

# **SECTION – 6**

**Employer's Requirement**

**Technical Specification**

**Islamic Republic of Afghanistan**

**National Water Affairs**

**Regulation Authority**

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# TECHNICAL SPECIFICATIONS

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## **PART 1**

### **1. GENERAL**

#### **1.01 Preamble**

The general Specifications shall form a part of the contract and shall be read in conjunction with the other Bidding Documents. At the time of issuing the Bidding Documents, the Engineer may issue Special Specifications modifying, amending supplementing the requirements spelt out in the general

specifications. In such a case, in case of conflict, the provisions in the Special Specifications shall prevail over those in the general Specifications. Any clause in this specification which relates to work or materials not required by the Bills of Quantities or subsequently by a variation or extra works order shall be deemed not to apply. The SI system shall be the official system of units.

### **1.02 Workmanship and Materials**

All workmanship shall be of the best quality appropriate to each category of work. Except where otherwise stated or approved by the Engineer, all materials used in the Works shall be of the best quality of their respective kinds as specified or described in the Specification, Drawings and Bills of Quantities and shall comply wherever possible with the current issue of the appropriate standard published by the American Standard Institution, British, India Standards Institutions, or other equivalent national standard proposed by the Contractor and approved by the Engineer.

The Contractor shall use locally produced materials in preference to imported materials provided that they comply with the Specification and are available in sufficient and timely quantities Temporary Works and Care during Construction The contractor shall construct and maintain all necessary channels, diversions and other temporary works necessary to ensure that irrigation water supplies are not interrupted during rehabilitation construction works; shall furnish all materials required therefore; and shall furnish, install, maintain and operate all necessary pumping and other equipment (if necessary) for maintaining water supplies around the rehabilitation works.

After having served their purpose, all temporary works at the construction site shall be removed in a manner approved by the Engineer, and such areas after those are removed shall be levelled and graded to the extent required to prevent obstruction in any degree whatever and maintaining the designed function of the structure.

The contractor shall be responsible for and shall repair at his expense any damage to the foundations, structures, or any other part of the works caused by floods, water or failure of any part of the temporary diversion or protective works.

### **1.03 Survey Datum**

The levels shown on the Drawings are with reference to a specific benchmark in the project area, and whose location and value are shown on the Drawings. It shall be the Contractor's responsibility before commencing the Contract to confirm with the Engineer, the location and value of the established benchmarks. The Contractor shall establish within the project area benchmark and reference points for use during the construction work. The Engineer shall approve the location of each benchmarks and reference point.

### **1.04 Setting Out of the Work**

The contractor shall be entirely responsible for accurate setting out of the works including staking of canal centre lines, check dam's axis and reference pegs based on the information supplied from the drawings and the instruction given by the Engineer. Before commencement of the work in the site, the contractor is responsible to re-work all the elevations, lines, coordinates etc. to confirm the structure's actual location or re-establish it in case of geographical changes on the site. For such parts of the Works where no setting out details are given in the drawings, the Engineer will supply setting out data or show the exact location on site during the course of the Contract.

### **1.05 Cleaning and Grubbing**

Site clearance shall be carried out only over the minimum area required by the Contractor to carry out the works and the extent of all clearing, whether to be paid for under items in the bill of quantities or not, shall

be agreed with the Engineer before the work is commenced. The Contractor shall give written notice to the Engineer at least ten days in advance, of his intention to commence site clearance to enable arrangements to be reached, and for the Engineer to ensure that any compensation arrangements are completed. Work shall commence only with the written authority of the Engineer.

The Contractor shall remove buildings, walls, gates, fences and other structures and obstructions, grub up and remove trees, hedges, bushes and shrubs and clear the site of the works at such time and to the extent required by the Engineer. The materials so obtained shall so far as suitable be reserved and stacked for further use. All rubbish and material unsuitable for use shall be destroyed or removed from the site. In areas of bulk excavation where top soil has to be excavated this shall be removed and stacked on site. After completion of construction, it shall be spread over the disturbed ground; any surplus being disposed of as directed by the Engineer.

No allowance will be made for cutting and removal of crops, grass, weeds and similar vegetation. The cost of all such works will be held to be included in rates entered in the Bills of Materials for site clearance.

During the Contractor's operations, the removal of certain trees and shrubs may be required, in which case, the Contractor shall remove such trees and shrubs to remain after seeking prior approval from the Engineer. All trees and shrubs to remain in place shall be protected from damage. Where clearing is required, all combustible materials from clearing operations shall be burned or removed from the Site for otherwise disposed of as directed by the Engineer. The Contractor shall at all times take special precautions to prevent fire from spreading.

#### **1.06 Safety of Adjacent Structures or Works**

The Contractor shall at his own expense provide and erect to the approval of the Engineer such supports as may be required to protect efficiently all structures or works which may be endangered by the execution of the Works and shall remove such supports on completion of the Works or otherwise take such permanent measures as may be required by the Engineer to protect the structures or works.

#### **1.07 Work Programme**

The Contractor shall submit to the Engineer a work programme showing how he proposes to carry out the Works by the intended Completion Date. The programme shall show the start and completion dates of the various activities, in order to complete the entire project by the Intended Completion Date. The Contractor will not start any activity, or part thereof, until and unless the Engineer has given his written approval. The Contractor shall submit a written request at least 48 hrs before concrete pour.

#### **1.08 Medical Arrangements**

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

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

#### **1.09 Transportation of Plant and Equipment**

All cost incurred by the Contractor of transportation and subsequent removal of the construction plant and equipment shall be deemed to be included in the unit prices.

#### **1.10 Reports and Photographs**

No separate payment shall be made for preparation of all documents, correspondence, returns and reports, photographs, etc. to be prepared by the Contractor and submitted to the Engineer in accordance with the provisions of the contract. The Contractor will be required to provide the Engineer with photographs of the



various stages of the work, particularly those relating to approval of the works. These photographs should be taken at the same location and from the same angle for different stages of the same work and scale rules (staff gauge) should be used to indicate depths where required.

### **1.11 Maintenance of Flow**

The Contractor shall at his own expense maintain the flow in all canals, drains, streams, water courses and rivers which may be encountered during the construction of the works.

### **1.12 Dewatering**

The Contractor shall take all risks regarding surface and sub soil water from whatever source and shall so deal with and dispose of such water in a manner approved by the Engineer to ensure that the excavations are kept dry. The Contractor shall provide all necessary plant, labour and materials required and all costs incurred shall be deemed to be included in his rates.

The Contractor shall be responsible for damage to the Works or other property arising from insufficient or excessive dewatering and shall make good the same as soon as possible to the complete satisfaction of the Engineer and other relevant authorities at his own expense.

### **1.13 Units of Measurement**

Unless specifically stated to the contrary, the units of measurement to be used throughout the Contract shall be based on the SI. System. Abbreviations, whether singular or plural, shall be as follows:

Kilometre	km
Metre	m
Millimetre	mm
Hectare	ha
Square meter	m <sup>2</sup>
Cubic metre	m <sup>3</sup>
Litre	l
Millilitre	ml
Tonne	t
Kilogram	kg
Gram	g

### **1.14 Method of Measurement**

All measurements shall be made according to the description of the methods of measurement contained in the CPMO standard documents relating to the preparation of Bills of Quantities.

### **1.15 Survey of Completed Structures and preparation of “As built drawings”**

The Contractor in coordination with the Engineer shall carry out survey of all completed structures to determine their final location for the purpose of preparing “as-built” drawings.

**1.16 Mobilization:**

Mobilization shall include all activities and associated tasks for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the construction site

**1.17 Site Cleaning and Demobilization:**

Site cleaning and demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site clean-up of offices, buildings, and other facilities assembled on the site

**1.18 Contractor's Offices**

The Contractor shall make his own arrangements, at his own expense, for all local accommodation he may require for offices, yards stores labour camps etc. and all buildings and all services in connection therewith which are required for the efficient execution of the Works

## PART 2

### 2. EARTHWORKS

#### 2.01 Definitions

The following definitions of earthworks materials shall apply to this and other clauses of the Specification in which reference is made to the defined materials:

"**Suitable material**" shall comprise all material which arises from excavations within the Site and which is approved by the Engineer as acceptable for use in the Works.

"**Unsuitable material**" shall mean other than suitable material and shall comprise:

- material from swamps, marshes and bogs;
- logs, stumps and perishable materials;
- material susceptible to spontaneous combustion; and
- Clay of liquid limit exceeding ninety (90) and/or plasticity index exceeding sixty-five (65).

"**Common**" material shall mean all material other than that defined as "rock".

