National Highways & Infrastructure Development Corporation Limited

(Ministry of Road Transport & Highways, Govt. of India)

PART DESIGN, CONSTRUCTION, OPERATION& MAINTENANCE (For a Period of 5 Years)OF FULLY AUTOMATIC MULTI-LEVEL CAR PARKING SYSTEM AT CENTRAL CIVIL SECRETARIAT, ITANAGAR, ARUNACHAL PRADESH

Contract No: NHIDCL/AMLCP Const Work/AP/2020

VOLUME 3

(EMPLOYER'S REQUIREMENTS)

EMPLOYER'S REQUIREMENTS WITH APPENDICES GENERAL

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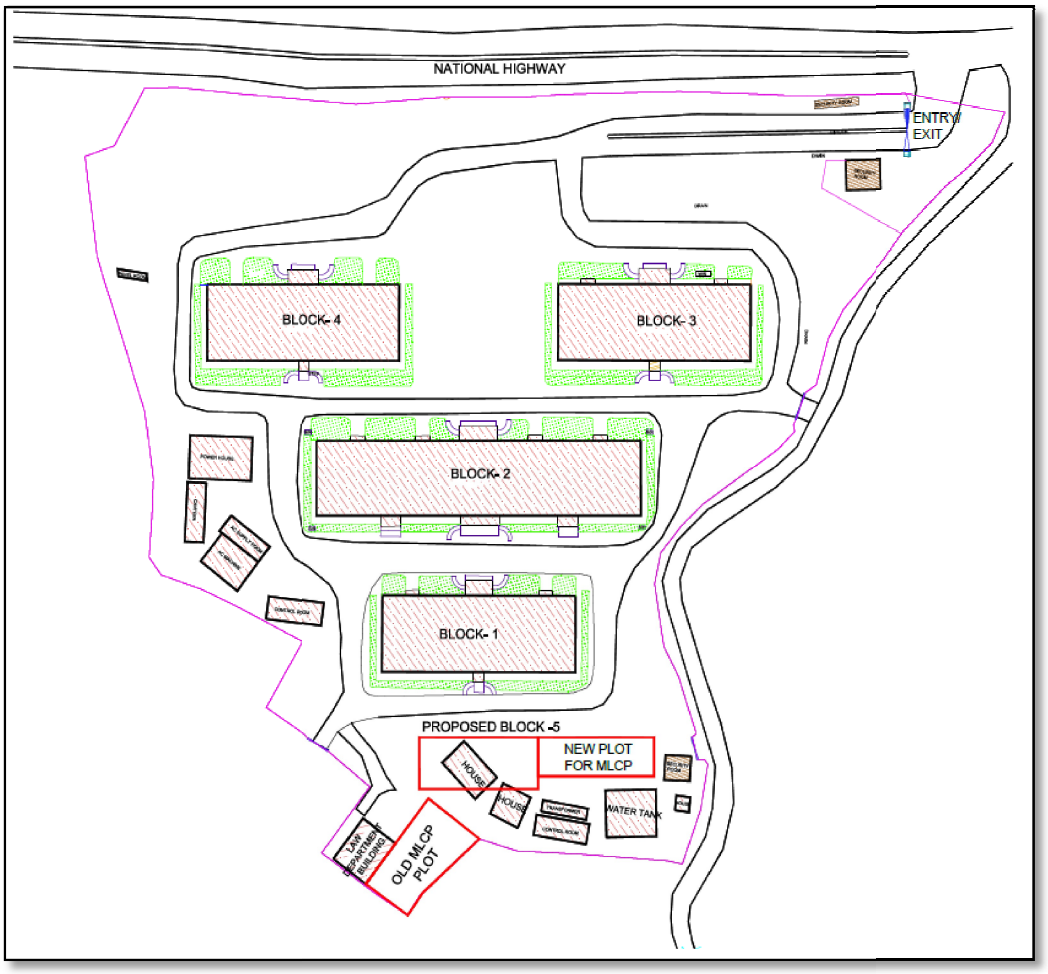
1.0 SITE OF THE PROJECT

1.1 Location of the Site

The site for constructing the proposed fully automatic multi-level underground car parking complex is in a vacant area opposite block no 1. The following figure shows the location of the site.



1.2 Site Specifications

The plot for the parking complex measures 12x 40m, and is designated for developing multi-level parking facility for Civil Secretariat Itanagar.

1.3 As shown in Figure 1, there is proposed block no. 5 opposite block no 1in the the same axis.

1.4 For the proposed Fully Automated MLCP building, the number of car parking are 12 car spaces per floor. The total count for car parking spaces is 108 for the complete multi-level car parking building. Ground floor level of the building shall be used as transfer area, wherein the control room, utility room, and driver room are planned. Two entrances, two exists, two elevators in the building with two fire staircases are planned in the building. The rooftop level is proposed with cafeteria with independent lift to the food court facility, so that it can be accessed by patrons directly. There are 4 floors above ground floor level and 4 basement floors for parking. The entry and exit are on the opposite side. 2 number of car lifts are planned to minimize the waiting time and creating queues

PROJECT DEFINITION

2.1 Introduction

While developing the part design and quoting for construction (including supply & installation of parking equipment), it must be borne in mind by the tenderer that the parking complex to be developed for Civil Secretariat of Arunachal Pradesh shall be aesthetic, state-of-art and world class standard. Basic design of the parking facility has done and approved from the competent authority. The contractor scope is to design parking facility as per his mechanical parking technology.

2.2 Scope of Work: Automated Multilevel Car Parking

A Parking complex with fully automatic parking facility is to be Part Designand Constructed complete with waterproofing & Drainage works, all E&M installations including Fire Protection, Mechanical Ventilation, lighting, signages, with all fittings & fixtures in fully functional state alongwithvehicles riding surfaces. Following component structures/Systems as listed below need to be developed as a part of proposed parking complex: -

(i) Multi-level parking structure for a minimum 108 ECS.
(ii) 'Automated parking' Equipment/System (Hardware/Software).
(iii) Food court and gymnasium on top floor of the building
(iv) Supply/Installation of DG Set required providing 100% power back up.
(v) <u>Comprehensively maintain and operating the Parking facility for 5 years.</u>
(vi) <u>Well-designed landscaping etc</u>

<u>Contractor will take care of shifting of utilities, as per payment schedule.</u>

The above facilities shall be as per the following description and shall conform to the minimum specifications given in Section 3.

2.2.2 It is reiterated that these shall be *state-of-the-art*, conforming to the latest National/ International standards and as per best industry practices.

2.3 Parking Structure

2.3.1 The parking (civil) structure shall be developed in the area described in Section 1. This is standalone structure along the proposed block no 5 opposite the block no 1 and shall be partly underground and partly above ground to accommodate a minimum number of 108 ECS.

2.3.2 The dimensions of cars/SUVs to be accommodated in the parking structure are given in the following table (Table 1).

Table 1: Dimensions of Cars/SUVs

Vehicle Type	Dimensions
SUVs	Length: 5.00m Width: 2.20m Height: 2.20m Weight: 2500kg

2.3.3 The parking structure shall be designed in such a way that it can accommodate 100% SUVs.

2.3.6 <u>Parking structure will be provided with vehicles' riding surfaces wherever required, waterproofing & Drainage works and all necessary E&M installations; Lighting/Mechanical ventilation/Fire protection/ Signagesetc complete with all fittings/ fixtures fully functional (except architectural finishes). but including well designed landscaped deck.</u>

2.4 Parking System

2.4.1 The parking system shall be fully automatic, and shall accommodate the number of ECS given in Section 2.2

2.4.2 System shall be capable of handling cars/SUVs defined in Section 2.3.2.

2.4.4 System shall have internationally state-of-the-art technology and shall conform to the minimum specifications laid out in Section 3.

2.4.5 Tenderer shall consider the following guidelines while selecting a particular parking system:

- Provide Fully Automatic, Multilevel car parking system. Manual and semi-automatic parking systems shall not be considered.
- System must have sufficient redundancy for every system/ sub-system of the car park equipment. It must be possible to evacuate each & every parked vehicle, even during partial equipment breakdown state.
- Entry boxes, input/ output terminals, turntables, etc, must not have any tripping hazards, and designed for wheelchair access. The system shall be women, physically challenged and elderly people friendly.
- Parking technology supplier must prove their technology worthiness to NHIDCLby demonstrating at least one parking facility working without breakdown for minimum period of five years anywhere in the world, supported by client's (Facility Owner) satisfaction letter.
- Car park equipment preferably use pallet-less technology.

- Car park equipment design must be modular.
- Incorporates *state of the art* Safety and Security features.
- System must have 24 hrs live remote dial–up links with the manufacturing/ operations base of the original equipment supplier, to enable remote troubleshooting, and prevent breakdowns.Tenderer shall enter into an agreement with Govt. of Arunachal Pradesh for comprehensive maintenance support for 5 (five) years. Similarly, there shall be an agreement between the tenderer and the technology provider for complete maintenance support for 5 (five) years.
- System offered must be capable of catering to heavy parking and retrieval demand during morning and evening peak periods
- Maximum retrieval time under the worst case scenario, for any car must be less than 180s (i.e., 3minutes). The bidder shall prove this with detailed time calculations and simulations.
- During normal operations period, at least 90% of the system must always be available for parking in and parking out procedures. This is applicable even for maintenance and/ or breakdown situations.
- The system must be capable to transfer out (evacuate) all parked vehicles in maximum time of 2 hours, if ever required in an emergency situation. The design calculations in support this must be provided.

3.0 TECHNICALSPECIFICATIONS

3.1 General

The technical specifications outlined in this chapter are to provide guidelines to the Contractors to formulate technical proposals for the project. The specifications given in this Schedule are minimum specifications, bidder shall follow best international practices and provide state-of-the-art technology, as directed and approved by NHIDCL.

3.2 Parking Facility

3.2.1 Requirements for Parking Structure (Civil)

- The requirements under this head shall include construction of parking structure (civil) alongwithcomplete waterproofing & Drainage, fully functional Fire Protection systems,E&M installations etc. e.g. lighting/Mechanical Ventilation/ Signageswith all the fittings & fixtures.
- The parking structure shall be partly underground and partly above ground , with the top floor used for cafeteria and gymnasium.
- Parking bays must be designed and made (in RCC) finished in flat surfaces compatible to the fully automated parking system.
- Entry boxes, input/ output terminals, turntables, etc, must not have any tripping hazards, and must be designed for wheelchair access
- Design of structure shall take into account the water table depth at site
- Required water proofing shall be provided i/c for deck slab.
- The structure shall be earthquake resistant
- The driveways at I/O level shall have rigid pavement

  Entire circulation area shall have state-of-the art road signs (including variable message signs) and markings to guide the traffic (vehicular as well as pedestrian). Signs shall be of Type VIII or better and paint for markings shall be of the state-of-the-art. Variable sign boards shall be sufficient to guide the traffic at I/O level.
- Parking structure shall have *state-of-the-art*& best possible fittings/ finishes.

3.2.2 The following table presents the minimum specifications to be considered for the parking structure.

Table 2(a): Specifications for Parking Structure

S. No:	Item	Requirement
1	Height of Building	Façade and height of building to be match with existing block no 1. Provisions shall be kept in the design to connect the parking block to future block no 5
2	Depth of the Building below Ground Level	Four basements has been proposed in the MLCP
3	Space per car	As per the system, to accommodate the car dimensions in Section 2(Table 1)
4	Parking bay dimension	As per the system, to accommodate the car dimensions Section 2 (Table 1)
5	Fire Protection	Sprinkler or any other system acceptable to 'Fire' authority, for multi-level car parks.
6	Roof	Roof of the MLCP shall match with the existing roof profile in the campus

3.2.3 The Contractor may adopt appropriate designs conforming to Approved plan and the detailed project report and the above covenants for the Parking Facility.

3.2.4 Appropriate arrangements shall be done to prevent grease/oil due to leakages and washing of floors does not contaminate ground water table.

3.2.5 Fire Safety

3.2.5.1 Fire safety measures in the form of

- Fire Escapes
- Fire alarm including smoke detection and
- **Fire fighting/extinguishing i/c smoke extraction arrangements etc.**

as recommended in applicable codes (Indian as well as International),also listed herein later, shall be implemented.

3.2.5.2 The firefighting system shall be adequate to control petroleum fires.

3.2.5.3 Provisions shall be made in an Automated Parking Facility that leakage of gasoline tanks or other flammable fluids are collected during transportation and storage of the vehicle and a suitable & technically sound arrangement for draining of the same.

