VADODARA SMART CITY DEVELOPMENT LIMITED (VSCDL)
GOVERNMENT OF GUJARAT

REQUEST FOR PROPOSAL

"Request for Proposal (RFP) for Supply, Erection, Testing and Commissioning of Smart LED Street Lighting System for the Main Roads of Vadodara City – Third Attempt"

DECEMBER 2019

VOLUME II – TECHNICAL SPECIFICATION

FOR SMART LIGHTING SYSTEM

OFFICE OF THE CHIEF EXECUTIVE OFFICER

VADODARA SMART CITY DEVELOPMENT LIMITED

VADODARA

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1. SCOPE OF WORK:

1.1. The scope of services covers the design, detailed engineering, preparation of construction drawing, manufacture, acceptance testing at manufacturer's works or at any accredited agency, supply, packing, forwarding and delivery from manufacturer's works/ place of storage to erection on site including transit insurance, unloading, storage at site, moving from place of storage to place of retrofitting/ installation, assembly, Cleaning/ lubricating, Touch up painting, retrofitting/ erection, testing, commissioning & performance demonstration and handing over of Luminaires and Centralized Control and Monitoring System (CCMS) (as applicable) of smart street lighting system on the selected roads.

1.2. Inland and overseas transit insurance, transport, testing at site shall be in CONTRACTOR's scope. Tender BOQ and drawings, if provided, are for reference purpose only which is the minimum requirements; CONTRACTOR shall ensure that design & equipment ratings shall be as per specification requirements.

1.3. The smart street lighting system shall include minimum components but not limited to the following;

a) Retrofitting of Conventional Street light fitting with designated rating of 12,000 nos. of LED Street Luminaires with accessories including 10 kV external Surge protections, Dimmable Drivers and smart communicable controllers as specified with necessary cables as required. All the controllers shall be individually controllable and shall communicate with the centralized ICCC

b) Decorative Mounting Brackets, hardware, and other accessories for equipment/system installations including necessary fabrications if required.

c) Fixing of smart communicable street light controllers in additional 3000 nos. of light fixtures which have already been converted to LED and are functioning as on date. All the controllers shall be individually controllable and shall communicate with the centralized ICCC

d) Earthing system for pole, luminaire and feeder pillars (as applicable) with accessories and termination.

e) GIS/GPS mapping (As suitable for offered CCMS) of the lighting system indicating total coverage area under the feeder pillars including light poles.

f) Connectivity for communication from Luminaires and Feeder Pillars to Cloud Server; Cloud registration; Web hosting of Lighting Management Software; uploading and managing all data after Mapping of all the Feeder Pillars and Luminaires as applicable.

g) Loading and handling of dismantled material of lighting fixtures and unloading at VMC/VSCDL identified premises.

h) Carrying out survey for identified roads; Preparation of Street light layout drawings on the Existing maps as ASBUILT drawings.

i) Any other electrical equipment/ component which are not specifically listed above but are necessary to make the system complete and functional in all respect as per specification and statute.

1.4. Existing Pole with foundation and Power supply distribution arrangement consisting of Feeder pillars, cables etc. shall be retained without any alteration.

1.5. CONTRACTOR shall take due care of the site Seismic conditions while design of all equipment/ components used in entire electrical systems covered in this specification.

1.6. The offered LED streetlight luminaires must have passed LM 79; from UL/ILAC/NABL accredited Third Party Laboratory (TPL) with photometry discipline. Necessary LM79 Report from UL/ILAC/NABL accredited Third Party Laboratory (TPL) shall be submitted within two weeks from the last week of bid submission. The offered luminaires shall be registered with BIS under the category of LED Luminaries for Road & Street Lighting and the BIS approval (CRS number, shall be provided) shall be submitted within two weeks from the last week of bid submission. Controller Certifications for Metering Accuracy as per IS 13779 Class 1, IP 66, Surge, 440V AC (withstand capacity for 48 hours), EIRP & ETA from Govt. approved Laboratory shall be submitted within two weeks from the last week of bid submission. However, it is preferable if the bidder submits all the above reports along with the bid.

1.7. Luminaire manufacturer shall have to submit LM 80 test certificates from the LED manufacturer for the LEDs used in the luminaire and the same shall be submitted along with the bid.

1.8. Submission of equipment/ system Design Calculation Sheets, Detail Engineering Drawings, Data Sheets, equipment Sizing Calculations etc. for review and approval by VMC/VSCDL before execution/ procurement and manufacturing.

1.9. Carrying out joint Inspection, Testing, Commissioning and Performance demonstration of the entire street lighting system within the Selected Roads and submission of reports for review & acceptance by Owner.

1.10. Any other equipment which are not specifically listed in this specification but are necessary to make the system complete and functional in all respect as per requirement and statute shall be included in the scope of this works. All design shall comply with the project requirements as specified.

1.11. All SAFETY considerations in design and manufacturing for safe operation & maintenance and safe practices during installation at site shall be in the scope of the BIDDER. Cost towards accomplishing the same shall be included in the BID price and no extra claim shall be entertained later.

1.12. Submission of all “As Built” drawings, Data sheets, Calculations etc. after execution and commissioning of the equipment and systems as specified above.

1.13. Submission of relevant documents and drawings to the concerned statutory authorities/ agencies and getting clearance and approval for the supplied and installed equipment under this specification is solely the responsibility of the BIDDER.

1.14. All Liaison activities for obtaining required mandatory approvals/ NOCs from relevant and concerned Statutory Authorities as applicable for drawings & documents, initiation of works, Load release, charging and commissioning of equipment and system etc. are within the scope of works.

1.15. Numbering on each light pole, light fixtures, feeder pillar, earth pit (indicating earth resistance value on each earth pit) and painting of the poles shall be considered in the scope of works. The painting shall be done as per the instructions of the engineer in charge.

1.16. Earthing system of the light poles and CCMS shall be considered in the scope of works. The work shall be carried out conforming to the latest version of IS: 3043. Measurement of earth resistance shall be carried out at the time of commissioning for smooth operation of the lighting system with prior permission.

1.17. If the Bidder satisfies all the conditions of the Qualification Criteria and the Technical Specifications mentioned elsewhere in this tender, the Bidder will be short-listed for on-site testing of Smart Lighting Solution. Short listed bidder shall have to submit **six** samples of all options within three days and install these samples of the offered luminaries for onsite testing. **Failure in submission of samples within two weeks, VMC/VSCDL will have the power to reject this bid.** The Bidder is strictly bound to submit the same streetlight fixtures/ model of which all the testing certificates are submitted. No deviation in model/fixture is allowed after submission of tender. In case the submitted samples are found to different from the technical documents submitted along with the technical bid, the bid is liable to be rejected.

1.18. **On-site Testing**: All the short-listed Bidders shall have to prove the Power Consumption & the functionality mentioned in the table specified under inspection part as decided by VMC/VSCDL. The on-site functionality shall be carried out in the presence of external Govt. approved lab/TPI agency and VMC/VSCDL officials. All charges for such on-site testing shall have to be borne by the Bidder.

1.19. **Technically Approved Bidder**: If the functionality of the on-site testing is found to be in line with the requirement along with submission of required test reports, then the Bidder shall be deemed to be Technically Approved.

1.20. Successful bidder shall have to provide 2 nos. Of laptops configured with licensed software which can be used for monitoring and controlling of smart street light system. CONTRACTOR shall provide maintenance and upgrades of the software for the next 2 years beyond the contract period of five years without any additional cost.

1.21. The Technically Approved Luminaire with the lowest input power consumption as per LM 79 report for achieving the minimum required lumens shall be considered as the Base and the Power Loading calculations shall be carried out as mentioned elsewhere in this tender. The total Price Loading amount due to excess power consumption shall be agreed upon jointly by the bidder, external Govt. approved lab/TPI agency and VMC/VSCDL officials.

1.22. Appropriate up-keeping, repairs, maintenance, and operation of all network, hardware, and software components, and ensure smooth functioning of the smart lighting system throughout the entire contract period.

1.23. All Luminaires shall be covered under Defect Liability period for Five (5) years from the date of commissioning. During defect liability period in case any replacement of material is required, CONTRACTOR shall make the replacement free of cost and it will be of better make and specifications as the original.

1.24. Maintaining a status Dashboard on the progress of the project and submission of periodic report on weekly basis to Owner/ PMC during Project execution

1.25. This specification is the minimum requirement and should be read in conjunction with relevant latest specifications, requirements, rules and regulations of the Local Authority. Any additional requirements as per Local Authority or latest Standards shall be offered by CONTRACTOR. The same shall be indicated in the Technical Proposal.

1.26. Equipment furnished/ supplied under this scope of works shall be complete in every respect with all mountings, fittings, fixtures, and standard accessories normally provided with such equipment and / or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specification unless included in the list of exclusions. Materials and component not specifically stated in the specification, but which are necessary for commissioning and satisfactory operation unless specifically excluded shall be deemed to be included in the scope of specification and shall be supplied without any extra cost. All similar standard components/ parts of similar standard equipment provided shall be inter-changeable with one another.

1.27. The CONTRACTOR shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinated performance of the entire system. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

1.28. CONTRACTOR shall plan and carry out all supply, installation, testing and commissioning of the lighting system conforming to the approved drawing, technical specification and good engineering practices.

1.29. The material supplied by the CONTRACTOR shall be subject to approval of the designated Authorities. Samples of the Supply material under the scope of works shall be inspected by Authorities or their representatives either at site or at Manufacturer's works and approve them for supply and execution. Notwithstanding any approval/ instruction given otherwise, if the Authority, during random checkup, finds any non-conformance with the quality of material supplied by the CONTRACTOR with respect to the technical specifications, Owner shall reject the entire lot/ batch of that particular material and ask to replace without any cost impact to it.

1.30. For all excavation works the CONTRACTOR shall restore the area/ road, as the case may be, after completing the installation work to its original condition.

1.31. During the execution work at site, it shall be the CONTRACTOR's responsibility to take care of the safety and security of its person and material at site. The CONTRACTOR shall be self-reliant with all the requirements including tools and tackles for digging, filling, erecting, lifting, etc. Electricity and water required for construction shall be arranged by CONTRACTOR at his own cost.

1.32. The CONTRACTOR shall make provision for adequate no. of Ladder mounted vehicles self-sufficient with all the required tools and instruments, duly calibrated, for installation and maintenance to meet the deadlines and benchmarks specified.

1.33. The CONTRACTOR shall carryout the installations in a safe and responsible manner without any inconvenience or danger to public. The CONTRACTOR shall take care not to damage any public/ private property by mistake or by intention during the course of work with its actions and shall be well insured to compensate the owner in case any such incidence happens.

1.34. The CONTRACTOR shall also liaison with DISCOM and other Govt. Bodies like PWD, CEIG, water board etc. for obtaining valid permission to work.

1.35. All the cost towards liaison with statutory Bodies for seeking all necessary statutory approvals and other activities involving Govt. Agencies viz., drawing approval, testing and commissioning etc, shall be borne by the CONTRACTOR.

1.36. All the statutory fees for the above approvals shall be borne by VMC/VSCDL. Such payments shall be reimbursed to the CONTRACTOR upon submission of stamped receipts to the VMC/VSCDL.

1.37. All the responsibilities related to installation of smart street lighting system in the identified roads shall be borne by CONTRACTOR in respect of cost, managing the technical problems and other related aspect.

1.38. The VMC/VSCDL shall not be responsible for any untoward incidence, if occurred due to faulty design and poor installations. The CONTRACTOR would be responsible for any civil/criminal proceedings arising out of such incidence and for damage caused to life and property thereof.

1.39. Upon completion of street lighting work on the identified Roads, fifteen (15)-days testing period will start to check the adequacy of the installed LED street lighting system. The issue of completion certificate to the CONTRACTOR is subject to successful testing and approval of VMC/VSCDL.

1.40. VMC/VSCDL is free to draw samples (not more than 0.5% per lot) after the start of supplies from the supplied quantity and subject the same to test in a NABL Accredited Lab. CONTRACTOR shall bear the cost of testing of such samples. The decision of VMC/VSCDL on the same shall be binding on the CONTRACTOR. Failure of the sample may invite disqualification of the CONTRACTOR from future tenders also.

1.41. Deleted.

1.42. Deleted.

1.43. The CONTRACTOR shall follow all Safe practices as per prevalent statute and practices for execution of work. All Personal Protective Equipment shall be provided for the Workmen/Staff in the Field while working. Failure to abide by the safety rules shall make the CONTRACTOR Liable for penalty/ Termination of contract (Under repeated incidences).

1.44. The CONTRACTOR shall be fully responsible for any damage and or for loss of life of his own employee or any outsider due to any accident, fire, hazards occurred during the work or after completion of work.

1.45. Design and detailed engineering of the materials procured by CONTRACTOR is included in scope. Contractor shall submit each document/ calculations of system which is included in scope to Purchaser/ Consultant for final review/ approval. All design documents/ calculations prepared by CONTRACTOR shall be with ISO documentation i.e. with duly singed by qualified authorities and stamped. Design documents/ calculations prepared by sub-Contractors shall be approved by CONTRACTOR and stamped copy of approval along with no-deviation sheet from sub-contractor shall be submitted by the CONTRACTOR to Purchaser/ Purchaser's representative for final review/ approval.

1.46. Expert or manufacturer supervision for sub-contractor supplied material shall be provided by CONTRACTOR and included in offer.

1.47. CONTRACTOR shall be solely responsible for any shortages or damages in transit for his supply scope, handling and/ or in storage of any materials and erection of the equipment, supply of erection tools at site. CONTRACTOR shall ensure that it will not affect any activity or project schedule. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the CONTRACTOR.

1.48. CONTRACTOR shall identify activities and mile stones of the work forecasted for next month with optimistic and pessimistic dates of work completion. CONTRACTOR shall prepare program evaluation and review techniques to identify critical path of project and activity sequences. The project schedule shall be prepared and updated fortnightly in MS Project.

1.49. Nothing in this specification shall be constructed to relieve the CONTRACTOR of his/ her responsibilities towards following best engineering practices established in the country.

1.50. All Liaison activities for obtaining required mandatory approvals/ NOCs from Electrical Inspector and relevant Government Agencies, Statutory Authorities as applicable for drawings & documents, initiation of works, charging and commissioning of equipment and system etc. are as applicable is included in CONTRACTOR's scope.

1.51. The CONTRACTOR shall include start up spares, essential spares, recommended spares and a set of special tools necessary for operation, routine maintenance of equipment supplied for a period of five years.

1.52. Whether specifically called for or not, all accessories, mountings, standard accessories required for normal and satisfactory operation (as deemed by the Purchaser) of the equipment shall be considered to be a part of the CONTRACTOR's basic scope of supply and/ or work and no claims whatsoever, for extra payment on these grounds, will be accepted.

1.53. CONTRACTOR should visit site and get himself/ herself ascertained regarding the scope of work for the complete Electrical & Instrumentation works before submission of quote/ offer. The List of Roads of Vadodara for Smart Street Lighting is provided in the Appendix 1.

1.54. All necessary and supplementary items & equipment required for completeness, safe & efficient operation of the system, even though these may not have been mentioned in this specification shall be considered by the bidder. Spares & consumables for successful commissioning, establishment of performance guarantee and five years of trouble-free & safe operation of the System shall be considered by the bidder.

1.55. Submission of drawings & documentation as specified under ''General Technical & Particular Requirement'' section for Electrical equipment/ systems.

1.56. It is not the intent to completely specify all details of design and construction herein. Nevertheless, the Electrical system shall conform to high standard of engineering, design and workmanship in all respects and shall be capable of performing satisfactorily in continuous commercial operation under the specified environmental conditions.

1.57. Purchaser reserves the right to issue addendum to the technical specification to indicate modification/ changes in the requirements, if so required at a later date.

1.58. Contractor has to complete the supply, installation; testing & commissioning work of smart street lighting system within the 240days from the date of the Issuance of LOI&for next 60days contractor has to complete the integration with the training to the VMC's officials.

1.59. Contractor must paint one coat of Red oxide / PU base primer and two coats of Aluminium / PU paint on the existing Poles at which the conventional HPSV/HPMV lights have been replaced &/or as per instruction of Engineer-In-Charge.

1.60. **Smart Lighting Mobile API (Application Programming Interface)**

- Successful Bidder shall provide a customized mobile application programming interface (API) to report if, any luminaire is malfunctioning. Feedback module will be also part of the mentioned API.
- The Mobile API should have the provision of raising the service ticket, if the luminaire is not functioning.
- The provision should be also made for escalation of the service ticket, if the issue is not resolved within 48 hours.
- It should be capable of handling 25,000 users at any given instance.
- It shall provide user friendly features like highlight, Zoom In/Out and search etc.
- This application shall be supported on all mobile/tabs platforms like android, iOS & Windows etc. with Digital Rights Management (DRM).
- Mobile API has to be integrated with an application of Vadodara Municipal Corporation.
- This mobile application shall also be accessed through web on any laptop or desktop by using defined login credential using browser.
- VMC/VSCDL shall have perpetual right of software solution for unlimited number of users.
- The mobile API and the integrated VMC's app with Mobile API, will be cloud hosted which will be the property of VMC/VSCDL.

2. PROJECT INFORMATION:

2.1. SITE/ ENVIRONMENTAL CONDITIONS:

2.1.1. Ambient temperature : 5°C - 50ºC

2.1.2. Relative Humidity : 5 - 95%

2.1.3. Area Classification : Non Hazardous

2.1.4. Seismic Data : As per IS 1893 latest issue

2.1.5. Environmental : Non corrosive, Humid and Dusty

2.2. NOMINAL SYSTEM VOLTAGE:

2.2.1. Incoming supply : Existing

2.2.2. Distribution supply: Existing

2.2.3. General lighting: Existing

2.2.4. Voltage variation:

a. 415 V supply : ± 10%

b. Frequency variation : ± 5%

c. Combined voltage and frequency variation : ±10%

2.3. SYSTEM EARTHING:

2.3.1. 415 V, 3 ph, AC system : Neutral solidly earthed

2.3.2. 240 V, 1 ph, AC system : Neutral solidly earthed

3. APPLICABLE CODES AND STANDARDS

3.1. All the equipment and systems shall conform to the latest applicable National and International standards; and latest Rules and Regulation of the Local Authorities. The codes and standards mentioned in this specification shall be latest as on the day of execution of the works unless otherwise specified. The revisions in the relevant codes and standards if any after the date of award of contract shall be informed by the Contractor to the Consultant/ Owner within 30 days of the issue of such revision of the codes/ standards. Consultant/ Owner may approve use of the earlier code/ standard if the revisions do not materially affect the statutory requirements of the project or does not impact safety practices. Any cost impact arising out of such revisions shall be mutually agreed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility.

4. DESIGN CRITERIA FOR ELECTRICAL EQUIPMENT/ SYSTEMS:

4.1. GENERAL:

4.1.1. The design criteria, given below has to be followed by the Contractor for designing/ sizing of electrical equipment covered under Contractor's battery limits; However, it is to be noted by the Contractor that, following this design criteria do not relieve the Contractor from adherence to the standards, regulatory requirements & best engineering practices.

