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Ministry of Infrastructure Development
Department of Urban Development and Building Construction
Urban Resilience and Livability Improvement Project
Project Coordination Office
Babarmahal, Kathmandu

DETAILED PROJECT REPORT
For
PUBLIC SPACE IMPROVEMENT WITH ACCESS ROAD
IN GANGOLIYA
URLIP/TT/CW03

VOLUME – IV: Specification
Project Implementation Unit, Tilottama Municipality

Design Consultant
DOHWA ENGINEERING *in association with*
ERMC (P.) Ltd., SILT Consultants (P.) Ltd., and DIGICON (P.) Ltd.

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TECHNICAL SPECIFICATIONS

FOR

**PUBLIC SPACE IMPROVEMENT WITH ACCESS
ROAD IN GANGOLIYA TILOTTAMA
MUNICIPALITY**

SECTION 1: EMPLOYER'S REQUIREMENT

The employer's requirements given in this section shall be read in conjunction with Technical Specifications and Conditions of Contract.

1.1 SECURITIES AND INSURANCES**1.1.1 Performance Security**

The Contractor shall provide Performance Security in the required amount and currencies from an approved bank/financial institutions in accordance as per the Conditions of Contract.

The Performance Security must be maintained and kept valid for the entire Project Period (duration of construction and thereafter additional 1-Year Defect Liability Period (DLP), or as explicitly instructed by the Engineer. The contractor is responsible for timely renewals of the security if the project period is extended.

Payment for the "Performance Security Bank Commission" shall be reimbursed strictly as per actuals. To claim this reimbursement, the Contractor must submit original, verifiable bank receipts, statements, or invoices demonstrating the exact commission fee charged by the approved bank/financial institution for issuing and maintaining the Performance Security. Payment will be released from the Provisional Sum only upon the thorough verification and approval of these financial documents by the Engineer.

1.1.2 Insurance of Works, Plants and Equipment

The Contractor shall insure the Works and all his plants and equipment against damages and losses with an approved insurance agency/institution as stipulated in the Conditions of Contract. The insurance coverage must remain valid continuously for the entire project construction period and the subsequent Defect Liability Period (DLP) until the final handover of the project.

1.1.3 Insurance of Contractors Workmen and Employees

The Contractor shall insure all his employees and workmen against such liability as stipulated in the Conditions of Contract. This insurance coverage must span the entire project period and the DLP until the final handover of the project. The Contractor is required to submit the original policy document to the Engineer within the stipulated date.

1.1.4 Third Party Insurance Policy

The Contractor shall obtain a Third-Party Insurance Policy as stipulated in the Conditions of Contract from an approved insurance agency/institution in a form acceptable to the Employer. This policy must explicitly cover all legal liabilities arising from the injury or death of any third-party persons/public, as well as any loss or damage to third-party property caused directly or indirectly by the execution of the works. This policy must remain active and valid continuously throughout the entire project period and the Defect Liability Period (DLP) until the final handover of the project.

1.1.5 Insurance of Employer's Personnel

The Contractor shall insure all nominated personnel of the Employer, including the Consultant's personnel, against such liability as stipulated in the Conditions of Contract. This

insurance must cover the entire project period and the DLP until the final handover of the project. The Contractor shall submit the original policy document to the Engineer within the stipulated date.

1.1.6 Measurement and Payment

Only the cost of providing the Insurance Policies as described above shall be paid to the Contractor as a lump sum amount, as provisioned in the Bill of Quantities (BOQ). Payment shall be processed exclusively against the submission of the original insurance policies along with the appropriate premium payment receipts, in a form acceptable to the Employer.

1.1.7 Other Provisional Items

All provisional items in the schedule shall be carried out at the discretion of the Engineer and shall form part of the contract. In case, the provisional items are carried out by the Contractor, the rates shall be settled as for extra items as stated in the conditions of contract.

1.2 SITE SURVEYS, SETTING OUT AND DETAILING.

1.2.1 General Description and Existing Layouts

The Contractor shall be responsible for the true and proper setting-out of the works in relation to the lines and levels of reference given by the Engineer or shown on the Drawings, for the correctness of the position, levels, dimensions, and alignment of all parts of the works, and for the provision of all necessary instruments, appliances, and labor used in connection therewith. The Contractor shall carry out a detailed route alignment survey of the site in advance of the commencement of construction work and supply full details to the Engineer. All setting out and leveling shall be based on permanent Benchmarks provided by the Employer/Engineer.

Before commencing operations on any section of the works, the Contractor shall survey all existing details in that section, in plan and in level, and shall plot the results in such detail and to such scales as shall be to the satisfaction of the Engineer. These survey plots shall be supplied to the Engineer at least four weeks before the intended commencement of construction on the section. Unless otherwise instructed, the detailed survey plots will be supplied in 1:200 scales both as soft and color hard copies.

Horizontal control lines shall be marked out by pegs at intervals of not more than 20m, and the lines traversed with a theodolite by steel band or by any other method acceptable to the Engineer. The alignments established shall be referenced by pegs offset at suitable distances on each side of the horizontal control lines. These offset pegs shall be painted in a conspicuous color. Cross-sections of the existing ground and of the ground after completion of earthworks shall be taken at intervals not exceeding 20m along the horizontal control lines in an approved manner and submitted in both soft and color hard copies.

1.2.2 Verification of Initial Survey Data and Benchmarks

During the period of commencement of works, the Contractor shall resurvey the Base Lines, Traverse Points, and Benchmarks, and confirm the coordinates and levels of the stations. The Contractor shall immediately notify the Engineer of any discrepancies and shall agree with the Engineer on any amended values to be used during the contract, including

replacements for any stations missing from the original survey.

As the work proceeds, the Contractor shall establish, at suitable locations, substantial permanent benchmarks, clear of the works, from which all subsequent setting out and leveling shall be carried out. The locations of the benchmarks shall be agreed upon with the Engineer before they are established. Benchmarks shall be constructed in class 20/20 concrete, with minimum dimensions of 0.3m x 0.3m, the upper surface being approximately 50mm above ground level. A 20mm diameter mild steel rod, not less than 300mm in length, shall be cast into the concrete so that it projects about 10mm above the center of the surface. The concrete surface shall be clearly engraved with the reference number of the benchmark. The coordinates and level of each benchmark shall be determined in meters to 3 decimal places. The Contractor shall check coordinates and levels of benchmarks at monthly intervals and immediately notify the Engineer of any discrepancies. The Contractor shall check, replace, and supplement as necessary the station points and agree on any revised or additional station details with the Engineer. All stations and reference points shall be clearly marked and protected to the satisfaction of the Engineer.

1.2.3 Assistance to the Engineer

The Contractor shall provide the Engineer with all necessary assistance for checking the setting out, agreement of levels, and any other survey or measurement which the Engineer needs to carry out in connection with the contract during the entire period of the contract. Such assistance shall include:

- a) Provision of suitably qualified surveyors to work under the direction of the Engineer as required.
- b) Provision of all necessary support for these surveyors including assistants, chainmen, labor, hand tools, pegs, and materials.
- c) Provision of survey equipment (Precision automatic levels, Total Station/Theodolite, and distomat) as required by the Engineer for survey works.

1.2.4 Working and Shop Drawings

The drawings issued with these Tender Documents are Tender Drawings, prepared to give a comprehensive idea of the works. These may be modified, expanded, or replaced subsequent to the opening of the tender. The finalized drawings, together with any modified drawings signed and made part of the contract, will be called Construction Drawings. Any questions or alterations affecting the requirements shall be submitted in writing to the Engineer for review.

The lines indicated on the Construction Drawings denoting locations of existing utilities or services are approximate. The Contractor must confirm the exact location of the utilities in consultation with relevant authorities and receive approval. The locations, layouts, and scope of works may be altered, and the Contractor shall not be entitled to any claim for such alterations over and above the measured works at tendered rates, except in accordance with the Conditions of Contract.

The Construction Drawings shall be supplemented by working or shop drawings prepared by the Contractor. The Contractor shall prepare alignment survey drawings as part of the working drawings as soon as work commences. Existing ground levels shall be taken at intervals not exceeding 10m. Information related to all existing structures, obstructions, and services must be located in the survey drawing.

Plans of the alignment showing the location of proposed alignments, the width of the right of way, existing services, obstructions, and edges of existing carriageways/pathways shall all be presented in Working Drawings before commencing work. The drawing shall clearly indicate the location of plot boundary walls. The existing services, as determined by site excavation, should also be marked up on these plans.

The shop drawings shall include, but not be limited to:

- a) General layout drawings for equipment and like items as deemed necessary by the Engineer.
- b) Detailed layout drawings of all roads, drainages, and structures to be built.
- c) Specific chainages and information to illustrate in detail the arrangement and integration of the various sections of the works.

All drawings shall be computerized and submitted both in color hard copy and digital data. Working drawings and documents shall be made available in sufficient time to maintain the Programme of Work. Delays due to a lack of approvals for working/shop drawings are the Contractor's risk, and no compensation shall be claimed.

To facilitate this, the Contractor shall employ two (2) Engineers and two (2) AutoCAD Technicians. These staff members shall have not less than five years of experience specifically for the planning and preparation of working drawings, and their qualifications must be approved by the Engineer. The Contractor shall also provide, as part of the site mobilization, the latest model computers and software together with a new A3 size color printer. The Engineer shall have access to this computer. If the Contractor fails to mobilize such staff and equipment, the Engineer reserves the right to mobilize the necessary staff and deduct the cost from any money due to the Contractor.

1.2.5 Approvals of Working Drawings, Materials, and Construction (RFA)

The Contractor shall liaise with the Engineer for the period required for any approval, which shall be a maximum of two weeks.

Procedure for review of drawings: The Engineer shall mark up the drawing in yellow (showing acceptance) and red (showing requirement for revision). The Contractor shall revise the red portions and round them off in green color to demonstrate compliance. On resubmission, the Engineer shall check the revisions and mark them in yellow to approve the drawing. Approved drawings shall be filed for future reference.

Material and Equipment Ordering: The Contractor shall ensure all ordered items can be accommodated in the positions shown. No materials or equipment shall be ordered, nor construction commenced, until approval is obtained. The Contractor is deemed to have a full understanding of the Engineer's design intents. No claim regarding a lack of knowledge will be admissible.

Request for Approvals (RFA) for Materials: The Contractor shall submit RFAs for all materials early in the contract period. The request must comprise the reference to the BoQ item, specification clause, source details, and supplier specifications. The Contractor shall submit samples prior to approval if requested. The Engineer shall generally give

comments/approval within 15 days of RFA submission.

Request for Approval for Construction: The Contractor shall submit an RFA prior to commencing any construction works for specific stretches of roads, drainages, or structures. Each stage of construction shall be approved by the Engineer prior to and after completion. The RFA must be accompanied by a copy of the approved working drawing for that location.

1.2.6 As-Built Drawings

The Contractor shall prepare and submit as-built drawings for approval immediately upon the completion of roads, drainages, and all structures. These shall be developed from the approved working drawings and must show the exact plan, profile, and structural details. The final as Built drawings (after incorporating Engineer-approved corrections) shall be submitted in soft and color hard copies with the final IP or before taking Final Completion Certificate. The as-built drawings must also be included in every monthly progress report and interim payment request submitted by the Contractor.

1.2.7 Soil Investigation and Report

A soil investigation has been undertaken during the Design phase. However, in case additional investigations are required during construction the Contractor shall be advised of such requirement and the Contractor shall promptly carry out such investigations as advised by the Engineer.

1.3 LABORATORY TESTING AND LABORATORY BUILDING

1.3.1 General Requirement and Scope

The Contractor shall provide, equip, and maintain a site laboratory within 25 days after signing the Agreement and maintain it continuously until the Contract period expires. The laboratory shall be established at any one of the sites chosen by the Engineer, where the tests for all relevant sites shall be processed.

- a) The laboratory building and equipment shall be used exclusively for material testing and shall, together with all equipment, samples, and records, be open to inspection by the Engineer during all working hours.
- b) The provision of laboratory facilities on site shall in no way relieve the Contractor of the responsibility for providing additional laboratory space and testing equipment as necessary to control materials at mixing plants and elsewhere to fulfill obligations under the Contract.
- c) The testing of the works by the Engineer in no way absolves the Contractor from their responsibility to carry out their own testing of the quality of works and materials used.
- d) The Contractor shall use an approved material testing laboratory for testing required by these specifications at his cost. An on-site laboratory staffed by qualified personnel may also be provided and used if allowed by the Engineer.
- e) The name and qualifications of independent testing laboratories shall be submitted to Engineer for approval no less than thirty calendar days prior to the date the laboratories are to be used. Once approved, dismissal and replacement of the approved independent testing laboratory shall require written authorization by the Engineer.
- f) The Contractor shall be responsible for the sampling, curing, and transport to the

laboratories of all materials for testing, and all testing costs including laboratory fees, and/or all costs in running the on-site laboratory, i.e., chemicals, reagents, and other test consumables, staff, and utilities.

1.3.2 Utilization of Existing P1 Project Laboratory

The main testing laboratory has been established under the P1 project. The Contractor shall utilize the existing testing machines from the P1 project (such as the Compressive Strength Testing Machine and other equipment's installed) to assure the quality of the materials and works.

1.3.3 Laboratory Building and Facilities

The Contractor shall furnish, equip, keep clean, and maintain a weatherproof laboratory building to the satisfaction of the Engineer.

1.3.4 Ownership

Unless otherwise stated in the contract the ownership of all laboratories and equipment shall revert to the Contractor.

1.3.5 Attendance

The Contractor shall keep the Laboratories in a well maintained, clean and habitable condition until issue of taking over certificate for the completed works. The Contractor shall provide all tools, consumable items for testing and all the assistance as may be required by the Engineer and his staff for measuring and checking the works.

1.3.6 Staffing Requirements

The laboratory shall be adequately staffed by the Contractor with materials technicians and assistants so that no interruption or unnecessary delay occurs to construction activities due to delays in sampling or testing.

- a) *Contractor's Materials Engineer / Senior Lab Technician*: The Contractor shall provide a full-time Senior Lab Technician/Materials Engineer responsible for the day-to-day activities of the laboratory and for site testing. This individual shall have not less than five years of experience in a soil test laboratory (including the testing of earthworks and concrete for structures) and shall be fully conversant with the testing of materials as per the latest Indian Standards. The CV, detailing experience and qualifications, must be submitted to the Engineer for approval. They shall report directly and solely to the Engineer or designated staff.
- b) *Lab Assistant*: The Contractor shall provide at least one qualified Lab Assistant to support testing operations.

1.3.7 Equipment and Field Apparatus

The Contractor shall independently provide all necessary field-testing apparatus in working condition, along with the materials required for tests.

At the commencement of the Contract, the Contractor shall submit a detailed list of the equipment proposed for provision, showing each item's type, model, serial number, manufacturer's name, and year of manufacture for the Engineer's approval.

List of Equipment's Required

S. N	Description	Quantity	Unit
A	General		
1	Weigh Balance		
i	Platform balance 300 kg	1	Set
ii	Electronic Balance Model CH30R11 30kgx5gm OHAUS or Equivalent	1	Set
iii	Electronic Balance Model CH30R11 20 kg0.5gm OHAUS or Equivalent	1	Set
iv	Electronic Balance Model CT6000 Capacity 6010x0.5gm OHAUS or Equivalent	1	Set
v	Electronic Balance Model NDB110 Capacity 2100x0.1gm OHAUS or Equivalent	1	Set
2	Waterbath Serological 2 rack electric as per IS 6593	1	Set
3	Thermometer		
i	Mercury Thermometer 250 ⁰ C	2	Set
ii	Dial Thermometer 400 ⁰ C	2	Set
iii	Gun Thermometer 250 ⁰ C	2	Set
iv	Mercury Thermometer 50 ⁰ C	2	Set
v	Wet and Dry Thermometer	1	Set
4	Stopwatch 1/5 sec Accuracy	1	Set
5	Glassware: Containers and small tools including		
6	Enamel Coated GI Trays		
i	300x300x75	6	Set
ii	400x400x75	6	Set
iii	600x600x75	6	Set
7	Aluminum Moisture Container 75x50mm	50	Set
8	Rubber Mallet	1	Set
9	Aggregate Steel Scoop (690*300*100mm)	2	Set
10	Aluminium Scoop (125*200*75mm)	1	Set
11	Guaging Trowel	2	Set
12	S.S Bowlb 2 Lit	2	Set
13	Volumetric Flasks		
	1000ml	2	Set
	500ml	2	Set
	250ml	2	Set
14	Measuring Cylinders		
	1000ml	2	Set
	500ml	2	Set
	250ml	2	Set
15	Beakers		
	1000ml	2	Set
	500ml	2	Set
	250ml	3	Set
16	Vernier Caliper 150mm	1	Set

S. N	Description	Quantity	Unit
17	Steel Ruler 300mm	1	Set
18	Pairs of heat resistant Aesbestos handgloves	4	Set
19	Set of sampling tools all materials	1	Set
20	Set of crowbars, pick and spade	2	Set
21	GI Sieve 450mm dia Size per IS 462 with lid and pan		
	75 mm	1	Set
	63 mm	1	Set
	50 mm	1	Set
	45mm	1	set
	37.50 mm	1	Set
	31.50 mm	1	Set
	26.5 mm	1	Set
	22.4mm	1	Set
	20 mm	1	Set
	19 mm	1	Set
	13.2 mm	1	Set
	12.50 mm	1	Set
	9.50 mm	1	Set
	6.30 mm	1	Set
	5.6 mm	1	set
	4.75 mm	1	Set
	Lid and pan set	1	Set
22	Brass Sieve 200mm dia Size(IS460 or BS 410)		
	4.75 mm	1	Set
	2.80 mm	1	Set
	2.36 mm	1	Set
	2.00 mm	1	Set
	1.18 mm	1	Set
	600 micro	1	Set
	425 micro	1	Set
	300 micro	1	Set
	150 micro	1	Set
	0.71 micro	1	Set
	0.09 micron	1	Set
	0.075 micron	1	Set
	Lid and pan set	1	Set
23	Specific Gravity Bottle 100ml	2	Set
24	Steel Bowl 750ml	5	pic.
B	Soil Test & Aggregate Test (Soil,sub-Base,Base)		
1	Organic Content testing kit (set)	1	Set
2	Sodium Sulfate	5	kg

S. N	Description	Quantity	Unit
3	Modified AASHTO Compaction apparatus as per IS 2720 (part8) or heavy compaction, complete with collar, base plate and hammer with all other accessories	1	Set
i	Compaction Mould 150mm	1	Set
ii	Sample Splitters (Riffle boxes) 50 mm	1	Set
iii	Scraper Tool	1	no
4	Liquid limit & Plastic Limit device with grooving tools As Per IS 2720	1	Set
i	Glass Plate 400x600x6mm	1	Set
ii	Spatulas 200mm	1	Set
iii	Evaporating Disc 150mm	1	Set
5	Sand Pouring Apparatus 150mm AS Per IS 2720 part 28	1	Set
i	Standard sand(Zone I,II,III)	9	Bags
i	Wash Bottle	2	Set
6	CBR Test Apparatus With Proving ring 10kn & 25kn as per IS 2720 part 16, electrically operated with speed control with all complete accessories	1	Set
i	Dial gauges 25 mm travel 0.01 mm/ division	1	Set
ii	Annular Weight 2.5kg	1	Set
iii	Central Hole Weight 2.5kg	1	Set
iv	CBR Mould 150mm	9	Set
v	Perforated Plate Brass	1	Set
vi	Spacer Disc	1	Set
vii	Tripod	1	Set
viii	Rammer 4.89 kg	1	Set
7	Sand equivalent test set, complete with graduate plastic cylinder, manual or mechanical shaker and stock solution IS 2720 Part 37	1	Set
8	Filter Paper(150mm Dia)	10	pkt.
C	Cement & Concrete Test		
1	Slump Test Apparatus BS 1881 Part 102	2	Set
2	Cube Mould 150mm	24	Set
3	MortarCube Mould 70.7 mm	24	Set
4	Light weight Hammer Test	1	Set
5	Rubber Hammer For Concrete cube Moulding	6	Set
6	Tool kit Box (195*240*435)Stainless Steel Materials Made including 6-22mm combination set 12 inch.sliding wrench 8 inch plier 5*6 screw driver,allen key set and other necessary accessories all complete set	1	Set
D	Bitumen & Asphalt Test		
1	Standared spray trays For Tray test Prime & Tack Coat	12	Set
2	Camber board and spirit level	1	Set

The list of equipment might be added or modified as per field condition and as per Employer/Engineer's instruction.

1.3.8 Testing Procedures and Standards

The Contractor shall arrange and carry out the tests of materials to be used in the Works or any other tests deemed necessary by the Engineer.

- a) *Standards*: All tests shall be performed in strict accordance with the appropriate NS, IS or other standards as approved by the Engineer.
- b) *External Testing*: Tests that cannot be carried out at the site laboratory or the P1 laboratory must be done in a recognized and well-established external laboratory approved by the Engineer. If external testing is required, the Contractor must obtain approval for the external laboratory within 15 days of the commencement of the Contract.

1.3.9 Samples and Approvals

The Contractor shall submit samples of all materials and goods for inclusion in the works to the Engineer promptly to avoid delays. Only materials approved by the Engineer and meeting the specified standards may be ordered for supply.

All executed work shall be of equal standard in all respects to the approved samples. The Engineer retains the right to reject any work that does not comply with the approved samples.

1.3.10 Third party Inspection

The contractor shall carry out the third-party inspection for the materials export from others country than Nepal like Bitumen, any other materials like tensile shed roofing materials, electrical items, etc.

1.3.11 Measurement and Payment

Payment and cost allocations for the site laboratory and testing shall be handled as follows:

- a) *Bill of Quantities (BoQ) Payments*: Payment under the BoQ is strictly limited to the rental fee for the site lab office, the remuneration for one Senior Lab Technician, one Lab Assistant, and the depreciation cost for field-testing apparatus and equipment. Payment for these specified provisions will be made proportionately based on the progress of the work.
- b) *Contractor's Costs*: All other costs shall be borne entirely by the Contractor, including but not limited to:
- c) The operation and maintenance (excluding BoQ-covered depreciation) of all field-testing apparatus and equipment.
- d) Transporting testing materials and samples from any site to the laboratory.
- e) Any external testing required at independent laboratories (unless explicitly stated otherwise in the BoQ).
- f) Additional testing facilities or space required at mixing plants.
- g) Demobilization and site reinstatement upon project completion

1.4 ACCOMMODATION OF PUBLIC ACCESS, TRAFFIC AND SITE SAFETY

1.4.1 Scope

This Clause covers the construction and maintenance of the necessary detours, diversions, temporary pathways, barricades, and signs, and everything necessary for the safe and easy passage of all public traffic (including pedestrians, park visitors, and local vehicular traffic)

during the construction period, as well as the removal of diversions as they become redundant, including bringing the area back to its original condition.

The Contractor shall take all necessary precautions regarding safety at the construction site. The Contractor shall strictly adhere to the stipulations of the latest applicable national safety codes, including the "SAFETY AT ROAD WORKS: A Code of Practice for Signing at Road Works" published by the Department of Roads, adapting these guidelines as necessary to ensure strict pedestrian and visitor safety within the construction area.

1.4.2 General Requirements

The Contractor shall always carry out works within the river corridor in a manner creating the least possible interference to the flow of pedestrian and vehicular traffic. For all works involving improvements to existing trails, access roads, or public areas, the Contractor shall provide and maintain a passage for users either along a part of the existing route under improvement, or along a temporary diversion constructed close to the worksite. The Contractor shall take prior approval from the Engineer regarding access arrangements during construction.

The Contractor may be allowed to stop access temporarily for safety critical works. The period of such closure shall be as agreed by the Engineer at least 14 days in advance, to enable the Engineer to issue the relevant public notices.

1.4.3 Temporary Diversions

1.4.3.1 Provisions of Diversions

Where some portions of the existing road cannot be used by through traffic, diversions as may be required to deviate traffic from such portions shall be constructed.

1.4.3.2 Survey Beacons and Monuments

Diversions shall be constructed so as not to damage or displace trigonometrical survey beacons and road monuments. In exceptional cases where this is not possible, arrangements shall be made to have survey beacons suitably referenced before they are displaced and relocated after the completion of the work.

1.4.3.3 Access to Properties

Access to properties which fall within or adjoining the area over which work is being carried out shall be provided in the manner as existed before the start of the work.

1.4.3.4 Temporary Works

If diversions are provided, they shall include the construction of temporary gates, grid gates, fences, drainage works, and other incidentals considered necessary.

1.4.3.5 Public Services

Arrangements shall be made for the continuity of all public services such as power lines, telephonelines, water mains, sewerage, drainage etc., if the existing services are likely to be affected.

1.4.3.6 Width of Diversions

The usable width for accommodation of two-way traffic shall not be less than 6m. Where diversions

consist of two separate one-way lanes the minimum usable width of each lane shall not be less than 3.5m.

1.4.3.7 Temporary Drainage Works

All necessary temporary drainage works required for proper surface run-off, such as side drains, catchwater drains, temporary cross-drainage structures, etc. shall be constructed.

1.4.3.8 Earthworks for Diversion

Diversion shall be shaped and graded making full use of all material that can be sufficient material cannot be obtained in this manner; material shall be imported from other sources.

Where necessary, cutting shall be made to obtain a satisfactory vertical alignment. All necessary clearing including the removal of all trees and stumps shall be performed.

1.4.3.9 Maintenance of Diversions

All diversion shall be maintained in a safe and smooth trafficable condition. Whenever required the diversions shall be bladed by means of graders to provide a smooth riding surface free of corrugations. All potholes shall be promptly repaired. Diversions shall be watered to keep down dust from traffic and in order to facilitate the proper blading of the surface. All drainage works shall be maintained in good working condition and kept unblocked.

1.4.3.10 Removal of Diversions

When traffic is routed permanently onto the new road following the completion of construction, the diversions which are no longer required shall be removed and the ground reinstated to its original condition.

1.4.4 Accommodation of Traffic Where the Route is Constructed in Half Widths

Whereby reason of difficult terrain or for any other reason, the construction of diversions is not possible, the pathway or access road shall be constructed in half widths at a time. The lengths of the half width for construction shall be kept to a minimum, with a provision for users traveling in opposite directions to pass at frequent intervals. The works in one half width of the route shall be so arranged that the public will have free one-way movement in the other half during the construction period. That half of the route which is being used by the public shall be maintained free of tripping hazards, corrugations, and potholes.

The Contractor shall ensure that the route is open and safe for users at night as per the approval of the Engineer. Should the route not be in a safe condition for two-way passage over the whole width at the end of each day's work, the Contractor shall provide adequate flagmen, signs, barriers, and lighting at his own cost to ensure a reasonably free flow of access alternately in each direction. Materials and equipment stored on, or adjacent to the existing route shall be so placed, and the work at all times shall be so conducted, as to cause no obstruction or hazard to the traveling public.

1.4.5 Public Safety and Control

The Contractor shall provide, erect, and maintain such barricades, including signs, markings, flags, lights, and flagmen as may be required for the information and protection of the public approaching or passing through the section of the corridor under development. Barricades, signs, and warning boards shall be provided in accordance with the relevant local codes and

the Traffic Signs Manual published by the Department of Roads, adapted appropriately for pedestrian park environments.

The barricades erected on either side of the construction zones close to the movement of the public shall be of strong design to resist violation and clearly marked. On all approaches, suitable regulatory and/or warning signs shall be installed for the guidance of park users and vehicles. On each approach, at least two signs shall be placed.

Where applicable, steel or heavy-duty plastic drums may also be placed. These drums shall be clearly visible, painted or sandblasted, and provided with retro-reflective tape strips (red on the left-hand side facing oncoming traffic and white on the right-hand side as appropriate). The minimum size of these tapes shall be 0.01 sq. m. The drums shall be maintained in a clean and effective condition, and no stones or unapproved warning devices shall be placed on top of them.

1.4.6 Measurement and Payment

Unless stated otherwise, no separate measurement and/or payment shall be made for all materials and works required under this Clause. All costs in connection with the work specified herein shall be included within other related items of the work in the Bill of Quantities (BoQ).

1.5 SITESAFETYANDUTILITIES

1.5.1 SiteSafety

The Contractor shall ensure that the works are carried out in a safe manner, according to internationally accepted guidelines on safe working procedures and to the satisfaction of the Engineer.

To guarantee public safety from and around the work, the Contractor is responsible for the complete implementation of Occupational Health and Safety Measures (OHS) including Personal Protective Equipment (PPE) at Construction Sites, and the provision of a First aid box and fire extinguisher at camp sites as per the instruction of the Engineer (covering Campsite, Storage Site, and Construction Sites).

Protective Clothing and Equipment: The Contractor shall ensure that all personnel working on site are supplied with the necessary protective clothing such as safety helmets, goggles, face masks, earmuffs, gloves, and boots, depending on the operations being performed. Throughout the period of the Contract, the Contractor shall provide safety helmets and high reflectivity jackets to all Consultant's/client staff and visitors.

Pedestrian and Structural Safety: While excavating roadside drainage along the road, sufficiently strong and wide timber bridges or iron bridges shall be provided for pedestrian or house members crossings. Suitable and sufficient scaffolds shall be provided and properly maintained for all work that cannot safely be carried out from the ground or from part of the structure or from a ladder.

Road Serviceability: The Contractor shall carry out maintenance of the existing road to keep the road serviceable throughout the contract period as per specification and instruction of the Engineer.

1.5.2 Traffic Management

1.5.2.1 Scope

This Clause covers the construction and maintenance of the necessary detours and diversions, barricades and signs, and everything necessary for the safe and easy passage of all public traffic during the construction period and also the removal of diversions as they become redundant including bringing up the area use into its original condition.

The Contractor shall take precaution regarding safety at road works. The Contractor shall strictly adhere to the stipulations of the latest publication of the document "SAFETY AT ROAD WORKS: A Code of Practice for Signing at Road works" published by the Traffic Engineering and Safety Unit of the Organization and management responsibility.

1.5.2.2 General Requirements

The Contractor shall at all times carry out work on the road in a manner creating least interference to the flow of traffic. For all works involving improvements of the existing road, the Contractor shall provide and maintain a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the road. The Contractor shall take prior approval of the Engineer regarding traffic arrangements during construction.

The Contractor may be allowed to stop traffic temporarily. The period of such closure shall be as agreed by the Engineer at least 14 days in advance, to enable the Engineer to issue the relevant notices.

1.5.2.3 Temporary Diversions

1.5.2.3.1 Accommodation of Traffic Where the Road is Constructed in Half Widths

Whereby reason of difficult terrain or for any other reason, the construction of diversions is not possible, the road shall be constructed at the time. The lengths of the half width for construction shall be kept to a minimum, with a provision for traffic traveling in opposite directions to pass at frequent intervals. The works in one half width of the road shall be so arranged that the traffic will have free one-way movement in another half during construction period. That half of the road which is being used for traffic, shall be maintained free of corrugations and potholes.

Contractor shall ensure that the road is open for the traffic at night as per approval of engineer. Should the road not be in a safe trafficable condition for two-way traffic over the whole width, at the end of each day's work the Contractor shall adequate flagmen, signs, barriers, and the necessary staff at his own cost to ensure a reasonable free flow of traffic alternately in each direction.

Materials and equipment stored on, or adjacent to the existing roadway shall be so placed

and the work at all times shall be so conducted, as to cause no obstruction of the traveling public and traffic.

1.5.2.4 Traffic Safety and Control

The Contractor shall provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic approaching to or passing through the section of the road under improvement and/or diversions. Barricades, traffic signs and warning boards shall be provided as per the Traffic Signs Manual (Latest Publication) published by the concerned Unit of the Department of Roads.

The barricades erected on either side of the carriageway/portion of the carriageway close to movement of traffic, shall be of strong design to resist violation, and be painted as per the said Traffic Sign Manual. On both sides, suitable regulatory and/or warning signs shall be installed for the guidance of the road users. On each approach, at least two signs shall be put. The location of these signs shall be in accordance with the Code of Practice published by the Department of Roads (Latest Publication).

In some locations steel drums may also be placed. These drums shall be white-washed, blasted with sand and provided with retro reflective tape strips, red on the left hand side facing

oncoming traffic and white on the right hand side as appropriate. The minimum size of these tapes shall be 0.01 sq. m. The drums shall be maintained in a clean and effective condition and no stones or any other warning devices shall be placed on top of the drums.

In order to improve the general vehicular traffic condition and minimize the scale and extent of disruption to public and commercial life, the Contractor shall provide all labour and materials to construct and maintain temporary traffic diversions throughout the construction activities. Plans for traffic diversion shall always be submitted to the Engineer and to the traffic police for their prior approval.

Traffic Control Devices and Barriers: The Contractor shall supply and provide temporary placement of Standard Traffic Cones with necessary ropes/ribbon for repetitive use within the site including multiple handling and transportation and standard Traffic Control Device for repetitive use within the site including handling and transportation during construction period from one stretch/gang to another for total mentioned gang by maintaining spacing of barriers not more than 1.5m c/c. The quoted rate includes relocating and reusing above mentioned facilities at any location within the project area.

Deployment of Manpower: Barriers must be provided to all excavations for the safety of the public. The Contractor is strictly responsible for providing and deploying required manpowers for diverting and controlling traffic (1 md = 8 working hours). Flagmen must be used for all items of plant for the safety of the operatives, supervision staff, and members of the public.

Public Notification: Sufficient written notice shall be given by the contractor to the residents who may be affected by the excavation. To facilitate this, the Contractor is responsible for printing brochures in Nepali for public information as per Traffic Management Plan and instructed by the Engineer (paper size A4) and distributing to the people.

1.5.2.4.1 Contents of a Typical Traffic Management Plan

The Traffic Management Plan proposed by the contractor shall, as a minimum, include the following:
In case of traffic restriction only:

- Drawing showing the extent of road stretch proposed to be worked on, with flow direction width of carriageway.
- Drawing showing proposed layout of road restriction together with trench width and access across RCC drain trench.
- Drawing showing sequence of activities: excavation, PCC work, form work, concreting, cube sampling, testing, and backfilling together with dates
- Drawing showing locations of traffic signs alerting traffic restrictions In case of traffic closure:
- Drawing showing extent of road stretch being closed.
- Drawing showing the roads along which traffic would be diverted.
- Drawing showing locations of traffic signs alerting traffic about diversion.
- Refer Condition of Contract for detail Traffic Management plan requirement.

1.5.3 Measurement and Payment

Unless stated otherwise, no separate measurement and/or payments shall be made for all materials and works required under this Clause. All costs in connection with the work specified herein shall be included with other related items of the work in the Bill of Quantities.

1.5.4 Utility Services

1.5.4.1 Contractor to establish location of Utilities.

Before the Contractor proceeds with the Works in any given area, he is required to establish the precise location of all services in that area. Existing service plans as provided in the drawing volume are only approximate and may not be taken as an accurate indication of the positions of all services. The contractor will therefore be required, acting in strict co-operation with the Engineer, Municipality, and other concerned authorities, to open up hand excavations at points to be agreed in order to establish the precise location of the existing services. The asphalt or concrete pavement needs to be cut with asphalt cutting machinery or concrete cutting machinery prior to deepening the trench.

1.5.4.2 Making allowance in Work Programme for location of utilities

The Contractor is required to make adequate allowance in his programming for this process and may be required to adapt his programme to accommodate the service protection and/or relocation works ordered as a result of these investigations. Within this programming, the Contractor shall also provide payment for easements on the relocation of government properties such as boundary walls, Chautara, and other government assets as per the instruction of the Engineer.

1.5.4.3 Shifting of utilities

The utilities, especially house connections, drainage, and sewers, may have to be dismantled and reinstated during the construction of road works. In such cases, the contractor will make arrangements for temporarily discontinuing the house connection or sewer line and make alternative arrangements for collecting and disposing of sewage from

the blocked inspection chamber/manhole. In certain cases, the house connections or sewers shall have to be dismantled to enable the construction of the road and shall be reinstated later. The contractor is responsible for the provision of supplying, laying, leveling, and jointing of water supply pipes, cutting existing water lines, and the dismantling and reinstatement of the line to its initial state using suitable materials and sizes. This complete work includes dismantling, cleaning of the area, temporary closure, and providing all new fittings (Tee, Elbow, Bends, Sockets, Nipples, Flange Sets, Unions, Valves, etc.) and required pipe pieces as instructed by the Engineer, encompassing all costs of labour, materials, tools, equipment, and all lead and lift.

The utilities such as power cables and telecom cables shall be protected at site by the contractor during excavation. Provisions are made for payment to statutory authorities for repairing accidental damages or breakages to telecommunication, optical fiber, and communication utilities during construction, which are reimbursable as per actuals.

For power utilities, the scope includes the provision for the supply, erection, and commissioning of 11 m long PSC poles, complete with all necessary accessories and insulators; installation of XLPE (covered) conductors, pin insulators, and associated line materials; and the construction of a 4-wire 400V LV line on PSC poles. This includes the dismantling of existing utilities, Low Tension (LT), and High Tension (HT) wires. Existing poles that meet standard size and condition requirements shall be relocated and realigned at the proposed site. All remaining, unusable, or surplus dismantled materials shall be transported and handed over to the Nepal Electricity Authority's (NEA) designated storage facility.

1.5.5 Access To Abutting Properties

For the duration of the works the Contractor shall at all times provide convenient access to paths, steps, bridges or drives for all entrances to property abutting the site and maintain them clean, tidy, and free from mud or objectionable matter.

1.6 PROVISION OF TEMPORARY FACILITIES

1.6.1 Temporary Diversions of Utilities

If in the opinion of the Contractor it is necessary to make temporary diversions of services in connection with the Works, the Contractor shall arrange with the relevant authority for the construction of diversions.

The Contractor may at his own cost and subject to the approval of the authority concerned, make such temporary diversions as may facilitate the carrying out of the Works. These temporary diversions shall be reinstated to the full satisfaction of the Engineer and the relevant authority on completion of the Works.

1.6.2 Detours and Traffic Control

The Contractor shall program his work in such a way that, wherever the temporary closure of street sections to public thoroughfare cannot be avoided, the duration of traffic diversion can be kept as short as possible. No streets shall be closed, and no detours shall be introduced, and no traffic diverted until the Contractor's proposals have been approved by the

Engineer and the appropriate Government authorities, such as the Department of Roads.

Where work is to be carried out in public roads, the Contractor shall give notice to the Engineer sufficiently in advance of the date on which he wishes to commence such work.

The Contractor shall be responsible for obtaining the permission of the Engineer, Road Department and the Police for activities he intends to carry out in public roads. Two copies of the Contractor's proposals to the relevant authorities shall be submitted to the Engineer. One copy of all obtained approvals shall be submitted to the Engineer.

The Contractor's attention is drawn to the fact that processing of the documentation required by the local authorities prior to the cutting of existing public road takes approximately 30 days. During the Monsoon period (June to August) no road cuttings are normally allowed.

