

Executive Summary

for

Proposed Pune Ring Road, Eastern Alignment (Part 2)– 66.560 km

Start from Solu Village and Ends at Varve (Kelawade)Village



[7(f) “Highways”, Category B]

Proposal No: SIA/MH/NCP/60419/2021

Submitted to

Maharashtra State Pollution Control Board (MPCB)

Environmental Consultant



buildingenvironment

Building Environment (India) Pvt. Ltd

Dakshina Building, Office No-401, 4th Floor,

Beside Raigard Bhavan, Sakal Bhavan Rd,

Sector 11, CBD Belapur,

Navi Mumbai, Maharashtra 400614

Telefax: 022 4123 7073/2757 8554

Web: www.beipl.co.in

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Submitted by



**Maharashtra State Road Development
Corporation Ltd**

(Government of Maharashtra
Undertaking, Mumbai)

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1.1 Introduction

Area wise Pune district is the second largest district in the state of Maharashtra (15,643 km²). Population wise, it is the most populated district in the State (94,26,959 as per 2011 Census). Pune is at the junction of four major state & national highways, NH-4, NH-50, NH-9 and SH 27 from which heavy outbound traffic passes through each day, that severely affects the infrastructure and traffic situation in the city. The traffic in and around Pune City has been increasing at high rate due to industrial and other socio-economic developments in and around Pune City. As a result, roads radiating from the city in all directions are required to be widened to 4 lane/ 6 lanes. Besides, the vehicles that are required to bypass the city are also passing through the city, thereby, creating traffic congestions. Such passing traffic, if diverted through road network outside the city limits will ease the traffic congestion within the city. In absence of such peripheral connections, the load of external floating traffic is ever increasing on the intra city road network. To avoid the traffic congestion in Pune, Maharashtra State Road Development Corporation (MSRDC) initiated to take up the development of an Outer Ring Road Corridors for the City of Pune under two packages viz.

- Eastern Alignment [approximate length 101.460 Km] starting from Urse on Mumbai-Pune Expressway and culminating at Khed Shivapur on NH-48 [Popularly known as Satara road] via Talegaon [Old Mumbai-Pune Ring Road – NH48], Kuruli [Nashik Road, Lonikand [Ahmednagar Road], Theur [Solapur Road], Wadki [Saswad road] and Bhivari [Pune Baramati Road]
- Western Alignment [approximate 66.100 Km length] starting from Urse at Mumbai-Pune Expressway Toll Naka. YCEW, and traverses through number of villages/towns viz. Parandwadi, Dhamne, Bebadohal, Chandkhed, Pachane, Pimploli, Kemsewadi, Javal, Padalgharwadi, Rihe, Ghotavade, Amedveth, Bhare, Kasar Amboli, Urwade, Ambegaon, Marnewadi, Mutha, Katavi, Bahuli, (Bhagwatwadi), Sangrun, Mandvi Budruk, Wardade, Mulkhed, Khamgaon Maval, Ghera Sinhgad, Kalyan, Rahatvade, Ranje, Kusgaon, Khopi, Kanjale and ends on Khed Shivapur at Satara Road [NH-48].

As per EIA Notification 2006 and its subsequent amendments, all State Highways are to be considered as 7(f) Category “B” project and will be appraised by State Expert Appraisal Committee (SEAC).

Application for the Terms of Reference (ToR) for Eastern Alignment (101.460 km) starting from Urse on Mumbai-Pune Expressway and culminating at Khed Shivapur on NH-48 [Popularly known as Satara road] was submitted in 4th August, 2016 on MoEF&CC portal via proposal No. SIA/MH/MIS/16915/2016 and ToR was granted in 134th Meeting of SEAC-I, Maharashtra in 8th September 2016. PROW of Nashik Railway runs parallel to the ring road eastern alignment at a distance of 350 m to 500 m from Ch 42+400 to Ch 48+200 (length 5.8 km) and crosses the proposed ring road alignment at Ch 51+672 near Bakori village. During finalization of detailed design, the alignment was refined to avoid overlapping of PROW of Nashik Railway with proposed PROW of PRR Eastern alignment at Ch 40+200 to CH 42+400 (length 2.2 km). This resulted in change in alignment from Ch 39+00 to Ch 48+200 (length 9.2 km) to keep the PROW of PRR Eastern Alignment and Railway line parallel to each other. After change in alignment, 76 m length is increased w.r.t approved alignment. The refinement in the alignment also led to increase in number of structures. Considering these changes, it was required to reapply for the ToR

which was within its validity period. For administrative purpose, MSRDC has further split the project in 3 packages from the original two packages. PRR Eastern Alignment is now having two packages namely Part-1 and Part-2 details given in Table 1.

Table 1:Pune Ring Road Project Details

Sr. No.	Name of Project work	Approximate Length
1	Eastern Alignment (Part-1): Starting from Urse to Ends at Solu	38.340 km
2	Eastern Alignment (Part-2): Starting from Solu to Ends at Varve (Kelawade) near Satara highway	66.560 km
3	Western Alignment: Starting from Urse Village to Ends at Varve (Kelwade) on Satara road Via Parandwadi, Paud road, Mula road, Mutha road	68.800 km
Total of Pune Ring Road project		173.7 km

During the finalization of PRR eastern alignment, realignment was required to keep the proposed ROW of Nashik railway and road corridor close to each other as shown in Figure 1 & Figure 2. The proposed alignment of Pune Ring Road Eastern Part 2 will be 66.560 km long, started at Solu village, Khed Taluka, Pune District at CH 38+340 km and ends at Varve (Kelwade) village, Bhore Taluka, Pune District at CH 104+900 km directly connecting 4 talukas and 29 villages.

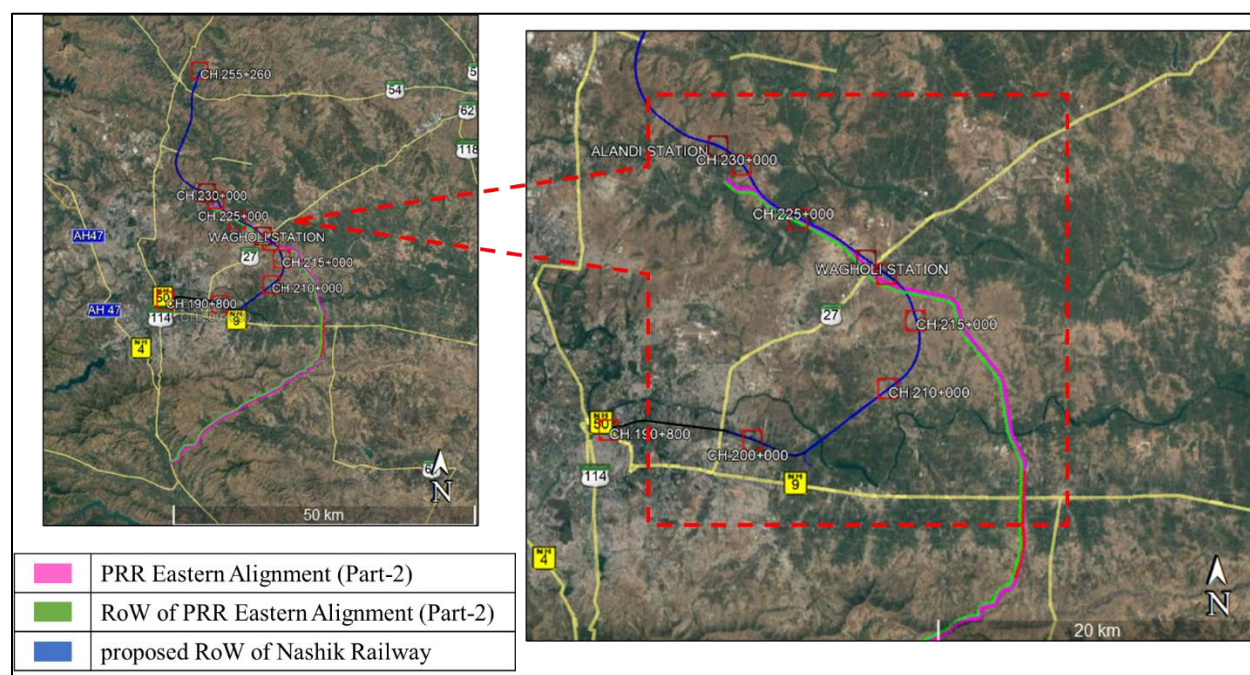


Figure 1:Image Showing realignment due to the overlapping proposed ROW of Nashik Railway

