

**Development of 8-lane SPUR starting from Km 26.582 of
Vadodara - Mumbai Expressway Main Alignment (Design
Chainage 0+000) and terminating at proposed Junction with
the Multi-Modal Corridor of MMRDA (Design Chainage
79+783) in the state of Maharashtra
(MoEFCC F. No. No. 10-29/2019-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

JANUARY 2021

EXECUTIVE SUMMARY

E.1 INTRODUCTION

The proposed project is 8 lane access controlled green field SPUR of Vadodara Mumbai Expressway. As per the EIA Notification, 2006 and its subsequent amendments, it falls in item. No 7 (f) of the Schedule to the Notification and is a **category "A"** project, requires Prior Environment Clearance from the Ministry of Environment, Forest and Climate Change (MoEFCC), GOI.

Form-I for obtaining ToR from the MoEFCC was submitted on 13th July 2019. The project was considered in 220th meeting of Expert Appraisal Committee (EAC) of MoEFCC held on 26th July 2019. After detailed deliberation, the EAC decided to carry out site inspection before issuing the ToR.

Accordingly a Sub-committee of EAC was constituted and the Sub-committee visited the proposed site from 13th to 15th November 2019. The site visit report of the Sub-committee was discussed and approved in the 227th EAC meeting held on 28th November, 2019 and compliance of the same was submitted on 18th February 2020.

The project was further considered in 232nd meeting of EAC held on 27th February 2020 and the EAC recommended for grant of ToR. Accordingly, the MoEFCC issued the ToR for conducting EIA Study vide letter dated 16th March 2020 (MoEFCC File No. 10-29/2019-IA.III). This EIA Report has been prepared in accordance with the approved ToR.

E.2 NEED OF THE PROJECT

During the draft Feasibility Study of the Mumbai – Vadodara Expressway, it was felt that the starting point of proposed Vadodara Mumbai Expressway on NH-8 near Dahisar at Mumbai end would pose a serious problem for safe and quick dispersal of traffic from the Expressway and also would not serve the purpose of connecting to major traffic generators like JNPT Port and to Mumbai-Pune expressway. Currently, the traffic bound for Gujarat and further north from JNPT, NH-4 and Mumbai – Pune Expressway follows Thane-Ghodbandar Road which is already congested and passes through / close to Sanjay Gandhi National Park. Widening of this stretch as per IRC standard is not feasible. This traffic has to pass through congested road network of Mumbai Metropolis from southward destination and the goods earmarked for export and import also find difficulty in commuting to and from JNPT, Navi Mumbai. Therefore it would be prudent to connect the proposed Vadodara Mumbai Expressway to major traffic generators like JNPT and Mumbai – Pune Expressway.

Keeping view of the above, provision of SPUR to VME was explored. The spur will not only connect to these major traffic generators but will also result in better dispersal of

traffic in the Mumbai Metropolitan Region. Therefore, the Consultants proposed that the VM Expressway should be connected to JNPT and Mumbai-Pune expressway via NH-3, NH-8 NH-222 and NH4B for proper traffic dispersal.

The project highway will provide smooth, safe and uninterrupted traffic movement between Vadodara to Mumbai in respect to the alternative road NH 48. The NH 48 (Old NH8) is currently carrying more than 100,000 PCUs with much substandard geometry and is heavily congested. It will reduce the travel time about 3 to 4 hours between Vadodara to Mumbai. The proposed expressway falls in the Delhi-Mumbai Industrial Corridor. It will connect to the largest container port, JNPT near Mumbai with northern part and Dahej port, other ports in Gujarat. Surat is at the heart of the world's diamond-polishing industry contributing billions of dollars to the Indian GDP. Vapi, Daman and Silvassa are the major industrial hub will be connected. Development of this section will reduce the existing distance between Vadodara-Mumbai by about 22 km and ultimately there will be reduction in distance between Delhi-Mumbai.

The SPUR connects the main expressway to JNPT, Maha Samrudhi Marg (Mumbai-Nagpur Expressway) and Mumbai Pune Expressway. Therefore the traffic bound for JNPT, Nagpur and Pune will ply on SPUR and will not enter the Mumbai city. This will reduce both traffic congestion and pollution in the city. The proposed SPUR of VME will be linking Vadodara – Mumbai Expressway, Ahmedabad- Vadodara Expressway, Mumbai –Nagpur Expressway and Mumbai - Pune Expressway and thus will provide expressway connectivity from Delhi – Ahmedabad – Mumbai – Nagpur - Pune.

This will further improve connectivity in terms of achieving smooth and safe traffic flow and improve level of service. In addition to above, substantial economic gain, this would eventually lead to reduction in the travel time and savings in terms of time, fuel and maintenance cost of vehicles. Further this stretch will be a part of Delhi- Mumbai expressway corridor.

