

Environmental and Social Due Diligence Report

Project Number: 47083-004
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INDIA: Accelerating Infrastructure Investment Facility in India – Tranche 3 Shamlaji Expressway Private Limited (Part 6 of 34)

Prepared by India Infrastructure Finance Company Limited for the India Infrastructure Finance Company Limited and the Asian Development Bank.

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Sl. No.	Activities	Physical Environment			Biological Environment		Geology		Topography
		Air	Water	Noise	Flora	Fauna	Natural Drainage	Soil	
12	Debris Generation						-ve/T	-ve/T	
13	Oil & Grease							-ve/T	
14	Construction in forest areas	-ve/T	-ve/T	-ve/T	-ve/T	-ve/T	-ve/P	-ve/P	-ve/P
B. Operation Phase									
1	Vehicular Movement	-ve/P		-ve/P	-ve/P	-ve/P			
2	Impact on forest areas	-ve/P		-ve/P	-ve/P	-ve/P			
3	Toll Collection	-ve/P		-ve/P					

Where, -ve = Negative Impacts, +ve = Positive Impacts, T = Temporary, P = Permanent

4.2. IMPACT DURING CONSTRUCTION PHASE

The impact during construction will be localized and short term with permanent changes in use of surrounding land as compared to the current conditions. Impact will be primarily related to the civil works and less intensive impact is expected during erection of the equipment and trial operation. The details are given in the section below.

4.2.1. LAND ENVIRONMENT

Impact

- Loss of agricultural land due to land acquisition for the road.
- Generation and storage of spoils and debris due to construction activities.
- Changes in land-use pattern due to proposed widening.
- Ribbon development of shops, eateries along the road.

Mitigation Measures

- Excavated earth materials should be re-used to the maximum extent in site preparation.
- Asphalt wastes, debris and other wastes material should be disposed of in environmentally safe area. Indiscriminate dumping would be avoided.
- Labour and construction camps should be constructed at the approved sites and away from operation road.
- Indiscriminate settlement of workers should be avoided.
- Haul roads and construction site should be adequately maintained and should not be directly connected to main roads, wherever possible.
- Construction activities should be kept confined to the PROW only.

4.2.1.1. SOIL ENVIRONMENT

Top-soil is a valuable resource for the vegetation. Accordingly, it shall be saved from proposed alignment that will be disturbed during road construction.

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Impact

Top soil will be generated due to clearing and excavation of the proposed alignment within formation width. Top soil is important for cultivation as it supports agriculture and other vegetation growth. At borrow area also loss of top soil is anticipated due to indiscriminate excavation of the area. Loss of fertile top soil may be anticipated if not managed properly.

During the construction activities, oil spillage, disposed of bituminous waste and chemicals may contaminate the soil which can affect its fertility in the project proximity if proper care is not taken. Compaction of soil and movement of construction vehicles and equipments consequently leads to loss of fertility in the agriculture land beyond PROW. The proposed project road is a new alignment and will be passing through mainly agriculture fields, so special attention would be required to avoid such problem.

Excavation of borrow pits and quarrying is another important activity, which have impact on land environment beyond the road alignment. Unplanned excavations of borrow pits leads to wastage of good agricultural lands. Without proper restoration plan, these pits can further have adverse impacts.

Mitigation Measures

- Top soil shall be stripped from each site prior to any associated filling or sub-surface excavation.
- It shall be saved by either stockpiling it adjacent to the proposed road formation, either immediately upslope or down slope of extent of works, or by stripping it from the road section about to be excavated and re-spreading it immediately onto the previously completed adjacent section of road. If topsoil is to be stockpiled it shall be done above the excavation site to avoid mixing it with excavated sub-soil.
- All the top soil will be preserved separately at earmarked site away from other construction materials at site to avoid mixing with other materials or contamination.
- The top soil will be reused for grass turfing embankment slopes.
- The balance quantity of top soil will be reused for rehabilitation of borrow pits to restore the biological characteristics of the area.
- Local community shall be encouraged to use the debris/excess materials to be disposed for various development works, subject to their willingness.

Mitigation Measures to avoid impacts on soil

- The proposed ROW boundary will be peg marked at site and movement of vehicles and equipments will be restricted within proposed ROW only.
- The bituminous drums/tanks and oils would be stored by providing impervious raised platform with catch-pits around the platform to avoid any chance of contamination of soil in case of spillage.
- Proper handling of spent wash from equipments and vehicle service station by providing catch-pits and soak-pits around the service station to avoid contamination of land adjacent to those sites.

Mitigation Measures at Borrow Areas

- Borrow materials for construction will be taken only from approved borrow areas. To operate borrow areas on private land; land-owner's written consent will be obtained.
- Borrow area will be selected as per Indian Road Congress Guidelines IRC SP:10.

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- No earth will be borrowed from within the proposed ROW.
- The borrow area will be located preferably on non-productive, barren lands, raised lands, waste lands and environmental considerations will be met with.
- The borrow pits will not be dug within 800m of town or village settlement.
- After completion of material extraction, no scar will be left unattended. The borrow area will be suitably rehabilitated either by backfilling it or by dressing the sides of the borrow pit to create slope consistent to the adjoining land. Bottom of the pits will be graded towards natural outfalls to prevent water accumulation.
- All trees located within borrow area will be preserved.

4.2.2. AMBIENT AIR QUALITY

Impacts during Construction Phase

Dust Emissions

During the construction phase, dust emissions in unpopulated areas will be emitted and deposited on the leaves of trees and other vegetation which may affect the growth of the trees and other vegetation. Certain amount of dust and gaseous emissions will generate during the construction phase from excavation machine and road construction machines. Pollutants of primary concern include particulate matters i.e. PM₁₀ and PM_{2.5}. However, suspended dust particles matter may be coarse and will be settled within a short distance of construction area. Therefore, impact will be temporary and restricted within the closed vicinity of the construction activities only.

Gaseous emissions include carbon monoxide (CO), unburned hydrocarbons, sulfur dioxide (SO₂), nitrogen oxides (NO_x), VOLATILE ORGANIC COMPOUNDS (VOCs) etc. from DG set/vehicles involved in transportation of materials during road construction.

Generation of dust and particles

- Site clearance and use of heavy vehicles and machinery etc.
- Transport of raw materials, borrow and quarry material to construction sites;
- Earthworks;
- Handling and storage of aggregates at the asphalt plants;
- Concrete batching plants and;
- Asphalt mixing plants due to mixing of aggregates with bitumen.

Generation of dust is a critical issue and is likely to have adverse impact on health of workers in quarries, borrow areas and stone crushing units. This is a direct adverse impact, which will last almost throughout the construction stage along the project road.

Generation of Exhaust Gases

Generation of exhaust gases is likely due to movement of heavy machinery for clearance of the PROW for construction. Toxic gases are released through the heating process during bitumen production.

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Although the impact will be much localized, it can spread downwind direction depending upon the wind speeds.

The health effects of inhaling particulate matter have been widely studied in humans and animals and include asthma; lung cancer, cardiovascular issues, and premature death are given in **Table 4.2**.

Table 4.2: Emission and their impacts (Prediction of impact on Ambient Air Quality)

Emission	Impact	
	Human	Vegetation
Hydrocarbons	Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Inhaling formaldehyde can cause irritation. It is a major contributor to eye and respiratory irritation which is caused by photochemical smog.	Ethylene cause injury to the leaves of sensitive plants. Effects are epinasty, chlorosis, curling, and abscission and growth retardation.
CO	Reduces the ability of hemoglobin to carry oxygen to the body issues.	-
NO _x	Nitrogen dioxide damages the cell membranes in the lung tissues and construction of the lung passages. Edema or a filling of the intercellular spaces with fluid. Eye and nasal irritation and pulmonary discomfort are also common.	Nitrogen dioxide causes growth retardation.
CO ₂	Asphyxiation, caused by the release of carbon dioxide in a confined or unventilated area. Kidney damage or coma.	Elevated atmospheric carbon dioxide and reduces plant growth.
Ozone	Ozone causes an irritant action in the respiratory tract, cough chest pain, eye irritation, headaches and asthma attacks. Chronic effects include losses in immune system functions, accelerated aging and increased susceptibility to other infections.	Ozone concentrations cause flecks on the upper surfaces, premature aging and suppressed growth, leaf bleaching, necrosis.
SO ₂	The health problems related to the mucous membrane and respiratory tract are due to sulfate aerosols. Chronic effects of SO ₂ include increased probabilities of bronchitis, “colds” of long duration and suppression of immune system.	SO ₂ produce injury on leaves and plants which is characterized by the killing of marginal or intervention areas of the leaf.
Fugitive Dust	Irritation to the eyes, nose and throat. Respiratory distress, including coughing, difficulty in breathing and chest tightness. Increased severity of bronchitis, asthma and emphysema.	Reduced photosynthesis due to reduced light penetration through the leaves. This can cause reduced growth rates and plant vigor. Increased incidence of plant pests and diseases.

Mitigation Measures

Adopting proactive site planning approach and other mitigation measures can mitigate problem associated with dust generation and gaseous emissions and its impacts on sensitive receptors. The section falling near sensitive receptors and settlements need special attention for controlling dust as well as gaseous emission. By observing environmental regulation regarding use of vehicles, crusher plants and asphalt mixing plant will also keep the air pollution within acceptable limit. Impact on air quality during construction phase is temporary and site specific and is difficult to quantify on an objective level. Proper Environment Management Plan can mitigate the impact to a large extent.

Following measures are suggested to mitigate the impact on air quality during construction;

Mitigation Measures for Mobile Source Emissions

- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the pollution emission levels conform to the SPCB norms.
- All the vehicles carrying construction material will be covered. Vehicles and machinery will be regularly checked as per the NAAQ Standard. Mixing equipment will be well sealed and equipped with dust control removal devices.
- To curb the increased fugitive dust emissions in the project area due to vehicular movement and raw material transport, provisions for sprinkling of water shall be made on all non-metalled and earthen haul roads in the area. Sprinkling of water shall be carried out at least twice a day on a regular basis during the entire construction period especially in the winter and summer seasons. Special attention shall be given to all haul roads passing through residential areas.
- Idling of deliver trucks or other equipment should not be permitted during periods when they are being unloaded or are not in active use;

Mitigation Measures for Fixed Sources Emissions

All the stationary construction equipment/plants like crushers and the batching plants will be sited at least 1.0 km away from the settlement towards downwind direction and a minimum area of 200 sq.m surrounding the site should be devoid of vegetation.

- It will be ensured that the Contractor fulfills at the statutory requirements before establishing and operating their own plant site and construction camps.
- All dust generating plants and equipments shall be fitted with dust suppression system and emission control devices and confirm to the limits as prescribed in the standards;
- All the construction machinery and equipments shall be maintained regularly.
- Crushing and grinding machinery should be put in enclosure. All the drilling operations are to be coupled with dust collectors.
- Areas prone to fugitive dust emissions (such as demolition, excavation and grading sites) should be stabilized by using water.
- Proper care should be taken for storage of furnace oil, LDO, etc.
- As soon as construction is over the surplus earth should be utilized to fill flow-lying areas.
- Water will be sprayed in the lime/cement and earth mixing sites, asphalt mixing site and temporary service and access roads.

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- After compacting, water will be sprayed on the earthwork regularly to prevent dust.
- Workers and construction site will be provided with adequate numbers of personal protective equipments, such as nasal masks, gloves, etc. to reduce the chances of exposure to dust and toxic gases.
- Regular monitoring of ambient air quality will be carried out as mentioned in the Environmental Monitoring Plan.

4.2.3. AMBIENT NOISE QUALITY

Impacts

Operation of Heavy Machineries: Movement of heavy vehicles, stone crushing, and aggregate mixing activities generates high noise and would increase the ambient noise level in the surrounding. The behavior of truck drivers also plays a role in increasing the noise level by the injudicious frequent use of blow horns. Especially in the settlement area this can pose a problem. Workers working near the noise generating equipment and plants are likely to be exposed to high noise level. The acceptable limits (for 8-hour duration) of the equivalent noise level exposure during one shift is 90 dB(A). hence, noise generated due to various activities in the construction camps may affect health of the workers if they are continuously exposed to high noise level. For reasons of occupational safety, exposure to impulses or impact noise should not exceed 140 dB(A) (peak acoustic pressure).

Mitigation Measures

- All noise generating equipments will be installed sufficiently away from settlement areas.
- The main stationary noise producing sources such as generator sets shall be provided with an acoustic shield around them. These can either be a brick masonry structure or any other physical barrier which is effective in adequate attenuation of noise levels. A three-meter-high enclosure made up of brick and mud with internal plastering of a non-reflecting surface will be very effective in these regards.
- The plants and equipment used for construction will strictly conform to CPCB standards.
- Vehicles and equipments used will be fitted with silencer and maintained accordingly.
- Noise to be monitored as per monitoring plan and if the noise level at any time is found to be higher, then immediate measure to reduce noise in that area will be ensured.
- Noise standards of industrial area/zone will be strictly enforced to protect construction workers from severe noise impacts. All the workers working very close to the noise generating machinery shall be provided earplugs to avoid any ill impacts on their health.

4.2.4. IMPACT ON WATER USE

Impacts

- Decrease in water table due to continuous withdrawal of ground water for the construction works.

Mitigation Measures

- Avoid wastes of water from existing sources.
- Rainwater harvesting structure should be constructed at the settlement area.
- Borrows should be re-developed as a water catchment area. The unlined roadside drains in rural stretches should be connected to water bodies like nalas/rivers/drains near the culverts and bridges.

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4.2.5. WATER RESOURCES

4.2.5.1. DRAINAGE

Impacts

- Incidence of water stagnation due to obstruction of drainage on the on-set of monsoon.
- Incidence of accidents in case of blockage of drainage spouts that create water pool on road.
- Increase of flood duration due to obstruction of natural drainage in construction of high embankment.
- Blockage of existing drainage in courses of earth work.

Mitigation Measures

- Adequate drains facilities (longitudinal, median and chute drains) should be provided along the road to facilitate the stability of road carriageway. It prevents soil erosion also.
- Existing drainage and cross drainage (CD) structures should be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool.
- Adequate new drainage and cross drainage (CD) structures should be provided for smooth runoff to avoid water stagnation.
- Inspection of existing drainage spouts before the on-set of monsoon.
- Adequate facilities of drainage at construction site and camp to avoid stagnant water pools that also lead to soil erosion and incidence of diseases.

4.2.5.2. SURFACE WATER RESOURCES

The proposed alignment is crossing the Upper Ganga Canal. The proposed alignment will not disturb to this canal due to planning over bridge. Therefore, this canal constitutes sensitive component of environment and deserve proper attention during construction period. There are no other major surface water bodies located in the area apart from rivers and irrigation canals.

Impacts

In the project, construction of bridges is proposed to across this canal. Bridge constructions require foundation works in the canal bed which includes excavation, drilling and piling works. Minor disturbance of the water flow may likely to occur due to piling and drilling works inside the canal bed for establishing bridge foundations. However, these are standard practices for bridge construction works.

Bridge foundation works may result into generation of some quantity of debris materials due to excavation and drilling works. These wastes may cause temporary increase in turbidity and thereby contaminating the water, but such situation will occur only for short duration. 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.

Mitigation Measures

The above-mentioned problems associated with foundation works can be managed through the proposed mitigation measures:

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- The bridge construction works will be carried out only during lean period when water flow in the canal is minimum.
- The bed of the canal will be cleared from all excavated soils and debris immediately after completion of foundation works.
- All water and liquid wastes arising from construction activities will be properly disposed off and will not be discharged into any water body without adequate treatment.
- Littering or unauthorized discharge will not be permitted.
- Permission of the engineer and the concern regulatory authorities will be obtained for disposal of the waste at the designated disposal point.
- The stream course and drain will be kept free from any dumping of solid wastes and earth materials.
- The fill and debris materials will be stored away from water bodies and only on the designated sites along the construction zones.

4.2.5.3. GROUND WATER RESOURCES

In the project area sufficient numbers of surface water sources are available which can cater to the water demand for construction purpose. Surface water as well as ground water will be used for construction period as availability of sources. Therefore, no impact on water table is anticipated due to the proposed project.

Impacts

Interference with Local Water Supply System

Water will be required for earthwork, compaction and other construction purposes. Water will also be required for dust suppression at different locations during construction. At workers camp, plant site relatively small quantity of water will be required for drinking and other domestic purposes. The water demands for the construction work may pose severe stress on the public water supply if common water sources are used to meet the water demand for construction as well as various domestic usages by the workers.

The road passes through a region which receives moderate rainfall. It is estimated that about 15 lacs KLD of water is required for various construction works and at camp sites.

Mitigation Measure

The Contractor will arrange their water demand from separate sources so as not to interfere with the normal public water supply. Water from surface water source will be used for construction works with requisite permission from concerned Irrigation Department. However, when the surface water is not available during lean period, approved bore-well from Central Ground Water Authority may be used with prior permission from the competent authority.

4.2.6. RAINWATER HARVESTING

This is a green field alignment project. The proposed project will increase of surface run-off due to more paved road surface. It will have adverse impact on ground water recharging if measures are not taken during the design. Therefore, compensation is required to recharge ground water.

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Impacts

- Loss of ground water table due to withdrawal of ground water for construction.
- Increase of surface run-off due to more paved road surface

Mitigation Measure

Detailed hydrological survey will be conducted and adequate drainage facilities provided to discharge the run-off to existing catchments area.

- Provision of recharge pits, in the design to recharge ground water, in the urban area.
- Longitudinal road-side drains on both sides of the road and out fall should be nearby culverts/ bridges on nalas/ rivers/ drains.
- All the construction preparatory activities for culverts, bridges and other structure will be carried out during dry seasons.
- Water for construction will be arranged by the contractor from the existing sources.
- Minimum use of water from existing sources for construction purpose will be ensured promoted at construction site/camps to minimize likely impacts on other users.

Rainwater harvesting structures shall be provided near the disposal point of the side drains as prescribed by CGWB guidelines.

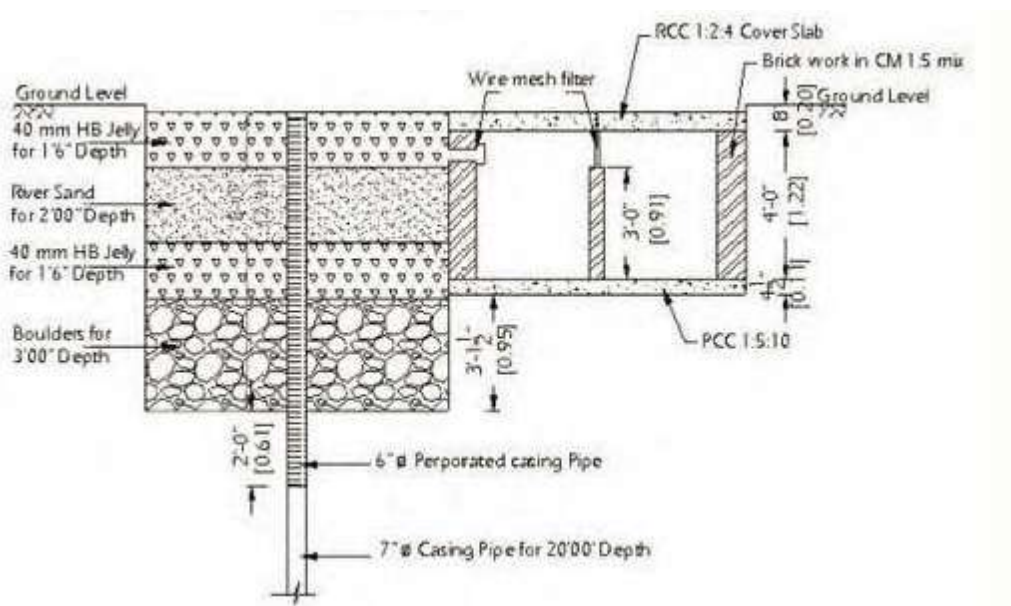


Figure 4.1: Typical Rainwater Harvesting Structure

4.2.7. SOCIAL ASPECTS

Amenities and Religious & Cultural Properties

- Roadside amenities and religious & cultural properties generally include:
- Educational institutions (schools & colleges)
- Medical amenities (hospitals & health centers)
- Drinking water sources (wells & tube-wells)
- Religious properties (temples & mosques)

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Impacts

- Additional land in the widening of the road, will affect the cultural and religious properties.

Mitigation Measures

- Religious and cultural properties should be suitably relocated, if fully affected.

4.2.8. WORKER'S CAMP

Impacts

- Influx of construction work-force to construct temporary tents.
- Likely deterioration in sanitation and hygiene conditions due to inflow of construction laborers.

Mitigation Measures

- Temporary camps should be constructed at designated sites with adequate sanitation, drinking water supply.
- Proper accommodation will be provided in the locality for the migrant construction engineers.
- It should be ensured that the workers are provided with adequate ancillary facilities i.e. sanitation at camps, drinking water, lavatories, first aid facilities and temporary electrification (if possible).
- It will be ensured through contract agreement that the construction workers are provided fuel for cooking to avoid cutting of trees for fuel wood.
- Regular cleanliness at camps.

4.2.9. ECOLOGY

The construction of proposed road can have a substantial impact on the degradation and loss of natural ecosystems, especially in less developed areas. Although the actual areas converted to highways may cover only a small proportion of the region, but the fragmentation of habitats caused by highway development is often severe. The scale of both the habitat conversion and habitat fragmentation effects caused by highway development varies with the size of the project. The impacts of projects also vary according to the environmental setting, especially the degree of naturalness in the local and regional ecosystems.

Impact during Design Phase

The design phase involves the siting of the final right-of-way footprint and all aspects of structural design and within design mitigations. By selecting such road parameters as width, slope, and type of crossing structures (e.g., bridges), this phase determines the specific potential impacts on adjacent and nearby ecosystems. While planning determines the general areas where habitat will be destroyed or degraded (areas within the proposed road corridor), design decides which specific locations will be affected or avoided. For this reason, small-scale mitigations are most important in the design phase.

Mitigation Measures

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This is the step where specific sensitive habitats can be avoided to the extent practicable. The mitigation goal is to avoid ecologically sensitive areas and limit encroachments. Any measures to minimize the amount of new highway construction in the alignment selection process will mitigate against adverse impacts.

Specific mitigations in the planning and design phase include the following:

- Avoid fragmentation of forest cover or other contiguous habitats
- Utilize existing non-forest lands and transportation corridors

Impact during Construction Phase

The construction phase involves the vegetation removal, earth moving and road building activities that impact on sensitive locations. The specific operation of construction activities may determine the severity of impacts such as erosion and disturbance. In addition to physical destruction of habitat within the footprint, soil erosion and other forms of pollution are the primary impacts in this phase. Mitigations involving both the timing and performance of these activities can dramatically reduce these later adverse impacts.

Mitigation Measures

- The principal mitigation measure in the construction phase is strict application of standard specifications for erosion and sediment control, including routine inspections. The trees to be cut will be kept at the minimum level by modifying alignments, eccentric and concentric widening. No construction vehicle will be allowed to enter the dense vegetation area.
- During construction, proper care will be exercised to avoid additional loss/cutting of trees.
- Construction camp will be sited at least 2 km away from the forest area or away from huge habitations.
- To balance the ecological loss, compensatory afforestation will be done as per the clearance condition laid down by the forest department.
- No significant wildlife is reported in the project area and hence, there will be no impact on wildlife.

4.2.10. HEALTH AND SAFETY

Health and safety are of major concern during the construction as well as operational phases. The impact on health and safety can be envisaged for both workers at site and road users as well as inhabitants of nearby to the project areas.

Impacts

Emission of gaseous pollutants and dusts are major result of various processes like material treatment, stone crushing, and asphalt preparation. This emission effect is only for short term till the construction work is over, but the effect may be significant from the point of view that the workers are directly exposed to these emissions. Apart from this, safety risks to road workers, primarily in the areas of storage and handling of hazardous materials, and in operation of heavy machinery close to traffic, slopes, power line and water courses, are also involved during the construction works.

