

Part-V

INTERFACE SCHEME MANAGEMENT

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DESIGN INTERFACES

1. INTERFACES

1.1 The Contract NGNDD01 (Project Architect/ E&M Consultant/ VAC Consultant) (DDC) shall interface the design of the Works with that of other Designers (excluding Structure Design), principally the Designers for the Designated Contracts as defined in this document. The Project Architect shall keep the Employer's Representative fully informed in respect of such interfaces, such information being given to the Employer's Representative in a manner and form and at such intervals as stated in the Contract or as required by the Employer's Representative.

1.2 Designated Contractors in interface with the NGNDD01 Contract are:

(A) Design and Built Civil Contract

Civil Structures

This contract provides for Noida-Greater Noida corridor. The Contractor shall provide design information to DDC to enable the DDC to carry out the SES analysis for the Metro Corridor.

(B) Contract for

Signalling and Communications -

This contract provides for signalling and automatic train control systems including equipments in the station control rooms and the Operation Control Centre (OCC) such as train mounted control equipment, relay room equipment, independent telephone networks including automatic switching centres and exchanges, main trunk cables, direct telephone lines, communication equipment, emergency telephones, closed circuit television, radio communication and all non-power SCADA system.

(C) Contract for

Railway Electrification and Power Supply –

This contract provides for rigid overhead 1500 V. dc traction power, receiving traction & auxiliary substation equipment, AC and DC switchgear, transformers and rectifiers, auxiliary power equipment and power cables and power SCADA system

(D) Contract for

Track work -

This contract provides for, manufacture and installation of points and crossings and plain line throughout the Metro Corridor Project including the Depot track work. It includes the provision of the second stage concrete track bed.

(E) Contract for

Automatic Fare Collection

This contract provides for the revenue control system at stations, including automatic

ticket vending machines, barriers, manual control and checking equipment and electronic linkages to station control rooms and the Central Control room.

(F) Contract for

Track and Turnouts

This contract provides for detailed design of ballast less track and turnouts in the Metro & Rail Corridor projects.

(G) Contract for

Rolling Stock

This contract provides for air-conditioned rolling stock in rakes of up to 6 coaches.

(H) Contract for

Lift & Escalator Contract

This Contract will design, manufacture, install and commission all lifts and escalators in the stations.

(I) Contract for

Signage and Graphics Contract

This Contract will provide for supply, installation and commissioning of signage and graphics.

(J) Contract for Electrical and Mechanical (E&M) Systems works

2. INTERFACE RESPONSIBILITIES

- 2.1 The responsibility for specification and provision of the requirements for the works, which interface with Designated Contractor's equipment, are tabulated below.
- 2.2 This Part of tender document describes the interface requirements between DDC and other Designated Contractors/ Designers/ Consultants.
- 2.3 This Part of tender document 2D shall be read in conjunction with the relevant clauses of the Employer's Requirements and Outline Specifications. The Project Architect shall be responsible for ensuring that all requirements of the specifications pertaining to interfaces are properly satisfied.
- 2.4 Notwithstanding the requirements described elsewhere in the Contract regarding document precedence the provisions contained in the Drawings and elsewhere in the Employer's Requirements shall prevail over the provisions contained in this Part of tender document.
- 2.5 This Part of tender document 2D outlines the interfacing requirements during the design and execution of the Works. However the requirements herein specified are by no means exhaustive and it remains the DDC's responsibility to develop, update

and execute jointly an Interface Management Plan (IMP) after the commencement of the Works and throughout the execution of the Works to ensure that:

- a) All interface issues between DDC and the Designated Contractors/ Designers/ Consultants are satisfactorily identified and resolved; and
- b) All the construction tolerances at the interface shall meet the requirements of the respective specifications relating to the interface points.

2.6 Where the details of the DDC's design are required to enable the Designated Contractors/ Designers/ Consultants to implement interface works, the DDC shall provide the Designated Contractors/ Designers/ Consultants with the necessary information including, but not limited to, those described in the summary table appended to this requirement. The level of information provided shall be in sufficient detail to enable the Designated Contractors/ Designers/ Consultants to design and / or construct the required interface works.