"**Rock**" shall mean any hard natural or artificial material requiring the use of approved pneumatic or hydraulic breakers and tools for its removal but excluding individual masses less than 1.0 m<sup>3</sup>.

#### 2.02 Classification of Excavation

Following classes of excavation shall apply:

**Common excavation:** this comprises all excavation made in all kinds of soil or soil and sand mixed with pebbles, boulders in the river/seasonal stream bed or banks or canal profiles.

**Rock Excavation:** Rock will include any hard material complying, in the opinion of the Engineer, with the definition given in Clause 2.01.

**Borrow Excavation:** shall be limited to excavation taken from borrow pits and cut areas.

#### 2.03 Excavation

All excavation shall be carried out to the lines and levels shown on the drawings or to such lines and levels as the Engineer may direct. The Contractor shall trim all permanent excavation to the lines and levels shown on the drawings. Excavation shall generally be executed in such a manner as to ensure that the side slopes, as shown on the drawings, are not in any way endangered by undercutting.

In case where the U/S floor level of the structure is lower than the natural bed level, the excavated line should join the natural bed level line in a smooth fashion (gentle slope) to the satisfaction of the engineer on the U/S side.

As far as practicable, all suitable materials from the excavations shall be used in embankment and backfill for structures. The Contractor shall dispose of unsuitable or excess soil of the excavated materials in a place that is acceptable to the local community and so that they do not interfere with proper functioning of the works.

All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavation in the soundest possible condition. Any damage to the work due to the Contractor's operations,

including shuttering to the material beyond the required excavation lines, shall be repaired at the expense of and by the Contractor. Any and all excess excavation or over excavation performed by the Contractor for any purpose or reason, except as may be directed in writing by the Engineer, and whether or not due to fault of the Contractor, shall be at the expense of the Contractor. Excavation taken out to a greater depth than is necessary shall be filled to the required level with concrete of appropriate class or other material approved by the Engineer. All such excess excavation and over excavation shall be filled at the expense of and by the Contractor.

The bottom and side slopes of excavation against which concrete is to be placed shall be finished accurately to the dimension shown on the drawings or as prescribed by the Engineer and the surface so prepared shall be moistened with water and tamped or rolled with suitable tools or equipment for the purpose of securing a firm foundation. If at any point the natural foundation material is disturbed during the excavation process or otherwise, it shall be compacted in place, or it shall be removed and replaced with suitable earth materials or concrete at the expense of the Contractor.

#### **2.04 Removal of topsoil**

Immediately after clearing operations and before excavation commences, topsoil shall be removed, where and to such depth as directed, from the surfaces of borrow area, the stockpile sites, the areas to be back-filled and the areas of the Works where surface excavation is required. Removal of topsoil from disposal areas will not be required. Topsoil shall be removed within 2m outside the limits of required excavation and the surface shall not be disturbed beyond these limits. Topsoil is defined as the surface or top layer of soil, including fine roots, the herbaceous vegetation and overlying grass and is characterised by the presence of organic matter.

#### **2.05 Embankment Earth-filling**

Material for filling shall be obtained from approved sources or selected from excavations and shall contain no organic, plastic or undesired perishable matter. It shall be graded to ensure a dense, stable and homogeneous fill when compacted. All embankments shall be constructed to the lines and levels shown on the drawings or as directed by the Engineer.

During placing and spreading, the materials should be thoroughly compacted by hand tampers or mechanical compactors. The distribution of the materials shall be such that the tamped materials will be homogenous and free from lenses, pockets, streaks or other discontinuities.

#### **2.06 Trench Excavation**

Trenches for all pipe lines and culverts shall be excavated to required lines and bottoms taken out to the exact gradients using profiles and boning rods or other suitable devices. The trench shall be of sufficient width to enable the pipes to be properly laid and jointed. No excavation shall be filled in or covered with concrete until the Engineer has inspected it and the Contractor has been authorised to proceed with the works. All surplus excavated materials from such excavation not required for refilling shall be carted away to tips or otherwise disposed of, as directed. All excavations shall be kept dry and all bating and pumping timbering shoring and supporting of sides that may be required, and any refilling, ramming and disposal of surplus materials necessary in carrying out the excavations and back filling of trenches shall be included in the prices of excavations. Special care shall be taken to provide a solid bed for the barrels of the pipes and where a concrete bed is not specified, the floor of the trench shall be properly shaped to receive the socket. The length of the trench opens ahead of pipe laying shall not exceed 200 m.

Trenches shall have a width not less than that shown on the drawings and shall have vertical sides unless the Engineer has approved the use of sloping sides in lieu of timbering. The bottom 50 mm of trench shall be left undisturbed until immediately before the pipe is to be laid when it shall be trimmed accurately by hand to the correct grade. If no bedding is required joint holes shall be formed as necessary so that the

pipe, when laid is bedded on the entire length of its barrel on the firm and undisturbed bottom of the trench.

### **2.07 Rock cutting in trenches for pipes**

Where solid rock is met within trenches, it shall be cut up to a depth of 150 mm below the intended levels of the bottom of the pipes and replaced with 150 mm of concrete of the appropriate class or suitable bedding material as specified or otherwise directed by the Engineer. In measuring such rock excavation, the contractor will be allowed a width of 300 mm more than the external diameter of the pipes to a level of 150 mm below the bottom of the pipes. The prices inserted in Bills of Quantities shall be held to cover all expenses in connection with excavating the rock, back filling after laying of pipes and disposing of surplus materials as directed by the Engineer.

### **2.08 Refilling of slips, over excavation, etc.**

The Contractor shall fill with approved material and consolidate all voids formed by over excavation, slips, rain, flooding or any other cause whatsoever at his own expense and to the satisfaction of the Engineer.

### **2.09 Back filling**

In all excavations where the excavated material is required to be returned to the excavation as backfill, suitable material shall be set aside during excavation and shall be kept free from contamination with top soil, vegetable matter or other unsuitable material, failing which the Contractor shall at his own expense import suitable material from elsewhere. Back filling shall not be placed in waterlogged excavations. Backfill material which is in the opinion of the Engineer too wet, shall be used until it has dried out sufficiently. Excessively dry backfill material shall be watered during backfill. The Contractor's rates shall allow for any additional costs these measures any may entail.

No back filling shall be carried out without the permission of the Engineer that will normally only be given when the Work has been inspected, tested and approved. After such permission has been given back filling shall be carried out as soon as possible. The utmost care shall be taken to ensure that no damage occurs to the Works and compaction methods employed shall be approved by the Engineer and shall ensure that excessive loads are not placed on pipes or structures upon or around which the backfill is being placed.

Unless specified otherwise all back filling shall be carried out in layers not exceeding 150 mm, such layers being brought up evenly around and above the work and well consolidated before the next layer is placed. Where compaction is carried out by hand, rammers of not less than 4 kg in weight shall be used and the ratio of men employed in ramming and filling shall be two to one.

### **2.10 Back filling of trenches**

Back filling of all structures like check dams, trenches... up to a level of 150 mm above the pipe shall be carried out with suitable fine material with a maximum particle size of 20 mm and shall be placed in layers not exceeding half the diameter of the pipe, kept at the same level on each side of the pipe, and carefully rammed under and around it to a density of 90% Modified AASHTO.

Where embankments are required to ensure sufficient cover to the pipes they shall be constructed to the dimensions shown on the drawings or indicated by the Engineer. They shall be built up evenly over their full width in layers not exceeding 150 mm and consolidated using tampers or mechanical compacting equipment. The cost of trimming the sides to shape and forming drainage ditches at the toe shall be included in the rates.

## **2.11 Borrow Pits**

If because of an insufficiency of suitable material for use in back filling of trenches, road formation or if because of other circumstances the Engineer so agrees or orders, the Contractor shall supply such materials from borrow pits. The Contractor shall obtain the approval of the Engineer to the location of borrow pits and shall adhere to instructions in regard to the area, width, depth and slope of the borrow pits and also to the depth of overburden if any, which has to be removed. Prior to excavating materials from borrow pits, the Contractor shall strip all unsuitable overburden and lay it aside. The use as fill of this and other unsuitable material will not be permitted.

After the use of a borrow pit has been finally discontinued, the overburden and any other unsuitable material previously laid aside shall be replaced in the pits, spread and levelled as required. The sides of the borrow pits shall be graded and the whole area shall be left in a tidy, regular and self-draining state, all to satisfaction of the Engineer. In case of payment for imported fill such fill will be measured solid, after compaction net as shown on Drawings. Supply of material from borrow pits shall, except where otherwise specified, be deemed to cover supply, spreading and compaction of the fill in the works and any other costs the Contractor might have including negotiations with owners, stripping and handling of overburden and the satisfactory reinstatement after completion.

