

United Nations Development Programme

Community-Oriented Policing Services

(COPS)

Technical Specification

For

The Construction of

6 Police Information Desks (PIDs)

Project Code:	
Project Name:	Construction of 6 Police Information Desks (PIDs)
Project Location:	6 Police Districts (PD# 5,8,9,11,12,15) Kaul Afghanistan

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6 Police Information Centers/Desks (PID) Construction project

SCOPE OF WORK (SOW)

The overall work is intended to complete the construction of Police Information Centers in 6 Police Districts - Kabul. The project shall be constructed according to all the Contract Documents including the Drawings and Specifications and also according to all applicable code requirements. To resolve any discrepancies or differences in the Drawings and Specifications, the Subcontractor shall contact the Community-Oriented Policing Services (COPS/UNDP) Engineers as soon as possible to resolve the issue.

Following is the detail description of activities:

- 1. Mobilization and preparation.
- 2. Excavation for foundation and backfilling of foundation.
- 3. Leveling and Compaction 90% of foundation and floor.
- 4. Laying boulder stones in foundation and floors.
- 5. PCC work, with M:150
- 6. Form Work/Shuttering work
- 7. RCC work, with M:250
- 8. Water supply and waste water/sewer/plumbing systems
- 9. Brick masonry work 140Kg/sqm
- 10. Floor work, installation of Terrazzo tiles and Skirting
- 11. Doors and windows installation with all accessories
- 12. Heating, ventilations and air conditioning (HVAC)
- 13. Electrical and IT systems
- 14. Suspended ceiling
- 15. Painting interior and exterior surfaces
- 16. PCC Side Walk around the PID structure
- 17. Provision and installation of furniture
- 18. Solar System
- 19. Internet System
- 20. Installation of project Sign Board
- 21. Project Demobilization and Close out

The project consists of the, material, labor, and equipment to build one story building in 6 Police Districts in Kabul, each building will be approximately 217 square meters.

The buildings will be a single story structures. Each building will have 2 responsive rooms, one hall for visitors/applicants, men and women toilets, kitchen and power storage room. The building will be constructed per the drawings and specifications.

The buildings will be constructed on reinforced concrete footer and reinforced concrete columns, slabs and beams with infill masonry per the attached structural drawings. All masonry surfaces will be covered with stucco and painted.

All of the work within this contract shall meet and be constructed in accordance with current U.S design (ADA) and International Building Codes (IBC).

Abbreviations

Wherever the following abbreviations are used in the Specifications or on the Drawings, they shall be taken to be the same as the respective expanded expressions.

	Abbreviations	Expansion
1.	ACI	American Concrete Institute
2.	ASTM	American Society for Testing Materials
3.	BOQ	Bills of Quantities
4.	SOW	Scope of Work
5.	DWG	Drawing
6.	UNDP	United Nations Development Programme
7.	COPS	Community-Oriented Policing Services
8.	MoIA	Ministry of Interior Affairs
9.	PD	Police District
10.	PID	Police Information Centers/Desks
11.	L.S. or l.s.	Lump Sum
12.	m	Meter
13.	mm	Millimeter
14.	m ³ or cu.m.	Cubic meter
15.	°C or C	Degree Celsius
16.	sec.	Second
17.	t or T	Metric ton
18.	USD or US \$	United States Dollar
19.	w/c	Water/Cement Ratio

Definitions

In these Specifications and other Contract documents, the following words and expressions shall have the meanings hereby assigned to them.

i) "*Accepted*" means accepted in writing by the Engineer.

ii) "*Approved"* means approved in writing by the Engineer including confirmation in writing of previous verbal approval by the Engineer.

iii) "*Directed"* means directed in writing by the Engineer including confirmation in writing of previous verbal direction by the Engineer.

iv) "*Manufacturer's Certificate"* means a signed statement by a person having legal authority to bind the manufacturer to bind its product, which supported by test results confirms that the materials and test results conform to the requirements of these Specifications.

v) "*Final grade"* means the level of the top surface of embankment or excavated area to be constructed.

vi) "*Shop drawings"* means working drawings showing all the detailed information and data for construction purposes including the relevant survey details, bar bending schedules fabrication and erection drawings, false work drawings, and other drawings that the Subcontractor shall prepare and submit to the Site engineer for approval before the Works commence.

Program of Work: Within seven days after the date of the Letter of Acceptance of his Tender, the Subcontractor shall submit to the Engineer for his approval a work program providing the following information:

a) Drawings and details showing the location and general arrangements of the Site engineer's facilities and the temporary housing and offices for the Subcontractor's use.

b) Details of the proposed labor strength and supervision arrangement throughout the Contract period.

c) Normal working hours and shift arrangements.

d) A description of the work methods including plant and personnel for each principal type of work involved, and supervision arrangements.

e) Arrangements for power, water, and supply of materials including a materials utilization program, stone crushing and aggregate production, cement handling, etc.

f) The proposed manner of arranging for the movement of the public traffic on the access roads during the construction operations.

g) Details of the location and time in which each principal operation will be performed.

The UNDP Engineer reserves his right to adjust the work sequence submitted in the program if in his opinion it is necessary. The Subcontractor shall ensure that his work methods are consistent with his schedule. The equipment shall be in good operating condition, sufficient in size and number to meet the requirements and produce a satisfactory quality of work. These equipment and all appurtenances shall be approved by the UNDP Engineer.

DRAWINGS: The Drawings referred to in the Conditions of Contract are those that the Subcontractor provides as well as such other supplementary drawings as shall be supplied.

All permanent Works shall be based upon the dimensions shown on the Drawings or the instructions issued in writing by the Engineer, and not upon scaled dimensions from the Drawings.

Any work for which it is necessary to prepare shop drawings or detailed working drawings to facilitate fabrication or construction, shall be prepared by the Subcontractor at his expense and submitted to the Engineer in triplicate. Similarly, calculations and drawings for temporary works like formwork, false work, etc. shall be submitted. The Engineer shall return the approved copy to the Subcontractor who shall carry out the work in accordance with these drawings. The Subcontractor shall prepare fair copies of these approved drawings and forward these to the Site engineer in duplicate for record.

During the progress of the work, if the Subcontractor wishes to modify any detail of the permanent work, or propose any new feature, he shall prepare detailed drawings and necessary calculations at his own expense and submit them to the UNDP Engineer following the procedure mentioned above.

At about the completion of the permanent works, the Subcontractor shall prepare "asbuilt" drawings and submit a soft copy to the Engineer as well as two hard copies.

MATERIALS: For materials to be incorporated in the Works, soon after the award of the Contract, and in any case at least 15 days prior to the procurement or incorporation in the Works, the Subcontractor shall submit to the Engineer a list of suppliers of manufactured items from whom he proposes to purchase, and the locations of quarries and material sources and manufacturer's certificates as applicable for approval.

All materials and workmanship not corresponding in quality with the approved samples will be rejected. The approved material sources shall not be changed without written authorization of the UNDP Engineer.

The Subcontractor shall maintain a detailed record of all materials received in his stores or working areas, and shall make these records available to the UNDP Engineer when he calls for them.

All materials used in the permanent works shall be new. To the possible extent, materials shall be procured from within Afghanistan provided these satisfy the specification requirements.

All materials and work rejected by the UNDP Engineer shall be promptly removed from the site with Subcontractor expenses.

TRAFFIC CONTROL: Subcontractor is responsible to ensure that nearby roads remain open to pedestrian and vehicular traffic during construction. The Subcontractor shall submit a plan for maintaining traffic flow during construction at the Pre-Construction Conference, if applicable. Barricades shall be required whenever safe public access to paved areas such as roads or Public latrine and bathroom in areas is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide reasonable visual warning of the hazard during both day and night. It is recommended that persons working on roadways or providing traffic control be issued reflective safety vests to enhance personal safety. Travel to and from the project site shall be restricted to a route approved by the UNDP Engineer.

WATER SUPPLY: The Subcontractor shall provide a sufficient supply of clean fresh water, both for construction of the Works and for all facilities. He shall undertake all arrangements including pipelines and meters for connecting to local water mains and the provision of pumps, storage tanks, and water conveyance where necessary, and payment for all fees and water charges.

The water shall be reasonably clear of suspended solids and free from any matter considered by the UNDP Engineer to be deleterious to the work. Water supplied to all the facilities shall be wholesome and potable to the satisfaction of the local sanitary authorities.

USE OF SITE: The Subcontractor shall restrict his activities to within the Site and shall avoid entry on to any other lands except where the Subcontractor has made his own arrangements for such entry. Any trespass, damage, or claims arising from such entry shall be the sole responsibility of the Subcontractor, who shall hold the Subcontractor indemnified against all claims arising from such trespass or damage. Existing access to all land or property outside the site shall be maintained by the Subcontractor during the continuance of the Works. The cost of such maintenance shall be deemed to be covered by and included in the rates tendered for the Contract.

WORKMANSHIP AND QUALITY CONTROL: The Subcontractor shall produce work which conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings. The Subcontractor must, at his own expense, institute a quality control system and provide experienced Site engineers, foremen, surveyors, materials technicians, other technicians and other technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of all supervision and process control, including testing, carried out by the Subcontractor.

The Subcontractor's attention is drawn to the provisions of the various sections of the Specifications regarding the minimum frequency of testing that will be required for process control. The Subcontractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control. On completion of every part of the work and submission to the UNDP Engineer for examination, the Subcontractor shall submit to the UNDP Engineer the results of all relevant tests, measurements, and levels indicating compliance with the Specifications.

PRECAUTIONS: The Subcontractor shall comply strictly with the local and general safety regulations, and shall provide and maintain at all times during the progress of the works adequate protection measures for lives and properties. He shall provide activities schedule to the local authorities and inform the local authorities before any activities takes place.

The Subcontractor shall bear full responsibility for any injury or death to any person and property damage resulting from his operations within the limits of the Works.

The Subcontractor shall take all reasonable precautions:

I) In connection with any rivers, streams, waterways, drains, water courses, lakes and the like to prevent silting, erosion of beds and banks, and as pollution of the water that might affect the quality of appearance the water adversely or cause injury or death to human, animal, or plant life;

ii) In connection with underground water resources (including percolating water) to prevent any interference with the supply to or abstraction from such sources and to prevent pollution of water that might affect adversely the quality.

The Subcontractor shall keep the whole of the works well drained and free of water of at all times. All rubbish and debris shall be removed upon shaping the embankment. No claims for damages because of erosion and scouring due to the Subcontractor's negligence will be accepted.

Upon completion of the Works, the Subcontractor shall, at his own expense, clear away and remove from the site all surplus materials, temporary works, and debris, and make the whole Site clean to the full satisfaction of the Site engineer.

Subcontractor's Office, Stores, and Workshop:

The Subcontractor shall provide and maintain on an approved site, a suitable office, adequately provided with sanitary facilities, drinking water, telephone connection, and temporary light and power. He shall also provide a storage area and workshop to be used solely for carrying out the Contract. The Subcontractor's camp facilities shall as far as possible be within the boundaries of the Site. If outside the Site, the Subcontractor shall be responsible for arranging with the landowners and pay all respective charges.

The Subcontractor shall maintain at the Site a design and drawing office manned by suitably qualified personnel for the preparation of detailed working drawings. These personnel shall also coordinate with his site construction staff to ensure that the Works are in accordance with the approved designs and drawings.

