Schedules

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SCHEDULE-A: Project Site

1 Background

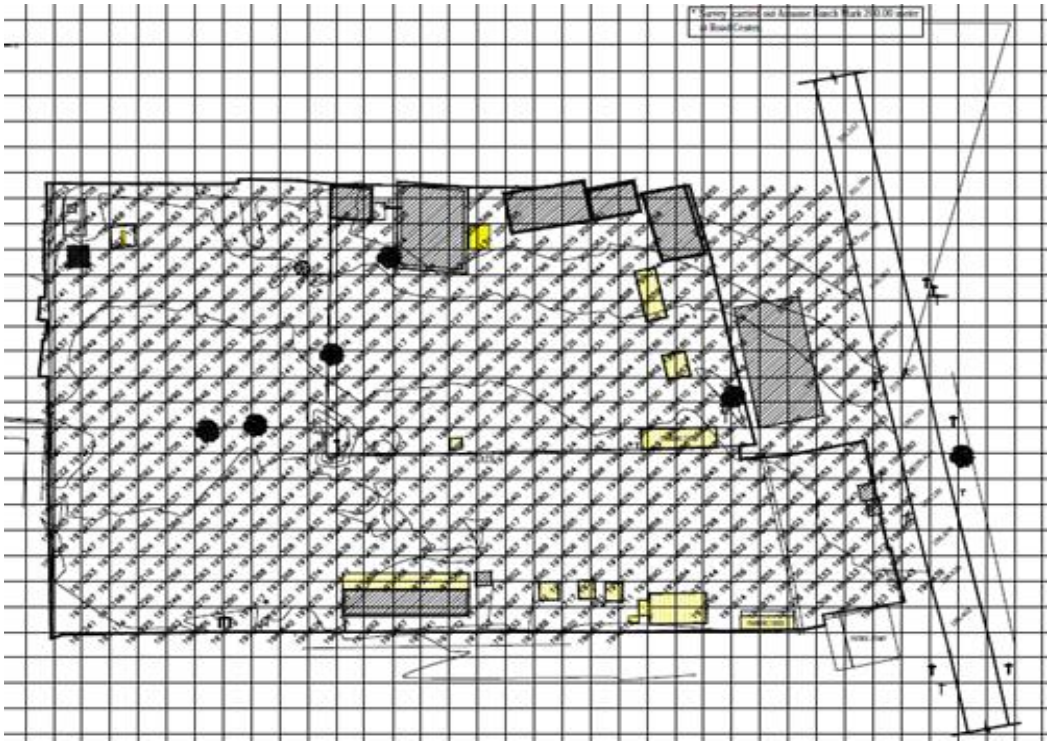
Ministry of Road Transport & Highways under its scheme for development of Bus Ports in India, has mandated NHIDCL as Central Executing Agency for development of Bus Ports. Further, Bus Port at Ramnagar has been decided to be undertaken on EPC basis. The proposed bus port is to be constructed after demolishing the existing structure.

2 The Site

1.1 Ramnagar is a small town and a municipal board in the Nainital district of Uttarakhand, India. It is located at 29.40°N 79.12°E which is approximately 65 kilometres from Nainital, the headquarters of the district.

1.2 Ramnagar is located at the foothills of the Himalayas on the bank of river Kosi and its proximity to Nainital, which is a famous hill station of Northern India. Ramnagar is the gateway to western Kumaon and Garhwal. It is also the commencement point of Kumaon Hills with the nearby town of Haldwani.

1.3 The proposed site for the bus terminal is abutting NH 309, situated within the Kosi Forest Range, Ramnagar Reserve Block at $29^0$23’47.3”N $79^0$07’32.5”E.



1.4 The details of existing structures and Site is given at Annexure-I of Schedule-A.

1.5 The dates of handing over the Site to the Contractor are specified in Annex-II of this Schedule-A.

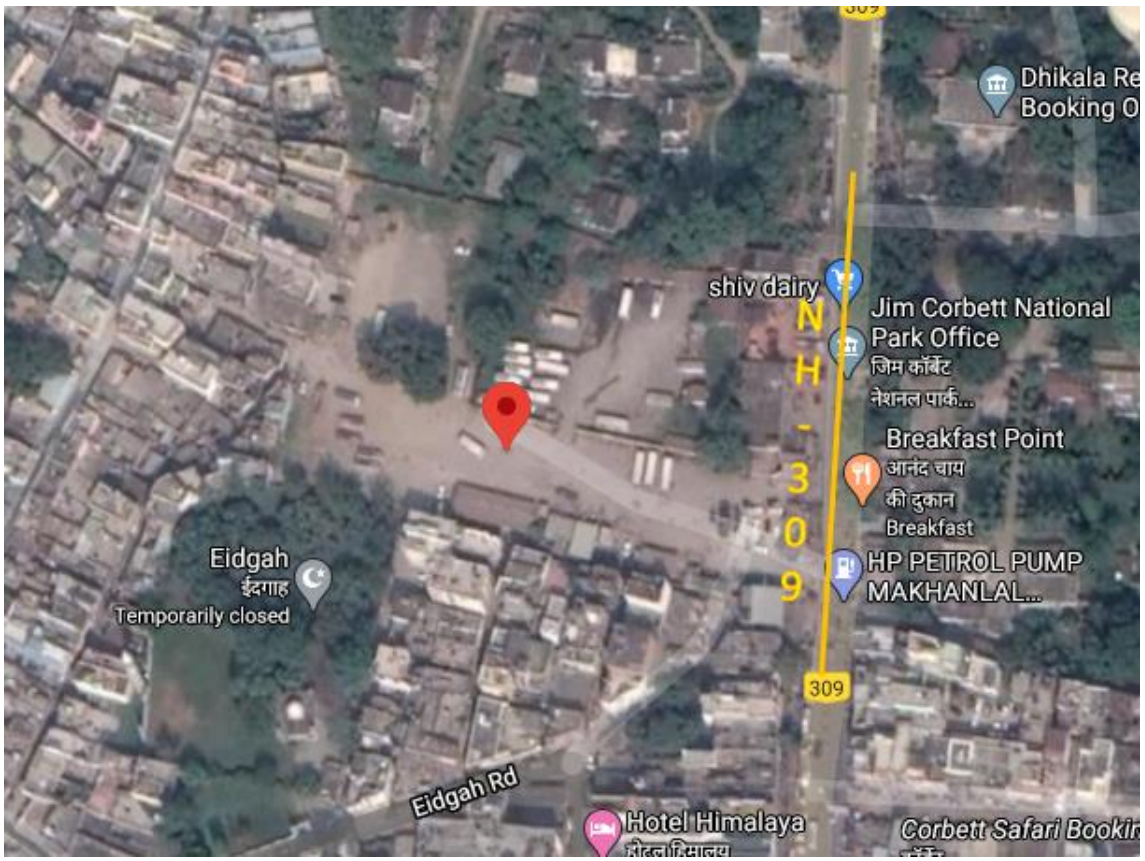
Annexure I

(Schedule-A)

Site

1 Site

The site for the bus port is abutting NH 309, situated within the Kosi Forest Range, Ramnagar Reserve Block at $29^0$23’47.3”N $79^0$07’32.5”E.



Road near Site Location

2 Land

The site is a flat rectangular patch of land.

3 Existing Structures on the Site

SN	Description	QTY	Unit
1	Shed -01	24.62	Sqm
2	Shed -02	65.64	Sqm
3	Shed -03	11.15	Sqm
4	Shed -04	10.09	Sqm
5	Shed -05	12.19	Sqm
6	Shed -06	72.6	Sqm
7	Shed -07	53.46	Sqm
8	Shed -08	4.56	Sqm
9	Shed -09	19.7	Sqm
10	Shed -10	36.58	Sqm
11	Building -01	98.61	Sqm
12	Building -02	46.31	Sqm
13	Building -03	104.44	Sqm
14	Building -04	170.93	Sqm
15	Building -05	41.39	Sqm
16	Building -06	15.44	Sqm
17	Petrol Pump	18.11	Sqm
18	UG Tank	27.45	Sqm
19	Trees	5	NO

Annexure -II

(Schedule-A)

The date of handing over the Site to the Contractor

The 90% of the area shall be handed over to the Contractor on the Appointed Date and remaining 10% within one month.

SCHEDULE-B: Scope of Work for the Project

1 General

1.1 The objective hereunder is to develop high-quality bus ports in the country with assistance from MoRTH. The development of standardized bus ports, complete with requisite infrastructure and facilities, with help in improving passenger comfort and give a much-needed boost to pubic bus transportation systems.

1.2 An allied objective is to bring private operators into the mainstream by allowing them entry into the bus-ports, so that all bus passengers can have access to safe boarding and de-boarding locations and avail of the amenities created in the bus ports such as drinking water, food, rest areas, washrooms etc. Even for the bus operators, bus-ports provide safe locations for vehicle parking and service operation.

1.3 The Contractor should develop a State-of-the-Art Bus Port with better facilities for passengers/ public and commercial facilities thereby creating a landmark facility with iconic exteriors/ facade. The proposed Bus Port shall be planned and designed as an iconic/ landmark building with contemporary innovative design on the lines of post modernism and design elements such as colonial style using fins, pergolas, glass facia etc. The exterior/ facade of the building could be in combination of glass/ metal/ tile/ fusion of materials and the provision of blocking arrangement shall be preferably used.

1.4 Specifications and standards shall be followed as given in schedule ‘D’

2 Broad Scope of Work

2.1 The development of Bus Port includes construction of the following components of bus port as per illustrative drawings at Schedule-I.

(i) Boundary wall and gates
(ii) Terminal Block
(iii) Commercial Area
(iv) Parking and Internal roads
(v) Electrical and Mechanical Works
(vi) Plumbing and Firefighting Works
(vii) Creation of facilities
(viii) Green Area development
(ix) Rooftop Solar Plant

2.2 The Contractor shall ensure that the Bus Port is constructed in accordance with the design approved by the NHIDCL and in conformity to the Standards and Technical Specifications set forth in EPC Agreement and the Applicable Laws.

2.3 The Project shall be designed and constructed in conformity with the Specifications and Standards specified in Schedule-D.

2.4 The Construction works for the Bus Port to be undertaken by the Contractor shall include all the construction works as per the EPC Agreement and catering to future requirements which shall include the following:

(i) The scope of works inter alia includes the detailed design, detailed engineering, preparation of all related good for construction drawings concerned and construction of the Bus Port and other ancillary facilities required for the bus port as per plan provided in Schedule-I.

(ii) International standards of passenger amenities viz general shops, parking areas for public, private and intermediate public transport, toilets, drinking water chambers, waiting halls, seating arrangements, dustbins, display boards etc.

(iii) Bus Port facilities like covered bus bays (alighting, boarding and idle parking), circulation area, enquiry counters, information centres, booking and reservation ticket counters, etc.

(iv) Design and construction of supporting infrastructure facilities related to Solid Waste Management, Rain Water Harvesting, Water Supply and Sanitation, Communication System.

(v) Design and construct any ancillary facility and/or structure required for proper functioning of the bus port or required for passengers comfort or traffic and passenger circulation.

(vi) The Contractor shall maintain the Project, including all repairs, Maintenance, rectification, restoration works, in accordance with the provisions of the Agreement, Applicable Laws and Applicable Permits, in conformity with the requirements set forth in Schedule-K.

(vii) The Contractor shall be responsible for demolishing the existing structures as per Construction Plan submitted to the Authority as per Clause 4.1 of the Agreement.

(viii) Green measures such as solar plant, energy efficient electrical and mechanical equipment, water saving toilet fixtures, rainwater harvesting, sewerage treatment plant/ effluent treatment plant, horticulture etc. are also to be provided.

(ix) Parking management & passenger information system is to be installed in the Bus Port.

Item no.	Description	Qty.	Unit
A	**PARKING MANAGEMENT SYSTEM**		
A.1	**BUS ENTRY LANE**		
1	**Boom Barriers-** Length of Boom: 4.0 Mtr Duty Cycle: Intensive Opening- Closing Time: 2-4 seconds (Adjustable) With –in Built crash protection feature manual over-ride, Push Button, Integration with Smart card and proximity reader.	1	NOS
2	**Automatic Ticket Dispensor:** Automatic Ticker Dispensor with Proximity Reader inbuilt at entry, bar code ticket printer,125 KHz proximity card subscriber reader, heater included, blinking high visibility push button(Flush mounted+ anchor base)	1	Nos.
3	**Number Plate Image Capturing Camera System**		
	ANPR/LPNR Camera IP Camera to take JPEG Image of Vehicle Registration Number	1	NOS
4	Parking Management Client License (one at each entry station)	1	NOS
A.2	**BUS EXIT LANE**		
1	**Boom Barriers-** Length of Boom: 4.0 Mtr Duty Cycle: Intensive Opening- Closing Time: 2-4 seconds(Adjustable) With –in Built crash protection feature manual over-ride, Push Button, Integration with Smart card and proximity reader.	1	NOS
2	**Exit Ticketing Station-** Entry Station consisting of POS (Windows 7 based embedded OS, 18.5" monitor, keyboard), POS License, Bar code Ticket reader, Usb/Rs232 converter, Receipt barcode ticket printer for Manned Station, Courtesy display for Manned Station,125kHz Isocard reader for manned station	1	Nos.
3	Fare Display	1	Nos.
4	Parking Management Software License for report generation, data base handling etc.	1	Nos.
A.2	**Bus Parking Guidance System**		
1	Ultrasonic Detectors	11	
2	LED Bus Bay Indicators	11	
3	Zone Controller	1	
4	Master Controller	1	
5	Parking Guidance System Software	1	
A.3	**Parking Information Display System**		
1	Bus Bay LED Information Display (4" ch. Height, MS enclosure)	11	Nos.
2	Passenger Information Display (10 Rows 6" ch. Size; LED Display with Display Controller displaying bay no, destination, exp departure time)	2	NOS
3	Passenger Information Display -LCD TV Screens (10 Rows with Display Controller displaying bay no, destination, exp departure time)	2	Nos.

Item no.	Description	Qty.	Unit
4	PIDS Client Software at each of LCD controllers	1	NOS
5	PIDS Server Software for data storage, signage etc.	1	Nos.
B	**Car Parking**		
B.1	**Car Entry**		
1	**Automatic Ticket Dispensor**		
	Automatic Ticker Dispensor with Proximity Reader inbuilt at entry, bar code ticket printer,125 KHz proximity card subscriber reader, heater included, blinking high visibility push button(Flush mounted+ anchor base)	1	NOS
2	**Boom Barriers-** Length of Boom: 4.0 Mtr Duty Cycle: Intensive Opening- Closing Time: 2-4 seconds (Adjustable) With –in Built crash protection feature manual over-ride, Push Button, Integration with Smart card and proximity reader.	1	NOS
3	**Number Plate Image Capturing Camera System**		
	ANPR/LPNR Camera IP Camera to take JPEG Image of Vehicle Registration Number	1	NOS
4	**Display at Entry Gate Of Building-** ROW LED DISPLAY 3 Numeric Character (For indicating total empty slots at respective level).LED DISPLAY with (At main Entrance)	1	NOS
	a) Height 4 inch		
	b) Letter 5 mm ultra-bright LED Matrix		
	c) Every line will have separate address in case of multiple lines		
	d) Power Supply - 230VAC		
	e) Communication through TCP-IP/RS 485		
	f) Out door display with weatherproof enclosure.		
	g) MS Powder coated Panel & all other Required Necessary Accessories.		
B.2	**Car Exit**		
1	**Manned Payment System-** Manned Payment Booth at EXIT consisting of POS (Windows 7 based embedded OS, 18.5" monitor, keyboard), POS License, Bar code Ticket reader, Usb/Rs232 converter, Receipt barcode ticket printer for Manned Station, Courtesy display for Manned Station,125kHz Iso card reader for manned station	1	Nos.
2	**Boom Barriers-** Length of Boom: 4.0 Mtr Duty Cycle: Intensive Opening- Closing Time: 2-4 seconds(Adjustable) With –in Built crash protection feature manual over-ride, Push Button, Integration with Smart card and proximity reader.	1	NOS
3	**Parking Management Software License**	1	NOS
C	**GPS- System**		
1	GPS Integration with Parking Management Software	1	Nos.
C	**Infrastructure**		

Item no.	Description	Qty.	Unit
1	Server Computer System for PMS & PIDS with OS & Database	1	Nos.
2	Managed Eathernet Switch	2	Nos.
3	Online UPS with 15 mnts battery backup	1	Nos.
D	**Baggage Scanners**		
	Providing & installation of baggage scanners for luggage asper following features	1	Nos.
	• Tunnel Size (In mm) : 755 (W) X 555 (H)		
	• Power Requirement: 220V AC (±10%)		
	• Conveyor Speed : 0.22m/s		
	• Load Weight : 580 kg (approx.)		
	• Wire Resolution : 39AWG		
	• Steel Penetration : 31mm		

(x) Contractor shall barricade entire area and ensure noise control essentially being wild life national park area.

2.5 Distribution of area is as tabulated below.

SN	Facilities	Designated Plinth Area (Sqm)
1	Terminal Block	3,730
2	Commercial Area	1,860
3	Workshop Area	225
4	Drop Off/ Parking area	1,750
5	Shed area	1,140
6	Washing plant and Fuelling station	300
7	Green Area	1,237
8	Road Area	4,770
	Total	**15,012**

Contractor while designing the bus port should follow the above area provisions only. In the interest of work 5% deviation in consultation with authority is permissible and cost shall be adjusted (+ or -) on prorate basis of Schedule 'H' only.

3 Investigation, Planning, Designing for Entire Scope of Work

3.1 Following designs to be prepared and submitted for approval.

(i) Site survey, Geo- technical investigation
(ii) Architectural and structural drawings
(iii) All drawings for electrical, sanitary work, services, plumbing, development, landscaping and art works
(iv) All shop drawings for DG sets, STP & Sub Station, lifts & escalators shop drawings etc.
(v) The structural design should confirm to Ground plus three stories considering future expansive if any.

3.2 Following clearances to be obtained

SN	Clearances Required	Status	Remarks

SN	Clearances Required	Status	Remarks
1	Land Acquisition	Land is transferred to the implementing agency which is under process.	-
2	Building Construction Permission	Required	Shall be provided by the State Govt.
3	Heritage Clearance	Required	Shall be provided by the State Govt.
4	Water & Sewerage Connection	Required	
5	Shifting of Services and utilities	Required	
6	Traffic Management during operation	Required	
7	Application for PAN, sales tax and other tax registrations etc.	Required	
8	Electricity connection	Required	
9	Clearance for employing labor-Primary Employer	Required	
10	Clearance for blasting and use of explosives	Required	
11	Employment of migrant labour	Required	
12	Storage of sludge/silt	Required	
13	Environmental Clearance	Required	
14	License for commercial activities	Required	
15	Realignment and channelization of Nallas	Required	
16	Installation of Lifts	Required	
17	Fire safety equipment	Required	
18	Drains and Sewers	Required	
19	Diesel Generator	Required	
20	Labour Camps	Required	
21	Working in Night Shifts	Required	
22	Re-routing of vehicular traffic	Required	

3.3 Digital walk through video of complete Bus Port perspective view of minimum two minutes shall be provided to the NHIDCL before start of physical work.

4 Construction of Boundary Wall and Fixing of Gates

4.1 The existing structures in the plots to be demolished and derbies to be removed. The complete area to be levelled at the level of 1 m above the High Flood Level (HFL).

4.2 Construction of boundary of 480 m wall and fixing of two gates to be completed as per the drawings and standards. The design of the gates to be approved by the authority. Overhead gantry on both the gates shall be placed. The gates should also be designed in matching ambience of culture of Uttarakhand. The boundary wall shall be constructed with pre cost panel with embrossed sign of NHIDCL and UTC

4.3 The frontage of the boundary wall to be painted with paintings on theme suitably matching with ambience of the Jim Corbett national park. Rest of the walls shall have exterior paint in consultation with the authority.

5 Terminal Block

5.1 The Terminal Block has an area of 3,730 sqm and shed area of 1,140 sqm.

5.2 Traffic data collection was undertaken to access the demand of bus bays. The number of Origin-Destination Bus Trips per day came out to be 44 with peak traffic of 8 and number of Pass Through bus trips per day came out to be 62 with peak traffic of 7. The bays are provided keeping in mind the peak number of bus trips in a day and the adequate number of bus bays are provided in the design as shown below.

Boarding and Alighting Bays	7
Idle Bus Parking Bays	4

5.3 The work includes complete work as per drawing and specifications which are illustrated below but not limited to

(i) Foundation work upto plinth level
(ii) Column/Shear Wall/ Slab/beams
(iii) Completion of Partition walls
(iv) Completion of Flooring
(v) Completion of Door, windows including wood work, painting, etc
(vi) Internal Finishing and painting.
(vii) Surface finishing with synthetic mortar
(viii) Painting work
(ix) External Finishing.
(x) False ceiling work
(xi) Internal Electric Installation.
(xii) Internal Plumbing Installation.
(xiii) Low side air-conditioning

5.4 The Contractor, while designing the Bus Port Facility shall consider and comply with the following planning & design parameters.

(i) The most important design consideration for a bus port is the safety requirements, which can be met by segregating the traffic movements and convert the bus port into an ‘active urban street’ concept. Pedestrian circulation inside the bus port complex shall be designed in such a manner that no passenger can come on to the bus movement area/s. For efficient working of the bus port and to reduce the noise & air pollution the movement of vehicular traffic in the bus port should be totally unobstructed and the entry & exit of buses as well as the arrival and departure bays shall be designed in such a fashion that the bus traffic shall not be in conflict with any of the other activities of the bus port.

(ii) The entire Project complex should be differently disabled friendly. Ramps with proper slope as per NBC codes shall be provided at user entry and exit of bus port, connectivity to parking area and passenger concourse area, interconnectivity between the passenger concourse areas and at any such places adjacent to footsteps following upward and downward gradient in the bus port passenger concourse area. Handrail

fixed to walls along the staircase and ramps shall be provided for ease and convenience of passengers.

5.5 The key Bus port Facility shall consist of the following:

(i) **Bus Port Transport Infrastructure**: The following key bus port facilities shall be provided:

(a) Covered Bus Bays (for Boarding, Alighting and idle bus parking)
(b) Bus Circulation Area & Approach Roads
(c) Ticketing Counters/ Reservation Counters Enquiry Counters
(d) Tourist Information Centres
(e) Authority administration requirements like Traffic Officer's office, Supervisor Office, Duty List branch, etc.
(f) Entry & Exit to the terminal building should be covered and to be used for solar power generation
(g) Entry & Exit to the Bus port Facility
(h) Passenger Entry & Exit to the Bus port Facility
(i) Interconnecting Subways, Pathways, Foot-over bridges, Ramps between various components, if applicable
(j) Management Information System including public address system
(k) Toilets for staff
(l) Store Room
(m) Passenger Information System

(ii) **Passenger Amenities**: The following key passenger amenities are proposed in the bus port:

(a) Passenger Concourse Area for Boarding & Alighting
(b) Passenger Platform for Alighting & Boarding
(c) Public Utilities (Toilets, Drinking Water Chambers etc.)
(d) Waiting Halls
(e) Cloak Room & Parcel Room
(f) Seating Arrangements, Information Signage's, Display Boards
(g) Commercial Facilities for the Bus port Facilities like kiosks, canteen, general store etc.
(h) Parking Area for private vehicles (two wheelers and cars) and intermediate public transport like auto rickshaws, taxis along with their approaches, entry and exit, covered drop-in and drop-off areas, covered pick-up zones

5.6 **Area for Development:** The area of the Terminal Block shall be as follows:

SN	Component	QTY	Unit
A	**Terminal Block**		
1	Passenger Concourse area- Double height	528	sqm
2	Waiting Hall – General and Ladies	330	sqm
3	Supervisor Office	30.38	sqm
4	Record room	32.75	sqm
5	Drivers/ conductors – dormitory	40.64	sqm

SN	Component	QTY	Unit
6	Control Room	29.93	sqm
7	Ticket counter	57.80	sqm
8	Enquiry office	26.25	sqm
9	Travel Desk, Reservation office / Hotel Reservation counter	29.93	sqm
10	Baby Care Room	13.60	sqm
11	First Aid room	16.05	sqm
12	CCTV security room	30.35	sqm
13	Cloak room	58.67	sqm
14	Tourist Information Centre	30.35	sqm
15	Toilets	65.79	sqm
16	Food Court	137.00	sqm
17	VIP Deluxe toilets, Luxury Lounges	132.37	sqm
18	Guest rooms with attached toilet- 4NO	78.88	sqm
19	Shops – Ground floor	836.02	sqm
20	Gate Cabin	20.00	sqm
21	Circulation & wall area	1,205.24	sqm
	TOTAL	**3,730.00**	sqm
B	**Shed Area**		
1	Shed Over Drop Off Area	650	sqm
2	Shed Over Bus bays	490	sqm
	TOTAL	**1,140.00**	sqm

6 Commercial Area

6.1 The Commercial area should be on the first floor with an area of 1,860 sqm. The design of the commercial area to be approved by the authority. The design should be so that it enable its use by users of the bus port.

6.2 The scope of work should include

(i) Foundation work upto plinth level
(ii) Column/Shear Wall/ Slab/beams
(iii) Partition walls, shutters, door, windows including wood work, painting etc.
(iv) Flooring
(v) False Ceiling work
(vi) Painting work
(vii) External Finishing.
(viii) Internal Electric Installation.
(ix) Internal plumbing work
(x) Low side HVAC Work

7 Parking and Internal Roads

(i) The parking and internal roads should be designed and constructed along with the

drainage system as per IRC:44-2017. The internal roads carriageway/rigid pavement have an area of 4,770 sqm and Carriage way/rigid pavement of parking & drop off area of 1,750 sqm. The design of the parking, drop off area and internal roads to be approved by the authority.

(ii) The Contractor shall construct the bus circulation and the parking area along with the approaches/roads to various components in the bus port with an embankment of 60 cm and rigid pavement of M45 grade. The minimum thickness of pavement should be 200 mm.

(iii) The driveways should follow the following:

SN	Parameter	Minimum Rigid Pavement Width Requirement
1	Driveway width for bus	not less than 15.0m
2	Driveway width at the bus entry/exit gates	not less than 7.0 m
3	Minimum width of ramps for usage by passengers	not less than 3.75m
4	Driveway width for passenger enter and exit from bus port	not less than 7.0 m
5	Driveway in front of Terminal Block for passenger drop-off	not less than 10.5 m
6	Pedestrian areas outside the terminal Block	not less than 2.0 m

(iv) The areas shall be marked and designated with thermoplastic paint along with the provision of appropriate informatory signage as per the directions of the Authority.

(v) The Intermediate Public Transport (IPT) modes like the auto rickshaws and taxis are the expected modal change for the users apart from the city bus transport. The private modes of transport are two-wheelers, cars and cycles. There should be provision for arrival, departure and parking of these categories of private and public transport.

(vi) Designated parking area shall be allotted for the public and private vehicles along with the drop in and drop off facility.

(vii) The entry and exit for the parking areas of IPT and private vehicles shall be segregated by use of railings or medians.

(viii) Driveway in front of Terminal Block for passenger drop-off shall be covered aesthetically with curved rigid slab to protect the passengers from the rain water.

8 Electrical and Mechanical Works

8.1 Scope of work covers the following:

(i) All Electrical Works including IEI, aviation light, lightning arrestor, DG Sets etc.

(ii) Design, Supply, installation, testing and commissioning of power supply to the building which includes Dry type transformer, HT/LT Panels, bus trunking/cables to all LT Panels, Feeder Panels as per specifications given in Schedule D.

(iii) Supply, transportation, foundation, installation, testing and commissioning of Silent type DG Sets. All minor civil works including Foundation, electrical and other works associated with the testing, installation and commissioning of the sets shall be carried out by the tenderer as per specification. The tender should quote for complete job to be executed under the works contract. Diesel engines directly coupled with alternators mounted on a rigid fabricated base frame with resilient anti vibration mountings.

(iv) Cabling, P&F rising main, meter, panel etc. and connection to the main receiving station

(v) Parking Management System including Access control-boom barrier

(vi) Passenger information system including LED screens of minimum 40 inch as per details given in Annexure-VIII of schedule 'D'.

(vii) Providing, Installation, Testing and Commissioning & putting into operation of lifts and escalators with all control equipment's & accessories for the required nos. of landings/openings and speed of lifts/escalators in accordance with NBC 2016 as amended up to the date. All electrical works including interconnections from TP& N Switch (including TP&N Switch) and loop earthing from the earth bar provided in the machine room. Provision of adequate lighting in the machine rooms, lift shafts and all landings. Provision of proper ventilation in machine rooms, lift wells and water proof lift pits including lighting. Provision of hoisting beam or hook above the lift well and trap door. Architrave work at lift entrance. Temporary barricades with caution boards at each landing to prevent accident during execution of work. Electric supply to individual lift shall be given from the dedicated lift panel.

(viii) UPS 3 nos. x 200 (minimum) KVA (2 Working +1 Standby) in parallel redundant mode with 30 min. battery back-up for following (Office – workstations, conference rooms, BMS/FAS etc.). The complete system with all switches, cabling, safety devices, batteries, earthing including the UPS system of capacity so calculated shall be in the scope of work.

(ix) Supplying, installation, testing & commissioning of high efficiency chillers, hot water generators, Primary pumps, secondary pumps, other pumps, cooling towers on roof, plant equipment, AHUs with Humidifiers, TFAs, Motorized Fire Dampers, heat pumps, ducting, chilled water and condenser piping, VFDs, VAVs, slot diffusers, under-deck insulation, toilet ventilation, kitchen ventilation and pressurization systems, fire survival cables and associated electrical panels and electrical works, besides others as required for the successful installation testing & commissioning of the required system. It shall be as per CPWD specification 2017 & NBC 2016, fire authorities and Local bylaws and as per approval of Engineer-in-charge. The work shall also include planning, designing, preparing drawings and getting the drawings approved from the Engineer-in-Charge and its subsequent execution. If any item required to make the system functional, is not specifically mentioned in the scope of services, the same is deemed to be included within the scope of this tender and nothing extra shall be paid on this account.

(x) All testing of control rooms, displays and system etc. complete as per the direction of Authority's Engineer

(xi) To monitor & supervise the entire area for security purpose, as well as record and inform officials on unwanted, untoward incidents. It is also essential to have recorded images to be stored at least for min 30 days of all critical area's to facilitate investigations of a reported incidents.

(xii) The hardware required for the system including Servers VMS & Recording, Workstations, Monitors, CAT-6 Patch Cable to connect the camera to nearest POE enabled LAN point, Cables, connectors, conduits, power supplies etc. will be in vendor's scope. Details of specification of IP back bone is given in the subhead of Local area network. Backbone upto core switch and rack in CCTV control room is taken in the scope of LAN subhead. The complete LAN networking, for the CCTV should be separate and exclusive for CCTV system only and not mixed with other LAN system. The proposal and design to ensure it.

(xiii) Planning, designing, supplying, installation, testing & commissioning of LAN networking with 10G backbone with Wi-fi modem on all floors covering complete floor area. The requirement of LAN outlets as indicated in the Internal EI subhead shall be taken into account for the designing of the complete system. The system shall have redundancy at the level of core switch as well for the backbone.

(xiv) Planning, designing, supply, installation, testing and commissioning of complete of IP based voice communication system with 4 no. PRI Trunks lines (30 channels) with clip facility for 100 IP users licence for life time. The outlets are as described in the Internal EI subhead. The scope of work also includes the provision of the IP based telephones.

(xv) The wiring shall be in the scope of the work of the firm and shall be IP based LAN networking, as described in the Internal EI subhead. LAN networking shall be covered in the LAN subhead. The complete system has to be supplied, installed, tested and commissioned in complete manner to have a fully functional system, as required.

(xvi) The Scope and purpose are to provide the voice communication with latest Pure IP at core Server based Voice communication system in (1+1) H.A mode to all the users within the campus including IP based operator console, In-skin Voice mail for all the users & access to call outside the campus through analog trunks or PRI trunks via local service provider (e.g. BSNL etc.).

(xvii) SITC Audio System consist of Two-Way Line Array Column Loudspeakers for Video Conferencing Presentation.

(xviii) Audio System consist of Two-Way Ceiling Loudspeakers for Speech / Sound Reinforcement

(xix) IP Over AV Based Switching & Control System.

(xx) Video conferencing facility with additional PTZ cameras etc.

(xxi) Large Display Panels/Video wall

(xxii) Building Management system shall be provided to monitor & Control all parameters of all Utilities. Building Automation System shall not only help in conserving energy

by making it possible to plan and execute various energy conservation control schemes but also help in reducing scarce trained man power requirement for operating and maintaining the building services without compromising on quality of services. It shall also act as a Management Information System (MIS) by keeping the management informed about the critical operation of various equipment and make available data required for analyzing the working of, and possibilities of conserving the energy. The system shall be based on Micro Processor Control System, using the various Energy Management Programmers' to save the energy with the latest techniques of controlling the environment.

(xxiii) Supplying, installation, testing & commissioning of Automatic Intelligent Addressable Fire alarm system. It shall be as per CPWD specifications, NBC 2016 and Local bylaws and as per approval of Local Fire Service. The work shall also include planning, designing, preparing drawings and getting the drawings approved from the Engineer-in-Charge and its subsequent execution. Scope work also includes integration of Automatic Intelligent Addressable Fire alarm system provided among various buildings, among other equipment like AHUs, Ventilation system etc., as per NBC 2016, requirements to the main control room, located at the one of the main gate.

(xxiv) Approvals / NOCs / clearances from local bodies and other statuary agencies etc.

8.2 The bus port shall be adequately lit as per the minimum approximate illumination standards prescribed. During night time common areas and facilities should be sufficiently illuminated to ensure visibility and safety to users. High mast lighting shall be provided to lit up the bus port area.

Minimum Illumination Standards

SN	Component	Minimum Illumination (Lux)
1	Passenger Circulation Area	150
2	Bus Platforms	200
3	Interactive Areas (task location)	200
4	Administrative Office	150
5	Corridors	70
6	Toilets	200
7	Waiting Halls	150
8	Signs, maps, displays	200
9	Parking Area a) Surface Parking b) Basement Parking c) Ramp	 50 70 70
10	Roofs	20
11	External Lighting	30

8.3 The Contractor shall provide signage with customer focussed approach following the below mentioned guidelines:

(i) Adequate number of traffic signs (informatory, cautionary and warning) and signage shall be provided in the bus port for convenience to crew and users.

(ii) Insofar as possible, architectural elements, landscaping, and other design features shall identify entrances, exits, etc.

(iii) Signs shall be located for maximum visibility at or before all decision points within facilities.

(iv) Signs shall be placed at frequent enough intervals so that the infrequent or new user can readily find his or her way without assistance.

(v) All signage should comply with relevant standards and codes and include items relating to regulatory enforcement (e.g. no smoking, no parking here, etc.).

9 Plumbing and Firefighting

9.1 The Contractor shall provide adequate number of Water Storage and Supply Structures in the form of Over Head Water Storage and Under Ground Water Storage Tanks. Water storage capacity of adequate capacity shall be designed and built as per relevant NBC standards. Apart from meeting the user requirements, water storage shall be maintained for meeting the contingency requirements in case of fire or similar incidents.

9.2 All pumps, valves, piping, cabling, protection and safety devices, electrical control panels with BMS compatibility, earthing etc. as required for the building for all the water based services to collect the water in the underground/ on ground/ overhead tanks and to pump them to the required tanks, as required to ensure the availability of the water for different type of utilities. This will include the water being received from local body, borewell, STP treated water etc. besides others if any as applicable.

9.3 Water treatment plant (RO) for the treatment of the water from the borewell to make it potable.

9.4 Pumping arrangement alongwith piping for the irrigation purpose for the complex.

9.5 Water Cooler – storage type water cooler of capacity of 150 ltr with complete stainless steel body with inbuilt stabilizer are to be provided for drinking water – 3 Nos. at each floor are to be provided. (Make: Blue star/ Voltas/ Usha/ Eureka forbs).

9.6 The Contractor shall also provide pump chamber along with the requisite mechanical, electrical equipment and other accessories installed in a proper enclosure as per relevant standards in a suitable area.

9.7 Supply and installation of Construction of the fire detection and firefighting systems etc.

9.8 Water softening plant for air-conditioning requirements based on the requirement of the water for AC on daily basis.

9.9 Complete internal and external water-supply system / grid including supply and Installation of Pumps., over Head Tanks, Water supply Lines, drainage pipes, Vitreous Chinaware, CP Fittings

9.10 Completion of sewerage system/ grid

9.11 Completion of Drainage system

9.12 Provide rain water harvesting system including recharge well &tube wells with properly designed network as per the Applicable Laws.

9.13 Supply and installation of STP with suitable technology of 66 kld, in discussions with Authority to treat waste water generated in the bus port.

10 Creation of Facilities

10.1 Scope of work covers the following:

(i) Construction of workshop with storage/working area of 225 sqm complete with civil, internal electrical works.

(ii) Construction of fuelling station of 225 sqm with civil, internal electrical works as per Oil Marketing Companies requirements.

(iii) Construction of washing plant of 75 sqm with civil works and plumbing works.

(iv) Supply of loose and fixed furniture and fixtures in terminal area.

10.2 Scope of work covers planning, designing, supply, installation, testing and commissioning of the following furniture and fixtures:

SN	Area	Item Description	Unit	Quantities
1	Waiting area	SS Seating chairs	NO	150
2	Enquiry & Information	Counter	NO	1
3		Chairs	NO	3
4		Back units	NO	3
5		Computers	NO	3
6	Office Furniture	Tables with side units	NO	20
7		Chairs	NO	20
8		Storage	SQM	10
9		Computers	NO	20
10	Ticketing Counter	Tables with side units	NO	6
11		Chairs	NO	6
12		Storage	SQM	4
13		Computers	NO	6
14	Record room	Tables with side units	NO	1
15		Chairs	NO	1
16		Storage	SQM	20
17		Computers	NO	1

SN	Area	Item Description	Unit	Quantities
18	Staff Lounge	Side table	NO	4
19		Chairs	NO	18
20		Storage	SQM	2
21	Staff Dormitory	Bed with furnishing	NO	4
22		Chairs	NO	2
23		Storage	SQM	8
24	First Aid Room	Bed with furnishing	NO	2
25		Chairs	NO	2
26		Storage	SQM	2
27	Paid lounge	Chairs	NO	50
28	Guest house	Bed with furnishing	NO	4
29		Chairs	NO	2
30		Storage	SQM	16

10.3 The Contractor shall obtain the approval of the Authority on the make and design before the supply of these items. The Authority retains the right to change the number of these items and the cost shall be adjusted based on the actual cost of procurement by the contractor, as evidenced by the submission of bills in original by the Contractor.

11 Green Area Development

11.1 No area/pocket in the bus port is to be left barren. An area of about 1,237 sqm is expected to be green. Adequate landscaping shall be done in the Project Site. This area has to be suitably provided for improving the aesthetics of the bus port. The pockets shall be properly illuminated and railings of suitable type shall be provided to boundary the area. Landscaped area shall be provided as a buffer between the passenger concourse area and the commercial development component.

11.2 Trees that are to be removed for development of this bus port may be replanted, as per Applicable Laws in the planned landscaped areas, where feasible.

11.3 Scope includes plantation grass, plants, trees, shrubs, hedges and compound wall upto height of 1.2 m (including MS Grill / railing) above FGL with gates.

12 Rooftop Solar Plant

12.1 Planning, designing, supply, installation, testing and commissioning of solar plant of 250 KW on the terrace and canopy consisting of following equipment's/components.

(i) Solar PV modules consisting of required number of Crystalline PV cell Modules.

(ii) Grid interactive Power Conditioning Unit with Remote Monitoring System

(iii) Mounting structures

(iv) Junction Boxes.

(v) Earthing and lightening protections.

(vi) IR/UV protected PVC Cables, pipes and accessories

12.2 The solar plant should follow the relevant MNRE guidelines.

12.3 The Contractor shall try to maximise the capacity of the solar plant.

12.4 In case, the capacity of the solar power plant varies from 250 KW, the payment to Contractor shall be adjusted as per the schedule-'H' on prorate basis.

12.5 The solar plant will be installed after creating MS structure at least 2 meter above the terrace level to have maximum installation.

13 List of Specialized Works (Civil)

The following work are the specialized works for which contractor has to associate specialized agencies to execute the work based on eligibility:

(i) Water Proofing.

(ii) Structural Glazing.

(iii) Aluminium work

(iv) Sanitary Installation & Water Supply.

(v) Acoustic Treatment work.

(vi) Wooden Flooring.

(vii) Stone Cladding Work.

(viii) Texture Paint.

(ix) UPVC-Windows.

(x) Fire Checked Doors

(xi) False Ceiling

(xii) Façade Cleaning

(xiii) Expansion Joint

(xiv) Other services as per CPWD works manual declared specialized.

The contractor shall engage specialized agencies or experience firm to execute the work as per requirement of the Authority's Engineer.

14 Site Office

Scope of work includes construction/providing of site office (Pre-fabricated structure or equivalent) with modern outlook for use by Engineer-in-charge and his staff consisting of 3 rooms (total area not less than 100 Sqm with 2 toilet and one conference Room with toilet having area not less than 40 Sqm for NHIDCL officers & staff. The location and plan shall be got approved from Authority's Engineer. Specification for the site office shall be suitable and matching for running an office which shall be got approved from Authority's Engineer. The Contractor shall provide a typical plan of site office & conference room (having light fixtures, wiring &, AC etc.) with specification within 15 days of award of work and shall construct after approval of Authority's Engineer. All running cost & charges shall be borne by the Authority.

15 Change of Scope

All the scope above in this Schedule shall be dealt on prorate basis of Schedule H and Article 13 of DCA if not covered in Schedule H.

SCHEDULE-C: Project Facilities

Nil

SCHEDULE-D: Specifications and Standards

1 Construction

The Contractor shall comply with the Specifications and Standards set forth in Annexures of this Schedule-D for construction of the Bus Port Project.

SN	Items	Annexures
1.	General Guidelines for Design-Civil Works	Annexure-I
2.	Particular Specification and condition for E&M Works	Annexure-II
3.	List of Applicable Codes	Annexure-III
4.	Specifications for Solar Works	Annexure-IV
5.	Landscaping and Horticulture works	Annexure-V
6.	Architectural Finishing Schedule	Annexure-VI
7.	Signage	Annexure-VII
8.	Parking Management and Passenger Information Display System	Annexure-VIII

2 Design Standards

The Bus Port Project including Project Facilities shall conform to design requirements set out in the following documents/ codes:

(i) The CPWD Specifications 2009 Vol. I to II hereinafter referred as CPWD Specifications

(ii) Draft "Guidelines for development of Bus Port" in India enclosed with the bid.