## **2.12 Disposal of Surplus Material**

The Contractor shall not, during the construction of the works, allow any accumulation of surplus earth, rock, clay or other material removed from the excavations and not required for refilling. As trenches are refilled or work is completed the surplus material from excavations, bricks and other rubbish or waste matter shall at once be removed, the surface properly restored and sites, roadways and footways left clear.

In general, and if approved of by the Engineer surplus soil, but not rubbish or rock, from excavations shall, without extra cost over schedule rates, be spread evenly over areas adjacent to such excavations to form a layer not exceeding 100 mm thick, provided always that such spreading does not interfere with other work under this Contract, the work of other Contractors, with the natural flow of storm water, or with the cultivation or other use of the land.

On no account shall the Contractor start making dumps of surplus materials except at places approved of by the Engineer.

## **2.13 Compaction**

Compaction shall be carried out using suitable equipment or hand rammers. Earth shall be slightly moist at the time of compaction and compacted in layers not exceeding 150 mm thick where machinery is used and 100 mm thick where hand-held equipment is used. Granular fill shall be compacted to ensure that it has reached minimum volume. Filling around structures shall be carried out carefully to avoid damage.

## **2.14 Random backfill at 95%**

Random backfill at 95% shall be deposited in horizontal layers not more than 150 mm thick after being compacted, and shall be brought to the moisture content required for the purpose of compaction as instructed by the Engineer and the moisture content shall be uniform throughout each layer. The density of compacted random backfill shall not be less than 95 per cent of the maximum dry density obtained by compaction or, where the backfill is a cohesion less, granular material to a field dry density not less than 1950 kg/m<sup>3</sup>. Random backfill shall be placed carefully in the vicinity of any structure so as not to damage the structure.

## **2.15 Measurement of and Payment for Earthworks**

The tendered prices for earthworks shall include for all associated work such as setting out in plan and in level, side sloping, timbering, shoring strutting, storm water protection, dewatering, draining, trimming to line and level or grade, removing tree roots and obstructions as specified disposal of soil and surplus material, testing to confirm compliance with the specification and all other contingent works not billed specifically.

All excavations shall be measured net to the lines and levels specified on the drawings or otherwise by the Engineer. Where not specified by the Engineer to the contrary sides of excavations shall be taken as vertical. The depth of excavation shall be taken as the depth from the actual cleared ground level to the formation level specified by the Engineer or, in the case of trench excavation for sewer, water, drainage or other pipes or culverts to the invert level specified by the Engineer. The Contractor shall be deemed to have allowed in his rates for any additional excavation:

- Necessary to accommodate the thickness of pipes or culverts and the specified bedding.
- Necessary to accommodate the joints of check dams or culverts...
- Due to inadvertent over break.
- Due to over break in rock specified elsewhere for trench, foundation excavations for structures.

## **PART 3**

### **3. CONCRETE WORKS**

#### **3.01 Concrete General**

Concrete shall consist of cement, graded aggregate and water thoroughly mixed, placed and compacted as specified.

Before starting concreting the Contractor shall obtain formal written permission for concreting from the Engineer or his representative on site. The Engineer or his representative shall allow concreting after ascertaining the required lines and levels, suitability of formwork, availability of required plant and labour, proper fabrication and spacing of the steel bars and quality and quantity of cement and aggregates. Further, air-entraining admixture (AEA) to be added during mixing of concrete according to ASTM C260. In-place, air content shall range 5 to 6 percent of the volume of concrete. For all concrete works (PCC/RCC/Mass) crushed aggregates should be used.

#### **3.02 Cement**

All cement shall be from reputable manufacturers and conform to international standards. Cement shall be stored where it cannot be damaged by rain or moisture and shall be free of lumps when used. Sulphate-resisting cement shall be used for foundations and ordinary Portland cement for other works or as directed by Engineer or his representative.

#### **3.03 Concrete Aggregates**

All concrete aggregates (sand & gravel) shall be furnished by the Contractor from any source approved by the Engineer. They shall be free from organic material, lumps of soft material, clay, chalk, lime, peat, loam, soft clayey shale or decomposed stone, vegetable and other impurities that may be harmful to concrete.

Sand for concrete shall be free of stones larger than 2 mm and not include significant amounts of silt and clay. If sand, when dried after wetting, adheres together then it shall be considered unsuitable.

Gravel for concrete shall be uniformly graded and consist of hard and dense rock. The gravel shall be free of materials finer than 5 mm and the surface shall be clean. Gravel for use in reinforced concrete shall be crushed rock. Generally, natural gravel and/or crushed rock particles shall be spherical or cubical in shape. The maximum nominal size of the gravel shall be eighty (80) mm in mass concrete, forty (40) mm in structural concrete and twenty (20) mm in other thin concrete structures like slabs.

#### **3.04 Water for Concrete**

Clean fresh water is to be used for the mixing of all concrete and mortar. Water that is safe to drink shall be considered suitable for making concrete.

#### **3.05 Steel Reinforcing Bars**

Steel reinforcement shall be steel bars manufactured to international standards with a minimum yield stress of 250N/mm<sup>2</sup> or high yield steel grade 4501425 as indicated in the Drawings and Bill of Quantities or as directed and must comply with BS 4449, BS 4461 or another approved standard. Steel fabrics shall comply with BS 4483.

The Contractor shall be responsible for the accuracy of the cutting, bending and placing of the reinforcement. Reinforcement will be inspected for compliance with the requirements as to grade, size, and shape, length, splicing locations, position and amount after it has been placed.



Reinforcing bars or fabric shall be accurately placed and secured in position so that there will be a clear distance of at least 25 mm between the bars or fabric and any adjacent embedded metal work and so that the bars and fabric will not be displaced during the placing of concrete, and the Contractor shall ensure that there is no disturbance of the reinforcing bars or fabric in concrete that has already been placed.

Chairs, hangers, spacers and other acceptable metal, plastic or concrete supports may be furnished and used by the Contractor for supporting reinforcing bars or fabric.

All reinforcement bars shall, immediately prior to placing, be free from loose mill scale, loose rust, oil, grease, dirt or other foreign matter. Reinforcement is to be placed and secured in the exact position as indicated on the drawings and kept in the correct position in the forms without displacement during the process of vibrating, tamping and ramming the concrete in place. All free ends of the plain round bars shall have hook as shown on the drawings or as directed by the Engineer. Bars shall be bound together with best mild steel wire which shall be twisted tight with proper pliers. The free ends of the binding wire shall be bent inward.

Minimum concrete cover for reinforcement, mass concrete, PCC should be 50 mm measured from the outside of the bar, unless shown on the drawings or directed by the Engineer.

The Contractor must inform the Engineer of the completion of any reinforcement in time, in order to facilitate its inspection and check of conformity with the Working Drawings well before the concrete is placed. Relevant formalities shall be agreed upon between the Contractor and the Engineer at the appropriate time.

### 3.06 Drawings and Bar Lists

Steel reinforcing bars or fabric shall be placed in concrete where shown on the Drawings or directed.

A bar bending schedule may be provided for the Contractor's convenience, but does not constitute a Contract Document the Contractor shall prepare for additional structures, in an approved manner, reinforcement detail drawings showing reinforcement bar lists, bar placement details and bar bending details for each structure, if not provided by the Engineer.

All reinforcing bars shown on the reinforcement detail drawings shall be identified on the bar lists in accordance with the standard reinforcing bar shapes as shown on the Drawings.

All bar lists shall be identified with the relevant reinforcement detail drawing and all bars scheduled on the bar lists shall be defined and dimensioned in a manner approved by the Engineer.

### 3.07 Concrete Classes

The classes of concrete to be used in the Works shall be as shown on the Drawings, Bills of Quantities or as directed by the Engineer. The concrete is classified on the basis of its compressive strength at twenty eight (28) days as well as the maximum size of the aggregate as shown below and nominal mix proportions shall be used only as a guide.

Concrete Max Slump(mm)	Concrete Class	Characteristic Cube Strength at 28 days (kg/cm <sup>2</sup> )	Maximum Aggregate size(mm)	Maximum water/ cement ratio (%)	Approx. cement content	Nominal Mix proportions (Kg/m <sup>3</sup> )
75	M25	250	20	45	400	1 : 1 : 2
75	M20	200	20	45	400	1 : 1.5 : 3
75	M15	150	40	50	310	1 : 2 : 4

100	M10	100	80	55	220	1 : 3 : 6
100	M5	50	20	60	170	1 : 4 : 8

Type	Description
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M25 & M20      Reinforced concrete for all RCC, Mass concrete and PCC works, etc.

