

United Nation Development Program (UNDP)

TECHNICAL SPECIFICATIONS

Name of Sub-Project Kariz Salim Storage Dam Project, Zeraf Kandahar.

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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 British Standards Institution, 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 and reference pegs based on the information supplied from the drawings and the instruction given by the Engineer. 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 arrangement 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 size 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 Quantities 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.

If the Contractor falls behind the Contractual Programme he shall, within 14 days of the date of such default, submit for approval a revision of the programme showing the proposed measures, including plant, labour and material resources, to complete the Permanent Works on time.

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 ²
Cubic metre	m ³
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 UNDP standard documents relating to the preparation of Bills of Quantities.

1.15 Survey of Completed Structures

The Contractor in conjunction 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 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/Ordinary" 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 or those hard natural or artificial material which cannot be removed except by blasting for loosening it and heavy machinery/ tools for its removal but excluding individual masses less than 0.5m³.

2.02 Classification of Excavation

Following classes of excavation shall apply:

Common Excavation / Ordinary Soil 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 or soil containing Kankar , sand , silt , hard and soft murrum and /or shingle , gravel , clay , loam , peat , ash , shale , etc. which can generally don't require blasting and can be excavated by excavator , loader , spade , pick axes , and shovel .

This also includes embedded rock, rubble and stones no larger than 0.5m³

(All material other than that defined as "rock" is called ordinary soil here,)

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.

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 find 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 open ahead of pipe laying shall not exceed 200m.

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 50mm 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 150mm below the intended levels of the bottom of the pipes and replaced with 150mm 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 300mm 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 200mm, 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 trenches up to a level of 200mm above the pipe shall be carried out with suitable fine material with a maximum particle size of 20mm 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 200mm 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 200mm thick where machinery is used and 100mm 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 90%

Random backfill at 90% 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 90 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/m³. 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 and fillings shall be measured net to the lines and levels specified on the drawings or specified by the responsible engineer in written. Where not specified in the drawings or by the

Engineer to the contrary sides of excavations shall be taken as vertical from foundation base edges. 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 and filling:

- Necessary to accommodate the thickness of pipes or culverts and the specified bedding.
- Necessary to accommodate the joints of pipes or culverts
- Due to inadvertent over break.
- Due to over break in rock specified elsewhere for trench excavations for pipelines.
- Due to high water table, water logging, sand/ gravel layers which do not stand straight and fell down to the excavated part/trench and extends gradually.
- Due to labours/ workers safety.
- Necessary for Upstream and Downstream Re-Shaping's as shown in the drawings.
- Note: Cut and fill for re-shaping parts shown on the drawings are not calculable and payable as part of ordinary soil excavation and backfilling line items of BOQ. The Contractor shall consider and add this expense on excavation and filling unit rates to complete this part.

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.

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 approved sources and to be 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 clean, well graded and free of stones larger than 2mm 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 5mm and the surface shall be clean. Gravel for use in all concrete works, Mass Concrete, PCC and RCC shall have angular 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/mm² or high yield steel grade 450/425 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 25mm 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 to reinforcement should be 50mm 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 ²)	Maximum Aggregate size(mm)	Maximum water/ cement ratio (%)	Approx. cement content	Nominal Mix proportions (Kg/m ³)
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 works, etc.

M15 For various types of concrete works such as Mass Concrete structures and PCC works.

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 10 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 Masonry Mortars shall be mixed by Machine, Hand Mixing is not permissible.

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. The surface of the concrete shall be thoroughly saturated and coated with a proportion of weight of 1:2 cement mortars one (1) cm thick before the placing of the concrete is resumed.

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 internal concrete vibrator will either be arranged by UNDP or by Contractor himself.

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 stop, with suitable water-resistant filler material and sealant as approved by the Engineer.

Joints required by the Contractor but not intended by the Exhibited Design are in principle subject to the Engineer's approval. The location and design of such joints are to be depicted in the Drawings that are then to be submitted to the Engineer in sufficient time. In determining the location of joints, the Contractor must consider the static requirements of the respective structural member, as well as the special local and climatic conditions.

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, such as THIPFLEX 600 of EXPANDITE or equivalent approved. Joint sealer shall be supplied with primer coats, backing material and/or bond breakers to the joint fitter, as required by the manufacture's 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 4 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
- That the ribs and central bulb, where applicable, match up exactly and are continuous.

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 screeding and trowelling with a wood float to produce a smooth finish free from water and air pockets or honey comb. Screeding 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 screeding 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 Concrete Pipe Culverts

General: The Contractor shall construct concrete pipe culverts under access roads as shown on the Drawings or as directed. Concrete pipes for culverts shall be between 450mm and 600mm in diameter or as directed by the Engineer, shall conform to the requirements of standards approved by the Engineer and shall be standard grade reinforced pipes with spigot and socket joints. All joints in concrete pipes shall be sealed with cement mortar as directed.

Installation: Pipes shall be laid in trenches in solid ground or in drainage depressions in locations approved by the Engineer. Compressible and other unsatisfactory material on the bottom of the trenches shall be removed as directed before laying the pipes.

Unless otherwise shown on the Drawings or directed by the Engineer, all pipes for concrete pipe culverts shall be laid on a 150 mm thick layer of selected fine granular bedding material and properly jointed. The bedding material shall not contain stones or rock fragments having a maximum dimension greater than 10 mm and shall be obtained from sources approved by the Engineer. Bedding materials shall be compacted by approved equipment to provide a firm and uniform bed for approximately one third of the circumference of the pipe as directed.

For concrete pipe culverts over which a roadway fill is to be placed, the Contractor shall ensure that the length of the culvert is sufficient to support the specified width of roadway at the batter slopes shown on the Drawings or directed.

After the pipes have been bedded, laid and jointed and approved by the Engineer, backfill material shall be placed about the pipes and compacted by approved equipment for a height of at least 300 mm above the top of the pipes, unless otherwise shown on the Drawings or directed. Backfill material placed within 300 mm of any pipe shall not contain stone or rock fragments having a maximum dimension greater than 80 mm. Insofar as it is practicable, backfill material shall be obtained from excavations in the vicinity of the pipe being backfilled and additional material which may be required shall be obtained from approved sources.