4.2. ILLUMINATION SYSTEM:

4.2.1. The level and type of lighting adopted for a street shall be based on its traffic importance, both vehicular or/and pedestrian. However, the system of lighting to be provided should take into account all the relevant factors, such as the presence of factories, market, or places of public resort, the character of the street like trees, landscape etc.

4.2.2. Public lighting should permit users of the road at night to move about with the greatest possible safety and comfort so that the traffic capacity of the road at night is as much equal to that planned for the daytime as possible.

4.2.3. The driver should be able to see distinctly without the use of dipped or driving headlights and locate with certainty and in time all significant details notably the alignment of the road (its direction and its surrounds).

4.2.4. The glare due to luminaries should be controlled at a value which keeps the visual discomfort to which the driver is subjected below an acceptable level as per the latest standard.

4.2.5. The pedestrian should be able to see distinctly the edges of the footways, vehicles and obstacles; dark patches should not occur.

4.2.6. The above aim shall be achieved with due respect to the aesthetic appearance of the lighted road within acceptable limits of cost of installation and maintenance.

4.2.7. The illumination requirement shall be as per IS: 1944. Wide angle lens shall be considered for LED fixtures. Efficacy shall be more than 110 lm/W for individual light fixtures and the colour temperature considered is 3500K - 4500 K to maintain the existing lighting characteristics to retain the colour characteristics of the city. Equivalent LED lamp proposed shall have uniform distribution and No Zebra effect.

4.2.8. The illumination levels to be considered for the design of lighting system for various areas shall be as following:

	Type-01	**Type-02**
Road Configuration	Two Way with Median (Central Verge)	Two Way with Median (Central Verge)
Mounting Height	10 m	10 m
Pole Spacing	36 m	40 m
Road Width	9 m Carriage Way on both side of Median	11 m Carriage Way on both side of Median
Median Width	1 m	1 m

Bracket Length	Up to 1.5 m Max (As per Design)	Up to 1.5 m Max (As per Design)
Avg. Lux Required	**15**	**30**
Uniformity (E_{min}/ E_{Avg})	≥ 0.40	≥ 0.40
Longitudinal Uniformity	≥ 0. 70 (To avoid Zebra Effect)	≥ 0. 70 (To avoid Zebra Effect)
Maintenance Factor	0.90	0.90
Bidder to Fill the below information		
Luminaire Make & Model		
Wattage as per LM-79 Report from Third Party NABL Lab		
Avg. Lux		
Uniformity		
Longitudinal Uniformity		
Dialux Reports (Results Overview & Value Chart) clearly fulfilling the above required criteria should be submitted along with the bid. The bidder should also submit soft copy of ies files of both options. Bidder to submit design using DIALUX Software only.		
Power Loading: The input power of the luminaire proposed by all the Technically Approved bidders shall be measured during on-site testing. The luminaire having the lowest Input Power shall form the 'Base' of the power loading calculations. Excess Power consumption with respect to the Base shall be considered for each Technically Approved bidder for the total qty. at unit price of Rs. 6.72/- for 50,000 Hours and added in their respective price bid.		
Bidder to submit Technical Datasheets & Solution Document with architecture along with the Technical Bid		
Note: All the communication or data costs shall be borne by the bidder for 5 years.		

4.2.9. All the required Design Factors shall be considered as per the latest version of IS 1944 and National Lighting Code 2010.

4.2.10. Maintenance factor shall not be considered less than **0.90** for the lighting calculation.

4.2.11. Lighting design shall be performed using latest version of DIALUX Software (Version 4.12 or higher)/ Original Equipment Manufacturer (OEM) validated software. **Dialux Report** and IES files shall be submitted along with the BID.

4.2.12. The following criteria shall be followed:

a) ON/OFF/DIM for individual luminaire shall be possible for all the street lights.

b) Individual and group control shall be possible for all the street lights.

c) All the light fittings shall be provided with dimmable drivers, dimming shall be possible from min 25% to 100% of the rated output.

4.3. EARTHING & LIGHTNING PROTECTION SYSTEM:

4.3.1. The safety earthing and lightning protection system will be generally on the basis of following codes and standards (including their latest editions).

a. IS 3043 -2018: Code of practice for Safety Earthing.

b. CEA Regulations - 2010: Measures related to safety & electric supply.

4.3.2. Following factors shall be considered for sizing the earthing conductor:

a)	Design Ambient Temperature	:	50°C
b)	Allowable temperature rise for steel welded joints	:	500°C
c)	Fault clearing time	:	1 Second
d)	Overall earthing resistance	:	≤ 1 Ohms

4.3.3. 1 no. of Chemical Earthing Earth electrode shall be provided per street light pole as per the specification listed out in this tender.

5. GENERAL TECHNICAL & PARTICULAR REQUIREMENTS FOR ELECTRICAL, EQUIPMENT/ SYSTEMS:

5.1. LED STREET LIGHT FIXTURES:

5.1.1. Applicable Standards: The design, manufacture and performance of equipment shall conform to the latest standards specified below. In case of conflict between the standards and this specification, this specification shall govern.

Lighting Fixtures & Accessories for General

i.	Testing procedure of photometric testing for LED luminaires	LM 79
ii.	Testing procedure on the lifespan of LEDs	LM 80
iii.	National Lighting Code	SP72
iv.	Method of Measurement of Lumen Maintenance of Solid-State Light (LED) Sources	IS:16105 – based on IES-LM-80-2008
v.	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products	IS:16106 – based on IES-LM-79-2008
vi.	Limits of Harmonic Current Emissions	IS 14700-3-2
vii.	DC or AC supplied electronic control gear for LED modules performance requirements	IEC 62384
viii.	Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules	IEC 61347-2-13
ix.	Environmental Testing: Test Z-AD: composite temperature/ humidity cyclic test	IEC 60068-2-38
x.	Electro Magnetic compatibility (EMC)- Limits for Harmonic current emission-– (equipment input current ≤ 16 A per phase)	IEC 61000-3-2 (2014)
xi.	EMC Immunity requirement	IEC 61547
xii.	LED modules for general Lighting-Safety requirements	IEC 62031
xiii.	Classification of degree of protections provided by enclosures (IP Codes)	IEC 60529
xiv.	Fixed general purpose luminaries	IEC 60598-2-1
xv.	General Lighting - LEDs and LED modules – Terms and Definitions	IS:16101 / IEC TS 62504
xvi.	LED Modules for General Lighting Part 1 Safety Requirements	IS:16103(Part1)

xvii.	LED Modules for General Lighting Part 2 Performance Requirements	IS:16103(Part2)
xviii.	Safety of Lamp Control Gear, Part 2 Particular Requirements Section 13 D.C. or A.C. Supplied Electronic Control gear for Led Modules	IS:15885(Part2/Sec13)

5.1.2. General Requirements: The Lighting system includes following items.

a) The luminaire light output (lumen) shall be constant and shall be able to withstand allowable supply source voltage variations/ fluctuations, spikes and harmonics.

b) The Luminaire shall have High quality Aluminum Die Cast body with extruded aluminum heat sink/PDC aluminium and with separate Driver compartment. The compartment should be such that driver can be maintained / replaced without disturbing the LED module. The housing should be equipped with NEMA receptacle and the controller shall be installed on the NEMA receptacle for plug & play. However non NEMA based sockets are acceptable for Existing light fixture.

c) Heat sink used should be aluminium extrusion having high thermal conductivity. The dimensions of luminaries shall be optimum and adequate to permit sufficient heat dissipation, through the body itself, so as to prevent abnormal temperature rise inside the lantern and consequential damage to the cover and gasket materials, LEDs, lenses and electronic drivers. Heat sink must be thermally connected to MCPCB/ LED light source.

d) The optical system shall consist of individual Poly Carbonate lenses on high power LEDs designed & tested to achieve typical street lighting distribution from the LED Luminaire. These lenses provided for individual LEDs are to be fixed on lens plate in order to have consistent light distribution from luminaries. Luminaries should conform to the Photometric Distribution / requirements of Cut-Off / Semi Cut – off light distribution and optics as classified in IS 1944 and NLC 2010.

e) Suitable number of LED lamps shall be used in the luminaries. The manufacturer shall submit the proof of procurement of LEDs from OEMs at the time of testing along with the test reports.

f) The Luminaries shall be provided with distortion free, clear, high tensile, heat resistant, toughened glass of IK 07 with UV resistant polycarbonate cover fixed with corrosion free/ stainless Steel screws or modular optical system, IP 66 rating of complete luminaire should be maintained. Felt gasket will not be accepted.

g) All Luminaires shall conform to RoHS/UL/CE/ERTL/ERDI requirements.

h) Name of the VMC/VSCDL, Year of Manufacture, Batch No., Serial Number or Identification No. on Sticker &Luminaries Manufacturer's Name / Logo, should be embossed on the housing.

i) LED luminaries should conform to the various National / International standards for safety & performance. Manufacturer should provide test reports as per LM 79 & LM80. The test report from third party NABL accredited laboratory shall be submitted along with the technical proposal/ Bid for LED as well as Luminaires. - all test reports not older than 1 year.

j) Luminaries should conform to the National / International standards for Safety & Performance as per IS 10322 Part 5 Sec 3.

k) The electrical component and LED driver must be suitably enclosed in separate sealed unit to function in environment conditions mentioned above.

l) Adequate protection against Overloading, Short Circuit, Over Voltage, Under Voltage, String Open, Surge Protection shall be provided within the Luminaries.

m) Design of the thermal management shall be done in such a way that it shall not affect the properties of the diffuser.

n) All the material used in the luminaries shall not contain any toxic material/ metal like mercury; shall be halogen free and fire-retardant conforming to relevant standards.

o) The Manufacturer shall have in-house LM79 and IS10322 testing facility NABL accredited and shall be offered for inspection to the VMC/VSCDL for verification of the required parameters and tests. CONTRACTOR shall confirm the same in the BID.

p) The control gear shall comply with the provisions of IEC 61347-2-13as appropriate.

q) Switching surges are expected in the power supply system. Appropriate surge protection shall be provided by the CONTRACTOR for all the Luminaires offered by it as well as external arrangements shall be provided for the existing fittings if they do not have such protections inbuilt. Such protections can either be provided centrally at the Feeder Pillar or at each individual luminaire level or a combination of both, as may be decided by the CONTRACTOR. No claim for failure of Luminaires, on account of voltage surges other than Lightning surges, will be considered.

r) Additionally, as per ANSI C 136.2-2014/ UL-1449, External Surge protection device (SPD) with Thermal Protection (TMOVs) of minimum 10 kV/ 10 kA to be separately installed with each fixture while an additional surge arrestor of 20kV/10kA shall be installed inside Feeder Pillar / field panel. The same shall be certified from independent lab and follow IEC 62305 & IEC 61643-11-2011. No claim for failure of Luminaries, on account of voltage surges other than Lightning surges, will be considered.

s) In case of voltage surges due to lightning, it is expected that lights, in the affected circuit, will fail in a group and not in an isolated manner. Hence, any such failure of lights in a group on account of Lightning surges, may be reported to the VMC/VSCDL, along with circumstantial evidence preferably within 48 hours of such occurrence. The responsibility for submission of supporting documentation rests with the CONTRACTOR.

t) The Luminaries shall be suitable for operation within the input supply voltage range specified. The driver of the light should be able to sense and cut-off power to the light in case of phase-to-phase/ 440 V fault. No claim in this regard shall be considered.

u) The lighting fixtures offered shall comply with the data sheet.

v) The complete luminaire assembly shall have a warranty period of 5 years.

w) Alert/Protection against any type of mischief / pilferage should be ensured.

5.1.3. Lighting Layout:

a) It shall be the responsibility of the Contractor to work out a detailed layout for the complete roads in order to provide the levels of illumination as indicated in the relevant standards

b) The types of fixtures to be used in various areas shall be also indicated in the above-mentioned drawing.

c) The Contractor shall be responsible for measuring the levels of illumination and uniformity after installation and establish compliance with the specification.

5.1.4. Reports and Tests:

a) The Routine test on each of the offered Luminaire shall be carried out by the CONTRACTOR before dispatch. Following tests shall be carried out as Routine tests by the CONTRACTOR for the offered Luminaires;

(i) Visual and Dimensional check
(ii) Checking of documents of purchase of LED
(iii) Insulation resistance test
(iv) HV test
(v) Reverse polarity

b) The Acceptance test shall be carried out by VMC's PMC/TPI on a sample of the lot offered for Acceptance. The Lot shall be different from the lot from which the Type test samples have been drawn. The cost of the testing shall be borne by the CONTRACTOR. Following tests shall be carried out as Acceptance tests by the CONTRACTOR for the offered Luminaires;

(i) Visual and Dimensional check
(ii) Checking of documents of purchase of LED
(iii) Insulation resistance test
(iv) HV test
(v) Over voltage protection
(vi) Power Consumption
(vii) Reverse polarity
(viii) Lux measurement
(ix) PF & THD
(x) IP 66 Protection

c) Following Type tests reports shall be provided by the CONTRACTOR for the offered Luminaires along with the BID;

(i) IES-LM-79 Reports from Third Party NABL Accredited Laboratory

(ii) IES-LM-80 Report for LED Chip along with Datasheet

(iii) BIS/CRS Registration Certificate for IS 10322 (Part 5 Sec 3)

(i) Marking
(ii) Construction
(iii) Creepage Distances & Clearances
(iv) Provision for Earthing
(v) Terminals
(vi) External & Internal Wiring
(vii) Protection against Electric Shock
(viii) Endurance Tests & Thermal Tests
(ix) Resistance to Dust & Moisture
(x) Insulation Resistance & Electric Strength
(xi) Resistance to Heat, Fire & Tracking
(xii) Photometric Tests
(xiii) Surge Protection Test

d) Apart from the tests indicated as above, all other test as per requirement and as per standards shall be performed.

5.1.5. The supplied LED Light Fixture shall comply to the following technical details.

Sr. No.	Parameter	Design Requirement / Value	Parameters To be filled By Bidder
1.	Type	LED Luminaires including dimmable driver, registered for Street Lighting under BIS-CRS Compulsory Registration Scheme (CRS number, shall be provided)	
2.	LED chip make	Nichia, Philip Lumiled, Osram, CREE or any brand approved by RDSO / EESL. COB Type LED is not allowed	
3.	Rated Voltage	230-240V	
4.	Over voltage cut off with auto restart	> 300 VAC	
5.	Expected Frequency	50 Hz +/- 3%	

6.	Operating Voltage Range	Single phase 140-280volt AC. But luminaries shall be tested for 100V to 300 V AC. The luminaire shall be able to withstand 440 VAC for minimum 48 Hours.	
7.	Power Factor	> 0.95	
8.	LED wattage	LED shall be high power SMD LED >2W	
9.	Operating Temperature Range	0 Deg C to 50 Deg C	
10	LED chip Efficacy	>135 Lm/Watt system lumen output at 25-degree C, supported by LM80 report, to be submitted.	
11	LED Drive current	<750 mA	
12	LED Beam Angle	As per Design requirement to meet the required parameters	
13	Colour Temperature	3500 K - 4500 K.	
14	Rated Minimum LED Life (L70)	50000 Burning Hours(With only 30% Lumen Degradation or 70% Lumen maintenance)	
15	System efficacy	≥ 110 Lm/Watt	
16	Total Lumen Output	CONTRACTOR to offer	
17	Colour Rendering Index of Luminaires	>70	
18	Driver Type	Constant Current based Electronic Driver	
19	Driver Efficiency	> 85%	
20	Driver Life	Same as LED Life.	
21	Driver Standard	As per IEC 61347-2-13	

22	Operating Temperature Range	-20 Deg C to + 50 Deg C	
23	Luminaries body temperature after 12 hours of continuous operation	≤ 45Deg C from ambient	
24	Junction temperature	< 85 Deg C - self certified by Manufacturer	
25	Solder point temperature	< 75Deg C	
26	Operating Humidity	10% to 95% RH	
27	Luminaire &Control Gear Wiring	As per IS 10322 (Part 5 Sec 3)	
28	Operating Hours	Dusk to Dawn (max 12 Hrs.)	
29	Total Harmonics Distortion (THD)	<10%	
30	Construction	High power SMD and LED must be mounted on Aluminium MCPCB for high thermal conductivity and fastest heat transfer from the LED junction	
31	IP Protection	IP66 or more; no water stagnation anywhere	
32	Luminary Housing	Pressure Die Cast Aluminum (grade 5000 or similar) housing with corrosion resistant polyster powder coating and/or extruded anodized aluminium heat sink & safety as per IEC 60598 / IS 10322.	

		Large surface area with fins to dissipate the heat to ambient air. The driver compartment shall be separate. The compartment should be such that driver can be maintained / replaced without disturbing the LED module. The housing should have capability of installing Control Node on top of the fixture along with a NEMA receptacle that is fixed on the luminaire.	
33	Luminaire configuration / technical requirement	Side entry type. The luminaire should be tiltable/non-tiltable and shall consist of separate optical and control gear compartments. It should be easily replaceable in the field condition. The Controller shall be installed with a help of NEMA receptacle	
34	Heat Sink	Refer to Sl. No. 32 of data sheet above	
35	Clip / Fasteners	Corrosion free/ Stainless steel.	
36	Optics	Secondary lens array should be provided for optimized roadway photometric distribution. Lens material should be optical high grade PMMA/PC with more than 90% light transmittance and UV protected.	
37	IK protection	≥ IK07 for the complete luminaire	
38	Photometric measurements	LM-79/IS16105.	
39	Minimum in built Surge Protection	≥ 10 kV	
Protection Required in Driver Module			

a.	Short Circuit	Yes; Constant current limit mode.	
b.	Open Circuit	Yes	
c.	Over Voltage	Yes; Auto Isolation	

Complete LM79 Report from UL/ILAC/NABL accredited Third Party Laboratory (TPL) shall be submitted within two weeks from the last week of bid submission. The offered luminaires shall be registered with BIS under the category of LED Luminaries for Road & Street Lighting and the BIS approval (CRS number, shall be provided) shall be submitted within two weeks from the last week of bid submission. However, it is preferable if the bidder submits all the above reports along with the bid.

5.2. SMART CONTROLLER:

5.2.1. The controller shall be installed in each luminaire and shall comply with standards - EMI/EMC: EN 61000-3-2 (2014), EN 61547 (2009), Environmental Standard: EN 60068-2-1 (2007).

5.2.2. The controllers shall be programmable remotely as well as locally. All suitable device and instruments for such access shall be considered part of the scope. It should send data from Real time basis or at uniform intervals as programmed. All programming carried out shall be affected within five minutes or better

5.2.3. Controllers shall either be provided within the Luminaire in IP66 enclosure or provided in Similar enclosure outside the Luminaire on the same pole with proper sustainable and rugged supports which are tamper and pilferage proof.

5.2.4. Controller shall have following constructional specifications

a) The enclosure shall be Die cast aluminium same as Luminaire enclosure or Polycarbonate and withstand all weather without any damage, crack, loosening of joints, etc and ensure IP66 protection for the entire tenure.
b) Controller case and terminal blocks shall be made of fire resistant material
c) Latching Relay should be ROHS compliant.