Detours shall be selected in such a way that the inconvenience to the affected traffic as well as to the inhabitants of the affected area is kept to a minimum.

The Contractor shall furnish, install and maintain at all times during the execution of the Works all necessary traffic signs, barricades, lights, signals and other traffic control devices, including flagging and other means of guiding traffic through the work zone. Traffic control shall be managed in accordance with prevailing rules and regulations, and with the approval and to the satisfaction of the Engineer.

All devices mentioned above shall be in conformity with the requirements of the Roads Department. All traffic signs and control devices to be furnished and installed by the Contractor shall be approved by the Engineer for their location, position, visibility, adequacy and manner of use under specific job conditions.

All traffic control devices necessary for the initial stage of construction shall be properly placed and operational before any construction is allowed to start. When work of a progressive nature is involved, the necessary signs shall be removed concurrently where they are needed. If the Engineer determines that proper provisions for safe traffic control are not being provided or maintained, he may restrict construction operations affected by such defective signs or devices until such provisions are established or maintained or may altogether order suspension of the Work until a proper traffic control is achieved. In case of serious or willful disregard by the Contractor of the safety of the public or his employees, the Engineer may take necessary steps to rectify the situation and deduct the cost thereof from monies due or becoming due to the Contractor. The Contractor shall be responsible for all resulting delays.

The Contractor shall designate or otherwise employ personnel to furnish continuous surveillance of the traffic control operations. The designated personnel shall be available day and night to respond to calls involving damage due to vandalism or traffic accidents. At sections where traffic is in operation and when ordered by the Engineer, the movements of the Contractor's equipment from one place of work to another shall be subject to traffic control. During rush hours movement of larger vehicles, such as trucks, cranes, dumpers, etc.

through main thoroughfare are not permitted by the police. Spillage resulting from hauling operations along or across the roadway shall be removed immediately at the Contractor's expense.

The cost of detours and traffic control is deemed to be included in the rates for road reinstatement.

1.6.3 Provision of Temporary Services

When the execution of the Works requires the temporary disconnection of existing public utilities, the Contractor shall provide the affected users with temporary services in at least the same standard as the original services.

For water supply he may install temporary lines or arrange for regular supply by tankers. The amount of water to be provided for the interruption period for a specific area shall be

assessed by the Contractor. The Contractor shall submit to the Engineer, for its approval, the recommended volume of water to be provided.

When forced to disconnect existing sewers the Contractor shall install temporary pipes of adequate size to carry off sewage from any private sewer facilities cut off by construction work. Connections to temporary pipes shall be made immediately by the Contractor upon cutting off the existing facility. No sewage shall be allowed to flow from any severed facility upon the ground surface or into the trench excavation. Pipes used in temporary sewers may be plastic or approved flexible material.

When the Contractor is forced to disconnect power or telephone connections the relevant authority shall be provided temporary connections at the Contractor's expense.

Upon completion of work the Contractor shall replace all severed connections, with the assistance of the concerned authority where necessary, and restore to operating order the existing facilities.

1.6.4 Protection of Adjoining Property

1.6.4.1 Land

The Contractor shall control the movement of his crews and equipment on the working easement including access routes approved by the Engineer so as to minimize damage to crops and

property and shall endeavor to avoid marring the lands. Ruts and scars shall be obliterated and damage to land shall be corrected, and the land shall be restored as closely as possible to its original conditions before final taking-over of the Works.

The Contractor shall be responsible directly to the tenant / land owner for any excessive or avoidable damage to crops or lands resulting from his operations whether on lands adjacent to right-of-way or on approved access road and deductions will be made from payment due to the Contractor to cover the amount of such excessive or avoidable damage if adequate compensation is not paid by the Contractor, in the opinion of the Engineer.

1.6.4.2 Buildings and other Structures

The Contractor shall be responsible and take all measures in order to protect adjoining property including buildings, electrical and telephone poles, bridges and culverts,

retaining walls, compound walls and fences, and other structures. Prior to the commencement of the activities, the Contractor shall assess the probability and extent of unavoidable damages, if any, to the building and properties and submit his assessment to the Engineer. The Engineer may make his own opinion and if required may order arrangements for protection or repair of such likely unavoidable damage in which event the Contractor shall complete the activities.

1.6.5 Reinstatement Upon Completion

Temporary facilities shall be provided by the Contractor, only for as long as required after which he shall dismantle and remove the same from their place of use as speedily as possible. Re-usable components shall be safely stored by the Contractor in his yard. The place of use shall be cleared and reinstated immediately to at least the condition existing before the temporary facilities were provided, and to the satisfaction of the Engineer.

1.6.6 Measurement and Payment

All temporary diversions of utilities and temporary services required for execution of the work shall be deemed to be included in other items of the BOQ and shall not be separately paid.

1.7 COORDINATION WITH OTHER AUTHORITIES

1.7.1 Statutory Services

As far as possible the Contractor shall acquaint himself with the actual location of all existing public utilities such as sewers, water mains, drains, cables for electricity, telephone lines, lighting poles, masts, etc., before commencing any activities likely to affect the existing utilities. The Contractor shall with the assistance of the Employer obtain such information directly from the responsible authorities as early as possible.

1.7.2 Notices, Permits

Well in advance of the programmed start of any work which may affect traffic or any existing utilities the Contractor shall give advance notice to the respective authority indicating the type, the exact location, the programmed starting time and the expected duration of the activities and shall provide whatever particulars may be required by the authorities to issue any required permits and make all necessary arrangements. The Employer will provide whatever assistance possible to the Contractor to facilitate the permit procedure which, however, will remain the sole responsibility of the Contractor.

1.7.3 Witnessing and Post-Construction Clearances

It is expected that the issue of these permits will be tied to the requirement that the work may only be carried out in the presence of authorized inspectors from the authorities concerned. Their job will be to witness and assess any damage or interference with their respective utility. Should such disturbances occur, it will be at their discretion to authorize either the Contractor to correct them or to arrange for specialized repairs through their own personnel.

The Contractor shall be fully responsible for all costs whatever resulting from avoidable damages or for

interference with other utilities.

As proof that the activities in question have been completed to the satisfaction of the authorities concerned, the Contractor shall submit to the Engineer upon request official post-construction clearances issued by the respective authorities.

1.7.4 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required. All the cost associated with this clause is deemed to be included in the item rates of the Bill of Quantities.

1.8 OTHER REQUIREMENTS

1.8.1 Co-operation

The Contractor shall establish full co-ordination with the officials of PIU, municipality and the Consultants and extend co-operation to complete work.

1.8.2 Records procedures and reports

A work order book shall be maintained by the contractor at site/workshop for taking instructions from Employer/Engineer or his representative. The Contractor shall maintain records pertaining to the quality of installation/erection work and inspection, testing, compliance with all technical requirements in respect of this entire work as described before. The Contractor shall submit such records to the Employer/Engineer after the completion of any particular work before submitting the bill. All such records shall be as verified and approved by the Engineer.

1.8.3 Personnel

The contractor shall depute sufficient staff to carry out construction, installation, the maintenance, and repair work efficiently and satisfactorily. In case of Joint Venture, the Lead Partner shall deploy suitably qualified and experienced Contractor's representative besides not less than two key professionals responsible to perform overall contractual obligations including but not limiting to project planning, management, and resource mobilization on behalf of the contractor.

The Contractor shall undertake to comply with applicable legislation and the code of labour law

on matters of health, hygiene and safety, and shall assume responsibility for works required in the event of any change in applicable regulations. The contractor shall provide all necessary superintendence during the execution of works and during maintenance. The Contractor's staff shall include adequate and competent persons with proven suitable, previous experience on similar contracts to supervise the works and sufficient skilled, semi-skilled and unskilled labour to ensure completion of works in time. The Contractor shall not remove any representative or skilled labour from the site without prior approval of the Engineer for the proper fulfilling of the contractor's obligations under the contract. The contractor or a competent and authorized agent or representative approved in writing by Employer based on qualification and experience to be furnished by the contractor, which approval may at any time be withdrawn, is to be constantly on the works and shall give his whole time to the superintendence of the work.

The contractor must demonstrate it shall deploy at site the Key personnel having the required qualifications.

1.8.4 Public Authorities

The Contractor shall comply with all rules & regulations, bye laws and directives given from time to time by any local or public authority in connection with this work and shall himself pay fees or charges which are leviable on him without any extra cost.

1.8.5 Safety of Materials Supplied to Site

The Contractor will be responsible for safety of the material supplied and kept in joint custody of the employer and the contractor till completion of contract. The Contractor shall at his own expense arrange for the safety of his labour / supervisor staff employed by him directly or indirectly for performing the work, as per statutory requirement. The Contractor shall report any accident or unusual occurrence with the work at site that takes place to employer immediately with the action, which he might have taken.

1.8.6 Acquaintance with Site and Work Conditions

The Bidder shall study the site and general conditions in respect of approaches, labourers, climate and the data included in the tender documents and get it verified with actual inspections of the site, before submitting the tender. In case of doubt about any item or data included in the tender, the same shall be got clarified in pre-bid meeting. Once the tender is accepted, it shall be concluded that the Contractor has verified and made himself conversant with all the details required for completing the work as stipulated conditions and specifications.

1.8.7 Project Information Boards

The Contractor shall provide and install a project information board at an approved location, strictly following the instructions of the Consultant's Site Engineer. The board shall measure 1.80 m x 1.2 m and consist of a 5mm thick zinc-coated steel plate fixed to a MS pipe frame. It must be securely mounted with appropriate foundation, with the installation encompassing all necessary site works, including excavation, concreting for the post foundations, and backfilling, all complete. Furthermore, the board shall be painted in an approved color and prominently display the details of the contract in the exact format and wording directed by the Engineer. This displayed information must explicitly include the proposed construction works and details of the Employer, the Implementing Agency, the Contractor, the Consultant, and any other project information as directed by the Consultant Engineer. All costs associated with the provision, installation, and related site works for these boards shall be covered and paid as per the respective item amount placed in the Bill of Quantities (BoQ).

1.8.8 Programme of works

- a) In respect of the programme of works required under Clause 35 of the General Conditions of Contract the following specific requirements shall apply: -
- b) The Work Programme shall be prepared using software such as MS. Project or Primavera.
- c) The programme shall state the sequencing of work, the interrelationship between elements of work, time taken for completion of different elements of work; it will also show the histograms of plant and equipment and personnel

- d) The works shall be programmed in such a way as to minimize disruption to public traffic. Works shall not be carried out simultaneously over large areas of the site but shall be sequenced so that all operations likely to cause disruption to public traffic shall be undertaken and completed in discrete area before commencement of operations in other areas. Works which, by their nature, will create disruption and / or obstructions to vehicular or pedestrian traffic, such as pavement rehabilitation or trench – work shall be programmed to be undertaken in a continuous sequence of events from the initial disruption until the restoration of access without and significant delay between operations.
- e) The programme submission shall be accompanied by outline traffic management plans in sufficient detail to indicate to the Engineer that the Contractor has considered this aspect of the work in his programme. Notwithstanding the above, acceptance of the Contractor's programme will not in any way relieve of his responsibilities for traffic management under Clause 1.1.5 of this Employer's Requirement.
- f) The Contractor's Programme shall, in so far as it is practicable to do so, take into consideration the commercial interest of individual shopkeepers e.g. operations should not be sequenced so as to disrupt access to individual shops having only one access from the road.
- g) The Contractor's Programme of Works, submitted in accordance with Clause 35 of the General Conditions of Contract, shall be subject to the approval of the Engineer and of Employer. If the Contractor's programme, in the opinion of the Engineer/Employer has not properly achieved the objectives of the programme, then the Contractor shall be instructed to revise his Programme and the Contractor shall revise the programme forthwith; for this reason, the Contractor is advised to liaise closely with the Engineer during the production of his Programme.
- h) In addition to the Works Programme required under Clause 35 of the General Conditions of Contract, the Contractor shall produce individual programmes for each element of the works likely to cause significant disruption to public and vehicular traffic, for the approval of the Engineer and prior to commencement of the element of the works, clearly showing the sequencing of construction operations in such a manner as to minimize the duration of the disruption.
- i) The Contractor shall note that different work in various parts of site by other contractors may be in progress or may commence during the Contract Period. It will be the Contractor's responsibility to liaise with contractors on adjacent sites in order to ensure the detail progress. The Contractor's Programme will be phased and will make full allowance for the need for a co-operative timing with adjacent contractors.

1.8.9 Method Statements

Immediately upon getting the Engineer's approval for the work programme, the contractor should submit method statements for construction of his chosen work fronts.

These method statements shall as a minimum describe the following.

- a) Length of road proposed to be taken up
- b) Equipment to be mobilized for excavation of road and the narrowness of the work area.
- c) The maximum width to be taken.
- d) The material and size of base, sub-base course
- e) The special requirements for effecting the excavation, such as cutting and filling.

- f) The special requirements for carting away the excavated material
- g) The nearest location where the excavated material could be stored ready for reuse.
- h) The duration of each task – excavation, cutting, backfilling, compaction, asphalt concrete
- i) The number of equipment and plant that will be deployed for working on the given stretch.
- j) The number and details of engineer, supervisory staff and skilled staff to be deployed.

1.9 ENVIRONMENTAL MANAGEMENT AND MONITORING

Environmental Management Plan (EMP): The Contractor shall prepare and implement an EMP, incorporating air dust control and other environmental mitigation measures throughout the project duration. All environmental protection works shall comply with the prevalent laws, regulations, and the Environmental Management Action Plan (EMAP).

Environmental Monitoring: The Contractor shall conduct periodic environmental monitoring as instructed by the Engineer. This shall include testing for (a) Air Quality, (b) Noise level, (c) Surface Water Quality, (d) Ground Water Quality, and (e) Soil Quality.

For the purposes of this Contract, the "environment" is defined as the surrounding area, including both human and natural resources, that may be affected by the execution and upon completion of the works. The Contractor shall take all necessary and reasonable precautions to safeguard the environment throughout the duration of the construction works.

The Contractor shall strictly abide by all prevalent laws, rules, and regulations governing pollution control and environmental protection. All operations shall be conducted in accordance with the mitigation measures, guidelines, and monitoring requirements specified in:

- The approved IEE Report (Initial Environmental Examination).
- The Project Environmental Monitoring Plan.

The Contractor shall be held solely and strictly responsible for the actions of their employees, agents, and subcontractors. Any environmental damage or violation of the aforementioned laws and guidelines caused by site personnel shall be rectified at the Contractor's own expense, and the Contractor shall be liable for any associated legal or regulatory penalties.

Environmental protection works, among others, shall also include the following:

1.9.1 Borrow/Quarry Sites

The Contractor shall obtain the permission of the Engineer before opening up any borrow pits or quarries. Such borrow pits and quarries may be prohibited or restricted in dimensions and depth by the Engineer where:

- a) they might affect the stability or safety of the works or adjacent property.
- b) they might interfere with natural or artificial drainage or irrigation.
- c) they may be environmentally unsuitable.

At least 14 days before he intends to commence opening up any approved borrow pit or

quarry, the Contractor shall submit to the Engineer his intended method of working and restoration. These shall include but not be limited to:

- a) the location, design and method of construction of any access track.
- b) the volume and nature of material to be removed.
- c) the sequence and method of excavation of materials.
- d) measures for controlling runoff and sediment from the site during operations.
- e) Proposals for site restoration including approximate finished levels, drainage, erosion and sediment control, and slope stabilization and re-vegetation, including reinstatement of any access track.

Operations of borrow pit or borrow area shall not be permitted until the method of working for that particular pit or area has been approved by the Engineer in writing. Restoration shall be to the satisfaction of the Engineer.

1.9.2 Disposal of Spoil and Construction Waste

Materials in excess of the requirements for permanent works and unsuitable materials shall be disposed of in locations and in the manner as agreed with the Engineer. The locations of disposal sites shall be such as not to promote instability, destruction of properties and public service systems. Exposed areas of such disposal sites shall be suitably dressed and be planted with suitable vegetation.

The Contractor shall plan his works in such a way that there is no spillage of POL products to the surface or sub-surface water.

1.10 MAINTENANCE OF ROAD

The Contractor shall be responsible for undertaking all routine maintenance of the existing road and all bridges on the road from the day the road is officially handed over to the Contractor until the issue of Defects Liability Certificate by the Engineer.

The Contractor shall also carry out all the routine maintenance of the completed works from the time of their substantial completion until the Defects Liability Certificate is issued.

The Contractor shall also maintain roads that he uses for construction or access and the use of such roads shall be identified in advance to the Engineer for inspection prior to use.

The routine maintenance of the road shall include besides other, trimming vegetation, cleaning all culverts, ditches, borrow pits, road side drainage, drainage channels and any other obstructions including minor landslide (up to 20 m³ at one spot, with unlimited number of spots), cleaning road signs and checking and undertaking the repair of guardrails and other road safety structures, cleaning including removal of obstructions on bridge decks and bridge deck drainage elements, checking including and cleaning removal of obstructions on bridge decks and bridge deck drainage elements, checking including removal of obstructions on bridge decks and bridge deck drainage elements, checking and cleaning of expansion joints and bearings, cleaning bearing shelves and weep holes, removing accumulated debris and vegetation around and between piers and abutments, repairing parapets, clearance on the road to allow free flow of traffic and reinstatement of any damaged or deteriorated carriageway, and protection of adjoining works. In case of road Section where the surface is

in badly damaged condition, the maintenance of existing road surface shall be maintained by potholes patching using gravel, rerolling and regressing as instructed by Engineer. The surface shall be maintained to ensure longitudinal and transverse profile. All the damages to the road carriageway and shoulder shall be repaired with the material of equal or higher standard than the original surfacing.

The Contractor shall perform the maintenance works as often as required to keep the carriageway, shoulders, and adjoining structures in proper working order to the satisfaction of the Engineer. During the period of commencement of works the Contractor shall mobilize labour and equipment to make an immediate start on the maintenance of the existing road.

The location and scope of the maintenance work shall be as directed by the Engineer. Existing ditches shall, where shown on the Drawing, be cleared by removing vegetation growths and deposits. The sides shall be trimmed throughout, and the bottoms uniformly graded, and the ditches kept clean and trimmed and maintained so long as required. Material removed from the existing ditches shall be disposed off at the places as directed by the Engineer. Should at any time the Engineer gives any instruction for the upkeep of a section of the road/site and the Contractor does not respond in 48 hours, the Engineer shall be empowered to instruct others to carry out the works. Any costs involved by this action shall be deducted from any money due to the Contractor.

1.10.1 Measurement and Payment

Maintenance of road in defects liability period quantified in months shall be paid as per contract price on lump sum basis. Maintenance of road during construction/rehabilitation period quantified in km-months shall be paid as per contract unit rate. The contract price and/or unit rate shall be the full and the final compensation to the Contractor.

1.11 CLEANING-UP OF SITE

Before application is made for the Employer to accept any substantially completed Section of the Works, all items shall be complete, ready to operate and in a clean condition. All trash, debris, unused building materials and temporary facilities shall have been removed from the Site. Tools and construction equipment not needed during the subsequent Defects Liability Period for repair and adjustment shall not remain on the Site. The temporary walkways, parking areas and roadway shall be completely swept and broomed.

SECTION 2: ENGINEER'S FACILITIES

2.1 DEFINITIONS

2.1.1 General

Acceptable/Approved (Approval)-Acceptable to/approved (approval) by the Engineer in writing.

Agreed-Agreed in writing.

As detailed-As detailed on the drawings.

Authorized/ordered/rejected-Authorized/ordered/rejected by the Engineer in writing.

Designated - Shown on the drawings or otherwise specified by the Engineer or, in relation to an item scheduled in the Bill of Quantities, description of an item.

Indicated - Indicated in or reasonably to be inferred from the contract or indicated in writing by the Engineer.

Instructed/directed/permitted-Instructed/directed/permitted by the Engineer.

Satisfactory-Capable of fulfilling or having fulfilled the intended function.

Submitted- Submitted to the Engineer.

Working easement— Areas required by the Contractor for execution of the Works, including the permanent right of way obtained or land purchased by the Employer plus any temporary way leaves arranged by the Contractor.

Working strip- The working easement on the pipeline route.

2.1.2 Tolerances

Deviation-

The difference between the actual (i.e., measured) size or position and the specified size or position.

Permissible deviation-The specified limit(s) of deviation.

Tolerance-The range between the limits within which a size or position must lie.

2.1.3 Measurement and Payment

Bill/schedule-The bill/schedule of quantities.

Billed/scheduled rate - The unit rate or price entered in the bill/schedule at which the Contractor undertakes to execute the particular work or to provide the required material, article or service, or to do any or all of these things, as set out in the item concerned.

Billed/scheduled-Listed in the bill/schedule of quantities.

2.2 LANGUAGES

All drawings, instructions, signs, notices, nameplates, etc. for use in the operation and maintenance of the completed Works shall be in English.

2.3 INTERFACE WITH OTHER CONTRACTS

Interfaces this Contract and other contracts are advised to be coordinate.

2.4 SCOPE OF WORKS

The activities to be undertaken by the Contractor within this Contract include the following: -

- a) To carry out all necessary topographic surveys, soils investigations, laboratory analyses or related

- investigations where necessary to supplement the data provided by the employer.
- b) To prepare working drawings for all elements of the works.
 - c) To undertake all steps necessary for temporary way leave facilities and/or upgrading of roads and bridges, all related to access to the Site, or other related matters, where his opinion differs significantly from those produced by the Employer.
 - d) Setup/Preparation of stock yards and storehouse for construction materials and equipment.
 - e) To take all steps necessary for the temporary or permanent diversion of services and the maintenance of services during the execution of the works, including diversion of overhead power lines, sewers and other underground services along the road.
 - f) To provide all necessary staff (including project manager, civil engineers, administrators, site supervision personnel) and workmen (including all necessary specialists, operators, tradesmen, artisans etc. in addition to semi-skilled and unskilled workers) necessary for execution of the Works through to completion and for defect liability period. Where appropriate, the contract shall provide all suitable facilities and accommodation for the staff and workmen and he shall make provision for all costs related to such provision and for medical, relocation, taxes or other expenses.
 - g) To provide all equipment, machinery, tools etc. and related spares for maintenance and consumables necessary for implementation of the Works.
 - h) To provide all site offices, stores, workshops and facilities necessary for use by the Employer, Engineer and support staff and for the Contractor himself and his support staff.
 - i) To liaise with other contractors on the site and to ensure harmonious co-operation with them so that conflicts are avoided and areas of common interest, construction interface or potential overlaps are addressed without cost to the Employer or delays in completion.
 - j) To prepare documentary records of the Works in the form of "as-built" drawings and GIS data, schedules etc., and to train staff of the Employer in the procedures for laying pipes, valves and fittings.
 - k) All the above activities shall be performed in a professional way and with good engineering and/or constructional practice. Upon completion of the Works the scheme shall be fully operational with minimum disruption or inconvenience to interested parties, including landowners, and there shall be no outstanding matters requiring attention.

2.5 FACILITIES FOR THE ENGINEER

2.5.1 Engineer's Site Office

2.5.1.1 General Requirements and Scope

The Contractor shall provide, establish, furnish, equip, and maintain a dedicated Site Office and accommodation facility in a rented permanent house near the Danda River Corridor development project site (or as otherwise approved by the Engineer) for the sole use of the Engineer's resident site staff for the entire project duration.

The Contractor shall submit proposals for the site office within 7 days of the Notice to Commence. The office building and all associated accommodation facilities shall be fully ready for occupancy, with all equipment provided, within 14 days after the Commencement

of Works.

2.5.1.2 Building and Layout Specifications

The facility shall be designed for both office and residential use as approved by the Engineer.

Space & Rooms: The facility must include a minimum of five (5) standard-sized, air-conditioned rooms (for office and residential use), one (1) standard-sized, air-conditioned meeting hall/conference room, one (1) kitchen, and separate, adequate toilet and bathroom facilities. The ceiling height shall be at least 2.5 m.

Windows & Ventilation: Each room must be well-ventilated, featuring at least two opening windows. Window frames shall be close-fitting and protected by fly screens. Sun blinds shall be provided for all windows.

Parking: The facility must include secure parking for site vehicles.

2.5.1.3 Utilities, Services and Housekeeping

Electricity & Climate Control: The Contractor shall ensure uninterrupted electricity and pay regular monthly electric bill. Each room shall be provided with dedicated air-conditioning facilities, fluorescent lighting, refrigerator, ceiling fan and power sockets.

Water & Drainage: A continuous supply of cold water under adequate pressure, meeting drinking water quality standards, shall be maintained, water filter system (RO filter), water dispenser (hot and cold).

Communications: The office shall have a telephone connected to the public system and a broadband internet connection with a Wi-Fi system, available for the Engineer's use always.

Housekeeping: The facility shall be maintained with regular, dedicated housekeeping services, including the provision of a designated office attendant for the entire project duration.

2.5.1.4 Furniture's and Appliances

The site office shall be fully furnished to the complete satisfaction of the Engineer. The Contractor shall provide a complete office furniture setup and residence setup, including all necessary kitchen utensils, as required by the Engineer.

2.5.1.5 Office and IT Equipment

The Contractor shall provide the following new equipment for the Site Engineers.

- 1nos. A3 and A4 color LaserJet Printers-2-Tray (with paper tray, minimum 30 ppm).
- 1 TB Hard Drive
- Multiplugs

2.5.1.6 Consumables and Amenities

The rate shall include the continuous supply of all office consumables, stationery, kitchen supplies, and bathroom amenities throughout the project period.

2.5.1.7 Demobilization and Ownership

Each site office component and all provided equipment shall remain the property of the Contractor upon the completion of the Contract and shall be subsequently removed from the

site.

2.5.1.8 Services to the Engineer

The Contractor shall be responsible for the proper maintenance of the above listed offices during the Contract period. He shall keep the offices and toilets clean and shall provide one cleaning staff for this purpose throughout the Contract period.

The Contractor shall regularly, and when required, clean, repair, and maintain the Engineer's offices, shall carry out emptying of the septic tanks and supply water to the water tanks.

All electricity, water and telephone charges, internet, fuel and gas relating to the Engineer's offices, including connection and disconnection fees and rental charges shall be paid by the Contractor.

The Contractor shall supply and erect, at approved locations, name boards in Nepali and English approved by the Engineer, giving a description of the Project as well as names and titles of the Employer, Engineer and Contractor as ordered or as shown on the Drawings. The Contractor shall keep the name boards in good repair for the duration of the Contract and shall remove them on completion of the Contract.

2.5.2 Vehicles for the Engineer

The Contractor shall lease, maintain, and make available to the Engineer the vehicles specified in the Bill of Quantities (BoQ) for the sole use of the Engineer and their resident site staff. Both one 4WD vehicle and one Motorbike latest made model shall be maintained in excellent working condition and made available at all times as per the instruction of the Engineer.

The Contractor shall provide one 4WD Supervision Vehicle on a rental basis. As per the BoQ, the quoted rate for this item shall strictly include the rental charge, a qualified driver (including all driver expenses, allowances, and meals), all regular maintenance costs, and fuel. All comprehensive insurance, applicable taxes, duties, and required accessories shall be borne solely by the vehicle owner/Contractor, all to the complete satisfaction and approval of the Engineer.

The Contractor shall provide one motorbike for site supervision. This provision shall include the supply of the motorbike along with all required fuel, all regular maintenance costs, driver/rider expenses, and accessories. The rate must also cover all applicable taxes, duties, and comprehensive insurance coverage as per the specifications and to the approval of the Engineer.

2.5.3 Occupational Health and Safety (OHS) and Safety Equipment's

The Contractor shall implement comprehensive Occupational Health and Safety (OHS) measures covering the entire project period. This includes the mandatory provision and enforcement of appropriate Personal Protective Equipment (PPE) for all workers and staff at the construction sites. Furthermore, the Contractor shall ensure the provision of fully stocked first aid boxes and properly maintained fire extinguishers at all camp and storage sites, all strictly as per the instruction of the Engineer.

In addition to the general site safety provisions for the workforce, the Contractor shall provide the Engineer with the specific safety equipment set listed below in the site office. The Contractor shall promptly replace each item after it wears out or becomes unsuitable for use;

- Safety Helmets
- Umbrellas
- Raincoats
- Safety Boots/Site Shoes
- Sunglass
- Hat/Cap

Measurement and payment for this item shall be made as per the Bill of Quantities (BoQ). The quoted rate shall comprehensively cover all costs associated with the implementation of site wide OHS measures, the provision of PPE for all construction personnel, the supply and maintenance of first aid and fire safety equipment at camps and storage sites, and the continuous provision and replacement of the specified safety equipment for the Engineer throughout the entire project period.

2.5.4 Measurement and Payment

Unless otherwise mentioned in BOQ, no separate measurements and/or payment shall be made for all materials and works required. All the cost associated with this Clause is deemed to be included in the item rates of the Bill of Quantities.

If the payment provision has been made in BOQ, following practices shall be adopted for payments:

- a) Payments for the supply of vehicle shall be made based on the actual number of month use of the facilities by the Engineer or his staff.
- b) Payment for provision of safety equipment will be made based on the actual number of month use of the facilities by the Engineer or his staff.

SECTION 3: ACCESS TO AND POSSESSION OF SITE

The leaves, right-of-way, easement, and access to the sites shall be governed by the Rules of the Country and Town Development by-laws of the local Government.

3.1 THE SITE

The Site is:

- That land along road alignments which are within the right-of-way of road and proposed park area.
- As presented in the drawings.

Final Possession of the Site, or Parts thereof, for the purpose of carrying out the execution of the Works to be given by the Employer pursuant as per the Conditions of Contract shall be subject to any restrictions mentioned in the Contract.

The Contractor shall himself obtain temporary way leaves on whatever additional lands or working easements are required by him to carry out the Works.

3.2 TEMPORARY WAY LEAVES AND ACCESS

The Contractor shall be responsible for obtaining temporary way leaves.

The cost of obtaining way leaves, including crop compensation, for temporary working areas, additional working easement and for any additional areas, required by the Contractor in connection with the Works as well as for the access to all of these shall be borne by the Contractor himself. The Contractor shall arrange for the serving of any Statutory Notices in connection with any temporary working area and shall give to the occupier of each such area seven days' notice of his intention to enter and shall ensure that his methods of working cause the minimum of disturbance to the land and to its owners and occupiers.

The Contractor shall at all times provide proper facilities for access and inspection of the Works by the Engineer, his assistants, inspectors, agents and representatives of public agencies having jurisdiction.

The extent of each temporary working area and the period of time for its occupation shall be such as the Engineer considers necessary having regard to the Contractor's reasonable requirements which shall be submitted together with the Work Program to the Engineer.

The Contractor shall reinstate any temporary working areas to the condition prevailing prior to his initial entry as soon as possible after the work in those areas has been completed so as to keep the period of occupation to a minimum. The Contractor shall in any event restore the area to as tidy and workmanlike condition. Boundary walls, fences and other structures that have been damaged, removed or otherwise interfered with by the Contractor shall be restored to a condition at least equivalent to their original condition.

3.3 ACCESS TO ADJOINING PROPERTY

If the Contractor's work will cause unavoidable interference with access to adjoining property,

the Contractor shall first give 7 days' notice to the occupier of such property and shall provide temporary means of access for vehicles, animals, and pedestrians.

Convenient access to driveways, houses and buildings adjoining the work shall be maintained and temporary approaches to intersecting streets and alleys shall be provided and kept in good condition by the Contractor.

As soon as a section of surfacing, pavement, or a structure has been completed, it shall be opened for use by traffic at the request of the Engineer.

The Contractor shall not prevent the free access to public water valves, water hydrants, or utility valves.

3.4 PERMANENT RIGHT-OF-WAY

The Employer will make all statutory arrangements necessary for obtaining the final possession of the Site and the permanent right-of-way in the shortest possible time.

3.5 MEASUREMENT AND PAYMENT

Unless otherwise mentioned in BOQ, no separate measurements and/or payment shall be made for all materials and works required. All the cost associated with this Clause is deemed to be included in the item rates of the Bill of Quantities.

SECTION 4: PROVISION AND MAINTENANCE OF SITE INSTALLATIONS

4.1 ESTABLISHMENT AND MAINTENANCE OF LABOUR CAMP AND SITE FACILITIES

The Contractor shall construct, guard, and comprehensively manage a fully functional labour camp for his workmen near the project site, together with necessary workshops, stores, and offices. In strict accordance with the Bill of Quantities, the labour camp accommodation shall consist of at least of 16 rooms, with each room measuring minimum 10' x 12'.

The Contractor must ensure that all accommodation rooms are well-ventilated, fully equipped with safe and reliable electric facilities, and specifically constructed with plinth levels safely elevated above historically known water-logging limits to protect workers during adverse weather. Furthermore, the Contractor shall actively implement and strictly monitor a comprehensive heat stress management protocol to safeguard the workforce during periods of extreme temperature.

4.1.1 Facilities and Services

To ensure the welfare of the workforce, the Contractor shall provide the following mandatory facilities and services:

- a) Medical & Sanitary Facilities: A dedicated medical room and separate toilet and bathroom facilities for ladies and gents.
- b) Utilities & Services: Uninterrupted provision of all necessary sanitation, potable water supply, and general utilities, heater, and fan in extreme weathers.
- c) Maintenance: Dedicated housekeeping services to ensure the standard of accommodation, ablution, and canteen facilities are kept in a seemly and highly hygienic state until the conclusion of the Contract.

4.1.2 Location and Alternative Arrangement

The exact site of the camp and all associated temporary buildings must be submitted to and approved by the Engineer prior to construction. Considering the potentially limited available space within the project site, the Contractor may elect to hire existing space or building(s) for the camp, workshops, stores, and offices in the nearest adjacent area, subject to the prior approval of the Engineer. If this option is utilized, the Contractor shall be strictly responsible for the timely payment of all rents and fees for such hired space/building(s).

4.1.3 Storage

Safe, dry and properly covered storage place shall be provided by the Contractor for all materials, particularly for cement. The capacity of the cement storage go downs shall be minimum 500 bags stored at each work site.

4.1.4 Water Supply and Power Supply

The contractor shall make his own arrangement for the supply of water, including portable water, for the purpose of construction and consume by workers. The quality of the water shall be to the approval of the engineer and suitable for the purpose for which it is intended.

Wastewater shall be disposed of clear of the site to the satisfaction of the Engineer so as to cause no damage or nuisance to the Environment and the surrounding areas.

The contractor shall make his own arrangements for the supply of electric power for the purposes of the construction works.

4.1.5 Medical Arrangements

The contractor shall make arrangements for treatment on the site of casualties and sick persons in first-aid units or in such other wards as may be necessary in accordance with the appropriate regulations.

Notwithstanding the minimum requirements prescribed above, the Contractor shall be responsible for the adequacy of all the arrangements made as per the provisions of the Contract.

The Contractor shall make his own arrangements for treatment of casualties on the Site. First-aid kits or units shall be provided. The Contractor shall be responsible for the construction of such first-aid units and their management and operation and rapid removal by ambulance of injured or sick employees to nearby hospitals. The first-aid services shall cover the Contractor's own personnel as well as that of the Employer, the Engineer, and all Subcontractors while working on the Site.

4.1.6 Latrines

The Contractor shall provide throughout the period of construction of the Works and shall maintain and clean suitable and sufficient latrines for use by his employees; he shall ensure that his employees do not foul the site but make proper use of the latrines.

4.1.7 Sanitation

The Contractor shall maintain the Site and all working areas in a hygienic condition. In all matters of health and sanitation he shall comply with the requirements of the local Health or other competent authority.

4.1.8 Sewage and Waste Disposal

The Contractor shall make provision for the discharge or disposal of from his camp, offices, and the Works of all wastewaters as well as of all liquid and solid waste products however arising. The methods of disposal shall be to the satisfaction of the Engineer and of any authority or person having an interest in any land or water course over or in which water and waste products may be so discharged and shall not in any manner be disposed of untreated to the environment.

4.1.9 Pollution

The Contractor shall take all reasonable measures to minimize any dust nuisance, sound pollution, pollution of streams and inconvenience to or interference with the public (or others) as a result of the execution of the Works. The air pollution shall be controlled properly with international practice.

4.1.10 Temporary Telephone and Internet Connections

The Contractor shall arrange at his own cost for temporary telephone and internet connections to his offices and other installations.

He shall be responsible for all installations, connection and disconnection charges for his and his Representative's offices.

4.1.11 Fire Protection

No naked fire shall be used by the Contractor on or about the Site without the permission of the Engineer in writing. If in the Engineer's opinion the use of naked fire may cause a fire hazard, the Contractor shall at no extra cost to the Employer take such additional precautions and provide such additional firefighting equipment as the Engineer considers necessary.

The term "naked fire" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.

Compliance with the requirements of the Engineer shall not relieve the Contractor of any of his obligations under the Contract.

4.1.12 Contractor's Canteen

The Contractor shall provide adequate eating facilities for his employees and workmen.

4.1.13 Notice Of Operations

The contractor shall give full and complete written notice of all important operations including setting out to the Engineer sufficiently in advance to enable the Engineer to make such arrangements, as the Engineer may consider necessary for inspection and for any other purpose. The Contractor shall not start any important operation without the written approval of the Engineer.

4.1.14 Supply Of Fuel Oils

The Contractor shall be responsible for arranging and ensuring that adequate supplies of high-speed diesel oil, motor spirit, kerosene, lubricants and other petroleum products are available at all times to meet his requirements for the purposes of or in connection with the Contract; the Contractor's particular attention is drawn to this requirement as from time-to-time shortages and interruptions in the supply of fuel oils, etc. occur in the region.

4.1.15 Demobilization and Site Reinstatement

Upon Completion of the Contract, the Contractor is responsible for the complete dismantling, clearing, and reinstatement of the camp area. All temporary buildings constructed in the camp shall be completely demolished, and the sites shall be left clean, tidy, and reinstated to their original condition (or as instructed), with all materials and debris thoroughly removed from the site, strictly adhering to the technical specifications and to the absolute satisfaction of the Engineer.

4.1.16 Measurement and Payment

Measurement and payment for these works shall be made as per the specific item stipulated in the Bill of Quantities, which encompasses the complete establishment, operation, maintenance, and ultimate dismantling of the aforementioned facilities.

4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

The Contractor shall provide, erect, construct, maintain, and subsequently remove proper offices, stores, workshops, laboratories, storage, and parking areas for his own use. Such facilities shall be sufficiently sized and equipped to enable him to manage his operations and

those of his Subcontractors in a professional manner and to enable him to carry out all his obligations under the Contract.

Sheds for storage of materials that may deteriorate or corrode if exposed to the weather shall be weatherproof, adequately ventilated and provided with raised floors. No material or equipment shall be placed directly on the ground.

Within his offices, a meeting room shall be made available for site meetings with the Engineer and the Employer.

The Contractor shall make necessary arrangement at his own cost for store shed, repairs shop/office, meter test bench etc.