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 VME – SPUR is a Greenfield alignment, which starts at km 26.582 of main alignment of the Vadodara Mumbai Expressway at Koshimb village of Palghar district at Ch. 0+000 and terminate at the proposed junction with the Multi-Modal Corridor of Mumbai Metropolitan Region Development Authority (MMRDA) in Morbe village of Raigad district at Ch. 79+783. Total **length of the SPUR alignment is 79.783 km**; out of which 18.900 km lies in Palghar district, 55.260 km lies in Thane district and remaining 5.623 km lies in Raigad district of Maharashtra.

Table E-1 Taluka wise break-up of Length of Proposed Expressway

District	Taluka	No. of Village	Start Chainage	End Chainage	Length (Km)
Palghar	Vasai	12	0+000	13+520	13.520
	Wada	3	13+520	18+900	5.380
Thane	Bhiwandi	22	18+900	45+400	26.500
	Kalyan	12	45+400	58+830	13.430
	Ambarnath	13	58+830	74+160	15.330
Raigad	Panvel	6	74+160	79+783	5.623
Total		68			79.783 Km

Source: DPR Prepared by ICT Pvt. Ltd.

The proposed VME – SPUR is also declared as part of NE-4 vide Gazette Notification dated 10th January 2020. The alignment of SPUR has already been included in the Mumbai Metropolitan Regional Plan 2016-36 of MMRDA.

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 October to December 2020. This data has been 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 Tansa River, Bhatsa River and Kalu River
Forest Clearance	Yes	Involves diversion of \cong 119.4411 ha forest land
Clearance from Monitoring Committee for Matheran ESZ	Yes	The proposed alignment passes through Matheran ESA from km 71+532 to 75+426(both buffer and eco-sensitive zone) and from km 77+115 to km 77+691 (only buffer zone).
Consent to Establish	Yes	NOC from MPCB under Air Act & Water Act
NBWL Clearance	No	Alignment does not passes through any Protected Area
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 SPUR of Vadodara - Mumbai Expressway Main Alignment
Total length	79.783 km
Start Point	Km 26.582 of VME main alignment (design Ch. of SPUR 0+000) at Koshimb village of Vasai Taluka, Palghar district
End Point	Terminate at the proposed junction with the Multi-Modal Corridor of MMRDA in Morbe village of Panvel Taluka, Raigad district (design Ch. of SPUR 79+783)
District and State	Palghar, Thane and Raigad districts in the State of Maharashtra
No. of affected villages	68
Proposed Right of Way	100 m in general / 70 m in forest area
No. of major bridges	13
No. of minor bridges	21
No. of culverts	230
Interchanges	7
Fly-over	3
Rail over bridge	2
Vehicular Underpass	5
Vehicular Overpass	8
Light Vehicular Underpasses	29
Small Vehicular / Cattle Underpasses	31
Way side Amenities	1 at Km 50+800
Smaller Parking Places with Toilet Facilities	2 at Km 11+000 and Km 16+000
Toll Plaza	7 at Km 1+860, Km 20+136, Km 39+748, Km 43+000, Km 52+810, Km 69+000 and Km 78+750
Truck Parking	At 2 locations
Tunnel	To preserve ecology of the Matheran, 4.160 km long tunnel (from Km 71.520 to Km 75.680) is proposed which will go under the Matheran Eco-Sensitive Zone.
Safety Measures	<ul style="list-style-type: none"> ▪ Thrie beam metal crash barriers ▪ Advanced Traffic Management System (ATMS)
Cost of Civil Construction	Rs, 5,243 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 October to December, 2020.

E.8.1 Physiography and Terrain

Geographically the proposed expressway lies between latitude 19°29'19.44"N, to 19°3'59.65"N and between 72°52'58.86"E to 73°10'49.57"E longitude with elevation varies from about 3 m to 639 m above MSL. The proposed expressway passes through mainly plain & rolling terrain except for a small stretches where it passes through hilly terrain in Matheran area.

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 SPUR alignment runs along River Tansa mainly over its right bank between chainage 0+000 to 18+800. The alignment crosses Tansa river twice at Ch. 3+400 and again at Ch. 18+850. No major tributary of Tansa crosses the proposed alignment within this stretch of about 18.8 km.
- Between chainage 19+000 to 45+000 the proposed alignment crosses only one major river namely Kamvadi River at Ch. 33+334.
- Between Ch. 45+000 to 67+400 the proposed alignment crosses major rivers namely River Bhatsa (Ch. 45+400), River Kalu (Km 47+300), River Barvi (Km 57+619) and River Ulhas (Km 67+470).
- From Km 70+000 onwards, the proposed alignment runs through Matheran hills upto Km 76+200. Rolling / Plain terrains are visible where the alignment approaches Panvel near Vichumbe.
- Rocks are visible in the beds and banks of almost all the rivers crossing the proposed alignment.
- Major Rivers of the study area are Tansa, Bhatsa, Kalu, Kamvadi, Barvi and Ulhas River.
- The Study area comes under Sub zone 5(a) for West Coast Region (Konkan Coasts) as per classification of The Central Water Commission.

