

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
Planning and Design Phase			
1	Contractor Preparatory Works (Upon issuance of Notice to Proceed)	EHS	1. The Contractor shall complete the following activities no later than 30 days upon issuance of Notice to Proceed, (a) appoint contractor's Safety, Health and Environmental Officer (SHEO); (b) SHEO will engage PMC-Environment Specialist to discuss ESMP, seek clarification and recommend corresponding revisions if necessary; (c) SHEO will agree with PMC the monthly monitoring template and deadlines for submission; (d) SHEO will submit for PMC's approval a work plan to secure all permits and approvals needed to be secured during construction stage which include but not limited to: i) operation of crushers and hot mix plants, ii) transport and storage of hazardous materials (e.g., fuel, lubricants), iii) waste disposal sites and disposal management plan, iv) temporary storage location, iv) water use, and v) emission compliance of all vehicles. Arrangements to link with government health programs on hygiene, sanitation, and prevention of communicable diseases will also be included in the action plan; (e) SHEO will submit for PMC's approval of the construction camp layout and management plan before its establishment; and (f) SHEO will update EIA (in consultation with PMC, in case of design changes) and also prepare site-specific ESMPs.
2	Labour Management	Labour	1. Compliance with Gol and state's labor legislation, ratified International Labour Organization conventions.
			2. Prohibition of child labor, including prohibition of persons under 18 years old from working in hazardous conditions (which includes construction activities) and from working at night; medical examinations required to determine that persons under 18 years old ((but definitely above 14) are fit to work.
			3. Elimination of discrimination with respect to employment and occupation, to be defined as any distinction, exclusion, or preference based on race, gender, religion, political opinion, trade union affiliation, national extraction, or social origin.
			4. Human resource policy or plans that establish (a) the rights and responsibilities of project company employees and any contractor employee working in the project regarding remuneration, working conditions, timings, benefits, number of leaves, disciplinary and termination procedures, occupational safety and health, promotion procedures, and training and (b) the rights, responsibilities, and requirements in contractor or subcontractor agreements related to worker rights.
			5. Grievance Redress Mechanism for workers should be established as early as possible to function no later than construction commencement, including provisions for addressing cases related to GBVH (Gender based violence and harassment)
			6. There will be provision for group accidental insurance for the workers.
		Health and Safety	1. Make mandatory the use of safety gears (helmets, safety belts, masks, gloves, Ear plugs/ muffs and boot) by workers depending on nature of work.
			2. Necessary planning and safety approach will be made for rescue during emergency.

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		Health and Safety	3. Use of dust controls (exhaust ventilation) for dust control.
			4. Workers will be provided with first aid and health facilities at the site.
			5. There should have facility to deal with medical aspects of health treatment with specialized services
3	Obtaining Clearance, Permission and Consents	Regulatory Compliance	1. Consultation and coordination with relevant authorities to prepare the documents to obtain clearance, permission and consents.
			2. Conditions set in clearance, other permission and consents to be incorporated into the site-specific ESMPs, with dedicated officers to maintain the regulatory compliance tracker.
4	Site Clearance and Demolition	Tree felling	1. HMDA and Contractor need to conduct a final tree inventory survey (number, type, height) with the final designs of alignment. Trees with conservation value should be transplanted. Plan to avoid cutting patrimonial trees, including adjustments in project design to minimize effect on such trees.
			2. Revisit the works in public parks or green spaces and potential tree removal, especially involving patrimonial trees of special significance, so minimize the impacts as much as possible.
			3. If unavoidable, implementation of acceptable plans for transplanting (to the extent technically and economically viable) or replacing such trees and for their short-term maintenance and care.
			4. Adequate coordination with applicable government regulatory authorities. Compensatory plantation of atleast 10 saplings for every tree felled will be done in sites to be identified. HMDA to allocate sufficient tree replantation budget.
			5. Stakeholder communication to avoid or minimize public concerns or protests.
		Noise	1. The procedure of demolition will be conducted as per the demolition plan prepared by the Contractor in consultation with HMDA.
			2. The existing structures should be demolished one after another cautiously.
		Physical Cultural Resources	1. Contractor to conduct pre-construction inspections if there are known or a significant likelihood of archaeological and/or culturally valuable sites or finds in the project's direct area of influence.
			2. Prepare a monitoring scheme prior to construction based on the above inspections.
			3. Compliance with applicable legislation (permits and procedures) and good international practice.
			4. Chance finds procedure to be prepared by Contractor and reviewed by PMC/HMDA.
5	Severance of utilities	Social	1. Assets and utilities will be maintained without affecting and damages by shifting temporary/ permanently where it is necessary.
			2. Based on utility maps and network information, HMDA and Contractor in collaboration with utility owners oversees an investigation of existing utility supply infrastructure using trial pits. HMDA and Contractor to conduct on-site inspections and a topographic survey. Utility owners will be involved in providing any new utilities needed for the road system and in designing the necessary diversions and protection measures.

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		EHS	3. For gas pipeline, Contractor will conduct the hazardous operation study to ensure the smooth and safe shifting.
			4. Utility shifting plan will be developed by HMDA and Contractor in coordination with concern authorities and shifting of utilities will be done as per agreed utility shifting plan prior to construction commenced. The plan will include required EHS management measures, supervision and monitoring of implementation, and final report and confirmation that construction works will be properly closed.
