Volume - III

BIHAR STATE HIGHWAYS PROJECT

BID DOCUMENT

FOR

CIVIL WORKS

Improvement/Upgradation, Widening and Strengthening of Manjhway to Ch: 21.88 Km. of Manjhway-Govindpur Road (SH-103) under Civil work Contract Package No. BSHP-III(Phase-2)/Pkg-6/SH-103

Invitation No. – BSHP-III(Phase-2)/ Pkg-6/SH-103/ 2021-22, Patna, Dated 17.02.2022

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ASIAN DEVELOPMENT BANK

Section-6(a)

ENVIRONMENTAL MANAGEMENT PLAN

SH-103 (Manjhway to Ch: 21.88 Km. of Manjhway-Govindpur Road)

ENVIRONMENTAL MANAGEMENT PLAN (MANJHWAY-GOVINDPUR ROAD OF SH-103)

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement/Road Safety								
1.1 Risk due to constricted sections, Pavement damage due to use of unsuitable sub-grade material, over loading and inadequate drainage provisions	▪ Embankment height raised ▪ Heavily built-up and geometrically deficit sections have been avoided ▪ Provision of concrete pavement in heavily built-up sections to reduce formation width avoiding damage to residential/commercial structures. ▪ CBR value of sub grade adopted in consistent to MORTH guidelines ▪ Overloading to be checked at weigh station ▪ Increase in vent size/waterway of cross drains ▪ Provision of additional culverts ▪ Embankment height raised ▪ Adequate side drains with suitable outfallls.	Design requirement IRC: SP: 19 IRC: 37-2018 IRC:SP:73-2007 IRC-SP:50-1999.	Lined drain of 3.360 km (both side)in urban areas. Realignment from Km 8+000 to Km 8+510 and from Km 13+130 to Km 13+450 Heavily built-up stretch requiring rigid/concrete pavement=3.360 Km Culverts- 2 additional, 63 replacements & 3 widening. Replacement of existing bridge at Km 17+605.	MI: Design and number of cross and side drains, PT: Design and numbers of CDs are in accordance with site needs and no incidence of overloading	Review of detail design documents & drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL

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1.2 Safety along the proposed alignment	▪ Geometric Improvements of curves ▪ Provision of crash barriers at accident prone areas and bridges ▪ Speed limitations near educational institutes, hospitals and other CPR. ▪ Provision of retro-reflective warning signboards near curves, school, hospital, religious places and other sensitive location ▪ Provision of sidewalks in the built-up sections on covered drains ▪ Signs and marking viz., delineators, object markers, hazard markers, safety barriers at hazardous locations, ▪ No service/slip road has been proposed ▪ Street Lighting in built-up sections and bridge locations proposed ▪ Major Junctions to be improved as per IRC/MORTH guidelines.	Design requirement IRC:SP:73 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MORTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012	Speed Regulatory signage, in built-up/ sensitive locations. Delineator: 123nos.[1] No service/slip road has been proposed Street lighting in built-up sections and bridge locations. 2 major junctions at Km 0+000 (with NH-82) and 21+880 (with NH-31), are to be improved with appropriate signages	MI: number and location of crash barriers, informatory and cautionary sign boards, service roads and street lighting as per design PT: numbers and location are in accordance with site needs .	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Design Consultant	BSRDCL
2. Natural Hazard/Climate Change Risk								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	▪ Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	IRC 37 2018 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDCL
2.2 Earthquake	▪ Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area	Dislodgement of superstructure shall be taken as per Clause 222 of IRC: 6.	Entire Stretch	MI: Culverts, Bridges, PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDCL

[1]Numbers of delineators given here is for the entire SH-84 in absence of section-wise break-up

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2.3 Flooding/Water-Logging	▪ 2 new culverts proposed. ▪ Replacement of 63 culverts & widening of 3 existing culverts ▪ Replacement of existing bridge at Ch-17.605. ▪ CD structures designed for 50year return period ▪ Waterways of bridges and culverts have been increased. ▪ Roadside drains to be provided	IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines	Roadside drains (both sides together)=3.36 km	MI: Design and numbers of cross & side drains, design and number of bridges PT: Design and numbers are in accordance with site needs	Review of design documents and drawings and comparison with site conditions	Covered under costs for DPR consultant	Contractor	BSRDCL
3. Loss of Land and Assets								
3.1 livelihood loss to affected persons	▪ Road improvement work to be accommodated within available ROW to the extent possible. ▪ Social Impact Assessment and Resettlement Plan to be undertaken as per national policy and ADB' guidelines. • Complete all necessary land and property acquisition procedures prior to the commencement of civil work. ▪ Adhere to the Land Acquisition procedures in accordance to RP's Entitlement Framework. ▪ Compensation and assistance as per project Resettlement Plan ▪ Implementation of Income restoration plan as per approved RP ▪ Preference in employment and petty contracts during construction to APs ▪ Constitute Grievance Redress Committee as per approved RP	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation And Resettlement Act, 2013 and ADB's involuntary resettlement policy. Contract Clause for preference to local people during employment.	Throughout the corridor (Pls. refer RP)	MI: Payment of compensation and assistance to DPs as per entitlement matrix of RP Number of complaints/grievances related to compensation and resettlement PT: Minimal number of complaints/grievances. All cases of resettlement and rehabilitation if any are resolved at GRC level. No case referred to arbitrator/court.	Check LA records; design drawings vs. land plans; Interview with affected persons Check status of employment given to local people during construction	Part of administrative and resettlement costs	BSRDCL and implementing NGO	BSRDCL
4. Diversion of Forest Land and Cutting of Trees								

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4.1 Deterioration in climatic condition. Increase in Green House effect/climate change impact	▪ Geometric adjustments made to minimize tree cutting. ▪ Obtain tree cutting permission from forest department ▪ Obtain Forest Clearance under Forest Conservation Act ▪ Compensatory plantation (1:3)as per Bihar Government's Forest Department circular dated 28.01.13 and 29.03.2016 ▪ Provision for additional plantation on 1: 7 basis to be implemented and guided by Tirhut model (TOR Attached with this EMP)	Forest Conservation Act, 1980	Total number of affected trees=484 Forest Area=Nil	MI: location of geometric adjustments to minimize tree cutting, budget allocated for compensatory and additional plantation PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory and additional plantation.	Covered under costs for DPR consultants	BSRDCL, Design consultants forest department	BSRDCL/Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	▪ Geometric adjustment has been made to minimize shifting need and/or the loss to any such facilities. ▪ All telephone and electrical poles/wires and underground cables should be shifted before start of construction ▪ Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services ▪ Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any ▪ Relocation of wells, hand pumps at suitable locations with consent from local community.	Project requirement	Throughout the corridor	MI: Number of complaints from local people, number, timing and type of notifications issued to local people, time taken to shift utilities PT: No. of complaints should be 0. Effective and timely notification. Minimal time for utility shifting	Interaction with concerned utility authorities and local public	Included under BSRDCL's costs	Contractor/ BSRDCL/utility company	BSRDCL /CSC
B. Construction Stage								
1. Air Quality								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	▪ Contractor to submit location and layout plan for storage areas of construction materials approved by CSC ▪ Transport, loading and unloading of loose and fine materials through covered vehicles. ▪ Paved approach roads. ▪ Storage areas to be located downwind of the habitation area. ▪ Water spraying on earthworks, unpaved haulage roads and other dust prone areas. ▪ Provision of PPEs to workers.	MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	MI: PM10 level measurements Complaints from locals due to dust PT: PM10 level< 100 g/m^{3}Number of complaints should be 0.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor	Included in civil works cost/ Incidental to work	Contractor	BSRDCL /CSC
1.2 Emission of air pollutants (HC,SO_2,NO_X,COetc.)fromvehiclesduetotrafficcongestionanduseofequipmentandmachinery	▪ Regular maintenance of machinery and equipment. ▪ Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. ▪ Only crushers licensed by the SPCB shall be used ▪ DG sets with stacks of adequate height and use of low sulphur diesel as fuel. ▪ LPG should be used as fuel source in construction camps instead of wood ▪ Ambient air quality monitoring ▪ Contractor to prepare traffic management and dust suppression plan duly approved by BSRDCL	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates PT: SO_2 and NO_2 levels are both less than 80ug/m^3. PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by contractor	Included in civil works cost	Contractor	BSRDCL /CSC
2. Noise								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and machinery	▪ All equipment to be timely serviced and properly maintained. ▪ Construction equipment and machinery to be fitted with silencers and maintained properly. ▪ Only IS approved equipment shall be used for construction activities. ▪ Timing of noisy construction activities shall be done during night time and weekend near schools, ▪ Implement noisy operations intermittently to reduce the total	Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof + Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Throughout project section especially at construction sites, residential and identified sensitive locations. Refer supplementary tables to EMP for information on sensitive receptors.	MI: day and night Noise levels. Number of complaints from local people PT: Zero complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of	Included in civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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	noise generated ▪ Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. ▪ Restrict construction near residential, built up and forest areas construction to daylight hours. ▪ Honking restrictions near sensitive areas PPEs to workers ▪ Noise monitoring as per EMoP.	works		work zone areas	construction site			
3. Land and Soil								
3.1 Land use Change and Loss of productive/topsoil	▪ Non-agricultural areas to be used as borrow areas to the extent possible. ▪ If using agricultural and, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. ▪ Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use	Project requirement	Throughout the project section and borrow areas (5 locations) Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits	Included in civil works cost	Contractor	BSRDCL /CSC
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	▪ Slope protection by providing frames, dry stone pitching, masonry retaining walls, planting of grass and trees at high embankments ▪ Side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than 2:1. ▪ The earth stock piles to be provided with gentle slopes to soil erosion.	IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site observation	Included in civil works cost	Design consultant and Contractor,	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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3.3 Borrow area management	▪ Obtain EC from DEIAA prior to opening any new borrow area. ▪ Comply to EC conditions of DEIAA ▪ Non-productive, barren lands, to be used for borrowing earth with the necessary permissions/consents. ▪ Depths of borrow pits to be regulated and sides not steeper than 25%. ▪ Topsoil to be stockpiled and protected for use at the rehabilitation stage. ▪ Transportation of earth materials through covered vehicles. ▪ Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation ▪ Borrow areas not to be dug continuously. ▪ To the extent, borrow areas shall be sited away from habitated areas. ▪ Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond.	IRC Guidelines on borrow areas and for quarries(Environmentalprotection ActandRules,1986;WaterAct,AirAct)+Clause305.2.2 MORTH Specifications for Road and Bridgeworks Guidelines for Borrow Areas management	Contractor is responsible for identifying the borrow area with all leads and lifts conforming Technical Specification after securing all permits as per Law of the Land.	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people. PT: No case of non-compliance to conditions stipulated by DEIAA in clearance letter. Zero accidents. Zero complaints.	Review of design documents and site observations Compare site conditions with EC conditions by DEIAA	Included in civil works cost	Contractor	BSRDCL /CSC
3.4 Quarry Operations	▪ Aggregates will be sourced from existing licensed quarries. ▪ Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to BSRDCL. ▪ The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. ▪ Obtain environmental clearance from DEIAA in case of opening new quarry	ClauseNo.111.3 MORT&H Specifications for Road and Bridgeworks Guidelines VI for Quarry Areas Management Environmental Protection Rules	Contractor is responsible for identifying the source conforming Technical Specification after securing all permits as per Law of the Land.	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new quarries	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	▪ Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. ▪ Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. ▪ Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. ▪ Land taken for construction camp and other temporary facility shall be restored to its original conditions	Design requirement	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition PT: Zero occurrence of destroyed/compacted land and undestroyed land	Site observation	Included in civil works cost	Contractor	BSRDCL /CSC
3.6 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	▪ Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. ▪ Fuel storage and refueling sites to be kept away from drainage channels. ▪ Unusable debris shall be dumped in ditches and low lying areas. ▪ To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. ▪ Waste oil and oil soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors ▪ Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. ▪ Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board	Design requirement	Fuelling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area PT: Soil test conforming to no – contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation	Included in civil work cost.	Contractor	BSRDCL /CSC

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4. Water Resources								
4.1 Sourcing of water during Construction	▪ Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority in view of National Green Tribunal ▪ Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. ▪ Water intensive activities not to be undertaken during summer season. ▪ Groundwater Augmentation by converting borrow areas into ponds	CGWA Guidelines	Throughout the Project section especially construction sites and labor camps	MI: Approval from competent authority. Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local people	Included in civil works cost	Contractor	BSRDCL /CSC
4.2 Disposal of water during construction	▪ Provisionsshallbemadetoconnectroadsidedrainswithexistingnearbynatural drains.	ClauseNo.1010EPAct1986MORT&H Specifications for Road and Bridge works	Throughout the Project section	MI: Condition of drainage system in construction site. Presence/absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents	Included in civil works cost	Contractor	BSRDCL /CSC
4.3 Alteration in surface water hydrology	▪ Existing drainage system to be maintained and further enhanced. ▪ Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping towards road alignment. ▪ Road level shall be raised above HFL level wherever road level is lesser than HFL. ▪ Culverts reconstruction shall be done during lean flow period. In some cases these minor channels may be diverted for a very short period (15-30 days) and will be bring back to its original course immediately after construction.	Design requirement, Clause No 501.8.6. MORT&H Specifications for Road and Bridge	Rivers, canal, streams and nallah passing through the proposed road. Streams – Tilyana River (Km 8.3), Dharanji River (Km 13.2)	MI: Proper flow of water in existing streams and rivers PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging	Review of design documents Site observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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4.4 Siltation in water bodies due to construction activities/earthwork	▪ Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. ▪ Provision of Silt fencing shall be made at water bodies. ▪ Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated. ▪ Earthworks and stone works to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. ▪ Retaining walls at water bodies /ponds to avoid siltation near ponds	Design requirement, ClauseNo501.8. 6.MORT&H Specifications for Road and Bridgeworks Worldwide best practices	Rivers, canal, streams and nallah passing through the proposed road. Streams – Tilyana River (Km 8.3), Dharanji River (Km 13.2)	MI: Presence /absence of siltation in rivers, streams, ponds and other water bodies in project area. Turbidity test levels PT: No records of siltation due to project activities. Surface water quality tests confirm to turbidity and TSS limit	Field observation	Included in civil works cost	Contractor	BSRDCL /CSC
4.5Deterioration in Surface water quality due to leakage from vehicles and equipments and waste from construction camps.	▪ Parking and refueling away from water bodies/waterways ▪ Oil/ grease trap and fuelling platforms to be provided at re-fuelling locations. ▪ Chemicals and oil shall be stored away from water on concrete platform with catchment pit for spills collection. ▪ All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand, written in the local language emergency response procedure, including reporting, will be provided by the contractors. ▪ Construction camp to be sited away from water bodies. ▪ Wastes must be collected, stored and taken to approve disposal site only. ▪ Water quality shall be monitored	The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.	Local streams - Tilyana River (Km 8.3), Dharanji River (Km 13.2)	MI: Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area PT: Surface water quality meets freshwater quality standards prescribed by CPCB	Conduction of water quality tests as per the monitoring plan Field observation	Included in civil works cost	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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5. Flora and Fauna								
5.1 Vegetation loss due to site preparation and construction activities	▪ Restrict tree cutting upto toe line considering safety to road users. ▪ Roadside trees to be removed with prior approval of competent authority. ▪ Mandatory compensatory plantation at 1:3 basis by Forestry Department ▪ Additional compensatory plantation 1:7guided by Tirhut model ▪ Employment preference to vulnerable ▪ Regular maintenance trees planted. ▪ Provision of LPG in construction camp ▪ Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and enable adequate sight distance. ▪ Additional plantation near sensitive receptors, river banks to minimize noise & air pollution, check erosion. ▪ Controlled use of pesticides/ fertilizers	ForestConservationAct1980 + IRC:SP:21andIRC:SP:66	Throughout project corridor Estimated No. of affected tree=484 Additional Plantation near Sensitive receptors, river banks, borrow areas	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Survival of Compensatory Plantation @ 70% and Additional plantation @ 80% done on Tirhut model	Review of relevant documents – tree cutting permit, compensatory plantation plan and key informants on Tirhut model of plantation Field observations	Additional plantation and compensatory plantation cost is included in project costs under BSRDCL.	Mandatory Compensatory plantation by forest Department and Additional plantation by NGOs guided by Tirhut model	BSRDCL /CSC
6. Construction Camps/sites Management and Occupational Health and Safety								
6.1 Impact associated with location	▪ All camps should be established with prior permission from SPCB. ▪ Layout plant shall be recommended by CSC and approved by EA ▪ Camps to maintain minimum distance from following: # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from through traffic route	Design Requirement The Water (Prevention and Control of Pollution)Act,1974and its amendments thereof	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community	Included in civil works cost	Contractor and EO	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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6.2 Worker's Health in construction camp/construction sites	▪ The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by EA. ▪ The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. ▪ Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. ▪ Preventive medical facilities in camp ▪ Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. ▪ No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. ▪ Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases. ▪ No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. ▪ All necessary fencing and lights will be provided to protect the public in construction zones. ▪ All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer".	TheBuildingandOtherConstruction workers(RegulationofEmployment andConditions of service)Act1996andThe Water(Prevention and Control of Pollution)Act,1974andamendments thereof	All construction camps	MI: Camp health records Site observation Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby	Part of the civil works costs	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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7. Management of Construction Waste/Debris								
7.1 Selection of Dumping Sites	▪ Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. ▪ Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality ▪ Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies ▪ Dumping sites must be having adequate capacity equal to the amount of debris generated. ▪ Public perception and consent from the village Panchayats has to be obtained before finalizing the location.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	At all Dumping/Disposal Sites	MI: Location of dumping sites Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available with contractor	Field survey and interaction with local people. Review of consent letter	Included in civil works cost.	Contractor.	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
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7.2 Reuse and disposal of construction and dismantled waste	▪ The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. ▪ All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. ▪ Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. ▪ The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. ▪ Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.	Design Requirement, MORT&H guidelines and General Conditions of Contract Document	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people	Included in civil works cost.		
8. Traffic Management and Safety								
8.1 Management of existing traffic and safety	▪ Traffic Management Plan shall be submitted by the contractor and	Design requirement and IRC: SP: 27 -	Throughout the project corridor especially at intersections.	MI: Traffic management plan. Presence/ absence of	Review traffic management plan	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	approved by the CSC. ▪ The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. ▪ The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. ▪ On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	1984,Report Containing Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children(5-12 Years Old) in Construction Zones IRC:SP:55-2014 The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document		safety signs, traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site	Field observation of traffic management and safety system Interaction with people in vehicles using the road			