3.2.5.4 Construct the Automated Parking Facilities' structure and the equipment with non-combustible construction without a specified fire resistance. In addition, those portions of the facility used for the transport and / or storage shall have a finish of non-absorbent, noncombustible material. Where the Automated Parking Facility is located below a building, a 2-hour fire resistance rated separation shall be provided between the Automated Parking Facility and the adjacent space use.

3.2.5.5 As the nature of an Automated Parking Facility provides the means to transport a vehicle without human interference, provisions shall be made to detect a vehicle on fire and to extinguish the fire immediately.

3.2.5.6 Fire escape staircases etc shall be provided as per requirements. The parking structure shall conform to NBC and other relevant codes, and various provisions for fire and structural safety.

3.2.6 Lighting

3.2.6.1 Contractor shall provide adequate lighting system in the Parking Complex, etc. Followingtable gives the minimum Lux levels to be achieved for the Project.

Table 3: Minimum Lux Levels Required in Various Areas

Area	**Minimum Lux Level**
Parking areas & Ramps	70
Roofs including landscaped deck	20
Entrance & exit Areas for Parking	150
For external lighting	20
Pedestrian Movement Area	70
Stairways and subways	100
Toilets	100

3.2.7 Signages:

The Contractor shall provide illuminated signs in accordance with National Building Codes (NBC)/ Indian Roads Congress (IRC) Codes and Standards at suitable locations within the Parking Facilities. The signs shall be of Type VIII or better. The scheme for signals shall be finalized in consultation with the Project Officer. The signage leading to the I/O terminal shall be clear and visible form sufficient distance to navigate drivers to the I/O terminals without

any ambiguity. The Contractor shall provide safety barriers at appropriate locations, to effectively manage pedestrian and vehicular traffic.

3.2.8 Power Backup:

Contractor shall develop space for power back-up adequate for 100% of the designed power load of the Parking Facility (except Walkways), and Toilet Area. The generator will have a switch-over mechanism so as to be activated automatically in the event of power failure. The generator shall be installed in a separate sound proof enclosure. The subway and stairways, Toilets and Entry and Exit Areas however shall be provided with auxiliary emergency lighting system such that in case of a failure the system is activated immediately.

3.2.9 Ventilation/ Air Conditioning

3.2.9.1 Areas accessible to the public / drivers shall be equipped with sufficient air ventilation to have good human comfort conditions. The system shall be designed to provide positive and uniform supply of fresh air in the parking and its exhaust through ducts / fans. The ventilation system shall be designed to achieve minimum 15 air changes / hour in the parking hours and 30 air changes in case of fire. The GI sheets for the sheet metal ductwork shall conform to IS-227 and the ductwork shall be fabricated and executed strictly as per the requirements of IS-655.

3.2.9.2 The Storage area of the System in which no drivers enter but only maintenance crews, may be unconditioned space, although ventilation of outside air shall be provided. As described earlier, 3 air cycles shall be consider for parking floors.

3.2.9.3 Depending on the design of the Entry and Exit Areas, ventilation of emissions shall be required in that area.

3.2.10 Accessibility for Maintenance

The Parking Structure shall be designed such that maintenance personnel have access to all storage spaces, machinery and electrical and electronic components in a safe manner.

3.2.11 Drainage

Contractor shall design and implement drainage facilities in such a manner that there is no stagnation of water at the Parking complex. Internal drainage system shall be connected to the main common drain at an appropriate location in accordance with the approved drawings. The existing storm-water drain at site shall be integrated in the overall scheme in such a way that the storm-water drain remains unaffected by the proposed parking complex.

3.3 Requirements for Parking System

3.3.1 As described earlier, the parking system to be developed at site shall have fully automatic parking system.

3.3.2 For the purpose of clarity, a fully automatic system is a parking system where all the processes of conveying to/from and parking/retrieving of the vehicle within the parking structure beyond a designated entry area (I/O terminal area) are fully mechanized. It is presumed that there is no human involvement with the vehicle (either by the owner/driver or by the designated operator)for parking or retrieving the vehicle from the storage area.

3.3.3 Contractor shall ensure that the technology chosen is:

(a) Appropriate to the site and ground situation.

(b) Accommodates proposed number of Equivalent Car Spaces (ECS)

(c) Has a precedent use in a project of similar nature and size

(d) Is supported by the technology/service provider for design, supply, implementation and ongoing maintenance

(e) Addresses all issues of Security and safety, including fire safety, operational safety and environmental safety

(f) Does not add to circulation problems for pedestrians and traffic in the contiguous area

(g) Shall have full support from the system provider during the system installation and Operation and Maintenance stage

(h) System shall be compatible with ambient maximum and minimum temperatures, humidity and other local conditions

3.3.4 After the Maintenance/operation period of Project Facilities, NHIDCL/Govt. of Arunachal Pradesh desires to take over an asset that would

- have the most appropriate technology under the circumstances
- be operationally the most safe and convenient design
- Environmentally the most friendly and aesthetic structure

3.3.5 Towards satisfying this objective, the Table 2(b) below lists the technical parameters that the Contractor shall complywith while selecting the appropriate technology and while designing the facilities there under.

3.3.6 Table 2(b) is not exhaustive and it shall be the obligation of the Contractor to adhere to all applicable norms and good industry practices in the design of the Project Facilities. The Contractor would be expected to adhere to all the relevant set of covenant(s) that would relate to the technology option(s) that is offered for the Project.

3.3.7 The parameters listed in the table would co-exist with the approved detailed project report as per the terms and conditions in this Agreement. They shall be read with and applied in conjunction with the development control norms, as appropriate. Any deviations, from these parameters, however, being within the compliance of the approved development control norms, shall be accepted by NHIDCL only at its sole discretion.

Table 4 : System Specifications

S. No:	Item	Requirement
1	Retrieval time	Not more than 3 min/180 seconds
2	Evacuation Time	Not more than 2 hours
3	Sound emissions	Maximum of 40dB
4	Power backup	Not less than 100% with automatic switchover mechanism
5	Queuing at entry, exit and within the system	Not more than 6 vehicles and 3 minutes
6	Heat and Smoke detection systems	To be provided
7	Security Systems	To be provided shall include CC TVs, I/O terminals equipped with motion detectors

3.3.8 The fully automatic system shall have sufficient redundancy to ensure functionality even in case of failure of one component. In case of failure, the system shall have a mechanism to retrieve the cars parked in the system.

3.3.9 The system should accommodate a 100% of SUVs. 2% ECS shall be reserved / developed for physically handicapped (PH) if the fully automatic system considered by the Contractor is not PH friendly.

3.3.10 Throughput Capability

3.3.10.1 The Throughput of a system is the minimum number of cars a system can store or retrieve (measured in any random one way traffic), in the timeframe of one hour. The system provided should have throughput of 50% of the total ECS proposed in the bid.

3.3.10.2 The parking system shall be designed for minimum throughput corresponding to the peak traffic requirement. However it must be taken into consideration that the drivers drive their car into or from the Entry and Exit Areas based on the technology proposed. A reasonable average dwell time of 45 seconds per car driving into the Entry and Exit Areas can be assumed if physical drive-in guidance is provided. In the absence of such physical guidance system, an average dwell time of 60 seconds shall be considered.

3.3.11 Sound Emissions/ Vibrations

3.3.11.1 The surrounding walls of the Automated Parking Facility shall cover any sound emission of more than 40 decibels emanating outside the structure, measured at the boundaries of the Project Site.

3.3.11.2 Not only sound but also vibrations resulting from the machinery need to be considered for potential negative impact to the rest of the building and their influence shall be kept to a very minimum.

3.3.11.3 The above are only minimum guidelines one shall follow while selecting a system. The system to be designed by the bidder shall conform to the relevant provisions in the Master Planand approved Development Control Norms.

3.4 D.G. Set for Power Back-up

The Contractor shall develop space for power back-up adequate for 100% of the designed power load of the Parking Facility (except Walkways), and Toilet Area. The generator will have a switch-over mechanism so as to be activated automatically in the event of power failure. The generator shall be installed in a separate sound proof enclosure.The subway and stairways, Toilets and Entry and Exit Areas however shall be provided with auxiliary emergency lighting system such that in case of a failure the system is activated immediately.

3.5 Overall Design Parameters

3.5.1 **Fixed Parameters: The Contractor cannot alter the fixed parameters. The fixed parameters for the project are given in table 1 to 4. Also the contractor cannot change the size and façade of the building.**

3.6.2 General Guidelines for Automated Parking Facilities

The Contractor shall incorporate the following guidelines while submitting drawings as mentioned under this Agreement:

3.6.2.1 Location

All entries shall be located away from the traffic junctions and exit locations. The preferred location of the Entry and Exit Areas and of the driveways serving it is near the center of the Parking structure on the perimeters. The preferred elevation of the entry and exit areas is that of the connecting road systems.

The entry and exit of vehicles shall be provided so that it does not hinder pedestrian movements.

3.7.2.1 Size

The Entry and Exit Areas be sized to allow drivers to safely and comfortably drive in and drive out the vehicle. Turning radii and width of drive aisles and minimum clear width of Entry and Exit Area shall be designed according to the respective needs and leaving adequate space to the left and right of the car for passengers to leave / enter the car and in accordance with Applicable Codes Listed earlier in this Schedule.

The length of the Entry and Exit Area and unobstructed height inside the Entry and Exit Areas shall be in accordance with Applicable codes listed earlier in this Schedule.

3.7.2.3 Components

(i) The Entry and Exit Areas shall be equipped with sensors to ensure the right positioning of the vehicle to be transported as well as determine the presence of the system. Within the parking complex, Motion detectors and CCTV cameras or similar devices shall be installed inside the Entry and Exit Areas or the vehicle when the machine starts moving.

(ii) The Entry and Exit Areas entrance doors shall be mounted, secured and operated safely, isolating the passengers from the Entry and Exit Areas during movement of the machinery and vehicles. Safety locks / emergency switches shall be installed to stop any machinery if a person or animal is detected in this area.

(iii) Cameras shall be installed to record digital photos of the physical condition of the car entering and exiting the premises. The images are also helpful to locate cars for drivers with a lost ticket and to validate damage claims.

(iv) Recesses in the floor area shall be minimized to the need of guiding the drivers in the “drive-in” process. All other areas shall be flat for pedestrian traffic. Flaps between moving parts and platforms need to be limited as per Applicable Codes mentioned in this Schedule.

(v) All Entry and Exit Areas must comply with disability requirements.

3.7.2.4 Function of Entry and Exit Areas

(i) The Entry and Exit Areas are the exchange point between drivers and machine or authorized operators as the case may be, as applicable, based on the technology provided and therefore special attention shall be paid to the smooth functioning of this exchange centre.

(ii) Each of the entry locations of the Parking Facility shall be provided with electronically controlled real time bay availability positions.

(iii) The driveways for inbound and outbound traffic shall be designed to provide sufficient queuing spaces; simple visual signage and guidance shall clearly direct approaching traffic off the street and into Entry and Exit Areas. Respective commands via a visual message center

shall be applied inside the Terminals for the drivers in such manner that an easy use of the system is possible.

(iv) Inbound / outbound traffic crossing shall be prevented.

(v) Inside and outside Entry and Exit doors shall be provided to prevent drivers and animals from coming into contact with any moving elements of the system.

(vi) As Entry and Exit Area are the exchange station of the Parking Structure, special attention shall be directed to ease “drive-in” and positioning of the car by the drivers (preferably by means of physical aids);

(vii) Means for catching of debris and dripping from the incoming cars shall be applied to avoid such dripping to cars and machinery inside the terminals, during transportation and storage inside the system.

(viii) A modern state of the art collection system such as Automated Parking Ticket Issuing Machine shall be designed for computation and collection of toll. The toll shall be collected from the vehicles at the exit point. A mechanized barrier gate shall be designed and synchronized with the toll collection system for regulating entry/exit of vehicles into and out of the Parking Facility. Uninterrupted Power Supply (UPS) of adequate capacity shall be provided in the toll collection booths for uninterrupted power supply to the computer and smart card readers and ticket dispensers. The Ticketing Station or access system shall be located outside the Entry and Exit Areas on the right side of the inbound traffic.

(ix) System shall have installed a radio frequency access system, the readers shall have enough range to detect approaching vehicles from at least 9 Meter outside of the Entry and Exit Areas.