2.7 The DDC shall take a lead in developing the Interface Management Plan. The IMP will be prepared in conjunction with the Designated Contractors/ Designers/ Consultants to cover all aspects of the implementation of the interface works required. The IMP will define the interface works necessary to complete all the works in this contract and is not limited to those listed in the summary table attached.

The IMP shall be fully conforming with the Works Programme and shall, in respect of the DDC and each of the Designated Contractors, show and be in logical agreement with Key Dates and Works Areas Handover Dates. The IMP shall indicate dates for the commencement and completion of each principal activity on the Site by each contractor, and delivery and installation of principal items of equipment.

Interfaces between Design & Built (Civil) Contractors/ Designers and DDC

Item No.	Subject	DDC responsibilities	Design & Built (Civil) Contractors/ Designers' Responsibilities
1	Elevated Stations/ Ancillary buildings	<ul style="list-style-type: none"> • Preliminary layout and cross-sections of the station box. • Details of all the openings/ cutouts in the Diaphragm Walls. • Details of all the cutouts for all the services in the station box and other structural members. • Provisions for specific arrangements in the structural design to meet systems/design requirement. • Final layout and detailed cross-sections of the station area including ancillary building and service galleries incorporating final dimensions of the structural members in consultation with the Designated Contractor. • Coordinated Details of Station-Ramp interfaces to be incorporated into Structural Design/ Construction. • Final Sizes of all the Structural members like Columns, Beams and Structural Slabs to be worked out. 	<ul style="list-style-type: none"> • To co-ordinate and carry out the responsibilities as per contract.
2	At-Grade Ramp and Elevated Viaduct (For Designated E&M and VAC Consultant)	<ul style="list-style-type: none"> • Design details to be worked out in co-ordination with Designated Contractor's design requirements. • Requirement for Provisions of all services in the Ramps and Elevated Viaducts 	<ul style="list-style-type: none"> • To co-ordinate and carry out the responsibilities as per contract.

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		<p>to be given to the Civil Contractor as per the Detailed Project Programme.</p> <ul style="list-style-type: none"> • CSD to be provided to the Civil Contractor for Construction Reference and necessary Interfacing work. 	
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Interfaces between E&M Contractors and DDC.

Item No.	Subject	DDC responsibilities	Design & Built (Civil) Contractors/ Designers' Responsibilities
1	Elevated Stations.	<ul style="list-style-type: none"> • Details of all the cutouts for all the services in the station box, Diaphragm walls and other structural members. • Details of all the Ducts, Shafts and Utility/ Service galleries. • Provisions for specific arrangements in the structural design to meet systems/design requirement. • Final layout of all the Operational rooms with details of cutouts. • Coordinated Details of Station-Ramp/ Station-Viaduct Services interfaces to be worked out in consultation with the Civil Contractor. • Design details to be worked out in co-ordination with Designated Contractor's design requirements. 	<ul style="list-style-type: none"> • Designated Contractor shall review the Systems design as per the Detailed Project Programme and indicate modifications etc required in the civil work if necessary. • Provide details of all cutouts/ shafts/ ducts etc as per the actual equipment layouts. • Coordinate with the Designated DDC and Civil Contractor for Design and Construction Interfacing.

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2	<p>At-Grade Ramp and Elevated Viaduct</p> <p>(For Designated E&M and VAC Consultant)</p>	<ul style="list-style-type: none"> • Services Provision to be kept inside Ramps/ Elevated Viaducts in confirmation with the Designated Contractor's design requirements • GFC to be provided to the designated systems contractor for provision of services on the ramps and elevated viaducts. • CSD to be provided to the Designated Contractors for Construction Reference and necessary Interfacing. 	<ul style="list-style-type: none"> • Coordinate with the Designated DDC, Civil Contractor and Other Designated Contractors for Design and Construction Interfacing.
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Interfaces between Contract for Railway Electrification and Power Supply and NGNDD01.