5.2.5. The controller shall sustain operating temperature of 0 – 50 deg C, operate at AC input (RMS Volts) 90-320V, 50 Hz supply conditions. The module shall operate on 90-320V, 50 Hz, NEMA connector with dimmer arrangement for new lamps while NON-NEMA based for retrofit (existing LED lamps) with dimmer. The details of 3000 nos. of LED street lights are to be fitted with smart controllers are models & details: Keselec Shreder - Brika -75W (1500 Nos.) Max & Voltana - 175W (1500 Nos.) Max.

5.2.6. Ability to communicate with remote central server/ CLOUD securely via LPWAN/NBIoT. All data shall be secured by encrypting them by 128-bit encryption. NBIoT communication is acceptable, however the defined Service Level Agreements (SLAs) as per tender specifications should be adhered to in totality. Further, an MoU with assurance by NBIoT partner as per Form 14 to establish the network as per project deadline is mandatory subject to compliance during onsite demonstration during technical evaluation as per tender requirements

5.2.7. The peak power requirement of the controllers shall be less than 2.5W and average power requirement shall be less than 1.5 W.

5.2.8. The controller shall provide Class I accuracy measurement of RMS Voltage & Current, Power (kW, kVA, kVARH), energy consumption with 1% as per IS 13779 (KWH, kVAH, kVARH) and Power factor.

5.2.9. Controller shall provide the following minimum but not limited alerts;

a) Load & mains failure.
b) Lamp failure alert & restoration.
c) High/low mains voltage alert & restoration.
d) Low power factor alert & restoration.

5.2.10. If the Controller fails due to any reason, the luminaire should remain 'ON' if the luminaire is healthy.

5.2.11. Controller/Application shall have the provision to store last 30 days data at one hour interval. All this data is accessible for reading, recording & optionally available by downloading through HHT (Hand Held Unit) through optical port or USB/Bluetooth given on controller front. For HHT, a smart phone-based solution for collecting /accessing data is also acceptable . USB/Optical port is not mandatory, however there shall be option to communicate with HHT for data retrieval and programming if there any failure of the communication equipment.

5.2.12. The controller shall have a built-in calendar and a local Real Time Clock (RTC) or Crystal Counter having an accuracy of +/- 1 minute per year or better, synchronized with remote time server, to enable functionality even in case of communication network failure. A separate internal Lithium battery or equivalent back-up shall be provided for continuous operation of controller RTC during time of mains failure or controller un-powered conditions.

5.2.13. The controller shall not have any replaceable components for minimum 5 years from the date of installation.

5.2.14. Controller shall be able to carry out switching operations based on Astronomical calendar of the location/ ON-OFF schedule as set manually/ Sensor based. It shall also Dim the Luminaires as programmed.

5.2.15. Controller shall facilitate local operation/manual mode in case of emergency or during maintenance with proper security verification.

5.2.16. Controller/Application shall be able to log minimum last 25 scheduled and unscheduled events including scheduled switching events, faults, abnormal power conditions and maintenance.

5.2.17. Controller/Application shall additionally be able to log minimum last 25 the power availability events.

5.2.18. The controller shall have protection logic to monitor the abnormal conditions like overload & over voltage conditions, against the benchmark/ threshold limits configured in it and carry out auto switching to disconnect the system if the abnormal condition prevails over predefined period. The controller shall reconnect after the normal system conditions are resumed. All such unscheduled switching activities shall be logged in the system.

5.2.19. Controller should have proper universal interface port (USB, Optical etc.) or device shall be provided to access all the stored data within the controller as well as to configure the controller locally either by a Hand-Held Unit or by connecting to a laptop in a secured manner. Configuration allows user to set operating modes, ON/OFF timings, RTC configuration, Updating GPS locations, Astronomical Mode etc.

5.2.20. The CPU of the controller shall be well protected with facility for overvoltage/surge protection upto 4 kV at the controller as per EN 61000-4-5; Burst pulses up to 4 kV as per EN 61000-4-5.

a) All the controllers shall be traceable when mapped through GPS coordinate.

b) The controller that is provided should have facility to ON, OFF, dimming, individual metering of all power parameters.

5.2.21. The communication module shall be a Two-way communicator. The Module shall be able to send data regarding energy usage, ON/OFF status etc. from controller as well as give commands from a central server/ CLOUD for switching ON/OFF scheduling etc.

5.2.22. Controller shall have battery back-up or equivalent suitable to sustain the stored data and transmit its own status of input failure for both power and communication failure.

5.2.23. Any firmware/software up-gradation which is required for the smooth operation of controller shall be done by CONTRACTOR. CONTRACTOR shall provide maintenance and upgrades of the software during the contract period &for the next 2 years beyond the contract period of five years without any additional cost.

5.2.24. Minimum Requirement for Communication Network

a) Communication range shall be sufficient for flawless performance without assistance of any additional equipment
b) Bi-directional communication between server and end devices
c) Power level not to exceed +25dBm EIRP
d) The end devices should be able to communicate to a gateway which will send data to the server
e) The gateway infrastructure site should be beyond the reach/access of general public and should be secured with lock and key (site to be fenced and should allow entry to authorized persons ONLY with proper authorization from the vendor)
f) The network receiver equipment must be installed on public cell tower & must be backed by stand-by power supply for min 2 hrs. However if the bidder insists to install in any other location, they shall ensure that the security of the equipment is not compromised and the same shall be demonstrated to the client's satisfaction. Theft of the Gateway will be responsibility of the bidder for the entire project duration and any theft/incident, the bidder shall install new gateway at his own cost. and the back-up for power supply for min 2 hrs.
g) There should be point to point communication between Controller & Gateway
h) Alternatively, if the communication to the gateway fails the end devices should have fail safe mode to switch on the lights as default download rules to the end devices
i) 1 Gateway should support > 1000 points and there should be point to point communication between Controller & Gateway

5.2.25. Battery Module

5.2.26. Back-up Power Module: Controller should have in-built battery or equivalent power supply arrangement to function during failure of grid power for the CPU & communication module to work / be communicable in case power failure to store all the data and send main power failure alarm to the remote server/cloud before it shuts down safely.

5.2.26.1. Bidder must provide a letter in writing assuring network SLA of 99.0 % availability either by OEM/Network provider as applicable.

5.2.27. Certifications: Submit Physical Certificate for below with tender submission documents: Govt (NABL or equivalent) approved lab for Metering IS: Class 1 as per Standard 13779Govt (NABL or equivalent) approved lab for Surge Immunity: 4Kv as per IEC 61000-4-5 & 440V Withstanding capacity from Govt (NABL or equivalent) approved lab for IP 66 for street lights controller Govt (NABL or equivalent) approved lab for EIRP report and ETA certification for the Communication modules being used inside the device/ product

5.2.28. The supplied controllers shall comply with the following technical details.

Sr. No.	Parameter	Design Requirement / Value	Parameters To be filled By Bidder
1.	Operating Voltage Range	90V - 320V	
2.	Operating Frequency	50 Hz	
3.	Operating mode	On, OFF, Dimming, Lux sensor, scheduled and Manual mode	
4.	Lux Sensor Mode	Device should have built in photo sensor and should have the capability to Switch On/Off the lights based on ambient lux levels. Sensitivity of the sensor should be able to adjust from the application software	
5.	Communications technology	Any of LPWAN/NBIoT with internal antenna	
6.	Case Material	Poly Carbonate	
7.	IP rating	IP 66	
8.	Operating Temperature	0°C to +60°C	
9.	Surge Protection (Internal)	4KV as per IEC61000-4-5	
10.	Withstand Capability	The Controller shall be able to withstand 440 VAC for minimum 48 Hours	
11.	Peak power requirement	<=2.5 W and average power <=1.5 W.	

12.	Capable of measuring and monitoring	1. RMS input voltage (Volts) 2. RMS input current (Amps) 3. Apparent power (VA) 4. Active input power (Watts) 5. Power factor (PF) 6. Energy (kWh)	
13.	Metering feature	Class I	
14.	Alerts	Load & mains failure	
15.	The Controller shall be able to detect the following failures specific to individual Luminaries	1. Lamp failure alert & restoration 2. High/low mains voltage alert & restoration 3. High/low mains current alert & restoration 4. Low power factor alert & restoration.	
16.	Controller Measuring Accuracy	1% as per IS 13779	
17.	Controller	Outdoor Type with PC housing & IP66.	
18.	Rated Life and Reliability at an ambient temperature of 50 degrees Celsius	5 years or more	
19.	Compliance Standards	EMI/EMC: EN 61000-3-2 (2014), EN 61547 (2009), Environmental Standard: EN 60068-2-1 (2007), Metering IS: Standard equivalent to 13779 & Protection Safety: IEC 60598 / IS 10322.	

20.	Security Features	The LPWAN/ NBIoT protocol has to provide 128-bit AES (advanced encryption standard) symmetric encryption at network and application level. There has to be provision of two layer of encryption keys for the payload. The payload post decryption would be available at IoT platform and can be relayed into the application via REST API through https SSL (secured socket layer) communication. The device data transmitted over RF should be protected using multiple encryption keys for data security at the Device side, Network Side and the Application side respectively. No single key should be able to decrypt the payload. The payload should be available at the application side only after putting all the 3 keys in right combination. Individual Light Control shall be capable of Over the Air (OTA) updates without any manual or physical intervention and such OTA should not adversely affect the speed of the overall system.	
21.	**Technical Specifications for Communication Network**		
22.	Communication range	5 KM from fixture	
23.	Bi-directional communication	Bi-directional communication between server and end devices	
24.	Power level	Not to exceed +25dBm EIRP	
25.	Gateway	As required	
26.	Power back up to Gateways	min 2 Hrs.	
27.	Fail Safe Mode	If the communication to the gateway fails the end devices should have fail safe mode to switch on the lights as default download rules to the end devices	

28.	Technical Specifications for Street Light Management System Software		
29.	Server	Server to be provided by VMC and installed in VMC CCC	
30.	Mode of Operation	Lux Sensor Mode, Astronomical Mode, Calendar Schedule & Manual/Maintenance Mode	
31.	Following parameters should be part of the configurable base	1. Time to switch on / off 2. Time slots when the unit will reduce power level using Dimming (multiple time slots with power level) 3. Variations in ON/OFF times based on the day of the week/seasons or by Lat/long 4. Actions to be taken for alarms 5. Actions to be taken for lamp failure	
32.	GIS based mapping	Required	
33.	Profile Creation	Profile created	
34.	Instant e-mail alerts	Instant e-mail alerts to the authorized personnel upon programmed alarms. All alerts SMS & E-mail shall be at near real time. However, in case of a group failure, there shall be single alert for all the luminaires grouped in the application. Individual alert in this case shall be avoided to prevent flooding of alerts of all individual luminaries. However summarized reports shall be at a user defined pre-configured time.	
35.	Reports	weekly, monthly and yearly basis	
36.	Fail Safe Mode	set of rules should be downloaded to the street lamp which will ensure that the lamp works normally even if there is a temporary disruption in communication	

37.	Application software Installation	application software is to be installed at VMC-CCC and all API's to be shared by supplier for centralized CCC application integration	
38.	Application User Licences	2 sets	
39.	Controller Certification for Metering Accuracy	as per IS 13779 Class 1, IP 66, and EIRP & ETA from Govt. approved laboratory to be submitted before the approval of controllers after award of tender	
40.	Data refresh rate	Data refresh rate should be instantaneous, any abnormality should be instantly updated to the application	

5.3. SOFTWARE APPLICATION FEATURES

5.3.1. The web application shall be offered through the VMC/VSCDL provided data center / server infrastructure as may be decided by the VMC/VSCDL at the time of execution.

5.3.2. The application shall enable receipt & storage of all the field data with a time stamp in Cloud or in-house local server at VMC.

5.3.3. The application shall facilitate to communicate, control and configure each controller remotely. The application shall be suitable to manage the data traffic from the field to the Cloud or Server.

5.3.4. Operation Time - It should be able to record LED luminaires glowing and non-glowing hours

5.3.5. The System should be suitable for third party integration if required.

5.3.6. Report Generation – shall enable Users to generate various reports related to the system performance parameters such as energy consumed report, lamp and system failure report, actual hours of operation, uptime (%), etc. as well as based on historical data on daily, monthly, quarterly or annually basis as the case may be from the data/readings received from the units. The reports shall be generated in Xcel as well as Graphical format.

5.3.7. The application should facilitate Roles and Permissions requirements at different level of user hierarchy. It should manage system access for different levels with multiple privileges for different purpose, including Administrator access to configure, work flow access for operations, and public access for viewing and uploading status.

5.3.8. Web application shall ensure system security and safety for users at different levels with security password for various users.

5.3.9. It should be possible to configure Switching point remotely through web application. Remote configuration includes setting new ON/OFF timings, setting RTC time, viewing the Real time data of each switching point, Energy meter parameters, Resetting of the any unit, time synchronization of controller with that of Server and GPS clock etc.

5.3.10. The minimum interval for the update of data should be programmable up to 5 minutes.

5.3.11. Asset Management –

(a) Application shall provide a map application that gives an overview of all Feeder Pillars on a street map or GIS map or a satellite image.

(b) Web application software shall offer asset management feature and allow user to locate Street Lights through GPS coordinates. It also enables user to identify each Street Light with unique/Asset ID with additional information like Wattage, Make, Installation date, replacement date, Replacement defect tracking. It is also possible to link details of every street light with reference to particular switching point.

5.3.12. Dashboard – Web application shall provide a comprehensive dashboard with real time status (Burning Ratio) of switching point, real time faults of various switching points, system uptime %, power consumption, graphical representation of cumulative data etc.

5.3.13. Data refresh rate should be within 5 mins; any abnormality should be updated to the application within 5 mins.

5.3.14. Application User Licenses (2 sets) must be provided in bundle with 3 types of Admin, Site User and Supervisor Types.

5.3.15. The application should operate from dedicated SERVER having required protection like Firewall, Malware, Antivirus etc., as per industry security standards. The data sent by device to IoT platform and further to application should strictly follow **128-bit AES Encryption standards.** The application should also follow **OWASP Application Security Verification Standard**. The supplier should provide documentary proof that the supplier follows Data Validation, Denial of Service. The supplier provided application should also follow **OAuth2 Security** based authentication process to provide customer user access to its application software.

5.3.16. The application software should be flexible to cater to customized requirement which are not foreseen at this point of time but are deemed necessary during the execution and O&M. Separate tabs shall lead to details regarding monitoring & control parameters like, Alerts, Maps, Configuration, Reports, uptime, fault penalty, history, energy savings, power failure, operational hour, lamp failure etc.

5.3.17. Each controller shall be represented by a separate Tab on the dashboard to show the switch point summary indicating the details, rating, location, meter parameters, history of alerts, active alerts, link to the map page, etc.

5.3.18. The application shall generate alarm and alerts through SMSs for any type of abnormal system conditions and faults as listed below to designated users which should not be less than six in numbers.

5.3.19. It should describe the abnormality or fault in short as well as highlight the same with different colours to indicate the status. It shall provide monthly reports on the faults through email.

5.3.20. The application should display the no. of faulty lights for each phase separately instead of giving a total figure of faulty lights for all the 3 phases together.

5.3.21. Application shall protect and report Jamming/ hacking attempts and maintain status-quo in cases of such attempts i.e. if lights are ON, they should remain ON till the default OFF time recorded in the system. In case lights are OFF at the time of Jamming / hacking attempt, lights should remain OFF till default ON time recorded in the system

5.3.22. The application shall provide API based integration to VMC/VSCDL Command and Control Center (CCC). It would be the joint responsibility of the service provider (street light application provider and CCC provider) to jointly work to get this integration up and running. CCC shall provide remote viewing and control of street light control application for troubleshooting and support.

5.3.23. There should be an automated mechanism in the form of “Mobile App” (IOS or Android) to capture pole, controller, lamp information/field information along with the Lat Long (location) of the pole, that would help the commissioning team to activate the system immediately. The mobile app should help map Controller Device ID, Lamp No and Pole No. effortlessly.

5.3.24. The software shall enable to divide the city lights in certain zones as per VMC/VSCDL requirement and assign access to the concerned authorities for control and monitoring from their mobile or laptop.

5.3.25. All alarms shall be notified in near real-time via SMS and email to responsible maintenance team. Appropriate API at SMS gateway shall be considered by the bidder and any upgradation in the SMS gateway shall be considered as per bidder's requirement.

5.3.26. The system shall support auto switching of street light according to light sensor input if provided in future.

5.3.27. The system shall support auto switching of street light according to input. Graphical view of the electrical consumption readings shall be available online for monitoring of the hourly, daily and monthly electricity consumption.

5.3.28. The application software is to be installed at VSCDL-CCC and all API’s to be shared by supplier for centralised CCC application integration. Necessary Servers & Computers shall be provided by VSCDL.

- **TECHNICAL SPECIFICATIONS OF CENTRALISED CONTROL AND MONITORING SYSTEM (CCMS – As if Applicable)**

  Apart from the Smart Lighting System, VMC plans to make the existing Feeder Panels smart by installing CCMS controllers.

- **Technical Specification:**

  The technical specification for CCMS Junction box is as specified below;

  - Class 1.0 Accuracy
  - Plug in Terminal
  - Plug & Play Operation
  - Data logging of 2 months
  - IP-55 Degree of Protection (minimum)
  - Communication port RS-232 or RS-485
  - Inbuilt intelligence to compute faults like over & under voltage faults, Over Current, Over Voltage Surge, Anti-theft alarm, Single phasing, Load unbalance, Over load, Over frequency & under frequency fault
  - GPRS interface to upload all electrical data (KW, KWH, KVA, VI, and PF etc.) & faults on web/cloud network through RS 232 port & GPRS modem
  - Sampling should be configurable from 15/30/45/60 minutes
  - Facility to enter the latitude & longitude axis point. So all feeder mapped & tracked using GIS through Google map
  - All feeders should be monitored from central control unit with capacity of 1000 to 2000 feeder unit control
  - Battery backup for 2-4 hours
  - /Central control unit should have cloud base system and access the information 24x7,365 days (provided that network availability of service provider is present)
  - Street light management server software should be a cloud based software platform for lighting management on cloud server
  - Web enabled, Group ON/OFF, rescheduling of each switching points, alteration of data interval should be configurable
  - Availability of reports: On/OFF switching, fault notification, Daily etc. should be able to be downloaded in CSV format
  - Power quality parameter measurements like Active, Reactive and Apparent power, Voltages & Current should be measurable
  - SLC unit should be able to send Geographical position of each switching point which is available in the map view
  - Capable of maintaining Astronomical time either by its own or by synchronizing with a remote service (web service)
  - Computation of number of glowing & non glowing lights by correlating the actual measured power & rated power of Induction Lamp
  - CCMS (Centralized Control & Monitoring System) Unit: It shall fetch data from wireless enabled streetlights and send the data over GPRS to cloud based street light management server software

- Single SLC should support up to 200 wireless streetlights

5.4. EARTHING SYSTEM:

5.4.1. Scope:

a) The scope includes collection of data, design of the system as per relevant National/International Standards, supply of earthing conductors, earth electrode, earthing strips installation and approval to the satisfaction of electrical inspector under this tender specification.

b) Earthing system shall be provided to ensure equipment safety, personnel safety and facilitate designed operation of protective switching during earth fault conditions in the associated system.