(x) The facility shall be equipped with sufficient lobby space to hold the expected peak accumulation of drivers waiting for retrieval of their cars. The pay stations or other access readers shall also be located inside the Lobby. Also sufficient electronic message centers shall be provided to guide the drivers to the respective location to collect their car.

(xi) In case toilets are not available in the near vicinity of the lobby, the same shall be provided in sufficient quantity to accommodate the driver’s needs close to the lobby.

(xii) The operator room shall be located suitably, so as to be most effective to assist drivers and to oversee the operation of the Parking Structure.

(xiii) All areas accessible for the public shall be well illuminated.

3.7.2.5 Traffic Effect and Queuing

1) The queuing issue shall be addressed taking peak traffic volume. Based on peak volume data, adequate number of Entry and Exit Areas shall be provided. The bid shall, through application of queuing theory, shall clearly establish the queue lengths and waiting times under the worst case scenario.

3.8 O&M REQUIREMENTS FOR PARKING FACILITY

3.8.1 Graphical User Interface/ Online Support

Automated parking facilities shall be furnished with a graphical user interface (hereafter referred to as “GUI”), or human –machine interface (hereinafter referred to as “HMI”). This interface shall be positioned in the control room. The GUI shall show the geometry of the system with occupancy and all installed machines moving in real time. The GUI shall be capable of running fully automated system without human assistance. It shall have manual and maintenance mode and the capability of system diagnostic of all critical mechanical, electrical and electronic equipment.

The parking facility shall have an installed and all time workable dial in capability to the manufacturer/technical operator with a short response time to handle any alarms generated by the system.

3.8.2 Diagnostics

(i) The automated systems shall include a Graphical User Interface (GUI), or Human Machine Interface (HMI). These devises are computer models of the layout of the parking facility illustrating the movement of the various transport/lift devises within the Parking Structure and Entry / Exit Areas, and are designed into the software and displayed on the computer screen. This interface shall be positioned in the control room. The GUI shall show the geometry of the entire parking facility with actual occupancy with all installed machines reflecting real time movements / positions of the machinery and parked vehicles.

(ii) The GUI shall be capable of running fully automated without human assistance. It shall have manual mode and maintenance mode operations and the capability of the system diagnostic of all critical, mechanical, electrical and electronic equipment components.

(iii) The Parking Facility may have an installed and real time, online connection to the manufacturer / technical operator which allows for resolution of most errors remotely with a short response time in reaction to any trouble alarms generated by the system.

(iv) The Parking Facility shall be capable of reporting in different classes according to their severity for the system functionality. It shall report the need of component checks for proper

performance of the different components. Preferably, a hotline support line shall be implemented to enable a remote system support.

3.8.3 Maintenance/ Operator

(i) **In order to ensure operational safety, the Contractor shall enter into Contract(s) with Equipment Supplier(s) for maintenance of the Equipment(s) during the entire O&M Period of 5 year in order to avoid system interruptions as much as possible and to remedy such interruptions in a reasonable time.**

(ii) Under all circumstances without any exception, trained personnel must be available round the clock at short notice. The Contractor shall enter into Contract with manufacturer to provide a trained technician for the prevention and remedy of interruptions during all hours of operation of the Parking Facility. The Contractor shall enter into agreement with the Manufacturer for training Contractor's on-site personnel to the degree, that they are capable of retrieving a car in semi-automatic mode of operation. Explicit provisions relating to training and know-how transfer, including sharing of manuals and procedures would have to be reflected in the Agreement that the Contractor may enter into with the Manufacturer.

(iii) The entire Parking Facility shall be adequately illuminated primarily for maintenance access. Portable task lighting outlets shall be provided for enhanced lighting Facility, machinery and electrical and electronic components in a safe manner.

3.8.4 Spare Parts Package

(i) For the parking systems, enough spare parts shall be stored at the Parking Facility to ensure an immediate availability of exchange components in any case of component failure.

(ii) In order to ensure needed repairs to be performed in a timely manner, the manufacturer and the Contractor shall agree for a respective maintenance contract, covering the operating times of the Facility including a sufficient on-site spare parts package.

3.8.5 Operational Requirements

For smooth operations, following minimum requirements shall be ensured:

(i) Collection of parking fee in such a way that maximum queuing at the entry/exit does not exceed 6 cars and 3 minutes

(ii) Queuing at no time spills onto the main roads outside the parking complex

(iii) No queuing at I/O terminals

(iv) Traffic within the complex to be guided for smooth and safe movement

(v) Checking the vehicles for security, through dog legged mirrors, checking of the boot space, and by other means

(vi) Round the clock security at the site

(vii) Keep the facility neat, tidy and orderly condition without debris, litter, etc.

(viii) Operate the entire system as per the good practice of the industry

3.8.6 Maintenance Requirements

For un-interrupted service at the parking complex, as a minimum, the developer shall adhere to the following maintenance practice:

(i) Repairs to the parking system, parking structure, approach roads leading to the site, etc.

(ii) Replacement of equipment/consumables as per the designed life of the system

(iii) Removing and disposing of any material, as per the relevant codes, rules and applicable laws

3.8.7 Manufacturer's maintenance manual and inspection schedule, for smooth and un-interrupted operation of the facility, shall be provided and adhered to by the Contractor. Given below is an indicative inspection mechanism :

(i) Visual Inspection

Visual inspections are general macro level inspections, which shall be carried on a daily basis. These shall be carried out by trained and qualified personnel. The purpose of visual inspections are to identify obvious defects in the system, and other faults in lighting, plumbing, operational deviations, etc.

(ii) Close Inspection

Close inspection could be visual or by means of instruments, and shall be generally for system components. Close inspection shall be carried out by qualified engineers and technicians deputed for the system maintenance.

(iii) Comprehensive Inspection

Comprehensive inspection shall be carried out against a detailed checklist prepared for the purpose, and is to ensure that the entire parking system, including allied services, like, power back-up, fire safety equipment, lighting systems, air conditioning systems, etc., are as per the construction requirements.

(iv) The following table presents the frequency as well as the type of inspections.

Asset	Daily	Monthly	Quarterly	Before and After Monsoon
Parking System	V	C	T	T

Entry and Exit Area	V	C	T	T
Floors and Walls	V	C	T	T
Chairs /Seats in Pedestrian /Driver Waiting Area	V	C	T	
Drinking Water Facilities	V	C	T	
Toilets	V	C	T	
Signs	V	C	T	T
Markings	V	C	T	T
Pavements/Ramps	V	C	T	T
Access Roads / Underpasses	V	C	T	T
Stair cases	V	C	T	
Lifts	V	C	T	
Doors and Windows	V	C	T	
Entry and Exit Gates	V	C	T	
Fee Collection Systems	V	C	T	
Power Backup	V	C	T	T
Lighting	V	C	T	
Fire fighting System	V	C	T	T
Air Conditioning	V	C	T	T
Painting	V		T	T
General Cleanliness	V	C		

3.8.8 Reporting Requirements

Monthly O&M reports shall be submitted by 7th of every month, capturing the O&M activities carried out in the previous month. The O&M report shall clearly specify the interruptions to the parking system. The report shall also capture the parking and retrieval times during peak periods and under worst case scenario as and when they arise.

Relevant pages of the complaint register on complains and the action take, including the time taken for resolving the complaint shall be appended to the O&M reports.

3.8.9 Miscellaneous Requirements

(i) The developer shall maintain an inventory of all items in the parking complex and deferent headings, like, parking system, Lighting, Power Back-up, etc,

(ii) Through the project period, the developer shall update the inventory, as per the up-gradation and replacements as they happen.

(iii) A copy of the inventory shall be maintained and shall be available for inspection any time during the project period.

3.8.10 Non-adherence to the agreed operation and maintenance / performance standards and time schedule would attract penalty provisions in addition to liquidity damages, levy penalty by the engineer which will be final & binding and the payment due violation occurs.

3.9 Applicable Permits (Indicative but not Exhaustive)

- Municipal Corporation of Itanagar
- Fire Department (Chief Fire Officer)
- Environmental Clearances (Ministry of Environment)
- State Pollution Board
- Services Agencies / Road Owning Agencies
- Traffic Police (for traffic management schemes during and after the Construction)
- Land/drain owning agencies
- Forest Officer
- Archaeological Survey of India
- Any other applicable permits

3.10 Applicable Codes and Standards (Not Exhaustive)

a) The codes and standards applicable for the design of the Project and Project Facilities are given below:

IS	383	Specification for coarse and fine aggregates from natural sources for concrete
IS	432	(All 2 Parts)–Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement. Part 1 - Mild steel and medium tensile steel bars, Part 2 - Hard drawn steel wires
IS	456	Plain and reinforced concrete - Code of Practice
IS	875	(All 5 Parts)–Code of Practice for design loads (other than earthquake) for buildings and structures
IS	1038	Specification for steel doors, windows and ventilators

IS	1077	Common burnt clay building bricks - Specification
IS	1200	(Relevant Parts) –Method of measurement of building and civil engineering works
IS	1239	(All 2 Parts)– Mild steel tubes, tubulars and other wrought steel fittings, Part 1 - Mild steel tubes, Part 2 -Mild steel tubulars and other wrought steel pipe fittings
IS	1343	Code of Practice for prestressed concrete.
IS	1443	Code of Practice for laying and finishing of cement concrete floor tiles.
IS	1542	Specification for sand for plaster
IS	1566	Specification for hard-drawn steel wire fabric for concrete reinforcement
IS	1742	Code of Practice for building drainage
IS	1786	Specification for high strength deformed steel bars and wires for concrete reinforcement
IS	1893	Criteria for Earthquake resistant design of structures
IS	1904	Code of Practice for designand construction of foundations in soils; general requirements
IS	2212	Code of Practice for brickwork
IS	2502	Code of Practice for bending and fixing of bars for concrete reinforcement
IS	2751	Code of Practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
IS	2911	(All 4 Parts)–Code of Practice for design and construction of pile foundations
IS	2974	(All 5 Parts)–Code of Practice for design and construction of machine foundations
IS	3370	(All 4 Parts)–Code of Practice for concrete structures for storage of liquids
IS	3764	Code of safety for excavation work.
IS	4014	(All 2 Parts) Code of Practice for steel tubular scaffolding
IS	4081	Safety code for blasting and related drilling operations
IS	4138	Safety code for working in compressed air
IS	6248	Specification for metal rolling shutters and rolling grills
IS	9103	Concrete Admixtures - Specification
IS	10262	Recommended guidelines for concrete mix design
IS	14687	False work for concrete structures - Guidelines

For any details, where the above codes are silent, one may refer to CPWD Specifications, other BIS and NBC Codes, IRC Codes & Standards, Building Bylaws and latest Master Plan of Arunachal Pradesh

b) Electrical system shall be provided as per the following applicable codes:

S. No:	Code No:	Applicable Details
1	IS-10118 (Part-I), 1982	Code of practice for selection, installation and maintenance of switch gear & control gear
2	IS-3636 (Part-I), 1992 (Rev-I) & Part-II	Guide for interior illumination
3	IS-732, 1989 Rev. 3	Electrical wiring design
4	IS-3043, 1987	Code of practice for earthing
5	IS-13032, 1992 (Rev. 2)	MCB distribution boards for voltage up to and including 1000V AC
6	IS-12640, 1988	Residual current operated circuit breakers
7	IS-649, 1990 (Rev. 3)	PVC insulated cables for working voltage up to and including 1100 V AC.
8	IS-9537 (Part-I), 1980	Conduits for electrical installations-general requirements
9	IS-10322 (Part-I), 1982	General requirements of luminaries
10	IS-13118, 1991	Circuit breakers-general requirements
11	IS-13947 (Part-III), 1993	Air break switches for voltage not exceeding 1000V AC or 1200 V DC
12	IS-1248 (All parts), 1983, 1984, 1993	Electrical direct acting instruments
13	IS-2147, 1962	Degree of protection provided by enclosures for LV switch gear and control gear
14	National Electrical Code Part 4, Appendix	Recommended values of illumination and limiting values of Glare Index – Industrial Building (Parking Space Indoor and Outdoor)

c) Where the aforesaid are silent on any aspect, the following standards in order of preference shall be adopted in consultation with the Project Officer, unless otherwise specified in this Schedule:

(i) Euro norm standards EN: 14010: 2003 for parking structure safety

(ii) American National Standard Institute (ANSI)

(iii) Building Officials and Code Administrators of America (BOCA)

(iv) International Standards Organization(ISO)

(v) British Standards (BS)

(vi) National Fire Protection Association of America (NFPAA)

(vii) National Electric Code of America (NEC)

(viii) Safety Code for Mechanized Parking Garage Equipment of America(ASA.A113.1)

(ix) American Society of testing Materials (ASTM)

(x) International society for Measurement and control(ISA)

(xi) ISO 9000

(xii) Occupation Safety and Health Administration of U.S. Department of Labor (OSHA)

(xiii) Americans with Disability Act Accessibility Guidelines (ADA)

(xiv) American Association of State Highway and Transport Officials (AASHTO)

(xv) American Society of Mechanical Engineers code on Storage Retrieval (SR) Machines and Associated Equipment (ASME B30.13)

(xvi) Suitable specification/Standard devised by the Project Officer

(xvii) Any other Standard proposed by the Contractor and approved by the Project Officer.