(iii) IRC Manual for Rigid pavement

(iv) Manual of Standards and Specifications for Two Laning of Highways (IRC:SP:73 – 2007) published by the Indian Roads Congress and MORTH Specifications for Road and Bridge Works shall be used.

(v) Code for Practice of Road Signs IRC 67:2001.

(vi) Standard prevailing designs if not covered above.

Annexure -I

(Schedule-D)

General Guidelines for Design - Civil Works

1 General

1.1 The work in general shall be carried out in accordance with the CPWD Specifications 2009 Vol. I to II hereinafter referred as CPWD Specifications.

1.2 For internal roads, Manual of Standards and Specifications for Two Laning of Highways (IRC : SP : 73 – 2007) published by the Indian Roads Congress and MORTH Specifications for Road and Bridge Works shall be used.

1.3 The other codes and standards applicable for the Project are as follows:

(i) Uttarakhand Building Bye laws 2011 including all the amendments thereafter
(ii) Indian Road Congress (IRC) Codes and Standards
(iii) CPWD Specifications 2019 Vol. I to II
(iv) General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) – 2017
(v) CPWD General Specifications for Electrical Works Part I Internal - 2013.
(vi) CPWD General Specifications for Electrical Works Part IV Sub Station – 2013.
(vii) CPWD General Specifications for Electrical Works Part VI Fire Detection and Alarm System – 2018.
(viii) CPWD General Specifications for Electrical Works Part VII D.G. Sets - 2013.
(ix) CPWD General Specifications for Electrical Works Part VIII Gas Based Fire Extinguishing System - 2013
(x) Bureau of Indian Standards (BIS)
(xi) National Building Codes 2016 and revisions. (NBC);
(xii) Local fire regulations
(xiii) MNRE guidelines for rooftop solar power plant
(xiv) Energy Conservation Building Code 2017 and
(xv) Approved zoning plan of the site.

1.4 Where the specification for a work is not given, Good Industry Practice shall be adopted to the satisfaction of the Authority's Engineer.

1.5 The Contractor shall use indigenous products, wherever feasible and shall provide a list of imported products to the Authority with sufficient details.

1.6 Statutory fees required to be deposited by the contractor for processing the case, shall be reimbursed by the department.

1.7 Approvals / NOCs / clearances from local bodies and other statutory authorities shall be responsibility of Contractor for design, execution and operation of the project or part thereof. All statutory fees / charges required for obtaining approvals / NOCs / clearances shall be paid by the Contractor.

1.8 All equipment shall be delivered with

(i) Manufacturer‘s test certificate,
(ii) Manufacturer‘s technical catalogues, and installation / instruction (O&M) manuals.

2 Sound Engineering Practice as per Directions of the Authority‘s Engineer

2.1 Before commencement of any item of work, the contractor shall correlate all the relevant architectural and structural drawings, and specifications etc. and satisfy himself that the information available is complete and unambiguous. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work based on any erroneous and or incomplete information and no claim whatsoever shall be entertained on this account.

2.2 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of the work. All such reference points shall be in relation to the levels and locations, given in the Architectural and plumbing drawings. On completion of work, the Contractor(s) shall submit six prints of ―as built drawings to the Authority‘s Engineer (Hard & soft copy both)

2.3 The Contractor should engage approved, licensed plumbers for the work and get the materials (fixtures/fittings) tested as per Applicable Laws at its own cost.

2.4 The contractor shall give performance test of the entire installation(s) as per the specifications in the presence of the Authority‘s Engineer or his authorized representative before the work is finally accepted and nothing extra what-so-ever shall be payable to the contractor for the test.

2.5 The contractor shall conduct his work, so as to minimize the interfere with or hinder the progress or completion of the work being performed by other contractor(s) or by the Authority‘s Engineer.

2.6 Sample of building materials, fittings and other articles required for execution of work shall be got approved from the Authority‘s Engineer before use in the work. The quality of samples brought by the contractor shall be judged by standards laid down in the relevant CPWD/ BIS specifications. All materials and articles brought by the Contractor to the site for use shall conform to the samples approved by the Authority‘s Engineer which shall be preserved till the completion of the work.

2.7 BIS marked materials except otherwise specified shall be subjected to quality test at the discretion of the besides testing of other materials as per the specifications described for the item/material.

2.8 The contractor shall procure the required materials in advance so that there is sufficient time to testing of the materials and clearance of the same before use in the work. The contractor shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight / dimensions as may be necessary for execution of work.

2.9 Regarding testing of civil & electrical materials, the testing of materials shall be conducted in Govt. Laboratory/ Govt. colleges/ IITs/NITs or from the laboratory approved by Authority's Engineer. The charges of testing of materials in approved laboratory shall be borne by the contractor.

3 Approved Make for Civil Works:

3.1 Specification / brands names of materials to be used as per the scope of work are listed here. The Contractor should also consider the availability of spares parts/components for maintenance purposes while proposing any brand/manufacturer. The materials of any other brand/manufacturer may be proposed for use by the contractor in case the brands specified below are not available in the market and/or contractor intends to use some other brand better than the brands mentioned in this list. The alternate brand can be used only after the approval of Authority's Engineer. The list of approved make for Civil Works is given below:

Structural and Civil

SN	Material	Preferred Makes/ Brands/ Manufacturer
1	Ordinary Portland Cement/ Portland Pozzolana Cement	ACC/ULTRATECH/ AMBUJA/NUVOCO / JKCEMENT
2	White Cement	BIRLACEMENT/J. KWHITE TRAVANCORE
3	Reinforcement Steel	SAIL/ TATA STEEL LTD./ RINL/JINDAL STEEL & POWER LTD / JSW / OR AS APPROVED BY THE AUTHORITY'S ENGINEER FROM TIME TO TIME AS PRIMARY PRODUCER
4	Parallel Threaded Couplers	DEXTRA / G-TECH
5	Re-barring Chemical	HILTI / 3M INDIA
6	Structural Steel	TATA/ JSW STEEL LTD/ SAIL/ JINDAL STEEL & POWER LTD./ RINL
7	Plasticizer, Super Plasticizer Admixtures, Other construction chemicals	M.C. BAUCHEMIE / FOSROC /SIKA BASF
8	AAC Block	AEROCON/BILTECH/JKLaxmi/ MAGICRETE
9	AAC Block Adhesive	ULTRATECH / FERROUS CRETE / BAL ENDURA / AEROCON / J K Laxmi
10	Polymer modified grout cementitious	BAL ENDURA/ WEBBER/ MYK LATICRETE
11	List of RMC producers	ULTRATECH/ NUVOCO / ACC / READY MIX INDIA PVT. LTD OR as Approved by the Authority's Engineer from time to time
12	Curing Compound	FOSROC / SIKA / PIDILITE / STP / CICO / BASF
13	Expansion Joint- modular	HERCULES / Z-Tech / SANFIELD
WATERPOOFING		
1	Waterproofing Self Adhesive (HDPE)Membrane	GRACE / FOSROC / MYK SCHOMBURG

SN	Material	Preferred Makes/ Brands/ Manufacturer
2	Single Component Liquid PU Elastomeric Membrane (spray applied) for Deck Waterproofing	BASF/SIKA/FOSROC/MYK SCHOMBURG/GRACE
3	Waterproofing Compound (Crystalline) and Swellable Bar	XYPEX / KRYTON / PENETRON / BASF / SIKA / FOSROC / MYK SCHOMBURG / GRACE
4	Polymeric Cementitious Coating	BASF / FOSROC / GRACE / STP / PIDILITE
5	Elastomeric Acrylic UV resistant liquid applied coating	BASF/ FOSROC / SIKA / GRACE
DOOR, WINDOWS & WOODWORK		
1	Laminated Particle Board / Particle board / Laminates / Plywood	MERINO / GREENLAM / CENTURY / DECOLAM/ NOVAPAN / ARCHIDPLY / KITLAM
2	Veneered Particle Board	MERINO/DURO/GREENLAM/KITPLY
3	SS Mesh	GKD / WMW
4	Flush door shutters	GREENPLY/ ARCHIDPLY / DURO / MERINO / KUTTY / JAYNA / CENTURY / KITPLY
5	Glass wool Insulation	UP TWIGA / POLY GLASS / LLOYDS/ OWENSCORNING
6	Rock Wool Insulation	LLOYDS / ROXUL ROCKWOOL
7	Polycarbonate Sheet	GE LEXAN / DANPALON/ GALLINA
8	Decking Steel sheet	TATA STEEL / LLOYDS / JSW
9	Natural wood veneer	SONEAR / GREEN PLY / TRUWOOD / ARCHID
10	Anti-static high-pressure laminate	FORMICA/BAKELITEHYLAM/DECOLAM MERINO /KITMICA
11	Fire Sealant	HILTI / 3M INDIA / FISCHER
12	Extruded Polystyrene Board	STP / SUPREME / OWNESCORNING, SHALIMAR
13	Wooden / Metal / Glaze-fire rated Door Shutters & Acoustic	NAVAIR / KUTTY / GODREJ/ SUKRI / SHAKTIMET
14	UPVC Doors & Windows	ALUPLAST/ENCRAFT/REHAU/FENESTA / LG-HAUSYS
15	Fire rated glass (2 hours fire rating)	GLAVERBEL/SAINTGOBAIN/ PILKINGTON/PYROGUARD/SCHOTT
FINISHING		
1	Melamine Polish	ASIAN PAINTS/ PIDILITE INDUSTRIES/ DULUX/ BERGER/
2	Polyester Powder Coating Shades	NEROLAC / BERGER / AKZONOBEL
3	Wall Putty	BIRLA WHITE / JK WHITE / FERROUSCRETE / BERGER / SAINT GOBAIN
4	Oil Bound Washable Distemper	ASIAN PAINTS / BERGER / NEROLAC / ICI / AKZONOBEL DULUX
5	Acrylic Distemper	BERGER / ASIAN / DULUX / NEROLAC
6	Cement Primer	BP WHITE (BERGER) / DECOPRIME WT (ASIAN) / NEROLAC / AKZONOBEL (DULUX)

SN	Material	Preferred Makes/ Brands/ Manufacturer
7	Steel / Wood Primer	AKZONOBEL (DULUX) / NEROLAC / BERGER / ASIAN PAINT / JENSON & NICHOLSON
8	Adhesives	ANCHOR/DUNLOP/PIDILITE- FEVICOL
9	Premium Acrylic Emulsion paints	DULUX AKZONOBEL / NEROLAC / ASIAN PAINTS / BERGER
10	Textured Exterior Finish	ASIAN (ULTIMA) / BERGER (WEATHER COAT ALL GUARD) / DULUX AKZONOBEL (ULTRA CLEAN) / NEROLAC (EXCEL TOTAL)
11	Synthetic Enamel Paint	ASIAN/BERGER/NEROLAC/ AKZONOBEL(DULUX)
12	Epoxy Paint	AKZONOBEL (DULUX) / NEROLAC / ASIAN PAINTS / FOSROC / BERGER
13	Fire Paint	ASIANPAINT/BERGERPAINTS/ SHALIMAR / JOTUN / AKZONOBEL
14	Gypsum Plaster	FERROUSCRETE/ ULTRATECH / INDIA GYPSUM / ELITE (90) OF GYPROC
15	Cement based Ready Mix Plaster	FERROUSCRETE / ULTRATECH / SAINT GOBAIN
16	Pre-Cast GRC Jali	UNISTONE / KERAKROME GRC
17	Polysulphide sealant	FOSROC / SIKA / TUFFSEAL / PIDILITE / WACKER/ DOW CORNING / GE/ STP
18	Silicone / Weather Sealant	WACKER / DOW CORNING / GE
STEEL & ALUMINIUM WORKS		
1	Stainless Steel	SALEM STEEL / JINDAL ALLOYS / SAIL
2	Welding Electrodes	ADVANI-OERLIKON / MODI
3	Dash / Anchoring Fasteners	HILTI / FISHER / BOSCH / AXEL
4	AnodisedAluminiumHardware (HeavyDuty)	HARDIMA/ALUALPHA/PULSE OF LGF SYSMAC / HINDALCO /EVERITE
5	Aluminium Structural Members – Windows, Glazing and Partitions	JINDAL/HINDALCO/NALCO/ INDALCO
6	Stainless Steel Railing, Accessories etc (Grade SS 316)	OZONE / GEZE / KICH / DORMA / JINDAL STAINLESS STEEL
7	G. I Steel door frame	SYNERGYTHRISLINGTON/ SHAKTIMET /NAVAIR
CEILINGS		
1	False ceiling Grid system	GYPROC/GRIDLINE/RK/ GRIDSYSTEM
2	False Ceiling – Gypsum	SAINT GOBAIN GYPROC / AMF / BORAL / LAFARGE / INDIA GYPSUM / HUNTER DOUGLAS
3	Metallic False Ceiling	ARMSTRONG / DURLUM / HUNTER DOUGLAS / SAINT GOBAIN
4	Acoustical Tile False ceiling	ARMSTRONG/SAINTGOBAIN/ ECOPHON/ DEXUNE/ANUTONE

SN	Material	Preferred Makes/ Brands/ Manufacturer
5	Calcium silicate ceiling tiles/ Board	GYPROC / AEROLITE / BORAL / HILUX / ARMSTRONG(MYLAR) / EVEREST/ NCL
6	Aluminium Composite Panel	ALUCOBOND / ALPOLIC / ALUDECOR / REYNOBOND
7	Acrylic Solid Surfaces	HANEX / L.G-HIMAC / DUPONT
FLOORINGS/ WALL TILES		
1	Glass Mosaic Tiles	BISAZZA, MRIDUL, OPIO, PALLADIO, ITALIA GLASS
2	Floor & Wall Tiles: Ceramic / Vitrified tiles / Antiskid / Matt / Glazed	KAJARIA / H&R JOHNSON / SOMANY/ ASIAN(AGL) / ORIENTBELL / VARMORA
3	PVC Flooring	ARMSTRONG / TARKETT / LG HAUSYS
4	Laminated flooring	ACTION / TESA / PERGO
5	Engineered stone - Marble / Quartz	ASIAN/JOHNSON/KALINGA/QUTONE
6	Chequered Tiles, Paver Block & Kerb Stone (of Non-Recycled C&D Waste)	OVILITE / UNISTONE / HINDUSTAN / KK / ULTRA / DALAL TILES/ NITCO
7	Tile / Stone Adhesive / Tile Grout	PIDILITE/FERROUSCRETE/ BALLENDURA / MYKLATICRETE
8	Floor hardener	PIDITOP 333 BY PIDILITE / FOSROC / SIKA / IRONITE / FERROK / HARDONITE
9	Epoxy Flooring	FOSROC / SIKA / CICO / LATICRETE / BASF
10	Heat Resistant Tiles	THERMATEK/ NATIONAL/ THERMAX
11	Floor Trap	JAYNA / CHILLI / NIRALI
GLAZINGS		
1	Glazing Structural / Suspended / Skylight/ clear/ float/ frosted/ mirror	SAINTGOBAIN/PILKINGTON/ GLAVERBELL
2	Clear / Float / Frosted Glass /Mirror	AIS / GLAVERBELL / MODIGUARD / PILKINGTON / SAINT GOBAIN/ ATUL
3	Glass Spider Fittings	DORMA / HAFELE / OZONE
4	Toughened Glass / Hermetically sealed performance glass	SAINT GOBAIN / GUARDIAN GLASS / PILKINGTON / MODIGUARD
HARDWARE		
1	Nuts / Bolts & Screws	GKW / HILTI / ATUL
2	Clampsystemfordrystone cladding	HILTI / FISCHER / BOSCH / AXEL
3	Hinges & Brassware	EARL BIHARI / KICH / INDO-BRASS / ASSA-ABLOY/ HAFELE/ GEZE/DORMA
4	MDF Board	NUWOOD/ DURATUFF
5	Vitreous Chinaware	HINDWARE/JOHNSON/CERA/ PARRYWARE

SN	Material	Preferred Makes/ Brands/ Manufacturer
6	All type of hardware and fitting for all type of glazing / doors/ windows etc. including mortise latch & lock, tower bolt, ball bearing butt hinges, friction stay hinges, sliding door bolts, lever handle, magic eye door closer etc.	DORMA / KICH / HAFELE / GEZE / GODREJ / ASSA-ABLOY / HARDWYN / IPSA / DORSET / INGERSOLL RAND / OZONE / HETTICH / EVERITE / LGF SYSMAC
7	Toilet Cubicles	MERINO / GREENLAM / DORMA
8	Hardware for Fire Check Door/ panic bar/ panic trim/ door closer/ hinges/ mortise lock	INGERSOLL RAND / DORMA / GEZE / HAFELE / ASSA-ABLOY / KICH
9	EPDM Gasket	HANU / ANAND / OSAKA
Plumbing & Sanitary		
1	GI Pipes	JINDAL(HISAR)/TATA/SURYA PRAKASH
2	GI Fittings	UNIK / ZOLOTO / SURYA
3	SS Pipes & fittings	JINDAL / VIEGA / J-PRESS
4	HDPE Pipes	RELIANCE / JAIN IRRIGATION / KISAN/ ORIPLAST / SUPREME
5	DI Pipes	ELECTROSTEEL (VEDANTA) / JINDAL / TATA DUCTURA
6	DI Fittings	ELECTROSTEEL(VEDANTA)/KALINGA / TATADUCTURA
7	CI Double flanged sluice valve	KIRLOSKAR / SONDHI / KEJRIWAL
8	Float Valve	LEADER / ZOLOTO / KSB
9	Centrifugally Cast (Spun) Iron Pipes &Fittings	JAYSWAL NECO / RIF / SKF
10	Centrifugally Cast (Spun) Iron (Class LA)Pipes	JAYSWAL NECO / ELECTRO STEEL / TATA
11	CI Manhole covers, Frames & GI Gratings	JAYASAWAL NECO / RIF / SKF
12	SFRC Manhole Covers & Gratings	KK / OCR / PARGATI / T-CON
13	Stoneware Pipes and Gully Traps	PERFECT / PARRY / BURN / ANAND / RK / HIND
14	RCC Manhole covers & Frames	KK MANHOLE / GRATING CO. (P) LTD
15	Gun Metal Valves, Globes	ZOLOTO / CASTLE / KARTAR
16	Sanitary CP Fittings & Accessories	ORIENTALSERIES‖ofMARCorequivalent series of: JAQUAR / PARRYWARE / GROHE / KOHLER / CERA / JOHNSON
17	Water Meter	PRIMA / ZOLOTO / LEADER / CAPSTAN
18	Brass Stop & Bib Cock	ZOLOTO / SANT / L&K / LEADER / ASTRAL
19	UPVC/ CPVC Pipe & Fittings	AKG / ASTRAL/ SUPREME / FINOLEX /

SN	Material	Preferred Makes/ Brands/ Manufacturer
20	Non-Return Valve (Check valve) and other kind of Valves	ZOLOTO / SANT / LEADER
21	Brass Ferrules	DHAWAN SANITARY UDYOG / KALSI / ANNAPURNA
22	Insulation for hot water pipes	KAIFLEX / ARMAFLEX / CAREFLEX / LLOYD
23	Insulation for external / exposed hot water pipes	KAIFLEX / ARMAFLEX / CAREFLEX
24	Pipe protection for external water supply pipes	PYPKOTE/ARMAFLEX/MAKPOLYKOTE
25	Stainless Steel Sink	NEELKANTH / NIRALI / CERA / JAYNA
26	RCC Pipes	LAKSHMI / SOOD & SOOD / JAIN &CO./ PRAGATI CONCRETE
27	Dash/ Stud/ Anchor Fasteners	HILTI / CANON / BOSCH / FISCHER
Electrical works		
1	FRLS PVC insulated copper wire /Telephone cable / copper conductorcontrol cable	L&T / Havells / Polycab/ Finolex /RR
2	HT/LT XLPE aluminum cable	Havells/ Polycab/ KEI/ RR
3	Co-axial TV cable	L&T/ Havells / Polycab/ Finolex
4	Steel Conduit	RM CON/ AKG / BEC ISI Marked
5	Conduit fittings	ISI marked
6	PVC Conduit	AKG / Polycab / Prince / Norpak (ISIMarked)
7	L. T. Panel / Meter Board	AdlecMundka/ Control and Switchgears Pvt. Ltd/ Tricolite / SPC Electrotech Ltd/ Ambit Switchgear Pvt Ltd/ Neptune India/Milestone
8	MCB/MCB DB and sheet steel Metalenclosed industrial socket, plug top and Isolators	Legrand/ Siemens/ L&T/ ABB / Schneider
9	Modular type switch/Socket, Telephonesocket, cable TV Antena socket, Electronic fan regulator and GIBoxes	Legrand (Myrius/ Havells (Piccadilly)/ Honeywell (citric) / North West(nova)
10	LED fitting	Philips/ Crompton/ Wipro/ GE/ Zumpobel /Trilux
11	Tube / Vane Axial Flow Fan	Kruger/ Nicotra/ Greenheck/ Airflow/Humidin/ Flaktwood
12	Ceiling Fan / Exhaust fan (BEE-5 Star)	Crompton Greaves/ Usha/ GEC/ Orient
13	Octagonal steel pole	Bajaj/ Valmont/ Utkarsh
14	Conical / Decorative Poles / Bollards	Bajaj/ Philips / Wipro /Valmont/ Utkarsh
15	Air Circuit Breaker	L&T-U Power/ Siemens-3WL/ ABB-Emax/Schneider-Master pact-NW
16	MCCB	L&T- Dsine/ Schneider- Compact NSX/ABB- Tmax/ Legrand- DPX3/ Siemens

SN	Material	Preferred Makes/ Brands/ Manufacturer
17	Digital Voltmeter/ Ammeter/ Multi-function meter	Schenider- conzerv/ Ducati/ Secure/AE
18	Capacitor	Epcos / L&T/ Schneider/ Siemens /Crompton Greaves.
19	APFC Relay	Epcos/ L&T/ Siemens/ Schneider/ Enercon
20	Power Contactor – AC 3 rating / capacitor duty contactor/ starter / Thyrister module /Harmonic reactors.	Siemens/ L&T/ ABB/ Schneider
21	11 KV HT(VCB) panel OEM	Siemens/ Schneider/ ABB/ CromptonGreaves
22	Distribution Transformer (dry type castresin type)	Crompton Greaves/ ABB/ Schneider/Siemens/ Bharat-Bijlee
23	Distribution transformer (oil type) is-1180, part2	Crompton Greaves/ ABB/ Schneider/Siemens/ Bharat-Bijlee
24	Package Type Substation	ABB/ Schneider/ Crompton Greaves
25	Solar street light fitting	Philips/ Bajaj/ Wipro/ Crompton Greaves
26	Rising mains / bus duct	Legrand/ Schneider/ C&S/ GE
27	Fire Extinguishers	Safex/ Minimex / Superex / Ceasfire
28	Diesel operated Power Generating Engine	Cummins India/ Caterpillar- Perkins
29	AMF Panel	OEM/ OEA of DG Set
30	Alternator	Stamford/ Leroy Somer/ Caterpillar
31	HDPE / DWC pipe	AKG/ Duraline / Rex
32	GI / M. S. Pipe	Jindal (Hissar) / TATA / BST
33	Standard M.S. Fittings & GI fittings	Jainsons Industries / INDUS
34	Ball Valve / Sluice Valve / Check Valve /Pot /Y Strainer / Butterfly Valve	Audco / Kirloskar/ Zoloto/ Advance
35	Pressure Switch	System Sensor / Indfoss / Denfoss
36	LIFTS	M/sOTIS M/sKone M/s Mitsubishi M/s Schindler M/s Johnson Lifts Pvt. Ltd. Chennai The contractor has to give at least three options out of the make mentioned above for lift and the department will be free to select any one of them.
37	BMS Operator Work Station	HP/ Dell / Lenovo /Acer
38	BMS Controller and Power Supply /Software	Siemens / Honeywell EBI / Sauter / TAC(Schneider) / ALC
39	BMS Controller Housing	Enclotek / Rittal
40	Temperature Sensor & Humidity Sensor /Enthalpy Sensor / Lux Sensor / COSensor	Siemens / Invensys / Honeywell / Sontay /Greystone / Sauter / Kele / TAC

SN	Material	Preferred Makes/ Brands/ Manufacturer
41	Pressure Transmitters / Air Velocity Meter	Siemens/ Invensys/ Kele/ Honeywell /Sontay/ Greystone/ Sauter/ TAC
42	Flow Meter	Forbes Marshal/ Kele/ Sontay/ Greystone/Siemens/ TAC/ Honeywell/ Schenitech
43	Differential Pressure Switch	Siemens / Invensys / Honeywell / Sontay /Greystone / Kele / Sauter
44	Ph Sensor / Conductivity / TDS	Forbes Marshal / Endres Hauser / Kele /Sontay / Greystone
45	Flow Switch / Level Switch / LevelIndicator	Siemens / Elektronik / Invensys / Honeywell/ Sontay / Greystone / TAC
46	Current Transducer / Voltage Transducer /Power Factor Transducer / Frequency Transducer	ABB / Southem Transducer / Veris / SETO / Sontay / Greystone
47	Personal Computer	Dell / IBM / HP / Compaq
48	Laser jet Printer	HP / Canon
49	Fire / Sprinkler Main Pump / JockeyPump	Mather & Platt India Limited / Grundfos /Kirloskar / KSB
50	Diesel Engine	Cummins / Kirloskar / Catepillar
51	Motor	ABB/ Siemens/ Kirloskar / CromptonGreaves
52	Anti-Vibration Mounting	Kanwal Industrial Corporation/ Resistoflex /Ewren
53	Starter	L&T/ Siemens / Crompton/ GE / ABB /BCH
54	Current Transformer (Cast Resin)	AE/ L&T/ Kappa
55	Anti-Vibration Pad	Cori/ Dunlop / Diamond Pipe Support/ EasyflexFlexionics / Resistoflex / Emerald
56	Factory fabricated duct	Waves/ Zeco /Ductofab/ GP Spira
57	Perforated with powder coating M.S. /Hot dipped G.I. cable trays	Vinous/ Indiana/ steelway / Slotco / Pilco
58	Addressable Multicriteria Smoke Detectors With base / Addressable Duct Type Smoke Detectors With base/ Fault Isolator with base/ Addressable Heat Detectors with base/ Addressable Manual Call points / Addressable Control Module/ Addressable Monitor Module / Sounder/ Hooter cum Strobe/ Fire Alarm Control Panel/ PA System Panel/ Telephone Jack / Hand Set/ Software/ Speaker	Notifier / Siemens / Bosch / Edward.
59	Conventional Fire Detection and Alarm SystemDetector PanelsManual Call Points Hooters	Daksh/Agni/ System Sensor/ Ravel

SN	Material	Preferred Makes/ Brands/ Manufacturer
60	Fire Survival Cable	Fusion Polymer/ Havells/ Bonton/ Rallison/Batra Henlay
61	Thermo plastic (Textilereinforced) Hose Reel ISI Mark	Mitra/ Kesra / Padmini
62	Stainless Steel Brach Pipe	Safex/ Padmini / GETech / New Age
63	Fireman Axe/ Installation Control Valve	Safex/ Padmini / GeTech
64	2-way/4-way FBC	Safex/ NewAge (Mumbai) / GeTech
65	Sprinkler Heads	Tyco/ HD/ omax UL listed
66	Pipe Protection Pypcoat (AW4) Wrapping	IWL/Taxa/ Mac- poly coat
67	Rubber Bellow	Kanwal Industrial Corporation / Resistroflex/ AIP Valves
68	Window Sprinkler	Tyco / HD
69	Deluge Valve	Safex/ Tyco / HD
70	Air release valve	Superex/ GeTech / NewAge / Safex
71	Welding Rods	Ador/ Esab / Essar/ Advani
72	Fastner	Hilti/ Fisher
73	Hose Box(External) (GI Powder Coated)	SPC Electrotech Ltd/ AdlecMundka/Ambit Switchgear Pvt Ltd/ Milestone/ Tricolite
74	Flexible Drop (UL Approved)	Safex / HD / Kofulso (Easy flex)
75	Galvanized Sheet Steel	Tata/ Jindal/ Sail
76	IP Based CCTV system CCTV CamerasBullet, Dome, PTZ Camera Network Video Recorder	Honeywell/ Panasonic /Sony
77	LED TV	Sony/ Panasonic/ Samsung
78	Data Networking System Information Outlet (I/O)Patch Panel, Patch Cords SFP	Legrand/ Molex/ Amp
79	Cat-6 /6A Cable	Legrand/ D-link / Ploycab
80	Managed Switch for Data Network,CCTV system	Cisco/ Hewlett Packard
81	Data Racks	i Ball/ D-link/ President/ Legrand
82	EPABX	Panasonic/ Alcatel/ Sansung
83	Telephone Handsets	Beetel/ Binatone/ Panasonic
84	MDF and Telephone Tag Blocks	Krone
85	Boom Barriers	Kaba/ Magnetic/ SEAA/ Makim/ FAAC
86	Solar PV Modules	Vikram/ Tata Solar/ Waaree/ Enkay Solar
87	Inverter (for solar power system)	Kaco/ Delta/ Schneider / SMA
88	Cables for solar power (XLPO/XLPE)	Lapp/ Havells/ Universal/ Polycab
89	String Combiner Box	Hensel/ Schneider
90	0.2 Class ABT Compliant Net Meter	Secure/ L&T/ Schneider

SN	Material	Preferred Makes/ Brands/ Manufacturer
91	Weather Monitoring Station	SMA/ ABB
HVAC		
1	Chilled Water Machine	Daikin / Carrier/ York /Dunham Bush
2	Pumps (primary, secondary&Condenser)	Armstrong / Grundfos / ITT/Willo
3	Cooling Tower	Nihon Spindle/ Baltimore / Evapco/PAHARPUR
4	Air Handling Unit (AHU)	VTS / System Air / Flaktwood/ZECO
5	Cooling Coil	VTS / System Air / Flaktwood/ZECO
6	Hydronic cassette unit	Carrier/ Bhutoria / Midea
7	UVGI system	Ruks / Trimed / Rydair
8	EC Fan &Plug Fan for AHU	System Air / VTS / Kruger/NIKOTRA
9	Air filter	Mechmaark / Pyramid / Thermodyne
10	Electrostatic Filter	Cleair / Kleanwaves / ZecoPureair/HONEYWELL
11	Variable Frequency Drive (VFD)	Danfoss / Siemens / LG/ABB
12	Exhaust Fan Section	Kruger / System Air / Greenheck
13	Ventilation Fan (Centrifugal / Axial)	Kruger / System Air / Greenheck
14	Inline Fan	Sphere / Kruger / Pineair
15	Propeller Fan	Marathon / Khaitan / GEC
16	MS Pipe	TATA / SAIL / Jindal (Hissar)
17	GI Pipe	TATA / SAIL / Jindal (Hissar)
18	PUF Pipe Support	Malanpur / Lloyd / Best Puf
19	Pressurized Expansion Tank & Air Separator	Grundfos / ITT /Anergy/EMRAID
20	Butterfly Valve	Advance / Audco/ Honeywell
21	Balancing Valve	Advance / Audco/ Honeywell/ Castle
22	Check Valve	Advance / Audco/ Honeywell
23	Y – Strainer	Rapidcool / Emerald /Castle/
24	Pot Strainer	Sant / Rapidcool / Emerald/
25	PIBC Control Valve with Actuator, Motor & Thermostat	Danfoss / Siemens / Oventrop/ Honey well
26	Motorized Butterfly Valve	Advance / Danfoss / Zoloto
27	Ball valve with & without strainer	Audco / Castle / Betaflo/ Honeywell
28	Thermometer / Pressure Gauge	Emerald / H-Guru / Anergy
29	Test Point	Anergy / Rapidcool / Emerald
30	Flow Switch	Siemens / Anergy / Honeywell
31	Flexible Pipe Connection	Resitoflex / Dunlop / Easyflex
32	Auto Air Vent with Stop Valve	Anergy / Rapidcool / Emerald
33	Factory Fabricated Duct	ZecoAircon / Ductofab / Rolastar
34	Flexible Duct	Sphere / ATCO / U.P.Twiga
35	G.I. Sheet	Jindal / TATA / Nippon / SAIL
36	Demand Ventilation Equipment	Conaire / Greenheck / Cynor
37	CO Sensor / CO_2 Sensor	Gas Alarm / Honeywell / Seimens / MSR

SN	Material	Preferred Makes/ Brands/ Manufacturer
38	Modulating Motor / Valve	Danfoss / Honeywell / Siemens / Oventrop
39	Fire Damper	System Air / Ruskin / Trox
40	Volume Control Damper, Fresh / Exhaust air louver	Pineair / System Air / Conaire/ Caryaire
41	Grilles/ Diffusers	Pineair / Conaire / Servex / Caryaire
42	Actuator for Fire Damper	Siemens / Honeywell / Danfoss
43	Nitrile rubber insulation	Armacell / Aflex / Supreme
44	Acoustic Insulation for Duct	UP Twiga/Owens conning
45	Fastener	Hilti /Wurth / Fisher
46	Electrical Panel	Tricolite / / Adlec/ KEPL/ System Power Control/ SPC Electrotech/
47	Motor for AHU Fan	Siemens / ABB / Crompton
48	Motor for Ventilation Fan	Siemens / ABB / Crompton
49	Starter	Siemens / Schneider
50	Single Phase Preventer	Minilec / EAP, Bangalore
51	Current Transformer (Cast Resin)	AE / L&T / Kappa
52	Switch / Fuse Unit / HRC Fuse	L&T / Siemens / ABB
53	MCCB	ABB(T-Max) / Siemens (Sentron-VL) / Merlin Gerin (Compact) / L&T (DNX Series) / Legrand (DPX)
54	MCB	Legrand (Lexic) / L&T (Hager) / Siemens (Betagard) / Schneider (Multi9) / ABB (S 270)
55	ACB (with microprocessor release)	Schneider-MVS / Siemens-3WL / L&T-U-power Omega / ABB-Emax
56	Ammeter / Voltmeter (Digital Type)	AE / L&T / Crompton Greaves/Siemens/Conserve
57	LED Indicating Lamp / Push Button	Siemens / GE power / ABB / L&T / Schneider Electric
58	Selector Switch	AE / L&T / Kaycee
59	Relay / Timer / Contactor/Starter/ Push Button	Siemens / L&T / Schneider Electric / ABB / BIL
60	Power Cable /CONTROL CABLE	Worldcab / Skytone / Polycab/ RR Kabel/ RHINO
61	Termination Kit	Raychem / Densons / Xicon / ABB
62	Perforated Cable Tray	B.E.C. / Apex / Indiana/ Steelway / OBO
63	Cable Gland	Commet / Gripwel / Dowell / Raychem
64	Solder less Lug	Dowell / Schneider Electric / Jainsons, Mumbai
65	Hot Water Generator	Rapidcool/ Emrald / KEPL
SOLAR EQUIPMENT		
1	SPV Modules	Schneider/ Moser Baer/ Tata/ BPSolar CEL/ BEL/ Reliance/ GE Solar/ Sanyo PCI/ PANASONIC
2	Power Control Unit(PCU)String PCU	EMERSON/ MITSHUBISHI/ SCHNEIDER/ DELTA
MEDIUM VOLTAGE EQUIPMENT		
1	Power Distribution Panel	As mentioned in the sub-station sub head

SN	Material	Preferred Makes/ Brands/ Manufacturer
2	Moulded Case Circuit Breaker (MCCB) 3&4 Pole With rotary operating mechanism	Schneider Electric (Compact NX) ABB (T-Max)/ Larsen & Toubro (D-Sine) Siemens (Sentron-VL)/ GE Power Controls (Record Plus)
3	Miniature Circuit Breaker (MCB)	Schneider Electric (MG)-Multi-9 ABB GE Power Controls/ Hager (L& T) Legrand Siemen
4	Residual Circuit Breaker (RCCB/ RCBO's)	Schneider Electric (MG)-Multi-9 ABB/ GE Power Controls Hager (L& T) Legrand/ Seimens
5	Lamps LED type,Push Button	Vaishno Electricals/ Larsen & Toubro (Esbee)/ Siemens/ Schneider Electri(MG)
6	Power/ Aux. Contractor 3 /4 Pole	Schneider Electric(Telemechanique)/ ABB/ GE Power Controls/ Larsen & Toubro/ Siemens
7	Lamps LED type,Push Button	Schneider Electric(MG)/ Vaishno Electricals/ Larsen & Toubro (ESBEE)/ Siemens
8	Electronic Digital Meters (A/V/PF/HZ/KW/KWII) Conzerv (Networkable) L &T	Schneider Electric Secure
9	XLPE insulated PVC sheathed copper conductor Armoured power cable of 1.1KVgrade Polycab	KEI/ HAVELLS/ GRANDLEY
10	LT JointingKit/Termination	Raychem MSeal
11	Cable Glands Double Compression with Earthing Links	Comet, Cosmos
12	Bimetallic/ Copper/ AluminiumCable Lug	Comet/ Dowell's (Biller India Pvt. Ltd.)/ Hax Brass (Copper Alloy India Ltd.)
13	PVC insulated copper conductor stranded flexible Finoles FRLS wire (Pretwisted) KEI	Polycab
14	Polycarbonate Junction Boxes	Hensel/ Clipsal/ Sintex
15	Selector Switch, Toggle Switch	Salzer (L & T)/ Siemens/ Kaycee
16	Timer	Siemens/ L & T/ Schneider Electric-TE
17	Material for Structure	TATA/JINDAL/SAIL
MISCELLANEOUS		
1	Irrigation Equipment	JAIN IRRIGATION, KISAN, FINOLEX, PLASSON
2	PVC water tank	SINTEX / POLYCON

3.2 Only material bearing ISI/BIS certifications ECBC/BEE mark shall be used in the work. Where articles of different designs/ makes bearing ISI/BIS certifications are available.

3.3 Where material bearing ISI/BIS certifications marks are not available, material conforming to relevant BIS/ISI shall be used with prior approval of Authority's Engineer. The decision of Authority's Engineer about the design/ make to be used in the work shall be final & binding on the contractor.

3.4 If the specifications of any item are not available, then the decision of the Authority's Engineer regarding quality shall be final & binding on the contractor.

3.5 All materials to be used at site shall be got approved from Authority‘s Engineer before using at site.

Annexure -II

(Schedule-D)

Particular Specification and Condition for E&M Works

1 Scope

The equipment and work shall be confirm to

(i) CPWD General Specifications for Heating, Ventilation & Air Conditioning Works 2017;

(ii) CPWD General Specifications for Electrical Works (Part I – Internal) 2013;

(iii) CPWD General Specifications for Electrical Works (Part II – External) 1994;

(iv) CPWD General Specifications for Electrical Works (Part-IV Sub-Station) 2013;

(v) CPWD General Specifications forElectrical Works (Part-III-LITS & Escalators) - 2003;

(vi) CPWD General Specification for Electrical Works- Part – V (Wet Riser and Sprinkler System) 2006;

(vii) CPWD GeneralSpecificationsforElectricalWorksPartVIFireDetectionandAlarmSystem – 2018;

(viii) Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice- IS 2189-2008;

(ix) All amended up to last date of submission of tender, relevant IE rules, relevant IS and as per directions of Authority's Engineer.

(x) All the materials used in the work as far as applicable shall comply with the relevant Indian Standard Specifications with all upto date amendments.

(xi) The contractor shall produce test certificates for their conforming to relevant I.S. specifications.

(xii) The materials having I.S.I. mark shall have precedence over the ones conforming to I.S. specifications.

2 Climatic Conditions

The equipment supplied shall be suitable for satisfactory performance on its rated capacity at

all weather conditions i.e. summer, monsoon and winter of Bus port site.

3 Sub Work - Internal & External Electrical Installation of E&M Works

The work shall be carried out in accordance with tender specifications and the following specifications / rules:

(i) CPWD General Specifications for Electrical work Part I Internal - 2013, as amended up to date.

(ii) CPWD General Specifications for Electrical work Part II External - 1994, as amended up to date.

(iii) The Indian Electricity Act, 2003.

(iv) National Electrical Code.

(v) Indian Electricity Rules 1956 amended up to date.

3.1 General

The specifications given below pertain to the internal and external electrical installation work to be carried out in the proposed Bus Port.

3.2 Wiring

(i) The wires used for the point wiring and power wiring shall be of 650 / 1100 Volts grade FRLS PVC insulated multi stranded copper conductor single core confirming to IS:694:1990.

(ii) All mounting boxes for plate type accessories shall be of metallic construction and of the same make as that of the plate type switches and accessories.

(iii) The connections, inter-connections, earthing and inter earthing shall be done by the contractor wherever required for energizing of the installation and nothing extra shall be paid on this account.

(iv) The rupturing capacity of the MCB‟s shall be 10 KA. The MCB‟s shall be ISI marked.

(v) The make of MCB, RCCB etc. shall be the same as that of MCB DB.

(vi) Three phase MCB DBs shall be provided with three independent neutral bars for per phase isolation in addition to main neutral link if provided in schedule of quantity.

(vii) Number of inspection boxes for conduit should be barest minimum, rather these

should be avoided.

(viii) Cutting of brick walls shall be with chase cutting machine only. All repairs and patch works shall be neatly carried out to match the original finish and to the entire satisfaction of the Engineer in Charge.

(ix) All the sub main and circuit wiring includes loose wire for connections inside switch boxes and MCB DB s. No payment for these loose wires shall be made.

(x) The connection between incoming switch / isolator and bus bar shall be made with suitable size of thimble and cable at no extra cost.

(xi) Copper conductor of insulated cables of size 1.5 Sq.mm and above shall be stranded and terminals provided with crimped lugs.

(xii) All hardware items such as screws, thimbles, GI wire etc. which are essentially required for completing an item as per specifications will be deemed to be included in the item even when the same have not been specifically mentioned.

(xiii) All hardware items such as nuts/ bolts/ screws/ washers etc. to be used in work shall be aluminum alloy / cadmium plated iron.

(xiv) Any conduit which is not be wired by the contractor shall be provided with GI fish wire for wiring by some other agency subsequently. Nothing extra shall be paid for the same.

(xv) The make of the materials have been indicated in the list of acceptable makes. Alternate makes are not acceptable. The materials to be used in the work shall be got approved by the Engineer in Charge / his representative before its use at site. The E-in-C shall reserve the right to instruct the contractor to remove the material which, in his opinion, is not acceptable.

(xvi) Modular boxes, switches, sockets, regulators etc. shall be of only one make.

(xvii) Wherever light fittings are proposed to be provided on the false ceiling, the respective light / fan point wiring will have to be brought up to the terminal of the light fittings / fans by the contractor. Flexible conduits shall be used for drawing wires from MS conduits on ceiling to fittings on false ceiling and nothing extra shall be paid to the contractor for the same.

(xviii) G.I. pipes shall be medium class as per ISI specification and shall be of single piece without any joints.