Item No.	Subject	DDC responsibilities	SYS Responsibilities
1	<p>Traction Substation structures, earth mats and supplementary earth pits, material handling cranes and gantries, access roads, fencing, ventilation, outdoor & Indoor lighting, other building services like fire detection, drinking water, drainage and toilet facility etc. & Receiving substation access roads, fencing/boundary walls, gates etc.</p> <p>Note: For the outdoor receiving substation portion, the earth mat shall be provided by SYS2.</p>	<p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in co-ordination with Designated Contractor design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> Confirm basic room sizes and building layout with reference to tender drawings and the capacity of lifting equipments (Vertical and Traveling hoists). Furnish equipment sizes and weights. Furnish equipment foundation/ mounting details Confirm room finishes. Furnish earth mat and supplementary earth pits & earth risers constructional requirements. Furnish requirements of cable trenches, cable routing and cable support provisions. Furnish ventilation and lighting requirements. Confirm fire safety provisions. Review the design from NGNDD01.
2	<p>Cable gallery structure from TSS to station structure including pathway, internal lighting and ventilation, fire detection, fire separation and cable mounting support.</p>	<p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor's design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> Furnish & Confirm cable gallery size and route alignment. Furnish ventilation and lighting requirements. Confirm fire safety and fire separation provisions. Furnish cabling mounting requirements.
3	<p>Oil drainage from main intake transformer oil sump.</p>	<p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in co-ordination with Designated Contractor's design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> Confirm oil drainage requirement.

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		<p>pipes and structures.</p> <p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor. 	
11	OCS warning and different types of Indicator Boards in the, stations and depot.	<p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor's design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> Confirm the location of OCS warning and Indicator Boards. Furnish the relevant drawings. Review the fixing arrangement design from NGNDD01.
13	Platform Insulation at stations.	<p>Design:</p> <p>Design details to be worked out in interface with Designated Contractor's design requirements.</p>	<p>Design:</p> <p>Confirm the requirement and material specification for safety of passenger/safe touch potential limit.</p>

Interface Specification of Lifts & Escalators Contract

Item No	Subject	DDC responsibilities	Lifts & Escalators Contractor responsibilities
1	Lifts	<p>Design:</p> <ul style="list-style-type: none"> • Establish lift locations and requirement. • Suggest machine room locations. • Consider maintenance access requirements. • Suggest lift and escalator monitoring panel location. 	<p>Design:</p> <ul style="list-style-type: none"> • Providewith detailed requirement for standard cab size machine room and structural provision and electric load. • Design cab communication system. • Inform the size of access necessary likely along the passage for moving the lift for installation. • Co-ordinate fire safety requirement with fire fighting systems. • Furnish requirement for lifting beams. • Furnish design for monitoring and control panel.
2	Escalators	<p>Design:</p> <ul style="list-style-type: none"> • Identify escalator locations and sizes of escalators. • Define mounting and structural provisions for escalator assemblies, also electrical power, Control Interfaces and system shall be developed. • Co-ordinate access and delivery space provisions 	<p>Design:</p> <ul style="list-style-type: none"> • Co-ordinate details of mounting provisions, power supply, electric load and control requirements. • Define requirements and provide design details to DDC for escalator sprinkler protection system. • Furnish the sizes for escalator machine rooms.

Interface specification of Track Work Contract

Item No	Subject	DDC responsibilities	SYS responsibilities
2	Provision of access from ground level to track level at each station for transportation of track material	Design: <ul style="list-style-type: none"> • Design details to be worked out in interface with Designated Contractor's design requirements. 	Design: <ul style="list-style-type: none"> • Confirm location and size of access for transportation of track material.
3	Details of track drainage	<ul style="list-style-type: none"> • Design of drainage system of metro corridor except the drains required within track. • Furnish details of levels of drainage system to Designated Contractor's to connect the drains required to be constructed within track. 	Design: <ul style="list-style-type: none"> • Design and construction of Drains required within track based on details of levels of drainage system provided by NGNDD01.