5.4.2. Applicable Standards:The earthing and lightning protection system shall conform to the CEA guidelines and the latest applicable standards indicated below:

a)	Code of Practice for Earthing	:	IS: 3043
b)	Hot dip galvanizing	:	IS: 2629, 2633, 4759
c)	Structural steel	:	IS: 2062 & 808
d)	Welding	:	IS: 816

5.4.3. Earthing Electrode:

a) All materials and fittings used in the earthing installation shall conform to the relevant Indian Standards or shall be approved by the Engineer's representative & CEIG.

b) High-grade solid steel rods molecularly bonded with 99.9% pure electrolytic copper with minimum coating thickness of 250 microns should be used as earth electrode. The rods must be UL listed as well as tested according to IEC62561-2 and comply to the requirements of IEC 60364-5-54. The rods also should withstand short circuit currents. All fasteners used should confirm to the requirements of the above standards. Earth enhancing compound (Soil conductivity improver) used should be tested according to IEC62561 – 7 from an NABL accredited laboratory. Exothermic welding material used shall be tested as per IEEE 837.

c) The underground joints in the system shall be properly welded or brazed and the bolted type connection shall be made with structures/ equipments. Petroleum jelly shall be applied to contact surface of the bolted joints, which will be covered with bituminous compound and tapes.

d) Galvanized Iron flat / wire shall be used as earthing conductor.

e) Earthing conductor shall be protected against mechanical damages considering the installation conditions.

f) All materials used for the earth electrode installation shall be purpose made for the application and site conditions and shall be approved by the Purchaser's Representative

5.4.4. Construction of Earth Pit:

a) A hole of 100 to 125 mm dia. shall be augured / dug to a depth of about 3.5 meters or as per instruction of Engineer in-charge.

b) The earth electrode shall be of minimum 14.2mm Dia., 3mtr. Long, 250micron copper rod, earth enhancement compound (10 Kg Bag X 2 = 20Kg) with minimum 14.2 mm universal SS clamp.

c) It will be penetrated into the soil by gently driving on the top of the rod. Here natural soil is assumed to be available at the bottom of the electrode so that min 150 mm of the electrode shall be inserted in the natural soil.

d) Earth Enhancing material (min20 KG) shall be filled in to the augured /dug hole in slurry form and allowed to set. After the material gets set, the diameter of the composite structure (earth electrode + Earth Enhancing material) shall be of minimum 100 mm dia. covering entire length of the hole.

e) Remaining portion of the hole is filled with backfill soil which is taken out during auguring / digging

f) Construction of masonry earth chamber and cast iron cover with earth resistance result with date or as per instruction of Engineer In-charge.

g) For interconnection of earth pits, SOLID copper conductors with a size of 25X 3 mm flat or 10 mm round are to be used for Lightning Protection/ General purpose.

h) Connections with nut and bolt need to be completely avoided in applications under ground level, instead exothermic / aluminothermy welding need to be performed.

Stainless Steel Clamp Specification

1. Material – Stainless steel

2. Class of SS- DIN 1.4571 (V4A)

The earth electrode shall be of minimum 14.2mm Dia., 1.25mtr. Long, 250micron copper rod, earth enhancement compound (10 Kg Bag X 2 = 20Kg) with minimum 14.2 mm universal SS clamp.

i) All civil works, such as excavation/digging, boring, provision of chemical bag in adequate quantity, backfilling for the installation of the earth electrodes and the earth pit/ inspection pit shall be in the scope of Contractor.

5.4.5. Important Instructions for Earthing:

a) Earth electrode with disconnecting facility shall be provided so that the resistance of the independent earth electrode may be measured.

b) All connections in the equipment earth conductors buried in ground (or otherwise) shall be cad welded/ brazed, whereas connection at equipment end shall be of bolted type. All connections shall be of low resistance. All bimetallic connection shall be treated with suitable compound to prevent moisture ingression. For Bimetallic bolted connection, bimetallic washers shall be used. All bolted joints shall have minimum two bolts to ensure proper surface contact. Termination of stranded conductors at earth inserts shall be with ring type/ lugs.

c) Galvanized conductors shall be touched up with zinc-rich paint where holes are drilled at site for bolting to equipment/structure.

5.4.6. Galvanizing:

a) Wherever galvanizing has been specified, the hot dip process shall be used. The galvanized coating shall be of uniform thickness. Weight of Zinc coatings for various applications shall not be less than those indicated below

Fabricated Steel	
i. Thickness less than 2 mm, but not less than 1.2 mm	340 gms/ sq.m
ii. Thickness less than 5 mm, but not less than 2 mm	460 gms/ sq.m
iii. Thickness 5 mm and over	610 gm/ sq.m
Fasteners	
i. Up to nominal size M10	270 gms/ sq.m
ii. Over M10	300 gms/ sq.m

b) Burrs shall be removed before galvanizing. Any site modification of galvanized parts should be covered well by zinc rich primer and aluminium paint.

c) Contractor shall ensure to use calibrated test equipment having valid calibration test certificates from standard laboratories traceable to National Standards.

5.4.7. Drawings/ Documents Required:

The Contractor should prepare earth pit drawings, after award of contract and before commencement of work for Purchaser's approval.

6. CAPACITY BUILDING

6.1. The CONTRACTOR needs to provide training to VMC/VSCDL employees and other stakeholders as directed by VMC/VSCDL for capacity building;

6.2. The CONTRACTOR shall prepare all the requisite audio/visual training aids that are required for successful completion of the training for all stakeholders. These include the following for all the stakeholders:

a) Training manuals for VMC/VSCDL employees / stakeholder departments;

b) Computer based training modules;

c) Presentations;

d) User manuals;

e) Operational and maintenance manuals for Smart Components implemented;

f) Regular updates to the training aids prepared under this project.

6.3. The CONTRACTOR shall maintain a copy of all the training material on the portal and the access will be provided to relevant stakeholders depending on their need and role. The access to training on the portal would be finalized with VMC/VSCDL. CONTRACTOR has to ensure the following points:

6.3.1. For each training session, the CONTRACTOR has to provide the relevant training material copies to all the attendees.

6.3.2. The contents developed shall be the property of VMC/VSCDL with all rights.

6.4. The CONTRACTOR has to ensure that the training sessions held are effective and that the attendees would be able to carry on with their work efficiently. For this purpose, it is necessary that the effectiveness of training sessions is measured. The CONTRACTOR will prepare a comprehensive feedback form that will capture necessary parameters on measuring effectiveness of the training sessions. This form will be discussed and finalized with VMC/VSCDL.

6.5. After each training session, feedback will be sought from each of the attendees on either printed feedback forms or through a link available on the web portal. One member of the stakeholder group would be involved in the feedback process and he/she has to vet the feedback process. The feedback received would be reported to VMC/VSCDL for each training session.

7. INSPECTION

7.1. The inspection may be carried out by the VMC/VSCDL or his representative at any stage of manufacturing. The successful CONTRACTOR shall grant free access to the VMC/VSCDL its representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the VMC/VSCDL shall not relieve the CONTRACTOR of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

7.2. The CONTRACTOR shall keep the VMC/VSCDL informed in advance regarding the time of starting and progress of manufacture of all the equipment in its various stages so that arrangements could be made for stage inspection, if desired by VMC/VSCDL.

7.3. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested and approved by VMC/VSCDL or an inspection waiver is given.

7.4. CONTRACTOR shall, during inspection/ at any stage as sought by VMC/VSCDL, will furnish test certificates for all equipment including bought out items as included in this BID. However, the VMC/VSCDL reserves the right to insist for witnessing the acceptance/routine testing of bought out items.

7.5. The CONTRACTOR shall communicate to the VMC/VSCDL the details of all testing programme at least Three (3) weeks in advance. VMC/VSCDL reserves the right to waive the inspection at any stage.

7.6. CONTRACTOR shall keep all his testing instruments duly calibrated against Standard Meters at designated Accredited Laboratory not earlier than 6 months from the date of test of the equipment, covered under this specification. Calibration certificates shall be made available during inspection. The calibrating instruments used as standard shall be traceable to National/ International standards.

7.7. A joint inspection of VMC/VSCDL Authority; Technical Officer, Project Manager and team of CONTRACTOR shall be carried out before commencing for operation.

7.8. Following Field Test shall be carried out on the system

a) Visual Inspection of quality of work,

b) Insulation resistance of the system including cable

c) Power consumption of individual Luminaire, each feeder pillar System for a particular road.

d) Lux level available with and without the other façade and vehicular lights. The lux level shall be tested in accordance with NLC.

e) Operational demonstration with CCMS

f) Earth resistance of each pole and feeder pillar

8. QUALITY CONTROL PLANS

8.1. The Quality Control Plan shall list and define in sequential order all process control activities, inspection and tests proposed to be performed on the equipment/ material starting from component procurement and from testing stages to product dispatch. The Quality Control Plan shall indicate and identify the applicable standards, detailed description with diagram the procedure, acceptance criteria, extent of check and record to be generated.

8.2. The CONTRACTOR shall within Fifteen (15) days of placement of order submit the following information to the VMC/VSCDL.

a) Descriptive list of the raw material as well as bought out accessories and the names of sub suppliers selected from those furnished along with the Specification.

b) Type test certificates of the raw material and bought out accessories.

c) Quality Assurance Plan (QAP) with holds points for VMC's/VSCDL's inspection. The QAP and hold points shall be discussed between the VMC/VSCDL and the CONTRACTOR before the QAP is finalized.

9. PRE COMMISSONING-TESTS ON ELECTRICAL EQUIPMENT/ SYSTEMS TO BE CARRIED OUT AFTER INSTALLATION & ON-SITE TESTING:

9.1. GENERAL:

Pre-commissioning tests in addition to mentioned in the specification requirements for various equipment but not limited to following shall be carried out by Contractor in presence of Purchaser/ Purchaser's representative. Commissioning shall be carried out only after obtaining satisfactory results, acceptable to Purchaser/ Purchaser's representative.

9.2. ON-SITE TESTING:

All the short-listed Bidders shall have to prove the Power Consumption & the functionality mentioned in the below table as decided by VMC/VSCDL. The on-site functionality shall be carried out in the presence of external Govt. approved lab/TPI agency and VMC/VSCDL officials. All charges for such on-site testing shall have to be borne by the Bidder.

Sl. No.	Functionality	Acceptance Criteria
1	On Demand- Switching ON, OFF & DIM lamp	The offered Smart Light should switch on & off when user clicks on button provided in Web/Cloud application. The bidder will also have to showcase dimming feature availability in the application software. The lights should respond in <5 mins.
2	Switching ON, OFF & DIM lamp based on predefined schedule	The offered Smart Light should switch ON & OFF based on trigger/input from predefined schedule
3	Switching on lamp based on photodiode mode	The offered Smart Light should switch ON & OFF based on trigger/input from connected photodiode based on ambient lighting conditions
4	Switching on of lamp based Astronomical data	The offered Smart Light should switch ON & OFF based on astronomical data based calendar/schedule stored in the application.
5	Fault monitoring	The application should showcase faults by fault type (Mains failure and Luminaire failure) and show this alert on the application screen. The alert should be triggered in the application software in less than 5 mins.

6	Application software - login, Dashboard & reports	User login to read & see the data to be provided to VMC/VSCDL and they should be able to see data & monitor performance from individual street lights. Demonstrate the logical grouping of working of street lights for their performance (ON/OFF by logical group)
7	Power Metering for the lamp	The bidder should demonstrate the power consumption (W) before and after dimming the light starting from full intensity. Also to demonstrate measurements of Voltage (LN), Current (I), Energy (Wh) & Power Factor (PF)
8	Fail-Safe Mode	In case the controller fails, lights should be On if the light is healthy.
9	Lighting Design	All the short-listed bidder shall have to prove lighting design parameters and above functionalities during onsite testing for both types of road width as decided by VMC/VSCDL. The on-site lighting measurement shall be carried out in accordance to CIE 140:2000 standards and the above parameters in the presence of external Govt. approved lab or TPI agency and VMC/VSCDL officials. All charges for such on site testing shall have to be borne by the bidder.

i. The Technically Approved Luminaire with the lowest input power consumption as per LM 79 report for achieving the minimum required lumens shall be considered as the **Base** and the Power Loading calculations shall be carried out as mentioned elsewhere in this tender. The total Price Loading amount due to excess power consumption shall be agreed upon as per formula (example) by external Govt. approved lab/TPI agency and VMC/VSCDL officials.

ii. The measurement of lux levels shall be as per 9-point method or any other method suggested by the third-party agency during on

iii. **Power Loading**

The input power of the luminaire proposed by all the Technically Approved bidders shall be measured during on-site testing. The luminaire having the lowest Input Power shall form the 'Base' of the power loading calculations. Excess Power consumption with respect to the Base shall be considered for each Technically Approved bidder. This difference in power consumption shall be loaded for each Technically Approved bidder as below:

For example, if there are 3 technically approved bidders who achieve required lumens have input power of x W, x+5W and x+10 W, respectively then x W shall become the Base. The prices of x+5 W and x+10 W luminaires shall be loaded considering a difference in power consumption of 5W and 10W, respectively.

Example:

	Difference in watts = D	**No. of lights L = 4000Nos.**	**LED Burning Hours 50,000**	**Unit rate Rs. 6.72**
	Power loading = D x L x 50000 x 6.72/1000			

Bidder	**D Watts**	**Power Loading in Rs.**
A – x W	0	**Base**
B – x+5W	5	6720000
C – x+10W	10	13440000

9.3. ELECTRICAL EQUIPMENT:

i. Lighting System:

a) Visual inspection for operating problems
b) System activation -burning in the lamps for 100 Hrs
c) Measuring light level & reflectance.

ii. Earthing System:

a) Earthing resistance of each earth pit.

10. DRAWINGS / DOCUMENTS:

10.1. **Documents required to submitted by contractor during technical bid:**

(a) Offered Solution for Smart Lighting with details of the technology.
(b) Typical Design report highlighting the solution &calculations for the each category of road as specified in the RFP above.
(c) LED Data sheet and Type test reports as specified above.
(d) Guaranteed Energy consumption for each Luminaire and its system including the losses.
(e) Luminaire Data sheet mentioned in the BOQ and their respective type test reports as specified above
(f) Detailed write up on the CCMS including proposed system, features offered, technology and components offered, System Architecture, data sheets of the components.
(g) Approach methodology for carrying out the scope of work for Project implementation and Operation and Maintenance phases
(h) Earthing and Surge suppression solutions offered
(i) Sustainability of the System offered
(j) Makes of component and systems offered
(k) Data Sheet of Luminaire including LM79 report, LM 80 test certificates.
(l) Data Sheet of controller including test reports.
(m) Controller Certifications for Metering Accuracy as per IS 13779 Class 1, IP 66, EIRP & ETA from Govt. Approved Laboratory
(n) The Luminaire manufacturer shall have to submit a letter of unconditional guarantee for 5(five) years from the date of supply along with the tender, expressly submitting their concurrence to conditions as mentioned in the tender.

10.2. **Documents required to be submitted by successful contractor**

10.2.1 Detailed Field Survey Report along with findings with maps

10.2.2 Detailed Project report with proposed solution as found in the Site Survey report including the following;

(a) Road details – Total RoW width, Width of carriage way/ foot path/ drains, road length etc.
(b) Design calculations for each road
(c) Summary of Road, road width as above, Design lux, Pole height, calculated lux level, uniformity ratio, threshold (TI), no. of FP, Luminaire wattage,
(d) Guaranteed Energy consumption for each FP including the losses.
(e) Location drawings for poles.
(f) Offered systems, components, their technical data sheets and type test reports;
(g) System Architecture drawing
(h) Details regarding Cloud Server and Lighting management Software-compatibility for integration with command control centre
(i) Communication Protocol
(j) Regular Inspection Plan, regular Quality Control Plan, regular maintenance plan for Predictive& Preventive maintenance.
(k) Office / Storage space General arrangement layout
(l) Resource Deployment plan for manpower and tools
(m) Details of Call centre & Complaint management system – system and component technical details
(n) Organisation structure and team CVs
(o) Detailed execution micro schedule to meet the target dates with milestones & deadlines – Order of roads for installation
(p) BOQ
(q) Makes offered

10.2.3 Execution drawing with coordinates of each pole and Switching point for each road

10.2.4 Bracket design for Smart Street Lighting System.

10.2.5 Equipment Manuals: Original Manuals from OEMs

10.2.6 Installation Manual: For all the application systems

10.2.7 User Manuals: For all the application software modules, required for operationalization of the system.

10.2.8 System Manual: For all the application software modules, covering detail information required for its administration.

10.2.9 Control schematic diagram and interconnection diagrams for switching points

10.2.10 Test reports of bought out components

10.2.11 Inspection reports of the components, luminaires and system

10.2.12 All drawings shall carry VMC/VSCDL's name, purchase order no. with date, project title, consulting engineer's name and adequate space for drawing approval.

10.2.13 Training Material: Training Material will include the presentations used for trainings and also the required relevant documents for the topics being covered. Training registers should be submitted for same.

10.2.14 Standard Operational Procedure (SOP) Manuals: The draft process (SOP) document for O&M and all other services shall be formally signed off by VMC/VSCDL before completion of Final Acceptance Test. This SOP manual will be finalized by the CONTRACTOR within 2 months of operationalization, in consultation with the VMC/VSCDL and formally signed off by the VMC/VSCDL.

10.2.15 The CONTRACTOR shall ensure upkeep & update all documentation and manuals during the Contract period. The ownership of all documents, supplied by the CONTRACTOR, will be with VMC/VSCDL. Documents shall be submitted in two copies each in printed (duly hard bound) & in softcopy formats

10.2.16 Data sheet to be filled by CONTRACTORS which are provided under relevant volumes.

11. LIST OF MAKES FOR REFERENCE ONLY

Sl. No.	Description	Approved Make
1.	LED Chip	Cree, Osram, Nichia, Philips Lumiledsor any brand approved by RDSO / EESL
2.	Lighting Fixtures	Makes meeting all specifications as stipulated in the Bid Document will be considered, but final decision on selection of make will be at the discretion of VMC/VSCDL confirming the eligibility criteria.
3.	Cable	Finolex/ RRKable / KEI / Havells / Gloster / Polycab
4.	Cable Lugs	Dowell's / 3D / Jainson
5.	Cable Gland	Jainson / Comet / HMI
6.	Earthing Electrode	JMV / Ashlok / OBO / Indelec/ETP
7.	Distribution Boards, MCB, ELCB	Legrand / Schneider / Hager / ABB / C&S / Siemens / L&T

NOTE:-

1. The approved makes given above are applicable in general. However final approval has to be taken from the client/consultant before execution of any item. Client/consultant has the right to choose any of the above make at the time of execution.