(xix) All the light and fans points should be properly earthed with 1.5 sq mm, FRLS PVC insulated copper wire.

(xx) Termination of wiring inside the DB's and main board should be done by crimped Copper lugs connections, for which no extra payment will be made.

(xxi) All metallic parts must be properly bonded to the earth. Earthing lugs shall be provided to all copper earth wires and shall be fixed whenever required by means of anodized bolts and nuts.

3.3 Surge Protection Devices

(i) SPDs (Surge Protection Devices) shall be of Type II for Panels as specified in and BOQ.

(ii) SPDs shall be suitable for TT, TNC, TNS or TNC-S earthing systems.

(iii) SPDs shall provide protection between line to earth (common mode), neutral to earth (common mode) and line to neutral (differential mode).

(iv) SPDs shall be of the "withdraw able cartridge" type. The base of the SPDs shall be able to accept cartridges of different discharge ratings of Imax

(v) Optional auxiliary contacts for remote indication shall be integrated in the base of the SPDs to eliminate possibility of wrong installation.

(vi) SPDs shall limit the transient let-through voltage in accordance to IEC 60364.

(vii) Protection against SPDs short-circuit (in the event of end-of-life of SPDs or/and short circuit at 50hz like neutral disconnection, inversion of Neutral /line) shall be provided by a dedicated miniature circuit breaker that has been tested to co- ordinate with the manufacturer's SPDs in accordance to IEC 60364.

4 Sub Work – Data Networking and Telephone, IP Based Video Surveillance/CCTV System, Fire Detection, Alarm and Control System, Firefighting System, HVAC, Building Management System

4.1 Sub Work – Data Networking and Telephone

(i) Passive cabling infrastructure - UTPCAT6 cables &components, fiber optics cable &components

(a) Complete installation shall be done in accordance with installation practices for a well-structured cabling system, using components from a single vendor to ensure consistent and assured performance. The structured cabling distribution network shall serve as a vehicle for transport of data, video and voice telephony signals over a common network throughout the network

(b) Installation, termination and identification of wiring between station outlets and networking rack shall be considered part of the contractor"s work.

(c) Wiring utilized for data and voice communications shall originate at networking racks and terminate at IOs terminated at wall.

(d) All cables and terminations shall be identified at all locations.

(e) All balanced twisted pair cable terminations shall comply with, and be tested to TIA/EIA568-C.2 standards for Category 3, Category 5e & Category 6 installations.

(f) Standards Compliance: - Unshielded twisted pair cabling system, conforming to ANSI/TIA/EIA 568-C.2 Category 6 cabling system, ISO/IEC 11801 2nd edition, EN-50173-1.

(g) The contractor carrying out the SITC shall make the system entirely operational for its intended use, by addition of components specific to its make/model even if not specifically mentioned in the BOQ.

(h) It shall be the responsibility of the installer and OEM manufacturer to ensure that the Passive Components of structured cabling distribution network will be free from manufacturing defects in material and workmanship under normal and proper use;

(i) The site will be duly certified by OEM for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier.

(j) 20-year systems performance guarantee by the OEM / manufacturer along with actual test results conducted at site such as attenuation, return loss, NEXT & ACR. Permanent link shall be tested for minimum guaranteed performance as per standards at 500 MHZ operation minimum.

(k) The Supplying, installation, testing and commissioning of UTP CAT6 data cables shall include supply and laying of cables in existing conduit on ceiling / wall / slab etc. shall be measured and paid on running length basis.

(ii) UTP CAT6 CABLINGSYSTEM

SN	Description	Specification
	Specifications of UTP Cabling System	
1	Following common specifications shall apply to all UTP CAT6 standards based structured cabling components, i.e., Cable, Patch Panel, IOs & Patch Cords. All components of the Structured Cabling System shall be from the same OEM Manufacturer.	
i	Standards Compliance	1. Unshielded twisted pair cabling system, conforming to ANSI/TIA/EIA568-C. 2. Category 6 Cabling system, ISO/IEC 11801 2nd edition, EN-50173-1.
ii	Warranty	20-year systems performance guaranty by the OEM/manufacturer along with actual test results conducted at site such as Attenuation, return Loss, NEXT & ACR. The cable shall be tested for minimum guaranteed performance as per standards at 500MHz operation minimum
iii	OEM Requirement	All passive cabling must be from same OEM(UTP and Fiber)
2	**CAT-6 UTP Cable**	
i	Standards Compliance	As per 1.i) above

SN	Description	Specification
ii	Conductors	23 or 24 AWG solid bare copper
iii	Insulation	PVC jacket or flame retardant LSZH
3	**I/O Jack**	
i	Standards Compliance	As per 1.i) above
4	**Patch Panel**	
i	Standards Compliance	As per 1.i) above
ii	Ports	24 Ports loaded with keystone Jacks
iii	Port arrangement	Individual keystone type or 6 port modular. Blank inserts for unused ports
vii	Height	1 U (1.75 inches)
xiv	Panel	Fully powder coated pencil grey
xv	Approvals	UL listed
xvi	Termination Pattern	TIA / EIA 568 A and B;
xvii	Performance Characteristics	Attenuation, NEXT, PS NEXT, FEXT and Return Loss
5	**Face Plates**	
i	Standard	Conforms to CAT6 Work Area Data I/O Outlet (RJ45) adhering to ANSI / TIA 568-C.2, ISO/IEC 11801(2002) and CENELEC EN50173-1 (2002)specifications
ii	Type	1-port, 2 -port or 4-port, White Face plate
iii	Material	ABS / UL 94 V-0
iv	No. of ports	One/ Two / Four
6	UTP CAT6 PATCH CORD (3 ft or 7 ft)	
i	Standards Compliance	As per 1.i) above
ii	Conductor Size	24-26 AWG, multi -stranded copper
iii	Lengths	3ft or 7ft or 10ft as required in a variety of colours

(iii) FIBER OPTIC CABLE ANDCOMPONENTS

i	Type	Single mode OS2 fiber cabling system from one OEM (Cables + Components)
ii	Networks Supported	1/10G. All passive components must be from same OEM (Copper + Fiber)
iii	Standard Compliance	ITU-T G.652 (A,B,C and D), IEC - 60793-2-50,TIA/EIA492CAAB
iv	Performance Testing	Must be UL listed or ETL certified and fiber Channel compliance to ANSI/TIA568 -C.0 forOS2
v	Warranty	20-year systems warranty; Warranty to cover Bandwidth of the specified and installed cabling system

(iv) Specifications for Optical Fiber Cable

1	Cable Type	6 core Single Mode, Armored, Loose-tube, Gel filled (Uni-tube construction) - Minimum 6 Tubes Cable)
2	Fiber Type	Single Mode, 9 / 125, 250-micron primary coated buffers. UL Listed fiber
3	Fiber core must be	As per Telecordia GR20, ITU-T G652D, IEC-60793-2-50,TIA / EIA 492-CAAB
4	No of cores	6 core – Raw fiber core make can be Corning/Fujikura - ISO 11801 - OS2
5	Armor	Corrugated Steel Tape Armor
6	Cable Construction Type	BELLCORE GR 20 / IEC 794-1 - Loose tube Corrugated steel tape (0.155mm Min) CSTA provided with FRP Rod as strengthening members
7	Outer Jacket Construction	High density polyethylene, anti - termite, anti –rodent suitable for direct burial application. Jacket must be UV Stabilized.
8	Losses @ 1310nm frequency	< = 0.35 dB/Km
9	Losses @1500nm frequency	< = 0.22 dB/Km
10	Max Tensile Load	1500N or higher
11	Maximum Crush (Impact) resistance	2000N or higher
12	Operating Temperature	-40 deg C to +60 deg C
13	Test Parameters	IEC794-1-E1, IEC794-1-E2, IEC794-1-E3, IEC794-1-E4, EIA-455-104, IEC794-1-E7, IEC794-1-E10, IEC794-1-E11, IEC794-1-F5
14	Marking:	The cable shall have identification marking at regular intervals of 1 meter which will be of permanent nature. The accuracy of the sequential marking will be within +/- 0.5%.
15	Multi-Channel requirement	The fiber cable must have been designed to provide optimum performance from 1265nm to 1625nm making it suitable for 16 – channel Course Wavelength Division Multiplexing (CWDM) applications.

(v) Specifications for 19” Rack Mounted Fiber Shelf/LIUs

1	Fiber optic patch panel	19-inch, Rack mounted Fiber optic patch panel
2	Height	1U
3	Number of fibers	12 / 24
4	Number of OSP (outdoor) Cables for termination	Minimum 2
5	Grounding	2 Nos. of earthing lugs, pre-loaded
6	Cable Management rings	Front and rear cable management rings, pre-loaded

7	Adapter plates	6 Port adapter plates with each plate loaded with Single Mode Couplers as required.
8	Fiber optic patch panel	Rack mounted Fiber optic patch panel
9	Construction	Complete Aluminum Alloy housing, fully powder coated CRCA
10	Splice tray	Shall be included in LIU and not to be quoted separately.
11	Splice tray Construction	Fully cushioned splice holder containing grooves for fixing splice protective sleeves
12	Cable Spools	Flame retardant plastic, high impact resistance. Must be part of LIU.
13	Cable spools Construction	Two halves spool design , Stackable design, sufficient room provided for storage of excess cable

(vi) Specifications for Fiber Optic Pigtails

1	Connector Type	LC-Style, Simplex - 1 meter - Compliance to ITU-G657.B-Bend Insensitive fiber
2	Operating temperature	-40 Degree C to +60 Degree C
3	Standard	Fully in compliance with JIS C5973 F04Type.
4	Durability	(500 Matting's): < 0.2 dB Max
5	Ferrules	Pre-radius Ceramic Zirconia Ferrule. Bayonet Coupling: 2.5 mm Zirconia Ferrule
6	Attenuation	Not more than 0.75 dB per mated pair
7	Parameters / standard	Meets or exceeds ITU specifications, UL listed

(vii) Specifications for Fiber Optic Patch Cords (1 or 3mtr)

1	Cable type	LC-LC type SM. Available in either 1.6mm or 3mm simplex or Duplex Zipcord. - Compliance to ITU-G657.B –Bend In sensitive fiber
2	Fiber type	Single mode 9/125 250 micron primary coated buffers
3	No of cores	2 for duplex and 1 for simplex
4	Outside Diameter	1.6mm x 3.0mm (Simplex) or 1.6mm x3.3mm(Duplex)
5	Operating Temperature	-40 Degree to + 60 Degree

(viii) 19" FLOOR STANDING NETWORKING ENCLOSURES (22U TO 42U USABLEHEIGHTS)

(a) Construction shall be high strength robust extruded aluminum frame structure with ventilation slots on the sides and top & bottom covers with provision to mount 4 fans on top cover (The Vertical Profiles which forms the frame of the racks are extruded aluminium type).

(b) The Other parts / components except the Vertical Profiles are made of CRCA Steel.

(c) CRCA steel used is "IS 513 Gr D" standard
(d) The Thickness of the CRCA sheets used for Doors is 1.2mm and for Side Panels is 1mm.
(e) Fully adjustable 19" equipment mounting angles
(f) The cabinet shall be made of high impact CRCA steel as per IS 513 Gr D standard and design confirming to DIN 41494 or EIA 310D standards.
(g) Top/ Bottom Covers and Side panels shall be of sheet steel and powder coated
(h) Vertical 19" metric panel mounts and door trims shall be of sheet steel and powder coated
(i) The top and bottom covers shall be provided with number of 50mm and 75mm round cable knockouts for cable entry and cable knockouts shall be edge protected with rubber grommets.
(j) Perforation - for full / split perforated doors the style should be "Honeycomb" type of perforation for maximum air circulation and stiffness. The perforation area should be 70% of the total door area.
(k) Cabinet can be capable of dismantling and reassemble at the site.
(l) Locks Options – options shall be available such as slam lock - common key or unique key, Swing handle lock, Digital Keypad operated locks, Biometric locks.
(m) Side Panels – must contain slam latches for locking purpose and option of providing slam locks, if required.
(n) Two pairs of 19" Equipment mounting angles with mounting holes conforming to IEC 2973
(o) Front Glass door made of toughened glass, tinted with easily detachable hinges.
(p) Two Pair of slotted vertical cable channel shall be provided at front and back for managing cables
(q) Lockable industrial grade castors with foot brakes
(r) Rack shall be supplied with 4 x 90 CFM fans at top, or optionally 250cfm
(s) Rack shall be supplied with equipment mounting hardware in pack of 100s such as mounting nuts and screws either 12-24 or M6 type as applicable
(t) Minimum 2 Nos. of 8 x 5/15 Amps power supply sockets, 2 nos. of vertical cable managers and 2 Nos. of 19" 1U size horizontal cable managers.
(u) Finish – cabinet shall be black or grey epoxy powder-coated of durable quality. The Powder coating of the racks is as per Nano Technology process with "Zirconium Coating".
(v) Load carrying capacity – between 500 – 750 kg
(w) Product must be UL listed and certified for use in Information Technology or Communication Equipment
(x) Manufacturer must be at ISO standard plants/facility.
(y) Environmental safety – the rack must be RoHS compliant.
(z) EIA standard pattern design with 12-24 tapped holes (EIA-310-E compliant) or EIA standard pattern design with 3/8" (9.5mm) square punches for Cage Nuts for mounting
(aa) Dimensions – at least 42U usable height, 800mmW x 1000mmD or 1000mmW x 1000mmD

(bb) Powder Coating–

- Powder Coating min 80 Microns with scratch resistance properties.
- Rack to be powder coated with Nano ceramic pre-treatment process using a zirconium coat
- The Powder coating process should be ROHS compliant
- Powder coating thickness shall be80 to 100 microns

(cc) The Metal Enclosures/Racks must have unit prices for its individual knocked down items such as - 42U x 800mmW x 1000mmD main frame, glass front door, perforated/vented steel rear door, vented side panels (2), 4 x 90cfm fans tray and fans, 8x5A/15A power strip, 1U Cable Manager, Sliding Shelf, Rotating Shelf, Cantilever Shelf, Heavy Duty Stationery Shelf, Castors, Vertical manager/runner, hardware and any other such accessory. It must be possible to configure the enclosure as per specific needs for a customized installation for every rack.

(ix) 19" FLOOR STANDING NETWORKING ENCLOSURES (15U USABLE HEIGHTS)

(a) Floor Mount single section 2 fan provision 15U 600W*600D
(b) Should have Minimum 2 Nos. 230v AC Fans 90 CFM
(c) Should have Minimum 2 Nos. A/C Box 6 Socket 5/15 amp metal
(d) Should have Minimum 2 Nos. Cable Manager Metal (1U)
(e) Should have Minimum 2 Nos. 19" Cantilever tray-1U

(x) ACTIVE COMPONENTS – NETWORKING SWITCH SPECIFICATIONS

(a) It is a high-performance networking design keeping in mind real time applications and reliability.
(b) Key considerations for network are - gigabit connectivity to each user from the server room to various users/departments/devices in a topology consisting of a central switch followed by the distribution and edge/access switches.
(c) The network shall have a mix of components for supporting PoE+ as well as non-PoE devices.
(d) A robust fiber optics-based backbone is being provided. It shall be based on ring topology using single mode fiber optics cable. The vendor shall ensure that the networking switches shall be populated with the necessary transceivers for achieving this design objective.
(e) Several applications are proposed to run on this network – IP-based voice communications supporting voice-data-video, network-based cameras and storage, integrated audio-video, video conferencing, interactive learning, integrated building management systems and important services integration such as fire detection.
(f) All Switches and Wireless Access Points be from same OEM.
(g) All Wireless Access Points asked in tender document should be fully compatible to existing Wireless LAN Controllers.
(h) All Switches asked in tender document should be fully compatible with existing switches.

(i) All Switches, Wireless Access Points and Existing Wireless LAN Controllers should have capability to manage, configure and troubleshoot from existing Network management system with a single pane of glass.
(j) All SFP and SFP+ should be from same OEM as of switches.
(k) OEM for equipment like Switches and Wireless Access Points should be listed in the leader‟s quadrant of the Gartner Magic Quadrant.

(xi) WIRELESS LAN INFRASTRUCTURE (CONTROLLER AND ACCESS POINT)

(a) Wireless deployment shall be on centralized controller-based architecture in High Availability mode providing seamless scalability
(b) The architecture should be scalable to 1500 APs in the campus
(c) Redundancy should be built in the architecture, i.e., 1+1configuration
(d) IEEE 802.1x with multiple EAP types (TLS or EAP/MSCHAP or TTLS or equivalent)
(e) Wireless system should support IPv6 from Day1
(f) Radio assurance for radio self-test and healing
(g) Increase available 2.4 and 5GHz wireless device density through management of spurious association traffic
(h) IEEE 802.1q – VLAN Tagging
(i) IEEE 802.1d – Spanning Tree
(j) IEEE 802.1p – Layer 2 Traffic Prioritization
(k) IPv6 Control – Increase wireless device density through control of unnecessary IPv6traffic on IPv4-only networks

4.2 Sub Work-IP Based Video Surveillance/CCTV System

(i) GENERAL

(a) The Surveillance System Components must be TCP/IP based components working on the same backbone network as the Data Network (LAN).
(b) Must have mix of IP Cameras as specified in this document.
(c) Must have the Video Analytics and monitoring software capable of meeting the requirements mentioned in this document. The video analytics has to be server based system with capability to interact with third party VMS systems.
(d) Must have the network based storage for the specified time and quality as specified.
(e) Must be scalable in terms of equipment (no. of cameras) as well as features (Analytics).
(f) True open platform functionality is an essential aspect of this specification; cameras from different OEMs must be able to integrate seamlessly with the specified 3rd party VMS platforms without any loss of features‟ functionality. Similarly, specified VMS platforms must also be able to integrate with a variety of cameras from different manufacturers.
(g) Camera vendors shall be direct original equipment manufacturers.
(h) All cameras must be with wide dynamic range and True D/N capability with removable IR cut filter.

(i) For better saving on storage and bandwidth the compression used shall be H.264 high profile for all types of cameras and devices. H.264 high profile shall be a common requirement for all cameras and devices irrespective of whether mentioned in individual sub-sections or not or if mentioned otherwise.

(j) All cameras shall be vandal resistant as per IK10rating.

(k) All cameras shall be ONVIF Profile S compliant

(l) Cameras shall have a wide dynamic range of between 90 to 100dB for ensuring good image performance in varying light conditions.

(ii) Full High Definition (HD), True Day/Night, Network PTZ Rapid Outdoor PTZ Camera

(a) The camera shall be FHD Rapid Dome PTZ camera supporting triple streaming code simultaneouslygeneratingandtransmittingJPEGandtwoindependentH.264 (preferably High Profile) video streams which are different in resolutions and frame rates.

(b) The camera shall utilize a 1/3-type CMOS/CCD/MOS sensor of approx. 2.0 Megapixel and have a True day/night capability.

(c) The camera shall be capable of 360-degree pan rotation and a minimum tilt range of 0° to 180°, designed for pole / wall /ceiling mount operation.

(d) The camera shall incorporate a built-in 30X optical, auto-focus zoom lens, and shall have 12X digital zoom capability.

(e) The camera shall be able to automatically sequence through the preset positions in programmable sequence, i.e., preset tours.

(f) The camera shall produce a high-quality picture with a minimum illumination of 0.6 lux in colour mode or 0.07 lux in B/W mode at F1.6 or better. It shall offer IR cut filter that switches on/off to enhance low-light sensitivity during B/W mode.

(g) The camera shall be equipped with an intelligent Auto Backlight Compensation feature, mask settings and level adjustment capabilities to compensate for backlight by masking brighter areas.

(h) The camera shall have feature to transform shadows and dark areas into natural and crisp images in real time.

(i) The camera shall support automatic tracing white Balance Adjustment feature.

(j) The Camera shall be capable of Advanced Auto Tracking function which will track and follow single moving indoor target 10 feet from the camera and occupies approximately 10% of the field-of view, in indoor lighting conditions greater than 2 lux. The Advanced Auto Tracking function shall not require an external video processor to control the network Camera. The Advanced Auto Tracking mode shall be able to be interrupted by manual operator control and automatically resume to its previous tracking mode after operator releases control.

(k) The camera shall have the light control mode to select the environment, i.e., indoor or outdoor, in which it is to be used.

(l) The camera shall have a 2D and 3D noise reduction capability which reduces AGC noise to provide clear images without motion blur.

(m) The network interface shall be via an 8-pin RJ-45 connector, 10Base-T/100Base-TX Ethernet. Both IPv6 and IPv4 shall be supported.

(n) The camera shall utilize JPEG and H.264 high profile compression. The maximum resolution for each codec shall be 1920 x1080.

(o) The camera shall be capable of generating HTML code for the video image, allowing for easy web page integration.

(p) The camera shall be capable of supporting up to twelve (12) users simultaneously over the network.

(q) The camera shall have the capability to stream JPEG and H.264 high profile video in TCP protocol H.264 in UDP (unicast/multicast) protocol.

(r) The camera shall incorporate a built-in algorithm for intelligent motion detection capability. The Camera shall offer this feature with four configurable areas per scene and fifteen sensitivity levels adjustment capabilities.

(s) The camera shall have 2-way audio feature where the Camera shall have built-in Audio input and output jacks and be capable of transmitting and receiving full duplex audio stream through the same Ethernet connection as the video. The audio shall be encoded using the G.726 or equivalent ADPCM standard.

(t) The camera shall support the following network protocols: TCP/IP, UDP/IP, HTTP, HTTPS, RTSP, RTP, RTP/RTCP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP, UPnP.

(u) The camera shall support HTTPS client authentication.

(v) The camera shall be compliant with the industry standard ONVIF (Open Network Video Interface Forum) specification with Profile S support.

(w) The camera shall have user configurable port settings.

(x) The camera shall have an email (SMTP) notification capability and in addition the Network Camera shall support the scheduled transfer of image data via FTP to an FTP server.

(y) The camera shall have privacy zone masking which blocks out unwanted or prohibited area within the video image to protect privacy.

(z) The camera software should include the IP Setup (including group camera management) program, Firmware Upgrade Tool, Privacy Masking Tool. If required, the software shall be supplied with the camera as a standard accessory.

(aa) The minimum electronic shutter setting shall be 1/30 second, and a maximum of 1/10,000sec.

(bb) The camera shall have 3 external I/O Terminals which can support alarm inputs/outputs or external Day/Night controls.

(cc) The camera shall can limit the bandwidth from 64 kbps to 8 Mbps in H.264 mode and also to operate without bandwidth limitation in JPEG format.

(dd) The Camera shall be capable of being configured to automatically transmit alarm images transfer via FTP file transfer and/or e-mail. In addition the Network Camera shall support the scheduled transfer of image data via FTP to an FTP server.

(ee) Terminal inputs, VMD alarms, and alarm commands shall be able to trigger actions such as memory recording, FTP file transfer, e-mail notification, alarm indications on web browser, alarm terminal output, and alarm command.

(ff) The camera shall also have a storage capability at device itself; it shall provide a memory card slot which can support up to a maximum of 64GB memory card that can cache images in the event of a network failure. The camera shall also support manual/alarm recording to the optional memory card. The camera shall provide notification of the remaining capacity of the memory card.

MECHANICALREQUIREMENTS

(a) The camera shall have 360° endless pan rotation and -14° to 180° tilt range. The unit shall be designed for pole / wall / ceiling mount operation.

(b) The camera shall have maximum pan/tilt speeds of 300° per second in presets and minimum pan/tilt speeds of 0.07° per second. The camera shall have two hundred and fifty six (256) user defined presets.

(c) The camera shall be vandal resistant. With IEC 62262compliance.

(d) The camera shall have inbuilt dehumidification feature to remove moisture from the camera.

(e) The camera shall be outdoor rated for ingress protection of IP66 rating and mechanical impact protection ratingIK-10.

(iii) Full High Definition (FHD), True Day/Night, Veri-Focal dome Network Camera

(a) The camera shall be a Full HD dome network camera supporting three codecs, JPEG and 2 nos. H.264 high profile, any two of which can be used simultaneously. The camera shall utilize a 1/3-type, CCD/MOS/CMOS sensor of approx. 2 Megapixels and have a true day/night capability.

(b) The camera shall be ONVIF Profile S compliant.

(c) The camera shall have a vandal-proof housing as standard and shall comply with IEC 62262, IEC 60068-2-75 test standard for impact resistance up to75J.

(d) The network interface shall be via an 8-pin RJ-45 connector, 10Base-T /100Base-TX Ethernet. Both IPv6 and IPv4 shall be supported.

(e) The camera shall utilize JPEG and H.264 high profile compression. The camera shall also be able to support full HD mode of 1920X1080 in H.264 compression mode with 30 fps.

(f) The camera shall incorporate a built-in web server, such that a standard web browser such as Microsoft Internet Explorer can be used to access the camera without need for special viewer software.

(g) The camera shall have an advanced function which allows the camera image to be viewed in JPEG format without using any plug-ins. This allows HTML code for the video image to be generated, allowing for easy web page integration.

(h) The camera shall can support up to ten (10) users simultaneously over the network.

(i) The camera shall have the light control mode to select the environment, i.e., indoor or outdoor, in which it is to be used.

(j) The camera shall have a 2D and 3D noise reduction capability which reduces AGC noise to provide clear images without motion blur.

(k) The administrator shall have complete access/control of the cameras.

(l) The camera shall have built-in motion detection capability.

(m) The camera shall support the following Network protocols: TCP/IP, UDP/IP, HTTP, RTSP, RTP, RTP/RTCP, FTP, SMTP, DHCP, DNS, DDNS, NTP, and SNMP.

(n) The camera shall support HTTPS client authentication.

(o) The camera shall have user configurable port settings.

(p) The camera shall have an integral 3 to 8 mm auto-iris type vari-focal lens.

(q) The camera shall be Power over Ethernet (PoE) capable, compliant to the IEEE 802.3a/f standard.

(r) The camera shall have privacy zone masking which blocks out unwanted or prohibited area within the video image to protect privacy.

(s) The software provided with camera shall include the IP Setup (including group camera management) program, Firmware Upgrade Tool etc.

(t) The minimum electronic shutter setting shall be 1/30 second, and a maximum of 1/10,000sec.

(u) The camera shall be capable of limiting the bandwidth from 64 kbps to 8 Mbps in MPEG-4 or H.264 high profile, and from 0.5 Mbps to an unlimited bandwidth in JPEG.

(v) The camera shall be capable of being configured to automatically transmit alarm images transfer via FTP file transfer and/or e-mail. In addition the camera shall support the scheduled transfer of image data via FTP to an FTP server.

(w) The camera shall feature a body-based automatic back focus mechanism for automatic and remote back focus adjustment by way of hardware button or software based control.

(x) The camera shall support feature to transform shadows and dark areas into natural and crisp images in real time. The camera shall also feature intelligent digital back light compensation, digital wide dynamic range circuit, digital noise reduction and electronic sensitivity-up for real surveillance purposes under severe conditions. For better picture quality, the camera shall feature digital 2H enhancer, digital aperture correction, knee circuit and digital white detective ATW. The camera shall also offer a user-configurable AWC setting for white balance at a manual setting.

(y) The camera temperature rating shall be -10 to + 50 deg C.

(z) The camera shall feature cropping function which enable to provide whole image (1920x1080) and the part of image (640x360) simultaneously. Up to 4-images capture areas can be specified, and it is also possible to control the sequence.

(aa) The camera shall also have a storage capability at device itself; it shall provide a memory card slot which can support up to a maximum of 64GB memory card that can cache images in the event of a network failure. The camera shall also support manual/alarm recording to the optional memory

card. The camera shall provide notification of the remaining capacity of the memory card.

MECHANICAL REQUIREMENTS

(a) The Camera shall be IP66 rated and shall adhere to IEC 60529 standard. Also, it shall be vandal resistant body for high reliability for 75Jimpact.
(b) The camera shall have feature to remove the humidity that manages to enter in its body.

(iv) FULL HD, OUTDOOR FIXED CS-MOUNT/BOX OR BULLET CAMERA SPECIFICATIONS

(a) The camera shall be a Full HD fixed-type CS-mount network camera supporting three codecs, JPEG and H.264 high profile (2 Nos), any two of which can be used
(b) Simultaneously. Camera shall utilize a 1/3" type CMOS/MOS sensor and have a resolution of approx. 2.0 MP and have a True day/night capability.
(c) The camera shall feature a Day & Night mode that may be automatically engaged on low light level and permit the use of an external infrared illuminator or manually selected.
(d) The camera shall incorporate independent automatic Colour-to-Black & White switching modes for switchover on light threshold and sensitivity to IR illumination in the 850 nm wavelength. Each Colour-to-Black & White switching mode shall incorporate two switching threshold light levels, high and low. Each Colour-to-Black & White switching mode shall incorporate three duration settings for automated switchover.
(e) The camera shall be ONVIF Profile S compliant.
(f) The camera shall utilize JPEG and H.264 high profile compression. The camera shall also be able to support full HD mode of 1920X1080 in H.264 compression mode with 30fps.
(g) Network interface shall be via an 8-pin RJ-45 connector, 10Base-T /100Base-TX Ethernet.
(h) The camera shall incorporate a built-in web server, such that a standard web browser such as Microsoft® Internet Explorer can be used to access the camera without need for special viewer software.
(i) The camera shall can support up to Ten (10) users simultaneously over the network.
(j) The camera shall incorporate a built-in motion detection capability with 4 areas, and 10 step detection size and sensitivity levels.
(k) The camera shall feature cropping function which enable to provide whole image (1920x1080) and the part of image (640x360) simultaneously. Up to 4-images capture areas can be specified, and the possibility to control the sequence.
(l) The camera shall support the following Network protocols: TCP/IP, UDP/IP, HTTP, HTTPS, RTSP, RTP, RTP/RTCP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP, UPnP, IGMP, ICMP,ARP

(m) The camera shall have both FTP client and server capabilities.
(n) The camera shall have user configurable port settings.
(o) The camera shall have a CS-mount 2MP IR corrected type vari-focal lens (3-8 mm/5- 50mm) as standard accessory.
(p) The camera shall be Power over Ethernet capable, compliant to the 802.3afstandard.
(q) The camera shall have privacy zone masking which blocks out unwanted or prohibited area within the video image to protect privacy.
(r) The camera shall have the capability for Camera ID as well as Date/Time data to be superimposed on the video image.
(s) The camera shall have the light control mode to select the environment, i.e., indoor or outdoor, in which it is to be used.
(t) The camera shall have a 2D and 3D noise reduction capability which reduces AGC noise to provide clear images without motion blur.
(u) The administrator shall have complete access/control of the cameras.
(v) The camera shall be capable of being configured to automatically transmit alarm images transfer via FTP file transfer and/or e-mail. In addition the camera shall support the scheduled transfer of image data via FTP to an FTP server.
(w) The minimum electronic shutter setting shall be 1/30 second, and a maximum of 1/10,000sec.
(x) Thecamerashallbecapablelimitingthebandwidthfrom64kbpsto8192kbpsin
(y) H.264 high profile and unlimited in JPEG.
(z) The camera shall support multi-casting and unicasting.

MECHANICALREQUIREMENTS

(a) The camera shall have a CS type camera lens mount in case Box type or inbuilt in case of Bullet type camera
(b) The camera lens supplied with the camera shall be IR corrected lens supplied by the camera OEM or other reputed makes of lens such as Tamaron or Fujinon or equivalent and having f 3-8mm, F1.2 to F1.9, DC auto-iris type vari-focal lens.
(c) The camera shall be installed in a vandal resistant IK10 rated housing.

(v) VIDEO SURVEILLANCESTORAGE

Configuration & Specification for Storage System for Video Surveillance & Recordings on a 24 Hrs x 30Days Basis

High Availability

(a) The Proposed Solution should be a Storage System configured with dual, redundant controllers.
(b) Each Controller must have Intel Sandy Bridge Quad core CPU per controller or equivalent.
(c) The Proposed Solution should be based on real time optimized operating

system. (It should not be a general purpose OS)

(d) The Proposed Solution should support Online Microcode / OS Upgrades.

(e) Must provide five 9s availability (99.999%)

Investment Protection

(a) The proposed Storage should be non-disruptively upgraded to 10G Ethernet, FC and FCoE protocols in future and managed by the same Unified Storage Management Software.

(b) Storage System quoted by the OEM should be in the Leaders Quadrant in the latest Gartner Magic Quadrant for Midrange and High-End Modular Storage Arrays Report.

RAM, Scalability and HDD Support

(a) The controllers should have a minimum 30GB cache spread across dual controllers.

(b) The Proposed Solution should be scalable to more than 110 Drives in the same Storage Array without upgrading the controllers.

Host Connectivity and Storage Backend Disk Connectivity

(a) The offered storage shall be supplied with at least 8nos x 1G iSCSI Ports across dual Controllers for Host Connectivity.

(b) The array proposed should have a minimum of 4nos x 6Gbps 2.0 SAS backend architecture.

Total Aggregate Bandwidth

(a) The Proposed storage disk should ensure a minimum total aggregate bandwidth of 2500Mbps on a 90% write &10% read application environment.

RAID Support

(a) All RAID types should be industry standard RAID and solution to be configured with **RAID5 protection**

(b) For every 30 disks, 1 no disk should be configured as Global hot spare.

Management

(a) The Proposed Solution should support a browser based built in management. It should have SNMP support. (Traps, e-mail, MIBII)

Current Required Protocols

(a) The Proposed Solution must support and be configured for FC & iSCSI

protocols.

Storage Capacity Requirements

(a) The Proposed Storage Array should be configured with Minimum 114TB Usable Capacity using SATA/NL-SAS Drives. The usable capacity is defined as the Net storage capacity available for the application stack, after deducting the penalties imposed by storage infrastructure requirements, disk and array formatting, RAID penalties, host OS and file system formatting including overheads or any other penalties which eat away usable disk space. Drives offered for the above capacity shall be of the Highest Capacity offered by the Vendor.

(b) The same Storage System should support 50% extra growth in terms of performance and capacity for future expansion without any controller upgrade.

Regulatory Model

(a) The device should have the following certifications - FCC Class A or CE Mark for immunity against electromagnetic emissions.

Safety and Quality Standards

(a) The device should have the following quality and safety standard certifications- CAN/ CSAC22.2-60950/UL60950.

LED DISPLAY

The LED Display shall have the following minimum specifications:

(a) Screen Size: 55”
(b) Resolution: 1920 x1080
(c) Input Interfaces: VGA (D-Sub), DVI-D, Component (CVBS common), HDMI, Stereo Mini Jack
(d) Contrast Ratio (Typical): 5000:11.5.6.
(e) Power Supply: AC 100 - 240 V~ (+/- 10 %), 50/60 Hz
(f) Power Consumption: 86W
(g) Operating Temperature: 0º C ~ 40º C
(h) Emission Standard:EMC
(i) Compliance: ENERGY STAR5.0

4.3 Fire Detection, Alarm and Control System (FAS)

The technical specification, installation, testing and commissioning of **Fire Detection, Alarm And Control System (FAS) shall confirm to CPWD General Specifications for Electrical Works Part VI Fire Detection and Alarm System – 2018 and** Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice- IS 2189-2008; all amended up to last date

4.4 Fire Fighting System

The firefighting system comprising of wet riser and sprinklers system as stipulated in schedule of quantity and all its equipment shall conform to CPWD General Specifications for Electrical Works – Part –V- (Wet Riser and Sprinkler System), CPWD General Specifications for Electrical Works (Part I – Internal) 2013; CPWD General Specifications for Electrical Works (Part II – External) 1994; CPWD General Specifications for Electrical Works (Part-IV Sub-Station) 2013, referred relevant IS, National Building Code-2016 and guidelines of Local Fire Services.

4.5 HVAC

(i) BASIS OF DESIGN

GEOGRAPHICALLOCATION: Ramnagar , Uttarakhand

(a) Outside Ambient Conditions considered for Design:
(b) Summer: DB110□F, WB78□F, RH24%
(c) Monsoon: DB90□F, WB83□F, RH82%
(d) Desired Indoor Design Conditions:
(e) DB : As mentioned in Heat Load Summary Sheet RH : 50% □ 5% (No Control)

REFERENCESTANDARDS

The entire System will be designed in accordance with following Standards

(a) National Building Code.
(b) ASHRAE Application 2007.
(c) ASHRAE Fundamentals 2005.
(d) Indoor Air Quality as per ASHRAE 62-1999.
(e) ISHRAE Codes.
(f) Duct construction standards as per relevant BIS Codes, IS 655:1963.
(g) Motors, Cabling, wiring and accessories as per BIS code Cable Insulation – IS 8130, IS 5831.

ASSUMPTIONS

(a) Inside condition – For Cooling / Heating 71.6 °F (22.0°C).
(b) Outside Condition (Ambient Condition) – Summer : 110 °F (43.33 °C) DBT / 78 °F(25.55
(c) °C) WBT & 24 % RH.
(d) Occupancy - As per design.
(e) Equipment Load - As per design.
(f) Lighting Load - As per design.
(g) Fresh Air CFM - As per ASHRAE Standard or 1 Air Changes per Hour

whichever higher.

(h) Exposed Glass - Single Glazing of Saint Gobain make with Neutral Graphite colour of ST 136 Code with Solar Heat Gain Co-efficient (SHGC) - 0.155 & U Value - 5.5 W / Sq. Mt. °K (0.968 BTU / Hr. / Sq. Ft.°F).

(i) Exposed Walls - U Value - Single wall assembly at North with 'U' Value of 1.46 W / Sq. Mt. °K (0.257 BTU / Hr. / Sq. Ft. °F) & for all other side (except North) Cavity wall with 'U' Value of 0.76 W / Sq. Mt. °K (0.134 BTU / Hr. / Sq. Ft.° F).

(j) Roof - with over deck insulation of 0.12 BTU / Hr. / Sq. Ft. °F U Value.

(ii) TECHNICAL SPECIFICATIONS

WATER COOLED CENTRIFUGAL CHILLING MACHINES

The water chilling units shall be complete in all respects and shall generally comply with the specifications as given in the following paragraphs

Water Cooled VFD Driven Centrifugal Chilling Unit and its component specification shall confirm to specification for the variable speed water cooled chilling units and its components mentioned in the relevant section under chapter 5 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIRCONDITIONING (HVAC) WORKS (2017)". Item nomenclature stipulated in the schedule of work shall be read with the technical specification of variable speed water cooled chilling units and its component including variable frequency drive.

Deviation if any in the technical specification of the chilling units and its component including variable frequency drive mentioned in the item nomenclature and relevant section under chapter5 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR- CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the variable speed centrifugal chilled water machine and its component including variable frequency drive stipulated in the item nomenclature and relevant section under chapter 5 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIRCONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

SLAVE PLANT CONTROLLER

The Slave plant Controller as elaborated in the schedule of work shall be of the same make of Variable speed Water Cooled Centrifugal Chilling units & its technical specifications shall be as per manufacturer's standard.

COOLING TOWER

Cooling Tower specification shall confirm to specification mentioned in the relevant section under chapter 7 of "CPWD GENERAL SPECIFICATIONS for HEATING,

VENTILATION& AIR-CONDITIONING (HVAC) WORKS (2017)" amended upto date. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of cooling tower and its components. Deviation if any in the technical specification of the cooling Tower and its component mentioned in the item nomenclature and relevant section under chapter 7 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR- CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the cooling tower and its component stipulated in the item nomenclature and relevant section under chapter 7 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

CIRCULATING WATER PUMPS

Circulating water pumps viz. Primary Chilled Water Pumps, Condenser Water Pumps and Variable Speed Secondary Chilled Water Pumps including the variable speed drives specification shall confirm to specification mentioned in the relevant section under chapter 8 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR- CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of circulating water pumps and its component including variable speed drive. Deviation if any in the technical specification of the circulating water pumps and its component including variable speed drive mentioned in the item nomenclature and relevant section under chapter 8 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the circulating water pumps and its component including variable speed drive stipulated in the item nomenclature and relevant section under chapter 8 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

Note: Pump Impeller shall be made of Bronze / SS.

VARIABLE SPEED PUMPING SYSTEM FOR SECONDARY CHILLED WATER PUMPS

Control Panel for Variable Speed Secondary Chilled Water System:

Variable Speed control panel will have the following as minimum: (See details below)

(a) VFD – One VFD per pump
(b) Differential Pressure Transmitters.

(c) Controls enclosure as per below specification.
(d) Necessary software duly downloaded.

Number of Pumps

The same will be able to control minimum 4 pumps.

Analog Input Processing

Will continuously scan the incoming signal from DPT`s all the time and keep on processing the output. Output will be the most deviated one compared to the set point, which will be fed by the user.

Two Additional Analog Inputs

Has provision for two additional analog inputs for:

(a) Taking input signal from Flow sensor (if provided by BMS contractor). This will help the system to protect the pumps against End of Curve condition.
(b) Taking the input from any external sensor (e.g. return temperature sensor, supply temperature sensor, ambient temperature sensor etc.). This input can be used to influence the system externally. This should have provision to influence the main signal up to 8 steps

Set Point

This can be set for separate "set points" as per real time clock & should have a min of 7 alternate set points to be activated by external digital inputs.

If a lower differential pressure is acceptable during certain periods, for instance after normal working hours or weekends, the set point can be lowered to minimize power consumption. It should have night set back facility to enable the system to run at lower set point during night time. It should use digital inputs to switch between set points automatically at any point of time.

Automatic cascade control of pump

Will start other pumps, which are available for operation, whenever system is not able to meet the demand for chilled water. Once demand is met then all the pumps will cut out with changeover, except for one pump. At least one pump will run at minimum 25% speed if DP value is satisfied.

Automatic Sequence Change

Will have automatic changeover facility based on:

(a) Fault – When any pump / motor / VFD / starter fail.

(b) Operation – While running /cascading.
(c) Time – As per the time set in the DPLC (daily or weekly).

To ensure equal number of hours run by each pump and to control the number of starts (to avoid hunting) on each pump, the system will alternate the sequence of the pumps used each time the system starts.

Additionally, should the demand not allow the pump set to completely shut down over a 24 hour period; this will stop the pumps that are running and start the pump / pumps with the lowest number of operating hours.

Auto Testing

Will start the pumps, which have not been cut-in because of lower load, for 2 seconds each day, to ensure that all the rotating elements do not bind. DPLC should have an option to set the same on 24 hrs / 48 hrs / weekly basis.

Friction Loss Compensation

It is possible to allow for the friction loss component of the system, calculated at full flow and set as a percentage of the set point. A linear approximation of system resistance curve is therefore allowed for, and differential pressure must automatically increase as system flow and subsequent frictional losses increase. As such power consumption will get reduced because of this.

Displays

Through the monitor keypad, all variable parameters are adjustable, current status of settings and measured values to be displayed on the minimum 320 pixels X 240 pixels VGA display with backlight Individual menus are available for monitoring individual pumps, settings, alarms and ON / OFF functions.