Source: AECOM

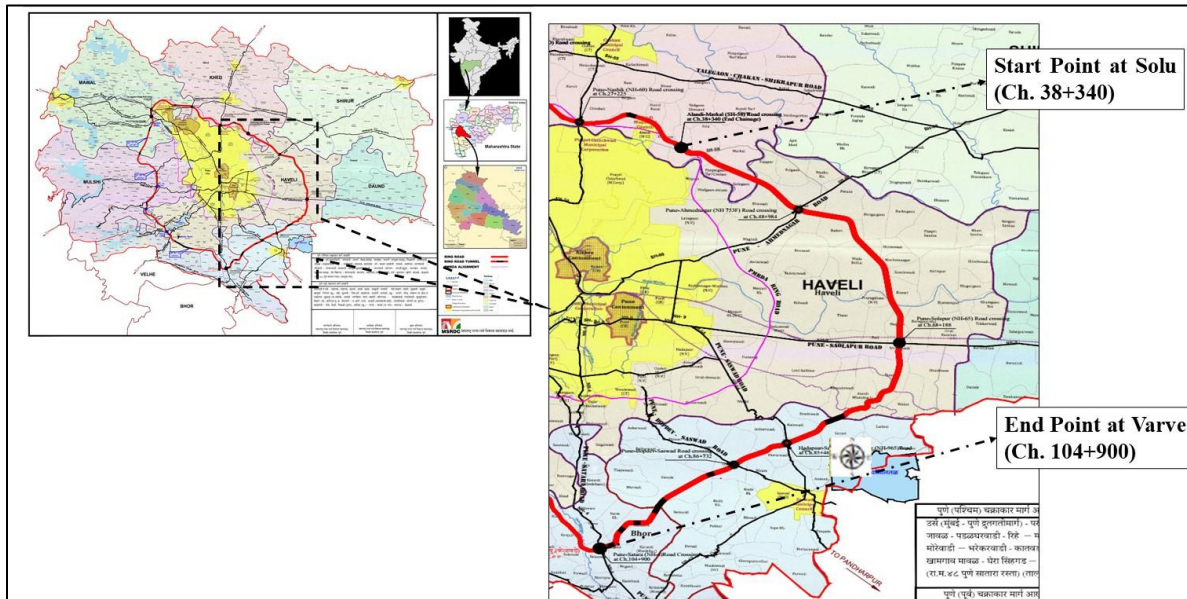


Figure 2: Index Map showing Location of proposed alignment- PRR East-Part 2

Source: MSRDC

1.2 Project Location

The proposed Pune Ring Road eastern alignment Part 2 starts from Ch 38+340 km at Solu on Alandi Markal Road (18° 39' 57.92" N latitude and 73° 56' 9.28" E longitude) and ends at Ch 104+906 km section to Varve (Kelwade) on NH-4 (18° 17' 14.66" N latitude and 73° 52' 26.33" E longitude). This section covers 4 tehsils i.e., Khed, Haveli, Purander and Bhore in Pune District. The location map of the proposed alignment is shown in Figure 3.

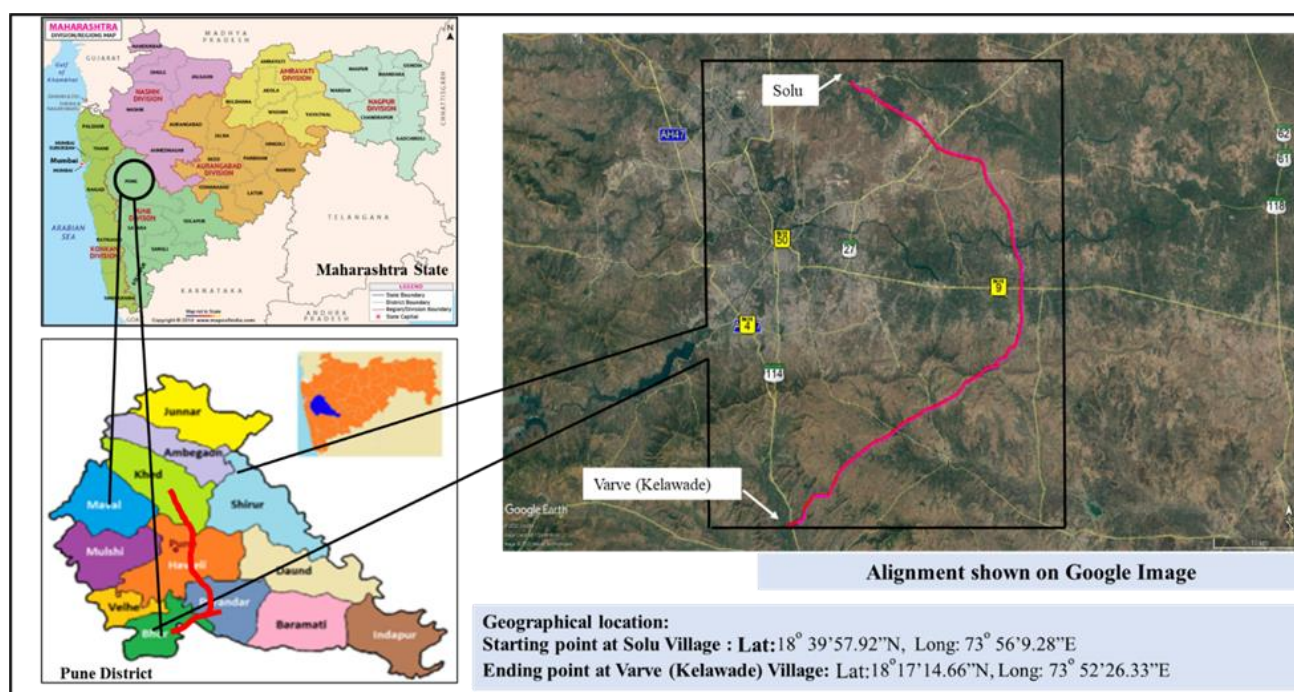


Figure 3:PRR Eastern alignment- Part 2 Location Map

1.3 Project description

Table 2:Project Details of Proposed Pune Ring Road Eastern Alignment Part 2

Sr. No.	Particulars	Proposed Details
1	Alignment	: Starting from Solu village (at Ch. 34+380) it passes through Solu, Markal, Golegaon, Tulapur, Bhavdi, Lonikhand, Perne, Bakori, Dongargaon, Vadebolhai, Gavadewadi, Murkutenagar, Biwari, Peth, Koregaon Mul, Shindwane, Walati, Tarde, Alandi Mhatabachi, Sonori, Kalewadi, Dive, Hivare, Chambali, Kodit Khurd, Garade, Kambare Khe. Ba., Naygaon, Kelawade village (at Ch. 104+900)
2	Geographical location	: Start Point of alignment: Solu Village Lat:18° 39'57.92" N, Long: 73° 56'9.28" E End Point of alignment: Varve (Kelwade) Lat:18° 17'14.66" N, Long: 73° 52'26.33" E
3	Chainage Details	: Start Point at Solu village -Ch. 34+380 End Point at Varve - Ch. 104+900
4	Location the proposed project	: State: Maharashtra District: Pune
5	Alignment passing through the Tehsils	: The Alignment is passing through 4 tehsils in Pune District. Taluka Khed Solu, Markal, Golegaon Taluka Haveli Tulapur, Bhavdi, Lonikhand, Perne, Bakori, Dongargaon, Vadebolhai, Gavadewadi, Murkutenagar, Biwari, Peth,