Interface Specifications of Automatic Fare Collection Contract

Item No.	Subject	DDC responsibilities	SYS responsibilities
1	<p>Ticket Booth related works: Construction of ticket booth with false ceiling and windows with glass panes, Indoor and outdoor lighting, Air-conditioning, Power points at counters Supply through UPS, Communication line for ticketing machines, Phones, Earthing Facility for ticketing machines, Fare and Route display. Construction of trenches for laying of Power and Communication lines</p>	<p>Design:</p> <ul style="list-style-type: none"> • Design of booth – number of windows and its location; • Design details to be worked out in interface with Designated Contractor's design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> • Confirm basic booth sizes and layout; • Furnish equipment sizes and Weights; • Furnish equipment mounting details; • Confirm room finishes; • Furnish requirements of cable trenches, cable routing and cable support provisions on walls and floor; • Furnish lighting requirements; • Confirm fire safety provisions; • Review the design from NGNDD01.
2	<p>Passenger Operated Machines POM</p>	<p>Design:</p> <ul style="list-style-type: none"> • Design details to be worked out in interface with Designated Contractor's design requirements. 	<p>Design: Furnish requirement of cable trenches, cable routing and cable support provisions.</p>

3	<p>Automatic Gates related works:</p> <ul style="list-style-type: none"> • Construction of bases for mounting of Gates, • Construction of trenches for laying of Power and Communication lines, • Lighting arrangement, • Supply through UPS, • Communication line for gates, • Earthing Facility for Gates • Phone. 	<p>Design:</p> <ul style="list-style-type: none"> • Design details to be worked out in interface with Designated Contractor 's design requirements. • Location and number of gates to be decided in consultation with Designated Contractor's contractor. 	<p>Design:</p> <ul style="list-style-type: none"> • Confirm basic gate sizes and booth layout • Furnish equipment sizes and weights • Furnish equipment mounting details • Confirm finishes • Furnish requirement of cable trenches, cable routing and cable support provisions • Review the design from NGNDD01.
4	<p>Supervisor Room related works: Construction, Indoor and outdoor lighting, Air-conditioning, Power points for Station computer, Supply through UPS, Communication line for Station Computer, Earthing Facility for computer, Phones.</p>	<p>Design:</p> <ul style="list-style-type: none"> • Design details to be worked out in interface with Designated Contractor 's design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> • Confirm basic booth size and layout • Furnish equipment size and weight • Furnish equipment mounting details • Confirm room finishes • Furnish requirement of cable trenches, cable routing and cable support provisions • Furnish lighting requirements • Confirm fire safety provisions • Review the design from NGNDD01.

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5	Ticket stock and Audit Room related works: Construction, Lighting arrangement, Power point for one computer, Supply through UPS, Communication line for computer, Earthing facility for computer, Vaults	Design: <ul style="list-style-type: none">• Design details to be worked out in interface with Designated Contractor 's design requirements.	Design: <ul style="list-style-type: none">• Confirm basic size and layout• Confirm room finishes• Furnish requirement of cable trenches, cable routing and cable support provisions• Furnish lighting requirements• Confirm fire safety provisions• Review the design from NGNDD01.
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Interface Specifications of Signalling and Communications Contract