6	Noise and Vibration Impacts Related Design	Environmental Nuisance	1. The detailed noise and vibration analysis (mathematical modeling) at sensitive receptors based on final engineering designs should be carried out, based on which, a set of mitigations should be prepared and shared with all lenders for review, prior to commencement of construction.
			2. Additional assessments of vibration, such as visual inspections of buildings and baseline monitoring in areas with sensitive buildings of cultural or historical significance.
			3. Noise at source will be controlled or reduced by incorporating suitable feature in the design of structures (e.g., noise barriers) and layout of machines and by use of resilient mounting and dampers etc. Low-noise pavement surfaces shall be considered.
7	Coordinate with the Traffic Department on Traffic Management Plan	Land Occupational safety Community safety	1. The Contractor shall develop detailed and robust traffic management plans consistent with the Indian Guidelines on Traffic Management in work zones (IRC:SP:55-2014), prior to mobilization for respective sections with site-specific plans and measures to minimize the overall impact on traffic throughout the construction period.
			2. At congested sections, the temporary traffic coordinators will be engaged by HMDA to facilitate the traffic management.
			3. At the minimum, the traffic management plans will have the following components: construction traffic, ensuring access to properties, accommodating pedestrians, parking, access by construction vehicles, faulty traffic lights and problem interchanges, use of public roads, parking provision during construction, use of residential streets and traffic diversion due to temporary road closures, and construction and use of temporary access roads.
			4. Strengthening impact and risk prevention measures, such as establishing construction site works to minimize the entrance and exit of vehicles at stations during peak traffic.
			5. The logistics should be considered to manage transport materials from storage areas to worksites and to return excavated soil and other materials to disposal locations. If needed, construction traffic may be confined to certain routes or restricted to certain off-peak hours.
			6. Any diversions of traffic will cause considerable confusion for pedestrians and drivers. To minimize the effects, it is necessary to conduct communication campaigns and disseminate appropriate information to urban residents and taxi and bus drivers in advance of disruptions. Efforts will be given to divert traffic to roads wide enough to accommodate extra traffic. Compliance with scheduled deadlines for the detour is essential.
			7. Incorporation of community safety considerations into plan design, especially at locations where buildings are close to the construction site.
			8. HMDA and local authorities continue to play an oversight role in approving these plans during construction, evaluating their cumulative impact with other infrastructure projects in the region, and ensuring their dissemination to all relevant stakeholders.

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8	Construction method, construction material and sites selection	Environment	1. Contractor is committed to use environmentally friendly construction methods and materials, including cement, asphalt, and base materials etc.
			2. Construction material shall be sourced from legalized and approved quarries.
			3. Energy saving technologies will be embedded into the Project design wherever possible. For instance, solar panels for site offices, energy-efficient lighting.
			4. Update of plan based on final contractor-defined estimated volumes and timing for groundwater pumping with intension of minimizing the groundwater consumption. The primary objective shall be to avoid extraction of groundwater for construction. However use of groundwater which has been generated by dewatering of excavations can be used in construction activities. In those instances where extraction of groundwater becomes unavoidable, contractor shall, with consent of HMDA, resort to such extraction.
			5. Procedures for minimizing waste segregation, reuse, temporary storage, recycling, donation, and disposal.
			6. Selection of waste disposal service providers (transport, recycling, and disposal) based on EHS criteria.
			7. Final selection of disposal or reuse sites for extracted soils from construction and assessment and determination of truck routes from project sites to disposal or reuse site.
			8. Focus will be placed on reuse of the extracted soil for enhancement of green space, waste recycle, and storm water runoff.
			9. Construction yards with aggregate crushing and screening, pre-casting, material and fuel storage and ready-mix concrete plants will be located away from habituated or ecologically sensitive areas. Locations will be decided by HMDA and cleared by lenders before construction commencement in consultation with Municipal Corporation and HMDA.
			10. The muck disposal sites will be decided by HMDA before start of construction in consultation with TSPCB, and Municipal Corporation, to ensure a safe distance from residential areas, water bodies and ecologically sensitive locations as to avoid disrupting natural drainage. The muck shall be filled in the dumping site in layers and compacted mechanically. Suitable slopes will be maintained on the stockpile. Once the filling is complete, it will be protected by low walls, provided with a layer of good earth on the top and covered with vegetation. A muck disposal plan will be prepared by Contractor.
9	Climate Designs	Health and Safety	1. Vulnerability of project to flooding on the project is indicated. Drainage design will account for intense rainfall events. On SH-01, adequate drainage facilities will be made in terms of evacuation of flood water using pumps in low-lying areas and the cut-and-cover tunnel section. Disaster management plan will pay special attention to flooding and other natural disaster to facilitate robust safety.
			2. Other climate adaptation designs will be embedded in the final design, such as (a) use of permeable pavements where feasible for stormwater management; (b) designing for better adaptability to heavy flooding through the use of higher road crown levels, sufficient culvert capacity, and check valves for sewer lines in flood-prone areas and the use of resilient materials that can get wet and then dry out with minimal damage; and (c) rainwater harvesting through gutters and pipes to either harvesting pits or for groundwater recharge at facilities.
			3. Climate change mitigation measures will be considered, such as solar panels on facility buildings and roofs to reduce the extensive use of grid-generated electricity supplied for operation and maintenance (e.g., for toll plazas, tunnel ventilation).