Headwalls, Wing Walls and Sumps: For road construction and elsewhere as shown on the Drawings or directed, stone pitched headwalls and wing walls shall be constructed at the end of pipe culverts, as directed. Culvert headwalls, wing walls and inlet sumps shall be constructed to the lines, grades and dimensions shown on the Drawings or directed.

3.26 Measurement and Payment of Concrete Pipe Culverts

Measurement, for payment, of concrete pipe culverts will be made of the length of pipe measured along the centreline of the pipes in place, with no allowance for tap at joints. Payment for furnishing and installing concrete pipe culverts will be made at the applicable rate per linear metre

tendered in the priced Bill of Quantities. These rates shall include the cost of furnishing and placing of bedding and backfill materials. Payment for excavation of trenches will be made in accordance with the specifications for excavations. Payment for stone pitching in the headwalls, wing walls and sumps will be made in accordance with Clause 4.12

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.

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 0.03m².

4.02 Masonry

Stone used in masonry shall be regular field 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.

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:

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)

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.

Sand for stone masonry mortar shall be clean well graded sand, it shall consist of crushed stone sand or natural clean well graded sorted sand or combination of any of these, sand shall be hard, durable, clean and free from adherent coating and organic matter and shall not contain any amount of clay, silt and fine dust.

Sand should be with an approximately even particle size distribution. As the smaller particles may fit in between the larger particles, this even distribution reduces the proportion of voids to solids and thus is less demanding on the binder than poorly-graded sand.)

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 three 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 ten (10) 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 150mm 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 400mm x 400mm with a thickness of 400mm. 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 30kg 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 0.03M³.

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 spills 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 Brick works

All bricks shall be of first class burned brick of standard size and specification (KORA-E-MELI – (کورہ ملی).

Bricks shall be regular in shape and their edges should be sharp and shall be free from cracks, chips, flaws and lumps.

Water absorption of bricks should not be more than one sixth of their weight after one hour of soaking by immersing in water.

Bricks shall be fully soaked in clean water by submerging in a container and continued till air bubbling is completely ceased

Bricks shall be laid in well bonded manner and every course shall be truly horizontal as well as the wall shall be truly in

Vertical joints of two consecutive courses shall not be directly over one another but vertical joint in alternate course shall come directly over one another. Joints between bricks, in brick masonry work shall not be more than 10mm and should be fully filled with mortar.

Brickwork shall be carried out not more than one-meter height at a time and if one part of brick masonry has to be delayed, stepping shall be left at an angle of 45 degrees. Corbelling or projection from the face of wall should not be more than one-fourth of brick length.

At the end of day all joints should be raked and the face of wall must be cleaned.

Brick masonry must be kept moist at least for 10 days and should be protected from freezing and other weathering effects.

Sand for mortar shall be clean, hard, durable, angular and sharp. It shall not have more than 5% clay and silt.

Cement for mortar shall be fresh Portland cement, free from lumps and admixtures

Materials of mortar shall be measured by measuring box and in the absence of concrete mixer, ingredients must be first dry mixed and then water be added slowly and gradually and mixed thoroughly.

4.10 Plastering

Prior to start plastering job on brick masonry walls, all joints shall be raked out to a depth of 15 mm and the surface of the wall be washed and kept wet for one days before plastering

The materials of mortar for plastering, cement, sand or in some cases lime should be of standard specification.

Materials of mortar shall be measured by measuring box and be first dry mixed, then water must be added slowly and gradually and mixed thoroughly.

The firs coat shall be dashed and pressed over the surface of the washed and raked joint's wall and then brought to a true smooth and uniform surface by means of float and trowel.

The work shall be tested frequently with a straight edge and plumb bob.

At the end of the day plaster shall be closed on the body of the wall and not near then 15 cm to any corner. Also, it shall be left cut clean to line. When the next day's plastering is started, the edge of the old work shall be scraped, cleaned and wetted with cement slurry.

Curing shall be started as soon as the plaster has hardened sufficiently, not to be damaged when watering. It shall be kept wet for at least 10 days.

Mix proportion should according to that given in drawings.

4.11 Painting

Ready-made lead free paint of trusty brand should be used for all oil paintings and plastic painting works. If thinning is required, pure turpentine may be added to the required extent.

The surface to be painted, shall be made perfectly smooth by rubbing with sand paper with different grades, first with coarse one and then with fine sand paper.

All cracks, holes and open joints should be filled with strong putty or other proper filler and smoothened by rubbing with sand paper.

In new works first one prime coat and then two other coats shall be applied on it. Each coat shall be perfectly dry before the next is applied. Before applying the next coat on previous coat, the surface shall be rubbed with no.10 sand paper to give smooth and glazed surface.

All old paints from old works shall be removed by washing with soda water or by using any other suitable remover. In no case sand paper or other dust producing means shall be used for cleaning of old paints. After removing old paints the surface must be dried and rubbed with sand paper and smoothened before new paint is applied

In steel and iron works all rusts, scales, oil, grease dirt and supplier delivery marks shall be perfectly removed by scrapping and brushing. Special care should be taken for

All structural steel works shall be painted with red lead-free primers before erection except the surface which will be in contact with concrete.

The timber shall be of the best quality, well-seasoned and free from saps, knots, warps, and crakes' other defects. All wood works shall be planed, and neatly and truly finished to the exact dimensions. All joints shall be neat and strong, toughly and accurately fitted and coated with white led before being fitted to gather.

All portion of timber built into or in contact of stone masonry or concrete, shall be given two coats of tar or other approved preservations. Exposed surfaces of timber shall be painted with two coats approved pain over a coat of primer.

4.12 Doors and Windows

All doors and windows shall be made very carefully and perfect precision from the best quality, well-seasoned, and free from sap, knots, warps, cracks and other deficiencies, according to BoQ.