E.8.4 Land Use

- Land Use within PROW: Agricultural and allied uses occupied largest part amounting 69.59% of the total area, followed by barren / waste land (11.95%), forest (11.42%), built-up area (5.51%) and water bodies (1.52%).
- **Land Use within Study Area:** Total study area is 301297.03 ha. Agriculture land occupied major part (40.19%) of the total area, followed by forest (23.97%), Barren/Waste Land (18.76%), built-up area (11.41%) and water bodies (5.67%)

E.8.5 Soil Quality

M/s Ultra-Teach Environmental Consultancy & Laboratory, Thane (A NABL Accredited and MoEFCC recognized laboratory) was engaged for collection and analysis of Soil samples. Four (4) sampling locations of different land use (forest, agricultural & residential) within 500 meters on either side of the proposed alignment were collected for studying soil characteristics.

Soil analysis reveals that pH of the slightly acidic in nature except soil of residential. Soil is moderately good in terms of nutrient availability. Low quantities of nitrogen, phosphorus and organic matter content estimated for the soil of residential area as compared to forest and agriculture areas. Soil quality is good for limited varieties of agricultural crops but addition of nitrogen, phosphorus and organic matter will help in improving the soil fertility and thereby obtaining variety of agricultural crops.

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 36.2°C and minimum temperature of 19°C was observed during the monitoring period (October to December 2020). Maximum Relative humidity is found to be 93.5% while minimum relative humidity was about 16.6%. Total rainfall during this period was 155.3 mm.

E.8.7 Ambient Air Quality

Six 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 SPUR. 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 **69% time** of the monitoring period air quality of the area was **satisfactory** while **30% time** of the monitoring period air quality of the area was **good** and **3% time** of the monitoring period air quality of the area was **moderately polluted**

E.8.8 Ambient Noise Level

To assess the background noise levels in the study area ambient noise monitoring was conducted at six locations. The daytime and night time equivalent noise levels show that the ambient noise levels are within the stipulated noise standards of residential and silence area. Maximum equivalent noise level during day time [54.3 dB(A)] is observed and during night time [43.9 dB(A)] is observed at at Kuske Village (NQ3). The measured and calculated values of the study area indicate that ambient noise levels **not exceeding the threshold limits**

E.8.9 Surface Water

Surface water samples (grab samples) were collected once in the month of November 2020 from 6 locations covering river and pond and analyzed for physical, chemical and bacteriological parameters as per established standard methods and procedures. pH values of the surface water are varies between 7.1-7.9 which is within the tolerance limit of 8.5. The slight alkalinity of the water may be associated with alkaline soil of the region. Dissolved Oxygen (DO) levels are found to be in the range of 5.9-6.8 mg/l. BOD ranges from 2.1-2.9 mg/l while COD ranges are found to be 8.1-18.2 mg/l. The values of BOD indicate that greater amount of oxidizable organic material in the water resulting increase of oxygen demand and thereby, lowering of dissolved oxygen levels. The BOD level in river water can be attributed to use of fertilizers in the agricultural fields of river catchment as well as industrial activities in the surrounding area. Chloride and sulphate contents were 19-880 mg/l and 21-440 mg/l respectively. Calcium content varied between 16-150 mg/l, magnesium ranged between 5-87 mg/l. Level of iron in all samples were less than 0.06 mg/l while arsenic, chromium, cadmium, copper, manganese, zinc and mercury are found to be below detectable limit. Fecal coliforms are also present in all the samples

E.8.10 Ground Water

- **Depth of Ground Water:** In the study area, pre monsoon depth to water level (May-2012) 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..
- **Ground Water Category:** As per the CGWA classification, all the Talukas, through which the proposed SPUR is passing, fall under safe category.

- **Ground Water Quality:** Ground water samples were collected once in the month of November 2020 from 6 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: Entire stretch of the proposed alignment comprises various land uses; Forest, forest land, human settlement, agricultural land etc. The survey was carried out between 19.12.2020 to 23.12.2020. For vegetation sampling quadrat method was used. For trees 10x 10m, for shrub 3x 3m while for herbs and grasses 1x 1m size of quadrat was used. A total 25 quadrats were laid out and calculated species' frequency, density abundance, diversity indices etc. Analysis of trees data shows that among six sites *Acacia auriculiformis* was the most frequent species followed by *Tectona grandis*. Density of *Tectona grandis* was also recorded highest among the tree species followed by *Acacia auriculiformis*.

Analyzing the shrub layer data it was found that the most frequent and dominant shrub species were *Calotropis procera*, and *Cassia siamea* among the six sampling sites. Data of herbaceous layer showed that in all the six sites most frequent and dominant herb species were *Cynodon dactylon*, and *Dactyloctenium aegypticum*, in all the six sampling sites, these species were also observed to be the densest species among the six forest sites.