4.3 PREPARATION OF THE TEMPORARY STOCKYARD IN THE SITE OF SUB-PROJECT

The preparation of the stockyard for construction materials shall include:

- a) Clearance of the Site
- b) Construction of side drains around the stockyard to avoid water logging.
- c) Construction of access tracks
- d) Erection of a security fence
- e) Construction of a guardhouse/storekeeper's office
- f) Erection of stores for jointing material etc. including the provision of fair-conditioning where necessary

4.4 CONTRACTOR'S CONSTRUCTION EQUIPMENT

When working in built-up areas, the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other Equipment that would otherwise cause a noise level exceeding 85 dB (A) during drilling, excavation, and other work. Alternatively, he shall, by means of barriers, effectively isolate the source of any such noise in order to comply with above requirement.

4.5 SUBMISSIONS BY THE CONTRACTOR

4.5.1 Pre-Construction Surveys and Setting Out

The Contractor shall verify all measurements and be responsible for their correctness. Any differences which may be found between actual measurements and the dimensions given in the Contract Documents shall be submitted to the Engineer, in writing, for consideration and directives before proceeding with the Works.

Site benchmarks shall be accurately and safely established, maintained, and removed upon completion of the Works, all to the satisfaction of the Engineer. The Engineer will indicate the position, coordinates and elevation of benchmarks near the works, as shown on the Drawings.

The Contractor shall prepare a plan detailing the location of the benchmarks and keep this up to date throughout the period of the Contract. Reproducible copies of the plans so prepared shall be supplied

edin soft and hard copy to the Engineer, as and when he may require. The Engineer reserves the right to order levels, considered necessary for the full and proper supervision and measurement of the works, to be taken at any time.

Before the Works, or any part thereof, are commenced, the Contractor and the Engineers shall together make a complete survey, and take levels, of the Site and agree on the dimensions and elevations upon which setting out of the Works shall be based.

These levels shall be related to the benchmarks and shall be plotted and drawn up by the Contractor. After agreement of the drawings, which shall be signed by the Engineer and the Contractor, these levels shall form the basis of setting out of the Works.

The Contractor shall submit the original of the drawings in soft and hard three copies, to the Engineer.

The Contractor shall be responsible for the true and proper setting out of the Works in relation to referenced data given on the Drawings and shall accurately set out the positions, levels and dimensions of all parts of the Works. Any delay or loss resulting from errors in the setting out of the Works shall be the responsibility of the Contractor.

Setting out shall be reviewed by the Engineer before commencing the Works, but any approval shall, in no way, relieve the Contractor of his responsibility for the correct execution of the Work.

Setting out of the Works shall use methods and the necessary instruments described in BS 5606 "Code of Practice for Accuracy in Building". The Contractor shall maintain, in good working order at all times, the instruments provided by him for the setting out of the Works and shall make such instruments available to the Engineer as instructed for checking or taking measurements.

The Contractor shall provide all assistance which the Engineer may require for taking measurements of the Works, including labor, equipment, and transportation.

4.5.2 Detailed Design of Temporary Works

The Contractor shall submit for approval full particulars, including drawings of any of the site installations and Temporary Works. If required the Contractor shall also submit calculations of the stresses, strains and deflections which will arise in false work or other Temporary Works and these calculations shall be accompanied by detailed Working Drawings to show the Contractor's proposals.

Approval by the Engineer of the Contractor's proposals, calculations or drawings shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

4.5.3 Working Drawings

The Drawings prepared by the Engineer, are called Engineer's Drawings. They may be modified or added to as provided by the following clauses.

The proposals shown on the Engineer's Drawings are based on information available prior to preparation

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tion of the Tender Documents. All levels indicated or proposed are based on survey information previously available but will need to be revised subject to the results of survey and site investigation carried out by the Contractor. Nevertheless, the Contractor shall follow such proposals in preparing his own proposals consistent with his own experience.

Working Drawings shall be submitted by the Contractor to the Engineer. Working Drawings shall include, but not be restricted to, roads and drains, reinforcement detail drawings and bending schedules, shop drawings for structural steel and miscellaneous metal work, and drawings for other work for which the Engineer's approval is required.

It shall be the Contractor's own responsibility to prepare such Working Drawings as he may require for the proper setting out and construction of all structures and facilities. Work shall not commence on an individual structure or facilities until the relevant Working Drawings have been approved by the Engineer.

Within 28 days of the date of the Letter of Acceptance, the Contractor shall submit to the Engineer a Drawings Submittal Schedule for the Working Drawings listing the anticipated dates upon which they will be submitted for approval by the Engineer. The submission dates shall be spaced at reasonable intervals to allow at least 14 days for the Engineer to duly check and to either approve them or to request changes or modifications, as the case may be.

All dimensions shall be in metric units and each drawing shall be properly identified by a drawing head and a numbering code in the form prescribed by the Engineer upon commencement of the Works. ISO or DIN standard sizes shall be used.

Drawings shall be scaled at A3 size, at A3 size.

Prior to submittal, the Contractor shall also check the drawings prepared by his Subcontractors for accuracy and completeness, especially that the relation to adjoining work is accurately shown.

The Contractor shall submit color 3 (three) copies of all drawings for approval.

Any changes or modifications to the Working Drawings that the Engineer considers necessary shall be made by the Contractor promptly and the drawings resubmitted for approval.

Approval of Working Drawings will be given by the Engineer in the form of a stamp "RELEASED FOR CONSTRUCTION" together with the date and the authorized signature. Only those Working Drawings carrying the signed and dated stamp shall be used for execution.

Copies of all such approved Working Drawings together with one unreduced transparency shall be supplied to the Engineer by the Contractor immediately after approval. The cost of preparing and providing all Working Drawings shall be included in the Contract Rates.

Should it be found at any time after approval has been given by the Engineer to a Working Drawing submitted by the Contractor that the said Working Drawing does not comply with the terms and conditions of the Contract or that the details do not agree with the Working Drawings

previously approved, such alterations and additions as may be deemed necessary by the Engineer shall be made therein by the Contractor and the work carried out accordingly without entitling the Contractor to extra payment on account thereof, except where such alterations and additions are to be made in direct consequence of written order by the Engineer to vary the Works.

No examination by the Engineer of any document submitted by the Contractor or of the Contractor's Working Drawings, nor the approval expressed by the Engineer in regard thereto, either with or without modification, shall absolve the Contractor from any liability imposed upon him by any provision of the Contract. Notwithstanding the Engineer's approval of the Working Drawings the Contractor shall be responsible for any dimensional or other errors.

4.5.4 As-Built Drawings and GIS Data Creation

4.5.4.1 As-Built Drawings

Such approved Working Drawings as have been selected by the Engineer shall be correctly modified for inclusion in the As-

Built Drawings incorporating such variations to the Works as have been ordered and executed. Such drawings shall show the actual arrangement of all structures and items of equipment installed under the Contract. The Contractor shall submit 1 (one) reproducible copy and 3 (three) prints of all As-Built Drawings clearly named as such to the Engineer for approval before applying for the Taking-Over Certificate for the respective Section of the Works. After approval of the As-Built Drawing the Contractor shall supply an electronic copy of the drawing in together with a licensed copy of the drafting software (at least AUTOCAD 2011). The software shall become the property of the Employer and shall be used to view the As-Built Drawings.

During the course of the Works, the Contractor shall maintain a fully detailed record of all changes from the approval to facilitate easy and accurate preparation of the As-Built Drawing.

Irrespective of the other contractual prerequisites no Section of the Works will be considered substantially completed until the respective As-Built Drawings have been approved by the Engineer.

4.5.4.2 GIS Data Creation and Drone Videography and Photography

In parallel with the preparation of as-built drawings, the Contractor shall produce comprehensive GIS data of the constructed works along the Danda River Corridor. The Contractor shall conduct all necessary survey work and ensure that vertical and horizontal measurements are captured at an accuracy of $\pm 0.1\text{m}$ at a 95% confidence level, using the most suitable and cost-effective field data collection technology and methodology. All horizontal and vertical survey measurements will be strictly referenced to the national georeference system.

The Contractor shall develop a checklist of Quality Control (QC) checks for each type of deliverable and will be responsible for ensuring that these QC checks are meticulously performed. The Contractor shall assign a dedicated GIS Quality Officer to manage the quality review process. This officer shall be independent of the primary data capture and production teams.

The Contractor shall be required to integrate the GIS deliverables with the municipality's

existing data, ensuring that the GIS data connects seamlessly to the national geo-reference system. This may entail revising GIS data of existing infrastructure or utilities at connection points. GIS data for the project will be delivered in an ESRI ArcGIS-compliant file geo-database.

The Contractor shall carry out professional drone videography and high-resolution aerial photography of the project site. This aerial documentation must be executed in two distinct phases:

- a) Phase 1 (Pre-Construction): Immediately prior to the commencement of any site mobilization or construction activities.
- b) Phase 2 (Post-Construction): Upon full completion of the works, immediately prior to final handover.
- c) To facilitate a direct visual comparison of the project's impact, the Contractor must ensure that the post-construction flight replicates the exact GPS coordinates, altitudes, and camera angles of the initial pre-construction flight. Flight operations must capture a minimum of 4K resolution video and high-resolution photographs.

Measurement and payment for these items shall be strictly as per the stipulated rates in the Bill of Quantities (BoQ). The item rate shall comprehensively cover all costs associated with:

- a) Mobilization of all specialized survey/GIS personnel, drone operators, and equipment.
- b) Securing any mandatory local aviation flight permits from relevant authorities.
- c) Conducting all flight operations and field surveys.
- d) Basic media editing, GIS data compilation, and quality control.
- e) The final submission of all raw and processed digital media files, as well as the complete ArcGIS geo-database, on a high-capacity portable storage device, strictly in accordance with these requirements and as directed by the Engineer.

4.5.5 Construction Programme and Progress of Works

4.5.5.1 Construction Programme

In amplification of the requirements as per the Conditions of Contract, the programme shall be in the form of a Critical Path Method (CPM) Diagram showing, sequences, dependencies, durations and dates for execution of all major items following the sub-divisions in the Bills of Quantities for the execution of the Works within the periods stated in the Contract. It shall be supported by:

- Data of the construction methods
- Equipment Utilization Schedule
- Manpower Utilization Schedule
- Subcontracting Schedule
- Mobilization/Demobilization Schedule

The CPM diagram incorporating the above-mentioned schedules shall be prepared using Microsoft Project, or similar approved project management software, and shall be presented in hard copy and electronic form to the Engineer.

In carrying out the Works due attention shall be paid to all measures which can reasonably be taken in order to diminish the inconvenience which the work may cause to services and access to property.

4.5.5.2 Updating, Monitoring and Progress Reporting

The Contractor shall monitor the progress of the Works including information provided by his Sub-contractors and suppliers, as necessary, for purpose of network planning, scheduling and updating and shall confirm the actual progress on each current activity shown on applicable CPM networks. The CPM networks shall form part of the Monthly Progress Report and shall indicate changes of schedule, if any in network activity duration and start/finish-imposed dates. It shall also be provided in electronic form.

The Contractor shall prepare written explanatory notes on the activities which are overrunning or going to overrun against the Master Schedule. If any such overrunning work is on the critical path, the Contractor shall state what corrective actions will be taken by him to bring it back on the schedule.

4.5.5.3 Detailed Fortnightly Programme

The contractor shall submit at the end of each working week a detailed bar chart program for the next fortnight. The program shall identify where further drawings or instructions are to be issued by the Engineer to avoid disruption to the progress of the Works.

4.5.6 Progress Reports

The Contractor shall furnish the Engineer with 5 copies of Progress Reports at regular monthly intervals in a form agreed with the Engineer, containing the following information:

- a) Physical progress for the report month and estimated progress for the next month.
- b) CPM networks and explanatory notes
- c) Updated S-curves for physical progress at different sections of the Works
- d) Progress on Quality Control and Quality testing Plan
- e) List of activities and obligations completed and planned for next month.
- f) Any report which may be specifically requested by the Employer and/or the Engineer.

These monthly progress reports shall be submitted not later than 7 days after the end of the reporting month.

4.5.7 Operation and Maintenance Manual

The contractor will submit an operation and maintenance manual, for all the roads, bridges and culverts and provide detail recommendation of maintenance works procedures.

4.5.8 Record / Progress Photographs

The Contractor shall arrange each month at least 18 Nos. of photographs to be taken by a professional photographer as Record Photographs and shall provide the electronic files and 2 color print each on glossy paper unmounted and of a size not less than 210mm x 297mm (A4) in transparent plastic pockets contained in hard cover album. Each print shall contain upon its back the date and description of the view taken. The Contractor shall ensure that no use is made of any negative or print without permission from the Employer.

Out of these Record Photographs the Contractor shall select 10 characteristic ones as Progress Photographs, copies shall be made of these to be attached to the Progress Reports.

4.5.9 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required. All the cost associated under this clause is deemed to be included in the item rates of the Bill of Quantities.

4.6 QUALITY CONTROL

4.6.1 Scope

This Section covers the Quality Control System and procedures, Quality Assurance Plan, program of tests, trials, and general procedures for acceptance as well as laboratory arrangements and related facilities which are required for the selection and control of the quality of materials and workmanship.

4.6.2 Contractor Responsible for The Quality of The Works

All materials incorporated and all workmanship performed shall be strictly in conformity with the requirements of the Specifications and the Contractor shall be responsible for the quality of the works in the entire reconstruction within the contract.

The Contractor shall provide, use and maintain on the Site, throughout the period of execution of the contract, a laboratory with adequate laboratory equipment operated by competent staff for carrying out tests required for the selection and control of the quality of materials and for the control of workmanship in accordance with these Specifications. The list of laboratory equipment to be procured and laboratory facilities to be provided shall be got approved from the Engineer.

The Contractor shall carry out quality control tests on the materials and work to the frequency stipulated in subsequent paragraphs. In the absence of clear indications about method and/or frequency of test for any item, the instructions of the Engineers shall be followed.

For satisfying himself about the quality of the materials and work, quality control tests will also be conducted by the Engineer (by himself, by his Quality Control Units or by any other agencies deemed fit by him), generally to the frequency set forth herein under. Additional tests may also be conducted where, in the opinion of the Engineer, need for such test exists.

The Contractor shall provide necessary co-operation and assistance in obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labour, attendants, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests.

Unless stated otherwise, the cost of sampling and testing of various materials proposed to be used on the works for quality control according to the Specification requirements shall be deemed to be incidental to the work and no extra payments shall be made for the same.

4.6.3 Testing Procedures and Sets of Tests

For ensuring the quality of the work, the materials and the workmanship shall be subjected to testing in accordance with procedures, set of tests and frequencies are not restrictive. The Engineer shall direct for the tests to be carried out as frequently as deemed necessary that the materials and workmanship comply with their Specifications.

Set of tests to be carried out on the materials and the workmanship as specified in these Specifications. Where no specific testing procedure is mentioned in the Specifications, the tests shall be carried out as per the prevalent accepted engineering practice or direction of the Engineer.

4.6.4 Laboratory Trials to Confirm Compliance with Specifications

4.6.4.1 Filling and Pavement Materials

For testing of samples of soils/soil mixes, granular materials, and mixes, bituminous materials and mixes, aggregates, cores etc., samples in the required quantity and form shall be supplied to the Engineer by the Contractor at his own cost.

Laboratory trials shall be carried out by the Contractor on filling and pavement materials proposed to be used in the works in their natural state. The laboratory trials shall establish a relationship between their specified requirements of the end product and properties which can be determined in the field for construction control purposes.

The mixed materials, the composition of which meets the specified requirements and is accepted by the Engineer, shall then be used in the site trials carried out to ensure that all specified requirements of the completed pavement courses can be achieved.

The Contractor shall submit the proposals for the site trials to the Engineer at least two weeks before he intends to use the mixed materials in the site trials.

4.6.4.2 Concrete

For testing of cement concrete at site during construction, arrangements for supply of samples, sampling, testing and supply of test results shall be made by the Contractor as per the frequency and number of tests specified in the relevant IS Codes, the cost of which shall be borne by the Contractor.

The compositions of concrete mixes which meet the specified requirements and are accepted by the Engineer shall be then used in the site trials carried out.

4.6.4.3 Other items

For cement, bitumen, mild steel, and similar other materials where essential tests are to be carried out at the manufacturer's plants or at laboratories other than the site laboratory, the cost of samples, sampling, testing, and furnishing of test certificates shall be borne by the Contractor. He shall also furnish the test certificates to the Engineer. Laboratory mixes and site trials shall be carried out in accordance with the requirements.

Manufacturer's test certificate together with invoice or delivery challan shall be furnished for every lot of supply apart from tests to be conducted at site laboratory for prime properties of the material like cement, bitumen etc. Where facilities for testing of materials are not available at site laboratory the same shall be tested at an outside laboratory in the presence of the Engineer. For specialized items such as sign boards, road marking paint, etc. the Engineer may instruct for third party test from approved laboratory.

4.6.5 Site Trials or Trial Sections

The Contractor shall demonstrate the efficacy of the equipment he intends to use at least for following items in all contracts having provision of field laboratory. The procedure to be adopted for the site trial shall first be submitted to the Engineer for approval.

4.6.5.1 Earthworks and Pavement Materials

Site trials for laying and compaction shall be carried out by the Contractor on all earthworks and pavement materials proposed for the works, using the same constructional plant and methods proposed by the Contractor for use in the works. The trials shall demonstrate the suitability of the method and equipment for laying and compacting the material to the specified density and confirm that other specific requirements of the completed earthwork or pavement work can be achieved. Each trial area shall be at least 100 meters long and to the full construction width and shall be laid to the specified depth for the material. It may form a part of the works provided it complies with the required Specifications. Any areas, which do not comply with the Specifications, shall be removed and new trial shall be made.

The Contractor shall allow in his program for conducting such site trials and for carrying out the appropriate tests on them in accordance with the Quality Assurance Plan. The trials on each pavement layer shall be undertaken at least 21 days ahead of the commencement of the related work.

The Contractor shall compact each section of the trial over the range of compact effort for the Contractor is proposing. The data in respect of the following shall be recorded for each level of compact effort at each site trial:

- a) The composition and grading of the material before the site trial.
- b) The composition and grading of the material including the lime or bitumen content.
- c) The moisture content at the time of compaction and the optimum moisture content for the specified compaction.
- d) The type, size, tyre pressures, frequency of vibration and the number of passes made by the compaction equipment.
- e) The maximum dry density or target density as appropriately measured on a sample before and at intervals through the site trials.
- f) The density achieved.
- g) The compacted thickness of the layer.
- h) Any other relevant information as directed by the Engineer.

At least, eight sets of tests shall be made by the Contractor on each 100 meters length of trial section for each level of compact effort. If all eight sets of results over the range of compact effort proposed by the Contractor meet the specified requirements for the material, the site trial shall be deemed successful. The above data recorded in the trial shall become the agreed basis on which the material shall be provided and processed to achieve the specified requirements. If required, the QAP shall be updated or modified based on these data.

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

The Contractor shall carry out modifications in the procedure of work, if found necessary, as directed by the Engineer during inspection. Works falling short of quality shall be rectified/redone by the Contractor at his own cost, and defective work shall also be removed from the site of works by the Contractor at his own cost.

The materials for embankment constructions shall be got approved from the Engineer. The responsibility for arranging and obtaining the land for borrowing or exploitation in any other way shall rest with the Contractor who shall ensure smooth and uninterrupted supply of materials in the required quantity during the construction period.

Similarly, the supply of aggregates for construction of road pavements shall be from quarries approved by the Engineer. Responsibility for arranging uninterrupted supply of materials from the sources shall be that of the Contractor.

4.6.5.2 Concrete

Site trials for concrete mixes as specified shall be carried out by the Contractor to demonstrate the suitability of his mixing equipment. During the site trials, compliance with the Specifications for weighing equipment, storage of ingredients, means of transport for concrete, placing, compaction and curing shall be checked by the Engineer. During the site trial a full-scale sequence including placing and compaction of concrete shall be carried out on a part of the works which will represent particular difficulties due to the presence of reinforcement, obstructions or others.

The Contractor shall allow in his programme for conducting the site trials and for carrying out the appropriate tests, including the time required to obtain compressive strength test results at 28 days. The Contractor shall inform in writing the Engineer at least two weeks before the date he proposes to use the concrete mixes in the site trials with all relevant data including the trial programme, the results of the laboratory trial test for the proposed concrete mixes and compliance test results of all constituents i.e. cement, aggregates, water and admixtures, if any.

4.6.5.3 Production of Materials and Crushing Plant

Full scale site trials corresponding to one day production shall be carried out by the Contractor on all type of materials to be processed using the crushing plant, related devices and methods to demonstrate the suitability of the equipment to provide materials of the characteristics and perform as specified in these Specifications.

At each stage of the processing, materials shall be sampled, and the following characteristics shall be determined in the laboratory and recorded:

- a) the grading of the material
- b) characteristics of the fine fraction: Sand Equivalent (SE): Mica Content; and if SE < 40, Plasticity Index.
- c) characteristics of the coarse fraction: LAA, AIV, ACV, FI, Adhesivity test, Crushing Ratio.

At least three sets of tests shall be conducted by the Contractor at each stage of the production. If all the three sets of results over the full sequence of production proposed by the Contractor meet the specified requirements for the

materials, the site trial shall be deemed successful.

4.6.5.4 Other Works and Equipment

Site trials for Pre-stressed Concrete Works, Painting of Structural Steelwork etc. are detailed in the relevant Sections of these Specifications.

Approval of the Engineer to a set of data recorded in a site trial shall not relieve the Contractor of his responsibilities to comply with the requirements of these Specifications.

4.6.6 Control Testing During Construction

4.6.6.1 Earthworks and Pavement Materials, Backfill to Drainage and Other Structures

All earthworks, pavement layers, and backfill to drainage and other structures shall be subject to control testing (process control) including, if required, testing by the Engineer in accordance with the Conditions of Contract. The Contractor shall allow in his programme or sequence of operations for any disturbance or delays occasioned by such control and testing.

4.6.6.2 Other Works and Equipment

Quality Control procedures are detailed in the relevant Sections of these Specifications.

4.6.7 Acceptance Tests for Completed Works or Parts of The Works

4.6.7.1 Earthworks and Pavement Materials, Backfill to Drainage and Other Structures

The Contractor shall request, in writing for the Engineer's approval for each layer of each section of earthwork, pavement construction and backfill to drainage and other structures. Such requests shall be made only when the Contractor is fully satisfied that the section of the works concerned is in the condition required by the relevant Specifications. Such request shall be accompanied by the test results required as per Specifications.

The Engineer shall thereupon, without undue delay, inspect the Section for any visible defects including, heaving material (visible during compaction) segregation, and for the uniformity of the mixing and compaction. If the visual aspects are satisfactory the Engineer shall test the section of the works submitted and inform the Contractor in writing of the results of the tests specifying acceptance or rejection of the section or the layer concerned.

Work on a layer shall in no circumstances commence until the preceding layer has been approved and accepted by the Engineer in writing. The Contractor shall be fully responsible for protecting and maintaining the condition of the work which has been submitted for approval.

Should any layer be left unprotected for more than 24 hours subsequent to approval, the Contractor shall request for re approval of the layer and the layer shall again be subject to proof rolling, construction control testing, and tolerance checks in accordance with these Specifications. Notwithstanding the Engineer's approval of a layer, the Contractor shall be responsible for making good any subsequent damage due to traffic, ingress of water or any other reason and should any damage occur, the layer shall again be subject to proof rolling, construction control testing and tolerance checks in accordance with these Specifications.

4.6.7.2 Other Works and Equipment

Acceptance tests for other works and equipment are detailed in the relevant Sections of these Specifications.

4.6.8 ScheduleOfTests

4.6.8.1 TestSchedule

The Contractor shall supply the materials and carry out the works as per specifications prescribed in the Clauses for the relevant item of work. For ensuring the requisite quality of construction, the material and works shall be subjected to quality control tests, as prescribed herein after. The testing frequencies set forth are the desirable and the Engineer shall have the full authority to carry out additional tests as frequently as he may deem necessary, to satisfy himself that the materials and works comply with the appropriate specifications and approved QAP.

4.6.9 QualityAssurancePlan

The Contractor shall submit Quality Assurance Plan (QAP) to the Engineer for his approval. The Quality Assurance Plan (QAP) shall be based on the detailed Program of the Works, and process-oriented focus on defect prevention.

The Quality Assurance Plan shall include the following:

- a) The Quality Assurance Schedule comprising of the recapitulative test schedule and testing program detailing the list of tests for compliance, laboratory trials, site trials and trials sections, construction control tests and their frequencies, tests for acceptance of the completed works with their dates.
- b) List of staff assigned to the laboratory, their position and responsibilities in the quality control procedures, their qualification and experience, general description, and detailed organization of the laboratory activities.
- c) The list of sources of materials and/or of manufactured articles, their main characteristics, their identification mode as provided by the supplier when required; the program of supply and procurement of material and/or manufactured articles in accordance with the Program pursuant.
- d) The Contractor shall provide all information needed for fulfilment of the program and required in accordance with the Conditions of Contract including the sequence in which he intends to work including implementation of quality assurance plan. If the Contractor requests a change in the sequence and such change is approved by the Engineer, the Contractor shall have no claim as per the Conditions of Contract for delay arising from such revision to the program.
- e) The list of tests and quality control procedures to be implemented by the Subcontractors, if any, pointing out the "critical" acceptance testing procedures relating to the Sub-contracted works, which correspond to the tasks on the Critical Path included in the Sub-contracted works.

The Contractor shall implement the Quality Control in compliance with the approved QAP.

The Engineer's approval of the QAP shall not relieve the Contractor from his responsibility of the quality of the Works as per the Conditions of Contract and these Specifications nor shall

the Engineer's approval of the QAP exempt the Contractor of any procedure to inform the engineer in writing or request for the Engineer's approval or re-approval as specified in the Conditions of Contract and/or in these Specifications.

The Contractor shall monitor and update the QAP on the basis of the decisions taken at the periodic review meetings or as directed by the Engineer and in accordance with the program of the works as per Clause 3.13 and the Conditions of Contract

4.6.10 Quality Control System

The Quality Control System comprises the methods, procedures, and organization for the Quality Control of the works. The Contractor shall implement the Quality Control System in the following sequence:

4.6.11 Sequence

- a) Complaint testing for materials including laboratory trials,
- b) Complaint testing for methods and equipment prior to the commencement of the work,
- c) Control testing during construction,

The Contractor shall carry out all necessary tests and shall report to the Engineer the results of such tests before submitting materials and/or finished works or part of works to the Engineer for approval in accordance with this Specification. In certain circumstances, tests may be carried out at the place of manufacture as per the Conditions of Contract.

For satisfying himself about the quality of the works, quality control tests shall be conducted by the Engineer himself or by any other agencies deemed fit by the Engineer. Additional tests may also be conducted where in the opinion of the Engineer such tests are needed.

Before commencement of the work, the Contractor shall demonstrate a trial run of all construction equipment for establishing their capability to achieve the laid down Specifications and tolerances to the satisfaction of the Engineer.

The supply, testing and monitoring shall be in compliance with a Quality Assurance Plan, and the provisions in the contract.

4.6.12 Quality Control Plan and Procedures

The Contractor shall be responsible for establishing and maintaining procedures for quality control that will ensure that all aspects of the Works comply with the requirements of the Contract.

As soon as reasonably practicable prior to the commencement of Works the Contractor shall submit for approval a Quality Control Plan giving detailed proposals for control of quality of all aspects of work on the Site and at suppliers' workshops.

The Quality Control Plan shall include the following:

- a) a list of the Contractor's staff engaged in quality control.
- b) a list of any outside testing agencies employed by the Contractor for work in connection with quality control.
- c) where a testing laboratory is to be established on Site under the Contract, a list of major items of equipment and a layout of the laboratory, together details of the tests which will be carried out there.

- d) a list of manufactured items and materials, obtained by the Contractor for the Works, which require inspection at the suppliers' premises, and the proposed procedures for ensuring quality control.
- e) a list of materials and operations to be inspected by the Contractor at the various stages of construction work on Site, together with inspection procedures, test types and frequencies.
- f) sample of proposed quality control records, testing and reporting forms.

Unless the Engineer permits otherwise, the approved Quality Control Plans shall be followed throughout the construction of the Works. Any approval by the Engineer of the Contractor's plan and procedures shall not relieve the Contractor of his obligation to ensure that the Works comply with the requirements of the Contract.

The Contractor shall appoint a suitably qualified member of his staff to be responsible for all aspects of quality control and to maintain effective liaison with the Engineer.

4.6.13 Sampling and Testing

The Contractor shall provide for the approval of the Engineer, samples of all construction materials and manufactured items required for the Permanent Works. All samples rejected by the Engineer shall be removed from Site. All approved samples shall be stored by the Contractor in a sample room, at a location approved by the Engineer, for the duration of the Contract, and any materials or manufactured items subsequently delivered to Site for incorporation in the Permanent Works shall be of a quality at least equal to the approved sample. The approved samples may only be disposed of with the Engineer's approval.

Samples shall be submitted, and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer. Samples for testing will generally be selected by the Engineer from materials to be utilized in the project and all tests will be under the supervision of, and as directed by, and at such points as may be convenient to the Engineer.

Material requiring testing shall be furnished in sufficient time before intended use so as to allow for testing. No materials represented by tests may be used prior to receipt of written approval of said materials.

The Contractor shall give the Engineer at least 14 days' notice in writing of the date on which any of the materials will be ready for testing or inspection at the suppliers' premises or at a laboratory approved by the Engineer and unless the Engineer shall attend at the appointed place and time the test may proceed in his absence. The Contractor shall in any case submit to the Engineer within 7 (seven) days after every test such number of certified copies of the test readings as the Engineer may require.

Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineer's powers under the Contract.

The provisions of this Clause shall also apply to materials supplied under any nominated subcontract.

4.6.14 Daily Logbook, Daily Work Programme and Daily Site Report

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The Contractor shall keep a Daily Logbook at each location where construction activities are taking place. This Daily Logbook shall be in a form approved by the Engineer and shall contain, but not be limited to, the following major items of information:

- a) name of Contractor and Package No.
- b) date
- c) weather conditions (max./min. temperature, hours and intensity of rainfall, cloudy, sunny, windy)
- d) work carried out during the day per Section (description, quantities)
- e) major equipment used per section (on contractual work, on extra work ordered, approximate operating time on either)
- f) strength of labour force per Section (on contractual work, on extra work ordered, hours worked on either)
- g) delays (cause, effects such as idle time etc.)
- h) unusual events (earthquakes, floods, fires, storms, accidents, strikes, agitation, rallies etc.)
- i) visitors at Site.

Each daily log shall be signed by the responsible Site Manager of the Contractor and "noted" by the Engineer.

4.6.15 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required. All the cost associated under this clause is deemed to be included in the item rates of the Bill of Quantities.

4.7 STANDARDS, CODES AND ABBREVIATIONS

4.7.1 Reference Standards and Codes

The Works shall be carried out in accordance with the relevant quality standards, test procedures, or codes of practice, collectively referred to as Reference Standards, listed in the relevant parts of the Specifications. The applicable issue of any Reference Standard shall, unless otherwise stated in the Specification, be the issue current at the date two months preceding the date for submission of the Bids for the contract. The Contractor shall familiarize himself fully with the requirements of such standards. If no standard is indicated then the relevant ISO Standard or, in the absence of such standard, the relevant German, British, American, Nepalese or Indian Standard shall apply, or others, if so approved.

The Contractor may propose, at no extra cost to the Employer, the use of any alternative relevant authoritative internationally recognized Reference Standard which shall be no less exacting, in the opinion of the Engineer, than the corresponding standard quoted in the Specification.

The Contractor shall demonstrate to the Engineer that the alternative standard is suitable and equivalent to the specified standard, as well as provide proof of previous successful use. Differences between the standards specified and the proposed alternative standards must be fully described in writing by

the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. The Engineer shall decide whether or not the use of such an alternative will be allowed as a Reference Standard.

The Contractor shall obtain and keep on Site at least one copy of each approved Reference Standard and each Reference Standard referred to in the Specifications and will make these accessible to the Engineer at any time upon request.

The Contractor shall obtain the Reference Standards from the addresses given below:

ISO	International Organization for STANDARDIZATION, Rue de Varembe, Geneva, Switzerland
DIN	Deutsche Industrie Norm (German Industry Standard) from Deutsche Normenausschuss, Beuth-Vertrieb, P.O. Box 1045, W-1000, Berlin 30, Federal Republic of Germany
BSI	British Standards Institution, 389 Chiswick High Road, London W4 4BR, England
AASHTO	American Association of State Highway and Transportation Officials, Suite 341, National Press Building, Washington, D.C. 2004, U.S.A.
ACI	American Concrete Institute, P.O. Box 4754, Redford Station, Detroit, MI 48219 U.S.A.
AISC	American Institute of Steel Construction, 101 Park Avenue, New York, NY 10017 U.S.A.
ASTM	American Society for Testing and Materials, 2501 Race St., Philadelphia, PA 19103, U.S.A.
AWS	American Welding Society, Inc., 2501 N.W. 7th St., Miami, FL 33125, U.S.A.
AWWA	American Water Works Association, 6666 West Quincy Ave. Denver, Colorado 80235, U.S.A.
IS	Indian Standards, Manak Bhawan-9, Bahadur Shah Jafar Marg, New Delhi, 110002
SIS	Swedish Standards
NS	Nepal Standards, Nepal Bureau of Standards and Metrology, Balaju, Kathmandu, Nepal

4.7.2 Metric Units

S.I. units of measurements shall be used throughout the Contract. All information and data originating from other systems shall be transferred by the Contractor into the S.I. system.

4.7.3 Abbreviations

ACI	=	American Concrete Institute
AC	=	asbestos cement, alternating current
AASHTO	=	American Association of State Highway and Transportation Officials
ASTM	=	American Society for Testing and Materials
BOQ	=	Bill of Quantities, Schedule of Quantities
BS	=	British Standard
CBR	=	California Bearing Ratio
cm	=	centimetre

cm ² /g	=	square centimetre per gram
CP	=	chromiumplated
d	=	day(s)
dia	=	diameter
DIN	=	DeutscheIndustrie Norm(GermanStandard)
GON	=	The Government of Nepal
g/cm ³	=	gram per cubic centimetre
g/m ²	=	grampersquaremeter
hr	=	hour
ha	=	hectare
HDPE	=	high densitypolyethelene
IDA	=	International Development Association
IS	=	IndianStandard
ISO	=	International Standard Organization
kg	=	kilogram
kg/cm ³	=	kilogramper cubiccentimetre
kg/cm ²	=	kilogram per square centimeter
km	=	kilometre
kN	=	kilonewton
l	=	litre
m	=	meter
m ²	=	square meter
m ³	=	cubicmeter
mm	=	millimetre
m/min	=	meterper minute
mm/s	=	millimetrepersecond
N	=	Newton
NEA	=	Nepal Electricity Authority
N/mm ²	=	Newtonpersquaremillimetre
NS	=	NepaleseStandard
NWSC	=	NepalWaterSupplyCorporation
OMC	=	Optimummoisturecontent
OPC	=	OrdinaryPortlandCement
PC	=	personalcomputer
PCC	=	PlainCementConcrete
PI	=	PlasticityIndex
RC orRCC	=	reinforcedconcrete
SI	=	SystèmeInternationald'Unités
Si	=	silicon
SRPC	=	Sulphate Resisting Portland Cement
T	=	temperature
t	=	metric ton
uPVC	=	unplasticised polyvinyl chloride
4WD	=	four wheel drive
<	=	smaller/less than
>	=	larger/more than

4.7.4 Measurement and Payment

Noseparatemeasurementandpaymentwillbemadeforitemsprovided,thecostofwhichshallbedeemedto be included in the rates of the BOQ.

4.8 NOTES ABOUT MEASUREMENT AND PAYMENT

4.8.1 Measurement

Unless specified, all measurements shall be made in metric system. Different items of work shall be measured in accordance with the procedures set forth in the relevant Sections read in conjunction with the General Conditions of Contract. The same shall not, however, apply in the case of lump sum contracts.

All measurements and computations, unless otherwise indicated, shall be carried nearest to the following limits:

i)	Length and Width	10 mm
ii)	Height, Depth or Thickness of:	
	a) Earthwork, Subgrade	5 mm
	b) Sub-base, Bases, Surfacing	5 mm
iii)	Structural members	2.5 mm
iv)	Areas	0.01 sq. m
v)	Volume	0.01 cu. M

In recording dimensions of work, the sequence of length, width and height or depth or thickness shall be followed.

The tolerances specified in these Specifications are for evaluation of accuracies only based on which the work shall be accepted or rejected. However, the measurement of the work performed within the limits of tolerances shall be the measurement of actual work done in place, if their dimensions are less than what have been specified or instructed by the Engineer. If the actual work done in place is more than what has been specified or instructed by the Engineer, but within the limit of tolerance, the measurement shall be the measurement of the work what has been specified or instructed by the Engineer.

4.8.2 Payment

Unless otherwise specified in the Contract, the unit rates and/or prices for items as set out in the Bill of Quantities are the full and the final compensation to the Contractor for:

General works such as setting out, clearance of site before setting out and clearance of works after completion.

- a) A detailed programme using modern project management software for the construction and completion of the works giving, in addition to construction activities, detailed networks activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/equipment and their installation and testing, for all activities of the Engineer/Employer that are likely to affect the progress of works, etc., including updating of all such activities on the basis of the decisions taken at the periodic site review meeting or as directed by the Engineer;

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- b) Sampling and Testing of various materials such as bitumen, cement, concrete, bearing etc. proposed to be used on the Works as required under these Specifications and furnishing test reports/certificates.
- c) Design of mixes as per the relevant Sections of the Specifications giving proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant Sections of these Specifications to be submitted to the Engineer for his approval before use on the Works.
- d) Cost of laying trial stretches.
- e) Preparation of Detailed drawings as per site condition.
- f) Detailed design calculations and drawings for all Temporary Works (such as from-work, staging, centering, specialized constructional handling and launching equipment and the like).
- g) Detailed drawings for templates, bar bending and cutting schedules for reinforcement, material lists for fabrication of structural steel, etc.
- h) Mill test reports for all mild and high tensile steel and cast steel as per the relevant provisions of the Specifications.
- i) Supply of all materials necessary to complete the item as per relevant specifications.
- j) Use of materials, labours, tools, equipment, machines, and other resources as per need.
- k) All handling, packing charges and transportation.
- l) Site commissioning.
- m) Cost of all operations like storing, erection, moving into final position, etc. necessary to complete and protect the work till handing over to the Employer.
- n) Inspection Reports in respect of formwork, staging, reinforcement, and other items of work as per the relevant Specifications.
- o) Any other data which may be required as per these Specifications or the Conditions of Contract or any other annexures/schedules forming part of the Contract.
- p) All temporary works, formwork, and false work.
- q) Cost of in-built provisions for Quality Assurance.
- r) Cost of providing "As built" drawings.
- s) Maintenance and making good.
- t) All duties and obligations as set out in the contract.
- u) All incidental costs to complete the work, and other items necessary for complying with the provision of the Contract not covered under above stated.