3.11 Other Guidelines

Construction sequence of Parking Facility shall be planned to minimize the interruptions to traffic flow in the surrounding area.

3.11.1 Before Commencement of Construction

3.11.1.1 Prior to the commencement of any construction activity, the Contractor shall finalize and furnish an implementation plan for the Project (Construction Plan) in consultation with the Project Officer. The Construction Plan shall, inter alia, include:

(i) A detailed schedule of implementation for putting up and operationalizing the Parking Facilities, and which shall specify at least 6 major milestones;

(ii) Advise to NHIDCL on alternate regulation of parking, if applicable, until such time that the parking facility is operational and operate the approved Scheme by NHIDCLduring the construction period;

(iii) Advise NHIDCL on the details of the utilities that are necessary to be shifted, including suggestions on the alternate routing, and the estimates of the costs associated with such shifting;

(iv) The Critical Path Method (CPM) / Program Evaluation and Review Technique (PERT) charts or similar activity planning techniques / methods for monitoring. This shall cover all stages and aspects of the Project Implementation including design and engineering, procurement of materials and equipment, installation, construction, testing, etc.

(v) Manpower deployment plan, including the designation of Key Personnel for the management and supervision of all Project Activities. This would include the designation of suitably qualified and experienced personnel for areas such as Contract Administration and Supervision, Construction Management, Traffic & Safety, Environmental Management, Plant & Equipment Maintenance, Procurement, Materials Management, Quality Control &

Assurance, etc. The manpower to be provided by the Contractor, shall match that of IE, in qualification and experience.

(vi) A broad method statement for key items setting out methodology of construction, materials and construction equipment mobilization, utilization plans, broad output calculations and details of the quality assurance and quality control procedures.

(vii) Format of the monthly report giving details of the physical progress in implementation of the Project and Operations & Maintenance Activities undertaken (Monthly Progress Report).

3.11.1.2 The Contractor shall, in consultation with the Project Officer workout an appropriate schedule for submission of documents set out in----- above to the Project Officer for review.

3.11.1.3 Prior to commencement of construction of any of the Project Facilities, the Contractor shall:

(i) Obtain all such applicable permits as mentioned in Schedule 3as are necessary to commence construction of Project Facilities;

(ii) Obtain the approval of local authority with regard to:

- Detailed schemes as per stipulated norms along with layout plan of the area under reference and integrating surrounding road network and land uses
- A traffic management scheme in the influence of the project so that there is no hindrance to smooth flow of traffic

(iii) Mobilize the requisite resources, personnel and organization necessary for the same and designate and appoint suitable offices / representatives as it may deem appropriate with responsibility to supervise implementation of the Project and for exchange of information with the Project Officer and NHIDCL;

(iv) Finalize in consultation with Project Officer a method statement setting out details of the actual methods that would be adopted by the Contractor for the construction of such Project Facilities, including details of equipment and machinery that would be used, their locations, and arrangements for conveying and handling materials;

(v) Finalize in consultation with the Project Officer, quality assurance and quality control procedures to cover all aspects of the work so as to ensure the desired quality. This would include establishment of a well equipped functional laboratory.

3.11.2 During Construction

3.11.2.1 The Contractor shall:

(i) Strictly follow the guidelines on quality set out in BIS/NBC/IRC codes/guidelines and any standards and specifications for Parking Facilities set out by Government of Arunachal Pradesh /NHIDCL or any other relevant organization. Where silent, for any specification, international best practices shall be adhered to

(ii) Do not use worn out construction machinery at site. Equipments should preferably be not more than 5 years but certainly not more than 8 years old.

(iii) Ensure that the construction of the Project Facilities, is undertaken with minimal inconveniences to the traffic using the roads surrounding the Project Site.

(iv) On a best effort basis, maintain the existing infrastructure and facilities to the extent possible subject to it not causing a hindrance in the implementation of the Project.

(v) Take the necessary precautions to minimize accidents and respond to emergency as quickly as possible.

(vi) Take precautions to avoid inconveniences to, damage to, destruction of or disturbance to any third party rights and properties.

(vii) Provide a safe, clear informative system of road signs in connection with the Project, whenever and wherever required.

(viii) Ensure adequate safety of the personnel deployed at the Project Site which would include measures for the safety such as the provision and maintenance of barricades, traffic signs and illumination during night in consultation with the Project Officer.

(ix) Be in compliance with the applicable laws and applicable permits obtained for the Project including the clearances obtained by the Government Agencies.

(x) Deploy adequate number of qualified and competent personnel having relevant experiences and skills for implementation of the Project and interaction with the Project Officer / the Government Agency.

3.11.2.2 Position and Levels

The Contractor shall be responsible for:

a) The accurate setting of the Project Site.

b) The correctness of the positions, levels, dimensions and alignment of all parts of the work.

c) The provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

3.11.2.3 Tests

(i) Various quality control tests would be undertaken for the project as per the standards prescribed by the Bureau of Indian Standards. Where no testing methods are specified by the said standards, details of the test to be carried out and specifications to be achieved for the respective Project Facilities / Construction Works or part thereof shall be agreed upon with the Project Officer prior to the Construction.

(ii) The tests would be carried out at a location (place of manufacture, fabrication or preparation, at site or any specialized testing laboratory) that the Project Officer may responsibly require, at the cost and expense of the Contractor.

3.11.2.4 No part of the Construction Works shall be covered up or put out of view before the same has been examined by the Project Officer or NHIDCL.

The Project Officer may from time to time require:

(i) Removal from the Project Site, within such time as may be specified in its instructions, any material, equipment, machinery or plans which, in its opinion, do not meet the standards specified in the Construction Requirements.

(ii) Substitution / Replacement of such improper material, equipment, machinery or plan.

(iii) Re-execution, of any or part of the construction works which in the opinion of the Project Officer do not meet the standards set out in the Construction Requirements.

(iv) The Contractor to make boreholes or to carry out exploratory excavation for the project.

3.11.2.5 The Contractor shall arrange for all the material requirements for the project and disposal of all material wastes. The applicable permits in this regard would have to be obtained by the Contractor. All excess and unsuitable excavated materials shall be piled at appropriate dumping places or otherwise disposed of by the Contractor in consultation with the Project Officer.

3.11.2.6 Prior to making the request for the issue of the Completion Certificate for the Parking Facility, the Contractor shall submit to the Project Officer / NHIDCL the following, duly finalized in consultation with the Project Officer.

(i) The Operation and Maintenance Manual for the Project (O&M Manual), setting out in details the standards, schedules, procedures, type, periodicity and other details of the Operation and Maintenance activities to be carried out for the Project during the operations period so as to meet the O&M Requirements as well as the details of the Management Information System to be incorporated, reports to be submitted and procedure for reviews.

(ii) As built drawings.

(iii) O&M contract with the System Provider for the automatic parking systems.

3.11.3 After Completion of Construction

Upon completion of construction, but prior to issue of Completion Certificate, the Project Site shall be cleared of all construction equipments, surplus materials, debris, and temporary installations and shall be left in tidy and an aesthetically pleasing appearance to the satisfaction of the Project Officer.

3.11.4 Reporting Requirements and Documents to be provided

During the Construction Period, the Contractor shall submit to the Project Officer / NHIDCL, Monthly Progress Report (for each calendar month or part thereof) within five working days of

the last day of the Month. The report shall review the progress made, identified slippages, if any, and project the future activities to be undertaken (including rectifications), operations and maintenance activities under taken and would, inter alia, include the following:

(i) Listing of working drawings/sketches submitted, as approved by relevant authorities

(ii) Progress of pre-construction activities – mobilization of plant and equipment, personnel, site office, utility relocation, etc.

(iii) Contractor's compliance inspection report, if any required

(iv) Constraints in construction

(v) Progress data with "S-curves", if applicable

(vi) Project data with contract detail and sectional completion details

(vii) Tests carried out, if any, and results thereof

(viii) Remedial measures taken by the Contractor following such tests, where required

(ix) Traffic management steps taken by the Contractor

(x) Review of milestones, and reasons for delay, if any

(xi) Suspensions of construction, if any, its reasons, duration, and steps undertaken to resume construction

(xii) Change of Scope notice issued by NHIDCL, if any, and status thereof

(xiii) All actual or potential deviations from the Construction Plan

(xiv) Disagreements/Disputes, if any and proposed measures to be taken

(xv) Maintenance activities carried out by the Contractor on the existing carriageway

(xvi) Injury to any construction personnel during construction, its severity, cause, and remedial measure(s) taken to avoid recurrence

(xvii) Brief report of any accident/incident within the project site, injury/fatality, property damage, cause of accident, and actions taken to avoid recurrence

(xviii) Traffic detour/diversion for construction, if any, time and duration

(xix) Notes of meetings between the Contractor, the Project Officer and the Government Agencies highlighting critical decisions taken or agreements reached. Minutes of the meeting issued by the NHIDCL shall also be included in the Monthly Progress Reports.

Prior to making the request for the issue of the Completion Certificate, the Contractor shall submit to NHIDCL the following documents, free of costs:

- Three hard copies and two copies in electronic form (two Compact Disks) of the Operations & Maintenance Manual
- Three hard copies and two copies in electronic form (two Compact Disks) of the As-built Drawings

EMPLOYER'S REQUIREMENTS

APPENDIX 1

DRAWING LIST

The Tender Documents contains a set of reference/Tender drawings applicable to the Contract Works. These drawings are purely indicative and the contractor shall design the parking complex based on the parking system that he would install at the site. Traffic circulation for vehicles and pedestrian shall be similar or better than that indicated in the attached drawings to meet the requirements.

General information given in the drawings will not be included in the Contract. The designs and drawings of the Contractor prepared during the design phase, duly approved by employer and all the relevant local bodies will form the basis of the Project.

The drawing volume contains a set of 12 drawings. The list is given below.

List of Drawings

List of Architectural Drawings		
Sr.N0.	**Title of Drawings**	**Drawing No.**
1	SITE PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.101
2	4TH BASEMENT FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.102
2	2ND & 3RD BASEMENT FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.103
3	1ST BASEMENT FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.104
4	GROUND FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.105
5	FIRST FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.106
6	SECOND FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.107
7	THIRD FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.108
8	FOURTH FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.109
9	FIFTH FLOOR PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.110
10	ROOF PLAN	DIMTS/BP/NHIDCL-ARCH-A-1.111
11	ELEVATION AT A	DIMTS/BP/NHIDCL-ARCH-A-1.112
12	ELEVATION AT B	DIMTS/BP/NHIDCL-ARCH-A-1.113
13	SECTIONS AT XX & YY	DIMTS/BP/NHIDCL-ARCH-A-1.114
14	SECTION AT ZZ	DIMTS/BP/NHIDCL-ARCH-A-1.115

List of Structural Drawings		
Sr.N0.	**Title of Drawings**	**Drawing No.**
1	Foundation layout and Details	DIMTS/BP/NHIDCL-STR-S-1.101
2	Column Layout and Schedule	DIMTS/BP/NHIDCL-STR-S-1.102
2	Basement Level (2nd and 3rd) layout	DIMTS/BP/NHIDCL-STR-S-1.103
3	Basement Level (1st) layout	DIMTS/BP/NHIDCL-STR-S-1.104
4	Ground Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.105
5	First Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.106

6	Second Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.107
7	Third Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.108
8	Fourth Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.109
9	Terrace Floor Layout	DIMTS/BP/NHIDCL-STR-S-1.110
10	Steel Truss Layout	DIMTS/BP/NHIDCL-STR-S-1.111
11	Steel Truss Details	DIMTS/BP/NHIDCL-STR-S-1.112