			1. Prior to mobilization, contractor to collect a full set of site-specific baseline data of air, water (surface and ground), noise, soil quality.

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10	Site-specific Environmental Baseline Collection and Assessment	Environment	2. Additional investigations in areas identified as having contaminated soil or groundwater to define the degree and extent of contamination and alternatives for soil and groundwater disposal. Assessment of potentially contaminated soil at site locations where soil work and excavations will be performed to examine the site situation. If there is a reasonable likelihood of contamination, then a specific management plan that includes (a) monitoring during construction consisting of visual inspections, on-site and in-situ monitoring to detect and confirm levels of contamination (and supplemented as needed by laboratory analysis), (b) on-site temporary storage and treatment, (c) final disposal (both for water and soil), and (d) worker health and safety procedures.
			3. Assessment and site-specific measures for controlling noise, dust, and illumination during construction (for example, when working 24 hours a day).
			4. Confirmation of potential uses of groundwater and pumping impacts (for example, settlement or subsidence). Efforts on minimizing the groundwater consumption.
			5. Contractor to prepare site-specific ESMPs for HMDA to approve before mobilization.
			6. Based on detailed construction work plan and associated occupational health and safety risks, strengthening the contractor's health and safety management system in site-specific ESMPs.
			7. HMDA and PMC to provide ESMP orientation to contractor.
11	Community Liaison	Social	1. To ensure that Grievance Redress Mechanism to function effectively for affected people on construction nuisance at ground level with grievance log well documented.
			2. Contractor to develop a community communication plan per the construction plan, including important measures to reduce community risk, such as fence and related protection around work sites (including strength and visual protection), education and awareness signs and information, and placement of safety risks (explosive and flammable materials, generators).
Construction Phase			
12	Construction Monitoring	EHS	1. Contractor to collect and monitor the Ambient environmental data of air, water (surface and ground), noise & vibration, soil quality and submit monitoring reports to PMC / HMDA on monthly basis.
			2. PMC / HMDA to review the data compared to baseline data and urge Contractor to take immediate actions over any project generated pollution / contamination.
			3. PMC to submit monitoring reports on quarterly basis to HMDA.
			4. If any unanticipated EHS impacts arise during construction, implementation or operation of the Project that were not considered in the EIA / ESMP, Contractor and PMC to promptly inform HMDA of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan. HMDA will report to all lenders accordingly.
			5. HMDA to engage qualified and experienced third party monitor to verify information produced through the Project monitoring process, and facilitate the carrying out of any verification activities by such third party monitor.
			6. HMDA to submit the semi-annual monitoring reports (PMC's and third party's) using the agreed the template to all lenders.
			7. HMDA to report all lenders any actual or potential breach of compliance with the measures and requirements set forth in the ESMP promptly after becoming aware of the breach.
			1. To ensure that ongoing timely consultations / communications with communities are provided on the progress of the project together with feedbacks on the environmental management performance of the project.

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13	Community Liaison	Social	2. Grievance Redress Mechanism for affected people should function effectively with grievance log well documented.
			3. Contractor will provide a minimum of two (2) weeks notification to directly affected residents, businesses and other relevant groups of the intended construction commencement date. In providing a mechanism for communication between the contractor and the community and informing the public of construction details (timing, expected impacts), HMDA will undertake consultations.
			4. Adaptive management that monitors, adjusts, or adds measures to reflect actual community risks.
			5. Important measures to reduce community risk, such as fence and related protection around work sites (including strength and visual protection), education and awareness signs and information, and placement of safety risks (explosive and flammable materials, generators).
14	Truck and Driver Management	Environment Social	1. Contractor's transport vehicles and other equipment shall conform to emission standards.
			2. Control, inspection, and documentation of trucks prior to leaving site, including removal of soil on tires. Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
			3. Definition of allowable routes, speeds, and times (day or week).
			4. Driver requirements and controls, including prework medical (and blood tests) and physical inspections, ongoing monitoring (of visual and alcohol or drug use), driver training, daily total allowable work time, and allowable deviations.
			5. Driver contracts with clearly specified requirements and remedies for noncompliance.
			6. Use of electronic monitoring (GPS), driver training, and stops.
			7. Procedure for truck maintenance, including selection of service providers considering environmental aspects, application of low-Sulphur fuel, no idling of trucks, routine maintenance (including assurance of proper engine operations related to emissions and noise), and disposal of used oil and other fluids, batteries, and tires etc.
15	Leveling of Site	Land	1. Interim drainage system will be installed prior to construction.
			2. Where feasible, infiltration losses could be countered by installing Rainwater Harvesting pits away from construction site.
		Noise	1. At sensitive locations, auger piling will be carried out in place of mechanical (by driven) piling which will generate less noise than mechanical piling (around 70-75 dB(A)). Also 2m high barricade of GI sheet will be installed on all sides of piling operations. This could effectively cut down noise levels by 10-15 dB (A). Piling operations will be restricted during day time hours only.
			2. Efforts should be made to keep the noise levels under control by appropriate noise attenuation and adopting employee safety measures.
			3. Use of low-noise equipment and ensuring good maintenance, and trying to avoid using high-noise equipment simultaneously at the same section.
			4. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			5. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.

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16	Mechanical piling		6. Enclose especially noisy activities if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
			7. Monitoring required during construction, including field observations and measurements.
		Vibration	1. Cast-in-situ piling will be deployed at locations with sensitive receptors so as to reduce vibration.