Diversion of Forest Land: The proposed project involves diversion of \cong **119.4411 ha** of forest land, which includes reserved forest (40.6%), protected forest (41.1%), section-35 forest (18.0%) and mangrove forest (0.3%). Proposal has been uploaded on 6th November 2020 (FC Proposal No. FP/MH/ROAD/53857/2020) and it is under examination with the State Government

Mangrove forest is not found along the alignment of the SPUR. However, there is a small patch of mangrove forest (\cong 0.362 ha) in Kashid Kopar village where interchange with NH-8 (new NH-48) has been proposed (km 1.800 of SPUR). However, there will be no impact on mangrove due to construction of the interchange.

Faunal Composition: The fauna of project area is based on direct sighting during field survey, stakeholder consultation, review of Forest working plans of Dahanu Division, Thane Division and Alibag Division, Wildlife Management plan of Tungeshwar Wildlife Sanctuary and published literature. During field visit no direct sighting of wildlife was occurred, except some birds. Hence local people and concerned forest departments were approached and information on wild life was gathered. It was noted that in areas which come within buffer zone, some Schedule-I species were reported. It was noted that total 24 Schedule-I species are noted in the buffer zone of the proposed alignment.

Protected Areas: The proposed SPUR does **not pass through** any protected areas and is located at a distance of **0.698 km** from the boundary of the Tungeshwar Wildlife Sanctuary. Final ESZ Notification of Tungeshwar Wildlife Sanctuary has been published on [S.O.3250 (E)] 11th September 2019. The proposed expressway is located at a distance of **0.275 km** from the notified ESZ boundary i.e. outside ESZ.

The proposed alignment passes through Matheran ESA from km 71+532 to 75+426(both buffer and eco-sensitive zone) and from km 77+115 to km 77+691 (only buffer zone). The Monitoring Committee for Matheran ESZ has approved the SPUR alignment inside the Matheran ESZ vide letter dated 16th April 2013. However, as suggested by the MoEFCC in the approved ToR, fresh application has been submitted on 24th November 2020 and it is under examination with the committee.

E.8.12 Coastal Regulation Zone (CRZ)

The proposed VME-SPUR crosses Tansa River (19°29'04.11"N 72°54'53.04"E), Bhatsa River (19°18'0.27"N 73°10'37.45"E) and Kalu River (19°17'14.17"N 73°11'20.01"E), which are regulated under CRZ Notification. CRZ map and report has been prepared by the National Centre for Earth Science Studies (NCESS), Thiruvananthapuram based on CRZ Notification 2011. NCESS is now updating the same based on Coastal Zone Management Plan (CZMP) of Thane and Palghar district (approved by MoEFCC on 28.02.2019).

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 alignment is passing through 68 villages and 6 Talukas (Vasai, Wada, Bhiwandi, Kalyan, Ambarnath and Panvel) in the State of Maharashtra. Out of 68 villages / towns only 62 villages are affected in terms of loss of private land.

- **Total Population:** Out of total 68 affected villages 11 villages of Vasai, Kalyan and Ambarnath tehsil fall under Municipal Corporations / Councils. The population details of these villages are not available separately. Total population of remaining 57 villages is 63,383 out of which 32,252 are male and 31,131 are female. The composition of schedule caste (SC) and schedule tribe (ST) is 2,418 and 23,526 respectively.
- **Distribution of Workforce:** In general, 43.64% of the total affected population is working. Majority of work force belongs to the category of main workers (74.19% of the total workers). Around 55.36% of total affected population is non-workers. Around 54.66% of total main workers are engaged in agriculture production and of

them 24.6% are cultivators. Due growing industrialization many of the people (42.92%) are engaged in other work in cities

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.2**:

Table - E.2 Summary of Anticipated Impacts and Recommended Mitigation Measures

Area	Impacts	Mitigation Measures
Construction Phase:		
Topography and geology	<ul style="list-style-type: none"> ▪ Disfiguration & change in existing profile of the land due to borrow pits & construction of realignments. ▪ Disturbance on geological setting due to quarrying. ▪ Uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease. ▪ Establishment of construction camp 	<ul style="list-style-type: none"> ▪ Borrow pits shall be allowed at only pre-identified locations with prior permission from competent authority ▪ Borrow pits shall be restricted to 1 m depth followed by resurfacing of pits. ▪ Road building materials shall be procured from approved and licensed quarries. ▪ Suitable seismic design of the structures shall be adopted to mitigate the earthquake impacts.
Soil	<ul style="list-style-type: none"> ▪ Disruption & loss of productive top soil from agricultural fields ▪ Soil erosion and contamination 	<ul style="list-style-type: none"> ▪ Adequate measures like drainage, embankment consolidation & slope stabilization shall be taken to avoid soil erosion. ▪ Top soils (15 cm) of borrow pit sites shall be conserved and restored after excavation is over. ▪ Accidental spills of lubricants/oil and molten asphalt shall be avoided by adherence to good practices. ▪ Oil Interceptor shall be provided for wash down, refueling areas ▪ 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.
Land use	<ul style="list-style-type: none"> ▪ Changes in existing land use pattern of the PROW for construction of the expressway ▪ Loss of agricultural land, forest land etc. due to land acquisition 	<ul style="list-style-type: none"> ▪ Earth material generated from excavation shall be reused for embankment construction and site development. ▪ Construction debris will be disposed of in suitable pre-identified dumping areas. ▪ Dumping areas will be biologically reclaimed. ▪ Construction camp will be provided to avoid