Item No.	Subject	DDC responsibilities	SYS responsibilities
1	Signalling & Telecommunication equipment rooms, UPS, and Station control rooms at stations.	<p>Design:</p> <ul style="list-style-type: none"> • Develop location, room layout with dimensions of Signalling & Telecommunication equipment room, UPS and station control room in relation to the entire station and facilities layout; • Develop routing of Cable ducts / conduits / hangers / trays within and between Signalling, Telecom equipment, UPS and station control rooms. • Furnish details of architectural finishes and building materials of the entire station; • Design details to be worked out in interface with Designated Contractor's design requirements; 	<p>Design:</p> <ul style="list-style-type: none"> • Confirm basic room sizes; • Furnish equipment dimensions, weights and colors. • Furnish equipment foundation/ mounting details; • Confirm room finishes; • Furnish cabling requirements including destinations, sizes, quantities and cable loadings of Cable ducts / conduits / hangers / trays within and between Signalling, Telecom equipment, UPS and station control rooms. • Furnish requirements of cable bores on walls / floor penetrations, complete with pipe, sleeves for routing of all types of cables • Furnish requirements of EMC and fire separation for cabling • Furnish air-conditioning / ventilation, lighting and power socket requirements; • Confirm fire safety provisions; • Review the design from NGNDD01.
2	Cabling infrastructure for Signalling & Telecommunication	<p>Design:</p> <ul style="list-style-type: none"> • Furnish sectional details of /guideways including structure gauge, architectural finishes and building materials; • Furnish details of architectural finishes and building materials of the entire station; • Develop routing of Cable ducts / conduits / hangers / trays for Signalling & Telecommunication cables throughout the 	<p>Design:</p> <p>Trackside:</p> <ul style="list-style-type: none"> • Furnish dimensions, weight minimum bending radius supporting and mounting details of Fibre Optic Cable, Cu- cable, Outdoor / indoor Sigg. & Telephone Cable, Leaky coaxial cable, along each guideways; <p>At Stations:</p> <ul style="list-style-type: none"> • Furnish dimensions, weight minimum bending radius supporting and mounting details of Optic Fibre Cables,

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		<p>station and each guideways</p> <p>Design details to be worked out in interface with Designated Contractor's design requirements.</p>	<p>Cu – cables, Leaky Coaxial Cables, radio antenna feeder cables and cables for Sigg. & Telephones, CCTV, Public Address system, Master clock system, PIDS and UPS power supply / earth distribution</p> <ul style="list-style-type: none"> • Furnish destination of each cable • Confirm size and location of Cable ducts / conduits / hangers / trays for routing Signalling & Telecommunication cables throughout the station including Receiving and Traction Substation and Auxiliary Substations. The cabling shall include, but not be limited to Optic Fibre Cables, Cu- cables, Leaky Coaxial Cables, radio antenna feeder cables and cables for Sigg. & Telephones, CCTV, Public Address system, Master clock system, PIDS and UPS power supply / earth distribution • Confirm size of cross track cable ducts; • Furnish requirements of EMC and fire separation for cabling • Review the design from Project Architect.
3.	Track side Signalling & Train Control Equipments.	<p>Design:</p> <ul style="list-style-type: none"> • Provision of space & fixing arrangements for lineside equipments like signal units, AFTC units, junction boxes, etc. <p>Design details to be worked out in interface with Designated Contractor's design requirements.</p>	<p>Design:</p> <ul style="list-style-type: none"> • Furnish the exact sizes, weight and fixing arrangements of the line side equipments like signal units, AFTC units, junction boxes, etc. • Review the design from Project Architect.
4	Clocks, Public Address System, CCTV cameras,	<p>Design</p> <ul style="list-style-type: none"> • Furnish details of architectural finishes, acoustic treatment and building materials of the 	<p>Design:</p> <ul style="list-style-type: none"> • Furnish weight, dimensions, colours and mounting details of clocks, telephones, Public address loudspeakers, ambient

