8.3.6 Hoist details

The hoist shall be manually operated single stem screwed spindle hoist suitably mounted on the steel deck to open, close and hold the slide gate in any position between fully opened and fully closed positions.

The hoist shall consist of stand, mechanical equipment, i.e., bearings, gear reducer unit, screwed and extension spindles, removable spindle support(s) with bracket(s), manual operating device, mechanical position indicator and all other necessary components including the hooks for proper and efficient operation of the hoist.

The hoist shall be designed to withstand the rated hoist load at the specified allowable stresses and the factors of safety. The spindle shall be of corrosion-resisting steel.

The mechanical equipment shall conform to the requirements of Sub-clause 8.1.5 hereinbefore.

Two hooks shall be provided at the horizontal beam as shown on the Drawings related for installation and maintenance purposes of the gate.

8.3.7 Shop assembly and tests

(1) Gate and guide frame

The gate including seals, side guides, lifting lug, etc., shall be assembled at the shop in the approximate position that it will have after installation at the Site. While assembled, the gate shall be checked for dimensions, tolerances and accuracy of alignment.

Any error and misalignment discovered shall be promptly corrected. The seals shall be fitted to their supports during the shop assembly.

The track frames, side guide frames, sealing frames, sill beam, lintel and front frames for the guide frames shall be assembled at the shop. All dimensions of the guide frames, that correspond to the gate dimensions, shall be checked and any error and misalignment discovered shall be corrected. Parts shall be clearly match-marked before disassembling for shipment.

(2) Hoist

The hoist shall be completely shop assembled and tested for smooth and proper performance. All units shall be tested at rated load and closely checked to ensure that all necessary clearance and tolerances have been provided and that no binding occurs in any moving part. All bearings shall be carefully checked. All lubricating grease and oil required for the performance of the test shall be furnished. Any improper operation discovered shall be corrected and the entire test shall be repeated.

8.3.8 Installation and tests at the Site

(1) Guide frame

The guide frame shall be assembled in the blockout in accordance with the "FOR WORK DRAWINGS" and approved erection manual, brought to line and grade within the tolerances specified and firmly secured in place. Alignment bolts or other necessary devices shall be used to install the guide frame at corresponding accurate position. Connections between guide frame, anchored materials and the alignment devices shall be adjusted, firmly tightened and welded to hold the guide frame securely in position while concrete is being placed in the blockout.

Additional bracing shall be provided where necessary to ensure the required alignment. Extreme care shall be taken to ensure that the sealing surfaces lie in a true plane within the tolerance specified for their entire length.

Placement of concrete in blockout shall not proceed until the guide frame has been completely assembled and secured. During and after concrete placing, alignment and tolerances shall be checked and remedial action taken if readings indicate that displacement has occurred.

(2) Gate

The gate complete with side guides, lifting lugs and seals shall be assembled and erected in accordance with the details shown on the "FOR WORK DRAWINGS" and approved erection manual.

The bottom of the gate, when erected, shall be in true alignment to ensure a tight and even bearing of the rubber seal on the embedded sill beam. The sides of the gate shall be true alignment so that the rubber seals, when installed, will have a tight and even bearing on the sealing surface

embedded in the concrete. The gate shall be assembled and erected within the shop test tolerance necessary to meet the specified tolerances.

(3) Hoist

Before assembly, all bearing surfaces, journals, grease and oil grooves shall be carefully cleaned and lubricated with an approved oil or grease. Before operation, all lubricating system shall be checked by the Contractor.

The hoist shall be completely assembled and installed in accordance with the "FOR WORK DRAWINGS" and approved erection manual. The hoist shall be located and adjusted so that they are in true alignment with lifting lugs of the gate.

After installation of the hoist and prior to setting the spindle, the hoist shall be operated and checked for proper operation. After completion of the above tests, the spindle shall be set and connected to the gate and the gate shall be tested. Any defect or improper operation discovered during the test shall be corrected and the entire test shall be repeated.

8.3.9 Tests on completion

After completion of installation work at the Site, the following tests shall be performed by the Contractor in accordance with the approved test procedure:

(1) Preliminary tests

(a) Inspection by feeler gauge measurement of satisfactory sealing of all seals, and
(b) Inspection of satisfactory installation of all components.

(2) Operation test

The operation tests shall include but shall not be confined to :

(a) Check of manual operation of hoist
(b) Check of satisfactory operation under dry and available maximum water level, and
(c) Check of gate position indicator.

8.3.10 Measurement and payment

Measurement, for payment, of steel slide gate and hoist will be made on the basis of actual installed number of steel slide gate and hoist in sets as shown on the Drawings or as directed by the Engineer.

