Technical Specifications- for the Ab Burdah BHC building

in Uruzgan province

1. General:

The General Specification shall form a part of the sub-contract, and shall be read in conjunction with the other parts such as the Notice Inviting Tenders, Instructions to Tenderers, Conditions of sub-contract, Bill of Quantities, Drawings, Special Specifications and other related Tender Documents.
The sub-contractor shall employ skilled and qualified laborers, technicians, foremen and engineers to complete the Works according to the Technical Specifications.
In the case of discrepancies between the technical specifications and other tender documents the sub-contractor shall immediately notify Employer in writing, and Employer shall respond to the sub-contractor as soon as practicable.

Definitions:

In these Specifications and Scope of Works, the following words and expressions shall have the meanings hereby assigned to them.

"Technical partner" means WAW (Women for Afghan Woman).

"Technical partner" Means WAW representative for this specific project.

1.1 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
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASA	American Standard Association

ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Material
AWS	American Welding Society
BSI	British Standards Institute
ICAO	International Civil Aviation Organization
BSICP	British Standard Institute Code of Practice
FAA	Federal Aviation Administration
PCA	Portland Cement Association
UBC	Uniform Building Code

1.2 Use of the Site

The sub-contractor shall restrict his activities to within the Site and shall avoid entry on to any other lands except where the sub-contractor has made his own arrangements for such entry. Any trespass, damage, or claims arising from such entry shall be the sole responsibility of the sub-contractor, who shall hold the sub-contractor indemnified against all claims arising from such trespass or damage.

1.3 Precautions

The sub-contractor 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.

The sub-contractor 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

1.4 Notice of Operations

The sub-contractor shall submit in writing to the Employer a notice of any important operations he intends to carry out. No operation shall be started without prior notice and consent of the Employer. The notice shall be given at least 24 hours in advance of the time of the operation.

1.5 Existing Utilities and Services

The sub-contractor shall carry out a survey and acquaint himself with the location of all existing utilities and services such as pipelines, power lines, telephone cables, water mains and other similar services before any work is started.

The sub-contractor shall be held responsible for damage to existing services and any damages caused shall be compensated at his own expense.

Notwithstanding the foregoing requirements and without lessening the sub-contractor's liability and responsibility, the sub-contractor shall inform the Employer immediately when any such existing utilities are exposed and deemed to interfere with or be damaged by the construction of the Works. The Employer will instruct the sub-contractor what measures to take.

Where the Employer requires the sub-contractor to arrange for an existing service to be relocated or modified, the cost shall be reimbursed to the sub-contractor at a negotiated rate. However, no separate payment shall be made for the cost of any survey or setting out required in this regard

1.6 Setting Out the Work

The sub-contractor 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 Employer. Before setting out or to take levels for any part of the Works, the sub-contractor shall give the Employer not less than twenty-four hours' notice in order that arrangements may be made for checking. The sub-contractor shall provide the Employer with all necessary instruments, personnel, and materials needed for checking the setting out.

1.7 Error by Sub-Contractor

If errors are found in the Construction works, they and the Works shall be corrected at the sub-contractor's cost.

1.8 Health and Safety

Precautions shall be taken by the sub-contractor to ensure the health and safety of his staff and labour. The sub-contractor shall, in collaboration with and to the requirements of the local health authorities, ensure that medical staff, first aid facilities, sick bay and ambulance service are available at the accommodation and on the Site at all times, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics. The sub-contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Employer's Representative may reasonably require.

The sub-contractor shall appoint a member of his staff at the Site to be responsible for maintaining the safety, and protection against accidents, of personnel on the Site. This person shall be qualified for his work and shall have the authority to issue instructions and take protective measures to prevent

accidents. The sub-contractor shall send, to the Employer's Representative, details of any accident as soon as possible after its occurrence.