### 3.08 Consistency

The concrete shall be of such consistency that it can be readily transported, placed and compacted in the Works without segregation of the materials. The resulting concrete shall be uniform and free from honey-combing. The consistency of the concrete as determined by the slump test shall be within the range of 5 cm to 7.5 cm. Samples for slump determination will be taken from the concrete during placing in the formwork.

### 3.09 Mixing Concrete by Machine

Unless otherwise authorized by the Engineer, concrete shall be machine mixed at site.

Where the concrete is to be mixed in machines, these shall be of the batch mixing or other approved type. The machines shall ensure that all the concreting materials including the water are thoroughly mixed together before any portion of the mixture is discharged. The machines must be capable of discharging their contents while running.

All classes of concrete shall be mixed for a period not less than 1½ minutes after all materials, including water, are in the mixer. All mixing water shall be introduced before one-fourth of the mixing time has elapsed. The mixers shall not be loaded beyond their rated capacity, nor be operated at a speed in excess of that recommend by the manufacturer, generally between 15 to 20 revolutions per minute. The mixer shall produce a concrete of uniform consistency and appearance. All mixing equipment's shall be cleaned before commencing mixing and shall be kept free from set concrete.

**Concrete for All Mass Concrete works, RCC works, & Stone Mortars shall be mixed by Machine, Hand Mixing is not allowed.**

### 3.10 Mixing Concrete by Hand

Where concrete is mixed by hand, this shall be done as near as practicable to the site where it is to be deposited. Clean mixing bankers of platforms of sufficient areas for the proper execution of the work shall be provided. These platforms if constructed of timber shall consist of planks closely jointed so as to avoid the loss of any grout or liquid from the wet concrete. The whole of the aggregate and cement shall be turned over on the banker in a dry state at least three (3) times. The water shall then be added gradually through a rose head, after which the materials shall again be entirely turned over in a wet state at least three (3) times before leaving the banker.

**Mixing Concrete by hand is allowed only for small quantity works of less than 1M3**

### **3.11 Foundation Preparation for Concrete**

Before placing concrete on foundations, the Contractor shall remove from all such surface oil, objectionable coatings, loose or unsound fragment of earth mud, debris and standing water, to the satisfaction of the Engineer and he shall keep such surfaces clean and free from standing water during concreting operations. Where new concrete is to be deposited on or against rock, the surface of the rock shall be toothed to form an adequate bond

### **3.12 Placing of Concrete**

The arrangements for placing concrete are to be such that in all cases the material may be conveniently handled and placed in the required position without re-handling or segregation. Except where otherwise directed, concrete shall not be placed unless the Engineer or his representative is present and has previously examined and approved the positioning, fixing and condition of reinforcement and any other items to be embedded and the cleanliness, alignment and suitability of the containing surfaces or formwork.

In placing concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On the bottom of beams or slabs, where the congestion of steel near the forms makes placing difficult, a layer of mortar of a composition compatible with the required concrete strength as directed shall be first deposited to cover the surface to a depth of approximately 3 cm.

Concrete shall not be placed in or in contact with standing or running water unless so specified or approved. Concrete shall not be placed against placed concrete which has been in position for more than 30 minutes unless a construction joint is formed as hereafter specified. When stoppage of concreting operations occurs for any reason, construction joints shall be placed. Before concreting operations are resumed, the surface of the concrete shall be cut or chipped to remove all laitance and to expose the aggregate.

Concrete as reinforced concrete work shall be deposited in small quantities in a plastic state with a water cement ratio such to give the specified strength. The depositing of concrete in individual members shall be continued without stoppage up to an approved pre-arranged construction joint or until the member is completed and shall be finished off in such a manner that the junction of members shall be monolithic unless otherwise specified.

### **3.13 Concreting in High or Low Ambient Temperature**

Where the ambient temperature exceeds thirty-two degrees Celsius (32°C), the Contractor shall take special measures in the mixing, placing and curing of concrete. The temperature of the concrete when deposited shall not exceed thirty degrees Celsius (30°C). The Contractor shall carry out all necessary special measures to ensure that the maximum concrete temperature after placing shall not exceed thirty degrees Celsius (30°C) at the time of placing. During placing suitable means shall be provided to prevent premature stiffening of the concrete placed in contact with hot surfaces. The Contractor shall not mix and place concrete when the ambient temperature falls below three degrees Celsius (3°C).

### **3.14 Concreting in Adverse Weather**

No concreting will be allowed to take place in the open during storms or heavy rains/ snowfall. Where strong winds are likely to be experienced additional precautions to ensure protection from driving rain and dust shall also be taken. The Engineer may withhold approval of commencement of concreting until he is satisfied that full and adequate arrangements have been made.

### **3.15 Vibration of Concrete**

Except where otherwise permitted by the Engineer, concrete shall be fully compacted throughout the full extent of the layer and shall be brought up in level layers of such depth that each layer is readily and properly incorporated with the layer below with the use of internal vibrators or by spading, slicing or ramming. It shall be thoroughly worked against formwork and around any reinforcement or embedded items without displacement.

The duration of vibration shall be limited to that required to produce satisfactory consolidation, without causing segregation. Vibration shall, on no account, be continued after water or excess grout (if any) appears on the surface.

### **3.16 Curing and Protection**

The Contractor shall take adequate measures to ensure that the concrete shall be kept damp continuously for a minimum of three (3) days after casting or for such other time as the Engineer may direct. After removal of this covering (layer of sacking, canvas, Hessian, straw mats or similar absorbent material or a layer of sand), the concrete shall then be sprayed with water for minimum period of a further fourteen (14) days.

All concrete liable to be affected by running water or wave action shall be adequately protected from damage during the setting period and all temporary protection works shall be to the satisfaction of the Engineer.

### **3.17 Joints in Concrete**

Joints in concrete shall be provided in manner and position as shown on contract drawings. In the case of water retaining structures, joints shall be made water-tight by the provision of a continuous water stopper, with suitable water resistant filler material and sealant as approved by the Engineer.

The expansion joints in mass concrete should not be exceeded than 10m or according to the drawings and the contraction joints should be varying in 2-4m interval in both directions.

### **3.18 Construction Joints**

Definition: Concrete surfaces, upon or against which concrete is to be placed and to which new concrete is to adhere, that have become so rigid that the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints.

Location of Construction Joints: The Contractor shall submit for approval, drawings showing his proposed location of construction joints not less than 30 days before placing concrete.

Forming Construction Joints: Construction joints shall be approximately horizontal or vertical unless otherwise shown on the Drawings or directed and shall be given the prescribed shape by the use of forms, where required, or by other means that will ensure suitable jointing with subsequent work; provided that unless otherwise shown on the Drawings, key-ways will not be required at construction joints. All intersections of construction joints with concrete surfaces which will be exposed to view shall be made straight and level or plumb.

### **3.19 Joint Sealer**

The joint sealing material must be resistant to oil, the most common chemicals and sunlight. It shall be of permanent elasticity, be suitable to carry the structural deformations and must possess an outstanding adhesion to the concrete. The elastic extension must be at least 150 % and the resistance to heat shall be between 50 degrees Centigrade and +120 degrees. Centigrade, which are to be confirmed by submission of verified test certificates.

Joint sealer shall be the make of a recognised manufacturer. Joint sealer shall be supplied with primer coats, backing material and/or bond breakers to the joint fitter, as required by the manufactures recommendations.

The Contractor shall submit to the Engineer a statement from the manufacturer(s) of the joint filler and sealing materials, that these materials are suitable under the prevailing local and structural conditions.

### **3.20 Water stopper**

Size and Material: Water stopper, nominally 225 mm wide, shall be placed in joints of concrete structures as shown on the Drawings or as directed. The water stopper shall be of extruded polyvinyl chloride complying with BS 2571: Class 3, Compound Type G4. The water stopper shall be of sufficient stiffness so that they remain in their correct position during concreting. The type shall suit the particular location in the structure in which the water stop is to be placed and the pattern shall be such that concrete can be placed all around it with complete consolidation and no voids or crevices.

Water stopper used in each location shall include at least on approved nailing strip so located that the efficiency of the water stop is not impaired, shall have a minimum thickness of 5 mm and shall be as approved. The width of the water stop shall be within a tolerance of 10 mm of the nominal width exclusive during storage. The Contractor shall store the water stopper in such a way that the material does not deteriorate during storage.