2. The successful contractor has to obtain approval for all the samples from the Consultants before procurement / delivery.

3. All the Vendors which are approved by the Vendor committee of VMC shall also be acceptable.

Appendix 1

List of Roads of Vadaodara for Smart Street Lighting

North Zone	
Sl. No.	Name Of Road
1	L & T Circle To Amit Nagar (SIDE Light)
2	InduChacha Road TP 13
3	Chistiya Nagar To Navayad Police Chokki
4	Karelibaugh Water Tank To Hathikhana
5	GorwaBhrige To Police Choki
6	Rajmahal Gate To Salat Wada
7	Muktanand To Karelibaugh Water Tank
8	Rajmahal Gate To lalbaughBhrige
9	Amit Nagar To KareliPani Ni Tanki
10	Kala Goda To Kothi
11	Deep Theater To Amar Nagar Cross Road
12	Abhilasha Char Rasta To Canal
13	JalJyot Soc. Road Sama
14	Channi Toll Plaza To Chani Canal
15	Chani Canal To Swaminarayan Circle
16	Swaminarayan Char Rasta To IPCL Circle
17	Ramakaka To Chani Police Choki
18	TP 13 Canal To Water Tank
19	Natasha Park To Abhilasha
20	Abhilasha To JalaramMandir
21	Mangal Panday Road
22	PramkhPrit To AsundharaTenament
23	TP 13 KeyaMoters To Zamku
24	TP 13 Canal To FulwadiPolicChoki
25	Bhimnath Road
26	Rajmahal Gate To Lal Court
27	Aradhna Cinema To Khaswadi Road
28	Kashiba Children Hospital To Bahucharaji
29	Narhari Hospital To Bal Bhavan
30	Dandiya Bazaar main Road
31	AjitaBhrige To Amit Nagar
32	L & T Small Circle To AjitaBhrige End
33	L & T Circle To Nagarwada Char Rasta
34	VIP Raod To AryaKanya
35	Baroda Auto To Jail Road
36	Nanubhai Tower To Abhilasha
37	PandyaBhrige To Railway Station
38	Girda Lab Road
39	PandyaBhrige To Fatehgunj Flyover To L&T Circle

40	Kala Goda To Railway Sation
41	AkhandDharaAvenu To Sama Canal
42	L & T Small Circle To Navrachna School
43	Side Light - Fatehganj Flyover
44	Small L & T Circle To Mangalam Duplex
45	Express Highway To Small L & T Circle
46	NCC Ground To Saffron Comp.
47	Jakat Naka To PandyaBhrige
48	Fatehganj Main Raod
49	Top Khana Road
50	Kashivishwnath To Vishwamita
51	Amitnagar Flyover
52	Gandhi Nagar Gruh To Padmavati
53	Maharani Nursing To AkotaBhrige
54	LalbaughBhrige Side Light To VishwamitriBhrige
55	KananChruch To Sama EME Gate
56	Punam Nagar To Umiya Nagar
	East Zone
1	Airport Circle To Golden Chokdi
2	Karelibaugh Water Tank To Uma Chaar Rasta
3	Uma Circle To D Mart To GurukulChaar Rasta
4	Panni Gate To AjwaChokdi
5	Pannigate Water Tank To VrundavanChokdi To N.H.8
6	Amit Nagar Bhrige East End To Sardar Estate Circle
7	Soma TalavChaar Rasta To VrundavanChokdi
	West Zone
1	Chakli Circle To Natubhai Circle To Gotritalav
2	Hari Nagar To Iskon Temple To Sun pharma
3	JetalpurBhrige To Chakli Circle
4	Sun Pharma Road
5	Nandalay To Race Course Depo
6	ESI Road Gotri
7	GotriBhayli Road
8	Undera To Genda Circle
9	Jyoti Circle To Genda Circle To Inkalab Circle(Trident)
10	ManishaChokdi To VasnaJakat Naka
11	SaiyadVasns Road
12	GotriVasna Police To Narayan Gardan
13	Rajesh Tower To Hari Nagar
14	Nandalay To Dashamaa Circle Road
15	Arunachal Soc. To KrunalChokdi To Radiyatbaa Nagar
16	ITI Gorwa To Kalpataru Super Market
17	GorwaBapu Ni Dargah To Karodia Road
18	GorwaBhrige To PanchvatiChaar Rasta

19	GorwaTalav Road
20	Inkalab Circle To Manisha Circle
21	Manisha Circle To AksarChok
22	Alkapuri Main Road
23	MalharPoint,OP Road To ParshuramNagar,Dinesh Mill Rd
24	OP Road Catalyser To Akota Road TramsformJimm.
25	AtladaraBhrige To BAPS Temple
26	KalaliBhrige To VishwamitriNala
27	OP Road Diwalipura Circle To AkotaBhrige
	South Zone
1	LalbaughBhrige South East End
2	LalbaughBhrige South End To Makarpura
3	Ambe School To DarbarChokdi To Vishwamitri Station
4	KalaliVishwamitriNala To VadsarBhrige To Sussen Circle
5	DarbarChokdi Railway Line End To Tulsidham Main Road
6	MahmmadTalav To Swami VivekanadVidhyalay
7	Shreyas School Manjalpur To Bhavans School Circle
8	TarsaliShaak Market To Dabhoi Road KapuraiChokdi
9	Sussen Circle To TarsaliShaak Market
10	Waghodiya D Mart To National Highway-8

Appendix 2

Safety Conditions for undertaking site work

1.0 SCOPE

This document gives broad guidelines to be followed by the CONTRACTOR for ensuring safe working conditions in and around the site.

2.0 SAFETY ORGANISATION

2.1) Each CONTRACTOR at site shall establish a Safety organization set up at site consisting of qualified safety officers, safety supervisors and stewards as per requirement. Safety officer who shall be responsible for administering safety functions like planning and implementing site inspections, audits, examination / testing, safety surveys, providing supervision, monitoring safe working conditions at all times for their workers. The Safety Officer shall have a degree or diploma in engineering, and diploma in Industrial Safety from recognised central/state government approved institute and also field experience of minimum 03 years in case of degree in engineering or minimum 05 years in case of diploma in engineering, in the relevant discipline. The safety officer shall also have the authority to stop / suspend the unsafe practices and works taken up in unsafe conditions.

2.2) CONTRACTOR shall define the roles and responsibilities of all the personnel at different levels in the safety organization in the CONTRACTOR's Site Safety Plan.

2.3) CONTRACTOR shall take active interest and participate in the development and operation of safety programs at site. His responsibility does not cease with establishment of Safety Group and approval of its various activities. He shall demonstrate his involvement by regular participation in safety meetings, review of safety records and taking corrective action where required, introduction of safety promoting bulletins, posters, suggestions and awards and by setting example by strictly observing safety rules. CONTRACTOR shall remove all waste material and debris from and around the work area and properly clean up the area at the end of each day before leaving the work site.

2.4) CONTRACTOR shall take all necessary precautions not only for safe working of his own workmen but also deploy all precautions to ensure safety of structures, equipment and workmen of other agencies in and around his work site.

2.5) CONTRACTOR shall ensure that his workmen do not trespass into prohibited/restricted work areas.

2.6) EMPLOYER/CONSULTANT shall have the right to inspect at any time, all items of machinery, plant and equipments (owned, borrowed / sub-contracted, leased, rented) brought to site by the CONTRACTOR or his agents or workmen and to prohibit the use on the site of any item, which in the opinion of the EMPLOYER/CONSULTANT is or may be detrimental to the safety of the site. The exercise of such right or the omission to exercise it in any particular case shall not absolve the CONTRACTOR or his agents or workmen of their responsibility of adhering to the safe working practices.

2.7) CONTRACTOR shall execute the work in a manner causing the least possible interference with the business of the EMPLOYER/CONSULTANT, or with the work of any other CONTRACTOR who may be engaged on the premises and shall at all times co-operate with the other CONTRACTORS working at site.

2.8) CONTRACTOR shall obtain daily work permit from the EMPLOYER/CONSULTANT before start of any work at site. The work permits are issued to prevent the CONTRACTOR from working in unauthorised areas and shall be valid for specific area for a stipulated period.

2.9) CONTRACTOR shall ensure at all times that his workers do not lie down or sleep under or around any machine, equipment, vessel or vehicle in his work area at any time.

2.10 RESPONSIBILITIES OF THE CONTRACTOR' S SAFE TY O FFI CER

The duties of a safety officer shall be to advise and assist the CONTRACTOR's management in the fulfilment of its obligations, statutory or otherwise concerning prevention of personnel injuries and maintaining a safe working environment. These duties shall include the following namely:

a) To advise the building workers in planning and organising measures necessary for effective control of personal injuries.

b) To advise on safety aspects in a construction work and to carry out detailed safety studies of selected activities.

c) To check and evaluate the effectiveness of action taken or proposed to be taken to prevent personal injuries.

d) To advise purchasing and ensuring quality of personal protective equipment confirming to national standards.

e) To carry out safety inspections of construction work in order to observe the physical conditions of work and the work practices and procedures followed by construction workers and to render advise on measures to be adopted for removing unsafe physical conditions and preventing unsafe actions by construction workers.

f) To investigate the near misses, incidents and major accidents and submit the detail report to EMPLOYER/CONSULTANT.

g) To promote the working of safety committees and to act as an advisor to such committees.

h) To design and conduct, either independently or in collaboration with other agencies, suitable training and educational programmes for prevention of accidents to building workers.

i) To frame operational control measures, safe rules and safe working practices in consultation with senior officials of the establishment.

j) Supervise and guide safety precautions to be taken in construction work of the establishment.

k) Ensure compliance to legal and contractual requirements affecting safety, health, and welfare of his workmen.

l) Keeping up-do-date with recommended codes of practice and safety literature.

Circulating information applicable to each level of employees.

m) Fostering within the company an understanding that injury prevention and damage control are an integral part of business and operational efficiency.

n) Attending job progress meetings where safety is a point on the agenda. Report on job safety performance.

3.0 Entry and Exit procedures:

3.1) CONTRACTOR must follow Entry / Exit to the project premises for all the project employee and materials will be from the designated entrance / exit point only.

3.2) CONTRACTOR must follow entry / exit systems through Photo ID card / bio-metric.

3.3) CONTRACTOR must follow Entry to the project premises with mandatory PPE's (safety helmet, shoe & reflective jackets).

3.4) The record of Entry / Exit of the personnel will be maintained by the security / time keeper at the gate by CONTRACTOR.

3.5) Vehicles of the CONTRACTORs must be parked only at the designated parking lots in the project premises.

3.6) General Safety awareness posters to be displayed at the entrance and exit gate points by CONTRACTOR.

3.7) CONTRACTOR must provide separate access for pedestrian/vehicles movement at the entry / exit Points.

3.8) ID cards should be displayed by all contract workmen at the entry / exit points.

3.9) CONTRACTOR must provide one full time ambulance and it must be parked near the Entry gate or at the First aid center manned by an experienced driver.

3.10) CONTRACTOR's Plant and Equipments will be screened at the gate before being deployed at site by Employer/Consultant.

3.11) Permission for Entry/Exit of CONTRACTOR's Plant and Equipment's into project premises must be through Employer/Consultant.

3.12) The CONTRACTOR shall arrange to separate pedestrian and vehicular (including material handling equipment) traffic wherever possible and maintain the routes clear of obstruction. To ensure safety of users' clear painted demarcation is encouraged as a discipline to be enforced.

4.0 STACKING AND STORAGE PRACTICE

4.1) All construction materials should be stored in designated areas. The CONTRACTOR shall submit a detailed scheme of construction and other hazardous materials' storage, stacking, dispensing and disposal also considering the physical and chemical properties along with the statutory requirements.

4.2) The CONTRACTOR shall ensure stacked material is bonded on a stable and level footing capable of carrying the mass of the stack. Adequate clearances shall be provided between the sides of the stack and top to facilitate unimpeded access to service equipment like overhead wiring, cranes, forklifts and firefighting equipment, and hoses. Circular items shall be sufficiently choked with wedges not with odd bits of materials. Free-standing stacks of gunny bags and sacks such as cement bags shall be stacked to prescribed safe-stack heights with layers formed for stable bonding, preventing slippage causing accidents. Stacking against walls shall not be permissible.

4.3) The CONTRACTOR shall maintain the premises and surrounding areas in clean and clear manner with safe access and egress.

5.0 STORAGE OF HAZARDOUS MATERIALS

5.1) CONTRACTOR shall store the Hazardous materials on solid bases. Solid bases shall include compacted earth, pallets, concrete or asphalt platforms or paving. Hazardous materials shall be stored, stacked and secured to prevent toppling, Spillage or other unintended dislodgement. Aisles and clearances shall be detailed as per requirement. Hazardous materials shall be stacked in such a manner that an observer standing in the aisle can read their labels and legend.

5.2) CONTRACTOR must provide each hazardous material contained be identified by a legible or legend as per governing statute, code or regulation. The label shall identify the item, quantity and appropriate warnings.

5.3) Hazardous materials which if brought in contact with each other could react or pose equal or greater hazard than either material stored alone shall be stored at a distance not lesser than twenty feet apart by CONTRACTOR.

5.4) CONTRACTOR shall display/post the Warnings and maintain it in a legible condition at all access points clearly defining the specific hazardous nature of the stored materials such as 'Explosive', 'Compressed Gas' , 'Flammable', 'Oxidising',

'Corrosive' or other hazardous nature.

5.5) Where hazardous materials are unloaded in the CONTRACTOR's storage maintained at site in a semi-permanent installation, such installations shall be approved by relevant statutory bodies. Copies of licences for storage shall be lodged with the EMPLOYER. The containers and storage shall display quantities stored with name of the hazardous material and the UN hazard classification label in prescribed colour code prominently painted in a conspicuous manner.

5.6) The CONTRACTOR shall inspect the hazardous storages and installations on a daily basis and shall undertake any requisite preventive action necessary to avoid safety risks.

6.0 STORAGE OF FLAMMABLE AND EXPLOSIVE MATERIALS

6.1) CONTRACTOR shall secure flammable and or explosive materials against accidental ignition.

6.2) CONTRACTOR storage facilities for flammable liquids such as petrol, diesel, kerosene and lubricants as well as the quantities stored shall meet the legal and statutory requirements. These shall be stored in approved fire-resistant rooms with a sump of sufficient volume to contain any spillage.

6.3) CONTRACTOR shall provide the electrical fittings with flame proof and follow a strict maintenance schedule. Containers shall be appropriately bonded in receptacles into which low flash point fuel is decanted. afety risks.

7.0 COMPRESSED GAS CYLINDERS

CONTRACTOR should store the compressed gas cylinders and secure it in the upright position at safe distances shielded from welding and cutting operations/hot work. Compressed gas cylinders in storage shall be shut off and torches, hose and manifolds removed and capped. Cylinders shall be periodically checked for leakages, if any. Compressed gas storages shall be provided with safety relief valves, Safety valves and rupture disc to protect them from overpressures.

8.0 VEHICLES/MACHINERY MOVEMENT IN PROJECT PREMISES

8.1) CONTRACTOR vehicles shall have valid registration , insurance, PUC, and road permit in conformance with regulations and always keep copies of valid travelling documents in the vehicle (Driving license, registration, insurance, and identity card and contact details).

8.2) CONTRACTOR vehicles (Four Wheelers) shall be equipped with seat belts both in front and rear seats, first aid box, portable fire extinguisher, standard stopper (wheel choke), emergency reflective triangles, etc. The drivers should be trained to use fire extinguishers.

8.3) CONTRACTOR vehicles operating on site shall be fitted with reverse horn, rear view mirror and driver shall always be accomplished by trained co-driver / helper.

8.4) CONTRACTOR vehicles shall be well maintained and kept in perfect working order and fully equipped with the proper safety gear. Conduct regular checks of the vehicle's condition and report defects immediately. Any defect has to be removed as soon as practicable, before the vehicle is put in use. Toeing of vehicle with the help of Hydra or back push from other vehicle is strictly prohibited on site.

8.5) CONTRACTOR shall have driver/operator medical fitness report as per regulation; at least once a year and copy of medical report shall be available with driver/operator.

8.6) CONTRACTOR drivers shall have an experience of minimum 5 years and age should be between 25 and 58 years (holding Heavy vehicle license).

8.7) All employees including CONTRACTOR shall wear crash helmet and shoes while driving motorbike. Safety helmets provided for project / site work shall not be worn as crashed helmets, as they are not adequate to withstand the impact caused during accident of vehicle (two-wheeler). Two wheel drivers shall use adequate crash helmets of approved ISI mark.

8.8) Any new CONTRACTOR driver before starting driving shall attend authorized training program for safe driving as per regulation.

8.9) CONTRACTOR drivers shall have his journey schedule showing expected date and time to complete the journey.

8.10) CONTRACTOR drivers shall ensure to take minimum 15 minutes rest for every 4 hrs of continuous journey. Also shall not drive more than 12 hrs in a day.

8.11) CONTRACTOR drivers shall operate only those vehicles for which they are trained, authorized and licensed.

8.12) Without proper authorization by EMPLOYER/CONSULTANT CONTRACTOR respective drivers/operators shall not operate any vehicle other than they are authorized to operate, even if they are capable of such operation.

8.13) CONTRACTOR shall ensure that the person in the driver's seat as well as others in the vehicle shall keep seat belts fastened, while the vehicle is in motion.

8.14) CONTRACTOR shall specify and safe speed limits to be observed and maintained at all times.

8.15) CONTRACTOR must specify vehicle operating instructions.

8.16) CONTRACTOR must ensure safe driving during bad weather conditions (rain showers, winds, snow, etc.) with utmost care.

8.17) CONTRACTOR must ensure that, mobile phones are not to be used whilst driving or operating a vehicle.

8.18) CONTRACTOR must display that Driving under the influence of alcohol or any sedative drug (including prescribed medication) is strictly prohibited.

8.19)CONTRACTOR shall ensure that eating, drinking (even non-alcoholic beverages), etc. during driving inside the project premises be avoided. Such activities increase the risk of accident due to distraction and lack of concentration.

8.20)When loading and unloading, the CONTRACTOR shall observe relevant guidelines and requirements to avoid danger to any person or damage to any property.

8.21) Drivers/Operators shall not attend to mobile calls/listen to music while driving the vehicles/machinery.

9.0 Excavation

9.1) As built drawings of underground services must be referred by the CONTRACTOR before starting the excavation activity.

9.2) CONTRACTOR should make detail excavation methodology and submit the Methodology for approval to EMPLOYER/CONSULTANT.

9.3) CONTRACTOR must ensure the stability of structure adjoining the workplace or other areas to be excavated by providing safety measures like Sheet piling, shoring or other similar means to support structure.

9.4) CONTRACTOR should provide a safe access by providing ladders, staircase or ramps.

9.5) CONTRACTOR should ensure at a construction site that any machinery used in excavation is positioned and operated in such a way that such machinery does not endanger the operator of such machinery.

9.6) In the event of an excavation or removing a manhole cover, the CONTRACTOR should ensure that any opening, sump or pit caused is securely fenced and covered before leaving the workplace for the day.