Where the Bill of Quantities does not include the items mentioned in Section 100, no separate payment shall be made for such works. The costs in connection with the execution of the works specified herein shall be considered to be included in the related items of other works specified in the Bill of Quantities or shall be considered to be incidental to the works specified. Items specified in this Section and included in the Bill of Quantities shall be paid at the contract unit rates as agreed and shown in the Bill of Quantities.

SECTION 5: SITE CLEARANCE

5.1 CLEARING AND GRUBBING

5.1.1 Scope

The Section covers the clearing and grubbing necessary for the construction of the works covered by the contract. Conservation of the topsoil and flora is also covered under this Section.

5.1.2 Description of Work

5.1.2.1 Clearing

Clearing shall consist of the cutting, removing and disposal of all trees, bushes, shrubs, grass, weeds, other vegetation, anthills, rubbish, fences, top organic soil not exceeding 150 mm in thickness and all other objectionable material, resulting from the clearing and grubbing. It shall also include the removal and disposal of structures that obstruct, encroach upon, or otherwise obstruct the work.

The moving of a certain amount of soil or gravel material may be inherent to or unavoidable during the process of clearing and no extra payment shall be made for this. Clearing shall include the removal of all rocks and boulders of up to 0.15 m³ in size exposed or lying on the surface.

5.1.2.2 Grubbing

In the roadway all trees up to 300 mm girth, stumps and roots shall be removed to a depth of not less than 900 mm below the finished road level and a minimum of 500 mm below the original ground level whichever is lower.

Except in borrow areas the cavities resulting from the grubbing shall be backfilled with approved material and compacted to a density not less than the density of the surrounding ground.

5.1.2.3 Conservation of Topsoil

Where suitable topsoil exists within the limits of the area to be cleared and grubbed, the Contractor shall, if ordered by the Engineer, remove the topsoil together with any grass and other suitable vegetation. If not used immediately, the topsoil shall be transported and deposited in stockpiles for later use.

5.1.2.4 Conservation of Flora

Where provided for in the contract, certain designated flora encountered in the road reserve and borrow areas shall be carefully protected by the Contractor. In his tendered rate for Site Clearance, he shall include for the careful removal and planting of the flora in a protected and fenced-off area and, on completion of the road, for the replanting of the flora in suitable positions in the road reserve in accordance with the Engineer's instructions.

5.1.3 Execution of Work

5.1.3.1 Area to be Cleared and Grubbed

Stumps, embedded logs, roots and all other vegetation growth and accumulated rubbish of whatever nature and all other objectionable material shall be completely removed to a depth as specified.

Normally the portions of the road reserve that fall within the limits of the road prism, as well as certain borrow areas shall be cleared and/or grubbed. Where the road reserve is to remain unfenced, the fullwidth of the road reserve shall be cleared and/or grubbed except for such trees designated by the Engineer to be left standing and uninjured.

The Contractor shall mark the boundaries of the area for clearing and grubbing and seek the approval of the Engineer before commencement of the work. The Engineer shall designate in detail the exact area to be cleared and grubbed and the time at which it shall be done.

5.1.3.2 Cutting of Trees

The Contractor shall take the necessary precautions to damage to structures and other private or public property. If necessary, trees shall be cut in sections from the top downwards. The branches of trees to be left standing shall be trimmed so as not to intrude into a space of 7 m above the roadway.

Such individual trees as the Engineer may designate and mark in white paint shall be left standing and uninjured. In order to minimize damage to trees that are to be left standing, trees shall be felled toward the center of the areas being cleared, if so required by the Engineer.

Permission for cutting trees must be obtained from the competent authority who may require that trees be numbered, measured and marked in the presence of officials from that authority. Cutting of such trees shall then be carried out by the Contractor and the timber stored at designated locations.

Felling and cutting of trees on the site and piling them off the site shall conform to the requirements of the competent authority.

All tree trunks and branches in excess of 150 mm in diameter shall be cleaned off, secondary branches cut into suitable length and stacked at sites indicated by the Engineer. Such timber shall not be used by the Contractor for any purpose and shall remain the property of the Employer.

All timber except such timber as can be used and all brush, stumps, roots, rotten wood and other refuse from the clearing and grubbing operations shall be completely removed from within the Right of Way.

5.1.3.3 Dealing with Anthills

Where anthills are encountered within the limits of the road prism, they shall be excavated to a depth of not less than 750 mm below the finished road level and the material carted to spoil. Cavities resulting from the clearance of anthill material shall be backfilled with approved material and compacted to a density not less than that of the surrounding ground. Where directed by the Engineer, the area covered by anthills shall be treated, after excavation and before backfilling of cavities, with an approved ant control chemical.

Payment for such treatment shall be made in the manner specified in the contract.

5.1.3.4 Disposal of Material

Material obtained from clearing and grubbing shall be disposed off in borrow pits or other

suitable places and be covered up with soil or gravel as directed by the Engineer. The burning of combustible material shall not, normally, be permitted and may only be done with the prior written approval of the Engineer.

Where fences have to be taken down, fencing wire shall be neatly wound into reels and all such wire, together with all fence posts and other serviceable material from structures, etc., shall be stacked at sites indicated by the Engineer.

5.1.3.5 Re clearing of Vegetation

When portions of the road reserve, borrow or other areas have been cleared in accordance with the Specifications, but in the course of time, vegetation grows again during construction, the Engineer may, if he considers it necessary, order that the area be re-cleared.

Before the bottom layer of the embankment is made, the Contractor shall grub up and remove any vegetation that may in the meantime have grown on the surfaces previously cleared and grubbed.

Such re-clearing of areas previously cleared include the removal and disposal of grass, shrubs and other vegetation in the same manner as for the first cleaning operation. No separate payment shall be made for re-clearing of vegetation.

5.1.4 Measurement

Clearing and grubbing executed as per this Specification shall be measured in square meter.

Cutting trees including removal of stumps and their roots of girth above 300 mm and backfilling to required compaction shall be measured in number according to the sizes given below:

- Above 300 mm to 600 mm
- Above 600 mm to 900 mm
- Above 900 mm to 1800 mm
- Above 1800 mm to 2500 mm
- Above 2500 mm to 3000 mm
- Above 3000 mm

For this purpose, girth shall be measured at a height 1 meter above the ground. Cutting of trees up to 300 mm girth including removal of stumps and roots and backfilling of holes with compaction shall not be measured separately.

5.1.5 Payment

Clearing and grubbing and cutting trees shall be paid at their respective contract unit rates which shall be the full and the final compensation to the Contractor. The contract unit rate for cutting of trees of girth above 300 mm shall also include handling, salvaging, piling and disposing of the cleared materials with all leads and lifts.

5.2 DISMANTLING CULVERTS, BRIDGES, OTHER STRUCTURES AND PAVEMENT

5.2.1 Scope

This work shall consist of removing as hereinafter set forth existing culverts, bridges, pavements, buildings and other structure like guard-rails, kerbs, manholes, catch basins,

inlets, walls, drains etc., which are in place but interfere with the new construction or are not suitable to remain in place, and salvaging and disposing off the resulting materials and back filling the resulting trenches and pits.

5.2.2 General

- a) Only those structures designated by the Engineer, or shown on the Drawings, shall be demolished or removed.
- b) Dismantling and removal operations shall be carried out in such a way that the adjacent pavement, structures are left intact and in place. All operations necessary for the removal of any existing structure which might endanger new constructions shall be completed prior to start of new work.
- c) Existing culverts, bridges, buildings and other structures which are within the road and which are designated for removal, shall be removed up to the limits and extent specified on the Drawing or as indicated by the Engineer.
- d) Materials that are to be salvaged shall be carefully removed and stockpiled near the site at a location designated by the Engineer. Materials which are to be salvaged or used in the reconstructed work, have been damaged or destroyed as a result of the Contractor's operations shall be expense. Materials that are not to be salvaged and stockpiled shall be removed and disposed away from the site by the contractor at his own expenses. In general, piling, piers, abutments and pedestals shall be removed to at least 300mm below ground level measured at the face unless a different depth is designated or specified. Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.
- e) When pipe culverts, wooden culverts, gabion walls or other structures with a salvaged value are removed, care shall be exercised in their safe removal. The material involved shall be kept intact without damage. The Contractor shall be responsible for the satisfactory removal of such structures in a usable condition.
- f) Salvaged reinforced concrete pipes, corrugated steel pipes, wooden boxes or other structures shall be stored at places as directed by the Engineer or shown on the Drawing. Structures or portions thereof which are specified in the contract for re-erection shall be stored in separate piles.
- g) Timber or lumber from old structures which is designated by the Engineer as materials to be salvaged shall have all nails and bolts removed there from and shall be stored in neat piles in locations suitable for loading.
- h) All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.
- i) All salvaged materials shall be the property of the Employer.
- j) All materials obtained from dismantling operations which, in the opinion of the Engineer, cannot be used or auctioned shall be disposed of.

5.2.3 Dismantling Culverts and Bridges

The structures shall be dismantled carefully, and the materials shall be so removed as not to cause any damage to the serviceable materials to be salvaged. The part of the structure to be retained and other structures nearby shall be safeguarded against any damages.

Where existing culverts/bridges are to be otherwise incorporated in the new work, only such parts of the existing structure shall be removed as are necessary and directed by the Engineer to provide a proper connection to the new work. The connection edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained.

Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. The structure shall be removed in a condition suitable for re-erection unless otherwise shown on the Drawing. All members shall be match-marked by the Contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc., shall be similarly marked to indicate their proper location; all pins, pin holes and machined surfaces shall be painted with a mixture of white lead and tallow and all loose parts shall be securely wired to adjacent members or packed in boxes.

5.2.4 Dismantling Other Structures and Pavements

In removing pavements, kerbs, gutters, walls (masonry and bricks) and structures like catch pits, outlets, etc., where portions of the existing construction are to be left in the finished work, the same shall be removed to an existing joint or cut and chipped to a true line with face perpendicular to the surface of existing structure. Sufficient removal shall be made to provide connections with the new work as directed by the Engineer. All pavements, base courses in carriageway and shoulders, etc. designated for removal shall be broken to pieces whose volumes shall not exceed 0.02 cubic meter and stockpiled at designated locations if the materials are to be used later or otherwise arranged for disposal.

5.2.5 Back-filling

Holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved materials and compacted to required density as directed by the Engineer.

5.2.6 Measurement

Prior to commencement of dismantling, the work of dismantling structures shall be measured in the units given below:

5.2.7 Type of Work Unit

- a) Dismantling brick/stone masonry/Concrete (plan and cu.m. reinforced)
- b) Dismantling gabion cu.m.
- c) Dismantling steel structures ton
- d) Dismantling timber structures cu.m.
- e) Dismantling pipes, guard rails, Kerbs and gutters lin.m.
- f) Utility services lump sum
- g) Pavement cu.m.
- h) Dismantling pipe culverts no. and Dismantling pitching and ripraps sq.m.

Associated works like disposal, stockpiling, marking and numbering, etc., shall not be measured separately.

5.2.8 Payment

The various dismantling works shall be paid at their respective contract unit rates which shall be full and the final compensation to the Contractor as per condition of contract and for the

cost of alloperationsinvolvedforcompletionofthisitem.

SECTION 6: MATERIALSANDTESTINGOFMATERIALS

All materials procured, supplied, and utilized for this project, as well as their corresponding testing procedures and frequencies, are strictly governed by the ***Standard Specifications for Road and Bridge Works, 2073 (3rd Amendment 2082)***. Any material approval, quality control, and laboratory or field testing shall be conducted in full compliance with the guidelines and parameters stipulated in this specification.

SECTION 7: PIPE DRAINS, PIPE CULVERTS AND CONCRETE CHANNELS

All construction and testing works related to ***Section: Pipe Drains, Pipe Culverts, and Concrete Channels*** all materials, construction methodologies, and quality control measures will strictly adhere to the provisions outlined in ***Section 700 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***.

SECTION 8:TRANSPORTATIONOFMATERIAL

For the ***Transportation of Material***, all operations—including locating material sources, managing access roads, and site clearance—shall strictly comply with the provisions set forth in Section 800 of the ***Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***. Furthermore, all activities concerning the operation of quarries, borrow pits, and stockpile areas must fully adhere to the prevalent laws and regulations of the Local Government, particularly regarding public health, safety, and environmental protection.

SECTION 9: EARTHWORKS

*All earthworks (roadway excavation, roadway filling, excavation for foundation, backfilling, excavation for drains, etc) associated with the access road and park development works in Gangoliya, Rupandehi, shall be executed in strict accordance with **Section 900: Earthworks of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082).***

SECTION 10: SUBGRADES

All subgrade works for the access road and periphery road of the park in Gangoliya shall be executed in strict accordance with ***Section 1000: Subgrades of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082).***

SECTION 11: ROADWORKSOVERALLREQUIREMENTS

All general execution standards for the access road and periphery road of the park shall be implemented in strict accordance **with Section 1100: Roadworks Overall Requirements of the *Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)*.**

SECTION 12: SUBBASE, BASE, HARD SHOULDER, AND GRAVEL WEARING COURSE

The pavement layers for the access road—comprising the subbase, base, hard shoulder, and gravel wearing course—are governed by ***Section 1200 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***. The design utilizes Crusher-Run Macadam for Base and Subbase, and all related operations, material sourcing, and quality control must strictly adhere to the requirements of Clause 1204.

SECTION 13: BITUMINOUS SURFACE AND BASE COURSE

The bituminous paving operations for the project—specifically the application of ***Prime Coat and Tack Coat as per Clause 1302 and the laying of Asphalt Concrete as per Clause 1309—are governed by Section 1300 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***. All related operations, including material sourcing, mix design, temperature controls, laying, and compaction procedures, must strictly adhere to these specifications.

SECTION 14: KERBSANDFOOTPATHS

All works related to the construction of kerbs, footpaths, and park pavements, shall be executed in strict accordance with ***Section 1400 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***. Standard concrete kerbs shall adhere strictly to the specification.

For surfacing, NS Standard (or equivalent) Rectangular Interlock Pavers (M35 or above, 200x100x60mm) shall be utilized on both the access road footpaths and the pavements within the park area, alongside the use of Matrix slabs/tiles (M35 or above, 400x400x40mm).

SECTION 15: TRAFFIC SIGNS, ROAD MARKING, ROAD MARKER STONES AND DELINEATORS

All works pertaining to the supply, installation, and quality control of traffic safety appurtenances shall be executed in strict accordance **with Section 1500 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)**. Furthermore, all installations and operations must fully adhere to the Department of Roads (DOR) Traffic Sign Manual.

The specific work components for this project shall be executed as follows:

- a) **Traffic Signs:** Aligns with **Section 1501** (Permanent Traffic Signs).
- b) **Thermoplastic Road Marking:** Aligns with **Section 1504** (Thermoplastic Road Marking).
- c) **Road Studs:** Aligns with **Section 1505** (Reflective Pavement Markers / Road Studs).
- d) **Delineators:** Aligns with **Section 1507** (Delineator Posts).

SECTION 16: FORMWORK AND SURFACE FINISH FOR CONCRETE STRUCTURES

All works pertaining to the design, erection, and removal of formwork, as well as the surface finishing of concrete structures, shall be executed in strict accordance with (***Section 1800: FLASEWORK, FORMWORK AND SURFACE FINISH FOR CONCRETE STRUCTURES***) of the *Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)*.

SECTION 17: CONCRETEFORSTRUCTURES

All works relating to the batching, mixing, transporting, placing, compacting, curing, and testing of concrete for structural elements shall be executed in strict accordance with ***Section 2000 of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***.

SECTION 18: RIVER TRAINING AND PROTECTION WORKS

All works relating to river training and protection works (GABION WORKS) shall be executed in strict accordance with (***Section 2400: RIVER TRAINING AND PROTECTION WORKS***) of ***the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)***

SECTION 19: BRICKWORKSFORSTRUCTURES

All brickworks related to trench filling and soling shall be executed in strict accordance with **Section 11.H (Flooring Works) of the Detailed Specifications of Building Construction (Civil) Works published by DUDBC-2076**. For brick bat filling, hard, tough, sound, and durable brick bats shall be laid in their natural bed. Smaller size boulders or pebbles shall be utilized to fill up the gaps between the brick bats to form a uniform, well-knitted floor structure. For flat dry brick soling, governed by **Clauses H12 and H15a**, the brick laying shall be performed over a 5cm sand filling set to the correct line and level. Each brick must be laid separately and tamped firmly into place within the sand bed, and all joints between the bricks shall be thoroughly filled with dry sand. Upon completion, the soling surface must be true to line and level, with no portion deviating from the true line and level by more than 20mm.

SECTION 20: MASONRYFORSTRUCTURES**20.1 BRICK MASONRY WORKS**

All general and fair face brick masonry works shall be executed in strict accordance with **Section 11.C (Masonry Works) of the Detailed Specifications of Building Construction (Civil) Works published by DUDBC-2076**

20.2 STONE MASONRY WORKS

All works relating to stone masonry shall be executed in strict accordance **with Section 2600: Masonry for Structures of the Standard Specifications for Road and Bridge Works, 2073 (with 3rd Amendment 2082)**. The construction involves providing and laying Random Rubble Stone Masonry utilizing machine-mixed cement-sand mortar in both 1:4 and 1:6 proportions, as dictated by specific structural requirements. In compliance with the specification for random rubble, all stones shall be carefully set, ensuring bond stones are provided at a minimum rate of one for every 0.9 square meters of exposed face. These bond stones must measure not less than 150 mm x 150 mm on the exposed face and extend not less than 450 mm in length or the full thickness of the wall, whichever is less. The scope of work comprehensively encompasses the preparation of the machine-mixed mortar, erection of necessary scaffolding, joint pointing, and meticulous curing of the completed masonry. Additionally, the execution mandates the precise installation of required weep holes using 110 mm diameter High-Density Polyethylene (HDPE) pipes (6 kg/sqm pressure rating) to facilitate proper structural drainage, ensuring all operations are completed in full alignment with the drawings and the direct instructions of the Engineer.

SECTION 21: MISCELLANEOUSWORKS**21.1 ANTI TERMITE WORKS****21.1.1 Scope of Work**

This specification covers the provision and injection of pre-construction anti-termite treatment to create a complete chemical barrier. The treatment shall be applied to foundations, footings, column pits, trenches, inside floor backfills, plinth levels, retaining walls, external perimeters, and surrounding pipes or conduits. All work shall conform to IS 6313 or equivalent BIS specifications.

21.1.2 Material Requirements

Chemical Agent: The treatment shall utilize Imidacloprid 30.5% SC (commercially known as Premise 30.5% SC).

Concentration: The chemical shall be mixed and applied at a concentration of 0.07%.

Properties: The selected termiticide must be an environmentally friendly, odorless, and non-repellent chemical that is safe for mammals.

21.1.3 Execution and Treatment Stages

Foundation Treatment (Isolated or Combined Footings): The bottom surface of the excavated foundation trenches shall be leveled and sprayed with the chemical emulsion at a rate of 7 liters per square meter prior to laying the soling. Pit surfaces shall also be treated up to a height of 300 mm using a high-power foot sprayer to ensure uniform spread and soil penetration. For pile foundations, this treatment applies just below the pile cap.

Backfill Treatment: Treatment shall commence at a depth of 500 mm below the final ground level. Soil in immediate contact with the vertical surfaces of RCC foundations shall be treated at a rate of 7 liters per running meter. For pile foundations, rod holes shall be made up to 1 meter deep around the tip of the pile caps, and the solution applied at 7 liters per running meter.

Plinth Level Treatment: The top surface of the consolidated earth within the plinth level shall be treated with the chemical emulsion at a rate of 7 liters per square meter before the placement of soling and PCC.

Outer Periphery Treatment: Following the clearing and compaction of the apron earth, holes measuring 1 to 1.5 feet deep shall be made at 1-foot intervals adjacent to the external perimeter wall. The chemical emulsion shall be poured into these holes at a rate of 9 liters per running meter, after which the earth shall be refilled and compacted.

21.2 WEEPHOLES

Weep holes shall be provided in solid plain concrete/reinforced concrete, brick/stone masonry, abutment, wing wall, return walls or other structures as shown on the Drawing or as directed by the Engineer. Weep holes shall be provided with 100mm dia polythene pipe for structures inplain/reinforced concrete or brick masonry. In case of stone masonry, weep holes shall be 100 mm wide, 100 mm high or circular with 100 mm diameter. Weep holes shall extend through the full width of concrete/masonry with a slope of 1 vertical 20

horizontal towards the draining face. The spacing of weep holes shall generally be 1 m in either direction or as shown on the drawing with the lowest at about 150 mm above the low water level or ground level whichever is higher or as directed by the Engineer. Surfaces of the weep holes shall be smooth, and it shall be ensured that the water is properly driven from the backfill.

21.2.1 Measurement

Unless otherwise specified, Weep holes shall not be measured separately. No deduction in the volume of structures shall be made for weep holes.

21.2.2 Payment

Unless otherwise specified, Weep holes shall not be paid separately. The contract unit rate for respective items shall be deemed to include costs for providing such holes.

21.3 TACTILEPAVING TILE

The tactile Paving tile is a special kind of tile which is generally use on foot path for providing directional/ warning for disabled citizen while walking on foot path. This kind of tile should be laid at the middle part of foot path along with interlocking concrete block. But during construction, this kind of tile should be laid first with line and level at the middle and then concrete interlocking block should be laid. The gap between tile and concrete block should be filled up with the concrete. The construction/laying methodology for the tile should be on fine sand or stone dust whereas for concrete interlocking block should be laid as usual on fine sand or stone dust.

21.3.1 Materials

Cement

Cement used in the manufacture of tiles shall be ordinary Portland cement conforming to IS 269 : 1989 or rapid hardening Portland cement conforming to IS H041 : 1990 or white Portland cement conforming to IS 803!: 19~9 or Portland pozzolana cement conforming to IS 1489 (Part 1) : 1976 and IS 1489 (Part 2) : 1991.

Aggregates

Aggregates used in the backing layer of tiles shall conform to the requirements of IS 383 : 1970. For the wearing layer, unless otherwise specified aggregates shall consist of marble chips or any other natural stone ChIPS of similar characteristics and hardness" marble powder or dolomite powder or mixture of the two. Hardners, if required may also be added.

Pigments

Pigments, synthetic or otherwise, used for coloring tiles shall have durable color. It shall not contain matters detrimental to concrete and shall according to the color required be one of the following or their combination.

Pigments	Relevant Indian Standard
a) Black or red or brownpigments	IS 44: 1991
b) green pigments	IS 54: 19S9
c) blue pigments	IS 55: 1970 or IS 56: 1975 or IS 3574(Part 2): 1966
d) White pigments	IS 411: 1991
e) yellow pigments	IS SO: 1980 or IS 3574(Part 1): 1965

The pigments shall not contain zinc compounds organic dyes. Lead pigments shall not be used unless otherwise specified by the purchaser.

21.3.2 Manufactures

Chequered cement concrete flooring tiles shall be manufactured from a mixture of cement, natural aggregates, and coloring materials where required, by pressure process. During manufacture, the tile shall be subjected to a pressure of not less than 14 N/mm² •

The proportion of cement to aggregate in the backing of the tiles shall be not leaner than 1 : 3 by mass.

Where coloring material is used in the wearing layer, it shall not exceed 10 percent by mass of cement used in the mix.

On removal from the mould, the tiles shall be kept in moist condition continuously for such a period that would ensure their conformity to the requirements of this standard. Tiles shall be stored under cover,

21.3.3 Dimensions

The size of chequered cement flooring tiles shall be as follows:

Length(mm)	Breadth(mm)	Thickness(mm)
200	200	22
250	250	22
300	300	25

NOTE- The thickness shall be measured at two points situated approximately 50 mm from the ends on the fracture line of the tile that is tested for wet transverse strength. The total thickness is the arithmetic mean of these two measurements.

Half tiles rectangular in shape shall also be available. Half tiles for use with full tiles in the floor shall have dimensions which shall be such as to make two half tiles when joined together, to match with the dimensions of the one full tile.

Tolerances

Tolerances on length or breadth of tiles shall be ± 1 mm. In addition, the difference in length of side between the longest side and the shorter side in the sample shall not exceed 1 mm, Tolerance on thickness shall be + 5 mm, in addition the difference in thickness between the thickest and the thinnest tile in the sample shall not exceed 3 mm

Thickness of Wearing Layer

The thickness of wearing layer measured from the top of the chequers shall not be less than 6 mm. The thickness of the wearing layer shall be measured at several points along the fracture line of the tile that was tested for wet transverse strength. The arithmetic means of

the two measurements which yielded the lowest value shall be the minimum thickness of the wearing layer.

21.3.4 General quality

Unless otherwise specified, the tiles shall be upper layer. The upper layer of the tiles shall be free from projections, depressions, cracks (hair cracks not included), holes, cavities and other blemishes. The edges of the tile shall be free from projections, depressions, cracks (hair crack not included), holes, cavities, and other blemishes. The edges of the tile may be rounded.

21.3.5 Finish

The colour and texture of the wearing layer shall be uniform throughout its thickness. No appreciable difference in the appearance of the tiles, from the point of view of colour of aggregate, its type and its distribution on the surface of the wearing layer shall be present.

21.3.6 Physical requirement

The tests on tile shall not be carried out earlier than 28 days from the date of manufacture.

Flatness of the Tile Surface

The tiles when tested according to the procedure laid down in Annex B, the amount of concavity and convexity shall not exceed) mm.

Perpendicularity

When tested in accordance with the procedure laid down in Annex C, the longest gap between the arm of the 'square' and the edge of the tiles shall not exceed 2 percent of the length of the edge.

Straightness

When tested according to the procedure given in Annex D, the gap between the thread and the plane of the tile shall not exceed 1 percent of the length of the edge.

Water Absorption

When tested according to the procedure laid down in Annex E, the average percent of water absorption shall not exceed.

Wet Transverse Strength

When tested according to the procedure laid down in Annex F, the average wet transverse strength shall not be less than 3 N/mm²

Resistance to Wear

When tested in the manner specified in Annex G, the wear shall not exceed the following value:

- a) Average wear 2 mm
- b) Wear on individual specimen 2.5 mm

21.3.7 Marking

Tiles shall be legibly and indelibly marked on the back with the identification of the source of manufacturer. The detail construction should be as indicated in the drawing or as per instruction of the Engineer.

21.4 WOODWORK

21.4.1 Quality

Generally, the timber shall be Sal wood unless otherwise stated of the best quality obtained from an approved sawmill. Timber for carpentry shall be straight and free from twist, sapwood, shakes, dead and loose knots, worm holes, other holes, signs of decay and other defects, and seasoned and shall comply with the requirements of IS 883-1994. All the timber shall be seasoned and free from decay, harmful fungi and insect attacks and from any other damage of harmful nature which will affect the strength, durability, appearance or its usefulness for the purpose for which it is required. The minimum compressive strength of the timber shall be 70 kg/cm².

21.4.2 Kind

The timber shall be best quality timber as specified in the item. The samples of the approved timber to be used shall be deposited in the office of Engineer for the purpose of comparison.

Colour:

The Colour shall be uniform as far as possible, the darkness of colour amongst colour species of timber being generally a sign of strength and durability.

Moisture:

The natural moisture content of any untreated timber delivered to site shall not exceed those as recommended by IS 287-1993. All timber shall be seasoned to moisture content of not more than 22% for frames and 15% for shutter. The contractor's price must include for any kiln drying that may be necessary to achieve these figures.

21.4.3 Sawing

All beams and scantling shall be sawed straight lines, planes and of uniform thickness with full measurement from end to end and shall be sawn along grain and under no condition beams, rafters, wall plates, blocks etc. shall be sawed across grain. They shall be sawn with such sufficient margin as to secure specified dimensions, lines and planes after being brought and dressed.

All woodwork except door/window frames or ceiling shall be painted with two coats of creosote conforming to IS 218 1952. Any timber rejected shall at once be removed from the site. The contractor shall be responsible up to the end of the maintenance period for executing at his own cost all work necessary to eradicate insect attack of timber which becomes evident, including the replacement of timber attacked or suspected of being attacked, notwithstanding that the timber concerned may have already been inspected and

passed as fit to use before.

21.5 DOORS, WINDOWS & VENTILATIONS

21.5.1 UPVC Window & Ventilation/ Louver Frames & Shutters

Polyvinyl chloride Resin suspension grade is the basic raw material for forming PVC compound. PVC resin then is mixed with chemicals like Calcium, Stearate, Hydrocarbon Wax, Titanium Dioxide, Calcium Carbonate, and acrylic processing aids. Further, additives like impact modifiers, pigments, epoxy plasticizer, UV stabilizer, lubricants, chemical blowing agent etc. are added. The purpose of adding the chemicals and additives is to impart cellular structure, strength, surface finish, colour and resistance to fading by light rays. These chemicals are mixed in the desired proportion and shall be used in the formulation of PVC material and for free and smooth extrusion of PVC profiles.

The Upvc work as scheduled and detailed shall be fabricated as per the Drawings. Fabricated Upvc work covered by this specification. shall be supplied and installed by the well-known local Upvc fabricators or manufacturer as approved by the Engineer.

Before placing any orders, the Contractor shall state the name of the window manufacturer he has selected from the list of approved manufacturers. The nominated manufacturer shall not be changed without prior approval of the Engineer.

The Quantity of UPVC door (Casement/Swing/Sliding etc.), window (Casement/Sliding etc.), and ventilator/Louvers frames and shutters may vary as per the requirement of site conditions in the revised drawings later. It shall be paid in sq.m.

21.5.1.1 UPVC Sections

- a) Providing and fixing UPVC Sliding window with net, frame 50x80mm, sash 58x36mm, white color with 5mm glass all complete.
- b) Providing and fixing UPVC Casement window with frame 60x60mm, sash 60x78mm, white color with 5mm glass all complete.
- c) Providing and fixing UPVC Fixed window with net, frame 50x80mm, sash 58x36mm, white color with 5mm glass all complete.
- d) Providing and fixing UPVC Single Door with full panel frame 60x60mm, sash 60x104mm, with color all complete.
- e) The UPVC work as scheduled and detailed shall be fabricated as per drawings.

21.5.1.2 Fabricated UPVC Work

Fabricated UPVC work covered by this specification shall be supplied and installed by the well-known UPVC fabricators as approved by the Engineer.

Before placing any orders, the Contractor shall state the name of the manufacturer he has selected from the list of approved manufacturers. The nominated manufacturer shall not be changed without prior approval of the Engineer.

21.5.1.3 Materials

Extruded aluminium components shall be manufactured from aluminium alloy B 6063 - T5. The lining to louver panels shall be 1.0 mm thick sheet aluminium powdered as specified. Hardware and hinges shall be as approved by the Engineer.

21.5.1.4 Manufacture

UPVC work shall be fabricated in accordance with the prevalent practice among the local Manufacturers and as per drawings showing jointing details, hardware and extrusion profiles. It will be the UPVC fabricators as well as the Contractors' responsibility to ensure that all fabricated aluminium work is carried out in accordance with drawings of the current series.

21.5.1.5 Finish and Protection

Fabricated UPVC work shall be caustic etched, powdered and sealed as required by AS K182 and finished with two coats of an approved lacquer. All components shall be powdered 0.03 mm thick.

21.5.1.6 Workshop Drawings

The Contractor shall arrange for the preparation of complete workshop drawings of all fabricated UPVC work and shall submit the same to the Engineer for his approval.

21.5.1.7 Fixing and Strength of Main Members

Main members shall be of such strength that a wind pressure of 1.16 kPa shall cause a deflection of not more than 1/240 of the span of the member. No permanent deflection shall result from such conditions of loading.

Fixing to members shall be such that the above loading shall be generated in the members without sufficient stress to cause failure or movement to be evident at any joint.

The UPVC fabricator and the Contractor shall take full responsibility that all fabricated aluminium work shall comply with the above conditions.

Load bearing brackets shall be fabricated and fixed as shown on the architectural drawings.

21.5.1.8 Expansion

Provision for vertical and horizontal expansion must be fully detailed on the UPVC fabricator's workshop drawings.

Vertical and horizontal expansion joints shall be so designed as to cover all weather conditions likely to be encountered on the site.

21.5.1.9 Flashing

All flashing required to be built in as the work proceeds shall be supplied by the building contractor and built in by the trade concerned.

All other flashing as detailed on the drawings shall be supplied and fixed in position by the UPVC fabricator.

The UPVC door, window, ventilation frames shall be installed in position and fixed rigidly in the wall, columns with metal grips confirming ISI and stainless-steel screws of dia. 6 - 8 mm.

The spacing of grips shall be kept at 500mm.

21.5.1.10 Weather seals

Approved British or Dow corning or equivalent weather seals as approved by the Engineer shall be metal backed/backing foam, siliconized, of the size called for on the relevant Public Works Department drawings. The adjacent glass areas are masked using a masking tape before application of silicone. The surface is cleaned with cleaning solvent. Now the sealant application is started by injecting weather sealant in between the glass over the backing foam or between glass and frame or between composite panels or between wall and aluminium frame. The sealant is immediately tooled after the sealant application and the masking tape is removed. Finally, the glass and aluminium is cleaned from inside and outside.

21.5.1.11 Glazing

Providing and fixing approved brand, and type and thickness of glass and for double glazed and single glazed as mentioned in the bill of quantities in door, clerestory, window, and ventilator/Louvers shutters with gaskets as shown in the Drawing. The strong adhesive double-sided tape shall be applied for structural glazing work as directed by the Engineer.

21.5.1.12 Material

The glass of specified thickness and type shall be provided of approved make and shade. The glass shall be free from shacks, bubbles, and air holes, veins blisters or any other defects. It shall be of uniform thickness. Samples shall be approved prior to use.

21.5.1.13 Workmanship

All windows shall have glazed fixed on outside face or as shown on drawings. The glass shall be cut to size to fit slightly loose. The panel pins shall be spaced not more than 500 mm. apart.

There shall be minimum 44 glazing clips per square meter of glass. Cracked, scratched glass shall be rejected. Rubber channels can also be used in place of gaskets.

21.5.1.14 Fly wire mesh

Providing and fixing GI fly wire mesh of 16gauge to window/ventilation as per design, drawing and approval of Engineer.

21.5.1.15 Measurement

It shall be done in square meter of the area done. Rate shall include labour, materials, fabrication and fixing including all necessary accessories such as French rollers, U shaped P.V.D.F gasket, Steel hook-locks, Japanese floor spring, Chrome Handle and with Double lock, Jointing to masonry shall be set with 1st class silicone on foam seal, 5 mm clear float glass in windows/ventilators and 8 mm clear float glass in doors with sand blast and high edge polish, MS Fly screens of 18 gauge on all openable windows and other necessary fixtures and fittings all complete. It shall be paid in sq.m.

21.5.1.16 Payment

Payment for work will be made on the basis of contract unit price indicated in the BOQ. The payment will be full and final compensation for all material, labour, and equipment to

complete the works as specified.

21.5.2 Aluminium Window & Ventilation/ Louver Frames & Shutters

Providing, fabrication and fixing of powder coated (30 microns thickness) Aluminium window and ventilator/Louvers frames and shutters (1.2- 2 mm thickness) including all necessary accessories such as 4 mm clear float glass in windows/ventilators and 6 mm clear float glass in doors with sand blast, 8mm, 10 mm th. Laminated particle board for doors of toilets and balconies, 16-gauge fly screens on all openable windows and high edge polish, French rollers, U shaped P.V.D.F gasket, Steel hook-locks, Japanese floor spring, Chrome Handle and with Double lock, 18-gauge Fly screens on all openable windows all complete as per drawing using the following sections and necessary fixtures and fittings. The Quantity of aluminium door (Casement/Swing/Sliding etc.), window (Casement/Sliding etc.), and ventilator/Louvers frames and shutters may vary as per the requirement of site conditions in the revised drawings later. It shall be paid in sq.m.

21.5.2.1 Aluminium Sections

Providing and fixing 2 or 3 panel sliding window of aluminium section in naturally anodized of black anodized/powder coated color, section size (87x56x1.2mm) fitted with 5mm clear glass with stainless steel fly mesh shutter.

Providing and fixing fixed window of aluminium section in naturally anodized of black anodized/powder coated color, section size (87x25+12*1.2mm) fitted with 5mm clear glass with stainless steel fly mesh shutter.

Supply and Installation of Aluminium Louver System Ventilation with naturally anodized color with section 101.6mmx44mmx1.5mm with 5mm clear glass and steel net including materials, labour, fixing and fitting all complete as per drawings, specification and instruction of the Engineer.

The aluminium work as scheduled and detailed shall be fabricated as per drawings.

21.5.2.2 Fabricated Aluminium Work

Fabricated aluminium work covered by this specification shall be supplied and installed by the well-known aluminium fabricators as approved by the Engineer.

Before placing any orders, the Contractor shall state the name of the manufacturer he has selected from the list of approved manufacturers. The nominated manufacturer shall not be changed without prior approval of the Engineer.

21.5.2.3 Materials

Extruded aluminium components shall be manufactured from aluminium alloy B 6063 - T5. The lining to louver panels shall be 1.0 mm thick sheet aluminium powdered as specified. Hardware and hinges shall be as approved by the Engineer.

21.5.2.4 Manufacture

Aluminium work shall be fabricated in accordance with the prevalent practice among the local Manufacturers and as per drawings showing jointing details, hardware and extrusion profiles.

It will be the aluminium fabricators as well as the Contractors' responsibility to ensure that all

fabricated aluminium work is carried out in accordance with drawings of the current series.

21.5.2.5 Finish and Protection

Fabricated aluminium work shall be caustic etched, powdered and sealed as required by AS K182 and finished with two coats of an approved lacquer.

All components shall be powdered 0.03 mm thick.

21.5.2.6 Workshop Drawings

The Contractor shall arrange for the preparation of complete workshop drawings of all fabricated aluminium work and shall submit the same to the Engineer for his approval.

21.5.2.7 Fixing and Strength of Main Members

Main members shall be of such strength that a wind pressure of 1.16 kPa shall cause a deflection of not more than 1/240 of the span of the member. No permanent deflection shall result from such conditions of loading.

Fixing to members shall be such that the above loading shall be generated in the members without sufficient stress to cause failure or movement to be evident at any joint.

The aluminium fabricator and the Contractor shall take full responsibility that all fabricated aluminium work shall comply with the above conditions.

Load bearing brackets shall be manufactured from 40 x 6 mm. mild steel bent to shape, hot dipped galvanised, bitumen coated only on surfaces coming in contact with aluminium and spaced at not more than 500 mm. Centres as approved by the Engineer.

Load bearing brackets shall be fabricated and fixed as shown on the architectural drawings.