Joints: The number of joints in the water stopper shall be the minimum practicable and all joints and bends shall be made as approved by the Engineer. The number of straight field joints shall be kept to a minimum and all 'Tee' and 'Cross' joints shall be factory produced. The Contractor shall protect the water stopper against perforation or damage during the progress of the work. All joints shall be made in such a manner as to ensure:

- that the material is not damaged by heat, searing or by the application of cementing materials;
- that the splices have a tensile strength not less than 80 per cent of that required of the specified material;
- that the splice is watertight and free of air bubbles, and

### **3.21 Form Work**

Formworks for concrete shall be constructed from materials of sufficient strength and supported to ensure that there is no deflection when concrete is placed. The formwork shall conform to the shapes, lines and dimensions of structures shown on the drawings. Where the concrete finished surface is exposed, the formwork shall be of good quality and free of gaps. Formwork shall not be removed until the concrete has obtained sufficient strength. Normally, formwork can be removed from walls after 2 days and from beneath slabs after 2 weeks.

The minimum periods between concreting and the removal of forms shall be as follows:

- Sides of beams, walls, columns and piles      24 hours
- Soffits of secondary slabs (props left in)                      4 days
- Soffits of main slabs (props left in)                      8 days
- Soffits of beams (props left in)                      8 days
- Removal of props - secondary slabs                      10 days

- Removal of props - beams and main slabs 21 days
- Arch centres, wedges eased 8 days
- Arch centres, struck 21 days

The times in the above table are given as a guide and are based on average weather conditions and the use of Ordinary Cement. They may be changed if other types of cement are used, subject to the Engineer's agreement. Formwork shall be constructed so that it can be removed without undue shock or vibration and so that side shutters of members can be removed without disturbing the soffit shutters; if the contractor wishes to leave some of the props in place when the soffit shutters are removed, these props shall not be disturbed during the striking. The detailed arrangements of the props shall be submitted in advance to the Engineer. In the case of heavy loading, folding wedges shall be provided. For pre-stressed units the side shutters shall be eased as early as possible and the soffit shutters shall permit movement of the units when the pre-stress is applied. All formwork must be removed without damage to the concrete.

### **3.22 Concrete Surface Finish**

The concrete surface shall be thoroughly worked during the operation of placing by means of a broad tined fork or concrete spade of an approved type. The working shall be such as to force all coarse aggregate from the surface by scree ding and trowelling with a wood float to produce a smooth finish free from water and air pockets or honey comb. Scree ding shall be carried out, following compaction of the concrete, by the slicing and tamping action of a screed board running on the top edges of the formwork or scree ding guides to give a dense concrete skin true to line and level. Wood float trowelling shall be carried out after the concrete has stiffened and the film moisture has disappeared.

### **3.23 Pre-Cast Concrete**

With the approval of the Engineer the Contractor may pre-cast members which were specified to be constructed in-situ. Pre-cast concrete units shall be of concrete strength as indicated on contract drawings or as indicated by the Engineer. The concrete pre-cast units shall be cast in horizontal position, unless otherwise directed by the Engineer. In general, same concrete quality measures should be applied as for other concrete component. Generally, members which are structurally dependent on a rigid fixing with adjoining structures will not be permitted to be constructed by pre-casting.

Pre-cast units shall be jointed with cement mortar as specified or other jointing system as shown on the Drawings, or as directed by the Engineer. The mortar shall be packed in layers between the units with steel tools until the whole of the joint is solidly filled and the exposed surfaces of the joint shall be raked out to a depth of 6 mm and flush pointed with similar mortar, but of pointing consistency.

### **3.24 Cement Mortar**

Cement mortar shall be machine mixed and unless otherwise specified, consist of three (3) parts of sand to one (1) part of Ordinary Portland cement mixed and thoroughly incorporated together. Just enough water will be added to give a workability appropriate to its use. The above proportions are by volume. Mortar shall be used whilst freshly mixed and no softening or re-tempering will be allowed.

### **3.25 Gravel Boulder under PCC:**

Gravel boulder under PCC on the bottom of the foundation should be laid and compacted as per drawings and should consist of base course material (Crush aggregates) size(5mm,10mm,20mm) as per design drawings, technical specification and complete Satisfaction of Field Supervisor/engineer.

# PART 4

## 4. STONE WORKS

### 4.01 Stone

Stone for all purposes shall be the best of its kind, sound and durable, free from flaws and from soft, weathered or decomposed parts. In general, the stones should be of uniform size to avoid voids between stones. The stone and the quarry from which it is obtained shall be subject to the approval of the Engineer before being used or placed. All the stone shall have a specific gravity of not less than 2.5.

Sites where suitable stones are available can be used in the project as per drawings after the approval of the engineer.

Rock used for stone pitching shall be sound durable rock selected from the harder rock from the required excavations or other approved sources. The rock shall not be less than 150 mm thick and shall be properly bedded to a uniform surface on an approved bedding material. The exposed surface of each stone shall be approximately flat and of an area not less than 0.03 m<sup>2</sup>.

### 4.02 Mass concrete and Stone Masonry

Stone used in masonry shall be regular field, river or quarry stone of approved quality, free from seams and other defect. All masonry stone shall be kept slightly moist at the time of use. Stone used for masonry shall be two-thirds of the wall thickness. Round stone will be permitted only in limited amount in combination with angular stone and shall not be used in walls having a thickness less than forty (40) cm.

Mass concrete should be supplied, placed, adding boulders, compacted and cured mass concrete M-20 (1:1.5:3) including formworks and expansion joints sealing works as per relevant drawing, specification and to the complete satisfaction of the site engineer. (Percentage of boulder in the mass concrete should be (25-40) % of total volume, also the sizes of the boulder should not be neither more than 1/5th of the lateral dimension of the structural element, nor 20 cm, whichever is less). Slump for mass concrete shall be (2.5 - 4) cm. Further, air-entraining admixture (AEA) to be added during mixing of concrete according to ASTM C260. In-place, air content shall range 5 to 6 percent of the volume of concrete. For all concrete works including mass concrete, clean crushed aggregates should be used. Stones should be spread in layers such that half of stone height is embedded in adjacent layers. The mass concrete should be laid in layers not more than 25cm-30cm in thickness. When cold joints occur in between layers of mass concrete, the stone grubbing should be done prior to placing new layers for proper bond between the layers. Cracks other than the hair line cracks are not acceptable. When foundation or banks of the structure face to hard rock materials, drilling, dowel bar 20mm with full epoxy should be used according to the contract drawings and satisfaction of engineer.

### 4.03 Types of Masonry

The stone masonry will be divided into two (2) types, Type A and Type B, according to cement mortar used for jointing. The cement-sand ratio by volume is given in the following table:

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Type of stone masonry	Ratio of cement-sand
Type A	One part of Portland cement to three sand (1:3)
Type B	One part of Portland cement to four sand (1:4)

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Type A stone masonry shall be used for protection work against abrasion and attack by boulder and gravel. Type B stone masonry shall be used for all stone masonry structure such as flumes, walls, piers, transition of canal structures, etc.

#### **4.04 Laying of Stones**

In laying the first course a full mortar bed shall be placed on the foundation to the full thickness of the wall. The stones shall be laid by hand with specified mix of mortar in between two stones and a 12 cm layer of mortar on the bottom of the new layer. The finished surface of the masonry shall be made as the shape and size of the stones will permit varying not more than 4 cm from the required contour. Each course is carefully plumbed and checked for vertical alignment. All alignment and plumbing of each unit to final position must be done while the mortar is soft.

#### **4.05 Surfacing and Pointing**

Joints on the face of all stone masonry exposed to view shall be neatly finished. The mortar in the joints of the stone masonry shall first be removed to a depth of three (3) cm. The joint shall then be cleaned thoroughly with a wire brush of all loose materials and filled with cement mortar with a mix proportion of one port-land cement and two part of sand by volume (1:3). The surface of the face stone shall be cleaned of all mortar upon completion of the finishing operation.

#### **4.06 Contraction Joints**

Contraction joints shall be provided at intervals of (2-4) meters or less except as otherwise mentioned on the drawings or as directed by the Engineer. The contraction joint shall be a straight line perpendicular to the flow direction and, where it is necessary on such horizontal surfaces as floors, shall be parallel to the flow direction.