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The dust and gaseous pollutant generation in the sections near settlement areas are likely to affect the health of people residing in the proximity of the proposed alignment. Excavation of borrow pits on both sides of the roads within and outside the proposed ROW can create unhealthy aesthetics and enhance the risk of water borne diseases. These areas provide ideal breeding zones for flies and insects due to stagnant water in borrow pits enhancing the possibility of spreading of diseases. The vehicles and equipment operation increase the chances of collision with vehicles, pedestrians and livestock.

Mitigation Measures

- The plants and equipments will be installed sufficiently away from settlements.
- All the construction equipments and vehicles will conform to the emission standards stipulated by the CPCB.
- Safe working techniques will be followed, and all the workers will be trained.
- All the workers will be provided with proper personal safety equipments at construction site.
- Proper traffic management will be ensured at the construction zone.
- An Emergency Response System in case of any incidents will be developed and implemented.
- Periodical health check facility for workers will be provided at camp sites.
- Placement of warning signals for the protection of the site personnel at various sites, e.g., safety sign should be appropriately posted at various places at site to advice workers regarding wearing of PPE.
- Barricade/fencing/displaying of warning sign by way of red flags/tape/lighting/paint etc. should be provided at the construction site.
- Proper site safety organization and safety committee should be constituted, and site safety assessment should be conducted by the contractor. Safety responsibilities of project manager, project safety officer and other required safety should be defined.
- Proper health and safety communication at site including installation of safety board at the site office where critical project specific safety data is displayed including number of accidents/incidents during a period, number of trees to be planted and already planted, first aid information, important safety notices / posters / newsletters / banners for the information of site personnel etc.
- Educational systems should be followed at site to communicate health & safety policies
- In-house trainings/seminars like induction & tool box training at site should be conducted regularly and recorded.
- Mechanism for incidents/accidents reporting and investigation should be put in place at the site.
- Health & safety records should be maintained at site and should be stored in a record room with required records files, e.g., environment & safety training records, emergency mock drill records, environment & safety assessment records, environment & safety monitoring records etc.
- Alcohol/drug policy should be properly communicated to the site personnel and displayed at public/works sites.
- Frequent medical examination should be done for crane operators, vehicle drivers & other site personnel engaged in other such hazardous activities.
- Awareness programmes should be conducted among workers regarding HIV/AIDS and other sexually transmitted diseases to avoid the spread of such disease in the community
- Proper stacking of all material in designated areas posing risk of incidents /accidents due to flammable and combustible material

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- Material Safety Data Sheets (MSDS) should be posted at the site-store stocking hazardous material and/or chemicals, hydrocarbons, engine oils, compressed flammable gases, acids/alkalis etc. MSDS should also be posted at sites, where such material is used, to guide the personnel with handling and usage instructions.

4.2.11. SOLID WASTE GENERATION

The road construction activities will generate several waste materials such as:

- Vegetation and demolition waste from site clearance;
- Excavated materials from earthworks (e.g. cuttings, pile foundations);
- General construction waste (e.g. wood, scrap metal, concrete);
- Chemical wastes generated by general site practices (e.g. vehicle and plant maintenance/servicing); and
- Municipal wastes generated by site workers

Impacts

The above-mentioned waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. The principal adverse effects relate to dust, water quality, general health and safety and visual impacts. Potential hazards associated with the inappropriate handling of chemical wastes include effects on human health (i.e. dermal and toxic effects with respect to site workers), phyto-toxic effects to vegetation, contamination of the soil, ground waters and surface water following spillage, risk of fire or explosions and discharge of chemical wastes to sewer and potential disruption of the sewage treatment works. If not appropriately managed, municipal wastes generated by site workers have a potential to cause impacts in terms of nuisance, insects and vermin. This may give rise to adverse environmental impacts for both site workers and site neighbors, which could include odour nuisance if putrescible material is not collected on a frequent basis, wind-blown material causing litter problems, if it is not well maintained and cleaned regularly. The waste management with disposal method is given in **Table 4.3**.

Table 4.3: Waste Management

Waste Type	Control Measures	Proposed Disposal Method
General Requirements	<ul style="list-style-type: none"> ✓ Minimization of waste generation for disposal (via reduction/recycling/re-use) ✓ Segregating waste materials according to type to facilitate re-use and recycling ✓ Separation of inert construction and demolition materials for either re-use on site or use as material fill ✓ During demolition work, segregating materials at source as far as practical 	

Waste Type	Control Measures	Proposed Disposal Method
	<ul style="list-style-type: none"> ✓ Co-ordinate material deliveries to site to minimize storage times on site and the likelihood of causing damage ✓ Training site staff in waste minimizations practices ✓ Transport of wastes off site as soon as possible ✓ Maintenance of accurate waste records ✓ Use of re-useable metal hoardings/signboards ✓ No on-site burning will be permitted 	
Vegetation from preparatory works	<ul style="list-style-type: none"> ✓ Segregation of materials to facilitate disposal ✓ In site mulching by contractor to reduce bulk and review of opportunities for possible use within landscaping areas 	Re-use/landfill
Demolition waste	<ul style="list-style-type: none"> ✓ Segregation of materials to facilitate disposal ✓ Appropriate stockpile management 	Pre-designated disposal site
Excavated materials	<ul style="list-style-type: none"> ✓ Segregation of materials to facilitate disposal/re-use ✓ Appropriate stockpile management ✓ Re-use of excavated material on or off site (where possible) ✓ Special handling and disposal procedures if contaminated materials are excavated 	Re-use of Suitable material on site. Disposal of Unsuitable materials to pre-designated disposal site
Construction waste	<ul style="list-style-type: none"> ✓ Segregation of materials to facilitate recycling/re-use (within designated area and in appropriate containers/stockpiles) ✓ Appropriate stockpile management ✓ Planning and design considerations to reduce over ordering and waste generation ✓ Recycling and re-use of materials where (e.g. metal, wood from hoardings, formwork) ✓ For material which cannot be re-used/recycled, collection should be carried by an approved waste contractor for landfill disposal 	Public fill for inert wastes. Disposal to landfill for Material unsuitable for public filling
Chemical waste	<ul style="list-style-type: none"> ✓ Storage within locked, covered and bunded area ✓ Storage area should not be located adjacent to sensitive receivers e.g. drains ✓ Minimize waste production and recycle oils/solvents where possible ✓ A spill response procedure should be in place and absorption materials available for minor spillages ✓ Educate site workers on site cleanliness/waste management procedures ✓ Collection by a licensed chemical waste collector 	Chemical Waste collection by a licensed agency

Waste Type	Control Measures	Proposed Disposal Method
Municipal waste	<ul style="list-style-type: none"> ✓ Waste should be stored within a temporary refuse collection facility, in appropriate containers prior to collection and disposal ✓ Regular, daily collections are required by an approved waste collector and recycler 	landfill

4.3. IMPACT DURING OPERATION PHASE

4.3.1. AIR ENVIRONMENT

4.3.1.1. PREDICTION OF IMPACT ON AMBIENT AIR QUALITY

To assess the impact on air quality of the project area during operation phase, air pollution dispersion modeling was carried out using future traffic projections. The modeling was carried out using CALINE-4, line source model developed by the California Transport Department. Carbon monoxide (CO) is the main component of the vehicular pollution. So, prediction of CO concentration is representative of the impacts of air pollution due to traffic movement.

CALINE-4 Model

CALINE-4 is line source Gaussian plume dispersion model, employing a mixing zone concept to characterize pollutant dispersion over the highway. The main purpose of the model is to assess air quality impacts near transportation facilities. Given source strength, meteorology and site geometry, CALINE-4 can predict the pollutant concentrations for receptors located within 500 meters of the roadway. It predicts the air concentrations of carbon monoxide (CO), nitrogen dioxide (NO_x), and suspended particles matter (SPM) near roadways. CALINE-4 model can be run for Standard and Worst-case conditions to predict the increment in pollutants concentration due to the proposed activity. For the present project, the model was used to predict for worst case scenario, to predict the maximum pollutions levels at receptors due to proposed project.

4.3.1.2. TRAFFIC DATA

The traffic surveys have been carried out along the corridor to establish base year traffic with reference to traffic movements.

4.3.1.3. ROAD GEOMETRY

In the CALINE-4 model the entire length of the road section is divided into various links. The division of sections into links has been done in such way, so that the link can be fairly considered as straight stretch of road having homogenous geometry with uniform width, height and traffic volume. The coordinates of end points of links specify the location of the links in the model. The model uses Gaussian dispersion parameters that are accurate up to 10 Km distance.

4.3.1.4. EMISSION FACTOR

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The following Emission Factors have been taken from the Automotive Research Association of India, Pune and details area given below **Table 4.4** as per standard.

Table 4.4: Emission Factors for Indian Vehicles

Type of Vehicles	Emission Factor (gm/km)			
	PM*	NO _x *	CO*	HC*
HCV Diesel Truck	1.24	9.30	6.00	0.37
HCV Diesel Bus	0.30	6.53	3.92	0.16
HCV CNG Bus	0.044	6.21	3.72	3.75
LCV Diesel	0.475	2.12	3.66	1.35
MUV Diesel	0.096	0.67	0.25	0.19
Passengers Cars (CNG)	0.002	0.01	0.60	0.36
Passengers cars (Diesel)	0.015	0.28	0.06	0.08
Passengers cars (Petrol)	0.002	0.09	0.84	0.12
Passengers cars	0.004	0.20	1.30	0.24
Three-Wheeler CNG	0.118	0.19	0.69	2.06
Three-Wheeler Diesel	0.091	0.51	0.41	0.14
Three-Wheeler (4 Stroke)	0.015	0.53	2.29	0.77
Three-Wheeler (2 Stroke)	0.043	0.16	1.15	1.63
Motorcycle (4 Stroke)	0.013	0.15	0.72	0.52
Motorcycle (2 Stroke)	-	-	-	-
Scooter (4 Stroke)	0.015	0.25	0.40	0.15
Scooter (2 Stroke)	0.057	0.02	0.16	0.86
Moped (4 Stroke)	0.010	0.29	0.81	0.50
Moped (2 Stroke)	0.018	0.02	0.46	0.60

*- Emission Factor development for Indian vehicles, ARAI Pune, 2006

It was observed that the maximum emission load due to road traffic occurred in morning office. Depending on the local weather conditions, dusts are expected to be generated in the form of fugitive emissions. This may lead to reduce the visibility and the air quality of the immediate vicinity due to SPM loading (Particulate Matter). This impact on the ambient environment is highly localized and short-term in nature. This will be used for future prediction of air pollution and its impact on near to the posed project.

In future, only CO will increase gradually due to vehicular emission after 6-lane highways. However, it is expected that under standard meteorological conditions and with improvement in vehicle technology, the actual incremental rise in the concentration of CO will be less than predicted.

4.3.1.5. MITIGATION MEASURES

- Vehicular emission will be controlled through enforcement of laws and public awareness. It will be ensured that all the vehicles have vehicular emission within the permissible limits.

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- Truck parking and bus- bays will be provided at required locations to facilitate smooth traffic flow vis-a-vis reduce air pollution.
- Regular monitoring of ambient air quality at specified representative locations will be conducted at fixed interval.
- Road side plantation along the road will act as sink of air pollutants.

4.3.2. NOISE ENVIRONMENT

Impacts

- Noise pollution due to traffic noise

Mitigation Measures

- Vehicular noise & use of horns will be controlled through enforcement of laws and public awareness. It will be ensured that all the vehicles are using proper horn as per norms to keep noise within the permissible limits.
- Silence zones will be demarcated and road signs prohibiting the use of horns will be displayed at residential areas, sensitive locations and silence zones.
- Regular monitoring of noise level at specified representative locations will be conducted at fixed interval.
- Plantation of avenue trees with suitable species that will result in partial noise attenuation.]

4.3.3. WATER QUALITY AND RESOURCES

Impacts

During operation phase there is less possibility of any impact to water bodies. The proposed road will be access controlled and no connectivity would be provided near any water bodies. Therefore, any impact on surface water quality is not anticipated due to the proposed alignment.

The proposed project has been designed above the ground water table. No adverse impact is anticipated on ground water quality. On the positive side, laying of pavement within the formation width may lead to increased runoff water.

Mitigation Measures

Keeping in view the water requirement and gradual decrease in water table in project area, rain water harvesting is proposed in the area at every 500 m interval as per IRC:SP- 50:1999. Thus, the project will have overall positive impact on water table during operation phase.

4.3.4. ECOLOGY

Impacts

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The operation and maintenance phase include all post-construction activities associated with the built project, including routine vehicle traffic and roadway maintenance, as well as accidents and spills. Routine maintenance activities include the following (Krame et al. 1985):

- Roadway paving and patching.
- Roadside blading and litter collection.
- Vegetation management (including mowing, chemical control, planting, seeding, and to fertilize).
- Cleaning, painting, and repair of road side structures, including curbs, drains, guardrails, and sip.
- Street cleaning, lighting, abrasives, and pavement marking.
- Equipment cleaning and hazardous material handling and storage.

Although similar in nature to construction impacts, the pollution effects of this phase are long term. Best management practices are the principal mitigation measures for these impacts.

Mitigation Measures

The operation and maintenance phase are the long-term result of the preceding phases. A highway will necessarily carry traffic and require regular maintenance activities. A certain amount of pollution (both surface runoff and atmospheric deposition of toxic materials) is associated with road traffic. Direct mitigation measures in the operation and maintenance phase fall into the following categories:

- Control litter and limit potential pollution sources.
- Manage pesticide and herbicide use so that sensitive receptors are not negatively impacted.
- Avoid direct discharge of highway runoff to receiving waters & Properly manage roadside and median vegetation.

4.3.5. SOLID WASTE GENERATION

Waste generated from the operational phase of the road widening project is likely to be restricted to small volumes associated with intermittent maintenance works and landscape upkeep (vegetation). If appropriate waste handling, storage and disposal procedures are adopted, no significant impacts are considered likely.

4.3.6. SOCIO-ECONOMIC ENVIRONMENT

The economic and social interaction of communities is going to be improved by the road projects. However, the widening of the existing road and new alignment will cause disruption to local interactions. In fact, at few places over the years people have occupied the open space of the proposed Right of Way (PROW) encroaching upon it. The encroachments are most common in market places, road crossings and in midsections. The local community activities go on the roadside, the footpath, the bus stops and even the road surface itself. These activities may take many forms, for example,



- Development of dhabas, tea shops, café and repair shops in view of catering the needs of trucks and truck drivers besides other automobiles.
- Make-shift shops in market places for catering the need of travelers and passengers besides the drivers of the vehicles & Uncontrolled stops by buses, taxis and informal public transport

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Some important observations during the field visits are:

- The PROW is squatted and encroached at some places of the Highway
- Public consultation reveals that peoples are aware of their illegal occupancy and are willing to support the project. Still, in our opinion, how will they behave at the time of project implementation is difficult to assess and One of the topmost priorities in designing the alignment was to save as many properties as possible.

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CHAPTER-5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)

5. ALTERNATIVES ANALYSIS (TECHNOLOGY AND SITE)

5.1. INTRODUCTION

The present road development activities include widening to six-lane of existing four- lanes highway from Udaipur to Ahmedabad, section of NH-8. The project road is assigned for retrofitting a six-lane cross section over the existing 4-lane such that the improved highway is safe, efficient and convenient to the road- users as well as public living adjacent to the highways. In addition to these following points need to be considered in the widening process.

- The project road should be safe for the road-users and the public living adjacent to the highways.
- The operation of highways should be smooth and efficient.
- Land acquisition is kept to the barest minimum.
- The construction should be least disruptive to the users and the public.
- Facilities created in the widening to 4-laning should be utilized to the maximum extent.
- Constraints of site should be resolved by proven technological solutions.
- Within the given constraints, the widening of project road should be sound, economical, constructible and manageable.

5.2. ANALYSIS OF ALTERNATIVES

Keeping in view the above constraints, widening has been considered, retrofitting the six lanes on existing 4-lane highway, without changing an alignment and the provision of bypass. Therefore, analysis of alternative has been studied on the view of ‘With Project’ and ‘Without Project’ Scenario, in term of potential impacts. The details are given in **Table 5.1**.

Table 5-1: Analysis of Alternatives


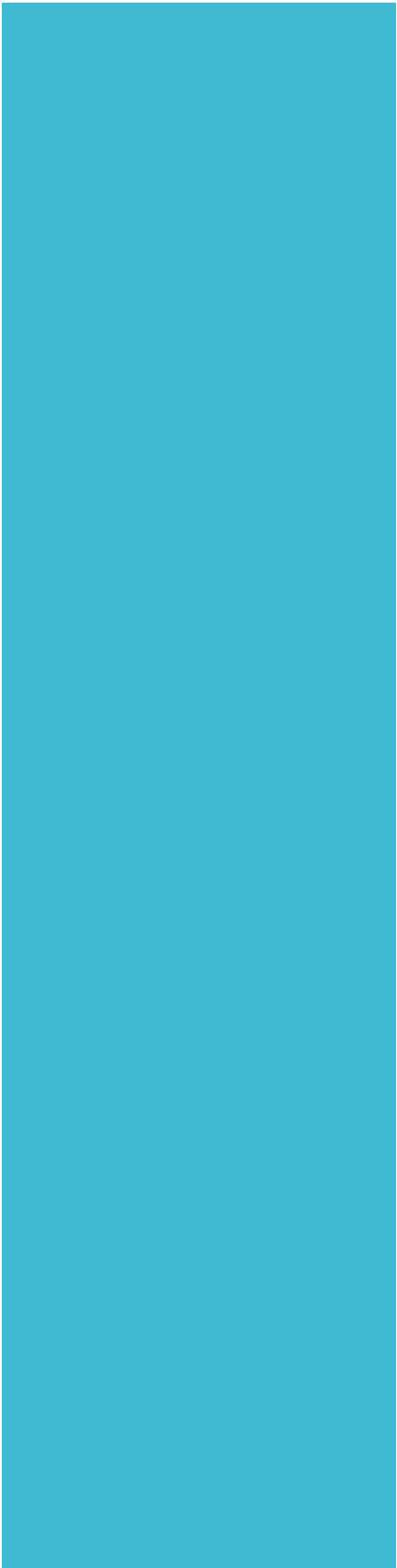
Sl. No.	Factors	Without Project Impacts		With Project Impacts (Widening to 6-lane on existing four-lane highways)	
		Positive	Negative	Positive	Negative
1	Surface Run-off / drainage Accessibility	-	Improper drainage system cause flooding, water logging on road surface.	Drainage system will be improved. No flooding in localized areas due to improved surface run-off.	-
2	Transportation/ Vehicle Maintenance /Operating Cost	-	More break-down due to poor road conditions. Increase cost of transport in	Movement of vehicles shall be smooth. Minimum vehicular break - down.	-

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Sl. No.	Factors	Without Project Impacts		With Project Impacts (Widening to 6-lane on existing four-lane highways)	
		Positive	Negative	Positive	Negative
			frequent traffic jams in heavy traffic.		
3	Travel time /increased speed	-	Increase time to reach at destination due to poor road conditions and congestion due to heavy traffics.	Decrease of travel time and fuel saving due to smooth and congestion free movement.	-
4	Change in Land-use pattern	No change in land –use pattern as no construction works	-	-	Change in land–use pattern
5	Loss of property and livelihood.	No loss of property and livelihood.	-	-	Loss of Property and livelihood
6	Change in Environmental Quality during construction.	No adverse impact on air, water and noise, as no construction involved.	-	-	Environmental Degradation due to vegetation loss, dust impacts on air, impacts on water quality.
7	Change in Environmental quality after construction	-	Environmental quality shall deteriorate further, due to movement of vehicles on existing road conditions.	Improvement of environment with respect to air quality and noise level as to have better road conditions. Minimal possibility of water contamination due to fewer break- down of ailing vehicles.	-

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Sl. No.	Factors	Without Project Impacts		With Project Impacts (Widening to 6-lane on existing four-lane highways)	
		Positive	Negative	Positive	Negative
8	Loss of vegetative cover	No loss of greenery and biodiversity	-	-	Vegetative loss and greenery due to felling of trees in widening
9	Road Safety/Accident rate	-	Increase in number of accidents on road and accidental spot	Decrease in road accident due to improvement of road alignments at critical sections and widened road.	-
10	Employment generation	-	Living standard shall remain unchanged. No development no changes in economic status and living standard of people.	Opening of Dhaba, Hotel, Motel, Petrol-pumps and other market places shall provide direct and indirect employment to the public. Opening of new transportation agency due to good road shall provide an employment. Increase of Economic status due to increase source of income.	-



CHAPTER-6

ENVIRONMENT MONITORING PROGRAM

6. ENVIRONMENT MONITORING PROGRAM

6.1. INTRODUCTION

Environmental monitoring provides feedback about the actual environmental impacts of a project. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes.

A monitoring program, backed up by powers to ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking a project's actual impacts, monitoring reduces the environmental risks associated with that project, and allows for project modifications to be made where required.

The purpose of the monitoring programme is to ensure that the intended environmental measures are achieved and result in desired benefits to the target population. To ensure proper implementation of the Environment Monitoring Plan it is essential that an effective monitoring programme is designed and carried out. The broad objectives of the environment monitoring program are:

- To monitor impacts on the surrounding environment and the effectiveness of mitigation measures during the construction and operation.
- To ensure that the environmental control systems installed at the plant and are operating satisfactorily.
- To suggest ongoing improvements in management plan, if required, for subsequent effective monitoring.
- To satisfy the requirements of environmental regulatory framework and community obligations.

6.2. PROGRAM INDICATOR

The physical, biological and social components, which are significant in affecting the environment at critical locations, have been suggested as Performance Indicators. The following specific environmental parameters can be qualitatively measured and compared over a period and therefore selected as Performance Indicators for monitoring due to their regulatory importance and the availability of standardized procedures and relevant expertise.

- Air quality with respect to PM₁₀, PM_{2.5}, NO_x, SO₂ and CO at selected locations.
- Water quality with reference to DO, BOD, COD, suspended solids, turbidity, alkalinity, oil and grease at selected water bodies.
- Noise level at sensitive locations (institutions, hospitals, religious places)
- Survival rates of trees planted as compensatory afforestation to compensate for removal of roadside trees.

6.1.1 AMBIENT AIR QUALITY MONITORING

The air quality is recommended for monitoring through an approved agency in the process of widening to 6-lane of existing four-lane highways from Shamlaji to Mota Chiloda. The monitoring of air sampling should be conducted at the location of Crusher plant, HMP, Stockyards Batching plant, Haul

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roads. In addition to these, air quality should also be monitored near the storage sites having aggregates, sands etc.

The parameters recommended for monitoring during construction are:

- Particulate Matter, PM₁₀, PM_{2.5}
- Sulphur Dioxide,
- Oxides of Nitrogen,
- Carbon monoxides, and
- Stack emission from DG sets

6.1.2 WATER QUALITY

Water quality and public health parameters should be monitored till the end of project and two years after the completion. Monitoring should be carried-out at quarterly basis, to cover seasonal variations, by any recognized agency. Water quality shall be analyzed by applying the standard technique. The parameters for monitoring are given in the below.

6.1.3 AMBIENT NOISE MONITORING

The monitoring of noise sampling should be conducted at the location of plant sites i.e crusher plant, HMP and construction sites etc. In addition to these, noise quality should also be monitored near the school, hospital, other sensitive sites and residential areas exist along the 40 meters to 50-meter distance of project road or at the designated locations fixed –up by the environmental expert.

6.3. ENVIRONMENTAL REPORTING SYSTEM

Monitoring and evaluation are important activities in implementation of all projects. Monitoring involves periodic checking to ascertain whether activities are going according to the plans. It provides the necessary feedback for project management to keep the programme on schedule.