1.9 Public Safety

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

1.10 Suspension of Work

The Employer's Representative may at any time instruct the sub-contractor to suspend progress of part or all of the Works. During suspension, the sub-contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

1.11 Failure to Remedy Defects

If the sub-contractor fails to remedy any defect or damage within a reasonable time, the Employer or the Employer's Representative may fix a date on or by which to remedy the defect or damage, and give the sub-contractor reasonable notice of such date.

If the sub-contractor fails to remedy the defect or damage by such date the Employer may (at his sole discretion):

(a) Carry out the work himself or by others, in a reasonable manner and at the sub-contractor's risk and cost, but the sub-contractor shall have no responsibility for such work: the costs properly incurred by the Employer in remedying the defect or damage shall be recoverable from the sub-contractor by the Employer;

(b) Require the Employer's Representative to determine and certify a reasonable reduction in the sub-contract Price; or

(c) If the defect or damage is such that the Employer has been deprived of substantially the whole of the benefit of the Works or parts of the Works, terminate the sub-contract in respect of such parts of the Works as cannot be put to the intended use: the Employer shall then be entitled to recover all sums paid for such parts of the Works together with the cost of dismantling the same, clearing the Site and returning Plant and Materials to the sub-contractor.

1.12 Removal of Defective Work

If the defect or damage is such that it cannot be remedied expeditiously on the Site, the sub-contractor may, with the consent of the Employer's Representative or the Employer, remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

1.13 Procedure for Claims

If the sub-contractor intends to claim any additional payment under any Clause of these Conditions or otherwise, the Sub-contractor shall give notice to the Employer's Representative as soon as possible and in any event within 14 days of the start of the event giving rise to the claim.

The sub-contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Employer's Representative. Without admitting the Employer's liability, the Employer's Representative shall, on receipt of such notice, inspect such records and may instruct the sub-contractor to keep further contemporary records. The sub-contractor shall permit the Employer's Representative to inspect all such records, and shall (if instructed) submit copies to the Employer's Representative.

Within 14 days of such notice, or such other time as may be agreed by the Employer's Representative, the sub-contractor shall send to the Employer's Representative an account, giving detailed particulars of the amount and basis of the claim. Where the event giving rise to the claim has a continuing effect, such account shall be considered as interim. The sub-contractor shall then, at such intervals as the Employer's Representative may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further particulars. Where interim accounts are sent to the Employer's Representative, the sub-contractor shall send a final account within 14 days of the end of the effects resulting from the event.

If the sub-contractor fails to comply with this Sub-Clause, he shall not be entitled to additional payment.

2 <u>Terms & Material:</u>

- **Terms**

2.1 Manner of Execution

All Materials to be supplied shall be manufactured, and all work to be done shall be executed, in the manner set out in the sub-contract. Where the manner of manufacture and execution is not set out in the sub-contract, the work shall be executed in a proper, workmanlike and careful manner, with properly equipped facilities and non-hazardous Materials, and in accordance with recognized good practices.

2.2 Delivery to Site:

The sub-contractor shall be responsible for procurement, transport, receiving, unloading and safe keeping of all Materials, sub-contractor's Equipment and other things required for the completion of the Works.

2.3 Inspection

The Employer and the Employer's Representative shall be entitled during manufacture, fabrication and preparation at any places where work is being carried out, to inspect, examine and test the materials and workmanship, and to check the progress of manufacture, of all Materials to be supplied under the Contract. The sub-contractor shall give them full opportunity to inspect, examine, measure and test any work on Site or wherever carried out.

The sub-contractor shall give due notice to the Employer's Representative whenever such work is ready, before packaging, covering up or putting out of view. The Employer's Representative shall then either carry out the inspection, examination, measurement or testing without unreasonable delay, or notify the Contractor that it is considered unnecessary. If the sub-contractor fails to give such notice, he shall, when required by the Employer's Representative, uncover such work and thereafter reinstate and make good at his own cost.