Payment shall be made for the number of sets measured as provided above at the Contract unit price per set stated in the Bill of Quantities, which unit price for steel slide gate and hoist shall constitute full compensation for the cost of all labour, tools, equipment and materials including designing, procuring, transporting, storing, handling, assembling, erecting, installing, galvanizing and painting as well as supply, installation of all related materials and fittings, and other items necessary to complete the Works.

Payment shall be made to the Contractor subsequent to the tests on completion specified in the preceding Sub-clause 8.3.9 and the Engineer has ascertained the gate and hoist have been completed and have become operational.

8.4 Flap Gates

8.4.1 General

The following square type steel flap gate shall be designed, supplied and installed at each small drainage channel which are located at arban areas in tributary by the Contractor.

- Type : Square type steel flap gate

- Location and size;

Location	Clear Span (mm)	Clear Height (mm)	Q'ty	Design Head (m)
STM-2R	400	400	1	1.790

In order to standardize the design, the design head shall be taken as 1.79 m commonly for all the flap gates of the Project.

- Operation : Automatically operated by water pressure difference.

8.4.2. Design stresses

Gate shall be designed taking into account of the hydrostatic load and the dead weight of itself. The design stresses shall conform to those specified in Sub-clause 8.2.2, Design stresses.

8.4.3. Design data

The gate and seating frame shall be designed for the following conditions:

(1) General data

Quantity	:	Refer to Sub-clause 8.4.1,General
Type of gate	:	Steel made flap gate
Clear span	:	Refer to Sub-clause 8.4.1,General
Clear height	:	Refer to Sub-clause 8.4.1,General
Design head	:	Refer to Sub-clause 8.4.1,General
Corrosion allowance	:	1.0 mm for water contact face members
Sealing method	:	4 edges rubber seal at anti-pressure side

Other design data such as HWL, elevation of conduit center, etc. are given in the Table of Drawings related together with the name of drainage channel and required quantity.

(2) Gate

(a) Hydrostatic load
Pressure side head water at HWL + 1.0 m
Anti-pressure side head water at lower sealing elevation of the gate

(b) Self weight of gate

(3) The loading on the seating frame shall be the bearing load and all other loads due to the flap gate. The seating frames and their anchors shall be capable of transferring all the loads to the concrete structure and of preventing harmful deflection of seating frames due to placing the secondary concrete in blockouts.

8.4.4 Gate details

The flap gate consists of skin plate, main beams, edge beams, upper hinge, connecting plate and other necessary components. The skin plate shall be provided at the river side (pressure side) of gate leaf, but the seal rubber shall be provided at the land side of gate leaf. Hinge pins and plate shall be of corrosion resisting steel.

8.4.5 Seating frame details

The seating frame consists of upper, under and side frames, hinge brackets and other necessary components. The seating frame should be embedded in the secondary concrete. The corrosion-resisting steel plates are attached to four edge frames. The seating frame and anchors are capable of transferring the load of the metal seals of the gate to the concrete structure. The hinge brackets are rigidly fixed by the anchors.

8.4.6 Shop assembly and tests

The gate including seating frames shall be assembled in the shop in an approximate position so as to be installed at the Site. While assembled, the gate shall be checked for dimensions, accuracy of alignment and operating performance. Any error and misalignment discovered shall be promptly corrected.

8.4.7 Installation

The gate and seating frames shall be assembled and erected in accordance with the final approved drawings. The seating frame shall be accurately set, aligned and surely anchored prior to placing of secondary concrete.

The sealing surface of the gate shall be in true alignment to ensure an even bearing on the seating frame.

8.4.8 Measurement and payment

Measurement, for payment, of steel flap gate will be made on the basis of actual installed number of flap gates in sets as shown on the Drawings or as directed by the Engineer. Payment shall be made for the number of sets measured as provided above at the Contract
unit price per set stated in the Bill of Quantities, which unit price for steel flap gate shall constitute

full compensation for the cost of all labor, tools, equipment and materials including designing, procuring, transporting, storing, handling, assembling, erecting, installing, galvanizing and painting as well as supply and installation of all related materials and fittings, and other items necessary to complete the Works.

Payment shall be made to the Contractor subsequent to the tests on completion and the Engineer has ascertained the gate has been completed and has become operational.

8.5 Timber Stoplog

8.5.1 General

The following number of timber stoplogs shall be designed, supplied and installed at each sluiceway by the Contractor. These sluiceway stoplog works are as follows.