FIRST AID: The Subcontractor shall provide and maintain an adequately equipped first aid station at the Site and employ experienced first aid personnel.

NOTICE OF OPERATIONS: The Subcontractor shall submit in writing to the UNDP Engineer a notice of any important operations he intends to carry out. No operation shall be started without prior notice and consent of the UNDP Engineer. The notice shall be given at least 24 hours in advance of the time of the operation.

PROJECT SIGN: At an appropriate locations designated by the UNDP Engineer, the Subcontractor shall install and maintain project signs includes two singe board temporary and permanent , not less than 1.20 m by 0.80m bearing the necessary project information lettered in Dari, Pashtu, and English as well as a local dialect where appropriate. The number of such signs shall be as directed by the UNDP Engineer.

These signs shall not be removed upon completion of the works. No separate payment shall be made for the signs.

SETTINGOUT THE WORK: The Subcontractor shall be responsible for the true and proper setting out the work as to alignment, levels, and grades in accordance with the Drawings or as directed by the UNDP Engineer. Before setting out or to take levels for any part of the Works, the Subcontractor shall give the UNDP Engineer not less than twenty-four hours notice in order that arrangements may be made for checking. The Subcontractor shall provide the UNDP Engineer with all necessary instruments, personnel, and materials needed for checking the setting out.

SOIL CONDITION: The Subcontractor must satisfy himself by his own investigation and experience as to the actual soil conditions at the site, and to prospect and obtain materials that conform to the Specifications.

Prior to making the Bid, the Subcontractor shall have determined the nature, quantity, location, and suitability of the soils to meet the specified requirements and base his bid price solely on his own determination of soil conditions. After award of Contract, no claim based on source of soil information will be accepted

INSPECTION, TESTING AND STAGE APPROVAL: All materials and each part or detail of the Work shall be subject to inspection by the UNDP Engineer. The UNDP Engineer, or his Representative shall at all times have access to the Works and to the Site and all workshops and places where the materials are being prepared or where materials are being procured for the Work. The Subcontractor shall offer every facility for and every assistance in obtaining the right to such access.

The Subcontractor shall submit a written request for inspection of any portion of the work at least 24 hours before such work is to be performed. The request shall include the date, time, location, and types of work to be performed. Similarly, a written request shall be submitted to the UNDP Engineer for testing and checking the work earlier performed by the Subcontractor.

Where the work involves operations in stages such as layers of embankment that have to follow one after the other, the subsequent stage can start only after approval of the UNDP Engineer for the earlier stage. For easy reference, the

Subcontractor shall maintain a stage passing register that should contain information about the stages up to which the work has been approved by the UNDP Engineer.

MINE CLEARING: This area is believed to be clear of mine hazards, but it is not guaranteed. Should the Sub-Subcontractor encounter mines and/or mine hazards during the course of the project, Sub-Subcontractor is directed to cease work and contact the UNDP Engineer for further instructions.

CLEAN UP: Subcontractor shall ensure the work area free of debris upon completion of work each day, as well as at the completion of the job. Subcontractor shall remove and properly dispose of all materials and equipment at the completion of the job. Materials or equipment owned by UNDP shall be returned to a location designated by the UNDP Engineer.

DURATION OF CONTRACT: The Project Manager shall allow a period of 12 **weeks** for the Subcontractor to complete the Work from the date of the signed Notice to Proceed. The Project Manager for inclement weather and flooding where situations interfere or otherwise obstruct the Sub-Subcontractor's ability to continue the work may grant additional days. The Subcontractor shall submit written requests for additional days to the Project Manager.

PROJECT SCHEDULE: The Subcontractor shall provide the Project Manager proposed start and completion dates and the duration of each task as described in the Scope of Work and Location of Work paragraph a thug above. The Site Engineer shall develop critical milestones from the proposed start and completion dates, to submit to the RAMP-UP-EAST Project Manager for reporting purposes. This shall also be used as a basis for percentages of work tasks completed and for delivery payment or work performed.

LABOR: A minimum of 80% of all skilled and unskilled labor used by Sub-Subcontractor on the project shall be from the local community/District. The local community is defined as an area within a 5-kilometer radius of the project site. Should appropriate local labor not be available locally, the Subcontractor shall consult with the Contracting Officer, the Project Manager, or the UNDP Engineer, before hiring labor from outside the local community.

FIELD VERIFICATION: It is the Subcontractor's responsibilities to field verify all conditions and measurements provided in this statement of work and accompanying BOQ. Subcontractor will provide a bid in strict compliance with the provided bidder's price list, but must also include an addendum setting forth all deviations from the bidder's price list and statement of work found at the project site, along with any required price deductions or additions required to properly complete the project. The addendum should also set forth all necessary or recommended substitutions of specified materials or equipment required by local market conditions. If Subcontractor fails to include such an addendum, Subcontractor will assume full

monetary responsibility for any and all additional work, materials, or equipment required to complete the project that was not included in the statement of work or bidder's price list that a reasonable site inspection would have revealed. Subcontractor will not be responsible for unforeseen conditions that a reasonable site inspection would not have revealed. Subcontractor understands that if he/she does not submit written request to the COR and get approval for additional days he will be charge a USD. XYZ.00 a day fee for going over the projected date

Section 1 – PROJECT REQUIREMENTS

1 MOBILISATION AND DEMOBILISATION

1.1 Mobilization:

This work consists of moving personnel, equipment and material to the project site and performing all work necessary before beginning of the project. Payment for Mobilization shall be compensation in full for the cost of establishing plant equipment facilities and personnel upon the site and shall include (but not necessarily be limited to).

- (i) Transport of plant, renting of buildings, temporary facilities to the site.
- (ii) Provision and erection of temporary buildings, office facilities on the site.

(iii) Provision of access roads, hard standings etc. within construction camps.

- (iv) Airfares, temporary accommodation during the mobilization phase, permits, bonds etc. necessary to establish expatriate supervisory personnel upon the site.
- (v) Establishment of testing and process control facilities on the site.
- (vi) Erection of contract signboards.
- (vii) Provision of transportation facilities for supervisory, administrative and technical personnel.

(viii) Provision of housing for supervisory, administrative and technical personnel.

Payment for mobilization shall be made when the Subcontractor has established himself upon the site to the satisfaction of the Engineer.

1.2 Demobilization:

Payment for demobilization shall be compensation in full for the costs of removing plant, equipment, facilities and personnel from the site and shall include (but not necessarily be limited to).

(i) Transport of plant, buildings, and temporary facilities from the site and export if required.

(ii) Dismantling and removal of all temporary facilities on the site.

(iv) Removal of contract sign boards.

(v) Restoration of all construction camp areas to a satisfactory condition.

Payment shall be made upon completion of demobilization to the satisfaction of the Engineer. This item shall be payable only in respect of the whole of the Works and shall not apply in cases of sectional completion.

Section 2 — SUBCONTRACTOR QUALITY CONTROL

2.1 DESCRIPTIONS:

This work consists of obtaining samples for Subcontractor quality control testing, performing tests for Subcontractor quality control, providing inspection, and exercising management control to ensure that work conforms to the contract requirements.

CONSTRUCTION REQUIREMENTS

2.2 SUBCONTRACTOR QUALITY CONTROL PLAN:

Before the start of the work, submit a written quality control plan for acceptance. With prior approval, submission of a quality control plan for items of work not immediately scheduled to begin may be deferred.

Submit the following with the quality control plan:

(a) **Process control testing.** List the material to be tested by pay item, tests to be conducted, the location of sampling, and the frequency of testing.

(b) Inspection/control procedures. Address each of the following subjects in each Phase of construction:

(1) Preparatory phase.

(a) Review all contract requirements.

- (b) Ensure compliance of component material to the contract requirements.
- (c) Coordinate all submittals including certifications.
- (d) Ensure capability of equipment and personnel to comply with the contract requirements.
- (e) Ensure preliminary testing is accomplished.
- (f) Coordinate surveying and staking of the work.

(2) Start -up phase.

- (a) Review the contract requirements with personnel performing the work.
- (b) Inspect start-up of work.
- (c) Establish standards of workmanship.
- (d) Provide training as necessary.
- (e) Establish detailed testing schedule based on the production schedule.

(3) Production phase.

(a) Conduct intermittent or continuous inspection during construction to identify and correct deficiencies.

- (b) Inspect completed work before requesting Government inspection acceptance.
- (c) Provide feedback and system changes to prevent repeated deficiencies.
- (d) Description of records. List the records to be maintained.

(e) Personnel qualifications.

(1) Document the name, authority, relevant experience, and qualifications of person with overall responsibility for the inspection system.

(2) Document the names, authority, and relevant experience of all personnel directly responsible for inspection and testing.

(e) **Subcontractors.** Include the work of all Subcontractors. If a Subcontractor is to perform work under this Section, detail how that subcontractor will interface with the Subcontractor's and other subcontractor's organizations.

Modifications or additions may be required to any part of the plan that is not adequately covered. Acceptance of the quality control plan will be based on the inclusion of the required information. Acceptance does not imply any warranty by the Government that the plan will result in consistent contract compliance. It remains the responsibility of the subcontractor to demonstrate such compliance.

Do not begin the work until the quality control plan covering that work is accepted. Supplement the plan as work progresses and whenever quality control or quality control personnel changes are made.

2.3 TESTING:

Perform testing according to the accepted quality control plan. Keep laboratory facilities clean and maintain all equipment in proper working condition. Allow unrestricted access for inspection and review of the facility.

2.4 RECORDS:

Maintain complete testing and inspection records by pay item number and make them accessible to the CO.

For each day of work, prepare an *"Inspector's Daily Record of Construction Operations"* (Form FHWA 1413) or an approved alternate form.

Detail inspection results including deficiencies observed and corrective actions taken. Include the following certification signed by the person with overall responsibility for the inspection system:

"It is hereby certified that the information contained in this record is accurate, and that all work documented herein complies with the requirements of the contract.

Any exceptions to this certification are documented as a part of this record."

Submit the record and certification within one working day of the work being performed. If the record is incomplete, in error, or otherwise misleading, a copy of the record will be returned with corrections noted. When chronic errors or omissions occur, correct the procedures by which the records are produced.

Maintain linear control charts that identify the project number, pay item number, test number, each test parameter, the upper and lower specification limit applicable to each test parameter, and the test results.

Use the control charts as part of the quality control system to document the variability of the process, to identify production and equipment problems, and to identify potential pay factor adjustments.

Post control charts in an accessible location and keep them up-to-date. Cease production and make corrections to the process when problems are evident.

2.5 ACCEPTANCE:

The Subcontractor's quality control system will be evaluated under Subsection 106.02 FP-0003 based on the demonstrated ability of the quality control system to result in work meeting the contract requirements.

If the Government's testing and inspection indicate that the Subcontractor's quality control system is ineffective, make immediate improvements to the system to correct these inadequacies. Furnish notification in writing of improvements and modifications to the system.

2.6 MEASUREMENT:

Do not measure Subcontractor quality control for payment.

Section 3 — SUBCONTRACTOR SAMPLING & TESTING

3.1 DESCRIPTION:

This work consists of obtaining samples for testing. When there is a contract pay item for Subcontractor testing included in the bid schedule, it also consists of testing and reporting required test results. It does not include Subcontractor quality control testing required.