All doors and windows shall be provided with the best quality fittings like handles, locks and, hinges, stops for keeping the leaves open and etc.

Glass shall be of the good quality and free from bubbles scratches and other imperfections with the thickness of 4mm or as specified.

The glass pan should have 1.5 mm clear gap all around to allow expansion and contraction of the frame. All sides off glass panel shall be filled by the best quality putty.

PART 5

5. *PIPEWORK*

5.01 General

Pipe work shall be of the material, pressure rating and nominal diameter shown on the Drawings. The pipes and fittings and method of installation shall comply in every respect with the following specifications, unless otherwise directed by the Engineer or shown on the Drawings.

Pipeline installation shall comply with the specifications and requirements of BS 8010, "Code of practice for pipelines". All fittings shall be compatible with the type and size of pipe. The jointing of pipes and fittings shall be in accordance with the manufacturer's instructions.

The Contractor shall install pipelines to the line and levels, and with the type of bedding, hunching and surround shown on the Drawings or as directed by the Engineer.

5.02 Types of Pipe

The pipes used in the works shall comply with the following standards:

- ☐ Reinforced cement concrete (RCC) pipes - BS 5911, "Precast concrete pipes, fittings and ancillary products" or as approved by the Engineer
- ☐ Galvanized mild steel pipe (known locally as galvanized iron) - BS 1387, "Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 threads" or as approved by the Engineer.

5.03 Pipeline Excavation

Trenches for pipes shall be excavated in accordance with Clauses 2.03 and 2.06. Unless otherwise stated on the Drawings, or as directed by the Engineer, the minimum depth to the crown of a pipe shall be 1 m.

Pipes shall be laid in trenches in solid ground or in drainage depressions in locations approved by the Engineer. Compressible and other unsatisfactory material on the bottom of the trenches shall be removed as directed before laying the pipes.

5.04 Pipe Bedding

Unless otherwise shown on the Drawings or directed by the Engineer, all pipes for concrete pipe culverts shall be laid on a 150 mm thick layer of selected fine granular bedding material and properly jointed. The bedding material shall not contain stones or rock fragments having a maximum dimension greater than 10 mm and shall be obtained from sources approved by the Engineer. Bedding materials shall be compacted by approved equipment to provide a firm and uniform bed for approximately one third of the circumference of the pipe as directed.

Where in the opinion of the Engineer, the material in the bottom of the trench is suitable, the pipes may be laid directly in the trench, provided the base is over excavated around the joints to

allow the barrel of the pipe to rest on the ground along its entire length. Otherwise, the bedding material shall be of the type, size and to the depth shown on the Drawings. The bedding material shall be well rammed and shall be scraped away from under the joints so that the barrel of the pipe is supported along its entire length. Granular bedding shall be graded within the following limits:

- Maximum particle size 20 mm
- Minimum particle size 0.6 mm

5.05 Laying of Pipes

The Contractor shall exercise care during the loading, transport and unloading of pipes to avoid damage to the pipes, surface finish and protective coating. Loading and unloading shall be carried out in such a way that the pipes are under control at all times. Under no circumstances shall pipes, fittings or jointing materials be dropped or dragged. Pipes and fittings shall be stored on Site in accordance with the manufacturer's instructions.

All pipes and fittings shall be inspected and approved by the Engineer representative immediately prior to laying and any defective or damaged component shall be rejected. The Contractor shall give the Engineer not less than 48 hours' notice of his intention to proceed with pipe laying and shall not commence until the pipes and fittings to be laid, have been approved.

Long radius curves in the alignment of pipelines may be accommodated at the joints between pipes. The maximum allowable deflection at each joint shall not exceed the manufacture's recommendations for the type and size of pipe/joint.

Joints shall be made strictly in accordance with the manufacturer's instructions. Before making any joints, all jointing surfaces shall be thoroughly cleaned and dried and maintained in such condition until the joints have been assembled or completely made.

The Contractor shall take all necessary steps to prevent dirty water or other extraneous matter from entering the pipeline and should this occur then the Contractor shall immediately carry out the necessary cleaning as directed by the Engineer. Except when actually jointing, the end of the last pipe laid and any other outlets or tees shall be kept plugged to the satisfaction of the Engineer.

The Contractor shall partially backfill the trenches as soon as possible after laying to protect the pipe and prevent floatation of the pipeline. Where a pipe surround is specified on the Drawings or ordered by the Engineer, the material shall be the same as the bedding material and shall be placed and compacted in even layers not exceeding 200 mm thickness, on both sides of the pipe.

Concrete haunching to pipes shall be provided where specified on the Drawings or as directed by the Engineer. The haunching shall not continue across pipe joints unless shown otherwise on the Drawings. The thickness of the haunching under the pipe and the class of concrete shall be as specified on the Drawings or as directed by the Engineer.

5.06 Backfilling of Trenches

General Backfill material shall comprise excavated material excluding lumps and stones retained on a 50 mm sieve. No excavated material, which in the opinion of the Engineer, is or has become

unsuitable shall be used for backfilling purposes. All backfilling will be in accordance with clauses 2.09 and 2.10.

For concrete pipe culverts over which a roadway fill is to be placed, the Contractor shall ensure that the length of the culvert is sufficient to support the specified width of roadway at the batter slopes shown on the Drawings or directed.

After the pipes have been bedded, laid and jointed and approved by the Engineer, backfill material shall be placed about the pipes and compacted by approved equipment for a height of at least 300 mm above the top of the pipes, unless otherwise shown on the Drawings or directed. The backfill material shall be placed in layers not exceeding 200 mm up to a level 300 mm above the crown of the pipe. Thereafter the layers shall not exceed 230 mm. Each layer shall be compacted using plate compactors or heavy hand operated rammers, particular care shall be exercised to prevent damage to the pipe or joints.