#### **4.07 Weep Holes**

Weep holes of sizes 150 mm x 150 mm are to be left in the body of masonry walls if shown on the drawings. These weep (drainage) holes are to be covered with inverted filters on the backfill side in an area of 400 mm x 400 mm with a thickness of 400 mm. They are to be located at 1m intervals both vertically and horizontally in a staggered way

#### **4.08 Riprap / Stone Pitching Protection**

The quality of stone shall be as specified in Clause 4.01. The stones for rip-rap shall be a natural, big size, of irregular shape having a minimum weight of 30 kg each and minimum thickness of 20 cm when measured at the thinnest section. At least 60% of the stones shall have a minimum weight of 40 kg each, with minimum volume of 0.03 M<sup>3</sup>.

The stone shall be laid by hand, to the required lines and grades and to the thickness shown on the Drawings and placed so that it will thoroughly tamped, or driven into place. The space between the larger stone shall be filled with spalls of suitable size driven to face, varying not more than 60 mm from the required contour. Before placing riprap rocks, the bedding which consists of well-graded sand shall be provided with the required thickness shown on the drawings or as directed by the Engineer. Such sand bedding shall be compacted thoroughly by mechanical tampers. The rocks in the riprap shall then be dumped and graded off on such sand bedding.

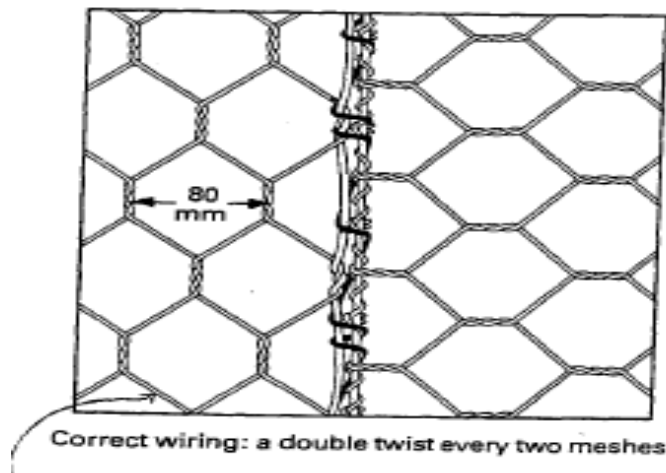
Pitching will be used where a finished horizontal or inclined surface is required. It shall consist of hand placed stones, with spalls wedged into the interstices to produce an even surface, without projection above the neat lines shown on the Drawings. Care shall be taken to ensure that the stones are well bedded and the



percentage of spalls shall not exceed forty percent (40%) of the total rock volume. Pitching on slopes shall be built upwards from the toe, unless otherwise directed by the Engineer. A coping consisting of large flat stones shall be laid along the top of stone pitching on slopes to produce a firm edge.

#### 4.09 Gabion Works

The quality of stone for gabion shall be as specified in Clause 4.01. The stone size ranges from 150 mm to 250 mm. Small stones should be avoided. The stones used should have a minimum size of not less than "D" (mesh width) and not greater than 3.5 times "D", where D is the specified mesh width as given below. Larger stones can be used provided that their total volume does not exceed 5% of the cell volume.



3mm

Gabions shall be of the types and sizes shown on the Drawings. The cages shall be constructed from mild steel wire complying with BS 1052, "Specification for mild steel wire for general engineering purposes", galvanised in accordance with BS 443, "Specification for testing zinc coatings on steel wire and for quality requirements". Wire used for the formation of the mesh panel will have a diameter of 3.0 mm.

#### 4.10 Filling and Placement

The foundation for each gabion and mattress shall be prepared by the Contractor to the satisfaction of the Engineer. Irregularities in the foundation shall be excavated or tightly filled with gravel to produce a surface which has no protrusions or cavities in excess of 100 mm.

The gabions and mattresses shall be flexible galvanised gabions of the size shown on the Drawings and shall be fabricated from wire mesh. Each gabion and mattress shall be divided by diaphragms into cells, whose length shall not be greater than the width of the gabions or mattresses plus 100 mm. The gabion and mattress boxes shall be fabricated 'Maccaferri' type or equivalent supplied by an approved manufacturer.

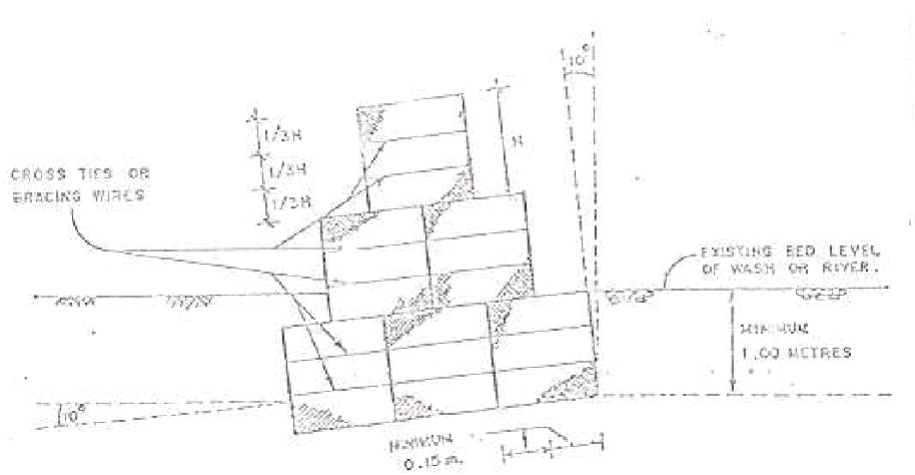
The prefabricated gabions and mattresses shall be obtained complete with sufficient suitable galvanised wire for completing the wiring of the gabions and mattresses on Site.

The wire in the gabions and mattresses shall be galvanised similar to or stronger than that used in 'Maccaferri' galvanised gabions. The wires in the gabions and mattresses shall be arranged so that the spacing between the wires is similar to or smaller than in 'Maccaferri' gabions and mattresses.

The empty gabions shall be placed to line and level as shown on the Drawings or as directed by the Engineer and then stretched so that the gabions regain their shape on being filled. Diaphragms shall be provided at no more than one metre (1 m) intervals for baskets and not more than 1.2 metre intervals for

mattresses. A gabion shall not be completely filled until the adjacent basket or mattress has been half filled, unless otherwise directed, in order not to cause displacements from bulging during filling.

Because of small horizontal movements associated with the settlement or consolidation, gabion walls must not be constructed with a vertical front face as it subsequently tilts forward slightly. All gabion walls must be constructed with the front face at the slight angle to the vertical (10:1 – vertical: Horizontal). This should be achieved by sloping the foundation accordingly as shown in the diagram below:



Before filling, adjacent baskets should be secured together using steel lacing wire provided for the purpose and conforming to the specification. The sides must be secured in straight lines with no gaps left between the sides of adjacent baskets. Where more than one layer of baskets is laid, they must be placed as shown on the Drawings or as directed by the Engineer with a minimum step of 0.15 m between the faces of the lower and upper gabion boxes.

All gabions must be connected to each other along corners with the same lacing operation. For correct lacing operation, the wire should be passed through each mesh, making a double twist every other mesh.

Careful attention must be given to the filling operation to ensure that the stones are placed evenly in the baskets with minimum voids in between. Smaller stones can be used to fill the central voids of the boxes, but all external stones must be at least 1.5 D where D is the diameter of the mesh.

The stones selected for the top layer of gabion baskets must have a flat surface to ensure that the wire that does not rest on sharp corners. They must have a minimum dimension of 1.5 D in all directions and be placed to ensure a minimum number of voids.

Bracing wires must be fixed at depths of  $1/3H$  where “H” is the height of the gabion box. The horizontal distance between the bracing wires should also be  $1/3H$  thus for a gabion basket of 2m x 1m x 1m dimension, eight bracing wires are provided. For the gabion boxes used on the project the bracing wires should be placed at the following depths and spacing.

Gabion Dimensions	Depth of Bracing Wire from bottom of gabion	Horizontal Distance
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Length (m)	Width (m)	Depth (m)	1 <sup>st</sup> Brace	2 <sup>nd</sup> Brace	Between Bracing (meters)			
2.00	1.00	1.00	0.35	0.70	0.40	0.80	1.20	1.60
1.00	1.00	1.00	0.35	0.70	0.35	0.70	-	-
2.00	1.00	0.50	0.25	-	0.40	0.80	1.20	1.60
1.00	1.00	0.50	0.25	-	0.35	0.70	-	-

Stones should be filled to the depth of the first brace and then the bracing wires placed directly above the level of the stone making sure the wire passes around at least two mesh widths. The procedure should then be followed for the next layer.

In aprons downstream of weirs and similar places where water falls directly on to the gabions, vertical bracing wires between the top and bottom mesh must be provided. Additional horizontal bracing must be used at the corners of structure.