PUMP STATUS

(a) Running Hours of each pump
(b) Actual pump status (running, not available, standby, fault)

ZONE STATUS

This menu is the main operating menu where all the setting and operating parameters can be viewed e.g.

(a) Current operating set point
(b) Measured values in the system
(c) Operating capacity in terms of total output
(d) Mode of operation for the zone
(e) Clock programs (relating to set point differential pressure value)

(f) Standby pumps (if any)
(g) Pump change over time
(h) Friction loss compensation
(i) System response times

SETTING MENU

In this menu all parameters for the operation of the pump set can be adjusted as required.

(a) Set points (up to7)
(b) On/ Off function (used to prevent unnecessary cycling at low demands)
(c) Displayed differential pressure units (Meter, Bar, PSI, MBar, KPa)
(d) Real time clock programming for any time of the day, week, or weekend)
(e) Friction loss compensation

ALARM

The alarm menu to display all faults / warnings that occur during operation, logging the time and date of when the fault occurred and when it was corrected, or whether it is still an actual fault, and up to 24 faults to be maintained as history in the controller.

Examples of faults

(a) Mains failure
(b) VFD fault
(c) Analogue input (differential pressure transducer) fault
(d) High discharge pressure fault
(e) Low discharge pressure fault
(f) Motor thermal overload fault

VARIABLE FREQUENCY DRIVE

VFD shall be Pulse Width Modulation (PWM) type, microprocessor controlled design labeled CE. The enclosure shall be ventilated for installation as a wall mounted or freestanding depending on Amp rating. Drive shall have customer modifiable adjustments of 2 to 600 seconds accel & decel time, Minimum & Maximum frequency, V/f ratio and Carrier frequency. Speed reference signal shall be customer selectable for 4 - 20 mA, 0 - 5 VDC and 0 - 10 VDC. The VFD shall be suitable for elevations up to 1005 Mts. above sea level without de-rating. Maximum operating ambient temperature shall be to 45 C. shall be suitable for environment condition up to 95% non-condensing.

(a) Built-in DC link filters to avoid power factor correcting devices like capacitors, line reactors etc.
(b) Energy saving mode with boost function (Sleep /Wake Mode), Quick set up menu.

DIFFERENTIAL PRESSURE TRANSMITTERS

Differential pressure transmitters shall be field mounted and shall transmit an isolated 4 – 20 mA DC signal indicative of process variable to the pump logic controller via standard three wire 24 DC system with Emission / Immunity confirming to EN 61000 – 6 – 2 / 3.

Unit shall have stainless steel wetted parts with two 7/16" process connections. It shall be protected against radio frequency interference and shall have water tight, IP 55 electrical enclosure. Sensor should be capable of withstanding a burst pressure of 25 Bar. Accuracy shall be within 2.5% BFSL (Best Fit Straight Line).

CONTROL ENCLOSURE

An IP42 (IP 55 if panel is required for outdoor installation) powder coated steel enclosure shall house all the electrical components.

The enclosure will be supplied loose for remote mounting. It shall be adequately ventilated for use in conditions up to a maximum ambient temperature of 45 °C.

SEQUENCE OF OPERATION

(a) The pumping system shall start upon the closure of customer's contact when the logic controller Mode of Operation selector switch is in the REMOTE position.
(b) When the pump logic controller selector is in the LOCAL position and start command is given via operator interface the pumping system shall operate automatically.
(c) Sensors / transmitters shall be provided as indicated on the plans.
(d) Each sensor / transmitter shall send a 4-20 mA signal to the pump logic controller, indicative of process variable condition.
(e) The pump logic controller shall compare each signal to the independent Engineer / user determined set points.
(f) When all set points are satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.
(g) The pump logic controller shall continuously scan and compare each process variable to its individual set point and control to the least satisfied zone.
(h) Of the set points cannot be satisfied by the designed lead pump, the pump logic controller shall initiate atimed sequence of operation to stage a lag pump (whenever applicable).
(i) The lag pump shall accelerate resulting in the lead pump(s) decelerating until they equalize in speed.
(j) In the event of an AFD fault, the pump logic controller automatically initiates a time sequence of events to start the retardant pump / AFD set in the variable speed mode. The retardant variable speed system shall be started through a pump logic controller.

(k) Upon AFD fault(s) the pump controller shall display an alarm condition through a plain English massage.

(l) AFD fault indication shall be continuously displayed on the operator interface of the pump until the fault has been corrected and the controller has been manually reset.

(m) In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/ compare programme. Alternate zone sensor / transmitters if available shall remain in the scan /compare programme for control.

(n) Upon sensor failure a plain English warning massage shall be displayed on the operator interface of the pump logic controller.

(o) The zone number corresponding to the failed sensor / transmitter shall be displayed on the operator interface of the pump logic controller.

(p) In the event of failure to receive all zone process variable signals, a user selectable number of AFD's shall maintain a user adjustable speed, reset shall be automatic upon correction of the zone failure.

(iii) TECHNICAL INFORMATION WITH TECHNICALSUBMITTAL

Tenders shall include the following and shall be specific to this project.

(a) System summary sheet.

(b) Sequence of operation.

(c) Shop drawings indicating dimensions, required clearances and location and size of each field connection.

(d) Power and control wiring diagrams.

(e) System profile analysis including variable speed pump curves and system curve. The analysis shall also include pump, motor and Adjustable Frequency Drive (AFD) efficiencies, job specific load profile, staging points, horse power and kilowatt/hour consumption.

(f) Pump data sheets.

(iv) QUALITYASSURANCE

(a) The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.

(b) All functions of the variable speed pump control system shall be tested at the factory prior to delivery. This test shall be conducted with motors connected to AFD output and it shall test all inputs, outputs and programme execution specific to this application.

(c) Tenderer shall comply with all sections of this specification relating to packaged pumping systems. Any deviations from these specifications shall be

clearly defined in writing at time of bid. If no exceptions are taken at time of bid, the supplier shall be bound by these specifications.

(v) PAINTING

All variable pumping system, pumps, motors and bases shall be supplied with approved finish. Shop coat of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas then coated with enamel paint to match the adjoining areas.

(vi) EXPANSIONTANK

Expansion Tank specification shall confirm to specification mentioned in the relevant section under chapter 10.9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Expansion Tank and its component. Deviation if any in the technical specification of the Expansion Tank and its component including mentioned in the item nomenclature and relevant section under chapter 10.9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING(HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in-Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Expansion Tank and its component including variable speed drive stipulated in the item nomenclature and relevant section under chapter 10.9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

(vii) Air moving Equipment

Air Handling Unit, Fan Coil Unit and other Air Distribution systems specification shall confirm to specification mentioned in the relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component. Deviation if any in the technical specification of the Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component including mentioned in the item nomenclature and relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR- CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component including variable speed drive stipulated in the item nomenclature and relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING,

VENTILATION &AIR- CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

Note: While commissioning CFM shall be a criteria not static pressure.

(viii) Water Based Ceiling Suspended / Wall Mounted Fan Coil Units General

Fan coil units shall comply with quality standard IS09001 / 9002 and be 'type' tested. The Contractor shall submit the make and type of each fan together with the 'type' test certificate for the Engineer-in-charge approval. Fans, filters, cooling coils, motors, thermal and acoustic insulation shall comply with the appropriate sections of this General Specification and the following requirements:-

Fans shall be of the Double Inlet Double Width (DIDW) forward curved centrifugal or tangential flow types and shall be of aluminium.

Air filters shall be of HDPE type with an efficiency of not less than 50% when tested in accordance with BS EN779.

Motors shall be quiet running and have sleeve or hall bearings factory lubricated for life. Motor windings and electrical components shall be impregnated or protected to avoid trouble from condensation. The fan motor shall be of the single phase permanent split capacitor type provided with three speed tapped windings.

All fan coil units capacity and air flow rate shall be selected based on the performance of the units at medium fan speed.

In selecting the fan coil units, allowance shall he made for the actual resistance imposed on the air flow of the units due to ducts and grilles. The added resistance is to be applied to all fan coil units whether shown to have ducts connected or not and shall be taken as not less than 50 Pa external to the unit.

The thermal, volumetric and acoustic performance of fan coil units shall meet the requirements indicated and testing and rating shall be in accordance with BS 4856.

(ix) Casings

Casings shall be of G.I. sheet metal with thickness not less than 1,0 mm suitably stiffened to minimize drumming and vibration and shall be protected against corrosion and finished inside and outside with stoved primer. All corners shall be rounded off without sharp edges. Casings shall be lined with material to act as both thermal and acoustic insulation which shall comply with the relevant specifications. Casings shall include space for pipe work connections and valves, and there shall be ready access to the fan and motor filter, damper, drain pan, pipe work connections and valves, for maintenance purposes.

The motor and fan shall be mounted on a detachable mounting chassis that can be removed from the fan coil enclosure as one assembly (with extended cables) to facilitate fan and motor cleaning. It shall then also be possible to remove the fan impeller scroll casing in order to properly clean the fan blades. Fan and motor assemblies shall be complete with neoprene rubber anti-vibration mountings.

(x) Coil

Cooling / heating coils shall be **minimum three-row** and shall include an air vent cock and drain valve, the chilled / hot water cooling / heating coil shall be ARI certified and constructed from seamless copper tubes mechanically bonded to aluminium fins.

Each Coil shall be provided with motorized 2-way solenoid control valve and isolation valves, flexible pipe connectors complete with union joints to facilitate removal of the entire unit shall be provided. The connector shall be stainless steel braided polymer tubing limited to 300 mm long and suitable for the system pressure,

Working pressure of coils shall suit specific requirements.

Coils should be suitable for a working water temperature of up to 50 °C.

All units shall include an easily removable filter capable of treating the total air volume. Filters shall, unless otherwise specified be washable. It shall be supported in stiff aluminium / stainless steel with draw able frame.

Drain pans shall be made of one piece stamped stainless sheet steel with no weld and protected against corrosion, or made of reinforced glass fibre materials insulated withaminimumof13mm thick flexible closed cell elastomeric insulation. Drain pans shall be large and deep enough to collect all condensate from the coil, return bends and pipework connections. The pan shall be removable and have a slight fall to the drain connection. For units whose loads include a high proportion of latent cooling the fall to the drain point and the size of the drain connection shall be adequate to deal with the condensed moisture. The coil &all fittings selected should ensure that the assembly can sustain working / static pressure of10 kg/cm².

Arrangement of Units
The arrangement of units (e.g. wall, floor or ceiling mounted), the position of inlet and outlet grilled if any, the need for G.I. sheet metal casing etc. shall be as indicated.

(xi) Controls, Dampers and Grilles

Fan coil units shall have a combined room temperature sensor complete with 3-speed controller and heating/cooling mode selector as specified. Where indicated they shall have connections for both fresh and re-circulated air and shall include a damper which shall be adjustable to give up to 25% of the fan capacity drawing from the fresh air source. Outlet grilles shall be capable of adjusting the direction of airflow without

adversely affecting pressure drop. On floor mounted units, supply grilles shall be on the top of the unit.

(xii) Noise level

The noise data provided shall include an octave band analysis of the sound power level of each unit when operating al its full or the stated design speed.

The entire FCU will be powder coated and will be provided with filter box. The FCU will also be provided with auxiliary drain pan (sand witched insulated). The drain connection will be made from both the drain points of main drain tray and the auxiliary drain pan.

Note: One no. of Fan Coil Unit will be got tested in presence of authorized representative of Engineer In charge.

(xiii) Water Based Cassette type Fan Coil Units Cassette Unit

The cooling / heating coils shall be made of Copper Tubing having extended aluminium fins. The tubes shall be mechanically expanded for positive bonding between tubes and fins. The cooling / heating coils circuit shall be fed with chilled / Hot water from the header through valve and the flow is modulating by modulating control valve with respect to load. Coils should be suitable for a working water temperature of up to 50 °C. The blower shall be statically and dynamically balanced and designed for silent operation at required airflow rates against required static pressure. The filters shall be washable synthetic media type arranged for convenient cleaning and replacement. In built Drain pump should be provided along with indoor unit for proper drainage of condensed water. The drain pan shall be fabricated out of heavy sheet steel, insulated with 1/4" expanded polyethylene sheet. The casing shall be of heavy gauge G.I., duly powder coated for weather protection.

(xiv) Controls and Interlocking

Electrically / electronically operated controls shall be provided with all components, auxiliary relays, capacitors including wiring for controls and interlocking.

(xv) Drain Piping

Condensate from the evaporator unit shall be drained through properly installed drain piping designed to prevent any accumulation of condensate in the drain pan. Drain piping shall be made of 1.1/4" dia. / 2" dia. rigid PVC pipe of with water tight threaded connections, leading from the room unit to a suitable drain point. Complete drain piping shall be made leak proof and water tight by means of precise installation and the use of leak proof sealant / adhesives. Insulation of drain piping should be carries out with Nitrile rubber.

Note: One no. of Fan Coil Unit will be got tested in presence of authorized

representative of Engineer In charge.

(xvi) Ventilation Fans

The design, materials, construction, manufacture, inspection, testing and field performance of the fans shall comply with all currently applicable international / national codes / safety regulations. Nothing in this specification shall be construed to relieve the VENDOR of his responsibility. In particular the equipment shall conform to latest editions of all applicable codes and standards listed below.

(a) AMCA-201 -Fans and systems –Application guide
(b) AMCA-203 -Field performance measurement of fan systems
(c) AMCA-210-Laboratory Methods of testing Fans for Aerodynamic performance rating. AMCA-2404 -Drive arrangements for centrifugal fans
(d) ASME Section-V -Code for Non Destructive examination
(e) ASME Section-IX -Welding and brazing procedure and welder's qualification BS: 848, Part-1 -Fans for general purposes -Methods of testing performance
(f) BS: 4675, Part-1/ ISO-2372 -Mechanical vibrations in rotating and reciprocating machinery VDI-2056 -Criteria for assessing mechanical vibrations of machines
(g) IS:816-Code of practice for use of metal arc welding for general construction in mild steel IS:823 -Code of practice for manual metal arc welding of mild steel
(h) IS: 1353(Grade C) -Black Hexagonal bolts, nuts and lock nuts and black hexagonal screws IS: 210 -Specification for grey iron castings
(i) IS: 2062 -Structural steel (standard quality) for general structural purposes
(j) IS: 2074 -Specifications for Red Oxide Zinc chrome, Priming Ready mixed paint air drying IS: 325 -Three phase induction motor
(k) IS: 4894 -Specifications for centrifugal fans
(l) ISO: 1940 -Balance quality of rotating rigid bodies (static &dynamic of rotary parts) IS: 4029 -Guide for testing three phase induction motor
(m) IS-3588 -Specification for Electric Axial flow fans IS-2312 -Propeller Type A.C. Ventilation Fans
(n) BS-848 -Methods of performance test for Fans
(o) IS-1367 -Technical supply conditions for threaded fasteners.
(p) IS-737-Wrought aluminum and aluminum alloy sheet and strip (for general engineering purposes)

(xvii) Tube Axial Fan - Application –Exhaust Air

Air Handling Unit, Fan Coil Unit and other Air Distribution systems specification shall confirm to specification mentioned in the relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component. Deviation if any in the technical specification

of the Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component including mentioned in the item nomenclature and relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION&AIR- CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Air Handling Unit, Fan Coil Unit and other Air Distribution systems and its component including variable speed drive stipulated in the item nomenclature and relevant section under chapter 6 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION&AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

(xviii) Sheet Metal Work

Ducting specification shall confirm to specification mentioned in the relevant section under chapter 9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION&AIR-CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Ducting and its component. Deviation if any in the technical specification of the Ducting and its component including mentioned in the item nomenclature and relevant section underchapter9of"CPWDGENERALSPECIFICATIONSforHEATING,VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Ducting and its component in the item nomenclature and relevant section under chapter 9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

(xix) Grilles and Diffusers

Ducting specification shall confirm to specification mentioned in the relevant section under chapter 9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR- CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Ducting and its component. Deviation if any in the technical specification of the Ducting and its component including mentioned in the item nomenclature and relevant section under chapter 9of"CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in- Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Ducting and its component in the item nomenclature and relevant section under chapter 9 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

(xx) INSULATION

All insulation work on the pipes, flange, valve, pumps etc. shall conform to quality standards & shall be carried out as per specifications and details given in relevant section under chapter 11 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION &AIR- CONDITIONING (HVAC) WORKS (2017)" amended upto date.

(xxi) Pipe Work

Water Plumbing Work specification shall confirm to specification mentioned in the relevant section under chapter 10 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" and specification of the component(s) mentioned below. Item nomenclature stipulated in the schedule of work shall be read with the technical specification of Water Plumbing Work and its component. Deviation if any in the technical specification of the Water Plumbing Work and its component including mentioned in the item nomenclature and relevant section under chapter 10 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING

(HVAC) WORKS (2017)" shall be brought to the notice of Engineer-in-Charge prior to or during the pre-bid meeting by bidders. Deviation in the technical specification of the Water Plumbing Work and its component including stipulated in the item nomenclature and relevant section under chapter 10 of "CPWD GENERAL SPECIFICATIONS for HEATING, VENTILATION & AIR-CONDITIONING (HVAC) WORKS (2017)" will not be acceptable provided same has been accepted and communicated prior to submission of the bid.

4.6 Building Management System

Planning, designing, supply, installation, testing and commissioning of BMS required for monitoring and control of various services installed in the building such as Lighting Control and Management System (LCMS), HVAC, Substation, Lifts, Firefighting, Fire Alarm & PA System, CCTV, water supply system, UPS system, Solar PV Power plant, Basement Ventilation and pressurization system, Fire curtains, Parking Management System etc. BMS shall have storage capacity and database for storing data up to last 5 years. BMS should have suitable detailed analysis and troubleshooting tools and software plug-ins so that effectiveness and proper operation of the systems can be analyzed at any point of time, and the BMS system should also provide with Net Zero Energy calculations and status. It should have feature to calculate the LPD, Lux levels etc. of the building.

Annexure -III

(Schedule-D)

List of Applicable Codes

1.1 The Contractor shall use the latest edition of relevant Standards & Specifications for Design and Execution of this project/work. The list of Standards & Specifications provided hereunder is not exhaustive and any other Standard & Specification which are not mentioned in this section are also applicable if required for the completion of work as per the Scope of Work shall be used in consultation with Authority.

1.2 Some of the relevant codes and standards are compiled below:

(i) FOR STRUCTURAL WORKS

S. No.	CODE	NAME
1	IS: 1893 – 2002	Criteria for Earthquake resistant deign of Structures
2	IS: 13920	Ductile detailing of Reinforced Concrete Structures Subjected to Seismic forces.
3	IS: 4326 – 1993	Earthquake resistant Design and construction of Buildings
4	IS: 875 – 1987 (Part I to III & Part V)	Code and Practice for Design Loads (Other than earthquake) for Building and Structures like Dead, Imposed, Wind and other Loads
5	IS: 456 – 2000	Plain and Reinforced Concrete (Code of practice)
6	SP: 16	Design aids for Reinforced Concrete Structure.
7	SP: 34	Handbook on Concrete Reinforcement and Detailing
8	IS: 3370 Part I, Part II and Part IV	Code of practice for Concrete structures for the storage of liquids.
9	IS: 1786	Specification for High Strength Deformed Steel bars and wires for concrete reinforcement
10	IS: 1904	Code and Practice for design and Construction of Foundations in Soils
11	IS: 2950	Code and Practice for Design and Construction of Raft Foundations
12	IS: 800-1980	Code of Practice for general Construction in Steel.
13	IS: 1343-1980	Code of Practice for Pre stressed Concrete.
14	BS 8081:2015 & BSEN-1537-2013 & IS 10270-1982 & IS 14268 class11/ASTM-416	Code of Diaphragm.
15	BS 8110: 1997 class-2 for gravity load. BS 8110: 1997 class-3 for gravity load and lateral load.	Code of PT slab

(ii) FOR PLUMBING WORKS

SN	I.S. Code	Description / Title
1.	IS: 1729	Specification for sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
2.	IS:1536	Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
3.	I.S: 1538 (Part-I to XXIII)	Specification for cast iron fittings for pressure for water, gas and sewage.
4.	I.S:3714	Code of practices for laying C.I pipes
5.	I.S:782	Specification for caulking lead
6.	I.S:1239 (Part-II)	Specification for mild steel tubes, tubular and other wrought steel filling.
7.	I.S:1879	Specification for malleable cast iron pipe fittings.
8.	I.S:4984	High-density polythene pipe for potable water supplies, sewage and Industrial effluents.
9.	I.S:783	Width and depth of trench for R.C.C pipes.
10.	I.S:4127	Width and depth of trench for S.W pipes.
11.	I.S: 780	Specification for sluice valve for water works purposes.
12.	I.S:651	Specification for salt glazed stoneware pipe and fittings
13.	I.S:7558	Code of practice for domestic hot water installation.
14.	I.S: 1742	Code of practice for building drainage
15.	I.S: 2064	Code of practice for selection, installation and Maintenance of Sanitary appliances
16.	I.S:2065	Code of practices for water supply in building
17.	I.S: 2183 (Part-I)	Code of practice for Plumbing in multistoried buildings.
18.	I.S:1239	Specifications for mild steel tubes 104ubular and other wrought steel fittings. (Fifth Revision)
19.	I.S:778	Specifications for copper alloy gate, globe and check valves for water works purposes.
20.	I.S:5312 (Part-I)	Specifications for swing check type reflux (Non-return) valve
21.	I.S : 3114	Code of Practice for laying of C.I. pipes (2nd Rev.)
22.	I.S. : 456	Code of practice for plain and reinforced concrete (3rd Rev.) (Amendment 2)
23.	I.S. : 12820	Code of practice for dimensional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas & sewage.
24.	I.S. : 1172	Code of basic requirements for water supply, drainage & sanitation (4th Rev.)

SN	I.S. Code	Description / Title
25.	I.S. : 1200 (Part-16)	Code of practice for methods or measurements of building and Civil Engineering works: Part 16 Laying of water and sewer lines including appurtenant items (3rd Rev.)
26.	I.S. : 1200(Part-19)	Code of practice for methods or measurements of building and Civil Engineering works: Part 19 Water supply, plumbing and drains (3rd Rev.)
27.	I.S : 3989	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (2nd rev.) (Amendment2)
28.	I.S : 13095	Butterfly valves for general purposes
29.	I.S : 458	Precast Concrete pipes (with or without reinforcement) (3rd rev.) (Amendment2)
30.	I.S : 1726	C.I. Manhole covers & frames (3rd rev.)
31.	I.S : 1916	Steel cylinder pipe with concrete lining and coating (1st rev.).
32.	I.S : 12592(part1)	Pre-cast concrete manhole covers and frames: Part 1 Covers (Amendment 3)
33.	I.S : 12592(part2)	Pre-cast concrete manhole covers and frames: Part 2 Frames
34.	I.S : 6392	Steel pipe flanges (Amendment 1)
35.	I.S : 6418	C.I and malleable C.I. flanges for general engineering purposes.
36.	I.S : 4985	Un plasticized PVC pipes for potable water supplies (2nd Rev) (Amendment 2)
37.	I.S : 7181	Horizontally cast double flanged pipes for water, gas and sewage.(1st Rev.) (Amendment 1)
38.	I.S : 210	Grey iron casting. (4th Rev.)
39.	BS EN 1057	Copper pipes
40.	BS EN 1254	Copper Fittings
41.	I.S : 4985	UPVC pipes
42.	I.S : 15778	CPVC pipes
43.	I.S : 8329	Ductile iron

List Codes and References mentioned below is not exhaustive and for reference purpose only. Contractor shall follow all the standards and codes mentioned in this schedule or adhere to relevant codes as per site requirement.

S. No.	CODE	NAME
1.	IS: 1893 – 2016	Criteria for Earthquake resistant deign of Structures
2.	IS: 13920-2016	Ductile detailing of Reinforced Concrete Structures subjected to Seismic forces.
3.	IS: 4326 – 1993	Earthquake resistant Design and construction of Buildings
4.	IS: 875 – 2015 (Part I to III & P a r t V)	Code and Practice for Design Loads (Other than earthquake) for Building and Structures like Dead, Imposed, Wind and other Loads
5.	IS: 456 – 2000	Plain and Reinforced Concrete (Code of practice)
6.	SP: 16	Design aids for Reinforced concrete Structure.
7.	SP: 34	Handbook on Concrete Reinforcement and Detailing
8.	IS: 3370 Part I, Part II and Part IV	Code of practice for Concrete structures for the storage of liquids.
9.	IS: 1786	Specification for High Strength Deformed Steel bars and wires for concrete reinforcement
10.	IS: 1904	Code and Practice for design and Construction of Foundations in Soils
11.	IS: 2950	Code and Practice for Design and Construction of Raft Foundations
12.	IS: 800-2007	Code of Practice for general Construction in Steel.
13.	IS: 1343-1980	Code of Practice for Pre stressed Concrete.
14.	IRC 5 : 1998	Standard specifications and code of practice for road bridges.
15.	IRC 6 : 2014	Standard specifications and code of practice for road bridges.
16.	IRC 24-2010	Standard specifications and code of practice for road bridges.

(iii) FOR FIRE FIGHTING WORKS

SN	I.S. Code	Description / Title
1.	I.S:1239	Specifications for mild steel tubes 106 tubular and other wroughtsteel fittings. (Fifth Revision)
2.	I.S:778	Specifications for copper alloy gate, globe and check valves forwater works purposes.
3.	I.S:5312 (Part-I)	Specifications for swing check type reflux (Non-return) valve
4.	I.S:908	Specifications for fire hydrant (2nd Revision)
5.	I.S:5290	Specifications for landing valve
6.	I.S:901	Specifications for coupling double male and female instantaneous pattern for firefighting (3rd revision)
7.	I.S:884	Specifications for first aid hose reel for firefighting (1st Revision)
8.	I.S:903	Specifications for fire hose delivery couplings branch pipe, nozzles and nozzles spanner (3rd revisions)
9.	I.S:933	Specifications for portable chemical from fire extinguisher
10.	I.S:15683	Specifications for fire extinguisher carbon dioxide type.

SN	I.S. Code	Description / Title
11.	I.S:2878	Specifications for fire extinguisher carbon dioxide type.
12.	I.S:9972	Specification for sprinkler
13.	I.S:3844	Code of practice for installation and Maintenance of internal fire hydrants and hose reels on promises.
14	I.S : 3114	Code of Practice for laying of C.I. pipes (2nd Rev.)
15.	I.S. : 456	Code of practice for plain and reinforced concrete (3rd Rev.) (Amendment 2)

(iv) (A) FOR HVAC WORKS

SN	I. S. Code	Description / Title
1.	I.S.3615	Glossary of Terms Used in Refrigeration & Air Conditioning.
2.	I.S.325	Three phase Induction Motors
3.	I.S. 1822	Motor Starters of voltage Not Exceeding 1000 volts
4.	I.S.3624	Bourden Tube Pressure and Vacuum Gauges
5.	I.S.2372	Timber for cooling towers
6.	I.S.7403	code of practice for selection of standard worm and helical gear boxes
7.	I.S.1620	Horizontal centrifugal pumps for clear, cold, fresh water
8.	I.S.996	Single phase small A.C. and Universal motors
9.	I.S.1239	Mild steel tubes, tubulars and other wrought steel fittings
10.	I.S.3589	Electrically welded steel pipes for water, gas and sewage
11.	I.S.6392	Steel pipe flanges
12.	I.S.778	Gun metal gate. globe and check valves for general purpose
13.	I.S.2592	Recommendation for methods of measurement of fluid flow by means plates and nozzles
14.	I.S. 277	Galvanised steel sheets
15.	I.S.737	Wrought aluminium and aluminium alloy sheet and strip for general purposes.
16.	I.S.655	Metal air ducts
17.	I.S. 732	Code of practice for electrical wiring and fittings for building.
18.	I.S.2516	A.C. circuit breakers
19.	I.S.900	Code of practice for installation and Maintenance of induction motors
20.	I.S. 1248	Direct acting electrical indicating installments
21.	I.S. 2516	A.C. circuit breakers for voltages not exceeding 1000 volts
22.	I.S.4047	Heavy duty air break switches and composite units of air break switches for voltage not exceeding 1000 volts.
23.	I.S.2208	HRC cartridge fuse links up to 650 volts
24.	I.S. 1554	PVC insulated (heavy duty) electric cables for working voltage up to and including (PART I) 1100 volts
25.	I.S.8183	Specification for bonded glass wool/ mineral wool
26.	I.S.4671	Specification for expanded polystyrene for thermal insulation purposes
27.	I.S.11561	Code of practice for testing of cooling towers
28.	I.S. 7896	Data for outside design conditions for air conditioning for summer months.
29.	I.S.8148	Packages air conditioners
30.	I.S.2370	Sectional cold rooms (walk-in type)

SN	I. S. Code	Description / Title
31.	I.S.5111	Testing of refrigerant compressors
32.	I.S.10594	Thermostatic Expansion Valve
33.	ASHRAE 62.1.2010	Ventilation for Acceptable Indoor Air Quality
34.	ECBC	Energy conservation Building Code
35.	NBC	National Bulging Code
36.	AHRI 550/590	Air-conditioning Heating and Refrigeration Institute
37.	ASME	American Society of Mechanical Engineers
38.	AMCA	Air Movement and Control Association
39.	UL	Underwriters Laboratories

(B) FOR I.S. SAFETY CODES

1.	I.S.660	Safety Code for Mechanical Refrigeration
2.	I.S.659	Safety Code for air conditioning
3.	I.S.3016	Code of Practice for precautions in welding and cutting operations
4.	I.S.818	Code of practice for safety and health requirements in electrical and gas welding and cutting operations
5.	I.S.5216	Code for safety procedure and practice in electrical works
6.	I.S.3696	Safety code for scaffolds and ladders

List of Main Bureau of Indian Standards Codes and Publications with latest revisions and amendments thereto be followed for analysis & Design.

SN	Code	Description
LOADS		
1.	IS-875 (Part-1)-1987	Code of practice for design loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored materials.
2.	IS-875 (Part 2)- 1987	Code of practice for design loads (other than earthquake) for buildings and structures – imposed loads.
3	IS- 875 (part 3) -1987	Code of practice for design loads (other than earthquake)for buildings and structures – wind loads)
4.	IS-875 (Part5)–1987	Code of practice for design loads (other than earthquake) for buildings and structures – special loads and load combinations.
5.	IS:1893-2002	Criteria for design earthquake resistant design of structures (general provision and buildings).
CONCRETE		
1.	IS:456 – 2000	Code of practice for plain and reinforced concrete.
2.	IS:1786 – 2008	Specification of high strength deformed bars and wires for concrete reinforcement.
3.	IS: 432 (Part-2) –1982	Specification of high strength deformed bars and wires for concrete reinforcement.
4.	IS:13920 – 1993	Ductile detailing of reinforced concrete structures subjected to seismic forces – code of practice.
5.	IS : 269 – 1989	Specification for ordinary, rapid hardening and low heat Portland cement.
6.	IS: 1489 – 1991	Specification for Portland pozzolana cement
7.	IS: 383 – 1970	Specification for coarse and find aggregates from natural sources for concrete.

SN	Code	Description
8.	IS : 516 – 1959	Method of test for strength of concrete.
9.	IS: 2645 – 1975	Specification for integral cement water proofing compounds.
10.	IS:3370-2009 Part 1& 2	Liquid retaining structures.
STEEL		
1.	IS:2062 – 1999	Steel for general structural purposes, specification.
2.	IS: 1161 – 1998	Specification of steel tubes for structural purpose.
3.	IS: 800 – 2007	Code of practice for general construction in steel.
4.	IS 4923	Hollow steel section for structural purpose.
5.	IS 1367	Technical specification for Thread bolts
6.	IS 816 - 1969	Code of practice for use of metal ARC welding for general construction in mild steel

(v) List of Reference Standards for Construction Activities

SN	Standard Number	Title
1	SP : 6 (1)	Structural Steel Sections
2	IS : 27	Pig Lead
3	IS : 325	Three Phase Induction Motors
4	IS : 554	Dimensions for pipe threads where pressure tight joints are required on the threads.
5	IS : 694	PVC insulated cables for working voltages up to & including 1100V.
6	IS : 779	Specification for water meters (domestic type).
7	IS : 782	Specification for caulking load
8	IS : 800	Code of practice for general construction in steel
9	IS : 1068	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium.
10	IS : 1172	Code of Basic requirements for water supply drainage and sanitation.
11	IS : 1367 (Part 1)	Technical supply conditions for threaded steel fasteners: Part 1introduction and general information.
12	IS : 1367 (Part 2)	Technical supply conditions for threaded steel fasteners: Part 2product grades and tolerances.
13	IS : 1554 (Part 1)	PVC insulated (heavy duty) electric cables: Part 1 for working voltages up to and including 1100 V.
14	IS : 1554 (Part 2)	PVC insulated (heavy duty) electric cables: Part 2 for working voltages from 33 KV up to and including 11 KV.
15	IS : 1726	Specification for cast iron manhole covers and frames.
16	IS : 1742	Code of practice for building drainage.
17	IS : 2064	Selection, installation and Maintenance of sanitary appliance code of practice.
18	IS : 2065	Code of practice for water supply in buildings.
19	IS : 2104	Specification for water meter for boxes (domestic type)
20	IS : 2373	Specification for eater meter (bulk type)
21	IS:2379	Colour code for identification for pipe lines
22	IS:2629	Recommended practice for hot dip galvanizing on iron and steel

SN	Standard Number	Title
23	IS : 3114	Code of practice for laying of cast iron pipes
24	IS : 4111 (Part 1)	Code of practice for ancillary structures in sewerage system: Part 1 manholes.
25	IS : 4127	Code of practice for laying glazed stoneware pipes.
26	IS : 4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes.
27	IS : 5329	Code of practice for sanitary pipe work above *ground for* buildings
28	IS : 5455	Cast iron *steps* for manholes.
29	IS : 6159	Recommended practice for design and fabrication of material, prior to galvanizing.
30	IS : 7558	Code of practice for domestic hot water installations.
31	IS : 8321	Glossary of terms applicable to plumbing work.
32	IS : 8419 (Part 1)	Requirements for water filtration equipment: Part 1 Filtration medium sand and gravel.
33	IS : 8419 (Part 2)	Requirements for water filtration equipment: Part 2 under drainage system.
34	IS : 9668	Code of practice for provision and Maintenance of water supplies and firefighting.
35	IS : 9842	Preformed fibrous pipe insulation.
36	IS : 9912	Coal tar-based coating materials and suitable primers for protecting iron and steel pipe lines.
37	IS : 10221	Code of practice for coating and wrapping of underground mild steel pipelines.
38	IS : 10446	Glossary of terms relating to water supply and sanitation.
39	IS: 11149	Rubber Gaskets
40	IS : 11790	Code of practice for preparation of butt-welding ends for pipes, valves, flanges and fittings.
41	IS : 12183 (Part 1)	Code of practice for plumbing in multistoried buildings: Part I water supply.
42	IS : 12251	Code of practice for drainage of building basements.
43	IS : 5572	Code of practice for sanitary pipe work.
44	BS : 6700	Specification for design, installation, testing and Maintenance of services supplying water for domestic use within buildings and their cartilages.
45	BS : 8301	Code of practice for building drainage
46	BSEN : 274	Sanitary tapware, waste fitting for basins, bidets and baths. General technical specification.
Pipes and Fittings		
47	IS : 458	Specification for precast concrete pipes (with and without reinforcement)
48	IS : 651	Salat *glazed* stone ware pipes and fittings.
49	IS : 1239 (Part 1)	Mild steel, tubes, tubulars and other wrought steel fittings: Part I Mild Steel tubes.

SN	Standard Number	Title
50	IS : 1239 (Part 2)	Mild Steel tubes, tubulars and other wrought steel fittings: Part 2 Mild Steel tubulars and other wrought steel pipe fittings.
51	IS : 1536	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
52	IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
53	IS : 1538	Cast Iron fittings for pressure pipes for water, gas and sewage.
54	IS : 1729	Sand Cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
55	IS : 1879	Malleable cast iron pipe fittings.
56	IS : 1978	Line pipe
57	IS : 1979	High test line pipe.
58	IS : 2501	Copper tubes for general engineering purposes
59	IS : 2643 (Part 1)	Dimensions for pipe threads for fastening purposes: Part 1 Basic profile and dimensions.
60	IS : 2643 (Part 2)	Dimensions for pipe threads for fastening purposes: Part 2 Tolerances.
61	IS : 2643 (Part 3)	Dimensions for pipe threads for fastening purposes: Part 3 Limits of sizes.
62	IS : 3468	Pipe nuts.
63	IS : 3589	Seamless or electrically welded steel pipes for water, gas and sewage (168.3 mm to 2032 mm outside diameter).
64	IS : 3989	Centrifugally cast (sun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
65	IS : 4346	Specifications for washers for use with fittings for water services.
66	IS : 4711	Methods for sampling steel pipes, tubes and fittings.
67	IS : 6392	Steel pipe flanges
68	IS : 6418	Cast iron and malleable cast iron flanges for general engineering purposes.
69	IS : 7181	Specification for horizontally cast iron double flanged pipe for water, gas and sewage.
Valves		
70	IS : 778	Specification for copper alloy float gage globe and check valves for water works purposes.
71	IS: 7181	Specification for sluice valves for water works purposes (50 mm to 300 mm size)
72	IS: 1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
73	IS : 2906	Specification for sluice valves for water works purposes (350 mm to 1200 mm size)
74	IS : 3950	Specification for surface boxes for sluice valves.
75	IS : 5312 (Part 1)	Specification for swing check type reflux (non return) valves: part Multi door pattern.
76	IS : 5312 (Part 2)	Specification for swing check type reflux (non return) valves: part Multi door pattern.
77	IS : 12992 (Part 1)	Safety relief valves, spring loaded : Design
Sanitary Fittings		

SN	Standard Number	Title
78	IS : 13095	Butterfly valves for general purposes
79	IS : 771 (Part 1 to 3)	Specification for glazed fire clay sanitary appliances.
80	IS : 774	Specification for flushing cistern for water closets and mina's (other than plastic cistern)
81	IS : 775	Specification for cast iron brackets and supports for wash basins and sinks
82	IS: 781	Specification for cast copper alloy screw down bib taps and stop valves for water services.
83	IS : 1700	Specification for drinking fountains.
84	IS : 2548 (Part 2)	Specification for plastic seats and covers for water closets: Part-1 thermoset seats and covers.
85	IS : 2556 (Part 1)	Specification for vitreous sanitary appliances (Vitreous china):part 1 general requirement.
86	IS: 2556 (Part 2)	Specification for vitreous sanitary appliances (vitreous china) part 2 specific requirements of wash down water closets.
87	IS: 2556 (Part 3)	Specification for vitreous sanitary appliances (vitreous china) part 3 specific requirements of squatting pans.
88	IS: 2556 (Part 4)	Specification for vitreous sanitary appliances (vitreous china) part 4 specific requirements of wash basins.
89	IS: 2556 (Part 6 sec 2))	Specification for vitreous sanitary appliances (vitreous china) part 6 specific requirements of urinals, section 2 half stall urinals.
90	IS: 2556 (Part 6 sec 4)	Specification for vitreous sanitary appliances (vitreous china) part 6 specific requirements of urinals, section 4 partition slabs.
91	IS: 2556 (Part 6 sec 5)	Specification for vitreous sanitary appliances (vitreous china) part 6 specific requirements of urinals, section 5 waste fittings.
92	IS:2556(part 6 Sec 6)	Specification for vitreous sanitary appliances (vitreous china) part 6 specific requirements of urinals, section 6 water spreaders for half stall urinals.
93	IS:2557 (part 7)	Specification for vitreous sanitary appliances (vitreous china) part 7 specific requirements of half round channels.
94	IS 2556 (Part 8)	Specification for vitreous sanitary appliances (vitreous china): Part 8 Specific requirements of siphoning wash down water closets.
95	IS : 2556 (Part 11)	Specification for vitreous sanitary appliances (vitreous china): Part 11 Specific requirements for shower rose.
96	IS : 2556 (Part 12)	Specification for vitreous sanitary appliances (vitreous china): Part 12 Specific requirements of floor traps.
97	IS : 2556 (Part 15)	Specification for vitreous sanitary appliances (vitreous china): Part 15 Specific requirements of universal water closets.
98	IS:2692	Specification for ferrule for water services
99	*IS :* 2717	Glossary of terms relating to vitreous enamelware and ceramic metal systems
100	IS : 2963	Specifications for waste plug and its accessories for sinks and wash basins.
101	IS : 3311	Specifications for waste plug and its accessories for sinks and wash basins.

SN	Standard Number	Title
102	IS : 5961	Specification for cast iron gratings for drainage purposes.
103	IS : 6249	Specification for gel-coated *glass* fibre reinforced polyester resin bath tubs.
104	IS : 6411	Specification for gel-coated glass fibre reinforced polyester resin bath tubes.
105	IS : 8931	Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services.
106	IS : 9758	Specification for flush valves and fitting for water closets and urinals.
Pumps & Vessels		
107	IS: 1520	Specification for horizontal centrifugal pumps for clear cold fresh water.
108	IS : 2002	Steel plates for pressure vessels for intermediate and high temperature service including boilers
109	IS : 2825	Code for unfired pressure vessels.
110	IS : 4648 (Part 1)	Code of practice for lining of vessels and equipment for chemical processes v Part 1 : Rubber lining
111	IS : 5600	Specification for sewage and drainage pumps
112	IS : 8034	Specification for submersible pump sets for clear, cold, fresh water
113	IS : 8418	Specification for horizontal centrifugal self-priming pumps.
114	IS : 374	Ceiling fans and regulators (3rd revision)
115	IS : 694	PVC insulated Electric cable for working voltage upto and including 1100 volts.
116	IS : 732	Code of practice for electrical wiring and installation
117	IS : 1255	Code of Practice for installation and Maintenance of Power Cables upto and including 33 KV rating (Second Revision).
118	IS : 1258	Bayonet tamp holders (Third revision)
119	IS : 1293	Three pin plugs and sockets outlets rated voltage upto and including 250 volts and rated current upto and including 160 amps.
120	IS : 1554 (Part - I)	PVC insulated (Heavy Duty) electric cables for working voltages upto and including 1100 volts.
121	IS : 1646	Electrical installation fire safety of buildings (general) Code of practice.
122	IS : 1885	Glossary of items for electrical cables and conductors
123	IS : 1913	General and safety requirements for fluorescent lamps luminaries Tubular
124	IS : 2071	Methods of high voltage testing
125	IS : 2309	Protection of building and allied structures against lightning
126	IS : 2551-	Danger notice plate.
127	IS : 3043	Code of practice for earthing.
128	IS : 3427	AC Metal enclosed switch gear and control gear for rated voltages above 1 KV and up to and including 52 KV.
129	IS : 3480	Flexible steel conduits for electrical wiring.
130	IS : 3837	Accessories for rigid steel conduit for electrical wiring.
131	IS : 4146	Application guide for voltage transformers
132	IS: 4615	Switch socket outlets.