Backfill material placed within 300 mm of any pipe shall not contain stone or rock fragments having a maximum dimension greater than 80 mm. Insofar as it is practicable, backfill material shall be obtained from excavations in the vicinity of the pipe being backfilled and additional material which may be required shall be obtained from approved sources. The pipeline trenches shall only be backfilled in the centre of the pipes leaving the joints and fittings exposed until after the pipeline has been tested to the satisfaction of the Engineer.

The Contractor shall restore and maintain all land surfaces to a condition as near as practical as the original surface. Paved surfaces of roads shall be reinstated to a standard commensurate with the original construction and to the satisfaction of the Engineer. Surplus excavated material shall be disposed of to approved spoil tips.

5.07 Reinforced Cement Concrete (RCC) Pipes

Reinforced cement concrete pipes used in the works shall comply with and are to be laid in accordance with the requirements of BS 5911, "Pre-cast concrete pipes, fittings and ancillary products" or as directed by the Engineer. Unless otherwise specified, all RCC pipe work shall be Class M with spigot and socket type flexible joints.

5.08 Galvanized Mild Steel Pipe

Galvanized mild steel pipe shall comply with BS 1387, "Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 threads" or as approved by the Engineer. Steel fittings with threaded joints shall comply with BS 1740, "Specification for wrought steel pipe fittings (screwed BS 21 R-series thread)". Galvanized steel pipes shall be medium gauge, unless otherwise approved by the Engineer.

Steel pipes shall be cut using an approved hand operated cutter to give a neat square finish. All threads shall comply with BS 21, "Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)". Threaded joints shall be sealed with PTFE tape to BS 4375, "Specification for unsintered PTFE tape for thread sealing applications".

5.09 Flanged Joints

Steel flanges shall be of the weld-on or screw-on type and comply with BS 4504, "Circular flanges for pipes, valves and fittings (PN designated)" or as approved by the Engineer. The pressure rating shall be PN10 unless otherwise stated.

Gaskets for flanged joints shall be of fabric reinforced rubber of the full face type and comply with BS 4865 : Part 1, "Specification for non-metallic flat gaskets (including gaskets for flanges to BS 4772)" or as approved by the Engineer. The joints shall be made using bolts and nuts to BS 4190, "Specification for ISO metric black hexagon bolts, screws and nuts", and washers to BS 4320, "Specification for metal washers for general engineering purposes (metric series)".

PART 6

6. *Pumping Equipment*

6.01 Summary of Requirements

The contractor will provide full details of the pumps to be provided including details of power source, coupling arrangements, capacity (50 l/sec. or m³/hr), total pumping head (m), suction lines with foot valves and strainers, delivery lines with connecting valves, manifold pipe, rising main, motor control centres (including starters, switches, amp meters, voltmeters, indicators and controls), cabling and associated earthen protection and all civil engineering and building works that are required to install and fix equipment in and outside pump house.

6.02 Pump Duty Point

The contractor is to define the pump duty point for the pumping system with the specified number of pumps each supplying a specified capacity at a declared maximum static head (m) plus an estimated dynamic friction head (m) in the rising main plus the dynamic head of the suction pipework, the delivery pipework, the delivery manifold to its connection with the rising main.

6.03 Net Positive Suction Head

The contractor is to submit the computations to indicate that the pump is capable of providing the net positive suction head from a stated minimum water level in metres at the pump inlet level and the pump inlet above the base of the frame.

6.04 Pumps

The specification and capacity of each pump should be stated giving their unit discharge against the computed total head. The estimated maximum turbidity of the water to be pumped should be stated. The pumps (if of a centrifugal radial flow type) should preferably be of a back-pull-out type for easy maintenance.

6.05 Pump Sets

The preferred pump set arrangement is for the pump and electric motor to be close coupled on a common frame provided by the manufacturer and supplier as a single complete unit.

6.06 Suction Pipework

The suction pipework is to be of a diameter not less than the pump suction diameter and of a class and material compatible with the location and nature of the installation and shall include a strainer, foot valve and gate or butterfly valve against the pump inlet.

6.07 Discharge Pipework

The discharge pipework shall be of a diameter not less than the pump discharge and of a class and material suitable within the pump station and shall include a non-return valve and gate or butterfly

valve on each pump, and a suitably sized manifold connecting the supplied number of pumps to the rising main located within a specified short distance of the outside face of the pump station.

6.08 Electric Motors

The electric motors shall be drip proof and from a manufacturer whose products are easily available in this country and the power output power shall be commensurate with the pump duty and starting load requirements.

6.09 Motor Controls

The motor controls shall be contained in an appropriate motor control centre cabinet containing the following:

- Input power voltmeter on each phase
- Input power on/off cut out
- Star delta starters
- Volt and ampere meters for each motor
- Automatic and manual motor selection of 2 pumps operational and one standby
- Hour metres for each motor
- Dry run cut out for each pump
- Green running lights for each motor
- Emergency stop buttons for each pump

6.10 External Electrical Connection

Current not available in most Rural Areas. If available, then the external electrical connection from the motor control centre to the Utilities termination shall be entirely to the approval of relevant Utilities.

6.11 Internal Electrical Connection/Building

The internal electrical connections shall be to Utilities approval. The cables between the motor control centre and the motors shall be in armoured conduit firmly attached to the floor of the pump house. The contractor shall include for adequate earthing protection for the entire electrical installation.

Installation of electrical services shall be undertaken in a safe, simple, systematic and orderly fashion giving attention to labeling of circuits, color codes and numbering of cables so that the completed installation can be effectively maintained by personnel with nominal understanding of electrical engineering. Location of conduit, fixtures, switches, outlets, distribution boards and other electrical equipment and appliances shall generally be in accordance with the updated construction drawings; and in accordance with the specifications and mounting heights and location details in drawings.

6.12 Building Work

The contractor must include for all associated building work required including making holes in 250 mm thick reinforced concrete walls for pipes and cables and in the roof and brickwork walls and making good.

6.13 Commissioning

The contractor must include for all costs for testing and commissioning the pumps and electrical connections and shall provide the necessary pressure gauges, flow meters and multi-meters. Each pump shall be tested against a closed discharge valve and in normal operating conditions for such time as the Purchaser's representative deems necessary. Should the Utilities supply connection not be available at the required time for commissioning then the installation shall be tested using a suitable generator to temporarily supply the power requirements of the commissioning tests.