Area	Impacts	Mitigation Measures
		<p>indiscriminate settlement of construction workers.</p> <ul style="list-style-type: none"> ▪ Construction activities shall be kept confined to PROW only
Drainage & Hydrology	<ul style="list-style-type: none"> ▪ The drainage network along the expressway is subject to impacts due to construction of embankment 	<ul style="list-style-type: none"> ▪ To minimize the impact drainage & hydrological flow, 13 major bridges, 21 minor bridges, 230 culverts are proposed to be constructed along the expressway ▪ It has been ensured that all the 1st and 2nd order streams crossing the proposed expressway alignment provided with necessary culverts, mirror bridges and major bridges with capacity of 20% excess discharge ▪ All bridges have been designed for a return period of 100 years and culverts have been designed for a return period of 50 years ▪ Silt fencing shall be provided between expressway and water bodies to avoid any siltation due to runoff from construction area ▪ Shoulder and toe drains has been proposed along the expressway on both side
Water use	<ul style="list-style-type: none"> ▪ Impact on the local water sources due to use of construction water. 	<ul style="list-style-type: none"> ▪ Minimum use of water from existing sources for construction purpose ▪ The contractor shall arrange water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. ▪ 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 ▪ Wastage of water during the construction should be minimized
Water quality	<ul style="list-style-type: none"> ▪ Increase of sediment load in the run off from construction sites and increase in turbidity in receiving water bodies. ▪ Water pollution due to generation of wastewater from construction camps ▪ Water pollution due to use of fly ash in the embankment 	<ul style="list-style-type: none"> ▪ Silt fencing will be provided to reduce sediment load ▪ Oil interceptor to stop and separate the floating oils ▪ Packaged Wastewater Treatment Plant has been recommended for the construction camp ▪ All the construction activities will be carried out during dry seasons only. ▪ In line with specifications of IRC:SP:58, method of construction of Fly Ash embankments is

Area	Impacts	Mitigation Measures
		<p>proposed by alternate layers of fly ash and soil i.e. Sandwich Type Construction</p> <ul style="list-style-type: none"> ▪ Rainwater Harvesting Structures has been proposed at toll plaza, way side amenities and along the expressway. With oil & grease removal provisions. ▪ The fuel storage and vehicle cleaning area shall be stationed at least 500m away from the nearest water body ▪ 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
Air quality	<ul style="list-style-type: none"> ▪ Deterioration of air quality due to fugitive dusts emission from construction activities and vehicular movement along unpaved roads. ▪ Deterioration of air quality due to gaseous emissions from construction equipment & vehicular traffic. ▪ Deterioration of air quality due to emission from hot mix plants and stone crusher. 	<ul style="list-style-type: none"> ▪ Construction materials will be stored in enclosed spaces to prevent fugitive emissions. ▪ Truck carrying soil, sand and stone will be duly covered to avoid spilling. ▪ Dust suppression measures such as regular water sprinkling on haul & unpaved roads particularly near habitation ▪ 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 ▪ A combination of dry and wet type control system is suggested for stone crusher to minimize the impact on air quality ▪ Hot mix plants & stone crusher shall be located at least 500 m away from inhabited areas & sensitive receptors ▪ Air quality shall be monitored during construction and operation phases as per environmental monitoring program to understand the effectiveness of mitigation measures suggested
Noise level	<ul style="list-style-type: none"> ▪ Increase in noise level due to construction activities like operation of construction equipment & vehicular traffic. 	<ul style="list-style-type: none"> ▪ Construction camp and temporary labour sheds will be located away from the immediate vicinity of the construction sites and major road traffic. ▪ PPEs will be provided to construction personnel exposed to high noise levels as preventive measure. ▪ Low noise construction equipment will be used. ▪ Stationary construction equipment will be