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.2 Pedestrians, animal movement	▪ Temporary access and diversion, with proper drainage facilities. ▪ Access to the schools, temples and other public places must be maintained when construction takes place near them. ▪ Fencing wherever cattle movement is expected. ▪ Large number of box and slab culverts has been proposed. All structures having vertical clearance above 3m and not catering to perennial flow of water may serve as underpass for animals	Same as above	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people PT: Easy access to schools, temples and public places. Zero complaints	Field observation Interaction with local people	Included incivil works cost.	Contractor	BSRDCL /CSC
8.3 Safety of Workers and accident risk from construction activities	▪ Contractors to adopt and maintain safe working practices. ▪ Usage of fluorescent and retro refectory signage, in local language at the construction sites ▪ Training to workers on safety procedures and precautions. ▪ Appointment of a safety officer. ▪ All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress shall be complied with. ▪ Provision of PPEs to workers. ▪ Provision of readily available first aid unit including an adequate supply of dressing materials. ▪ The contractor will not employ any person below the age of 18years ▪ Use of hazardous material should be minimized and/or restricted. ▪ Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. ▪ Accident Prevention Officer must be appointed by the contractor.	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction workers	Included in civil works cost	Obligation of Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
8.4 Accident risk to local community	▪ Restrict access to construction sites only to authorized personnel. ▪ Physical separation must be provided for movement of vehicular and human traffic. ▪ All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. ▪ Provision of temporary diversions and awareness to locals before opening new construction fronts. ▪ Alternate access facility to common properties near construction zones ▪ Fencing and speed limitation wherever cattle movement is anticipated.	Same as above	Construction sites and Accident Prone Area especially at Ch- 0.0km (Manjhway) and Km 21.880 (Junction with NH-31)	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people	Included in civil works cost	Contractor	BSRDCL /CSC
9. Site Restoration and Rehabilitation								
9.1 Clean-up Operations, Restoration and Rehabilitation	▪ Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. ▪ The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. ▪ All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. ▪ All the opened borrow areas will be rehabilitated and 'Engineer' will certify	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	MI: camp, Condition borrows areas and construction sites, Presence/absence of construction debris after construction works is over PT: Clean and tidy sites. No trash or debris left on site. Site restored/leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found satisfactory	Included in civil works cost.	Contractor	BSRDCL /CSC

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
Operation and Maintenance stage								
1. Air Quality								
1.1 Air pollution due to vehicular movement	▪ Compensatory tree plantations shall be maintained as prescribed by forest department.80% survival rate for additional plantation shall be maintained as per Tirhut model ▪ Regular maintenance of the road will be done to ensure good surface condition ▪ Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. ▪ Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption. ▪ Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipments	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	MI: Ambient air quality (PM_{10}, CO,SO_2 NO_2) PT: Levels are equal to or below baseline levels (Air Quality Standard, CPCB)	As per CPCB requirements Site inspection	Included in Operation/ Maintenance cost	BSRDCL	
2. Noise								

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2.1 Noise due to movement of traffic	▪ Effective traffic management and good riding conditions shall be maintained ▪ Speed limitation and honking restrictions near sensitive receptors. ▪ Construction of noise barriers near sensitive receptors with consent of local community ▪ The effectiveness of the multilayered plantation should be monitored and if need be, solid noise barrier shall be placed. ▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	Noise Pollution (Regulation and Control)Rules,2000andamendments thereof	Sensitive receptors as given in supplementary table to EMP	MI: Noise levels PT: Levels are equal to or below baseline levels (Noise Quality Standard, CPCB)	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites	Included in Operation/ Maintenance cost	BSRDCL	
3. Land and Soil								
3.1 Soil erosion at embankment during heavy rainfall.	▪ Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. ▪ Necessary measures to be followed wherever there are failures	Project requirement	At bridge locations and embankment slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation/ Maintenance cost	BSRDCL	
4. Siltation/Water-logging								
4.1 Siltation/ Contamination	▪ Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion. ▪ Monitoring of surface water bodies	Project requirement	Near surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the road	Site observation	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4.2 Water logging due to blockage of drains, culverts or streams	▪ Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. ▪ Monitoring of waterborne diseases due to stagnant water bodies	Project requirement IRC: SP:21-2009	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging	Site observation	Included in Operation/ Maintenance cost	BSRDCL	
5. Flora								
5.1 Vegetation	▪ Planted trees, shrubs, and grasses to be properly maintained. ▪ The tree survival audit to be conducted at least once in a year to assess the effectiveness	ForestConservationAct1980	Project tree plantation sites	MI: Tree/plants survival rate T: Minimum rate of 80% tree survival	Records and field observations. Information from Forestry Department	Included in Operation/ Maintenance cost	BSRDCL/NGO/ADB	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	▪ Maintain shoulder completely clear of vegetation. ▪ Minimum offset as prescribed in IRC:SP:21-2009 to be maintained ▪ Regular maintenance/trimming of plantation along the roadside ▪ No invasive plantation near the road.	Project requirement IRC: SP:21-2009	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records	Included in Operation/ Maintenance cost	BSRDCL	

Environmental Issue/Component	Remedial Measure	Reference to laws/guideline	Location/Nos./ sections	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	▪ Traffic control measures, including speed limits, will be enforced strictly. ▪ Further encroachment of squatters within the ROW will be prevented. ▪ No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law ▪ Monitor/ensurethatallsafetyprovisions includedindesignandconstructionpha seareproperlymaintained ▪ Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. ▪ Tow-way facility for the breakdown vehicles if possible.	IRC:SP:55-2014	Accident Prone Areas especially at Ch- 0.0km (Manjhway) and Km 21.880 (Junction with NH-31)	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non fatal accident rate is reduced after improvement	Review accident records Site observations	Included in Operation/ Maintenance cost	BSRDCL	
6.3.Transpor tof Dangerous Goods	▪ Existence of spill prevention and control and emergency responsive system ▪ Emergency plan for vehicles carrying hazardous material	-	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in Operation/ Maintenance cost	BSRDCL	

ADB: Asian Development Bank, BSRDCL: Bihar State Road Development Corporation Ltd., EA: Executing Agency, CSC: Construction Supervision Consultant, CPCB: Central Pollution Control Board, CGWA: Central Groundwater Authority, CBR: California Bearing Ratio, DEIAA: District Environmental Impact Assessment Authority, EMP: Environmental Management Plan, EMOP: Environmental Monitoring Plan. EO: Environmental Officer, IRC: Indian Road Congress, MOEFCC: Ministry of Environment, Forests and Climate Change, MORTH: Ministry of Road Transport and Highways, NGO: Non-Governmental Organization, RP: Resettlement Plan

The “Project engineer” or “the engineer” is the team of Construction Supervision Consultants (CSC) responsible for approving the plans, engineering drawing, release of payments to contractor etc. on behalf of the employer (BSRDCL). It is usually the team leader of the CSC that takes the responsibility of signing approval documents on behalf of the CSC team. The “environmental officer” is the environmental specialist under the CSC who is responsible for providing recommendations to the CSC team leader for approving activities specific to environment safeguards on behalf of “the engineer”.

Supplementary Tables to EMP

List of Other Common Properties

S.no	Structure	Easting	Northing	Elevation
1	Temple	330791.4488	2744610.778	106.197
2	Temple	330792.9315	2744614.187	106.089
3	Temple	330788.6285	2744616.49	106.187
4	Temple	335479.3137	2741894.325	102.39
5	Temple	335479.2323	2741893.525	102.629
6	Temple	335482.0834	2741893.261	102.648
7	Temple	336873.8935	2741878.301	101.336
8	Temple	336873.9586	2741881.776	101.329
9	Temple	336873.3209	2741881.785	101.331
10	Temple	337786.7223	2741434.604	99.667
11	Temple	337787.7139	2741436.48	99.728
12	Temple	337785.7687	2741437.527	100.118
13	Temple	337980.9298	2741348.672	100.8
14	Temple	339707.4988	2740642.244	102.489
15	Temple	339716.1635	2740638.779	103.141
16	Temple	339714.2244	2740632.061	102.618
17	Temple	339880.302	2740601.858	102.835
18	Temple	339883.5707	2740601.081	102.6
19	Temple	339881.0473	2740605.427	102.664
20	Temple	339872.5401	2740530.55	102.857
21	Temple	339873.3361	2740533.028	102.655
22	Temple	339875.9582	2740532.405	102.747
23	Temple	337577.0137	2741003.213	101.888
24	Temple	337574.5715	2741004.211	102.111
25	Temple	337573.4994	2741001.661	102.245
26	Temple	337943.093	2741360.465	100.859
27	Temple	337938.6214	2741362.494	101.397
28	Temple	338388.4913	2741102.762	101.381
29	Temple	338397.7716	2741102.97	101.417
30	Temple	338395.378	2741112.824	101.537
31	Temple	338395.1816	2741119.79	101.38
32	Temple	338392.6709	2741120.115	101.379
33	Temple	338395.5504	2741112.522	101.397
34	Temple	338367.9352	2741034.258	101.304
35	Temple	338370.4788	2741030.569	101.34
36	Temple	338367.8076	2741032.627	101.319

S.no	Structure	Easting	Northing	Elevation
37	Temple	340771.3124	2740596.136	104.921
38	Temple	340776.5653	2740595.65	104.988
39	Temple	340771.7599	2740606.683	105.084
40	Temple	340762.2752	2740443.28	106.154
41	Temple	340752.8132	2740442.095	105.541
42	Temple	340753.5883	2740439.887	105.474
43	Temple	344113.0133	2739630.321	106.364
44	Temple	344112.4994	2739628.362	106.365
45	Temple	344111.2597	2739630.94	106.522
46	Temple	342807.3628	2740217.218	104.452
47	Temple	342807.782	2740217.878	104.414
48	Temple	342807.2426	2740218.206	104.411
49	Temple	342232.3373	2740393.611	105.029
50	Temple	342232.708	2740395.746	104.93
51	Temple	342230.5112	2740396.328	105.212
52	Temple	342045.0861	2740405.543	105.087
53	Temple	342044.4425	2740403.21	105.262
54	Temple	342041.6252	2740404.043	105.09
55	Temple	341974.6571	2740423.044	105.84
56	Temple	341984.0039	2740423.083	105.71
57	Temple	341983.9401	2740429.64	105.651
58	Temple	342583.9367	2740293.997	103.087
59	Temple	342581.9955	2740296.877	103.731
60	Temple	342580.7311	2740293.849	103.786
61	Temple	341487.333	2740427.516	103.403
62	Temple	341487.6877	2740429.237	103.474
63	Temple	341485.716	2740429.749	103.622
64	Temple	345909.956	2739028.166	109.689
65	Temple	345905.0309	2739028.733	109.677
66	Temple	345904.5659	2739025.287	109.679
67	Temple	346645.2933	2738897.071	110.952
68	Temple	346644.3872	2738892.25	110.887
69	Temple	346640.9468	2738897.979	111.066
70	Temple	350318.5091	2738438.147	112.404
71	Temple	350329.1411	2738436.84	112.419
72	Temple	350330.5472	2738455.467	112.459
73	Temple	350247.2031	2738398.612	113.189
74	Temple	350240.6191	2738399.968	113.923
75	Temple	350241.0102	2738402.444	114.299

S.no	Structure	Easting	Northing	Elevation
76	Temple	350855.7683	2738352.409	113.907
77	Temple	350856.1473	2738358.965	113.579

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air Quality	Construction stage	PM 10 PM2.5 SO2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	Active construction site/ HMP site and representative sample one each for residential, commercial/Industrial and Sensitive Locations (Total 4 Locations)-	24 hr. continuous, 3/year for 2.5 years	Air quality standard by CPCB	4x3x2.5 =30	Contractor through approved monitoring agency	BSRDC /CSC
	Operation stage			Representative sample 1 each for residential, commercial and industrial area (3 Locations)-	24 hr. continuous, 3/year for 1 year	Air quality standard by CPCB	3x3x1 =9	BSRDC through approved monitoring agency	BSRDC
Water Quality	Construction stage	Ground water: (IS: 10500:1991) and Surface water criteria for freshwater classification	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Groundwater at Construction Camps, HP of residential area and Surface water of Perennial Rivers/Ponds (4 Samples) -	3/year for 2.5 years	Water quality standard by CPCB	4x3X2.5 = 30	Contractor through approved monitoring agency	BSRDC /SC
	Operation stage			Groundwater at 1 locations and surface water at 1 locations and 1 pond developed due to Borrows areas – (Total 3 Samples)	3/year for 1 year	Water quality standard by CPCB	3X3X1 = 9	BSRDC through approved monitoring agency	BSRDC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and night	IS:4954-1968 as adopted by CPCB for Identified Study Area CPCB/IS:4954-1968Using Noise level meter	Active Construction sites and 1each at residential, commercial and sensitive locations along the alignment. (5 Locations) -	24 hr. continuous, 3/year for 2.5 years	National Ambient Noise Standard specified in Environment Protection Act, 1986	5x3x2.5 =38	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage			Near Sensitive locations and residential/Commercial areas (3 Locations)	3 / year for 1 year		3x3X1 =9	BSRDC through approved monitoring agency	BSRDC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer BSRDC / CSC	Camp/ HMP sites Dumping Site and one random sample from agricultural Land	Twice in a year for 2.5 years	ICAR standard	3x2x2.5 =15	Contractor through approved monitoring agency	BSRDC/CSC
	Operation stage	Oil and grease		At oil spillage locations and other probable soil	Twice for the first year of operation	CPCB standard	2x2x1= 4	BSRDC through approved agency	BSRDC