The reporting system will operate linearly with the Concessionaire, who will report to Independent Consultant (IC), who will in turn report to the Project Implementation Unit (PIU). All reporting by the Concessionaire and Independent Consultant shall be on monthly/ quarterly/ annual basis. The PIU shall be responsible for preparing targets for each of identified EMP activities.

The compliance monitoring and the progress reports on environmental components may be clubbed together and submitted to the PIU regularly during the implementation period. The operation stage monitoring reports may be annual, or biennial provided the project Environmental Completion Report shows that the implementation was satisfactory. Otherwise, the operation stage monitoring reports will have to be prepared as specified in the said project Environmental Completion Report.

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6.4. ENVIRONMENTAL MONITORING COST

The environmental monitoring cost is estimated based on the length and existing environmental scenario of the project roads. Environmental monitoring cost of 9,21,800/- has been allocated for construction and operation stages for each 6 monthly. The details are provided in Table 6.2.

Table 6.1: Environment Monitoring Cost for Construction & Operation Phase

Component	Stages	Particular	Quantity	Rate/ Sample	Total (INR)
Air	Construction	Monitoring near hot mix plant locations	At 5 locations twice, a month for 6 months	4000	240000
		Monitoring at construction sites		4000	240000
	Operation	Ambient Air Quality Monitoring		4000	240000
Surface Water	Construction	Surface water resources	At 2 locations for twice in six months	4500	18000
	Operation	Surface water resources		4500	18000
Ground Water	Construction	Ground water bodies	At 2 locations for twice in six months	3800	30400
	Operation	Ground water bodies		3800	30400
Noise	Construction	At equipment yards	At 5 locations for twice in six months	1500	15000
	Construction	At construction sites identified by IC		1500	15000
	Operation	As directed by the Engineer		1500	15000
Soil	Construction	At productive agricultural lands abutting	At 3 locations for twice in six months	5000	30,000
		traffic detours and traffic diversions, to be identified by Engineer			
	Operation	At five locations where baseline	At 2 locations for twice in six months	5000	30,000
		monitoring has been carried out			
Total Monitoring Cost					9,21,800



CHAPTER-7

ADDITIONAL STUDIES

7. ADDITIONAL STUDIES

7.1. INTRODUCTION

As per the conditions of the standard Terms of Reference (ToR) as published by MoEF&CC for preparation of EIA/EMP Report, several documents were to be prepared to provide a clear picture of the project area. The studies suggested included:

- Public Hearing & Consultation
- Road Safety Measures

7.2. PUBLIC HEARING & CONSULTATION

As per the conditions of the ToR and the EIA Notification 2006, public consultation will be held for the project. “Public Consultation” refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained with a view to considering all the material concerns in the project or activity design as appropriate. Public consultation process comprises of two parts, viz Public Hearing and written response from stakeholders.

The Public Hearing shall be arranged in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site(s) or in its proximity District -wise, by the concerned State Pollution Control Board (SPCB). The EIA report will be submitted to the State Pollution Control Board along with other relevant documents and additional studies. The SPCB will process the application for Public Hearing and conduct the hearing within 45 days of the application.

For obtaining responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity, the concerned regulatory authority and the State Pollution Control Board (SPCB) or the Union territory Pollution Control Committee (UTPCC) shall invite responses from such concerned persons by placing on their website the Summary EIA report along with a copy of the application in the prescribed form, within seven days of the receipt of a written request for arranging the public hearing. Confidential information including non-disclosable or legally privileged information involving Intellectual Property Right, source specified in the application shall not be placed on the web site. The regulatory authority concerned may also use other appropriate media for ensuring wide publicity about the project or activity. The regulatory authority shall, however, make available on a written request from any concerned person the Draft EIA report for inspection at a notified place during normal office hours till the date of the public hearing. All the responses received as part of this public consultation process shall be forwarded to the applicant through the quickest available means.

After completion of the public consultation, the applicant shall address all the material environment concerns expressed during this process, and make appropriate changes in the draft EIA and EMP. The final EIA report, so prepared, shall be submitted by the applicant to the concern EAC for appraisal.

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The applicant may alternatively submit a supplementary report to draft EIA and EMP addressing all the concerns expressed during the public consultation.

7.3. ROAD SAFETY FEATURES

Road safety features are essential for high speed facilities such as highway projects. Various types of road safety features are proposed along the highway as described below.

7.3.1. ROAD SIGNS

7.3.1.1. MANDATORY SIGNS/ REGULATORY SIGNS AND COMPULSORY SIGNS

The mandatory signs are meant to convey to road users a definite instruction they must follow, e.g. circular signs for speed or other restrictions etc., compulsory signs such as “Compulsory keep Left” compel the drivers to follow a definite route.

7.3.1.2. WARNING SIGNS/CAUTIONARY SIGNS

The warning signs are meant to convey to road users a warning about dangers/hazards ahead. These are triangular signs warning about hazards lying ahead. Proper warning signs shall be designed for the highway.

7.3.1.3. INFORMATORY SIGNS

The informatory signs are provided to convey to road user’s information on places of interest, services and facilities and guide road users along routes, etc. This also includes other signs which are useful to the drivers like Direction signs, toll plaza ahead sign, etc. For highways these signs gain more importance since at interchanges weaving maneuvers are needed and for that warning and informatory signs are necessary. These signs shall generally be mounted on gantries fixed across the carriageway.

7.3.1.4. ROAD MARKINGS

It will be essential to provide suitable carriageway/markings for conveying to the drivers of hazards or directional lane changes. These are provided also to ensure safety and orderly use of the carriageway in accordance with traffic regulations, to define lanes and guide/regulate vehicles at junction and to complement the traffic signs.

The carriageway markings as suggested should be simple, clear to purpose and type, hard wearing and skid resistant in both dry and wet weather conditions. Provisions have been made for road marking on the entire length of the highway, which, include, carriageway edge-lines, lane markings, chevron markings at diverge and merge locations, etc. Hot applied thermoplastic materials (super-imposed type) are proposed for road markings and shall be applied with the help of marking machines.

7.3.1.5. CARRIAGEWAY EDGE LINES

Carriageway Edge Lines are specifically required to define edges of the carriageway wherever there are paved shoulders or emergency lane. Carriageway Edge Lines recommended are 150 mm wide, yellow in colour and continuous along both sides of the carriageway except at merge and diverge locations where a broken edge line is used to provide continuity.

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7.3.1.6. OTHER MARKINGS

Other markings such as Directional Arrows, Deceleration Lane Arrows, Chevron and Diagonal markings, Lane markings, and other related markings required for smooth operation of traffic are proposed to be provided in accordance with relevant AASHTO/IRC standard code of practices.

7.3.2. ROAD FURNITURE

7.3.2.1. METAL BEAM CRASH BARRIERS

Metal Beam Crash Barriers shall be provided on both edges of the road where road height exceeds 3m, and on the outer edges of the road on sharp curves.

These shall consist of W-Beam fixed on posts placed 15 m apart C/C with spacers Suitable reflectors shall be fixed on the beam@3m C/C for proper delineation of the barrier line. The metal beam crash barrier shall start with a parabolic flare away from the carriageway in the incoming section, the equation of the parabola being

$$y = wx^2/I^2$$

Where,

w= tangent offset at minimum flare

I = total length of flare

y = tangent offset at any point in guardingly flare

x = distance from point of tangent to any point of offset

For the highway project, double crash barrier shall be provided on both edges to ensure safety for the proposed highway project.

7.3.2.2. ROAD STUDS

Direct reflecting road studs shall be fixed on the carriageway edge lines to provide visual guidance at right about the carriageway edges. These shall be fixed as per standard IRC guidelines for road studs.

7.3.2.3. DELINEATORS

Delineators provide visual assistance to drivers about the alignment of road ahead and warn them about hazards, particularly at night. The different types of Delineators proposed for the proposed road project are:

- Clusters of Red Reflectors on triangular notes as object markers provided at the heads of medians and directional islands.
- Circular Red Reflections on face/tips of islands and median
- Circular White Reflectors fixed on Guard Posts at prescribed spacing to delineate the alignment in sharp curves.

7.3.2.4. FENCING

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The highway being a full access-controlled facility, suitable fencing shall be provided at the PROW limits to desist pedestrians, stray animals, etc. on to carriageway. The fencing shall be standard chain link type or similar suitable arrangement.

7.3.2.5. LANDSCAPING AND ARBORICULTURE

A proper landscape has been proposed to be provided along the highway alignment, especially in the alignment, toll plaza areas, rest and services areas to fit in with the surroundings for pleasing appearance, reducing headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion.

The proposal for landscaping includes the following:

- Treatment of embankment slopes as per IRC:56-1974, depending upon soil type involved;
- Turfing of slopes of high embankment for controlling rain and wind erosion;
- Planting of low height shrubs on medians for reducing glare effect and visual intrusion;
- Planting of trees along PROW as part of compensatory afforestation;

Grading of ground between the embankment toe and PROW and provision of surface drain along the PROW. This will help in physical delineation of the PROW and avoid encroachment at later date.

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CHAPTER-8

PROJECT BENEFITS

8. PROJECT BENEFITS

8.1. INTRODUCTION

Improvement of existing road from two lanes to 6/8 lane configuration will provide better, fast, safe and smooth connectivity for the commuters between the two states as well as in the region. Smooth and fast-moving traffic will cause only lower emissions thereby reducing pollution levels. Accident rates are also expected to come down substantially. Development of the proposed project road will boost the local agriculture and enable farmers to realize better value for their products as well as attract more investment to that region. The vehicle operating, and maintenance cost is expected to go down substantially. The proposed road alignment will also include general amenities like bus bays, truck lay byes, rest areas, service road at built-up locations, pedestrian and cattle underpasses, landscaping and tree plantation, traffic aid post, emergency telecom system, emergency medical aid post, street light at built ups etc. and thus overall facilities to the road users shall improve.

People will have increased access to better social and health infrastructure and other services located outside the project area. This will in turn lead to overall improvement of the quality of life of people residing in the project zone in terms of their economic, social and health status. Growth of local tourism and resultant boost to local economy is also expected due to proposed project.

8.2. ECONOMIC DEVELOPMENT

The proposed expressway project will provide better connectivity between Rajasthan & Gujarat and other areas of SW in India. This can contribute to economic development by encouraging attraction of business to site equipped with good access and by improving the travel efficiencies of the existing business and to start new avenues. This also helps in developing the following:

- Development of new industries
- Development of new educational institutions and hospitals/health centers
- Development of real estates
- Development of Infrastructure projects
- Development of IT parks.

8.3. EMPLOYMENT OPPORTUNITIES

Highway development projects require large number of local people during construction stage. The proposed construction and connecting roads requires large number of people from nearby villages during construction stage of the project. Thus, there will be increase in employment opportunity for the project area:

8.3.1. PROPERTIES LIKELY TO BE AFFECTED

Proportionate to the investment in the project, large employment opportunities will be generated because of the project implementation.

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- 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 labour) labourers. Most of the skilled labourers may come from other parts of the country; the opportunities for semi-skilled and unskilled sections of the work-force will primarily be available from the local communities.
- Apart from these temporary employment opportunities, there would be permanent employment opportunities for the local community due to the enlarged development of industries as it will stipulate more workers to cater to their increasing needs.
- It is expected that after construction there will be change in land use. There will be more commercial establishments such as shops, dhaba/ restaurants/, small workshop serving the vehicles moving along the expressway. These activities will provide additional socio-economic development and increased wages in the project area.
- Additional job opportunities may also be developed due to the development of proposed industrial and infrastructure activities along the expressway.

As discussed above, the community people will get huge job opportunities due to the development of the planned expressway, which in turn will further improve their living status and overall social paradigm of the district.

8.4. ROAD SAFETY

The construction/widening of National Highway and widening/improvement of existing NHs will ensure smooth flow of the traffic. Installation of proper road safety system through signage, barricades, and crash barriers will add to be safety to the traffic. Bus bays, lay byes, rest areas, underpasses, service roads are proposed in the project, which shall enhance the road safety.

8.5. REDUCTION IN VEHICLE OPERATING COST

Vehicle Operating Cost (VOC) will be reduced when a road is improved. Fuel consumption, wear and tear of tyre, suspension will be benefited when a geometric of the road is improved. VOC consist of the following components:

- Fuel consumption
- Lubricating oil consumption
- Spare part consumption
- Tyre consumption
- Vehicle depreciation.

8.6. ENVIRONMENT BENEFITS

The proposed widening project will ensure the smooth flow of traffic, which reduces the emissions and noise level. Apart from these, plantation will be done throughout the project road, which will increase the aesthetic of the project road. All the bus bays will be provided with proper toilet and drinking water facilities for the people who will be using the local communications. Rest areas with various facilities are proposed for the highway users.

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8.7. INDIRECT BENEFITS

In addition to the direct benefits, there are number of indirect benefit attributed to Highway project. Lowering transportation cost for users and improving access to goods and services enables new and increased economic and social activity.

The indirect benefits include changes in land use and development, changes in decision on residential area or colonies where land are less expensive or more desirable, changes in development of business to take advantage of improved speed and reliability in the transportation system. These benefits hence lead to increase property values, increased productivity, employment and economic growth.

The indirect benefit of the proposed expressway would work through the dynamic developmental externalities generated through the forward and backward linkages. A better connectivity between two states will increase the business, which will reflect in the changes in the pattern of economic activities, income generation, price evolution, and employment condition. There will be also increase in greater accessibility to market, health and educational facilities.

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CHAPTER-09

ENVIRONMENTAL MANAGEMENT PLAN

9. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1 Introduction

Environmental Management Plan (EMP) is a summary of all project impacts which suggest remedial measures for the minimal impacts on the surrounding environment. EMP contains institutional strengthening through Environmental Management plan and training in addition to presenting a well-defined Environmental Monitoring Plan that will help the National Highway Authority of India (NHAI, GoI) to move toward ecologically sound widening to 6-lane of existing 4-lane highway of NH-8.

The environmental management plan is essential a contract between the project-promoting institution and the rest of society. The permission to implement a project is given by society based on set of assurances from the project promotor. These assurances broadly refer to the following aspects.

The EMP starts by identifying the required mitigative measures at their specific contexts. These contexts are to be understood by interpreting the defined impacts upon the environment. The degree of caution and comprehensiveness required to design the given mitigative measures is indicated by magnitude of impacts.

9.2 Collaboration in Designing Mitigative Measures

The responsibility for designing the mitigative measures is delegated to the project promotor institution, which is the National Highway Authority of India (NHAI, GoI). It is essential to mobilize an appropriate expertise in design works to overcome or reduce the impacts. Therefore, NHAI will need to collaborate with other institution in the public and private sectors. For instances, through the Forest Department, NHAI is authorized to plan and implement afforestation programme. Similarly, mitigative measures related to the engineering solution should be included in the design of road and bridges by the design consultants.

9.3 Implementation of EMP

The environmental experts/officers of various agencies are identified to implement the mitigation measures for the minimal impact on environment.

- **Environmental Experts/Officers:** The role of Environmental Experts/officers of various agencies is to ensure that all works should be carried out in accordance with the environmental management plan prepared for a specific project as per the environmental legislation (Laws, Acts, and Rules etc.) and the guidelines of funding agency. It should make a part of the Tender Document for appointment of Environmental Expert for imposition of penalty to the violators, particularly contracts.
- **Civil Work Contractor:** The environmental problems and issues usually arise out from the construction sites and workers camps are to be controlled by the civil work contractor. Such type of role of civil work contractor should be clearly defined in the Tender Document.

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- **Revenue Department:** The District Collector is the head of the Revenue Department. His responsibility is to support the project through providing civil and soymam land for compensatory afforestation on one hand and disbursement of compensation to PAPs without delay and dispute on other.
- **Forest Department:** The Divisional Forest Officer (DFO) at Division and Conservator of Forest (CF) at Circle level are head of the Forest Department. Whatever, issues arise in relation to diversion of forest land and resources (tree felling etc.) to be supported for the developmental activities as per all the regulatory authorities.
- **Project Promoter:** The responsibilities of the project promoter are to verify the well managed practices, which can be smoothly followed and implemented under project. It also keeps in mind the accident-prone zones and environmental hazards. The interface of project promoter is extremely valuable for taking additional actions to the implementing and supervising agency for eco-friendly implementation of EMP.

9.4 Environment Management Plan (EMP)

The Environment Management Plan (EMP) outlines the environmental management system that will be implemented during the detailed design and construction stage of the project for minimization of deleterious effects and implementation of enhancement measures. The EMP embraces environmental management issues comprising of beneficial impacts as well as long-term adverse impacts and their remedial measures.

The highway management should implement sound Environment Management Plan (EMP), which will make environment protection an essential requirement. Prediction of the potential environmental and social impact arising due to development activities are considered as the heart of EIA process. An equally essential element of this process is to develop measure to eliminate, offset or reduce adverse impacts to acceptable levels and enhance the beneficial ones during implementation and operation of the projects. The integration of the project planning is done by clearly defining the environment requirements within an Environment Management Plan (EMP). The Management Action Plan aims at controlling pollution at the source level to the maximum possible extent with the available and affordable technology followed by treatment measures before they are discharged. Specifically, the EMP lays stress on key environmental aspects and issues of the project during operation phase by:

- Identifying potential environmental impacts;
- Recommending mitigation measures for the negative impacts;
- Identifying opportunities for enhancement measures;
- Providing an organizational framework for operating Environment Management System and other functions of the project by assigning roles and responsibilities for environmental monitoring and management;
- Formulating Environmental Action Plans (EAPs) which specify mitigation, periodic and annual monitoring activities during project implementation and operation.

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9.5 Environment Management Cell: Structure and Responsibilities

A separate environment management cell comprising of a team of experienced and qualified personnel reporting to a very senior level executive preferably an environmental engineer is proposed. He will be assisted by well-trained staffs comprising of environmental and safety specialists. Staff will be trained for environment control measures like air, water quality monitoring, solid waste management, noise abatement etc. Staff would also be trained to operate ESP and other pollution control equipment at optimum efficiency.

The Environment Management Cell will be responsible for managing the following activities related to environment function of proposed highway project:

- Coordinate and manage the EMP implementation during pre-construction, construction and operation phase
- Appoint dedicated environment staff to manage environmental monitoring responsibilities
- Manage and coordinate environmental monitoring and control
- Coordination with other sections of the plant and government agencies in relation to environmental management activities
- Implement and monitor greenbelt protection and plantation activities
- Safety specialist will ensure safe working practices in all the sections of the plant

9.6 Environmental Management Action Plan

This section describes the Environmental Management Action Plan for the proposed project during different stages of project. The Environmental mitigation measures have been incorporated at all the stages of the project right from Designing phase to Construction and Operational Phase. All care has been taken to have minimum impact on trees and ground cover, to keep impacts on people at a minimum, to keep land acquisition at a minimum, to provide maximum safety to the Highway users and to provide mitigation measures to all expected environmental degradation during design stage itself. Further to this the Management Plan has been formulated for implementation of environmental mitigation measures to be carried out by the Concessionaire and to ensure that the provisions of the EMP are strictly followed and implemented by strengthening implementation arrangements to prevent and minimize the adverse environmental impacts during Construction phase of the project. EMP has also addressed certain environmental measures to be taken to prevent further deterioration of environment components and to improve the safety of the Highway users and roadside communities during Operational Stage of the Project.

Appropriate measures have also been identified for action during various stages of the project, viz, design and pre-construction, construction and operational phases. The measures identified for all three phases, are tabulated in **Table 9.1** which describes the nature of the potential environmental impact, the measures, which have or will be taken, the timeframe in which they are taken, the implementing agency and responsible organization.

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Table 9.1: Environmental Management Action Plan

Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
A	Pre-construction Stage			
A-1	Land and Properties Loss	<ul style="list-style-type: none"> Land acquisition will be marginal. The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement framework for the project. Early identification of entitlement for compensation and planning of Resettlement and Rehabilitation Action Plan to compensate the losses. All the affected people will be compensated as per NHAI policies before commencement of Construction works. 	PIU, Revenue Department	PIU-NHAI
A-2	Preservation of Trees	<ul style="list-style-type: none"> All efforts will be made in design to save maximum trees. Compensatory Plantation to be carried out as per Forest (Conservation) Act and Forest Rules of State Government. The owners of the trees will be adequately compensated as per Resettlement and Rehabilitation Action Plan. Apart from Compensatory Plantation green belt shall be developed all along the design alignment section. 	PIU, Revenue Department	IC, PIU-NHAI
A-3	Location of crushers, hot-mix plants, WMM Plant, Concrete batching Plants etc.	<ul style="list-style-type: none"> Stone Crushers: WMM Plants and Concrete batching plants will be sited sufficiently away from settlement, agricultural operations and any commercial establishments. Such plants will be located at least 500m away from the nearest village/ settlement preferably in the predominant down-wind side. Mobile equipment can be placed within 50 m from the nearest dwelling. The Concessionaire shall submit a detailed layout plan for all such sites and approval of the Environmental Expert of Independent Consultant (IC) shall be necessary prior to their establishment. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> Arrangement to control dust pollution through provision of wind screens, sprinklers and dust encapsulation will have to be provided at all such sites especially for crushers. Use of buildings and equipment within the plant site as wind barriers may be considered. Specifications of crushes and hot mix plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the Environmental Expert of Independent Consultant (IC). The Concessionaire shall not initiate plant operation till the required legal clearance are obtained and submitted. 		
A-4	Other construction vehicles, equipment and machinery	<ul style="list-style-type: none"> All vehicles, equipment and machinery to be procured and brought to site for construction will confirm to the relevant Bureau of India Standard (BIS) norms and the manufacture's specifications. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipment such as compactors, rollers, front loaders concrete mixes, cranes (Movable), vibrators and saws will not exceed the value specification the Environment (protection) Rules, 1986. The equipment proposed to be used for bridge and culvert construction and must be checked and certified fit, especially with respect to the potential leakage of oil and grease. The inspection should verify that: <ul style="list-style-type: none"> ✓ Equipment is clean (free of mud, dirt and oil) ✓ Equipment is in good working order ✓ A drip plan is available for equipment that will be stored on site. ✓ Concessionaire has a spill kit ✓ Operator is trained on the refueling, maintenance and emergency spill. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> ✓ A logbook will be maintained documenting all fueling and maintenance events (date, time, location, condition of site, weather conditions, amount of fuel on maintenance event, issues). ✓ Adequate inspections will be conducted during the construction period. 		
A-5	Borrow Areas	<ul style="list-style-type: none"> • Finalizing borrows areas and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the Concessionaire. • The Concessionaire will not start borrowing earth from selected borrow area until the formal agreement is signed between the land owner and the Concessionaire and a copy is submitted to the IC and PIU. • Locations finalized by the Concessionaire shall be reported to the Environmental Expert of IC and who will in turn report to PIU. • In addition to testing for the quality of borrow materials by the IC, the environmental experts of the IC will be required to inspect every borrow area location prior to approval. 	Concessionaire /Contractor	IC, PIU-NHAI
A-6	Quarry Areas	<ul style="list-style-type: none"> • The quarry materials requirement of this project may be taken from the existing approved quarries along the project highways. • District administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the PIU and Environment Expert of IC. 	Concessionaire /Contractor	IC, PIU-NHAI
A-7	Arrangement for construction water	<ul style="list-style-type: none"> • The Concessionaire will use ground water/surface water as a source of water for the construction after taking prior permission from the Competent Authority. • The Concessionaire will provide a list of locations and type of sources from where water for construction will be used. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> To avoid disruption/disturbance to other water users, the Concessionaire will extract water from fixed locations and consult the Environment Expert before finalizing the locations. The Concessionaire will not be allowed to pump water from any irrigation canal and surface water bodies used by the community. The Concessionaire is required to comply with the requirements of the State Ground Water Department and seek its approval for doing so and submit copies of the permission to Environment Expert of IC & PIU. 		
A-8	Site identification for disposal of unsuitable materials	<ul style="list-style-type: none"> The Concessionaire shall identify site away from the project area where unsuitable materials (debris, solid waste) generated while the construction can be safely disposed-off. Such locations shall be inspected by the Environment Expert of Independent Consultant and approved in consultation with the PIU before construction work starts. 	Concessionaire /Contractor	IC, PIU-NHAI
A-9	Construction camp location, design and layout	<p>Sitting of the construction camps will be as per the guidelines below:</p> <ul style="list-style-type: none"> Locations of construction camp to be identified by the Concessionaire. Construction camp will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials will be identified at least 1000 m from water sources. The waste disposal and sewage system for the camp will be designed, built and operated such that no odour is generated. Unless otherwise arranged by the local sanitary authority, arrangements for night soils (human excreta) disposal approved by the local medical health or municipal authorities or as directed by Environmental Expert will have to be provided by the Concessionaire. 	Concessionaire /Contractor	IC, PIU-NHAI
A-10	Arrangements for temporary land	<ul style="list-style-type: none"> The Concessionaire as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for workers camp, construction sites/hot mix plants/traffic detours etc. The Environment Expert will ensure that the clearing up of the 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		site prior to handing over to the owner (after construction or completion of the activity) is duly carried out by the Concessionaire.		
A-11	Bore-well and hand-pumps	<ul style="list-style-type: none"> The owners of hand pumps and bore-wells will be compensated as per Resettlement Action Plan. The bore-wells and hand pumps will be relocated as per consultation of the owners if required Relocation of all affected bore-wells, handpumps in advance prior to start of construction The borehole/wells beyond formation width will be retained for utilizing them as ground water recharging well with proper safety arrangements. 	PIU, Revenue Department	PIU-NHAI
A-12	Severance Problem	<ul style="list-style-type: none"> Underpasses has been provided for crossing the highway for pedestrians, local traffic and cattle to avoid severance problem. 	Concessionaire /Contractor	IC, PIU-NHAI
B	Construction Phase			
B-1	Clearing & Grubbing	<ul style="list-style-type: none"> Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. The Concessionaire, under any circumstances will not cut or damage trees. Trees identified under the project will be cut only after receiving permission from the State Forest Department. Vegetation only with girth of over 30 cm measured at a height of 1.0 m above the ground will be considered as trees and shall be compensated. 	Concessionaire /Contractor	IC, PIU-NHAI
B-2	Generation of debris from dismantling	Debris generated due to the dismantling of the side of existing road for pavement rehabilitation will be suitably reused in the proposed construction, subject to the suitability of the materials and approval of the Engineer and Environment Expert as follows:	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
	structures and road surface	<ul style="list-style-type: none"> The existing base and sub-base material shall be recycled as sub-base for the haul road or access roads. The Concessionaire will suitably disposed-off unutilized debris materials at pre-designated disposal locations, subject to the approval of the Environment Expert. The Concessionaire will ensure that the surface area of such disposal pits is covered with a layer of soil. All arrangements for transportation during construction including provisions, maintenance, dismantling and clearing debris, will be planned and implemented by the Concessionaire as approved and directed by the Environment Expert. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by the Concessionaire in consultation with the Environment Expert and Engineer of the IC. 		
B-3	Disposal other construction waste	<ul style="list-style-type: none"> The Environmental Expert will approve these disposal sites after conducting a joint inspection on the site with the Concessionaire. Non-bituminous wastes may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil No new disposal site shall be created as part of the project, except with prior approval of the Environment Expert before handling over. All waste materials will be completely disposed of and the site will be fully cleaned and certified by Environment Expert before handling over. 	Concessionaire /Contractor	IC, PIU-NHAI
B-4	Stripping stocking and presentation of top soil	<ul style="list-style-type: none"> Stockpiles will not be surcharged, or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> It will be ensured by the Concessionaire that the topsoil will not be unnecessary trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for- <ul style="list-style-type: none"> ✓ Covering all disturbed areas including borrow areas ✓ Top dressing of the road embankment and fill slopes ✓ In the agricultural fields of farmers, acquired temporary. Residual topsoil, if there is any will be utilized for the plantation. 		
B-5	Accessibility	<ul style="list-style-type: none"> The Concessionaire will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property access as connecting the project road. The Concessionaire will also ensure that the existing accesses are not blocked without providing adequate provisions and to the prior satisfaction of Environmental Expert. The Concessionaire will take care that the cross roads are constructed in such a sequence so that traffic movement on any given area does not get affected. 	Concessionaire /Contractor	IC, PIU-NHAI
B-6	Planning for Traffic diversion	<ul style="list-style-type: none"> The Concessionaire will provide specific measure for safety of pedestrians and workers at night as a part of traffic control plans. The Concessionaire will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The Concessionaire will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from IC and PIU. 	Concessionaire /Contractor	IC, PIU-NHAI
B-7	Earth from Borrow Areas for Construction	<ul style="list-style-type: none"> No borrow area will be opened without permission of the Environment Expert. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of IC and in accordance to the IRC recommended borrow pits for road embankments. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		The borrowings operations will be carried out as specified in the guidelines for setting an operation of borrow areas.		
B-8	Quarry Operation	<ul style="list-style-type: none"> The Concessionaire will develop a Comprehensive Quarry Redevelopment Plan as per the Mining Rules of Uttar Pradesh and submit a copy to PIU and IC prior to opening of the quarry site. The quarry operations will be undertaken within the rules and regulations in force. 	Concessionaire /Contractor	IC, PIU-NHAI
B-9	Construction water	<ul style="list-style-type: none"> The Concessionaire will arrange adequate supply and storage of water for the whole construction period at his own costs. The Concessionaire will submit a list of sources from where water will be used for the project to IC and PIU. The Concessionaire will source the requirement of water preferentially from ground water but with prior permission from the competent authority/authorities, if required. A copy of the permission will be submitted to IC and PIU prior to initiation of construction. The Concessionaire will take all precaution to minimize the wastage of water in the construction process/operation. 	Concessionaire /Contractor	IC, PIU-NHAI
B-10	Drainage & Flood Control	<ul style="list-style-type: none"> The Concessionaire will ensure that construction materials like earth, stone are disposed-off so that it does not block the flow of water of any watercourse and cross drainage channels. The Concessionaire will take all necessary measures to prevent the blockage of water flow. In addition to the design requirements, the Concessionaire will take all required measures as directed by the Environmental Expert of IC to prevent temporary or permanent flooding of the site or any adjacent area, if any. 	Concessionaire /Contractor	IC, PIU-NHAI
B-11	Slope Protection and Control of Soil Erosion	<ul style="list-style-type: none"> The Concessionaire will take slope protection measures as per design, or as directed by the Environmental Expert of IC to control soil erosion and sedimentation through use of dyke's sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> All temporary sedimentation, pollution control works, and maintenance thereof will be deemed as incident to the earth work or other items of work and as such no separate payment will be made for them. The Concessionaire will ensure the following safeguards: <ul style="list-style-type: none"> ✓ During construction activities on road embankment, the side slopes of all cut and fill area will be graded and covered with stone pitching, grass and shrub as per design specifications. ✓ Turfing works will be taken up as soon as possible, provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching, netting and seeding of batters and drains immediately on completion of earthworks. ✓ In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. 		
B-12	Water pollution from construction wastes	<ul style="list-style-type: none"> The Concessionaire will take all precautionary measures to prevent the waste-water generated during construction from entering into canals, water bodies or the irrigation system and avoid construction works close to canals or water bodies during monsoon. All waste arising from the project is to be disposed-off in the manner that is acceptable to the State Pollution Control Board or as directed by Environmental Expert. Run-off from wasted concrete may be alkaline and thus pH reduction may be needed. The Environmental Expert will certify that all liquid wastes disposed-off from the sites meet the discharge standards. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
B-13	Water pollution from fuel and lubricants	<ul style="list-style-type: none"> The Concessionaire will ensure that all construction vehicle parking locations, fuels/lubricants storage sites, vehicles, machinery and equipment maintenance sites are located at least 100 m away from any water body. The Concessionaire will also ensure that spillage of fuels and lubricants do not contaminate the ground. If fuel storage and refueling areas are located on agricultural land or areas supporting vegetation, the topsoil will be stripped, stockpiled and returned after cessation of such activities. All location and layout plans of such sites will be submitted by the Concessionaire prior to their establishment and will be approved by the Environment Expert and PIU. The Concessionaire will arrange for collection and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to IC and PIU) and approved by the Environment Expert. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC and State Pollution Control Board guidelines. 	Concessionaire /Contractor	IC, PIU-NHAI
B-14	Dust Pollution	<ul style="list-style-type: none"> The Concessionaire will take precautions viz water sprinkling etc. to reduce the level of dust generating from construction site. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The Concessionaire will provide necessary certificates to confirm that all crushers used in construction confirm to relevant dust emission control legislation. Crushers licensed by the State Pollution Control Committee of Board shall be used for the project. Fly ash shall be used as per IRC-SP-58 guidelines. On daily basis it will be ensured that all dumpers carrying fly ash are fully covered by tarpaulin. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> Water sprinkling during loading and unloading of fly ash shall be periodically. Storage of fly ash within enclosures shall be done and regular water sprinkling will be ensured over the stack. 		
B-15	Emission from construction vehicles, equipment & machineries	<ul style="list-style-type: none"> The Concessionaire will ensure that all vehicles, equipment and machineries used for construction are regularly maintained and confirm the pollution emission levels comply with the relevant requirements of State Pollution Control Committee. The Concessionaire will submit PUC certificates for all vehicles /equipment/machinery used for the project and maintain a record of the same during the contract period. Monitoring results will also be submitted to IC and PIU as per monitoring plan. 	Concessionaire /Contractor	IC, PIU-NHAI
B-16	Noise from vehicles, equipment and machineries	<ul style="list-style-type: none"> The Concessionaire will confirm the following: <ul style="list-style-type: none"> ✓ Servicing of all construction vehicles and machinery will be done for exhaust silencers and will be checked and if found defective will be replaced. ✓ All construction sites within 150 m of the nearest habitation, noisy construction work such as crushing; concrete mixing will be stopped during the night time between 10.00 pm to 6.00 am. ✓ No noisy construction activities will be permitted around educational institutions/health centers (silence zones) up to 100 m from the sensitive receptors. ✓ Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to IC and PIU. ✓ Environmental Expert will be required to inspect regularly to ensure the compliance of EMP. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
B-17	Personal Safety measures for labour	<ul style="list-style-type: none"> The Concessionaire will provide: <ul style="list-style-type: none"> ✓ Protective footwear and protective goggles to all workers employed on asphalt materials, cement, concrete etc. ✓ Protective goggles and clothing to workers engaged in store breaking activities. ✓ Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. ✓ Adequate safety measures for workers during handling of materials at site. The Concessionaire will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO). The Concessionaire will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. They will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint is rubbed and scraped. The Concessionaire will mark 'no smoking' in high risk areas and enforce noncompliance of use of PPE with zero tolerance. These will be reflected in the construction Safety Plan to be prepared by the Concessionaire during mobilization and will be approved by IC and PIU. 	Concessionaire /Contractor	IC, PIU-NHAI
B-18	Traffic & Road Safety	<ul style="list-style-type: none"> The Concessionaire will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert of IC for the information and protection of traffic approaching or passing through the section of any existing cross roads. The Concessionaire will ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications or as directed by the Engineer., a Traffic Management Plan 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		will be devised and implemented to the satisfaction of the Concessionaire's vehicle drivers must be strictly controlled particularly when plying on local/village roads.		
B-19	Risk from electrical equipments	<ul style="list-style-type: none"> The Concessionaire will take all required precautions to prevent danger from electrical equipment and ensure that- <ul style="list-style-type: none"> ✓ No material will be stacked or placed as to cause danger or inconvenience to any person or the public. ✓ All necessary fencing and lights is provided to protect the public in construction zones. All machines to be used in the construction will confirm to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environment Expert. 	Concessionaire /Contractor	IC, PIU-NHAI
B-20	First aid	The Concessionaire will arrange for- <ul style="list-style-type: none"> An available first aid unit including adequate supply of sterilized dressing materials and appliances as per the factories Rules in every work zone. Availability of suitable transport always to take injured or sick person(s) to the nearest hospital. Equipment and trained nursing staff at construction camp. 	Concessionaire /Contractor	IC, PIU-NHAI
B-21	Informatory Signs and Hoardings	<ul style="list-style-type: none"> The Concessionaire will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environment Expert of IC. 	Concessionaire /Contractor	IC, PIU-NHAI
B-22	Road side Plantation Strategy	<ul style="list-style-type: none"> The Concessionaire will carry out the plantation as per the Green Belt Development Plan prepared for the project as per IRC-SP: 21: 2009. 5 times the number of trees to be felled would be planted, in the form of strip and block plantations depending on the availability of land. Plans for compensatory plantation will be 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<p>drawn up in consultation with the State Forest Department. Minimum 75 percent survival rate of the saplings will be acceptable otherwise the contractor will replace all casualties at his own cost to ensure this survival percentage. The contractor will maintain the plantation till they handover the project site</p> <ul style="list-style-type: none"> The Environment Expert of IC will inspect regularly the survival rate of the plants and compliances with regards to tree plantation guidelines. 		
B-23	Accommodation for labour camps	<ul style="list-style-type: none"> The Concessionaire will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility provision of each labour camp will be submitted to IC and PIU prior to their construction. The construction will commence only after written approval of the Environment Expert. The Concessionaire will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the IC. 	Concessionaire /Contractor	IC, PIU- NHAI
B-24	Water Demand and supply	<ul style="list-style-type: none"> The Concessionaire will provide potable water facilities within the precincts of every work-place in an accessible place. The Concessionaire will also guarantee the following: <ul style="list-style-type: none"> ✓ Supply of sufficient quantity of potable water (as per IS) in every workplace/labour camp at suitable and easily accessible places and regular maintenance of such facilities. ✓ If any water storage tank is provided, the bottom of the tank will be kept at least 1 m above from the surrounding ground level. 	Concessionaire /Contractor	IC, PIU- NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
		<ul style="list-style-type: none"> ✓ If water is drawn from any existing well, which is within 30 m proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking. ✓ A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. ✓ Environmental Expert will be required to inspect the labour camp once in a week to ensure the compliance of the EMP. 		
B-25	Sanitation and Sewage system	<p>The Concessionaire will ensure that-</p> <ul style="list-style-type: none"> • The sewage system for the camp will be designed, built and operated in such a fashion that it should not pollute the ground water or nearby surface water. • Separate toilets/bathrooms, will be arranged for men and women • Adequate water supply is to be provided in all toilets and urinals • All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition • Night soil (human excreta) is to be disposed by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15cm, layer of waste or refuse and then covered with a layer of earth for a fortnight. 	Concessionaire /Contractor	IC, PIU-NHAI
B-26	Waste disposal	<ul style="list-style-type: none"> • The Concessionaire will provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposed-off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of IC. • Unless otherwise arranged by local municipal authority, arrangements for disposal of night soils (human excreta) suitably approved by the local municipal authority or as directed by Environment Expert, will be arranged by the Concessionaire. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
B-27	Pollution Monitoring	<ul style="list-style-type: none"> The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in environmental monitoring plan will be the responsibility of Concessionaire. PIU will appoint MOEF/SPCB approved pollution monitoring agency/ laboratory for this purpose. 	Concessionaire /Contractor	IC, PIU-NHAI
C	Operation Phase			
C-1	Monitoring Operation Performance	<ul style="list-style-type: none"> The PIU will monitor the operational performance of the various mitigation/enhancement measures carried out as a part of the project. The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision for relocated utilities, hand pumps and other relocated structures if any; status of rehabilitation of borrow areas; and noise barriers, which are proposed at different locations. 	Concessionaire /Contractor	IC, PIU-NHAI
C-2	Maintenance of Drainage	<ul style="list-style-type: none"> PIU will ensure that all drains (side drains, cross drains etc.) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months. 	Concessionaire /Contractor	IC, PIU-NHAI
C-3	Pollution Monitoring	<ul style="list-style-type: none"> The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in environmental monitoring plan will be the responsibility of Concessionaire. 	Concessionaire /Contractor, Pollution Monitoring Agency	IC, PIU-NHAI
C-4	Monitoring of survival rate of	<ul style="list-style-type: none"> Every year there will be monitoring for the survival rate of plantation in the PROW for the first five years before on set of monsoons. A minimum survival of 85% will be maintained. Any loss will be made up by fresh plantation. 	Concessionaire /Contractor	IC, PIU-NHAI

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Sl. No.	Environment Issues & Impacts	Mitigation Measures	Planning and Execution	Supervision
	plantation in the PROW			
C-5	Changes in Land-use pattern	<ul style="list-style-type: none"> NHAI/PIU shall take initiative and act as facilitator to prepare an action plan for balanced regional development in consultation with local development authority and State Government to control the ribbon development along the project road. A land use regulation control need to be adopted. A land use – zoning map may be developed, under which up to a distance from the PROW of the alignment no development will be allowed. Necessary hoardings will be erected indicating the availability of PROW and legal charges for encroachment of PROW. Budgetary provisions are to be made to control the ribbon development along project road. Safety of public and road users shall be maintained through traffic control and management throughout the operation period. Trauma centers for treatment of accident victims should be established at regular intervals and operated to the full satisfaction of PIU. 	Concessionaire /Contractor	IC, PIU- NHAI
C-6	Corporate Social Responsibility (CSR)	<p>As part of CSR, the following provisions are suggested:</p> <ul style="list-style-type: none"> Undertaking regular road safety, HIV/AIDs, health awareness campaigns Assistance to improve skills for income generation to community people Development of schools, health cares, dispensaries or public facilities Workshops/Training to farmers to impart the knowledge to use modern methods and tools for farming To ensure that the contractors provides all necessary amenities and facilities for the workers at construction camps/work sites and no employment of child labour is practiced at site 	NHAI	NHAI

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9.7 Organizational Details

Table 9.2: Environmental Management Action Plan

Designation	Designated Persons
Vice President	Mr Sanjay Shrivastava
Project Manager	Mr Jitendra Chaturvedi
Dy. Manager (QA/QC)	Mr. Ravi Kant Pandey
Dy. Manager (Structure)	Mr. Jitendra Behra.
Asst. Manager (Structure)	Mr. Sant Vir Singh
Sr. Engineer (Highway)	Mr. Hargovind Singh
Assistant Engineer (Highway)	Mr. Hemant Tiwari
Sr. Engineer (Structure)	Mr. Amit kumar Aman
Sr. Engineer (Structure)	Mr. Sandeep kumar
Lab Technician	Mr. Aditya Bajpai.
Computer Operator	-
Office Assistant	-
Safety Officer	Mr. Vineet Mishra
Account Manager	Mr. Kishor Dhakad
HR Manager	Mr. Sumeet Sharma.
Sr. Engineer (Planning & Billing)	Mr. Shashi Kumar

Table 9.3: Organization Chart

Employment	Required	Deployed
Project Head	1	1
Project Manager (Highway)	1	0
Project Manager (Bridge)	1	0
Dy. Project Manager (Highway)	1	1
Dy. Project Manager (Bridge)	1	1
Sr. Engineer (Highway)	5	5
Sr. Engineer (Bridge)	3	3
Supervisors/Jr. Engineer (Highway)	10	10
Supervisors/Jr. Engineer (Bridge)	10	4
Survey Engineer (Highway & Bridge)	5	2
Survey Assistants (Highway & Bridge)	20	10
Safety Engineer (Highway & Bridge)	3	0
Manager QA/QC.	1	1
Sr. Material Engineer	2	0
Sr. Lab Technician	10	2
Lab Technicians	10	3
Sr. Manager Planning & Billing.	1	0
Asst. Manager Planning & Billing.	3	0
Store Manager & Staff	15	2

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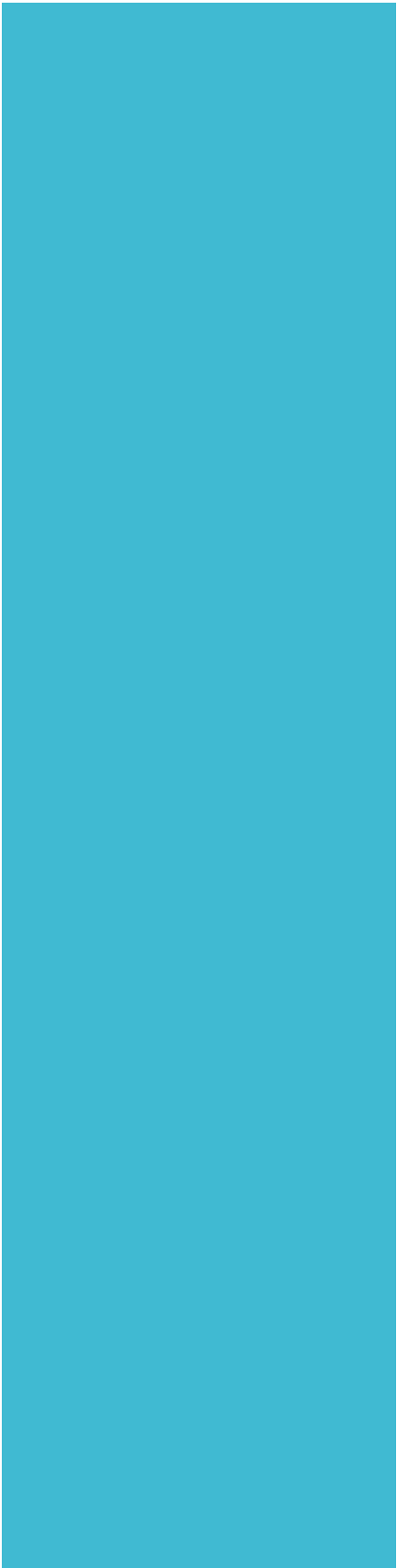
Employment	Required	Deployed
Purchase Manager	2	0
Accounts Manager & Staff	3	1
HR Manager & Staff	5	1
Liason Head & Land Acquisition & Staff	3	1
DGM (Plant & Machinery)	1	0
Plant Managers	5	0
Plant Operators & Staff	40	10
Mechanical Staff	25	5
Auto CAD Operator	3	0
Computer Operators	2	0
Support Staff	50	6
Total	242	69

9.8 Conclusion

Afforestation should commence with the start of the project. The entire available land should be covered with trees under the afforestation programme. If the land is not sufficient on the project routes, separate proposal for afforestation should be planned for the plantation of tree away the project site, where land is available to recover greenery loss. Green belt development plan is formulated as part of road up-gradation project. As part of greenbelt development, plantation should be made in entire open space on the both side of the road and central verge to enhance floral cover and scenic beauty as well as sink of air pollution and act as noise barrier. Plantation may be carried out around the water bodies or along river front.

The loss of forest due to felling of trees in the process of widening shall be compensated as a part of afforestation programme. It is proposed to develop greenbelt around the perimeter of various project appurtenances, selected locations such as along water reservoir periphery, bus stops, truck lay bye, along the sensitive receptors near institutions, hospital etc. The plantation will act as sound barriers also.

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CHAPTER-10

SUMMARY & CONCLUSION

10. SUMMARY & CONCLUSION

10.1. PROJECT BACKGROUND

The National Highways Authority of India (NHAI) has been entrusted with the development, maintenance and management of such of the highways as entrusted to it by the Government. Under National Highway Development Programme (NHDP), Phase-V, the Government has decided to convert some of the existing four lane highways into six lane highways. These projects are to be executed by private entrepreneurs as Design, Build, Finance and Operate (DBFO) projects. The Louis Berger has been appointed as consultant for carrying out feasibility study for upgrading the existing 4-lane highway to 6-lane partially access control highway from Kishangarh to Udaipur section of NH-79A, NH-79 and NH-76 including Udaipur bypass (As a separate study) and CES has been appointed as consultant for carrying out feasibility study for upgrading the existing 4-lane highway to 6-lane partially access control highway from Udaipur to Ahmedabad section of NH-76.