			2. At locations where the alignment is close to sensitive receptors, the contractor shall implement the pre-construction structural integrity inspections.
			3. Contractor to ensure that vibration levels at historically and culturally sensitive Structures, and Structures in poor state condition will not exceed 2.0 mm/s.
			4. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			5. Monitoring during construction including field observations and measurements.
		Physical Cultural Resources	1. Before start of piling, Contractor and HMDA will coordinate with State Archeological department to reconfirm that there is presence of buried artifacts along the road line alignment. No piling will be allowed unless cleared by the Archeological Department.
			2. Archeological monitoring during construction stage, including specialists in field with authority to stop work.
			3. All workers will undergo a briefing with the Archaeology Department to ensure safeguarding of heritage resource and cultural/religious practices.
			4. A proof of compliance to this requirement to include the name of participants and date and location of briefing will form part of the monthly report to HMDA.
			5. Archeological rescue and protection in case of chance finds, follow specific measures (reporting, monitoring) recommended by UNESCO.
		Health & Safety	1. Auger piling methods will be used to reduce the impacts of noise. 2m tall screens of GI sheets will be installed between source (pile driver) and receptors (workers & nearby populations).
			2. To reduce the harmful effects, personnel working at high noise levels would be provided with noise protective gears such as ear muffs, sound barriers, job rotations per occupational exposure limits etc.
			3. Procedure to receive, evaluate, and compensate (if applicable) damages due to construction and establishment of financial resources to cover this expense.
17	Diaphragm Wall Construction	Air	1. Fugitive dust could be controlled using water sprinkling. Water sprinkling to be carried out by Contractor at regular interval (to be mutually decided by the contractor and HMDA).
			2. Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites.
			3. Imposition of speed controls for vehicles on unpaved site roads. Ten kilometers per hour is the recommended limit.
		Waste	1. Bentonite slurries used in diaphragm wall construction should be reconditioned and reused wherever practicable.
			2. The disposal of residual used bentonite slurry should follow the international good practice.
			3. Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
			4. Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site.
			1. To specify the number and length of shifts for each worker.

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		Health and Safety	2. Oversight of project safety is needed to ensure proper support and lining of excavated sections to avoid collapse. 3. Excavations for the cut-and-cover tunnel have to be properly lit, drained, and ventilated to provide visibility, dry working conditions, and breathable air free of dust even in confined spaces. 4. Where a site boundary adjoins a road, streets or other areas accessible to the public, hoarding should be provided along the entire length except for a site entrance or exit.
18	Excavation (The quantum of soil excavated will be about [X] lakh cubic	Air	1. Fugitive dust could be controlled using water sprinkling. Water sprinkling to be carried out by Contractor at regular interval (to be mutually decided by the contractor and HMDA).
			2. Imposition of speed controls for vehicles on unpaved site roads. Ten kilometers per hour is the recommended limit.
			3. Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites.
			4. Excavation machinery will be topped up by low-Sulphur fuel.
		Noise and Vibration	1. Efforts should be made to keep the noise levels under control by appropriate noise attenuation and adopting employee safety measures.
			2. Use of low-noise equipment and ensuring good maintenance, and trying to avoid using high-noise equipment simultaneously at the same section.
			3. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			4. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			5. Enclose, especially noisy activities, if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
			6. Monitoring required during construction, including field observations and measurements.
			7. Provide timely notification of residents about cut-and-cover tunneling works will limit the nuisance of noise and vibration due to excavation operation.
			8. Contractor to ensure that vibration levels at historically and culturally sensitive Structures, and Structures in poor state condition will not exceed 2.0 mm/s.
		Surface water	1. Proper drainage systems using contour information will be constructed around active and large construction sites. The wastewater should be discharged after sedimentation in tanks.
			2. To avoid water pollution and soil erosion due to flooding, earthwork will be limited during monsoon season.
		Groundwater	1. Dewatering will be done only when required. Groundwater will be collected in sedimentation tanks and reused in non-potable uses. This water will be treated to meet TSPCB standards before discharge.
			2. Groundwater monitoring, including groundwater quality and aquifer status.
		Soil	1. Soil erosion by runoff will be controlled by installing proper drainage systems using contour information. It is suggested to avoid bringing soil from outside the project boundary and to use the excavated mounds for filling low lying area where it is necessary.
			2. The topsoil should be preserved (by storing it at appropriate places) so that same can be restored after completion of work.
			1. Plan showing location of construction site and affected structures.
			2. Groundwater extraction adjacent the project could lead to subsidence under non-project structures. At locations where the water table is high, dewatering needs to be carefully managed.

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	meter)	Subsidence	3. Groundwater drawdown can be minimized by sealing joints in excavation support systems. In addition, where required adjacent structures will be given additional supports. Sides of deep excavations for the cut-and-cover tunnel will be supported by walls which minimize water seepage. In built up areas where side walls are not feasible, adjacent structures will be provided additional supports.
			4. Collapse of excavation will be prevented by proper shoring and benching. Subsidence above excavation due to removal of material and water beneath will be prevented by such supports.
			5. Monitoring records which include but not limited to, groundwater drawdown records from borewells, vibration records, geotagged photographs with date.