21.5.2.8 Expansion

Provision for vertical and horizontal expansion must be fully detailed on the aluminium fabricator's workshop drawings.

Vertical and horizontal expansion joints shall be so designed as to cover all weather conditions likely to be encountered on the site.

21.5.2.9 Flashing

All flashing required to be built in as the work proceeds shall be supplied by the building contractor and built in by the trade concerned.

All other flashing as detailed on the drawings shall be supplied and fixed in position by the aluminium fabricator.

The aluminium door, window, ventilation frames shall be installed in position and fixed rigidly in the wall, columns with metal grips confirming ISI and stainless-steel screws of dia. 6 - 8 mm. The spacing of grips shall be kept at 500mm.

21.5.2.10 Weather seals

Approved British or Dow corning or equivalent weather seals as approved by the Engineer shall be metal backed/backing foam, siliconized, of the size called for on the relevant Public Works Department drawings. The adjacent glass areas are masked using a masking tape

before application of silicone. The surface is cleaned with cleaning solvent. Now the sealant application is started by injecting weather sealant in between the glass over the backing foam or between glass and frame or between composite panels or between wall and aluminium frame. The sealant is immediately tooled after the sealant application and the masking tape is removed. Finally, the glass and aluminium is cleaned from inside and outside.

21.5.2.11 Glazing

Providing and fixing approved brand, and type and thickness of glass and for double glazed and single glazed as mentioned in the bill of quantities in door, clerestory, window, and ventilator/Louvers shutters with gaskets as shown in the Drawing. The strong adhesive double-sided tape shall be applied for structural glazing work as directed by the Engineer.

21.5.2.12 Material

The glass of specified thickness and type shall be provided of approved make and shade. The glass shall be free from shacks, bubbles, and air holes, veins blisters or any other defects. It shall be of uniform thickness. Samples shall be approved prior to use.

21.5.2.13 Workmanship

All windows shall have glazed fixed on outside face or as shown on drawings. The glass shall be cut to size to fit slightly loose. The panel pins shall be spaced not more than 500 mm. apart.

There shall be minimum 44 glazing clips per square meter of glass. Cracked, scratched glass shall be rejected. Rubber channels can also be used in place of gaskets.

21.5.2.14 Fly wire mesh

Providing and fixing GI fly wire mesh of 16gauge to window/ventilation as per design, drawing and approval of Engineer.

21.5.2.15 Laminated particle board

Providing and fixing of 10mm thick laminated particle board for doors of toilets and balconies may be used as per BOQ and drawing.

21.5.2.16 Measurement

It shall be done in square meter of the area done. Rate shall include labour, materials, fabrication and fixing including all necessary accessories such as French rollers, U shaped P.V.D.F gasket, Steel hook-locks, Japanese floor spring, Chrome Handle and with Double lock, Jointing to masonry shall be set with 1st class silicone on foam seal, 6 mm clear float glass in windows/ventilators and 8 mm clear float glass in doors with sand blast and high edge polish, MS Fly screens of 18 gauge on all openable windows and other necessary fixtures and fittings all complete. It shall be paid in sq.m.

21.6 FLOORING**21.6.1 Plain Cement Concrete**

Providing, mixing, laying and compacting (1:2:4 concrete) screeding of specified thickness on floor in true line and level including the cost of curing all complete

Plain cement concrete M15 (1:2:4) flooring with cement, sand and stone ballast, including laying in panels (the side of the panels shall be bounded with teak wood batten or flat iron bars of same size and fixed with weak mortar or with nails or hooks), providing proper slope for draining wash water, all complete, in sqm.

21.6.1.1 Preparation of Base

Before laying the cement concrete screeding, base shall be cleared of all foreign matter. If necessary, the base shall chip and cleaned with wire brushes. Clean base shall then be wetted with water thoroughly, but no water pool shall be allowed. Necessary slope shall be given as per the drawing and instruction of Engineer.

21.6.1.2 Proportion

The proportion shall be 1 cement: 2 sands: 4 stone aggregate 12 mm. and down gauge by volume as specified in the schedule. Grading of aggregate shall be as per reinforced concrete specification.

21.6.1.3 Placing

The screeding shall be laid to specify thickness and maintain the slope as per the drawing and instruction of Engineer. Screeding of the flooring shall be casted in one operation.

21.6.1.4 Finishing

Compact first with wood float. The blows shall be fairly heavy but as consolidation takes place, light rapid strokes shall be given. Beating shall continue till all hollows in concrete are filled with mortar cream. Then the surface shall be troweled till the moisture disappears. The surface shall be checked with straight edge. The finish surface shall be cured for 7 days. Sample of workmanship shall be got approved prior to work.

21.6.1.5 Measurement

Measurement shall be the exact length and breadth. It shall be paid in Sq.m of the work done. Nothing shall be admissible for slope, small area, corners and work in any shape. No deduction shall, however, be made for protruding or independent columns occurring in the floor, door frame embedded in floor or any other part, when the area involved does not exceed 0.1 sq. m. Rate shall include materials and labour complete.

21.6.2 Skirting

21.6.2.1 Cement skirting

Providing and laying 20 mm. thick cement plaster skirting up to 150 mm. height with cement mortar 1: 3 (1 cement: 3 sand) finished with a floating coat of neat cement and hardening liquid including curing.

It shall be paid in rm.

The thickness of the skirting shall be governed by the thickness of internal plaster. It shall project by 6 mm. from the finished surface of the plaster. The receiving surface shall be prepared similar to that for the plastering on walls.

21.6.2.2 Mortar

Mortar shall be 1 cement: 3 sand well mixed and applied as per cement plaster. When the surface becomes even it shall be uniformly covered with a coat of neat cement mixed integrally with the hardening liquid 2 litres to 50 Kg. of cement 6 mm. thick finished smooth. The corners, angles, junctions shall be truly vertical and or horizontal. Rounding of corners and junctions as required shall be done without any extra charge. The finished surface shall be cured for 7 days.

Samples of workmanship shall be got approved prior to execution of work.

21.6.2.3 Measurement

It shall be measured in running meter of the work done. The rate shall include material and labour complete. It shall be paid in RM.

21.6.3 Cement Punning

Providing, mixing, laying cement punning (1:1) in true line and level including the cost of curing, grooving (if any) as per drawing, specification

It shall be paid in sq. m.

Measurement: It shall be in square meter of the work done and rate shall include material and labour complete.

21.6.4 Porcelain Floor/Wall/Skirting Tiles

Providing and laying natural glazed/mat finish coloured homogeneous porcelain tiles on wall / floor / skirting of Indian/Chinese brand of approved colour and size in cement mortar 1:4 or 1:2, as indicated in the Bill of Quantity and Drawings all complete.

21.6.4.1 Materials

Mat finish porcelain tiles (soman/ Nitco/AGL/Kajariya or equivalent) shall be of homogeneous natural finish of approved colour, model and make. These shall be of specified size approved by the Engineer.

21.6.4.2 General

Prior to installing any tile, the Contractor shall inspect surfaces and conditions in areas to receive tile work and shall notify the Engineer of any serious defects or conditions that will interfere with or prevent a satisfactory tile installation and shall co-ordinate with other trades of work.

21.6.4.3 Installing the Tile

The surface shall be brushed, cleaned, and wetted. Tile shall be soaked completely by immersing in clean water at least 30 minutes and drained. No free moisture shall be allowed to remain on the backs of the tiles at the time of setting. Tiles shall be installed by applying a skim coat of plastic mix of 1:4 (1 cement: 4 sand) or 1:2 (1 cement: 2 sand), as may be the case, cement mortar maximum 12 mm thick on wall/floor by firmly pressing tile into the cement mortar applied on the wall so that the back of the tile is completely in touch with the mortar. Joints in the tile work shall be accurately aligned with horizontal joints level and vertical joints in plumb. Joints shall be maintained uniformly 1.5 mm wide or as directed by the Engineer by aligning spacer lugs on tile edges if tiles are so manufactured or by use of wetted strings. Tiles shall be laid out in such a way that no tile is less than half size course. Where tile must be cut at edges or penetrated the cut edges shall be carefully filed and neatly ground. Chipped, cracked or broken tiles shall not be used, and all defective work

shall be replaced and repaired to the satisfaction of the Engineer at the Contractor's expense. After tiles have been set firm and strings from set tiles removed tiles shall be dampened and joints grouted full of a plastic mix of white cement by trowel, brush, or finger application. During grouting all excess grout shall be cleaned off the tile surface with damp cloth or sponge. All tile work finishing shall be adequately protected from damage during the progress of construction till completion and any damage shall be repaired to the satisfaction of the Engineer at the Contractor's expense. Upon completion prior to final inspection and acceptance, the Contractor shall clean all tile work. Acids or other agents liable to damage the work shall be avoided. If tile surface shows mass scratches, cracks or other imperfections, which cannot be removed by cleaning; the contractor shall remove the defective material and replace with new material at no additional expense.

Sample of workmanship shall be approved prior to execution of work.

21.6.4.4 Measurement

The measurement shall be done in square meter of the work done on floor/wall/skirting including the setting mortar. Rate shall be for the material and labour complete. This shall be paid in sq.m.

21.6.5 Vitrified Floor/Wall/Skirting Tiles

Providing and laying natural glazed/mat finish coloured homogeneous 8mm thick vitrified tiles on wall / floor / skirting of Indian/Chinese brand of approved colour and size in cement mortar 1:4 or 1:2, as indicated in the Bill of Quantity and Drawings all complete.

21.6.5.1 Materials

Mat/glazed finish vitrified tiles (somany/ Nitco/AGL/Kajariya or equivalent) shall be of homogeneous natural finish of approved colour, model and make. These shall be of specified size as per BOQ or approved by the Engineer.

21.6.5.2 General

Prior to installing any tile, the Contractor shall inspect surfaces and conditions in areas to receive tile work and shall notify the Engineer of any serious defects or conditions that will interfere with or prevent a satisfactory tile installation and shall co-ordinate with other trades of work.

21.6.5.3 Installing the Tile

The surface shall be brushed, cleaned, and wetted. Tile shall be soaked completely by immersing in clean water at least 30 minutes and drained. No free moisture shall be allowed to remain on the backs of the tiles at the time of setting. Tiles shall be installed by applying a skim coat of plastic mix of 1:4 (1 cement: 4 sand) or 1:2 (1 cement: 2 sand), as may be the case, cement mortar maximum 12.5 mm thick on wall/floor by firmly pressing tile into the cement mortar applied on the wall so that the back of the tile is completely in touch with the mortar. Joints in the tile work shall be accurately aligned with horizontal joints level and vertical joints in plumb. Joints shall be maintained uniformly 1.5 mm wide or as directed by the Engineer by aligning spacer lugs on tile edges if tiles are so manufactured or by use of wetted strings. Tiles shall be laid out in such a way that no tile is less than half size course. Where tile must be cut at edges or penetrated the cut edges shall be carefully filed and neatly ground. Chipped, cracked or broken tiles shall not be used, and all defective work

shall be replaced and repaired to the satisfaction of the Engineer at the Contractor's expense. After tiles have been set firm and strings from set tiles removed tiles shall be dampened and joints grouted full of a plastic mix of white cement by trowel, brush or finger application. During grouting all excess grout shall be cleaned off the tile surface with damp cloth or sponge. All tile work finishing shall be adequately protected from damage during the progress of construction till completion and any damage shall be repaired to the satisfaction of the Engineer at the Contractor's expense. Upon completion prior to final inspection and acceptance, the Contractor shall clean all tile work. Acids or other agents liable to damage the work shall be avoided. If tile surface shows mass scratches, cracks, or other imperfections, which cannot be removed by cleaning; the contractor shall remove the defective material and replace with new material at no additional expense.

Sample of workmanship shall be approved prior to execution of work.

21.6.5.4 Measurement

The measurement shall be done in square meter of the work done on floor/wall/skirting including the setting mortar. Rate shall be for the material and labour complete. This shall be paid in sq.m.

21.6.6 Marble Flooring

Providing and laying 16 -18mm thick Rajasthani Marble in floor & wall skirting (approved colour and pattern) in 1:2 green mortar including the cost of cutting, grinding, polishing, groove making, moulding, placing, and filling with grout and screeding of required thickness in 1:6 cement mortar as required all complete as per specification.

21.6.6.1 Materials

Marble stone floor shall be used for specified areas. The marble slabs shall be of selected quality, hard, sound, dense, and homogeneous in texture free from cracks, decay, weathering and flaws.

The Sample shall be approved by Engineer before supplying and laying.

The thickness of the marble slab shall be 16-18 mm and shall be machine cut to required dimensions. The bedding mortar for the marble slab shall be minimum 12 mm thick 1:2 (1 cement: 2 sand mortar). Before laying marble floor it is essential that a level surface is required. The joints shall be as fine as possible. The flooring shall be cured for a minimum period of seven days. Slight unevenness at the meeting of edges of marble slabs shall be removed by chiselling. The surface shall be ground evenly with machine fitted with finest grade grinding stones. Then oxalic acid shall be dusted over the surface sprinkled with water and rubbed hard with pad and woollen rags to give smooth and shining finished surface.

21.6.6.2 Measurement

It shall be done in square meter of the area done. It shall be paid in sq.m. Rate shall be for all the works including all labour and materials complete.

21.6.7 Granite Flooring

Providing and laying 16 -18mm thick Granite (floor & wall skirting) (approved color and

pattern) in 1:2 green mortar including the cost of cutting, grinding, polishing, groove making, moulding, placing and filling with grout and screeding of required thickness in 1:6 cement mortar as required all complete.

21.6.7.1 Materials

Granite stone floor shall be used for specified areas. The Granite slabs shall be of selected quality, hard, sound, dense, and homogeneous in texture free from cracks, decay, weathering and flaws. The Sample shall be approved by Engineer before supplying and laying.

The thickness of the granite slab shall be 16 mm and shall be machine cut to required dimensions. The bedding mortar for the granite slab shall be minimum 12-38 mm thick 1:2 cement: sand mortar. Before laying granite floor it is essential that a level surface is required. The joints shall be as fine as possible. The flooring shall be cured for a minimum period of seven days. Slight unevenness at the meeting of edges of granite slabs shall be removed by chiseling. The surface shall be ground evenly with machine fitted with finest grade grinding stones. Then oxalic acid shall be dusted over the surface sprinkled with water and rubbed hard with pad and woolen rags to give smooth and shining finished surface.

21.6.7.2 Measurement

It shall be done in square meter of the area done. It shall be paid in sq.m. Rate shall be for all the works including all labour and materials complete.

21.6.8 Slate stone cladding

Providing and Laying 15-20mm thick slate stone cladding in 20mm thick cement sand 1:2 mortar on floor, skirting etc. including polishing and finishing work all complete as per specification and instruction of site engineer.

21.6.8.1 Materials

Slate stone cladding shall be used for specified areas. The slate stone shall be of selected quality, hard, sound, dense, and homogeneous in texture free from cracks, decay, weathering and flaws. The Sample shall be approved by Engineer before supplying and laying.

The thickness of the Kotastone slab shall be 15-20 mm and shall be machine cut to required dimensions. The mortar for the slate stone shall be minimum 20 mm thick 1:2 cement: sand mortar. Before laying granite floor it is essential that a level surface is required. The joints shall be as fine as possible.

21.6.8.2 Measurement

It shall be done in square meter of the area done. It shall be paid in sq.m. Rate shall be for all the works including all labour and materials complete.

21.6.9 Machine Made Brick Telia Tile**21.6.9.1 General**

Machine made brick telia tile (20-25 mm thick) on roof terrace (floor & wall skirting) having gap 10 mm between two tiles including 12mm thick 1:2 Cement sand mortar bed with proper

line and level including the joint filler on floors, fittings and grouting of joints with red oxide as per drawing, BOQ and Engineer's instruction.

Telia tiles are to be uniform in size, shape and colour and free from twist and other defects, in every respect equal to samples to be deposited with and approved by the Engineer.

21.6.9.2 Measurement

Measurement of works will be made in m² of plan area of works.

21.6.9.3 Payment

Payment for work will be made on the basis of contract unit price indicated in the BOQ. The payment will be full and final compensation for all material, labour, and equipment to complete the works as specified.

21.6.10 Concrete Interlocking Tiles

The cement concrete interlocking tiles of approved shape size and color shall be provided in cement sand mortar. These shall be either pre-cast concrete blocks or cast-in-situ concrete. Cement sand mortar used for bedding and joint shall be in 1:4 ratio.

21.6.10.1 Laying

The tiles shall be laid on either concrete or compacted sand-gravel as indicated in the Drawing.

In the case of cement sand base, it shall be 1 part cement; 4 parts sand and mixing shall be done as per specification for mortar mixing of brick masonry work laid to the dimensions, lines and levels shown in the Drawing and well compacted by ramming or other means. Before laying the foundation of lean concrete, the base shall be leveled and slightly watered to make it damp.

In the case of sand gravel it shall consist of a material approved by the Engineer. The tiles shall then be laid out and bedded on 12 mm thick cement sand mortar of 1:4 ratios. The gaps between the block/slabs shall not be more than 12 mm and shall be filled with 1:4 cement sand mortar.

21.6.10.2 Tests and Standard of Acceptance

Concrete shall be tested in accordance with specification for concrete and shall meet the specified criteria. All tiles shall be laid true to the lines and levels shown on the Drawing or as instructed by the Engineer.

21.6.10.3 Measurement

The work shall be measured in square meter of the area. Concrete and/or sand-gravel foundation shall be measured in cubic meters. Excavation for foundation shall not be measured. It is deemed included in the measurement of the tiles.

21.6.10.4 Payment

The tiles measured as above shall be paid at the contract unit rate which shall be the full and the final compensation to the Contractor. Concrete and/or sand-gravel foundation shall be paid for separately, as provided under respective Sections of these Specifications.

21.6.11 Wooden Planking

The seasoned and aldrin treated Timber Planks of finished size of 450mm x65mm x15mm of specified hardwood or as directed by the consultant shall be used and laid in approved type of pattern over levelled cement punned surfaces and fixed to the floor with Dendrite glue or water-repellent Glue and each tile is screwed to ground with two nos. sheet metal screws and grip. At the edges, of floor the plank should have minimum of 8mm gap for the expansion and contraction. The top surface shall be finished in perfect line and level. The planks shall be painted with chapra paints as per the specifications and finished with 2 coats of Polyurethane paints as wearing coat. The texture of the floors shall be in mat or as instructed by the Engineer.

21.6.11.1 Measurement

The measurement shall be done in square meter of the work done including epoxy resin and hardener, skilled/unskilled labour all complete and ready for use. Rate shall be for the material and labour complete. This shall be paid in sq.m.

21.6.12 Wood Composite Panel Flooring Works**21.6.12.1 Scope of Work**

This work shall consist of the supply and installation of WPC (Wood Plastic Composite) Co-Extrusion Decking for outdoor spaces. The scope includes the provision of all decking panels, necessary clips, hardware, labor, and equipment required to complete the installation as per the Drawings and the approval of the Architect/Engineer.

21.6.12.2 Material Requirements

The decking panels shall be high-class Wood Plastic Composite matching the following exact specifications:

- a) Dimensions: 2800 mm (Length) x 138 mm (Width) x 23 mm (Thickness).
- b) Composition: 55% Wood, 35% High-grade polymer (HDPE), and 10% Additives (including bonding stabilizers, UV stabilizers, etc.).
- c) Physical Properties: The decking section must have a bulk density of 1.35 g/cm³. It must be strictly weatherproof and suitable for outdoor temperature fluctuations ranging between -10 °C to 60 °C.
- d) Performance Standards: The material must comply with the following testing standards:
 - e) Moisture Resistance: Conforming to EN15534-1:2014.
 - f) Abrasion Resistance: 37.9 mg/1000r as per ASTM D4060-14.
 - g) Artificial Weathering Resistance: Minimum 4.5 grades of colorfastness.
 - h) Bending Strength: 26.8 MPa as per EN15534-1:2014.
 - i) Anti-Slip Property: R10 rating as per DIN 51130-2014.
- j) Accessories: The system shall include all necessary proprietary installation clips, specifically DBK-16 and DBK-18, functioning as starter clips and gap clips.

21.6.12.3 Installation and Execution

The WPC decking shall be installed on a prepared sub-frame or base as approved by the Engineer.

Installation must strictly utilize the specified DBK-16 and DBK-18 starter and gap clips to ensure proper spacing, thermal expansion accommodation, and a secure fit.

The finished deck must be true to line, level, and plumb, without uneven gaps or surface irregularities.

21.6.12.4 Measurement

The WPC Co-Extrusion Decking shall be measured in square meters (sq.m) of the net area successfully installed, finished, and accepted by the Architect/Engineer.

21.6.12.5 Payment

This rate shall be the full and final compensation for the supply of all materials (decking panels, DBK-16/DBK-18 clips, and fasteners), labor, tools, equipment, surface preparation, and all other incidental operations necessary to successfully complete the work to the satisfaction of the Architect/Engineer.

21.6.13 Flag Stone Paving

Flag stone of specified thickness shall be of uniform colour free from cracks and other defects. Each of the four edges shall be trimmed to four straight lines with right angle to other edge unless otherwise stated. The size of the flagstone shall be of uniform in width of 45cm and the variable length not less than 30cm. Thickness of the slab shall not exceed more than 50mm nor be less than 30mm.

21.6.13.1 Laying

Stone slab of specified thickness shall be laid on sand bed or 1:4 cement sand bed as specified by engineer. Joints shall be kept as thin as possible and shall not exceed 6mm and all the joints are pointed with 1:1 Cement sand mortar unless specified otherwise by engineer.

Laying shall start from one side in the slope as indicated in drawing or instruction. Under no circumstances shall the contractor insert small stone chips underneath the slab to raise its level to desired level. After the slabs of stone are laid, the mortar in the joints shall be raked to a depth of 12.5mm to 20mm. Joints flush pointed with 1:1 cement sand mortar. Special care shall be taken to protect the floor from walking over it before it is completely dry or in any event not earlier than 3 days.

Sample of floor stone shall be produced before site In-charge for approval and the contractor shall procure only those stone slabs that clearly and definitely confirm with the approved sample. At any case, the procured slabs shall be exhibited before using as floor slab.

21.6.13.2 Measurement

It shall be measured in square meter for specified thickness.

21.7 PLASTERING**21.7.1 Cement Plastering Walls**

Providing and laying 20mm thick cement plaster on walls with 1:6 cement sand mortar in perfect line and level including the cost of scaffolding, curing etc. all complete.

21.7.1.1 Materials

Cement shall conform to as specified under cement concrete work. Sand shall conform to as specified under cement concrete work and 50 % fine sand shall be mixed.

The cement mortar shall be in 1:4 (1 cement: 4 sand) by volume. The ingredients shall be accurately gauged and be well and evenly mixed together in a mechanical pan mixture, care being taken not to add more water than is required. No mortar that has begun to set shall be used. If hand mixing is allowed, then it shall be done in brick tanks. The gauged material shall be put in the tank and mixed dry. Water will then be added and the whole mixed again until it is homogeneous and of uniform color. Not more than one bag of cement shall be mixed at one time which can be consumed within half an hour of its mixing.

The joints in the brick work shall be raked out to a depth of 12.5 mm or 20mm. minimum and the surface watered and cleaned of all dust and dirt. Concrete surfaces shall be properly raked to get adequate key. Tip (makers) shall be provided on the surface for proper thickness and obtaining the finished plaster surface in plumb.

The finished surface shall be minimum average 12.5 mm. on ceiling or 20mm thick on inner wall and 12.5mm outer wall as specified in BOQ. The surface shall be finished at once by being rubbed over with trowel till the cement appears on the surface. All corners, angles and junctions shall be truly vertical and horizontal as the case may be and carefully and neatly finished. Rounding of corners and junctions as required and directed shall be without extra charge. The finished plaster shall be cured for 7 days and protected against damage. Sample of workmanship shall be approved prior to commencement of work.

21.7.1.2 Measurement

It shall be done in square meter of the surface over which the plaster has been done. The thickness of the plaster shall not be taken into account except for independent columns where the measurement shall be of finished surface allowing 12.5 mm. over the designed dimensions. Opening shall be deducted in full and jambs and soffits shall be allowed. Each opening less than 1 sq. m. shall neither be deducted nor extra be paid for jambs, soffits or the sides of such opening. The rate shall include rounding of all corners, junctions, making grooves and forming drip course wherever required materials, scaffolding and curing. Unless otherwise specified nothing extra shall be allowed for plaster on independent columns and beams, any short width or on curved surfaces and difficult location. It shall be paid in sq. m.

21.7.2 Plastering Soffits of Slabs and Independent Concrete Surface

Providing and laying 12.5 mm thick cement plaster on ceiling/Independent Concrete surface with 1:3 cement sand mortar in perfect line and level including scaffolding, curing etc. all complete

Plastering the R. C. C. soffits/slab, column, shear wall with 12.5 mm. thick cement plaster 1: 3 (1 cement : 3 sand 50 % coarse sand + 50 % fine sand).

The work shall be done as per specification of item No. 10.1. The plaster shall be composed of 1: 3 (1 cement: 3 sand) cement mortar. Cement slurry shall be used as required. Care should be taken to ensure that the finished plaster surface shall be plump, plane, straight

and true to line. All arises and corners shall be straight, clean and sharp. All plaster work be subjected to approval of the Engineer and work failing to meet the requirement shall be dismantled and replaced at the Contractor's expense.

21.7.2.1 Measurement

It shall be measured in square meter of the surface over which plaster has been done. The rate shall include rounding of all corners, junctions and forming drip course, making grooves, material, scaffolding and curing all complete. It shall be paid in sq. m.

21.7.3 Tile Shape Plaster

25mm thick tile shape plaster in cement sand mortar (1:4) in slope portion of slab in perfect line and level racking the joints, wetting the surface and curing the work all complete as per specification and construction of the consultant/engineer all complete.

The work shall be done as per specification of item No. 10.1. The plaster shall be composed of 1: 4 (1 cement: 4 sand) cement mortar. Cement slurry shall be used as required. Care should be taken to ensure that the finished plaster surface shall be plump, plane, straight and true to line. All plaster work be subjected to approval of the Engineer and work failing to meet the requirement shall be dismantled and replaced at the Contractor's expense.

21.7.3.1 Measurement

It shall be measured in square meter of the surface over which plaster has been done. The rate shall include, material, scaffolding and curing all complete. It shall be paid in sq. m.

21.8 WATER PROFING TREATMENTS**21.8.1 Water Proofing Works in terrace and balcony**

Elastocrete cementitious elastomeric water proofing coating two components capacity per kg 6 sq.ft 2 coat including supply and applying all complete work as per drawing, specification and direction of the engineer.

21.8.1.1 Surface preparation

The substrate must be sound, clean and have an open capillary system, and feel like fine sandpaper to ensure mechanical bond (surface adhesion) and allow Elastocrete cementitious elastometric water proofing to penetrate. Horizontal surface should have a rough wood foot or broom finish. Smooth formed walls or smooth trowel led slabs must roughened.

Remove all dirt, cement laitance, form release agents, curing compounds, loose particles, paints etc. by means of acid etching, wet or dry sand-blasting or other suitable mechanical means.

Remove all protrusions, work back to sound concrete, chiselling out any honeycombed or damaged areas.

Stop active water leakage by using quick setting compound and grouting method, if required. Thoroughly rinse the entire surface to be waterproofed with clean water. Pre-water several times so that the concrete or masonry is saturated to control surface suction and ensure the

growth of the crystalline formation deep within the pores of the substrate. When Elastocrete cementitious elastomeric water proofing is applied, the surface should be damp, but not wet. Any surface water on horizontal surfaces must be removed.

21.8.1.2 Mixing

Add Elastocrete cementitious elastomeric water proofing (3 parts) to water (1 part) and mix thoroughly until the mixture is completely free of lumps. Mix only as much material as can be used within 30 minutes.

21.8.1.3 Vertical/ Horizontal surface coating

Apply Elastocrete cementitious elastomeric water proofing in slurry form to pre-watered concrete substrate with a masonry brush. Brush on the material evenly and work it well into the surface. Apply second while the first coat is still tacky (green).

21.8.1.4 Measurement

Measurement shall be in square meter of the actual covered area. Nothing extra shall be allowed for smoothing any rough surface by dressing cement mortar. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.8.2 Water Proofing Works in toilet wall and floor

Supplying and Applying 400gsm Polythene Polypropylene Polymer Compound Waterproof Membrane in toilet walls and floors all complete as per specification and instruction of the engineer. Polyethylene polypropylene polymer waterproof membrane is mainly polypropylene non-woven fabric and polyethylene as the main raw material, by adding the host to improve the performance of a reinforced protective layer, anti-aging layer, waterproof layer and sticky enhanced layer of four layers of sheet material as one of the conformities of waterproof rolling material.

21.8.2.1 Surface preparation

The application procedure for a polyethylene polypropylene polyester polymer waterproof membrane may include the following steps:

- a) Prepare the base: Clean and level the base layer and repair any surface defects.
- b) Prepare the membrane: Pre-lay the membrane and align it.
- c) Apply the adhesive: Pour cement binder on the base and scrape it evenly.
- d) Push the membrane forward: Push the membrane forward and remove any excess adhesive or air.
- e) Create a protective layer: Apply a 2 cm thick cement mortar protective layer in two layers, staggering the layers by 20 cm.
- f) Create overlaps: For roofs, toilets overlap the membranes by 10 cm. For basements, use a cover lap that is 10-15 cm wide and bond the cover with high polymer.

21.8.2.2 Membrane on Vertical/ Horizontal surface

Apply Polythene Polypropylene Polymer Compound Waterproof Membrane in toilet walls and floors properly following the specification.

21.8.2.3 Measurement

Measurement shall be in square meter of the actual covered area. Nothing extra shall be

allowed for smoothing any rough surface by dressing cement mortar. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.9 PAINTING

21.9.1 Applying Priming Coat of Approved Brand

Cement primer sq. m.

Wood primer sq. m.

Metal primer sq. m.

Enamel primer.....sq.m.

The primers shall be in seal tins. These shall be of (Berger, Nerolac, Birla, KNP, Asian or Equivalent Brand) or equivalent as per BOQ and approved by the Engineer.

21.9.1.1 Preparation

All surfaces shall be papered by sandpaper rubbing and cleaned properly.

Description of Work	How measured	Multiplying Factor
i) Panelled or Framed	Measured flat	1 for each side
ii) Flush doors	-do-	1 for each side
iii) Fully glazed or wire	-do-	½ for each side
iv) Part panelled or part glazed or gauged	-do-	1 for each side
v) Fully ventilated or louvered	-do-	1½ for each side
vi) Trellis or Jeffri	Measured flat overall.	2 for painting all over
vii) Railing with guard bars, balusters, gratings	-do-	1 for painting all over
viii) Gates, open palisade fencing including standard braces, rails stay	The height shall be taken from the lower end of the palisade upto the top of the palisade but not to the top of the standards if they are higher.	all over

The surface for cement plaster shall be patched up with the thick paste of the same primer and smoothed after drying.

In case of timber having knots and nails holes, they should be filled with stopping and knotting materials. The knotting material shall consist of pure shellac dissolved in Methylated spirit. For stopping, Russian talc or gaskets shall be used. The stopping shall consist of two parts of whiting (powdered chalk), One part of white lead mixed together in double boiled linseed oil and well kneaded. The surface thus kneaded shall be allowed to dry up and then sand papered, or readymade approved gaskets may be used.

In case of metal, derusting shall be done and properly cleaned after sand papering.

21.9.1.2 Application

After preparing the surface, the priming coat shall be applied with hairbrushes and as per manufacturer's printed instructions.

21.9.1.3 Measurement

Measurement shall be done in square meter. The measurements shall be as follows:

Nothing extra shall be paid for short width and surface of any shape, size. This shall include for two or more coats inclusive of materials, scaffolding and labour complete.

21.9.2 Wall Putty

Providing and applying wall putty (Berger, Birla, KNP, Asian or Equivalent Brand) on wall and ceiling surface with two or more coats to give an even and uniform shade as per BOQ, drawing and specification.

21.9.2.1 Materials

Wall Putty shall be of Berger, Birla, JK, Asian or any other equivalent brand as per BOQ and approved by the Engineer in sealed tins.

21.9.2.2 Application

Before wall putty is commenced on surface, all dirt and foreign matter shall be completely removed. A vertical stroke with another horizontal stroke shall be termed one coat. Wall putty shall be applied to the surface with thin smooth steel plate in a number of coats to get uniform finish. After the first coat of the paint has hardened, the second coat is applied. Similarly required number of coats shall be given to get an even and uniform shade.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.2.3 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.9.3 Waterproof Cement Painting

Painting the plastered surface with water proofing cement paint of approved brand and of colour with two or more coats to give an even and uniform shade.

21.9.3.1 Materials

Water proofing cement shall be of (Berger, Nerolac, Birla, KNP, Asian or Equivalent Brand) as per BOQ and approved by the Engineer in sealed tins.

21.9.3.2 Application

Before painting is commenced on surface, all dirt and foreign matter shall be completely removed. The surface shall be wetted by sprinkling water with a fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface. A vertical stroke with another horizontal stroke shall be termed one coat. Paint solution to be applied to the surface with hairbrushes in a number of coats to get uniform finish. After the first coat of the paint has hardened, It shall be cured with water at least for 24 hours before the second coat is applied. Similarly required number of coats shall be given to get an even and uniform shade. It shall be kept damp at least for seven days.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.3.3 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 12.1.3. Nothing extra shall be allowed for painting any rough surface e.g. external sand - faced plaster or work in short width or surfaces in any shape. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.9.4 Plastic Emulsion Painting (Interior)

Providing and Applying Primer coat and two coats of the approved brand, colour & quality acrylic coat plastic Emulsion Paint low (VOC) on internal wall and ceiling surface (Nerolac, Burger, Asian Paints, Birla, KNP or equivalent for internal paint and silicon based weather coat 1st quality emulsion for exterior wall paint (Nerolac, Burger, Asian Paints, Birla or equivalent)) paint to achieve evenly shaded surface including the cost of scaffolding as per the specifications & instructions all complete.

21.9.4.1 Materials

Acrylic coat plastic emulsion shall be of Nerolac, Burger, Asian Paints, Birla, KNP or any other equivalent brand as per BOQ and approved by the Engineer in sealed tins.

21.9.4.2 Application

All surfaces shall be thoroughly levelled, and sand papered. Knotting and stopping as required shall be attended.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.4.3 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 12.1.3. Nothing extra shall be allowed for painting any rough surface e.g. external sand - faced plaster or work in short width or surfaces in any shape. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.9.5 Enamel Painting

Providing and application of two or more coats paint with synthetic enamel paint of approved brand and colour to give an even and uniform shade all complete.

21.9.5.1 Materials

The paints shall be of Nerolac, Burger, Asian Paints, KNP or any other equivalent brand as per BOQ and approved by the Engineer, in sealed tins.

21.9.5.2 Preparation of surface

All surfaces shall be thoroughly planed and sand papered. Knotting and stopping as required shall be attended.

21.9.5.3 Application

After preparing the surface and after the priming coat has been applied a topcoat shall be applied. Another coat shall be applied after the previous coat is dry. Care should be taken that dust or other foreign materials do not settle; they will disfigure the various coats.

The same brand of materials will be used for various coats. The paints shall be used and

applied as per manufacturer's printed instruction. The paint shall be applied with bristle brushes and not horsehair ones. The paints shall be applied in the thinnest possible layers with parallel drawings. No flowing down shall be allowed. Painting to false ceiling and acoustic tile, soft board etc. shall be done by spray painting only.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.5.4 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 18.1.3. The rate shall include for two or more coats inclusive of materials, labor, scaffolding all complete. It shall be paid in sq. m.

21.9.6 Plastic Emulsion Paint (Exterior)

Providing and Applying Primer coat and two coats of the approved brand, colour & quality silicon-based weather coat 1st quality emulsion for exterior wall paint (Nerolac, Burger, Birla, KNP or equivalent)) paint to achieve evenly shaded surface including the cost of scaffolding as per the specifications & instructions all complete.

21.9.6.1 Materials

The paint shall be of Nerolac, Burger, Asian Paints, Birla, KNP or equivalent or equivalent brand as per BOQ and approved by the Engineer in sealed tins.

21.9.6.2 Application

Before painting is commenced on surface, all dirt and foreign matter shall be completely removed. The surface shall be wetted by sprinkling water with a fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface. A vertical stroke with another horizontal stroke shall be termed one coat. Paint solution to be applied to the surface with hairbrushes in a number of coats to get uniform finish. After the first coat of the paint has hardened, it shall be cured with water at least for 24 hours before the second coat is applied. Similarly required number of coats shall be given to get an even and uniform shade. It shall be kept damp at least for seven days.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.6.3 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 12.1.3. Nothing extra shall be allowed for painting any rough surface e.g., external sand - faced plaster or work in short width or surfaces in any shape. Rate shall include all materials, tools, labour as well as scaffolding all complete. It shall be paid in sq. m.

21.9.7 Frech/Chapra Polish

Applying five or more coats with French polish of approved brand and color to give an even and uniform shade including a shining polish of approved brand.

21.9.7.1 Materials

The material required for French polish shall be Chapra, Ramtilak, Sprit, Geru, sandpaper, color, shining polish, etc.

21.9.7.2 Preparation of surface

All surfaces shall be thoroughly planed and sand papered. Knotting and stopping as required shall be attended.

21.9.7.3 Application

After preparing the surface and after the priming coat has been applied a topcoat shall be applied. Another coat shall be applied after the previous coat is dry. Care should be taken that dust or other foreign materials do not settle; they will disfigure the various coats. A number of coats of French polish shall be applied till the surface gives a shining appearance. Finally, shining coat shall be approved.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.7.4 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 12.1.3. The rate shall include for five or more coats inclusive of materials, labour, scaffolding all complete. It shall be paid in sq. m.

21.9.8 Silicon Paint (Exterior)

Providing and applying two coats of the approved brand, colour & quality water-based silicon paint for exterior wall paint (Nerolac, Burger, Birla, KNP or equivalent)) paint to achieve evenly shaded surface including the cost of scaffolding as per the specifications & instructions all complete. Silicone masonry paint is specifically designed to be highly breathable, waterproof and highly durable in even the harshest weather conditions.

21.9.8.1 Materials

The paint shall be of Nerolac, Burger, Asian Paints, Birla, KNP or equivalent or equivalent brand as per BOQ and approved by the Engineer in sealed tins.

21.9.8.2 Application

Before painting is commenced on surface, all dirt and foreign matter shall be completely removed. The surface shall be wetted by sprinkling water with a fine spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to soak into the surface. A vertical stroke with another horizontal stroke shall be termed one coat. Paint solution to be applied to the surface with hair brushes in a number of coats to get uniform finish. After the first coat of the paint has hardened, It shall be cured with water at least for 24 hours before the second coat is applied. Similarly required number of coats shall be given to get an even and uniform shade. It shall be kept damp at least for seven days.