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
				contamination location (2Locations)					
Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		Throughout the Project Corridor especially at River banks, bridge locations and river training structures	After first rain	Visual Checks	Included in Engineering Cost	Contractor	BSRDC/CSC
	Operation Stage				Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of BSRDC	
Drainage Congestion	Construction stage	Visual Checks		Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Contractor'	BSRDC/CSC
	Operation Stage				Once in a year before rainy season	None Specific	Routine Engineering Work	BSRDC	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines + Compliance conditions of DEIAA	Part of the Contractor's quote	Contractor with approval from BSRDC	BSRDC/CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			BSRDC	
Construction Sites and Labour Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Contractor with approval from BSRDC, BSRDC	BSRDC/CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		Throughout the Project Section	During site clearance in construction phase	As suggested by Forest Dept. And follow Tirhut Model for Additional Plantation	Compensatory: BSRDC Additional Plantation: BSRDC Cost	Compensatory: BSRDC/Local Forest Departments Additional Plantation: BSRDC through NGO	
	Operation stage	Audit for survival rate of trees plantation		Throughout the Project Section	As prescribed in Tirhut Model			The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period BSRDC will be responsible for monitoring additional plantation done by NGO	
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by BSRDC		Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by PMC/SC	Part of the regular monitoring	Contractor	BSRDC/CSC
	Operation stage			Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of BSRDC with support from local police	

BSRDC: Bihar State Road Development Corporation, NPK: Nitrogen, Phosphorous and Potassium, CSC: Construction Supervision Consultant, EIA: Environmental Impact Assessment, IRC: Indian Road Congress, SPCB: State Pollution Control Board, CPCB: Central Pollution Control Board, IS: Indian Standard

Sample Site Environmental Compliance Inspection and Monitoring Form

Below is a sample compliance inspection form to be prepared monthly by the contractor and validated by the supervision consultant.

Project :_____ **Implementing Agency** :_____

Subproject :_____ **Monitoring Agency** :_____

Location :_____ **Enforcement Agency** :_____

Date :_____ **Contractor(s)** :_____

Reporting Period:_____ **Implementation Phase:** Preconstruction / Construction /Operation

1. Contractor(s)

Contractor(s) Environmental Awareness	*Yes/No*	*Actions Required*	*Contractor Response /Comment*
Contractor(s) aware of mitigation requirements?			
Contractor(s) have a copy of EMP?			

2. Mitigation Compliance Inspection

Impact/Mitigation Measures	Mitigation Implemented	Mitigation Effective	Impact Observed/Location	Action Required	Contractor's Response/Comment	Endorsed by	
						Implementing Annecy	Monitoring Agency
(From EMP)	Yes/No	(1 to 5)*)					

* Mitigation Effectiveness Rating Criteria (Indicative examples)

1. Very Good (all required mitigations implemented)
2. Good (the majority of required mitigations implemented)
3. Fair (some mitigations implemented)
4. Poor (few mitigations implemented)
5. Very Poor (very few mitigations implemented)

3. Emission Discharge monitoring (ifrelevant)

Parameter	Date/ Location	Measured By	Monitoring Equipment	Result	Standard	% Exceedence	Action Required	Contractor Responses/ Comments	Endorsed by:	
									Implementing Annecy	Monitoring Agency

4. Ambient Monitoring (if relevant)

Parameter	Date/ Location	Measured By	Monitoring Equipment	Result	Standard	% Exceedence	Action Required	Contractor Responses/ Comments	Endorsed by:	
									Implementing Annecy	Monitoring Agency

5. Environmental Incidents During Reporting Period (if relevant)

Environmental Incidents (Accidents, spills, complaint)	Date/ Location	Reported by	Description/Location	Action Taken	Further Action required	Endorsed by	
						Implementing Annecy	Monitoring Agency

6. Environmental Incidents During Reporting Period (if relevant)

Action Required	Timeframe (e.g. within one week)	Responsible Parties	Follow-up (to be completed if inspection/monitoring indicates actions are required)
			Required Action Taken:
			Effectiveness:
			Further Action Required?
			Prepared by:
			Date:

Inspection Completed by:_____ **Date:**_____

Signature:

Notes:

Attachments:

(e.g. laboratory reports, photographs)

Drawings

(SH-103; Manjhway to Ch: 21.88 Km. of Manjhway-Govindpur Road)

See Volume IV

Section 6 - Employer's Requirements

This Section contains the Technical Specifications, Environmental Management Plan, Drawings, and supplementary information that describe the Works to be procured.

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TECHNICAL SPECIFICATIONS

1 PREAMBLE

1.1 The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents as specified in Volume-I.

1.2 **Site Information**

1.2.1 It is proposed to develop the road to 2 lane standard configuration with carriageway of 7.0 m with 2.5 m width earthern shoulder on both sides. For the Structures 2 Lane standard configuration is proposed.

1.2.2 The information given hereunder and provided elsewhere in these documents is given in good faith by the BSRDC but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the BSRDC is erroneous or insufficient.

1.2.3 The area in which works are located is generally plain terrain.

1.2.4 General climatic Condition

1.2.4.1 The variation in daily temperature in the project region is area as under:

- During summer months (March-July) from about 25 ^{0}C minimum to 47^{0}C maximum.
- During winter months (October-February) from about 3 ^{0}C minimum to 20 ^{0}C maximum.

1.2.4.2 The average rainfall in the area is of the order of 1100 mm to 1560 mm. Major portion of which is concentrated during the month of July to September.

1.2.4.3 Seismic zone

The project area is located in Earthquake Zone V (as defined in IRC: 6)

2 GENERAL REQUIREMENTS

The Technical Specifications in accordance with which the work shall be constructed and completed by the Contractor shall comprise of the following:

2.1 Part-I: General Technical Specifications

The General Technical Specifications shall be the "SPECIFICATIONS FOR ROADAND BRIDGE WORKS" 5th Edition Second Revision 2019, issued by the Ministry of Road Transport & Highways, Government of India (MORTH) and published by the Indian Roads Congress.

2.2 Part-II: Supplementary Technical Specifications

The Supplementary Technical Specifications shall comprise of various Amendments/Modifications/ Additions to the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" referred to in Part-I above and Additional Specifications for particular item of work not already covered in Part-I.

2.2.1 A particular Clause or a part thereof in "SPECIFICATIONS FOR ROAD AND BRIDGE

WORKS (5th Edition Second Revision 2019)" referred in Part-I above, where Amended/Modified/Added upon, and incorporated in Part-II, referred to above, such Amendment/Modification/ Addition supersedes the relevant Clause or part of the Clause.

2.2.2 The additional specifications shall comprise of specifications for particular item of work not already covered in PART – I.

2.2.3 When an amended/modified/added clause supersedes a clause or part thereof in the said specifications, then any reference to the superseded clause shall be deemed to refer to the amended / modified/ added clause or part thereof.

2.2.4 In for as amended/modified/added clause may come in conflict or be inconsistent with any of the provisions of the said specifications under reference, the amended/modified/added clause always prevails.

2.2.5 The following Clauses in the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (5th Edition Second Revision 2019)" have been amended/modified/added upon:

102, 105, 108, 109, 110,112, 113, 120, 121, 201, 202, 301, 305, 306, 401, 406, 408, 500,501, 502, 503, 505, 507,509,601, 602, 801, 802, 803, 805, 900, 901, 903, 1002, 1006, 1007, 1009, 1014, 1502, 1503, 1509, 1513, 1704, 1705, 1706, 1707, 1708, 1712, 1805, 1807, 2009, 2504,2702, 2706 and 2708

2.2.6 **Additional Specifications**

Clauses 122, 124 and the clauses A-1, A-2 & A-3 have been added to the 'Specifications for Road and Bridge Works (5th Edition Second Revision 2019).

CLAUSE A-1 PASSENGER SHELTER

CLAUSE A-2 TRAFFIC MANAGEMENT AND SAFETY DURING CONSTRUCTION OPERATION

2.2.7 In the absence of any definite provision in any particular issue in the aforesaid Specifications, reference may be made to the codes, standards and specifications of IRC, MORTH and BIS guide lines and official publications as applicable to National Highways. For aspects not covered by IRC & BIS, International Practice such as British and American Standards may be adopted. Where even these are silent, the construction and completion of the works shall conform to sound Engineering practice as approved by the Engineer of Supervision Consultants and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer shall be final and binding on the Contractor.

2.3 Compliance with Specification

All material, plant, labour and workmanship involved in and connected with the execution of the works shall be the best of their respective kinds without regard to any trade terms and the Contractor shall comply in these and all other respects with the relevant Clauses in the Specification and shall carry out the Contract in a proper and workmanship like manner and in strict accordance with Specifications, working drawings and instructions of the Engineer.

2.2.8 PART II

SUPPLEMENTARY TECHNICAL SPECIFICATIONS

AMENDMENTS/MODIFICATIONS/ADDITIONS TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS

Clause 102 DEFINITIONS

The following abbreviations shall be added in this Clause:

"MORT&H" : **M**inistry of **R**oad **T**ransport &**H**ighways

"BSRDC" : **B**ihar **S**tate **R**oad **D**evelopment **C**orporation Ltd. (A Govt. of Bihar Undertaking)

Add a paragraph at the end of this Clause as under:

"Wherever in the Technical Specifications, the phrase "The General Condition of Contracts is used, it shall mean Conditions of Contract contained in the Bidding Documents"

Clause 105 SCOPE OF WORK

(i) Add the following as clause 105.4 on Programme of works

The contractor shall provide the work programme required under clause 8.3 of the Conditions of Contract within28days from commencement of permanent works. The Contractor shall submit a fully detailed and time related programme showing the order of procedure and method in which the Contractor propose to carry out the Works for all major items of work like site clearance, embankment, sub-grade, sub base, base, surfacing, culverts, bridges, retaining wall, substructures, etc which requires a method of working. The programme shall be so detailed as to show the order of work, planned rate of progress, amount and type of equipment proposed, details of methods to be employed, details of Temporary Works etc.

The programme shall be coordinated with climatic and other conditions to provide for the completion of the works in the order and by the time specified.

The Contractor shall carry out the contract in accordance with the programme agreed with the Engineer, but he shall in no manner be relieved by the Engineer's approval of the programme, of his obligation to complete the works in the prescribed order and by the prescribed completion date and he shall from time to time review his progress and make such amendments to his rate of execution of the works as may be necessary to fulfill his obligation. The sole responsibility for the safety and adequacy of the methods adopted by the Contractor will, however, rest on the Contractor, irrespective of any approval given by the Engineer.

The programme shall not be in form of a bar chart only, but shall show clearly the anticipated quantities of work to be performed each month, as well as the anticipated earnings for the various sections of work. Further it shall show the critical path of activities. The Works shall be carried out so as to achieve a continuous and

consecutive output of fully completed road. The order of execution of the Works shall be subject to reasonable adjustment as requested by the Engineer.
Add the following at the end of this clause survey datas of the road project like NGL and other side details shall be completed within 6 month from date of commencement.

Clause 110 Encumbrances in Construction Area, including Trees and Utilities

Clause 110.1 Add at the end of Para 5-

"The Contractor shall be responsible to coordinate with service provider / concerned authorities for cutting of trees, shifting of utilities and removal of encroachments etc. and making the site unencumbered from the project construction area required for completion of work. This will include initial and frequent follow-up meetings/actions/discussions with each involved service provider/concerned authorities. The contractor will not be entitled for any additional compensation for delay in cutting of trees, shifting of utilities and removal of encroachments by the service provider / concerned authorities. Payment for shifting of utilities as required by the concerned department shall be made by the BSRDC

Clause 110.2 Replace the sub-clause with the following:

Drawings scheduling the affected encumbrances such as trees and services like water pipes, sewers, oil pipelines, cables, gas ducts, electricity lines, accessories, telephone poles and OFC cables etc. included in the contract document may not be exhaustive, and it shall be the responsibility of the contractor to ascertain the utilities that are likely to be affected by the works through site investigations and collection of information from concerned utility owners.

Clause 110.8 Add the following after first paragraph

"The BSRDC will only make payments for supervision charges to the respective service provider / authorities for shifting of utilities, wherever required. The contractor will obtain necessary approval from such Authorities after payments by the BSRDC and also in cases where payments are not required to be made for such shifting."

CLAUSE 112 ARRANGEMENTS FOR TRAFFIC DURING CONSTRUCTION

Clause 112.1 General

Add the following as second paragraph to this Clause.

Special consideration shall be given in the preparation of the Traffic Control Plan to the safety of pedestrians and workers and delineation of the roadway at night.

Temporary diversions will be constructed only with the approval of the Engineer and will generally be constructed at bridge/culvert sites where new bridges/culverts are to be located on the existing road alignment.

Clause 112.2This clause shall read as under

"For widening and strengthening of the existing carriageway when the widening is concentric and where part width of the existing carriageway is proposed to be used

for passage of traffic, paved shoulder shall be provided on one side of the existing road with the following minimum requirement to be provided by the contractor.

i) At least one 3.5m lane to remain open to traffic at all time.
ii) The surface used by the through traffic shall at all time be a firm bituminous compacted surface free of pot hole and other defects.
iii) The maximum continuous length over which construction under traffic may take place shall be limited to 750m. However in longer stretches passing places of 7m widths with bituminous surface of at least 50m. Long shall be provided at every 0.75 km. Interval.
iv) The treatment for paved shoulders shall consist of suitable granular sub-base course overlaid with suitable granular base layer and treated with 20 mm CGPS/MSS as directed by the Engineer.
v) Construction activity shall be restricted to only one side of the existing road.

"The Contractor shall be responsible for traffic management and safety throughout the project construction period, and shall implement the same in accordance with additional Clause A-2 and MORT&H clause 813. Before commencement of the construction works, the Contractor shall prepare and submit for approval, a traffic management and safety plan which, inter alia shall show details of the arrangements he proposes to make i) for temporary diversion in accordance with clause 112.3and ii) for safe and convenient passage of traffic during construction, design of barricades, the delineators, signs, markings, lights, flagmen etc. proposed to be used by him, and get the same approved from the Engineer before undertaking any construction work."

The road section (s), handed over to the contractor for its construction/upgradation shall be maintained in traffic worthy manner. Contractor shall maintain/repair applying adequate specification as per IRC which includes bituminous repair work also and in no time he shall leave it unattended. He shall maintain the existing road for all weather proofed condition. No separate/extra payment shall be given to the contractor on this account.

Clause 112.3Passage of traffic along temporary diversion

The first para shall be substituted by the following:

In stretches where it is not possible to pass the traffic on part width of the existing carriageway, temporary diversions shall be constructed with 5.5m carriageway with 2.5 earthen shoulders on each side (Total width of road way 10.5m) with the following adequate provision for road crust including bituminous work in the 5.5m width: after getting the alignment longitudinal section, pavement of diversion including junctions and temporary cross drainage approved from the Engineer-in-charge.