9.7) Hard barricading should be provided around excavation area by CONTRACTOR.

9.8) Excavated earth must be placed 2m away from the excavated area and Suitable warning boards and signs should be put up by CONTRACTOR near excavation work area.

10.0 Scaffolds

10.1) Before erecting scaffold at site, CONTRACTOR has to get approved the scaffold design/drawings from EMPLOYER / CONSULTANT.

10.2) Scaffold materials must be as per IS standard.

10.3) Competent person must be involved in scaffold erection.

10.4) CONTRACTOR must use Mandatory scaffold components Base plate, ladders, Steel platform (tied with the scaffold), mid rail, Hand rail, Toe board (150 MM), bracings while erecting the scaffold.

10.5) EMPLOYER/CONSULTANT will inspect the CONTRACTOR scaffolding whether erected scaffold is as per the approved design.

10.6) SCAFF tag must be followed (Red Tag- Unsafe/Not to use, Green Tag – Safe to use).

10.7) CONTRACTOR must ensure usage of mobile scaffold is strictly prohibited.

10.8) CONTRACTOR must provide the scaffold with proper fall protection system intact and display the suitable warning boards.

10.9)CONTRACTOR must ensure area to be barricaded during erection and dismantling of scaffolds.

11.0 WORKING AT HEIGHTS

11.1) CONTRACTOR workmen engaged must undergo medical fitness examination before deploying them for work at heights.

11.2) CONTRACTOR workers should wear safety full body harness with double lanyard with hook properly fastened.

11.3) CONTRACTOR workmen engaged on work at heights should be experienced in such work.

11.4) Steel scaffold staging should be erected as per IS code and the design for Scaffold staging must be submitted to EMPLOYER/CONSULTANT for approval.

11.5) Wherever multiple work activities CONTRACTOR must use safety nets beneath the place of work for safety.

11.6) CONTRACTOR when working over equipments or tanks, Full body safety harness with double lanyard, safety lifeline and safety nets should always be used whether or not staging and scaffolding is provided.

11.7) Safe access to all points of works should be provided in the form of Suitable Ladders /stairways/ boom lifts by CONTRACTOR.

11.8) Area around the work place should be barricaded suitably or fenced off to avoid Injuries to personnel passing by. Suitable warning boards and sign should be put up by CONTRACTOR.

11.9) Life line and fall protection arrangements should be provided for working at heights by CONTRACTOR

11.10) CONTRACTOR must ensure loose materials should be cleared on daily basis from scaffolds.

11.11) Man-basket not permitted for height works.

12 Hot Work (Welding / Gas cutting work)

12.1) Only qualified welders should be employed at the work site. The CONTRACTOR should organise the qualifying test at site for his welders and the EMPLOYER / CONSULTANT should approve the welders. All welders should have to undergo

qualifying test and only on passing the test, they should be allowed to work at site.

12.2) CONTRACTOR must organise for all welding work at site, Rectifier / Thyristor sets instead of AC transformer sets. AC transformer sets are banned for welding jobs (both open and closed top type).

12.3) CONTRACTOR should get his welding sets certified by the EMPLOYER/CONSULTANT before start of the work. These certificates should have to be renewed every month. A copy of the certificates should be displayed on respective welding sets.

12.4) Only cables in good condition and insulated holders should be used. The length of supply cable to welding site should not exceed 8 metres and the welding set body should be properly earthed.

12.5) CONTRACTOR welder should not use a building structure, pipeline or railway track etc. as a return path of the current. Adequately rated circuit breaker should be provided in the power circuit for human protection on all power supply points.

12.6) Before starting any Hot work like Gas cutting, welding and grinding etc., the CONTRACTOR should obtain hot work permit from the EMPLOYER/CONSULTANT. The permit should be renewed on day-to-day basis.

12.7) CONTRACTOR should ensure purging of piping and equipment to make it totally safe before carrying out any hot work.

12.8) No combustible material should be stored on or near any source of heat like hot pipes, welding or gas. Before leaving the place of work or the CONTRACTOR's sheds, the CONTRACTOR's workmen should ensure that no material or item that could start a fire is left at site. Special attention should be paid to collection and disposal of oil soaked cotton waste or rags. On no account are these to be dropped into corners, pushed below equipment or left hanging on pipes.

12.9) CONTRACTOR must use gas cylinders in a safe manner. These should not be dropped from heights or dragged on the floor. Trolley with rubber rimmed wheels should be used for transporting gas cylinders within the site. All cylinders should be kept in upright position. Oxygen cylinders should not be kept near inflammable materials like oil etc.

12.10) Standard colour codes for the cylinder must be followed (Oxygen-Black, Acetylene-Maroon) by CONTRACTOR.

12.11) CONTRACTOR must provide the gas cutting sets with flash back arrestor at

both ends (Cylinder and Torch) and gas cutting rubber tube ends fixed with the clamps.

12.12) CONTRACTOR must provide the fire blankets for fire protection and not tarpaulins in the vicinity of welding and gas cutting jobs.

12.13) CONTRACTOR must provide charged fire extinguisher of DCP / CO2 type with each welding/gas cutting set.

12.14) LPG shall not be used for cutting / heat treatment purpose (strictly prohibited).

13 ERECTION, LIFTING APPLIANCE AND GEAR

13.1)CONTRACTOR shall submit detail erection methodology and shall get the same approved by EMPLOYER / CONSULTANT.

13.2)CONTRACTOR shall mobilize the lifting appliance and gear in good working condition.

13.3)CONTRACTOR shall submit a valid Test Certificate to the EMPLOYER / CONSULTANT, from approved certifying authorities for all of his lifting gear and hoists, slings, chains, wire ropes, hooks, chain-pulley blocks, winches, hoists and cranes etc. before commencing work.

13.4)These third party test shall be carried out at site by the CONTRACTOR

13.5)These certificates shall be available at site in the CONTRACTOR office for Inspection as and when required.

13.6) Full time mechanic shall be deployed to maintain all the lifting appliance and gear at site.

14 CLEANLINESS

CONTRACTOR must ensure cleanliness as an integral part of plant / project site outlook; the main obstacle to cleanliness in concrete batching plants, hot mix plants, grout mix plants, crushing plants, mine works, is the emission of fugitive dust. This must be fought by special care taken of the following:

a) Material unloading & handling systems
b) Equipments and workshops

c) Unloading / Storage / handling of the materials
d) Road systems.

It must be emphasized that the proper design and sizing of dust removal / extraction equipments is of utmost importance to ensure cleanliness; adequate & special care while designing & selection of machinery to be taken in the following dust prone areas:

a) Cement Bag packing area.
b) Cement Truck loading area.
c) Adequate sizing of all dust preventing, dust collecting and dust suppression / recovery devices.
d) Proper design, positioning, use and maintenance of dust control equipment.
e) Proper design, positioning and maintenance of storage bins like silos, bunkers, screw conveyors etc.

15 MATERIAL HANDLING SYSTEMS

CONTRACTOR shall have Material handling systems such as loading and unloading areas, conveyor belts and transfer points used to handle materials as raw meal, additives, solid fuels, clinker, and cement, these be equipped with dust removal devices. While designing the conveyor systems CONTRACTOR must take special care to minimize transfer points & provide dust suppression to control fugitive emission.

16 EQUIPMENT AND WORKSHOP

CONTRACTOR shall ensure that all dusty work areas such as cement bagging, truck/wagon loading, mixing or weigh hopper landing must be properly ventilated and filtered adequate care of dust suppression to be taken while designing.

Also important to allow for cleaning away dust produced by various types of equipment if they breakdown or are taken apart. This capacity of cleaning must be included in equipment design and selection criteria. It must also be accounted for when designing work-areas.

17 STORAGE OF FINE MATERIALS

CONTRACTOR should ensure that fine materials stored in silos, must be equipped with adequate dust filtering equipment. Storage of fine materials in the open air or open buildings is only accepted at exceptional locations. These storage zones must be protected from the dominant winds either by strategic positioning or through artificial protection (walls, barns). Areas where fine materials are stored in the open must be equipped or designed in such a way that potential runoff from rain/storm water does not contaminate the environment; this means that runoff waters must be collected and settled before release to off-site receiving bodies.

18 SCRAP AND REFUSE BINS-REMOVAL SYSTEM

The CONTRACTOR shall ensure that he has sufficient waste bins that are identified for different wastes and maintained in clearly demarcated areas. Wastes with oily or other ignitable materials such as oily cotton wastes and hand gloves shall be stored separately with covers to prevent fires and shall be made of metal. Different wastes shall be segregated and stored separately and disposed off. These shall be emptied at routine intervals to prevent that they do not overflow with wastes.

18.1) Solid Waste Management

The CONTRACTOR shall ensure that he has sufficient waste collection bins categorised as hazardous and non-hazardous waste with specific names. Non-hazardous waste shall be disposed in environment friendly manner. CONTRACTOR shall maintain adequate records of hazardous waste disposed.

The waste collection bins should be covered properly.

18.2) Vehicle Wash bay

The CONTRACTOR shall establish a wash bay near each entrance to the project site. All trucks/vehicles moving outside the site shall have the tyres washed prior to the site leaving the project site. This is to ensure that the roads outside the site are not dirtied / defaced by construction muck. The wash bays shall have submersible pump (1+1 backup) and a hose jet along with recyclable water for washing tyres. Dedicated workers would be manning the wash back at each time. Dump trucks to have lift covers on top to prevent muck/dirt/smell from flowing across roads.

18.3) Sedimentation tank

The CONTRACTOR shall establish that the trade effluent generated as a result of maintenance of concrete batch mixing plant / grout mix plant or washing any residuals of tests conducted on concrete, be properly routed to a designed and approved sedimentation tank. The CONTRACTOR shall also periodically monitor and ensure the compliance to acceptable limits of the vital parameters of the treated water like pH, oil and chemical contents, BOD, COD, TDS, Turbidity etc or as prescribed under the conditions of consent to operate the plant before discharging.

19 PROTECTION OF WATER

Both surface water and underground water resources must be protected from all possible pollution be it chronic or accidental.

20 NOISE REDUCTION

CONTRACTOR must ensure noise does not represent a nuisance to neighbours, all measures must be taken to reduce emission of noise from equipment (crushers and/or grinders must be enclosed, as well as compressors, diesel generators; care must be taken in selection of low-noise blowers). Noise reducing devices / acoustical enclosures must be installed systematically on the noiseist equipment. CONTRACTOR must follow the statutory legislation for noise levels. Timely preventive and break-down maintenance of the equipment and machinery shall be carried out by CONTRACTOR in order to reduce the noise generation.

21 WASTE MINIMIZATION

CONTRACTOR must avoid or minimize production of waste with an objective to aim towards zero-waste.Production facility must be provided with all the necessary equipment to manage its wastes; storage, sorting, cleaning, pre- processing, and recycling. Temporary waste storage facilities should be designed in such a way as to control emissions to the atmosphere (volatile organics, fugitive dust) and to protect surface and underground water.

22 ASBESTOS

22.1) Use of asbestos under any form is strictly forbidden in all construction activities and facilities.

22.2) Only CONTRACTOR trained in removal of asbestos should be eligible for asbestos removal. All removal work should be managed and approved by the EMPLOYER / CONSULTANT.

Appendix 3

Contractors Safety and Health programme

1.0 SAFETY ORGANISATION

1.1 SAFETY AND HEALTH POLICY

The CONTRACTOR's organisation shall have a written SAFETY AND HEALTH POLICY issued by the Chief Executive of the organisation, appropriate to the scale and nature of the risks involved in the CONTRACT works. A copy of the policy shall be made available to the PURCHASER at the time of the award of the CONTRACT in evidence of the CONTRACTOR's commitment to management of employee's safety & health and compliance to statutory and regulatory requirements. The policy along with its component operation procedures shall be evidenced as working document publicised among the CONTRACTOR's and his SUB-CONTRACTORS' employees through appropriate languages. All the CONTRACTOR's employees shall be familiar with the policy and their role and obligations in its implementation. The policy shall meet the relevant statutory and regulatory requirements and other requirements of the PURCHASER/CONSULTANT. The policy shall periodically be reviewed for updating with respect to new and emerging legal and other requirements.

1.2 SITE SPECIFIC SAFETY PLAN

The CONTRACTOR shall make detailed Site specific Safety Plan which should include the nature of work, time frame, work force involved, hazards and control measures and shall get the same approved by the Employer/consultant. Method statements shall be attached with Site Safety plan and the approved Safety Plan shall be displayed prominently in the Contractor's site office.

1.3 SAFETY OFFICER :

1.3.1) SAFETY OFFICERS QUALIFICATION:

A person shall not be eligible for appointment as Safety officer unless he

(i) Possesses a recognized Degree in any branch of Engineering or Technology and had practical experience of working in industrial projects in a supervisory capacity for a period of not less than 3 years or possesses a recognised Diploma in any branch of engineering or technology and has had practical experience of working in industrial projects in a supervisory capacity for a period of not less than 5 year.

(ii) Possesses a recognised degree or Advanced diploma in industrial safety. (Approved by the EMPLOYER/CONSULTANT on the basis of his adequate Safety qualification [Advanced Diploma in Industrial Safety approved by State Board of Technical Education] and his/ her experience in safety field).

(iii) Has adequate knowledge of the language spoken by majority of construction workers from the construction site in which he is deployed.

1.3.2) The CONTRACTOR shall also nominate in writing competent Safety Appointees from various disciplines to assist the Safety Officer in implementation of safety measures in their routine contract works. The Safety Officer shall have sufficient authority to direct the CONTRACTOR's or his SUB-CONTRACTOR's personnel to meet Safety and Health requirements and to stop performance of work until such requirements are met.

1.4 EMPLOYEE CONSULTATIONS,SAFETY COMMITTEE&COMMUNICATION

1.4.1) The CONTRACTOR shall ensure full involvement of all his employees recognising their right to consultation on Safety, Health and Environment matters. The Safety officer shall be responsible for ensuring employees' involvement through routine Safety inspections, Hazard and Risk assessment in new and any changes in the work and their control. The CONTRACTOR shall maintain appropriate operating procedures to guide these requirements. The contractor shall plan, maintain and implement for entire Project duration, Training / matrix for regular SHE induction, job specific and specialized training programmes for all working levels.

1.4.2) The CONTRACTOR shall also appoint a Safety Committee comprising of the Safety Appointees from the various areas under the chairmanship of the Safety officer. Safety Officer shall report to Authority one level above the Contractor’s Project In-charge. The committee should also include representatives of Sub- contractors. The committee shall meet minimum once in month to discuss the status and adequacy of the safety management, and any safety concerns of the employees. The committee shall also formulate and validate the safety procedures incorporating controls to prevent or mitigate hazards and risks before submission for approval by the EMPLOYER/CONSULTANT. Safety Officer shall maintain the records of the meetings and minutes of the Safety Committee meeting shall be submitted to the Employer/CONSULTANT.

1.4.3) The CONTRACTOR shall communicate to the employees regularly on job hazards applicable to their tasks in hand and hazards present on Project site. The Safety Appointees shall hold 'Toolbox Talks' or pep talks for this purpose on a routine basis before undertaking any safety critical and/or non-routine activities. Weekly meetings of the CONTRACTOR and his SUB-CONTRACTORS attended by the Safety Officer and the Safety Appointee shall

include safety as a key item in the agenda to discuss hazards and risk assessments, job safety analysis and control procedures and to review accidents and incidents (Near-miss) for remedial measures to prevent reoccurrence. The minutes of the meeting shall be submitted to the EMPLOYER/CONSULTANT. The Safety Officer shall maintain the records

CONTRACTORS attended by the Safety Officer and the Safety Appointee shall include safety as a key item in the agenda to discuss hazards and risk assessments, job safety analysis and control procedures and to review accidents and incidents (Near-miss) for remedial measures to prevent reoccurrence. The minutes of the meeting shall be submitted to the EMPLOYER/CONSULTANT. The Safety Officer shall maintain the records.

1.5 Insurance, Statutory Requirements:

1.5.1) CONTRACTOR should obtain Contract Labour License from Inspector of labour/Inspector of factories as per Contract labour act 1970.

1.5.2) All the Contractor's workmen should be covered by Site Specific Workmen compensation insurance or Group Workmen compensation insurance with site name endorsed for the project duration (Workmen Compensation Act 1923) or should cover under ESI(If the project location is in ESI Zone).

1.5.3) All the Contractor's workmen shouldbe covered under EPF (Employee Provident Fund Act 1952).

1.5.4) All CONTRACTORS should comply with local statutory requirement: (i) Building and other Construction workers Act, 1996.
(ii) Environmental protection Act, 1986. (iii) Factories Act, 1948.
(iv) Indian Electricity Act, 2003. (v) Indian Boilers Act, 1923.
(vi) Petroleum Act, 2002.

1.5.5) CONTRACTOR shall obtain CAR Policy / ESIC policy for the entire project value / duration.

1.5.6) Other Statutory requirements:
(i) Electrical Equipment's, Scaffold materials, Gas cylinders, mechanical equipment and machineries which are deployed at site are as per IS code.
(ii) Storage of combustible materials inside the project premises must be as per the allowable limits mentioned in the Petroleum act/Gas cylinder storage act.
(iii) PPE's must be as per IS standard.

(iv) CONTRACTOR is accountable for any statutory violations observed by the enforcement/inspecting govt authorities.

(v) In case of accidents, inside the project premises, the accountability lies with the CONTRACTOR.

1.6 CONTRACTOR'S MONTHLY SAFETY REPORTS

1.6.1) CONTRACTOR shall submit a monthly written report to the EMPLOYER/CONSULTANT, which shall be due on the fifth workday of every month. The Safety and health of all full time, part-time, permanent, temporary, contract employees and any outsourced employee undertaking any part of the CONTRACT works shall be included in the safety report. The report shall include the total number of working hours for the month, the number of recordable accidents and the number of lost-time injury /accidents. A cumulative trend plot of the monthly severity and frequency rate of the reportable incidents/ accidents shall be included in the Monthly safety report.

1.6.2) CONTRACTOR shall arrange to display the safety statistics and the cumulative plot of severity and frequency of accidents mentioned above painted on a board prominently displayed, as a means of encouragement and assurance to all interested parties and for publicising the safety achievements.

1.7 CONTRACTOR'S ACCIDENT/INCIDENT REPORTS/PENALTY SYSTEM

1.7.1) CONTRACTOR shall report orally, to the EMPLOYER/CONSULTANT regardless of their extent, duration and severity, immediately on occurrence of all incidents/accidents resulting in:

(a) Personal injury / Dangerous Occurrences
(b) Property damage
(c) Near misses

1.7.2) CONTRACTOR shall submit the accident / incident report in writing to the EMPLOYER/CONSULTANT within 24 hours of its happening in the form as prescribed by the governing statute or in the absence of which, in the form prescribed by the EMPLOYER/CONSULTANT. The CONTRACTOR shall detail in the 'Accident / Incident Report', the particulars of the dangerous occurrence leading to the accident, lost time of absence due to accident, root cause analysis and the corrective and preventive actions to prevent such recurrence. In addition, the CONTRACTOR shall include his estimate of the impact of accident on project schedule. Incident including near miss cases shall also be reported in the same manner identifying root cause(s) to eliminate such potential occurrence or risks. The CONTRACTOR shall ensure that corrective & preventive action is taken so that recurrence of the accident / incidents at one location on site shall not take place at other locations/sites.