2.4 Rejection

If, as a result of inspection, examination or testing, the Employer's Representative decides that any Materials or design or workmanship is defective or otherwise not in accordance with the sub-contract, the Employer's Representative may reject such Materials, design or workmanship and shall notify the sub-contractor promptly, stating his reasons. The sub-contractor shall then promptly make good the defect and ensure that the rejected item complies with the sub-contract.

If the Employer's Representative requires such Materials, design or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If such rejection and retesting cause the Employer to incur additional costs, such costs shall be recoverable from the sub-contractor by the Employer, and may be deducted by the Employer from any monies due, or to become due, to the sub-contractor.

- **Material**

All materials shall be tested and approved by the Engineer before use. The sub-contractor shall notify the Employer representative of the sources of materials and the Engineer will approve the sources prior to delivery of materials to the Site. Where the source of material does not meet Specification requirements, the sub-contractor shall furnish material from other sources. Delivery of materials produced from commercial manufacturing processes shall be accompanied by the manufacturer's certification and test report showing the materials comply with the Specification requirements. The Employer representative approval of a source does not imply that all the material in that source is approved.

2.5 Stone

2.5.1 Stones shall be mountain stone, rough quarry stone which is sound, tough, durable, dense, resistant to the action of air and water, and suitable in all respects for the purpose intended.

2.5.2 River stones/rocks, over size stones or tinny stones shall not be used. (Note: The best PCC block are the solid big size black stones with no cracks and with sharp edges.

2.5.3 The Employer's Representative shall approve the quality and dimensions of the stones prior to use. The stone should meet the graduation requirements in Table below 1.

TABLE 1

Graduation Requirement for Stones

Nominal Thickness (mm)	Approximate Given Size		Equivalent Cubic Dimension (mm)	Total Size Smaller than Given Size (%)
	Weight (kg)	Volume (cu.m.)		

Nominal Thickness (mm)	Approximate Given Size		Equivalent Cubic Dimension (mm)	Total Size Smaller than Given Size (%)
	Weight (kg)	Volume (cu.m.)		
150	15	.006	175	100
	10	.004	150	80
	5	.002	125	50
	0.5	.0003	50	10*
250	45	.018	250	100
	27	.011	225	80
	11	.005	165	50
	2	.0003	75	10*

2.6 Cement

2.6.1 The entire quantity of cement and steel required for the work shall be procured by the sub-contractor. The sub-contractor is responsible for all transport and storage of the materials and shall bear all related cost, the storages for cement and steel shall be reviewed, inspected and approved by the Engineer. Employer's Representative shall be entitled at any reasonable time to examine the cement and steel supplied by the sub-contractor.

2.6.2 The cement procured by the sub-contractor shall comply with the requirements of ACI 318 - 08. It shall be of the best normal setting quality unless especially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. The cement shall be Type SR (Sulphate Resistance).

2.6.3 All cement shall be procured in bags and shall be stored in a dry place for which the sub-contractor shall be responsible. Consignment of bagged cement shall be properly stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in approximately in the chronological order in which it is received, but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be

used unless it has been re-tested at the expenses of the sub-contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 90 days from the date of initial sampling shall be rejected.

2.6.4 Cement which has become caked or perished shall on no account be used on the works and shall be rejected. Although the Engineer may have passed any consignment, he shall however have the power at the subsequent time to reject such consignment if he finds that any deterioration in the quality thereon has taken place.

2.6.5 The rejected consignment of cement and steel should be removed from the site within two days.

2.7 Sandy Gravel River Sandy Gravel)

2.7.1 All sandy gravel shall be from River; sandy gravel from other areas will not be accepted.

2.7.2 The sandy gravel materials are expected to be clean and free of any silt or clay, in case of use of river sandy gravel the Employer's Representative should approve the river sandy gravel to ensure that the gravel does not contain any silt or clay and to ensure that there is permissible mixing ratio (1:2) of sand and gravel,

2.7.3 The sandy gravel shall be clean and free from any organic or other undesired materials. The sub-contractor shall select a barrow for gravel which shall be approved by Employer's Representative.