Clause 112.6 Measurement for payment and Rate

Replace first sentence of first para by the following:

All arrangements as contained in the sub-clause 112.1 & 112.2 shall be incidental to work. For passage of traffic along a part of Existing Carriageway under

improvement/traffic diversion as per clause 112.3 shall be measured and paid as per respective BOQ items.

Add following as second paragraph to the sub-clause:

"All arrangements for traffic safety, control and management including maintenance of traffic diversion till completion of adjacent improvement shall be considered incidental to the work and shall be the Contractor's responsibility. However, in the event of any accident, compensation shall be the responsibility of contractor and paid by him."

CLAUSE 113.2

Delete First and Second Para and add the following:

No lead is specified in the Contract for earthworks or any construction materials or any pavement layers except where specifically mentioned in the supplementary Technical Specification. When payment for lead or overhaul is not specified in the Supplementary Specifications, the respective bid rate shall include for all transportation of the material and no compensation for haulage of materials will be paid separately.

Clause 120 FIELD LABORATORY

Clause 120.5 RATE

This clause shall be replaced to read as under:

"The cost of supply, erection, maintenance and running of functional field laboratory will include supply of approved laboratory equipment and also provision of adequate number of qualified personnel, all consumable like chemicals and reagents and providing uninterrupted electrical and water supply including stand-by generator and shall be treated as incidental to the work and no separate payment shall be made for these items."

CLAUSE 121 SUPPLY OF PROJECT RECORD
Clause 121.4RATE

This clause shall be replaced to read as under:

"Supply of project record in digital format and colored record photographs mounted in albums in two copies (one for the Engineer and the other for the Employer) including drone video recording should be provided as and when required by the Engineer/Employer measured as per BOQ."

ADDITIONAL CLAUSE

CLAUSE122 BASE OFFICE FOR BSRDC / BSRDC'S REPRESENTATIVE

Clause 122.1 SCOPE

The work covers hiring, providing and maintaining of furnished base office accommodation for BSRDC or its representative and his staff.

Suitable furnished base office accommodation for the BSRDC and his staff shall be provided at suitable location as directed by the Engineer and maintained by the Contractor.

Clause 122.2 DESCRIPTIONS

The Contractor shall arrange to provide fully furnished office accommodation for office constructed with permanent specification as approved by the Engineer. The office shall have a floor area of 100sqm. consist of at least three individual office rooms of about 15sqm each, a general Drawing office, a conference room, two sets of toilets, a kitchenette etc. The rooms shall be adequately ventilated and lighted. The office shall have adequate covered parking space for at least two cars.

Work includes providing electric supply, all electrical items like lights, fans and complete wiring, providing water supply including all pipes, fittings, tanks, tube well, potable water pumps, valves etc. complete, septic tank, sewer lines, drains, internal surfaced roads, fencing, paved footpaths, open spaces, plantation etc. as per layout to be approved by the Engineer. In order to ensure uninterrupted power supply, the Contractor shall install and maintain back-up power generating set with automatic switch over of sufficient capacity to keep all electrical appliances, including air conditioners, running during failure of main power supply. Furniture and equipment to be provided/installed and maintained for the Base Office shall be as in Table 100-3

Within 7 days of commencement of work, the Contractor shall submit the detailed actual Drawings of the building to the Engineer with detailed list of furniture / equipment including the make / name of supplier for his approval.

The Contractor shall provide the office accommodation within 3 months from the date of receipt of the notice to commence.

Table 100-3

LIST OF FURNITURE TO BE PROVIDED AND MAINTAINED FOR BSRDC/BSRDC'S REPRESENTATIVES' BASE OFFICE

S.No.	Item	Specification	Nos. Reqd.
1	Executive tables	Make-Godrej Model No. T-108 or equivalent	1
2	Executive chair s	Make-Godrej Model No. PCH – 701 or equivalent	1
3	Tables	Make-Godrej Model No. T-104 or equivalent	4
4	Ordinary chairs Type I	Make-Godrej Model No. CHR-6 or equivalent	12
5	Tables (for all other staff)	Make-Godrej Model No. T-101 or equivalent	6
6	Ordinary chairs Type II (for all other staff)	Make-Godrej Model No. CHR-6 or equivalent	6
7	Stools	Make-Godrej Model No. ST-2 or equivalent	2
8	Steel Almirah 1980mm x 915mm x 485mm	Make-Godrej Model No. 1 Storewell plain or equivalent	1
9	Steel Almirah 1270mm X 765mm X 440mm	Make-Godrej Model Minor plain or equivalent	3

S.No.	Item	Specification	Nos. Reqd.
10	Steel Cash Chest of size 1.5' x 1.5' (450mm x 450mm approx.)	Make Godrej Storewell-8or equivalent	1
11	(i)Computer (Desktops/Laptops)with printer and accessories	(A) Desktop/Laptop PC ,4 GB RAM, 1 TB hard disk, 21 inch SVGA color Monitor with 32MB Video RAM, 48X DVD ROM Drive, Key Board, mouse and 0.5 KVA-30min. back up UPS. (B) A4 size 600dpi laser printer, 8ppm-1 (C) Installation of following software on all computers Window10, MS-Office-2016 AutoCAD R-2017 (D) Data backup Device (500-1000 GB) CD Writer (External)	4/2 2 as required 1 1
12	Water Cooler	128 Litre Voltas or equivalent	1
13	Air Conditioner	1.5 tone Voltas or equivalent	6
14	Photocopier cum A3 Printer	Toshiba Studio 16 S or equivalent	1
15	4 Drawer Filing Cabinet with Visafile Suspension System	Make Godrej or equivalent	2
16	Fax Machine cum Printer	HP Officejet V40 or equivalent	1
17	Telephone Connections		2
18	Internet Connection	DSL or equivalent	1
19	Visitors Chairs/Conference Room Chairs	Make Godrej DCH-7004 or equivalent as per Engineers design	10
20	Tables for Computers with Three drawers, key board/ mouse pull out trays size 1664mm x 900mm	Make Godrej or equivalent as per Engineers design	4
21	Printer Desk	Make Godrej or equivalent	2
22	Side Tables	Make Godrej or equivalent	4
23	Waste paper baskets	Make Godrej or equivalent	8
24	4 Door Book Case	Make Godrej as per P-Coder-0800 or equivalent	1
25	Racks – 5 tyre 1800mm X 900mm X 375mm	Made of slotted angles and MS sheets	2

S.No.	Item	Specification	Nos. Reqd.
26	Conference Table	Make Godrej T-12 or equivalent	1
27	Revolving Chairs for Computer Rooms/Drawing Room		4
28	Blinds/curtains for windows		As required
29	Room Heater	2000 Watts bajaj make or equivalent	6
30	Ceiling Fans 1400mm Sweep	Shall be of Khaitan/Orient/USHA or equivalent of approved colour	6

Note- The items and their numbers listed above in this Section are indicative and shall be as per the requirements of the Project and modified accordingly.

Clause 122.3 Ownership

The base office with all furniture, fittings and equipment shall revert back to the Contractor on issue of the final payment certificate.

Clause 122.4 Maintenance

Maintenance includes the day to day upkeep of the building and the surroundings attending to repairs to various parts of the buildings, fitting and the connected services as and when necessary, including technical support for servicing and maintenance of the periodic white/color washing of building and painting of wood work, steel work, replacing the broken window/door/ventilator/glasses/equipment and other hardware and maintenance necessary watch and ward during day and night: it shall also include maintenance of base telephone and fax equipment.

Clause 122.5 Measurements for Payments

The cost of hiring, providing and maintaining of base office shall be on per month basis and payment shall be made for the same under BOQ.

If the Contractor fails to handover the furnished office accommodation within the period stipulated under Clause 122.2 an amount of Rs.30,000/- per month or part thereof shall be debited to the Contractor's account for the period of delay.

If at any stage the Contractor fails to carry out the required maintenance satisfactorily, an amount of Rs.10,000/- per month or part thereof shall be debited to his account.

CLAUSE 124 PROVIDING AND MAINTAINING VEHICLE FOR EMPLOYER

Clause 124.1SCOPE

The contractor shall arrange to provide new AC Passenger Cars (Scorpio, Innova or equivalent- approx. running of each vehicle 3000 km per month & Dezire/Indigo or equivalent approx. running of each vehicle 1500 km per month) to BSRDC's representative within 15 days of commencement of work for the entire duration of contract including the extended period if any. The operation and maintenance charges of these passenger cars shall be responsibility of the contractor. If the contractor fails to provide or/and carry out the required maintenance and operation as directed by the Engineer at any stage of work, an amount of Rs. 25000/- (Rupees Twenty Five Thousand only) per month per passenger car or part thereof shall be debited to the contractor.

Clause 124.2Measurements for Payment and Rate

The cost of hiring, operating and maintaining of vehicles shall be paid as per actual provided on monthly basis or part thereof as per BOQ.

CLAUSE 201 CLEARING AND GRUBBING

Clause 201.5 Measurements for Payment

Replace the word **"excluding"** by **"including"** in 1st sentence of 3rd paragraph.
Replace 4thparagraph of this clause as
"Depression pit created due to removal of stumps and roots of trees shall be backfilled in layers with suitable material to required compaction and deemed to be included in contract unit rate."

Clause 201.6 Rates

Clause 201.6.1

Delete the last sentence of the paragraph. and add

"Arranging disposal sites, removal and disposal of all materials obtained from clearing and grubbing operation which in the opinion of the Engineer cannot be used; shall be included in the Contract unit rate"

Clause 201.6.2

Add as the last sentence of the paragraph.

"Cutting of trees, making into logs, including removal of stumps and roots of trees girth above 300 mm including cutting of trunks branches and handling, stacking and disposal of cleared material along with carriage of wooden logs, roots and stumps to forest stock yard / depot with all lifts & leads shall be included in the Contract unit rate."

"Translocation of tree having girth less than 300 mm shall be incidental to work."

Clause 202.6 Measurements for payment

Add the following items after item (vi):

"(vii) Dismantling RCC pipe of pipe culverts, and concrete and pipe hand railing of bridges in linear metre".

(viii) 5th kilometer stone/kilometer stone/hectometer stone in Nos.

Clause 202.7 Rates

Delete the last sentence of the first paragraph and replace with:
"These will also include excavation and back filling where necessary to the required compaction and for handling, piling and disposal of the dismantled materials with all lifts and leads as specified in Sub-Clause 202.5 The cost of carriage of materials with no salvage value to disposal sites for all leads is deemed to be included in the rates for dismantling."

CLAUSE 301 EXCAVATIONS FOR ROADWAY AND DRAINS

Clause 301.1 Scope

Add the following as second paragraph under this Clause:

"The work shall also include excavation for channel training at culverts/bridges, excavation of existing shoulders and medians for purposes of widening the pavement and excavation of existing embankment for reconstruction to specification."

Clause 301.3.7 This Clause shall read as under:

"In works involving widening of existing pavements or providing paved shoulders, the existing shoulders/verge/median shall be removed to its full width. The subgrade material within 0.5m from the lowest part of the pavement shall be checked for compaction which should not be less than 97% of Maximum Dry Density (MDD) as per table 300-2. In case the Compaction is found to be less 97% of MDD as per table 300-2, then the subgrade shall be loosened, excavated and recompacted as per Clause 305 to a compaction not less than 97% of MDD determined according to IS: 2720 (Part 8). Any unsuitable material encountered in this portion of subgrade shall be removed and replaced with suitable material and compacted in accordance with Clause 305.

Clause 301.3.11 Disposal of excavated materials

Delete this sub-clause and replace with:

"Suitable material obtained from the excavation of the roadway, shoulders, verges, drains, cross drainage works, etc. shall be used for/or as determined by the engineer:

i) Filling for roadway embankments
ii) Filling existing pits in the right of way as directed by the Engineer, including leveling and spreading, with all lifts and lead.
iii) For landscaping of the road as directed by the Engineer, including levelling and spreading, with all lifts and leads.

Unsuitable and surplus material, which, in the opinion of the Engineer cannot be used in the works, shall be removed from site by the Contractor and

disposed offwith all leads and lifts in accordance with all statutory requirements

Clause 301.9 Rates

Clause 301.9.1

301.9.1 (vi) shall be read as

"Arranging disposal sites and removal of all surplus or unsuitable materials obtained from excavation operations which in the opinion of the Engineer cannot be used in the works shall be included in the contract rate."

CLAUSE 305 EMBANKMENT CONSTRUCTIONS

Clause 305.2.1.2 Replace –"50 percent" with 35 percent (in 2nd and 4th line of this clause)

Clause 305.2.1.4 Delete second and third sentence.

Clause 305.2.1.6 Replace this sub-clause as

"The material to be used in subgrade shall confirm to the design soaked CBR value (IS2720-Part 16) of minimum 5% (Five Percent) at 97% of maximum laboratory dry density (IS 2720-Part 8) of the test specimen statically compacted at optimum moisture content."

Clause 305.2.2.2 Borrow Materials

Para 1 of this Clause shall be read as under:

"No borrow area shall be made available by the Employer for this work. The arrangement for the source of supply of the material for embankment and sub-grade/shoulder and compliance with the guidelines, and requirements in respect of excavation and borrow areas as stipulated, from time to time, by the Ministry of Environment and Forest, Government of India and the local bodies, as applicable together with those mentioned in EMP report including redevelopment of borrow area shall be the sole responsibility of the Contractor."

Clause 305.2.2.4

The Table 300 – 2 shall read as under:

Table 300-2
Compaction requirements for embankment and subgrade

Sl. No.	Type of Work/Material	Relative compaction as %age of maximum laboratory dry density as per IS:2720 (Part 8)
1.	Subgrade and earthen shoulders	Not less than 97%
2.	Embankment a) Up to 6m height	Not less than 95%

Sl. No.	Type of Work/Material	Relative compaction as %age of maximum laboratory dry density as per IS:2720 (Part 8)
	b) High embankment (exceeding 6m height)	Not less than 97%
3.	Expansive clays	Such material is not allowed

Add point no. – (iii) &(iv)at the end of paragraph no.-2

(iii)The dry density-moisture content – CBR relationships for each of the fill materials he intends to use in the subgrade."

(iv) Expansion ratio shall not be more than 2% for subgrade material when tested in accordance with IS2720(Part-16)

Sub-Clause 305.3 **Construction Operations**

Sub-clause 305.3.4 Add as 5th para of this sub-clause

"In case of backfilling layers in pits, trenches, below the level covered by paras above, are to be compacted to the relative natural ground density, as to be assessed for each type of soil encountered by conducting field density tests at each of three widely spaced locations along the centerline of the proposed additional carriageway at a depth between 0.5 and 1.0m. Samples of natural ground are collected at each location, and are tested in accordance with IS:2720 (Part 8). The relative density (i.e. the percentage of the field dry density to the laboratory maximum dry density) is assessed for each sample, and the greatest (i.e. largest) relative density obtained is selected as the "natural ground density". If the natural ground density is less than 85% then these are to be compacted after necessary watering so as to achieve not less than 85% of relative compaction."

Sub-Clause 305.3.5 Spreading material in layers and bringing to appropriate moisture content

Sub-Clause 305.3.5.1 Add the following at the end of this sub-clause

"To ensure the density of each layer, the contractor shall prepare a layer chart indicating layer number, level, density etc. in the format as approved by the Engineer".