Area	Impacts	Mitigation Measures
		<p>placed 113 m away from inhabited areas.</p> <ul style="list-style-type: none"> ▪ Stationary construction equipment will be placed 200 m away from the silence zones ▪ Construction activities carried out near residential area will be scheduled to the daytime only so that minimum disturbances are caused to people. ▪ 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) ▪ Noise level shall be monitored during construction and operation phases as per environmental monitoring program to understand the effectiveness of mitigation measures suggested
<p>Floral, Fauna and Forest</p>	<ul style="list-style-type: none"> ▪ Proposed project involves diversion of approx. 119.4411 ha forest land and felling of approx. 61,078 no. of trees (Trees in forest-land - 19,562 and Trees in non-forest land - 41,516) ▪ Loss of habitat of fauna due to felling of trees and diversion of forest land <p>Note: Forest land proposed to be diverted and trees in forest land non-forest land may be changed during Forest Clearance process and land acquisition process. The same will be updated time to time</p>	<ul style="list-style-type: none"> ▪ Forest clearance for diversion of forest land ▪ Efforts will be made to save trees outside formation width standing on edge of the PROW ▪ 69,680 no. of trees and 40,098 no. of hedges proposed to be planted under greenbelt development plan ▪ Plantation suggested under Compensatory afforestation for diversion of 119.4411 ha forestland shall be 2,39,000 plants. However, this shall be finalized by the Forest Department ▪ Wildlife awareness & environmental protection training shall be provided to the work force by the Contractor and a budget of Rs. 32 lakh has been proposed for training in the EMP Budget. ▪ Cooking fuel (LPG) shall be provided to construction workers to avoid cutting / felling of trees for fuel wood. ▪ Soil erosion shall be checked by adopting bio-engineering measures ▪ 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 ▪ Noise will be kept under control by regular maintenance of equipment and vehicles. ▪ Noisy activity shall be prohibited during night

Area	Impacts	Mitigation Measures
		time
Protected Area	<ul style="list-style-type: none"> ▪ The proposed expressway does not pass through any National Park, Wildlife Sanctuary, Conservation Reserve and Community Reserve; hence no direct impact is envisaged ▪ The proposed SPUR alignment is intervening Matheran Eco Sensitive Zone at two locations between Km 71.532 to 75.426 and km 77.115 to km 77.691 ▪ Proposed expressway may cause obstruction in movement of wildlife 	<ul style="list-style-type: none"> ▪ There is no report of wildlife killed in the stretch of old NH-8 parallel or closed to the proposed expressway (VME-SPUR). 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. ▪ To preserve ecology of the Matheran, 4.160 km long tunnel is proposed in this section which will go under the Matheran Eco-Sensitive Zone. Start and end point of the tunnel is outside the buffer zone of Matheran ESZ. The Monitoring Committee of Matheran ESZ approved the VME-SPUR alignment through Matheran Eco-Sensitive Zone vide letter dated 16th April 2013. However, as suggested by the MoEFCC, application has been resubmitted to obtain fresh permission as the previous permission is 7 years old. ▪ 13 major bridges, 21 minor bridges, 60 cattle / light & small vehicular underpasses have been proposed along the expressway. In addition, the 230 culverts will act as cattle underpass / animal crossings during summer season. ▪ In addition to culverts & underpasses, for easy movement of animals, major bridge cum viaduct of 4.2 km length has been proposed. ▪ Monitoring of wild animals should be done during construction phase and any incidence of sighting should be immediately reported to Forest Department. ▪ Measures recommended during Environment & CRZ Clearance, Forest Clearance and from the Chief Wildlife Warden, Govt. of Maharashtra shall be complied; progress report of implementation of EMP and recommendations by various authorities shall be submitted as per the schedule
Tunneling	<ul style="list-style-type: none"> ▪ Disturbance on geological setting due to tunneling. ▪ Run off from unprotected tunnel faces can result in 	<ul style="list-style-type: none"> ▪ The detailed analysis of Geophysical study shows that there is no water body encountered along the SPUR alignment and the rock is hard and compact which will not affect on the

Area	Impacts	Mitigation Measures
	<p>excessive soil erosion.</p> <ul style="list-style-type: none"> ▪ Muck generated from tunnel construction ▪ Change in underground drainage system due to tunnel. ▪ Draining of excess water from excavated tunnel. ▪ Increase in noise & vibration level due to construction activities like tunneling ▪ Trees in tunnel locations saved, thus preserving the ecology of the area 	<p>alignment and it is safe for tunneling.</p> <ul style="list-style-type: none"> ▪ The structural geology study shows that the area is good for tunneling. ▪ The lineament study and Aquifer mapping shows that the area is safe for tunneling and will not affect any ground water body present in the area. ▪ Stabilization measures for tunnel and slope shall be as per final recommendation of Geotechnical Investigation report. ▪ Careful planning, timing of cut and fill operations and re-vegetation shall be done to minimize soil erosion. ▪ Muck generated from tunnel construction shall be reused in filling operations, embankment construction and other construction activities. ▪ Continuous pumping of excess water into the storm water drains, which finally meet the natural water source. ▪ Noise & vibration monitoring as per Environmental Monitoring Program
Solid Waste	<ul style="list-style-type: none"> ▪ Waste generated during construction may impact soil, agriculture and water quality ▪ Waste generated from workers' camps may impact surface and ground water quality and agriculture 	<ul style="list-style-type: none"> ▪ Approx. 300 kg/day domestic waste will be generated by the construction workers in all the packages, out of which biodegradable waste is estimated to be 120 kg/day and remaining 180 kg/day is non-biodegradable waste. There will be "Refuse Containers" at site for the management of domestic waste generated by the construction labourers and these containers shall be emptied at least once daily and will be disposed of as per Solid Waste Management Rules, 2016 in consultation with the local authority.
Construction camp	<ul style="list-style-type: none"> ▪ Influx of construction work-force & suppliers who are likely to construct temporary tents in the vicinity. ▪ Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers. 	<ul style="list-style-type: none"> ▪ Temporary construction camps with adequate potable water supply, primary health facilities and fuel for cooking shall be provided ▪ Packaged Wastewater Treatment Plant has been recommended for the construction camp ▪ It will be ensured that the construction workers are provided fuel for cooking to avoid cutting of trees from the adjoining areas. ▪ Contractor to provide a full-fledged dispensary. The number of beds shall be as per the requirement of the labour license