Sr. No.	Particulars		Proposed Details	
				Koregaon Mul, Shindwane, Walati, Tarde, Alandi Mhatabachi,
			Taluka Purandar	Sonori, Kalewadi, Dive, Hivare, Chambali, Kodit Khurd, Garade
			Taluka Bhore	Kambare Khe. Ba., Naygaon, Kelawade
6	Connecting villages	:	29 Nos. of Villages	
7	Length of the proposed alignment	:	66.560 km	
8	Project cost	:	Total Cost: 68,68,27,67,204 /- Rs & civil cost: 5,793 Cr	
9	Total land acquisition	:	Total: 618.6103 Ha	
			Agricultural Land: 510.3127 Ha	
			Forest land: 81.8165 Ha	
			Barren & Other Land: 26.4811 Ha	
10	Carriageway	:	The proposed expressway will have 3+3 lane with 15 m depressed median for Solu to Solapur Road section and 3+3 / 2+2 lane with 22.5 m depressed median for Solapur Road to Satara road, for future development carriageway will be divided on median side.	
11	Design Speed	:	Plain: - 120 km/hr, Rolling: 100 km/hr and Mountainous terrain: 80 km/hr	
12	Proposed ROW	:	90 m	
13	Proposed Interchanges	:	4 Nos. of interchange at following locations: 1) Start ch. 48+984 km & ends at ch. 49+104 km at Pune - Ahmednagar Cross road (SH-27) (Lonikhand) 2) Start ch. 68+188 km & ends at ch. 68+328 km at Below Pune-Solapur Road (NH 9) Structure) (Sortapwadi) 3) Start ch. 85+467 km & ends at ch. 85+587 km at Saswad-Pune Road (Saswad) 4) Start ch. 89+732 km & ends at ch. 89+852 km at Saswad-Bopdev-Pune Road (Chambali)	
14	Bridges	:	Major bridges: 2 Nos. Minor bridges: 21 Nos.	
15	Viaducts	:	18 Nos. (Total Length = 4.620 Km)	
16	Vehicular overpass & underpass	:	VUP- 15 nos. LVUP 32 Nos. & Minor Bridge Cum LVUP- 3 nos. VOP:4	
17	Culverts	:	Box culvert:83 nos. Box Culvert with Retaining Wall: 2 nos.	
18	Connecting Road	:	7.5 m wide	
19	Depressed Median	:	15 m	
20	Paved Shoulder & Edge Strip	:	On median side, 0.75 m wide edge strip & On outer side 3.75 m wide paved shoulder	
21	Tunnels	:	7 Nos. (Total length 3.705 km) 1) start Ch. 78+910 & End Ch.79+965 (Length – 1.055 Km)	

Sr. No.	Particulars		Proposed Details
			2) start Ch. 81+790 & End Ch. 81+990 (Length – 0.200 Km) 3) start Ch. 87+440 & End Ch. 87+690 (Length – 0.250 Km) 4) start Ch. 97+000 & End Ch. 98+150 (Length – 1.150 Km) 5) start Ch. 100+475 & End Ch. 100+675 (Length – 0.200 Km) 6) start Ch. 101+525 & End Ch. 101+775 (Length – 0.250 Km) 7) start Ch. 103+675 & End Ch. 104+275 (Length – 0.600 Km)
22	No. Fly-over	:	1 (Inner Ring Road Crossing)
23	Railway over bridge	:	3 Nos. Total Length= 1.194 km 1) start Ch. 51+523 & End Ch.52+069 (Length – 0.546 Km) 2) start Ch. 64+514 & End Ch. 67+550 (Length – 0.036 Km) 3) start Ch. 73+291 & End Ch. 73+903 (Length – 0.612 Km)
24	Embankment	:	Total length of embankment - 45.300 km Average height of embankment 5 m
25	Service Road/Slip Road	:	Instead of service roads slip roads are proposed to discourage local traffic on the highway. This road shall be placed at the edge of PROW and width of carriage way shall be 7 m wide.
26	No. Way side Amenities (Rest Area)	:	1 no. Near Sortapwadi (Ch. 53+250 RHS)
27	No. Toll Plaza	:	4 Nos Ramp Plazas in each interchange location
28	No. Truck Parking	:	Nil
29	Drain	:	Total length of unlined Open drain – 104.5 km Total length of Box drains – 12.0 km
30	RWH structures	:	133 nos. of Rain water harvesting strcutures are proposed at every 500 m interval throughout the alignment as per IRC: SP- 50:1999 by taking Adequate measures.
31	Horticulture and landscaping	:	Throughout

1.4 Site Sensitivity

The majority of area in project alignment is hilly & plain having greenery throughout the year. This corridor crosses two major rivers of Pune viz. Bhima River [between Ch. 44+343 km to Ch. 44+523 km] & Mula-Mutha river [between Ch. 64+012 km to Ch. 64+282 km]. The key sensitive receptors near proposed alignment & probable impacts due to project activities are identified in the study area as shown in Table 2 2.

Table 3: Sensitive Receptors along the alignment

Sensitivity Categories	Receptor	Distance from the alignment	Probable Impacts
Water Bodies (Rivers / Dams/ Reservoirs)	Bhima River (Indrayani River)	Alignment Crossing between Ch. 44+343 km to Ch. 44+523 km (Length-180 km)	• Sedimentation of surface water • Oil seepage during construction • Impact on drainage pattern • Impact on the habitat and productivity of aquatic organism. • Discarding of generated waste during construction may lead to water pollution • Contamination of the river bed sediment from bore hole flushing. • Impact on aquatic fauna due increased turbidity.
	Mula Mutha River	Alignment crossing between Ch. 64+012 km to Ch. 64+282 km (Length-270 km)	
	Bhima River	~ 0.06 km from alignment at Ch. 39+000	
	Sortapwadi Canal	Alignment Crossing between Ch. 69+011 km to Ch. 69+041 km (Length- 30 km)	
	Reservoir near Bhawadi Village	~0.11 km from alignment at Ch. 48+100	
	Garande Dam	~0.08 km from alignment at chainage 93+300	
Forest area	Pune Forest Division (Km 44+300 to Km 79+550) & Bhore Sub-Division (Km 79+550 to Km 104+900)	7.886 km of alignment from Ch 44+300 km to Ch.79+540 km is passing through Forest area (67.4075 Ha) of Tulapur, Bhawadi, Dongargaon, Wade Bolhai, Biwari, Koregaon Mul, Walati, Tarade & Alandi Mhatabachi villages of Haveli taluka of Pune Forest division. 1.922 km of alignment from Ch. 79+540 km to Ch. 104+900 km is passing through forest area (14.4090 ha) of Sonori, Kalewadi, Hivare, Kambare Khe. Ba., Naygaon, Kelawade villages of Purandar & Bhore Taluka of Bhore Forest Sub-Division. Alignment is passing through 81.8165 Ha area of forest land, out of which 3 Nos. of tunnels are	There will be tree cutting in forest area causing loss of native/exotic trees, loss of micro habitat, loss of nesting site, loss of feeding opportunity for specific fauna, etc. The removal of vegetation may cause erosion, and increased run-off would in turn may lead to erosion of productive soil.

Sensitivity Categories	Receptor	Distance from the alignment	Probable Impacts
		proposed in 9.808 ha of forest land respectively.	
Religious and historic places	Alandi- Shree Dnyaneshwar Maharaj Samadhi Mandir	Alandi- Shree Dnyaneshwar Maharaj Samadhi Mandir is at ~4.01 km from Solu village (starting point of the alignment) Prati Balaji Temple Shree Venkateshwara Balaji Temple- 6.37 km from Varve village (Ending point of the alignment) Baneshwar temple- 3.75 km from Varve village (Ending point of the alignment)	Probable impacts from increase in noise level, dust and vehicular emissions
Highways	NH-48	Ends at Ch 104+906 km section at Varve (Kelwade)	Traffic diversion Chances of accidents and road kills

1.5 Site connectivity

The project road starts from Solu village at Alandi Markal Road traverses through number of villages/towns viz. Solu, Markal, Golegaon, Tulapur, Bhavdi, Lonikhand, Perne, Bakori, Dongargaon, Vadebolhai, Gavadevadi, Murkutenagar, Biwari, Peth, Koregaon Mul, Shindwane, Walati, Tarde, Alandi Mhatabachi, Sonori, Kalewadi, Dive, Hivare, Chambali, Kodit Khurd, Garade, Kambare Khe. Ba., Naygaon and ends at Varve (Kelvade) of Satara Road [NH4]. The proposed road will connect Pune and Pimpri - Chinchwad area with various interconnecting roads. This project will also interconnect the arterials road around Pune city Viz- Pune Mumbai Expressway, Pune Nashik Highway (NH-50), Pune- Nagar Road, Pune-Solapur Road (NH9) and Pune – Satara Road (NH4). The connectivity details are shown in the Figure 4 and in Table 4.