Sub-Clause 305.3.6 **Compaction**

Insert the following sentence before the last sentence of Paragraph 4:

"The co-relation between sand replacement densities and nuclear gauge densities shall be based on trials with minimum 30 coherent density measurements"

Sub-Clause 305.9 Rates

Sub-Clause 305.9.1 Add new subsection as (xv) **"slush removal"**

CLAUSE 306SOIL EROSION AND SEDIMENTATION CONTROL

Clause 306.4 Measurements for Payment

Substitute Clause 306.4 as follows:

"All temporary sedimentation and pollution control works shall be deemed as incidental to the earthwork and other items of work and as such no separate payment shall be made for the same."

Clause 306.5 Rates

This Clause shall be deleted.

CLAUSE 401 GRANULAR SUB-BASE

Clause 401.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed in accordance with Clause 901.15."

Clause 401.2 Materials

Clause 401.2.1 Delete second sentence of paragraph 1.

Modify third sentence of first para as

The material shall be free from organic or other deleterious constituents and conforming to Grading V given in Table 400-1 and physical requirement as per Table 400-1.

Modify Table 400-2 : 1st column, last row shall be read as
"Soaked CBR at 98% of maximum laboratory dry density as per IS2720 (Part-8)"
Modify Table 400-2 : 2nd column, last row shall be read as
" IS2720(Part-16)"

The last sentence of the Para "Where the sub-base ……. not be less than 150mm" shall be read as
"Where the sub-base is laid in two layer as upper layer sub-base and lower layer sub-base the thickness of each layer shall be as per specified in contract or as per the approval of the Engineer."

Clause 401.3.2 Spreading and compacting

Add at the end of first para - It shall be ensured prior to actual execution that the material to be used in the sub-base has a minimum CBR value of 30% when compacted and finished. When directed by the Engineer, this shall be verified by performing tests in the laboratory. The CBR tests shall be conducted on specimen soaked for 4 days and compacted to 98% of the maximum dry density as per IS:2720 (Part 8)

Delete second sentence of 3rd para of this sub-clause
"Insert following between second and third para
"For granular sub base, arrangement shall be made for the lateral confinement of the mix. This shall be done by laying earthen shoulder and following the sequence of the operations described in sub-clause 408.4.1. where granular sub base is not extended over the full formation width.

CLAUSE 406 WET MIX MACADAM SUB-BASE/BASE

Clause 406.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed in accordance with Clause 901.15."

Clause 406.2.1.1 Physical Requirements

Table 400-12 : Physical Requirements of Course Aggregates for Wet Mix Macadam for Sub-base/Base Courses is modified as below:

Sl. No	Test	Test Method	Requirements
1	Los Angeles Abrasion value & Aggregate Impact value	IS:2386 (Part-4) IS:2386 (Part-4) or IS:5640	40% (Max.) 30% (Max.)
2	Combined Flakiness and Elongation Indices (Total)	IS:2386 (Part-1)	35% (Max.)

Add the following at the end of the paragraph: Soundness test shall be carried out in accordance with IS : 2386 (Para 5). The average loss of weight of coarse after 5 cycles shall not exceed 12% when tested with sodium sulphate and 18% when tested with magnesium sulphate as specified in IS : 383. The fraction of material passing through 4.75 mm sieve shall be crusher run screening only.

Clause 406.3.2 Provision of lateral confinement of aggregates

Replace second sentence of this sub-clause as

"This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in sub-clause 408.4.1

Clause 406.3.5 Compaction

Substitute para 7 of this Clause with the following:

"Rolling shall be continued till the density achieved over the full thickness of the material laid is at least 98% of the maximum dry density as determined by the method outlined in IS:2720 (part 8) and satisfies the requirements of Clause 903.3."

Clause 408.4.1Shoulder

Replace 1st sentence of para 4 of this sub-clause with the following:

"Compaction requirement of earthen shoulder shall be as per Table 300-2."

CLAUSE 410 FOOTPATHS AND SEPARATORS

Replace the entire Clause 410 with the following:

410.1 Scope

The work shall consist of constructing footpaths and/or separators at locations as specified in the drawings or as directed by the Engineer. The lines, levels and dimensions shall be as per the drawings. The scope of the work shall include provision of all drainage arrangements as shown in the drawings or as directed.

410.2. Materials

The footpaths and separators shall be constructed with the following type:

Precast cement concrete block/tiles of Grade M30 as per Sections 1700 of the Specifications. The minimum thickness of the cement concrete block/tile shall be 25 mm and minimum size shall be 300 mm x 300mm.

410.3. Construction Operations

410.3.1 Drainage pipes below the footpath originating from the kerbs shall be first laid in the required slope and connected to the drains/sumps/storm water drain/drainage chutes as per provisions of the drawings, or as specified.

410.3.2 Portion on back side of kerbs shall be filled and compacted with granular sub-base material as per Clause 401 of the Specifications in specified thickness.

410.3.3 The base shall be prepared and finished to the required line, levels and dimensions as indicated in the drawings with the following:-
(a) Minimum 150 mm thick, compacted granular sub-base material as per Clause 401 of the Specifications.

(b) Minimum 25 mm thick cement concrete of Grade M15.

Over the prepared base, precast concrete tiles shall be set/laid as described in Clauses 410.3.4.

410.3.4 Precast cement concrete tiles:

The tiles shall be set on a layer of average 12 mm thick cement-sand mortar (1:3) laid on prepared base in such a way that there is no rocking. The gaps between the tiles shall not be more than 12 mm and shall be filled with cement-sand mortar (1:3).

410.4 Measurements for Payment

Footpaths and separators shall be measured in sq. meter between inside of kerbs.

410.5 Rates

Contract unit rates shall be inclusive of full compensation of all labour, materials, tools, equipments and incidentals to construction of footpaths. Cost of providing pipes and arrangement for their discharge into appropriate drainage channels shall be incidental to the construction of footpaths.

SECTION 500 BASES AND SURFACE COURSES (BITUMINOUS)

General

Clause 501.2.1Binder

Modify first sentence of 501.2.1 (i) as
"Modified bitumen from the refinery sources or blended at approved central plant using appropriate industrial process and plant with high shear mill and testing facility to achieve stable and homogeneous mix shall be used."

Clause 501.3 Mixing

Substitute first sentence of second para as
"Hot mix plant shall be batch type of minimum capacity of 100 Tonne Per Hour. Use of drum mix type hot mix plant shall not be allowed on the project in any circumstances."

CLAUSE 502 PRIME COAT OVER GRANULAR BASE

Clause 502.1 Scope

Add the following at the end of this Clause:
"A site trial shall be performed in accordance with Clause 901.15."

Clause 502.3 "100C" in the 2nd line shall be read as "10ºC"

Clause 502.8 Replace "0.6 kg/m^2"in 4th line by "0.7-1.0 kg/m^2".

CLAUSE 503 TACK COAT

Clause 503.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed in accordance with Clause 901.15"

Clause 503.2 Materials

Modify this Clause as under:

"Binder: The binder used for tack coat shall be cationic bitumen emulsion (RS1) of rapid setting type conforming to IS:8887". The exact quantity of binder to be used for the tack coat shall be decided by the Engineer based on field trials to be carried out by the contractor in the presence of the former in accordance with clause 901.15

Clause 503.8 Replace "0.2 kg/m^{2}" in 4th line by "0.2-0.3 kg/m^{2} for bituminous surface and 0.25-0.3 kg/m^{2} for granular surface treated with primer.

CLAUSE 505 DENSE BITUMINOUS MACADAM

Clause 505.1 Scope

Add the following at the end of para.

A site trial shall be performed in accordance with the Clause 505.3.5 and 901. 15."

Clause 505.2 Materials

Clause 505.2.1Bitumen

This clause shall be read as under:

"The Bitumen shall be paving bitumen of Viscosity Grade (VG-30) as per Indian Standards Specifications for Paving Bitumen – IS:73:2006 (Third Revision)

Clause 505.2.2 Coarse Aggregates

Delete the words "crushed gravel" from the first sentence of clause 505.2.2.

Replace second para of this clause as;

"The material shall be derived from parent rock that is hard, sound, durable and un -weathered. It shall not contain deleterious constituents such as organic matter, clay and decomposed rock.

Clause 505.3.1 Requirement of mix

Add the following requirements to the list of Table 500-11:

- Water sensitivity (ASTM D1075):Retained stability (Ratio of Marshal Stability for 24 h Immersion and 30min Immersion in water at 60 degree centigrade temperature) = not less than 75 %

- At least 50 % of the filler fraction shall be Portland cement introduced

separately into the mixer (pug mill) of HMP .

- Air void in mix () determined on specimen compacted to "Refusal Density" by 300 and 450 blows of Marshal Hammer for Marshall method and Modified Marshall method respectively on each end shall not be less than 3%

Clause 505.3.3Job mix formula

Add at the end.

"Mix design for dense bituminous macadam shall be carried out in accordance with the modified marshal method described in Asphalt Institute Manual MS-2. The construction of Dense Bituminous Macadam/Bituminous concrete course shall be taken up only upon successful site trials and Engineers approval to the materials and the Job Mix Formula."

Clause 505.3.5Laying trials

Delete second sentence of first para.
Substitute "100 sqm" by "500 sqm" in first para.

Clause 505.4.8 Spreading

Add the following at the end of para

"The temperature of mix at the time of laying shall be in the range of 120-145 degree Celsius."

Clause 505.9 Rate

Substitute second sentence of first para as

"The rate shall include the provision of bitumen as a minimum 4.5% by weight of total mixture for grading 1 and 2..

Second para deleted and substituted as :
The variation in actual percentage of bitumen used as per job mix formula shall be incidental to the rate and no payment shall be made on this account.

CLAUSE 507 BITUMINOUS CONCRETE

Clause 507.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed in accordance with Clause 507.3.5and 901.15."

Clause 507.2.1 - The clause to be read as

" The Bitumen shall be modified bitumen of grade CRMB60 conforming to Indian Standard Specification for Modified Binder IS 15482 and IRC:SP:53-2010.

Clause 507.9 - Substitute the first sentence as

" The contract unit rate shall be all as specified in the clause 505.9 except the rate shall include the provision of bitumen as minimum 5.4 % by weight of total mix respectively.

Second para deleted and substituted as :

The variation in actual percentage of bitumen used as per job mix formula shall be incidental to the rate and no payment shall be made on this account.

Clause 509.2.4 - Anti-Stripping Agent

This clause substitute as under :

Where the proposed aggregate fails to pass the stripping test then no anti-Stripping Agent shall be added to the binder to meet the specification. The contractor shall use the appropriate aggregate as per technical specification without addition of the Anti-Stripping Agent.

CLAUSE 508 CLOSE GRADED PREMIX SURFACING/MIXED SEAL SURFACING

Sub-Clause508.2.2 Coarse Aggregates

Replace "511.1.2.2" with "510.1.2.2" in the Sub-Clause 508.2.2.

Sub Clause 508.8 Rate

Add the words "except for item of prime coat and tack coat" after the words "required operations" in 2nd line.

CLAUSE 510 OPEN GRADED PREMIX SURFACING

Sub Clause 510.1 Open-Graded Premix Surfacing using Viscosity Grade Paving Bitumen

Sub Clause 510.1.8 Rate

Add the words "except for item of prime coat and tack coat" after the words "required operations" in 2nd line.

CLAUSE 516 MASTIC ASPHALT

Sub-Clause 516.4.5 Spreading

Replace "Table 500-6" with "500-5" in sub-paragraph 2) of 4th paragraph of Sub-Clause 516.4.5.

CLAUSE 601 DRY LEAN CEMENT CONCRETE SUB-BASE

Clause 601.1.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed in accordance with Clause 901.15."

Clause 601.2.1 Material

Add the following at the end of this Clause

If it is found after trail sources of supply previously approved do not produce uniform and satisfactory products, or if the product from any other sources proves unacceptable at any time. The contractor shall furnish acceptable material from other sources at his own expenses.

Provision of clause 1002 shall also apply

Clause 601.2.2 Cement

The clause shall read as follows:

Cement OPC 43 Grade to be used.

If the soil around has soluble sulphates exceeding 0.5% the cement used shall be sulphate resistant and conform to IS:12330

"Cement to be used shall be obtained in bulk or in standard size bag. The cement shall be stored in accordance with Clause 1014. The cement shall be subjected to acceptance test just prior to its use."

Clause 601.2.5 Water

The clause shall read as follows:

"Water used for mixing and curing concrete shall conform to Clause 1010 of Section 1000."

Clause 601.6.7 Curing

Add the following at the end of the clause:

Method (a) shall be adopted

CLAUSE 602 CEMENT CONCRETE PAVEMENT

Clause 602.1.1 Scope

Add the following at the end of this Clause:
"A site trial shall be performed in accordance with Clause 901.15."

Clause 602.2.2 Cement

The clause shall read as follows:

Cement OPC 43 Grade to be used.

If the soil around has soluble sulphates exceeding 0.5% the cement used shall be sulphate resistant and conform to IS:12330

"Cement to be used shall be obtained in bulk or in standard size bag. The cement shall be stored in accordance with Clause 1014. The cement shall be subjected to acceptance test just prior to its use."

Clause 602.2.7 Water

The clause shall read as follows:

"Water used for mixing and curing concrete shall conform to Clause 1010 of Section 1000."

Clause 602.3.2 Cement Content

The clause shall read as follows:

Cement content in the concrete should not less than 360 kg/cu.m

Clause 602.3.3.2Concrete Strength

Add at the end of the paragraph

"The compressive strength of the concrete for the rigid pavement shall not be less than 40 MPa after 28 days."

Clause 602.3.4.1Workability

Delete the last sentence of the paragraph and replace with:

"The control of workability in the field shall be exercised by Slump Test (IS: 1199) and shall be further confirmed/controlled by Compaction Factor Equipment and the compaction factor shall be in the range of 0.8 to 0.92"

CLAUSE 801 TRAFFIC SIGNS

Clause 801.3.7 Replace the last Sentence & read as under:

"Cut-out messages and borders, wherever used, shall be made out of prismatic grade sheeting (Type-XI) as per Clause 801.3.4.3, except those in black which shall be of non-reflective sheeting."

Clause 801.3.11 Warranty and Durability

The first and second sentences of this Clause shall read as under:

"The Contractor shall obtain from the manufacturer a ten-year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of high intensity grade and submit the same to the Engineer. In addition, a seven year warranty for satisfactory in-field performance of the finished sign with retro-reflective sheeting of high intensity grade, inclusive of the screen printed or cut-out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the Contractor/Supplier and passed on to the Engineer."

Clause 801.4.1Installation

The first sentences of this Clause shall read as under:

"The traffic sign shall be mounted on support post of mild steel angle iron post (ISA 75x75x6) conforming to IS:2062.

The fourth sentence of this clause shall read as under:

Posts shall be firmly fixed to the ground by embedding in properly designed foundation (45cmx45cmx60cm) of M15 grade concrete. The cost of foundation shall be deemed to be included in the rate of the sign board.

CLAUSE 802 OVERHEAD SIGNS

Clause 802.1 General

Add at the end of the Clause:

"The locations of cantilever overhead and overhead signs (Gantry type) shall be decided by the Engineer."

Sub-Clause 802.4.2 Replace the words "they shall …. IS Specifications." with "they shall be thoroughly descaled, cleaned, primed along with all other components of signs, except reflective portion. They shall be painted with two coats of epoxy paint. The sign back side shall be painted with grey colour and post shall be painted in black & white alternate bands. The post below ground shall be painted with three coats of red lead paint.