#### **4.11 Gabion Wire Protection**

A concrete layer will be provided on the crest of wires as shown in the Drawings or directed by the Engineer to protect the gabion mesh against damage. This should be of minimum thickness of 0.10 meter and should be provided once the structure has been completed and any initial settlement has taken place. Contraction joints should be provided at regular intervals, which should not exceed 3 meters.

A rigid capping of concrete to gabions walls is not to be provided as this restricts the flexibility of the gabion structure. When the Engineer recommends protection of such walls, as in the case of protection of theft of wire, a thickness of 0.05 m should be provided. Where greater thickness is recommended, a flexible protection material must be used.

#### **4.12 Measurement and payment of Pitching and Gabions**

Stone Pitching: Measurement, for payment, of constructing stone pitching will be made of the actual area of stone pitching in place to the lines, grades and dimensions shown on the Drawings or directed. Payment for constructing stone pitch will be made at the rate per square metre tendered in the priced Bill of Quantities.

Gabions and Mattresses: Measurement, for payment, of furnishing and placing gabions and mattresses will be made of the volume of completed gabions and mattresses in place to the lines, grades and dimensions shown on the Drawings or as directed. Payment for furnishing and placing gabions and mattresses will be made at the applicable rate tendered thereof in the priced Bill of Quantities. These rates shall include the cost of all freight, labour, fabrication, erection, filling and placing of gabions and mattresses required to complete the work.

#### **4.13 Curing:**

All mortar works and PCC capping works should be sprayed with potable water at constant interval or straw mats or similar absorbent material or a layer of sand should be used to the satisfaction of the engineer, for a minimum period of a fourteen (14) days.

#### 4.14 Steering Gates, Fence and Railing:

**Steering gate:** Supply/fabrication and installation of Steel Gate including three coats of enamel paint (one coat of red-oxide + two coat of enamel paint), labour and material as per relevant drawing, technical specification and with satisfaction of Field Supervisor/engineer. The iron gate materials should be high quality.

**Fences and railing:** steel box materials should be high quality, with three coats of enamel paint (one coat of red-oxide + two coat of enamel paint), labour and materials as per relevant drawings, technical specification and complete satisfaction of field supervisor/engineer. Fence box thickness should not be less than 3mm (see the drawings)

Fence, railing steels should be square/rectangular cold formed hollow section EN 10219:2006 GRADE S235 / S355, LENGTH 7.6-12.2 M, weight per length should not be less than 1.24 Kg/m

#### (Part 5). Environment and Social Mitigation Measures:

<b>1. General</b>	The Contractor shall observe and comply with all National Laws, Government Regulations, Presidential Decrees, and Ministerial Regulations pertaining to environmental protection, pollution control, waste management and biodiversity protection, labour laws and land laws.  In conducting his construction activities, the Contractor shall take all necessary precautions to minimize environmental disturbance to the project area and
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	<p>surroundings and to prevent the escape of polluting substances into streams, water courses, and groundwater. The Contractor shall also utilize all necessary practicable methods and devices as are available to prevent and otherwise minimize atmospheric emissions or discharges of air contaminants.</p>
<p><b>2. Pollution of Water Courses and Streams</b></p>	<p>The discharge of polluting liquids, solid waste or other waste into drains, water courses, or groundwater shall not be permitted. No concrete or cement washings from the works or drainage from the Contractor's concrete batching and mixing areas, asphalt (hot mix) plants, or other manufacturing or production facilities shall be allowed to discharge into streams or drains without passing through an adequate system of settling ponds.</p> <p>Storage of fuels, fuelling and maintenance of plant and vehicles, etc. shall take place only on sites and under conditions that that do not allow spilt fuels to be discharged to water bodies. Fuel storage and fuelling areas shall be equipped with adequate protective measures to confine and retain accidental spillages. No drainage from fuel store and plant maintenance depots shall be allowed to be discharged without passing through an adequate arrangement of oil traps and separators.</p> <p>Washing of vehicles shall not be permitted in streams but only in specially designated and equipped areas.</p> <p>The Contractor shall be responsible for installation, operation and maintenance of a comprehensive liquid and solid waste system to all areas of the works, site office and worker's camp. The system shall be constructed such that no discharges of sewage, oil, cement, silt or other liquid or solid waste matter can enter the streams and water courses at the site; and it shall have all necessary solid waste and sediment traps, settling ponds, oil separators, etc., required to ensure that pollution of streams watercourses and natural bodies of water does not occur. The Contractor shall be responsible for maintaining the system to the satisfaction of the Site Engineer.</p>

<p><b>3. Air Pollution</b></p>	<p>The Contractor shall take all necessary steps to minimize air pollution resultant from his operations. Except where stipulated in these Specifications for the disposal of natural vegetation and organic materials from clearing operations, the burning of waste materials for disposal, particularly oil and petroleum wastes, rubber, plastics and similar materials will not be permitted.</p> <p>During the performance of the work required under the Contract or of any operations appurtenant thereto, whether on the Project Site or elsewhere, the Contractor shall take all steps necessary, and shall furnish all labor, equipment, materials and means, required to reduce dust nuisance from the Works, and to prevent dust originating from his operations from damaging crops, orchards, cultivated fields, and dwellings; or causing a nuisance to persons. The Contractor shall be held liable for any damage resulting from dust originating from his operations including on Government roads, rights-of-way or elsewhere. The emission of dust into the atmosphere shall not be permitted during the manufacture, handling and storage and handling of cement and of concrete aggregates, and the Contractor shall use such methods and equipment as are necessary for the prevention, or the collection and disposal, of dust during such operations.</p> <p>All truckloads of loose materials shall be covered during transportation.</p> <p>Concrete batching and mixing areas, asphalt (hot mix) plants, or other manufacturing or production facilities shall be sited at least 500 m away from the nearest habitation. Emission outlets shall be fitted with pollution control devices in compliance with relevant current emission control legislation.</p> <p>In order to reduce the formation of dust on haul roads, access roads, government roads, aggregate stockpiles, etc.; water spraying or any other methods shall be used by the contractor to maintain the works areas, adjacent areas, and roads, in a dustless condition.</p>
<p><b>4. Noise Pollution</b></p>	<p>The Contractor shall take all necessary precautions to minimize the amount of noise and vibrations coming from construction activities. The Contractor shall ensure that all plant and equipment is properly maintained in good operating condition, and that noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means, to avoid disturbance to any nearby noise sensitive receivers. All plant and equipment shall comply with relevant legislation covering sound emissions.</p> <p>Quarry operations and blasting shall be undertaken so as to minimize blasting and disturbance during the night.</p> <p>Operation of trucks and heavy vehicles and machinery shall be restricted to the night hours of 06:30 to 19:00. All necessary measures shall be undertaken to protect schools, hospitals and other adjacent noise sensitive receptors, including the use of noise barriers.</p>
<p><b>5. Damage to Property,</b></p>	<p>The Contractor shall limit the movement of his employees and, vehicles and equipment within the project area and on adjacent land, including access routes</p>

<p><b>Crops and Vegetation</b></p>	<p>approved by the Site Engineer, so as to minimize damage to natural vegetation, crops and property, and shall endeavour to avoid any damage to land.</p> <p>The Contractor shall strictly ensure employees and, vehicles and equipment do not enter any sensitive environmental areas that are demarcated as “no-entry” zones.</p> <p>The Contractor shall preserve existing trees, plants and other vegetation that are to remain within or adjacent to the Works and shall use every precaution necessary to prevent damage or injury thereto. Trees or shrubs shall only be felled or removed where such impinge directly on the permanent works and in case of necessary temporary works areas; double the quantity of so cut trees should be planted by the contractor. The contractor should provide for each area or location a detailed tree list and/or site map which records each individual tree to be cut. The contractor shall not proceed to cut any tree, particularly of fruit trees without approval from the employer/owner.</p> <p>On completion of the Works all areas disturbed by the Contractor’s construction activities shall be restored by the Contractor to their original condition, or as may be acceptable to the Employer.</p> <p>The Contractor shall be responsible directly to the Employer for any excessive or unnecessary damage to crops or lands arising from his operations, whether within the project area, on lands adjacent thereto, or adjacent to approved access roads. Deductions will be made from the payment due to the Contractor to cover the cost of such excessive or unnecessary damage, as determined by the Employer.</p> <p>The contractor is responsible for compensation for lost assets, including effects on fruit trees, crop, structure, temporary loss of livelihood and other productive income, if this loss is caused by contractor. Compensation should be calculated as replacement cost based on current market price.</p>
<p><b>6. Safety Procedures</b></p>	<p>The Contractor shall:</p> <ul style="list-style-type: none"> <li>(a) comply with all applicable safety regulations,</li> <li>(b) take care for the safety of all persons entitled to be on the Site,</li> <li>(c) use reasonable efforts to keep the Site and Works clear of unnecessary obstructions so as to avoid danger to these persons,</li> <li>(d) provide fencing, lighting, guarding and watching of the Works until completion and taking over, and</li> <li>(e) Provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.</li> </ul>
<p><b>7. Avoidance of Interference</b></p>	<p>The Contractor shall not interfere unnecessarily or improperly with:</p> <ul style="list-style-type: none"> <li>(a) the convenience of the public, or</li> <li>(b) The access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.</li> </ul> <p>The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.</p>