2.7.4 In case of course material existence the sandy gravel should be passed through a wire mesh to avoid/retain any course material (above 2.54 cm/1 inch) for PCC and RCC.

2.8 Water required for Construction

All required piping arrangements and pumping if required for water shall be made by the sub-contractor at his cost. Water for mortar, mixing and curing of concrete shall be free from harmful matter or other substances that may be deleterious to concrete or steel and taken from a source approved by the Employer's Representative.

2.9 Admixtures

Only where a beneficial effect is produced shall any admixture be used and that too after test has been carried out to convince the Engineer that no harmful effect will be produced by the use of such admixture and after approval by the Engineer.

3 The Works

3.1 Excavations:

3.1.1 All excavations shall be carried out to the widths, depths and side slopes shown on the Drawings or as directed by the Employer's Representative.

3.1.2 The work shall be planned and executed so that the suitable materials available from excavation are satisfactorily utilized in fills.

3.1.3 The sub-contractor shall not excavate outside the slopes or below the established grade lines, or loosen any material outside the limits of excavation. Subject to the permitted tolerances, any excess depth excavated below the specified levels shall be made good by the sub-contractor at his own expense. During excavation, the sub-contractor shall limit vertical and other temporary faces to such heights as are suitable to the soil exposed. If slips, slides or subsidence occur during construction and extend below the specified lines or levels, the excess excavation and repairs shall be at the sub-contractor's own expense to the satisfaction of the Employer's Representative.

3.1.4 The sub-contractor shall use water during all earth works as necessary to ensure dust control and mitigate the environmental impacts resulted from the earth works as appropriate.

3.2 Scheduling Excavation for Structures

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

3.2.2 Earthwork at the site should not, in general, precede ahead of the drainage works in such a manner that the site becomes an obstruction to cross drainage. Where this happens, the sub-contractor 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 sub-contractor.

3.2.3 No trench or pit for a structure shall be left in an exposed condition for a period exceeding thirty (10) days.

3.3 Dewatering

3.3.1 During construction of the works, the embankments shall be maintained in such a condition that it will be well drained at all

times. In order that the embankment or any other works may not be subject to excessive water or flooding, during or after construction, the sub-contractor shall at all times, and especially at an early stage of the work, be required to provide adequate drainage by scheduling ditch work and outlet construction or by pumping to prevent such flooding.

3.3.2 The sub-contractor shall clean and trim all such drainage ditches from time to time during the work or when directed by the Employer's Representative, so that there may be a free water flow throughout the construction period.

3.3.3 Damage attributable to excessive water for failure to provide such measures shall be immediately repaired by the sub-contractor at his own expense. Unless otherwise specified in the bill of quantities, the rates for the items of work shall be considered as inclusive of pumping out or bailing out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, and sub-soil water table being high due to any other cause whatsoever.

3.4 Preparation of Foundation

3.4.1 The bottom of foundations shall be leveled longitudinally and transversely or stepped as directed by the Employer's Representative. Where the material is other than rock, it shall be compacted to at least 95 percent MDD.

3.4.2 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 Employer's Representative. All seams shall be cleared and filled with cement mortar to the satisfaction of the Employer's Representative.

3.5 Concrete Works

3.5.1 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.

3.5.2 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

Technical Drawings or as directed by the Employer's Representative.

3.5.3 Concrete curing charges are included in the price for all items in which the use of cement is involved.

3.6 Mixing of Concrete:

3.6.1 The plain cement concrete PCC shall be proportioned 1:2:4 (Cement, Sand, Gravel) The amount of water required being measured either by weight or volume the adjustments must be made to frequent intervals at the discretion of the Employer representative or his assistant to account for the moisture content of the aggregates.