			6. Real-time monitoring of structures above tunneling operations and adjustments of operation if required.
			7. Record sheet showing type, size and identification number of structure, time of occurrence, type of equipment in use before and when the damage was first noticed, the type of minor repair executed, number of occupants present and evacuated, time of evacuation, status of adjacent structures, type of rehabilitation implemented on each affected structure, date of resumption of construction activities, date of return of occupants.
		Physical Cultural Resources	1. Before start of excavation, Contractor and HMDA will coordinate with State Archeological department to reconfirm that there is presence of buried artifacts along the road line alignment. No excavation for the cut-and-cover tunnel will be allowed unless cleared by the Archeological Department.
			2. Archeological monitoring during construction stage, including specialists in field with authority to stop work.
			3. All workers will undergo a briefing with the Archaeology Department to ensure safeguarding of heritage resource and cultural/religious practices.
			4. A proof of compliance to this requirement to include the name of participants and date and location of briefing will form part of the monthly report to HMDA.
			5. Archeological rescue and protection in case of chance finds, follow specific measures (reporting, monitoring) recommended by UNESCO.
		Health and Safety	1. To specify the number and length of shifts for each worker.
			2. Oversight of project safety is needed to ensure proper support and lining of excavated sections for the cut-and-cover tunnel to avoid collapse.
			3. Excavations have to be properly lit, drained, and ventilated to provide visibility, dry working conditions, and breathable air free of dust even in confined spaces.
			4. Where a site boundary adjoins roads, streets or other areas accessible to the public, hoarding should be provided along the entire length except for a site entrance or exit.
		Aesthetics	1. The excavation sites for the cut-and-cover tunnel will be barricaded on all sides using GI sheets. Hauling will be carried out in non-peak hours.
			2. Aesthetic value of the site will be restored after completion of the works.
19	Blasting	Aesthetics	1. Rock is not anticipated along the alignments.
			2. In the unforeseen event that blasting is required, a site-specific ESMP will be prepared by Contractor and approved by HMDA before blasting commencement.
			3. Good housekeeping practice should be adopted.
			1. The traffic management plan will be stringently implemented with regular monitoring and inspections.
			2. The trucks/dumpers carrying the excavated material will be covered using tarpaulin/similar covering materials.

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20	Hauling of excavated material	Air	3. Sprinkling of water should be carried out.
			4. Truck tires will be washed to excess remove soil clinging to it. Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
			5. Water for sprinkling and tire washing will be sourced from treated effluent from ETPs located nearby or surface runoff. Groundwater will not be used in view of status in Hyderabad.
			6. Haul roads will be kept in good state of maintenance.
		Noise	1. The routing, timing and logistics of the haul truck movement should be planned to have minimal impacts on noise level.
			2. The route selection will avoid any sensitive receptors.
			3. Efforts should be made to keep the noise levels under control by appropriate noise attenuation and adopting employee safety measures.
			4. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			5. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			6. Enclose especially noisy activities if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
			7. Monitoring required during construction, including field observations and measurements.
		Social	1. The local community has to be taken into confidence before the construction commences. Their concerns must be taken and incorporated in decision making.
			2. Grievance Redress Mechanism for affected people should function effectively with grievance log well documented.
		Health & Safety	1. The routing, timing and logistics of the haul truck movement should be planned to have minimal impact on occupational and community health and safety.
21	Dumping of excavated materials	Air	1. Site of dumping will be selected in consultation with authorities.
			2. The disposal plan will be stringently implemented with site monitoring and inspections.
			3. It will be located outside of urban habitation.
			4. Sprinkling of water should be carried out.
		Soil	1. The dumping will be done in pre-designated low lying areas identified by HMDA, TSPCB, for this specific purpose.
			2. The disposal plan will be stringently implemented with regular monitoring and inspections.
		Air	3. Field inspections, monitoring, and documentation of dumping excavated materials.
			1. Permission from Hyderabad Traffic Police will be sought before commencement of work. Detours will be properly planned and enacted during non-peak hours only, if possible. Traffic marshals will be posted near such detours. Proper signage has to be posted informing motorists about detours following IRC norms.
			2. Adaptive management with field inspections and monitoring during plan implementation and adjustments, as needed, to reflect actual traffic congestion or related issues.
			3. The Contractor will discuss and coordinate the implementation of the traffic re-routing scheme particularly at junction areas and the cut-and-cover tunnel section.

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22	Traffic diversion	Noise	1. Permission from Traffic police will be sought before commencement of work. Detours will be properly planned and enacted during non-peak hours only, if possible. Traffic marshals could be posted near busy intersections, to oversee the smooth flow of traffic.
			2. Detour route selection to avoid sensitive receptors to noise.
			3. Adaptive management with field inspections and monitoring during plan implementation and adjustments, as needed, to reflect actual traffic congestion or related issues.
		Social	1. Implement the traffic management plan. Plans will be made to spare traffic diversion during peak hours (morning and evening peaks). Also separate arrangements for bus, auto and taxi parking bays will be made. Street furniture for pedestrians will be provided wherever possible.
			2. Real-time communication to public prior to site-specific work (for example, via signs, radio, and newspaper) and during key periods of traffic interference or peak traffic.
			3. Adaptive management with field inspections and monitoring during plan implementation and adjustments, as needed, to reflect actual traffic congestion or related issues.
		Resource consumption	1. The detour will be planned to be optimum in terms of road length. The faster completion of works will also tend to reduce enhanced fuel consumption.