SN	Standard Number	Title
133	IS : 5133 (Part -I)	Boxes for the enclosure of electrical accessories.
134	IS : 5216 (Part-1)	Guide for safety procedures and practices in electrical work.
135	IS : 5424	Rubber mats for electrical purposes.
136	IS : 5578 & 11353	Marking and arrangement of bus bar
137	IS : 7098 - (Part - II)	Cross linked polyethylene insulated PVC sheathed cables. Voltages from 3.3 KV up to and including 33 KV
138	IS : 8130	Conductors for insulated electric cables and flexible cords
139	IS : 8623 - (Part -D	Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC and 1200 V D C.
140	IS : 8828	Miniature Circuit Breakers
141	IS : 9537	Rigid Steel Conduits for electrical wiring (Second Revisions)
142	15:10810	Methods of test for cables.
143	IS : 12640	Earth Leakage Circuit Breakers
144	IS : 13947	Degree of protection provided by enclosures for LV switchgear and control gear.
145	IS : 13947	General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.
146	IS : 15652	Insulating mats for electrical purposes.
147	IS : 1651 & 1652	Stationary cells and batteries lead acid type.
148	IS : 2551-1982	Danger notice plate.
149	IS : 3043 - 1987	Code of practice for earthing.
150	IS : 4146 - 1983	Application guide for voltage transformers
151	1S : 5216 1982 (Part- I)	Guide for safety procedures and practices in electrical work.
152	IS 5:1994	Colours for ready mixed paint and enamels
153	IS 2705 (Part-1) : 1992 (second revision)	Current transformers - Specification General requirements
154	IS 2705 (Part-2) : 1992 (Second Revision)	Current transformers – Specification Measuring Current Transformers
155	IS 2705 (Part-3) : (Second revision)	Current transformers – Specification Protective Current Transformers
156	IS:2705 (part 4) Second revision1992	Current transformers – Specification Protective Current Transformers for Special Purpose Applications
157	IS 3043 :1987	Code of practice for earthing
158	IE Rules, with amendments upto 1995 :1956	Indian Electricity Rules
159	IS : 2071 - 1974 - 76	Methods of high voltage testing
160	IS : 3427 :1997 IEC:60298,60694	AC Metal enclosed switchgear and control gear for rated voltage above lkv and upto and including 52kv.
161	IS : 12729 :1998	General requirement for switchgear and control gear for voltage exceeding 1000V

SN	Standard Number	Title
162	IS : 13118 :1991	Specification for high voltage alternating current circuit breaker
163	IS: 5578 & 11353-1985	Marking and arrangement of bus bars
164	IS: 3156	Potential transformer
165	IS: 9385	HV HRC Control Fuse
166	IS: 1248	For measuring instruments
167	IS : 2026 - 1977 to 81 (Part Ito IV)	Power Transformers
168	IS : 2551-1982	Danger notice plate.
169	IS : 3043 — 1987	Code of practice for earthing.
170	IS : 4146 — 1983	Application guide for voltage transformers
171	IS : 5216 — 1982 (Part-I)	Guide for safety procedures and practices in electrical work.
172	IS 5:1994	Colours for ready mixed paint and enamels
173	IS 2705 (Part-1) : 1992 (Second Revision)	Current transformers - Specification General requirements
174	IS 2705 (Part-2) 1992 (Second Revision)	Current transformers – Specification Measuring Current Transformers
175	IS 2705 (Part-3) : (Second Revision) 1992	Current transformers – Specification Protective Current Transformers
176	IS 2705 (Part-4) : (Second Revision)1992	Current transformers – Specification Protective Current Transformers for Special Purpose Applications
177	IS 3043 :1987	Code of practice for earthing
178	IE Rules, with amendments upto 1995 :1956	Indian Electricity Rules
179	1EC 44 -1 :1996	Instrument Transformer -P1 : Current Transformer
181	IS:10561 :1977	Power Transformers: General
182	IS 4146: 1983	Application guide for voltage transformers
183	1S:8478: 1978	Application guide for on-load tap changers
184	IS:10028 Part-1: 1985	Code of practice for selection, installation and Maintenance of power transformers: Selection
185	IS:10028 Part-2 1981	Code of practice for selection, installation and Maintenance of power transformers: Installation
186	IS:3639 : 1966	Fittings and accessories for power transformers
187	IS:4201: 1983	Application guide for current transformers
188	IS:4257 Partl : 1981	Dimensions for clamping arrangement for bushings 12kV to 36Kv
189	IS:8603 Parts lto3 : 1977	Dimensions of porcelain transformer bushings for use in heavily polluted atmosphere

SN	Standard Number	Title
190	IS: 554-1985 (Reaffirmed 1996)	Dimensions for pipe threads where pressure tight joints are required on the threads
191	IS: 665 – 1963 (Reaffirmed 1991)	Metal air ducts
192	IS: 659 - 1964	Air conditioning (Safety code)
193	IS: 660 - 1963	Mechanical Refrigeration (Safety code)
194	IS: 694 – 1990 (Reaffirmed 1994)	PVC insulated (HD) electric cables for working voltage upto and including 1100 volts
195	IS: 732-1989	Code of Practice for electrical wiring
196	IS: 780-1984	Sluice valves for water works purposes
197	IS: 822-1970 (Reaffirmed 1991)	Code of procedure for inspection of welds
198	IS: 1239 (Part-I) 1990	Mils steel tube
199	IS: 1239 (Part-II) 1992	Mild steel tubulars and other wrought steel pipe fittings
200	IS: 1255 - 1983	Code of practice for installation and Maintenance of Power Cables upto and including 33 KV rating (Second Revision)
201	IS: 1554 - 1988	PVC insulated (Heavy Duty) electric cables (part-I) for working voltages upto and including 1100 volts
202	IS: 1897 – 1983	Copper bus bar
203	IS: 2379 – 1990	Colour code for the identification of pipelines
204	IS: 2551 – 1982	Danger notice plate
205	IS: 3043 – 1987	Code of practice for earthing
206	IS: 3103 – 1975	Code of practice for Industrial Ventilation
207	IS: 3837 – 1976	Accessories for rigid steel conduit for electrical wiring
208	IS: 4736 – 1986	Hot-dip zinc coating on steel tubes
209	IS: 4894 – 1987	Centrifugal Fan
210	IS: 5133 – 1969	Boxes for the enclosure of electrical accessories
211	IS: 5216 – 1982 (Part-I)	Guide for safety procedure and practices in electrical work
212	IS: 5312 (Part-II) 1984 (Reaffirmed 1990)	Swing – check type reflux Non-return valves for water works
213	IS: 5421 – 1969	Rubber mats for electrical purposes
214	IS: 5578& 11353–1985	Marking and arrangement of bus bars
215	IS: 6392 – 1971 Reaffirmed 1988)	Steel pipe flanges
216	IS: 8623 – 1977 (Part-I)	Factory bill assemblies of switchgear and control gear for voltages upto an including 1000 VAC and 1200 VDC
217	IS: 8623 – 1980 (Part-II)	Bus Bar trunking system
218	IS: 8828 – 1996 IEC 898 - 1995	Miniature Circuit Breakers

SN	Standard Number	Title
219	IS: 9537 – 1981	Rigid steel conduits for electrical wiring (Second Revisions)
220	IS: 10810 – 1988	Methods of test for cables
221	IS:13947(Part-II)– 1993	Air circuit breakers
222	IS:13947IEC 947 – 2–1989	Molded case circuit breakers
223	IS: 13947 – 1993	Degree of protection provided by enclosures for LV switchgear and control gear
224	IS: 13947 – 1993	General requirement for switchgear and control gear for voltage not exceeding 1000 volts
225	**ASHREA**	American society of Heating Refrigeration & Air-conditioning books HVAC Systems and Equipment 2008
		HVAC Application 2007
		Refrigeration 2006
		Fundamental 2005
		Indoor air quality 90.1.2007
226	IEC	Relevant Sections
227	ASME, Section VIII	Boiler and Pressure Vessel Code
National Fire Protection Association (NFPA) – USA		
228	No. 70 – 90 or 70 - 93	National Electric Code
229	No. 72 – 1993	National Fire Alarm Code
230	No. 101 – 91	Life Safety Code
231	No. 90A	Practice for Smoke Control System
232	No. 76	Telecommunication Facilities
233	No. 318	Clear Room Applications
Underwriters Laboratories Inc. (UL) – USA		
234	UL 50	Cabinets & Boxes
235	UL 268	Smoke detectors for Fire Protective Signaling Systems
236	UL 864	Control units for Fire Protective Signaling Systems
237	UL 268A	Smoke detectors for Duct Application
238	UL 521	Thermal detectors for Fire Protective Signaling Systems
239	UL 228	Door Closers – holders for Fire Protective Signaling Systems
240	UL 464	Audible signaling appliances
241	UL 38	Manually activated Signaling Boxes
242	UL 346	Water floor indicators for Fire Protective Signaling Systems
243	UL 1481	Power supplied for Fire Protective Signaling Systems
244	UL 1076	Proprietary burglar alarm units & systems
245	UL 1791	Visual notifications appliances

Road Works	
IRC 5	Standard Specifications and Code of Practice for Road Bridges,
	Section I – General Features of Design
IRC 6	Standard Specifications and Code of Practice for Road Bridges,
	Section II – Loads and Stresses
IRC 11	Recommended Practices for the Design of Layout of Cycle Tracks

IRC 19	Standard Specifications and Code of Practice for Water Bound Macadam
IRC 112	Standard Specifications and Code of Practice for Road Bridges
	Section III–Cement Concrete (Plain and Reinforced)
IRC 22	Standard Specifications and Code of Practice for Road Bridges,
	Section VI – Composite Construction
IRC 37	Guidelines for the Design of Flexible Pavement
IRC 48	Tentative Specifications for Bituminous Surface Dressing Using Pre-coated Aggregates
IRC:SP 11	Handbook of Quality Control for Construction of Roads and Runways
IRC:SP 11	Handbook of Quality Control for Construction of Roads and Runways
IRC:44-2017	Guidelines for Cement Concrete Mix Design for Pavements (Third Revision)

(vi) CONDUIT AND WIRE

Conduit	Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
Wire	All system wiring shall be new. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. a. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meet the requirements of NFPA72. b. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA90A.

(vii) Lighting Protection

IEC 60598-1	Luminaires – Part 1: General requirements and tests
IEC 60598-2	Luminaires – Part 2: Particular requirements
IEC 60400	Lamp holders for tubular fluorescent lamps and starter- holder
NFPA	National Fire Protection Association

Annexure -IV

(Schedule-D)

Specifications for Solar Works

1 Solar Photovoltaic Modules

1.1 The total Solar PV minimum array capacity should not be less than 250kWp and should comprise of modules with latest technological features to provide minimum of 16% module efficiency with minimum 320 Wp and above wattage of module. Module capacity less than 240 Wp should not be supplied. The module type must be qualified as per IEC 61215. SPV module conversion efficiency should be equal to or greater than 16.0% under STC of 1000w/m2 and cell operating temp of 250 C and AM 1.5 radiations. Modules must qualify to IEC 61730 Part I and II for safety qualification testing. Certificate for module qualification from IEC or equivalent to be submitted as part of the bid offer.

1.2 The PV module shall perform satisfactorily in humidity up to 100% with temperature between 0^0C to + 50^0C. Since the modules would be used in a high voltage circuit, the high voltage insulation test shall be carried out on each module and a test certificate to that effect provided.

1.3 Manufacturers / Contractors should confirm whether they are supplying PV module using a RF identification tag (RFID), which must contain the following information. The RFID can be inside or outside the module laminate, but must be able to withstand harsh environmental conditions.

(i) Name of the manufacturer of PV Module

(ii) Name of the Manufacturer of Solar cells

(iii) Month and year of the manufacture (separately for solar cells and module)

(iv) Country of origin (separately for solar cells and module)

(v) I-V curve for the module

(vi) Peak Wattage, Im, Vm and FF for the module Unique Serial No and Model No of the module

(vii) Date and year of obtaining IEC PV module qualification certificate

(viii) Name of the test lab issuing IEC certificate

(ix) Other relevant information on traceability of solar cells and module asper ISO 9000series.

1.4 Other general requirement for the PV modules and subsystems shall be the following

(i) The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-

pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP65rated.

(ii) Necessary I-V curves at 25^0c, 45^0c, 60^0c and at NOCT are required to be furnished. Offers to provide PV module warranty of 10 years with no more than 10% degradation in performance/output.

2 Technical Specifications for High Efficiency PV Modules

2.1 The PV modules to be positioned to take maximum advantage of available sunlight within string constraints. Bidder will position the PV modules in such a manner that the maximum power is obtained with the sun's movements during the day.

2.2 The supplier / manufacturer of the PV Module shall be in existence for atleast 15 years for international supplier and 3 years for Indian supplier in the Solar PV manufacturing field with proven track record.

2.3 The Photovoltaic modules must be qualified as per IEC 61215 and in addition, the modules must conform to IEC 61730□1 and IEC 61730□2 requirements for construction & Part□2 requirements for testing, for safety qualification. The modules shall be RoHS compliant. The test certificates can be from any of the International Accredited Testing Calibration Laboratories

2.4 The PV Modules shall be "PID Free" and the certification of the same shall be submitted along with the modules by the supplier from an Internationally Recognized certification agency for PID testing.

2.5 The PV Modules shall be "LID Free" and there shall not any effect of LID on the modules in the first year of installation.

2.6 Minimum proven cell efficiency shall be greater than or equal to 22% on commercial scale and on lab scale the minimum proven cell efficiency shall be greater than or equal to25%.

2.7 The efficiency of the module should be greater than or equal to 19.0%. Supplier shall follow the latest engineering practice; ensure long term compatibility requirements and continuity of equipment supply and the safety of the operating staff.

2.8 The PV Modules shall be Salt Mist Corrosion Tested Panels of min severity level 5 or above, since the modules may be installed very close to seashore or factories emitting pollutant gases or harsh environmental conditions.

2.9 The optimum generation of electricity of PV capacity installed vis-à-vis available solar radiation at the site may be obtained through use of either a seasonal tilt structural arrangement or single axis solar tracking system, lower cable losses, maximization of power transfer from PV modules to electronics, maximization of power generation by enhancing incident radiation by optional methods like seasonally changing tilt angles etc.

2.10 The manufacturer of the modules shall provide certification on qualification of PV modules.

2.11 The PV module shall perform satisfactorily in humidity upto 100% with temperature between +20 deg. C to +40 deg C and with stand wind dust up to 150 km/h from back side of the panel. Photo / electrical conversion efficiency of the modules of SPV module shall be greater than or equal to 19.0 %. Since the modules would be used in a low/medium voltage circuit, the insulation test shall be carried out on each module and a test certificate to that effect provided. The bidder shall indicate minimum efficiency. PV modules used in solar power plants/ systems must be warranted for minimum 90% output of Pmin capacity for the first ten years and 80% output of Pmin capacity at the end of 25 years. The product workmanship shall be guaranteed for 10 years.

2.12 The panel should have positive tolerance of Maximum output power and the maximum voltage shall not exceed 1000V. The negative temperature coefficient of power max shall be equal to or less than □0.3% per deg C temperature.

2.13 PV module shall be provided with frame of Anodized Aluminum (either Black or Other) channels for size and simplicity in installation offered as a single module or series parallel combination of modules. The module frame, if any, shall be made of a corrosion resistant material which shall be electrolytic ally compatible with the structural material used for mounting the modules.

2.14 The PV modules shall be made of light weight cells, resistant to abrasion, hail impact, rain, water and environmental pollution. The PV modules shall be provided with Anti Reflection coating and the Glass shall be AR Coated tempered glass.

2.15 The PV module shall use lead wire with weatherproof connector for output terminal.

2.16 The power output of the PV system under Standard Test Conditions (STC) should be sufficient to meet the requirement and the required power made of suitable module size depending upon manufacturer prudent practice with required output voltage. The number of modules to be supplied shall be worked out accordingly. Module less than 240Wp capacity should not be supplied or installed.

2.17 In order to optimize the overall structural cost, each of the PV Modules shall be less than or equal to 15 Kg weight in order to reduce the overall civil cost of the project.

3 Technical Specification for Inverter

3.1 Central / String inverters shall be used. The inverter should convert DC power produced by SPV modules, in to AC power and adjust the voltage & frequency levels to suit the local grid conditions. Inverter shall interconnect and feed power to the LT panel and wherever required export surplus power to the grid at 11KV. Mandatory Technical Specification is as below:

Specification of Inverter

a.	**AC side**	**As per Tender design**
i	Nominal AC Power	25 kW

ii	Output AC Voltage	415 V, 415V+/- 10%
iii	Frequency	50 Hz
iv	Total harmonic distortion	< 3% at nominal power.
v	AC over / under voltage, under frequency protection.	Yes
vi	Phase SIFT (COS Phi)	1
b.	**DC Side**	
i	PV Power	23 kWp
ii	Maximum DC Voltage	1000 V
iii	MPPT Voltage range	1000 V
iv	Maximum DC Current *	Design to be submitted
v	DC voltage ripple	<3%
vi	DC over voltage protection	Yes
c.	**Other Parameters**	
i	Minimum efficiency (CE)	>98%
ii	Ambient temperature	0-50º C
iii	Humidity (Non Condensing)	95%
iv	Degree of protection for enclosure	IP 54 (Outdoor type)
v	Dimension / Weight	As per Manufacturer
vi	Noise level	< 65 dBA
vii	Cooling	Forced Air

3.2 Other important Features/Protections required in the Inverter

(i) Automatic morning wake-up and nightly shutdown

(ii) Inverter must have the feature to work in tandem with other similar inverters and be able to be successively switched ON and OFF automatically based on solar radiation variations during the day.

(iii) Mains (Grid) over-under voltage and frequency protection

(iv) Fool proof protection against ISLANDING.

(v) Included authentic tracking of the solar arrays maximum power operation voltage (MPPT).

(vi) Array ground fault detection.

(vii) LCD and piezoelectric keypad operator interface Menu driven Automatic fault conditions reset for all parameters like voltage, frequency and/or blackout.

(viii) MOV type surge arresters on AC and DC terminals for over voltage protection from lightning-induced surges or else suitable arrangement shall be provided externally.

(ix) The inverter shall have AC /DC side dis-connector of appropriate rating or else suitable arrangement shall be provided externally.

(x) Inverter should be rated to operate at 0 –55 deg centigrade unless provision for air conditioning is included in Inverter

(xi) Shall be provided with an isolating transformer.

(xii) Allparametersshouldbeaccessiblethroughanindustrystandardcommunicationlink.

4 Parallel Operation with Grid

4.1 The Inverter shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents.

4.2 The Inverter shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of Inverter component failure or from parameters beyond the Inverter‘s safe operating range due to internal or external causes. The self-protective features shall not allow signals from the Inverter front panel to cause the Inverter to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the Inverter, including commutation failure, shall be cleared by the Inverterprotectivedevicesandnotbytheexistingsiteutilitygridservicecircuitbreaker.

4.3 The Inverter shall go to shutdown/standby mode, with its contacts open, under the following conditions before attempting an automatic start after an appropriate time delay; insufficient solar power output.

4.4 Insufficient Solar Power Input.

4.5 When the power available from the PV array is insufficient to supply the losses of the Inverter, the Inverter shall go to a standby/shutdown mode. The Inverter control shall prevent excessive cycling during rightly shutdown or extended periods of insufficient solar radiation.

4.6 Utility-Grid Over or Under Voltage

4.7 The Inverter shall restart after an over or under voltage shutdown when the utility grid voltage has returned to within limits for a minimum of two minutes.

4.8 Utility-Grid Over or Under Frequency

4.9 The Inverter shall restart after an over or under frequency shutdown when the utility grid voltage has returned to the within limits for minimum of two minutes.

4.10 The Inverter Powerfactoratthepointofutilityserviceconnectionshallbe>0.99laggingor leading when operating at above 25 percent of the rated output, but may be less than 0.99 laggingbelow25percentoftheratedoutput.

4.11 The high voltage and power circuits of the Inverter shall be separated from the low-voltage and control circuits. The internal copper wiring of the Inverter shall have flame resistant insulation.UseofPVCisnotacceptable.Allconductorsshallbemadeofstandardcopper.

4.12 The Inverter shall withstand a high voltage test of 2000Vrms, between either the input or the output terminals and the cabinet (chassis).

4.13 Full protection against accidental open circuit and reverse polarity at the input shall be provided.

4.14 The Inverter shall not produce Electromagnetic Interference (EMI) which may cause malfunctioning of electronic and electrical instruments including communication equipment, which are located within the facility in which the Inverter is housed.

4.15 The Inverter shall have an appropriate display on the front panel to display the instantaneous AC power output and the DC voltage, current and power input. Each of these measurement displays shall have an accuracy of 1 percent of full scale or better. The display shall be visible from outside the Inverter enclosure. Operational status of the Inverter, alarms, trouble indicators and ac and the dc disconnect switch positions shall also be communicated by appropriate messages or indicator lights on the front cover of the Inverter enclosure.

4.16 Communication Modbus protocol with LAN/WAN options along with remote access facility and SCADA package with latest monitoring systems including individual string monitoring with Web/IP data monitoring shall be provided.

5 Electrical Safety, Earthing and Protection

5.1 Internal Faults: In built protection for internal faults including excess temperature, commutation failure, overload and cooling fan failure (if fitted) is obligatory.

5.2 Galvanic Isolation: Galvanic Isolation is required to avoid any DC component being injected into the grid and the potential for AC components appearing at the array (required inc central inverters).

5.3 Over Voltage Protection: Over Voltage Protection against atmospheric lightning discharge to the PV array is required. Protection is to be provided against voltage fluctuations in the grid itself and internal faults in the power conditioner, operational errors and switching transients.

5.4 Earth fault supervision: An integrated earth fault device shall have to be provided to detect eventualearthfaultonDCsideandshallsendmessagetothesupervisorysystem.

5.5 Cabling practice: Cable connections must be made using PVCC u cables, as per BIS standards. All cable connections must be made using suitable terminations for effective contact. The XLPODC Grade Cu cables of 1.1kV grade must be run in GI trays with covers for protection.

5.6 Fast acting semiconductor type current limiting fuses at the main bus-bar to protect from the grid short circuit contribution. The Inverter shall include an easily accessible emergency OFF button located at an appropriate position on the unit.

5.7 All exposed surfaces of ferrous parts shall be thoroughly cleaned, primed, and painted or otherwise

6 General Features of Inverter:

6.1 The Inverter enclosure shall be weatherproof and capable of surviving climatic changes and should keep the Inverter intact under all conditions in the room where it will be housed. The Inverter shall be located outdoor with suitable protection and should be either wall/pad mounted. Moisture condensation and entry of rodents and insects shall be prevented in the Inverter enclosure. The enclosure for housing the inverter shall be minimum IP54 protection level.TheinverteritselfshallbeminimumIP20protectionlevel.

6.2 Components and circuit boards mounted inside the enclosures shall be which shall also serve to identify the items on the supplied drawings.

6.3 All doors, covers, panels and cable exists shall be gasket or otherwise designed to limit the entry of dust and moisture. All doors shall be equipped with locks. All openings shall be provided with grills or screens with openings no larger than 0.95cm.(about3x8inch).

7 Operating Modes

7.1 The following operating modes are to be made available: Night or Sleep mode: Where the inverter is almost completely turned off, with just the timer and control system still in operation, losses should not exceed1watts per 5 kilowatt.

(i) Standby mode: Where the control system continuously monitors the output of the solar generator until pre-set value is exceeded (typically10watts)

(ii) Operational or MPPT tracking mode: The control system continuously adjust the voltage of the generator to optimize the power available. The power conditioner must automatically re-enter stand-by mode when input power reduces below the standby mode threshold. Front Panel display should prove the status of the Inverter, including AC Voltage, Current, Power output & DC Current, Voltage and Power input, pf and fault Indication (ifany).

8 Technical Specifications for Array Structure

8.1 Wherever required, suitable number of PV panel structures shall be provided.

8.2 Structural material shall be corrosion resistant and electrolytically compatible with the Materials used in the module frame, its fasteners, nuts and bolts. Galvanizing should meet ASTMA-123 hot dipped galvanizing or equivalent which provides atleast spraying thickness of 80 microns on steel as per ISi5905, if steel frame is used. Aluminum frame structures with adequate strength and in accordance with relevant BIS/international standards can also be used.

(i) Structures shall be supplied complete with all members to be compatible for allowing easy installation.

(ii) Each structure shall have a provision to adjust its angle of inclination to the horizontal as per the site conditions by way of motorized operation i.e. single axis and dual axis tracking for maximization of the power generated.

(iii) The structure should be capable of withstanding a wind load of 150 km/hr after grouting & installation. Grouting material for SPV structure shall be as per M15 (1:2:4) concrete specification.

(iv) The structures shall be designed for simple mechanical and electrical installation. There shall be no requirement of welding or complex machinery at the installation site. If prior civil work or support platform is absolutely essential to install the structures, the Contractor shall clearly and unambiguously communicate such requirements alongwith their specifications in the bid. Detailed engineering drawings and instructions for such prior civil work shall be carried out prior to the supply of Goods.

(v) The Contractor shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings. Such details shall include, but not limited to, the following;

(a) Determination of true south at the site;
(b) Array tilt angle to the horizontal, with permitted tolerance;
(c) Details with drawings for fixing the modules;
(d) Details with drawings of fixing the junction/terminal boxes;
(e) Inter connection details inside the junction/terminal boxes;
(f) Structure installation details and drawings;
(g) electrical grounding(earthing);
(h) Inter-panel/Inter-row distances with allowed tolerances; and
(i) Safety precautions to be taken.

The array structure shall support SPV modules at a given orientation and absorb and transfer the mechanical loads to the terrace columns and beams properly. All nuts and bolts shall be of very good quality stainless steel. Detailed design and Drawing shall have to submitted to the consultant engaged by client or the Engineer-in-charge for acceptance and approval before execution of work.

9 Technical Specifications for Cables & Wires

9.1 Cabling: Cabling shall be carried out as per IE Rules. All other cabling above ground should be suitably mounted on cable trays with proper covers. Only LSHZXLPO cables must be used for DC side, DC grade cables shall be used. For AC power shall be XLPE insulated PVC sheathed aluminium/ copper conductor cables.

9.2 Wires: Only FRL Scopper wires of appropriate size and of reputed make shall have to be used.

9.3 Cables Ends: All connections are to be made through suitable cable/lug/terminals/MC-4connectors; crimped properly & with use of Cable Glands.

9.4 Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified.

9.5 Multi Strand, Annealed high conductivity copper conductor
(i) Overall PVC insulation for UV protection and confirm to IEC69947

(ii) All cables shall conform to BIS standards (IS694)and (IS1554)28

(iii) The size of each type of cable selected shall be based on minimum voltage drop, however, the maximum drop shall be limited to 2%

(iv) Allelectricalcontrol/powercables/wiresinsidethebuildingtobefixedinaccordance withCPWDspecificationsforelectricalworksPart-IinternalonlyRigidSteelConduit should be used for wiring inside the building

(v) Proper laying of cables have to be ensured in appropriate cable trays, pipes/trenches as per site requirement.

10 Technical Specifications for Surge Arrestor

10.1 SURGE PROTECTOR CATEGORYII

(i) The surge Protection manufacturer shall offer a complete line of surge Protection product to support the requirements for the Distribution. The surge protector at this stage shall be provided to protect the downstream electrical and electronics against any induced switching surges that may be passed on to the downstream electrical & electronic system.

(ii) The Protection unit shall be based on Single High Capacity Metal Oxide Varistors (MOV), capable of handling 8/20μs surges and shall be able to give an indication in the event module failure and be pluggable to facilitate the in-service replacement without distributing the lines.

10.2 PLANT METERING/DATA LOGGING

(i) PV array energy production: Digital Meters to log the actual value of AC Voltage, Current One way HT energy meter (Export metering) Class 0.2 SABT Compliant shall be incorporated in the system on the main 11KV AC Grid supply complete with CTs/PTs in the main plant ODY.

(ii) Solar Irradiance: An integrating Pyranometer (Class I) should be provided, with the sensor mounted in the plane of the array. Read out should be integrated with data logging system.

(iii) Wind Speed: An integrated wind speed measurement unit be provided.

(iv) Temperature Sensor: Integrated temp. sensors for measuring the module surface temp., inverter inside enclosure temp. and ambient temp to be provided complete with read outs integrated with the data logging system.

(v) A data logging system (Hardware and software) for plant control and monitoring shall be provided with the following features: 2no‘s suitable Computers (HP/DELL): 3GHz Pentium i7 latest with 1.0T BHDD, 3GB RDRAM, 2 Parallel & 2 Serial Port, Wi-Fi Lan Card, DVDRW Drive, 20 ǁLED display, USB Scroll Mouse, alongwith two All in one (HP) professional series 600dpi/20ppm Desktop Laser Jet printers along with one 2KVA on-lineups with 1 hour battery backup.

(vi) Remote Supervisory Control and data acquisition through SCADA software at the Departments location through Handheld device/GSMcellular device with latest

software/hardware configuration and service connectivity for online/real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the contractor.

(vii) All major parameters should be available on the digital bus and logging facility for energy auditing through the internal microprocessor and can be read on the digital front panel at any time the current values, previous values for upto a month and the average values. The following parameters should be accessible via the operating interface display.

(a) AC Voltage
(b) AC Output current & Output Power
(c) DC Input Voltage DC Input Current
(d) Active Time disabled
(e) Time Idle Temperatures Inverter Status
(f) Protective function limits (Viz-AC Over voltage, AC Under voltage, Over frequency, Under frequency ground fault, PV starting voltage, PV stopping voltage, Over voltage delay, Under voltage delay over frequency, Ground fault delay, PV starting delay, PV stopping delay)

10.3 Inverter/ARRAYSIZERATIO

The Inverter continuous power rating shall be not below 90% of array power. Calculations must be submitted.

10.4 Maximum Power Point Tracker(MPPT)

Maximum power point tracker shall be integrated in the Inverter to maximize energy drawn from the array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned. The MPPT must have provision (manual setting) for constant voltage operation.

10.5 Plant Control, data logger & plant monitoring unit

Basically, this unit should perform the following:

(i) Individual Array monitoring via string monitoring system

(ii) Measurement and/or recording of energy parameters.

(iii) Simple data logger or energy meter to record the energy data on a pre-determined interval basis.

(iv) Measurement & continuous acquisition of ambient air temperature, wind speed, solar radiation, PV module temperature, individual string current, inverter output

(v) Voltage and current, output frequency

(vi) Operating state monitoring and failure indication.

(vii) Representation of monitored datas in graphics mode or in tabulation mode.

(viii) Controlling&monitoringtheentirepowersystemthroughremoteterminalatdepartmentoffi

ce as well as from a local terminal

(ix) Remote control/Instrumentation: The microprocessor control unit should have the provision for installation of RS – 232/485 communication link, should remote control and monitoring capability (by personal computer) be desired. All parameters, status and indicators and targets accessible through the local operator interface may be accessed remotely through these ports. Optional analog outputs (0-5VDC) for AC powers, DC current, DC Voltage can be supplied to interface with external data acquisition systems. Optional contacts inputs from an external SCAD/RTU or other remote control device can be provided within the inverter enclosure for remotely disabling or resetting setting the unit.

10.6 AC DISTRIBUTION PANEL BOARD

(i) AC Distribution Panel Board (DPB) shall control the AC power from inverter and Inter connection from ACDB to transformer and then to HT bus (if required to export power) be carried out and complete equipment along with metering (if required to export power) to be installed in the ACDB. Requirement/specifications of DCDB and ACDB may be changed as per site conditions. The AC panel shall be provided with adequate safety features to prevent transmission of fault.

(ii) The existing LT panel shall be upgraded to receive the solar power.

10.7 FIRE EXTINGUISHERS:

The firefighting system for the proposed power plant for fire protection shall be consisting of Portable fire extinguishers in the control room for fire caused by electrical short circuits. Sand buckets in the control room the installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing the batteries and Inverters.

10.8 LIGHTNING AND OVER VOLTAGE PROTECTION

There shall be the required number of suitable lightning arrestors installed in the array field. Suitableearthingsuchthatinducedtransientsfindanalternateroutetoearth.Protectionshall meet the safety rules as per Indian Electricity Act. All building earth conductors shall be interconnected through the concept of earth mats for interconnection with separate earth pits. For each earth pits necessary test points shall have to be provided.

10.9 EARTHING PROTECTION

Each array structure should be grounded properly. Provision should be kept for shorting and groundingofthePVarrayatthetimeofmaintenancework.Allmetalcasing/shieldingoftheplantsho uldbethoroughlygroundedinaccordancewithIndianelectricityAct/IERules.EarthResistancesho uldbetestedinpresenceoftherepresentativeofCPWDafterearthingbycalibrated earth tester. Inverter S, ACDB and DCDB should also be earthed properly. The 11KV side equipment and parts shall be earthed in compliance to Indian Electricity Rules‘1956, all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.

10.10 TOOLS & TACKLES AND SPARES:

After completion of installation & commissioning of the power plant, necessary tools &

tackles are to be provided free of cost by the contractor for maintenance purpose. List of tools and tackles to be supplied by the contractor for approval of specifications and make from CPWD. A list of requisite spares in case of Inverter comprising of asset of control logic cards, IGBT driver cards etc., Junction Boxes, Fuses, MCCBs etc. alongwith spare set of PV modules and batteries be indicated, which shall be supplied along with the equipment (at extra cost if required by the department). A minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished.

10.11 DANGER BOARDS

Dangerboardsshouldbeprovidedasandwherenecessaryasper IEAct./IErulesasamendedupto date.

11 List of Standards

(i) FM (Factory Mutual) USA for application in NEC Class1, Division 2, Group C&D

(ii) UL(Underwriterslaboratory)forelectricalandfiresafety(ClassCfirerating)

(iii) IEC61215

(iv) IEC61646

(v) IEC61730

(vi) UL1703

(vii) CEMark

(viii) Electrical Safety Tester (EST)Series

(ix) CE certified.

(x) TUV Rhine land.

(xi) RDSO approved.

(xii) BBIS approved

(a) BIS:694 PVC insulated Electric cable for working voltage upto and including 1100 volts.
(b) BIS:732 Code of practice for electrical wiring and installation
(c) BIS:1651&1652 Stationary cell & batteries, lead acid type.
(d) BIS:1885 Glossary of items for electrical cables and conductors
(e) BIS:2551 Danger noticeplates.
(f) BIS:3043 Code of practice for earthing.
(g) BIS:5216 Guide for safety procedures and practices in electrical work.
(h) BIS:5578 Guide for marking of insulated conductors
(i) BIS:8130 Conductors for insulated electric cables and flexible cords
(j) BIS:8623 Factory built assemblies of switch gear and control gear for voltages upto and including 1000V AC and 1200V DC.
(k) BIS:8828 Miniature Circuit Breakers
(l) BIS:9537 Rigid Steel Conduits for electrical wiring (Second RevBISions)

(m) BIS:10810 Methods of test for cables.
(n) BIS:11353 Guide for uniform system of marking and identification of conductors and apparatus terminals.
(o) BIS:12640 EarthLeakageCircuit Breakers
(p) BIS:13947 Molded Case CircuitBreakers
(q) BIS:13947 Degree of protection provided by enclosures for LV switchgear and control gear.
(r) BIS:13947 General requirement for switchgear and contro gear for voltage not exceeding 1000 Volts. SP:6(1) Structural Steel Sections
(s) BIS:325 Three Phase Induction Motors
(t) BIS:554 Dimensions for pipe threads where pressure tight joints are required on the threads.
(u) BIS:800Codeofpracticeforgeneralconstructioninsteel
(v) BIS:1367(Part1)Technical supply conditions for threaded steel fasteners
(w) Part1 Introduction and general information.
(x) BIS:1367 (Part2) Technical supply conditions for threaded steel fasteners: Part2 product grades and tolerances.
(y) BIS:2026 (Part I-IV) Power Transformer
(z) BIS:111 71 Dry type Transformer
(aa) BIS:1554 (Part1) PVC insulated (heavy duty) electric cables: Part1 for working voltages upto and including 1100V.
(bb) BIS:1554 (Part2) PVC insulated (heavy duty) electric cables: Part2 for working voltages from 3.3KV upto and including 11KV.

12 Acceptable Makes of Equipment

(i) Modules: Waaree/Nevitor/Goldigrain
(ii) Inverter: ABB/Bergen/Delta
(iii) Cables (XLPO/XLPE):C.C.I/Havells/Universalcable/Finolex/Polycab
(iv) String Combiner Box: Hensel/Onexis
(v) DC Connector: Elmax/Staubli
(vi) AC Junction Box: Rittal/SuRe

Annexure -V

(Schedule-D)

Landscaping and Horticulture Works

1. The work shall be carried out as per "Schedule of Rates, Analysis of Rates and Specifications(Horticulture & Landscaping)-2018**",** with upto date correction slips and as per CPWD Yard stick, **NBC 2016,** in absence of detail specification the standard horticulture practices for healthy growth of plants beautification should be followed as approved by engineer in charge.

2. The Scope of work include preparation of landscaping plan including parks, planters and other details etc. for the horticulture works and execution of same including providing unfiltered/recycled water supply lines from the existing WTP/STP and installation of additional pumps if required, providing drip irrigation system for trees, shrubs and hedges, sprinkler system for lawns etc. complete will be responsibility of agency. Development of parks, construction of its boundary wall, providing MS railings (including painting), wicket gates, water hydrants, etc. shall be completed as per the specification and drawing approved by the Authority Engineer. Contractor has to do horticulture works as per approved landscaping plan including grassing, grass turfs, plantation of shrubs, plants, trees etc.

3. Grassing will be done with selection No.1 grass including supplying good earth if needed including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing.

4. Grass turf will be provided with selection No.1 grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden (Dhurmos) and then rolling the surface with light roller making the surface smooth.

5. Plantation of tress at site will be done with healthy, well developed trees established at the site of following varieties including watering, removal of unserviceable materials etc. in quantity as per approved Landscaping drawings.

6. Preparation of garden area: Trenching in ordinary soil upto a depth of 60cm including removal & Stacking of serviceable materials and then disposing of surplus soil by spreading and neatly levelling within all lead of 50m and making up the trenched area to proper levels by filling with earth or earth mixed with sludge or/and manure before & after flooding trench with water (excluding cost of imported earth sludge or manure. 2.6.1 All kinds of soil.

7. Complete maintenance of entire garden features :- Complete maintenance of the entire garden features having as per yard stick in the garden area i.e. lawn trees, shrubs, hedge, potted palnt, cement pot, flower beds, foliages, creepers etc. including hoeing, weeding pruning replacement of plants, gap filling, watering, mowing of lawn, grass cutting by lawn mover and brush cutter, removal of garden waste, applying insecticide, pesticide & fertilizers(whenever required) top dressing of lawn with good earth and manure and maintenance of other garden related works as directed by office-in-charge (Cost of Good Earth, Manure, Fertilizer, Insecticide, Pesticide will be provided by the Department & lawn

mover and brush cutter with fuel , other T & P material/articles shall be provided by the contractor.)

8. Grassing will be done with Selection No. 1 grass including supplying good earth if needed including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing.

9. Grass turf will be provided with Selection No. 1 grass turf with earth 50 mm to 60 mm thickness of existing ground prepared with proper level and ramming with required tools wooden (Dhurmos) and then rolling the surface with light roller making the surface smooth.

10. Plantation for landscaping and ornamental plant for beautification plants at site will be done with healthy, well developed plants established at the site. Suiting to the environment at the Bus Port site in Consultation with Forest Department & Authority's Engineer.

11. Displayed of Indoor / Outdoor decorative plants in good looking ornamental attractive planters in consultation with Authority's Engineer.

12. Plantation of trees at site will be done along the boundary wall with healthy, well developed trees established at the site of the varieties suiting to the environment of Bus Port site in Consultation with Forest Department and Authority's Engineer.

13. Plantation of shrubs at site will be done with healthy, well developed shrubs established at the site with varieties suiting to the environment of Bus Port site in Consultation with Forest Department and Authority's Engineer.

14. Soil testing for texture, nutrient level, water retaining capacity, PH value and other essential test for healthy growth of plants shall be conducted near every building where horticulture/ Landscapings works are to be done, from approved laboratory and at least 25% from ICAR/Krishi Vigyan Kendra. Necessary recommendation for fertilizer requirement and water consumption requirement shall be made available from the laboratories.

15. In general the quality of soil in construction area is not very conducive for growth of plants and grasses. Top good soil from the construction site shall be preserved for horticulture purposes. The soil not suitable for grasses and growth of trees shall be removed and good quality soil either from the preserved top soil or brought from outside the campus shall be used for horticulture purpose. No extra payment shall be made for same. The agency will be responsible for healthy growth of plants, trees, shrubs and grasses during construction stage and maintenance upto one year.

16. Manure and Fertilizers: Cattle manure/ compost shall be well decayed (should be at least 6 months covered in dump), free from grits and any other unwanted materials. The Contractor shall also provide and spread manure (cow dung manure/compost) for healthy growth the plants & trees under his maintenance. Depending upon requirement to maintained the nutrients level of the soil necessary application of chemical fertilizers (NPK) and other micro nutrients should be done.

17. Watering should be done in such any way that optimum level of moisture content for healthy growth of plants and trees is maintained, at no time moisture content should fall below the wilting point. Inadequate or excessive watering is to be avoided. During the dry season watering should be carried out at least daily in summer & twice a week in winter or as per requirement of the tree plant, shrub, water should be sourced from STP (Sewerage Treatment Plants) in case of emergency the source other than STP and be used provided that prior approval of Authority Engineer has been obtained.

18. Weeding and Hoeing: The work includes maintaining areas close to the base of the trees and shrubs free from weeds within 300mm radius from the stem of the trees / 150mm radius from the stem of the plants. Weeding has to be carried out once in a month. All weeds are to be disposed off from the site with all leads and lifts.

19. Pruning and Trimming: All dead or injured twigs, water shoots, unwanted branches are to be removed. Trees, shrubs and ground cover should be pruned to maintain natural shape. The hedges and shrubs shall be given special shapes and sizes to give aesthetic appearance of the greenery at regular intervals.

20. Pest and Disease control: All trees/plants are to be inspected once in a month to determine any disease or pest infections. Once the infection is identified adequate control measures are to be taken.

21. The trees and shrubs having height less than 3 metre in the median and planters shall be washed by sprinkler attached with water tankers on monthly basis. The contractor shall take utmost care of the trees and shrubs so that the casualty is brought to a minimum. The dead and fallen tree should be removed immediately from the site of work for smooth traffic movement and it should be brought to the notice of Department so that further survey and auction of the same can be done

22. Authority shall not be responsible for any injury partial or permanent or death of any workers at site due to accident or mal functioning of the equipment or by negligence of the staff.