3.6.2 The concrete mixing shall be done by concrete mixer or equivalent approved by the Employer's Representative. During the mixing process the sub-contractor shall ensure that the concrete is not mixed with undesired materials such as but not limited to: dirt, organic materials, trash, debris…etc.

3.6.3 Concrete temperature while pouring shall be below 30®. Construction/Expansion joints shall be provided in the PCC and stone masonry wall as shown in the technical drawings to avoid any shrinkage in the PCC and stone masonry wall.

3.6.4 Concrete shall be placed only under direct observation of the Employer's Representative Do not place concrete outside of regular working hours, unless the Employer's Representative has been notified at least 48 hours in advance.

3.6.5 Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

3.6.6 The mix should not be dropped from such a height as it may cause segregation and air entertainment. When the mix is placed in position, no further water shall be added to provide easier workability.

3.6.7 No concrete mix shall be used for the work if it has been left for a period exceeding its initial setting time before being deposited and vibrated into its final position in the member.

3.6.8 As soon as one concrete is being placed in position it shall be immediately spread and ramped sufficiently and suitable to attain dense and complete filling of all spaces between and around the reinforcement and in to the corners of form work for ensuring a solid mass entirely free from voids.

3.7 Reinforced Cement Concrete (RCC):

Descriptions

3.7.1 The Reinforced Cement Concrete (RCC) shall be used for the slabs, paraphyte walls, beams, abutments, aqueducts, super passages, syphon and other structures according to the dimensions and details in the technical drawings, the concrete shall be mixed with ratio of 1:1.5:3.

3.7.2 **STEEL REINFORCEMENT**

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.

3.7.3 **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	AASHTOM 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

3.7.4 **Construction Requirements**

3.7.4.1 The number, size, shape and position of all reinforcement shall be in accordance with the Drawings, or as authorized by the Employer's Representative.

3.7.4.2 Welding of bars shall not be permitted, unless specifically provided in the Contract.

3.7.4.3 Lapping of bars other than that shown on the Drawings shall be avoided.

3.7.4.4 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.

3.7.4.5 All cutting and binding of the bars shall follow the schedule incorporated in the Drawings.

3.7.4.6 The sub-contractor shall be responsible for its accuracy and shall satisfy himself as to errors and omissions. When a new bar bending schedule is required, the sub-contractor shall prepare such schedules and submit them to the Employer's Representative for approval.

3.8 Concrete Under Water

3.8.1 Concrete shall be deposited in water only with the permission of the Employer's Representative and under his supervision.

3.8.2 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.

3.8.3 Placing of the concrete under water shall be by means of a termite, bottom-dumping bucket, or other approved method that does not permit the concrete to fall through the water without adequate protection.

3.8.4 The concrete shall not be disturbed after being deposited. No concrete shall be placed in running water.

3.8.5 Forms that are not reasonably watertight shall not be used for holding concrete deposited under water.

3.8.6 During and after concreting under water, pumping or dewatering operations in the immediate vicinity shall be suspended until the Employer's Representative permits them to be continued.

3.9 Concreting in Cold Weather

3.9.1 Unless authorized in writing by the Employer's Representative, the concreting operations shall be discontinued when a descending ambient air temperature reaches 5^0 C. When directed by the Employer's Representative, the sub-contractor shall enclose the structure in such a way that the concrete and air within the enclosures can be kept above 15^0C for a period of 7 days after placing the concrete.

3.9.2 The sub-contractor 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.

3.9.3 When directed by the Employer's Representative, all aggregates and/or mixing water shall be heated to a temperature of at least 10^0C but not more than 21^0C.

3.10 Concreting in Hot Weather

3.10.1 The concreting work shall be discontinued at the time when the ambient temperature reaches 38^0C unless the sub-contractor uses adequate means for cooling the ingredients, including use of chilled water to keep the temperature of the mixed concrete below 32^0C.

3.10.2 The surface of freshly placed concrete shall be well protected in all cases against drying by covering with wet hessian cloth or polyethylene.