Table 4: Project Connectivity Details

Sr. No.	Location (Chainage)	Category of Cross Road
1	38+200	Alandi Markal Road
2	49+000	SH 27
3	50+100	Theur Kesnand Road
4	56+100	Kesnand Road
5	60+200	Kesnand Wade Gaon Road
6	61+200	Koregaon Biwri Road
7	62+800	Gote Mala Biwri Road
8	63+600	Koregaon Biwri Road
9	65+400	Prayagdharm Hospital Road
10	66+100	Naigaon Road
11	67+100	Uruli Peth Road
12	68+200	Upune Solapur Highway (NH 9)
13	69+300	Sortapwadi Canal Road
14	85+500	Hadapsar Saswad Jejuri Road
15	89+800	Saswad-Bopdev-Pune Road

16	91+800	Khed-Shivapur-Saswad Link Road
17	104+900	Pune - Satara Highway (NH – 4 & AH47)

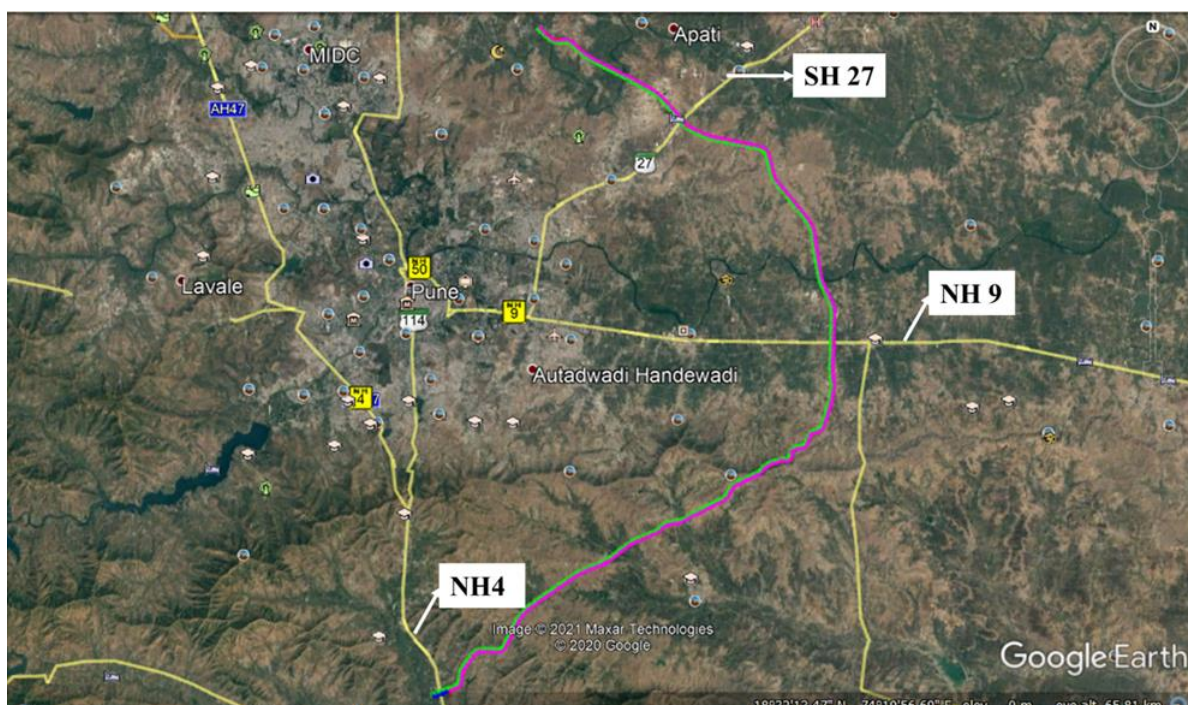


Figure 4:Connectivity – PRR Eastern Part 2

1.6 Details of the Resources to be used for the construction Manpower

1.6.1 Manpower

The construction for the project will be completed tentatively in 2.5 years. It is estimated that at peak level around 600 workers during construction will be engaged on site. The construction phase will include hiring of local labourers but considering the magnitude of development, a temporary influx of population from outside areas is expected. The labour camps will be provided with water and power supply and sanitation facilities including mobile toilet facilities along with mobile STP.

In the operation phase, it is expected that the project will provide social benefits to about 800 people in terms of direct employment by way of better commercial and industrial development of the area.

1.6.2 Water requirement

Total water requirement for the construction purpose will be 42,90,476 KL and for the domestic purpose will be 81 KLD. Water required for construction activities will be sourced from the tankers and nearby deep tube wells at suitable places. The NoCs for the water to be used during construction phase will be taken from the gram panchayat or municipal corporation.

1.6.3 Waste generation

The project is likely to generate 270 kg/day of municipal solid waste during construction phase out of which, 108 kg/day will be biodegradable, and 162 kg/day will be non-biodegradable waste. The waste will be segregated at source by providing separate bins on site and will be handed over at municipal recycling centers for further processing. The construction waste generated from site is estimated to be 14,80,000 m³ from cut and fill, muck (2,50,000 m³) and sludge from the piling in major and minor bridges and cutting soil from earthwork area. The demolition waste will also be generated from demolition of existing buildings coming in the RoW of the proposed project.

1.6.4 Power Supply

LSD D.G sets shall be used for power for onsite construction sites, wherever grid power supply is not available. The power requirement of the proposed project will be met through 5 no. of DG sets with 650 KVA of each during construction phase & 4 no. of DG sets with 250 KVA of each during operation phase.

1.7 Project Timeline & Cost

Proposed project is scheduled to be completed in 2.5 years. For construction purpose the project is divided into 5 packages, 2.5 years will be timeline for each package. All packages will be started and completed simultaneously.

The estimated total cost of the project is approximately Rs. 68,68,27,67,204 /- Rs. for all the 5 packages, which includes civil cost approximately Rs. 5,792.68 Cr.

1.8 Description of Environment

The baseline environmental study has been carried out in post-monsoon season from 15th December 2019 to 15th March, 2020 by Enviro-Tech Services- An Environment, Food, Ayush, Fuel, Soil, Ore & Minerals Analytical Laboratory [Certified ISO 9001:2015, 14001:2015 & 45001:2018, Recognized by MoEF (Govt. of India) Accredited by ISO/IEC-17025:2017 NABL & UPPCB] laboratory based at Gaziabad (U. P.).

Baseline monitoring was carried out considering nature and magnitude of project activity. Also, the environmental setting and potential receptors of the impact were considered for determining monitoring locations. Collection of primary baseline data (environmental and social) within study area consisting of core (500 m) and buffer zone (5 km on either side of the alignment) from the PRow. The parameters considered for the description of the environment are given below;

Sr. No.	Parameters	Observations and Inferences
1.	Physiography	Physio-graphically, the Pune district can be divided in to three distinct belts i.e. - The western belt stretching from 16 to 31 km east of Sahayadri- an extremely rugged country cut by deep valleys, divided and crossed by hill ranges. - The central belt extending for about 30 km east of western belt across the tract whose eastern belt is roughly marked by a line drawn from Pabal in the north to south up to Purandar through Pune. In this belt a series of small hills stretch in to valleys and large spurs from Plateau and - The eastern belt with a rolling topography and low hills sinking slowly in to the plains with relatively broader valleys.
2.	Geology and Geomorphology	Study area comprise Deccan Trap Basalt deposited in Late Cretaceous to Palaeocene Age. Fourteen basaltic flows of Vesicular and Amygdaloidal zeolitic basalt and massive basalt of Indrayani, Karla, Diveghat, Purandargarh, Mahabaleshwar formation of Sahyadri Group also occurs in study area.
3.	Hydrogeology	The entire area of the district is underlain by the basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow alluvial formation of Recent age also occurs as narrow stretch along the major rivers flowing in the area. The ground water in the district occurs under phreatic, semi – confined and confined conditions. Generally, the shallower zones down to the depth of 20 to 22 m bgl form the phreatic aquifer. The water bearing zones occurring between the depth 20 and 40 m bgl when weathered or having shear zones yield water under semi-confined condition. The deep confined aquifers generally occur below the depth of 40 m bgl. The depth of ground water level in the district is - Pre-monsoon-0.40 to 20.10 m bgl - Post monsoon-0.09 to 14.65 m bgl
4.	Seismology	The study area falls in Zone III, this is Moderate intensity zone as per BMTPC Vulnerability atlas.
5.	Landuse/Landcover	Landuse/Landcover of the 10 km radius from the project site was studied. Out of total area of 14572.3 Ha, 145.7 sq. Km (9 %) area comes under built-up land class.