23. The Contractor shall be responsible for removal of garden waste from the site and disposed off at designated dumping area or any other composting yard as approved by Authority's Engineer.

24. The Agency should ensure adequate deployed of mali having experience of Horticulture work, In case of any deficiency the Authority's Engineer can issue the necessary direction to increase the staff and Agency should abide by order of Authority's Engineer

25. The Contractor shall maintain the plants, hedges, trees, shrubs and lawns in good and healthy condition during construction period and maintenance period. This will include Complete maintenance of the entire garden features of the garden area i.e. lawn, trees, shrubs, hedge, potted plants, flowers beds, creepers etc. and other garden feature including watering hoeing, making of plants basic manuring, trimming and cleaning of hedges / plants, Beds, spraying of insecticides, fungicides, weeding, mowing, and top dressing of lawn with good earth and

manure and hedge clipping and removal of the garden waste, composting of green waste from plants, trees, lawn mowing, etc as per direction and satisfaction of the Authority Engineer.

26. The following activities are covered under this contract.

SN	Item of work	Nos./Qty./Frequency Required
(i)	Pruning & trimming of trees/shrubs creepers etc.	Quarter Yearly / need based
(ii)	Hedges Cutting	Monthly
(iii)	Any other item (Horticulture, Civil, Elect, U/F water supply) required for proper maintenance	On need basis
(iv)	Irrigation	Daily in summer season and twice a week during winter and need based
(v)	(i) Manuring (ii) Fertilization	a) Trees/palms - once in every three months b) shrubs/grounds covers –monthly c) Grass -once every three months.
(vi)	Lawn Mowing & trimming of shrubs	Monthly or as and when required.
(vii)	Plant Protection	Pest-Fortnightly Disease control-Fortnightly during rainy season and monthly in other seasons
(viii)	Cultivation & Weeding	Monthly or earlier as per the requirement.
(ix)	Seasonal Flowers	Wherever feasible
(x)	Top dressing with soil &/or manure	Yearly
(xi)	Repair & replacement of plants, levelling etc.	As and when required

Annexure -VI

(Schedule-D)

Architectural Finishing Schedule

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
CONCOURSE LEVEL, Ground Floor and First Floor complete							
1	Bus Port Entrances passageway	Honed finish Granite Flooring	Granite stone 30mm over Screed laid to slope	Vitrified Tile Cladding as per design, upto a height of 3.05 m. Anti-dust paint above upto full height (colour as per design)	10mm tile over 12mm cement mortar	Open Cell Metal ceiling with Fascia on both sides and Anti dust paint above (colour as per design)	3000mm
2	Bus Port Entrances Staircases (Ground to Concourse)	Flamed Granite treads; Polished Granite Risers; Stainless Steel wall mounted and floor mounted Handrails	Tread: 30mm granite over 20mm cement mortar Riser: 18mm Granite over 12mm cement mortar	Vitrified Tile Cladding as per design, upto a height of 3.05 m. Anti dust paint above upto full height (colour as per design)	10mm tile over 12mm cement mortar	Texture Paint (as per approved sample) Thickness 3mm on pre- plastered surface	-
3	Staircase	Flamed Granite treads; Polished Granite Risers; Stainless Steel and Glass floor mounted Handrails	Tread: 30mm granite over 20mm cement mortar Riser: 18mm Granite over 12mm cement mortar	Vitrified Tile Cladding as per design, upto a height of 1.05 m. Anti dust paint above upto full height (colour as per design)	10mm tile over 12mm cement mortar -	-	-
4	Passenger Concourse area- Double height	Honed Granite Flooring (with Tactile strip as per design)	Granite stone 30mm over Screed laid to slope with trenches for AFC as per system contractor's requirement	Vitrified Tile* Cladding as per design, upto a height of 3.65m. Anti dust paint above upto full height (colour as per design)	10mm tile** over 12mm cement mortar	1200 x 600 Open Cell Metal ceiling with Fascia as per design	Minimum 3000mm varying to 4200mm
5	Control Room	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Clear toughened laminated Glass on Concourse side and Cement Plaster finished with Acrylic Emulsion paint elsewhere	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Metal false ceiling (Non – perforated, Powder coated)	3000mm
6	Bus Port Manager Room/offices	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Metal false ceiling (Non – perforated, Powder coated)	3000mm
7	Ticket Office	Raised floor filled with Foam Concrete finished with Granite.	Total 400 mm 30mm Granite over Foam Concrete with trenches as per	Clear toughened laminated Glass (as per detail) on Concourse side and Cement	300mm skirting in 18 mm thick granite stone on 12mm cement mortar	Metal false ceiling (Non – perforated, Powder coated)	3000mm

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
		Granite Counter top as per design	system contractor's requirement	Plaster finished with Acrylic Emulsion paint elsewhere	Paint over 12mm plaster		
8	Enquiry office	Raised floor filled with Foam Concrete finished with Granite. Granite Counter top as per design	18mm Granite stone over 20 mm cement mortar	Clear toughened laminated Glass above counter height & Granite cladding outside below counter height.	12mm glass 30mm granite cladding; maximum depth of cladding 75mm including tolerances	-	-
9	First Aid room	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Vitrified Tile Cladding as per design, upto a height of 1200m.with Acrylic Emulsion paint above upto full height (colour as per design)	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Concrete finished with Anti-dust sealer coat	-
10	CCTV security room	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Concrete finished with Anti-dust sealer coat	-
11	Supervisor Office	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Concrete finished with Anti-dust sealer coat	-
12	Record room/ Cloak room	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Concrete finished with Anti-dust sealer coat	
13	Drivers/ conductors – dormitory	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete/ Concrete block Wall finished with Anti- dust sealer coat	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Concrete finished with Anti-dust sealer coat	
14	Travel Desk, Reservation office / Hotel Reservation counter/ Tourist Information Centre	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete/ Concrete block Wall finished with Anti- dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
15	Baby Care Room	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Vitrified Tile Cladding as per design, upto a height of 1200 m from FFL& Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Calcium Silicate board finished with Acrylic Distemper paint	3000mm

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
				above upto full height (colour as per design)1200 mm height			
16	Food Court	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Vitrified Tile Cladding as per design, upto a height of 1200 m from FFL& Cement Plaster finished with Acrylic Emulsion paint above upto full height (colour as per design)1200 mm height	10mm tile over 12mm cement mortar Paint over 12mm plaster	Calcium Silicate board finished with Acrylic Distemper paint	3000mm
17	Sewage Pump Room	Hardonite Industrial floor	Total 400mm 52mm Hardonit Flooring over Foam Concrete filling	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
18	VIP Deluxe toilets, Luxury Lounges	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete block Wall finished with Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 18 mm thick granite stone on 12mm cement mortar Paint over 12mm plaster	Metal false ceiling (Non – perforated, Powder coated)	3000mm
19	Public Toilets	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Vitrified Tile Cladding as per design, upto a false ceiling height of	10mm tile over 12mm cement mortar	Calcium Silicate false ceiling (Non – perforated, Powder coated)	3000mm
20	Guest rooms with attached toilet	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete block Wall finished with Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 10mm thick Vitrified Tile on 12mm cement mortar	Metal false ceiling (Non – perforated, Powder coated)	3000mm
21	Shops	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Concrete block Wall finished with Cement Plaster finished with Acrylic Emulsion paint	300mm skirting in 10mm thick Vitrified Tile on 12mm cement mortar	Concrete finished with Anti-dust sealer coat	3000mm
22	OTE Duct & Cable Gallery	Concrete finished with Anti-dust sealer coat inside					

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
23	Platform Area	Honed Granite flooring (with 600mm wide 60mm thick flamed granite edge + 30mm Granite over Screed + yellow tile strip + Tactile strip as per design)	Total 150mm at edge sloping to 120mm laid in 1:100 slope away from platform edge	Vitrified Tile Cladding on walls	10mm tile over 12mm cement mortar	1200 x 600 Open Cell Metal ceiling with Fascia as per design	7200mm
24	Columns In platforms area and waiting area			Stainless Steel Cladding on columns including SS seating benches around columns	3mm SS sheet cladding: maximum depth of cladding 25mm including framework		
25	Lift	Honed Granite Flooring	18mm Granite stone over 20 mm cement mortar	Granite cladding on Lift walls	30mm granite cladding; maximum depth of cladding 75mm including		
26	DB Panel Room/Panel room	Hardonite Industrial floor	52mm over filling in Screed to match the general flooring level in vicinity	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
27	Undercroft including UPE Duct and Cable Gallery	Screed to slope (to be done by Civil contractor) Finished with Anti-dust sealer coat		Concrete/ Concrete block Wall finished with Anti-dust sealer coat		Concrete finished with Anti-dust sealer coat	
28	Water Tank	Waterproof Compartment (to be made by Civil Contractor)		Waterproof Compartment (to be made by Civil Contractor)		Waterproof Compartment (to be made by Civil Contractor)	
29	Pump Room	Hardonite Industrial floor	52mm (over 150 mm Screed filling with drainage channel if drainage channel is not provided in slab to be done by Civil Contractor)	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
30	Chiller Plant Room	Hardonite Industrial floor	52mm (over 150 mm Screed filling with drainage channel if drainage channel is not provided in slab to be done by Civil Contractor)	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
31	Auxiliary Sub Station	Hardonite Industrial floor	52mm	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
32	Dosing Plant Room	Hardonite Industrial floor	52mm	Concrete/ Concrete block Wall finished with Anti-dust sealer coat	300mm high skirting in 18mm thick Cement Plaster	Concrete finished with Anti-dust sealer coat	
33	Terrace				Paint over 15mm Cement Plaster		
34	Main Building Outside Walls	-	-	Granite stone/Texture Paint as per design	40mm stone cladding; maximum depth of cladding 75mm including tolerances/ Paint over 15mm Cement Plaster	-	-
35	Boundary Wall			Granite stone/Texture Paint as per design	Paint over 15mm Cement Plaster with 150mm high skirting in 25mm thick Kota Stone and 40mm stone cladding; maximum depth of cladding 75mm including tolerances	-	-

FINISHING SCHEDULE FOR OTHER ITEMS

S.No	ITEM	SPECIFICATIONS
1	INTERNAL DOORS IN OFFICES (HEIGHT 2.40 METERE)	(1) Main entrance doors for all rooms: Toughened glass door shutter along with glass partition toward corridor side
2	TOILET DOORS	Second class teak wood with laminate top flush doors
3	MAIN ENTRANCE DOOR	Toughened glass door shutter with automatic sliding system
4	FIRE CHECK DOORS	GF and above- Wooden Fire rated door with shutter of 120 minutes rating with insulation (full glazed fire door shutters with frame of 2 hours rating)
5	LIFT LOBBY DOOR	SS Steel frame with glazed steel door and having Fire rated glazing of Saint Gobain and with 120 minutes rating
6	HARDWARE FINISH	SS of matt/ polished finish of Hafele or equivalent
7	FACADE TREATMENT	Combination of stone cladding/ACP cladding/ texture paint as per elevation details Jalis - GRC Jali based on design as per arch detail.. Structural Glazing - Saint Gobain or equivalent with solar control and thermal insulation (with dual colour scheme for elevation bands) (Approx. 20% of total elevation area)

SN	Room Name	ARCHITECTURAL FINISHES					
		FLOOR		WALL		CEILING	
		Finish	Thickness (in mm) over TOC	Finish	Thickness (in mm)	Finish	Finished Ceiling level from FFL
		Murals in the façade wall- GRC / WPC of suitable shade and pattern.					
8	TOILET FITTINGS	FAUCETS- All faucets of chrome matt finish of Jaquar or equivalent of international standard SANITARYWARE- Jaquar or equivalent – wall mounted EC , Urinals, Wash Bowl over slab for Wash Basin etc. of international standard.					

NOTES:

1. All design, patterns and actual sizes of materials shall be as per drawings and samples approved.
2. All items to be read in conjunction with relevant technical specifications.
3. Actual dimensions may vary at site, for which contractors shall prepare shop drawing and obtain approval from the Authority Engineer before starting the work.
4. Contractor shall coordinate with all designated systems' contractors' for interface requirements and incorporate the min the shop drawings for finishing works.

Annexure -VII

(Schedule-D)

Signage

1 General

The Contractor shall develop shop drawings for all types of required signage's for the Project as per the intent suggested by the Architect and shall submit to the Authority's Engineer for approvals before executing the works. Contractor will arrange samples and required mockups as instructed by Authority's Engineer for some important areas.

The scope in this section shall be engineering, procurement and execution of all types of Signage like informative cautionary and mandatory.

2 External Signage's

The Contractor shall provide following signage as required and necessary. Sizes mentioned are indicative for intent purpose.

2.1 Main Building Signage

Main Building Signage in brushed finished SS cut letters in both English and Hindi alphabets, stuck on dry stone wall, back lit with approved shade and color of LED. SS to be of 316 L grade, letters to be fixed on the wall with inbuilt nails

(i) At GF Location-I size having size not lets than 50mm deep and height 450mm.

(ii) At GF Location-II size to be 50mm deep and height 450mm

(iii) At Roof Level Location-I size to be 100mm deep and height 900mm.

(iv) At Roof Level Location-II size to be 100mm deep and height 900mm

2.2 Legal Entity with Signage

Legal Entity with Signage in brushed finished 3mm thick Stainless Steel plate, laser engraved text (English and Hindi Language) in approved colour laser fused pigment, fixed on wall by means of SS screws / Studs. SS to be of 316 L grade

Reference Image

(i) At GF Compound Wall at Entry and Exit gates size to be 600mm x 900mm

(ii) At GF Building Entrance size to be 600mm x 600mm

2.3 External Way finding Signage

External Way finding Signage in brushed finished stainless steel 3mm brush finished Plate with 3mm grooves slits, laser engraved text (English and Hindi Language) in approved colour laser fused pigment. Some signage may be fixed on wall or some shall be individual pole structure. SS to be of 316 L grade Size: 450mm x 900mm

Reference Image

2.4 External Parking / General Signage

External Parking / General Signage in brushed finished stainless steel 3mm brush finished Plate with 3mm grooves slits, laser engraved text (English and Hindi Language) in approved colour laser fused pigment. Some signage may be fixed on wall or some shall be individual pole structure. SS to be of 316 L grade Size 400mm x 400mm

Reference Images


3 Internal Signage's

The Contractor shall provide following signage as required and necessary. The Sizes, shapes mentioned are indicative for intent purpose.

3.1 Reception Logo

Reception Logo in brushed finished SS cut letters in both English, stuck on dry stone wall. SS to be of 316 grade letters to be fixed on the wall with inbuilt nails. Size to be 50mm deep and height 450mm

3.2 Building Directory at GF Entry

Building Directory at GF Entry in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment, fixed with double side tapes with silicon paste on doors. with silicon paste. SS to be of 316 grade, size may be 900mm x 1800mm or as decided by Engineer-in-charge.

3.3 Floor Directory at All Floor Lift Lobby

Floor Directory at All Floor Lift Lobby in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment, fixed with double side tapes with silicon paste on doors. with silicon paste. SS to be of 316 grade, size may be 600mm x 1200mm or as required and decided by Engineer-in-charge.

3.4 Floor and Lift Identification at All Floor Lift Lobby, Staircases Service lift

Floor and Lift Identification at All Floor Lift Lobby, Staircases Service lift in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment, fixed with double side tapes with silicon paste on doors. with silicon paste. SS to be of 316 grade, size may be 150mm x 200mm or as required.

3.5 Location Signage's

Location Signage's in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment. SS to be of 316 grade, size to be 600mm x 200mm. Signage to be cantilevered or Hanging.

3.6 Individual Room Signage's

Individual Room Signage's for all rooms in entire building excluding the toilet / rest rooms in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment, fixed with double side tapes with silicon paste on doors. with silicon paste. SS to be of 316 grade, size to be 300mm x 75mm

3.7 Workstation / Cubicle Signage's

Workstation / Cubicle Signage's for all consisting of Vinyl Stickers.Size 200mm x 50mm or as required as decided by Engineer-in-charge.

3.8 Rest Room Signage's

Rest Room Signage's for all Toilets in entire building in brushed finished 3mm thick Stainless Steel plate, laser engraved text in approved colour laser fused pigment, fixed with double side tapes with silicon paste on doors. with silicon paste. SS to be of 316 grade, size to be 75mm x 75mm

3.9 Fire Exit, Emergency, Informatory Signage's

Fire Exit, Emergency, Informatory Signage's to be in 4mm thick Acrylic Base + Photoluminiscent sheet / Auto Glow sheet with 2hrs glowing effect+ Content in vinyl printing, some signage to be fixing with double sided tape with silicon paste on walls and some shall be double sides painted and hanging from ceiling with SS rods., size as per standard

3.10 Fire Evacuation Plan Signages

Fire Evacuation Plan Signages to be in 4mm thick Acrylic Base + Photo luminiscent sheet / Auto Glow sheet with 2hrs glowing effect+ Content in vinyl printing, signage to be fixing with double sided tape with silicon paste on walls, size as per standard

Annexure -VIII

(Schedule-D)

Parking Management and Passenger Information Display System

Parking Management Solution for cars and 2 wheelers inside the parking basement including the ticket dispensers and exit payment stations and Bus entry/exit management with the required bus entry and payment module.

Passenger Information Display System including the bus bay LED displays and Passenger Information displays.

Details of gates are as under:

			Width of Lane		Nos. of Lane	
Gates	**Gate Width (MM) approx**	**Vehicle Type**	**Entry**	**Exit**	**Entry**	**Exit**
Bus Entry	7500	BUS	7500		1	
Bus Exit	7600	BUS		7600		1
Car Entry	6000	Car	4000		1	
Car Exit	6000	Car		4000		1

1 Requirements for Bus Terminal

1.1 **Parking Management System:** There are a surface parking for the cars, Taxis & Autos for the travellers in which bus port wants to deploy the ticket dispensers and boom barriers at the entrance and manned payment station at the exit. There is also another place for buses to enter the terminal and exit. Client also wants to deploy the bus entry exit management. There is a night parking also available at the terminal for the buses, the bus entry/exit management system should also take care of the night parking charges for the buses.

1.2 **Passenger Information Display System:** At the terminal, there are approximate 11 departure/arrival bays at Ramnagar Bus Terminal wants to deploy an state of the art Passenger Information System which should communicate to the passengers the exact details of the buses standing at the bus port with their schedule of departure along with their destination. Individual bus departure bays shall also be guiding the passengers with this information. Main display shall also display the Arrival Status of the Buses. This shall be done by integration of transit bus data from GPS devices installed in each Bus.

1.3 Specific Requirements:

(i) Bus Passenger Information Display System:

(a) Issue of smart card and recharge will be done at the exit payment station.
(b) PIDS will be provided in Hindi & English which can be selected as per choice or as scheduled.

(c) PIDS for arrival with manually feeding of details in the system. While one of the big 10 line LED display shall show details of arrival and other LED display panel shall show departure details of the buses. Similarly, the LCD displays shall also be displaying arrivals & departures separately. The data for the arrival shall currently be taken from the entry stations.
(d) Requisite configuration software for digital signage shall also be provided.
(e) GPS devise shall be installed in each bus which shall be transmitting the data to the Central Software System which shall be collated by the Software and then the Arrival time etc shall be displayed on the Main Bus Display for better passenger information.

(ii) Car Parking Management System:

(a) Issue of Bar-coded Parking Ticket thru Automated (un-manned) Ticket Dispenser
(b) Boom Barrier for automated vehicle entry.
(c) Boom Barrier at exit to operate after receipt of Parking Charges at manned Payment Booth.
(d) Manned Payment Booth at exit to collect payment as per Parking Tariff on scanning the parking ticket issued at entry.
(e) Display of available parking capacity at LED Display Boards installed at Entry.

(iii) Idle Bus Parking Area:

(a) Tracking of incoming Bus for their Entry Time using Smart Card Readers installed at Entry Lanes.
(b) Boom Barrier at entry to allow buses to enter after swapping of Smart Cards
(c) Boom Barriers at exit to allow buses to exit after swapping of Smart Cards.
(d) Time Recording of Bus entry & exit for subsequent Idle Time analysis on individual Buses.

2 Parking Management System

Parking Management System as defined in the business requirement section is divided into four different categories:

2.1 **Bus Entry:** Buses are entering the ISBT from one entry gate. There will be one lane for the bus entry. This lane will be un-manned station equipped with boom barrier, vehicle image camera, receipt printer, desktop PC along with the Bus entry management application. Busses will enter and they will get a paper slip with a vehicle image printed on it, after they press a Button on the Automatic Ticket Dispenser. Bus entry shall also have the provision of Smart Card Reader for monthly pass and other regular buses.

2.2 **Bus Exit:** At the exit; there will be one lane; this shall have manned station. This lane would be equipped with Boom barrier, scanner, printer, desktop PC along with the

bus exit management application. Bus driver will hand-over the entry slip which will be scanned at the exit and the charges would be displayed on the fare display. Driver can then pay the charges and exit from the premises. The Smart card holder bus shall swipe the card at the Exit Smart Card Reader and gain the exit out of the terminal after required validation process.

2.3 **Car Entry:** The surface parking is for cars, Taxis & Autos. There will be one lanes for entry & separate gate for exit. At the entrance, there will be a Barcode ticket dispenser with an integrated smart card reader for the staff vehicles. There will also be a vacancy display at the entrance to display the total slot availability for 4 wheelers. The 2 lanes would also have 2 different boom barriers.

2.4 **Car Exit:** There will be separate exit lane for cars, Taxis & Autos. This will be equipped with a single manned payment station. The entry slip would be scanned here and the total parking charges would be displayed at the fare display. User will pay the parking charges and the boom barrier will be opened for the user to exit the parking.

2.5 **Smart Card Issuance & Recharge:** The process of Smart Issue & Recharge shall be done at the respective exit payment stations as per the process defined by the authorities.

3 Passenger Information Display System

A passenger information display system (PIDS) is an electronic information system which provides real-time passenger information. It shall display information related to departure and also the same could be used to run advertisements as well. It may be used both physically within a transportation hub and remotely using a web browser or mobile device. These displays may also display Social Awareness Messages as and when required. Total requirement of PIDS is 3 nos.

There are 11 bus bays where the buses scheduled to departure would stand. There will be bus bay displays installed at every bus bay. These bus bay displays will show the slot number, roadways/destination of the bus and expected time of departure/arrival.

With the help of passenger Information Display System all these bus bay displays would be updated on the real-time basis in Hindi & English languages, selected manually or as scheduled. The PIDS will also include the Passenger Information displays. These displays would be 10 row LED displays displaying the information about the next 10 buses in the queue to depart.

(i) Departure LED Display Panel

Bus No.	Destination	Dept Time	Bay No.
DL1P 1307	Delhi	10:45	01
CH1A 1125	Ludhiana	11:00	06
CH1A 2698	Amritsar	11:15	29
CH1A 2459	Shimla	11:30	32
CD1A 3621	Manali	11:45	12
DL1P 9845	Delhi	12:00	20
RJ11M 4197	Jaipur	12:15	16
CH1A 8759	Jammu	12:30	31
UK07C 6851	Dehradun	12:45	18
DL1P 7419	Delhi	13:00	25

(ii) Arrival LED Display Panel

Bus No.	From	Arrival Time
DL1P 1307	Delhi	10:45
CH1A 1125	Ludhiana	11:00
CH1A 2698	Amritsar	11:15
CH1A 2459	Shimla	11:30
CD1A 3621	Manali	11:45
DL1P 9845	Delhi	12:00
RJ11M 4197	Jaipur	12:15
CH1A 8759	Jammu	12:30
UK07C 6851	Dehradun	12:45
DL1P 7419	Delhi	13:00

(iii) STANDARD REPORTS

(a) Car entry and exit reports
(b) Shift wise/operator wise collection report
(c) Occupancy/vacancy report
(d) Daily/weekly/monthly collection report
(e) Bus entry/exit report
(f) Bus expected departure report
(g) Night parking report
(h) Daily collection from buses
(i) Any other customized report

(iv) BENEFITS AND CONCLUSION

Few of the benefits based on your industry and application in your business include:

(a) Smooth vehicle entry exit

(b) Fully controlled and reported movement of staff
(c) Smooth flow of buses in and out of terminal
(d) Complete report of vehicle entering and exiting the terminal
(e) Appropriate Passenger information communication
(f) Ease for passengers to get the details of the buses they are waiting for
(g) Optimum utilization of parking space
(h) State of the art technology
(i) Comprehensive MIS reporting and reconciliations.
(j) Less recurring cost and manpower.

(v) **Entrance System for 4W & 2W**

(a) Equipment's at Entry Lane:

- Boom Barriers (03 Mtr) : 01 Nos.
- Automatic Ticket Dispenser with Smart Card Readers : 01 Nos.
- LED Display Board for Vacancy Status : 01 Nos.
- High-Res License Plate Camera : 01 Nos.

Process Flow:

- Entry lane shall be equipped with Automatic Ticket Dispenser, Boom barrier, Camera.
- As soon as the vehicle presence is detected on the Activation Loop of the Ticket dispenser, the Push Button shall get activated which, otherwise, remain in idle mode to avoid any false push & ticket printing.
- The normal vehicle drivers shall press the button at the Dispenser and collect the ticket to seek entry into the parking. This parking ticket shall be Bar Coded.
- On the press of Push Button, the camera shall click the image of the vehicle and save it against the specific transaction. This number plate image may also be printed on the Parking Ticket.
- Smart Card owners (Staff or Monthly/Weekly Pass Holders) shall swap the card to the Smart Card Readers installed in the Ticket Dispenser to get the validation and seek entry into the facility.
- The LED display installed at the Entry Lane shall display the total number of parking spaces available inside the parking facility. Once this capacity is full, the ticket dispenser shall stop dispensing the tickets and display shall also display FULL.
- The loop installed near the boom barrier shall further detect the movement of the vehicle inside and close the boom barrier automatically just when the vehicle crosses over the induction loop. At this point only the vehicle count shall be taken and updated in the software. In case the vehicle is not detected on the second loop, the system shall presume as if the vehicle has not entered inside and has gone back.

- The entry transaction is complete at this point and vehicle moves inside after verifying the status of vacancy at LED display board installed at the Main Entry itself.

(b) Vehicle Exit:

The exit shall have separate lane for 4-W & 2-W exit is proposed with following equipment's:

- Boom Barriers : 01 Nos.
- Manned POS Kiosk : 01 Nos.

Process Flow:

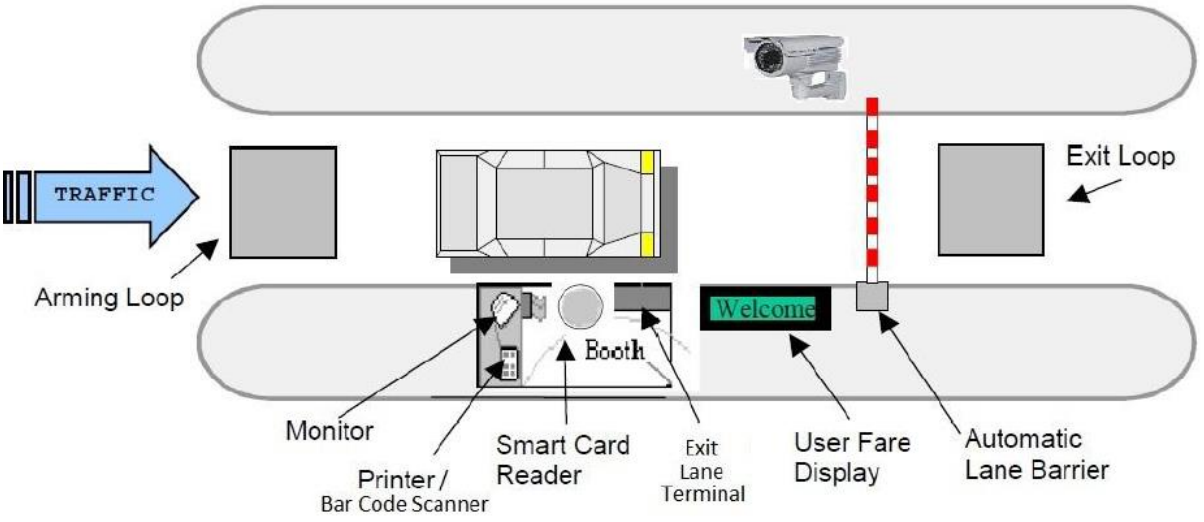
- The vehicle shall approach the exit lane, swap the bar-coded parking ticket or Mobile QR Code or Smart Card, at the manned POS and make the payment as per prevailing parking tariff & duration as computed by the Software and then the system shall trigger open the boom barrier for smooth exit of the vehicle.
- The boom barrier shall automatically close when the vehicle crosses over the induction loop installed for avoiding accidental closure of the boom on the travelling vehicle.
- The transaction shall get over and the system shall be updated with the vehicle exit count & accordingly Main LED display boards shall get updated.

4 Data Communication to Central Command & Control Centre:

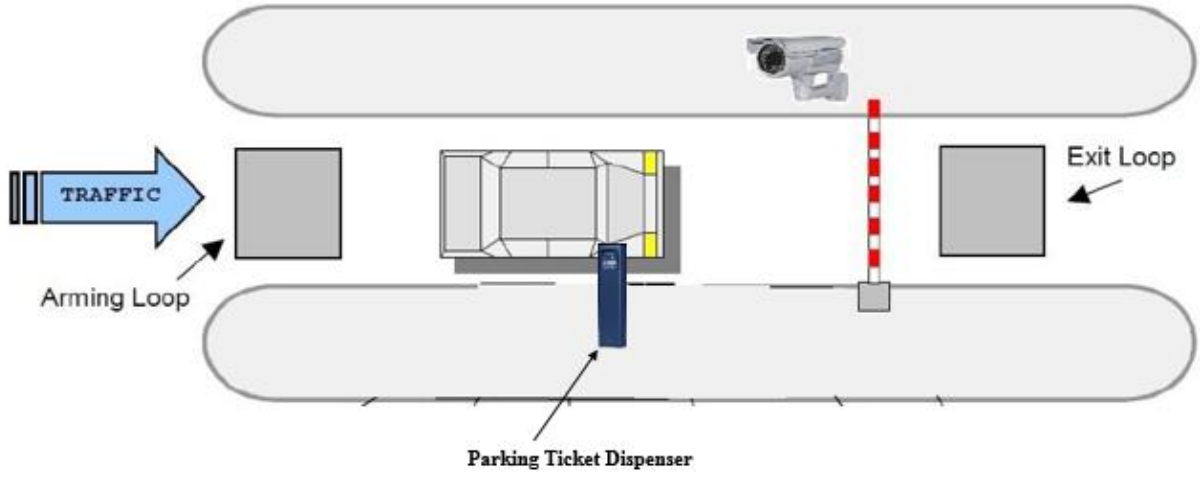
All entry & exit data, as a single record, as per format (csv, xml) shall be transmitted to Central Server using internet connectivity. Vehicle License Plate images, duly linked to specific transaction ID shall be also be made available to Central Server, if the internet bandwidth permits.

The data so sent shall include the pre-defined codes for the location of the parking lot.

Typical Basement Parking Exit Lane



Typical Basement Parking Entry Lane



5 ITEM WISE SPECIFICATIONS

5.1 Automatic Ticket Dispenser

Input Power	230 VAC +_ 10%, 50Hz
Cabinet/Housing	MS Powder coated Grey color or any other suitable color.
Size	310 x 335 x 1215 mm (l x p x h)
Weight	20 Kg
Absorbed power	100 VA
Temperature of use	from -20 to +50°C
Display	LCD backlit 20x2”
Processor	Micro-Processor based with built-in memory, storage space for min 10000 cards, 50000 transactions
Ticket Printer	Heavy Duty Thermal Printer with Auto-Cutter, and bar code printing capacity
Printing Speed	140mm/s
Type of Paper	78mm x 80 GSM
Paper Roll Capacity	3000 Ticket , 200 MM OD
Loop sensors	Single channel
Push button	Illuminated for Ticket Request, SS for SOS
SOS Feature	POP-UP message at Server
Communication port	TCP-IP
Proxy Card Reader	Contact less Reader of passive transponders
Card detection frequency	13.56 Mhz
Card format	ISO

5.2 Boom Barrier

Voltage rating	24VDC
Power Consumption	72W
Movement	Direct movement on the reduction gear output shaft
Opening & Closing time	3-4 sec
Model	LOG-BR
Power Supply	230V 50Hz
Clutch	Electronics (Torque adjustment)
Approaching at the end of the maneuver	With slowing down
Safety on impact	Encoder
Sensors input	Photo cell, loop sensors
Duty Cycle	100%
Reaction to impact	Reversal of movement
Travel	self-learning
Structure	Fe 360 - Pickled 2 plates mm
Size	320Lx220Px1010H mm
Hand Operation	From outdoor with Key
Protection Level	IP54

Boom	Aluminum
Road passage	4M
Certification	CE

5.3 NPR (Number Plate/License Plate) Camera

Voltage rating	12Vdc
Current rating	1A
Power Consumption	<11.5W
Max. IR LEDs length	50M
Day/Night	Auto (ICR) /Color/ B/W
Focal length	2.7mm ~ 12mm
Max Aperture	F1.4
Focus Control	Motorized
Communication	TCP-IP
Resolution	1080P
Image sensor	1/2.7" 2 mega pixel
Overall Size	272x94x94mm
Weight	1.1kg
Operating Temp	-20 to +60°C
IP Grade	IP67
Certification	CE

5.4 Manned POS Station

Voltage rating	220Vac
Current rating	1.3A
Power Consumption	280 W
Processor	Intel Dual Core Processor
RAM	4GB
HDD	500GB
DVD	Inbuilt
Monitor	19"
Key board	Standard
Mouse	Optical
Handheld scanner	Zebra LS1203
Smart Card Reader	125khz ISO card reader
Interface	RS485 to USB
LCD Display	Posiflex PD320U
Thermal Printer	Epson TM-82
Operating System	Window7
Software	POS-1

5.5 Baggage Scanners

Providing & installation of baggage scanners for luggage as per following features

(i) Tunnel Size (In mm) : 755 (W) X 555 (H)

(ii) Power Requirement: 220V AC (±10%)

(iii) Conveyor Speed: 0.22m/s

(iv) Load Weight: 580 kg (approx.)

(v) Wire Resolution: 39AWG

(vi) Steel Penetration: 31mm

5.6 Central PMS Server

Voltage rating	220Vac
Current rating	1.3A
Power Consumption	280 W
Processor	Intel i5 Processor
RAM	4GB
HDD	500GB
DVD	Inbuilt
Monitor	19"
Key board	Standard
Mouse	Optical
Connectivity	To Ticket Dispenser, NPR Camera, Boom Barrier, Exit Ticket Verifier via RS-485/TCP-IP
Smart Card Reader	125khz ISO card reader
LCD Display	Posiflex PD320U
Thermal Printer	Epson TM-82
Operating System	Window7
Software	Custom Made Software: Central Server will connect to ticket machine, NPR camera and boom barrier. It also shares information with PGS server about vehicle in transit and exit verifier about vehicle exit details. Also contains details of proximity cards and their access rights along with new issue & recharge options. It will open the barrier and give command to ticket dispenser to print ticket depending upon access rights or card use classification of vehicle detected and corresponding button pressed at ticket machine. In case of error, a message will be sent to ticket dispenser machine display, manned booth and barrier shall not open.

5.7 LED Display

Voltage rating	AC 230V - 50Hz
Current rating	1.2A
Power Consumption	250W
Communication	GSM
No. Of Rows	1
No. Of Dynamic Digits	3 digits
Height of Character	10"
LED Type	LED 5mm single row oval ultra-bright RED led
No. Of the Fix Character	Configurable, 3M reflective tape
Enclosure	48"x30" (Approx)
Mounting	Pole/Wall mounting - Outdoor weatherproof
Operating Temp	20 to +60°C
Enclosure	MS powder coated Panel

5.8 PGMS Server

(i) PC i3 Processor, 4 GB DRAM, 500 GB HDD with 19" TFT and Windows 7 or higher OS.

(ii) PGS Server software to show vehicle occupancy in graphical mode for cars.

(iii) Suitable software and hardware for web interface for showing parking availability on different client nodes.

(iv) Connection to PMS server through TCP/IP and software support to extract information for vehicle in transit.

(v) MIS Report generation as per requirement.

5.9 Recommended make List

(i) Boom Barriers : Magnetic, Kaba, Somfy, O&O.

(ii) Parking Management System : Magnetic, Skidata, Somfy

(iii) PIDS (Passenger Information Display) : Magnetic, Skidata, Somfy

SCHEDULE-E: Specifications and Standards

1 General

1.1 Maintenance for Project shall be 48 months from the date of successful handing over and issue of virtual completion certificate with requisite staff deployed at site in terms of the plan finalised with the Authority.

1.2 The contractor shall be responsible for minimum 5-year warranty on all the Equipment installed and 10 years on water proofing for the smooth operation of the project.

2 Maintenance Requirements

2.1 The Contractor shall, at all times maintain the Project in accordance with the provisions of this Agreement, Applicable Laws and Applicable Permits.

2.2 The Contractor shall repair or rectify any Defect or deficiency set forth in Paragraph 2 of this Schedule-E within the time limit specified therein and any failure in this behalf shall constitute non-fulfilment of the Maintenance obligations by the Contractor. Upon occurrence of any breach hereunder, the Authority shall be entitled to effect reduction in monthly lump sum payment as set forth in Clause 14.6 of this Agreement, without prejudice to the rights of the Authority under this Agreement, including Termination thereof.

2.3 All Materials, works and construction operations shall conform to the MORTH/ CPWD/ Uttarakhand PWD Specifications for Building & Infrastructure Works, and the relevant IRC publications. Where the specifications for a work are not given, Good Industry Practice shall be adopted.

3 Repair/rectification of Defects and deficiencies

The obligations of the Contractor in respect of Maintenance Requirements shall include repair and rectification of the Defects and deficiencies specified in Annexure-I of this Schedule-E within the time limit set forth therein.

4 Other Defects and deficiencies

In respect of any Defect or deficiency not specified in Annex - I of this Schedule-E, the Authority's Engineer may, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards, and any deviation or deterioration beyond the permissible limit shall be repaired or rectified by the Contractor within the time limit specified by the Authority's Engineer.

5 Extension of time limit

Notwithstanding anything to the contrary specified in this Schedule-E, if the nature and extent of any Defect or deficiency justifies more time for its repair or rectification than the time

specified herein, the Contractor shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Authority's Engineer and conveyed to the Contractor and the Authority with reasons thereof.

6 Emergency repairs/restoration

Notwithstanding anything to the contrary contained in this Schedule-E, if any Defect, deficiency or deterioration in the Project poses a hazard to safety or risk of damage to property, the Contractor shall promptly take all reasonable measures for eliminating or minimizing such danger.

7 Daily inspection by the Contractor

The Contractor shall, through its engineer, undertake a daily visual inspection of the Bus Port and maintain a record thereof in a register to be kept in such form and manner as the Authority's Engineer may specify. Such record shall be kept in safe custody of the Contractor and shall be open to inspection by the Authority and the Authority's Engineer at any time during office hours.

8 Pre-monsoon inspection / Post-monsoon inspection

The Contractor shall carry out a detailed pre-monsoon inspection of all the bus port before [1st June] every year. Report of this inspection together with details of proposed maintenance works as required on the basis of this inspection shall be sent to the Authority's Engineer before the [10th June] every year. The Contractor shall complete the required repairs before the onset of the monsoon and send to the Authority's Engineer a compliance report. Post monsoon inspection shall be done by the [30th September] and the inspection report together with details of any damages observed and proposed action to remedy the same shall be sent to the Authority's Engineer.

9 Repairs on account of natural calamities

All damages occurring to the Project on account of a Force Majeure Event or default or neglect of the Authority shall be undertaken by the Authority at its own cost. The Authority may instruct the Contractor to undertake the repairs at the rates agreed between the Parties.

Annexure -I

(Schedule-E)

Repair/rectification of Defects and Deficiencies

The Contractor shall repair and rectify the Defects and deficiencies specified in this Annex-I of Schedule-E within the time limit set forth in the table below.

SN	Nature of Defect or Deficiency	Time limit for Repair/ Rectification
1	Gates	24hours
2	Security Block utilities	24 hours
3	Sign Boards	48 hours
4	RCC /masonry wall	7 days
5	Soil Sink	7 days
6	Plaster & Paints	7 days
7	Glazing & ACP	7 days
8	Door, Window & Gates	48 hours
9	Flooring	7 days
10	Any cracks in internal road surface	48 hours
11	All Utilities Works	48 hours
12	Cleaning of toilets	Every 4 hours
13	Defects in electrical, water and sanitary installations in the Terminal Block	24 hours
14	Obstruction by plants in a minimum head- room of 5 m above carriageway or obstruction in visibility of road signs	24 hours
15	Removal of fallen trees	4 hours
16	Deterioration in health of trees and Bushes	Timely watering and treatment
17	Trees and bushes requiring replacement	15 days
18	Removal of vegetation affecting sight line and road structures	15 days
19	Maintenance of Major Equipment	24 hours
20	Major faults / Breakdown	24 hours

Note:

- Where necessary, the Authority may modify the time limit for repair/rectification, or add to the nature of Defect or deficiency before issuing the bidding document, with the approval of the Authority Engineer.
- The Contractor shall submit a warranty for all equipment, material and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.
- The form of warranty shall be as approved by Authority Engineer.
- The warranty shall expressly include replacement of all defective or under capacity equipment/material. Authority Engineer may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.

- The warranty include replacement of any equipment found to have capacity lesser that the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Authority Engineer.

SCHEDULE-F: Applicable Permits

1 Applicable Permits

1.1 The Contractor shall obtain, as required under the Applicable Laws, the following Applicable Permits:

Building Construction Permission	Local Authority / Municipal Corporation of Ramnagar
Environment Clearance	Ministry Of Environment And Forests
Heritage Clearance	Permission from ASI/ relevant Authority
Water & Sewerage Connection	Concerned Authority
Shifting of Services and utilities	Directorate of State Transport Concerned Authority, Local Authority, PWD (B&R) Department
Traffic Management during operation	Traffic Police
Application for PAN, sales tax and other tax registrations etc.	Concerned departments of Government of Haryana and Government of India (GoI)
Electricity connection	Respective Electricity Board in Haryana
Clearance for employing labor-Primary Employer	Labour Commissioner
Clearance for blasting and use of explosives	Commissioner of Explosives and Police Department, GoUK
Employment of migrant labour	Labour Commissioner
Storage of sludge/silt	Uttarakhand State Pollution Control Board
License for commercial activities	Concerned Authority
Realignment and channelization of Nallas	Concerned Authority, Uttarakhand PWD (B&R)
Installation of Lifts	Concerned Authority
Fire safety equipment	Concerned Authority /Police Department
Drains and Sewers	Concerned Authority, Uttarakhand PWD (B&R)
Diesel Generator	Uttarakhand State Pollution Control Board
Labour Camps	District Health Officer
Working in Night Shifts	Concerned Authority, Police Department
Re-routing of vehicular traffic	Concerned Authority, Traffic Police
Completion Cum Occupancy Certificate Stage	
Completion certificate from local authority Approval from the Lift Inspector- Required for installing lift in the building Consent to operate from State Pollution Control Board NOC from Weight and measurement Department as per Legal Metrology Laws NOC from explosive department NOC from Industry department NOC from labour department	

1.2 The above list is indicative and not necessarily complete or accurate. The Contractor shall make his / her own assessment of the statutory clearances required and shall be responsible for obtaining all such clearances. The Contractor shall at all times, obtain and maintain all Applicable Permits which are required by Applicable Law to undertake the Project. Charges for all permits etc. shall be borne by the Contractor.