CLAUSE 803 ROAD MARKINGS

Clause 803.6.6 Tolerances Add at the end of the Clause:

Line and curves, whether broken or unbroken, shall not consist of chords but shall follow the correct radius.

ii) Faulty Workmanship or Materials

If any material not complying with the requirements is delivered at the Site or used in the Works, or if any sub-standard work is carried out, such material or work shall be removed, replaced or repaired as required by the Engineer, at the Contractor's own cost. Rejected traffic markings and paint that has been splashed or has dripped onto the surfacing, kerbs, structures or other such surfaces shall be removed by the Contractor at his own cost, in such a way that the markings of split paint will not show up again later."

CLAUSE 805 DISTANCE INDICATOR POSTS

Clause 805.3 The first sentence of this Clause shall read as under:

"The hectometer/kilometer stones shall be made of concrete of grade as shown in the Drawing or as approved by the Engineer."

CLAUSE 807 BOUNDARY STONES

Sub Clause 807.1 Scope

Add at the end of Paragraph 1, "The boundary stones shall be of concrete as shown in drawing." The words 'SH-.....' or as directed by the Engineer should be engraved on each stone appropriately.

CLAUSE 809 TUBULAR STEEL RAILING

Sub Clause 809.3 Add the following to the end of this Sub-Clause:

"The railing shall be embedded in the concrete foundation of size and the grade of concrete along with the depth of the embedment of post as indicated in the drawing."

Sub Clause 809.5 Rate

After the words "test and final erection at site" in 3rd line of this Clause, add the words "including cost of excavation, concrete foundation etc."

CLAUSE 811 CRASH BARRIER

Sub Clause 811.2.1.2 This Clause shall read as under:

"The grade of concrete shall be M-40."

Sub Clause 811.2.2.2Replace "Clause 810.2.2.3" **with** "Clause 811.2.2.3" in the 4th line of 1st paragraph of Clause 811.2.2.2.

CLAUSE 811.3 Metal Beam Crash Barrier

Sub-Clause 811.3.7 Measurements for Payment

Sub-Clause 811.3.7.1 The 2nd sentence "Terminals/anchors of various types shall be paid by numbers" is **deleted**.

Sub-Clause 811.3.7.2 This Clause shall read us under:
"No separate measurement for payment shall be made for Terminals/anchors of various types required for the work. The cost of these elements shall be deemed to be included in the rate quoted by the Contractor. Furnishing and placing anchor bolts and/or devices for guard rail posts on bridges shall be considered incidental to the construction and the costs thereof shall be included in the price for other items of construction."

Sub-Clause 811.3.7.3 The words "and concreting" shall be added after the words "or backfilling".

Sub Clause 811.3.8 Rate

Add the words **"and drawings" at the end of the last sentence in** Sub-Clause **811.3.8.**

CLAUSE 900 QUALITY CONTROL FOR ROAD WORKS

SUB-CLAUSE 901.8.

Delete the last sentence of the paragraph and replace by

The cost of testing undertaken by the Contractor in terms of his obligations under the contract for the purposes of all quality control, including the taking of samples, reinstating where samples have been taken, and all testing equipment, labour, materials, etc, shall be included in the rates bid as incidental to works for the various items of work supplied and will not be paid for separately.

Copies of test results, manufacturer's certificates & the level details for the respective positions are submitted by the Contractor to the Engineer in good time to enable the Engineer to assess the information for approval.

Clause 901.15 Site Trial

The Contractor shall carry out full-scale site trials outside of permanent carriageway on all earthwork and pavement materials proposed for the Works using the equipment and methods proposed by the Contractor for constructing the Works. The trials shall be carried out with the agreement and in the presence of the Engineer or his authorized representative.

The trials shall be carried out to enable the Contractor to demonstrate the suitability of his mixing and/or compaction equipment to provide the specified material and compact the same to the specified density and to confirm that the other specified requirements of the completed earthworks and pavement courses can be achieved.

Each trial area shall be at least 500 square meters and shall be laid to the specified depth for the material. It may form part of the works if so ordered by the Engineer provided it complies with the specification. Any trial areas, which do not comply with the Specification, shall be removed.

The Contractor shall allow in his program for conducting site trials and for carrying out the appropriate tests on them. The trials on earthworks and each pavement layer shall be undertaken at least 7 days ahead of the Contractor proposing to commence full scale work on earthworks and the pavement layers.

The following data shall be ordered at each site trial:

- The composition and grading of the material, including the bitumen content and properties, if appropriate;
- If appropriate, the moisture content at the time of laying;
- If appropriate, the temperature at the time of laying and rolling;
- The type and size of compaction equipment and the number of passes;
- The maximum density or target density as appropriate and the density achieved in the trial;
- The maximum compacted thickness of layer;
- The surface levels and the surface irregularities
- Calibration of machinery for best and efficient results;
- Any other relevant information

Not less than ten sets of tests for each test shall be made on each 500 square meters of trial area, and provided nine out of ten sets of results meet the specified requirements for the material/work in Clause 903, the site trial shall

be deemed successful. The above data recorded in the trial shall become the agreed basis on which the particular material shall be provided and processed to achieve the specified requirements.

If, during execution of the Works, the construction control tests indicate that the requirements for a material are not consistently being achieved, then work on that layer shall stop until the cause is investigated. Such investigation may include further laboratory and site trials on the material to determine a revised set of data, as above which, when agreed, shall be the basis on which all subsequent material will be provided and processed to achieve the specified requirements.

Approval by the Engineer to a set of data recorded, as above in a site trial shall not relieve the Contractor of responsibility to comply with the requirements of Technical Specifications.

CLAUSE 903 QUALITY CONTROL TESTS DURING CONSTRUCTION

Clause 903.2.1Borrow material
Serial number (f) of the sub-clause shall be read as

" CBR tests on the material to be incorporated in the subgrade on soaked sample IS 2720(Part-16): One CBR test (average of three specimen compacted statically at 97% of laboratory maximum dry density and OMC) or closer as and when required by the Engineer."

Clause 903.4.1 Add at the end of this Clause:

"The density test shall be carried out by 150 mm and 100 mm diameter core cutter machine on Dense Bituminous Macadam and Bituminous Concrete respectively as per the frequency specified".
In Table 900-4, substitute "Tests for quality of binder as specified in relevant IS Code" under Test column for "Quality of binder".
In Table 900-4, serial No.5 for Dense Bituminous Macadam/Bituminous Macadam and for Bituminous Concrete, add the following at the end in the *Frequency* column:

"10% of the density tests shall be done on edges."

Clause 903.4.4 Characteristics to be tested on completed Bituminous Layers

Add the following

The characteristics to be tested on completed bituminous layers are:

- Relative compaction
- Layer thickness

For testing the above characteristics, the following sampling criteria shall apply:

(a) Random Sampling

When testing any lot, or an isolated section, which is obviously defective or exhibits abnormal variation of the characteristics under consideration, all samples shall be taken in a random pattern.

(b) Lot Size

The lot size shall normally be a section laid and compacted in one process and for which essentially the same materials had been used. Where production is on a continuous basis, a lot shall normally mean one-day production and shall not exceed two full days production. However, the Engineer for investigating compliance with the specifications may order a lot of any smaller size, if:

- The factors affecting the characteristics under investigation exhibit abnormal variation within the normal lot size;
- The area is obviously defective or of poorer quality than that of the rest;
- The rate of production is very high.

CLAUSE1000 MATERIALS FOR STRUCTURES

CLAUSE 1002Add at last in paragraph 2

"If the product from the approved source proves unacceptable at any time, the Contractor shall provide new sources of acceptable material from other sources at his own expense conforming to specifications."

Paragraph 3 shall be read as

"For manufactured items like cement, steel reinforcement, prestressing strands, the Contractor shall intimate the Engineer details of the source (plant where the material is manufactured), testing facilities available with the manufacturer and arrangements for transport and storage of material at site. If directed by the Engineer, the Contractor shall furnish samples and test results of recently manufactured material. The Engineer, at his discretion, may require the Contractor to test the materials in an independent laboratory approved by the Engineer, and furnish test certificates. The cost of these tests shall be borne by the Contractor. The sampling and test procedures shall be as laid down in Indian Standards or where these are not available as per the directions of the Engineer. Only material from the sources approved by the Engineer shall be brought to the site. If the material from the approved sources proves unacceptable at any time, the Contractor shall provide new sources of acceptable material conforming to specifications from other sources at his own expense."

CLAUSE 1006 CEMENT

The first para of this Clause shall read as under :

"Cement to be used in the works,

a) Ordinary Portland Cement 43 grade, conforming to IS:8112

b) Ordinary Portland Cement 53 grade conforming to IS:11269

c) Sulphate Resistance Portland Cement conforming to IS:12330

CLAUSE 1007 Coarse Aggregates

(i) Delete from the first sentence "crushed gravel ---------- inert material" appearing in 3rd and 4th line.

(ii) Add the following at the end of the Clause:

"Primary and secondary stone crusher should be employed for getting proper size and grading of coarse aggregates by means of proper screening system."

CLAUSE 1009 Steel

Add a new clause-

Clause 1009.3.3 Corrosive Treatment

Corrosive treatment by using Cement Polymer Composite Coating System (C.P.C.C) developed by CECRI, Karaikud, if specified, shall be carried out following their method and by the expert Licensee of CECRI.
The brief specifications are given below:

1. The surface of the steel reinforcing bars to be cleaned by sand and or grit blasting to the near white metal and completely free from rust. The prepared surface shall meet the visual standards of comparisons as in SSPC-VIS-1 or SSPC-VIS-2. The reinforcement steel first cut to required size and then sand blasting is to be done.
2. The reinforcement steel is to be cut in required size and then cleaned by suitable solvent to remove the rust.
3. After getting rust-free surface, immediately Primer Coat is to be applied on the surface of reinforcement by patented Primer Solution (patent No.-481/Del/93) by brush or by dipping or by spray. No surface area should be left uncoated.
4. After application of Primer Coat, the reinforcement steel is to be kept for air-drying for 30 mts.
5. After air-drying for 30 mts. The Sealing Coat is to be applied by patented Cement Polymer Sealing Solution (Patent No. 259/Del/92) by brush or by dipping or by spraying. No surface area should be left uncoated.
6. The coated reinforcing steel are to be kept of air drying for 6 hours and then can be handled.
7. If the rebars are cut after application of coatings, then on the cut-ends patching can be done by patented Primer Solution and Patented Sealing Solution by brush. If due to mishandling, the coating is damaged, patented Sealing Solution can do then patching.
8. The Patented Primer Solution and Patented Sealing Solution must be manufactured by the Licensee of CECRI only.
9. The application of all the chemicals (i.e. execution of complete C.P.C.C. system) id to be done by the Licensee of CECRI only.
10. The patented Primer Solution & Sealing Solution and Coated bars should meet the specifications laid down by CECRI.

CLAUSE 1014 STORAGE OF MATERIALS

Clause 1014.3 Aggregates

The following shall be added to this Clause:

"Aggregates shall be stored or stockpiled in such a manner that segregation & moisture correction of fine and coarse sizes will be avoided and also that the various sizes will not become intermixed before proportioning. They shall be stored, stockpiled and handled in such a manner that will prevent contamination by foreign materials."

CLAUSE 1500 FORMWORK

CLAUSE 1501 DESCRIPTION

Add the following paragraphs at the end of this Clause:

"The Contractor shall prepare a formwork mobilization and utilization plan and submit the plan for Engineer's approval at least 21 days before the commencement of construction of structures. The requirement of formwork shall be worked out considering the overall construction program of all the structures to be cast in one or more stages, as specified in the drawings. The plan shall take into account the time required for erection of formwork, retention in position, stripping, and removal and subsequent use in the next and subsequent structures.
Notwithstanding Engineer's approval of mobilisation plan, if due to any reason, Contractor has to arrange additional formwork, to meet the requirements of the construction program, it shall be done by the Contractor without any extra cost to the Employer."

Clause 1502 Materials

This Clause shall be read as under:

"All materials shall comply with the requirements of IRC-87.

Material and components used for formwork shall be examined for damage or excessive deterioration & free from corrosion before use/reuse and shall be used only if found suitable after necessary repairs.
Only steel formwork shall be used. The steel used for forms shall be of such thickness that the forms remain true to shape. All bolts should be countersunk. The use of approved internal steel ties or plastic spacers shall be permitted. Structural steel tubes used as support for forms shall have a minimum wall thickness of 4 mm."

CLAUSE 1503 DESIGN OF FORMWORK

Clause 1503.2 The following para shall be added to this Clause:

"For distribution of load and load transfer to the ground through staging, an appropriately designed base plate must be provided which shall rest on firm sub-stratum or precast concrete slab or cast in-situ concrete."

CLAUSE 1509 RE-USE OF FORMWORK

This Clause shall be read as under:

"After forms are stripped, all materials shall be examined for any damage and damaged pieces, if any, shall be removed either as rejected or for rectification if possible. The materials found fit to be reused shall be thoroughly cleaned. Holes bored through sheathing for form ties shall be plugged by driving in common corks or foamed plastics. Patching plaster may also be used to fill small holes. After cleaning and before re-fixing, each formwork shall be got approved from the Engineer.

Formwork and staging shall be so used as to ensure quality of the exposed surface. The maximum number of uses shall be limited to 20 provided the form work etc., is in satisfactory condition and capable of giving good quality exposed surface. However, if in the opinion of the Engineer, any particular panel/member has become unsatisfactory for use at any stage, the same will be rejected and removed from site.

All bent steel props shall be straightened before reuse. The maximum deviation from straightness is 1/600 of length. The maximum permissible axial loads in used props shall be suitably reduced depending upon their condition.

Clause 1513 Rate

Add the following at the end of the first para:
"The unit rate shall also include all costs for preparation of erection scheme, designs of false work and formwork and their approval."

SECTION 1600 STEEL REINFORCEMENT

CLAUSE 1602 GENERAL

Paragraph 2 of Clause 1602 shall read as follows:

"Reinforcements shall be High Strength Deformed Steel Bars (HSD) of grade Fe 500D conforming to IS: 1786."

CLAUSE 1603 PROTECTION OF REINFORCEMENT

Replace "1010.3.2" **with** "1009.3.2" in 2nd line of 3rd paragraph of Clause 1603.

CLAUSE 1704 PROPORTIONING OF CONCRETE

Add the following at the end of this Clause:

"In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the manufacturer's weight per bag, a reasonable number of bags shall be weighed separately to check the net weight. Where cement is weighed from bulk stock at site and not by bag, it shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined as frequently as possible; frequency for a given job being determined by the Engineer according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. The determination of

moisture content in the aggregates shall be done as per IS: 2386 (Part III). Suitable adjustments shall also be made in the weight of aggregates to allow for the variation in weight of aggregates due to variation in their moisture content."

CLAUSE 1705 ADMIXTURES

3rd paragraph of this Clause shall read as under:

The general requirements, physical and chemical requirements shall be as per Clause 1012."

Clause 1706 Size of Coarse Aggregate

Table 1700-7 in this clause shall read as under :

Components	Maximum Nominal size of coarse aggregate (mm)
i) RCC Well curb	20
ii) RCC/PCC well steining	40
iii) Well cap or pile cap solid type piers & abutments	40
iv) RCC work in girders, slabs, kerb, approach slab, piers and abutments, pier / abutment caps, piles	20
v) PSC Work	20
vi) PCC in bottom plug and top plug/intermediate plug	40
vii) RCC Work in wearing coat and handrails	12.5
viii) Any other work	As specified or as directed by the Engineer.