Area	Impacts	Mitigation Measures
Occupational health & safety	<ul style="list-style-type: none"> Health & safety related problems to construction workers due to inadequate health & safety measures. 	<ul style="list-style-type: none"> Adequate safety measures complying to the occupational safety manuals will be adopted to prevent accidents / hazards to the construction workers Contractor shall conduct monthly health check-ups of all his laborers in his camps through registered medical practitioner Contractor to conduct workshop on HIV / AIDS for all his laborers at all his camps at least once in a quarter
Road safety	<ul style="list-style-type: none"> Increase on incidence of road accidents due to disruptions caused in existing traffic movements. 	<ul style="list-style-type: none"> 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 / Independent Engineer (AE / IE) regarding traffic arrangements during construction. Reduction of speed through construction zones.
Operation Phase		
Land use and Encroachment	<ul style="list-style-type: none"> Change of land use by squatter/ encroachment within ROW and induced development outside the ROW. 	<ul style="list-style-type: none"> Boundary wall has been proposed along the ROW boundary of the entire expressway Planning agencies and Collector / Revenue Officer will be made involved for controlled development and prohibiting squatter/ encroachment within ROW.
Drainage	<ul style="list-style-type: none"> Filthy environment due to improper maintenance of drainage. 	<ul style="list-style-type: none"> Shoulder drain & 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.
Water quality	<ul style="list-style-type: none"> Chances of contamination of 	<ul style="list-style-type: none"> Adequate drains have been proposed to

Area	Impacts	Mitigation Measures
	water bodies from road surface run off containing oil spills due to traffic movement & accidents.	<p>accommodate increased run-off. The out fall for these drains will be the nearby culverts / bridges or natural drainage channel.</p> <ul style="list-style-type: none"> ▪ Silt fencing will be provided to sediment entering into the water courses. ▪ Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents. ▪ Regular maintenance of rainwater harvesting structures shall be done during the operation stage to prevent choking of these structures ▪ Monitoring of water quality at specified locations will be conducted at fixed interval
Air quality	<ul style="list-style-type: none"> ▪ Air pollution due to vehicular emission from road traffic. 	<ul style="list-style-type: none"> ▪ 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, 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. ▪ Plantation along the expressway will act as sink of air pollutants ▪ Monitoring of air quality at specified locations will be conducted at fixed interval
Noise level	<ul style="list-style-type: none"> ▪ Noise pollution due to traffic noise. 	<ul style="list-style-type: none"> ▪ Plantation along the expressway will act as a natural noise barrier. ▪ Monitoring of noise level at specified representative locations will be conducted at fixed interval. ▪ Maintenance of noise barrier
Flora & fauna	<ul style="list-style-type: none"> ▪ Illegal felling of trees along the expressway ▪ Effect on aquatic fauna in case of accidental spill of oil, fuel & toxic chemicals into water bodies 	<ul style="list-style-type: none"> ▪ Monitoring of avenue plantation along the expressway to be done. 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. ▪ Regular watering of plants to be done in dry season through drip irrigation system. ▪ Regular maintenance of the cattle underpass and culverts, which will act as animal crossing.
Road safety	<ul style="list-style-type: none"> • Impacts on human health due 	<ul style="list-style-type: none"> ▪ To improve the safety of such high speed

Area	Impacts	Mitigation Measures
	<p>to accidents.</p> <ul style="list-style-type: none"> • Damage of expressway due to wear & tear. 	<p>corridor, Thrie beam metal crash barriers shall be provided in entire length on both sides of each main carriageway (i.e. on 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"> ▪ 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

E.10 RESETTLEMENT POLICY AND MITIGATION MEASURES

- Land will be acquired by the CALA (Competent Authority for Land Acquisition) as per National Highways Act, 1956 and relevant provisions of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013 & amendment of State Government.
- Compensation will be determined in accordance with First Schedule, rehabilitation and resettlement assistance specified in the Second & Third Schedule of RFCTLARR Act, 2013 applicable to the land acquisition under the National Highways Act, 1956

E.11 ANALYSIS OF ALTERNATIVES

The main objective of the proposed SPUR of VME is to take the through traffic of VME to JNPT and further southward so that it does not enter Mumbai. A Comprehensive Transportation Study for the Mumbai Metropolitan Region has been done in 2008-2009 by the MMRDA. The alignment options studied for VME & SPUR follow the links identified in the MMRDA study and have been modified to suit site conditions.