The proposed project (Package-6) starts from Rajasthan/Gujarat Border (Km 401.200 of NH 8/design chainage 447.385) and ends near Ahmedabad (Km 494.400 of NH-8/design chainage 540.595). The road passes through the Aravali, Sabarkantha, Gandhinagar and Ahmedabad District of Gujarat. The existing road is part of NH-8. The land-use pattern of the project area is mainly agriculture land, settlements, industrial and commercial areas including hilly terrain at some locations along the project road.

10.2. PROJECT DESCRIPTION

The Scope of Project is as below: -

- Construction of the Project on the Site set forth in Schedule-A and as specified in Schedule-B together with provision of Project Facilities as specified in Schedule-C, and in conformity with the Specifications and Standards set forth in Schedule-D of CA.
- Operation and Maintenance of the Project in accordance with the provisions of CA; and Performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all the obligations of the Concessionaire under the CA; Proposed project will be developed on a total land area 15,01,460 m² (150.146 Ha) out of which only 9,63,110 m² (96.311 Ha) will be planned area for the said scheme 169A of IDA. Balance area 5,88,350 m² (53.835 Ha) has been transferred to Govt.

Table 10.1: Broad Scope of the Work

Sl. No.	Particular	Unit	As per CA (Schedule B)
1.	New Service Roads	Km	117.060
2.	At Grade Junctions	Nos.	30
3.	Minor Junctions (on Service Road)	Nos.	80
4.	Grade Separated structures (Flyovers)	Nos.	9
5.	Vehicular Underpasses	Nos.	8

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Sl. No.	Particular	Unit	As per CA (Schedule B)
6.	Light Vehicular Underpasses	Nos.	12
7.	Cattle Underpass	Nos.	1
8.	Pedestrian Underpasses	Nos.	34
9.	Minor Bridges New/Reconstructed	Nos.	9
10.	New Minor bridges on Service Road	Nos.	9
11.	Minor bridges to be widened	Nos.	2
12.	Slab/box culverts to be widened	Nos.	20.00
13.	Slab/box culverts to be reconstructed	Nos.	2.00
14.	Pipe culverts to be widened	nos.	101
15.	Pipe culverts to be widened over irrigation canal	nos.	7
16.	New Rail Over Bridge (ROBs)	m	3

10.3. DESCRIPTION OF THE ENVIRONMENT

Baseline data generation forms a part of the environment impact assessment study, which helps to Evaluate the predicted impacts on the various environmental attributes and helps in preparing an Environmental management plan (emp) outlining the measures for improving the environmental Quality and scope of future expansions for environmentally sustainable development.

Baseline data was generated for various environmental parameters including air, water (surface and groundwater), land and soil, ecology and socio-economic status to determine quality of the prevailing environmental settings. Sampling of soil and water, monitoring of air quality and noise level and other field data collection were carried out by the team operating from this field station. The field team consisted of technical personnel viz. environmental scientists and social experts along with the field staff. The baseline study period was November 2018.

10.3.1. METEOROLOGICAL CONDITION

Post-Monsoon Season starts from middle of November to end of February. March to May constitute summer season and the monsoon season starts from second week of June to end of September.

Rainfall: The total average annual rainfall was found to be 740.6 mm of which average 7.0 mm rainfall during the winter period, 13.4 mm for summer period, 706.8 mm for monsoon period and 17.4 mm for post monsoon period in a year.

Temperature: The area showed moderate temperature through the all seasons, with the maximum average temperature recorded at 41.6°C in the month of May and the minimum average temperature of 12.1°C in January.

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Relative Humidity: The Relative Humidity was maximum during the monsoon season with the month of August recording the highest average at 87%.

Wind Speed and Direction: The maximum wind speed was found to be 11.8 kmph in the month of June and minimum wind speed was found to be 4.8 kmph in the month of October & November. The predominant wind direction at the IMD station was from NE followed by SW and W.

10.3.2. AIR ENVIRONMENT

Five Ambient Air Quality Monitoring (AAQM) Stations were selected. Criteria used for designing the network were principally governed by the wind rose pattern & coverage factor calculation of windblown for Post-Monsoon Season and the accessibility of the selected sites. Attempts were made to locate most of the AAQ stations in predominant downwind direction with respect to the project site. Logistic considerations such as accessibility, security, and availability of reliable power supply etc. were also examined while finalizing the stations.

The monitoring has been carried out at a frequency of two samples per week at each of Eight locations, adopting a continuous 24-hour continuous schedule for Particulate Matter, Sulphur Dioxide and Nitrogen Dioxide except CO for one hour.

Table 10.2: Baseline Interpretation

S. No.	Parameters	Baseline Status
1.	Particulate Matter (PM ₁₀ & PM _{2.5})	The particulate matters size not greater than 10 µm in diameter is collectively referred to as PM ₁₀ . Due to their small sizes, PM ₁₀ can be inhaled readily and can penetrate deep into the human body. In study area particulate matter 10 varying from 134.8 µg/m ³ to 156.2 µg/m ³ . PM _{2.5} was observed 55.2 µg/m ³ to 61.8 µg/m ³ . Overall particulate matter was observed near to standards or exceeding from the standards because of the road construction activities as going on for road development which normal & will reduce long time air pollutants as the work will be complete.
2.	Gaseous Pollutants (SO ₂ , NO _x & CO)	The source of SO ₂ in the study area is mainly from burning fuels containing sulphur or emissions from biomass depending on the sulphur content in the material. Other anthropogenic sources are high vehicular moment. The primary sources of NO ₂ in the study area are motor vehicles, electric utilities and residential sources that burn fuels. SO ₂ was varying from 12.4 µg/m ³ to 14.6 µg/m ³ & NO _x was observed 17.5 µg/m ³ to 20.0 µg/m ³ in study area. CO was observed from 1.24 mg/m ³ to 1.46 mg/m ³ in study area. All the parameters are complying to the standards as defined by CPCB.

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10.3.3. LAND-USE

In Study Area, majority of the land in the study area is agriculture land i.e. 52.3%, Fallow Land 19.6 %, Waste land 12.2%, Open scrub 5.5 %, Forest 3.6 %, Built-up 3.0%, Sandy Area 3.0 % & Water body 1.3%.

10.3.4. SOIL ENVIRONMENT

To assess the baseline status of soil quality in the study area for tree plantation, filtration/percolation of water, ground water scenario etc. total 3 soil samples were collected. The samples were collected by ramming an augur into the soil up to 30-cm depth. The sealed samples were sent to laboratory for analysis. Soil samples were analyzed as per the standard methods prescribed in “Soil Chemical Analysis” (M.L. Jackson, 1967).

The samples were analysed as per the standard methods prescribed in Department of Agriculture & Cooperation Ministry of Agriculture, Government of India” & IS 2720. The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and organic matter, kjehldal Nitrogen, Phosphorous and Potassium.

The soil was Sandy Loam to Sandy Clay Loam in the study area. The pH was ranges 7.42 to 8.01 which was slightly alkaline to moderately alkaline as per ICAR guideline. The conductivity was varying from 369.2 μ mhos/cm to 615.2 μ mhos/cm in the study area which is meeting to average soil quality. The organic carbon of the study area was less to sufficient in term of fertility. Overall the soil quality was good having the good bulk density, porosity and infiltration rate. The land was good in term of fertility for leguminous plants.

10.3.5. WATER ENVIRONMENT**SURFACE WATER QUALITY**

As seen from the analysis data, physical parameters were analyzed as turbidity, pH, TDS, Na and K. The turbidity was observed very good in both ponds & rivers/nallahs. The chemical parameters were analyzed for Alkalinity, Total Hardness, Calcium, Magnesium, Chloride, Bicarbonate, Sulphate, Nitrate, Fluoride, DO and COD were analyzed. Dissolved oxygen & BOD were observed accorded to Class B & E as per CPCB water quality criteria. The heavy metals were also analyzed in the surface water. Only iron & zinc were detected. Other parameters were below to the detection limits. Total coliform was meeting to the Class C of water quality criteria as defined by CPCB.

GROUND WATER QUALITY

The physical parameters were meeting to the acceptable limits of drinking water as TDS was varying from 591 mg/l to 712 mg/l. Parameters as pH, Na, K are also complying to acceptable limit of drinking water standard 10500:2012. The chemical parameters were analyzed as alkalinity, calcium, hardness, chloride, Sulphate, fluoride and nitrate etc. all the parameters were meeting to the permissible limits of drinking water standards IS 10500:2012 at all locations. The heavy metals were also analyzed, only

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metals were detected as iron & zinc which was meeting to the acceptable limits of drinking water standard 10500:2012 and other metals were below to the detection limits of laboratory.

10.3.6. NOISE ENVIRONMENT

At each location, noise monitoring has been carried out once during study period over a period of 24 hours to obtain Leq values at uniform time intervals of 1 hour. In each hourly time interval Leq values have been computed from SPL readings taken at uniform time intervals of 10 minutes. For each location, day and night time Leq values have then been computed from the hourly Leq values such that comparison could be made with the national ambient noise standards. Day time Leq was computed from the hourly Leq values between 6.00AM - 10.00PM and night time Leq from the hourly Leq values between 10.00PM- 6.00AM.

The Sound Pressure Level recorded during the daytime on all locations varies from 52.0 dB(A) to 56.3 dB(A) and during night-time varying from 33.3 dB(A) to 36.3 dB(A). The noise level was found well within prescribed standards due to absence of any major noise generating activities in the area.

10.4. IMPACT ASSESSMENT

10.4.1. AIR IMPACT

Air emissions have no boundaries and can migrate from area to area depending upon the wind direction and speed. The sources of air emission can be grouped into three categories of point, area and line sources:

- A Point source is a single source of emission with an identified location, such as an industry;
- An Area source is when the sources of emission are many widely distributed point sources having relatively comparable significance; and
- A line source is when the sources of emissions from a number of fixed or moving facilities have relatively comparable significance, such as roads.

During the construction phase, dust emissions in unpopulated areas will be emitted and deposited on the leaves of trees and other vegetation which may affect the growth of the trees and other vegetation. Certain amount of dust and gaseous emissions will generate during the construction phase from excavation machine and road construction machines. Pollutants of primary concern include particulate matters i.e. PM10 and PM2.5. However, suspended dust particles matter may be coarse and will be settled within a short distance of construction area. Therefore, impact will be temporary and restricted within the closed vicinity of the construction activities only.

Gaseous emissions include carbon monoxide (CO), unburned hydrocarbons, sulfur dioxide (SO₂), nitrogen oxides (NO_x), VOLATILE ORGANIC COMPOUNDS (VOCs) etc. from DG set/vehicles involved in transportation of materials during road construction.

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10.4.2. NOISE IMPACT

Movement of heavy vehicles, stone crushing, and aggregate mixing activities generates high noise and would increase the ambient noise level in the surrounding. The behavior of truck drivers also plays a role in increasing the noise level by the injudicious frequent use of blow horns. Especially in the settlement area this can pose a problem. Workers working near the noise generating equipment and plants are likely to be exposed to high noise level. The acceptable limits (for 8-hour duration) of the equivalent noise level exposure during one shift is 90 dB(A). hence, noise generated due to various activities in the construction camps may affect health of the workers if they are continuously exposed to high noise level. For reasons of occupational safety, exposure to impulses or impact noise should not exceed 140 dB(A) (peak acoustic pressure).

10.4.3. WATER IMPACT

In the project, construction of bridges is proposed to across this canal. Bridge constructions require foundation works in the canal bed which includes excavation, drilling and piling works. Minor disturbance of the water flow may likely to occur due to piling and drilling works inside the canal bed for establishing bridge foundations. However, these are standard practices for bridge construction works.

Bridge foundation works may result into generation of some quantity of debris materials due to excavation and drilling works. These wastes may cause temporary increase in turbidity and thereby contaminating the water, but such situation will occur only for short duration. 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.

In the project area sufficient numbers of surface water sources are available which can cater to the water demand for construction purpose. Surface water as well as ground water will be used for construction period as availability of sources. Therefore, no impact on water table is anticipated due to the proposed project.

10.4.4. ECOLOGY

The construction of proposed road can have a substantial impact on the degradation and loss of natural ecosystems, especially in less developed areas. Although the actual areas converted to highways may cover only a small proportion of the region, but the fragmentation of habitats caused by highway development is often severe. The scale of both the habitat conversion and habitat fragmentation effects caused by highway development varies with the size of the project. The impacts of projects also vary according to the environmental setting, especially the degree of naturalness in the local and regional ecosystems.

The design phase involves the siting of the final right-of-way footprint and all aspects of structural design and within design mitigations. By selecting such road parameters as width, slope, and type of crossing structures (e.g., bridges), this phase determines the specific potential impacts on adjacent and

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nearby ecosystems. While planning determines the general areas where habitat will be destroyed or degraded (areas within the proposed road corridor), design decides which specific locations will be affected or avoided. For this reason, small-scale mitigations are most important in the design phase.

10.4.5. IMPACT ON SOCIO ECONOMIC

The economic and social interaction of communities is going to be improved by the road projects. However, the widening of the existing road and new alignment will cause disruption to local interactions. In fact, at few places over the years people have occupied the open space of the proposed Right of Way (PROW) encroaching upon it. The encroachments are most common in market places, road crossings and in midsections. The local community activities go on the roadside, the footpath, the bus stops and even the road surface itself.

10.5. ANALYSIS OF ALTERNATIVES

The present road development activities include widening to six-lane of existing four- lanes highway from Udaipur to Ahmedabad, section of NH-8. The project road is assigned for retrofitting a six-lane cross section over the existing 4-lane such that the improved highway is safe, efficient and convenient to the road- users as well as public living adjacent to the highways. In addition to these following points need to be considered in the widening process.

- The project road should be safe for the road-users and the public living adjacent to the highways.
- The operation of highways should be smooth and efficient.
- Land acquisition is kept to the barest minimum.
- The construction should be least disruptive to the users and the public.
- Facilities created in the widening to 4-laning should be utilized to the maximum extent.
- Constraints of site should be resolved by proven technological solutions.
- Within the given constraints, the widening of project road should be sound, economical, constructible and manageable.

10.6. ENVIRONMENT MONITORING PLAN

A monitoring program, backed up by powers to ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking a project's actual impacts, monitoring reduces the environmental risks associated with that project, and allows for project modifications to be made where required.

The objective of monitoring is:

- To monitor impacts on the surrounding environment and the effectiveness of mitigation measures during the construction and operation phases.
- To ensure that the environmental control systems are operating satisfactorily.
- To suggest ongoing improvements in management plan, if required, for subsequent effective monitoring.

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10.7. ADDITIONAL STUDIES**10.7.1. RISK ASSESSMENT**

These kinds of project are not a threat to environment. However due care shall be taken to minimize all possible causes. The primary objective of risk assessment study is to propose a simple approach to carry out risk analysis and conduct feasibility studies for the project, planning and management of hazard analysis study.

10.7.2. SAFETY MEASURES

The construction/widening of National Highway and widening/improvement of existing NHs will ensure smooth flow of the traffic. Installation of proper road safety system through signage, barricades, and crash barriers will add to be safety to the traffic. Bus bays, lay byes, rest areas, underpasses, service roads are proposed in the project, which shall enhance the road safety.

10.8. PROJECT BENEFITS

The proposed expressway project will provide better connectivity between Rajasthan & Gujarat and other areas of SW in India. This can contribute to economic development by encouraging attraction of business to site equipped with good access and by improving the travel efficiencies of the existing business and to start new avenues. This also helps in developing the following:


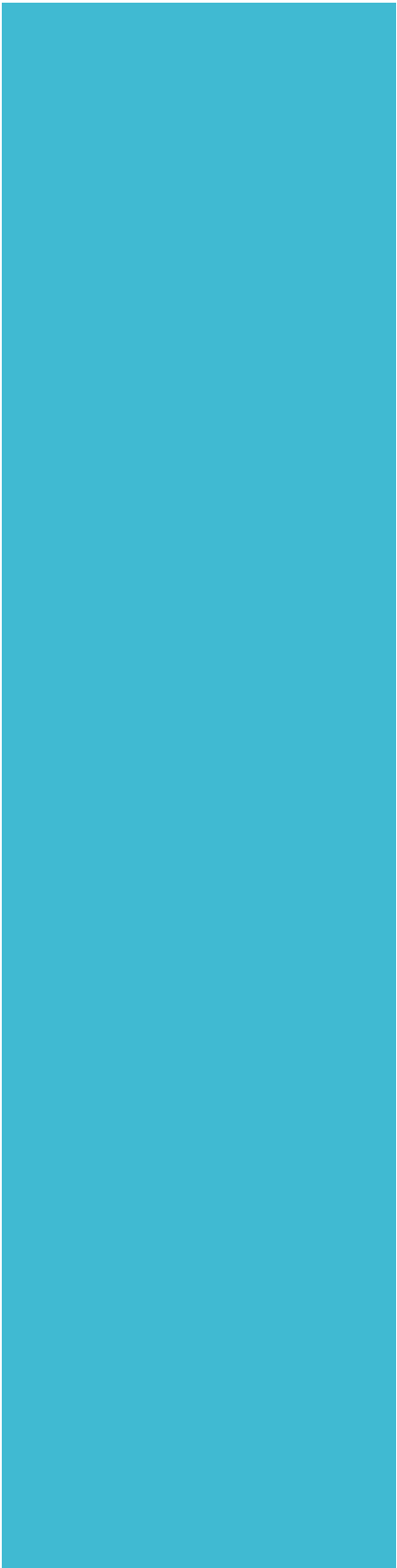
- Development of new industries
- Development of new educational institutions and hospitals/health centers
- Development of real estates
- Development of Infrastructure projects
- Development of IT parks.

10.9. ENVIRONMENT MANAGEMENT PLAN

In the process of project planning, an EMP needs to be formulated to ensure that resources are used with maximum efficiency, waste is minimized, residuals are treated adequately, and products are recovered and recycled to the maximum extent possible. The overall strategy should not be to cut down pollution control costs but should result in savings in the cost of operation.

A separate environment management cell with a team of experienced and qualified personnel reporting to a very senior level executive preferably an environmental engineer is proposed. He will be assisted by well-trained staff comprising of environmental and safety specialists.

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CHAPTER-11

DISCLOSURE OF THE CONSULTANT

11 DISCLOSURE OF CONSULTANT**11.1 GENERAL**

In Situ Enviro Care is premier Consulting and contracting Firm for various aspects of environmental management; having specialization in Wastewater Management Systems, Industrial Effluent Treatment plants and Sewage Treatment Plants since more than five years.

We have established analytical firm and field staff for taking care of all environment related Air, Water and Soil problems. Our firm has MOU with Lake Conservation Authority, Bhopal for technical and professional services and in process of obtaining recognition from MoEF, New Delhi (Ministry of Environment and Forest).

11.2 SPHERE OF ACTIVITIES

- Environment Management Services
- Consultancy Services

11.3 ENVIRONMENT MANAGEMENT SERVICES

- Turnkey Project
- Effluent Treatment Plant (ETP)
- Sewage Treatment Plant (STP)
- Water Treatment Plant (WTP)
- Recycling of sewage and industrial effluent
- Upgradation of ETP / STP
- Field Studies & Surveys
- Measurement & Evaluation of meteorological data such as:
 - Temperature /Humidity
 - Wind Direction & Speed
 - Rainfall
 - Dust fall
- Estimation of dispersion of gaseous releases using Gaussian Model
- Pollution Load Assessment at factory sites
- Guidance for site selection of Industries
- Environment Impact studies

11.4 CONSULTANCY SERVICES

- Regulatory guidance in the field of Pollution Control.
- Obtaining Environmental Clearance from Department of Environment (State, Central Govt. and MoEF).
- Obtaining consents (Establish, Operate, Renewal & Amendment) for various industries.
- Carrying out Environment Impact Assessment / EMP/Environmental audit studies.
- To provide all assistance in liasoning work.

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- Design, fabrication & Engineering of effluent Treatment Plants & Air Pollution Control Schemes layout of Civil Works.
- Preparation of DPR of Municipal Solid waste as Per MSW handling rule 2000
- Data Sheets & Specification for bought-out components
- Specifications for Electrical Installations
- Preparation of Environmental Status Report
- Operation and Maintenance of ETP / STP
- Preparation of Feasibility Report for ETP / STP
- Liasoning with MoEF, CPCB and all state PCB's on Technical matters only
- Geophysical investigation for ground water assessment/ Deep bore well drilling turnkey job work.
- Mining related Environment work, preparation of mining plans, EMP & other mining technical problems.

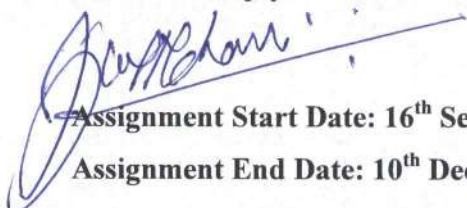
11.5 DECLARATION BY EXPERTS

Declaration by Experts contributing to the EIA of Six-Lanning of Shamla Ji to MotaChilodha Section of NH-8 from Km 401.200 to Km 494.410 (Length 93.210 Km) in the state of Gujarat under NHDP Phase -V (Package-VI) On Hybrid Annuity Mode

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator

Name: Mr. Ajay Mohan



Assignment Start Date: 16th September 2018

Assignment End Date: 10th December 2018

Associated EIA Coordinator

Name: Mr. G K Mishra



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Table 11-1: Functional Area Experts

S. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task)	Signature
1	AP	Mr. P. S. Sharma	September 2018 to December 2018 Air Pollution Assessment	<i>P. S. Sharma</i>
2	WP	Dr. Nishi Naryani	September 2018 to December 2018 Water Pollution Assessment	<i>Nishi Naryani</i>
3	SE	Mrs. Asha Mathur	September 2018 to December 2018 Socio Economic Assessment	<i>Asha Mathur</i>
4	EB	Mr. Madan Prakash	September 2018 to December 2018 Ecology & Biodiversity Study	<i>Madan Prakash</i>
5	HG	Mr. Ajay Mohan	September 2018 to December 2018 Hydro-Geological Study	<i>Ajay Mohan</i>
6	SC	Dr. A. K. Mishra	September 2018 to December 2018 Soil Analysis Study	<i>A. K. Mishra</i>
7	AQ	Mr. Ravindra Kamath (Modelling done by Outsourced Lab)	September 2018 to December 2018 Air Quality Assessment	<i>Ravindra Kamath</i>
8	NV	Mr. P S Sharma	September 2018 to December 2018 Noise Analysis	<i>P. S. Sharma</i>
9	LU	Dr. R. M. Singh	September 2018 to December 2018 Land Use Assessment	<i>R. M. Singh</i>
10	RH	Mr. P S Sharma	September 2018 to December 2018 Risk & Hazard Assessment	<i>P. S. Sharma</i>
11	SHW	Mr. G.K. Mishra	September 2018 to December 2018 Solid & Hazardous Waste Assessment	<i>G. K. Mishra</i>

11.6 LABORATORY USED FOR PRIMARY DATA & AIR QUALITY

One season baseline data (November 2018) generation along with air quality modelling have been completed by our associated lab M/s Rajasthan Environmental Testing Lab (Accd. No. TC-5425 in lieu of T-3128, Valid upto 30th March 2019).

11.7 DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Ajay Mohan, hereby, confirm that the above-mentioned experts prepared the EIA of Six-Lanning of Shamla Ji to Mota Chilodha Section of NH-8 from Km 401.200 to Km 494.410 (Length 93.210 Km) in the state of Gujarat under NHDP Phase -V (Package-VI) On Hybrid Annuity Mode, also confirm that I shall be fully accountable for any mis-leading information mentioned in this statement.