6.14 Spare Parts

The tender shall include a detailed schedule of all spare parts recommended by the manufacturers for the operation of the pumps and motors for a period of 5 years and shall include at least 3 No full size pump impellers.

6.15 Manuals

The tender shall include for the provision of 3 complete sets of operation and maintenance manuals on the entire installation and the workshop manuals and spares lists on the pumps, motors and motor control centres.

6.16 Training

The tender shall include for the provision of on-the-job training for the representatives of the irrigation scheme's management on the basic operation of the pump station and further training for the Purchaser's representatives in the operation and maintenance of the installation.

6.17 Utilities Supply

The Utilities electrical supply shall be provided as a 100kVA 11/0.4kV pole-mounted substation and 20m of 70mm² of 4 core underground cable to their termination point.

6.18 Provision of Generator

Should the Utilities connection not be available, then the Contractor shall provide a suitable generator and make all the necessary connections and operate the generator for the duration of the commissioning tests and until a completion certificate has been received for the works.

6.19 Other Contractors

During the completion of this contract other contractors shall be working on the site and the Supplier must afford all reasonable opportunities for them to carry out their work.

7. (Part 7) Environment and Social Mitigation Measure

7.01 General	<p>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.</p> <p>In conducting his construction activities, the Contractor shall take all necessary precautions to minimize environmental disturbance to the project area and 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>
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7.02 Pollution of Water Courses and Streams	<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>
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7.03 Air Pollution	<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>
7.04 Noise Pollution	<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. 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>

7.05 Damage to Property, Crops and Vegetation	<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 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 anytree, 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>
7.06 Safety Procedures	<p>The Contractor shall:</p> <ul style="list-style-type: none"> (a) comply with all applicable safety regulations, (b) take care for the safety of all persons entitled to be on the Site, (c) use reasonable efforts to keep the Site and Works clear of unnecessary obstructions so as to avoid danger to these persons, (d) provide fencing, lighting, guarding and watching of the Works until completion and taking over, and (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.
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7.07 Avoidance of Interference	<p>The Contractor shall not interfere unnecessarily or improperly with:</p> <p>the convenience of the public, or</p> <p>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.</p> <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>
7.08 Access Routes	<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> <p>the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;</p> <p>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;</p> <p>the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;</p> <p>the Employer does not guarantee the suitability or availability of particular access routes; and</p> <p>(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</p> <p>(f) the contractor should also ensure uninterrupted traffic of humans and animals by providing temporary access bridge across canal.</p> <p>(g) the contractor's site camp should be in a significant distance from the nearby community to avoid any interference.</p> <p>(h) the contractor shall bring the camp site back to normal physical status once the construction work has been done.</p>

<p>7.09 Cultural Resources</p>	<p>All moveable and Immovable 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 Law on the Preservation of Afghanistan's Historical and Cultural Heritages and Artifacts (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>
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8. *Staff and Labour*

8.01 Engagem nt of Staff and Labour	<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 labour with appropriate qualifications and experience from sources within the Country.</p>
8.02 Rates of Wages and Conditions of Labour	<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>
8.03 Labour Laws	<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>
8.04 Working Hours	<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> <p>otherwise stated in the Contract,</p> <p>the Engineer gives consent, or</p> <p>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</p>

	<p>advise the Engineer</p> <p>The working hours for youths between 15 and 18 year of age, should not exceed the limit of 35 hours per week.</p>
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8.05 Facilities for Staff and Labour	<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>
8.06 Health and Safety	<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"> 1. provide first aid services and conditions, 2. transfer the worker concerned to medical centres and provide for treatment conditions, 3. When the worker is cured, transfer him to his/her place of residence, (Article 114, labour law). <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>
8.07 Disorderly Conduct	<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>
8.08 Supply of Water	<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>
8.09 Festivals and Religious Customs	<p>The Contractor shall respect the Country's recognized festivals, days of rest and religious customs.</p>
8.10 Funeral Arrangements	<p>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.</p> <p>The contractor shall provide financial aid for the deceased employee's family</p>

	for burial ceremony equal to 10 months wage along with its benefits as per the last salary (Article 134, labour law).
8.11 Prohibition of Forced or Compulsory Labour	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.
8.12 Prohibition of Harmful Child Labour	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.
8.13 Soil Erosion	Plantation of appropriate vegetation on hill slopes and other potentially erodible places along the embankment. Appropriate earth compaction and in construction of access roads , restriction of vehicular and construction machinery movements very close to the canal/river banks
8.14 Degradation of borrow pits	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.
8.15 Increase inequities between Downstream and upstream communities:	Contractor to ensure that employment opportunities are equally available to downstream and upstream communities. Contractor to be aware of and pay particular attention to equity issues where different ethnic or tribal groups are located upstream and downstream
8.16 Contractor Environmental and Social Focal Point	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

The dam related detailed scope of work and specifications is figured out below on numeric order:

NOTE:

1. The cutoff trench And Nucleus (core) portion of Dam Filling Materials must be consider of impervious material that have more than 80 percent Clay , that will not allow the passage of any water (i.e. impervious).
 - I. For Cover Portion of Dam use impervious material that have more than 55 percent Clay, that will not allow the passage of any water (i.e. impervious).
2. Basically, the textural classes involved are as follows: Any soil with more than 55 percent clay can be considered as a 'clay'. A 'sandy clay' is a soil with between 33 percent and 55 percent clay and up to 65 percent sand. A 'sandy clay loam' has between 20 percent and 30 percent clay and up to 80 percent sand and loam.
3. Texture tests:
 - I. Texture tests are carried out to determine soil types. Excluding stones and gravels,
4. The mineral part of the soil is made up of particles in three size ranges
 - I. C - Sand: 0.05-2.00 mm diameter.
5. Rapidly fluctuating water levels for long periods the dam should have impervious Foundation If seepage is excessive this can lead to instability and eventual failure of dam.
6. Most dams, homogenous or zoned, can benefit from the construction of a cutoff in
 - I. The foundation. A cutoff will reduce seepage and improve stability.
 - II. Whether stable clay, or other material is being used, the cutoff trench must be excavated to a depth that will minimize all possible seepage. Ideally, the cutoff trench should be dug down to solid rock that extends to great depths. If underlying rock is assured or uneven it can be cleaned off and concreted to offer a good surface on which the clay can be laid.
7. For larger indentations or cracks, slush grouting should be used, which is a thick slurry mix of cement and water poured and boomed any question do contact with quality control engineer.
8. Generally, homogeneous dams should have relatively flat slopes (1:3 upstream and 1:2 downstream) as insurance against possible instability, for this project we consider 1:3 for more stability, it has a huge catchments area.
9. A flatter upstream slope, required by all earth dams, allows the saturated section below water level to resist slumping.
10. . Also the weight of the water stored above it exerts a down force which, when combined with the weight of the dam, equals or exceeds the horizontal thrust
Exerted by the depth of the water against the embankment.
11. Water levels should not be allowed to fall or rise too fast, especially if the embankment material is impermeable. This is because a rapid lowering of the reservoir could lead to slumping of the upstream face or, if the wall has been allowed to dry, a rapid rise in level could lead to erosion through cracks and fissures. Both may eventually result in erosion, loss of material and, in a worst case scenario, a breach.
12. Every layer must be well compacted and if the whole dam length cannot be completed at any one time. Each section must be well keyed and bonded to the next since the cutoff trench and

- core are designed as one homogeneous unit to avoid seepage and structural problems, any more question do contact with Quality Control Engineer.
13. Compaction can be carried out by hand (tamping damp material by ramming poles 100-150 mm diameter) or by machinery (rollers or vibrators), or a combination of both.
 14. Light irrigation of the borrow area, some hours before excavation, can often assist in the scraping and scooping of the material, as long as it is not too wet.
 15. Rain on the site can cause problems and an over-wet clay will prove difficult to compact. In this situation it is better to wait for the soil to dry before continuing with construction.
 16. Continual or, at least frequent, monitoring of core material quality, moisture content and layering procedures is advisable, especially where inexperienced plant
 17. Soil pits and trenches dig soil pits and auger holes to assess the top and subsoil layers and the foundation condition in the embankment area.
 18. Auger holes dug on a grid to depths of 3 m throughout a potential source area will allow a general assessment of soil types to be made. A series of trial pits and trenches can then be dug in more promising areas to allow a visual assessment of the soil profile to be made in line with local soil coding and classification techniques.
 19. Samples can be taken for subsequent texture and laboratory analysis, any question do contact with Quality Control Engineer.
 20. INVESTIGATIONS
Ideally, the entire earth fill should be drawn from within the reservoir area and, if required, from any cut spillway areas.
 21. The importance of a correct analytical approach to determine the various soil types for a zoned embankment cannot be stressed too much.
 22. Although using a soil laboratory is expensive, the results can more than repay the cost involved and, more often than not, will ensure the exclusion of doubtful material in the construction process. This approach will include selecting the soils to be used, laboratory testing and mechanical analysis (if such facilities are available) to ensure the selected materials are suitable and interpretation of the results of these tests by an experienced engineer or technician to permit the appropriate materials to be used, any more question do contact with Quality Controlee Engineer.
 23. Core and cutoff material
A soil is required that will limit the passage of water but not to such an extent that undesirable differential pressures could build up across and within the embankment. The impermeability of the soil used will vary between localities, but some standardization of water tightness can be achieved through varying the degree of compaction involved.
 24. A more pervious material will require greater compaction and vice versa. Generally, soils containing a significant percentage of clay are ideal for the core but clays with a tendency to crack should be avoided. If the latter are used they should be carefully compacted, placed in lower parts of the dam that are unlikely to dry out (such as in the cutoff trench) or covered by a gravel layer or topsoil with grass.
 25. Sands and clays, and combinations of them, are most suitable for earth dam construction. Generally, however, silty soils are unsuitable because of their inherent instability when wet and should not be included in any of the earthworks.

26. To precisely define textural classes requires laboratory techniques but, with experience and specific local knowledge, hand testing to determine texture can prove important for the initial stages of identifying appropriate earth fill materials.
27. Clay soil areas can be demarcated in the field with the better soils (i.e. higher percentage clays) being reserved for the core and upstream shoulder of the embankment.
28. Silts are often similar in both appearance and feel to wet clays when dry but can usually be differentiated when wet as the clay will exhibit sticky, plastic-like characteristics while silt has a silky, smooth feeling with a tendency to disperse.
29. Hand-testing techniques involve the taking of a small sample of a soil - usually in the hand not required for making notes - dampening it (avoid soaking it) and rolling it into a ball to examine its cohesive constituents.
30. A better quality clay can be manipulated into a thin strip without breaking up, rolled into a ball and dropped onto a flat surface from waist height without cracking unduly. Also, when cut it will exhibit a shiny, smooth surface.
31. The best clay soil is always reserved for the core and cutoff and must be well compacted. Basically, the lower the clay percentage (to an arbitrary minimum as low as 3-5 percent), the more compaction and care in construction is
32. Sandy clay soils are most suited for inclusion in this upstream section as they compact well, have much reduced seepage characteristics but do not allow the buildup of high soil-water pressures.
33. Clays are not required in the downstream shoulder as it is essential that this section is free draining.
34. Within a river valley a cross-section of soils may be available. The valley sides, where less leaching has occurred, can provide soils with a higher proportion of clay. The more heavily leached areas can provide amounts of sands, gravels and/or silts. The streambed proper should be a source for silts, sands and gravels, the latter being useful for drains and concert work.
35. Of great economic importance is the need to find such materials close to the dam site, preferably within the reservoir area, and in large enough quantities to justify their removal. Avoid complete removal of impervious materials, as exposure of more permeable layers beneath could lead to seepage problems in later years, especially when under pressure of several meters of water.
36. Embankment materials Semi-pervious materials such as sandy clays and clay loams with a proportion of fines, such as clay or perhaps silt particles, are suitable for inclusion in the upstream shoulder. These will allow a limited passage of water and, in a properly constructed embankment, will resist slumping when wet. Where poorer soils are used, special attention to compaction techniques will have to be given to minimize the volume of air spaces in the soil and to maximize its stability when wet.
37. Pervious materials such as coarser grained sand and. Gravels - suitably washed and Screened/sieved for size and grade - are used in the downstream shoulder and sections of the embankment requiring mass and drainage.