CONSTRICTION REQUIREMENTS

3.2 SAMPLING:

Sample material to be tested according to the Sampling and Testing Requirements tables included at the end of each section. The sampling schedules and times will be provided by the CO using a random number system. In addition, sample any material that appears defective or inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or corrected.

Sample and split samples according to ACI or other acceptable procedures. Allow the CO the opportunity to witness all sampling. Immediately perform splits when required. Deliver the Government's portion of the sample or split sample in an acceptable container suitable for shipment. Label all samples with the following information:

- (a) Project number
- (b) Source of material
- (c) Pay item number
- (d) Sample number
- (e) Date sampled
- (f) Time sampled
- (g) Location sample taken
- (h) Name of person sampling
- (i) Name of person witnessing sampling
- (j) Type of test required on sample

3.3 TESTING:

When there is a contract pay item for Subcontractor testing included in the bid schedule, perform all tests required by the Sampling and Testing Requirements tables at the end of each section. Allow the CO the opportunity to witness all testing. Testing of trial samples may be required to demonstrate testing competence.

3.4 RECORDS:

Report test results on forms containing all sample information required by Subsection 154.02 FP-0003. Label clearly all interim measurements used to determine the results. Attach work sheets used to determine test values to the test result forms when submitted. When tests are on material being incorporated in the work, report test results within 24 hours except as specified in the Sampling and Testing Requirements tables. Payment for work may be delayed or the work suspended until test results are provided.

3.5 ACCEPTANCE:

Subcontractor sampling and testing will be evaluated under Subsections 106.02 and 106.04 FP-0003 based on Government verification testing.

Section 4 — SCHEDULES FOR CONSTRUCTION CONTRACTS

4.1 DESCRIPTION:

This work consists of scheduling and monitoring of all construction activities.

CONSTRUCTION REQUIREMENTS

4.2 GENERAL:

Submit 3 copies of a preliminary construction schedule at least 7 days before the preconstruction conference.

A preliminary construction schedule is a written narrative with a detailed breakdown of all contract activities for the first 45 days after the notice to proceed is issued. Within 7 days after the preconstruction conference, the preliminary construction schedule will be accepted or rejected. If rejected, submit a revised schedule within 3 days. Do not begin work, except mobilization, traffic control, and Section 637 work, without an accepted preliminary construction schedule.

Use either the Bar Chart Method (BCM) or the Critical Path Method (CPM) described below to develop the construction schedule for the total contract work. Preface each construction schedule as follows:

- (a) Project name
- (b) Contract number
- (c) Subcontractor
- (d) Original contract time allowed or completion date
- (e) Type of construction schedule (initial or update)
- (f) Effective date of the schedule
- (g) Percent work complete
- (h) Percent time used

Submit 3 copies of the construction schedule within 7 days after the notice to proceed is issued. Allow 5 days for acceptance or rejection of the construction schedule or a revised schedule. If rejected, submit a revised schedule within 7 days. No progress payment will be made for any work until a construction schedule is submitted to the CO and accepted by the CO.

Do not show conflicts with any scheduled activities and order of work requirements in the contract. Do not show conflicts with any scheduled activities, limits on operations, order of work requirements, interim or final completion dates, or other contract restrictions.

Show completion of the work within the contract time.

4.3 BAR CHART METHOD (BCM):

The BCM construction schedule consists of a progress bar chart and a written narrative. (a) **Progress bar chart.** The following applies to the initial submission and all updates:

(1) Use a time scale to graphically show the percentage of work scheduled for completion during the contract time.

(2) Define and relate activities to the contract pay items.

(3) Show all activities in the order the work is to be performed, including submittals, submittal reviews, fabrication, and delivery.

(4) Show all critical (major) activities that are controlling factors in the completion of the work.

(5) Show the time needed to perform each activity and its relationship in time to other activities.

(6) Show the total expected time to complete all work.

(7) Provide enough space for each activity to permit 2 additional plots parallel to the original time span plot. Use one space for revision of the planned time span, and one for showing actual time span achieved.

(b) Written narrative. Furnish a written narrative of the activities displayed in the progress bar chart.

4.4 CRITICAL PATH METHOD (CPM):

The CPM construction schedule consists of a diagram, a tabulated schedule, and a written narrative.

(a) **Diagram.** Use the "activity-on-arrow" format for the arrow diagrams or the "activity-onnode" format for precedence diagrams. The following applies to the initial submission and all updates:

(1) Use a time scale to graphically show the percent of work scheduled for completion by any given date during the contract time.

(2) Define and relate activities to the contract pay items.

(3) Show the sequence and interdependence of all activities including submittals, submittal reviews, fabrication, and deliveries.

(4) Show all activity nodes, activity descriptions, and durations.

(5) Show all network dummies (for arrow diagrams only).

(6) Identify the critical path.

(b) **Tabulated schedule.** The following requirements apply to the tabulated schedule:

(1) For arrow diagrams, show activity beginning and ending node numbers. For precedence diagrams, list activities and show lead or lag times.

- (2) Show activity durations.
- (3) Show activity descriptions.
- (4) Show early start and finish dates.
- (5) Show late start and finish dates.
- (6) Show status (critical or not).
- (7) Show total float.

(c) Written narrative. Furnish a written narrative of the activities displayed in the schedule diagram.

4.5 WRITTEN NARRATIVE:

The following applies to the written narrative:

(a) Estimate starting and completion dates of each activity.

(b) Describe work to be done within each activity including the type and quantity of equipment, labor, and material to be used.

(c) Describe the location on the project where each activity occurs.

(d) Describe planned production rates by pay item quantities (e.g., cubic meters of excavation per day/week).

(e) Describe work days per week, holidays, number of shifts per day, and number of hours per shift.

(f) Estimate any periods during which an activity is idle or partially idle. Show the beginning and end dates for reduced production or idle time.

(g) Describe expected and critical delivery dates for equipment or material that can affect timely completion of the project.

(h) Describe critical completion dates for maintaining the construction schedule.

(i) Identify the vendor, supplier, or Subcontractor to perform the activity. State all assumptions made in the scheduling of the subcontractor's or supplier's work.

4.6 SCHEDULE UPDATE:

Review the construction schedule to verify finish dates of completed activities, remaining duration of uncompleted activities, any proposed logic, and time estimate revisions. Keep the CO informed of the current construction schedule and all logic changes.

Submit 3 copies of an updated construction schedule for acceptance at least every 3 weeks or when:

(a) A delay occurs in the completion of a critical (major) activity.

(b) A delay occurs which causes a change in the critical path for CPM schedules or a change in a

critical activity for BCM schedules.

(c) The actual prosecution of the work is different from that represented on the current

construction schedule.

(d) There is an addition, deletion, or revision of activities caused by a contract modification.

(e) There is a change in the schedule logic.

Allow 7 days after receipt for acceptance of the updated construction schedule or a return for revisions. No progress payment will be made for any work until an updated construction schedule has been submitted to and accepted by the CO.

SECTION 5: SITE CLEARANCE AND FINAL CLEAN UP

- **5.1 Description**: The work shall consist of clearing the Site of Works of trees, vegetation, rubbish, existing structures, masonry/concrete walls, old pavements, etc. within the designated limits for facilitating construction of new works. The Site Engineer will establish the limits of the areas to be cleared and grubbed, and designate the trees, buildings, structures and other items to be removed or to remain in position. The work shall be carried in accordance with the following specifications, and the Subcontractor shall use only such methods, tools, and equipment as are approved by the UNDP Engineer and which will not affect the property to be preserved.
- **5.2 Clearing and Grubbing**: The designated site, including, the slopes of existing embankments designated to be widened as directed by the Engineer and the borrow areas shall be cleared of trees, shrubs, stumps, and vegetation. However, any tree found suitable for site improvement not interfering with the works shall not be disturbed. The Subcontractor shall avoid injury to plants, shrubs and other vegetation growing outside the clearing limits.

All trees, stumps, and roots falling within the site area shall be cut to such depth below ground level that in no case these remain within 500 mm of the final grade level. They shall be removed to a location designated by the Engineer.

Except in areas to be excavated, stump holes and other holes made during the removal of the trees or other obstructions shall be carefully backfilled with suitable materials and compacted to the satisfaction of the Engineer. All the trunks, roots and other debris removed shall be disposed of in a neat manner to avoid damages to the adjoining properties.

All drainage ditches designated to be retained shall be cleared of all debris, and the resulting material spread within the site in a neat manner or disposed as directed by the Site Engineer.

- **5.3 Stripping:** Where the top soil falling in fill areas contains humus or other deleterious materials harmful to the stability of the site, the Site Engineer may order such top soil to be stripped from the area, within the limits designated. Depth of stripping shall be 150 mm unless the Site Engineer directs larger depths to be stripped. The stripped areas shall be compacted as directed by the Site Engineer. The stripped materials shall be spread within the site in a neat manner to even depths, or disposed of as directed by the Site Engineer.
- **5.4 Removal of Structures and Obstructions**: The item shall consist of the removal, wholly or in part, and satisfactory disposal of all structures and obstruction within the site which have not been designated to remain. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes and pits. All

salvaged materials shall be properly stacked as directed by the Engineer and shall become the property of the Government of Afghanistan.

The structures to be removed shall include but not limited to the following : buildings, sheds, walls, slabs, foundations, box and pipe culverts, trash racks, retaining walls, irrigation structures, standpipes, manholes, ditch linings, pipeline, posts, fences, gates, kerbs, gutters, sidewalks, trees, site pavements, etc.

Holes and cavities resulting from removal of the structures and obstructions shall be backfilled with acceptable materials to the adjoining ground level.

5.5 EXCAVATION FOR STRUCTURES

5.5.1 Description

The work shall consist of removal of materials for the construction of foundations for bridges, culverts, Irish dips, headwalls, cutoff walls, pipe culverts, catch basins, manholes, inlets, outlets, retaining walls, and other structures in accordance with the requirements of these specifications, and to the lines and dimensions shown on the Drawings or as directed by the Engineer. The work shall include all necessary clearing and grubbing, all necessary bailing, drainage, pumping, sheeting and the construction of cofferdams or cribs if found necessary, and their subsequent removal; trimming and compacting bottoms of excavations; backfilling to the level of the original ground; and disposal of all surplus and unsuitable excavated materials.

5.5.2 Classification of Excavation

For the purposes of these specifications, there shall be two classes of excavation for structures, namely:

- a) <u>Structural excavations in common soil</u>: This shall be excavation in all classes of materials except in rock.
- b) <u>Structural excavation in rock</u>: This shall be excavation in rock of the type that requires the use of pneumatic tools or blasting for removal. Any boulder of 0.2 cu. m. or more in volume shall be deemed as rock. Where rock is encountered, the Subcontractor shall first remove the overburden and take cross-sections to the approval of the Engineer before excavating.

5.5.3 Construction Requirements

5.5.3.1 General

The site shall first be cleared and grubbed in accordance with Clause 201 after which the limits of excavation shall be set to the specified lines and dimensions and approved by the Engineer. No excavation shall start until all the necessary crosssections have been taken and attested by the Engineer.

5.5.3.2 Excavation

Excavation shall be taken to the width of the lowest step of the footing. The sides be left plumb where the nature of the soil allows it. Where the nature of the soil or the depth of the trench does not permit vertical sides, the Subcontractor shall put up necessary shoring, strutting and planking, and/or cut slopes to a safer angle at his own expense with due regard to the safety of the workmen and the works to the satisfaction of the Engineer.