Signature:

Name: Ajay Mohan

Designation: CEO/EIA Coordinator

Name of the EIA Consultant Organization: In Situ Enviro Care

NABET Certificate No. NABET/EIA/1619/RA 0070 & Issue Date: 07, December 2017.

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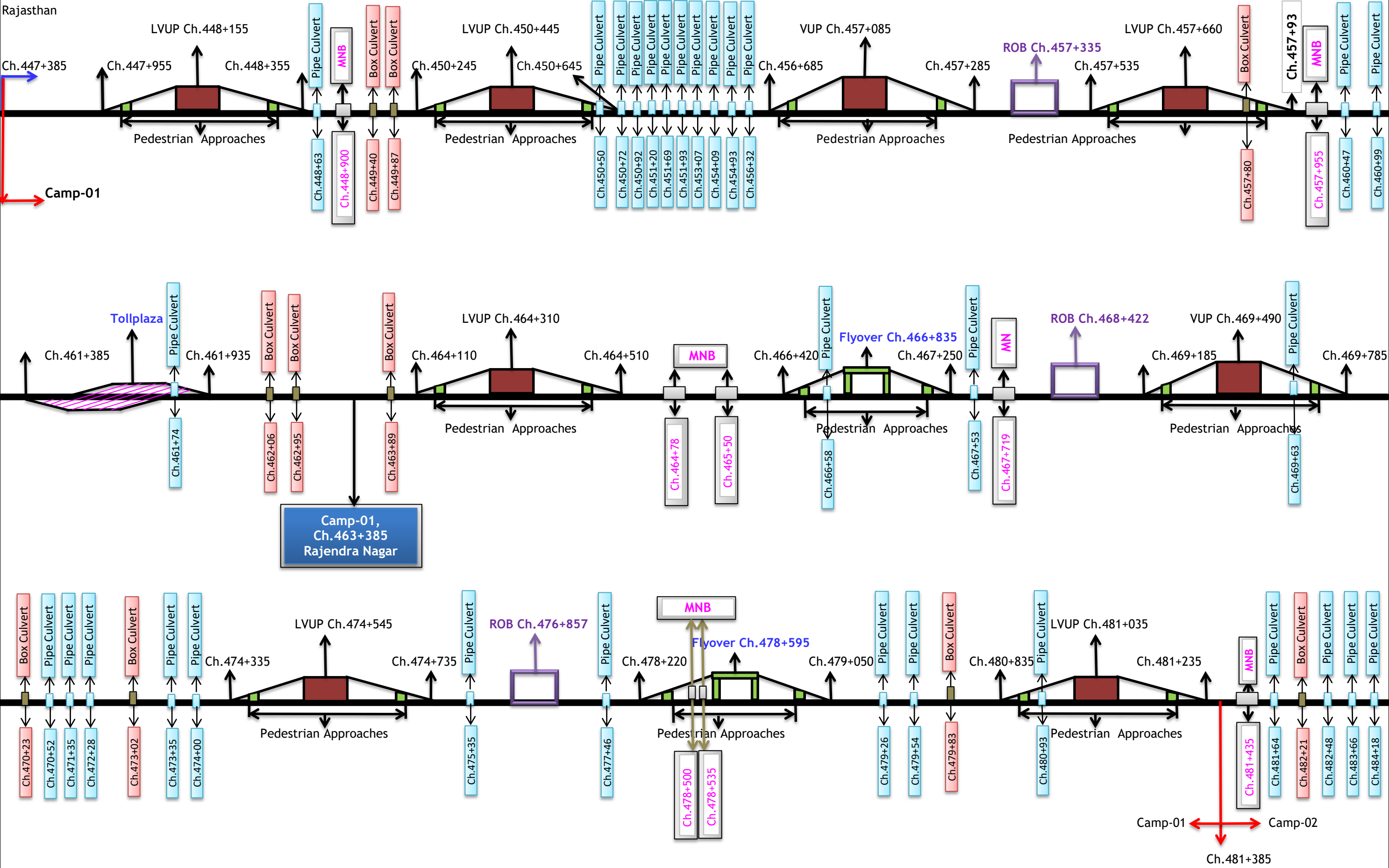
ANNEX



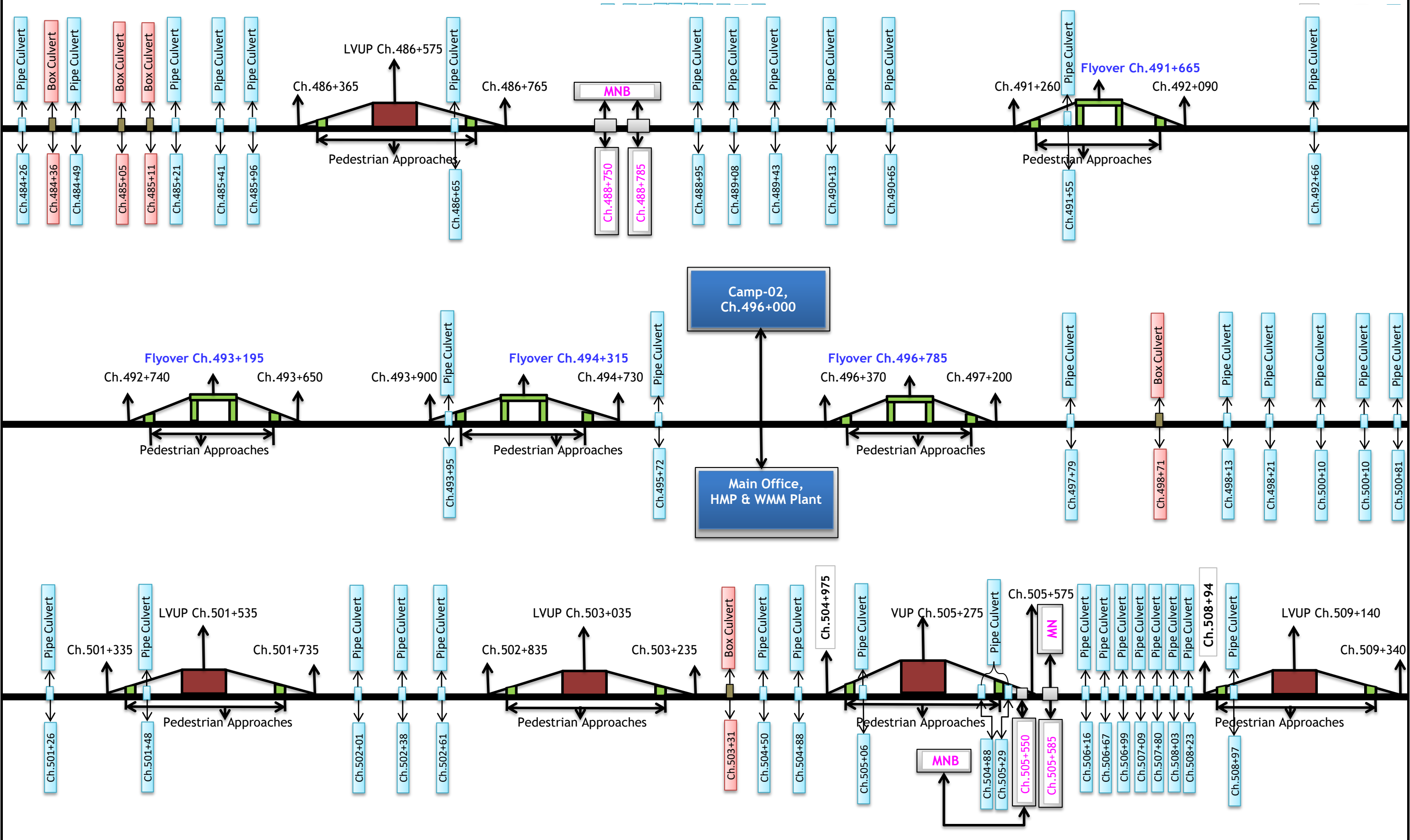
ANNEX – I

ROAD MAP

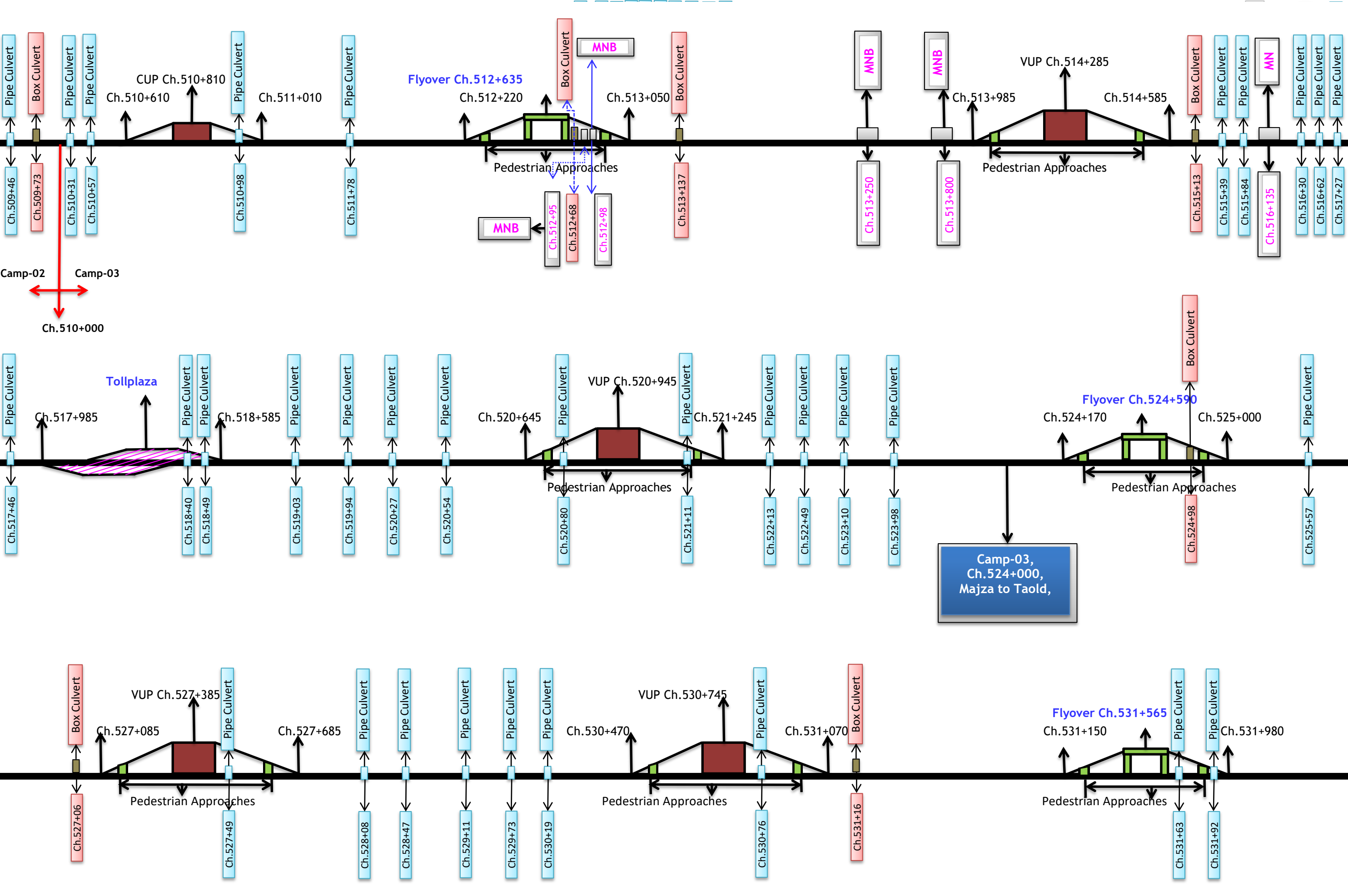
Rajasthan-Gujarat Border (Shamla Ji to Motachilodha Ex.Ch.401+200 to 494+410, Design Ch.447+385 to 540+595 Length 93.210 Km)



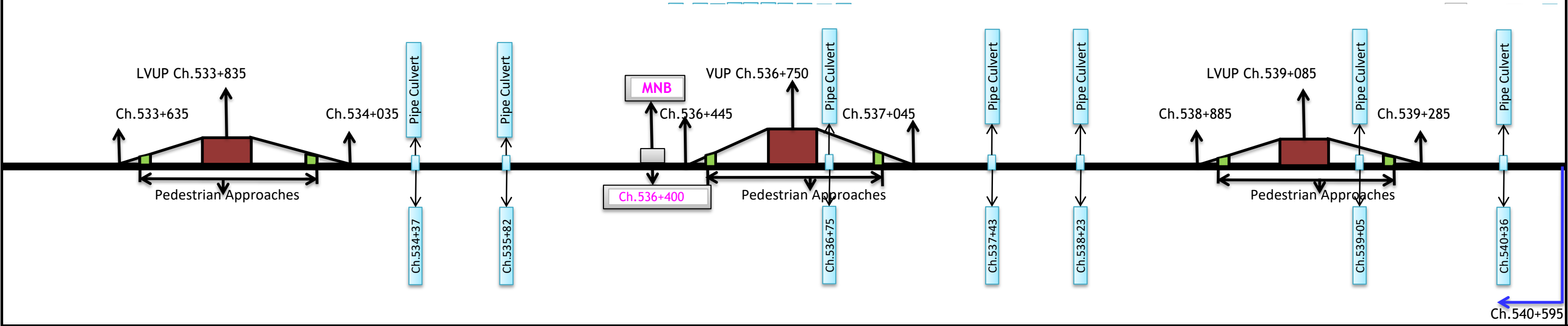
Rajasthan-Gujarat Border (Shamla Ji to Motachilodha Ex.Ch.401+200 to 494+410, Design Ch.447+385 to 540+595 Length 93.210 Km)



Rajasthan-Gujarat Border (Shamla Ji to Motachilodha Ex.Ch.401+200 to 494+410, Design Ch.447+385 to 540+595 Length 93.210 Km)



Rajasthan-Gujarat Border (Shamla Ji to Motachilodha Ex.Ch.401+200 to 494+410, Design Ch.447+385 to 540+595 Length 93.210 Km)





ANNEX – II

COST ESTIMATION



National Highways Authority of India

**(Ministry of Road, Transport & Highways)
Government of India**

**Six Laning of Rajasthan/Gujarat Border at Km 401.200 to
494.410 of NH-8 in the States of Rajasthan and Gujarat
(Length 93.210 Km)
Package-VI**

COST ESTIMATE

February 2016

G-5 & 6, Sector – 10, Dwarka, New Delhi – 110 075

**Six Laning of Rajasthan/Gujarat Border at Km 401.200 to 494.410 of NH-8 in the States of Gujarat
(Length 93.210 Km)**

PKG 6

**SUMMARY OF COST
(2015-2016)**

BILL NO.	ITEM OF DESCRIPTION	AMOUNT (Rs.)	AMOUNT in Cr.
i	CIVIL WORK COST		
1	SITE CLEARANCE	11,532,973	1.15
2	EARTHWORKS	531,204,717	53.12
3	SUB-BASE COURSE & BASE COURSE	1,536,857,600	153.69
4	BITUMINOUS WORKS	2,278,006,390	227.80
5 & 6	STRUCTURE (CULVERTS & CROSS DRAINAGE, BRIDGES, UNDERPASSES, OVERPASSES, FLYOVERS, ROB'S ETC).	1,507,653,032	150.77
7	DRAINAGE AND PROTECTIONS WORK	1,484,545,304	148.45
8	TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES	151,616,442	15.16
9	ELECTRICAL	114,978,667	11.50
10	MAINTANANCE OF ROAD	3,717,681	0.37
11	TOLL PLAZA	201,264,054	20.13
12	HIGHWAY TRAFFIC MANAGEMENT SYSTEM (HTMS), ADMINISTRATIVE BLOCK, OPERATION AND MAINTENANCE BASE CAMP, ETMS.	133,349,500	13.33
13	TRAFFIC SAFETY DURING CONSTRUCTION PERIOD	9,321,000	0.93
14	Service Road, Project facilities (Bus bye, Truck lay bye) , Junction	1,928,112,992	192.81
15	MISCELLLEANEOUS	14,890,000	1.49
	TOTAL COST FOR CIVIL WORKS	9,907,050,351	990.71

	Total Project Cost (including 15% Centages)	11,393,107,904	1139.31
	Green Highway Fund @ 1% of civil cost	99,070,503.51	9.91
	Environment mitigation measures	181.6725	0.00
	Land AND STRUCTURE ACQUISITION AND REHABILITATION, FOREST AND SOCIAL COST		
	Shifting of Utilites		
	CIVIL COST PER KM	106,287,419.28	10.63
	TOTAL PROJECT COST PER KM	122,230,532.18	12.22

S.no.	Item		Stage for Payment	Unit	Quantity	Rate	Amount item wise	Total cost
1	Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures (but excluding service roads)		A- Widening and strengthening of existing road					
			(1) Earthwork up to top of the sub-grade					
		1.01	Excavation					
			Ordinary soil	Cum	695100	48	33364778	
			Excavation in Hard Rock	Cum	0	290	0	
		1.02	Embankment	Cum	735077	220	161716991	
		1.03	Embankment from cutting material	Cum	278040	106	29472221	
		1.04	Subgrade	Cum	628967	260	163531341	
		1.05	Earth work between RE Wall	Cum	541249	260	140724768	
		1.06	Median Filling	Cum	11403	210	2394618	
		1.07	Salvage Vale of Excavated rock	Cum	0	100	0	
			Sub total					531204717
			(2) Granular work (sub-base, base, shoulders)					
		1.01	GSB	Cum	434754	2138	929504595	
		1.02	GSB From excavated Non Bituminous base courses	Cum	13144	1200	15772365	
		1.03	WMM	Cum	247523	2390	591580640	
			Sub total					1536857600
			(3) Bituminous work					
		1.01	Prime Coat	Sqm	983316	19	18683008	
		1.02	Tack Coat (over prime coat)	Sqm	983316	10	9833162	
		1.03	Tack Coat (over Bt.)	Sqm	5794079	8	46352632	
		1.04	DBM	Cum	186929	7053	1318408844	
		1.05	BC	Cum	113180	7817	884728744	
			Sub total					2278006390
			(3)CC Pavement					
		3	DLC	Cum	0	0	0	
		3	PQC	Cum	0	0	0	
			Sub total					0
			(4) Widening and repair of culverts				272866695	
			(5) Widening and repair of minor bridges				25708150	
			Sub total					298574844
3			C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments,bypasses:					
			(1) Culverts				6566080	
			(2) Minor bridges				357317745	
			(3)Cattle/Pedestrian underpasses				7668500	
			(4) Pedestrian overpasses				0	
			(5) Grade separated structures					
		(a)	Underpasses				180096000	
		(b)	Overpass				0	
		(c)	Flyover				305520000	
		(d)	DUP				0	
		(e)	LVUP				162259200	
			Sub total					1019427525

S.no.	Item		Stage for Payment	Unit	Quantity	Rate	Amount item wise	Total cost
4	Major Bridge works and ROB/RUB		A- Widening and repairs of Major Bridges					
			(1) Foundation				0.00	
			(2) Sub-structure				0.00	
			(3) Super-structure (including crash barriers etc. complete)				0.00	
			Sub total					0
5			B- Widening and repair of					
			(a) ROB				13170000	
			(b) RUB				0.00	
			Sub total					13170000
6			C- New Major Bridges					
			(1) Foundation				0	
			(2) Sub-structure				0	
			(3) Super-structure (including crash barriers etc. complete)				0	
			Sub total					0
7			D- New rail-road bridges					
			(a) ROB				176480663	
			(b) RUB				0	
			Sub total					176480663
8	Structures (elevated sections, reinforced earth)		(1) Foundation				0.00	
			(2) Sub-structure				0.00	
			(3) Super-structure (including crash barriers etc. complete)				0.00	
			Sub total					0
9	Other works		(i) Service roads/Slip Road					
			a) C& G	Cum	81.94	50008	4097756	
			b) Embankment	Cum	0	220	0	
			c) Subgrade	Cum	421475	260	109583378	
			d) GSB	Cum	163884	2138	350383992	
			e) WMM	Cum	212976	2390	509012730	
			f) Prime Coat	Sqm	819420	19	15568980	
			g) Tack Coat on on granular surface	Sqm	819420	10	8194200	
			h) Tack Coat on Bituminous surface	Sqm	819420	8	6555360	
			i) DBM	Cum	49165	7053	346762156	
			j) BC	Cum	32777	7817	256216246	
			Sub total					1606374796
10			(ii) Toll Plaza	No.	2	100632027	201264053.94	
			Sub total					201264054
11			(iii) Road side drains					
			1 RCC Drain (1.5 X1.0)m	Rm	117060	4500	526770000	
			2 Unlined Drain	Rm	32082	33	1052287	
			3 Median Drain	Rm	0	1800	0	
			Sub total					527822287

S.no.	Item		Stage for Payment	Unit	Quantity	Rate	Amount item wise	Total cost
12			(iv) Road signs, markings, km stones, safety devices,					
			1 Lane/centre line / edge marking / transverse and any other marking	Sqm	122324	131	16024465	
			2 Chevron Marking:	Sqm	3070	0	0	
			3 Providing and applying two coats of synthetic enamel paint including primer to concrete kerb surfaces etc. complete as per MORT&H Specifications clause 803.	Sqm	0	7860	0	
			4 a) M-20 Kerb	Rm	0	270	0	
			b) M-20 Kerb with channel	Rm	0	508	0	
			5 Supplying and fixing at site retro-reflectorised type sign boards/signs made of encapsulated lense type of reflective sheeting fixed over aluminum sheeting 2.0 mm thick with minimum coefficient of retro-reflection (determined in accordance with ASTM Standard E:810) as indicated in Table 800-1 complete including vertical pipes, angles, posts etc. all complete as per drawings and MORT&H Specifications clause 801.					
			A) Mandatory /Regulatory Signs of Size.					
			i) Circular 600 mm dia.	No.	240	2875	690000	
			ii) Octagon 900 mm height (for "STOP").	No.	274	4464	1223136	
			iii) Triangular 900 mm size (for "GIVE WAY").	No.	156	0	0	
			(iv) Speed limit 600mm dia	No.	240	2875	690000	
			B) Cautionary/Warning Signs-Triangular 900mm size		156	4386	684216	
			C) Informatory Signs					
			a) Direction and Place Identification signs					
			i) Advance Direction/Destination signs	No.	120	3981	477720	
			ii) Direction signs 1200 x 700 mm	No.	220	9624	2114393	
			iv) Place Identification Signs 900x1200mm	No.	120	3981	477720	
			v) Truck Lay Bye signs 800x600	No.	2	5499	10999	
			vi) Toll Booth Ahead signs 900x1200mm	No.	0		0	
			b) Facility and Other Useful information Signs 800x600mm	No.	2	5499	10999	
			D) Overhead signs	No.	8	700000	5600000	
			Cantilever Overhead signs	No.	10	450000	4500000	
			6 Road Delineaters					
			i) Roadway indicators (Post type)	No.	0	800	0	
			ii) Hazard markers	No.	334	2800	935200	
			iii) Object marker	No.				
			7 Stud	No.	2698	275	741950	
			8 Led Traffic Blinker	No.	12	12000	144000	
			9 Km Stone					
			9.01 5th Kilometre Stone	No.	37	0	0	
			9.02 Kilometre Stone	No.	149	3355	499895	