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38. Always seek specialist advice for use of these materials in drainage and filter works. These can often be better compacted dry or if only slightly damp. Once completed, a dry downstream Face will prevent slippage and reduce risk of failure.
 39. Materials to avoid should there be any question about a soil's suitability, it is safest to avoid using it. Some materials should never be used in dam construction, in particular the following: Organic material (except when used to top dress the embankment and other parts of the dam site at the end of the construction period).
 40. Decomposing material. Material with a high proportion of mica, which forms slip Surfaces in soils of low clay percentages. Calcite soils such as clays derived from limestone which, although generally stable, are usually very permeable.
 41. Fine silts, which are unsuitable for any zone of the dam. Schists and shales which, although often gravelly in texture, tend to disintegrate when wet. Schists may also contain a high proportion of mica.
 42. Cracking clays that fracture when dry and may not seal up when wetted in time to prevent piping through them. Sodic soils, which are fine clays with a high proportion of sodium. They are difficult to identify in the field, so any fine clay should be analyzed.
 43. PH is the standard measure of acidity related to the concentration of hydrogen ions. A pH of
 44. Neutral, soils with a pH between 1 and 7 are acidic and those above 7 (to 14) are alkaline.
 45. A soil with a predominance of sand should not be used in dam construction. A sandy soil can be used in the downstream shoulder but should not be used elsewhere unless there is no alternative. If a sandy soil is used in the rest of the dam special attention must be paid to compaction, the best soil reserved for the core, and some consideration given to obtaining embankment water tightness by other means. Sands do have an important role in larger dams as a filter material.
 46. LABORATORY TESTS
 47. Laboratory tests on selected samples should be undertaken to confirm the field evaluations and to determine the physical properties of the soils. Say in a silty-clay, but care must be taken in its use and application to ensure it is balanced with other soils and to keep percentage contents low. As they can be confused with fine clays, it is important to differentiate the two when testing for texture. Laboratory analysis may, therefore, be required.
 48. FREEBOARD
 49. Freeboard for small dams should never be less than 1.0 m preferred. Where wave action is likely, additional freeboard may be required.
 50. SETTLEMENT ALLOWANCE
 51. The embankment will always settle a little after construction and the finished crest should be given a settlement allowance that raises it above its design height at the mid-point by between 5 percent and 10 percent and tapering off to the spillway and valley sides.
 52. STONE PITCHING AND TRAINING BANKS Stone pitching is usually not necessary, as a good grass cover is normally sufficient to protect the embankment here. However, occasionally training banks may require stone pitching protection, depending on the climatic regime and likely flood flows.
 53. The training banks should be long enough to divert water safely away from the downstream toe of the dam. They should have the same proportions and crest level as the main embankment. Where natural spillways are to be used.

54. COMPACTION EQUIPMENT AND TECHNIQUES

The compaction of soil is essential to increase the shear strength of a material to achieve high levels of embankment stability. A high degree of compaction will increase soil density by packing together soil particles with the expulsion of air voids. Comparing the shear strength with the moisture content for a given degree of compaction, it is found that the greatest shear strength is generally attained at moisture contents lower than saturation. If the soil is too wet, the material becomes too soft and the shear stresses imposed on the soil during compaction are greater than the soil's shear strength, so that compaction energy is dissipated largely in shearing without any appreciable

Increase in density. If the soil is too dry, a material compacted in this condition will have a higher percentage of air-spaces than a comparable soil compacted wet. It will take up moisture more easily and become more nearly saturated with consequent loss of strength and impermeability.

55. CONSTRUCTING THE EMBANKMENT, the core/cutoff trench As this is the most important part of any embankment, great care is necessary in the excavation, fill and use of material. Width and depth should have been determined at the design stage. Width (2m) minimum will often depend on the equipment used in the excavation and also on the size of the dam otherwise use formula if you have any question do contact with QC engineers.

56. The minimum depth necessary will depend on site conditions but in all excavations the cutoff trench must be taken down to good quality impermeable material such as clay or solid rock

57. If rock is located and is generally good, it is permissible to fill any cracks or fissures with compacted clay or mortar, provided they can be fully cleaned and traced to ensure seepage paths will not develop later.

58. If permeable material is found it is vital that the cutoff is taken through it to a depth sufficient to find more impermeable material.

59. Before backfilling, the excavation should be checked to ensure that the conditions above have been complied with. Short cuts taken at this stage can prove costly later and seepage through the embankment can become excessive if the correct depth into the correct material is not achieved. A little extra time and care in the excavation of the core is usually worthwhile,

60. Other requirements such as coffer dams, special compaction, dewatering equipment and safety provisions in the trench should be considered before excavation starts, to allow the work to be carried out efficiently.

61. An assessment of the site condition, for example to ascertain groundwater levels, at the design stage would allow such special provisions to be included in the cost estimates.

62. Once the excavation has been checked and found satisfactory, backfilling can occur. The best clay soil should be used and compacted in layers no more than 75-100 mm thick (50-75 mm is best), throughout the length of the trench.

SPILLWAY :

63. Natural spillways are generally best for all earth dams but often some degree of cut is required to obtain the necessary design slopes. In all cases the movement of machinery over the spillway area should be minimized to avoid over compacting the existing soil.