The excavation shall be taken to the elevation shown on the Drawings or as directed by the Engineer. Over-excavation below the footing elevation not approved by the Engineer shall be backfilled with the same class of material as for the footing and constructed monolithically with the footing at the Subcontractor's expense.

No payment shall be made for unauthorized over depth or over width excavating.

Where rock is met with in the foundation trench for toe walls, cut-off walls, head walls for pipe culverts and retaining walls, and the matter shall immediately be brought to the notice of the Engineer who, on examination of the quality of the rock, decide on the depth to which the rock, should be excavated.

Where, in the opinion of the Site Engineer, the material at the foundation level is unsuitable, it shall be excavated to the depth ordered by him. Backfilling shall be with the same material as the footing material and be constructed monolithically with the footing.

5.5.3.3 Dewatering and Protection

Where water is encountered in excavation due to waterways, seepage, springs, rain or other reasons, the Subcontractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, cofferdams and other necessary works to keep the foundation trenches dry when required as well as to protect the green concrete and masonry against damage by erosion or the sudden rise in water level. The methods to be adopted for this shall be left to the choice of the Subcontractor but subject to approval of the Engineer. Approval of the Engineer shall, however, not relieve the Subcontractor of the responsibility for adequately dewatering and protection arrangements as well as for the quality and safety of the Works.

Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed, and be made as watertight as necessary for facilitating construction inside them. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit the installation of pumping equipment, etc. inside the enclosed area.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for a

period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.

At the discretion of the Subcontractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.

The Subcontractor shall take all precautions in diverting channels and in discharging the drained water so as not to cause damage to the works, crops, or any other property.

5.5.3.4 Preparation of Foundation

The bottom of foundations shall be leveled longitudinally and transversely or stepped as directed by the Engineer. Where the material is other than rock, it shall be compacted to at least 95 percent MDD. Where rock and soil are encountered in part widths, the area in the soil portion shall be excavated to a depth of 100 mm and backfilled with Class C concrete. All rock faces shall be free of soft and loose material, cleared and cut to a firm surface. They shall be level, stepped, or serrated as directed by the Engineer. All seams shall be cleared and filled with cement mortar to the satisfaction of the Engineer.

5.5.3.5 Slips and Blowouts

If there are any slips or blowouts in the excavation, these shall be removed by the Subcontractor at his own expense.

5.5.3.6 Public Safety

Near towns, villages, and other frequented places, trenches and foundation pits shall be securely fenced with proper caution signs and marked with red lamps at night to avoid accidents.

5.5.3.7 Scheduling Excavation for Structures

The Subcontractor shall schedule excavation, embankment, and structural work in such a manner that they complement each other. The general principles that the Subcontractor shall observe are as follows.

- Earthwork at the site should not, in general, proceed ahead of the drainage works in such a manner that the site becomes an obstruction to cross drainage. Where this happens, the Subcontractor shall open an adequate waterway within the site at locations where drainage structures are to be constructed. Any damage to the works caused by water passing through these openings shall be repaired at the expense of the Subcontractor.
- ii) For structures in sidelong cut, the structural excavation shall start only after the excavation to Clause 301 is completed up to the final grade level.
- iii) No trench or pit for a structure shall be left in an exposed condition for a period exceeding thirty (30) days.

5.5.3.8 Backfilling

Work on backfilling of voids created by structural excavation shall be started only after the concrete or masonry in the structure is fully set and the permission of the Engineer is obtained. Backfilling work shall be carried out in such a manner so as not to cause undue thrust on any part of the structure.

For earth retaining structures like retaining walls provided with weep holes, the backfill material shall be granular conforming to the requirements of selected material to Clause 301.3 (ii).

The backfill material shall be placed in 150 mm thick (loose) layers and compacted by suitable equipment such as mechanical tampers. Density achieved shall be at least 95 percent MDD.

5.5.3.9 Disposal of Surplus Excavated Material

The Subcontractor shall be responsible for the proper disposal of all surplus excavated materials. The materials shall be used to fill up the borrow pit excavated areas on priority basis to minimize negative environment impacts.

Surplus materials, if any, may be disposed within the right-of-way in locations approved by the Engineer. The Engineer may also permit the materials to be used to widen embankments or flatten slopes. Such materials will not be included in the approved embankment cross sections for purposes of computing pay quantities. Materials disposed within the right-of-way shall be leveled or shaped as directed or approved by the Engineer. The disposed materials shall not adversely affect waterways or threaten to cause damage to the roads or adjacent public or private property.

When materials are to be deposited outside the site, the Subcontractor shall be responsible for obtaining the permission of the landowner and paying any compensation involved. Material deposited within view of the site shall be leveled or shaped as directed or approved by the Engineer so that it does not present an objectionable appearance

SECTION 6: PLAIN AND REINFORCED CEMENT CONCRETE

CEMENT CONCRETE

6.1 Description

Cement concrete shall consist of Portland cement, fine and coarse aggregate and water, proportionately mixed, placed, and cured in accordance with these specifications for the class of concrete specified. Where the concrete is to be placed for a structure, it shall consist of furnishing all materials and constructing the structure on approved formwork to the shape, levels, and dimensions shown on the Drawings or as directed by the Engineer.

6.2 Classes of Concrete

The classes of concrete with their respective cement contents and minimum required compressive strengths are shown below.

Class	28-day compressive	Min. cement	Max size of
strength, kg/cm ²	kg/cu. m		Aggregate
 AA	260	400	 50 mm **
A	210	350	50 mm **
В	154	300	50 mm
С	105	200	63 mm

NOTE: 1.The strength values relate to cylindrical specimens tested in accordance with AASHTO T-22

**2. For general use in reinforced concrete, the maximum size shall be restricted to 20 mm.

For thick sections, the maximum size of 50 mm may be used.

6.3 Materials

6.3.1 Cement

Cement shall be Portland type, originating from manufacturers approved by the UNDP Engineer, shipped in sealed, labeled bags. The quality of the Portland cement shall be equivalent to AASHTO M-85, Type II. Where the concrete is subject to sulphate attack, sulphate-resisting cement (Type V to AASHTO M-85) shall be used at no extra cost. Only one type of brand of cement shall be used in any one structural member. Mixing of types or brands shall not be permitted.

6.3.2 Fine Aggregate

Fine aggregate shall consist of natural sand, rock-crushed sand or other approved material having hard and durable particles and conforming to AASHTO M6.

It shall not contain harmful materials such as coal, mica, or shale. If necessary, fine aggregate shall be washed and sieved to remove deleterious substances. It shall also meet the following requirements.

Test	Test Method	Requirement
Fineness Modulus	AASHTO M6	2.0-3.5
Sodium Sulphate SoundnessLoss on 5 c	yclesAASHTO T104	10% Max.
Friable particles content	ASTM C 142	1% Max.
Test for organic impurities standard	AASHTO T21	Lighter than
Sand equivalent	ASTM D 2419	
Oven Dry Specific Gravity	ASTM C 128	
Loose/Roded unit weight g/cc	ASTM C 29	
Fraction passing 75 micron sieve max.	AASHTO T27	5% by weight

(10% max. for crusher dust)

Gradation of the aggregate shall produce a dense concrete and shall conform to the standard AASHTO & ASTM grading (AASHTO M6/ASTM C33) corresponding to the maximum nominal size of the aggregate.

Sieve Size		Specifications Limits (AASHTO M 6/ASTM C33)	
INCH	ММ	MIN	MAX
3/8	9.5	100	100
#4	4.75	95	100
#8	2.36	80	100
#16	1.18	50	85
#30	0.600	25	60
#50	0.300	5	30
#100	0.150	0	10

6.3.3 Coarse Aggregate

Coarse aggregate shall consist of crushed gravel or crushed stone, free from clay or other deleterious substances, and conform to AASHTO M80. It shall not contain harmful materials such as iron pyrites, coal, mica, laminated material, or any materials that may attack the reinforcement, in such a form or in sufficient quantity to affect adversely the strength and durability of the concrete. If necessary, coarse concrete aggregate shall be washed to remove deleterious substances.

The coarse aggregate shall conform to the following quality requirements.

Tests	Test Method
Los Angeles Abrasion	ASTM C 131.
Soundness	ASTM C 88
Content of Friable Particles	ASTM C 142
Flakiness Index	ASTM D 4791
Elongated pieces	ASTM D 4791
Crush Particles	ASTM C 171
Oven Dry Specific Gravity for 25 & 19mm	ASTM C 127
Combined quantity of chlorides	ASTM D1411
Loose/Roded unit weight g/cc 25&19 mm	ASTM C 29

Gradation of the aggregate shall produce a dense concrete and shall conform to the standard ASTM grading (ASTM C33) corresponding to the maximum nominal size of the aggregate.

Sieve Size		Specifications Limits (ASTM C33 Size No.67)	
INCH	ММ	MIN	MAX
1	25	100	100
3/4	19.0	90	100
1/2	12.5	20	55
3/8	9.5	0	15
#4	4.75	0	5

6.3.4 Water

In no case shall be water contain an amount of impurities that will cause a change in the setting time of Portland cement of more than 25% nor a reduction in the compressive strength of mortar at 14 days of more 5% when compared to the results obtained with distilled water.

Water for curing concrete shall not contain any impurities in such an amount to cause discoloration of the concrete or produce etching of the surface.

The water for mixing and curing concrete shall not contain solids and impurities more than following permissible limits.

Impurities	Permissible Limits
Organic	200 mg/l
Inorganic	3000 mg/l
Chlorides (as Cl) 1000 mg/l for reinforced concrete w	2000 mg/l for plain cement concrete work and ork

The pH value of water shall generally be between 6 to 8.

6.3.5 Limits for Total Chemical Impurities

For reinforced concrete work, the total chemical impurities from aggregates, cement, admixtures and water shall not exceed the following limits.

Impurities

Permissible limits of undesirable chemicals in concrete in percentage by weight of cement 0.06%, Chlorides (as ClSulphates (as SO₃) 4.0%

6.3.6 Admixtures

No admixtures other than that permitted by the Engineer can be used in the concrete. The Site engineer may permit the use of admixtures on satisfactory evidence that their use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability, and has not deleterious effect on the reinforcement.

6.4 Approval and Storage of Materials

All materials to be incorporated in the concrete shall be approved by the Engineer. Approval of the materials shall in no way relieve the Subcontractor of his responsibility of producing and placing dense and durable concrete satisfying the strength requirement.

All cement is subject to the Engineer's approval and each shipment of cement shall be accompanied by a manufacturer's certificate giving results of tests. The Engineer reserves the right to order a retest of the cement at any time. The Subcontractor shall bear all costs in connection with the test certificate and laboratory tests. When field tests show that the material does not conform to the specifications, the entire consignment from which the sample was taken will be rejected. This material will be removed from the site and replaced with cement, which meets the required specifications. Cement shall be stored according to the manufacturer's instructions. Generally, cement bags shall not be stacked higher than eight bags. Cement shall be stored in a dry weatherproof shed with a wooden floor raised at least 15 cm above the surrounding ground and shall be delivered in quantities sufficient to ensure that there is no suspension or interruption of the work of concreting at any time. Each consignment shall be kept separate and distinct, and shall be used in order of delivery.