S.no.	Item		Stage for Payment		Unit	Quantity	Rate	Amount item wise	Total cost
	Other works		9.03	Hectometre Stone	No.	746	2015	1503190	
			9.04	Boundary Stone	No.	3728	886	3303008	
		10		Plastic screens height of 1.5m	Rm	0	1500	0	
		11		Seperator (MS Railing)	Rm	139982	800	111985552	
		12		Paved Median in builtup section (M15) 150mm Thick	Cum				
				Sub total					151616442
13		(v)		Project facilities					
		a)		Bus shelter	No.	37	150000	5550000	
		b)		Bus bye					
		1		C&G	Ha	7.1	50008	355719	
		2		Embankment	Cum.	60,865	220	13390300	
		3		Subgrade	Cum.	30,433	260	7912450	
		4		GSB	Cum.	9,130	2138	19519406	
		5		Providing & laying DLC	Cum.	10,670	0	0	
		6		Providing & laying PQC	Cum.	17,042	3397	57892353	
		7		Providing and Laying M-20 Footpath Slab	Sqm.	2,334	550	1283877	
		8		Pavement marking with hot applied thermoplastic paints	Sqm.	3,210	131	420477	
		9		Construction of plain cement concrete kerb M-20 grade	Lm	1,554	270	419580	
		10		Providing and applying two coats of synthetic enamel paint including primer to kerb surfaces	Sqm.	567	7,860	4458271	
		11		Providing & fixing guard railing with tubular steel sections	Lm	555	513	284715	
		12		P/L "word "BUS" with Thermoplastic Paint	No.	37	500	18500	
		13		Informatory Sin for Bus Bay (600mm X 800mm)	Sqm	18	5,499	97670	
		14		Arrow Marking	Nr.	74	127	9398	
		15		Drainage 150 mm dia Pipe = 4 nos	Nr.	444	200	88800	
				Sub total					111701516
		c)		Truck lay bye					
		2.01		C&G	Ha	1.78	50008	88839	
		2.02		Embankment	Cum.	23,210	220	5106200	
		2.03		Subgrade	Cum.	11,605	260	3017300	
		2.04		GSB	Cum.	3,482	2138	7443447	
		2.05		Providing & laying DLC	Cum.	2,665	0	0	
		2.06		Providing & laying PQC	Cum.	4,974	3397	16897357	
		2.07		Median Filling	Cum.	3,082	210	647262	
		2.08		Providing and Laying M-20 Footpath Slab	Sqm.	2,750	550	1512500	
		2.09		Construction of plain cement concrete kerb M-20 grade	Lm	9,020	270	2435400	

S.no.	Item		Stage for Payment		Unit	Quantity	Rate	Amount item wise	Total cost
	Other works		2.10	Providing and applying two coats of synthetic enamel paint including primer to kerb surfaces	Sqm.	3,292	7,860	25877478	
			2.11	Pavement marking with hot applied thermoplastic paints	Sqm.	308	131	40348	
			Sub total						63066132
		d)	Other						
14		(vi)	Repairs to bridges/structures					0.00	
		a)	Providing wearing coat					0.00	
		b)	Replacement of bearings, joints					0.00	
		c)	Providing crash barriers					0.00	
		d)	Other items					0.00	
			Sub total						0
15		(vii)	Road side plantation						
		1	Plants along ROW		No.	0	165143	0	
		2	Median Plantation		No.	0	75	0	
		3	Compulsory Afforestation (Tree)		No.	0		0.00	
		4	Median Plantation in builtup section		No.	0		0.00	
			Sub total						0
16		(viii)	Protection works						
			Slope Protection						
		1	Stone Pitching		Cum	0		0	
		2	Filter Media		Cum	0		0	
		3	Chute Drain		Rm	0		0	
		4	No. of Dissipation Basin		No.	0		0	
		5	Jute blanket (sqm)		Sqm	0		0	
		6	Turving (sqm)		Sqm	0	28	0	
		7	Earth work filling between Chute drain in shoulder		Cum			0	
		8	Kerb With Channel		Rm			0	
			Sub total						0
17		(ix)	Safety and traffic management during construction					9321000	
			Sub total						9321000
18		(x)	Junction		No.				
		1	BC		Cum	4718	7817	36878730	
		2	DBM		Cum	5481	7053	38660032	
		3	WMM		Cum	14743	2390	35235770	
		4	GSB		Cum	11794	2138	25216427	
		5	Subgrade		Cum	29486	260	7666360	
		6	Prime Coat		Sqm	81713	19	1552547	
		7	Tack Coat over Prime Coat		Sqm	81713	10	817130	

S.no.	Item		Stage for Payment	Unit	Quantity	Rate	Amount item wise	Total cost
			8 Tack Coat over Bituminous Course	Sqm	117944	8	943552	
			Sub total					146970548
19			(xi) R.E Wall/TOE Wall					
			i) Retaining Wall					
			1 Excavation	Cum	7544	41.00	309304.00	
			2 PCC (M-15)	Cum	377	4950.00	1867140.00	
			3 M-30	Cum	1870	5943.00	11111032.80	
			5 Steel	MT	149	54135.00	8079107.40	
			6 Back filling	Cum	1361	1517.00	2064940.40	
			7 Filter media	Cum	0	2371.00	0.00	
			8 Weep Hole	No.	1640	304.00	498560.00	
			Sub total					23930085
			ii) Reinforced Earth					
			RE Wall Panel (M35)	Sqm	125775	3200	402480712	
			Filter Media	Cum	75465	1613	121725260	
			C.I. drain pipe	Rm	30400	475	14440119	
			Friction Slab PCC (M-15)	Cum	5928	4950	29343841	
			Friction Slab +Crash Barrier (M-35) with hand rail	Rm	30400	12000	364803000	
			Sub total					932792932
20			(xii) Highway Lighting					
			i) Builtup Section					
			Double Arm	No.	1976	35000	69160000	
			Single Arm	No.	1307	32000	41818667	
			ii) Bus Bye (Single Arm)	No.	37	32000	1184000	
			iii) Truck lay byes (Single Arm)	No.	88	32000	2816000	
			iv) In Grade Separated Str. (Double Arm)	No.	0	35000	0	
			v) In Toll Plaza Approach (Single Arm) with 2m overhang with spacing 50m staggered on both side	No.	0		0	
			High Mast Ligth (Toll Plaza)	No.	3		0	
			Sub total					114978667
			(xiii) Providing crash barriers					
			a) W beam Crash Barrier	Rm	808	0	0	
			b) New Jersey Crash barrier	Rm	0	3127	0	
			Sub total					0
			(xiv) Site clearance & dismantling					
			1 Dismantling existing carriageway					
			a) Bituminous courses	Cum	12518	268	3354757	
			b) Non Bituminous base courses	Cum	18777	210	3943091	
			1 C& G	Hac	84.69	50008	4235125	
			Sub total					11532973
			(xv) Miscellaneous items					
			1 For Utility Along the road NP4 600mm dia pipe					

S.no.	Item		Stage for Payment		Unit	Quantity	Rate	Amount item wise	Total cost
			1	NP4 600mm dia pipe	Rm	0	2800	0	
			2	Chamber	No.	0	1800	0	
			2	Median Opening	No.	0			
			i	DLC	Cum	0	0	0	
			ii	PQC	Cum	0	3397	0	
			3	HIGHWAY TRAFFIC MANAGEMENT SYSTEM ITEMS					
			a)	a) Emergency communication system (ECB)	Nos	93	150,000	13981500	
			b)	b) Radio Mobile System					
				Base station-3 Nos, Vehicle Mounted-8 Nos, Voice Logger-1, Main Console-1 Nos,	Sets	2	3,000,000	6000000	
				c) CCTV surveillance system	Nos	60	320,000	19200000	
				d) Automatic Traffic counter and classifier	Nos	2	1,500,000	3000000	
				e) Variable message signs (6 Nos LED Based)	Nos	12	3,000,000	37284000	
				f) Metrological data system					
				CR 10X Measurement & Control Module, Model 41372-02 RH element, Model 09101 Wind monitor SE, Model 41372 VC Rel. Humidity/ Temp. Probe, SVS1-E-2 Visibility Sensor, Model 44203 Temp Sensor, Model 70092 Solar radiation Sensor.	Nos	3	2,000,000	6000000	
				g) Solar Power	Nos	2	300,000	600000	
				h) Traffic control Centre/ Administrative Building	Sqm	500	11,000	5500000	
				I) Backbone Communication (OFC)	Km	93	400,000	37284000	
				j) Emergency Service (Cranes+Ambulance+Fire Brigades)	Sets	1	4,500,000	4500000	
			4	Construction of accommodation & post for Medial aid post & 2 residential quarters for Doctor complete as per drg and direction of Engineer.					
			5	Vehicle Rescue Post	No.	1	200000	200000	
			6	Traffic Aid post	No.	1	200000	200000	
			7	Miscellaneous items- vechicle, phone , Photographs etc					
			1	Supply of color record photographs with CD and two colour prints in approved size there from mounted in album as per MORT&H Specifications Clause 125.	Nr.			0.00	
			2	Same as above but additional prints of colour record photographs	Nr.			0.00	
			3	Supplying of digitized CD ROMs during construction as per MORT&H Specifications Clause 126.	Nr.			0.00	

S.no.	Item		Stage for Payment		Unit	Quantity	Rate	Amount item wise	Total cost
	Other works			4	Providing site office for the independent consultant including furnishing the same complete as per MORT&H specifications clause 120.	Nr.			0.00
				5	Maintaining site office for the independent consultant and other supervisory staff complete as per MORT&H specifications clause 120.	Nr.			0.00
				6	Providing and maintaining Vehicles for the independent consultant and his staff including driver, POL etc. complete as per MORT&H specifications clause 124.	Nr.			0.00
				7	Providing and maintaining mobile phones of NOKIA or equivalent make with SIM card for use of PIU including roaming and using charges Rs. 3,000/- per month subject to increase every year with 5%.	Nr.			0.00
				8	Construction of temporary diversion where necessary and maintenance there of including traffic control and safety devices complete as per MORT&H specifications clause 112.	Rm	8050	1800	14490000
				9	Tack coat on bitumen surface Overlay on existing road	Sqm.	9321	8	74568.00
				10	Overlay on existing road with 50 mm BC as per MORT&H Specification clause 508 to the area of the existing Carriage way.	Cum	466	7817	3643112.85
				11	Pot hole repair	Sqm.		250	0.00
				Sub total					151957181
				Civil Cost				9907050351	9907050351

S.No	Facility	Unit	Qty.
1	Junction/Intersections		
	a) Major Intersections	No.	10
	T	No.	3
	Y	No.	0
	+	No.	7
	b) Minor Intersections	No.	36
	T	No.	13
	Y	No.	2
	+	No.	21
2	VUP	No	13
	LVUP	No	10
	Flyover	No	12
3	Road over bridges (ROB)	No	2
4	Toll Plaza	No	2
5	Truck Lay byes	No.	11
6	Rest Area	No.	0
7	Bus Lay byes	No.	37
8	Median Opening	No.	0.0
9	Slip Roads (5.5 m)	Km	0
	Service Roads (7.0 m)	Km	117.06
11	Road side Furniture		
	Overhead signs	No.	25
	Cantilever Overhead signs	No.	12
12	Utility Duct	No.	0
13	Crash Barrier (C-b(iv))	M	808
	New Jersey Type where the median width is less than 2m	M	0
14	Utility	M	0
	Utility Chanber	No.	0
15	Street Light		
	i) Builtup Section		
	a) Double Arm	No.	1976
	b) Single Arm	No.	1307
	ii) Bus Bye (Single Arm)	No.	37
	iii) Truck lay byes (Single Arm)	No.	88
	iv) In Grade Separated Str. (Double Arm)	No.	
	Led Traffic Blinker	No	36
13	High Mast Ligth		
	Toll Plaza	No.	3
14	Soudium Lamp	No.	26
15	Gard Rail	Rm	555
16	Seperator (MS Railing)	Rm	139982
17	Exit & Entry	No.	

Costing of all Structures

S.no	Particular	Amount
1	widening of Structures	
	widening of culverts	422,058,750
	widening of Minor bridge	39,910,185
	widening of Major bridge	-
2	New structures	
	New culverts	
	New Minor bridge	260,556,061
	New Major bridge	200,468,486
	New ROB	175,977,742
	New VUP	433,165,514
	New PUP/CUP	96,351,405
	New interchange	-
	New Flyover	1,734,793,647
	Repair of ROB	

3,363,281,791

Costing of all Structures

Package6

S.No.	Type of Structure	nos.	Length	Formation Width	Area*	Rate	Amount	Remarks
1	VUP	13	20.0	26.8	6968.0	62165.0	433,165,514	new construction
2	PUP	10	7.00	31.3	2191.0	43976.0	96,351,405	new construction
3	Flyover 400.583 a)	1	14.15	26.8	379.2	35851.8	13,595,733	new construction
	Flyover 400.583 b)	1	46.60	26.8	1248.9	48900.1	61,070,376	new construction
	Flyover 400.583 c)	1	382.90	26.8	10261.7	62165.0	637,919,521	new construction
4	Flyover 420.650	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
5	Flyover 432.650	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
6	Flyover 445.490	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
7	Flyover 447.010	9	30.00	26.8	7236.0	48900.1	353,841,236	new construction
8	Flyover 450.600	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
9	Flyover 466.450	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
10	Flyover 468.200	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
11	Flyover 478.400	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
12	Flyover 494.900	6	30.00	26.8	4824.0	48900.1	235,894,158	new construction
13	Flyover500.400	1	30.00	26.8	804.0	48900.1	39,315,693	new construction
14	Flyover 508.550	3	30.00	26.8	2412.0	48900.1	117,947,079	new construction
15	Major bridge 390.288	1	112.10	11.7	1311.6	33063.6	43,365,172	new construction
16	Major bridge 507.500	2	108.00	11.7	2527.2	62165.0	157,103,313	new construction
16	Minor bridge 467.100	2	6.7	13.4	179.6	64530.2	11,587,036	widening
17	Minor bridge 467.650	2	8.7	13.4	233.2	64530.2	15,045,853	widening
18	Minor bridge 507.470	8	3.0	15.2	364.8	36396.1	13,277,296	widening

Costing of all Structures

Package6

S.No.	Type of Structure	nos.	Length	Formation Width	Area*	Rate	Amount	Remarks
19	Minor bridge 418.598	1	18.0	13.4	241.2	33063.6	7,974,930	new construction
20	Minor bridge 419.320	1	30.0	15.2	456.0	48900.1	22,298,453	new construction
21	Minor bridge 421.534	1	36.0	13.4	482.4	33063.6	15,949,861	new construction
22	Minor bridge 435.250	1	15.7	15.2	238.6	35851.8	8,555,682	new construction
23	Minor bridge 442.600	1	13.0	13.4	174.2	35851.8	6,245,390	new construction
24	Minor bridge 459.400	2	8.0	13.4	214.4	64530.2	13,835,267	new construction
25	Minor bridge 504.800	1	29.0	13.4	388.6	48900.1	19,002,585	new construction
26	Minor bridge on service road 392.436	2	16.0	10.2	326.4	35851.8	11,702,039	new construction
27	Minor bridge on service road 418.598 a)	1	16.4	10.2	167.3	33063.6	5,530,872	new construction
	Minor bridge on service road 418.598 b)	1	18.0	10.2	183.6	33063.6	6,070,469	new construction
28	Minor bridge on service road 421.534	2	36.0	10.2	734.4	33063.6	24,281,878	new construction
29	Minor bridge on service road 432.350	2	15.6	10.2	318.2	64530.2	20,536,079	new construction
30	Minor bridge on service road 442.600	2	13.00	10.2	265.2	42375.5	11,237,986	new construction
31	Minor bridge on service road 459.400	2	8.00	10.2	163.2	64530.2	10,531,323	new construction
32	Minor bridge on service road 466.800	2	7.90	10.2	161.2	64530.2	10,399,681	new construction
33	Minor bridge on service road 467.100	2	6.7	10.2	136.7	64530.2	8,819,983	new construction
34	Minor bridge on service road 467.650	2	8.7	10.2	177.5	64530.2	11,452,813	new construction
35	Minor bridge on service road 490.250 a)	1	16.8	10.2	171.4	35851.8	6,143,571	new construction

Costing of all Structures

Package6

S.No.	Type of Structure	nos.	Length	Formation Width	Area*	Rate	Amount	Remarks
	Minor bridge on service road 490.250 b)	1	16.8	10.2	171.4	64530.2	11,057,889	new construction
36	Minor bridge on service road 504.800	2	29.0	10.2	591.6	48900.1	28,929,308	new construction
37	Rob 411.150	1	34.0	15.2	516.8	62165.0	32,126,857	new construction
38	Rob 422.237	1	106.9	15.2	1624.3	48900.1	79,427,089	new construction
39	Rob 430.672	1	68.18	15.2	1036.3	62165.0	64,423,797	new construction
40	PIPE CULVERT	80	45.0	1.0	1.0	22,627	81,456,552	widening
41	PIPE CULVERT	185	30.0	1.0	1.0	22,627	125,578,851	widening
42	PIPE CULVERT	34	30.0	1.0	1.0	24,716	25,210,136	widening
43	BOX/SLAB CULVERT	3	0.9	25.0	67.5	54,624	3,687,125	widening
44	BOX/SLAB CULVERT	1	3.0	25.0	75.0	54,624	4,096,806	widening
45	BOX/SLAB CULVERT	2	3.2	25.0	160.0	54,624	8,739,853	widening
46	BOX/SLAB CULVERT	1	3.5	25.0	87.5	54,624	4,779,607	widening
47	BOX/SLAB CULVERT	2	3.6	25.0	180.0	54,624	9,832,334	widening
48	BOX/SLAB CULVERT	2	3.6	40.0	288.0	54,624	15,731,735	widening
49	BOX/SLAB CULVERT	1	3.8	40.0	152.0	54,624	8,302,860	widening
50	BOX/SLAB CULVERT	2	4.0	25.0	200.0	54,624	10,924,816	widening
51	BOX/SLAB CULVERT	1	4.1	25.0	102.5	54,624	5,598,968	widening
52	BOX/SLAB CULVERT	2	4.2	33.0	277.2	54,624	15,141,795	widening
53	BOX/SLAB CULVERT	3	4.8	33.0	475.2	54,624	25,957,362	widening
54	BOX/SLAB CULVERT	1	5.2	25.0	130.0	54,624	7,101,130	widening

Costing of all Structures

Package6

S.No.	Type of Structure	nos.	Length	Formation Width	Area*	Rate	Amount	Remarks
55	BOX/SLAB CULVERT	1	5.3	25.0	132.5	54,624	7,237,690	widening
56	BOX/SLAB CULVERT	2	5.5	25.0	275.0	54,624	15,021,622	widening
57	BOX/SLAB CULVERT	1	5.6	25.0	140.0	54,624	7,647,371	widening
58	BOX/SLAB CULVERT	1	5.7	25.0	142.5	54,624	7,783,931	widening
59	BOX/SLAB CULVERT	1	5.8	25.0	145.0	54,624	7,920,491	widening
60	BOX/SLAB CULVERT	2	5.9	25.0	295.0	54,624	16,114,103	widening
61	BOX/SLAB CULVERT	1	6.0	25.0	150.0	54,624	8,193,612	widening
62	Repair of flyover 400.583	1	443.04				7,530,000	Repair work
63	Repair of Rob 411.151	1	34.00				580,000	Repair work
64	Repair of Rob 422.237	1	106.86				1,820,000	Repair work
65	Repair of Rob 430.672	1	68.18				1,160,000	Repair work
66	Repair of Rob 466.000	2	61.10				2,080,000	Repair work
						TOTAL	3,376,451,791	

Quantities for Bus bay

No of Bus Bays		37
Tapper	100	
ADD tapper	0	
Bus Shelter	15	
Tapper	100	
ADD tapper	0	
Total Area	215	
Carriage width	7	
Bus Shelter Width	3	
Hand Rail	15	
Median Width	1.5	

For one bus lay bye

Sr. No.	Description	Quantity	
1	Surface Area of Each Bus Lay Bay	1923	m ²
2	Total Area for Earthwork	1645	m ²
3	Kerb Stone	42	m
4	Earthwork	1645	m ³
5	Subgrade	822.5	m ³
6	GSB	246.75	m ³
7	DLC	288.375	m ³
8	PQC	460.6	m ³
13	150 mm dia Pipe = 4 nos	12	m
14	Area of Tiles for Bus Bay including ramp	63.1	m ²
16	Box Markings(100 mm thick)	1.2	m ²
17	Marking along paved portion	9.07	m ²
18	600mm gap marking	10	m ²
19	letters for Bus	3	nos.
20	Pedestrian crossing (Zebra)	15.75	m ²
21	CL straight marking	43	m ²
22	Chevron marking	28	m ²
23	Pedestrian crossing sign	2	nos.
24	Informatory Sign for Bus Bay 600X 800	2	nos.
25	Bus Shelter	1	nos.
26	Median Filling	16.02	m ³
27	paint on kerb 0.365 per m	15.33	sqm

Quantities for Truck lay bye

Tapper	70	240
Straight	100	
Tapper	70	
Carriage Wddth	7	
Median	2.5	
Seperator	1	

Truck Bays

No of Truck Bays	11
Tapper	70
Straight	100
Tapper	70
Total Length	240

Sr. No.	Description	Quantity	Unit
1	Surface Area of Each Truck Lay Bye =	1615	m ²
2	Total Area for Earthwork =	2110	m ²
3	Kerb stone	820	m
4	paint on kerb @ 0.365 per m	299.3	m ²
5	Earthwork	2110	m ³
6	Subgrade	1055	m ³
7	GSB	316.5	m ³
8	DLC	242.25	m ³
9	PQC	452.2	m ³
10	150 mm dia pipes=11 nos	44	m
11	Area of tiles	250	m ²
12	Pedestrian crossing	25	m ²
13	Chevron marking	28	m ²
14	Sign for truck parking	2	nos
15	Pedestrian Crossing Sign	2	nos
16	Lighting(Tubular pole with one arm @30 m	11	nos
17	Drinking water and toilet	1	nos
18	Opening in raised median	11	nos
	(a) M 15	0.00	m ³
	(b) M 20	0.00	m ³
19	RCC Drain	240	m
20	Median Filling	280	m ³

RCC Retaining Wall

Quantity Calculation

H	b1	b2	b3	b4	B	h1	h2	Excav	PCC	RCC M35	Reinf.	Backfill	Filter Media	Weep Hole
2	0.700	0.300	0.000	1.100	2.100	0.300	0.300	4.600	0.230	1.140	0.091	0.830	0.000	1
4	1.000	0.300	0.100	1.400	2.800	0.300	0.300	6.000	0.300	2.135	0.171	3.950	1.200	1
5	1.200	0.300	0.200	1.700	3.400	0.350	0.300	7.200	0.360	2.978	0.238	6.240	1.800	2
12	1.400	0.300	0.325	2.500	4.525	0.425	0.300	9.450	0.473	7.033	0.563	38.680	6.000	7

Details of Proposed Retaining Wall

TCS Type	Length (m)	Total Length (m)
6	1,640	1,640
11 V	0.00	-
12	0.00	-
Total		1640

Summary of Quantities (3 m av. Ht)

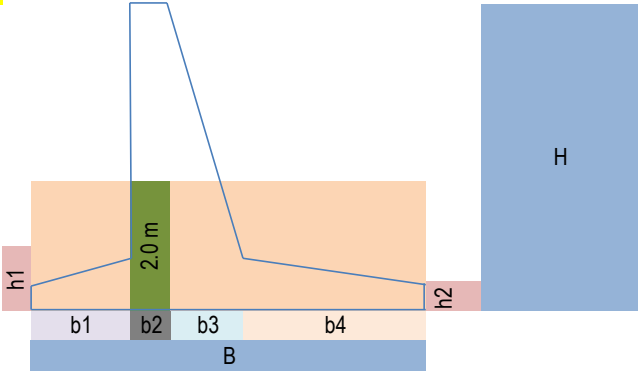
Items	Unit	Quantity
Excav	cum	7,544
PCC	cum	377
RCC M30	cum	1,870
Reinf.	MT	149
Backfill	cum	1,361
Filter Media	cum	-
Weep Hole	Nr	1,640.00

177	1,333,779
4,765	1,797,358
6,817	12,745,063
74,789	11,161,510
308	419,250
2,077	-
141	231,962
	27,688,922
Rm	16,883