23	Restricted pedestrian movement	Social	1. Safe passage for pedestrians with proper sunshade / fall protection and signage will be planned. Public consensus will be built.
			2. Grievance Redress Mechanism for affected people should function effectively with grievance log well documented.
		Health & Safety	1. Safe passage for pedestrians with proper fall protection and signage will be planned.
24	Muck generation & disposal (incl. spent Bentonite & drill fluid and slurry)	Surface water	1. Muck disposal plan will be stringently implemented with regular monitoring and inspections.
			2. The construction sites will be provided with garland drains with intercepting pits to trap silt & muck.
			3. Muck will be stored in lined tanks / ponds (if such area is available). Or mechanically dewatered if such area is unavailable. After screening & detention, supernatant liquid from such tanks should be discharged into drainage lines adhering to TSPCB standards. Such tank/ ponds could be covered during monsoon to control runoff.
			4. The temporary muck storage areas will be maintained by the Contractor at all times until the excavate is re-utilized for backfilling or disposed of as directed by Employer. Dust control activities will continue even during any work stoppage.
			5. Transportation of muck will be scheduled by time and route to minimize air pollution in habitat areas.
		Groundwater	1. The tanks/ ponds holding muck will be lined to prevent infiltration into groundwater.
			2. Groundwater quality monitoring.
		Aesthetics	1. The construction site will be covered from all sides to reduce visual impacts.
25	Raft foundation	Soil	1. Concrete spoils will be collected manually and will be disposed in proposed disposal grounds.
26	Steel structure preparation	Soil	1. Steel scrap will be collected, sorted by diameter and sold to scrap dealers on alter date.
		Health & safety	1. Workers will be provided appropriate hand gloves and personal protective equipment (PPE).
			2. Skilled workers working at height or doing hot work will be required to seek permission from site management.
27	Stacking & warehousing	Surface water	1. Small dikes and garlanding drains along the periphery of the yard and plot boundary could be constructed. This will control runoff and washing out of finer material.
		Soil	1. Proper care will be taken. Such spills will be cleared by scraping and disposing the products as road sub-grade material.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
27	of raw material	Health & Safety	1. Cement and sand will be stacked under tarpaulin and secured by GI sheet barricading (working & wind break). Shorter work shift and daily medical checkups of workers will be implemented.
			2. Dust filters atop cement silos, wet suppression for aggregate crushing and screening will be employed.
		Aesthetics	1. The height of walls between the residential area and RM yard / construction area will be raised using GI sheets.
28	RCC pouring (using concrete pump)	Noise	1. Timing of using RCC pumps will be specified.
			2. RCC pumps will be covered from all sides.
			3. Bends and excessive head will be avoided.
			4. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
		Soil	1. The spoils from pouring concrete will be collected and reused as sub-grade material in road construction.
		Aesthetics	1. After each pouring cycle, the spoils will be manually collected and reused as sub-grade material in road construction.
29	Setting of concrete (using needle vibrator)	Noise	1. If the consistency of concrete could be altered, the need for use of vibrator (esp. in low temperature & low thickness casting) could be reduced. Damping could be used to reduce high frequency noise, and thereby reducing the noise levels. Workers should be provided with suitable PPEs.
			2. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed per IFC/WB guideline.
		Soil	1. The spoils from pouring concrete will be collected and reused as sub-grade material in road construction.
30	Curing of concrete (use of water)	Surface water	1. Garland drainage is proposed to be constructed around the construction yard. This will intercept the runoff generated from site. Rainwater harvesting (as a compensatory measure) will be practiced.
		Groundwater	1. In view of low groundwater levels, use of groundwater will not be resorted to. Water will be sourced from municipal supply or treated effluent from ETPs or treated surface runoff.
		Aesthetics	1. Garlanding drain will be constructed around the construction area. The curing water impounded will be reused for curing.
31	Use of Crane & Launchers	Noise	1. The sensitive receptors (workers & external parties, if applicable) have to be isolated from heavy construction noise generated. This is possible by erecting reinforced 2 m tall GI sheet barrier around the area where heavy construction works is undertaken.
			2. Workers working inside or near construction equipment should be provided with proper PPEs like ear plugs / muffs complying with IS 4869.
			3. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			4. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			5. Enclose especially noisy activities if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
		Health & Safety	1. As per SHE, operation of launchers and cranes should be only done under the strict supervision of a qualified engineer and a safety supervisor. Only qualified & trained crane/ launcher operators should be allowed. Proper examination of crane, launchers, labours & operators should take place before commencement of work.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
32	Construction of labour camp(s) and associated environmental issues	Surface water	1. Labour camps will be constructed in semi urban / urban set-ups. Thus, sewage and other discharges from the labour camps will be discharged in public sewers or septic tanks should be provided where access to public sewers is not possible.
		Groundwater	1. Contractor to collect the groundwater baseline data prior to construction.
			2. Disposal in compliance with applicable regulatory requirements.
			3. Groundwater quality monitoring.
			4. Water abstracted must be measured/ recorded periodically.
			5. After Construction, Contractor will conduct groundwater analysis and be obliged to reinstate the used sites to its original use or as requested by the land owner. In any case it should not be worse than the conditions of pre-construction.
		Soil	1. Contractor to collect the soil baseline data prior to construction.
			2. Municipal solid waste will be collected and taken away and disposed by municipality.
			3. Solid waste will have to be disposed in compliance with Municipal Solid Waste (Management & Handling) Rules, 2000, as amended to date.