List of Firefighting Drawings		
Sr.N0.	**Title of Drawing**	**Drawing No.**
1	Fire Fighting Basement Floor Plan (2nd, 3rd and 4th Basement)	DIMTS/BP/NHIDCL-FIRE-F-1.101
2	Fire Fighting 1st Basement Floor Plan	DIMTS/BP/NHIDCL-FIRE-F-1.102
3	Fire Fighting Ground Floor Plan	DIMTS/BP/NHIDCL-FIRE-F-1.103
4	Fire Fighting 2nd Floor Plan	DIMTS/BP/NHIDCL-FIRE-F-1.104
5	Fire Fighting 3rd Floor Plan	DIMTS/BP/NHIDCL-FIRE-F-1.105
6	Fire Fighting 4th Floor Plan	DIMTS/BP/NHIDCL-FIRE-F-1.106
7	Fire Fighting Schematic layout	DIMTS/BP/NHIDCL-FIRE-F-1.107

List of Plumbing Drawings		
Sr.N0.	**Title of Drawing**	**Drawing No.**
1	Plumbing Drainage Layout 4th Basement Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.101
2	Plumbing Drainage Basement Floor Plan (2nd and 3rd Basement)	DIMTS/BP/NHIDCL-PLUM-P-1.102
3	Plumbing Drainage 1st Basement Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.103
4	Plumbing Drainage Ground Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.104
5	Plumbing Drainage 2nd Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.105
6	Plumbing Drainage3rd Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.106
7	Plumbing Drainage 4th Floor Plan	DIMTS/BP/NHIDCL-PLUM-P-1.107
8	Plumbing Drainage Layout Roof Level	DIMTS/BP/NHIDCL-PLUM-P-1.108
9	Water Supply Schematic layout	DIMTS/BP/NHIDCL-PLUM-P-1.109

List of Electrical Drawings		
Sr.N0.	**Title of Drawing**	**Drawing No.**
1	ELECTRICAL LAYOUT FOR 2ND,3RD & 4TH BASEMENT LEVEL PLAN	DIMTS/BP/NHIDCL-ELEC-E-1.101
2	ELECTRICAL LAYOUT FOR 1ST BASEMENT LEVEL PLAN	DIMTS/BP/NHIDCL-ELEC-E-1.102
3	ELECTRICAL LAYOUT FOR GROUND AND FIRST FLOOR	DIMTS/BP/NHIDCL-ELEC-E-1.103
4	ELECTRICAL LAYOUT FOR SECOND FLOOR	DIMTS/BP/NHIDCL-ELEC-E-1.104
5	ELECTRICAL LAYOUT FOR THIRD FLOOR	DIMTS/BP/NHIDCL-ELEC-E-1.105
6	ELECTRICAL LAYOUT FOR FOURTH FLOOR	DIMTS/BP/NHIDCL-ELEC-E-1.106

EMPLOYER'S REQUIREMENTS

APPENDIX 2A

WORKS AREAS

WORKS AREAS

The Employer will transfer the site measuring approx. 500 sq. m. to the contractor, upon signing of the agreement. The contractor shall use this site for construction, site office, etc. No additional land shall be provided to the Contractor for the purpose of this project implementation.

EMPLOYER'S REQUIREMENTS

APPENDIX 2B

CONTRACT KEY DATES AND COMPLETION DATE

Key Dates	Weeks from Commencement Date	Description of Stage
Key Date 1	3	Preliminary Design/DrawingsSubmission; Plans Approval by Local Authority
Key Date 2	4	Submission of Definitive Design& mobilization of Rigs for D/walls
Key Date 3	8	Completion of excavation work
Key Date 4	10	Completion of foundation
Key Date 5	12	Completion of retaining walls
Key Date 6	15	Completion of 1st basement floor slab
Key Date 7	18	Completion of 2nd basement/Entry floor slab
Key Date 8	21	Completion of 3rd basement floor slab
Key Date9	24	Completion of 4th basement floor slab
Key Date10	27	Completion of 4th basement floor slab
Key Date11	30	Completion of ground floor roof slab
Key Date12	33	Completion of ist floor roof slab
Key Date13	36	Completion of 2nd floor roof slab
Key Date14	39	Completion of 3rd floor roof slab
Key Date15	42	Completion of 4th floor roof slab
Key Date 16	45	Completion of sloping roof
Key Date 17	48	Procurement of parking system
Key Date 18	51	Completion of Parking Structure
Key Date 19	54	Completion of front facade
Key Date 20	63	Setting up of Parking System
Key Date 21	64	Setting up of lighting, signages, etc. and dry run of the system
Key Date 16	65	Opening the system for operations

Note:- The total amount of penalty under Schedule/Part there of may be up to 5% of payment due for Schedule/Part thereof. The penalty is in addition to liquidated damages. Changes in the intermediate key dates may be agreed by NHIDCL, provided Contractor is able to demonstrate through revised time schedule approved by NHIDCL, that completion date of the project will be maintained.

EMPLOYER'S REQUIREMENTS

APPENDIX 2C

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX 2D

DESIGN AND CONSTRUCTION INTERFACES

Not used

EMPLOYER'S REQUIREMENTS
APPENDIX 3

PROJECT CALENDAR

(1) The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week. Month is a calendar month, and shall start on 1st of a Month.

(2) Requirements for the computation of Key Dates are given in Appendix 2B to the Employer's Requirements.

(3) A 7 day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes.

(4) For Project purposes, the presentation shall be in 'Week"' units.

EMPLOYER'S REQUIREMENTS

APPENDIX 4

PROGRAMME REQUIREMENTS

1. GENERAL

(1) **Purpose of Programme**

There are two primary purposes for the requirement of Programme (Scheduling) information described in this document:

a. Evaluation of Tender

b. Status Reports During Construction

To provide the Engineer with status reports for managing,monitoring and coordinating the awarded contracts during their execution within the overall multi-contract project schedule.

The requirements are organized in two stages. The first stage is a requirement for all Tenderers and shall be submitted as part of Tender. The second stage is a requirement of the Employer and describes a series of reports to be submitted by the Contractor to the Engineer during the execution of the contract, following the award of Contract.

(2) The Tenderer/ Contractor shall programme his work at all times to meet the Key Dates and the Works Area Hand-over Dates stated in Appendix 2A to 2D to the Employer's Requirements, and shall during the progress of the Works constantly monitor his progress against the programmes described below.

(3) The Tenderer/ Contractor shall include in all programmes his work obligations towards shared access, shared Site areas and other coincident or adjacent Works Areas.

(4) The Works Programme, and all more detailed or revised versions, shall be submitted to the Engineer for his consent in accordance with the provisions of the GCC.

2. METHODOLOGY

(1) The computerized Critical Path Method (CPM) network using the Precedence Diagramming Method (PDM), has been selected by the Employer as the technique for contract management system and in co-ordinating the project. This technique shall also be employed by the Tenderer in preparing their Tender submissions and by the Contractor in their Construction Stage submissions.

(2) Unless otherwise agreed by the Engineer, all programmes submitted by the Contractor shall be produced using computerized Critical Path Method (CPM) Networks developed implementing the Precedence Diagramming Method (PDM) with Cost Loaded Charts and Tables.

(3) The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre-construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

3. PROGRAMME MANAGEMENT SOFTWARE

(1) CPM programming software used shall be Primavera Project Planning (P3) Program - Ver 2.0b or later. Any other compatible system capable of direct file interchange capability with software program used by the Employer - Primavera (P3), Ver 2.0b can be used with Engineer's consent. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications

(2) The Tenderer may use a system other than Primavera but will be required to demonstrate that full electronic data transfer to Primavera is available and that the various levels of reporting and coding capabilities are at least equivalent to Primavera. Compatibility and comparable performance between Primavera and the Tenderer's proposed system shall be demonstrated in his Tender submission. Should compatibility not be demonstrated to the Employer's satisfaction the Contractor shall utilise Primavera for development, status, updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

4. (Not Used)

5. POST CONTRACT AWARD

5.1 The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit within 15 days of the date of the Notice to Proceed and its more detailed version within **thirty (30) days** of receiving the Engineer's consent to the proposed Initial Works Programme.

5.2 The first Three Month Rolling Programme shall be submitted within thirty (30) days of the date of Notice to Proceed and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Programme Update as described below. These programmes shall subsequently be updated as described below.

5.3 Following the Contractor's Initial Works Programme submission but in any case no later than six (3) months from the date of award of contract, the contractor shall make submissions of the detailed **Works Programme**. The resubmitted programme when approved by the Engineer shall form the **Baseline Programme** against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

5.4 For Initial & Detail Work Programme submission, one (1) original and six (6) copies each of the following Programmes and Reports shall be submitted to the Engineer:

a) Programme: Baseline CPM Network

b) Programme: Baseline Milestone based Cost Activity Schedule

c) Baseline Schedule Report

d) Narrative

e) Baseline Physical Progress 'S' curve

f) Baseline Resource Charts

5.4.1 The Engineer shall review and comment on the Contractor's programmes and information submitted under this Clause. The Engineer will confirm his consent or otherwise of the submissions within thirty (30) calendar days.

5.5 The Engineer shall require the Contractor to re-submit within thirty (30) calendar days if he is of the opinion that the programmes and information submitted by the Contractor is unlikely to meet the Contract key dates.

5.6 If in the opinion of the Engineer, any of the Contractor's revised programmes or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the Contractor to meet a Milestone.

5.7 Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.

5.8 Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

6. WORKS PROGRAMME

(1) The Works Programme shall show the Contractor's plan for organising and carrying out whole of the Works.

(2) The Works Programme shall be a computerised Critical Path Method (CPM) network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly or monthly time scale.

(3) Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:

(a) Key Dates, and Works Area Hand-over Dates,

(b) all physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,

(c) the requested date for issue of any drawings or information by the Engineer,

(d) incorporation of principal aspects of the Design Submission Programme,

(e) procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,

(f) any off-site work such as production or pre-fabrication of components,

(g) installation of temporary construction facilities,

(h) interface periods with Designated Contractors or utility undertakings,

(i) design, supply and/or construction activities of sub-contractors,

(j) any outside influence which will or may affect the Works.

(4) The Works Programme shall show achievement of all Key Dates and Works Area Hand-over Dates.

(5) Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the Contractor.

(6) The Works Programme shall be organised in a logical work-breakdown-structure including work stages and phases, and shall clearly indicate the critical path(s).

Each activity in the Works Programme shall be coded to indicate:

(a) Activity ID as per fields in the Activity ID Code Structure (Figure E-1)

(b) Standard codes provided in the Activity Code Structure. The Contractor may create additional activity codes within the spaces of the Activity Code Structure allocated to Contractor (Figure E-1, Table:1, 2-A, 2-B)

(c) The Engineer may request additional activity coding to the extent available without restraint to the Contractor's utilisation of the programme software. When requested the Contractor shall add the required additional coding to the Programme. The Contractor shall use additional code fields as requested to comply with the requirements and for the use of the Contractor.

(7) Activity duration shall not exceed two (2) weeks, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Programme/Project Calendar cross reference clearly indicating the allowance for holidays.

(8) The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic (3½" diskettes or CD-R) and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).

(9) **Activity Report** shall list all activities, and events in the Works Programme, sorted by activity identification number.

The Activity Report shall include the following for each activity and event:

(a) activity identification number and description,

(b) duration expressed in Days,

(c) early and late start, & early and late finish dates. Planned start and finish dates,

(d) calculated total float and free float,

(e) predecessor(s) and successor(s), accompanying relationships and lead/lag duration,

(f) imposed time or date constraints,

(g) calendar.

(10) **Narrative Statement**

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences and primary item of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity duration are established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which

may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

(11) **Baseline Physical Progress 'S' Curve**

The Contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the CPM Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerised CPM Network Logic Diagram.

(12) **Baseline Resource Charts**

The Contractor shall also submit a Resource Charts, generated from the Contractor's CPM Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project.

As an additional monitoring facility, indicator resources shall be assigned to relevant activities for the major items of work. Indicator resources shall be directly allocated for excavation (cu.m.), like for, piling (no.), diaphragm walling (m.), concrete (cu.m.), tunnel lining (m), etc. Resource indicators may be input as a daily rate, expected required rate, or as an activity total in the relevant units. These are purely indicative quantities and do not form part of contract.

(13) All submissions of proposed Works Programmes subsequently, after approval of the Initial Works Programme, shall include the actual physical progress of work and forecast of the remaining work. Actual progress shall be stated in percent complete, remaining duration, and actual start and finish dates for each activity in the Works Programme.