Data

PCC thickness 0.10 m
PCC offset 0.1 m

reinforcement 80 kg/cum RCC



DRAINAGE WORKS RATES										
1 ESTIMATION FOR COVER DRAIN (RCC)										
2.0m Width Cover Drain										
Sl.No	Description of Item	No	Unit	Length	Breadth	Height	Quantity	Rate	Amount	Remarks
1	Earthwork in excavation									
	All type soil cutting	1	Cu.m	1	2.0	1.00	2.00	41.00	82	250 mm Above from FRL
2	PCC Grade M15 for Leveling Cours	1	Cu.m	1	2.0	0.100	0.20	-	-	
3	RCC M20									
	Wall	2	Cu.m	1	0.125	1.0	0.25			
	Cover	1	Cu.m	1	2.00	0.100	0.20			
	Raft	1	Cu.m	1	2.00	0.100	0.20			
						Total =	0.65	5,859	3,808	
4	Reinforcement	1	MT	1			0.033	54,135	1,759	
						Rate Per Km in Lakhs =			5,650	0.05650
5 ESTIMATION FOR UNLINED DRAIN										
Sl.No	Description of Item	No	Unit	Length	Bredth	Depth	Quantity	Rate	Amount	Remarks
1	Earthwork in excavation									
	All type soil cutting	1	Cu.m	1	1.00	0.8	0.80	41	33	
						Rate Per Km in Lakhs =			0.33	

New Toll Plaza

2 Nos
 10 Lanes- each 3.2 m width with 1.9m width Island between each lane
 3.2 m- Width each
 2 Lanes- each 4.5 m width
 4.5 m- Width each
 25 m- length Toll Both Island
 1.9 m- width Toll Island
 500 m-Length of Toll

Area of Islands = 523 Sqm
 Area of median = 1,800 Sqm
 Width at start of Toll = 25 m
 Width at center of Toll = 62 m
 Area one Toll plaza = 22,068 Sqm
Paved Area one Toll plaza = 19,746 Sqm
 unpaved area LHS = 60,827 Sqm
 unpaved area RHS = 35,503 Sqm
Unpaved Area one Toll plaza = 96,330 Sqm
 Paved Area one Toll plaza = 25,031 Sqm
 Unpaved Area one Toll plaza = 62,153 Sqm

Sl.No	Description	No.	Length (m)	Width (m)	Height (m)	Quantity	Unit	Rate	Amount
1	Embankment Filling								
	Over Paved Area	2	19746.00		0.15	5924			
	Over Unpaved Area	2	96330.00		0.50	96330			
					Total =	90,254	Cum	220	19,855,836
2	Sub-grade	2	19746.00		0.50	19746			
					Total =	19746	Cum	260	5,133,960
3	GSB	2	19746.00		0.15	5924			
					Total =	5924	Cum	2138	12,665,084
4	DLC	2	19746.00		0.15	5924			
					Total =	5924	Cum	3397	20,123,149
5	PQC	2	19746.00		0.30	10848			
					Total =	10848	Cum	5977	64,836,105
6	Longitudinal cover Drain (RCC M-20)								
		2	500			1000	Lm	5100	5,100,000
7	Lateral Covered Drains before and after Toll Booth Island (RCC M 20) with CI Gratings (0.5m x 0.5m)	8	61.90			495	Lm	2550	1,262,760
8	Tunnel Works (Box 3.0 m X 2.5 m)								
	i) RCC								
	a) Wall	4	68.9	0.30	2.50	207			
	b) Raft & Slab	4	68.9	3.00	0.30	248			
						455	Cum	6263	2,848,037
	ii) Reinforcement					27	MT	77845	2,123,954
9	Precast Chequered Tiles in Island								
	Toll Booth Island	22	22.50	1.90		940.5			
					Total =	940.5	sqm	450	423,225
10	Cement Concrete Kerb								
	Plain Kerb	0	19.00			0		0.00	-
					Total =	0	Lm		
11	Toll Booth Building	22	2.50	1.90		104.5	sqm	10000	1,045,000
12	D.G.Set Room	2	5	5		50	Sqm	6000	300,000

Sl.No	Description	No.	Length (m)	Width (m)	Height (m)	Quantity	Unit	Rate	Amount
13	Administrative Building	2	50.00	6.00		600	sqm	12000	7,200,000
14	Weigh Bridge Office Room	2	1.5	1.5		4.5	Sqm	6000	27,000
15	Storage buildings	2	100			200	Sqm	6000	1,200,000
16	Canopy	2	61.90	5.50		680.9		12000	8,170,800
						680.9	sqm		
17	Weigh Bridge	4				4	Nos	650000	2,600,000
18	Weigh in motion systems	20				20	Nos	790000	15,800,000
19	Sign Board	2	30.95	1.20		74.28			
					Total =	74.28	sqm	1500	111,420
							0		
20	Vehicle wise Toll Rates Board and Ministry, CD Nos. vehicles etc. Toll Free vehicle details boards.	8	2.78	2.15		47.816	74.3	1500	71,724
							137		
21	Automatic Barrier								
	a) 3.5m width	20				20	Nos	18000	360,000
	b) 4.5m Width	4				4	Nos	19000	76,000
22	CCTV	24				24	Nos	3500	84,000
23	Each Toll Lane with toll lane computer, printer and independent AVC system (automatic vehicle counter), Intercom in all toll booth for communication with control.	2				2	Set	200000	400,000
24	Traffic Blinker Signal for toll plaza with liquid electromagnetic display at all intersections	24				24	Nos	4000	96,000
25	Wire Fencing								
	Edge of Toll area	4	500.00			2000			
	Administrative Building	2	50.00			100			
						2100	Lm	1500	3,150,000
27	High Mast (30m height)	2	3.00			6	Nos	400000	2,400,000
28	Toll Plaza approach lighting	8	20			160	Nos	45000	7,200,000
29	Silent type D.G. Set	2	1			2	Nos	1000000	2,000,000
30	Transformer	2	1			2	Nos	500000	1,000,000
31	Administrative building front Island & landscaping etc complete (25% of unpaved area)	2	8000			16,000	Sqm	850	13,600,000
								Total	201264053.9
								In Lakh	2012.641



ANNEX – III

BASELINE DATA

BASELINE DATA

SIX-LANNING OF SHAMLA JI TO MOTACHILODHA SECTION OF **NH-8** FROM **KM 401.200 TO KM494.410 (LENGTH 93.210 KM)** IN THE STATE OF GUJARAT UNDER NHDP PHASE -V (PACKAGE-VI) ON HYBRID ANNUITY MODE

BASELINE
DATA

Ambient Air Quality of Period November 2018

Chiloda						AAQ-1
S.No.	Date	PM10 ($\mu\text{g}/\text{m}^3$)	PM2.5 ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO ₂ ($\mu\text{g}/\text{m}^3$)	CO($\mu\text{g}/\text{m}^3$)
1	03-11-2018	135.6	56.5	12.5	15.6	1.13
2	04-11-2018	142.5	48.5	10.5	18.5	0.98
3	10-11-2018	146.2	57.5	13.2	17.5	0.78
4	11-11-2018	128.9	51.5	12.5	16.2	0.69
5	17-11-2018	133.6	53.2	11.6	18.2	1.12
6	18-11-2018	148.5	56.2	8.5	14.2	1.17
7	24-11-2018	127.5	48.5	9.5	13.9	1.22
8	25-11-2018	139.6	52.7	12.4	18.2	1.34

Chhala						AAQ-2
S.No.	Date	PM10	PM2.5	SO ₂	NO ₂	CO
1	01-11-2018	136.5	52.2	10.2	17.8	1.05
2	02-11-2018	124.5	45.5	13.2	19.5	1.11
3	08-11-2018	119.5	48.5	11.5	16.5	1.14
4	09-11-2018	132.5	51.2	12.5	17.5	0.89
5	15-11-2018	136.9	54.5	8.9	14.5	0.91
6	16-11-2018	141.2	57.5	7.5	18.2	0.78
7	22-11-2018	128.5	50.2	12.5	16.2	1.31
8	23-11-2018	144.5	49.5	13.4	17.5	1.27

Motipura						AAQ-3
S.No.	Date	PM10	PM2.5	SO ₂	NO ₂	CO
1	05-11-2018	139.6	54.2	14.8	18.5	1.11
2	06-11-2018	157.5	62.5	8.7	14.5	1.18
3	12-11-2018	148.5	57.5	9.5	16.5	1.25
4	13-11-2018	125.5	48.5	11.5	17.5	1.32
5	19-11-2018	138.5	53.5	13.2	19.5	1.14
6	20-11-2018	142.5	57.4	10.4	15.5	1.48
7	26-11-2018	122.5	48.5	7.9	13.2	1.35
8	27-11-2018	137.5	52.8	10.9	15.9	1.28

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**BASELINE
DATA**

Prantij						AAQ-4
S.No.	Date	PM10	PM2.5	SO ₂	NO ₂	CO
1	03-11-2018	126.0	49.5	13.2	19.5	1.11
2	04-11-2018	118.2	45.0	10.5	20.1	1.21
3	10-11-2018	132.1	51.5	13.2	16.5	1.36
4	11-11-2018	124.5	49.5	11.6	17.5	1.14
5	17-11-2018	128.5	52.5	10.8	16.2	1.28
6	18-11-2018	129.5	53.2	12.5	18.2	1.07
7	24-11-2018	135.5	56.5	9.8	14.5	1.19
8	25-11-2018	127.5	50.7	12.7	16.7	1.28

Raigarh						AAQ-5
S.No.	Date	PM10	PM2.5	SO ₂	NO ₂	CO
1	01-11-2018	125.5	48.5	11.2	16.5	1.11
2	02-11-2018	133.2	53.2	9.2	15.2	1.19
3	08-11-2018	146.2	57.5	12.4	17.5	1.08
4	09-11-2018	128.0	50.2	9.5	14.2	1.24
5	15-11-2018	139.5	56.5	10.5	16.5	1.19
6	16-11-2018	124.0	48.5	9.1	13.2	1.32
7	22-11-2018	141.5	57.5	11.6	17.5	1.28
8	23-11-2018	139.5	54.6	12.1	15.9	1.29

Shamlaji						AAQ-6
S.No.	Date	PM10	PM2.5	SO ₂	NO ₂	CO
1	05-11-2018	122.2	47.5	10.2	16.5	1.05
2	06-11-2018	132.2	53.2	9.9	15.2	1.22
3	12-11-2018	127.2	50.2	10.1	19.5	1.17
4	13-11-2018	135.2	55.5	12.4	15.4	1.24
5	19-11-2018	128.5	52.2	10.5	14.7	1.06
6	20-11-2018	131.1	50.9	9.7	12.7	1.15
7	26-11-2018	129.2	52.4	11.9	16.5	1.07
8	27-11-2018	118.7	46.5	9.3	17.5	0.97

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SIX-LANING OF SHAMLA JI TO MOTACHILODHA SECTION OF **NH-8** FROM **KM 401.200 TO KM 494.410 (LENGTH 93.210 KM)** IN THE STATE OF GUJARAT UNDER NHDP PHASE -V (PACKAGE-VI) ON HYBRID ANNUITY MODE

**BASELINE
DATA****Ambient Noise Quality of Study Area**

Noise Locations/Codes		Co-Ordinates	Category of Area	Day Time in dB(A)			Night Time in dB(A)		
				L _{Max}	L _{Min}	L _{eq}	L _{Max}	L _{Min}	L _{eq}
Chiloda	N-1	23° 13' 29.2" N 72° 43' 49.6" E	Res./Com.	60.2	39.2	54.0	39.9	29.1	35.7
Chhala	N-2	23° 18' 26.1" N 72° 46' 26.2" E	Res./Com.	62.1	40.1	56.3	38.3	30.2	35.0
Prantij	N-3	23° 26' 39.6" N 72° 51' 07.5" E	Res./Com.	58.9	32.6	52.9	35.4	29.8	33.3
Motipura	N-4	23° 34' 34.2" N 72° 57' 28.7" E	Res./Com.	60.8	38.2	55.5	38.1	29.2	34.4
Raigarh	N-5	23° 36' 07.3" N 73° 10' 57.0" E	Res./Com.	58.5	38.3	55.4	39.7	29.4	36.3
Shamlaji	N-6	23° 41' 20.8" N 73° 23' 16.6" E	Res./Com.	56.0	33.9	52.0	38.8	29.0	35.9

BASELINE DATA

SIX-LANNING OF SHAMLA JI TO MOTACHILODHA SECTION OF **NH-8** FROM **KM 401.200 TO KM 494.410 (LENGTH 93.210 KM)** IN THE STATE OF GUJARAT UNDER NHDP PHASE -V (PACKAGE-VI) ON HYBRID ANNUITY MODE

BASELINE DATA**Soil Quality of the Study Area**

Parameters	Unit	Chiloda	Pantij	Shamlaji
Location Code →		S-1	S-2	S-3
Coordinates →		23° 13' 34.7" N 72° 44' 05.0" E	23° 26' 46.7" N 72° 50' 50.5" E	23° 40' 53.2" N 73° 23' 33.1" E
pH	----	7.42	8.01	7.59
Electrical Conductivity	µmhos /cm	369.2	482.1	615.2
Moisture	%	13.2	15.1	19.5
Soil texture	----	Sandy Loam	Sandy Loam	Sandy Clay Loam
Clay	%	13	15	21
Silt	%	23	29	13
Sand	%	64	56	66
Infiltration Rate	cm/hr	1.53	1.54	1.49
Bulk density	gm/cm ³	1.47	1.46	1.51
Porosity	%	44.7	45.1	43.2
Nitrogen as N	kg/ha	169	158	187
Phosphorus as P	kg/ha	36	54	62
Potassium as K	kg/ha	117	132	127
Organic Carbon	%	0.19	0.27	0.50
Organic matter	%	0.32	0.46	0.87

BASELINE DATA

SIX-LANNING OF SHAMLA JI TO MOTACHILODHA SECTION OF **NH-8** FROM **KM 401.200 TO KM 494.410 (LENGTH 93.210 KM)** IN THE STATE OF GUJARAT UNDER NHDP PHASE -V (PACKAGE-VI) ON HYBRID ANNUITY MODE

BASELINE
DATA

Ground Water Characteristics

Parameters	Unit	Chiloda	Pranjit	Motipura	Shamlaji	IS 10500 :2012	
Location →		GW-1	GW-2	GW-3	GW-4	Acceptable limits	Permissible limits
Co-ordinates→		23° 13' 34.7" N 72° 44' 05.0" E	23° 26' 46.7" N 72° 50' 50.5" E	23° 40' 53.2" N 73° 23' 33.1" E	23° 35' 13.6" N 72° 59' 12.2" E		
pH	--	7.82	7.69	7.64	7.92	6.5-8.5	NR
Conductivity	µS/cm	1163.0	1052.0	958.4	989.5	\$	\$
Total Dissolve Solids	mg/l	712	642	591	612	500	2000
Alkalinity as CaCO ₃	mg/l	324.6	306.5	298.5	248.5	200	600
Total Hardness as CaCO ₃	mg/l	344.1	316.8	298.6	322.0	300	600
Calcium as Ca	mg/l	97.5	91.5	87.5	71.0	75	200
Magnesium as Mg	mg/l	24.5	21.5	19.5	35.2	30	100
Sodium	mg/l	68	56	42	47	\$	\$
Potassium	mg/l	6	9	12	11	\$	\$
Bicarbonate	mg/l	324.6	306.5	298.5	248.5	\$	\$
Chloride as Cl	mg/l	159.5	141.2	109.5	165.4	250	1000
Sulphate as SO ₄	mg/l	10.5	8.5	11.2	24.1	200	400
Nitrate as NO ₃	mg/l	16.4	2.3	1.6	1.9	45	NR
Fluoride as F	mg/l	0.64	0.16	0.16	0.31	1.00	1.5
Phenolic compound as C ₆ H ₅ OH	mg/l	BDL	BDL	BDL	BDL	0.001	0.002
Cyanide	mg/l	BDL	BDL	BDL	BDL	0.05	NR
Aluminum	mg/l	BDL	BDL	BDL	BDL	0.03	0.2
Arsenic	mg/l	BDL	BDL	BDL	BDL	0.01	0.05
Cadmium	mg/l	BDL	BDL	BDL	BDL	0.003	NR
Chromium as Cr ⁺⁶	mg/l	BDL	BDL	BDL	BDL	0.05	NR
Iron	mg/l	0.15	0.18	0.18	0.21	0.3	NR
Copper	mg/l	BDL	BDL	BDL	BDL	0.05	1.5
Lead	mg/l	BDL	BDL	BDL	BDL	0.01	NR
Manganese	mg/l	BDL	BDL	BDL	BDL	0.1	0.3
Mercury	mg/l	BDL	BDL	BDL	BDL	0.001	NR
Zinc	mg/l	2.6	1.6	2.1	1.2	5	15

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Surface Water Characteristics

Parameters	Unit	Prantij	Shamlaji	Water Quality Criteria as per CPCB
Location Code →	-	SW-1	SW-2	
Co-Ordinates→	-	23° 26' 47.3" N 72° 50' 49.4" E	23° 40' 52.4" N 73° 23' 34.2" E	
Turbidity	NTU	24	31	\$
pH	--	7.28	8.94	Class A
Conductivity	µS/cm	876.5	1098	\$
Total Dissolve Solids	mg/l	492	765	\$
Alkalinity as CaCO ₃	mg/l	92.3	210.8	\$
Total Hardness as CaCO ₃	mg/l	109.9	102.7	\$
Calcium as Ca	mg/l	31.5	21.2	\$
Magnesium as Mg	mg/l	7.6	12.1	\$
Sodium	mg/l	97	168	\$
Potassium	mg/l	6	13	\$
Bicarbonate	mg/l	92.3	210.8	\$
Chloride as Cl	mg/l	168.5	194.5	\$
Sulphate as SO ₄	mg/l	22.6	52.8	\$
Nitrate as NO ₃	mg/l	1.9	2.4	\$
Fluoride as F	mg/l	0.32	0.18	\$
Phenolic compound as C ₆ H ₅ OH	mg/l	BDL	BDL	\$
Cyanide	mg/l	BDL	BDL	\$
Aluminium	mg/l	BDL	BDL	\$
Arsenic	mg/l	BDL	BDL	\$
Cadmium	mg/l	BDL	BDL	\$
Chromium as Cr ⁺ ₆	mg/l	BDL	BDL	\$
Iron	mg/l	0.19	0.31	\$
Copper	mg/l	BDL	BDL	\$
Lead	mg/l	BDL	BDL	\$
Manganese	mg/l	BDL	BDL	\$
Mercury	mg/l	BDL	BDL	\$
Zinc	mg/l	3.2	1.9	\$
Dissolve Oxygen	mg/l	5.1	5.7	Class B & C
COD	mg/l	10.2	8.7	\$
BOD, 27°C 3 days	mg/l	4.2	6.1	Below E
Total Coliforms	MPN/100ml	>950	>950	Class B & C

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Climatology and Meteorology of Study Area as per IMD, Ahmedabad (1971-2000)

Month	Temp (°C) (Daily)			Humidity (%)		Rainfall	Wind Speed
	Max	Min.	Average	08:30	05:30	mm	kmph
January	28.1	12.0	20.1	64	35	1.9	6.0
February	30.5	14.0	22.3	57	28	1.0	6.4
March	35.7	19.1	27.4	50	21	0.5	7.0
April	39.7	23.7	31.7	57	22	2.7	8.0
May	41.6	26.5	34.1	66	25	10.2	11.3
June	38.7	27.3	33.0	75	45	95.1	11.8
July	33.5	25.7	29.6	85	69	281.3	10.0
August	32.0	24.9	28.5	87	71	234.6	8.7
September	33.8	24.3	29.1	82	60	95.8	7.2
October	35.7	21.3	28.5	67	41	12.3	4.8
November	32.8	16.6	24.7	58	37	4.3	4.8
December	29.4	13.2	21.3	61	37	0.8	5.5
YEAR	34.3	20.7	27.5	67	41	740.6	7.6

Source: Climatological Table 1971 – 2000, Indian Meteorological Department, Govt. of India, New Delhi

Wind Variability of Study Area as per IMD, Ahmedabad (1971-2000)

Month	N/360	NE/45	E/90	SE/135	S/180	SW/225	W/270	NW/315	CALM/0	SEASON
DEC	12	27	33	1	0	0	0	3	24	Winter
	24	17	17	2	1	1	1	15	22	
JAN	16	21	22	1	1	0	2	7	30	
	31	16	10	2	1	2	4	25	9	
FEB	13	16	16	2	0	1	4	17	31	
	24	10	9	2	3	5	11	30	6	
Total	120	107	107	10	6	9	22	97	122	
MAR	10	8	12	2	1	2	11	33	21	Summer
	15	5	4	2	2	8	18	39	7	
APR	6	1	4	1	3	8	21	45	11	
	9	1	1	2	4	13	30	34	6	
MAY	2	0	0	2	8	28	30	28	2	
	4	1	1	2	10	29	31	20	2	

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SHAMLA JI EXPRESSWAY PVT. LTD.	INSITU ENVIRO CARE	

BASELINE DATA

SIX-LANNING OF SHAMLA JI TO MOTA **CHILODHA** SECTION OF **NH-8** FROM **KM 401.200** TO **KM 494.410 (LENGTH 93.210 KM)** IN THE STATE OF GUJARAT UNDER NHDP PHASE –V (PACKAGE-VI) ON HYBRID ANNUITY MODE

BASELINE
DATA

Month	N/360	NE/45	E/90	SE/135	S/180	SW/225	W/270	NW/315	CALM/0	SEASON
Total	46	16	22	11	28	88	141	199	49	
JUN	1	0	1	5	15	40	23	9	6	Monsoon
	1	0	1	5	24	36	21	7	5	
JUL	0	0	0	2	14	52	17	4	11	
	0	1	1	5	18	41	19	5	10	
AUG	1	0	0	1	8	45	26	8	11	
	2	0	1	3	11	38	23	8	14	
SEP	2	1	2	3	6	19	28	25	14	
	5	2	2	3	9	25	21	15	18	
Total	12	4	8	27	105	296	178	81	89	
OCT	10	8	14	6	2	2	5	16	37	P. Monsoon
	14	9	10	6	4	6	5	14	32	
NOV	13	21	29	3	1	0	0	3	30	
	20	13	19	3	1	1	2	9	32	
DEC	12	27	33	1	0	0	0	3	24	
	24	17	17	2	1	1	1	15	22	
Total	93	95	122	21	9	10	13	60	177	
YEA R	7	9	11	2	5	16	14	16	20	Annual
	12	6	6	3	7	17	16	19	14	
Total	19	15	17	5	12	33	30	35	34	



ANNEX –IV

NABET CERTIFICATE



Quality Council of India

National Accreditation Board for Education & Training



CERTIFICATE OF ACCREDITATION

In Situ Enviro Care

E-4/60, In Front of Metro Walk, Arera Colony,
Bhopal-462016 (M.P.)

Accredited as **Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA/EMP reports in the following sectors:

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals opencast only	1	1 (a) (i)	A
2	Thermal power plants	4	1 (d)	B
3	Cement Plants	9	3 (b)	B
4	Distilleries	22	5 (g)	B
5	Sugar Industry	25	5 (i)	B
6	Building and construction projects	38	8 (a)	B
7	Townships and Area development projects	39	8 (b)	B

Note: Name of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated Jun. 08 and Sep. 27, 2017 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/17/0379 dated Aug.16 2017. The accreditation needs to be renewed before the expiry date by In Situ Enviro Care, Bhopal, following due process of assessment

Sr. Director | NABET
Dated: Dec. 07, 2017

Certificate No.
NABET/ EIA/1619/ RA 0070(Rev.02)

Valid upto
30.11.2019

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer QCI-NABET website.