3.10.3 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.

3.11 Finishing

3.11.1 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.

3.11.2 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.

3.11.3 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.

3.11.4 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.

3.12 Curing

3.12.1 Curing shall be done to avoid excess shrinkage or harmful effort to the concrete

3.12.2 The method adopted shall be effective and any special method used must be approved by the Engineer and be subject to complete supervision, there shall not be any delay in curing process.

3.12.3 Concrete shall be maintained above 10° and below 30°.and in a moist condition for 28 days after placing, except that high early strength concrete shall be maintained in a moist condition for 3 days.

3.13 Inspection and Repair of Surfaces

3.13.1 The sub-contractor 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 Employer's Representative.

3.13.2 The sub-contractor shall, on the written instruction of the Employer's Representative, 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.

3.13.3 The method of repairing and replacing the defective concrete that the sub-contractor proposes to adopt shall first be submitted to the Employer's Representative for approval before the repair work is carried out.

3.14 Concrete and Masonry Surface

Where surfaces have been treated with curing compounds, oil or other such materials, sandblasting or wire brushing shall remove the materials. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.15 Joints

3.15.1 **Construction Joints:**

3.15.1.1 Details and proposed location of construction joints is/are indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

3.15.1.2 Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

3.15.1.3 A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one 2.5 cm on horizontal joints.

3.15.1.4 Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

3.15.2 **Expansion Joints:**

3.15.2.1 Provide expansion joints where indicated in the technical drawings. Space approximately 20 meters apart, unless otherwise indicated.

3.15.2.2 Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 10 mm thick, unless otherwise indicated.

3.16 FORMWORK

3.16.1 **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.

3.16.2 **Construction Requirements**

3.16.2.1 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.

3.16.2.2 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.

3.16.2.3 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.

3.16.2.4 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 Employer's Representative plus an allowance for shrinkage or settlement.

3.16.2.5 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.

3.16.2.6 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.

3.16.3 **Removal of Formwork**

3.16.3.1 The time at which the formwork is struck shall be the sub-contractor'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

3.16.3.2 The sub-contractor shall remove all formwork without damage or injury to the concrete.

3.17 Stone Masonry

3.17.1 Skilled masons shall be employed by the sub-contractor to ensure that the stone masonry works are completed according to the technical specifications.

3.17.2 Cement and sand mortar shall be used to fill all the gaps between the stones. The mortar shall be used to give adequate bonding and fill all the gaps to provide impermeable stone wall.

3.17.3 The stones shall be installed in a way that provides best interlocking and transfer the shear forces diagonally at approximately 45°. To the extent possible the stones shall be installed so that the base of the stone –especially for the irregular shape stones- is closer to the ground i.e. "minimum potential energy" and hence maximum stability.

3.17.4 The overall surface of the stone wall shall be smooth and leveled. The pointing shall be smooth and shall be leveled with the stones (NOT grooved and NOT protruded).

3.17.5 The cement and sand mortar shall be mixed 1:4. Clean sand shall be used for the mortar and the mixing shall be done in a clean metal pan to avoid mixing with undesired materials.

3.17.6 After completing the stone masonry works the sub-contractor shall do all required back filling.

3.17.7 The sub-contractor shall place a bedding of fresh mortar at least 3 cm thick on the prepared formation. The sub-contractor shall construct this mortar bedding progressively by laying the surface stones in such a manner that the stones are always securely bedded in the mortar before it hardens.

3.17.8 The sub-contractor shall place the stones firmly against each other to provide the required paving thickness measured perpendicular to the slope. The sub-contractor shall then place additional mortar to fill all spaces between the stones completely. The finish shall be almost flush with the surface of the lining but the mortar shall not cover the stones.

3.18 Mortar and Plaster Surfaces and Bedding

3.18.1 The surfaces which are to receive a scratch or finished coat of mortar shall be roughened, brushed and washed clean and be free from all scaling, scum, loose aggregate, dirt and other foreign matter.