64. Any large volume spillway cut should be done at a time when the excavated material (if suitable) can be included with the material being moved to construct the main embankment or reserved to fill in borrow pits. Smaller volumes of cut material can usually be included in the training bank.
 65. Slope (cross fall) towards the upstream side of the embankment to permit the safe drainage of rainwater to the reservoir rather than the downstream slope. Over the next few months, and finally after one year, the embankment should be rechecked to assess settlement and to allow the placement of soil at any sections that settle to below horizontal.
 66. The spillway should be checked to prove the design slopes were adhered to. If large flood flows occur, or are expected, stone pitching or concreting of the end of the embankment and one or both sides of the spillway channel may be necessary to reduce the risk of erosion.
 67. It is very important that good grass cover, preferably of creeping grass type, is established on both the embankment and the spillway before the likelihood of heavy rains. This could mean constructing most of the spillway before work on the embankment itself starts, ideally at the end of the previous rainy season when water for establishing grass is available.
 68. Either way, the last soil layers to be laid on the embankment, and on any spillway cut sections, should be of good quality topsoil so as to encourage rapid and dense grass growth. Manuring and irrigation may prove beneficial. To minimize erosion caused by people and animals the embankment should be fenced and gated and, in some cases, special protected pathways for watering livestock should be provided to keep animals well clear of sensitive areas.
 69. If erosion does occur, particularly at the early stages, much time and effort can be saved by prompt remedial action. After any heavy rainstorm the dam should be inspected. Any rills or gullies filled in and replanted with grass before the situation becomes too advanced. Where soil and grass cover are difficult to establish, wiring of the topsoil and vegetation may assist in re-tariffing with suitable sods in any holes that occur. All new dams that have not completely stabilized and settled require frequent visits again and, again, the beginning of the rainy
- INSPECTION REQUIREMENTS:
70. At the time of siting the dam it should have been made clear to the local community/dam owner that to maintain the dam in good condition and to prolong its life as a sound, useful water resource, competent and timely inspection and maintenance are going to be required. Once the excavation has been checked and found satisfactory, backfilling can occur. The best clay soil should be used and compacted in layers no more than 75-100 mm thick (50 75 mm is best), throughout the length of the trench.
 71. All dams must be inspected at least annually. In dry season climates the best time to carry out this work is before the beginning of the rainy season, when most of the dam and its reservoir area can be seen.
 72. Time after the inspection (and before the rains begin) must be allowed for to complete any remedial or repair work.
 73. All dams with grass spillways must be visited after every heavy rainstorm and flood. This is most important at the beginning of the rainy season when, because of limited grass cover, erosion risks are highest.
 74. Season is an important time, especially if a grass cover has not been established. After the first year or so, a more routine inspection programmer can commence. Initially visits (which will vary from site to site) should not be less than twice a month and after every rain or flood.

Seepage and drainage:

75. All earth dams will leak to some extent and seepage only becomes a problem if it endangers the embankment - either by encouraging erosion in the downstream area or by causing water logging of the dam and thus affecting its stability.
76. Dirty water seeping from the downstream face of any dam is cause for concern. As finer materials are eroded, and carried out of the embankment, this could lead to piping or slumping in the structure.
77. At the time of construction and, particularly if the dam does not have a dry, well-drained downstream foundation area, drains should be installed before the embankment is built. If this was not done and seepage has become excessive, the following may reduce the problem:
Settlement:
78. However well the dam was built, it will always experience some settlement. Most dams settle out in the first year or so after construction. Invariably most settlement occurs at the highest point of the dam where mass is greater and other pressures highest.
79. At the time of construction, a settlement allowance should have been incorporated on the top of the embankment. At every inspection the crest must be checked to ensure it remains horizontal and that no low spots have developed.
80. All over settlement must be attended to with backfill and additional monitoring. If this is neglected, and should either the crest level fall overmuch, or an exceptional storm lead to backing up of floodwater from the spillway, the dam will overtop, water will concentrate in the low spots and serious damage result.
81. Unusual settlement in an older dam can indicate foundation movement or removal of embankment material by seepage or erosion. Always seek expert assistance when this occurs. Another form of settlement can arise when, due to poor construction techniques, the core has been compacted comparatively more than other parts of the embankment.
82. The upstream and downstream sides or shoulders of the embankment settle more than the core as they are less well compacted and, as the foundation is firm (and it cannot fully absorb the differential settlement), cracks appear along the crest edges as the settlement takes place. These cracks do not represent a serious problem and can usually be treated by ramming in damp soil complete with grass as soon as they develop. It is important to prevent water entering such cracks (otherwise erosion and water logging will follow) and in the rainy season it may be necessary to sandbag the area to minimize runoff.
83. When large, deep cracks appear on older dams (indicating foundation movement or slumping of either shoulder), the reservoir water level must be lowered and expert assistance must be sought without delay.

TREES AND BUSHES:

84. Do not allow trees, bushes or other deep-rooted plants to grow anywhere near the embankment the spillway and its outfall. Keep all parts of the dam clean with a low grass cover to protect against erosion and assist inspection and maintenance. Trees on the embankment do not help stabilize the soil and their roots will eventually reach to water. When dead and decomposed, pathways for insects, animals and water are then formed. Therefore, remove all trees and bushes before they become established.
85. In a situation where large, old trees have been allowed to establish themselves on the embankment they should be removed when the upstream water level is low. The trees should

- be cut as low as possible and, if the stumps cannot be excavated, they should be soaked in petrol and burnt or treated with chemicals to most gullies in the spillway areas and on embankment slopes are started when rainfall and the subsequent runoff concentrate in depressions caused by footpaths, vehicle tires or animal tracks.
86. To determining foundation, strengthen and impermeability it is required to test it stability against settlement as well result of laboratory test should be check by QC engineer.
 87. Embankment back fill materials should be check in laboratory to determine its imperiously characteristic of materials which is used on dam body construction base on project requirement, alter QC engineer approval it can go ahead for remaining construction activities.
 88. Several compaction and backfield materials laboratory tests are needed to be considered in estimation volume schedule (BoQ) that one laboratory is assigned for all project life cycle.