<p><b>8. Access Routes</b></p>	<p>The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.</p> <p>Except as otherwise stated in these Conditions:</p> <ul style="list-style-type: none"> <li>(a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;</li> <li>(b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;</li> <li>(c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;</li> <li>(d) the Employer does not guarantee the suitability or availability of particular access routes; and</li> <li>(e) costs due to non-suitability or non-availability for the use required by the Contractor of access routes shall be borne by the Contractor</li> <li>(f) the contractor should also ensure uninterrupted traffic of humans and animals by providing temporary access bridge across canal.</li> <li>(g) the contractor's site camp should be in a significant distance from the nearby community to avoid any interference.</li> <li>(h) the contractor shall bring the camp site back to normal physical status once the construction work has been done.</li> </ul>
<p><b>9. Cultural Resources</b></p>	<p>All moveable and Immoveable historical and cultural artifacts and heritage items that are discovered or remain buried and not discovered/excavated in Afghanistan are the property of the Islamic Republic of Afghanistan and any kind of trafficking of such items is considered theft and is illegal under <b>Law on the Preservation of Afghanistan's Historical and Cultural Heritages and Artifacts</b> (Official Gazette, April 16, 2004. These include monuments, structures, works of art, or sites of "outstanding universal value" from the historical, aesthetic, scientific, ethnological, or anthropological point of view, including unrecorded graveyards and burial sites.</p> <p>All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings, moveable and immovable historical and cultural artifacts and heritage items</p> <p>The Contractor shall, upon discovery of any such finding, give notice to the Engineer no later than seven (7) days if he/she lives in the capital city of Kabul, and no later than fourteen (14) days in case of provinces. The Engineer shall issue instructions for dealing with it.</p> <p>If the Contractor do not report such discoveries within the specified period, they will be incarcerated for a minimum of one (1) month but not more than a maximum of three (3) months.(Art. 75)</p>
<p><b>10. Environment</b></p>	<p>"The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations. The Contractor shall:</p> <ul style="list-style-type: none"> <li>(a) establish an operational system for managing environmental impacts,</li> <li>(b) carry out all of the monitoring and mitigation measures set forth in the Environmental Management and Monitoring Plan(EMMP)(which will be an appendix to this bidding document) of the Initial Environmental Examination ("IEE"), Environmental Assessment and Review Framework ("EARF"),</li> <li>(c) allocate the budget required to ensure that such measures are carried out, and</li> <li>(d) Comply with any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the initial environmental examination and the environmental management plan.</li> </ul> <p>The Contractor shall submit quarterly reports on the carrying out of such measures to the Employer."</p>
<p><b>11. Labor Law and Regulation</b></p>	<p>The Contractor shall comply with all relevant (a) labour laws and regulations applicable to the Contractors personnel, including staff, consultants, contractors, and agents; and (b) workplace health and safety laws.</p> <p>The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including</p>



	<p>recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline.</p> <p>The Contractor shall (a) provide equal wages and benefits to men and woman for work of equal value or type; (b) use their best efforts to employ women and local people, including disadvantaged people, living in the vicinity of the Project; and (c) maximize female training and employment”.</p>
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***Part-6***

***6 Staff and Labor***

<p><b>1. Engagement of Staff and Labor</b></p>	<p>Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, feeding, transport, and, when appropriate, housing.</p> <p>The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor with appropriate qualifications and experience from sources within the Country.</p>
<p><b>2. Rates of Wages and Conditions of Labor</b></p>	<p>The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall follow the principle of “equal pay for equal work” and pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.</p> <p>The wage of the youths (age 15-18) would be paid in an amount equal to the wage of the workers of 18 years of age and more, with due regard to rank and grade, but regardless of the reduced working time contained in article 31 of the labour law (Article 129, labour law). The wage and other rights of the work-related disabled worker cannot be less than the wage that he/she earned previously (Article 117, labour law).</p> <p>The Contractor shall inform the Contractor’s Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.</p>
<p><b>3. Labor Laws</b></p>	<p>The Contractor shall comply with all the relevant labour Laws applicable to the Contractor’s Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.</p> <p>The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.</p>
<p><b>4. Working Hours</b></p>	<p>No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:</p> <ul style="list-style-type: none"> <li>(a) otherwise stated in the Contract,</li> <li>(b) the Engineer gives consent, or</li> <li>(c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer</li> <li>(d) the working hours for youths between 15 and 18 year of age, should not exceed the limit of 35 hours per week.</li> </ul>
<p><b>5. Facilities for Staff and Labor</b></p>	<p>Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor’s Personnel.</p> <p>The Contractor shall not permit any of the Contractor’s Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.</p>

<p><b>6. Health and Safety</b></p>	<p>The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.</p> <p>In the event that untoward accidents and unexpected diseases occur at the worksite, the contractor would be obliged, as the case may be , to:</p> <ol style="list-style-type: none"> <li>1. provide first aid services and conditions,</li> <li>2. transfer the worker concerned to medical centres and provide for treatment conditions,</li> <li>3. when the worker is cured, transfer him to his/her place of residence, (Article 114, labour law).</li> </ol> <p>The contractor has the responsibility to provide job for the employees who have become disabled while performing their jobs. After their disability is confirmed, according to their capability, they have to be provided with job opportunities (Article 117, labour law).</p>
<p><b>7. Disorderly Conduct</b></p>	<p>The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.</p>
<p><b>8. Supply of Water</b></p>	<p>The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.</p>
<p><b>9. Festivals and Religious Customs</b></p>	<p>The Contractor shall respect the Country's recognized festivals, days of rest and religious customs.</p>
<p><b>10. Funeral Arrangements</b></p>	<p><b>The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.</b></p> <p>The contractor shall provide financial aid for the deceased employee's family for burial ceremony equal to 10 months wage along with its benefits as per the last salary (Article 134, labor law).</p>
<p><b>11. Prohibition of Forced or Compulsory Labour</b></p>	<p>The contractor shall not employ "forced or compulsory labour" in any form. "Forced or compulsory labour" consists of all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.</p>
<p><b>12. Prohibition of Harmful Child Labour</b></p>	<p>The Contractor shall not employ any child under 15 year of age to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.</p>
<p><b>13. soil Erosion</b></p>	<p>Plantation of appropriate vegetation on hill slopes and other potentially erodible places along the embankment.</p> <p>Appropriate earth compaction and in construction of access roads , restriction of vehicular and construction machinery movements very close to the canal/river banks</p>
<p><b>14. Degradation of borrow pits</b></p>	<p>Replace stockpiled soil cover. Replant grass/ shrubs. Install sediment runoff control devices. Ensure ongoing erosion monitoring and restore the area back to normal condition by filling the borrow pit in the source area.</p>

<p><b>15. Increase inequities between</b></p> <p><b>16. downstream and upstream communities:</b></p>	<p>Contractor to ensure that employment opportunities are equally available to downstream and upstream communities.</p> <p>Contractor to be aware of and pay particular attention to equity issues where different ethnic or tribal groups are located upstream and down stream</p>
<p><b>17. Contractor Environmental and Social Focal Point</b></p>	<p>The Contractor shall designate one of their staff member as the Environmental and Social Focal Point (ESFP) who is familiar with Environmental and Social aspects of irrigation projects and will be responsible for the Environmental and Social Management</p>

# Drawings

(Drawing is attached)

## Personnel Requirements

Using Form PER - 1 and PER - 2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

No.	Position	Total Work Experience [years]	Experience In Similar Work [years]
1	Project Manager (Civil Engineer)	5	3
2	Surveyor	3	3
3	Safety Officer	3	3
4	Site supervisor	3	3

# Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

No.	Equipment Type and Characteristics	Minimum Number Required
1	Excavator	1
2	Compactor	1
3	Mixer	1
4	Vibrator	1
5	Dump truck	2