1.3 Applicable Permits, as required, relating to environmental protection and conservation shall have been procured by the Authority in accordance with the provisions of this Agreement.

SCHEDULE-G: Form of Bank Guarantee

Annexure -I

(Schedule-G)

Performance Security

The ……
……..
……..
……

WHEREAS:

(A) _____ [name and address of contractor] (hereinafter called the "**Contractor**") and [name and address of the authority], (hereinafter called the **"Authority"**) have entered into an agreement (hereinafter called the "**Agreement**") for the Development of Bus Port at Ramnagar in the State of Uttarakhand on Engineering, Procurement and Construction (the "**EPC**") basis, subject to and in accordance with the provisions of the Agreement

(B) The Agreement requires the Contractor to furnish a Performance Security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the {Construction Period/ Defects Liability Period and Maintenance Period} (as defined in the Agreement) in a sum of Rs….. cr. (Rupees ……..….. crore) (the "**Guarantee Amount**").

(C) We, …….. through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (*hereinafter called the* **"Guarantee**") by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Contractor's obligations during the {Construction Period/ Defects Liability Period and Maintenance Period} under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of Chief Engineer in Raipur, Chhattisgarh that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that

the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfillment and/ or performance of all or any of the obligations of the Contractor contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfillment, compliance and/or performance of all or any of the obligations of the Contractor under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Guarantee shall cease to be in force and effect on ****[$]. Unless a demand or claim under this Guarantee is made in writing before expiry of the Guarantee, the Bank shall be discharged from its liabilities hereunder.

9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if

sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

13. This guarantee shall also be operatable at our…….. Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment there under claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation. 14. Bank Guarantee has been sent to authority's bank through SFMS gateway as per the details below:-

Sl. No	**Particulars**	**Details**
1	Name of the Beneficiary	National Highways and Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank, Transport Bhawan, 1st Parliament street, New Delhi-110001

Signed and sealed this ……. day of …….., 20…… at ……..

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

Appendix-II

Bid Securing Declaration

I hereby submit a declaration that the bid submitted by the undersigned, on behalf of the bidder, (Name of the bidder), wither sole or in JV, shall not be withdrawn or modified during period of validity i.e. not less than 180 (one hundred eighty) days from the bid due date.

I, on behalf of the bidder, (Name of the bidder), also accept the fact that in case the bid is withdrawn or modified during the period of it validity or if we fail to sign the contract in case the work is awarded to us or we fail to submit a performance security before the deadline defined in clause 7 of the request of proposal (RFP), then (Name of bidder) will be suspended for participating in the tendering process for the work of MoRTH/NHAI/NHIDCL and works under other Centrally Sponsored Scheme, for a period of one year from the bid due date of this work.

(Signature of the Authorised Signatory)
(Official-Seal)

Annexure -II

(Schedule-G)

Form of Guarantee for Withdrawal of Retention Money

……..
…….
……..
……

WHEREAS:

(A) [name and address of contractor] (hereinafter called the "**Contractor**") has executed an agreement (hereinafter called the "Agreement") with the [name and address of the authority], (hereinafter called the "**Authority**") for the Development of Bus Port at Ramnagar in the State of Uttarakhand on Engineering, Procurement and Construction (the "**EPC**") basis, subject to and in accordance with the provisions of the Agreement.

(B) In accordance with Clause 7.5.3 of the Agreement, the Contractor may withdraw the retention money (hereinafter called the "**Retention Money**") after furnishing to the Authority a bank guarantee for an amount equal to the proposed withdrawal.

(C) We, …….. through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (hereinafter called the "**Guarantee**") for the amount of Rs. --------- cr. (Rs.----------crore) (the "**Guarantee Amount**").

NOW, THEREFORE, the Bank hereby unconditionally and irrevocably guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of Chief Engineer in Raipur, Chhattisgarh, that the Contractor has committed default in the due and faithful performance of all or any of its obligations for under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Retention Money and any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Retention Money.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Guarantee shall cease to be in force and effect 90 (ninety) days after the date of the Completion Certificate specified in Clause 12.4 of the Agreement.

9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

11. This Guarantee shall come into force with immediate effect and shall remain in force and effect up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

13. This guarantee shall also be operatable at our…….. Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall

be made available on demand. In the contingency of this guarantee being invoked and payment there under claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation. 14. Bank Guarantee has been sent to authority's bank through SFMS gateway as per the details below:-

Sl. No	Particulars	Details
1	Name of the Beneficiary	National Highways and Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank, Transport Bhawan, 1st Parliament street, New Delhi-110001

Signed and sealed this …… day of ……..., 20…… at ……..

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

Appendix-II

Bid Securing Declaration

I hereby submit a declaration that the bid submitted by the undersigned, on behalf of the bidder, (Name of the bidder), wither sole or in JV, shall not be withdrawn or modified during period of validity i.e. not less than 180 (one hundred eighty) days from the bid due date.

I, on behalf of the bidder, (Name of the bidder), also accept the fact that in case the bid is withdrawn or modified during the period of it validity or if we fail to sign the contract in case the work is awarded to us or we fail to submit a performance security before the deadline defined in clause 7 of the request of proposal (RFP), then (Name of bidder) will be suspended for participating in the tendering process for the work of MoRTH/NHAI/NHIDCL and works under other Centrally Sponsored Scheme, for a period of one year from the bid due date of this work.

(Signature of the Authorised Signatory)
(Official-Seal)

Annexure -III

(Schedule-G)

Form of Guarantee for Advance Payment

……..
……..
……..
……..

WHEREAS:

(A) [name and address of contractor] (hereinafter called the "**Contractor**") has executed an agreement (hereinafter called the "**Agreement**") with the [name and address of the authority], (hereinafter called the "**Authority**") for Development of Bus Port at Ramnagar in the State of Uttarakhand on Engineering, Procurement and Construction (the "**EPC**") basis, subject to and in accordance with the provisions of the Agreement

(B) In accordance with Clause 19.2 of the Agreement, the Authority shall make to the Contractor an interest free advance payment (herein after called "**Advance Payment**") equal to 10% (ten per cent) of the Contract Price; and that the Advance Payment shall be made in three installments subject to the Contractor furnishing an irrevocable and unconditional guarantee by a scheduled bank for an amount equivalent to 110% (one hundred and ten percent) of such installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement. The amount of {first/second/third} installment of the Advance Payment is Rs. ------ cr. (Rupees ------ crore) and the amount of this Guarantee is Rs. ------- cr. (Rupees ------ crore) (the **"Guarantee Amount")**[$]

(C) We, …….. through our branch at ……. (the "**Bank"**) have agreed to furnish this bank guarantee (*hereinafter called the* **"Guarantee"**) for the Guarantee Amount.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid instalment of the Advance Payment under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and

2. A letter from the Authority, under the hand of an officer not below the rank of Chief Engineer in Raipur, Chhattisgarh, that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the

[$]The Guarantee Amount should be equivalent to 110% of the value of the applicable instalment. without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

instalment of the Advance Payment under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Advance Payment.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Guarantee shall cease to be in force and effect on ****.[$] Unless a demand or claim under this Guarantee is made in writing on or before the aforesaid date, the Bank shall be discharged from its liabilities hereunder.

9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

11. This Guarantee shall come into force with immediate effect and shall remain in force and effect up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

13. This guarantee shall also be operatable at our…….. Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment there under claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation. 14. Bank Guarantee has been sent to authority's bank through SFMS gateway as per the details below:-

Sl. No	**Particulars**	**Details**
1	Name of the Beneficiary	National Highways and Infrastructure Development Corporation Limited
2	Beneficiary Bank Account No.	90621010002659
3	Beneficiary Bank Branch	IFSC SYNB0009062
4	Beneficiary Bank Branch Name	Transport Bhawan, New Delhi
5	Beneficiary Bank Address	Syndicate Bank, Transport Bhawan, 1st Parliament street, New Delhi-110001

Signed and sealed this ……. day of …….., 20…… at ……..

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

Appendix-II

Bid Securing Declaration

I hereby submit a declaration that the bid submitted by the undersigned, on behalf of the bidder, (Name of the bidder), wither sole or in JV, shall not be withdrawn or modified during period of validity i.e. not less than 180 (one hundred eighty) days from the bid due date.

I, on behalf of the bidder, (Name of the bidder), also accept the fact that in case the bid is withdrawn or modified during the period of it validity or if we fail to sign the contract in case the work is awarded to us or we fail to submit a performance security before the deadline defined in clause 7 of the request of proposal (RFP), then (Name of bidder) will be suspended for participating in the tendering process for the work of MoRTH/NHAI/NHIDCL and works under other Centrally Sponsored Scheme, for a period of one year from the bid due date of this work.

(Signature of the Authorised Signatory)
(Official-Seal)

SCHEDULE-H: Contract Price Weightages

1.1 The Contract Price for this Agreement is Rs ----------

1.2 Proportions of the Contract Price for different stages of Construction of the Bus Port shall be as specified below:

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
1	2	3	4
Investigation, Planning, Designing,	2.00%	**Investigation, planning, Designing for entire scope of work and opening of office for Authority**	
		(1) On approval of inception report & Site survey, Geo- technical investigation and preparation of preliminary Architectural Drawings	12.00%
		(2) On approval of final drawings Architectural Drawings	13.00%
		(3) On approval of structure design by Authority Engineer	15.00%
		(4) On obtaining required approvals from Various government bodies	12.00%
		(5) On approval of all drawings for electrical, sanitary work, services, development, landscaping/horticulture and art works	12.00%
		(6) On approval of DG sets, STP & Sub Station, lifts & escalators shop drawings etc	10.00%
		(7) Establishing office for Authority as per Schedule-B	18.00%
		(8) Digital walk through video of complete Bus Port prospective view of minimum 2 minutes.	8.00%
Site Levelling, Grading and Demolition of existing structures	0.50%	**Site Levelling, Grading and Demolishing of Existing Structures**	100%
Boundary Wall & Gate	1.50%	**A-Boundary Wall & Gate**	
		(1) Foundation works	20.00%
		(2) Civil works of boundary wall	50.00%
		(3) Construction/erection of two gate cabin	15.00%

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
		(4)Construction/erection of Gate works (entry and Exit) and signages (at entry and Exit)	15.00%
Terminal Block and Commercial Area (Ground Floor)	28.00%	**A- Completion of Civil Works**	
		(1) Foundation work upto plinth level	20.00%
		(2) Column/Shear Wall/ Slab/beams	12.00%
		(3) Construction of walls	10.00%
		(4) Construction of Flooring	20.00%
		(5) Supply and fixing of Door/windows including wood work, painting, etc	10.00%
		B - Internal Finishing and painting	
		(1) Surface finishing with synthetic mortar	4.00%
		(2) Painting work	4.00%
		C- External Finishing	10.00%
		D- Internal Electric Installation	5.00%
		E- Internal Plumbing Installation	5.00%
Terminal Block and Commercial Area (First Floor)	17.00%	**A- Completion of Civil Works**	
		(1) Column/Shear Wall/ Slab/beams	19.00%
		(2) Completion of walls	14.00%
		(3) Completion of Flooring	21.00%
		(4) Completion of Door, windows including wood work, painting, etc	12.00%
		B - Internal Finishing and painting	
		(1) Surface finishing with synthetic mortar	5.00%
		(2) Painting work	5.00%
		C- External Finishing	12.00%
		D- Internal Electric Installation	6.00%
		E- Internal Plumbing Installation	6.00%

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
Parking & Road	8.00%	(1) Earth work upto subgrade level including embankment height of 0.6 m.	15.00%
		(2) Subbase/base course	20%
		(3) PQC/Rigid Pavement	55%
		(4) Thermoplastic paint and informatory signage's	10.00%
Completion of E&M works	13.00%	**(1) All Electrical Works including DG Sets etc. complete as per the scope of work complete.**	
		(i) Supply of Equipments / parts	17.00%
		(ii) Installation, Testing & Commissioning	3.00%
		(2) Completion of Cabling, P&F rising main, meter, Panel etc. and connection to the Main Receiving Station including clearance of statutory authorities.	3.00%
		(3) Parking Management System	22.00%
		(4) Designing & Installing & commissioning of CCTV Cameras covering all, covering entry &exit points of each buildings and main gates with adequate display of cameras on LED screens in control rooms, including control rooms, display system and software support system and required data cabling etc. complete. Installations of Boom Barriers on campus gates etc.,	5.00%
		(5) Complete Installation of Lifts, Escalators	20.00%
		(6) Completion of HVAC and BMS Work	20.00%
		(7) All testing of control rooms, displays and system etc. complete as per the direction of Authority's Engineer	10.00%
Completion of Plumbing & fire fighting works	12.00%	(1) Complete Installation of Fire Fighting system	30.00%
		(2) Complete external water-supply system / grid including supply and Installation of Pumps., over Head Tanks, Water supply Lines, drainage pipes, Vitreous Chinaware, CP Fittings	40.00%
		(3) Completion of sewerage system/grid.	10.00%
		(4) Completion of Drainage system & Rain water Harvesting including recharge well & Tube Wells.	10.00%
		(5) Completion of STP/ETP, waste water recycling plant, etc	10.00%
Creation of Facilities	7.00%	(1) Workshop Block	
		(i) Completion of Civil Works	30.0%
		(ii) Internal Finishing and painting @ Sqm.	5.0%
		(iii) External Finishing @ Sqm.	4.0%
		(iv) Internal Electric Installation @ Sqm.	2.0%
		(v) Internal Plumbing Installation @ Sqm.	2.0%

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage
		(2) **Fuelling Area**	
		(i) Completion of Civil Works	10.0%
		(ii) Internal and External Finishing and painting.	3.0%
		(iii) Internal Electric and Plumbing Installation.	2.0%
		(3) Furniture	
		(i) Installation of fixed furniture	21.00%
		(ii) Supply of loose furniture	21.00%
Completion of all Horticulture Works	1.00%	(2) Complete supply, installation, testing of the irrigation system for Horticulture works such as filling of good earth, grassing, tree plantation etc.	60%
		(2) Development of Horticulture work as per the approved plan mentioned in the tender document and drawings.	40.00%
Solar Installation	5.00%	(1) Supply of solar panels	50.00%
		(2) Civil work	10.00%
		(3) Installation & commissioning	20.00%
		(4) Grid Integration	20.00%
Commissioning of Bus Port	5.00%	Commissioning of Bus Port by Authority	100.00%

1.3 Procedure of estimating the value of work done.

1.3.1 Bus Port Works

Procedure for estimating the value of work done shall be as follows:

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
1	**2**	**3**	**4**	
Investigation, Planning, Designing,	2.00%	**Investigation, planning, Designing for entire scope of work**		

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
		(1) On approval of inception report & Site survey, Geo- technical investigation and preparation of preliminary Architectural Drawings	12.00%	On approval of inception report & Site survey, Geo-technical investigation and preparation of preliminary Architectural Drawings
		(2) On approval of final drawings Architectural Drawings	13.00%	On approval of final drawings Architectural Drawings
		(3) On approval of structure design by Authority Engineer	15.00%	On approval of structure design by Authority Engineer
		(4) On obtaining required approvals from Various government bodies	12.00%	On obtaining required approvals from Various government bodies
		(5) On approval of all drawings for electrical, sanitary work, services, development, landscaping/horticulture and art works	12.00%	On approval of all drawings for electrical, sanitary work, services, development, landscaping and art works
		(6) On approval of DG sets, STP & Sub Station, lifts & escalators shop drawings etc	10.00%	On approval of DG sets, STP & Sub Station, lifts & escalators shop drawings etc
		(7) Establishing office for Authority as per Schedule-B	18.00%	On completion of establishment of office as per Schedule-B
		(8) Digital walk through video of complete Bus Port prospective view of minimum 2 minutes.	8.00%	On completion and submission of digital walk through video of complete Bus Port prospective view of min. 2 minutes.
Site Levelling, Grading and Demolition of existing structures	0.50%	**Site Levelling, Grading and Demolishing of Existing Structures**	100%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area/length.
Boundary Wall & Gate	1.50%	**A-Boundary Wall & Gate**		
		(1) Foundation works	20.00%	Unit of measurement is area/length (sqm/m). Payment of each stage shall

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				be made on pro rata basis on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length.
		(2) Civil works of boundary wall	50.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length
		(3) Construction/erection of two gate cabin	15.00%	Unit of measurement is complete work as per specification. Payment of each stage shall be made on completion of the one gate cabin on pro rata basis.
		(4)Construction/erection of Gate works (entry and Exit) and signages (at entry and Exit)	15.00%	Unit of measurement is complete work as per specification. Payment shall be made on the completion of atleast one no. of gates and signages on prorata basis.
Terminal Block and Commercial Area (Ground Floor)	28.00%	**A- Completion of Civil Works**		
		(1) Foundation work upto plinth level	20.00%	Unit of measurement is area/length (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length.
		(2) Column/Shear Wall/ Slab/beams	12.00%	Unit of measurement is area/length (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length.
		(3) Construction of walls	10.00%	Unit of measurement is area/length (sqm/m). Payment of each stage shall be made on pro rata basis

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length.
		(4) Construction of Flooring	20.00%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(5) Supply and fixing of Door/windows including wood work, painting, etc	10.00%	Cost of completed works shall be determined pro rate with respect to the total number of door/windows works including painting. Payment shall be made on the completion of atleast five no. of doors and windows.
		B - Internal Finishing and painting		
		(1) Surface finishing with synthetic mortar	4.00%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(2) Painting work	4.00%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		C- External Finishing	10.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		D- Internal Electric Installation	5.00%	
		E- Internal Plumbing Installation	5.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				than 10 (ten) percent of the total area.
Terminal Block and Commercial Area (First Floor)	17.00%	**A- Completion of Civil Works**		
		(1) Column/Shear Wall/ Slab/beams	19.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(2) Completion of walls	13.00%	Unit of measurement is area/length (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area/length of not less than 10 (ten) percent of the total area/length.
		(3) Completion of Flooring	21.00%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(4) Completion of Door, windows including wood work, painting, etc	12.00%	Cost of completed works shall be determined pro rate with respect to the total number of door/windows works including painting . Payment shall be made on the completion of atleast five no. of doors and windows.
		B - Internal Finishing and painting		
		(1) Surface finishing with synthetic mortar	5.00%	Unit of measurement is area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(2) Painting work	5.00%	Unit of measurement is area (sqm). Payment of each

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		C- External Finishing	12.00%	
		D- Internal Electric Installation	6.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		E- Internal Plumbing Installation	6.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
Parking & Road	8.00%	(1) Earth work upto subgrade level including embankment height of 0.6 m.	15.00%	Unit of measurement is finished top area (sqm). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(2) Subbase/base course	20%	
		(3) PQC/Rigid Pavement	50%	
		(4) Thermoplastic paint and informatory signage's	15.00%	
Completion of E&M works	13.00%	**(1) All Electrical Works including DG Sets etc. complete as per the scope of work complete.**		
		(i) Supply of Equipments / parts	17.00%	Unit of measurement is Cost of supplied equipments/parts. Payment shall be determined pro rate with respect to the total cost of equipments/parts. Payment shall be made on the supply of atleast 20% of the cost of the equipments/parts.
		(ii) Installation, Testing & Commissioning	3.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
		(2) Completion of Cabling, P&F rising main, meter, Panel etc. and connection to the Main Receiving Station including clearance of statutory authorities.	3.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(3) Parking Management System	22.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 20 (twenty) percent of the total area.
		(4) Designing & Installing & commissioning of CCTV Cameras covering all, covering entry &exit points of each buildings and main gates with adequate display of cameras on LED screens in control rooms, including control rooms, display system and software support system and required data cabling etc. complete. Installations of Boom Barriers on campus gates etc.,	5.00%	Cost of completed works shall be determined pro rate with respect to the procurement, installation & commissioning works. Payment shall be made on 40% on procurement and balance on the completion of all works.
		(5) Complete Installation of Lifts, Escalators	20.00%	Cost of completed works shall be determined pro rate with respect to the procurement, installation & commissioning works. Payment shall be made on 70% on procurement and balance 30% on the completion of all works.
		(6) Completion of HVAC and BMS Work	20.00%	Cost of completed works shall be determined pro rate with respect to the procurement, installation & commissioning works. Payment shall be made on 40% on procurement and

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				balance 30% on the completion of all works.
		(7) All testing of control rooms, displays and system etc. complete as per the direction of Authority's Engineer	10.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
Completion of Plumbing & firefighting works	12.00%	(1) Complete Installation of Fire Fighting system	30.00%	Cost of completed works shall be determined pro rate with respect to the procurement & installation works. Payment shall be made on 70% on procurement and balance 30% on the completion of all works.
		(2) Complete external water-supply system / grid including supply and Installation of Pumps., over Head Tanks, Water supply Lines, drainage pipes, Vitreous Chinaware, CP Fittings	40.00%	Cost of completed works shall be determined pro rate with respect to the procurement & installation works. Payment shall be made on 50% on procurement and balance 50% on the completion of all works.
		(3) Completion of sewerage system/grid.	10.00%	
		(4) Completion of Drainage system & Rain water Harvesting including recharge well & Tube Wells.	10.00%	
		(5) Completion of STP/ETP, waste water recycling plant, etc	10.00%	
Creation of Facilities	7.00%	(1) Workshop Block		
		(i) Completion of Civil Works	30.0%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(ii) Internal Finishing and painting @ Sqm.	5.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(iii) External Finishing	4.0%	Unit of measurement is area

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
		@ Sqm.		(sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 10 (ten) percent of the total area.
		(iv) Internal Electric Installation @ Sqm.	2.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(v) Internal Plumbing Installation @ Sqm.	2.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(2) **Fuelling Area**		
		(i) Completion of Civil Works	10.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(ii) Internal and External Finishing and painting @ Sqm.	2.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(iii) Internal Electric and Plumbing Installation @ Sqm.	2.0%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(iv) On declaring complete by the Competent authority	1.0%	On declaring complete by the Competent Authority.
		(3) Furniture		
		(i) Installation of fixed furniture	21.00%	Cost of completed works shall be determined pro rate with respect to the procurement & installation works. Payment shall be made on 50% on procurement and balance 50% on the completion of all works.
		(ii) Supply of loose furniture	21.00%	Cost of completed works shall be determined pro rate with respect to the procurement & installation works. Payment shall be made on 50% on

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage	Procedure of Payment
				procurement and balance 50% on the completion of all works.
Completion of all Horticulture Works	1.00%			
		(1) Complete supply, installation, testing of the irrigation system for Horticulture works such as filling of good earth, grassing, tree plantation etc.		Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 25 (twenty five) percent of the total area.
		(2) Development of Horticulture works as per the approved plan mentioned in the tender document and drawings.	40.00%	Unit of measurement is area (sqm/m). Payment of each stage shall be made on pro rata basis on completion of a stage in a area of not less than 25 (twenty five) percent of the total area.
Solar Installation	5.00%	(1) Supply of solar panels	50.00%	Cost of completed works shall be determined pro rate with respect to the procurement & supply works. Payment shall be made 25% on completion of all works.
		(2) Civil work	10.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(3) Installation & commissioning	20.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
		(4) Grid Integration	20.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.
Commissioning of Bus Port	5.00%	Commissioning of Bus Port by Authority	100.00%	Unit of measurement is completion of works. Payment shall be made on completion of all work.

2. Procedure for payment for Maintenance

2.1 The cost for maintenance shall be as stated in Clause 14.1(v).

2.2 Payment for Maintenance shall be made in quarterly instalments in accordance with the provisions of Article 14 and Article 19.

SCHEDULE-I: Drawings

1 Drawings

In compliance of the obligations set forth in Clause 10.2 of this Agreement, the Contractor shall furnish to the Authority's Engineer, free of cost, all Drawings listed in Annex-I of this Schedule-I.

2 Additional Drawings

If the Authority's Engineer determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in Annex-I, it may by notice require the Contractor to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Contractor shall promptly prepare and furnish such drawings to the Authority's Engineer, as if such drawings formed part of Annex-I of this Schedule-I.

Annexure -I

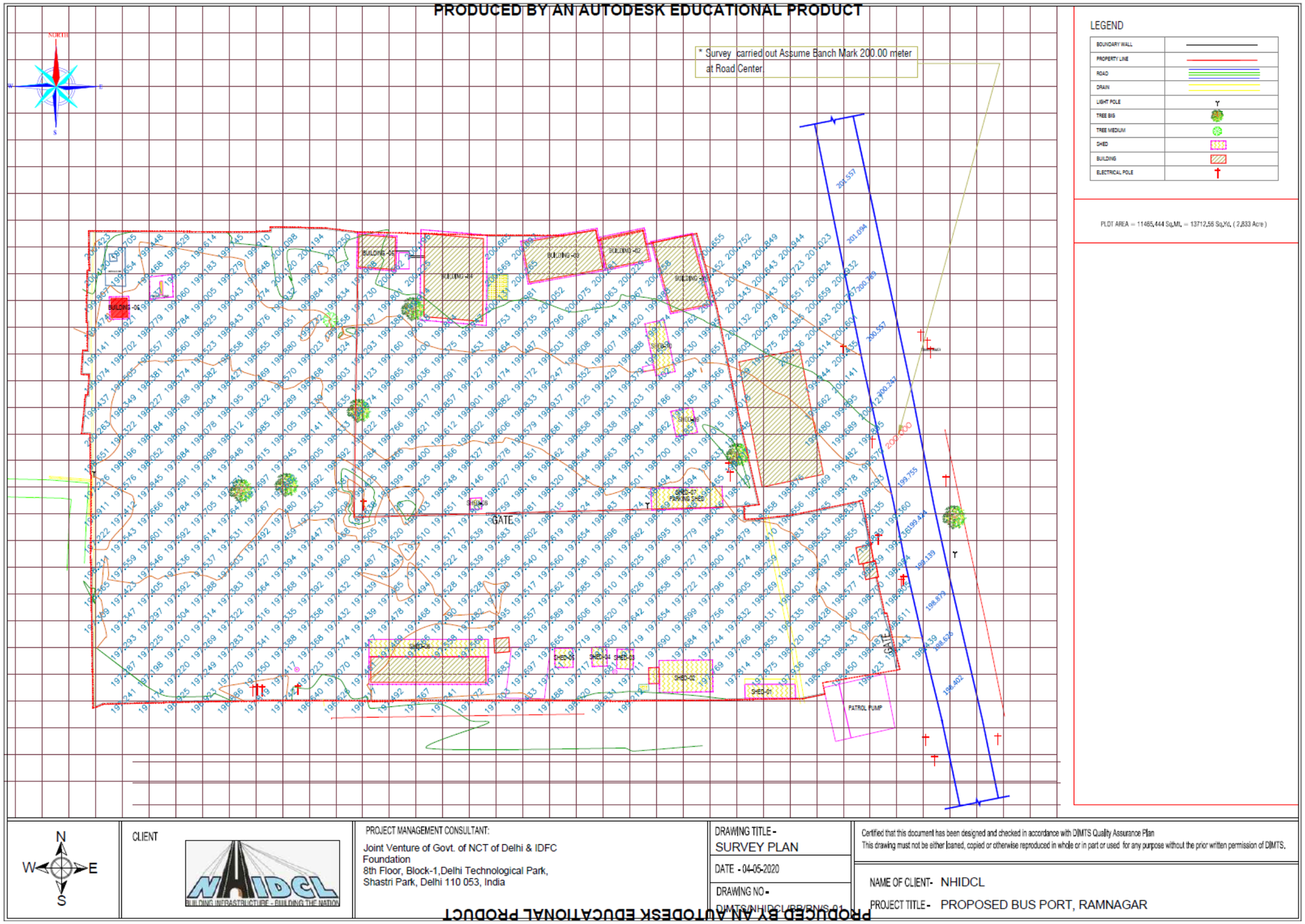
(Schedule-I)

List of Drawings

Note: The Authority shall describe in this Annex-I, all the Drawings that the Contractor is required to furnish under Clause 10.2.

INDEX

Sheet No.	Drawing Title	Drawing No.	Revision	Date
1	Survey Plan	DIMTS/NHIDCL/BP/RN/S-01	R0	05-04-2020
2	Site Plan	DIMTS/NHIDCL/BP/RN/A-100	R0	05-04-2020
3	Ground Floor Plan	DIMTS/NHIDCL/BP/RN/A-101	R0	05-04-2020
4	First Floor Plan	DIMTS/NHIDCL/BP/RN/A-102	R0	05-04-2020
5	Terrace Plan	DIMTS/NHIDCL/BP/RN/A-103	R0	05-04-2020
6	Elevations & Sections	DIMTS/NHIDCL/BP/RN/A-104	R0	05-04-2020
7	Workshop plan	DIMTS/NHIDCL/BP/RN/A-105	R0	05-04-2020
8	Fuelling station	DIMTS/NHIDCL/BP/RN/A-106	R0	05-04-2020
9	Boundary wall	DIMTS/NHIDCL/BP/RN/A-107	R0	05-04-2020


PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
* Survey carried out Assume Banch Mark 200.00 meter at Road Center
NORTH
LEGEND
BOUNDARY WALL
PROPERTY LINE
ROAD
DRAIN
LIGHT POLE
TREE BIG
TREE MEDIUM
SHED
BUILDING
ELECTRICAL POLE
PLOT AREA = 11465.444 Sq.Mt. = 13712.56 Sq.Yd. (2.833 Acre)
BUILDING -05
BUILDING -04
BUILDING -03
BUILDING -02
BUILDING -01
BUILDING -06
SHED-08
SHED-07 PARKING SHED
SHED-06
SHED-05
SHED-04
SHED-03
SHED-02
SHED-01
GATE
PATROL PUMP
CLIENT
PROJECT MANAGEMENT CONSULTANT:
Joint Venture of Govt. of NCT of Delhi & IDFC Foundation
8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India
DRAWING TITLE - SURVEY PLAN
DATE - 04-05-2020
DRAWING NO -
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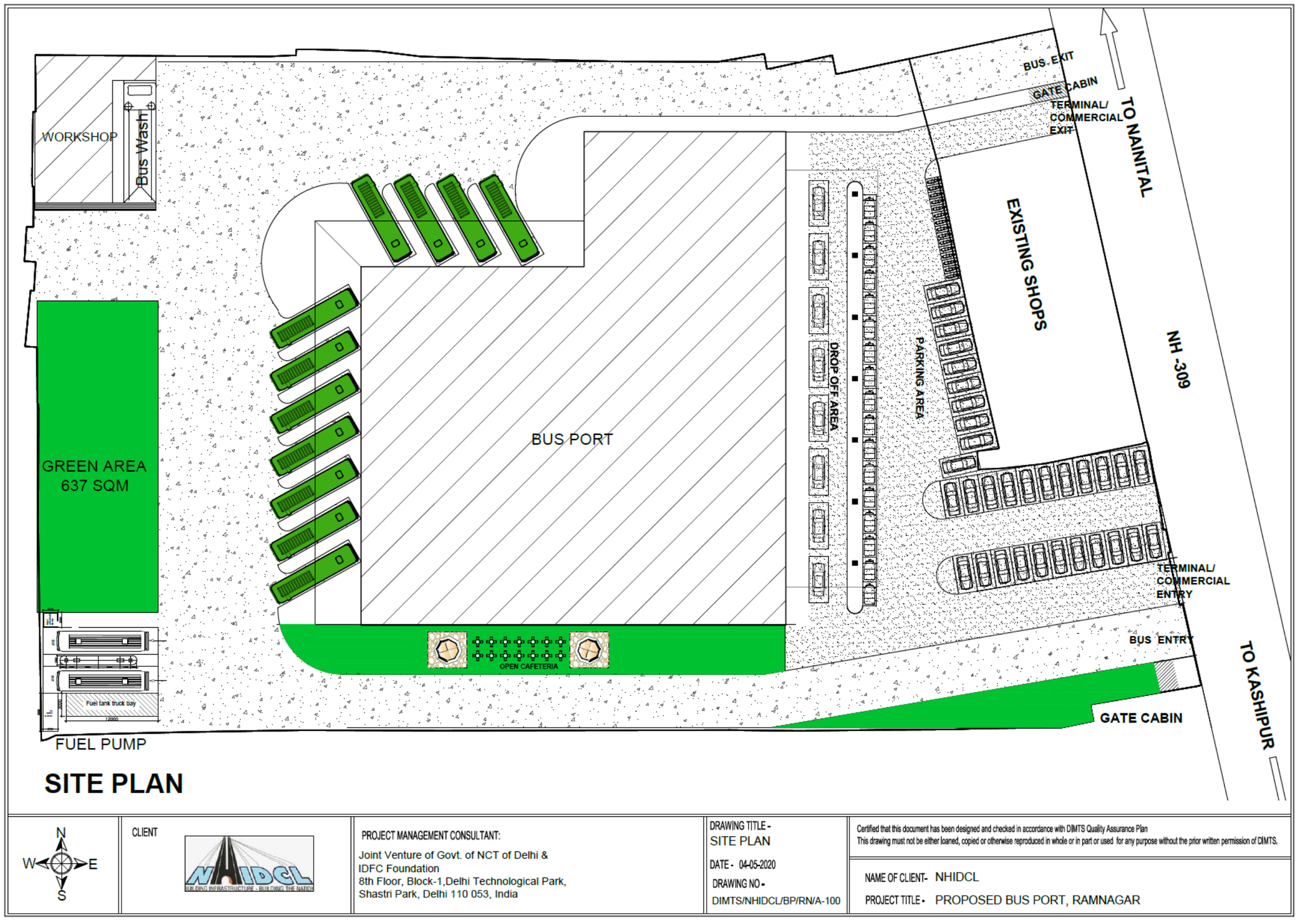
NAME OF CLIENT- NHIDCL
PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



SITE PLAN

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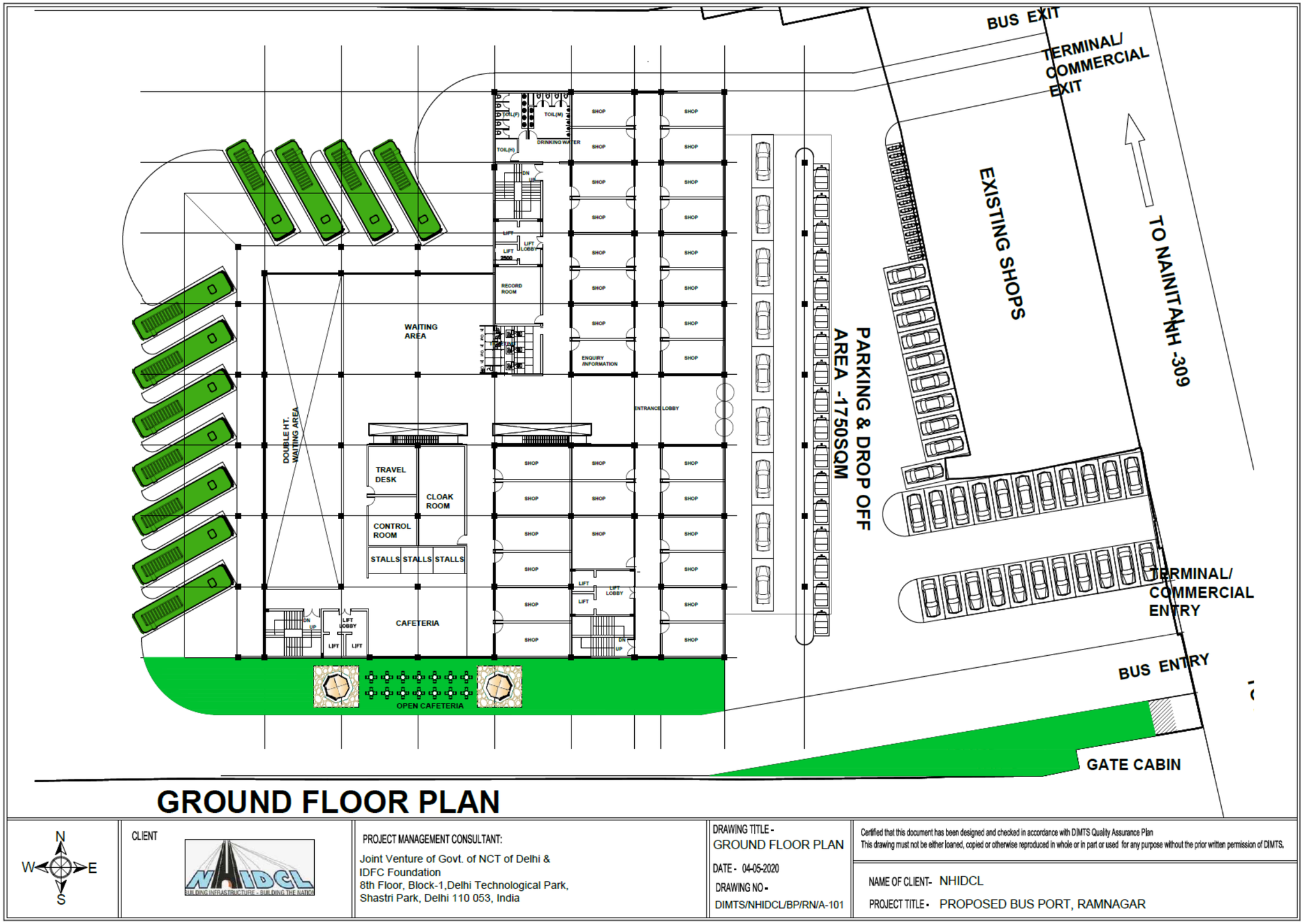
CLIENT

NHIDCL
BUILDING INFRASTRUCTURE - BUILDING THE NATION

PROJECT MANAGEMENT CONSULTANT:
Joint Venture of Govt. of NCT of Delhi &
IDFC Foundation
8th Floor, Block-1,Delhi Technological Park,
Shastri Park, Delhi 110 053, India

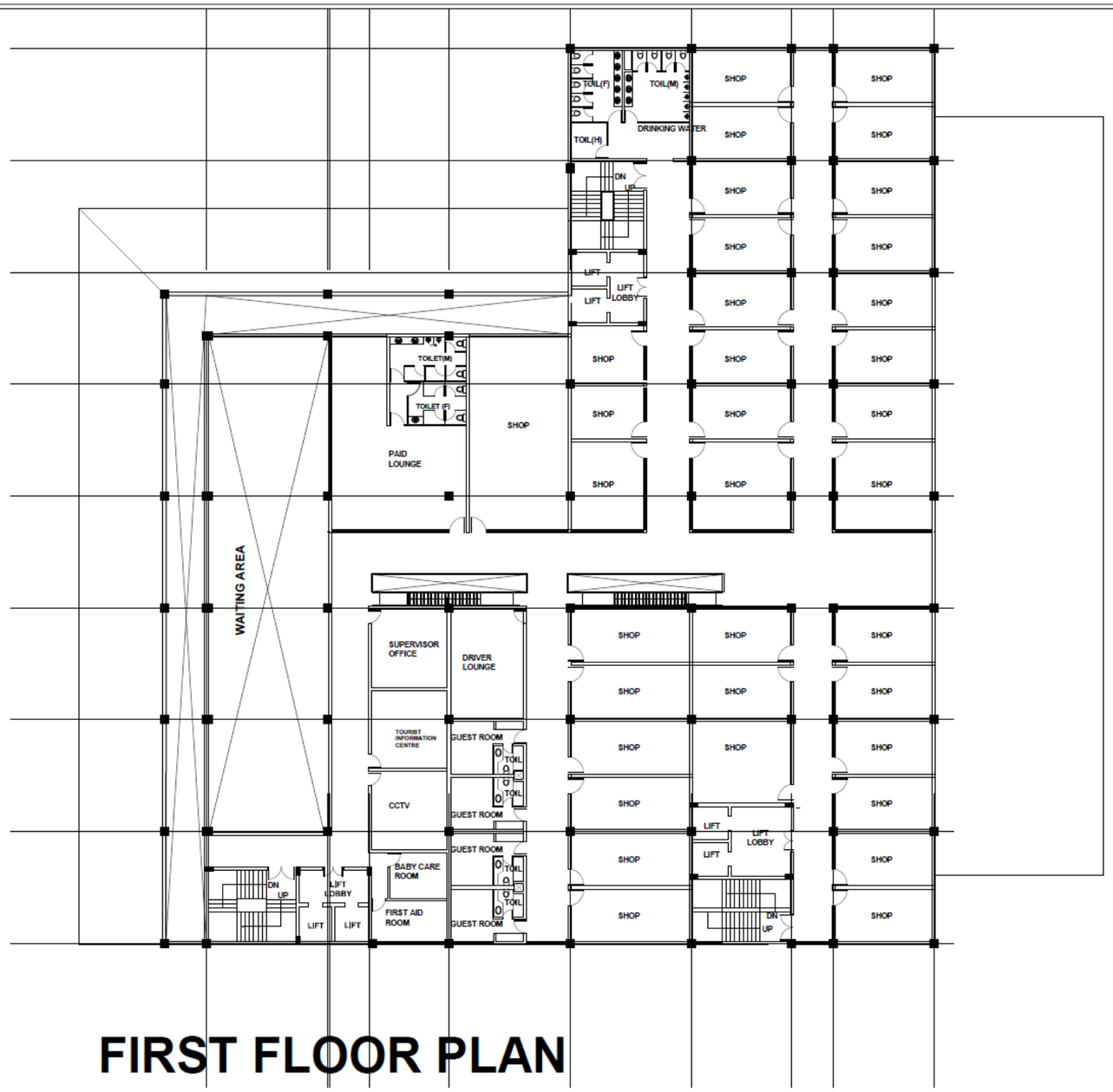
DRAWING TITLE - SITE PLAN
DATE - 04-05-2020
DRAWING NO - DIMTS/NHIDCL/BP/RN/A-100