7. INITIAL WORKS PROGRAMME

(1) The Initial Works Programme submitted as under Clause 5.1 need not include the fulldetails given under Clause 6 above. It should be a condensed version with combined activities of longer. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.

(2) Within sixty (30) days of the Engineer's consent to the Initial Works Programme, the Contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Programme containing all of the information and detail required under Clause 5 above.

8. **WORKS PROGRAMME REVISIONS**

(1) The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Programme, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen(14) days of the date of notifying the Engineer submit for the Engineer's consent its proposed revised Works Programme and accompanying Narrative Statement. The proposed revised Works Programme shall show the sequence of operations of any and all works related to the change and the impact of changed work or changed conditions.

(2) If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Programme which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen(14) days after the Engineer's instruction. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions.

(3) All activities that have negative float must be analysed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key Dates.

9. THREE MONTH ROLLING PROGRAMME

(1) The Three Month Rolling Programme shall be an expansion of the current Works Programme, covering sequential periods of three months. The Three Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods. In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary to a daily level of detail.

(2) The Three Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A1 size reproducible media. Tasks in the programme shall be derivatives of and directly related to tasks in the approved Works Programme.

(3) The Contractor shall describe the discrete work elements and work element inter-relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors.

(4) Activity duration shall not exceed two (2) weeks unless otherwise consented to by the Engineer.

(5) Each activity in the Three Month Rolling Programme shall be coded, or described so as clearly to indicate the corresponding activity in the Works Programme.

10. THREE MONTH ROLLING PROGRAMME REVISIONS AND UPDATE

(1) The Three Month Rolling Programme shall be extended forward each month as described under Clause 5(1) above. Each submission of the Three Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period.

(2) If the Three Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three month period, including programme assumptions and methods to be employed in achieving timely completion.

(3) The Contractor shall revise the Three Month Rolling Programme or propose revisions of the Works Programme, or both, from time to time as may be appropriate to ensure consistency between them.

11. THREE WEEK ROLLING BAR CHART SCHEDULE

Once a week, on a day mutually agreed to by the Engineer and the Contractor, a meeting will be held to assess progress by the Contractor during the previous work week. The Contractor shall submit a construction schedule listing activities completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Programme. Copies of the schedule shall be submitted on A3 sized paper.

12. PROJECT CALENDAR

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 5 days week - Monday through Friday, except for National (Govt. of India) Holidays. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week.

13. PROGRAMMING PERSONNEL

The Contractor shall submit, as part of its Staff Organisation Plan, the names and required information for the staff to be employed on Works Programming. The principal Works Programmer shall hold reputable professional qualifications acceptable to the Engineer including at least five (5) years relevant experience in programming civil engineering works. Others in the group shall have at least three (3) years experience in such work. The programmers shall be employed by the Contractor full time on the Contract until the completion or such earlier time the Engineer may give his consent.

14. PROGRAMME AND REPORT SUBMISSION FORMAT

The Contractor shall submit one (1) original and six (6) copies and one (1) reproducible (for Programmes) of all submissions to the Engineer. All submissions shall be in AO, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer. In addition, the computerisedprogramme and report shall be submitted in 3-1/2 inches diskettes (similarly for submissions required under Clause 5.4).

The format for all Programme and Report submissions shall be strictly in accordance with the format as stated herein or as requested by the Engineer.

15. FAILURE TO SUBMIT PROGRAMME

Failure of the Contractor to submit any programme, or any required revisions thereto within the time limits stated for acceptance by the Engineer, shall be sufficient reason for not making the relevant stage on account payment by the Engineer

EMPLOYER'S REQUIREMENTS

APPENDIX 5

MONTHLY PROGRESS REPORTS

1. GENERAL

The Contractor shall submit to the Engineer, a Monthly Progress Report. This Report shall be submitted by the end of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission. It shall be submitted in a format to which the Engineer shall have given his consent and shall contain sections/sub-sections.

2. FINANCIAL STATUS

(1) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.

(2) A spread sheet summarising each activity, the budget, costs incurred during the period, costs to date, costs to go, cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).

(3) A spread sheet indicating the status of all payments due and made.

(4) A report on of the status of any outstanding claims. The report shall in particular provide interim updated accounts of continuing claims.

3. PHYSICAL PROGRESS

(1) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.

(2) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

4. PROGRAMME UPDATE (For Entire Project)

Programme updating shall include:

(a) the monthly Programme Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:

(i) Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.

(ii) Updated Detail Programme Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:

- If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.

- Identify by activity number and description, activities in progress and activities scheduled to be completed.
- Discuss Variation Order Work Items, if any.

(b) the Programme Status which shall :

(i) show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.

(ii) be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;

(c) the Activity Variance Analysis which shall analyse activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Programme.

5. MILESTONES STATUS

A report on the status of all Milestones due to have been achieved during the month and forecasts of achievement of any missed Milestones, and those due in the next month.

6. THREE MONTH ROLLING PROGRAMME

The monthly issue of the Three Month Rolling Programme.

7. PLANNING AND CO-ORDINATION

(1) A summary of all planning/co-ordination activities during the month and details of outstanding actions.

(2) A schedule of all submissions and consents/approvals obtained/outstanding.

8. PROCUREMENT REPORT

(1) A summary of all significant procurement activities during the month, including action taken to overcome problems.

(2) A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

(a) purchase Order Date - Scheduled/Actual,

(b) manufacturer/Supplier and Origin,

(c) letter of Credit Issued date,

(d) manufacturer/Supplier Ship Date - Scheduled/Actual,

(e) method of Shipment,

(f) arrival Date in India- Scheduled/Actual.

9. PRODUCTION AND TESTING

The parking system installed at site shall be tested at least for 2 weeks. This shall include dry runs with a test vehicle. It shall be followed with at least one week operation of the system with close monitoring and supervision by the system provider as well as manufacturer.

10. SAFETY

A review of all safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

11 ENVIRONMENTAL

A review of all the environmental issues during the past month to include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

EMPLOYER'S REQUIREMENTS

APPENDIX 6

QUALITY ASSURANCE

1. General

The Contractor shall implement a Project Quality Management Plan in accordance with ISO-9001 "Quality System - Model for Quality Assurance in Design/Development, Production, Installation and Servicing" to ensure that all materials, workmanship, plant and equipment supplied and work done under the contract meets the requirements of the contract. This plan shall apply to all activities related to the quality of items, including designing, purchasing, inspecting, handling, assembling, testing, storing, and shipping of materials and equipment and different elements of construction work and installations of system components.

The Quality Plan to be prepared by the Contractor and submitted to the Engineer shall follow the requirements of ISO 9000 and address each element therein.

Registration of the Contractor's organisation, or subcontractors or sub-consultants is not required for this Project but the Project Quality Management Plan as submitted shall meet the intent of the ISO 9000 requirement in that there is a comprehensive and documented approach to achieving the project quality requirements.

2. Quality Assurance Management Plan

The Project Quality Management Plan (PQMP) shall as a minimum address the quality system elements as required by ISO 9001, generally noting the applicability to the Contractor's Works Programme for the Project. Procedures or Quality Plans to be prepared by others (Suppliers, SUBcontractors, SUBconsultants) and their incorporation in the overall PQMP shall be identified.

The Contractor shall provide and maintain a Quality Assurance Plan (QA) to regulate methods, procedures, and processes to ensure compliance with the Contract requirements. The QA Plan, including QA written procedures, shall be submitted to the Engineer for his review.

Adequate records shall be maintained in a readily retrievable manner to provide documented evidence of quality monitoring and accountability. These records shall be available to Employer at all times during the term of the Contract and during the Defects Liability Period and for a five year period thereafter.

The Plan shall identify:

- Design Process: that control, check and verify the accuracy, completeness and integration of the design shall be performed by certified personnel and in accordance with documented procedure that have the written consent of the Engineer.
- Special Processes: that control or verify quality shall be performed by certified personnel and in accordance with documented procedures that have the written consent of the Engineer;
- Inspection and Test: Inspection and testing instructions shall provide for reporting nonconformances or questionable conditions to the Engineer; Inspection shall occur at appropriate points in the installation sequence to ensure compliance with drawings, test specifications, process specifications, and quality standards. The Engineer shall designate, if necessary, inspection hold points into installation or inspection planning procedures;
- Receiving Inspection: These procedures shall be used to preclude the use of nonconforming materials and to ensure that only correct and accepted items are used and installed;
- Identification and Inspection Status: a system for identifying the progressive inspection status of equipment, materials, components, subassemblies, and assemblies as to their acceptance, rejection, or non-inspection shall be maintained;

- Identification and Control of Items: an item identification and traceability control shall be provided;
- Handling, Storage, and Delivery: provide for adequate work, surveillance and inspection instructions.

The Plan shall ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, and defects in materials and equipment shall be promptly identified and corrected.

The Plan shall provide for establishing, and maintaining an effective and positive system for controlling non-conforming material including procedures for the identification, segregation, and disposal of all non-conforming material. Dispositions for the use or repair of non-conforming materials shall require the Engineers consent.

3. Plan Implementation and Verification

The Plan shall clearly define the QA Organisation. Management responsibility for the QA shall be set forth on the Contractor's policy and organisation chart. The Plan shall define the requirements for QA personnel, their skills and training. Records of personnel certifications shall be maintained and monitored by the QA personnel. These records shall be made available to the Engineer for review, upon request.

The QA operations shall be subject to the Engineers, Employer or Employer's authorised representative's verification at any time, including: surveillance of the operations to determine that practices, methods and procedures of the plan are being properly applied; inspection to measure quality of items to be offered for acceptance; and audits to ensure compliance with the Contract documents.

The contractor's Quality Audit Schedule shall be submitted to the Engineer for consent every three months or more frequently as required.

The results of Quality Audits shall be summarised in the Contractor's monthly reports.

The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Engineer is being implemented fully and properly.

EMPLOYER'S REQUIREMENTS

APPENDIX 7

DRAUGHTING AND CAD STANDARDS

1. INTRODUCTION

(1) The purpose of this document is to define the minimum Draughting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the Works.

(2) By defining a common format for the presentations of drawings and CAD files, the exchange of drawn information is improved and will maximise the use of CAD in the co-ordination process.

(3) All submissions shall be made to the Employer's Requirement in a format reviewed without objection by the Employer's Requirement and in accordance with the requirements in:

(a) the Contract;

(b) the Document Submittal Instructions to Consultants and Contractors.

(4) Paper and drawing sizes shall be “A” series sheets as specified in BS 3429.

(5) The following software compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

Document Type	Electronic Document Format
Text Documents	MS Word, Ver. 7.0
Spread Sheets	MS Excel, Ver. 7.0
Data Base Files	MS Access, Ver. 7.0
Presentation Files	MS PowerPoint, Ver. 7.0
Programmes Ver2.0a	Primavera for Windows, Ver. 2.0b , Suretrack
AutoCAD Graphics	CorelDraw ,Ver. 8.0/ AutoCAD ver.14
Photographic	Adobe Photoshop, Ver.4.0
Desktop Publishing	Page Maker 6.5,5
CADD Drawings	AutoCAD Ver 14

(6) Media for Electronic File Submission

One copy shall be submitted unless otherwise stated in CD-ROM.

(7) Internet File Formats/Standards

(a) The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Employer.

(b) All the data formats or standards must be supported by Microsoft Internet Explorer version 3 or above running on Windows NT and Windows 98.

(c) The following lists the file types and the corresponding data formats to be used on Internet. The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different Data format:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files (CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi)
Sound	Wave file (.wav)

(8) The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different standard:

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

The hard copy of all documents shall be the contractual copy.

2. GENERAL REQUIREMENTS

2.1 General

(1) The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract.

(2) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.

(3) The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

P - Preliminary Design Drawing

D - Definitive Design Drawing

C - Construction Reference Drawing

W - Working Drawing

B - As-Built Drawing

M - As Manufactured Drawing

E - Employer's Drawing

2.2 Types of drawings

(1) Design drawings' mean all drawings except shop drawings and as-built drawings.

(2) Working drawings' are design drawings of sufficient detail to fully describe the Works and adequate to use for construction or installation.

(3) Site drawings and sketches' are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings where site conditions warrant changes that do not invalidate the design.

(4) Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.

(5) As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basis as the works progress, and shall not be left until completion of the entire works.

3 COMPUTER AIDED DESIGN & DRAUGHTING (CAD) STANDARDS

3.1 Introduction

Scope of Use

Data input procedures between the Engineer and contractors must be coordinated, and the key parameters used to form CAD data files must be standardized. The production of all CAD data files shall comply with the following requirements.