1.7.3) Penalty clauses applicable to contractor/ sub contractor against non-

compliance of SHE norms, requirements, terms, clauses and instructions given by employer
/ consultant / applicable statutory laws & requirements.

1.8 FIRST-AID PERSONNEL AND FACILITIES

1.8.1) CONTRACTOR shall ensure first-aiders (person who is well trained and can administer first aid) are available on site. The Contractor shall ensure that adequate numbers of first-aid boxes and or first- aid stations as per statutory requirements. The persons holding current certificates of competency of recognised institutions in prescribed numbers as per any governing statute. First- aiders' names shall be prominently displayed.

1.8.2) The First-aid boxes shall display contents of medical and medicinal articles with quantity maintained, which shall be in accordance with governing statute. Nominated first-aider shall replenish stock of first aid boxes promptly.

1.9 OCCUPATIONAL HEALTH CENTRE

1.9.1) CONTRACTOR should establish and maintain an Occupational Health Centre. (In case, Where the CONTRACTOR out-sources such facility, it shall meet the statutory requirements and shall be approved by the EMPLOYER /CONSULTANT and the statutory body).

1.9.2) Occupational Health Centre shall be served by a full time medical officer holding a medical degree in allopathic medicine with a minimum of five years experience in Occupational Health/Medicine. A male nurse, one dresser/compounder and one sweeper-cum-ward boy who will all be available during working hours.

1.9.3) Occupational Health Centre shall be capable of undertaking emergency care services or emergency treatment facilities which shall include emergency life saving aids and appliances to handle head and spinal injuries, severe fractures, snake bites, burns of all nature, electric shocks, cases of asphyxiation and such other severe injuries as could be reasonably anticipated at the facilities and shall meet provisions of any governing statute.

1.9.4) AMBULANCE ROOM AND AMBULANCE VANS: The CONTRACTOR shall arrange for an ambulance room and an ambulance van directly or outsource the facilities meeting the governing statutory needs for prompt transportation of serious cases of accident and or sickness to the hospital. Such facilities shall be maintained in good repair and equipped with facilities such as dry powder type extinguishers, flashlights, portable oxygen unit, self-contained breathing apparatus etc. as prescribed by the governing statute. Ambulance van shall be available round the clock.

1.10 INDUCTION AND JOB-SAFETY TRAINING

1.10.1) The CONTRACTOR shall maintain a procedure for identification of the training needs and training his employees to create a Safety and Health conscious work- force that will comply with the law and safety requirements of the organisation. He shall also maintain a procedure for safety induction and initial training as well as follow-up training on the job safety for new entrants. All employees shall receive effective training and periodic refresher training on the operation control procedures specific to their tasks designed to control the job-safety risks. A booklet of such operation control procedures and safety rules with need based pictorial illustrations shall be made available to all employees who are to learn and be familiar with such procedures. All training shall be monitored for effectiveness as per established procedures. The CONTRACTOR shall maintain records of all such training.
The induction program shall include the following:

i) Site Safety and Health policy ii) Site entry and access.
iii) Standard conditions of work in the site.
iv) Site layout and arrangements such as rest rooms, storage and facilities. v) Emergency response procedures and escape routes.
vi) Incident and near miss reporting. vii) Medical and welfare facilities.
viii) Details of Work permit.

1.10.2) The safety officer shall conduct regular fortnightly or monthly mock-safety drills for different imaginary accident scenarios, in premeditated work areas to provide on-job training such as:
i) Use of safety appliances such as water monitors, fire hydrants, fire hydrant pumps, fire-hoses, extinguishers, breathing apparatus and safety harness for working at height,
ii) Response to health and safety emergencies, iii) Fighting fires using various equipment and iv) First-aid

1.10.3) Participants shall receive training during mock-drills through role-play of their normal expected tasks during emergencies and fire fighting. The degree of demonstrated ability in the chosen tasks during such safety drills shall be recorded as participants' competence level for planning his further training.

1.10.4) The Safety officer shall be trained on a standardised comprehensive advanced training programme covering safety management, legal aspects, techniques of Hazard identification and Risk assessment and specific Job- safety in various disciplines such as Civil, Electrical, Instrumentation and Mechanical plant and equipment of the CONTRACTOR. The training records shall be maintained subject to audit by the EMPLOYER/CONSULTANT. Training effectiveness shall be

assessed and recorded and used as input for further training plans of the employee.

1.11 SAFETY PROMOTION

Safety Posters, Banners and Slogans displayed for safety promotion shall be rotated at frequent intervals at the site locations. The CONTRACTOR is encouraged to have safety promotion as an item in the Safety Committee agenda. The CONTRACTOR is encouraged to include safety promotion programmes such as: safety competitions in slogan and poetry writing on safety, screening of safety films, celebration of National safety and Environmental day, safety suggestion schemes and safety library etc.

1.12 PURCHASE AND PROCUREMENT CONTROL

1.12.1) CONTRACTOR shall maintain a procedure for control of his purchases to ensure that all safety requirements are appropriately vetted by the safety personnel during all stages of procurement including planning of specifications, inspection for acceptance and commissioning in order that threats to safety are not overlooked and appropriate attention is paid to the training of personnel in the operation of the Contractor's new or changed machinery and their Operation & control procedures, to prevent/control risks.

1.12.2) CONTRACTOR shall exercise due diligence in appointing his SUB-CONTRACTORS and outsourcing contract services, that no new safety or Health threats are created. The CONTRACTOR shall ensure personnel of SUB-CONTRACTORS and outsourced contract services are competent in Safety, Health and Environmental management to meet the POLICY requirements. They shall be made aware of the safety rules, emergency procedures and any information that will have a bearing on the safety, health and related contractual obligations.

1.13 HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

1.13.1) CONTRACTOR shall ensure that his key personnel and safety personnel are trained to be competent in Hazard identification, Risk assessment and risk control processes. The CONTRACTOR shall on a routine basis identify, evaluate and control all safety & health risks especially in the hazardous work activities and also to validate the previous risk assessments. Elements such as hazard identification, evaluation of risks with existing control measures in place and estimate of tolerability of the residual risks shall be an ongoing process. Any additional/new control measures shall be designed based on this process on need basis.

1.13.2) CONTRACTOR shall maintain a Hazard Identification, Risk Analysis and Control Manual (HIRAC) pertaining to all his activities duly updated as detailed above. The HIRAC for activities shall be made available to

the EMPLOYER/CONSULTANT during regular inspections and audits.

1.14 WORK PERMITS

The CONTRACTOR shall maintain a work permit procedure. Essential features of the work permit system are as follows:

1.14.1) Clear identification of who may authorize particular jobs and who is responsible for specifying the necessary safety precautions.

1.14.2) Communication of instructions on the issue and use of permits.

1.14.3) Monitoring and auditing to ensure that the system works as intended.

1.14.4) The types of jobs requiring the control of a work permit are:

(i) Hot work of any type (e.g. Hot metal riveting, gas cutting, brazing, grinding, gouging, gas and electric welding) and Work which may cause uncontrolled hydrocarbon release, including any disconnection or opening of a closed pipeline, vessel or equipment containing flammable material.
(ii) Work at height above 1.2m / 4ft or those works at unprotected elevations that demands fall protection to prevent from falling or involving danger of dropped objects.
(iii) Work involving electrical isolation or work on live electrical systems and equipment.
(iv) Work involving the use of dangerous substance (Radioactive materials). (v) Demolitions and Excavations.
(vi) Pressure testing. (vii)Maintenance operations. (viii) Entry into confined spaces.
The work permit issued under the procedure shall be valid for a specified period and shall be issued only after all safety precautions are fulfilled and duly verified by the concerned department engineer and safety officer (EMPLOYER/CONSULTANT).If deemed necessary the same work permit sheet may be revalidated to extent beyond the specified period provided the site conditions and the persons on job remain the same.

1.15 Job Safety Inspection:

1.15.1) Employer/Consultant will conduct planned inspections of the contractors work area and activities. The inspections will verify the contractor`s safety records. The Contractor safety inspection will cover the safe behaviour of contractor employees, safe work condition of equipment in use and the safety and housekeeping of area where work is carried out.

1.15.2) Contractor also shall maintain a procedure for safety inspection at routine

intervals to provide assurance that the instituted safety procedures are in place to prevent deviations from established standards that could lead to a safety hazard and consequential risk. The Contractor shall establish appropriate standardised checklist for systematic job safety verification to ensure

i) Set standard are followed without deviation.

ii) Employees are competent to perform as prescribed operational control procedure.

iii) Monitoring of safety of the various work areas/tasks.

iv) Adequacy of existing operation reports and proposed remedial measures shall be submitted to the employers/Consultant.

1.16 Safety Audits

1.16.1) The Employer/Consultant shall retain their rights to audit the contractor's safety management system either directly by their employees or his nominated representatives for its effectiveness.

1.16.2) The contractor shall undertake periodic safety audits to confirm through investigative methods the effectiveness of the measures set out in policy. In order to be effective such safety audit shall be comprehensively covering all aspects detailed in the specification to ensure effective loss-control/accident prevention programme. Safety audits shall take into account the safety inspection records, remedial measures and effectiveness of the safety programme shall be based on the contractor`s effective hazard identification and risk assessment processes for design of operational control procedures and on the safety statistics. Audit reports and preventive actions and safety improvement programmes shall be submitted to the Employer/Consultant.

2.0 EQUIPMENT, SUBSTANCES AND PERSONAL SAFEGUARDING

2.1 MECHANICAL SAFETY

2.1.1) The CONTRACTOR shall ensure that all his equipments and machinery are safe to use while in motion or working. Operators shall have received training or instruction on operation of the machinery and the regulatory requirements. The CONTRACTOR shall have adequate procedure to ensure the stability and securing of his working machinery during operation. He shall restrict repair and maintenance of the machinery to trained personnel and maintain records of repairs and maintenance. The equipment shall have appropriately designed means of isolating from sources of energy and shall have emergency stop control, which is easily accessible. All controls shall be clearly and uniformly marked. All operation controls, interlocks, sensing devices and guards on tools and equipment shall be functional and their status shall be regularly checked and recorded. The CONTRACTOR shall provide evidence of compliance to these requirements in any contractual write-ups submitted to the EMPLOYER/ CONSULTANT for approval in respect of critical construction/contract

works.

2.1.2) The CONTRACTOR shall provide only good quality Hand tools and ensure control of condition, storage, routine inspection and use of such hand-tools. Unsafe tools such as with cracked or broken handles, mushroomed chisels and punches, worn screwdrivers, hardened hammer heads; power tools with unsafe resistance to earth or without safety guards shall be strictly prohibited.

2.1.3) All safety ladders, scaffolding and such access equipment shall meet requirements of IS 3696 and IS 4014:1967 and such standards as the EMPLOYER/CONSULTANT may stipulate. The safety work permits shall be issued only after ensuring that all safety requirements of access equipment are complied with. Access equipment shall be inspected on a routine basis to prevent injuries caused by falls. It shall be the responsibility of the Contractor to provide safe work access to all work places.

2.1.4) The CONTRACTOR shall ensure safety of all those concerned with lifting and those who may be affected by material hoisting, lifting and handling using various mechanical aids. All lifting equipment such as cranes, hoists, lifting tools and tackles, shackles, hooks chains and links shall be designed as per appropriate international codes of construction. Operators shall have been trained in operation and maintenance of such equipment besides training on standard hand signals to be employed during the hoisting and lifting operations. Safe Working Loads (SWL) shall be marked on equipment prominently. SWL shall be evidenced to have been established by test procedures in accordance with acceptable codes of practices. Medical Examination of Operator & Signalman is mandatory.

2.1.5) Riding on construction equipment, forklifts and cranes shall be prohibited unless such vehicles are provided with passenger seats.

2.1.6) Pressurized gas and air systems shall be maintained safe in good working order and shall meet the requirements of the Factories Act 1948, The Static and Mobile Pressure Vessels Rules 1984 and the Gas Cylinder Rules 1934 as applicable. The safety relief valves, safety appurtenances and isolation systems shall be compliant with safety code of practices. Any statutory register of pressure vessel records and the code of practices shall be subject to periodic auditing by the EMPLOYER/CONSULTANT. The CONTRACTOR shall ensure the pressurized gas and air systems are periodically tested by competent authority and records are maintained properly.

2.1.7) The areas of highly dangerous activities like hoisting, lifting and rock blasting, and radiation, shall be appropriately barricaded to protect personnel and machinery and guided by work permit discipline. Emergency plans shall cater to emergencies arising out of such activities.

2.1.8) Signs, barricades, barrier tapes and warning or entry restriction devices or accessories shall be provided to minimise work related risks of accidents and injuries. Signage shall meet all regulatory requirements such as under The Building and Other Construction Workers Act, 1996; Factory Act, 1948; Manufacture, Storage and Import of Hazardous Chemicals Rules under Environmental Protection Act 1986; Indian Explosives Act 1984 and Gas Cylinder Rules, 1981 and Indian Electricity Act, 1910 and Rules there of and any other safety requirements of the EMPLOYER/CONSULTANT.

2.1.9) CONTRACTOR shall follow the Environment Act 1986 and Rules framed there under. Devise and adopt appropriate noise control measure to maintain noise level at site reasonably below the acceptable statutory noise levels. Work area monitoring & Ambient Air monitoring for various parameters [i.e. Noise, Dust Water, SPM, SO2, NO2 etc.] to be checked through approved laboratory.

2.2 ELECTRICAL SAFETY

2.2.1) CONTRACTOR shall provide only such equipment for work that is electrically Safe to work. The CONTRACTOR shall have a procedure to identify and record all his electrical equipment in a register, with provisions to record his periodic inspections of such equipment. Inspection shall cover cables, extension leads, all electrical equipment drawing power from socket outlet. He shall identify and maintain in good working order all electrical installations such as distribution panels and major switchgear ensuring safe accessibility. A clear area shall be maintained around panels and switchgears. The installed equipment shall be periodically inspected by qualified personnel to ensure their
continued safe operating condition. Inspection shall include earth polarity checks, continuity checks and earth resistance checks. The CONTRACTOR shall ensure use of flameproof and explosion proof switchgears and lighting fittings where required as per governing codes.

2.2.2) Approved earth leakage relays or alternative safety devices to relevant are and International codes shall be used on all portable electrical hand tools. Where possible low-voltage electric power supply shall be used for hand tools, earth leakage units shall protect electrical installations in workshops, kitchens, cafeterias, first-aid rooms, laboratories and offices. Record of regular checks shall be maintained. The CONTRACTOR shall comply with ‘Code of Practice for Earthing as per IS: 3043.

2.2.3) Safety rubber matting of appropriate voltage rating conforming to IS 5424 entitled ‘Rubber Mats for Electrical Purposes’ shall be provided in front of all switchgears and power distribution panels for the safety of personnel operating such equipment.

2.2.4) CONTRACTOR shall arrange displaying signage under Indian Electricity Act 1910, such as:

(i) Danger notices as per IS 2551 in conspicuous places on all Low, Medium and High voltages as per Rule 35,

(ii) Instruction of restoration of persons suffering from electric shock in English and local languages as per Rule 44 in switchgear rooms, substations and places where electricity is used and
(iii) Notice prohibiting unauthorized entry in areas where electrical apparatus are used.

2.2.6) All power cables providing construction power to various construction machinery and the connectors shall be in safe and sound condition. Cables shall be routed through cable trays supported on appropriately designed structures, duly clamped, secured and identified. Road crossing cables shall be laid in conduits buried at least 600 mm below the surface to prevent damage due to vehicular traffic. All cables shall be off the floor to avoid damage or tripping hazard. Cables shall be terminated at the switchgear and sockets in a workman like manner to prevent loose contacts and flashover. Only safety receptacles shall be used for providing power connection to hand-tools. All switches and distribution boards shall be clearly marked. All electrical distribution and panel wiring diagrams shall be available with the electrical maintenance personnel. The CONTRACTOR shall maintain a safe electrical isolation/Lockout – Tagout (LOTO) procedure.
2.2.7) The CONTRACTOR shall ensure lighting circuits are not used for hand-tools. No electrical equipment shall be overloaded. Tools and test equipment used on electrical systems shall be insulated.

2.3 SUBSTANCES ABUSE PROGRAMME

2.3.1) The CONTRACTOR is encouraged to have a ‘Substance Abuse Programme’. Drinking during working hours shall be strictly prohibited. The CONTRACTOR shall promote through poster and other publicity, awareness on abuse of substances such as alcohol and such depressant drugs that slows the activity of brain and spinal cord on abusive usage endangering the safety and health of users and others affected by their work.

2.3.2) No tobacco in any form shall be allowed in EMPLOYER project premises.

2.4 HAZARDOUS SUBSTANCES CONTROL

2.4.1) CONTRACTOR shall prevent all injuries, illnesses and damage to property or the environment caused by any article or substance, which proves to be hazardous.

The code of practices of construction and operation and maintenance and control procedures shall meet required statutory and regulatory requirements. Personnel shall be trained on use, handling, storage, disposal and emergency spillage procedures.

2.4.2) CONTRACTOR shall detail and deploy operational controls to reduce hazardous wastes and their disposal as required by the statute 'Hazardous Waste (Management and Handling) Rules 2000'. Oil wastes, used oils, soil and cotton soaked in oil consequent to handling operations, grease and many class of paints and asbestos sheets and gaskets are typical hazardous wastes.

2.4.3) CONTRACTOR shall identify, contain and control all sources of radiation. Appropriate regulatory approvals shall be obtained before commencement of work involving radiation sources. Radiation protection advisors suitably qualified and experienced shall be appointed whose names shall be submitted to EMPLOYER/CONSULTANT. Surveillance of personnel engaged in such work shall be maintained in accordance with regulatory requirements.

2.4.4) CONTRACTOR shall prominently display Material Safety Data Sheets (MSDS) of all chemical, and hazardous substance used, handled, stored on site, and should ensure that these MSDS are available for reference to all employees at all times and displayed at site (preferably in local language) understandable by the workmen / labour.

3.0 PERSONAL SAFGUARDING

3.1) PERSONAL PROTECTION EQUIPMENT (PPE)-General

The CONTRACTOR shall provide his employees required PPE meeting the requirements of the stated IS specifications and guidelines or equivalent International Standards as may be prescribed by the EMPLOYER / CONSULTANT from time to time. The CONTRACTOR shall have instituted good working procedures and practices in providing PPEs, maintenance, issue and training on their usages. All PPE shall be periodically checked to ensure worn, damaged equipment are replaced expeditiously.

3.1.1) Control Issue, Use and Maintenance of the PPE Employees shall be responsible for the PPE issued to them. The CONTRACTOR shall meet requirements of IS 8519 entitled 'Guide for Selection of Industrial Safety Equipment for Body Protection' or any equivalent international specification that the PURCHASER/CONSULTANT may prescribe.