CLAUSE 1707 EQUIPMENT

The first para of this Clause shall read as follows:

"Unless specified otherwise equipment for production, transportation and compaction of concrete shall be as under:

a) For Production of Concrete

i) For Culverts, Retaining/Toe walls, -batch type concrete mixer diesel or electric operated, with a minimum size of 200 litres, automatic water measuring system and integral weigher (hydraulic/pneumatic type)

ii) For Rigid Pavement, Major/Minor Bridges, ROBs/RUBs and Underpasses – concrete batching and mixing plant fully automatic with minimum capacity of 15 cum per hour and plant shall be approved by Engineer".

Clause 1708.4 Transporting, Placing and Compaction of Concrete

Add the following at the end of 3nd para of clause

For placing Concrete with Pumps: Pipe Lines from the pump to the placing area should be laid out with minimum of bends. For large concrete placements standby pumps shall be available. Suitable valves (air release valves, shutoff valves etc.) shall be provided as per site needs. The pumping of concrete shall be preceded by a priming mix to lubricate the pump and pipeline. A rich mix of creamy consistency shall be required for lubricating the pipelines. Continuous pumping shall be done to the extent possible. After concrete has been placed, the lines and all related equipment shall be cleaned immediately. A plug sponage ball shall be inserted in the end near the pump and shall be forced through the line by either water or air pressure. Pipes for pumping should not be made from materials which can harm concrete; aluminium alloy pipelines shall not be used.

CLAUSE 1712 PROTECTION AND CURING

Clause 1712.2Water Curing

Add the following at the end of para 1:

"Wherever possible, use of water sprinklers or perforated pipes should be encouraged for curing of concrete. Such arrangement must be maintained for a minimum period of 14 days after concreting.

Approved concrete curing compounds should be preferred where water curing cannot be done reliably."

Clause 1805WORKMANSHIP

Clause 1805.3.1 Post tensioning

The following para shall be inserted between the 5th and the 6thpara.

"The steel sheaths or duct formers shall be suitably tied to secondary reinforcement or to properly located with drawable through-shutter bolts, precast concrete blocks or similar effective means, in such a manner that they do not give rise to excessive friction when the steel is being tensioned.

Clause 1807 TENSIONING EQUIPMENT

Add the following at the end:

"Before initial use and subsequently at suitable intervals, the pre-stressing equipment shall be checked to determine any variation from the normal values during use.

So far as these variations depend upon external influence (eg. Temperature in the case of oil jacks) they shall be taken into account."

CLAUSE 2009 MEASUREMENTS FOR PAYMENT

Add the following in Paragraph 1:

POT- cum-PTFE Bearings shall be measured in numbers, according to their capacities

Add the following after Paragraph 2:

"Tar Paper bearings shall be measured in square meters."

CLAUSE 2011 TAR PAPER BEARING

Add **the new Clause 2011 at the end of the Section 2000.**

"2011 TAR PAPER BEARING

Tar Paper bearing shall be reinforced bitumen laminated Kraft paper conforming to the requirements of IS- 1398."

CLAUSE 2100 OPEN FOUNDATIONS

CLAUSE 2104 WORKMANSHIP

Sub Clause 2104.1 Preparation of Foundations

Replace "M10" **with** "M15" in 5th line of 1st paragraph of Clause 2104.1.

Sub Clause 2104.3 Construction

Replace "M10" **with** "M15" in 1st& 7th line of sub-paragraph ii) of Clause 2104.3.

SECTION 2200 SUB-STRUCTURE

CLAUSE 2210 RATE

This Clause shall read as under:

"The contract rate for masonry, concrete reinforcement and weep hole in substructure shall include all works as given in respective sections of these Specifications and cover the cost of all incidental items like providing cofferdams, dewatering, providing special formwork, where necessary, and all other items for furnishing and providing substructure as mentioned in this Specifications and shown on the drawings.

The necessary material (asphaltic/bituminous board or equivalent material) and labour, tools etc. required for maintaining 20 / 40 mm gap between faces of various structures (old / new) wherever required / as shown in drawing shall be incidental to work and shall not be measured / paid separately."

CLAUSE 2009 MEASUREMENTS FOR PAYMENT

Replace 1st para with "POT-cum-PTFE bearing shall be measured in tonne i.e. capacity of the bearing."
Add the following after para 2:

"Paper bearings shall be measured in square meters."

CLAUSE 2500 RIVER TRAINING WORKAND PROTECTION WORK

CLAUSE 2504 PITCHING/REVETMENT OF SLOPES

The title of this Clause shall read as under:

"**PITCHING/REVETMENT & FILTER MEDIA ON SLOPES"**

Clause 2504.2.2 Filter Media

Add after 1st para:

"The material for filter media behind abutment shall conform to general guide lines given in Appendix 6 of IRC-78-2014 (Standard Specification and Code of Practice for Road Bridges – Section-VII)."

CLAUSE 2700 WEARING COAT AND APPURTENANCES

CLAUSE 2702 WEARING COAT

Clause 2702.1Type 1 may be read as

Type 1 : Bituminous Concrete 50 mm thick laid in single layer or as specified in the drawing.

CLAUSE 2706 WEEP HOLE

Substitute second sentence as under

"Weep hole shall be provided with 100mm dia AC/PVC-U (IS:15392 (Type-B)) pipes for structure in plain/Reinforced concrete, brick masonry.

CLAUSE 2708 MEASUREMENTS FOR PAYMENT

Substitute first sentence in i) as under

"Bituminous and cement concrete wearing coat shall be measured in sq metres."

ADDITIONAL SPECIFICATION

The Additional Technical Specifications provided here in this section shall be read in conjunction with General Technical Specifications and Particular Specifications included.

Clause A1 Cement Treated Soil for Improved Sub-grade

Clause A1.1 Scope

This work shall consist of laying and compacting an improved sub-grade of soil treated with cement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer.

Clause A1.2 Materials

Clause A1.2.1 Soil:

The soil used for cement treatment shall be local soil having Plasticity Index value (PI) less than 20%.

Clause A1.2.2 Cement:

Cement for stabilization shall either be Ordinary Portland cement, Portland slag cement or Portland Puzzolana cement and shall comply with the requirements of IS: 269, 455 or 1489 respectively.

Clause A1.2.3 Quantity of cement in Cement-Soil Stabilized Mix:

The quantity of cement to be added as percent by weight of the dry soil shall be Minimum 2 percent. The mix design shall be done on the basis of CBR value specified in the contract (minimum CBR 15 percent). The laboratory 7 days soaked CBR value shall be at least 1.5 times the minimum field value of CBR stipulated in contract (minimum CBR 15 percent).

Clause A1.2.4 Water:

The water to be used for cement stabilization shall be clean and free from injurious substances. Potable water shall be preferred.

Clause A1.3 Construction Operations

Clause A1.3.1 Weather limitations:

Cement-soil stabilization shall not be done when the air temperature in the shade is less than 10^0 C.

Clause A1.3.2 Degree of pulverization:

For cement stabilization, the soil before addition of stabilizer shall be pulverized using implements like heavy duty rotavator (greater than 100 hp), recycler to the extent that it passes the requirements set out in Table A-1 when tested in accordance with the method described in **Appendix 3** of MoRTH Specifications for Road and Bridge Works 2013.

Table A-1 Soil Pulverization Requirements for Cement Stabilization

IS Sieve designation	Minimum percent by weight passing the IS Sieve
26.5 mm	100
5.6 mm	80

Clause A1.3.3 Equipment for construction:

Stabilized soil Sub grade shall be constructed by mix-in-place method of construction or as otherwise approved by the Engineer.

The equipment used for mix-in-place construction shall be heavy duty rotavator (greater than 100 hp), recycler or similar approved equipment capable of pulverizing and mixing the soil with additive and water to specified degree to the full thickness of the layer being processed, and of achieving the desired degree of mixing and uniformity of the stabilized material. Trial runs with the equipment shall be carried out to establish its suitability for work.

The thickness of any layer to be stabilized shall be not less than 150 mm when compacted. The maximum thickness can be 250 mm, provided the plant used is accepted by the Engineer.

Clause A1.3.4 Addition of cement:

Spreading of cement at the required dosage rate may be carried out by cement spreader with controlled spray rate.

No traffic other than the mixing equipment shall be allowed to pass over the spread cement until after completion of mixing.

Mixing or remixing operations, regardless of equipment used, shall continue until the material is free of any cement streaks or pockets of cement and the mixture is uniform.

Clause A1.3.5 Moisture content for compaction:

The moisture content at compaction checked vide IS: 2720 (Part 2) shall neither be less than the optimum moisture content corresponding to IS: 2720 (Part 8) nor more than 2 percent above it.

Clause A1.3.6 Rolling:

Immediately after spreading, grading and levelling of the mixed material, compaction shall be carried out with approved equipment preceded by a few passes of lighter rollers if necessary. Rolling shall commence at edges and progress towards the centre, except at super elevated portions where it shall commence at the inner edge and progress towards the outer edge. During rolling, the surface shall be frequently checked for grade and cross fall (camber) and any irregularities corrected by loosening the material and removing/adding fresh material. Compaction shall continue until the density achieved is at least 98 percent of the maximum dry density for the material determined in accordance with IS: 2720 (Part 8).

Care shall be taken to see that the compaction of cement stabilized material is completed within two hours of its mixing or such shorter period as may be found necessary in dry weather/hot weather.

During rolling it shall be ensured that roller does not bear directly on hardened or partially hardened treated material previously laid other than what may be necessary for achieving the specified compaction at the joint. The final surface shall be well closed, free from movement under compaction planes, ridges, cracks or loose material. All loose or segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

Clause A1.3.7 Curing:

The Sub-grade shall be suitably cured for a minimum period of 7 days after which subsequent pavement courses shall be laid to prevent the surface from drying out and becoming friable. No traffic of any kind shall ply over the completed Sub-grade unless permitted by the Engineer.

Clause A1.4 Surface Finish and Quality Control of Work

The surface finish or construction shall conform to the requirements of Clause 902.

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 of MoRTH Specifications for Road and Bridge Works 2013

Clause A1.5 Strength

When cement is used for improving the subgrade, the soil-cement mix shall be tested for its CBR value. In case of variation from the design CBR, in situ value being lower, the pavement design shall be reviewed based on the actual CBR values. The extra pavement thickness needed on account of lower CBR value shall be constructed by the Contractor at his own cost.

Clause A1.6 Arrangements for Traffic

During the period of construction, arrangements for traffic shall be provided and maintained in accordance with Clause 112 of MoRTH Specifications for Road and Bridge Works 2013.

Clause A1.7 Measurements for Payment

Stabilized soil sub-grade shall be measured as finished work in position in cubic metres.

Clause A1.8 Rate

The Contract unit rate for sub-grade shall be payment in full for carrying out the required operations including full compensation for:

Making arrangements for traffic to Clause 112 of MoRT&H Specifications for Road and Bridge Works 2013 except for initial treatment to verges, shoulders and construction of diversions;

Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts;

All labour, tools, equipment and incidentals to complete the work to the Specifications;
Carrying out the work in part widths of roads where directed; and
Carrying out the required tests for quality control.

CLAUSE A-2 PASSENGER SHELTER

A-2.1 Scope

The work covers the construction of passenger shelter complete as per drawing and to the satisfaction of Engineer in charge.

A-2.2 Ownership

The bus shelter with all fittings shall be the property of the employer. The land for the bus shelter shall be provided by the employer and location shown on the drawing.

A-2.3 Maintenance

The contractor shall arrange to maintain the bus shelter until the Taking over Certificate for complete work.

A-2.4 Measurement

The measurement for construction and provision of bus shelter shall be measured in numbers.

A-2.5 Rate

The contract unit for constructing and providing bus shelter shall include the cost of all the material, labour and other operations including flooring, seating arrangement, pipe columns roofing, concrete kerb, etc. required for construction of passenger shelter as per the drawing and to the satisfaction of Engineer-in-Charge.

CLAUSE A-3 TRAFFIC MANAGEMENT AND SAFETY DURING CONSTRUCTION OPERATIONS

Clause A-3-1 Description

These specifications describe the traffic management and safety measures to be taken by the Contactor throughout the construction period for ensuring the safe and convenient passage of public traffic through the project road on one hand and safety of the project workers on the other. It shall be understood that the Contractor is solely responsible for all the traffic management and safety measures which should be got approved by the Engineer prior to taking up any construction work on the project.

Any construction work on or near a public travelled way will pose a set of new situations, which may include diversion of road users on to unfamiliar paths, exposure of road users to moving construction equipment and workers, stacking of construction materials to cause reduction in the space available for public traffic, inadequate space for maneuvering, etc. which may pose several surprises. These may cause to develop hazardous situations in case adequate advance precautions in the form of notification, advance warning, clear delineation of construction areas and travel path for public traffic etc. are not taken. Within the construction area itself, the workers may be handling materials like hot bitumen and moving road construction equipment which may prove to be a cause of serious accident if adequate precaution and safety measures are not taken. Thus, the guiding principles on which the Contractor shall base the traffic management and safety measures will include:

i) Advance warning sign for road users about the road situation including diversion ahead.
ii) Providing clear and safe demarcated channels for guiding the public traffic.
iii) Providing necessary traffic warning/ guiding devices such as signs, safety cones, pavement markings, red lights, reflecting studs/tapes, etc.
iv) Barricading construction area so that public traffic steer clear of these and do not come into conflict with construction activities.
v) Providing the project workers with necessary safety gears such as gum boots, luminous yellow jackets, crash helmets etc. as appropriate.
vi) Taking all other necessary measures so that safety is ensured during all hours of day and night during construction activities.

Clause A-3 -2 Construction Works Involved in the Project

The following broad types of construction works which will have impact on movement of public traffic are involved in the project.

- Widening of existing carriageway to two-lane carriageway and reconstruction/widening of related cross drainage structures etc.
- Construction of Bridge

Prior to start of the construction work at the site, the Contractor shall prepare a detailed traffic management and safety program tailored to the works program proposed by him and get the same approved from the Engineer.

Clause A-3-3 Traffic Management and Safety

Any construction activity on the project will pose a hazardous situation to the road users. For least disturbance to safe passage of public traffic appropriate traffic management and safety measures should be adopted throughout the construction period. In this regard, the construction zone in which conflict from safety angle may arise between the road users on one hand and the construction activities on the other shall be divided into 4 sub zones, and safety measures as appropriate for each sub-zone shall be ensured. The sub-zones and the safety measures to be adopted therefor shall be as described hereunder:

i) Advance Warning Zone

This warning sub-zone is meant to inform, alert and prepare the approaching driver well in advance by providing information regarding the distance and extent/type of hazard ahead so that he is able to reduce the speed and be in readiness to carry out the necessary manoeuvres as he meets with the changed situation. For the operating speeds on the project road, length of this sub-zone shall be 100mtr., in plain terrain. Information in this sub-zone will be conveyed through a series of traffic signs, which will include "Men at Work" and the speed reduction signs at the start and middle of this sub-zone.

ii) Transition Sub-Zone

This sub-zone is the area in which the traffic is steered and guided into and out of the diverted path around the work sub-zone. This is the most crucial sub-zone from safety angle, as vehicles have to be guided on to the diverted path, and most of the movements will be of turning type. The elements for designing this sub-zone are speed of the vehicles, extent of lateral shift and elevation difference between the normal and the diverted paths. The essential safety measures shall include delineation of the travel path and prevention of wayward movements of vehicles by means of barricades, channelizers, red cones, and red lamps during hours of darkness etc., as appropriate.

In the design of this sub-zone adequate attention shall be paid for providing necessary turning radius of the curves, grade to permit for safe passage of animal driven vehicles, drainage and dust-proofing. Where necessary traffic control shall be effected through manual flagging and by battery operated traffic lights during hours of darkness. Where vehicles have to wait, the waiting area shall be demarcated by stop lines.