3.2 Objectives

The main objectives of the CAD standards are as follows:

(a) To ensure that the CAD data files produced for Project are coordinated and referenced in a consistent manner.
(b) To provide the information and procedures necessary for a CAD user from one discipline or external organization to access (and use as background reference), information from a CAD data file prepared by another discipline or external organization.
(c) To standardize the information contained within CAD data files which may be common to more than one discipline such as drawing borders, title boxes, grid lines etc.
(d) To establish procedures necessary for the management of CAD data files.
(e) To ensure use of 'Model space' and 'Paper space' in the production of CAD files'.

3.3 General

(1) To facilitate co-ordination between contractor and NHIDCL, it is a requirement that all drawings issued by contractor for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.
(2) The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies which have been issued by the contractor or organisation originating the drawing.
(3) Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD data files.
(4) Deleted
(5) In particular, automatic determination of physical dimensions from the data file shall always be verified against the figured dimensions on the paper or polyester drawings. Figured dimensions shall always be taken as correct where discrepancies occur.

3.4 Terminology & Associated Standards / Guidelines

Any terminology used within this section that is ambiguous to the user shall be clarified with the Employer's Requirement. British Standard BS1192 is used in principle as a guide for drawing practice, convention, CAD data structure and translation.

3.5 Paper Drawings

(1) For the Project "Paper" drawings are considered to be the main vehicle for the receipt and transmittal of design and production information, typically plans, elevations and sections.
(2) The Project wide accepted media for the receipt and transmittal of "Paper" drawings will be paper and polyester film of various standard ISO 'A' sizes. The composition of this information shall be derived from a CAD "Model".

(3) The CAD derived "Paper" drawing composition will reflect a window of information contained within a CAD "Model Space" file together with a selection of information contained within the associated CAD "Paper Space" file.

3.6 CAD Data Creation, Content & Presentation

A consistent method of CAD data creation, together with content and presentation is essential. The method of CAD "Model Space and Paper Space" creation is as follows:

(1) Model Space Files

(a) Typically CAD "Model Space" files are required for general arrangement and location plans and will consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files should be kept to an absolute minimum). Data contained within a CAD "Model Space" files is drawn at full size (1:1) and located at the correct global position and orientation on the Project Grid / or defined reference points.

(b) Each CAD "Model Space" file will relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD "Model Space" file. Dimensions shall be included within a CAD "Model Space" but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD "Model Space" as defined above, but do not need to be positioned and orientated on the Project Grid.

(2) Paper Space CAD Files

(a) Paper Space" CAD files are utilised to aid the process of plotting "Paper" drawings and are primarily a window of the CAD "Model Space" file. A "Paper Space" CAD file will typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned, the majority of "Paper Drawing" plots at various approved scales are efficiently and consistently generated by displaying different combinations of element layers and symbology contained within the "Paper Space" file and the referenced "Model Space" files.

(b) The purpose is to ensure that total co-ordination is achieved between the CAD "Model Space" file and the "Paper Drawing" output during the revision cycle of the design and production process. Duplicated data in "Model and Paper Space" files will not be acceptable unless an automatic update link exists between the two data sets. "Paper Space" files are not typically required as part of the CAD Media Receipt from contractors, unless specifically requested.

3.7 CAD Quality Control Checks

(1) Random CAD Quality Control Audits will be carried out by Engineer on all CAD media received and transmitted.

(2) These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organisation), however compliance with Project CAD and Draughting Standards shall be checked.

(3) In addition, the contractor who transmits and receives CAD data from the Project shall have CAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

3.8 CAD Data Transfer Media and Format

When CAD data is received & transmittal between Engineer and the Contractor, the media shall be as follows:

(a) Data Exchange Format - Autocad Release 14 (.DWG)
(b) Operating System - / Window NT 3.51 /Windows 95/98
(c) Data Transfer Media :

3.5" high density diskettes in DOS format (Maximum 10 diskettes)
12cm Compact Disc (650 MB) is highly preferred
Portable SCSI harddisk (return to the Contractor upon data transfer) with software

(d) All floppy diskettes or tapes must be labelled on the data shield with:
  (i) Name of Company
  (ii) Project Title
  (iii) Drawing Filenames (for diskettes only)
  (vi) Diskette No. / Total No. of diskettes or Tape No. / Total No. of Tapes

(e) All media shall be submitted with a completed Form (CAD Disk/Tape Sheet)

(f) The Contractor must ensure the supplied media is free from virus. SUB-directories on tapes or disks are not permitted. If CAD Data is created using UNIX, archive commands must be un-rooted.

3.9 CAD Media Receipt & Transmittal

(1) CAD Media Transmittal (from the Contractor to Engineer) - this will consist of the following:

(a) CAD Digital Media (disk(s), CD's or tape (s)) shall typically contain CAD "Model Space" and "Paper Space" files.
(b) CAD data sheet
(c) CAD issue / revision sheet
(d) CAD Quality Checklist confirming compliance.
(e) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

(2) The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by Employers' Representative from the contractor shall be in AutoCAD (version 14)

(3) All CAD media received from contractor will be retained by Engineer except for SCSI disk (if used) as an audit trail / archive of a specific contractor's design evolution.

(4) CAD Media Receipt (from Engineer to the Contractor)
(a) CAD media should normally be obtained from the respective interfacing contractor(s), but should Engineer issue CAD media it will consist of the following :
  (i) CAD Digital Media (disk (s) or tape (s)) typically contain only CAD "Model Space" files.
  (ii) CAD data sheet.
  (iii) CAD issue / revision sheet

(b) The above CAD media will be collectively known as the "CAD Media Receipt Set". The CAD data file transmittal format used by Engineer to all contractors will be in AutoCAD (version 14)

(c) Each CAD transmittal disk / tape will be labelled with proper disk label as approved by the Engineer. Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

3.10 Revisions

(1) All 'Revisions', 'In Abeyance' and 'Deletions' shall be located on a common layer. This layer can be turned on or off for plotting purposes.

(2) The following example text indicates the current CAD file revision, i.e. 'Revision [A]'. This shall be allocated to a defined layer on all CAD "Model Space" files, in text of a size that will be readable when the CAD "Model Space" file is fitted to the screen, with all levels on.

3.11 Block Libraries, Blocks, & Block Names

(1) All Construction Industry symbols produced as CAD Cells shall typically conform to British Standard BS1192 - part 3.

(2) All Blocks created shall be Primitive (i.e. NOT Complex) and shall be placed Absolute (i.e. NOT Relative).

(3) The Contractor's specific block libraries shall be transmitted to Engineer together with an associated block library list containing the filename (max. 6 characters) and block description. The Contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.

(4) All Blocks of a common type, symbols or details should initially be created within a CAD "Model Space File" specifically utilised for that purpose. These files will be made available on request by Employers' Representative.

(5) All Blocks created will typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point, located within the extents of each Block's masked area or volume.

3.12 CAD Dimensioning

Automatic CAD Dimensioning will be used at all times. Any dimensional change must involve the necessary revision to the model space file. If the CAD Quality Control Checks find that the revisions have not been correctly carried out, the rejection of the entire CAD submission will result.

3.13 CAD Layering

All CAD elements shall be placed on the layers allocated for each different discipline. The layer naming convention to be adopted by the Contractor shall be submitted for acceptance and inclusion within these standards.

3.14 Global origin, Location & Orientation on the Alignment Drawing.

(1) Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.

(2) Location plans shall have at least three setting out points shown on each CAD "Model Space" file. Each setting out point shall be indicated by a simple cross-hair together with related Eastings and Northings co-ordinates. The Civil Contractor(s) will establish the three setting out co-ordinates for their respective works, which will then be used by all other contractors including the Contractor.

3.15 Line Thickness and Colour

To assist plotting by other users, the following colour codes will be assigned to the following line thickness / pen sizes.

Colour	Code No	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35
Brown	34	0.5
Blue	130	0.7
Orange	30	1.0
Green	3	1.4
Grey	253	2.0

3.16 CAD Utilisation of 2D & 3D Files

Although the project standard is 2D CAD files, certain disciplines and contractors may use 3D CAD files for specific applications or where the isolated use of 3D aids the design and visualisation process (i.e. Architecture, Survey and Utilities). In these specific instances 3D CAD data will only be transmitted if all other users can use this data. If this is not the case, a 3D to 2D translation shall be processed by the creator prior to issue.

3.17 CAD File Numbering

(1) Contractors CAD File Numbering shall be described in 2.2 above.
(2) Employer CAD File Numbering Unlike most of the contractors, Employer will not be required to produce numerous CAD files. This will follow the numbering system Except that the status of the drawing in 2.1(3) shall be "E".

3.18 CAD File Naming Convention – General

CAD “Model Space” files shall be named in accordance with general drawing conventions.

EMPLOYER'S REQUIREMENTS

APPENDIX 8

WORKS AREAS & TEMPORARY POWER SUPPLY

1. INTRODUCTION

(1) The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Engineer, the compounds and facilities for the Engineer and other contractors of the Employer defined under Clause 2 of this Appendix.

(2) The standard conditions applying to the use of any Works Area by the Contractor for its site facilities are given under Clause 2 of this Appendix.

(3) The Conditions for supply of electricity by the Contractor to Designated Contractors are given under Clause 3 of this Appendix.

2. STANDARD ENGINEERING CONDITIONS

The following standard engineering conditions apply to all Works Areas:

(1) Formation

(a) The Works Areas shall be formed to the levels that the Engineer has given his consent. No such levels shall be amended without prior consent of the Engineer.

(b) The Works Areas shall be surfaced in a manner agreed with the Engineer, compatible with their intended use, and, in particular, footpaths and roadways connecting facilities shall be clearly defined. Measures shall be taken to the satisfaction of the Engineer to ensure all areas are properly drained and kept free of static water.

(c) The removal, diversion or reinstatement elsewhere as may be required of any existing works or installation whatsoever within the Works Areas shall be carried out to the satisfaction of the Engineer.

(2) Roads & Parking

(a) Space shall be provided within the Works Areas for parking, loading/unloading and maneuvering of motor vehicles.

(b) Any damage done to the adjoining public roads and fixtures and properties (public or private) shall be made good to the satisfaction of the Engineer.

(3) Drainage & Sewerage

(a) All storm or rainwater from the Work Areas including any access roads thereto shall be conveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance are caused by storm water or rain water to the adjacent property.

(b) No drain or watercourse shall be used without consent of the Engineer.

(c) Damages or obstructions caused to any watercourse, drain, water-main or other installations within or adjoining the Works Areas shall be made good to the satisfaction of the Engineer.

(d) Treatment and disposal of sewage and wastewater from the Works Area shall be provided to the satisfaction of the Engineer.

(4) Buildings

(a) No permanent structures other than those required for the Permanent Works shall be permitted on the Works Areas.

(b) Electricity, water, telephone and sewerage shall be provided by the Contractor, as required, for all temporary buildings.

(c) No potable water from the NDMC/MCD shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of the Engineer.

(5) Pedestrian Access

Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.

(6) Fencing

The Works Areas shall be secured against unauthorized access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

3. Temporary Water & Power Supply

During construction phase, shall use power & water supply provided by the Contractor. Facilities provided shall be:

(a) a mains water supply of 25 mm diameter complete with stopcock; and

(b) 230 V single phase power supply, suitably earthed and each with sockets capable of receiving three (3) electric plugs of the size and type used for hand-held construction equipment.

4 Applicability

(1) Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with Paragraphs of this Appendix.

(2) When the Contractor makes use of temporary electrical supplies provided by others he will observe and comply with the requirements of this Appendix.

5, Work on Site

(1) The Contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Engineer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring the safety of all temporary electrical equipment on Site. The Contractor shall not install or operate any temporary Site electrical systems until this representative is appointed and has commenced duties.

(2) The name and contact telephone number of the representative having been reviewed without objection by the Engineer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.

(3) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for his consent.

(4) All electrical installation work on Site shall be carried out in accordance with the requirements

laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorised electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations 1990.

5. Electrical General

Temporary electrical Site installations and distribution systems shall be in accordance with:-

(1) Indian Electricity Rules

(2) The Power Companies' Supply Rules;

(3) Electricity and its subsidiary Regulations;

(4) IEE Wiring Regulations (16th Edition);

(5) BS 7375 Distribution of Electricity on Construction and Building Sites;

(6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and

(7) BS 6164 Safety in Tunnelling (underpasses) in the Construction Industry.