3.1.2) Head Protection

CONTRACTOR shall comply with requirements of IS 2925. Hard hats with chin strip shall be used and worn. Hard hats intended for use by visitors shall have replaceable paper lining.

3.1.3) Eye and Face Protection

Eye protection shall be worn during all operations by operators and people in the vicinity, where there is a danger of flying particles of metal such as generated during use of hand tools such as chisels, grinding, welding and cutting - lathe work on brass and cast iron, acid and alkali splash, high pressure jet cleaning or insulation removal from heights using high pressure jets. The CONTRACTOR shall meet the requirements of IS 8520 entitled 'Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection'.

3.1.4) Footwear

Safety shoes, boots and gumboots fitted with steel toe-caps of approved quality conforming to prescribed Indian or international standards. Wearing of unsafe safety shoes such as jogging shoes, tennis shoes, slippers and sandal etc. are prohibited. The CONTRACTOR shall meet the requirements of IS 10667 entitled 'Guide for Selection of Industrial Safety Equipment for Protection of Foot and Leg'.

3.1.5) Protective Clothing

CONTRACTOR shall prevent hazards of loose clothes worn by workmen getting caught in moving machine parts. Loose and thin garments such as dhoti and pyjamas are prohibited. While the CONTRACTOR shall ensure that all workmen wear long sleeved shirts, jackets or the like with the sleeves rolled down and secured at the cuff, long pants/ trousers extending upto the top of the safety shoes so as to prevent injuries caused by contact with heat, cold abrasive and sharp surfaces shall be strictly enforced. Such protective clothing shall be mandatory in hazardous areas especially during start-up operations involving hot, inflammable, and other chemical hazards, furnaces and boilers and such fired equipment and asphalting plants. Personnel exposed to acids and alkalies hot fluids and steam during such operations shall be provided with appropriate heat or corrosion resistant clothing. The CONTRACTOR shall meet the requirements of IS 8990 entitled 'Maintenance and Care of Industrial Safety Clothing'.

3.1.6) Hand Protection

CONTRACTOR shall provide appropriate hand gloves as per IS 8807 entitled 'Guide for Selection of Industrial Safety Equipment for Protection of Arms and Hands' to prevent injuries to hands during work. The CONTRACTOR shall maintain

appropriate inventory of gloves for different applications like acid and alkali handling, general-purpose work gloves and asbestos or heat resistant hand gloves etc.

3.1.7) Safety Harness

CONTRACTOR shall provide Full body Safety harness with double lanyard to workmen engaged for work in heights such as open-sided floors, open-sided scaffoldings, floor and roof openings, overhead construction works of various nature etc. where there is a falling hazard of two meters or above. Storage, issue, wearing and maintenance of full body safety harness with double lanyard shall be under strict supervision and records shall be maintained. Practices for safety harnesses and fall arrests shall conform to IS 4912, IS
11972 and IS 8519 or equivalent international codes.

3.1.8) Falling Object Protection

Where work is in progress in elevated areas, barricades, barrier tapes, signs and such entry restriction devices shall be used to keep area below clear of personnel to prevent injury due to falling objects. If work is required in the area below elevated work area, it shall be scheduled at a time different from elevated works. The workmen below shall be protected from falling objects by the debris net or a catch platform with an adequate toe board to prevent material from falling off. Use of safety net for elevated works shall be
considered in the work-permits where appropriate. Where a lift is made above
a working area, the area below the path of the lift shall be cleared of personnel during the lift and barricaded and guarded to prevent entry of persons generally in conformity with IS 4912, IS 11972 and IS 13416 for protective barriers in and around building and preventive measures against safety hazards in work places and safety requirements for floor and wall opening, railings and toe- boards.

3.1.9) Respiratory Equipment

CONTRACTOR shall maintain where appropriate, procedures for training and use of Self-Contained Breathing Apparatus (SCBA). The SCBA shall be provided together with lifelines and rescue teams to safeguard personnel working in areas where gases such as carbon monoxide, methane chlorine and such life endangering atmospheres are present. The CONTRACTOR shall meet requirements of IS 9623 for ‘Selection, Use and Maintenance of Respiratory Protective Devices’. The CONTRACTOR shall have trained adequate number of personnel including the identified fire fighting teams, hose teams and SAs in the use of the SCBA. The CONTRACTOR shall use the periodic safety drills to demonstrate, train and establish competence of personnel in the use of SCBA.

3.1.10) Hearing Conservation

CONTRACTOR shall ensure reasonable precautions are taken to avoid injury to the hearing of the employees. All noise levels shall be controlled within 85 dBA. The CONTRACTOR shall identify noise areas and display caution boards in such noise areas where noise levels exceed prescribed safe level, the CONTRACTOR shall arrange for appropriate engineering control measures to minimise the noise level in such high noise level areas. Where this is not feasible, appropriate earmuffs or ear protectors (ear plugs) shall be provided to workmen ensuring these are worn by those exposed to noise levels beyond safe levels. Periodic hearing acuity tests shall be conducted on such persons exposed to high noise levels to ensure that they do not suffer any hearing impairment as per requirements of IS 8520:1977, The contractor shall also maintain records of such medical tests. The CONTRACTOR shall devise training programme for awareness on effects of high noise hazards and control measures for all the employees.

3.2) MANUAL MATERIAL HANDLING AND ERGONOMICS

3.2.1) CONTRACTOR shall have procedures to identify risks involved in manual / material handling operation and tasks. The CONTRACTOR shall ensure appropriate training to prevent any possible injury. Full use of mechanical aids shall be made to avoid risks arising out of such manual handling. Employees shall be adequately trained on such manual tasks and related safety precautions to reduce the risk of injury to personnel engaged in such work.

3.2.2) CONTRACTOR shall undertake ergonomic study of manual operations to prevent musculoskeletal injury during manual handling, besides visual fatigue and mental stress giving considerations to matters such as seating, lighting and ventilation, etc.

4.1) FIRE PROTECTION AND PREVENTION

4.1.1) CONTRACTOR shall arrange to train his personnel meeting the prescribed qualifying competence needs, in requisite numbers in the operation of such fire protection equipment and systems.

4.1.2) Risk assessments shall be carried out to identify potentially vulnerable areas to provide sufficient quantities of correct type of extinguishers and ancillary equipment to deal with various types of fire hazards.

4.1.3) Where required under the CONTRACT the CONTRACTOR shall provide appropriate type of extinguishers close to areas of fire hazard but not too close they are cut off from use during a fire. Water based extinguishers shall not be positioned close to or used on electrical equipment.

4.1.4) Extinguishers shall be marked / labeled and recorded with location particulars in a register. These shall be inspected at monthly intervals to ensure they are in operable sound condition. There shall be a systematic plan for servicing, repairing and recharging fire extinguishers and for recording such dates on the register and equipment.

4.1.5) The location of fire fighting equipment shall quickly and easily be identifiable especially in emergencies in a conspicuous manner painted as high as possible to identify the location of the extinguisher to prevent it from being obscured by machinery and goods stacked in front and to return the equipment to its location after emergency use in other locations. In order to ensure this,
'Keep Clear' area shall be demarcated and maintained. Location plans of extinguishers and fire-fighting equipment shall be prominently displayed when desired by the EMPLOYER/CONSULTANT.
4.1.6) Safety Officer / Security shall be trained on fire fighting techniques who shall co-ordinate and control Fire protection and prevention programmes.

4.1.7) Where required under the CONTRACT, the CONTRACTOR shall maintain alarm systems powered by mains and by battery for back-up. Where required under the CONTRACT, emergency lighting shall be provided to aid evacuation in poor lighting conditions following the alarm. The alarm system shall be made known to all employees. When the EMPLOYER extends these facilities for use by the CONTRACTOR, he shall provide appropriate training to his personnel in the use of such emergency facilities and duties.

4.1.8) A clear written procedure for action in the event of fire should be produced. Fire teams and hose teams shall be identified and their responsibilities during emergencies shall be detailed in writing. Personnel shall be trained on their fire duties and use of fire-fighting equipment. Regular drills shall be conducted to test procedures and to validate them. Fire instructions and emergency procedures shall be displayed throughout the premises. Emergency response procedures are detailed under para 5.0 below.
4.1.9) A means of escape shall be provided in all work areas and storages and maintained and kept free from obstruction. All exits shall be clearly marked and kept unlocked whilst the premises are in use. Escape routes shall be protected from fire.
4.1.10 When a hot work permit is issued, the CONTRACTOR shall ensure:

(i) Identification of combustibles such as paper, cardboard and wood and moving away from area where hot work is undertaken using open flame or electric arc.
(ii) Determination that flammable vapours and liquids are not present.
(iii) Protection of floor and wall openings to keep out sparks.
(iv) Determination that sprinkler and hydrant and other installed fire systems are functional.

(v) Establishing a fire-watch with fully loaded extinguishers or charged Water-hoses
throughout the operation and 30 minutes after completion of operation
(vi) Adequate ventilation for welders, by means of natural air movement
Local exhaust ventilators or air-line respirators as required.
(vii) Workmen performing the task are adequately briefed on job safety analysis, hazards and risks and the safeguards against risks.

4.2) SECURITY

4.2.1) Where required under the contract, security personnel shall do all that is reasonably practicable to ensure the safety of employees and property of the company in the face of accidents by fighting fires and containing losses due to pilferage, theft, vandalism and industrial espionage both by employees and external elements. Security personnel shall be appropriately competent and
receive adequate safety training. Security personnel shall routinely report on a standardized basis on aspects such as violation of fire-protection rules, use of alcohol and narcotic drugs, condition of security fencing, floodlighting and storages etc.

4.2.2) Where the project is located where a number of other companies are in operation, the CONTRACTOR shall plan for mutual assistance /off site programmes in cases of emergencies, as are practiced in the area in conjunction with the EMPLOYER.

4.2.3) Where common boundaries exist between companies, the CONTRACTOR in conjunction with the EMPLOYER shall co-ordinate security control over factors common: such as floodlights, fencing, pipelines containing gas, fuel and electricity.

4.2.4) Security personnel shall be represented in the Safety Committee through the Safety Appointees nominated from the area.

5.0) EMERGENCY PLANNING / EMERGENCY RESPONSE

5.1) CONTRACTOR shall plan to deal with on site emergencies. An emergency planning/emergency response specific to the job site shall be written and communicated to all employees. The emergency
planning/emergency response shall identify for the potential for and responses to incidents and emergency situations and for preventing and mitigating the likely illness and injury that may be associated with them.

5.2) CONTRACTOR shall review his emergency preparedness and response plans and procedures in particular after occurrence of incidents or emergency operations.

5.3) CONTRACTOR shall designate his emergency team with their duties during emergencies defined, including those of the hose teams, medical personnel, first-aiders and security. The CONTRACTOR shall maintain a procedure as to how his emergency organization shall liaise with the EMPLOYER/CONSULTANT representatives in the emergency planning/emergency response.

5.4) CONTRACTOR shall also periodically test such emergency procedures by conducting mock-drills and use the experience for updating the emergency planning/emergency response and for training the employees on the perceived competence needs.

5.5) The Emergency Planning/Emergency Response of the CONTRACTOR shall be under the control of the Safety Representative who shall be able to co-ordinate with the EMPLOYER/CONSULTANT for liaising with government agencies, neighboring industries and community.

5.6) The Emergency Planning/Emergency Response shall be designed to allow people to work under disaster conditions when normal services such as telephone water, light power, transport and sanitation are not available and first aid and fire fighting facilities are not able to cope with sudden demand on services.

5.7) The Telephone numbers of Ambulance, Police, Fire , Hospitals/ medical centers, Managers and the Employers key executives shall be prominently displayed in the identified Emergency Response Centre.

6.0) PREMISES AND HOUSE-KEEPING

6.1) ORDERLY WORK-PLACE

CONTRACTOR shall maintain a well-managed safe working place in sound clean condition. The CONTRACTOR shall ensure that there is a place for everything and everything in its place so that optimum use is made of valuable floor space with commensurate cleanliness and reduced handling time. He shall ensure that his entire infrastructure including temporary and semi- temporary buildings are kept clean and good repair.

6.2) GOOD LIGHTING-NATURAL AND ARTIFICIAL

CONTRACTOR shall provide lighting natural or artificial to enable work Processes are carried out safely. Artificial lighting shall be adequate especially in the nights and emergencies. The lumen levels shall meet the statutory requirements.

6.3) VENTILATION-NATURAL AND ARTIFICIAL

CONTRACTOR shall ensure that workplaces are ventilated with at least prescribed amount of clean or cleaned fresh air of a suitable temperature, especially where toxic or irritating substances are present such as welding, vehicle exhaust fumes, irritating dusts, organic solvents or any other inimical atmosphere creating health hazards or safety.

6.4) WELFARE AND HYGIENE FACILITIES

CONTRACTOR shall provide Welfare facilities to ensure a high standard of cleanliness for all activities and rest. The CONTRACTOR shall provide facilities for his employees such as ablutions, toilets change rooms, kitchens and cafeterias adequate and in a clean and hygienic state.

6.4.1) DRINKING WATER

The Contractor shall make in every place where building or other construction work is in progress, effective arrangements to provide and maintain at suitable points conveniently situated for all persons employed therein, a sufficient supply of wholesome drinking water.

6.4.1.1) All such points shall be legibly marked “Drinking Water” in a language understood by a majority of the persons employed in such place and no such point shall be situated within six meters of any washing place, urinal or latrine.

6.4.1.2) Container used to distribute drinking water shall be hygienic and clearly marked as to the nature of its contents and not used for any other purpose.

6.4.2) LATRINE AND URINAL ACCOMODATION.

Latrines or urinals, as the case may be, required to be provided shall be of the types as specified below.

6.4.2.1) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a door and fastenings;

6.4.2.2) Where both male and female building workers are employed there shall be displayed outside each block of latrine or urinals a notice containing therein “ :

(i)For Men Only” or “For Women Only”, as the case may be, written in the

language understood by majority of such workers;
(ii) Such notice shall also bear the figure of a man or a woman, as the case may be.
(iii) Every latrine or urinal shall be conveniently situated and accessible to site workers at all the times;
(iv) Every latrine or urinal shall be adequately lighted and shall be maintained in a clean and sanitary condition at all the times;
(v) Every latrine or urinal other than those connected with a flush sewage System shall comply with the requirements of public health authorities. (vi) Water shall be provided by means of a tap or otherwise so as to be conveniently accessible in or near latrine or urinal;
(vii)Wall, ceilings and partitions of every latrine or urinal shall be white washed or color washed once in every period of four months.
(viii)Hand soap or similar cleaning agent shall be provided in each latrine.

6.4.2) CANTEENS:

6.4.2.1) CANTEENS AT LABOUR CAMPS:

(i) In every place wherein not less than two hundred and fifty building workers are ordinarily employed, contractor of such building workers shall provide an adequate canteen.
(ii) The canteen shall consist of a dining hall with furniture sufficient to accommodate building workers using such canteen, a kitchen, and store room, pantry and washing places separately for building workers and for utensils.
(iii) The canteen shall be sufficiently lighted at all the times when any person has access to it.
(iv) The floor of canteen shall be made of smooth and impervious material and inside the walls of such canteen shall be lime-washed or colour-washed at least once every six months.
(v) The precincts of canteen shall be maintained in a clean and sanitary condition;
(vi) Waste water from canteen shall be carried away in suitable covered drains and shall not be allowed to accumulate in the surrounding of such canteen.
(vii)Suitable arrangements shall be made for collection and disposal of garbage from canteens.
(viii) Building of canteen shall be situated at the distance not less than 15.2 metres from any latrine or urinal or any source of dust, smoke obnoxious fumes.
(ix) Site where workers can not avail canteen facility due some reason and are need to take food close to work place, at such locations contractor shall provide a separate place for food serving facility with sound hygienic principles and shall meet the applicable laws.

6.4.2.2 CANTEEN AT PROJECT PREMISES

(i) Workers must not cook in the project premises.
(i) Workers shall carry the food from labour camps and shall have at designated lunch shed made by the contractor.
(ii) Contractor should make shed for workers having lunch in designated location approved EMPLOYER/CONSULTANT.
(iii) Workers having food in open / work location are strictly prohibited.

6.4.3 SAFETY , HEALTH AND WELFARE AT LABOUR CAMPS

(i) The Contractor shall provide free of charge as near to it as may be possible, temporary living accommodation to all building workers employed by him for such period, as the building or other construction work is in progress.
(ii) The temporary accommodation provided by the contractor shall have separate cooking place, Bathing, washing & lavatory facilities.
(iii) As soon as may be, after the building or other construction work is over, the CONTRACTOR shall, at his own cost, cause removal or demolition of the temporary structures erected by him for purpose of providing living accommodation, cooking place or other facilities to the building workers and restore the ground in good level and clean condition.
(iv) Colony/shelters constructed shall be situated at suitable heights where danger of water (waste or rainy) accumulation does not exists; as water accumulation ultimately leads to breeding ground for mosquitoes.
(v) Shelters constructed at labour camp shall protect labourer/workers from rain, cold and heat. And shall be so constructed, equipped and maintained, so far as reasonably practicable, as to prevent the entrance or harbour of rodent, insect, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected.
(vi) Electric supply shall be provided at labour camps for illumination purpose.
(vii) Safe and Adequate potable water shall be provided at camps. The quantity of water shall be decided after taking number of persons residing in camp into consideration.
(viii) Proper access shall be provided to the shelters.
(ix) Labourers residing at camp shall be encouraged to maintain their camp clean by providing waste bins and waste disposal system.
(x) Facility shall be created to drain out waste water. Drainage of camps/colony shall be connected to drainage system or soak tanks to avoid water accumulation. (xi) Adequate toilets and washing facilities shall be provided for the labourers inside the camp.
(xii) Safety & Health related posters shall be placed in the camp to increases safety and health awareness amongst the labourers.
(xiii) First-aid facility shall be provided in the camp. Also few workers should be trained to render first-aid and fire fighting in case of emergencies.

6.4 POLLUTION TO GROUND, AIR AND WATER

(i) The CONTRACTOR shall strive to exceed established minimum performance norms in waste and pollution control. All drains shall be identified as clean water and foul water to aid non-armful disposal. The CONTRACTOR shall ensure safe collection and disposal of solid, liquid and other waste, and ensure periodical cleaning of disposal bins, septic tanks and shall maintain the records.
(ii) The CONTRACTOR shall have a System in place to segregate waste during construction and subsequent reuse or recycling.
(iii) The CONTRACTOR shall take necessary measures to prevent construction activity pollution by controlling soil erosion and sedimentation as per the National Building Code (NBC) 2005 guidelines. The Top soil shall be staked and reused for land scaping, wherever applicable/ reused suitably.
(iv) The CONTRACTOR shall take necessary measures to control dust generation at site and roads by sprinkling water at regular interval.
(v) The CONTRACTOR shall conduct periodic ambient air quality monitoring through approved lab to check the pollution levels at the site particularly in areas where batching plant shall be maintained by the CONTRACTOR and produced to EMPLOYER/ CONSULTANT.