Storage buildings shall have capacity for storage of sufficient quantity of cement to allow sampling at least 14 days before the cement is to be used. Stored cement shall meet the test requirements at any time after storage when retest is ordered by the Engineer. At the time of use all cement shall be free flowing and free of lumps.

At least 14 days prior to extraction and preparation of coarse aggregate, the Subcontractor shall provide the following information, samples, and test results for aggregates from each source to the Engineer for his approval.

i) Location of the quarry source and depth at which the stones for crushing are proposed to be extracted;

ii) Results of tests on the aggregate as set in Clause 601.3.3; and

iii) 50 kg. Sample from each proposed quarry for testing in the Engineer's or other approved laboratory.

The Subcontractor can extract the aggregate only after obtaining the approval of the Site engineer.

Stockpiling of aggregates shall be in the manner approved by the Engineer. Every precaution shall be taken to prevent mixing of different aggregates. The aggregates shall be brought to the site of mixing at least 24 hours before use to ensure adequate drainage. Aggregates of different sizes shall be stored in different stockpiles that shall be separated from each other and kept free from contact with deleterious matter.

Fine aggregate shall be from a source approved by the Engineer based on the test results and samples furnished by the Subcontractor. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternatively in the same class of construction without permission from the UNDP Engineer.

Any aggregate that has been contaminated during handling or stockpiling shall be rejected and shall be removed from the site unless the UNDP Engineer permits the Subcontractor to reprocess or wash such aggregates and resubmit them for approval. Segregated aggregates shall not be used until they have been thoroughly remixed and resultant pile is of uniform and acceptable gradation.

6.5 Trial Mixes

After the UNDP Engineer's approval of the aggregates, cement, and water, the Subcontractor shall prepare trial mixes of each class of concrete under the supervision of the Engineer. The proportions of the trial mixes shall be such as to produce a dense mixture containing the cement content specified, meet the workability requirements, and the strength requirements specified for the designated class of concrete. The quantities of all ingredients of each trial mix, including water, shall be carefully determined by weight or as otherwise directed by the Engineer. The trial mixes shall show no tendency to segregate when handled and compacted by the methods by which the Subcontractor proposes to handle and compact the same grade of concrete in the works.

Six cylindrical specimens shall be prepared from each trial mix, three of which will be broken after 7 days and the remaining three after 28 days. Based on the test results, the Engineer will determine which of the trial mixes shall be used. If the test results of trial mix fail to meet the requirement of the specifications, the Engineer will direct the Subcontractor to prepare additional trial mixes.

No class of concrete shall be prepared or placed until its job mix proportions have been approved by the UNDP Engineer. The Engineer shall designate the approved job mix for each class of concrete with the following properties within the limits of the specifications:

- i) The minimum cement content in kg. per cubic meters of concrete.
- ii) The ratio of coarse and fine aggregate
- iii) The maximum allowable water content in liters per sack (50 kg.) of cement including free moisture but excluding water absorbed by the aggregates.
- iv) Slump designated at the point of delivery.

When a job mix has been approved, no variation shall be made in the proportions, method of working, or in the approved sources of the ingredients without the consent of the Engineer.

The approval of the job mix proportions by the Engineer does not relieve the Subcontractor of the responsibility of producing concrete that meets the requirements of the specifications.

All costs related to the preparation of the trial mixes and the design of the job mixes shall be borne by the Subcontractor.

6.6 Construction Requirements

6.6.1 Batching of Ingredients

Batching of ingredients for concrete shall be by weight or volume in a suitable concrete mixer approved by the UNDP Engineer. The weigh batching equipment shall be of a type approved by the UNDP Engineer and capable of batching the ingredients within a tolerance of \pm one percent throughout the time of use.

Volume batching may be allowed for Class B and Class C concrete.

6.6.2 Mixing

The concrete may be mixed at the site of the work in a central mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. The batch shall be so charged in the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of mixing period. The mixing time shall neither be less than 60 seconds nor more than 120 seconds. The mixer shall discharge in such a way that there is no segregation of the mixed material, and the entire batch shall be discharged before recharging. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity recommended by the manufacturer except that an overload up to 10 percent may be permitted with the approval of the Engineer. Should there be a stoppage of mixing

longer than 30 minutes, the drum and other containers of the mixer shall be thoroughly washed and cleaned before mixing is resumed.

Concrete shall be mixed only in quantities that are required for immediate use. Concrete shall not be used which has developed initial set or is not in place one-half hour after the water has been added for non-agitated concrete. If agitated, the concrete must be in place within one and on-half hours after the water has been added. Retampering concrete by addition of water or by other means shall not be permitted.

6.6.3 Hauling and Placing of Concrete

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or other approved containers. The time elapsing from the water is added to the mix until the concrete is deposited in place at the site of the work shall not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor more than 90 minutes when hauled in truck mixers or truck agitators.

Where concrete is supplied from a central plant, there shall be sufficient transporting equipment to ensure continuous delivery at the rate required. The rate of delivery shall be such as to provide for the proper handling, placing, and finishing of the concrete. The method of delivery and handling the concrete shall be in a way that will facilitate placing with a minimum of rehandling and without damage to the structure or the concrete. Methods of delivery and handling for each site shall be approved by the UNDP Engineer. The UNDP Engineer may suspend the mixing and placing of concrete at any site for which he considers the Subcontractor's delivery equipment inadequate until the Subcontractor provides additional approved delivery equipment.

Concrete shall be placed only when the UNDP Engineer or his Representative is present at site and has previously checked and approved the positioning, fixing and condition of the reinforcement as well as the alignment and suitability of the formwork.

Concrete shall be placed to avoid segregation of the materials and displacement of the reinforcement. When placing involves dropping the concrete by more than 1.5 meters, it shall be conveyed through sheet metal troughs, chutes, or other approved method. The chutes or troughs shall be kept clean and free from coating of hardened concrete by thoroughly washing with water after each operation.

Concrete shall be deposited in horizontal layers to compacted depths not exceeding 450 mm. Spreading in the forms shall be by means approved by the UNDP Engineer and in no case be assisted by the use of vibrator.

The concrete in each integral part of a structure shall be placed continuously. The Subcontractor shall not commence work on any such part unless sufficient quantities of approved materials are available and his labor forces and equipment are sufficient to complete the part without interrupting the placing of the concrete.

The concrete shall be compacted in its final position in the forms to produce a dense homogenous mass, free from honeycombing, voids, or cracks, and having a dense surface finish. Compaction shall be by vibrators. Class C concrete may, however, be compacted by tamping in a manner acceptable to the UNDP Engineer. Vibrators shall operate at not less than 3,000 cycles/minute. The UNDP Engineer may require the Subcontractor to provide standby vibrators at the site for immediate use in case any of the working vibrators break down. Vibrators shall not be held against forms or reinforcing steel. Vibrators shall be manipulated to produce concrete that is free of voids, is of proper texture on exposed faces, and of maximum consolidation. Vibrators shall not be held so long in one place as to result in segregation of concrete or formation of laitance on the surface. In no case shall the vibrator be operated longer than 20 seconds or less than 10 seconds in any one location.

Placing concrete by pumping will be permitted only if authorized by the UNDP Engineer. The equipment shall be suitable and adequate in capacity for the work and shall be arranged so that no vibrations damage freshly placed concrete or displace the reinforcement. The operation of the pumps shall be such that a continuous stream of concrete without air pockets is produced.

Placing and/or finishing concrete shall not be permitted at night unless adequate lighting is provided and the written approval of the UND Engineer is obtained.

6.6.4 Construction Joints

Construction joints shall be located where shown on the Drawings or permitted by the Engineer. Construction joints shall be perpendicular to the principal lines of stress and in general shall be located at point of minimum shear.

Any skin or laitance as well as the tops of larger exposed aggregates at construction joints shall be removed as soon as possible after pouring by means of brushing and washing. If the concrete has hardened, any skin or laitance shall be removed and the surface roughened by approved power tools followed by washing and brushing to remove all loose particles.

In the case of vertical joints, the face shall be cut to near vertical and all loose particles shall be removed by scrubbing and washing. Immediately before placing fresh concrete, 1:1 cement-sand slurry shall be applied on the face to make a good bond between the old and new concrete.

Joints in concrete due to interruption of work shall be avoided as far as possible. Such joints, when they become necessary, shall be constructed as construction joints with the approval of the Engineer.

6.6.5 Finishing

All top surfaces, such as the top of retaining walls, curbs, abutments, etc. shall be treated by tamping and floating with a wooden float in such a manner as to flush the mortar to the surface and provide a uniform surface, free from pits or porous areas. The surfaces thus obtained shall be troweled to produce a smooth surface and brushed lightly with a damp brush to remove the glazed surface. The outer surface shall be struck-off with a template in an approved manner to provide the shape as shown in the Drawings. Before the concrete has taken initial set, the surface shall be tested for irregularities or waves by means of a straightedge. Any variation of 4 mm or more, as measured in this manner, shall be immediately remedied.

All concrete surfaces shall be true and even, free from stone pockets, excessive depressions, or projections beyond the surface. The concrete surfaces that are not in an acceptable condition as per the drawings to be surface finished, shall be rubbed to a smooth and uniform texture with a carborundum brick and clear water as soon as the forms are removed and the concrete is ready to hone. The finished surface shall be free from all loose material.

6.6.6 Curing

All newly placed concrete shall be protected from sunshine, drying winds, and other similar adverse conditions. The concrete shall be cured by continuous spray or ponding of water or by covering with wetted hessian or other material approved by the Engineer for at least seven days after placing.

The Subcontractor shall ensure that all concrete is adequately protected against inclement weather and rain until properly set.

6.6.7 Concrete under Water

Concrete shall be deposited in water only with the permission of the Engineer and under his supervision. The minimum cement content of the class of concrete being deposited in water shall be increased by ten percent without additional compensation and the slump shall be approximately 15 cm. Placing of the concrete under water shall be by means of a tremie, bottom-dumping bucket, or other approved method that does not permit the concrete to fall through the water without adequate protection. The concrete shall not be disturbed after being deposited. No concrete shall be placed in running water. Forms that are not reasonably watertight shall not be used for holding concrete deposited under water. During and after concreting under water, pumping or dewatering operations in the immediate vicinity shall be suspended until the Engineer permits them to be continued.

6.6.8 Concreting in Cold Weather

Unless authorized in writing by the UNDP Engineer, the concreting operations shall be discontinued when a descending ambient air temperature reaches 5° C. When directed by the UNDP Engineer, the Subcontractor shall enclose the structure in such a way that the concrete and air within the enclosures can be kept above 15°C for a period of 7 days after placing the concrete. The Subcontractor shall supply such heating apparatus as stoves or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided.

When directed by the Engineer, all aggregates and/or mixing water shall be heated to a temperature of at least 10° C but not more than 21° C.

6.6.9 Concreting in Hot Weather

The concreting work shall be discontinued at the time when the ambient temperature reaches 38°C unless the Subcontractor uses adequate means for cooling the ingredients, including use of chilled water to keep the temperature of the mixed concrete below 32°C.

The surface of freshly placed concrete shall be well protected in all cases against drying by covering with wet hessian cloth or polyethylene. Where ordered, water sprinkling shall be continuously supplied during the first few hours after placing and the surface shall not be allowed to dry in any case during the first week after placing.

