incidence of road accidents due to disruptions caused in existing traffic movements.</li> </ul>	<ul style="list-style-type: none"> <li>▪ The proposed project is a greenfield alignment and there is no normal operating traffic as in the case of existing highways. Therefore, there is no specific standard requirement for traffic management plan during construction phase. It is normally the construction vehicles, which will be plying on temporary roads for the construction works. Wherever the proposed expressway is crossing any existing road, during construction phase, the Contractor shall provide and maintain a passage for traffic either along a part of the proposed RoW or along a temporary diversion constructed close to the crossing. The Contractor shall take prior approval of the Authority Engineer (AE) regarding traffic arrangements during construction.</li> <li>▪ Reduction of speed through construction zones.</li> </ul>
<b>Operation Phase</b>		
Land use and Encroachment	<ul style="list-style-type: none"> <li>• Change of land use by squatter/ encroachment within ROW and induced development outside the ROW.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fencing has been proposed along the ROW boundary of the entire expressway</li> <li>▪ Planning agencies and Collector / Revenue Officer will be made involved for controlled development and prohibiting squatter/ encroachment within ROW.</li> </ul>
Drainage	<ul style="list-style-type: none"> <li>• Filthy environment due to improper maintenance of drainage.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Shoulder drain &amp; toe drain of sufficient capacity has been provided on both sides of the expressway to accommodate increased run-off. The out fall for these drains will be the nearby culverts / bridges or natural drainage channel. Silt fencing will be provided to sediment entering into the water courses.</li> </ul>
Water quality	<ul style="list-style-type: none"> <li>• Chances of contamination of water bodies from road surface run off containing oil spills due to traffic movement &amp; accidents.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adequate drains have been proposed to accommodate increased run-off. The out fall for these drains will be the nearby culverts / bridges or natural drainage channel.</li> <li>▪ Silt fencing will be provided to sediment entering into the water courses.</li> </ul>

Area	Impacts	Mitigation Measures
		<ul style="list-style-type: none"> <li>▪ Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.</li> <li>▪ Regular maintenance of rainwater harvesting structures shall be done during the operation stage to prevent choking of these structures</li> <li>▪ Monitoring of water quality at specified locations will be conducted at fixed interval</li> </ul>
Air quality	<ul style="list-style-type: none"> <li>▪ Air pollution due to vehicular emission from road traffic.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Results of air quality modeling indicate that due to higher carriageway width, air turbulence and high design speed, emissions from traffic are low at receptor locations. With the introduction of BS-VI compliant fuels and vehicles in 2020 onwards, the vehicular emission is expected to further reduce and may offset the increased pollutant concentration due to increased traffic volume. Hence, the pollutant concentration is not expected to increase beyond stipulated limits in operation phase of the expressway.</li> <li>▪ Plantation along the expressway will act as sink of air pollutants</li> <li>▪ Monitoring of air quality at specified locations will be conducted at fixed interval</li> </ul>
Noise level	<ul style="list-style-type: none"> <li>▪ Noise pollution due to traffic noise.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Plantation along the expressway will act as a natural noise barrier.</li> <li>▪ Monitoring of noise level at specified representative locations will be conducted at fixed interval.</li> <li>▪ Maintenance of noise barrier</li> </ul>
Flora & fauna	<ul style="list-style-type: none"> <li>▪ Illegal felling of trees along the expressway</li> <li>▪ Effect on aquatic fauna in case of accidental spill of oil, fuel &amp; toxic chemicals into water bodies</li> </ul>	<ul style="list-style-type: none"> <li>▪ Monitoring of avenue plantation along the expressway to be done for 5 years as per Green Highway policy. Dead sapling shall be replaced and survival rate of 90% shall be maintained. Saplings shall be provided with tree guards to protect from cattle grazing.</li> <li>▪ Regular watering of plants to be done in dry season</li> <li>▪ Regular maintenance of the cattle underpass and culverts, which will act as animal crossing.</li> </ul>
Road safety	<ul style="list-style-type: none"> <li>• Impacts on human health due to accidents.</li> <li>• Damage of expressway due to wear &amp; tear.</li> </ul>	<ul style="list-style-type: none"> <li>▪ To improve the safety of such high speed corridor, Thrie beam metal crash barriers shall be provided in entire length on both sides of each main carriageway (i.e. on</li> </ul>