			4. After Construction, Contractor will conduct soil analysis and be obliged to reinstate the used sites no worse than the conditions of pre-construction.
		Social	1. Mixing of skilled non-local labours with local unskilled people will reduce social frictions.
			2. To avoid labor influx risk, sensitizing of local community and the non-local workers separately as well as jointly will be done regularly.
		Health & safety	1. Regular counselling, medical checkups and treatment at separate clinics, coordination with local health authorities will be conducted.
			2. Per Building & Other Construction Workers (BOCW Regulation of Employment and Conditions of Service) Act, 1996 the employer (contractor) is liable to arrange for sanitation, health care facilities of labours, free of charge. Labour camps will be in full compliance of BOCW Act.
		Resources	1. Liquid petroleum Gas cylinders will be made available free of cost to the labourers by the Contractor.
			2. Labour camps are provided with canteen systems.
33	Loading /unloading of construction material	Air	1. The traffic management plan will be stringently implemented with regular monitoring and inspections.
			2. The trucks/dumpers carrying the material will be covered using tarpaulin/similar covering materials.
			3. Fugitive dust could be controlled using water sprinkling. Contractors should carry out water sprinkling.
			4. Truck tires will be washed to excess remove soil clinging to it. Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
			1. The RM storage yard will be separately built and enclosed from all sides. This will reduce noise generation at site.
			2. Concrete preparation will only take place in casting yards (away from habitation).
			3. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
	Construction material	Noise	4. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			5. Enclose especially noisy activities if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
		Health & safety	1. Cement and sand will be stacked under tarpaulin and secured by GI sheet barricading (working & wind break). Shorter work shifts and regular health checkups will be implemented. The RM storage yard will be separately built and enclosed from all sides. The worker will be provided with suitable PPEs. Also they will be trained and encouraged in using PPEs.
34	Use of batching plant	Air	1. High GI sheet screens and water sprinkling will be employed.
			2. Batching plant / casting yard shall be barricaded and made as a compulsory PPE zone. This will effectively reduce the fugitive dust generation.
		Noise	1. GI sheet barricading around batching area and worker PPE like ear muffs will be used.
			2. Batching plant / casting yard shall be barricaded and made as a compulsory PPE zone. This will reduce the impacts of noise generation.
			3. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
		Soil and Groundwater	1. Contractor to collect baseline soil and groundwater quality data prior to operate the plants.
			2. Municipal water will be used. In view of fragile groundwater status, extraction will be avoided.
			3. The construction sites will be provided with drains with intercepting pits in which the cement and sand will settle. After screening & detention, liquid will be discharged into drainage lines. Disposal in compliance with applicable regulatory requirements.
			4. Soil and Groundwater quality monitoring.
			5. After Construction, Contractor will conduct soil and groundwater analysis and be obliged to reinstate the used sites no worse than the conditions of pre-construction.
		Hazardous waste	1. The use and storage of hazardous materials at the casting yard and batching plant should adhere to TSPCB requirements.
			2. The transport, handling and storage of hazardous waste will be done in accordance with the provisions of Hazardous Chemicals (Management & Handling) Rules. Hazardous wastes from construction activity and equipment are labeled, recorded, stored in impermeable containment and for periods not exceeding mandated periods and in a manner suitable for handling storage and transport.
			3. The contractor shall maintain a record of sale, transfer, storage of hazardous waste and make these records available for inspection.
			4. The contractor shall get Authorized Recyclers to transport and dispose Hazardous Waste.
			5. Proper collection and storage facilities will be provided especially for hazardous waste.
		Resources	1. If power from the grid is used, permission from power supply company must be obtained by the Contractor.
			2. DG sets, if used, should: (a) conform to height of stack norms as per CPCB rules; (b) conform to emission norms as per E (P) Act, 1986; (c) noise level at 1 m distance from enclosure should not be >75 dB(A).
			3. The required permissions from TSPCB shall be obtained by the Contractor for using DG sets for power supply.
			4. Diesel storage if done beyond threshold limit (1000 L) permission should be obtained. Diesel should be stored on pukka platforms and spillages should be avoided.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
			5. Refer to Activity 43 "Use of DG sets" and Activity 45 "Storage of Diesel" for further measures.
35	Casting of segments and I-beams	Groundwater	1. Municipal water will be used. In view of fragile groundwater status, extraction will be avoided.
			2. The construction sites will be provided with drains with intercepting pits in which the cement and sand will settle. After screening & detention, liquid will be discharged into drainage lines. Disposal in compliance with applicable regulatory requirements.
			3. Groundwater quality monitoring.
		Resources	1. Pre-stressing and casting are basic requirements. However, most of the power should be drawn from approved lines, not from DG sets.
36	Curing of segments & I-beams	Groundwater	1. Wastages from curing could be collected separately and reused if possible. Stagnation of water (and resultant vector propagation) should be avoided.
			2. Groundwater quality monitoring.
			3. Disposal in compliance with applicable regulatory requirements.
			4. Groundwater will not be used. Water will be sourced from municipal supply or treated effluent from ETPs or treated surface runoff.
37	Hauling of segments to site	Air	1. The traffic management plan will be stringently implemented with regular monitoring and inspections.