6.6.10 Inspection and Repair of Surfaces

The Subcontractor shall not proceed with surface finishing or apply slurry on concrete surfaces from which the shuttering has been removed until the concrete has been inspected and approved by the UNDP Engineer.

The Subcontractor shall, on the written instruction of the UNDP Engineer, remove and reconstruct any such portion of works that is deemed unsatisfactory regarding to concrete quality, incorrect dimensions, poorly placed reinforcement bars, or other such defects that will render the work below the standard required the strength and durability of the construction. The method of repairing and replacing the defective concrete that the Subcontractor proposes to adopt shall first be submitted to the UNDP Engineer for approval before the repair work is carried out.

6.6.11 Protective Treatment to Concrete Surface

The reinforced concrete structures in an aggressive environment shall be treated as follows:

For part of substructure in contact with earth	One coat of primer and two coats of coal-tar bitumen
For concrete surfaces exposed to atmosphere other than the top of deck slab	Waterproof cement paint, two coats

The coat-tar bitumen shall conform to Type II of M118-79 (1993). The primer shall conform to M121-79 (1993). Waterproof cement shall be of proven quality from a reputed supplier to be approved by the Engineer.

The paint shall be evenly applied to the prepared surface by brush or by any approved means. The coal tar bitumen paint shall be thoroughly dried before next applications. The thickness of primer coat and each bitumen coat shall be 50 and 80 microns respectively with total finished coat thickness of 210 microns.

Surface Preparation: The surface of concrete to be coated shall be free from dirt, dust, residue of grease, demoulding oil, curing compound and other deleterious material. The surface shall be cleaned with wire brushes. Use of cup brushes attached to the electric grinder shall be preferable. The cracks and depressions in the concrete surface shall be sealed with sealant of approved quality.

Before application of bitumen paint, it shall be ensured that the concrete surface shall be cured and free of moisture and dust.

6.7 Sampling and Testing of Concrete

For checking the quality of the concrete and its acceptance, the Subcontractor under the supervision of the UNDP Engineer, shall make six cylindrical specimens from each day's run of concrete for each structure in accordance with AASHTO T23. The concrete shall be sampled on the site as close as possible to the point of deposition. Three of the cylinders will be broken after 7 days and the remaining three after 28 days in accordance with AASHTO T22. In addition, when directed by the UNDP Engineer, samples shall be taken for slump or compacting factor tests and for checking cement content.

Acceptance of the concrete shall be based on the following criteria:

i) The 28 day strength of each of the three cylinders shall not be less than the specified strength; or

ii) The average 28-day strength of the set of three cylinders shall not be less that the specified strength if the difference between the greatest and least strengths of the three cylinders shall not be greater than 25 percent of the average strength.

When the cylinders from a batch do not meet the criteria, the whole of the concrete within the element containing that batch shall be considered not to comply with the specification.

When the test cylinders fail to meet the strength criteria, the Engineer may require core samples to be taken to determine the acceptability of the structure in which the concrete has been placed. A minimum of three core samples shall be taken and crushed at the expense of the Subcontractor for checking against the acceptance criteria.

62 FORMWORK

62.1 Description

The work shall consist of providing and fixing all formwork, false work, and centering for facilitating the casting of cement concrete to the specified shape, dimensions, levels, and regularity. The formwork shall be easily removable when it is no longer required without causing any damage or injury to the concrete.

62.2 Construction Requirements

Forms may be of metal or timber. They shall be of substantial and rigid construction true to the specified shape and dimensions. Where metal forms are used, all bolts and rivets shall be countersunk and well ground to provide a smooth, plane surface. Where timber is used, it shall be well seasoned and free from loose knots, projecting nails, splits, or other defects that might mark the surface of the concrete. For exposed concrete faces, timber forms shall be of plywood or hard-pressed fiberboard.

Forms shall be so designed and constructed that they serve their intended purpose and are in a position to be removed without injuring the concrete. For all formwork, the Subcontractor shall prepare detailed drawings and submit them to the UNDP Engineer for his approval before their use. In designing forms and centering, concrete shall be regarded as a liquid. In computing vertical loads a weight of 2,400 kg per cubic meter, and in computing the horizontal pressure, not less than 1,350 kg per cubic meter shall be assumed. The maximum deflection of any formwork component shall not exceed 1/1000 of the span. For structures having spans exceeding 5 m, the UNDP Engineer may require the Subcontractor to submit calculations in this regard for approval.

Forms shall be mortar tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations, including vibration. Forms shall be constructed and maintained to prevent the opening of joints due to shrinkage of the lumber.

Where internal metal ties are permitted, they shall be capable of being extracted without damage to the concrete and the remaining holes filled with mortar. In case of permanently embedded metal parts, cover to the finished concrete surface shall not be less than 40 mm. Unless otherwise provided all exposed edges shall be chamfered to 20 mm sides.

The centering shall be strong enough to carry the intended loads without yielding or buckling, and shall be adequately braced. These shall be set to give the structural camber indicated on the Drawings or as directed by the Engineer plus an allowance for shrinkage or settlement.

The inside of all forms shall be oiled with light, clear paraffin base oil that will not discolor or otherwise injure the surface of the concrete. The oiling shall be done where possible after completing the forms and prior to placing reinforcement.

Forms shall be inspected by the Engineer immediately before placing the concrete. Dimensions and surface regularity shall be checked carefully and any bulging or warping remedied. All dirt, sawdust, wood shavings or other debris within the forms shall be removed to the satisfaction of the Engineer. The maximum undulation or deviation of the surface at any point shall not exceed 3 mm in a length of 3 m. The Engineer may require the revision or reconstruction of forms at any time and may refuse permission to place concrete within the forms until they are satisfactorily constructed. If, at any period of all the work during or after placing the concrete, the forms show signs of sagging or bulging, the concrete shall be removed to the extent directed by the Engineer, the forms brought to the proper position and new concrete placed at the expense of the Subcontractor.

Where formwork is to be reused, it shall be thoroughly cleaned and repaired in a manner that will make it suitable for producing the concrete faces to the required standard

62.3 Removal of Formwork

The time at which the formwork is struck shall be the Subcontractor's responsibility, but the minimum periods between concreting and the removal of forms shall be as follows:

Sides of beams	-	12 hours
Vertical wall surfaces	-	24 hours
Centering under beams and slabs	-	14 days
Sides of Columns and piers	-	24 hours

The Subcontractor shall remove all formwork without damage or injury to the concrete.

62.4 Inspection and Repairs to Exposed Faces

Immediately after the removal of the forms, all fins caused by form joints and other projections shall be removed. All pockets shall be cleaned and filled with a cement mortar composed of one part by volume of Portland cement and two parts sand. Sufficient white cement shall be mixed with the cement in the mortar, so that when dry, the color will match the surrounding concrete. Patches shall be moistened before mortaring to obtain good bond with the concrete. When directed by the Engineer. The Subcontractor shall, at his own expense, substitute with approved epoxy grout for the Portland cement mortar or provide an epoxy bonding agent to be used in conjunction with the Portland cement mortar. If, in the judgment of the Engineer, voids or pockets in the exposed concrete are of such extent or character as to materially affect the strength of the structure or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of that portion of the structure affected. Portions of the structure that cannot be finished or properly repaired to the satisfaction of the Engineer shall be removed and replaced to the specifications.

63 STEEL REINFORCEMENT

63.1 Description

The work shall consist of furnishing, placing, and fixing steel reinforcement of the size, shape, and dimensions shown on the Drawings and to the requirements of these specifications.

63.2 Materials

Reinforcing steel shall conform to the requirements of the following Specifications.

Deformed billet-steel bars for concrete reinforcement	AASHTO M 31 (ASTM A 615)
Deformed steel wire for concrete reinforcement	AASHTO M 225 (ASTM A 496)
Welded steel wire fabric for concrete reinforcement	AASHTO M 55 (ASTM A 185)
Cold-drawn steel wire for concrete reinforcement	AASHTO M 32 (ASTM A 82)
Fabricated steel bar or rod mats for concrete reinforcement	AASHTO M 54 (ASTM A 184)
Welded deformed steel wire fabric of concrete reinforcement	AASHTO M 221 (ASTM A 497)
Plastic coated dowel bars	AASHTO M 254 (Type A)
Low alloy steel deformed bars for concrete reinforcement	ASTM A 206

Bar reinforcement for concrete structures, except No. 2 bars shall be deformed in accordance with AASHTO M 42, M 31 and M 53 for Nos. 3 through 11.

Dowel and tie bars shall conform to the requirements of AASHTO M 31 or AASHTO M 42 except that rail steel shall not be used for tie bars that are to be bent and straightened during construction. Tie bars shall be deformed bars. Dowel bars shall be plain round bars. They shall be free from burring or other deformations restricting slippage in the concrete. Before the delivery to the site of the work, a minimum of one half the length of each dowel bar shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of an approved design to cover 50 mm (2 inches), plus or minus 6.3 mm of the dowel, with a closed end, and with suitable stop to hold the end of the sleeve at least 25 mm (1 inch) from the end of the dowel bar. Sleeves shall be of such design that they do not collapse during construction.

Plastic coated dowel bar conforming to AASHTO M 254 may be used.

63.3 Construction Requirements

The number, size, shape and position of all reinforcement shall be in accordance with the Drawings, or as authorized by the Engineer. Welding of bars shall not be permitted, unless specifically provided in the Contract. Lapping of bars other than that shown on the Drawings shall be avoided. All bars shall be placed so that there is concrete cover for the bars at all times. The bars shall be connected to form a rigid cage.

All cutting and binding of the bars shall follow the schedule incorporated in the Drawings. The Subcontractor shall be responsible for its accuracy and shall satisfy himself as to errors and omissions. When a new bar bending schedule is required, the Subcontractor shall prepare such schedules and submit them to the UNDP Engineer for approval.

Bars shall be cold bent conforming to the following requirements or as shown on the Drawings.

D = 6d for five (5) mm through twenty two (22) mm bar size

D = 8d for twenty four (24) mm through twenty eight (28) mm bar size

Where:

D = Minimum pin diameter around which a bar may be bent

d = Bar diameter

Layers of bars shall be separated by pre-cast mortar blocks, steel spacer bars, or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, or wooden blocks shall not be permitted.

Splicing of reinforcement shall be taken up as shown in the drawings. For bars longer than 10 m and no splice joint is shown in the Drawings, one splice joint of 50 dia. of bar lap length placed at the least stressed zone can be considered for every 10 m length of the bar beyond the first 10 m length. Wherever it is necessary for the Subcontractor to splice reinforcement at points other than those shown on the Drawings, because of the standard length of steel available, drawings showing the location of each splice shall be submitted by the Subcontractor to the UNDP Engineer for approval before reinforcing steel is placed. No measurement or payment shall be made for additional reinforcement steel used for splices not shown on the Drawings or for bars of individual length less than 10m. Splices shall be avoided at points of maximum stress. They shall be staggered where possible and be designed to develop the strength of the bar without exceeding the allowable unit bond stress.

Cover blocks required for ensuring that the reinforcement is correctly positioned shall be as small as possible, consistent with their purpose, and of such shape that they will not overturn when concrete is placed. They shall be made of concrete with 10 mm maximum aggregate size. The mix proportions shall produce the same strength as the adjacent concrete.