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	CCTV monitors, , Passenger Information Display Boards, telephones and Radio access units and associated MMIs at stations	<p>entire station;</p> <ul style="list-style-type: none"> Develop locations of CCTV cameras for coverage for station surveillance and platform monitoring using a maximum of 24 cameras at each station Furnish level of lighting (Lux) both normal and emergency in various areas of CCTV coverage Design details to be worked out in interface with Designated Contractor’s design requirements; 	<p>noise sensors, Passenger Information Display Boards, all types of CCTV cameras including housing and associated pan/ tilt / zoom units, CCTV monitors on each platform and in station Control Room;</p> <ul style="list-style-type: none"> Furnish quantities, position and sizes of space cut-outs to the ceiling/ wall finishes for mounting clocks, telephones, Public address loudspeakers, ambient noise sensors, Passenger Information Display Boards, all types of CCTV cameras including housing and associated pan/ tilt / zoom units, CCTV monitors on each platform and in station Control Room; Confirm standard of acoustic treatment of areas of coverage by PAS throughout the station Confirm level of emergency lighting Review the design from NGNDD01.
5	Power supply source (AC single phase / 3 phase)	<p>Design:</p> <ul style="list-style-type: none"> Furnish details of normal and standby power supply for the Train control & Signalling and & Telecommunication installations; <p>Design details of normal and emergency supply to be worked out in interface with Designated Contractor’s design requirements.</p>	<p>Design:</p> <ul style="list-style-type: none"> Furnish details of complete load for Telecommunication and Train control & Signaling installation; Review the design from NGNDD01
6	Train Radio Antenna system	<p>Design:</p> <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor’s design requirements. 	<p>Design:</p> <ul style="list-style-type: none"> Furnish the locations, dimensions & load for Antenna mounting Tower Structure for Train Radio Base Station (s).

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7	Station Control Room	Design: <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor's design requirements; 	Design: <ul style="list-style-type: none"> Furnish weight, dimensions, colours and mounting details of work stations/control panels/ Radio access unit for all Signalling & Telecommunication system and telephones.
8.	Provision of Earthing (1) At station in Signalling & Telecom equipment rooms, Station Control room, UPS/Battery room.	Design: <ul style="list-style-type: none"> Design details to be worked out in interface with Designated Contractor's design requirements; 	Design: <ul style="list-style-type: none"> Furnish requirements for clean earth and main earth Review the design from NGNDD01

Interface between Rolling Stock Contract and NGNDD01 Contracts

These shall include the following but not limited to:

Item No.	Subject	NGNDD01	RS
1	Kinematic Envelope	DDC shall incorporate in his design.	Designated Contractor shall provide the DDC with the Kinematic Envelope.
3	Location of air-conditioners of Cars	DDC shall incorporate in his design as regard to location of Track way exhaust duct.	Designated Contractor shall indicate location of the car air-conditioners vis-à-vis the train.
4	Heat release rate from air-conditioners	DDC shall incorporate in his design.	Designated Contractor shall provide data of heat release rate from the air-conditioners.
5	Heat release rate from brake system	DDC shall incorporate in his design.	Designated Contractor shall provide data of heat release rate

			from the brake system.
6	Train fire and heat release load	DDC shall incorporate in his design.	Designated Contractor shall indicate the fire load of the train
7	Train configuration and specification	DDC shall incorporate in his design.	Designated Contractor shall provide this information as SES input data.
8	Station ambient details	DDC shall provide to RS	Designated Contractor shall take account of this data in his design.
10	Heat release rate from traction and auxiliary equipments and their location	DDC to use data in ECS design	Designated Contractor to furnish data

Earthing & lightning protection to be provided by the DDC to meet the Interface Requirements of Signal & Train Control and Telecom System.

1.0 **Objectives**

Earthing points shall be designed by the DDC and shall be provided by the civil contractor for all the indoor Signalling & Train Control and Telecommunication installations to achieve the following objectives:

1. To provide safety for the operating & maintenance personnel against electric shock on account of any potential (voltage) appearing on exposed equipment or conductive surfaces with respect to earth due to electromagnetic or due to electrostatic induction.
2. To ensure safe & reliable operation of the equipment by limiting or eliminating the induced voltages in the Signalling & Train Control and Telecommunication equipments.
3. To protect equipment against build up of unduly high voltages, which can cause dielectric (Insulation) breakdown or damage to the equipment or their parts?
4. To serve as a common voltage reference point.

2.0 **Policy:**

1. The Earthing system shall meet or exceed the requirements of IEEE 1100, NFPA 780 and IEC 1024 or relevant international standards.
2. Earthing shall be designed by DDC to accomplish the following minimum requirements but not limited to:
 - (a) Protection of personnel and equipment from electrical hazards, including lightning.
 - (b) Reduction in potential to system neutrals.