			2. The trucks/dumpers carrying the excavated material will be covered using tarpaulin/similar covering materials.
			3. Sprinkling of water should be carried out.
			4. Truck tires will be washed to excess remove soil clinging to it. Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
			5. Haul roads will be kept in good state of maintenance.
		Noise	1. The routing, timing and logistics of the haul truck movement should be planned to have minimal impacts on noise level. The route selection will avoid any sensitive receptors.
			2. Efforts should be made to keep the noise levels under control by appropriate noise attenuation and adopting employee safety measures.
			3. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			4. Information dissemination to local residents and shop owners about the nature and duration of intended activities including the construction method, probable effects, quality control measures and precautions prior to commencement and kept updated as to changes in the management and mitigation plan.
			5. Enclose especially noisy activities if above the noise limits and employ transportable noise screens between noise sources and identified noise sensitive areas for the duration of noisy construction activities.
			6. Monitoring required during construction, including field observations and measurements.
		Social	1. The local community has to be taken into confidence. Their advice has to be taken and incorporated in decision making.
		Health & safety	1. The routing, timing and logistics of the haul truck movement will be planned to have minimal impacts on occupational and community health and safety.
		Aesthetics	1. Proper housekeeping activities have to be undertaken near the casting yard and nearby areas.
			1. Primary power source will be power distribution company, DG sets will be used only for power back-ups for site offices and tunnel ventilation.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
38	Use of DG sets	Air	2. The required permissions from TSPCB shall be obtained by the Contractor if using DG sets for power supply. DG sets compliant with CPCB norms will be used. Specification no. GSR 520(E) dt. 1-7-2003 for DG sets rating < 800 KW, and GSR 489(E) dt. 09-07-2002 for DG sets > 800 KW under E (P) Rules, 1986.
			3. Stack height of DG sets will be as per CPCB requirement [stack ht. = 0.2*(rating in kVA)0.5].
			4. Stack monitoring will be conducted monthly of the criteria pollutants.
			5. Compliance monitoring will be done to the regularly and check the monitoring instruments.
			6. Fuels used for DG will be High Speed Diesel with low-sulfur content.
		Noise & Vibration	1. DG sets compliant with CPCB norms will be used.
			2. Wherever baseline noise already exceeds the standards, only 3dB of noise increase is allowed.
			3. Monitoring required during construction, including field observations and measurements.
			4. DG sets will be enclosed type, with noise levels approx. 75 dB (A) at a distance of 1m in compliance with GSR 371(E) dt. 17-05-2002.
			5. Noise will be controlled using acoustic enclosure.
			6. The DG sets will be mounted on damping skids, which will reduce the vibration generated from DG sets.
		Resources	1. DG sets should always be use as a power back up, and not the primary sources of power. This should be made mandatory for all Contractors.
			2. Refer to Activity 45 "Storage of Diesel" for further measures.
		Aesthetics	1. Enclosures will be used to keep them off from public views.
			2. PM content of DG sets smoke will be as pert the CPCB norms, thus the DG will emit dark smokes only during start-up & shut-down (b) Noise will be controlled using acoustic enclosure.
39	All Construction Activities (C&D Waste Management)	Environment	1. Records of movement and loading/unloading of C&D waste and records of waste loaded by vendors.
			2. C&D waste will be reused/recycled as it has the potential to save natural resources (stone, river sand, soil etc.) and energy. C&D waste generated from road construction has potential use after processing and grading.
			3. The contractor will segregate and temporarily store the C&D waste till the vendor takes it away for recycling and disposal at authorized facilities.
			4. Contractor will adhere with the C&D Waste Management Rules.
		Occupational Health and Safety	1. Worker safety is important on all construction projects. It is important to consider the effects of staffing on worker safety and to provide appropriate training in safety awareness for all labor.
			2. For cut-and-cover tunnel construction, it is very important to conduct a fatigue assessment and to specify the number and length of shifts for each worker. Oversight of project safety is needed to ensure that tunneling is completed in suitable soil and drainage conditions and with proper support and lining of excavated sections to avoid collapse. Apart from the stringent inspection, tunnels have to be properly lit, drained, and ventilated to provide visibility, dry working conditions, and breathable air free of dust even in confined spaces.
			3. The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).
			1. Before it percolates into the groundwater, contaminated runoff water can be run through adsorbents such as bentonite to remove the diesel. The diesel will be quickly collected into steel trays and disposed to authorized recyclers.

Sl. No.	Activity	Aspect /Parameter affected	Mitigation measures
40	Storage of Diesel	Groundwater	2. All bulk diesel tanks shall be properly supported in an elevated position to facilitate gravity discharge. They shall stand within a bund constructed to contain a volume of 110% of the volume of the tank. There shall be no breaches in the bund wall, no material shall be stored within the bund and rain water collecting in the bund shall be regularly removed to prevent build-up.
			3. Spillage will be controlled using methods mentioned in the environmental contingency plan.
			4. Groundwater quality monitoring.
		Health & safety	1. Proper onsite emergency plan will be prepared and will be approved through HMDA. 2. If the diesel storage crosses the threshold limits permissions, proper fire protection norms have to be undertaken as per National Building Code, 2005 (if building)/ Oil Industry Safety Directorate Standard 117 (if installation).
41	Cleanup Operations, Restoration and Rehabilitation	Environment	The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. All spaces excavated and not occupied by the foundation or other permanent works shall be refilled with earth up to surface of surrounding ground. Land used should be restored to its original state/use.