Six alternative alignments for the SPUR to connect JNPT and Mumbai Pune Expressway have been studied. It was desired that the SPUR alignment should be synergized with the other developments being envisaged in the Mumbai Metropolitan

Region by the Government of Maharashtra.

A Committee under the chairmanship of the Divisional commissioner (Konkan Division) was constituted vide Public Works Department Govt. Circular dated 24-5-2010 for the selection of the greenfield alignment of VME including SPUR. The other members of the committee included CGM NHAI; Chief Engineer (NH) PWD; **Chief Conservator of Forest, Thane**; Chief Engineer MMRDA; Collector Thane; Additional Chief Transportation Engineer, CIDCO and Additional Collector (Tribal), Jawhar, Thane. The committee held 5 meetings between April 2010 to August 2010 after joint site visit and the final report of the committee was submitted to Chief Secretary on November 2010.

Considering technical aspects brought out from the visit made by the NHAI, Forest Department. PWD and CIDCO and taking into account the merits of the outer alignments, the Committee recommends the outer alignment (Node No. 1-2-4-11-12-9-10-14) of SPUR of the main Vadodara Mumbai Expressway in Maharashtra. The Government of Maharashtra accepted the recommendations of the committee. A formal approval of the alignment was granted by the Government of Maharashtra in February 2011. The alignment of SPUR has also been included in the Mumbai Metropolitan Regional Plan 2016-36 of MMRDA

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 / Independent Engineer (AE / IE) who in turn shall report to the PIU. The Contractor will submit monthly and quarterly environmental compliance reports to the AE / IE. The AE / IE will submit separate quarterly environmental monitoring reports to Project Implementation Unit (PIU) of NHAI and PIU will be responsible for preparation of the targets for non-compliances identified by the AE / IE.

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. 48.82 Crore** has been kept towards implementation of environmental management plan.

Table E-3 Summary of Environmental Budget

Component	Description	To be implemented by	Amount in Rs.
A	Greenbelt Development	Contractor	14,46,18,000
B	Cutting of Trees including trunks, branches & removal		3,20,88,630
C	Mitigation / Enhancement		5,24,30,000
D	Environmental Monitoring		96,77,500
E	Training, Capacity building & Mobilization		32,00,000
F	Subtotal (A+B+C+D+E)		24,20,14,130
G	Contingency @3%		72,60,424
H	Total (F + G)		24,92,74,554
I	CA & NPV	NHAI	23,88,82,200
Grand Total (H + I)			48,81,56,754
Say			Rs. 48.82 Cr.

E.14 CONCLUSIONS

Keeping in view of the importance of the National Highways for the economic development, the Government of India has taken up an ambitious program of development of the National Highways under different phases of National Highway Development Program (NHDP). The construction of about 379 km long proposed Vadodara Mumbai Expressway along with SPUR is envisaged to fulfill this objective and decided to be implemented under NHDP (Phase-VI).

The proposed expressway (VME-SPUR) will provide smooth, safe and uninterrupted traffic movement between Vadodara to Mumbai in respect to the alternative road NH 48. The NH 48 (Old NH8) is currently carrying more than 100,000 PCUs with much substandard geometry and is heavily congested. It will reduce the travel time about 3 to 4 hours between Vadodara to Mumbai. The proposed expressway falls in the Delhi-Mumbai Industrial Corridor. It will connect to the largest container port, JNPT near Mumbai with northern part and Dahej port, other ports in Gujarat. Surat is at the heart of the world's diamond-polishing industry contributing billions of dollars to the Indian GDP.

Vapi, Daman and Silvassa are the major industrial hub will be connected. Development of this section will reduce the existing distance between Vadodara-Mumbai by about 22 km and ultimately there will be reduction in distance between Delhi-Mumbai. The VME-SPUR connects the main expressway to JNPT, Maha Samrudhi Marg (Mumbai-Nagpur Expressway) and Mumbai Pune Expressway. Therefore the traffic bound for JNPT, Nagpur and Pune will ply on SPUR and will not enter the Mumbai city. This will reduce both traffic congestion and pollution in the city.

Based on the EIA study, it can be concluded that adverse environmental impacts can be mitigated to an acceptable level by implementation of the mitigation measures as stated in the EIA Report. The mitigation measures suggested and the Environment Management Plan (EMP) prepared for this project seems sound enough to mitigate the present as well future consequences if any during implementation and operation phase.

The expressway will reduce the traffic load on NH-48 (Old NH-8), NH-3 & NH-222; which will mitigate the safety issues, reduce pollution load in the surrounding area, increase employment opportunity and improve economic development of the region. Further, the proposed SPUR of VME will be linking Vadodara – Mumbai Expressway, Ahmedabad- Vadodara Expressway, Mumbai –Nagpur Expressway and Mumbai - Pune Expressway and thus will provide expressway connectivity from Delhi – Ahmedabad – Mumbai – Nagpur - Pune.