- (c) Reduction or elimination of the effects of electrostatic and electromagnetic interference arising from within the DMRTS on account of traction voltages, traction return current, rolling stock characteristics and other extraneous sources in the vicinity of Designated Contractor's installations
 - (d) Provision of a proper Earthing method for all equipment enclosures, cabinets, drawers, assemblies and sub-assemblies.
 - (e) Provision of a clean zero-volt reference point where required.
3. The Earthing system shall be so designed by DDC so as to give earth resistance within the stipulated limits (as given below) at all locations and under all climatic conditions.
 4. Any electrical joints in the Earthing system shall be protected from moisture ingress by using proper wrapping, sealing with waterproof tape, or such other approved measures.
 5. For the purpose of measurement of earth resistance, a small interconnecting copper strip of appropriate cross-section shall be provided in the ring earth in a small accessible chamber so that the ring earth can be broken from the loop for testing.
 6. The Earthing methods design and details be submitted to the Employers' Representative for review.

2.1 Stations area (Indoor Equipments):

2.1.1 Clean Earth System:

"Clean Earth system means earth network for the use of particular systems which are not to be subjected to electrical interference from other systems."

There shall be two separate & independent "Clean- Earths", one each for Signalling equipments & Telecom equipments (separate from system earth i.e. main electrical earth bus for other utilities). These earths shall cater for the Signalling & Train Control and Telecom Equipments to be provided inside the equipment rooms at the Station/Control centre. These earths shall be brought inside the equipment rooms using insulated copper conductors & connected to the "Clean-earth terminals" using isolating link. It shall provide full earth, fault protection facilities. A local "Clean- earth" bus shall be set up in side the equipment rooms by running a copper strip. The route chosen for the insulated clean earth conductor shall minimise inductive interference from power-supply cables and the main earth network.

These "Clean-Earths" shall be designed so as to give not more than **0.5 Ohm** resistance in dry condition. The earths shall make use of copper electrodes of appropriate size. The Earthing electrodes for these equipment earths shall be kept at least 20 m away from the "Main-Earth" provided for electrical systems & utilities.

2.1.2 Main Earth:

Apart from these two separate clean earths, one earth point shall also be provided from the "Main-Earth" bus in each of the Signalling & Telecom

equipment rooms, Station Control room (SCR) and UPS/Battery room at the station and Control center. This shall be used as the chassis earth. The value of this earth should not be more than **1.0 Ohm** at any location and under any climatic condition.

NGNDD01: DDC shall design and the Civil contractor shall provide the Earthing pits for clean earths & main earth and shall connect them up to the Earthing terminals inside the rooms as above.

Other Designated Contractor: Designated contractor shall set up Earthing ring bus inside the rooms.

3.0 Out Door Installations:

The following out door installations are required to be earthed:

- i) Metallic sheath & armouring of all main cables at regular intervals.
- ii) Location Boxes.
- iii) Signal posts and screens.
- iv) AFTC tuning units.
- v) Any other installation as may be necessary to cover complete scope of works under Other Designated Contractor

4.0 Guidelines for Transient Protection & Lightning protection:

4.1 General:

- a) Despite the provision of Earthing as specified above, failures of Solid State Electronic equipments do occasionally occur on account of finite earth resistance, particularly high voltage transients and also due to lightning.
- b) Typically, transient & lightning are temporary, and are usually short duration, surge voltages of limited energy. Electronic equipment with high input impedance is inherently more susceptible to transients.

4.1.1 Lightning Protection:

While the Station/Control center above ground structures shall be provided with lightning protection arrangements by DDC the protection against lightning surges traveling through conductors into equipment's side shall be done by the Designated Contractor using appropriate devices in accordance with Designated Contractor's contract document.

Earthing and protective measures in preceding para are given only as indicative guidelines. The Designated Contractors shall interface with each other to ensure the correct & safe working of equipments / sub-system