Sr. No.	Parameters	Observations and Inferences
		- Out of the total area of 24,456.7 Ha, 244.6 sq. km (15.2 %) area comes under forest vegetation. - Water bodies are spatially distributed in 6.3 sq. km area which is 0.4 % of total study area. - Within study area total 513.3 sq. km. areas come under Open Land class which is 31.9 % of total area and - Out of total area 38,138.3 Ha area 318.4 sq. km of the area (23.7 %) is found under fallow land. 197 sq. km area (13 % of the total area) found under hill slopes and 88.3 sq. km is under barren land area which is 5.5 % of total study area.
6.	Soil Quality	Soil quality was monitored at 8 locations in total and observations are as follows; - The pH of the samples varied from 7.27 to 7.71. The pH of samples collected was moderately alkaline as per the ranges and classification of pH given by Department of Agriculture. (Source: Method Manual, Soil Testing in India, 2011). It is a very important property of soil as it determines the availability of nutrients, microbial activity and physical condition of soil. - The Bulk Density of soil is in the range of 1.1 g/cm³ to 1.4 g/cm³ respectively. The important cations present in soil are calcium, magnesium sodium and potassium. It is observed that calcium & magnesium concentrations are in the range of 18 to 25.1 mg/kg & 41.2 to 44.9 mg/kg respectively, whereas sodium and potassium are in the range of 195 to 218.6 mg/kg and 66.3 to 89.5 mg/kg respectively. - Organic matter present in soil influences its physical and chemical properties of soil. Soil OM is important to a wide variety of soil chemical, physical, and biological properties. As soil OM increases, so does CEC, soil total N content, and other soil properties such as water holding capacity and microbiological activity. Organic matter, total nitrogen and phosphorous are found to be in the range of 1 to 1.2 %, 32 to 42.5 mg/kg and 48 to 66.9 mg/kg respectively.
7.	Air Quality	Meteorology

Sr. No.	Parameters	Observations and Inferences
		Hourly meteorological secondary data was obtained from Envitrans for Pune, which were used for plotting annual & seasonal variation of average wind speed, wind direction, temperature and wind-rose plot from 1st October 2018 to 30th September 2019 & from 1st Dec 2018- 31st March 2019 respectively. The seasonal-specific (1st Dec 2018- 31st March 2019) 24-hourly wind rose is shown in Figure 3 16. It interprets that during monitoring period predominant wind blowing from was WNW followed by NW and W directions and blowing towards ESE, SE & E directions respectively for most of the time during the study period. The calm condition prevails 24.2 % of total time. The annual wind rose plot during 1st October 2018 to 30th September 2019 shows predominant wind blowing from WNW followed by W and WSW directions and blowing towards ESE, E and NEE directions respectively. Ambient Air quality were monitored at 9 locations in total & observations are as follows; • Maximum concentrations of PM10, is higher at all the location as compare to National Ambient Air Quality Standards (for Industrial, Residential, Rural and Other area) prescribed by Central Pollution Control Board (CPCB) during the study period as shown. • Maximum concentrations of PM2.5, is higher at all the location except AAQ7 as compare to National Ambient Air Quality Standards (for Industrial, Residential, Rural and Other area) prescribed by Central Pollution Control Board (CPCB) during the study period. • Maximum concentrations of SO2, NOX CO & O3 is well within limits as compare to National Ambient Air Quality Standards (for Industrial, Residential, Rural and Other area) prescribed by Central Pollution Control Board (CPCB) during the study period.
8.	Ambient Noise and Vibrations	Ambient Noise quality were monitored at 9 locations in total. The noise levels observed at the above noise monitoring locations are well within CPCB limits at all locations, except Pir Saheb Darga, Solu Village (NQ1), Pimpalgaon Village (NQ2), Bolhai mata Mandir, Wadebolai Village (NQ3), Prayag Dham Hospital, Naigaon village (NQ4), Chintamani Hospital & Research Centre and Residential Area, Sonari Village (NQ6) during day time & night time & Uruli Khanchan Village (NQ5) during day time. The readings are observed above the allowable

Sr. No.	Parameters	Observations and Inferences
		CPCB limits due to proximity of roads (Alandi-Markal, Village roads, Road junctions, Naigaon Road, NH9).
9.	Surface Water Quality	Surface water quality were monitored at 5 locations in total and water quality analysis indicates that all the parameters were well within permissible limits within permissible limits for all the parameters except Magnesium, (Mg) at SW1, SW4 & SW5 locations, Iron (Fe) at SW1 & SW2 location & Total Coliform Count & Fecal Coliform (FC) at all the location as prescribed by Indian Standard Drinking Water — Specification (Second Revision)-IS10500:2012. The water from the river cannot for considered for drinking purpose and should be treated before use. The possible sources of pollution might be the unmonitored use of the river bank for sanitation purposes and discharge of untreated waste water from the adjoining areas.
10.	Ground Water Quality	Ground Water quality were monitored at 5 locations in total and the results indicate that the ground water quality was within permissible limits for all the parameters at all the location as prescribed by Indian Standard Drinking Water — Specification (Second Revision)-IS10500:2012. Hence the water samples are potable for drinking purpose.
11.	Ecology and Biodiversity	The project alignment is passing through mostly agricultural land and forest involved are above the tunnels. However, the alignment partially passes through forest vegetation amounting to cutting of 9505 nos. The faunal value of this forest area is moderate mainly involving arthropods, reptiles, birds and marginal number of wild mammals mainly representing macaques, palm squirrels, mongoose, jackals etc. There have been incidents of leopards coming to areas in the proximity of the PRow. The overall impact on the flora is high due to direct loss of trees, whereas impacts on shrubs and herbs are relatively less as most of the shrubs and herbs are non native or alien invasive species. The loss of trees in the forest areas cannot be mitigated as such, as the compensatory afforestation may be carried out in the far-off districts. The loss of 15,899 Trees in the non-forest areas may be compensated better as the replacement is within the same area. Plantation of trees is recommended as per native species found in the area and minimum 3 times of the trees that will be cut. The Green Highway Policy,2015 guidelines to be followed for plantation along the PRow. The impacts on fauna is low to moderate as there is a linear disturbance in the otherwise agricultural land. The surrounding region also being agricultural, the birds, insects and mammalian species can find habitat in the nearby areas.

Sr. No.	Parameters	Observations and Inferences
12.	Socio-Economic Profile	The Socio-economic analysis of the project affected persons reveals their opinion the project corridor. Construction of the project road will lead to the involuntary resettlement of PAPs. It is of utmost importance to resettle and rehabilitate them as per the provisions of TRFCTLARR Act-2013 and TRFCTLARR (Maharashtra) Rules-2014. Affected people shall be consulted at every stage of the project planning and implementation. Their worries and suggestions shall be taken into account and the negative impacts shall be mitigated.

1.9 Anticipated Impacts and Mitigation Measures

Table 5: Anticipated Impacts and Suggested Mitigation Measures for Construction Phase

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
Pre-construction Stage			
Site survey & demarcation	Loss of vegetation	The removal of vegetation may increase surface run-off during monsoon which in turn lead to erosion of productive soil. About 14 km of area is passing mountainous area of which 5 km is passing through tunnels. For remaining area of about 9 km the impacts of erosion may be significantly high.	As such mitigation can't be provided at this stage, the survey team is advised to keep the vegetation clearance to the bare minimum.
Land acquisition	Involuntary Displacement	Loss of land and properties	The compensation is being provided as per the conditions of LAAR Act, 2013. The actual compensation is being offered much more than the existing market price for the land. This will allow the affected person to comfortably buy suitable land in the vicinity and maintained the source of livelihood.
	Land Diversion	Out of 618.6103 Ha. of land, forest land 81.8165 Ha (13.23 %)	Tunnels have been proposed in the forest areas to avoid loss of forest areas and maintaining the road requirements for smooth movement of vehicles. The entry and exit of tunnels are through non-forest areas resulting in no loss of forest land. However, CA land will be allotted against the forest area which will be kept intact above the tunnels. Other than tunnels, forest land is required for the construction of the road where total 9505 nos. of trees are required to be cut for which afforestation will be carried out on the CA land after obtaining Forest Clearance.
		Agricultural land 510.3127 Ha (82.49 %) – Loss of income	The compensation is being provided as per the conditions of LAAR Act, 2013. The actual compensation is being offered much more than the existing market price for the land. This will allow the affected farmers to comfortably buy suitable land in the vicinity and maintained the source of livelihood by continuing agricultural practices. However, the loss of agricultural land remains and it will impact negatively on overall productivity of the region.
		Agricultural land 510.3127 Ha (82.49 %) – Loss of agricultural productivity	The compensation is being provided as per the conditions of LAAR Act, 2013. The actual compensation is being offered much more than the existing market price for the land. This will allow the affected farmers to comfortably buy suitable land in the vicinity and maintained the source of livelihood by continuing agricultural practices. However, the loss of productivity will remain and it will impact negatively on overall productivity of the region.
		Barren land 26.4811 Ha (4.28 %)- Loss of habitat	As such no mitigation required. However, in the Corporate Environmental Responsibility (CER) activity the impacts can be further reduced by funding habitat enhancement projects which may be taken up by local NGOs which will also involve local population actively in the environmental conservation
		Barren land 26.4811 Ha (4.28 %)- Loss of landcover	No mitigation required
	Tree felling or cutting	9505 trees in forest areas to be cut	CA land will be allotted against the loss of forest area. As there is a permanent localized impact, the severity & extent of impacts remains the same. The CA land may not be allotted in the same district.
		About 15,899 nos. of trees proposed to be cut in non-forest areas (as per tree enumeration done in 2016) for Site levelling and road development	As per Green Highway Policy 2015, (Plantation, Transplantation, Beautification & Maintenance), it is recommended to plant new trees of native varieties & more than 3 times the number of trees that will be cut. Additionally, shrubs to be planted along the median & in the lower tire along the road sides.