Area	Impacts	Mitigation Measures
		<p>median and on earthen shoulder of both carriageway), Loops and Ramps excluding stretches covered by bridges and RE wall structures, where concrete barriers to be provided.</p> <ul style="list-style-type: none"> <li>▪ In addition to safety barrier, safety features like road marking, traffic sign, boundary stones, kilometer stones and hectometer stones, pavement marking and lighting has been proposed. Advanced Traffic Management System (ATMS) for entire expressway have been proposed to facilitate the road users, which will include mobile communication system, meteorological data system, automatic traffic counter and vehicle classification, video surveillance system, video incident detection system. To improve antiglare, hedge plantation on median have been proposed</li> </ul>

## E.10 SOCIAL IMPACTS

**Table - E.4 Summary of Project Impacts (Phase-II of Main Alignment)**

Sl. No.	Impact Summary	Number / Area
1	Total private / government land acquisition requirement (in ha tentative)	710.3247
2	Total number of private land units / plots affected (No.)	2393
3	Fully displaced land owner (15% of affected land owners) (No.)	359
4	Total number of structures affected of all categories (Including Private, Government, and Religious)	895
5	Total number of affected private structures	717
6	Number of Fully displaced structure owner (15% of affected structure owners)	108
7	Total number of affected Households Including Land & Structures	3110
8	Total number of Govt. /Communities properties	175
9	Total number of religious properties	3

Source: Field Survey

## E.11 ANALYSIS OF ALTERNATIVES

The identification of the route alignment of Vadodara Mumbai Expressway was initially taken up in the early 1990s by the Ministry of Road Transport & Highways from a Technical Assistance Program of Asian Development Bank. The alignment was finalized

by M/s Wilbur Smith. Based on this alignment the Government of Gujarat has frozen a corridor of 600m width. NHA in the year 2008 awarded the task of finalization of VME alignment to M/s SECON through a desk study. As per the terms of the study SECON was to study Wilbur-Smith's alignment on satellite imagery and modify it based on the present site conditions by carrying out a desktop study.

In the current consultancy assignment, the Consultant was given the alignment as was finalized by M/s SECON to follow. It was stipulated that the consultant might review the alignment based on existing conditions at site if it passes through problematic area and propose alternate solution. The consultant reviews the alignment and modifies it based on technical, environmental and social consideration and submitted to NHA for approval. After a series of presentations in NHA headquarters in front of senior NHA officials, approval has been granted to the VME alignment vide letter No. NHA/V-M Expressway/DM/2008/30 dated 8<sup>th</sup> February 2010.

## **E.12 ENVIRONMENTAL MONITORING PROGRAM**

Environmental monitoring involves regular checking of the environmental management issues detailed in the EMP and to ascertain whether the mitigation measures are achieving their objectives, according to the EMP, with the progress of the works.

To mitigate the potential negative impacts of proposed development and measurement the performance of mitigation measures, an Environmental Monitoring and Management Plan is developed. Contractor is the main executor of the implementation activities. The contractor will report to the Sr. Environmental Specialist of Authority Engineer (AE) who in turn shall report to the PIU. The Contractor will submit monthly and quarterly environmental compliance reports to the AE. The AE will submit separate quarterly environmental monitoring reports to Project Implementation Unit (PIU) of NHA and PIU will be responsible for preparation of the targets for non-compliances identified by the AE.

## **E.13 ENVIRONMENTAL MANAGEMENT PLAN**

EMP has been prepared addressing the following issues:

- Stage wise (design & pre-construction stage, construction stage & operation stage) environmental management measures;
- Environmental monitoring program during construction and operation phase including performance indicator, monitoring schedule (parameters, locations, frequency of monitoring & institutional responsibility) and reporting system;
- Green belt development plan
- Institutional & implementation arrangement and capacity building
- Various guidelines such as Top Soil Conservation and Reuse, Siting and Layout of Construction Camp, Slope Stabilization, Management of Borrow and Quarry Area, Sediment Control, Comprehensive Waste Management Plan, Traffic Management Plan, Worker's Safety during Construction, Storage, Handling, Use and Emergency

Response for Hazardous Substances etc.

Environmental Budget: A capital cost provision of about **Rs. 66.42 Crore** has been kept towards implementation of environmental management plan.

Corporate Environment Responsibility (CER): A capital cost provision of about **Rs. 35.05 Crore** has been kept under CER for implementation of various activities for overall improvement of environmental and ecological conditions of the project area.

## E.14 CONCLUSIONS

Based on the EIA study and surveys conducted for the project, it can be concluded that associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA Report. Adequate provisions shall be made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs as suggested in environmental budget. The proposed expressway will provide fast connectivity between Ahmedabad to Pune for a length of about 650 km by providing link between Ahmedabad Vadodara Expressway and Mumbai Pune Expressway. The proposed expressway will reduce the travel time, vehicle operating cost, no. of accidents, increase employment opportunity and improve economic development of the region.

\*\*\*\*\*