All reinforcement placed in position shall be inspected by the UNDP Engineer. Concreting shall not start until the approval of the UNDP Engineer is obtained in writing.

SECTION 7: BUILDING

9 BRICK MASONRY

9.1 Description

This Specification section describes materials, methods and procedures for placement and construction of non-load bearing brick masonry structures.

9.2 Materials

Bricks. Unless otherwise approved by the UNDP Engineer, bricks used for masonry construction shall be locally manufactured deep red units $65 \times 115 \times 220$ mm. Bricks shall be of uniform size and shape, clean and free from flaws and cracks. They shall have sharp, right angle edges and even surfaces.

Mortar. Unless otherwise approved by the Engineer, the mortar used for masonry construction shall be in accordance with applicable portions of the Specification section titled "Mortar Plaster and Grouts".

Reinforcing Steel. Unless otherwise approved by the Engineer, reinforcing steel used in conjunction with masonry construction shall be in accordance with the specification section titled "Reinforcing Steel".

Ties and Anchors. Metal ties and anchors shall be the size and shape as indicated on the drawings and in conformance with the requirements this Specification Section. If ties and anchors are not detailed on the drawings the Subcontractor shall, prior to the commencement of work, submit to the UNDP Engineer for approval proposed ties and anchorage details noting sizes and locations for all brick walls and partitions.

9.3 Submittals

Bricks. The Subcontractor shall submit to the UNDP Engineer for approval at least six sample pieces of the brick intended for use. The samples as approved by the UNDP Engineer shall be retained on the site and used as a base for acceptance or rejection of all brick masonry units supplied for the work.

Shop Drawings. For all brick masonry walls and partitions submit shop drawings indicating splicing, laps, shapes, dimensions, and details of joints, reinforcing steel, and accessories. Include details of anchors, and ties.

9.4 Construction Requirements and Procedures

Preparation. Surfaces on which masonry is to be placed shall be smooth, clean and free of foreign substances when mortar is applied.

Protection. Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

Workmanship.

Carry masonry up level and plumb.

Furnish and use story poles or gage rods throughout the work.

Changes in coursing or bonding after the work is started will not be permitted.

Do not carry one section of the walls up in advance of the others.

Check heights of masonry at each floor and at sills and heads of openings to maintain the level of the walls.

Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and spalling of faces and edges. Cut masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses.

Provide chases of approved dimensions for pipes and other purposes where indicated and where necessary.

Cover tops of exposed walls and partitions not being worked on with a waterproof membrane secured in place and extended down at least 600 mm on both sides.

Inspect scaffolding regularly to ensure that it is amply strong, well braced and securely tied in position.

Do not overload scaffolding.

Tolerances. Masonry work shall be within the following limits:

- (a) Pilasters and Columns: 6 mm from true line.
- (b) Face of Brick: 1 mm from face of adjacent brick.
- (c) Variation from True Plane: 6 mm in 3 m and 20 mm in 10 m.
- (d) Variation from Plumb: 6 mm in each story, non-cumulative and 13 mm maximum in two stories or more.
- (e) Variation from Level: 3 mm in 1 m, 6 mm in 3 m maximum.
- (f) Variation in Wall Thickness: Plus or minus 6 mm.

Application.

Unless indicated or specified otherwise or required by the Engineer, lay brick in running bond.

Bricks shall be thoroughly soaked with water before their use.

Completely fill joints between bricks with mortar.

Form bed joints of a thick layer of mortar slightly furrowed or battered; bevel or pyramid the bed mortar.

Form head joints by applying a full coat of mortar on the brick to be laid.

Lay closure bricks with mortar on each bedding surface of unit to be laid and units in place. Place brick carefully without disturbing brick previously laid.

Dry joints will not be permitted.

Bonding and Anchoring.

Structurally bond or anchor masonry walls and partitions to each other and to concrete walls, beams and columns.

Securely anchor non-load-bearing partitions and interior walls to the construction above in a manner that provides lateral stability while permitting unrestricted deflection of construction above.

Completely embed anchors in mortar joints.

Intersections of Non-Load-Bearing Partitions with Other Walls or Partitions:

Tie with wire mesh ties at vertical intervals of not more than 600 mm or with masonry bonding in alternate courses.

Masonry Walls Facing or Abutting Concrete Members:

Anchor masonry to concrete with dovetail or wire-type anchors inserted in slots or inserts built into concrete.

Locate anchors not more than 300 mm vertically and not more than 600 mm horizontally.

Cleaning of Exposed Masonry Brick.

Exposed brick masonry shall be free of stains, efflorescence, mortar or grout droppings and debris. Restore damaged, stained, and discolored work to original condition or provide new work.

Clean exposed masonry surfaces with clear water and stiff fiber brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue scrubbing with warm water and detergent. Where soil still remains on brickwork, continue cleaning as follows:

Thoroughly wet exposed surfaces of dark-colored brickwork with clear water and scrub with stiff fiber brushes and a solution of not more than 1 part of muriatic acid to 9 parts of water applied to an area of 1 to 2 square meters.

Immediately after cleaning each area, rinse thoroughly with clear water.

Do not use caustic solutions or sandblasting to clean surfaces.

Mortar Joints.

Uniform thickness of 10 mm unless otherwise indicated.

Strike flush joints. Tool vertical joints first.

Brush joints to remove all loose and excess mortar.

Horizontal joints shall be level.

Vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 10 mm in 10 m.

SECTION 10: ELECTRICAL

10.1 DESCRIPTION

This Specification section provides requirements and procedures for furnishing and installing all materials and equipment necessary for complete in place electrical works in buildings and surrounding areas.

10.2 STANDARDS AND REGULATIONS

The work under this Specification section shall be carried out in accordance with the regulations issued by the local electricity authority and the following standards and codes:

NEC:	National Electrical Code (U.S.A.)
NECA	National Electrical Subcontractor s "Standard of Installation" (U.S.A.)
NEM:	National Electrical Manufacturers Association (U.S.A.)
CEGS- 16670	Lightning Protection System, Department of Army (U.S.A.)

(a) The Subcontractor must carefully examine at his own expense all of regulations issued by the local Electricity Authority and standard and codes listed above. Selected materials and method of installation shall be in accordance with these.

(b) Regulations and requirements pertaining to lightning rods and associated grounding systems shall be in accordance with the CEGS-16670 Lightning Protection System, Department of Army (U.S.A).

10.2 EXECUTION OF THE WORK

(a) For the actual fabrication, installation, and testing of the work described in this Specification section, the Subcontractor shall use only thoroughly trained and experienced personnel who are completely familiar with the requirements for this work and with the installation recommendations of the manufacturers of the specified items.

(b) In acceptance or rejection of the installed electrical systems, no allowance will be made for lack of skill on the part of installers.

(c) All work shall comply with the Drawings and this Specification section, and the codes, regulations and requirements of the relevant Afghan Authorities and those stipulated in this Specification section.

10.3 DRAWINGS AND SUBMITTAL

(a) The Subcontractor shall refer to all relevant drawings to ascertain for himself the location and routes of all other utility services so as to maintain adequate clearance between electrical and other services. Supplied drawings indicate generally the arrangement of the work.

(b) The Subcontractor shall provide shop drawings showing the exact routes of all underground or overhead cables and ducts, the exact run of all conduits and trunking, the

location of manholes, draw-in and junction boxes, the number and size of wires in each conduit or trunking, the final connection arrangements at lighting and distribution panels, the detail of ducts and the method of fixing street lighting and distribution panels for the approval of the Engineer before commencing any portion of the Works.

(c) The Subcontractor shall include all installations, cable routings as well as known locations of existing electrical lines and utilities on his "As Built" drawings prepared in accordance with requirements given under Specification Section 101, "General Requirements."

(d) Upon completion of the work, and as a condition of its acceptance, the Subcontractor shall supply Operations and Maintenance Manuals and Operation and Maintenance Training as directed by the Engineer.

10.4 CONDUIT

(a) In buildings, electrical conduit shall be an approved hard plastic ducting specifically manufactured for electrical applications.

(b) Building installed conduit shall be concealed.

(c) Whenever required or necessary, pull boxes and junction boxes shall be installed at convenient and inconspicuous locations, regardless if such boxes are shown or not shown on the drawings.

(d) Exposed conduit runs shall have saddles or sheet steel supports spaced not more than 1.5 meters apart. All runs shall have least 2 supports. Supports shall be installed with runs paralleled or perpendicular to walls, structural members, or intersections or vertical planes and ceilings, with right angle turns.

(e) Conduit to be embedded in concrete shall be PVC in accordance with the requirements of Specification Section 1001, "Installation of Underground Piping."

(f) Conduit to be installed under the ground shall be zinc-coated steel by a hot-dip galvanizing process. The zinc coating shall be on the interior and exterior of the conduit.

(g) Metal conduit smaller than 22 mm electrical trade size shall not be used, unless otherwise specified. It shall be the option of the Subcontractor, at his own expense, to use larger size conduit if desired, and where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. No reducing couplings will be permitted.

(h) The ends of all metal conduits shall be well reamed to remove burrs and rough edges. Field cuts shall be made square and true so that the ends will butt or come together for the full circumference thereof.

(i) Slip joints or running threads will not be permitted for coupling conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used.

(j) The threads of all steel conduits shall be well painted with a good quality of lead or rust-preventative paint before couplings are made up.

(k) All steel couplings shall be screwed up until the ends of the conduits are brought together, so that a good electrical connection will be made throughout the entire length of the conduit run. Where coating on steel conduit has been damaged in handling or installing, such places shall be thoroughly painted with rust-preventative paint.

(I) All conduit ends shall be threaded and capped with standard conduit couplings capped with conduit push pennies until wiring is started.

(m) When couplings and push pennies are removed the threaded ends shall be provided with approved conduit bushings. The use of any plugs, even though temporary, in lieu of the aforementioned conduit couplings and push pennies is expressly prohibited.

(n) Conduit stubs from bases shall extend at least 15 cm from the face of foundations and at least 80 cm below the top of foundations.

(o) Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit.

(p) Where factory bends are not used, conduit shall be bent, using an approved conduit bending tool employing correctly sized dies, without crimping or flattening, using the longest radius practicable.

(q) All PVC conduit bends shall be pre-formed.

(r) Conduit terminating in poles or pedestals shall extend approximately 15 cm above the foundation vertically and shall be sloped towards the hand-hole opening.

(s) Conduit entering through the bottom of a pull box shall be located near the end walls to leave the major portion of the box clear.

(t) At all outlets, conduit shall enter from the direction of the run, terminate 15 to 20 cm below the pull box lid and within 9 cm of the box wall nearest its entry location.

(u) Suitable markers shall be set at the ends of conduits that are covered so that they may be easily located.

(v) A galvanized pull wire shall be installed in all conduits that are to receive future cables. At least 60 cm of pull wire shall be doubled back into the conduit at each termination.

10.5 CABLES AND WIRING

10.5.1 General Requirements

(a) All cables and wires shall comply with the relevant standards and appropriate code requirements.

(b) Wiring within cabinets, manholes, etc. shall be neatly arranged.

(c) Powdered soapstone, talc, or lubricant shall not be used in placing cables in conduit.

(d) Splicing in conductors will be permitted only at manholes, transformer leads, in pole bases, junction boxes or at control equipment.