(8) Any other applicable national standards

7. Materials, Appliances and Components

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

8. Design Considerations

(1) Distribution equipment utilised within the temporary electrical distribution system shall incorporate the following features:-

(a) flexibility in application for repeated use;

(b) suitability for transport and storage;

(c) robust construction to resist moisture and damage; and

(d) safety in use.

(2) All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.

(3) The installation on Site shall allow convenient access to authorised and competent operators to work on the apparatus containedwithin.

9. Mains Voltage

(1) The Site mains voltage shall be as per the Electricity Authority, 415V/ 3 phase 4 wire system.

(a) Single phase voltage shall be as per the Electricity Authority, 230V supply.

(b) Reduced voltages shall conform to BS 7375.

(2) Types of Distribution Supply

The following voltages shall be adhered to for typical applications throughout the distribution systems:

(a) fixed plant - 415V/ 3 phase;

(b) movable plant fed by trailing cable - 415V /3 phase;

(c) installations in Site buildings - 230V /1 phase;

(d) fixed flood lighting - 230V/ 1 phase;

(e) portable and hand held tools - 115V /1 phase;

(f) Site lighting (other than flood lighting) - 115V /1 phase; and

(g) portable hand-lamps (general use) - 115V /1 phase.

(3) When the low voltage supply is energised via the Employer's transformer, any power utilised from that source shall be either 415V 3 phase or / 230V 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.

(4) Protection of Circuits

(a) Protection shall be provided for all main and sub-circuits against excess current, under and over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.

(b) Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with:-

(i) BS 88;

(ii) BS EN 60898; and

(iii) BS 7375;

(iv) Any other appropriate Indian Standards.

10. Earthing

(1) Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.

(2) Earthing systems shall conform to the following standards:-

(a) IEE Wiring Regulations (16th Edition);

(b) BS 7430;

(c) BS 7375; and

(d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

11. Plugs, Socket Outlets and Couplers

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

12. Cables

(1) Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.

(2) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specifications appropriate to the duties imposed on it:

(a) BS 6708 flexible cables for use at mines and quarries;

(b) BS 6007 rubber insulated cables for electric power and lighting; and

(c) BS 6500 insulated flexible cords and cables.

(3) Where low voltage cables are to be used, reference shall be made to BS 7375. The following specifications shall also be referred to particularly for underground cables:-

(a) BS 6346 for armoured PVC insulated cables; and

(b) BS 6708 Flexible cables for use at mines and quarries.

(4) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to weldingelectrodes) shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.

(5) Armoured cables having an over sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.

(6) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.

(7) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.

(8) All cables which are likely to be frequently moved in normal use shall be flexible cables.

Flexible cables shall be in accordance with BS 6500 and BS 7375.

13. Lighting Installation

(1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.

(2) Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where

the lighting fixture is fixed in position.

(3) Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.

(4) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas where required by the Engineer,.

(5) Mechanical protection of luminaries against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.

14. Electrical Motors

(1) Totally enclosed fan cooled motors to BS 4999: Part 105 shall be used.

(2) Motor control and protection circuits shall be as stipulated in BS 6164. Emergency stops for machinery shall be provided.

15. Inspection and Testing

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16th Edition).

16. Identification

Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

17. Maintenance:

(1) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.

(2) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

18. Metering

The Contractor shall install a separately metered and invoiced supply or supplies of electricity for:-

(a) Site fabrication facilities;

(b) Site workshops and work yards; and

(c) Site offices and stores.

EMPLOYER'S REQUIREMENTS

APPENDIX 9

Not Used

EMPLOYER'S REQUIREMENTS

Appendix – 10

Deleted

EMPLOYER'S REQUIREMENTS

APPENDIX 11

Deleted

EMPLOYER'S REQUIREMENTS
APPENDIX 12

UTILITIES

Definitions-

Utilities-

Utilities are defined as public utilities above or below ground and include all live water mains, power cables, street lights, transformers, telephone posts, telecommunication cables, sewers, storm water drains shown on tender drawings OR uncharted which are not shown on the tender drawings.

Charted Utilities-

Charted Utilities are the utilities (as defined above) which are shown on the tender drawing.

Uncharted Utilities-

Uncharted Utilities are the utilities (as defined above) which are not shown on the tender drawing.

Responsibility of the Contractor and Payment-

1. The Contractor shall make his own enquiries and investigations, including excavating trial holes, to ascertain the existence, nature, location and size of utilities. A schedule of utility diversions and utilities to remain but to be supported (the utility diversion plan) will be prepared by the Contractor and submitted with the Preliminary Design The schedule will list out utilities that
   - willl be diverted by the Contractor during the course of the Works
   - will remain in place and require the use of specific construction methods to complete the underground structures around and below the utilities including support of the utilities during construction.

2. The Contractor shall take into consideration time taken for utility diversions into overall programme for the contract. However the efforts shall be made to avoid shifting/disturbance of any utility and try to work by supporting the same but the required services being provided by these utilities shall be maintained at all the times at the cost of the contractor.

3. The diversion work shall be undertaken by the Contractor as per the approval of the Utility owning Agencies and agreed by the Employer. Temporary supports and protection by methods proposed by the Contractor and agreed by the utility owner shall be provided to the utilities; permanent supports and protection shall be provided if wherever required for the safety and security of the utility service.
4. The Contractor shall immediately inform the Engineer and the utility agencies of any (a) damage to utilities; (b) leakage of utilities; (c) discovery of utilities not previously identified;
5. The Contractor shall inform the Engineer of the programme of all works of utility diversions and shall take all steps to enable the utility diversions to proceed in accordance with the programme. The Contractor shall maintain close liaison with the utility undertakings. The Contractor shall set up and manage a Utility Liaison Group of experienced personnel for the duration of the contract.
6. Records of the existing utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Engineer. The records shall contain the following details :
   (a) location of utility;
   (b) date on which the utilities were encountered;

(c) nature and sizes of the utilities;
(d) condition of utility;
(e) temporary or permanent supports provided; and
(f) Diversions made –Temporary or permanent

7. The Contractor shall include the details (plan, location, ownership, size and material) of all such utilities on the As Built Drawings.

EMPLOYER'S REQUIREMENTS

APPENDIX 13

Deleted

EMPLOYER'S REQUIREMENTS
APPENDIX 14

CONTRACTOR'S SITE LABORATORY

1. SITE LABORATORY

(1) The Site Laboratory shall be approximately 250m^2 in area. It shall consist of the following accommodation :
1 concrete laboratory
1 Soil laboratory
2 office
1 store room
1 kitchen
male toilets, changing room & shower

(2) The remainder of the 250m^2 shall consist of storage area for concrete cube curing tanks. The laboratory, office etc. shall be in one building; the curing tank storage building may be in a separate building, but if so it shall be adjacent to the laboratory building & connected to it by a level, weatherproof passageway. In addition, an area of covered hard-standing of 50m^2 for motor vehicles shall be provided adjacent to the laboratory.

2. STANDARD OF CONSTRUCTION

(1) The laboratory shall be constructed to the best Engineering practice and as approved by the Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas as agreed with the Engineer.
(2) A water tank with minimum capacity of 2000 litres shall be installed, as a source of constant water pressure (15 kPa minimum) for each laboratory.
(3) In the case of sinks used for washing samples, adequate trapping and/or separating devices shall be provided to ensure the proper functioning of the facility.

3. FURNISHINGS AND FIXTURES

The contractor’s site laboratory shall be provided with required furnishings and fixures.

4. LABORATORY EQUIPMENT

(1) The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to commence work the name of the supplier it intends to use for each piece of apparatus together with the relevant catalogue number.

(2) The layout of the equipment in the testing laboratory shall be instructed by the Engineer. The equipment shall be maintained to an accuracy appropriate to the required testing methods with routine calibration by an accredited organisation as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.

(3) The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quantity of equipment required for testing may be varied by the Engineer depending on the detail of the Contractor's Design and Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

Determining Liquid Limit (1 complete set)

Liquid limit device (Casagrande type)	1 set
Grooving tools	1 No.
Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Laboratory balance, capacity 500 gm, (sensitivity 0.01 gms.)	1 No.
Wash bottle, capacity 500 ml.	1 No.
Moisture cans, capacity 50 ml.	24 No.

Determining Plastic Limit (1 complete set)

Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Glass plate 250mmx250mmx12mm	2 No.
Moisture cans, capacity 50 ml.	12 No.
Stainless steel rods, 3 mm dia.	2 No.

Determining Moisture Content (1 complete set)

Micro Oven, capacity 35 litres, control temperature up to 200 °c	1 No.
Balance, capacity 200 gm., sensitivity 0.01 gm.	1 set
Lab. Tongs	1 No.
Moisture cans 75ml. with lid	36 No.

Compaction Characteristics (1 complete set)

Standard compaction mould 100mm dia.	1 No.
Modified compaction mould 150mm dia.	1 No.
Standard compaction Rammer, 2.5 kg.	1 No.
Modified compaction Rammer, 4.5kg.	1 No.
Straight edge 300mm long	1 No.
Sample ejector for 100mm and 150mm mould	1 No.
Sample tray 60 x 60 x 8 cm	3 No.
Wash bottle, 500 ml.	2 No.

Moisture cans 250 ml.	24 No.
Density of soil in-place by sand cone method (2 complete set)	
Sand density cone apparatus, 150mm	2 No.
Plate, 300mmx300mm with centre hold 150mm	2 No.
Glass jug for sand cone	2 No.
Chisel 25mmx 150mm	2 No.
Hammer	2 No.
One-gallon field cans	24 No.
Sampling spoon	2 No.
Soft hair brush	2 No.
Moisture cans 250 ml.	48 No.
Sieve Analysis	
Sieve shaker (portable)	1 unit
Coarse sieves In Sizes from 100mm to 10mm	(1 set
Fine Sieves #4,#8,#16,#30,#40,#50,#100,#200	each)
Pans & Covers	
Specific Gravity and Absorption of Coarse Aggregate	
Wire basket, 200mm dia.	
Heavy duty suspension balance, 20 kg x 1 gm. with accessory for weight in water	1 set
Suitable water container	1 No
Unit Weight of Aggregate	
Balance, 100 kg. capacity with 10 gm precision	1 No.
Tamping rod 16mm diameter x 600mm long	1 No.
Measuring containers (3,10,15,30 litres)	1 each
Flakiness and Elongation	
Flakiness gauge, elongation index	1 set
Soundness Test	
Sodium sulphate	25 kg
Soaking tank	1 No.
Balance, Capacity 3 kg., Sensitivity 0.1 gm.	1 set
Sieves :Coarse	1 set
Fine	1 set
Concrete	
Buckets for concrete sampling	12 No.
Slump cone	12 No.
Tamping rod	12 No
Base plate	12 No.
Mixing pan for concrete	2 No.
Scoop for general purpose	2 No.
Concrete thermometer	1 No.
Concrete cylinder mould, 150 mm * 300 mm; 100 mm * 300 mm	10 each
Concrete cube mould, 100 mm cube & 150 mm cube	10 each
Adjustable spanners for dismantling cube moulds	6 No.
Capping set	2 No.
Capping compound	
Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover	5 No.

Schmidt test hammer	1 No.
Compression testing machine (simple hand operated)	1 No.
Mould oil	
Temperature chart recorder	1No.

Miscellaneous

Vernier callipers to measure up to 200mm, with elongated jaws	5 No.
Steel rule, 300 mm long graduated	2 No.
Rubber gloves	10 pr.
Cotton working gloves	20 pr.
First aid kit	1 set
Wire brush	6 No.
Steel tape, 3m, 5m, 30m	3 each
Ball peen hammer, 1 kg	2 No.
Paint scraper. Approx. 100mm wide	8 No.
Float, steel Approx.280 x 120 mm	8 No.
Sack barrow	1 No.
Shovel: Square Mouthed	2 No.
Round Mouthed	2 No.
24-wheel trolley, heavy duty, approx. 0.7m x 1.0m long pneumatic tyred type	1 No.
Wheelbarrow, rubber tyred	1 No.
Comprehensive tool kit. To include screwdrivers, pliers, claw hammer, multi-grips, spanners (adjustable)	1 No.
Type NR Schmidt Hammer and tester with recording device	1 No.
Testing Anvil for Schmidt Hammer test (SHT)	1 No.
Chart recording paper for SHT	10 pkts
Covermeter for detecting metal objects to depth of 100mm below the surface of non-magnetic objects	3 No.
Noise meter	1 No.