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
		The removal of vegetation may cause erosion on hill slopes, and increase surface run-off would in turn may lead to erosion of productive soil	The project will be designed at design gradients of 1:2. High embankment section of the road shall be suitably truffled by stone pitching or any other suitable material; Adequate slope protection measures are proposed as part of engineering design; All the topsoil to be preserved separately and covered to avoid mixing with other raw materials and site runoff. Proper conservation plan for the conservation of top soil to be done by the contractor constructing the road. The topsoil to be reused for grass turfing at embankment slopes/plantation along RoW and at median within one year of generation. The balance quantity of topsoil to be reused for rehabilitation of borrow pits (as mentioned in of Chapter 2 EIA) to restore the biological characteristics of the area.
Demolition activities and utility shifting	Generation of Noise and Vibrations	Demolition activity will be for short period & there are no long-term impacts of these activities	High noise generating machines to be equipped/ fitted with silencers to reduce the noise levels; PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines Temporary barricading to be provided for high noise producing machineries
	Dust emissions from demolition activities	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. On source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	Demolition to be carried out in the phased manner, inner structures to be demolished first; PPE (face masks) will be provided to the workers operating on site Temporary barricading to be provided
	Demolition waste generation	Unplanned dumping of debris generated from the construction and demolition activities may lead to dust generation, there would be impact on health due to inhalation of dust to certain extent. Also, it may affect water and soil quality.	Waste to be stored at the designated site and to be disposed according to C&D waste rules 2016.
Material Transportation	Dust and vehicular emissions from loading and unloading of materials	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. At source mitigation can significantly reduce the values. However, there may be impacts on health due to inhalation of dust to certain extent.	Material transportation vehicles to be covered with tarpaulin sheets to minimize dust emission; Idling of the delivery trucks during unloading or other inactive periods is to be prevented; Material carrying vehicles to be routinely serviced and maintained with a valid Pollution Under Control (PUC) Certificate in accordance with the Motor Vehicles Act, 1988; As far as practicable, loading unloading activity to be halted during the periods of strong winds; Road surface to be kept wet by regular water sprinkling for dust suppression; Maintaining minimum possible drop height while unloading /screening of material.
	Generation of Noise and Vibrations	Noise generation due to the vehicular movement will remain throughout the construction phase, Exposure of loud noise can cause disturbance to the surrounding receptors, thereby causing physical or psychological impairments	Instructions to be given to contractors to ensure no unnecessary honking near settlements. Road signages to be provided & areas near settlements may be provided with temporary barricading to reduce impacts of the noise. Restriction on vehicular movement during night time.
	Accidental spillage of the oil and other hazardous materials	Contamination of the soil	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection. Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing with oil traps.
		Contamination of surface water Bhima River (Indrayani) (between Ch. 44+343 km to Ch. 44+523 km), Mula Mutha River (between Ch. 64+012 km to Ch. 64+282 km) & Sortapwadi Canal (Between Ch. 69+011 km to Ch. 69+041 km)	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection. Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing with oil traps.
		Contamination of ground water due to seepage	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection.

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
			Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing with oil trap
	Vehicle parking and servicing	The sites where transportation vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants.	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection. Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing; Overflow of service and washing areas shall be pass through oil interceptors.
Construction Stage			
Storage and handling of raw material	Dust emissions from loading and unloading of loose materials	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. On source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	Frequently sprinkling water in the dust prone areas; 7-8 feet high fencing to be provided around material storage space; Prohibition of excavation soil heaps in the downwind direction; Down washing of trucks prior to departure; Maintaining minimum possible drop height while unloading /screening of material; Cleaning of paved roads regularly and stabilizing & watering of un-paved regularly; The Contractor will be required to: Conduct regular water spraying on earth piles, trenches, and sand piles. Conduct regular visual inspection along alignments and construction zones to ensure no excessive dust emissions.
		Impact on photosynthesis of plants due to stomatal clogging from fine dust	Frequently sprinkling water in the dust prone areas; 7-8 feet high fencing to be provided around material storage space; Prohibition of excavation soil heaps in the downwind direction.
	Accidental spillage of the oil and other hazardous materials	Contamination of the soil	Handling of spent wash from equipment and vehicle service station by providing catch pit and soak-pits around the service station to avoid contamination of land adjacent to those sites.
		Contamination of surface water Bhima River (Indrayani) (between Ch. 44+343 km to Ch. 44+523 km), Mula Mutha River (between Ch. 64+012 km to Ch. 64+282 km) & Sortapwadi Canal (Between Ch. 69+011 km to Ch. 69+041 km)	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection. Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing with oil trap
		Contamination of ground water due to seepage	The vehicles to be routinely serviced and maintained; Regular checking of fuel tanks for leakage detection. Over loading of the transporting material to be avoided to prevent accidental spillage; Designated areas to be provided for vehicle washing with oil trap
	Noise generation while loading and unloading of the materials.	Noise & vibration generation may be nuisance to local inhabitants of the area, damage structures, affect human health	PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines; Construction yards to be located away from settlement areas preferably on the down wind direction of sensitive areas such as schools, hospitals or human settlement etc.; In unavoidable circumstances, the time of the operation of the plant shall be limited; The necessary permission should be obtained from the local government officials.
RMC Plant Operations	Dust & air emission	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. On source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	Site selection for RMC plant operation should be done considering criteria given in section 2.12.2 of chapter 2. Regular water sprinkling to be carried out for dust suppression; Spraying of water on the stones while unloading from the truck/dumper; Spraying of water at the primary crusher feeder chute; Spraying of water at the transfer points from one belt conveyor to another; Silt curtains recommended for tapping the dust emissions from RMC plant; Placing of dust arresters surrounding the crusher and the construction yards will prevent the dispersion of the dust to a great extent.
		Dust generation on leaves will affect the respiration of plants due to blockage in stomata impacted on photosynthesis of plants	Site selection for RMC plant operation should be done considering criteria given in section 2.12.2 of chapter 2. Regular water sprinkling to be carried out for dust suppression. Spraying of water on the stones while unloading from the truck/dumper;

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
			Spraying of water at the primary crusher feeder chute; Spraying of water at the transfer points from one belt conveyor to another; Silt curtains recommended for tapping the dust emissions from RMC plant; Placing of dust arresters surrounding the crusher and the construction yards will prevent the dispersion of the dust to a great extent.
	Generation of large number of test cubes of concrete	Unplanned dumping of debris generated from the construction and demolition activities may lead to dust generation, soil, and water contamination	Test cubes can be reused in Landscaping, pavements and shoulders. Curing water should be stored in settling tank. After initial settlement, settled materials to be sent to landfill site & water can be used for construction purpose; Settling tank should be covered with tarpaulin to prevent mosquito breeding
	Run-off from plant washing	Contamination of surface water Bhima River (Indrayani) (between Ch. 44+343 km to Ch. 44+523 km), Mula Mutha River (between Ch. 64+012 km to Ch. 64+282 km) & Sortapwadi Canal (Between Ch. 69+011 km to Ch. 69+041 km	Direct run-offs should be prevented from the plant site near drinking water bodies; Plant sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Contour trenching shall be provided wherever land is undulating on the downstream side. Facilities like drainage system at plant site to avoid stagnant water pools.; The plant wash water will be sent out to settling pits and once settled the water will be used for dust suppression. The settled material will be disposed to disposal sites approved by local authorities.
		Increased turbidity reduces euphotic zone of the water column which affects light penetration and decreases aquatic producer. Also increased turbidity affects filter feeding organisms such as zooplankton Increased sedimentation may disturb aquatic lifeforms sedimentation and habitat modification may deviate fish from construction areas Reduction in microbial activity slows down remineralization of organic matter which affects food chain Suspended solids may affect aquatic organisms by clogging and damaging their feeding and breathing organs.	Direct run-offs should be prevented from the plant site near drinking water bodies; Plant sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Contour trenching shall be provided wherever land is undulating on the downstream side. Facilities like drainage system at plant site to avoid stagnant water pools.; Plant wash water will be sent out to settling pits and once settled the water will be used for dust suppression. The settled material will be disposed to disposal sites approved by local authorities.
		Contamination of ground water due to seepage	Direct run-offs should be prevented from the plant site near drinking water bodies; Plant sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Plant wash water will be sent out to settling pits and once settled the water will be used for dust suppression. The settled material will be disposed to disposal sites approved by local authorities.
		Contamination of the soil due to seepage	Direct run-offs should be prevented from the plant site near drinking water bodies; Plant sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Plant wash water will be sent out to settling pits and once settled the water will be used for dust suppression. The settled material will be disposed to disposal sites approved by local authorities.
	Noise generation during plant operation	Noise & vibration may be nuisance to local inhabitants of the area, damage structures, affect human health	Regular maintenance and servicing of machinery and equipment to minimize its operational noise. Noise level will be one of the considerations in equipment selection which will favor lower sound power levels. PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines. The time of the operation of the plant shall be limited. The necessary permission should be obtained from the local government officials. Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, these DG sets are not going to be kept close to one another. The 5 nos. of DG Sets of 650 KVA Capacity are recommended with a minimum Transmission Loss Rating of 30 dBA;