(e) The permissible bending radius of the cables and wiring shall be as follows:

(f) Shield cables. Single core: more than 12 times of the outside diameter; Multi-core: more than 8 times of the outside diameter

(g) Non shield cable and wiring. Single core: more than 12 times of the outside diameter; Multi-core: more than 6 times of the outside diameter

10.5.2 Cables

- (a) Conductors shall be solid copper suitable for operation at the specified voltages.
- (b) The maximum conductor operating temperature at rated current shall be less than 70 degrees C.
- (c) All cables shall be suitable for operation at the specified voltage in open, duct or conduit, under the condition of the maximum conductor operating temperature that at rated current shall be less than 70 degrees C.
- (d) Cables shall be delivered to the Site on substantial non-returnable wooden drums, each bearing a securely fixed label stating gross weight, serial number, length of cable and other description. Covers shall be provided around the periphery of the drum in order to protect the cable in transit and the inner cable end shall be adequately protected by a metal guard or other approved means. Both ends of the cable shall be sealed by a suitable method to prevent the entrance of moisture.

- (e) All cables inside of the lighting pole shall have two conductors per lantern. Cables shall be 600 volts, grade "Polyvinyl Chloride Insulated and Sheathed Cable" or shall be of the type approved by the Engineer.
- (f) Conductors shall have a minimum cross-sectional area of 10 mm² for use in underground installations.
- (g) All cables to be used shall be certified as tested, and approved by the Engineer before installation.
- (h) Cables shall be terminated using compression cable lugs, tinned copper cable sockets or other approved method(s).
- (i) The size of power wires and cables shall be selected by Subcontractor, with due consideration for allowable voltage drop, current capacity and mechanical tension. The Engineer shall approve all cable and wire sizes and types.
- (j) All underground shall be PVC insulated, Galvanized Flat Steel wire armoring, and PVC sheeting approved by the Engineer.
- (k) Conductors shall be color code in accordance with Vietnamese standards as follows:
- Phase A : Red
- Phase B : Blue
- Phase C : Black
- Neutral : White
- Earth : Green/yellow

10.5.3 Interior Wiring

- (a) All wiring shall be PVC insulation and sheath shall have flame-retardant as approved by the Site Engineer.
- (b) Conductors 1.5 mm^2 to 2.5 mm^2 shall be solid copper.
- (c) Electrical wires more than 4 mm², shall be stranded copper.
- (d) Wire color coding shall be as follows:
 - Positive : Red, Blue, and Black
 - Negative : White
 - Earth : Green/Yellow

10.5.4 Exterior Wiring

- (a) All cables located outside of the buildings and between distribution panels shall be steel tape armored PVC insulated and shielded X-PLE copper conductors.
- (b) Unless otherwise indicated, all underground cables within the toll plaza compound areas shall be enclosed in plastic ducting located at least 0.7 meters below ground surface and in accordance with details shown on the drawings.
- (c) Underground cabling located outside the toll plaza compound areas shall be enclosed in zinc galvanized piping located 1.2 meters below ground surface.
- (d) Unless otherwise approved by the Engineer, all exterior cables shall be installed in continuous lengths without splices.

10.5.5 GROUNDING

(a) The Subcontractor shall investigate each site and measure the grounding resistance of the sites. After taking the data, the Subcontractor shall obtain the Engineer's approval for grounding method(s) before installation.

- (b) All lighting fixtures and plug sockets shall be connected to a panel board grounding bus with a suitable grounding wire.
- (c) All exposed conductive parts or metal work associated with an electrical installation, but forming part of a current carrying circuit shall be grounded.
- (d) Grounding rods shall be installed where required by drawings, and/or applicable electrical codes.
- (e) The minimum grounding resistance shall be not greater than 100 ohms.
- (f) Resistively tests on supplementary earth electrodes and on earth conductors shall be made as the Engineer directs. The result shall be reported in writing.
- (g) Conduit, steel poles and cabinets shall be made mechanically and electrically secure to form a continuous system, and shall be effectively grounded. Bonding and grounding jumpers shall be copper wire of the same cross-sectional area for all systems.
- (h) All necessary suppression chokes shall be included and shall be capable of withstanding fault conditions.
- (i) All cable armoring, conduits, trucking, trays, and the like shall be bonded together and to structural work and connected to adequate earth electrodes. Particular attention shall be paid to the correct bonding and grounding of single core cable armoring.
- (j) Bonding jumpers shall be used in all non-metallic boxes. Metallic boxes shall employ hubs of double lock nuts and bushes. The bonding of all conduits, lighting poles and panels to form a continuous ground system shall be in accordance with applicable code standards. If directed by the Engineer each lighting pole shall be individually grounded.
- (k) Details of all grounding points shall be submitted to the Engineer for approval.

10.5.5 Grounding Rods

Ground rods shall be copper 10 dia. x 1,500 millimeter minimum, depth 1.2 meter below finished grade and thermo-welded or connected using connection hardware to the 6 mm² grounding wire.

10.5.6 Grounding Wires

Size of grounding wire shall be minimum 6 mm² Bare Copper Conductor (BCC) or as approved by the Engineer

10.5.7 Grounding Plates

Grounding plates shall be of copper 1.5 mm thick and 900 mm².

10.5.8 LIGHTING ARRESTING SYSTEM

All lightning rods and arresting systems, including materials and accessories shall be in accordance with the following, which are incorporated as an integral part of these specifications: "Guide Specification for Lightning Protection System for Buildings and Other Structures, Section 16670, Department of Army U.S."

10.5.9 General

The location of each facilities and appurtenances shown on the Drawings are approximate and the Subcontractor shall propose the exact location to the Engineer for approval.

10.6.1 Material and Installation

- (a) Lightning receiving part including elevation rod
 - A pointed lightning receiving part is projected into air.
 - It shall consist of metallic body made of alloy aluminum used for receiving a lightning stroke directly and be connected to earth electrode by lightning conductors.
- (b) Lightning conductor
 - The lightning conductor shall be annealed copper stranded wire of 50mm², or aluminum solid wires, stranded wires, strip or tubes which conform to requirements.
 - The down conductor shall be copper of 50mm² and be protected in the reinforced concrete pier.
 - The combined value of earthing resistance of foundation of the object to be protected and that of earth electrode shall be not more than 5.
- (c) Earth Electrode
 - The earth electrode shall be a copper plate of 1.5 mm tick, 0.9m x 0.9m with a 1.5m length of annealed copper stranded wire 15 mm in diameter.

10.6.2 ELECTRICAL SPLICE MATERIALS

- (a) Splices and taps shall be made with pressure type solder-less connectors to securely joint the wires both mechanically and electrically.
- (b) An epoxy resin, cast type insulation shall be formed in clear plastic molds. The material used shall be compatible with the insulation specified in the Contract Drawings or these Specifications. Materials to be used for the work shall have the quality approved by the Site Engineer.
- (c) Insulating tape when specified for use in splice formation shall be approved by the Site Engineer.
- (d) Un-fused quick-disconnect connectors such as In-line connectors or Tee connectors shall be of a quality approved by the Site Engineer.

10.6.3 LIGHTING FIXTURES

General Requirements

- (a) The Subcontractor shall ensure that the lighting furnished for building structures is compatible with the ceiling suspension system being installed.
- (b) Lighting fixtures shall be the type size and capacity as shown on the drawings. Prior to ordering any fixtures the Subcontractor shall submit for approval by the Engineer full details including manufacture's catalogs and data describing the fixtures. The Engineer may require submission of sample fixtures for approval.
- (c) Lighting units shall consist of lighting lanterns, lamps, electrical control ballast's and mounting accessories.

- (d) The Subcontractor shall submit for approval, detailed street lighting panel diagrams for each type of lantern he proposes to install.
- (e) The Subcontractor shall submit to the UNDP Engineer for review and approval complete electrical shop drawings detailing all fixture locations, wiring and installation details.
- (f) All lighting shall be fabricated and finished in accordance with the manufacturer's standards. The color of fixtures shall be subject to approval by Engineer.
- (g) Interior and outdoor lighting fixtures shall be carefully and neatly installed complete with all necessary accessories, connectors, adjustable mounting wall brackets and trims as required.
- (h) The exact location and height of fixtures shall be determined by the structural and mechanical limitations of building and fixtures shall be installed in such a manner as to avoid obstructions and to give the proper illumination result.
- (i) Fixtures shall be installed in such a manner as not to injure outlet boxes, conduit tubes, wall, ceiling, etc., by their weight.
- (j) The lighting fixtures for outdoor use shall be of weatherproof type. Special care shall be exercised on selection of fixtures so that illumination of the lamps is not obstructed by accumulation of insects and dust.
- (k) Fluorescent lighting fixtures shall be AC single phase 220 volts 2 wires 50Hz system and be provided with required ballast with high power socket of the pin fall proof type.
- (I) Emergency lighting fixtures shall have a built-in battery rated for 30 min operation of the lamp.

10.6.4 WALL SWITCHES

Wall Switches shall be rated not less than 16 A, 220 volts and shall be single or double switch as required. The type of switch shall be tumble rocker type operation, for flush mounting in a shallow PVC box with a rectangular faceplate.

10.6.5 OUTLET BOXES

All outlet boxes for concealed work shall be of hot-dip galvanized stamped steel. All wall boxes on exposed work shall be of aluminum or cadmium-plated cast-iron.

10.6.6 POWER DISTRIBUTION PANELS

Power distribution panels shall be installed in each location shown in the drawings. The panels shall be in accordance with the following:

- (a) Panels shall include a molded case circuit breaker distribution board (MCCB) and a miniature circuit breaker distribution board (MCB) and shall be factory built and assembled.
- (b) Panels shall be totally enclosed by galvanized or painted sheet steel 2.0 mm thick for length less than 2 m or 2.3 mm thick for length greater than 2 m. The metal enclosure shall be adequately sized to allow for free circulation of air.
- (c) Panels shall be factory primed and painted with at least one (1) coat of anticorrosion primer and a baked on enamel finish.
- (d) Panel doors shall be hinged 180 degree swing gasket doors, fitted with ball catch and chrome-plated handles. Panel boards located in areas accessible to the public shall be provided with cylindrical locks complete with three (3) keys.

- (e) Knock out and slot openings shall be neatly provided suitable for conduit/trucking connection and proper protection by bushes, grommet, etc. to protect cable entry from damage shall be included.
- (f) Bus bar shall be hard drawn high conductivity properly tinned copper. The bus bar shall be rated not less than the rating of main switch or main circuit breaker.
- (g) Neutral connectors shall be brass block types having finished screw terminals equal in number and in same order as the individual outgoing circuits. An earthing terminal shall be provided.
- (h) Circuit breaker shall be molded plastic case types, 2 or 3 poles as required, quick make, quick-break with trip flee operating handle, position indication and thermal magnetic trip device.
- (i) Proper indication of phases by color discs or approved equivalent insulating means shall be provided.
- (j) Removable insulating phase barriers and front shields covering live bus bar and terminal shall be provided from 2.5mm thick acryl sheeting.
- (k) Replacement of fuses, MCCB and bus bar from the front shall be possible.
- (I) Except for solder less termination type MCCB or fuse holder, all cable terminations shall be by compression cable lug or proper soldered lugs.
- (m)A permanent circuit chart shall be affixed to identify all individual circuits.
- (n) All panels shall be provided with 20% spare circuit breakers.