Sample of workmanship shall be approved by the Engineer prior to commencement of work.

21.9.8.3 Measurement

It shall be measure in square meter by multiplying length and width of actual covered area. Measurement shall also be done as per 12.1.3. Rate shall include all materials, tools, labour

as well as scaffolding all complete. It shall be paid in sq. m.

21.10 ROOFING

21.10.1 CGI Roofing Sheet

21.10.1.1 Quality

The surfaces of the sheets must be clean, bright and free from rust; any sheet showing a white powdery deposit should be rejected. Iron galvanized after and not before the process of corrugations should be used. 0.52mm thick CGI sheet and plain GI ridge of approved brand and colour shall be used.

21.10.1.2 Laying and Fixing

They are laid over purlins, one at each end and one in the middle of each sheet. Each sheet is laid with end lap of 150 mm and the side laps should be of 2 corrugations. The sheets are either riveted or jointed with limpet washer. The rivet holes should be drilled & all holes should be in ridges and never in gutters. The tools must be very sharp so that there is no tearing. It is better to rivet 3 or 4 in breadth and then hoisted to the position. The rivet holes should be about 224 mm apart on the sides and at every second corrugation at the ends where four sheets overlap. It is better to drill the holes do not punch.

All rivets will be G.I. and will be passed from below with a lead washer on the top extending 12 mm round beyond the edge of the hole. Care should be taken that the sheet is well supported underneath, and no inundations are made on the upper surface. The sheets are secured to the iron purlins by means of 10 mm dia. hooks or bolts passing through the sheets and 75 mm screws to the wooden purlins.

The bolt holes should be slightly larger than the diameter of the bolts and covered with a limpet or leaden washer. All rivets, bolts etc. should be set in white lead.

21.10.1.3 Ridges and Hips

The ridges and hips are covered by plain G.I. riveted sheets and fastened with limpet washers to Plain GI sheets and overlap of 300 mm on each side and joint set-in white lead.

The sheets should be fastened at eaves and ends, by continuous length of flat steel bars called "Wind Ties" which are usually 40 mm x 6 mm with slotted holes bolted down to the bressummer or rafter at about 100 mm intervals. These bolts should not be less than 45 mm in length with 150 mm square plates over pillars or walls. The projection at eaves is generally 32 mm to 50 mm.

The pitch is sloped up to 25 to 40 degrees. The finished surface shall be uniform, and the lines of corrugations shall be uniform, and the lines of corrugations shall be straight and parallel.

21.10.2 Steel Tubular Trusses and Purlins

Steel tube roof trusses, and truss girders etc. with BS or IS steel tube sections including welding, hoisting and fixing with necessary M.S. bed plates, anchor bolts etc. as per detailed

drawings all complete.

21.10.2.1 Material

Steel tubes used in the trusses shall be finished tubes conforming to the requirements specified in IS: 1161 & IS: 806-1968.

21.10.2.2 Fabrication

The fabrication of trusses using steel tubes shall be done in accordance with IS: 800-1962, welding shall be done with reference to the IS: 820 and IS: 816-1956. The component parts of the structure shall be assembled in such a manner that they are neither twisted nor damaged. The fabricator shall submit fabrication shop drawing for approval. The members of the truss shall be assembled, and welding done according to the drawing. All materials before assembly shall be straight end, if necessary, unless required to be of a curvilinear form and shall be free from twist.

21.10.2.3 Bolting

Washers shall be specially shaped where necessary or other means used, to give the nuts and the heads of bolts a satisfactory bearing. In all cases where the full bearing area of the bolt is to be developed, the threaded portion of the bolt shall not be within the thickness of the parts bolted together and washers or appropriate thickness shall be provided to allow the nut to be completely tightened. Edges should be dressed to a neat workman like finish and be free from distortion where parts are to be in contact with metal.

21.10.2.4 Sealing to Tubes

Where the ends of a tube are not automatically sealed by virtue of its connection by welding to another member, the end shall be properly and completely sealed. Before sealing, the inside of the tube should be dry and free from loose scale.

21.10.2.5 Flattened Ends

In tubular construction, the ends of tubes may be flattened or otherwise formed to provide for welded, riveted or bolted connections provided that the methods adopted for such flattening do not injure the material. The change of section shall be gradual.

21.10.2.6 Erection

The contractor must see to it that the base plates are in one level as shown in drawing. The truss shall be erected only after the walls and columns have been constructed to the full height. The bolts shall be fitted loosely at first. The bolts shall be tightened hard only after two pieces of the truss have been closely fitted till then the truss should be supported fully from underneath by means of props. All the bolts in the truss for the whole building shall be tightened at one time. The contractor is to pay special attention so that bolts are not bent due to mishandling of the truss.

21.10.2.7 Painting

All tubes shall unless specified otherwise shall be painted with one coat of red oxide paint before erection at site and one coat of red oxide paint after erection.

21.10.2.8 Measurement

It shall be measured in weight and shall be paid in Kg. Rate shall include the strut, purlin, base plate, gusset plate, nut & bolts and other accessories, materials and labour all

complete.

21.10.3 Gypsum Board M/F Suspended Ceiling/Wall (Regular Single Layer)

Providing and fixing suspended false ceiling and in wall, which should be included providing and fixing GI perimeter channels of size 0.55 mm thick having one flange of 20mm and another flange of 30mm and a web of 27mm along with perimeter of ceiling, screw fixed to brick wall/partition with the help of nylon sleeves and screws, at 610 mm centers. Then suspending GI intermediate channels of size 45 mm, 0.9 mm thick with two flanges of 15mm each with the help of a level adjuster made of zinc alloy 50 x 25 mm as per dress from the soffit at 1220mm center with MS flat 25 x 3 mm thick fixed to soffit with GI cleat and metal expansion fastener, ceiling section of 0.55 mm thickness having knurled web of 51.5 mm and two flanges of 26mm each with lips of 10.5 mm are then fixed to the intermediate channel with the help of connecting clips and in direction perpendicular to the intermediate channel at 475mm centers.

21.10.3.1 Boarding

Providing and fixing 12.5mm thick Waterproof (aluminium foiled lining on one side) Gypsum board (Armstrong, Boral, SCG or equivalent) conforming to IS-2095-1982 is then screw fixed to ceiling section with 25mm drywall screws at 230mm centre. Screw fixing is done mechanically either with screwdriver or drilling machine with suitable attachments.

21.10.3.2 Sealing of joints

Boards are to be jointed and finished so as to have a flush look. This should be included filling and finishing of the boards with jointing compound, paper tape and two coats of primer suitable for gypsum boards.

For Light fittings & cutoutsetc have to be made with the frame of perimeter channels of size 20mm x 27 mm x 30 mm x 0.55 mm thick supported suitable.

Angle bead is to be used at steps to get straight line finish.

Edge bead to be used to protect the exposed Gypsum core of board specially cut edges of the openings for light fittings, diffusers, etc.

Control joints to be used in excess of 10Meter Long ceiling in both directions.

21.10.3.3 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete. It shall be paid in sq. m.

21.10.4 Synthetic tensile Roofing work

21.10.4.1 Scope of Work

This work shall consist of providing and installing a PVC-coated tensile fabric roofing membrane over a prepared space truss structure. The scope encompasses the supply of the membrane, all necessary tensioning accessories, fixtures, labor, tools, and equipment required for a complete and secure installation in strict accordance with the manufacturer's specific instructions and the approval of the Engineer.

21.10.4.2 Material Requirement

The tensile roofing membrane shall be manufactured from a high-strength polyester (PES) base fabric and shall strictly conform to the following technical parameters:

Coating and Finish: PVC-coated with a double-sided PVDF protective finish (PVDF/PVDF S2).

Color: Off-white.

Weight: 950 gsm.

Thickness: 0.75 mm.

Tensile Strength (Minimum): 550/550 daN/5 cm (warp/weft).

Tear Strength (Minimum): 80/60 daN (warp/weft).

Adhesion Strength: 20–30 N/10 mm (10–15 daN/5 cm).

Optical Properties: Low visible light transmittance of approximately 4–8% and low solar transmittance of approximately 6%, tested in accordance with EN 410.

Fire Performance: Classified as C-s2,wd0 in accordance with EN 13501-1.

General Characteristics: The material must possess high durability, high dimensional stability, and low maintenance characteristics. It must be strictly weather-proof and highly resistant to UV exposure, heat, and cold.

21.10.4.3 Installation and Execution

Handling: The fabric membrane must be handled with care to avoid scratching, tearing, or creasing the PVDF coating during transit and lifting.

Erection: The membrane shall be correctly positioned and securely anchored over the supporting space truss system using the specified proprietary hardware and accessories.

Tensioning: Tensioning shall be carried out evenly to the manufacturer's required pre-stress levels to ensure the roof is taut, stable under wind loads, and free from wrinkles or ponding risks.

21.10.4.4 Measurement

The synthetic tensile roofing work shall be measured in square meters (sq.m) of the actual net surface area of the membrane successfully installed, tensioned, and accepted by the Engineer.

21.10.4.5 Payment

The work, measured as provided above, shall be paid at the contract unit rate per square meter (sq.m). This rate shall be the full and final compensation for the supply of all materials (including the PES fabric and all tensioning accessories/hardware), labor, tools, equipment, lifting arrangements, surface tensioning, and all other incidental operations necessary to successfully complete the item to the satisfaction of the Engineer.

21.10.5 25mm Thick Eaves Board**21.10.5.1 General**

The Supplying and fixing 25mm thick sal wood eaves board at edge of CGI/UPVC roof in order to prevent water toward structure as per instruction of engineer.

21.10.5.2 Laying and Fixing

They are laid at edge of roof by means of 10 mm dia. hooks or bolts passing through the sheets and 75 mm screws to the rafters.

21.10.5.3 Measurement

The eaves board shall be measured in Sqm. Rate shall include the Hilti screw/self-tapping screw and bolts, limpit, washer, bitumen washer, and other accessories, materials, and labour all complete.

21.10.6 Rainwater Gutter**21.10.6.1 Quality**

Providing and installation of 1mm thick MS sheet of size 300x250mm. The surfaces of the sheets must be clean, bright and free from rust; any sheet showing a white powdery deposit should be rejected. Iron galvanized after and not before the process of corrugations should be used.

21.10.6.2 Measurement

The MS rainwater gutter shall be measured in running meter. Rate shall include the manufacturing, installation and other accessories, materials, and labour all complete.

21.10.7 Rockwool Insulation**21.10.7.1 Scope of Work**

This work shall consist of the supply and installation of aluminum foil-backed Rockwool insulation on concrete ceilings. The insulation is intended to provide thermal, acoustic, and fire safety compliance. The scope encompasses the provision of all insulation panels/rolls, adhesives, mechanical fasteners, tape, labor, tools, and scaffolding required to complete the installation successfully as per the Drawings, Technical Specifications, and the instruction of the Engineer.

21.10.7.2 Material

The Rockwool insulation must strictly comply with the following technical parameters and performance standards:

Base Material: Rockwool (mineral wool) designed for thermal, acoustic, and fire safety applications.

Dimensions & Density: The insulation shall have a thickness of 50 mm and a bulk density of 48 kg/m³.

Facing: The insulation shall feature an aluminum foil backing on one side.

Thermal Performance:

Thermal Conductivity: Maximum 0.035 W/mK at 20 °C mean temperature, tested in accordance with ASTM C518.

Thermal Resistance (R-Value): 1.47 m²K/W at 50 mm thickness.

Fire Safety & Performance:

Combustibility: Completely non-combustible, classified as Class A1 in accordance with EN 13501-1.

Melting Point: Greater than 1000 °C, tested in accordance with ASTM E794-06.

Surface Burning Characteristics: Flame Spread Index of 0 and Smoke Developed Index of 0, tested in accordance with UL 723.

Acoustic Performance: Noise Reduction Coefficient (NRC) of 1 at 50 mm thickness, tested in accordance with BS EN ISO 354:2003.

Moisture Resistance: Water absorption shall be less than 0.04% by volume, tested in accordance with ASTM C1104/C1104M.

21.10.7.3 Installation and Execution

Surface Preparation: The concrete ceiling surface must be clean, dry, and free from dust, grease, or any loose materials before installation begins.

Fixing: The insulation shall be firmly installed against the concrete ceiling with the aluminum foil facing the correct direction (usually downwards/towards the room) as specified by the Engineer. Installation shall be carried out using approved mechanical fasteners (insulation pins/anchors) and/or suitable adhesives as per the manufacturer's recommendations.

Jointing: All joints between insulation batts/rolls must be tightly butted to prevent thermal bridging or acoustic leaks. Foil tape matching the aluminum facing shall be applied over all joints and fastener penetrations to ensure a continuous vapor barrier.

21.10.7.4 Measurement

The Rockwool insulation work shall be measured in square meters (sq.m) of the actual net surface area of the ceiling successfully insulated, finished, and accepted by the Engineer. Overlaps and wastage shall not be measured for payment.

21.10.7.5 Payment

The work, measured as provided above, shall be paid at the contract unit rate per square meter (sq.m). This rate shall be the full and final compensation for the supply of all materials (Rockwool, aluminum foil backing, mechanical fasteners, adhesives, foil tape), labor, tools, equipment, scaffolding, surface preparation, and all other incidental operations necessary to successfully complete the item to the satisfaction of the Engineer.

21.10.8 25mm THICK EPS THERMOCOL

21.10.8.1 General

25mm EPS70 Insulation Boards can be used in floors, walls and roofs. It is common to see EPS Insulation used in both commercial and residential settings to satisfy building regulations. One of the most common uses of 25mm EPS Insulation Boards are below concrete slabs with concrete poured on top. In addition to this, 25mm EPS 70 boards feature high compression strength, which makes them great for load bearing applications. This is why you tend to see them used mostly as floor insulation. EPS works great in flooring applications as it can help to minimize the heat lost through flooring.

21.10.8.2 Material

Expanded Polystyrene is a tough, rigid, lightweight, closed cell insulation foam commonly known as EPS. Having densities in- between 8 Kg/M3 to 32 Kg/M3. Its close cell structure

provides low water vapour permanence and hence it is widely used for thermal insulation.

Shape	Rectangular
Size	2.4 Mtr X 1.2 Mtr
Material	Expanded Polystyrene (EPS)
Thermal Conductivity	0.038W/mK
Density	15 kg/Cubic Metre
Fire Rating	Euroclass F
Edge Type	Square
Weight	0.37 kg/m ²

21.10.8.3 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete.

21.10.9 10mm THICK CEMENT BOARD PARTITION

21.10.9.1 General

Supplying, fabrication, fixing of cement board in position for internal and external made with 10mm thick cement board fixed to C-stud fixed to U-track with spacing 300mm c/c of horizontal frame, including sealing joints with fibre tapes and joint sealing compound, filling screw heads as per manufacturer's installation guidelines, sealing perimeter gaps with silicon sealant etc. all complete.

21.10.9.2 Material

Fiber cement boards consist of a composite material comprising of reinforced fibres, cement, sand, and silica. Fiber cement boards provide non-combustible properties, rendering them suitable for a diverse range of applications. Various thicknesses and sizes are available for these materials, enabling them to be cut, moulded, and placed in a manner akin to conventional wood. These entities exhibit a significant degree of resistance to fire, water, moisture, and heat.

21.10.9.3 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete.

21.10.10 PUFF ROOF/WALL PANEL

21.10.10.1 General

Puff Roof and Wall Panel (Sandwich PUF Panel) typically consist of three layers: a core and two side skins, commonly used in prefabricated building construction. These panels are known for their lightweight nature, resilience to weather conditions, and eco-friendliness.

21.10.10.2 Material

PUF panels consist of three layers: a core material made of polyurethane foam, and two outer layers made of metal sheets. The metal sheets are usually made of steel or aluminum and can vary in thickness depending on the intended use of the panel. The thickness of the

metal sheets can range from 0.4 mm to 1.2 mm, with a standard thickness of 0.5 mm.

The core material of PUF panels is made of polyurethane foam, which is a type of plastic that is produced by reacting two chemical components, polyols and isocyanates. The polyols are typically derived from petrochemicals, while the isocyanates are derived from phosgene, a highly toxic gas. These two components are mixed together in a chemical reaction that produces polyurethane foam.

The polyurethane foam used in PUF panels is a closed-cell foam, which means that the cells are tightly packed together and do not allow air or moisture to penetrate. This makes PUF panels an excellent thermal insulator, as well as providing good sound insulation and fire resistance.

The outer layers of PUF panels are bonded to the core material using an adhesive. The adhesive used in PUF panels is usually a two-component polyurethane or epoxy resin that is applied to the metal sheets and the core material before they are bonded together. The adhesive helps to ensure that the metal sheets and the core material are firmly bonded together, and that the panel is able to withstand the stresses and strains of use.

Surface material	Exterior- 0.45-0.5mm PPGL (Prepainted Galvalume) Interior- 0.45-0.5mm PPGL PPGL (Prepainted Galvalume)
Thickness	Roof- 30mm, 40mm, 50mm, 75mm, 100mm Wall- 40mm, 50mm, 75mm, 100mm
Width	1000mm
Length	2-6.5m
Insulator	PUFF (Polyurathane Foam)
Density	45-50 kg/m3
Thermal Conductivity	0.022-0.028 W/mK

21.10.10.3 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete.

21.10.11 EXTRUDED HOLLOW CLAY/TERRACOTTA VENTILATED RAINSCREEN FAÇADE TILES

21.10.11.1 General

Providing and fixing of Extruded Hollow Clay / Terracotta Ventilated Rainscreen Façade Tiles of grid dimensions 300 x 1000/1200mm (c/c) in a horizontal direction on the building facade. The extruded hollow clay tile cladding material shall be rigid and of adequate strength and shall have a minimum total thickness of 24 mm ($\pm 10\%$). The tiles shall be installed using the ventilated rainscreen principle, with provision for natural ventilation of the space between the façade tiles and the structural wall. The clay tiles shall be of the hollow type, fixed to a supporting aluminium framework (Alloy 6063 T5/T6) consisting of vertical 'T'/ 'L' Tube sections measuring 80x60x2mm/ 40x60x2mm/ 40x40x2mm respectively, spaced at maximum 1200mm c/c intervals matching to the tile vertical grid, and horizontal aluminium 'C'-clamps measuring 60 x 38mm x 150mm/ 75mm length fixed on top of the vertical

sections at maximum 300mm c/c matching to the tile horizontal grid.

21.10.11.2 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete.

21.10.12 SHRERA FLEXING BOARD**21.10.12.1 General**

Providing and cladding 8mm thick decorative Shera Flexy Board (teak texture) or equivalent on exterior walls of approved quality, design and shape with necessary m.s. battens, screws, fevicol, grips etc. with concealing the screws as per manufacturer's specification all complete with scaffolding in perfect line and level all complete as per drawing.

21.10.12.2 Material

Shera Board is a non-asbestos fibre-cement building board composed of Portland cement, cellulose fibre and refined sand. Using a manufacturing process called autoclave, Shera board acquires the strength, durability of cement plus easy workability and dimensional stability. Shera Boards come in various formats and can be used in a wide variety of building applications. These entities exhibit a significant degree of resistance to fire, water, moisture, and heat.

Shera boards have a pH value of 7–8, thermal conductivity of 0.15 W/m. K and moisture movement of + 0.04%. The standard size for SHERA boards is 1200 mm x 2400 mm.

21.10.12.3 Measurement

It shall be done in square meter of the area done. Rate shall be for all the works including all labour and materials complete.

21.11 TURFING/GRASS SLIPS

Providing and laying Turfing/grass slips with approved weed free turfs or grass Carpet, watering and maintenance of lawn for at least 30 days all complete and it shall be paid in sq. m.

Turfs shall be interpreted as grass carpet of size 30cmx 30 cm slip that is seasonally dormant during cold or dry seasons and is capable of renewing growth after the dormant period. The turfs shall be brought by the Contractor from areas where the topsoil is reasonably fertile and contain a high percentage of loamy topsoil. Turfs shall be cut or stripped from living, thickly matted turf relatively free from weeds or other undesirable foreign plants, large stones, roots or other materials which might be detrimental to the development of the turf or to future maintenance. Turf including the soil containing the roots shall be planted in a neat and systematic way.

The topsoil on which Turfing is to be done shall be free of admixture of sub-soil, stone, gravel, clay lumps, plants or their roots, sticks or other extraneous material exceeding 50 mm. diameter. It shall be clay loam. The topsoil shall be approved by the Engineer before being placed.

The strips of turf shall be in uniform widths not less than 230 mm. and length not more than 460 mm. and such lengths should be readily lifted without breaking, tearing or loss of soil. The turfs shall be transplanted within 24 hours from the time it is stripped unless storing is necessary. If stored, turfs shall be stacked, kept moist and protected from exposure to sun. Turfs shall be cut and moved only when the soil mixture conditions are such that favorable results can be expected. Turfing shall be performed only during the seasons when satisfactory results can be expected. Turfing may be transplanted during drought free periods with the approval of the Engineer provided the turf bed is watered to moisten the soil to a depth of at least 100 mm immediately prior to laying the turf.

The turf shall be carefully placed by hand, edge to edge with staggered joints, in rows at right angle to the slopes, commencing at the base of the area to be turfed and working upward. The turf shall immediately be pressed firmly into contact with bed by tamping to provide a true and even surface. Screened soil of good quality shall be used to fill all cracks between turfs. The quality of fill soil shall not cause smothering of the grass.

The Contractor shall provide general care for the turfed area, protect against traffic and shall continue care until final inspection and acceptance of the work. If the surface become gullied or otherwise damaged during the period, the affected area shall be repaved to stabilize grade and condition as directed.

21.11.1 Measurement

It shall be measured in square meter on the ground surface including materials and labour.

21.12 PLANTATION WORKS

21.12.1 Flower Plantation

Supplying and planting of seasonal flowering plants with a root height of 8" minimum. The work includes pitting, transplanting, composting, and mulching.

Execution: Pit size shall be 30 cm diameter x 30 cm depth. Mix compost with soil and backfill into the pit to 1/4 of the pit volume.

Materials: The size and type of flowers to be planted shall be approved by the Engineer prior to supply and plantation.

21.12.2 Colourful Planting Works

Providing and planting approved species of colourful ornamental plants/shrubs in prepared soil.

Execution: Plants shall be placed at 150 mm c/c spacing on the Buddha lotus pond area.

Inclusions: The work includes excavation, manure application, watering, staking, trimming, maintenance, and all necessary materials and labour complete.

21.12.3 Grass Turfing Works with Sods

21.12.3.1 General

This work shall consist of furnishing and laying of the live sod of perennial turf forming grass on embankment slopes, verges (earthen shoulders) or other locations shown on the drawings or as directed by the Engineer. Unless otherwise specified, the work shall be taken up as soon as possible following construction of the embankment, provided the season is favourable for establishment of the sod.

21.12.3.2 Materials

The sod shall consist of dense, well-rooted growth of permanent and desirable grasses, indigenous to the locality where it is to be used and shall be practically free from weeds or other undesirable material. At the time the sod is cut, the grass on the sod shall have a length of approximately 50 mm and the sod shall have been freed of debris. Thickness of the sod shall be as uniform as possible, with some 50 - 80 mm or so of soil covering the grass roots depending on the nature of the sod, so that practically all the dense root system of the grasses is retained in the sod strip. The sods shall be cut in rectangular strips of uniform width, not less than about 250 mm x 300 mm in size but not so large that it is inconvenient to handle and transport these without damage. During wet weather, the sod shall be allowed to dry sufficiently to prevent rearing during handling and during dry weather shall be watered before lifting to ensure its vitality and prevent the dropping of the soil in handling.

21.12.3.3 Construction Operations**21.12.3.3.1 Preparation of the earth bed**

The area to be sodded shall have been previously constructed to the required slope and cross section. Soil on the area shall be loosened, freed of all stones larger than 50 mm size, sticks, stumps and any undesirable foreign matter, and brought to a reasonably fine granular texture to a depth of not less than 25 mm for receiving the sod. Where required, topsoil shall be spread over the slopes. Prior to placing the topsoil, the slopes shall be scarified to a depth which, after settlement, will provide the required nominal depth shown on the plans. Spreading shall not be done when the ground is excessively wet. Following soil preparation and top soiling, where required, fertilizer and ground limestone when specified shall be spread uniformly at the rate indicated on the plans. After spreading, the materials are incorporated in the soil by discing or other means to the depths shown on the plans.

21.12.3.3.2 Placing the Sods

The prepared sod bed shall be moistened to the loosened depth, if not already sufficiently moist, and the sod shall be placed thereon within approximately 24 hours after the same had been cut. Each sod strip shall be laid edge to edge and such that the joints caused by abutting ends are staggered. Every strip, after it is snugly placed against the strips already in position, shall be lightly tamped with suitable wooden or metal tampers so as to eliminate air pockets and to press it into the underlying soil. On side slopes steeper than 2 (horizontal) to 1 (vertical), the laying of sods shall be started from bottom upwards. At points where water may flow over a sodded area, the upper edges of the sod strips shall be turned into the soil below the adjacent area and a layer of earth placed over them followed by its thorough compaction.

Staking the Sods

Where the side slope is 2 (horizontal) to 1 (vertical) or steeper and the distance along the slope is more than 2 m, the sods shall be staked with pegs or nails spaced approximately 500 to 1000 mm along the longitudinal axis of the sod strips. Stakes shall be driven approximately plumb through the sods to be almost flush with them.

21.12.3.3.3 *Top Dressing*

After the sods have been laid in position, the surface shall be cleaned of loose sod, excess soil and other foreign material. Thereafter, a thin layer of topsoil shall be scattered over the surface of top dressing and the area thoroughly moistened by sprinkling with water:

21.12.3.3.4 *Watering and Maintenance*

The sods shall be watered by the Contractor for a period of at least four weeks after laying. Watering shall be so done as to avoid erosion and prevent damage to sodded areas by wheels of water tanks. The Contractor shall erect necessary warning signs and barriers, repair or replace sodded areas failing to show uniform growth of grass or damaged by his operations and shall otherwise maintain the sod at his cost until final acceptance.

21.12.3.4 **Measurement and Payment**

The measurement turfing with sods shall be made as finished work in square metres, accepted on site by the Engineer. The quantities measured shall be paid at the unit rates shown in the Bill of Quantities. This payment shall be the full and final compensation to the Contractor for making arrangements for traffic control, providing and delivering sods, all labour, tools, equipment, safety harness and incidentals to complete the work as per these Specifications. Topsoil shall be paid separately, if applicable.

21.12.4 **Site Planting and Sowing (Grass Hedging Works)**

The Contractor shall plant, or sow grasses, shrubs and trees as shown on the Drawing or required by the Engineer. This shall be done according to the specifications described hereunder, as and when required. The Contractor shall supply all necessary expertise, resources, and facilities to ensure that these requirements are met.

Due to the nature of bio-engineering works, they may also be undertaken by small local contractors with a range of agricultural skills, if so, provided in the Contract. If provided in the Contract, any bio-engineering site activity may also be managed by direct employees of the Division Road Office.

It shall be the Contractor's responsibility to ensure that all planting stock, whether provided from a nursery under a separate contract or through a separate instruction, is of high quality and is vigorous enough to grow on the site to be planted.

All seeds and other planting stock shall be of species indigenous to Nepal unless otherwise specified. All species shall be covered in the current approved lists of species produced from time to time by the Geo-Environment and Social Unit of the Department of Roads. They shall be appropriate for the precise site conditions in which they are to be planted and the Contractor shall ensure that they apply to the specific altitude and other environmental characteristics of the site in question.

Activities such as planting, and seed sowing shall be carried out within the critical few weeks when they will yield the desired results. All other operations shall be carried out in a timely manner to permit this to happen. The Contractor shall be responsible to keep works to the strict schedule required and under no circumstances to permit delays.

21.12.4.1 Sowing of Grasses on Site

The Contractor shall be required to carry out the sowing of grass seeds according to the Engineer's specific instructions.

If the site for sowing is to be prepared under a separate contract, then it shall be assumed that the site will already have been prepared for seed sowing.

Nevertheless, it shall be the responsibility of the Contractor to ensure that the condition of the site is good enough for the successful establishment of grasses.

The Contractor shall be required to supervise all field operations very closely. The sowing of grass seeds is a delicate business and shall be approached in the same way as for agricultural crops. The Contractor shall employ experienced agricultural labourers for this work.

If seeds have to be provided under a separate contract, then they shall be properly stored. However, it shall be the Contractor's responsibility to check that it has been carefully stored and remains fully viable.

Immediately before sowing, the ground surface shall be lightly scarified using a rake to ease early root penetration. Seeds shall then be laid thinly over the surface. Under no circumstances shall they be broadcast, because the lightness of perennial grass seeds and the steepness of the slopes to be treated give a poor cover using such a technique. The Contractor shall be responsible for ensuring that the correct quantities of seeds are used, while giving a good, even cover.

A cover of 25 grams of grass seed per square meter of surface shall be achieved unless otherwise specified.

After sowing, a mulch of prepared and dried cut herbs shall be laid over the whole seeded area in a thin layer. If the mulch is too thick it will prevent light from getting to the seed and will inhibit germination. Herbs suitable for this and locally available in large quantities are:

- Tite pate (*Artemisia vulgans*);
- Tapre (*Cassia* species);
- Ban mara (*Eupatorium adenophorum*).

However, freshly cut herbs shall not be used because of the danger of resprouting and weeding.

If specified, the mulch should be secured with jute netting of mesh size 300x 500 mm and the netting fixed in place using suitable live pegs or hardwood cuttings (e.g. Simali, *Vitexnegundo*) at one meter centres.

Measurement and Payment: Work shall be measured in square meters on the basis of

actual area of grass seeded and covered surface. The payment shall be the full and the final compensation to the Contractor for making arrangements for traffic control, providing seeds, collection and application of mulch, all labour, tools, equipment, safety harness and incidentals to complete the work as specified herein. If the seeds and mulch are supplied through a separate contract, costs for the supply of the same shall not be included herein. However, if the Contractor is responsible for the supply and storage of seeds and mulch no separate payment shall be made for these items.

21.12.4.2 Direct Seed Sowing of Shrubs and Trees on Site

The Contractor shall be required to carry out the sowing of shrub and tree seeds according to the Engineer's specific instructions.

It is assumed that the site will already have been prepared for seed sowing, if this item has to be executed under a separate contract. Nevertheless, it shall be the responsibility of the Contractor to ensure that the condition of the site is good enough for the successful establishment of shrubs and trees.

The Contractor shall be required to supervise all field operations very closely. As the sowing of any seeds is a delicate business and, therefore, shall be approached in the same way as for agricultural crops. The Contractor shall employ experienced agricultural labourers for this work.

Seed shall have been collected and stored well before the time of sowing, if they have to be supplied under a separate contract. However, it shall be the Contractor's responsibility to check that it has been carefully stored and remains fully viable.

Sowing shall start at the top of the slope and the labourers shall work downwards. Care shall be taken not to disturb areas already seeded.

To sow the seeds, a small hole shall be made in the slope. The tool used to do this shall depend on the size of the seed. For some seeds, a piece of gabion wire will be adequate; for others, a piece of mild steel with a flattened end is required.

The hole shall be in the best soil available but if there is little real soil, then a crevice between two stones is acceptable. Two seeds should be placed in each hole and a covering of soil or whatever fines are available shall be placed over them. This covering shall never exceed 10 mm and shall preferably be about 5 mm; it shall never be less than and this. Seeds shall be placed at 200 to 250 mm centres, as ground conditions dictate.

In some cases, the seed can be broadcast starting at the top of the site and working down slope as evenly as possible so that the whole site is lightly covered. This shall be used where the site is still active and only warrants minimum expenditure, or where the site is naturally rough, providing plenty of niches in which the seed can catch. Quantities of seed shall depend on the type of seed involved but are generally half that of the quantities used in the nursery unless otherwise instructed by the Engineer. With utis (*Alnusnepalensis*) seed it shall be at a rate of 1 gram of seed per square meter.

Measurement and Payment: Work shall be measured in square meters on the basis of actual area of grass seeded and covered surface. The payment shall be the full and the final

compensation to the Contractor for making arrangements for traffic control, providing seeds, collection and application of mulch, all labour, tools, equipment, safety harness and incidentals to complete the work as specified herein. If the seeds and mulch are supplied through a separate contract, costs for the supply of the same shall not be included herein. However, if the Contractor is responsible for the supply and storage of seeds and mulch no separate payment shall be made for these items.

21.12.4.3 Site Planting of Grass Slips and Cuttings

The Contractor shall be required to carry out the planting of grass seedlings or rooted the cuttings, according to the Engineer's specific instructions. The configuration of planting shall be determined according to individual site conditions. It shall be either random, contoured or downslope, as instructed by the Engineer.

It is assumed that the site shall already have been prepared for planting if this is to be prepared under a separate contract. Nevertheless, it shall be the responsibility of the Contractor to ensure that the condition of the site is good enough for the successful establishment of grasses, and accords with the specifications given in Clause 2806.

Using appropriate tools (such as tape measures and spirit levels), planting lines shall be marked out with string as required.

The Contractor shall be required to supervise all field operations very closely.

The plants supplied to the Contractor from nursery (if so provided in the Contract) shall be prepared for planting by the Contractor as given below. The Contractor shall transport them from the nursery wrapped in hessian jute. At all times, plants shall be kept moist and as cool as possible, and should be wrapped in wet hessian between all operations such as extraction from the bed, pruning and planting. Under any circumstances, all plants supplied shall be planted within two days of that they are lifted from the nursery.

Grass slips or cutting shall be carefully separated from the clumps to give the maximum viable planting material. Preparation of slips, cuttings or rhizomes shall be strictly followed as mentioned in Sub-clause 2803 (1).

Planting shall be started at the top of the slope and under no circumstances shall new plants be walked on or otherwise disturbed. Using a small bar (usually made of mild steel and with a flattened end), a hole shall be made that is just big enough for the roots. The slip or cutting is inserted; care shall be taken that the roots are not tangled or bent back to the surface. Soil shall then be replaced around the roots and firmed with the fingers. The spacing of plants within rows shall be 100 mm unless otherwise specified. Two grass slips shall be planted in each drill.

If the soil is dry and there is no rain within 16 to 24 hours of planting, the site shall be watered carefully with a fine spray. The Contractor shall be required to water for the first two weeks after planting in the event of inadequate rainfall.

If it provided in the Contract that the plants are to be collected from locations other than nurseries then utmost care shall be taken to minimize disruption to neighbouring land, in the

event that species are collected from areas surrounding the road. It shall be the Contractor's responsibility to collect the stock required from a wide area and not to give rise to any soil erosion through the excessive removal of plants in one locality.

Measurement and Payment: The measurement shall be the actual area of grass planted and covered surface in square meters for the random planting and any other patterns of planting up to the 300 mm between the lines. The contour line planting in 500-1000 mm in any slopes shall be measured in linear meter. The payment shall be the full and final compensation to the Contractor for making arrangements for traffic control, providing grass slips or rhizome, collection of mulch, all labour, tools, equipment, safety harness and incidentals to complete the work as per these Specifications. If the grass slips and mulch are supplied through a separate contract, costs for the supply of the same shall not be included herein. However, if the Contractor is responsible for the supply slips and mulch, no separate payment shall be made for these items.

21.12.4.4 Use of Fertilizer

Under certain circumstances, the use of chemical fertilisers may be specified in place of farmyard manure or mulching.

Levels of fertiliser application shall vary according to soil type and nutritional content. However, if nutritional data are not available, the following figures shall be used as a rough guide:

- Nitrogen (N): 10 g/m²;
- Phosphorus (P). 5 g/m²;
- Potassium (K). 4 g/m².

21.12.5 Trees, Shrubs and Ground Cover Plantation

Providing, transporting, and planting trees, shrubs and ground cover of specified species in contract, types, and heights.

Execution: Excavation of planting pits of required size, backfilling with approved topsoil mixed with farmyard manure and fertilizers.

Inclusions: Watering, staking and tying with suitable supports, mulching, tree guards where specified, replacement of dead or defective trees, maintenance during the establishment period, and all labour, materials, tools, equipment, transportation, and incidentals, complete in accordance with the drawings, specifications, and the Engineer's instructions.

21.13 METAL (MILD STEEL-MS) GRATING

Providing, fabrication and fixing of MS iron works for grating with one coat of red oxide paint all complete

21.13.1 Measurement

It shall be measured in Kg. Rate shall be inclusive of all materials and labour complete.

21.14 ROLLING SHUTTER

Supplying and fixing 16/18-gauge M.S. rolling shutter including red oxide paint all complete as per instruction as per site engineer. These shall consist of MS laths 1.25mm thick and 80mm wide laths or as specified. The laths shall be machine rolled and straightened with an effective bridge depth of 16mm and shall be interlocked together throughout their entire length and jointed together at the end with end locks. These shall be mounted on specially designed pipe shaft. Each lath section shall be continuous single strip piece without any joint.

The springs shall be coiled type. The spring shall be manufactured from high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong mild steel brackets.

21.14.1 Guide Channel

The guide channels shall be of mild steel deep channel section and of rolled, pressed or built up (fabricated) construction. The thickness of the sheet used shall not be less than 3.15mm. The minimum depths for guide channels shall be as follows:

Clear width of shutter		
Depth of Guide Channel. Up to 3.5m		60mm
3.5m and above	75mm	

The gap between the two legs of the guide channel shall be sufficient to allow the free movement of the curtain and at the same time - close enough to prevent the rattling of the curtain due to wind.

Each guide channel shall be provided with a minimum of three fixing elates or supports for attachment to the walls or column by means of bolts or screws. The spacing of cleats shall not exceed 0.75m. Alternatively, the guide channels may also be provided with suitable dowels, hooks or pins for embedding in the walls.

The guide channels shall be attached to the jambs, plumb and true, either in the overlapping fashion, projecting fashion or embedded in grooves, depending on the method of fixing. The cover of shaft, spring etc. shall be of the same material as that of lath.

21.14.2 Fixing

Brackets shall be fixed on the lintel or under the lintel as specified with rawl plugs, and screws bolts etc. the shaft along with the spring shall then be fixed on the brackets. The lath portion (shutter) shall be laid on ground and the side guide channels shall be bound with it with ropes etc. the shutter shall then be placed in position and top fixed with pipe shaft with bolts and nuts. The sides guide channels and the cover and frame shall then be fixed to the walls through the plate welded to the guides. These plates and bracket shall be fixed by means of steel screws bolts, and rawl plugs drilled in the wall. The plates and screws bolts shall be concealed in plaster to make their location invisible. Fixing shall be done accurately in a workman like manner that the operation of the shutter is easy and smooth.

21.14.3 Painting

All surfaces are to be painted with primer coat and minimum two coats of enamel paints as per specification, after drying and thoroughly cleaned to remove all loose scale and loose

rust. Surfaces not in contact but inaccessible after shop assembling, shall receive the full-specified protective treatment before assembling.