Length of this sub-zone will generally be between 50 and 100m.

iii) Work Sub-Zone

This is the area where construction activity takes place, and the main concern relates to safety of workers as also prevention of public traffic from entering the work area. In this sub-zone, path of traffic shall be clearly delineated to avoid intrusion of public traffic moving on to the work area or construction equipment moving on to the public traffic. It shall be ensured that adequate distance is available between 2 consecutive work zones (2 km. on urban section and 5-10 km. in rural sections) so that vehicles get sufficient breather space for overtaking slow vehicles etc. Traffic across this sub-zone shall be guided through with the help of various traffic control devices, such as signs, delineation of travel path by cones/drums, barricades, luminous tapes etc. as appropriate.

iv) Termination Sub-zones

The sub-zone is intended to inform the road users of the end of the construction zone. This shall be effected through suitable informatory sign boards.

Clause A-2-4 Traffic Control Devices

Traffic control devices in the construction zones perform the crucial task of warning, informing and alerting drivers apart from guiding the vehicle movements so that the drivers of the vehicles as well as the workers on site are not faced with situations posing surprise/hazard, and safe passage to traffic is affected.

The primary traffic control devices used in work sub-zones are signs, delineators, barricades, cones, pylons, pavement marking, flashing lights etc. They shall be such that they are easily understood without any confusion, are clearly visible during day and night, conform to the prevailing speeds in immediate vicinity, stable against sudden adverse weather conditions and are easy in installation, renewal and maintenance. Broad details of the different devices are hereunder:

i) Signs

The construction signs fall into 3 major categories namely, regulatory signs, warning signs and guide or informatory sign as defined and detailed in IRC: 67-1977, Code of Practice for Road Signs. These signs shall be placed on the left hand side of the travel path.

The common Regulatory signs used in the construction zones are “No Entry”, “Road Closed”, “Speed Limit” etc. These shall be used in consultation with the local police and / or authorities.

The warning signs to alert the drivers of the possible danger ahead in the construction zones are “Lane Closed”, “Diversion to other carriageway” etc. It will be advisable to explain the signs with the help of a rectangular definition plate of size

of appropriate to the size of warning triangle and placed 0.15m. below, from the bottom of the triangle.

Guide signs in construction zones shall have different background colour than the normal informatory signs of IRC:67-1977, These signs shall have black messages and arrows on yellow (Traffic Yellow of IS: 5-1978) background. The guide signs to be commonly used are "Diversion, "Road Ahead Closed", "Sharp Deviation of Route" etc.

The commonly used temporary signs during construction are depicted in the Drawings. These should preferably be of reflectorised type to be visible during hours of darkness.

ii) Delineators

Delineators are channelising devices such as cones, traffic cylinders, tapes, drums etc. which are placed in or adjacent to the roadway to guide the driver along a safe path and to control the flow of traffic. These shall normally be retro-refelectorised for night visibility. IRC:79-1981 (Recommended Practice for Road Delineators) gives details of some of the delineators. The other types of delineators commonly used are traffic cones, drums and barricades.

iii) Traffic Cones

Traffic cones shall normally be 0.5m to 0.75m high and 0.3m to 0.4m diameter or in square shape at the base. These shall be made of plastic or rubber with retro reflectorised red and white band and have suitable anchoring so that they are not easily blown over or displaced. The cones shall be placed close enough together (spacing 3-9m) to give an impression of the continuity. Larger size cones shall be used for high speeds or where more conspicuous guidance is required.

iv) Empty Bitumen Drums

Empty bitumen drums can be used as channelising device since they are highly visible, give the appearance of being formidable objects, thereby commanding the respect of the drivers. These drums can also be of plastic, which are lighter, easy to transport and store. As delineators, these drums shall be painted in circumferential strips 0.10m to 0.15m wide, alternatively in black and white colours.

v) Barricades

Whenever the traffic has to be restricted from entering the work areas such as excavations or material storage sites so that hazardous locations are barred for public and protection to workers is provided, or there is need for separating the two way traffic, barricades shall be used. The barricades may be of portable or fixed type and can be made of wooden planks, metal or other suitable material. The horizontal component facing the traffic shall be made of 0.30m wide wooden planks joined together and painted in alternate yellow and white strips of 0.15m width and sloping down at an angle of 45° in the direction of traffic. Suitable support or ballasting shall be provided so that they do not over turn or are not blown away in strong winds. In

case of fixed type barricades, a gate or moveable section shall be separately provided to allow the movement of the construction/supervision vehicles.

vi) Flagmen

In large construction sites, flagmen with flags and sign paddles shall be effectively used to guide the safe movements. The flags for signalling shall be 0.60m x 0.60m size, made of good red cloth and securely fastened to a staff of approximately 1 meter in length. The sign paddles shall conform to IRC:67-1977 and provided with a rigid handle.

For one-way operation at a time during hours of darkness, battery operated red/green lights shall be used at either end of the affected section.

Clause A-3-5 Safety and Management Practices

Measures for providing safe movement of traffic in some of the most commonly occurring work-zones on highways shall be as follows:

(i) Detour on Temporary Diversion

In certain situations during the project construction period it may become necessary to pass the traffic on temporary diversion constructed parallel to highway.

A temporary diversion road shall basically satisfy the following requirements

- ❖ It shall have smooth horizontal and vertical profile for easy negotiation by vehicles.
- ❖ It shall not get overtopped by flood or drainage discharge under any circumstances.
- ❖ It shall have adequate capacity to cater for the diverted traffic.
- ❖ It shall be dust free and shall ensure clear visibility at all times of the day and night. Pavement and riding surface for the diversion will depend on the duration over which the diversion will be used, and shall be as directed by the Engineer. The commonly used specifications are mix seal surfacing over 150-200mm thick WMM constructed on completed sub-grade.
- ❖ It shall be provided with the required safety standards and

The warning for the construction ahead shall be provided by the sign "Men at Work" about 1 km. in advance of the work zone. In addition a supplementary plate indicating "Diversion 1 km. Ahead" and a sign "Road closed Ahead" shall be placed. It shall be followed by "Compulsory Turn right/Left Sign". The "Detour" and sharp Deviation" sign shall be used to guide the traffic on to the diversion. Hazard markers shall be placed where the railings for the cross drainage structures on the diversion start.

(ii) Switch over of traffic from widened to unwidened section and vice-versa

In the course of construction widening of the carriageway will have to be taken up in stretches with intervening space between two such stretches. This will bring about the situations in which the traffic passing through the widened road would have to pass on and merge with the unwidened section and vice-versa.

For such cases, apart from "Men At Work" signs with distance plate in the advance warning zone, the signs indicating "Road Narrowing" or "Road widening" as appropriate shall be installed.

Clause A-3-6 Precautions for Safety

The following general precautions shall apply to all the work sites.

(a) General Measures

i) All the signs and delineators shall be maintained in a clean and brightly painted conditions at all times.

ii) Adequate lighting arrangements shall be made for proper visibility during night travel through the work area.

iii) Adequate arrangements for frequent sprinkling of water shall be made to keep the area dust free.

(b) For Safety of Workmen

i) Workmen shall be trained in use of tools and plant.
ii) Bitumen handling labour shall be given gum boots, spectacles etc.
iii) First -aids kits shall be provided.
iv) Workers required on site during night hours shall be provided with fluorescent jackets with reflective tapes.

(c) For Safety of Road User

i) As far as possible, the material, equipment and machinery shall be installed/ parked in places sufficient away from the berms in the available road land. Only in avoidable cases the same be allowed near the edge of berms.

ii) Machinery shall be parked at appropriate places away from the path of public traffic, and shall be provided with red flags and red lights.

iii) Only minimum quantity of material required for the construction operations shall be collected at site near the public travelled way.

Clause A-3-7 Safety Audit

Safety audit shall be conducted periodically by the Engineer on the safety measures adopted by the contractor during the constructions operations. The main aspects to be covered shall include:

a) Manpower and their safety
b) Machinery
c) Temporary works
d) Equipment &Vehicles
e) Material storage and handling
f) Construction procedures
g) Environment
h) Site safety guidelines
i) Miscellaneous services

The Contractor shall also constitute special teams from his staff for the above audit, and shall take appropriate corrective measures to the directions of the Engineer.

A-4.1 Scope

A-4.1.1 Street Lighting

Providing and erecting street light mounted on a steel circular hollow pole of standard specifications for street lighting, 10 m high spaced 30 m apart, 1.8 m overhang on both sides if fixed in the median and on one side if fixed on the footpath, fitted with sodium vapour lamp and fixed firmly in concrete foundation or as directed by Engineer. at locations indicated by the Engineer. These shall be generally at spacing of 30m on either side unless otherwise modified by the Engineer.

A-4.1.2 Material

A-4.1.3 CONSTRUCTION OPERATIONS

Excavation for fixing Galvanized hollow Pipe sections: At the locations.

Plain cement concrete (M20grade)

A-4.1.4 Measurements for Payment

It will be measured in number of Poles (including Fixing & arrangement of all necessary fittings.

A-4.1.5 Rate

Rate for this item of work shall be paid in fill completing the respective work including all materials, labour, equipment and incidentals.

Clause A-5 PROVIDING AND ERECTING HIGH MAST POLE

A-5.1 SCOPE

Mast Structure

The height of mast shall be 30 meters. The Masts shall be continuously tapered of OCTAGONAL cross section, presenting good visual appearance based on proven design conforming to international standards, to give an assured performance, and reliable service. The pole shall be suitable for wind loadings as per IS 875 part-3 1987.

Dynamic Loading

The mast structure shall be suitable to sustain an assumed maximum reaction arising from a wind speed as per IS 875 (three second gust), and shall be measured at a height of 10 metres above ground level. The design life of the mast shall be 25 years. Applicable wind speed shall be measured at a height of 10 meters above level ground. Wind excited oscillation shall be damped by the method of construction and adequate allowance made for the related stress. Full design calculations for the mast will be provided by the manufacturer.

Masts have been subject to full scale destructive testing by the accredited laboratory at the structural test centre if required or asked for. (Cost shall be paid by client for destructive test). The test should prove design calculations and exceeded the predicted failure load, and final test to destruction confirmed the manner and location of failure expected by engineers. Masts may also require qualifying wind tunnel test to derive the correct shape coefficient for use in calculations. Manufacture design should certify to ISO 9001 for the design of high masts and other lighting columns.

Mast Construction

All steel used in the construction of the masts shall comply with BS EN 10 030 or equivalent in Indian Standard of appropriate grade. Welding shall be in accordance with relevant BIS.
The masts shall be constructed from mild steel plates cut and folded to form a polygonal section, telescopic jointed and fillet welded, with the exception of site joints.

Each mast section delivered over 6m in length shall include a telescopic and welded joint to provide diaphragm stiffness and to maintain the structural section during delivery.

A door shall be provided in the base of the mast to permit clear access to equipment. The door shall be weather and vandal resistant with a heavy duty lock. The base flange welded connection to the mast shall fully develop the strength of the section. In addition, supplementary gussets shall be provided between bolt holes. The mast shall be delivered to site in sections and joined with stressing equipment, thus forming a sleeve joint - no site welding or bolted joints will be permitted.

Metal Protection

The entire mast shall be hot dip galvanised after fabrication, internally and externally, in accordance with BS EN ISO 1461 or equivalent BIS.

Mechanical Arrangements

For installation and maintenance purposes it shall be possible to raise or lower the lantern carriage using a winch in the base of the mast. The stainless steel wire rope supporting the lantern carriage shall be in tension at all times to prolong rope life and will not depend on latches for security.

Mast Head Assembly

The pulleys shall be of large diameter, appropriate to the multicore flexible cable being used. They shall be of non-corrodible material and run on self-lubricating bearings with stainless steel spindles. Arrangements shall be provided to ensure that the electric cables and steel wire ropes are separated before passing over their respective pulleys to prevent ropes and cables leaving the pulleys' grooves. The pulleys shall be housed in a chassis integral with a sleeve which slips over the top of the mast and is secured axially and in azimuth. Guides and stops shall be provided for docking the lantern carriage. The complete chassis assembly shall be hot dip galvanised after fabrication. The pulley assembly shall be protected by a weatherproof cover.

Assemblies with Three point suspension pulleys can be supplied.

Lantern Carriages

The lantern carriage shall be of durable steel tube designed to act as electric conduit, with cable holes fully protected by grommets. It shall be fitted with junction box mounting plate(s) and be in two halves joined by bolted flanges to permit removal from the erected mast.
Lantern fixing arms and plates shall be welded to the carriage. The carriage shall incorporate buffer arrangements to prevent damage to the mast finish and luminaries and not require rollers or other moving parts.

Winches

shall be completely self-sustaining without the need for brakes, springs or clutches which require adjustment, or which can be affected by moisture or lubricant. The gear ratio shall be 53:1. The winches shall be self-lubricating by means of an oil bath, and lubricant recommended by the supplier shall be used.

Termination of the winch ropes shall not involve distortion or twisting of the rope structure. At least four turns of rope shall remain on the drum when the lantern carriage is fully lowered. In the case of multi-drum winches each rope shall be direct from lantern carriage to winch and not include any intermediate connection. The

winch shall be designed to be installed or removed through the door opening. Winch drums shall be grooved to ensure a tidy rope lay and be fitted with a device to ensure smooth return of the rope for each layer. A test certificate shall be supplied with each winch. The capacity, operating speed and recommended lubricant shall be clearly marked on each winch with an indelible label. The winch shall be capable of operation by hand or by means of a power tool. The driving spindle shall be positively locked when not in use by automatic means. Each winch shall be supplied with a fitted waterproof cover.

Winch Driving Tools

The power tool shall be a multi-speed reversible tool incorporating a torque limiting device which can be readily adjusted and locked. A remote control switch shall be incorporated to allow the equipment to be operated from a distance of 5 metres. Arrangements shall be provided to support the power tool accurately and securely during operation.
Handles shall be provided for manual operation of the winches and they will also incorporate a torque limiting device which can be adjusted and locked.

Steel Wire Ropes

shall be flexible 'marine grade' stainless steel of 7/19 construction. Thimbles and terminals shall be of compatible material. Steel wire ropes shall be factory cut terminated and pre-rigged for ease of installation. Ropes with hemp or nylon cores shall be not used.
Cable & Cable Connections

Multi core flexible round sheath power cables shall be provided, terminating in the base compartment of the mast, fitted with plugs and sockets and a guard ring. At the mast head, cables shall be connected to a weatherproof junction box on the lantern ring equipped with suitable nylon glands. The equipment shall be suitably rated for the required duty. Power cables shall be factory cut and pre-rigged for ease of installation.

Foundations

Guaranteed performance, medium tensile, high yield, galvanized holding down bolts shall be supplied, complete with anchor plate for casting into the foundation. A precision made steel template with tube holes, to ensure correct vertical and horizontal bolt alignment, shall also be provided.

Earthing Terminal

A 12mm diameter stainless steel bolt shall be attached to the mast structure at a convenient point within the base compartment to provide a lightning and cable earthing point.

Extension Lead

An extension lead or leads of multicore cable, equal to that within the mast and fitted with a plug and socket, shall be provided to enable the lanterns and permanent supply cable to be tested when in the lowered position, using the base compartment socket supply.

A-5.2 Measurements for Payment

It will be measured in number of Poles (including Fixing & arrangement of all necessary fittings).

A-5.3 Rate

Rate for this item of work shall be paid in fill completing the respective work including all materials, labour, equipment and incidentals.