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
			DG sets having acoustic enclosure along with sufficient stack height of 3 m to be used at construction site complying with emissions norms notified by MoEF&CC / CPCB.; Noise barrier to be provided;
Casting of Structures at Casting Yards	Air emission from operation of DG sets, Cranes, construction machineries; vehicles and equipment	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. at source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	DG sets having acoustic enclosure along with sufficient stack height of 3 m to be used at construction site complying with emissions norms notified by MoEF&CC / CPCB. As far as practicable, plant activity to be halted during the periods of strong winds. Regular water sprinkling to be carried out for dust suppression. Placing of dust arresters surrounding the crusher and the construction yards will prevent the dispersion of the dust to a great extent. Spraying of water on the stones while unloading from the truck/dumper. Spraying of water at the primary crusher feeder chute. Spraying of water at the transfer points from one belt conveyor to another. Barricading to be provided.
	Noise generation from operation of DG sets, Cranes, construction machineries; vehicles and equipment	Noise & vibration generation may be nuisance to local inhabitants of the area, damage structures, effect on human health	Casting yards to be located away from settlement areas. Aggregate crushing plants shall be located on the down wind direction of sensitive areas such as schools, hospitals or human settlement etc. In unavoidable circumstances, the time of the operation of the plant shall be limited. A vegetative barrier will be suitably less expensive for a casting yard. The native species is always preferable. DG sets having acoustic enclosure along with sufficient stack height of 3 m to be used at construction site complying with emissions norms notified by MoEF&CC / CPCB. Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. However, these DG sets are not going to be kept close to one another. The 5 nos. of DG Sets of 650 KVA Capacity are recommended with a minimum Transmission Loss Rating of 30 dBA; Noise barrier to be provided.
Pilling activity for major Bridges between Ch. 44+343 km to Ch. 44+523 km & between Ch. 64+012 km to Ch. 64+282 km & 21 minor bridges (addressed in of Chapter 2 EIA)	Generation of Noise and Vibrations	Noise & vibration may be nuisance to local inhabitants of the area, damage structures, affect human health	Regular maintenance and servicing of machinery and equipment to minimize its operational noise; PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines; Compressors with pre-installed Acoustical Canopy should be chosen so that the noise generated at the source itself is lesser than 85 dB; The contractor should carefully choose the above equipment to meet with the CPCB Norms; Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise; Valves should be covered with Removable Acoustical Blankets; Maintenance of the piling rigs to reduce noise and air emissions; Noise barrier to be provided
	Surface run-off	Contamination of surface water Bhima River (Indrayani) (between Ch. 44+343 km to Ch. 44+523 km), Mula Mutha River (between Ch. 64+012 km to Ch. 64+282 km) & Sortapwadi Canal (Between Ch. 69+011 km to Ch. 69+041 km)	Piling in the waterbodies shall be done within encasement to reduce turbidity. The impact of increase in turbidity and siltation can be mitigated by providing coffer dams and silt trap around the foundation site before start of piling/drilling works. Checking of the samples of riverbed sediment.
		Increased turbidity reduces euphotic zone of the water column which affects light penetration and decreases aquatic producer Release of heavy metals and pollutants from the sediments Also increased turbidity affects filter feeding organisms such as zooplankton Increased sedimentation may disturb aquatic lifeforms Release of heavy metals & pollutants may lead to increasing in undesirable species biota Suspended solids may affect aquatic organisms by clogging and damaging their feeding and breathing organs.	Piling in the waterbodies shall be done within encasement to reduce turbidity. The impact of increase in turbidity and siltation can be mitigated by providing coffer dams and silt trap around the foundation site before start of piling/drilling works. Checking of the samples of riverbed sediment.

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
	Muck generation [Pilling activity for major Bridges between Ch. 44+343 km to Ch. 44+523 km & between Ch. 64+012 km to Ch. 64+282 km & 21 minor bridges (addressed in of Chapter 2 of EIA)]	The generated muck (250000 m ³) if disposed without treatment will lead to contamination of the soil	Excavated soil, if contaminated to be disposed at secured landfills, whereas non-contaminated soil will be reused for filling of borrow areas (locations as mentioned in Error! Reference source not found. of Chapter 2 of EIA); Muck will be disposed at designated location with prior approvals.
Leveling, compaction & paving of road	Air emission from operation of construction machineries; vehicles and equipment	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. On source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	Frequently sprinkling water in the dust prone areas; The Contractor will be required to: Conduct regular water spraying on earth piles, trenches, and sand piles. Conduct regular visual inspection along alignments and construction zones to ensure no excessive dust emissions.
	Noise generation from machineries	Noise & vibration generation may be nuisance to local inhabitants of the area, damage structures, affect human health	In unavoidable circumstances, the time of the operation of the plant shall be limited. Regular maintenance and servicing of machinery and equipment to minimize its operational noise. PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines; Compressors with pre-installed Acoustical Canopy should be chosen so that the noise generated at the source itself is lesser than 85 dB The contractor should carefully choose the above equipment to meet with the CPCB Norms.
Construction of bridges	Soil erosion	Elevated sections of road, particularly all high embankments along the 2 major bridges between Ch. 44+343 km to Ch. 44+523 km & between Ch. 64+012 km to Ch. 64+282 km Ch. & 21 minor bridges (addressed in table 2.21 Chapter 2) and the interchanges (at Ch. 48+984 km to Ch. 49+104 km, Ch. 68+188 km to Ch. 68+328 km, Ch. 85+467 km to Ch. 85+587 km & Ch. 89+732 km Ch. 89+852 km) may be vulnerable to erosion	Securing slopes with suitable methods like retention walls, gabion, etc. Contractor to identify suitable locations for storing of excavated soil and later they may sell it to nearby nurseries.
	Surface run-off	Contamination of surface water Bhima River (Indrayani) (between Ch. 44+343 km to Ch. 44+523 km), Mula Mutha River (between Ch. 64+012 km to Ch. 64+282 km) & Sortapwadi Canal (Between Ch. 69+011 km to Ch. 69+041 km Disturbance to aquatic fauna due to resuspension of sediment	Direct run-offs should be prevented from the road near drinking water bodies; The construction sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Coffer dams to be provided around the work site while working in the waterbodies. The remaining water shall be drained before removal of Coffer dams.
		Increased turbidity reduces euphotic zone of the water column which affects light penetration and decreases aquatic producers Release of heavy metals and pollutants from the sediments Also increased turbidity affects filter feeding organisms such as zooplankton Increased sedimentation may disturb aquatic lifeforms Release of heavy metals & pollutants may leads to increasing in undesirable species biota Suspended solids may affect aquatic organisms by clogging and damaging their feeding and breathing organs.	The construction sites should be protected by bunds at sites where large amount of soil may be washed off to the nearby waterbodies. Coffer dams to be provided around the work site while working in the waterbodies. The remaining water shall be drained before removal of Coffer dams.
	Air emission from construction machinery	Air quality deterioration from dust generation; though the gaseous emissions may not significantly increase, the values of PM ₁₀ , PM _{2.5} and total suspended particles will go significantly high. On source mitigation can significantly reduce the values. However, there would be impact on health due to inhalation of dust to certain extent.	The Contractor will be required to: Conduct regular water spraying on earth piles, trenches, and sand piles. Conduct regular visual inspection along alignments and construction zones to ensure no excessive dust emissions. DG sets having acoustic enclosure along with sufficient stack height of 3 m to be used at construction site complying with emissions norms notified by MoEF&CC / CPCB. Regular water sprinkling to be carried out for dust suppression.
	Noise and vibration	Noise & vibration generation may be nuisance to local inhabitants of the area, damage structures, affect human health,	Regular maintenance and servicing of machinery and equipment to minimize its operational noise.

Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
			PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines; Compressors with pre-installed Acoustical Canopy should be chosen so that the noise generated at the source itself is lesser than 85 dB. Valves should be covered with Removable Acoustical Blankets. Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise. The contractor should carefully choose the above equipment to meet with the CPCB Norms.
	Construction Debris	Bridge foundation works may result into generation of debris materials due to excavation and drilling works which may cause temporary increase in turbidity and thereby contaminating the water.; Excavation waste such as muck (250000 m³) and sludge from the piling in major and minor bridge's location and cutting soil from earthwork area may give adverse impacts on the dumping site, if contaminated. Unplanned dumping of debris generated from the construction and demolition activities may lead to dust generation, soil, and water contamination. Hazardous waste generated from the construction site and labour colonies may pose a potential hazard to the human health or the environment (soil, air, water) when improperly managed.	Admixtures barrels can be reused by cutting them into halves to collect waste. Construction waste to be stored at the designated site and to be disposed according to C&D waste rules 2016. Excavated soil, if contaminated to be disposed at secured landfills, whereas non-contaminated soil will be reused for filling of borrow areas (locations as mentioned in of Chapter 2 of EIA). There should be a dedicated space to store hazardous waste. Its disposal to be done as per the Hazardous and Other Waste (Management & Trans boundary) Rules 2016 and MSIHC rules 2008, as amended. The waste material generated during the excavation of rock will be reused during the site development to some extent. The material will be used after testing its quality. No dumping allowed on private property. The disposal waste material should be properly compacted. The waste carrying trucks should be properly covered by tarpaulin
Labour camp	Waste Generation	Soil contamination may take place due to waste disposal from the labour camp	Site selection for labour camp should be done as per given in section 2.12.4 of chapter 2. Facilities like drainage system at construction site and labour camps to avoid stagnant water pools. Temporary camps will be constructed with adequate sanitation, drinking water supply. The domestic wastewater will be sent out to two settling pits and once settled the water will be used for watering surrounding plantations. The settled material will be either used as fertilizer (from kitchen waste) or disposed to disposal sites approved by local authorities.
	Biomedical waste generated due to COVID-19 prevention measures	Waste generation in from of PPE kits, gloves etc. may lead to health hazards	Covid-19 precautionary guidelines to be followed.
Tunneling by NATM (Chainage addressed in Error! Reference source not found. of Chapter 2 of EIA)	Generation of Noise and Vibrations due to blasting	Generated noise can be nuisance to local inhabitants of the area.	Regular maintenance and servicing of machinery and equipment to minimize its operational noise. PPE (ear plugs or earmuffs) will be provided to the workers operating in the vicinity of high noise generating machines; Compressors with pre-installed Acoustical Canopy should be chosen so that the noise generated at the source itself is lesser than 85 dB. Valves should be covered with Removable Acoustical Blankets. The contractor should carefully choose the above equipment to meet with the CPCB Norms.
	Waste generation	The generated muck (250000 m ³) if disposed without treatment will lead to contamination of the soil	Excavated soil, if contaminated to be disposed at secured landfills, whereas non-contaminated soil will be reused for filling of borrow areas (locations as mentioned in of Chapter 2 of EIA); muck will be disposed at designated locations with prior approvals
	Ventilation	Suffocation and death of people working inside the tunnel from improper ventilation	Ventilation shaft to be provided at the tunnel location for safety of workers (details of tunnel safety during construction and operation are provided in Chapter 7)
	Water percolation	Seepage of water may induce rock fall	Consolidation grouting over the crown for the seepage of water and rock fall will be carried out at tunnel location.

Table 6: Anticipated Impacts and Suggested Mitigation Measures for Operation Phase

S. No.	Project Activities	Aspect	Anticipated Impacts	Mitigation Measure
Operation Phase				
1	Proposed road development	Ancillary development	Change in landuse	Ancillary development will be their due to better connectivity & individual development will proposed their own mitigation while obtaining required clearance
		Traffic movement	Vehicular emission will impact air quality	Three Tier Plantations along both side of the road and plantation of shrubs along the median. Provision of Charging points for electrical vehicles to encourage use of EVs.
			Noise generation due to traffic movement as the alignment is green field and people were not used to vehicular movements from a highway before, may be nuisance to local inhabitants of the area, effect on human health;	Noise Barrier to be provided nearby sensitive receptors, Honking should be strictly prohibited in the forest area
		Waste generation	Due to waste generated at wayside amenities Toll plazas water soil get polluted	Green colour coded bin must be used to collect bio-degradable waste especially food waste at toll plaza way side amenities. The container should remain closed all the time to prevent flies, insects, and other animals from spilling the waste and to reduce the odour from decomposition of the food waste. To reduce waste generation good housekeeping is to be maintained and source segregation of the waste is to be encouraged before disposal. Proper sanitation facilities like septic tank with soak pit facility or mobile toilets should be provided No dumping allowed on private property. The disposal waste material should be properly compacted.
			During maintain ace work, hazardous waste like, paint, thinners, etc., may pollute water or soil.	No dumping allowed on private property. The disposal waste material should be properly compacted. There should be a dedicated space to store hazardous waste. Its disposal to be done as per the Hazardous and Other Waste (Management & Trans boundary) Rules 2016 and MSIHC rules 2008, as amended.
		Movement of animals	Possibility of Road killing	PUP has been considered in design for movement of animals & pedestrian in non-forest area. Animal underpass or fencing may be provided to prevent entry of animals on road near forest area if suggested by DCF & same will be incorporated in design.

1.10 Environmental Monitoring Program

An Environmental Monitoring Program is an integral part of Environment Management plan which provides a mechanism to monitor the adverse environmental impacts arising from project activities and defines frequencies and responsibilities of monitoring program.

The frequency of parameters to be measured during construction phase will be once in a season till end of construction and during operation will be once in a year.

Half yearly compliance report in respect of the stipulated terms and conditions of prior environmental clearance shall be submitted by project proponent to the concerned regulatory authorities on 1st June and 1st December of each calendar year.

1.11 Additional Studies (Risk Assessment and Disaster Management Plan)

The hazard potential of activities/events of both construction phase and operation phase and estimation of consequences in case of accidents has been identified and risk assessment has been carried out to quantify the extent of damage and suggest recommendations for safety improvement. Also, the disaster vulnerability of the project site location is evaluated and the probabilities associated with natural hazards with reference to Pune are provided.

Risk mitigation measures based on risk evaluation matrix and regulatory compliance are incorporated in order to improve overall system safety and mitigate the effects of major accidents.

An effective Disaster Management Plan (DMP) to mitigate the risks involved has been prepared. This plan defines the responsibilities and resources available to respond to the different types of emergencies envisaged. Training exercises will be held to ensure that all personnel are familiar with their responsibilities and that communication links are functioning effectively.

1.12 Project Benefits

The proposed ring road will provide fastest access to western part of Pune region through many towns/villages. During the construction phase, the employment opportunities will be created for skilled (engineers, transport, mechanical), semi-skilled (technician, road Inspectors, plant operator, office support etc.) and unskilled (general labor) laborers. The ring road contributes to the economic development by encouraging attraction of business to site equipped with good access and by improving the travel efficiencies of the existing business areas like, Mumbai and to start new avenues in areas like, Nashik, Surat, and Aurangabad. This also helps in the development of new industries, development of new educational institutions and hospitals/health centers, development of real estates and infrastructure projects. The main economic benefit generated by the project will be savings of vehicle operating cost.

The proposed project will ensure the smooth flow of traffic, which reduces the emission load and noise level. Smooth and fast-moving traffic will cause lower emission loads thereby reducing pollution levels.

The indirect benefits include changes in decision on residential area or colonies where land is less expensive or more desirable, changes in development of business in order to take advantage of improved speed and reliability in the transportation system.

1.13 Environmental Management Plan

Environment management plan is prepared to monitor the effectiveness of mitigation measures suggested to minimize the impact on the surrounding environment during the construction and operation phase.