21.14.4 Measurement

It shall be measured in Sq.m. Rate shall be inclusive of all materials and labour complete.

21.15 BOUNDARY WALL USING MS GRILLS/ SQUARE HOLLOW PIPES

Supplying, fabrication and fixing in Boundary Wall with 20x20mmx2mm thick Square MS hollow pipe and 100x100x5mm MS square vertical post including the cost of materials, labour, fixing, fitting and primer works all complete as per Drawing, Technical Specification and instruction of Engineer.

21.15.1 Materials

The Mild Steel pipe of 20x20mm square and 2mm wall thickness shall be cut to shape, and size, properly welded to fill the gaps in every joint. The Pipe shall confirm the IS 4923:1997 Specification for structural Steels.

21.15.2 Installation

The end of Hollow square pipe along the face of concrete Member shall be embedded for minimum of 6" inside the concrete or properly welded in structural steels or frames for firm finishing. Not any slots or holes in welded joints are permitted while preparing the grill of square pipe. Spacing, Size and Shape of the finished grill shall be as per the drawing or as instruction of Engineer. The top end of Vertical pipe shall be finished with minimum 50mm high pyramid of 20x20mm base. 100x100x5mm MS hollow pipe shall be erected at every 2 m interval between Concrete Pillars for framing the Grill from either Side. The Post shall be properly erected over the concrete block of 1:1.5:3 Cement concrete foundation. The cost of Concrete foundation shall be paid as separate item.

21.15.3 Measurement

The measurement shall be done in square meter (m²) of finished grill by multiplying the clear spacing between two concrete pillars with total height of grill from base of vertical 20x20x2mm square pipe with tip of square pyramid (20x20mm base). The rate shall include the vertical post from foundation to top, horizontal pipes, vertical pipes, semicircular design pipes, welding, joining, fixing, finishing and one coat of primer all complete.

21.16 BOUNDARY WALL USING MS ANGLE, POST, GI MESH AND FENCE WIRE

Supplying & fitting 50mm dia. Black iron pipe post c/c 2.0m, 20*20*4mm & 25*25*4mm size mid angle frame for 10 S.W.G.G.I chain link 2"*2" mesh size & 3*20 angle fabrication 0.15m fitting all complete.

21.16.1 Materials

The angle of 20x20mm 25x25mm and 4mm wall thickness shall be cut to shape, and size, properly welded to fill the gaps in every joint. The Pipe shall confirm the IS 4923:1997 Specification for structural Steels

21.16.2 Installation

The 50mm dia. 4mm thick MS Post shall be erected at every 2m spacing c/c. embedded in the concrete Block (1:1.5:3) from beneath the foundation. The top 70cm length of Post shall be bend 45 degrees for fencing works. Fencing shall be properly hooked in the post. The MS angles of specified size in BoQ shall be used as a frame for GI chain link mesh. Horizontal top of the Angle frame shall be welded with the 150mm height 3*20mm MS Strip with hook type design at top. The spacing of the strip shall not be more than 120mm c/c. 10 S.W.G.G.I chain link 2"*2" mesh size fence shall be fixed in the angled portion of post. The angle frame shall be properly welded in the Metal post or fixed with bolt in post as per instruction of Engineer. The MS frame and post shall be painted with aluminium paint all complete after installation.

21.16.3 Measurement

The measurement shall be done in square meter (m²) of finished grill by multiplying the C/C spacing between two Posts with total height of grill from Lower angle to upper angle. i.e. height of the vertical strips shall be excluded in measurement. The total length of Metal post from the foundation to the top end including the bend portion has been included in this item and no extra payment shall be done for this.

21.16.4 Payment

Payment of finished works shall be done in square meter of the above measured quantity. The Cost of Supplying, fabrication, fixing, painting all complete has been included.

21.17 MS GRILL WORKS**21.17.1 Scope of Works**

This work shall consist of the supply, fabrication, fitting, and fixing of Mild Steel (MS) circular or square pipes (medium size/weight category) and MS grills, complete with necessary base plates. The scope includes cutting, welding, surface preparation, and the application of primer paint, executed strictly in accordance with the Drawings and the instructions of the Site Engineer.

21.17.2 Material Requirements

MS Pipes (Circular/Square): All MS circular and square hollow sections shall be of "Medium" class designation, conforming to IS: 1161 (for circular tubes) or IS: 4923 (for square/rectangular hollow sections), or equivalent approved standards. They must be free from rust, cracks, and surface flaws.

MS Grills and Base Plates: Mild steel flats, bars, angles, and plates used for grills and base plates shall conform to IS: 2062 (Standard Quality). The thickness and dimensions shall strictly follow the approved Drawings.

Welding Consumables: Electrodes used for welding shall conform to relevant IS or equivalent standards and shall be suitable for the grade of steel being welded.

Primer Paint: Primer shall be a premium quality anti-corrosive red oxide zinc chromate primer or as specified by the Site Engineer.

21.17.3 Fabrication and Erection

Fabrication: All cutting, bending, and welding shall be done meticulously to the exact dimensions and shapes shown in the Drawings. Joints shall be fully welded, providing structural rigidity.

Finishing: All welded joints must be properly ground using a mechanical grinder to achieve a smooth, flush finish without sharp edges or burrs.

Installation: Base plates shall be securely fixed to the concrete/masonry using approved anchor fasteners or embedded directly during concreting, as dictated by the Drawings. The pipes and grills shall be installed true to line, level, and plumb.

Surface Preparation and Painting: Before applying the primer, all steel surfaces must be thoroughly cleaned to remove rust, mill scale, dirt, oil, and welding slag using wire brushes or sandblasting as required. Immediately after cleaning, the surfaces shall receive at least one uniform coat of the approved anti-corrosive primer paint.

21.17.4 Measurement

The work shall be measured in Kilograms (kg) or Metric Tonnes (MT) of the total weight of the MS pipes, MS grills, and base plates successfully installed and accepted by the Engineer. The weight shall be calculated based on the standard theoretical weight of the sections used, excluding the weight of weld metal and primer paint.

21.17.5 Payment

This rate shall be the full and final compensation for the supply of all materials (MS pipes, grills, base plates, electrodes, primer), labor, tools, equipment, fabrication, hauling, erection, surface preparation, painting, and all other incidental operations necessary to successfully complete the work to the satisfaction of the Site Engineer.

21.18 STAINLESS STEEL WORKS

This work shall cover the supply, fabrication, and installation of Grade 304 Stainless Steel (SS 304) works. This comprises SS pipe columns, vertical posts, handrails, SS base plates, connectors, and brackets, executed in strict accordance with approved drawings, specifications, and the direction of the Engineer.

21.18.1 Materials

Stainless Steel: All pipes, columns, vertical posts, handrails, base plates, connectors, and brackets shall be exclusively manufactured from Grade 304 Stainless Steel.

Fixing Accessories: All anchor bolts and fasteners shall be of compatible stainless-steel grade to prevent galvanic corrosion.

21.18.2 Fabrication and Construction Procedure

Fabrication: Components shall be precision-cut, aligned, and assembled as per the approved shop drawings.

Welding: Continuous and structurally sound welding shall be applied at all designated joints

using SS 304 compatible consumables.

Grinding and Polishing: All welds shall be ground flush and smooth. The entire assembly shall undergo extensive mirror or satin polishing as specified in the drawings, ensuring a uniform, unblemished surface finish free of weld discoloration or mechanical marks.

Installation: The prefabricated components shall be securely erected in position using the specified anchor bolts and base plates, ensuring perfect plumb, line, and level.

21.18.3 Measurement

The work as fixed in place shall be measured in running meters (linear meters). Measurement shall be taken along the centerline of the top handrail. Weight of cleats, brackets, packing pieces, bolts, nuts, washers, and base plates shall not be measured separately.

21.18.4 Measurement

The work shall be measured in the unit specified in the BOQ (e.g., metric tons, kilograms, or square/linear meters depending on the specific application).

21.18.5 Payment

The contract unit rate shall be the full and final compensation for the supply of SS 304 materials, fabrication, welding, grinding, mirror/satin polishing, fixing accessories, labor, equipment, and workmanship complete.

21.19 STRUCTURAL STEEL WORK FABRICATION AND ERECTION

21.19.1 Scope of Works

This work shall consist of providing, fabricating, assembling, and erecting structural steel components and elements, including all necessary nuts, bolts, and gusset plates. The scope encompasses the preparation of detailed shop drawings, conducting trial assemblies, providing full facilities for inspection and testing, and executing the work strictly in accordance with the Drawings.

21.19.2 Materials

Structural Steel: All structural steel components (including gusset plates) shall comply with the relevant IS Codes (e.g., IS: 2062 for weldable structural steel, IS: 808 for rolled sections) or as explicitly specified in the Drawings.

Fasteners: All nuts, bolts, and washers shall conform to the required structural grades and standards as specified.

Acceptance: Manufacturer's test certificates shall be submitted for all steel and fasteners to confirm compliance with the specified grades before fabrication commences.

21.19.3 Shop Drawings

Before the commencement of any fabrication, the Contractor shall prepare and submit detailed shop drawings for the Engineer's approval. These drawings shall include all exact dimensions, material specifications, weld details, bolt hole layouts, and assembly

configurations.

21.19.4 Fabrication and Trail Assembly

Fabrication: Fabrication shall be carried out strictly in accordance with the approved shop drawings. All cutting, drilling, and welding must be executed with precision to avoid distortion or stress concentration.

Trial Assembly: To ensure proper fit-up and alignment, a trial assembly of the structural components shall be conducted at the fabrication shop prior to dispatching the materials to the site. Any required adjustments shall be made during this stage.

21.19.5 Erection

The erection of structural steelwork shall be systematically carried out using appropriate lifting equipment to ensure safety and prevent damage to the components. The components shall be accurately aligned, leveled, and plumbed before final tightening of bolts or site welding. Temporary bracing shall be provided as necessary to secure the structure during the erection process.

21.19.6 Inspection and Testing

The Contractor shall provide all necessary facilities, equipment, and safe access for the Engineer to inspect the materials, fabrication processes, and erection. This includes facilities for testing welds (e.g., Non-Destructive Testing) and checking the tightness of bolted connections.

21.19.7 Measurement

Structural steel work shall be measured in Kilograms (kg) based on the calculated net weight of the steel structure successfully fabricated, erected, and accepted by the Engineer. Unless otherwise specified, the weight of gusset plates, nuts, and bolts shall be included in the total weight calculation of the structural components.

21.19.8 Payment

The structural steelwork, measured as provided above, shall be paid at the contract unit rate for the respective item. This rate shall be the full and final compensation for the supply of all materials, preparation of shop drawings, fabrication, trial assembly, site erection, provision of inspection/testing facilities, and all labor, tools, equipment, and incidentals required to complete the work.

SECTION 22: ELECTRICAL WORKS**22.1 GENERAL SPECIFICATIONS**

All electrical installations must comply with the Nepalese Electricity Act, relevant Nepalese Electricity Regulations, and Nepalese Standards (NS).

Corresponding Indian Standards (IS) or British Standards (BS) shall be utilized for specific works where NS is unavailable.

Contractors are required to prepare and submit detailed Single Line Diagrams (SLD) and schematic drawings of the distribution system for approval prior to construction.

All materials and equipment must be new and bear the IS/NBC Standard mark.

The contractor must supply "as-built" electrical drawings and wiring diagrams indicating circuit numbers and controls upon completion of the works.

22.2 WIRING AND CONDUITS

Internal wiring shall utilize PVC insulated multi-stranded copper conductors of 650/1000V grade.

Circuit wiring shall employ a looping-in system with no joints allowed along the length of the conductors.

Wiring for light circuits must be strictly separated from power, telephone, and data networking conduits.

Concealed wiring shall be housed in high-quality HDPE pipes embedded in RCC slabs or recessed in brick masonry using a chase cutting machine.

Phase wiring shall be color-coded Red, Yellow, or Blue, while neutral wires must be Black. Earth continuity conductors must be Green or Yellow/Green.

Switch and outlet boxes shall be made of hot dip galvanized mild steel with a minimum clear depth of 60 mm.

22.3 SWITCHGEAR AND DISTRIBUTION BOARDS

Moulded Case Circuit Breakers (MCCBs) must conform to IEC 60947-II or IS 13947-II and possess a short-circuit breaking capacity of not less than 25kA rms at 415V AC.

Miniature Circuit Breakers (MCBs) must have a minimum 10kA breaking capacity (I_{cn}) as per IEC 60898.

MCBs for lighting circuits shall be "B" series, whereas circuits feeding power outlets or machinery shall use "C" series breakers.

Distribution Boards (DBs) must be constructed of powder-coated sheet steel and feature double doors with extended loose wire boxes.

Indoor DBs shall conform to IP-42 protection, while outdoor/wet location DBs must conform to IP-65.

Main Distribution Boards (MDBs) must be floor-mounted, extensible, and provide a minimum dust and damp protection rating of IP-54.

Distribution Board Configurations

DB Type	Configuration	Incomer Details
10 Way SPN	Double Door Glazed	1 No. 40 A DP, 2 No. 16 A DP
16 Way SPN	Double Door Glazed	1 No. 40 A DP, 10 No. 6 A MCB
8 Way TPN	Double Door Glazed	1 No. 32 A 4P, 10 No. 6 A MCB
12 Way TPN	Double Door Glazed	1 No. 40 A 4P, 30 No. 6, 10, 16 Amp SP
Feeder Pillar Panel	63 A (FPP)	Suitable for 415 V, 3-phase, 4-wire, IP55 enclosure

22.4 OUTDOOR AND LANDSCAPE LIGHTING

7-metre Street Light Poles: Single-arm and double-arm decorative spun tapered aluminum poles (Alloy 6063-T6) capable of withstanding 160 km/h winds, fitted with 90 W LED street light luminaires (IP66, IK08).

12-metre High Mast System: Octagonal/tapered polygonal steel mast (IS 2062 Grade E250/E350) equipped with four 150 W LED flood lights (IP66, IK10).

3-metre Heritage Post-Top Poles: Mild steel pipe poles with cast iron/aluminum bases, featuring single-lantern and 3-lantern designs, equipped with 30 W LED luminaires.

15 W LED Bollard Lights: Extruded aluminum body (0.9-1.0m height) with a UV-stabilized polycarbonate diffuser. A specialized variant includes a decorative 15 W LED bollard light with an integrated 20 W RMS waterproof outdoor speaker.

Accent and Feature Lighting: Includes IP66 LED Flexible Neon Lights, 18 W LED Brick-Size Foot Lights, decorative LED bauble lights for trees, 12 W and 15 W LED Outdoor Spot Lights, and 20 W LED Profile Lights.

100 W LED Flood Lights: Designed for outdoor sports courts and landscapes, featuring die-cast aluminum housings and a minimum luminous efficacy of 130 lm/W.

22.5 INDOOR LIGHTING AND ACCESSORIES

Recessed/Surface Mounted LED Luminaires: Specified in 12 W, 15 W, and 18 W variants with die-cast aluminum housings, flicker-free drivers, and minimum luminous efficacy of 100 lm/W.

Spotlights and Strip Lights: 5 W COB LED Spotlights for indoor accent lighting and 10 W/m IP65 LED Strip Lights.

Utilitarian Lighting: 18/20 W (4 ft) IP65 LED non-corrosive polycarbonate tubular lights, 9/12 W LED Mirror Lights, 10 W LED Bulkhead Lights, and 15 W LED Up-Down Lights.

Fans: 1200 mm sweep ceiling fans (230 V AC) with double ball bearings and aerodynamic blades, alongside 250/300 mm exhaust fans.

Switches and Sockets: Modular plate-type rocker mechanism switches with silver contacts, including 6A for lighting and 16A for power outlets.

22.6 CABLING, NETWORK AND INFRASTRUCTURE

Power cables for street lighting shall be 2 core, 4 sq.mm copper unarmored cables.

Underground cabling must utilize Heavy Duty HDPE pipes, specifically in 110 mm, 75 mm, and 32 mm outer diameters (PN 10).

Data networking requires Cat 6 RJ45 modular sockets and unshielded twisted pair (UTP) Cat 6 cables.

Telephone systems require RJ11 modular telephone sockets wired with 2-pair copper cables.

An outdoor IP PTZ Camera system (4 MP resolution, 250m IR distance, IP66) shall be mounted on a 12 m hot-dip galvanized octagonal steel pole and connected via a 24 Core Single Mode Armoured Optical Fiber Cable.

Power Cable Specifications

Cross-Section	Cores	Conductor Material	Insulation/Armouring
4 mm ²	3 Core	Copper	XLPE Armoured
6 mm ²	3 Core & 4 Core	Copper	XLPE Armoured
10 mm ²	4 Core	Copper	XLPE Armoured
25 mm ²	4 Core	Copper	XLPE Armoured
50 mm ²	3.5 Core	Aluminium	XLPE Armoured
95 mm ²	3.5 Core	Aluminium	XLPE Armoured

Cross-Section	Cores	Conductor Material	Insulation/Armouring
150 mm ²	3.5 Core	Aluminium	XLPE Armoured

22.7 EARTHING AND LIGHTNING PROTECTION

Air terminal rods for lightning protection must be made of pure copper, with a minimum diameter of 12 mm and a length of 1.2 m.

Down conductors shall consist of soft annealed 25x3 mm pure copper insulated strips, copper tape, or 50 mm² Yellow/Green cables.

The maintenance-free chemical earthing system must utilize 99.9% molecularly bonded copper on low carbon steel rods with a minimum 100-micron copper coating.

Electrolytic ground rods must be installed vertically with a minimum length of 2 m and a diameter of 102 mm.

Earth resistance must be tested using an earth resistance tester and shall not exceed 5 ohms.

Additional earthing components include 25x3 mm copper strips, 8 SWG copper wire, and 20 mm dia FRLS UPVC conduit.

22.8 SUBSTATION EQUIPMENT

11 kV/433 V, 300 kVA Outdoor Unitized Compact Substation (CSS): This package substation is fully factory-assembled and type-tested. It comprises an 11 kV Ring Main Unit (RMU) with Load Break Switches and earth switches.

The transformer is a 300 kVA, 11/0.433 kV, ONAN cooled, copper wound, Dyn11 unit with off circuit tap changers. The system includes an LT distribution panel, interconnecting busbars, metering, protection, and earthing. The enclosure must be dust-proof, vermin-proof, and tamper-resistant, suitable for outdoor installation.

22.9 SHOP DRAWINGS

Before initiation of electrical installation contractor shall submit detailed SLD and Schematic diagrams of electrical installations. After completion of electrical installation & commissioning contractor shall submit the Final executed SLD and Schematic Drawings of electrical installations (As Build drawings). Work Completion certificate shall be issued only after submission of above and to the full satisfaction. The electrical work not covered in BoQ or elsewhere but required for the completion of building shall be deemed to be covered in the scope of contractor at his own cost.

Works indicated shall include all civil and electrical works required to achieve a satisfactory electrical installation, whether or not such are specifically outlined in these specifications. The entire installation shall be suitable for a three phase, four wire, 400/230 VAC, 50 Hz system.

Prior to commencing the electrical works, the contractor shall provide the detail design of electrical installation for building to the Project Manager a set of drawings to appropriate scale showing detailed conduit layout and wiring drawings showing all details such as the route and size of the conduit, number and size of cables in the conduit, location of outlet boxes, openings or duct outlets in civil works if required, routing and dimensions of cable trenches etc. Materials used, standards specified for fabrication or procurement of items such as the main switchboard, distribution panels and other items for which custom design is necessary shall be shown.

This drawing shall be prepared in complete co-ordination with and understanding of the civil and architectural works, which will be undertaken. The drawing shall be immediately modified and approved if any changes in design are undertaken, and a record of such amendments shall be kept. A set of the up-dated and approved drawings shall always be available at the site for inspection by the Engineer.

22.10 SAMPLES

Prior to commencing procurement, the Contractor shall submit for approval technical description, related catalog/brochures and a recommended brands of sample item each of all cable, conduit accessories, switchgears, switches, power outlets, lamps, led light, flood lights, fluorescent tubes, fixtures etc., which are to be procured and installed.

22.11 LOCATION OF FIXTURES

Location of conduit, fixtures, switches, outlets, distribution boards and other electrical equipment and appliances shall generally be in accordance with the updated construction drawings; and in accordance with the specifications and mounting heights and location details mentioned herein. Notwithstanding the guidelines given in the drawings and specifications, the location of all electrical items, equipment and appliances in the buildings shall be approved by the Project manager prior to commencement of electrical installation works.

ABBREVIATION

NEA -	Nepal Electricity Authority
LT -	Low Tension
HT -	High Tension
AC -	Alternating Current
MPB -	Main Panel Board
MDB -	Main Distribution Board
KV -	Kilo Volt
KA -	Kilo Ampere
PVC -	Poly Vinyl Chloride
SWG -	Standard Wire Gauge (British)
IS -	Indian Standard

TP -	Three Pole
DP -	Double Pole
SP -	Single Pole
TPN -	Three Pole Neutral
MCB -	Miniature Circuit Breaker
MCCB -	Moulded Case Circuit Breaker
CT -	Current Transformer
SLD-	Singe Line Diagram
SMC-	Sheet moulding compound

SECTION 23: WATER SUPPLY, PLUMBING AND SANITARY WORKS

23.1 GENERAL

23.1.1 Scope

This scope of work shall cover materials and workmanship required for installation of water, supply, sanitary and drainage system. Work under this section shall consist of furnishing all labor

materials necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories required by the drawings and specified hereinafter or given in the schedule of quantities.

Without restricting to the generality of the foregoing the sanitary fixtures shall include all sanitary fixtures, CP fittings and accessories necessary and required for the buildings. Whether specifically mentioned or not, all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required. All exposed pipes within toilets and near fixtures shall be chromium plated unless otherwise specified.

All hot water pipes shall be lagged & properly insulated from the hot water storage tanks to the hot water taps & outlets.

Work for the water supply and sanitary consists of furnishing all labor, materials, equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the schedule of quantities.

Without restricting to the generality of the foregoing, the water supply system shall include the following:

- a) Connecting the main supply to the designed tanks as per the drawings.
- b) Control valve, masonry chambers and other appurtenances.
- c) Connections to all plumbing fixtures, pantries and overhead tanks.
- d) Excavation and refilling of pipe trenches.
- e) Pipe protection and painting.

Drainage lines shall be laid to the required gradients and profiles as directed by the Consultant. All drainage connections work shall conform to the local municipal byelaws. All slopes and run off shall conform to the best standard of the IS Hydraulic engineering practices. The minimum bed slope for drainage works should be 1.5% unless otherwise directed by the consultant.

The Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority as shall be required by local ordinances. Location of all manholes, catch basins, etc, shall be confirmed by the Consultant before the actual execution of the work at site. All works shall be executed as directed by the Consultant and subject to the final approval of the Consultant.

Without restricting to the generality of the foregoing, the drainage system shall include:

Sewer lines including excavations, pipelines, manholes, drop connections, underground storm water drains, including pipes, manholes, catch basins, open drains and culverts.

23.1.2 Standards

- a) In case where the specification given is found to be inadequate, latest IS or NS specification shall hold good. Whether reference has been made to IS or NS the same shall refer to the latest specification mentioned in this section. If type is not specified elsewhere the type of material and fixture shall be as directed by consultant. If any ambiguity or missed item the same shall be decided by the client in consultation with the consultancy.
- b) All materials shall be best of their kind and shall conform to the latest IS or NS standards.
- c) All samples shall be approved by consultant regarding its quality as specified, prior to the procurement by the contractor. Each sample shall be accompanied by the manufacturer's specification, brochures, test certificates and guarantee statements for approval.
- d) All set of specimen sample of approved materials shall be kept at Site Office by the contractor.
- e) The workmanship shall be the best of its kind and shall conform to the specification of IS or NS standard in every respect or latest trade practice. All defective or unsuitable materials and/or workmanship shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship by the contractor in his own cost.
- f) Available Codes
- g) Unless specifically mentioned otherwise, all the applicable codes and the standards shall be as the standard published by the Bureau of Indian Standard (IS) or Nepal Bureau of Standard (NS) and its subsequent revision in respect of design workmanship, quality and properties of materials and method of testing.

Some of these available standards are listed below and must be followed.

IS:778-1984	Specification for gun metal gate, check valves
IS:1172-1971	Basic requirements of water supply, drainage and sanitation
IS:1239-1982	Specification for M.S. or G.I. pipes
IS:2065-1983	Code of practice of water supply in buildings
IS:4985-2000	Specification for uPVC soil, waste and ventilating pipe and accessories
IS:1729-1974	Specification for cast iron manhole covers and frames
IS:1742-1983	Code of practice for building drainage
IS:2064-1973	Code of practice for selection, installation, and maintenance of sanitary appliances
SP35(1987)	Handbook on Water Supply and Drainage
IS:2064(2002)	Selection, Installation and Maintenance of Sanitary Appliances
NBC208:2003	Nepal National Building Code, Sanitary and Plumbing Design Requirements

IS:15778-2007 Chlorinatedpolyvinylchloride(CPVC)pipes

23.1.3 Materials and Methods

All materials provided for the Contract will be in strict accordance with the latest version of the applicable Indian Standards. All manufacturer's data, specifications, and relative information together with samples will be submitted to the Engineer for approval prior to being purchased, otherwise at the Contractor's own risk.

Sanitary fixtures shall be of the best quality approved by the Consultant. Wherever particular makes are mentioned, the choice of selection shall remain with the Consultant. The water supply and sanitary works are to be laid to alignments and grades shown on the drawings but subject to such modification shall be as instructed by the consultant from time to time to meet the requirements of the work. All water supply and sanitary pipes, fittings, fixtures and appurtenances which are to be embedded into concrete, masonry, earth or any construction work shall be embedded only after approval of consultant. All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned in the schedule of quantities, specifications or drawings or not.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Consultant's/interior designer's requirements. Wherever necessary, the fittings shall be cantered to dimensions and pattern desired. Fixing screws shall be half round head chromium plated brass screws with CP washers wherever required as per directions of consultant. All fittings and fixtures shall be fixed in a neat workmanlike manner true to level at heights shown on drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor.

All CI brackets, fittings clamps and shall be painted with one coat of approved primer and 2 coats of Black Japan paint. All painting works shall be carried out to full satisfaction of the consultant. If directed, additional coats of paints shall be applied to get uniform and matching finish without any extra cost. In case of non-availability of specified sized fixtures in specified units the nearest size in FPS or Metric units shall be provided with prior approval of the consultant for which neither extra will be paid nor shall any rebate be recovered.

Wherever the word 'approved' is used it shall mean approved by the consultant.

Prior to casting any RCC structure the contractor shall put necessary sleeves through beam, slab and other structure to make easy water, waste and soil lines passing through the particular structure. At the proper elevations to give the desired slopes needed to meet the recognized standards for drainage.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner. Short or long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections. As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes up to 65mm dia. in case of GI/MS pipes.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc. Pipes shall be securely levelled to the required slopes & fixed to walls and ceilings by suitable clamps at intervals specified. Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance, and repairs.

The rates quoted shall be for complete items as fixed in position and cover all costs of materials, labor, tools, equipment, supervision, cutting of holes, chases etc., excavation and satisfactory backfill in any type of soil, and for providing fixing arrangements such as clamps, brackets, blocks etc. The rates shall also include restoration to original condition. All debris from demolishing shall be removed without any extra charge. Work shall be planned in such a manner that demolition and chipping are held to the very minimum. This form of installation shall not be recognized as the "norm" and if the consultant determines that excessive retrofitting is being done, he may instruct the contractor to remove sections and accomplish the work and replace the removed work at his (contractor's) expense.

Tenders shall be based upon complete installations. Products required which are not shown or mentioned, or not specified herein as to manufacturer, quality, etc. shall be furnished of the highest quality (commercial standard).

Materials shall be new and free from all defects.

All materials, apparatus or equipment called for on the Plans or in the Specifications by trade names, or the name of a particular manufacturer, or by catalogue reference are the materials, apparatus, or equipment which should be allowed for in the Tender, or qualifications submitted at the time of Tender submission.

The work shall be carried out in accordance with all rules, regulations, by-laws and requirements of all authorities having jurisdiction. All changes and alterations required by an authorized inspector of any authority having jurisdiction shall be carried out at no cost to the employer.

23.1.4 Drawings and Specifications

These Specifications shall be considered as an integral part of the Drawings which accompany them. Neither the Plans nor the Specifications shall be used alone. Any item or subject omitted from one, but which is mentioned or reasonably implied in the other shall be considered as properly and sufficiently specified and therefore must be supplied by the Contractor.

Misinterpretation of any requirements of either the Drawings or Specifications shall not relieve the Contractor of his responsibility for properly completing his work.

The Contractor shall apply to the Engineer for any explanation which he may require in regard to the meaning and intent of any clause in the Specification and Contract. He shall be held responsible for any errors or losses consequent upon failure to obtain such explanation.

The Contractor shall consult with the Engineer to obtain detail drawings or instructions for exact location of equipment as work progresses, before installing fitting or equipment and will be responsible for coordination with all other work trades including finishes.

Drawings show general location and routes to be followed by pipes, ducts, etc. where not shown, or shown diagrammatically, the Contractor shall install them in accordance with best trade practices.

23.1.5 As Built Record

The Contractor shall request a complete set of drawings, (white) from the Engineer and use these for "As Built" records.

"As Built" records shall be retained in the site office and kept up to date daily in regard to changes in actual installation from the Plans and Specifications. Alterations to duct work, piping services, etc. shall be noted and the revised arrangement drawn in accurately, complete with dimensions from column lines. Every precaution shall be taken to protect the Drawings from damage and loss.

The "As Built" records shall be made available to the Engineer upon request and made available at each site meeting. After no further alteration can be expected and the Contract is nearing completion, the records shall be submitted for final approval.

The Contractor shall include on "As Built" records the dimensions location of all buried piping and valves, and during construction plainly mark location of exterior services and valves to prevent damage to these until the Project is completed.

The contractor shall submit as built drawings of all water supplies, rain, waste and soil lines and installations based upon actual construction to consultant after completion and before handover of the project at his own cost.

23.2 INTERNAL WATER SUPPLY

23.2.1.1 Scope

The work shall cover all materials required for such pipes and fittings, clamps, long screws etc. The work shall include water supply external and internal, including line marking, jointing the pipes, fixing in position, painting, excavation, groove cutting and reinstating to its original finish complete with testing and ready for operation.

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the schedule of quantities. Without restricting to the generality of the foregoing, the water supply system shall include the following:

- Connecting the main supply to the designed tanks as per the drawings.
- Control valve, masonry chambers and other appurtenances.
- Connection to all plumbing fixtures, pantries and overhead tanks.
- Excavation and refilling of pipe trenches.

- Pipe protection and painting

23.2.1.2 General Requirements

All materials shall be new of the best quality conforming to specifications. All work executed shall be to the satisfaction of the Engineer. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner. Short or long bends shall be used on all main pipelines as far as possible. If HDPE, Ppr, Pvc, Cpvc, multilayer pipes are used then methods approved by the manufacturer shall be used. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc. Pipes shall be securely levelled to the required slopes

& fixed to walls and ceilings by suitable clamps at intervals specified. Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance and repairs.

23.2.1.3 CPVC pipe for hot and cold water

All CPVC Schedule 40 and schedule 80 pipe shall be manufactured from a Type IV, Grade I Chlorinated Polyvinyl Chloride (CPVC) compound with a Cell Classification of 23447 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM F441, consistently meeting the Quality Assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality. The pipes shall be produced in Nepal or India using domestic materials, by an ISO 9001 certified manufacturer, and shall be stored indoors after production, at the manufacturing site, until shipped from factory. This pipe shall carry the Nepal Standard or Indian Standard seal.

Chlorinated Polyvinyl Chloride (CPVC) water supply Pipes should be of standard dimensional ratios SDR 11 (class 1). All CPVC Pipes and Fittings should be made from identical CPVC compounds having the same physical properties. Pipes and fittings should be product of SDR 11 meet the requirement of ASTM D2846, specific to Copper Tube Size dimension.

Pipe	Temperature (°C)	Pressure Rating (kg/sq cm)
SDR 11	27	27.6
	82	6.8

The joints should be same of Astm F-493 Solvent Cement Application. Horizontal and vertical pipes should be supported by pipe clamps or by hangers not less than 75 cm and as per requirements. Threaded CPVC fittings with tapered pipe threads should be used with a suitable thread sealant to ensure leak proof joints. The diameter and thickness corresponding as tabulated below.

Nominal Size (mm)	OD (mm)	Wall thickness (mm)
15	15.9	1.73
20	22.2	2.00

NominalSize(mm)	OD (mm)	Wallthickness (mm)
25	28.6	2.60
32	34.9	3.20
40	43.3	3.80
50	54	4.90

The joint of pipes and fittings shall be either threaded joints or solvent cement joints as directed in above codes.

Complete installation of CPVC pipes include supply of pipes and necessary fittings such as Tees, Bends, Reducers, Crosses, Unions, socket, elbow, crossover, transition piece, transition joint, end cap, clamp etc. with both male and female of respective fittings, chasing in wall or floor and repair to original finish, laying and jointing of pipes and fittings and pressure testing. All water supply CPVC pipes, fittings and valves shall be tested by hydrostatic pressure of at least 10 kg/cm². Pressure shall be maintained for a period of at least 24 hours without appreciable drop in the pressure.

In addition to the testing carried out during the construction, the Contractor shall test the entire installation after connections to the plumbing systems. The Contractor shall rectify all leakage and shall replace all defective materials in the system.

After commissioning of the water supply system, the contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. The valves, which do not operate effectively, shall be replaced by new ones at the Contractor's cost and tested as above.

Upon completion of all the test and necessary replacements, all water pipings shall be disinfected as below:

After thoroughly flushing the system with clean water, the system shall be filled with a measured quantity of sodium hypochloride solution to the water to give free residual chlorine of 5mg/1 litre. After 1 hour of retention, the system shall be drained, re-flushed and returned to service.

23.2.1.3.1 Measurement

Measurement for the Contract Item CPVC pipes will be made per running meter of complete installation. The rate shall include for all labour and materials required. The measurements shall be done for running meters, fittings etc. not payable separately.

23.2.1.4 Clamps

CPVC pipes in shafts and other locations shall be supported by MS clamps of design approved by Engineer. Pipes at ceiling level shall be supported on structural clamps fabricated on MS structural brackets as described in relevant sections of this specification. Pipes in typical shafts shall be supported on slotted angles/channels as specified.

23.2.1.5 Unions

The Contractor shall provide adequate numbers of unions/flanges on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks or

check valves and on straight runs as necessary at appropriate locations and required and/or directed by the Engineer.

23.2.1.6 Gate, Globe, and Check Valves

Stop Valves shall be gunmetal wedge gate valves, rising stem, hand-wheel operated with screwed female ends conforming to IS 778-1984 Class 1 or equivalent. Valves 65 mm dia. and below shall be heavy gunmetal full-way valves or globe valves conforming to IS 778-1971 class I. Valves shall be tested at the manufacturers with test results and their name stamped on it.

The Engineers shall approve all valves before they are allowed to be used in the works. For the cold and hot water distribution pipelines unless otherwise specified by the engineer, the contractor shall use the valves and pipes of same brand, preferably from same manufacturer.

23.2.1.7 Air Valves

Air valves shall be provided at all high points in the system. Each air valve shall be isolated by a c. l. double flanged sluice valve. Air valves shall be of approved make conforming to Indian standard. The valve shall conform IS 14845 (2000).

23.2.1.8 Scour valves

Scour valves shall be provided at all low points in the system. Each air valve shall be isolated by a c. l. double flanged sluice valves as specified and discharged into the nearest storm water drains.

23.2.1.9 Ball Valves

Ball valves shall be of brass with float of copper sheet 0.58 mm. thick for float up to 115 mm size. The body of the valves shall withstand pressure of 14 kg/sq m. and shall conform to I.S: 1708-1962.

23.2.1.10 Pressure Reducing Valves

The Water Pressure Reducing Valve shall be installed to reduce static and flowing pressures in water distribution systems. The unit shall be a diaphragm/balanced piston type with integral stainless-steel strainer and a built-in bypass to relieve pressure build-up downstream of the assembly. The valves shall be spring loaded to open and shall be diaphragm actuated to close under pressure conditions. The valves shall be suitable for supply pressure up to 400 psig and water temperatures from 33° to 180°F. The valve's internal parts such as the cartridge assembly, strainer, diaphragm, and springs shall be accessible for inspection, repair or replacement without disconnecting the device from the pipeline. In addition, the valve shall have a clean-out feature to allow for removal of the strainer and seat disc without disturbing the pressure setting. It shall meet the requirements of the following standards:

- Materials: Invest Cast Stainless Steel Materials
- Pressure Setting and Flow Rate of Direct – Activated Pressure Reducing Valve
- Direct – Activated Pressure Reducing Valve Directly Opens and Closes Valve Gate by the outlet Pressure.
- When outlet pressure is under setting pressure, Valve gate automatically opens, to make valve gate fully open, Adjustable pressure range and setting pressure are relative points.

The PRV shall be of AIRA brand of high-pressure range that can allow minimum 40 kg/sq cm water head

at inlet and outlet can be adjusted to 20 kg/sqcm water head or equivalent.

23.2.1.11 Brass Fittings

All brass stopcocks and bibcocks shall be heavy type bright finished with renewable leather washers conforming to I.S. 781-1967. The weight shall be as follows:

Diameter(mm)	StopCock(kg)	BibCock(kg)
15	0.40	0.40
20	0.75	0.75
25	1.30	1.25

23.2.1.12 PPR pipe for External cold water

PPR pipes, also known as polypropylene random copolymer pipes, are a type of plastic piping used for hot and cold-water supply as well as for heating systems. PPR pipes are made from a type of plastic called polypropylene, which is known for its durability and resistance to corrosion. The pipes shall be produced in Nepal or India using domestic materials, by an ISO 9001 certified manufacturer, and shall be stored indoors after production, at the manufacturing site, until shipped from factory. This pipe shall carry the Nepal Standard or Indian Standard seal.

23.3 STAINLESS STEEL TANK

Providing and fixing in position a vertical or horizontal cylindrical Stainless Steel (S.S.) water tank as per the standard engineering practices and Site Engineer's approval.

General Details:

Capacity: 1000 Liters

Orientation: Vertical or Horizontal cylindrical (as per site requirements and drawings).

Approved Make/Brand: Syntex, Nepatop, or equivalent approved by the Site Engineer.

Scope of Work:

Hoisting and Positioning: Safe lifting, hoisting, and placement of the tank at the designated location (roof, staging, or ground) as specified in the structural/architectural drawings.

Supports: Providing and fixing all required structural supports, structural frames, or masonry platforms to ensure the tank is stable, level, and securely positioned.

Plumbing Connections: Making all necessary inlet, outlet, overflow, washout/drain, and air vent connections using appropriate fittings, unions, and valves to make the system fully functional.