NAME OF CLIENT- NHIDCL
PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



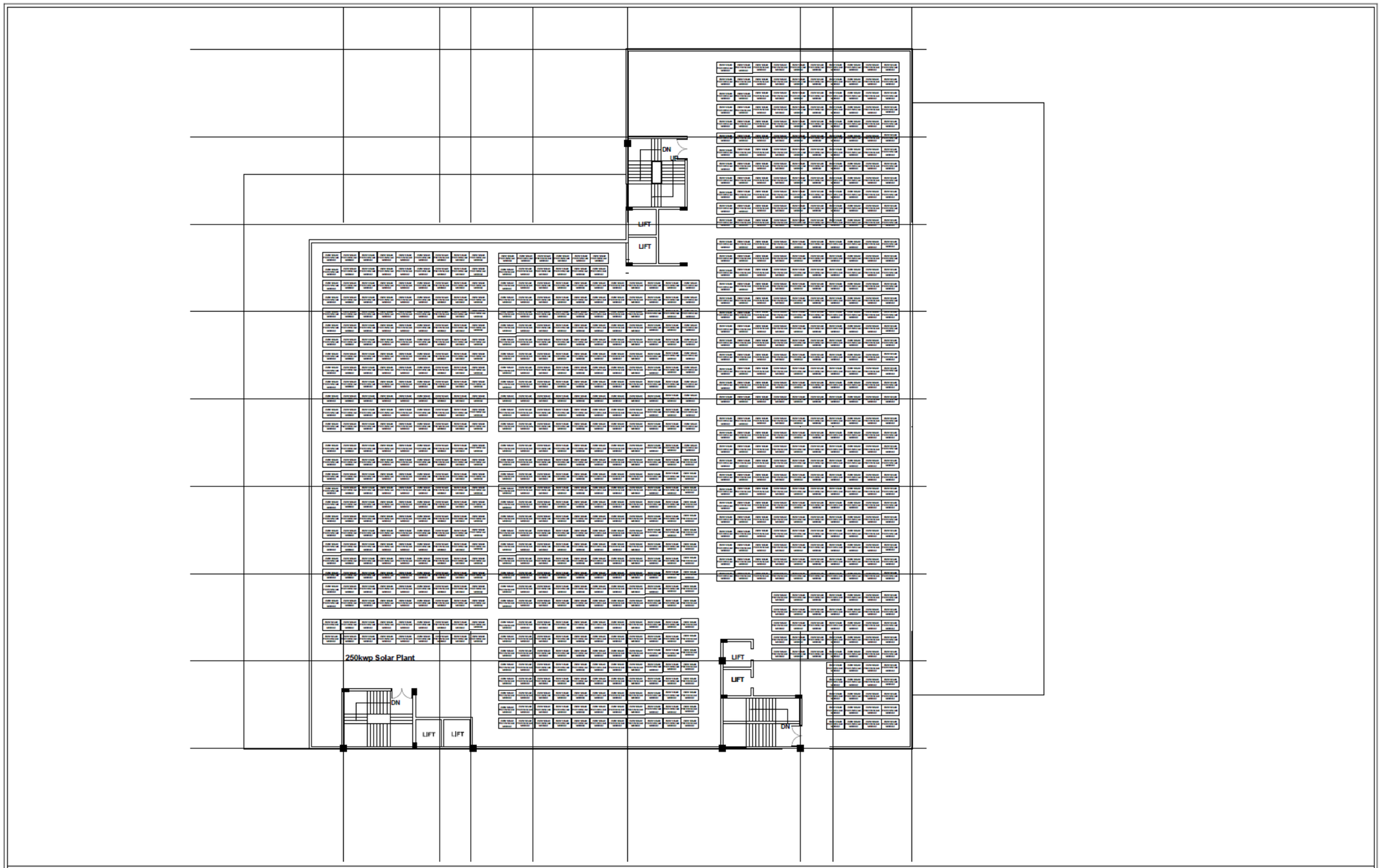
GROUND FLOOR PLAN

	CLIENT NHIDCL BUILDING INFRASTRUCTURE - BUILDING THE NATION	PROJECT MANAGEMENT CONSULTANT: Joint Venture of Govt. of NCT of Delhi & IDFC Foundation 8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India	DRAWING TITLE - GROUND FLOOR PLAN DATE - 04-05-2020 DRAWING NO - DIMTS/NHIDCL/BP/RN/A-101	Certified that this document has been designed and checked in accordance with DIMTS Quality Assurance Plan This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior written permission of DIMTS. NAME OF CLIENT- NHIDCL PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



FIRST FLOOR PLAN

N W E S	CLIENT NHIDCL BUILDING INFRASTRUCTURE - BUILDING THE NATION	PROJECT MANAGEMENT CONSULTANT: Joint Venture of Govt. of NCT of Delhi & IDFC Foundation 8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India	DRAWING TITLE - FIRST FLOOR PLAN DATE - 04-05-2020 DRAWING NO - DIMTS/NHIDCL/BP/RN/A-102	Certified that this document has been designed and checked in accordance with DIMTS Quality Assurance Plan This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior written permission of DIMTS. NAME OF CLIENT- NHIDCL PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



N
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CLIENT

NHIDCL
BUILDING INFRASTRUCTURE - BUILDING THE NATION

PROJECT MANAGEMENT CONSULTANT:

Joint Venture of Govt. of NCT of Delhi &
IDFC Foundation
8th Floor, Block-1,Delhi Technological Park,
Shastri Park, Delhi 110 053, India

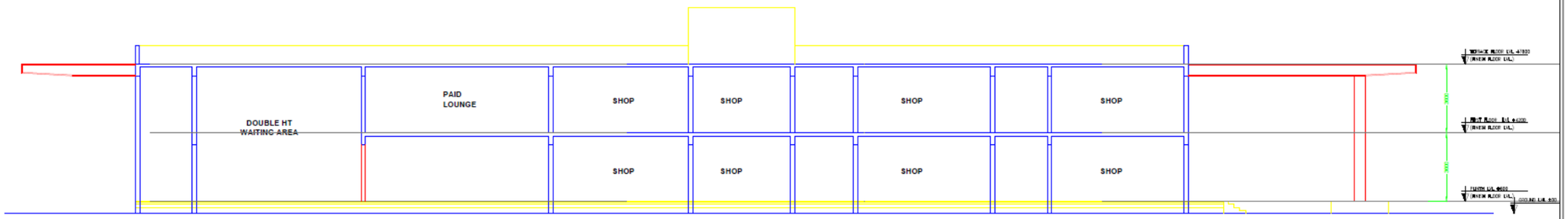
DRAWING TITLE -
TERRACE PLAN

DATE - 04-05-2020

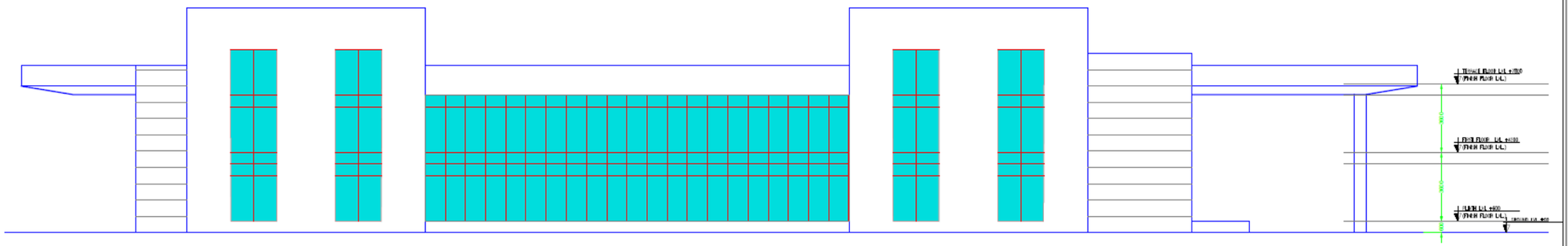
DRAWING NO -
DIMTS/NHIDCL/BP/RN/A-103

NAME OF CLIENT- NHIDCL

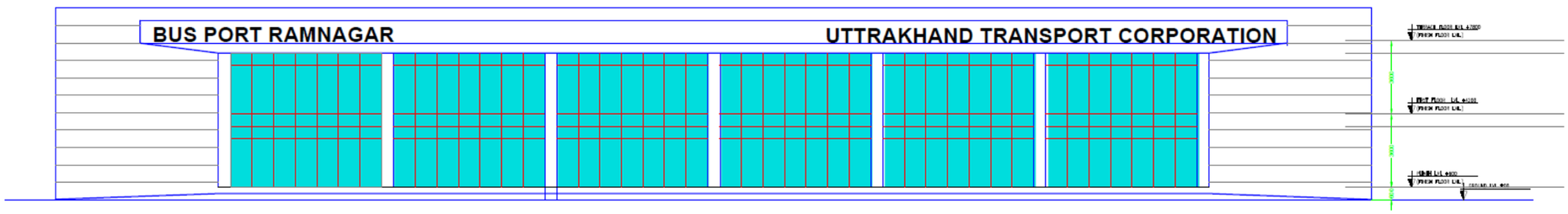
PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



SECTION A-A

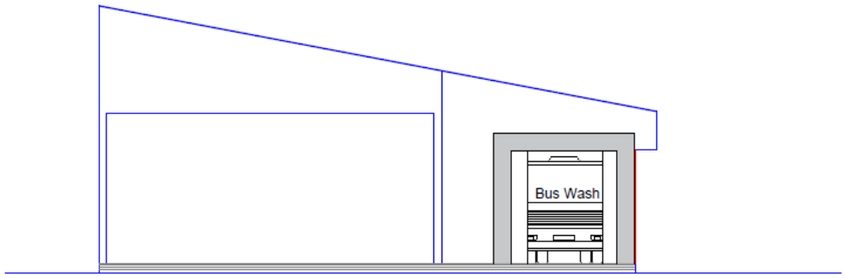


SOUTH SIDE ELEVATION

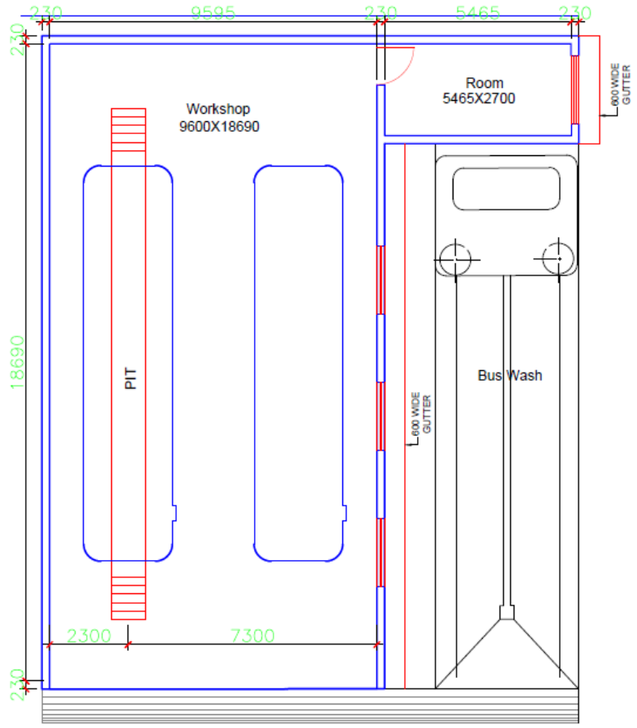


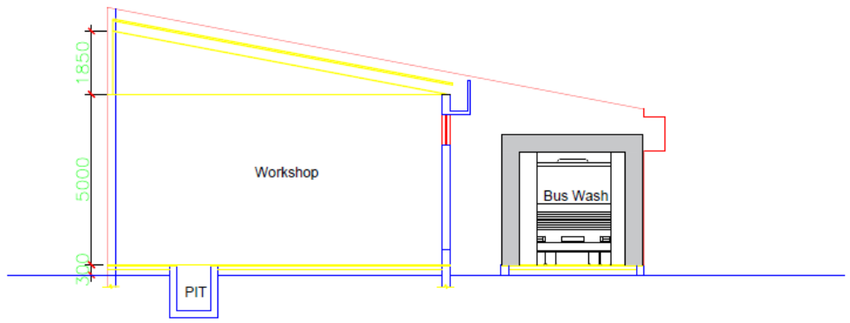
EAST SIDE ELEVATION

N W E S	CLIENT	PROJECT MANAGEMENT CONSULTANT: Joint Venture of Govt. of NCT of Delhi & IDFC Foundation 8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India	DRAWING TITLE - ELEVATIONS& SECTIONS DATE - 04-05-2020 DRAWING NO - DIMTS/NHIDCL/BP/RN/A-104	Certified that this document has been designed and checked in accordance with DIMTS Quality Assurance Plan This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior written permission of DIMTS. NAME OF CLIENT- NHIDCL PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



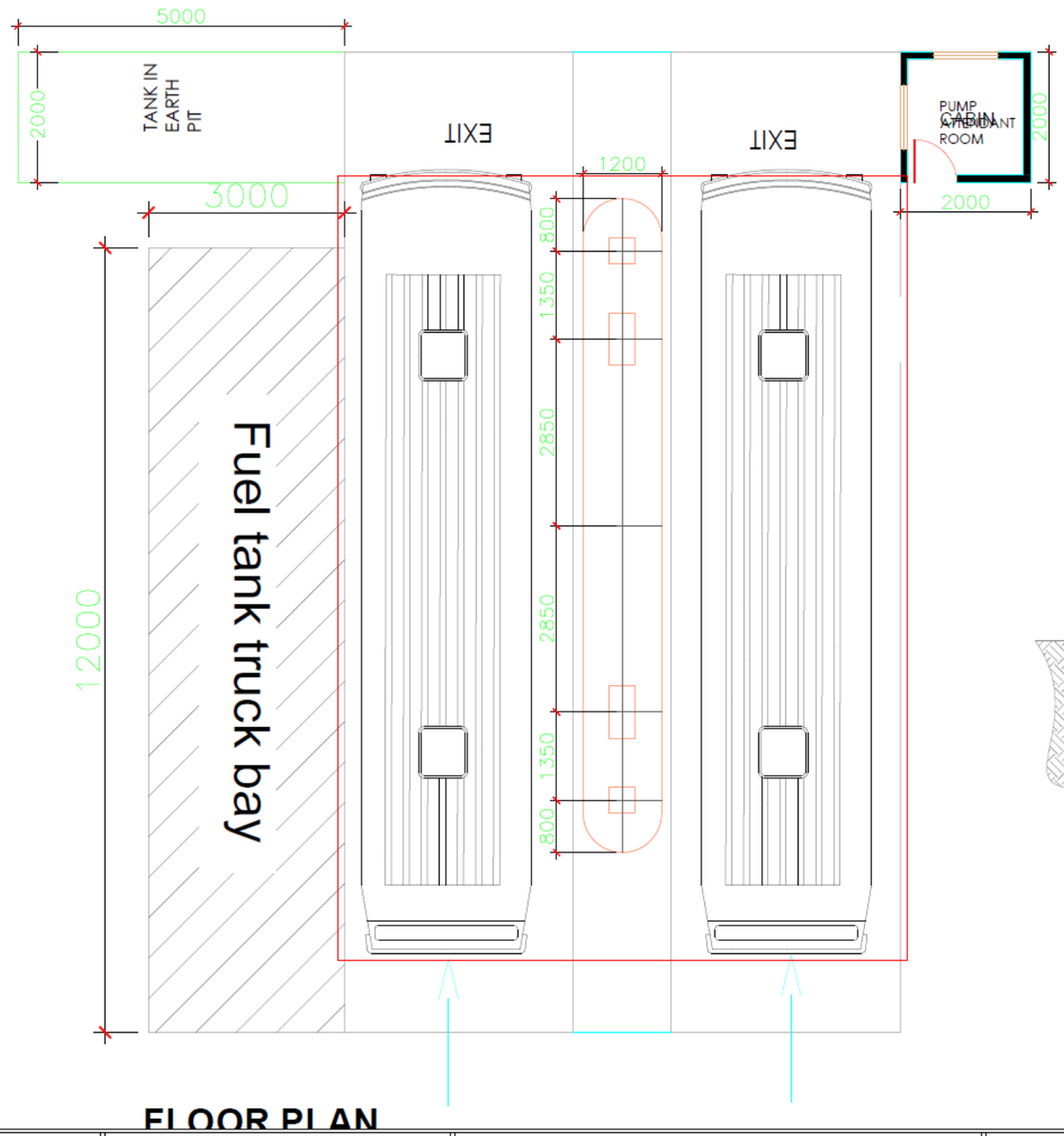
FRONT ELEVATION



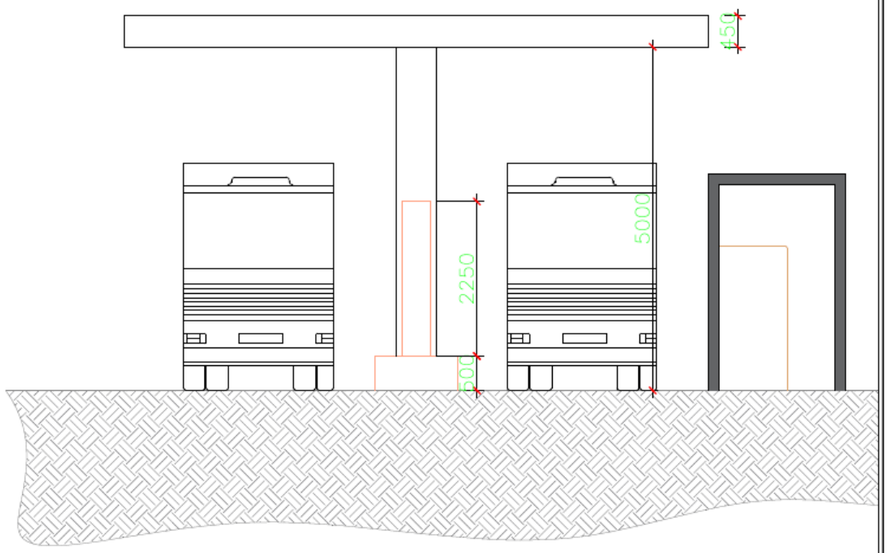


SECTION A-A

N W E S	CLIENT	PROJECT MANAGEMENT CONSULTANT: Joint Venture of Govt. of NCT of Delhi & IDFC Foundation 8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India	DRAWING TITLE - WORKSHOP DATE - 04-05-2020 DRAWING NO - DIMTS/NHIDCL/BP/RN/A-105	Certified that this document has been designed and checked in accordance with DIMTS Quality Assurance Plan This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior written permission of DIMTS. NAME OF CLIENT- NHIDCL PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



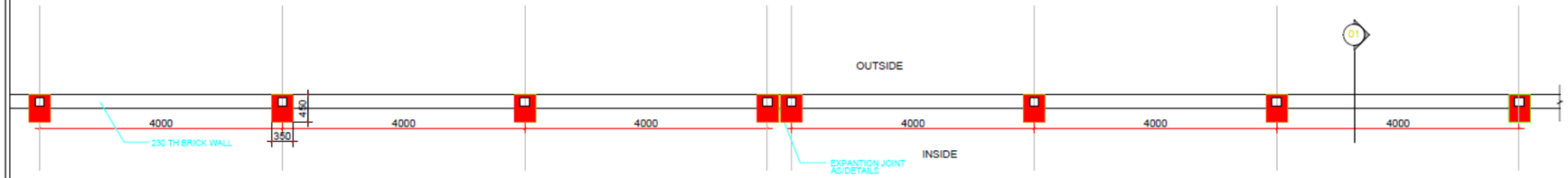
FLOOR PLAN



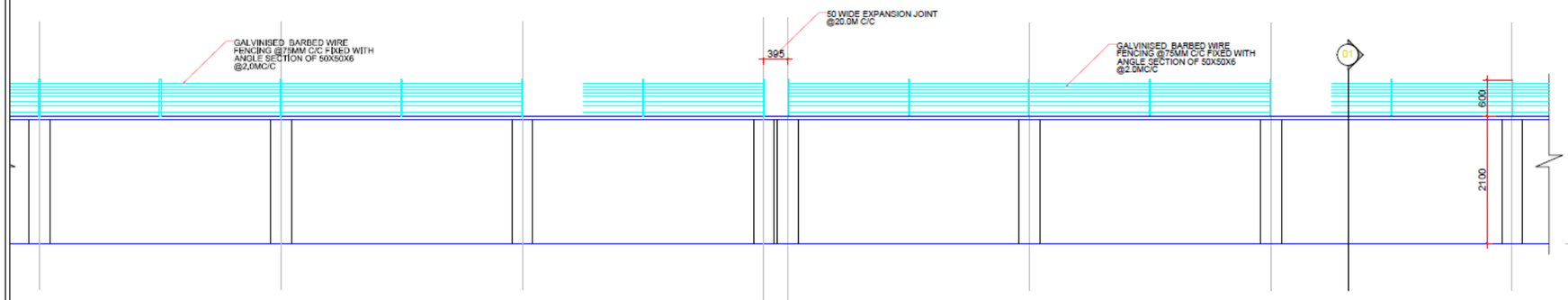
ELEVATION

NOTE : FINAL LAYOUT PLAN SHALL BE AS PER APPROVAL FROM OIL COMPANY .

N W E S	CLIENT NHIDCL BUILDING INFRASTRUCTURE - BUILDING THE NATION	PROJECT MANAGEMENT CONSULTANT: Joint Venture of Govt. of NCT of Delhi & IDFC Foundation 8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India	DRAWING TITLE - FUELING STATION DATE - 04-05-2020 DRAWING NO - DIMTS/NHIDCL/BP/RN/A-106	Certified that this document has been designed and checked in accordance with DIMTS Quality Assurance Plan This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior written permission of DIMTS. NAME OF CLIENT- NHIDCL PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR



PART PLAN



PART ELEVATION

SECTION 01

N W E S

CLIENT

NHIDCL BUILDING INFRASTRUCTURE - BUILDING THE NATION

PROJECT MANAGEMENT CONSULTANT:

Joint Venture of Govt. of NCT of Delhi & IDFC Foundation
8th Floor, Block-1,Delhi Technological Park, Shastri Park, Delhi 110 053, India

DRAWING TITLE - BOUNDARY WALL DETAIL

DATE - 04-05-2020

DRAWING NO - DIMTS/NHIDCL/BP/RN/A-107

NAME OF CLIENT- NHIDCL

PROJECT TITLE - PROPOSED BUS PORT, RAMNAGAR

SCHEDULE-J: Project Completion Schedule

1 Project Completion Schedule

During Construction period, the Contractor shall comply with the requirements set forth in this Schedule-J for each of the Project Milestones and the **Scheduled Completion Date**. Within 15 (fifteen) days of the date of each Project Milestone, the Contractor shall notify the Authority of such compliance along with necessary particulars thereof.

2 Project Milestone-I

2.1 Project Milestone-I shall occur on the date falling on the 90th (Ninety) day from the Appointed Date (the "**Project Milestone-I**").

2.2 Prior to the occurrence of Project Milestone-I, the Contractor shall have commenced construction of the Project and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 10% (ten per cent) of the Contract Price.

3 Project Milestone-II

3.1 Project Milestone-II shall occur on the date falling on the 180th (One hundred and eighty) day from the Appointed Date (the "**Project Milestone-II**").

3.2 Prior to the occurrence of Project Milestone-II, the Contractor shall have continued with construction of the Project and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 30% (thirty per cent) of the Contract Price.

4 Project Milestone-III

4.1 Project Milestone-III shall occur on the date falling on the 270th (Two hundred and seventy) day from the Appointed Date (the "**Project Milestone- III**").

4.2 Prior to the occurrence of Project Milestone-III, the Contractor shall have continued with construction of the Project and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 60% (sixty per cent) of the Contract Price.

5 Scheduled Completion Date

5.1 The Scheduled Completion Date shall occur on the 365th (Three hundred and sixty fifth) day from the Appointed Date.

5.2 On or before the Scheduled Completion Date, the Contractor shall have completed construction in accordance with this Agreement.

6 Extension of time

Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Completion Date, as the case may be, under and in accordance with the provisions of this Agreement, the Project Completion Schedule shall be deemed to have been amended accordingly.

SCHEDULE-K: Tests on Completion

1 ScheduleforTests

1.1 The Contractor shall, no later than 30 (thirty) days prior to the likely completion of construction, notify the Authority's Engineer and the Authority of its intent to subject the Project to Tests, and no later than 10 (ten) days prior to the actual date of Tests, furnish to the Authority's Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of Works.

1.2 The Contractor shall notify the Authority's Engineer of its readiness to subject the Project to Tests at any time after 10 (ten) days from the date of such notice, and upon receipt of such notice, the Authority's Engineer shall, in consultation with the Contractor, determine the date and time for each Test and notify the same to the Authority who may designate its representative to witness the Tests. The Authority's Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 12 and this Schedule-K.

2 Tests

2.1 Other tests: The Authority's Engineer may require the Contractor to carry out or cause to be carried additional tests, in accordance with Good Industry Practice, for determining the compliance of the Project with Specifications and Standards.

2.2 Environmental audit: The Authority's Engineer shall carry out a check to determine conformity of the Project with the environmental requirements set forth in Applicable Laws and Applicable Permits.

2.3 Safety Audit: The Authority's Engineer shall carry out, or cause to be carried out, a safety audit to determine conformity of the Project with the safety requirements and Good Industry Practice.

3 Agency for conducting Tests

All Tests set forth in this Schedule-K shall be conducted by the Authority's Engineer or such other agency or person as it may specify in consultation with the Authority.

4 Completion Certificate

Upon successful completion of Tests, the Authority's Engineer shall issue the Completion Certificate in accordance with the provisions of Article 12.

SCHEDULE-L: Provisional Certificate

1 I, ……. (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated ……. (the **"Agreement"**), for Development of Bus Port at Ramnagar in the State of Uttarakhand on Engineering, Procurement and Construction (EPC) basis through …… (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been undertaken to determine compliance of the Project Highway with the provisions of the Agreement.

2 Works that are incomplete on account of Time Extension have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement. In addition, certain minor works are incomplete and these are not likely to cause material inconvenience to the Users of the Project Building & Instructure work or affect their safety. The Contractor has agreed and accepted that as a condition of this Provisional Certificate, it shall complete such minor works within 30 (thirty) days hereof. These minor works have also been specified in the aforesaid Punch List.

3 In view of the foregoing, I am satisfied that the Project for Building & Infrastructure work can be safely and reliably placed in service of the Users thereof, and in terms of the Agreement, the Project Building & Instructure work is hereby provisionally declared fit for entry into operation on this the …… day of …….. 20…...

ACCEPTED, SIGNED, SEALED AND DELIVERED	SIGNED, SEALED AND DELIVERED
For and on behalf of	For and on behalf of
CONTRACTOR by:	AUTHORITY's ENGINEER by:
(Signature)	(Signature)

COMPLETION CERTIFICATE

1 I, ……. (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated …… (the "**Agreement**"), for Development of Bus Port at Ramnagar in the State of Uttarakhand on Engineering, Procurement and Construction (EPC) basis through ……. (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been successfully undertaken to determine compliance of the Project Building & Instructure work with the provisions of the Agreement, and I am satisfied that the Project Building & Instructure work can be safely and reliably placed in service of the Users thereof.

2 It is certified that, in terms of the aforesaid Agreement, all works forming part of Project Highway have been completed, and the Project Highway is hereby declared fit for entry into operation on this the …… day of …… 20…..

SIGNED, SEALED AND DELIVERED

For and on behalf of the Authority's Engineer by:

(Signature)

(Name)

(Designation)

(Address)

SCHEDULE-M: Payment Reduction for Non-Compliance

1 Payment reduction for non-compliance with the Maintenance Requirements

1.1 Monthly lump sum payments for maintenance shall be reduced in the case of non-compliance with the Maintenance Requirements set forth in Schedule-E.

1.2 Any deduction made on account of non-compliance with the Maintenance Requirements shall not be paid even after compliance subsequently. The deductions shall continue to be made every month until compliance is done.

1.3 The Authority's Engineer shall calculate the amount of payment reduction on the basis of weightage in percentage assigned to non-conforming items as given in Paragraph 2.

2 Percentage reductions in lump sum payments

2.1 The following percentages shall govern the payment reduction:

2.2 The amount to be deducted from monthly lump-sum payment for noncompliance of particular item shall be calculated as under:

R=P/IOO x M x C1

Where
P = Percentage of particular item/ Defect/deficiency for deduction
M = Monthly lump-sum payment in accordance with the Bid
C = its % in the Schedule H (of Contract Price)
R = Reduction (the amount to be deducted for non-compliance for a particular item/ Defect/ deficiency

The total amount of reduction shall be arrived at by summation of reductions for such items/ Defects/ deficiency or non-compliance.

SCHEDULE-N: Selection of Authority's Engineer

1 Selection of Authority's Engineer

1.1 The provisions of the Model Request for Proposal for Selection of Technical Consultants, issued by the Ministry of Finance in May 2009, or any substitute thereof shall apply for selection of an experienced firm to discharge the functions and duties of an Authority's Engineer.

1.2 In the event of termination of the Technical Consultants appointed in accordance with the provisions of Paragraph 1.1, the Authority shall appoint another firm of Technical Consultants forthwith and may engage a government-owned entity in accordance with the provisions of Paragraph 3 of this Schedule-N.

2 Terms of Reference

The Terms of Reference for the Authority's Engineer (the "**TOR**") shall substantially conform with Annex 1 to this Schedule N.

3 Appointment of Government entity as Authority's Engineer

Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Authority's Engineer; provided that such entity shall be a body corporate having as one of its primary functions the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government-owned entity which is owned or controlled by the Authority shall not be eligible for appointment as Authority's Engineer.

Annexure -I

(Schedule-N)

Terms of Reference for Authority's Engineer

1 Scope

1.1 These Terms of Reference (the "**TOR**") for the Authority's Engineer are being specified pursuant to the EPC Agreement dated ..... (the "**Agreement**), which has been entered into between the [name and address of the Authority] (the "**Authority**") and ..... (the "**Contractor**") for Development of multimodal logistic park, package-II on Engineering, Procurement, Construction (EPC) basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

1.2 The TOR shall apply to construction and maintenance of the Project.

2 Definitions and interpretation

2.1 The words and expressions beginning with or in capital letters and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.

2.2 References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.

2.3 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, *mutatis mutandis*, to this TOR.

3 General

3.1 The Authority's Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

3.2 The Authority's Engineer shall perform the duties and exercise the authority in accordance with the provisions of this Agreement, but subject to obtaining prior written approval of the Authority before determining:

(i) any Time Extension;

(ii) any additional cost to be paid by the Authority to the Contractor;

(iii) the Termination Payment; or

(iv) any other matter which is not specified in (a), (b) or (c) above and which creates an obligation or liability on either Party for a sum exceeding Rs. 5,000,000 (Rs. fifty lakh).

3.3 The Authority's Engineer shall submit regular periodic reports, at least once every month, to the Authority in respect of its duties and functions under this Agreement. Such reports shall be submitted by the Authority's Engineer within 10 (ten) days of the beginning of every month.

3.4 The Authority's Engineer shall inform the Contractor of any delegation of its duties and responsibilities to its suitably qualified and experienced personnel; provided, however, that it shall not delegate the authority to refer any matter for the Authority's prior approval in accordance with the provisions of Clause 18.2.

3.5 The Authority's Engineer shall aid and advise the Authority on any proposal for Change of Scope under Article 13.

3.6 In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the Agreement, the Authority's Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

4 Construction Period

4.1 During the Construction Period, the Authority's Engineer shall review the Drawings furnished by the Contractor along with supporting data, including the geo-technical and hydrological investigations, characteristics of materials from borrow areas and quarry sites, topographical surveys, and the recommendations of the Safety Consultant in accordance with the provisions of Clause 10.1.6. The Authority's Engineer shall complete such review and send its observations to the Authority and the Contractor within 15 (fifteen) days of receipt of such Drawings; provided, however that in case of a Major Structure, the aforesaid period of 15 (fifteen) days may be extended upto 30 (thirty) days. In particular, such comments shall specify the conformity or otherwise of such Drawings with the Scope of the Project and Specifications and Standards.

4.2 The Authority's Engineer shall review any revised Drawings sent to it by the Contractor and furnish its comments within 10 (ten) days of receiving such Drawings.

4.3 Authority's Engineer shall review the Quality Assurance Plan submitted by the Contractor and shall convey its comments to the Contractor within a period of 21 (twenty-one) days stating the modifications, if any, required thereto.

4.4 The Authority's Engineer shall complete the review of the methodology proposed to be adopted by the Contractor for executing the Works, and convey its comments to the Contractor within a period of 10 (ten) days from the date of receipt of the proposed methodology from the Contractor.

4.5 The Authority's Engineer shall grant written approval to the Contractor, where necessary, for interruption and diversion of the flow of traffic to the bus port for purposes of maintenance during the Construction Period in accordance with the provisions of Clause 10.4.

4.6 The Authority's Engineer shall review the monthly progress report furnished by the Contractor and send its comments thereon to the Authority and the Contractor within 7

(seven) days of receipt of such report.

4.7 The Authority's Engineer shall inspect the Construction Works and the Project Building & Instructure work and shall submit a monthly Inspection Report bringing out the results of inspections and the remedial action taken by the Contractor in respect of Defects or deficiencies. In particular, the Authority's Engineer shall include in its Inspection Report, the compliance of the recommendations made by the Safety Consultant.

4.8 The Authority's Engineer shall conduct the pre-construction review of manufacturer's test reports and standard samples of manufactured Materials, and such other Materials as the Authority's Engineer may require.

4.9 For determining that the Works conform to Specifications and Standards, the Authority's Engineer shall require the Contractor to carry out, or cause to be carried out, tests at such time and frequency and in such manner as specified in the Agreement and in accordance with Good Industry Practice for quality assurance.

4.10 The Authority's Engineer shall test check at least 20 (twenty) percent of the quantity or number of tests prescribed for each category or type of test for quality control by the Contractor.

4.11 Timing of tests referred to in Paragraph 4.9, and the criteria for acceptance/ rejection of their results shall be determined by the Authority's Engineer in accordance with the Quality Control Manuals. The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Contractor for its own quality assurance in accordance with Good Industry Practice.

4.12 In the event that results of any tests conducted under Clause 11.10 establish any Defects or deficiencies in the Works, the Authority's Engineer shall require the Contractor to carry out remedial measures.

4.13 The Authority's Engineer may instruct the Contractor to execute any work which is urgently required for the safety of the Project, whether because of an accident, unforeseeable event or otherwise; provided that in case of any work required on account of a Force Majeure Event, the provisions of Clause 21.6 shall apply.

4.14 In the event that the Contractor fails to achieve any of the Project Milestones, the Authority's Engineer shall undertake a review of the progress of construction and identify potential delays, if any. If the Authority's Engineer shall determine that completion of the Project is not feasible within the time specified in the Agreement, it shall require the Contractor to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which the Project Completion Date shall be achieved. Upon receipt of a report from the Contractor, the Authority's Engineer shall review the same and send its comments to the Authority and the Contractor forthwith.

4.15 The Authority's Engineer shall obtain from the Contractor a copy of all the Contractor's quality control records and documents before the Completion Certificate is issued pursuant to Clause 12.4.

4.16 Authority's Engineer may recommend to the Authority suspension of the whole or part of

the Works if the work threatens the safety of the Users and pedestrians. After the Contractor has carried out remedial measure, the Authority's Engineer shall inspect such remedial measures forthwith and make a report to the Authority recommending whether or not the suspension hereunder may be revoked.

4.17 In the event that the Contractor carries out any remedial measures to secure the safety of suspended works and Users, and requires the Authority's Engineer to inspect such works, the Authority's Engineer shall inspect the suspended works within 3 (three) days of receiving such notice, and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.

4.18 The Authority's Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-K and issue a Completion Certificate or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 4.18 and all matters incidental thereto, the Authority's Engineer shall act under and in accordance with the provisions of Article 12 and Schedule-K.

5 Maintenance Period

5.1 The Authority's Engineer shall aid and advise the Contractor in the preparation of its monthly Maintenance Programme and for this purpose carry out a joint monthly inspection with the Contractor.

5.2 The Authority's Engineer shall undertake regular inspections, at least once every month, to evaluate compliance with the Maintenance Requirements and submit a Maintenance Inspection Report to the Authority and the Contractor.

5.3 The Authority's Engineer shall specify the tests, if any, that the Contractor shall carry out, or cause to be carried out, for the purpose of determining that the Project is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Contractor in this behalf.

5.4 In respect of any defect or deficiency referred to in Paragraph 3 of Schedule- E, the Authority's Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.

5.5 The Authority's Engineer shall examine the request of the Contractor for closure of the Project or part thereof for undertaking maintenance/repair thereof, and shall grant permission with such modifications, as it may deem necessary, within 5 (five) days of receiving a request from the Contractor. Upon expiry of the permitted period of closure, the Authority's Engineer shall monitor the reopening of such lane(s), and in case of delay, determine the Damages payable by the Contractor to the Authority under Clause 14.5.

6 Determination of costs and time

6.1 The Authority's Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

6.2 The Authority's Engineer shall determine the period of Time Extension that is required to be determined by it under the Agreement.

6.3 The Authority's Engineer shall consult each Party in every case of determination in accordance with the provisions of Clause 18.5.

7 Payments

7.1 The Authority's Engineer shall withhold payments for the affected works for which the Contractor fails to revise and resubmit the Drawings to the Authority's Engineer in accordance with the provisions of Clause 10.2.4 (d).

7.2 Authority's Engineer shall –

(i) within 10 (ten) days of receipt of the Stage Payment Statement from the Contractor pursuant to Clause 19.4, determine the amount due to the Contractor and recommend the release of 90 (ninety) percent of the amount so determined as part payment, pending issue of the Interim Payment Certificate; and

(ii) within 15 (fifteen) days of the receipt of the Stage Payment Statement referred to in Clause 19.4, deliver to the Authority and the Contractor an Interim Payment Certificate certifying the amount due and payable to the Contractor, after adjustments in accordance with the provisions of Clause 19.10.

7.3 The Authority's Engineer shall, within 15 (fifteen) days of receipt of the Monthly Maintenance Statement from the Contractor pursuant to Clause 19.6, verify the Contractor's monthly statement and certify the amount to be paid to the Contractor in accordance with the provisions of the Agreement.

7.4 The Authority's Engineer shall certify final payment within 30 (thirty) days of the receipt of the final payment statement of Maintenance in accordance with the provisions of Clause 19.16.

8 Other duties and functions

The Authority's Engineer shall perform all other duties and functions as specified in the Agreement.

9 Miscellaneous

9.1 A copy of all communications, comments, instructions, Drawings or Documents sent by the Authority's Engineer to the Contractor pursuant to this TOR, and a copy of all the test results with comments of the Authority's Engineer thereon, shall be furnished by the Authority's Engineer to the Authority forthwith.

9.2 The Authority's Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody.

9.3 Within 90 (ninety) days of the Project Completion Date, the Authority's Engineer shall obtain a complete set of as-built Drawings, in 2 (two) hard copies and in micro film form

or in such other medium as may be acceptable to the Authority, reflecting the Project as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the Project and setback lines, if any, of the buildings and structures forming part of Project Facilities; and shall hand them over to the Authority against receipt thereof.

9.4 The Authority's Engineer, if called upon by the Authority or the Contractor or both, shall mediate and assist the Parties in arriving at an amicable settlement of any Dispute between the Parties.

9.5 The Authority's Engineer shall inform the Authority and the Contractor of any event of Contractor's Default within one week of its occurrence.

SCHEDULE-O: Forms of Payment Statements

1 Stage Payment Statement for Works

The Stage Payment Statement for Works shall state:

(i) the estimated amount for the Works executed in accordance with Clause 19.3.1 subsequent to the last claim;

(ii) amounts reflecting adjustments in price for the aforesaid claim;

(iii) the estimated amount of each Change of Scope Order executed subsequent to the last claim;

(iv) amounts reflecting adjustment in price, if any, for (iii) above in accordance with the provisions of Clause 13.2.3 (a);

(v) total of (i), (ii), (iii) and (iv) above;

(vi) Deductions:

- (a) Any amount to be deducted in accordance with the provisions of the Agreement except taxes;
- (b) Any amount towards deduction of taxes; and
- (c) Total of (a) and (b) above.

(vii) Net claim: (v) – (vi) (c);

(viii) The amounts received by the Contractor upto the last claim:

- (a) For the Works executed (excluding Change of Scope orders);
- (b) For Change of Scope Orders, and
- (c) Taxes deduct

2 Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

(i) the monthly payment admissible in accordance with the provisions of the Agreement;

(ii) the deductions for maintenance work not done;

(iii) net payment for maintenance due, (i) minus (ii);

(iv) amounts reflecting adjustments in price under Clause 19.12; and

(v) amount towards deduction of taxes

3 Contractor's claim for Damages

Note: The Contractor shall submit its claims in a form acceptable to the Authority.

SCHEDULE-P: Insurance

1 Insurance during Construction Period

1.1 The Contractor shall effect and maintain at its own cost, from the Appointed Date till the date of issue of the Completion Certificate, the following insurances for any loss or damage occurring on account of Non Political Event of Force Majeure, malicious act, accidental damage, explosion, fire and terrorism:

(i) insurance of Works, Plant and Materials and an additional sum of [15 (fifteen)] per cent of such replacement cost to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing ansd removing any part of the Works and of removing debris of whatsoever nature; and

(ii) insurance for the Contractor's equipment and Documents brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

1.2 The insurance under paragraph 1.1 (i) and (ii) above shall cover the Authority and the Contractor against all loss or damage from any cause arising under paragraph 1.1 other than risks which are not insurable at commercial terms.

2 Insurance for Contractor's Defects Liability

The Contractor shall effect and maintain insurance cover for the Works from the date of issue of the Completion Certificate until the end of the Defects Liability Period for any loss or damage for which the Contractor is liable and which arises from a cause occurring prior to the issue of the Completion Certificate. The Contractor shall also maintain other insurances for maximum sums as may be required under the Applicable Laws and in accordance with Good Industry Practice.

3 Insurance against injury to persons and damage to property

3.1 The Contractor shall insure against its liability for any loss, damage, death or bodily injury, or damage to any property (except things insured under Paragraphs 1 and 2 of this Schedule or to any person (except persons insured under Clause 20.9), which may arise out of the Contractor's performance of this Agreement. This insurance shall be for a limit per occurrence of not less than the amount stated below with no limit on the number of occurrences.

The insurance cover shall be not less than: Rs. [*****]

3.2 The insurance shall be extended to cover liability for all loss and damage to the Authority's property arising out of the Contractor’s performance of this Agreement excluding:

(i) the Authority's right to have the construction works executed on, over, under, in or through any land, and to occupy this land for the Works; and

(ii) damage which is an unavoidable result of the Contractor's obligations to execute the

Works.

4 Insurance to be in joint names

The insurance under paragraphs 1 to 3 above shall be in the joint names of the Contractor and the Authority.

END OF THE DOCUMENT