3.18.2 Scratch coats shall be given a rough, scratch finish and kept moist until the application of the finish coat.

3.18.3 All surfaces to receive a mortar coating shall be sufficiently and uniformly dampened immediately before the application of mortar. Concrete surface shall be kept thoroughly wet for 6 hours prior to application of mortar.

3.18.4 Cement mortar shall be used within 30 minutes from the time of mixing. Retendering will not be permitted.

3.19 Backfill Around Structures

3.19.1 To avoid interference with the construction of protection walls, retaining walls, abutments and/or wing walls for culverts the sub-contractor shall, at points to be determined by the Employer's Representative, suspend work on embankments forming approaches to such structures until the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the structures.

3.19.2 The sub-contractor shall provide tools, materials, machinery and manpower to back fill the back sides of the newly constructed stone masonry walls, protection walls, retaining walls, abutments and/or wing walls, culverts and other structures from Excavated local materials with adequate compaction, The work includes back filling with compaction of excavated material around the embankment of the retaining wall , Culverts, and water divider, the specific locations will be spotted by Employer Representative while actual implementation of the project but will not exceed from the boundaries of all structures proposed structures.

3.19.3 Unless directed otherwise, the filling around culverts, bridges, and other structures shall not be placed against any abutment or wing wall unless permission has been given by the Employer's Representative, but in any case not until the concrete or masonry has been in position for 14 days. The backfill shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of the work in this regard shall be approved by the Employer's Representative.

3.19.4 Where it may be impracticable to use power rollers or other heavy equipment, the compaction shall be carried out by mechanical tampers or other methods approved by the Employer's Representative. Care shall be taken to see that the compaction equipment does not hit or come too close to any structural member to cause any damage to them or excessive pressure against the structure.

3.19.5 The back filling layers should not be more than 15-20 CM each layer, in order to get proper compaction

3.19.6 Deep excavated areas shall be supported against collapse for safety reasons.

3.20 Clearance of Site

3.20.1 During the execution of the Works, the sub-contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any sub-contractor's equipment or surplus materials. The sub-contractor shall clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

3.20.2 Sub-contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works the sub-contractor shall leave such part of the Site and the Works in a clean and safe condition to the satisfaction of the Employer's Representative. Except that, the sub-contractor shall be entitled to retain on Site, until the expiry of the Contract Period, such sub-contractor's Equipment, Materials and Temporary Works as required by him for the purpose of fulfilling his obligations under the Contract.

3.20.3 The sub-contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the side to the satisfaction of the Employer Representative before the work is considered as complete.

4 Measurement

4.1.1 All the quantities mentioned in the BOQ, drawings and the SoW are estimated quantities. The sub-contractor shall be paid based on actual quantities. Actual quantities shall be measured by the sub-contractor and approved by the Employer Representative.

4.1.2 The excavations quantities shall be based on the volume of undisturbed materials i.e. (in-situ) or (bank).

5 Environmental Specifications

5.1.1 All the works shall be implemented in compliance with the Standard Norm environmental procedures set forth in the Environmental Procedures]

5.1.2 All the works shall be implemented in compliance with the applicable local environmental procedures

5.1.3 The sub-contractor shall ensure dust control by sprinkling the appropriate amount of water during the earthworks, excavations, compaction and surface leveling.

5.1.4 The sub-contractor shall ensure that all debris and trash resulting from construction works are removed promptly from the canal and hauled to the dumping area approved by local authorities.

5.1.5 The sub-contractor shall NOT: Demolish a farm/village structure including but not limited to: mud walls, houses, roads, culverts, bridges…etc. Cut a tree whether private or public.

5.1.6 DO NOT Change the water flow direction or change the design cross section of the canal.

5.1.7 Dump trash or debris in the canal or the adjacent fields; all debris and trash shall be removed from the project site and hauled to a dumping area approved by local authorities.