Execution and Quality Control:

Installation: The installation must strictly adhere to the manufacturer's guidelines, approved drawings, and specifications.

Testing & Commissioning: Upon completion of fixing and connections, the tank shall be filled

with water and tested for any leaks in the body or at the connection joints. The system must be fully water-tight and handed over ready for operation.

Approval: All materials, positioning, and final execution are subject to the inspection and prior approval of the Site Engineer.

23.4 SOIL, WASTE, VENT, AND RAINWATER PIPES

23.4.1 Scope

Work under this section shall consist of furnishing all labour, materials, equipment and applications, necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the Bill of Quantities. Without being restricted to the generality of the foregoing, the soil waste and vent pipe system shall include:

- Vertical and horizontal soil waste and vent pipes, rainwater pipes and fittings, joints, clamp and connection to fixtures.
- Connection of all pipe to sewer and stormwater lines as shown on the drawings at ground floor levels.
- Floor and urinal traps, clean-out plugs and inlet fittings.
- Waste pipe connection from all fixtures e.g., Wash basins, sinks, urinals, kitchen, equipment and plant room equipment.

23.4.2 General Requirements

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Engineer. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc. Fitting positions shall in all cases line up with & conform to access panels for ease of maintenance. Pipes shall be securely fixed to walls by suitable clamps at intervals specified. Access doors for fittings and clean-outs shall be so located that they are easily accessible for repair and maintenance. All work shall be executed as directed by the Engineer.

23.4.3 PVC Pipes and Fittings: Soil, Waste and Vent Pipes

Where specified, soil, waste, vent and rainwater pipes shall be confirmed to IS 4985:1981 of 4 kg/cm² and 6 kg/cm² as specified in BOQ. uPVC pipe should have length of 3m or 6m with molded. Fittings for uPVC pipes shall be of thickness not less than 3.2mm. Pipe color shall be as specified by the consultant.

Before use at site, all pipes shall be tested by filling up with water for at least 10 minutes. After filling, pipes shall be struck with a hammer and inspected for blowholes and cracks. All defective pipes shall be rejected and removed from the site.

Pipes shall be further tested after installation by filling up the stack with water as per manufacturer's specification. All opening and connections shall be suitably plugged. Any joint found leaking shall be re-laid and joined. All pipes shall be fixed in gradient towards the outfall drain. Pipes inside toilets shall be concealed or otherwise as per drawings and instruction. uPVC pipelines

through basement ceilings shall be clamped as per drawings and instruction.

Complete installation of uPVC pipes includes supply of pipes and necessary fittings such as Tees, Bends (with or without door), single and double Y (with or without door), Reducers, Crosses, Couplers, Solvent cement, NC putting, rubber, rings, clip etc. It also includes trench excavation in any type of soil and backfilling with proper compaction, chasing in wall or floor and repair to original finish, laying and jointing and pressure testing.

The buried pipes shall be bedded with a soil free from rock or sharp-edged objects (preferably sand) with a minimum of 75mm at all sides.

Measurement:

Measurement for uPVC Pipes will be made per running meter of complete installation.

23.4.4 UPVC Pipes

All Soil, waste, vent and rainwater pipes shall be unplasticized rigid Poly Vinyl Chloride (UPVC) pipes conforming to IS: 4989-1958. Pipes shall be of following specifications:

Normal diameter (mm)	Working pressure kgf/cm ²
50	6
75	4
110	4
160	4

Pipes shall be of colours specified by the Engineer. Fittings for UPVC pipes shall include coupling tees, bends, elbows, unions, reducers, nipples and plugs. Outlet of suitable diameter for connection to the appliance shall be provided. Contractor shall use pipes and fittings of matching specifications. Fittings shall be of the required degree of curvature with or without access door. Access door shall be screwing type with neoprene gaskets as shall be approved by the Engineer.

23.4.5 Clamps

Holder bat clamps shall be of standard design and fabricated from M.S. flat 40 mm x 3 mm thick and 12 mm dia. rod and 6 mm nuts bolts. They shall be painted with two coats of black bitumen paint before fixing. Holder bat clamps shall be fixed in cement concrete of 1:2:4 mix. Where holder bat clamps are to be fixed on RCC column, wall or beam they shall be fixed with 40 mm x 3 mm flat iron "U" type clamps with anchor fasteners of approved design. Rates for both types of clamps shall be the same and no addition or deduction shall be made.

Structural clamps shall be fabricated from MS structural member e.g., rods, angles, channels, flats as per detailed Drawing. Contractor shall provide all nuts, bolts, welding and paint the clamps with one coat of red oxide.

23.4.6 Pipe Supports and Hangers

Spacing for supports & hangers of fixing for internal piping shall be as given in the following table.

KindofPipe(mm)	SizeofPipe(mm)	HorizontalRun(m)	VerticalRun(m)
UPVC	50	2	2
	75	2.5	2.5
	100	2.5	2.5

23.4.7 WastePipefromAppliances

Waste pipe from appliances e.g. wash basins, sinks, urinals, bath tubs, water coolers shall be of UPVC pipes with proprietary fixtures & fittings of the approved make conforming to all relevant ISS & also to IS 4984-1978. All pipes shall be fixed in gradient towards the out-falls of drain. Spacing for clamps for such pipes shall be as follows:

KindofPipe	HorizontalRun(m)	VerticalRun(m)
PVC Pipes	300cm	240cm
HDPE Pipes	180cm	120cm

23.5 SANITARY WARES

23.5.1 General

23.5.1.1 Scope

Work under this section shall consist of furnishing all labour materials necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories required by the drawings and specified hereinafter or given in the schedule of quantities. Without restricting to the generality of the foregoing the sanitary fixtures shall include all sanitary fixtures, CP fittings and accessories, etc, necessary and required for the buildings. Whether specifically mentioned or not, all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required. All exposed pipes within toilets and near fixtures shall be chromium-plated brass or copper unless otherwise specified. All hot water pipes shall be lagged & properly insulated from the hot water storage tanks to the hot water taps & outlets.

Sanitary ware, accessories and chrome plated CP fittings shall be of the best quality, as approved. Wherever particular quality is mentioned, the choice or selection shall remain with the consultant.

All fittings and fixtures shall be fixed in a neat workmanship manner to correct level at the heights shown on Drawings, in accordance with the manufacturer's recommendations.

23.5.1.2 General Requirements

Sanitary fixtures shall be of the best quality approved by the Engineer. Wherever particular makes are mentioned, the choice of selection shall remain with him. All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned in the schedule of quantities, specifications or drawings or not. All fixtures and accessories shall be fixed in accordance with a set pattern

matching the tiles or interior finish as per Engineer/interior designer's requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern desired. Fixing screws shall be half round head chromium plated brass screws with CP washers wherever required as per directions of Engineer. All fittings and fixtures shall be fixed in a neat workmanlike manner true to level at heights shown on drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor.

23.5.2 Commode and Water Closet

Commode and Water closet shall be of white vitreous or another colour as specified with wash down flushing cistern and 100 mm diameter double symphonic close porcelain P or Strap without vent horn. These shall be conforming to IS 2556. Commodes shall be provided with Bakelite black heavy solid plastic seat cover and lid. WC shall be flushed by means of matching earthenware, ceramic cistern.

The WC shall be fixed in level in a neat workmanlike manner. The WC and trap shall be set in cement concrete 1:2:4 mix (1 cement 2 coarse sand 4 stone aggregate 20mm nominal size). Joints between WC and flush pipes shall be made with a putty of white lead and linseed oil and caulked well or with an approved rubber joint. A proper procedure of water proofing, water sealant shall be applied in order to prevent leakage.

Valve shall be of 12.7mm diameter CP brass with inlet connection of required length with union and CP brass cap.

23.5.2.1 Measurement:

Measurement for the commode and water closet shall be made per unit set of complete installation. Nothing extra shall be provided for the water proofing sealant, water proofing work that shall be carried out as per the instruction.

23.5.3 White Glazed Wash Basin

Wall mounted and counter types wash basin shall be of white vitreous of first-class quality conforming to IS 2556 and of specified size. Wash basin shall be fitted with the heavy CP bottle trap below.

Basins shall be supported on a pair of CI brackets of metal angles and channels cantilevering from wall face. All brackets shall be installed in such a way as to be hidden from view.

They shall be provided & fixed in place early so that the built-up vanity may be installed in sufficient time to comply with completion dates. Each basin shall be provided with 32mm dia CP waste with overflow, pop up waste or rubber plug and chain 32mm dia CP brass bottle trap with CP pipe wall and flange as given in the schedule of quantities.

Each basin shall be provided with mixing fitting or pillar tap as specified in the Bill of Quantities and/or as approved by the Consultant. Basins shall be fixed at proper heights as shown on drawings. If heights are not specified, the rim level shall be 70cms or as directed by the Consultant.

23.5.3.1 Measurement

Measurement for the white glazed wash basin shall be made per unit set of complete installation.

23.5.4 Mixing Fittings

Mixing fittings shall be C.P. brass of approved quality with modern head for hot and cold for spray and rim with diverter.

23.5.4.1 Measurement

Measurement for the mixing fittings shall be made per unit set of complete installation.

23.5.5 Angle valve

Angle Valve shall be of 12.7mm dia. C.P. brass with C.P. cap and c.p. nipple. The connection between angle valve and supply line laid in chase shall be made in a manner so that the union is flush with finished face of the wall and no threaded portion of the angle valve or supply line is visible.

23.5.5.1 Measurement

Measurement for the Angle Valve shall be made per unit set of complete installation.

23.5.6 Urinals

Urinals shall be lipped type half stall white glazed vitreous china of size 610 x 400 x 380 mm size. Flat back urinal shall be provided with 15mm dia. spreader, 32mm dia. PVC bottle trap with pipe and wall flange and shall be fixed to wall by one CI bracket and two CI wall clips complete as recommended by manufacturer's directives with approval by Engineer. Urinal shall be fixed with CP brass screws. Flush pipes shall be GI pipes concealed in wall chase but with chromium-plated bends at inlets and outlets wherever they are visible.

Urinals may be flushed with flush valves, if given in the schedule of quantities and as described in the item

Waste pipe shall be concealed by chasing into the walls as directed by the Engineer. Specifications for waste pipe shall be same as given in the relevant section of this specification.

Urinals shall be fixing to wall by concealed hangers, brackets, C. P. screws as required and recommended by manufactures.

Each range of urinals shall be provided with an automatic flushing cistern with cover of vitreous china with brackets as specified. The size of the cistern, main flush pipe and spreader pipes shall be as follows:

No of Urinals in range	capacity of cistern litres	size of main flush pipe mm	size of branch pipe mm	size of distribution pipe mm
One	5	-	-	15
Two	10	20	-	15
Three	10	25	-	15
Four	12.5	25	20	15

Painting: the bracket shall be painted with 2 coats of white synthetic enamel paint of approved

manufacture over and including aprimingcoator redlead.

Measurements: shall be per urinal set for different ranges as specified in the schedule of quantities.

23.5.7 Sinks

Sinks shall be stainless steel as specified in the schedule of quantities. Each sink shall be provided with RS or CI brackets and clips and securely fixed. Countertop sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 32 mm dia CP waste coupling with chain and rubber plug, 32mm dia. Bottle trap with clean out hole and plug 15mm dia CP Sink Cock. Fixing shall be done as directed by the consultant and shall be coordinated with the interior fit-out program. Supply fittings for the sinks shall be fittings of CP cock/mixer as specified.

Fixing of the sink: It shall be laid in wall in a workman like manner care being taken not to damage the sink in the process of fixing. If damaged in anyway, it shall be replaced at no cost to the Employer. The sink shall be fixed on a proper base of cement concrete 1:2:4 mix (1 cement: 2 coarse sands: 4 stone ballast 20mm. nominal size) taking care that cushion is uniform and even without having any hollows between the concrete base and sink. Joining between the sink and wall shall be neatly done and no hair cracks shall be visible. Joining between the outlets of sink shall be made leak proof.

23.5.7.1 Measurement

Measurements shall be made per unit set of complete installation.

23.5.8 Flush Valves

CP flush valves shall be fitted to the urinal. The flush valves shall include 25mm diameter control cock and elbow set complete with adjustable sleeve and wall flange.

23.5.8.1 Measurement

Measurement for the stainless flush valves shall be made per unit set of complete installation.

23.5.9 Mirrors

Mirrors shall be of approved quality. All edges shall be rounded off. Mirrors shall be fixed to wall with brass chromium plated screws and washers. The approval shall be taken from the Engineer prior to installation.

Mirrors shall be electro-coated copper 5.5mm thick of guaranteed quality of float glass and reputed make. The size shall be as specified in the schedule of quantities & the drawings. The images shall be clear and without waviness at all angles of vision. Mirrors shall be provided with blacking of 12mm thick marine ply wood fixed with CP brass semi-round headed concealed screws and cup washers or CP brass clamps as specified or instructed by the Consultant.

23.5.9.1 Measurement

Measurement for the Mirror shall be made per unit set of complete installation.

23.5.10 Towel Rails and Rings

Towel rails and rings shall be of Jaguar quality of heavy-duty CP brass with two brackets. The size of the rail shall be as specified. The brackets shall be firmly fastened by means of CP

brass screws and nylon gripp plugs firmly embedded in the wall.

23.5.10.1 Measurement

Measurement for the Towel Rail shall be made per unit set of complete installation.

23.5.11 Robe Hook, Toilet Paper, and Soap Dish

Robe hook, toilet paper holder and soap dish shall be heavy grade Jaguar quality. All fixtures shall be fixed in a neat workmanship manner with CP brass screws, where required.

23.5.11.1 Measurement

Measurement for the robe hook, toilet paper holder and soap dish shall be made per unit set of complete installation.

23.5.12 CP Fittings

All CP fittings sink tap, basin tap, bibcock, surgical valve, scrub/sink spout, basin mixer, shower mixer, shower rose, spray, flush valve, conceal stop valve, push flush cock and spreader etc. shall be Jaguar as specified in BOQ and approved by consultant. The fittings shall be installed with necessary accessories at correct levels in a neat workmanship. All the CP fittings shall comply with IS 8931 (1993) or its latest revisions.

23.5.12.1 Measurement

Measurement for each CP fitting shall be made per unit set of complete individual installation.

23.5.13 Multi Floor Trap and Gratings

Multi floor trap shall be made of uPVC Panckanya or equivalent quality with water seal. The floor traps shall be covered with 3mm thick heavy CP brass grating. The floor finish around the trap shall be careful and executed by skilled workmanship to provide perfect finish with slope.

23.5.13.1 Measurement

Measurement for the multi floor trap and gratings shall be made per unit set of complete installation.

23.6 SUBMERSIBLE PUMP

23.6.1 Material

Supply and installation of Electric Submersible water pump of capacity 350 lpm head 33m. 1 Working and 1 Standby set with Three phase Motor of approx 1.5 Hp, automatic pump control panel. Cables etc complete set.

23.6.2 Measurement

Measurement for the submersible pump shall be made per unit set of complete installation.

23.7 OUTDOOR PIPE INSTALLATIONS, MANHOLE, SEPTIC TANK, AND SOAK PITS

23.7.1 Valve chambers

All underground sluice valves, scour valves and fire hydrants shall be located in brick masonry chambers of size as given in the bill of quantities conforming to the drawings.

23.7.2 HDPE /PVC PipeSystem

HDPE pipes shall conform to IS: 4984/72. The high-density polyethylene shall be of medium quality and of wall thickness conforming to a working pressure of 6 kg/sq cm. the pipes

shall be manufactured using virgin GM5010T2 raw materials as manufactured by Nepal polythene and plastic industrial or their equivalents.

Fitting shall high density polythene pipe of series II, made at site their form shall be true to shape, smooth and cylindrical, their inner and outer surface being as far as practicable concentric.

These shall be sound and cast so as to be free from cracks, pin holes or other imperfections.

The floor traps and others such HCL fittings indicated in the schedule are to be jointed with the HDP pipes after being heated so as to cause the required expansion and laid in position.

Jointing, laying and testing shall be as per the manufacturer's specifications.

Pipes shall be of colors specified by the engineer. Fitting for P.V.C. pipes shall include couplings, tees, bends, elbows, unions, reducers, nipples, and plugs. Outlets of suitable diameter for connection to the appliance shall be provided. P.V.C. pipes shall be jointed with P.V.C. pipes shall be done in the best workmanship.

No joints shall be covered until these are rechecked and tested by the engineer. Inlet and outlet level of the soil pipes, waste pipes lines shall be strictly followed (peg marking to be approved). Fitting where specified as HCL shall be used, and no alternative HDP fabricated shall be used unless specifically approved by the resident engineer.

The contractor shall ensure that only workman experienced in HDP pipe work are used. The resident engineer shall reject any and all works found to be not up to the standards required and request replacement of workman if found necessary.

23.7.2.1 Measurement

P.V.C. / H.D.P. pipes shall be measured per running meter and include meter and include items as stated in the bill of quantities.

23.7.3 Manholes

The internal size of manholes shall be as specified in BOQ and depth depends upon gradient of waste or soil or rainwater lines and wall thickness depending upon depth and site conditions. The RCC foundation, benching, wall, finishing, level of inlet and outlet, cover with frame etc. for manholes shall be constructed as per drawing and instruction. The soil manholes shall not retain any night soil in it.

Bed Concrete: Manholes shall be built on a bed of 150mm thick cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 graded stone ballast 20 mm. nominal size).

Plaster: - Inside and outside of wall shall be plastered with 20mm thick cement plaster 1:4 (1 cement: 4 coarse sand) finished with a floating coat of neat cement. In wet ground, outside plaster, shall be water proofed with addition of any other equal and approved waterproofing compound. The waterproof plastering shall be done 300mm. above wet ground.

Measurement: - Manholes shall be measured in numbers. Depths of manholes shall be measured from top of the cover to the bottom of channel. Manholes with depth greater than the specified shall be paid as extra depth per meter depth or part thereof.

Manhole covers shall be Swastika or equivalent heavy as per instruction. All manhole covers shall be of double seal and the frame of manhole shall be embedded firmly on RCC coupling. All surfaces of frames and cover shall be painted with coal tar. Manhole frames and covers shall be of clean well-defined castings (i.e. key slots and edges shall be smooth and easy to access). Depth of manholes shall dictate size variations as per safety requirements. Manholes shall be integrated with the materials surrounding them in a manner which is aesthetically pleasing.

RCC precast manhole covers may be instructed. In which case they shall be 3" thick with 1½" x 1½" squares holes set in a neat pattern between the rebars and conforming to the drainage volume required to pass through the set of holes into the sink. The rebars shall be adequate to withstand rolling loads of motor trucks fully loaded. The size shall conform to the manhole or sink sizes.

Drop connections shall be provided between branch sewer and main sewer or in the main sewer itself in steep ground when the difference in invert level of the two exceeds 45 cms

of the required sizes. Drop connections from gully trap to main sewer in rectangular manholes shall be made inside the manholes and shall have HCl special type door bend on top and heel rest bend at bottom connected by a HCl pipe. This pipe shall be supported by holder batclamps at 180 cms intervals with at least one clamp for each drop connection. All joints shall be load caulked 25mm deep.

Drop connections from branch sewer to main sewer shall be made outside the manhole wall with cast iron LAP tee connections, vertical pipe and bend at the bottoms. The top of the tee shall be finished up to the surface level and provided with a Cl hinged type frame and cover 30x30 cms. The connections shall be embedded in cement concrete 1:2:4 mix 15 cms all-round the pipe and tee up to the surface chamber of the tee.

Drop connection made from vertical stacks directly into manholes shall not be considered as drop connections. They shall be paid for under the relevant soil and waste pipes.

23.7.3.1 Measurement

Manholes shall be measured in numbers. Depths of manhole shall be measured only inner dimension. Manhole with depth greater than 1.5m shall be paid as extra as per civil items.

23.7.4 Soak Pit

The soak pit work shall be done as per the Drawing. The earthwork in excavation shall be carried out to the exact dimensions given in the Drawing. The soak pit shall be constructed and honeycomb dry brick shaft as per the Drawing. Round the shaft and within the radius of given measurement shall be placed well-burnt brickbats. Brickbats of sizes 50 to 80 mm shall be packed round the radius of given measurement. The top of the slab shall be as per the Drawing or direction of the Project Engineer.

23.7.4.1 Measurement

Measurement for the Soak Pit shall be done as per the individual item of the civil works.

23.8 PERFORATED PIPE FOR DRAINAGE WORKS

This work shall consist of supplying High-Density Polyethylene (HDPE) PE 100 PN6 pipes, mechanically perforating them to the specified dimensions, and laying them in prepared trenches for sub-surface drainage. The work includes excavation, provision of granular bedding, aligning, jointing, and backfilling with filter material as per the approved drawings and the direction of the Engineer.

23.8.1 Material

Drainage Pipe: The pipe shall be HDPE of grade PE 100 with a nominal pressure rating of PN6. The pipe must conform to relevant standards (e.g., NS 40 or equivalent ISO/IS standards for HDPE pipes) and be free from blisters, shrinkage, cracks, or other manufacturing defects.

Filter/Bedding Material: The granular bedding and backfill around the perforated pipe shall consist of clean, hard, and durable crushed rock or gravel conforming to the specified filter gradation (typically 10mm to 40mm aggregate).

23.8.2 Perforation Specifications

For effective sub-surface groundwater collection without compromising the structural integrity of the PE 100 PN6 pipe, the following perforation geometry is recommended:

Hole Diameter: Perforations should be 5 mm to 8 mm in diameter. Holes smaller than 5 mm are prone to clogging, while holes larger than 8 mm may allow surrounding filter gravel to enter the pipe.

Spacing: Holes should be spaced at 75 mm to 100 mm intervals longitudinally along the pipe.

Rows and Angle of Perforation: Provide 3 to 4 longitudinal rows of holes.

Radial Placement: The rows should be arranged to cover the upper 240 degrees of the pipe, leaving the bottom 120 degrees (the invert) unperforated. This solid bottom acts as a channel to carry the collected water away efficiently without letting it seep back into the subgrade.

Example Configuration: If using 4 rows, place them at approximately 45 degrees and 135 degrees from the top-center vertical axis on both sides of the pipe.

Method: Perforations shall be neatly drilled. Punching or burning holes is strictly prohibited, as it creates burrs that trap debris and reduce flow capacity. All drill shavings must be completely removed from the inside of the pipe before laying.

23.8.3 Construction and Laying Procedure

Trench Preparation: The trench shall be excavated to the designated line, grade, and cross-section. A minimum of 100 mm to 150 mm of granular bedding material shall be placed and compacted at the bottom of the trench to establish the correct gradient.

Laying the Pipe: The perforated PE pipe shall be laid on the prepared granular bed with the unperforated section (the solid invert) facing strictly downwards. The pipe shall be laid starting from the lowest point (outfall) and working upwards.

Jointing: Pipes shall be jointed using standard butt-fusion welding, electro-fusion, or approved mechanical HDPE couplers to ensure secure connections that will not pull apart during backfilling.

Backfilling: The granular filter material shall be placed carefully around the sides and over the top of the pipe to a minimum cover of 300 mm, ensuring the pipe is not displaced or crushed. The material must be placed in layers and lightly compacted to prevent damage to the pipe.

23.8.4 Measurement

The work shall be measured in running meters (linear meters) of pipe, measured along the centerline of the laid pipe, completed and accepted in place.

Unless specified as separate items in the BOQ, excavation, granular bedding, perforation labor, and backfilling shall not be measured separately but deemed included in the pipe laying rate.

23.8.5 Payment

The work measured as provided above shall be paid at the contract unit rate per linear meter. This rate shall be full compensation for supplying the PE 100 PN6 pipe, mechanical drilling of perforations, transportation, trench excavation, providing and placing granular bedding and backfill, jointing, equipment, tools, and all labor required to complete the operation.

23.9 ANAEROBIC SEWAGE TREATMENT PLANT

Supply of a prefabricated Anaerobic Sewage Treatment Plant as per the technical parameters.

Capacity: 6 KLD (Kilo Liters per Day)

Physical Dimensions & Connections:

Dimensions: 2070 mm (Diameter) x 2510 mm (Height)

Inlet/Outlet Size: 100 mm

Vent Size: 50 mm

Efficiency: Designed for a Biochemical Oxygen Demand (BOD) reduction of up to 70%.

The unit must be ISO Certified.

The unit must be UL Certified.

23.10 EXCAVATION & RELATED WORKS FOR EXTERNAL PLUMBING

23.10.1 Alignment and grade

The drainage, water supply and sewer lines are to be laid to alignment and gradients shown on the drawings but subject to such modifications as shall be ordered by the engineer from

time to time to meet the requirements of the works. No deviations from the lines, depths of cuttings or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the engineer.

23.10.2 Opening out trenches

In excavation the trenches, etc. the soling, road metaling, pavement, kerbing etc. and turf is to be placed on one side and preserved for reinstatement when the trench or other excavation shall be filled up. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the engineer. The contractor shall not cut or break down any fence or trees in the line of the proposed works but shall tunnel under them, unless the engineer shall order to the contrary.

The contractor shall grub up and clear the surface over the trenches and other excavations of all trees, stumps roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the engineer.

23.10.3 Obstruction of Roads

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and if insufficient space, he shall remove the materials excavated within a lead of the 200' and bring them back again when trench is required to be refilled. The contractor shall obtain the consent of the engineer in writing before closing any road to vehicular traffic and the foot-walks must be always kept clear.

23.10.4 Removal of filth

All night soil, filth or any offensive matter met with during the execution of the works immediately after it is taken out any trench, sewer or composes, shall not be deposited upon the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall at once be put into carts and remove to suitable place incontestable to the project & Employer.

23.10.5 Excavation to be taken to proper depths

The trenches shall be excavated to such a depth that the sewer lines shall rest on concrete as described in the items relating thereto and so that the inverts may be the levels given on these sections. In bad ground the Engineer may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with concrete, broken stone, gravel, or other materials. For such extra excavation and concrete broken stone gravel or other materials the contractor shall be paid extra if the works were ordered by the engineer, in writing, but if the contractor should excavate the trench to a greater depth than is required without specific order to that effect in writing of the Engineer the extra depth shall have to be filled up with concrete at the contractor's own costs and charges, to the requirements and satisfaction for the Engineer.

23.10.6 Refilling

After the sewer or other work has been laid and proved to be watertight, the trench or other excavations shall be refilled. Almost care shall be taken in doing so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and up to 3" above the crown of the sewer shall consist of the finest selected materials placed carefully in 6" layers

with materials taken from the excavation, each layer being watered to assist in the consolidation. Unless the Engineers shall otherwise direct, Turfings shall be laid over as instructed.

23.10.7 Contractor to restore settlements and damage

The contractor shall, at his own costs and charges, make good promptly during the whole period the works are in hand, any settlement that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces, etc. whether public or private caused by his trenches or by his other excavations and he shall be liable for any accidents caused thereby. He shall also, at his own expenses and charges, repair and make good any damage done to buildings and other property. If in the opinion of the Engineer the contractor fails to make good such works with all practicable dispatch, the Employer shall be entitled to carry out by his own workmen or other contractor and Employer shall be entitled to recover from the contractor as per conditions of contract.

23.10.8 Disposal of Surplus Soil

The contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored, and roadways and sides left clear.

23.10.9 Timbering of sewer and trenches

The contractor shall at all times support efficiently and effectively the sides of the trenches and other excavations by suitable timbering, piling and sheeting and they shall be closed, timbered in loose or sandy strata below the surface of the sub-soil water level.

- a) All timbering, sheeting and piling with their supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.
- b) The contractor shall be held responsible and accountable for the sufficiency of all timbering, bracing, sheeting and piling used for, all damage to persons and property resulting from improper quality, placing, maintaining or removing of the same.

23.10.10 Shoring of buildings/structures

The contractor shall shore up all buildings and structures, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damage to persons or property resulting from any accidents to any of such buildings.

23.10.11 Dewatering of Trenches

The contractor shall at all times during the progress of the work keep the trench and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use for the same by the public.

23.10.12 Cement concrete, brickwork and finishing

Wherever applicable in this section the materials for cement concrete, brick masonry and finishing like plaster required for the manhole, chambers, gully trap, septic tank and other works shall conform to the specifications works and materials for civil works. The works, sizes and set shall be as shown in the drawings.

23.10.13 Excessexcavation

If any excavation is carried out at any point or points to greater width than the specified cross section of the sewer or trench the full width the trench shall be filled with concrete by the contractor at his own expense and charged to the requirements of Engineer.

23.10.14 Increased Width, Depth of Trench

The Engineer shall have power by giving an order in writing to the contractor to increase maximum width or depth in respect of which payment will be allowed for excavation in trenches of sewer, manholes, and other works in certain lengths to be specifically laid down by him, on account of bad ground or other unusual conditions, he considers that such increase in width is necessary in view of site conditions.

23.10.15 Measurement

Unless stated in the item the measurement and payment of excavation shall be as per the terms of civil specifications.

23.11 LIST OF APPROVED MAKES OF MATERIALS

S.No.	Description	IS No.	Recommended Brand Name
1.	Sanitary ware	IS2556-4(2004)/ IS2556-1(1994)	Hindware/Parryware/ Jaquar/American Standard
2.	CP Fittings (inc Grab Bars)	IS8931(1993)	Jaquar/Grohe/Schell/Hindware, Parryware
3.	SWR Pipes		Aajaya, Marvel, Supreme (or Equivalent)
4.	Water Supply Pipes & Fittings		Aajaya, Raksya, Astral, Ashirbad (or equivalent)
5.	Looking Mirrors		Modiguard (or equivalent)
6.	Water Tanks (S.S. Cylinder)		Syntex, Nepatop (or equivalent)
7.	Anaerobic Sewage Treatment Plant		Sintex (or equivalent)
8.	GI Pipes/Black steel pipe	IS1239-2(2011)	HIPCO/Jindal
9.	Plastic Tanks	IS:12701 -1996	Hilltake/Rijalco/Nepatop
10.	High density polyethylene (HDPE PIPES)	IS4984(1995)	Supreme/Pancha Kanya
11.	GI Fittings (malleable cast iron)	IS1879 (Part II to X)	Sun/UNIK/Essar
12.	Gun metal Valves (Full way check and globe valves)	IS778(1984)	SANT/Swastik/LEADER
13.	Bib and Stopcocks (Brass)	IS781(1984)	SANT/L&K/BS
14.	Ball cocks	IS9890(1981)	Do
15.	CI Manholes	IS1726(1991)	Himal/HEPCO
16.	Pressure Reducing Valve	IS9739(1981)	SANT/Bermad

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17.	SolarWaterHeater	IS12976(1990)	Hot-Pot/Sunking
18.	CPVCPipe andFittings	IS15778(2007)	Panchakanya,Marvel
19.	UPVCPipe andFittings	IS4985-2000	Panchakanya,Prince,Marvel
20.	Pump	IS4985-2000	KSB/ Willo/ Lubi/ Pedrollo

Note: Please follow required specification of Department of Irrigation/Department of Water supply and Sewerage Management (DWSSM) for deep tube boring andSpecification of DWSSM for external Water Supply work.

SECTION 24: FURNITURE WORKS**24.1 CUSTOMER SERVICE DESK/CSD (RT)**

Fabrication and installation of Customer Care Desk: made up of 19 mm approved brand ply board, post forming top, granite top, Italian marble/Onex at front of desk, toughened glass, 1mm Greenlam/ Merinalam/ centurylam or equivalent Formica finish in all inner and outer part, chapra polish in side, Sallo wood lipping, best quality hardware and all complete a commercial ply for both vertical and horizontal supports and finished with 1mm thick laminates to be applied with Fevicol adhesive. The desk shall be provided with a portable Drawer with S. S. locks and handles on all shutters, a Laminated Wooden Keyboard Trey, and a metal slider CPU holder. There shall be high-quality S. S. locks and handles on all drawers, heavy-duty runners on all shutters. It should have a 12mm thick sisham wood edging finished with high quality melamine paint. All the interior surfaces shall be finished in high quality 156 board 156 polish (at least three coats) The dimension of the furniture shall be verified at site. Furniture all complete as per drawing, specification and direction of site Engineer. (Ply: Surya/Sagun and Greenply). Measurement shall be in square meter of exact length and height.

24.2 TELLER COUNTER (TC)

Fabrication and installation of Teller Counters made up of 19mm commercial ply on both vertical and horizontal supports. Postforming top, Top of the teller shall be high quality and polished 19mm jet Black Granite, Italian marble/Onex at front of Desk, toughened glass. The teller shall be finished with 1mm Greenlam Laminates to be applied with Fevicol adhesive in all inner and outer surface. The each of the teller shall be provided with a fixed Drawer with S. S. locks and handles on all shutters, a Laminated Wooden Keyboard Trey, and a metal slider CPU holder. Each of the first drawers shall have partitions to hold cash of different denominations. There shall be high-quality S. S. locks and handles on all drawers, heavy duty runners on all shutters. It should have a 12mm thick sisham wood edging finished with high quality melamine paint. All the interior surfaces shall be finished in high quality 156 board 156 polish (at least three coats) The dimension of the furniture shall be verified at site. Furniture all complete as per drawing, specification and direction of site Engineer. Measurement shall be in square meter of exact length and height.

24.3 STAFF DESK (T1)

Supply and Installation of wooden modular Desk for staff made up of 25-75mm thk. Postforming top, 19mm commercial ply for both vertical and horizontal 156 board 156io with 1mm thick laminates; a Portable CPU holder, a portable Drawers; 12mm edge polished frosted glass on top held, clear rubber buffer below the glasses. It shall have a Portable metal CPU holder, a Metal Keyboard Trey. There shall be high quality S. S. locks and handles on all drawers, heavy duty runners on all Drawers. It should have a 12mm thick sisham wood edging finished with high quality French Polish. All the interior surfaces shall be finished in high quality 156 board 156 polish (at least five coats over sand finished wooden surface.) The dimension of the furniture shall be verified at site. Furniture all complete as per drawing, specification/schedule of finishes and direction of Architect. Measurement shall be done in number.

24.4 FILING CABINET

Supply and Installation of storage racks of dimensions stated below, made up of 25mm thk. Post forming top, 19mm commercial Ply for all vertical and horizontal supports and finished with 1mm thick laminates to be applied with white adhesive in all inner and outer surface. There shall be high quality S. S. locks and handles on all shutters, heavy duty runners on all shutters. Shutter shall be hold with autohinge. It should have a 12mm thick sisham wood edging finished with high quality French Polish. All the interior surfaces shall be finished in high quality 157oard157 polish all complete as per drawing, specification/schedule of finishes and direction of Engineer. Measurement shall be in square meter of exact length and height.

24.5 STAFF/MEETING CHAIR (RC1):

Provide Staff Chairs: revolving, adjustable height, Black PU cover with internal foam, stainless steel legs, all complete as approved and specification/schedule of finishes and direction of Engineer. Measurement shall be done in number.

24.6 OFFICE VISITORS CHAIR(C1):

Provide Visitor Chairs: SS Legs, Black PU cover with internal foam, all complete as per approval and drawing, specification/schedule of finishes and direction of Engineer. Measurement shall be done in number.

24.7 MEETING TABLE (MT)

Top Board: 19mm Plywood with Laminate top and polished pine wood edge lipping; Frame: wooden frame laminate finishes all complete. Measurement shall be done in number.

24.8 SOFA (1/2/3/5-SEATER)

Providing sofa using fabric with high density u-foam for the back and seat with necessary wooden framework supported on 3" designed wooden members finished in three coats of melamine, all accessories all complete as per drawing, specification/schedule of finishes and direction of Architect. Measurement shall be done in number.

24.9 AIRPORT SOFA (C2) (4/8/12-SEATER)

Provide Waiting sofa for waiting: fixed, custom designed, artificial leather, stainless steel legs, cover -as approved, drawing, specification/schedule of finishes and direction of Engineer. Measurement shall be done in number.

24.10 CURTAINS

Window Curtains made from cotton fabrics (Base Price of Curtains not less than 400Rs/m) including wooden polished hanging rods, hooks and necessary accessories all complete as per drawings and instructions. (Samples to be approved by 157oard157ion157) (Height of window may vary upto 8ft) (measurement in installed net area of window). Measurement shall be in square meter of exact length and height.

24.11 ULTIMATE DOOR MAT

Supply and install graphic loop pile carpet of 450 gm/sq.m and 5mm thick of approved colour and pattern as per attached drawing, specification and direction of site Engineer. Measurement shall be in square meter of exact length and breadth.

24.12 PLANTER BOX

Supply and 158 board 158ion 158n of wooden modular planter box made with 19mm plywood, 1mm laminates finish at outer surface, 2mm aluminium sheet pasted at inner surface as per design all complete as per instruction of Engineer. Measurement shall be done in number.

24.13 HELMET RACK

Supply and fabrication of wooden modular helmet cabinet made with 19mm plywood, 1mm laminates at all inner and outer surface, 19mm postforming top, different color and pattern design of glossy/matt laminates design, salves as per design all complete as per instruction of Engineer. Measurement shall be done in number.

24.14 GUARD CHAIR

Provide guard Chairs: SS Legs, Black PU cover with internal foam, all complete as per approval and drawing, specification/schedule of finishes and direction of Engineer. Measurement shall be done in number.

24.15 GUARD TABLE

Supply and Installation of wooden modular guard table made up of 25-75mm thk. Postforming top, 19mm commercial ply for both vertical and horizontal 158board 158io with 1mm thick laminates; a Portable CPU holder, a portable Drawers; 12mm edge polished frosted glass on top held, clear rubber buffer below the glasses. It shall have a Portable metal CPU holder, a Metal Keyboard Trey. There shall be high-quality S. S. locks and handles on all drawers, heavy duty runners on all Drawers. It should have a 12mm thick sisham wood edging finished with high quality French Polish. All the interior surfaces shall be finished in high quality 158 board 158 polish (at least five coats over sand finished wooden surface.) The dimension of the furniture shall be verified at site. Furniture all complete as per drawing, specification/schedule of finishes and direction of Architect.

24.16 TOUGHEN GLASS

Supplying, fabrication and fixing in position 12mm thick clear toughen glass with SS 304 readymade with all necessary fixtures and fitting such as SS caps, necessary hole cutting, metal grip, welding, jointing all complete as per drawing, BOQ, specification & approval of Engineer.

24.16.1 Measurement

It shall be measured in square meter of the finished work. The rate shall include handrail, balusters, caps, newel post, and other accessories including hole cutting, fixing of handrail, and balusters in position, labour, materials all complete. It shall be paid in square meter.

24.17 LIST OF APPROVED MAKES OF MATERIALS

S. No.	Description	Brand
1.	Ply board	Surya, Sagun, Green, Duro
2.	Laminates	Greenlam, Century, merinolam
3.	Prelaminated MDF Board	Tesa, Green Panelmax
4.	Veneer	Green Decowood, Century Veneer
5.	Hardware	Hettich, Dorma, Godrej, Haffle
6.	Form	Everest, Dunlop