No.	Dimension			Stoplog Type	Q'ty		Design Head (m)
	Clear Span		Clear Height		Stoplog (set)	Guide frame	
1.	0.4m	×	0.4m	Timber stoplog	1		1.790
2.	0.8m	×	0.8m	Timber stoplog	1	9 sets in total	2.391
3.	1.0m	×	1.0m	Timber stoplog	1		2.835
4.	1.1m	×	1.1m	Timber stoplog	1		2.644

Stoplogs shall be used for maintenance and repair of the slide gate slots.

Stoplogs shall be stored at storage yard and transported by the ordinary truck to the designated place.

The general data for the design of stoplogs are given in Sub-clause 8.5.3, Design data, hereinafter and these data shall remain fixed and shall not be altered.

The arrangement of stoplogs shall be as shown on the Drawing enclosed in Vol. IV- Drawings.

8.5.2 Design stresses

The allowable bending and shearing stresses of first class teak wood shall not exceed 110 kgf/cm^2 and 11 kgf/cm^2, respectively. The other design stresses shall conform to those specified in Sub-clause 8.2.2, Design stresses.

8.5.3 Design data

The stoplogs and guide frames shall be designed for the following conditions :

(1) General data

Quantity	:	Refer to Sub-clause 8.5.1, General
Stoplog type	:	Timber stoplog
Clear span	:	Refer to Sub-clause 8.5.1, General
Clear height	:	Refer to Sub-clause 8.5.1, General
Design head	:	Refer to Sub-clause 8.5.1, General
Operation head	:	Water head difference of 0.2 m
Height of each block	:	200 mm

Other design data such as HWL, sill elevation, operation deck elevation, etc., are given in the Table of Drawings related together with the name of drainage channel and required quantity.

(2) Stoplog

(a) Hydrostatic load
Head water at HWL
Tail water below sill elevation

(b) Self weight of the stoplog leaf

(c) Operating load

(3) Guide frame

The loading on the guide frame shall be the bearing loads and all other loads due to most adverse operation of the stoplog. The guide frame and the anchors shall be capable of transferring all loads

from the stoplog to the concrete structure.

(4) Portable hanger (Not Applicable)

The portable hanger shall be designed to lift the dead weight of stoplog, plus all friction load due to the stoplog block.

8.5.4 Stoplog details

(1) General

Each block of stoplog shall be a timber piece with two lifting eye bolts. Timber quality shall be hard wood and well seasoned first class teak wood. Timber shall be treated with coal tar creosote. Two lifting eye bolts including nuts and plain washers shall be hot-dip galvanized.

(2) Tolerances

Each stoplog block shall be accurately fabricated and installed within the following tolerances;

Point to be measured	Tolerances (mm)
Stoplog width	± 5
Stoplog height	± 5
Stoplog depth	± 5
Distance between lifting eye	± 3

The tolerances not specified herein shall be defined by the Contractor himself and subject to the Engineer's approval.

8.5.5 Guide frame details

(1) General

Two guide frames shall be provided at both the slots as shown on the Drawing. The guide frame shall be of angle beam and the anchors. The frames shall be straight and flat for providing a close fit with the stoplog block.

(2) Tolerances

The guide frame shall be fabricated and installed within the following tolerances ;

Point to be measured	Tolerances (mm)
Clear span	± 5
Height of frame	± 5
Flatness of frame	± 1/m
Straightness of frame	± 2

The tolerances not specified herein shall be defined by the Contractor himself and subject to the Engineer's approval.

8.5.6 Portable hanger details (Not Applicable)

Each portable hanger shall be provided at the outlets conduit of Saluran Cenkaren drainage channel for easy handling the timber stoplogs. The portable hanger shall consist of a hanger support, required number of stands and a handling tools with slings and hooks.

The hanger support shall be of a steel pipe construction with a U - hook for suspending a handling tool. The stand for hanger shall be adequate for removing the hanger. The handling tool shall be of manually operated chain block type and the capacity and lift shall be suitable for the timber stoplog to be handled. The structure of the portable hanger shall be as shown on the Drawing or as directed by the Engineer.

8.5.7 Shop assembly and tests

Each stoplog block shall be manufactured at the shop. After manufacturing, each stoplog block and guide frame shall be checked for dimensions, tolerances and accuracy of alignment. Any error or misalignment discovered shall promptly be corrected.

8.5.8 Installation and tests at Site

The guide frame and the anchors shall be erected with reinforcement bars and form works in accordance with the "FOR WORK DRAWINGS" and approved erection manual, brought to line and grade within the tolerances specified and firmly secured in place. Placement of concrete shall not proceed until the guide frames and the anchors have been completed, assembled and secured. During and after placing the concrete, alignment and tolerances shall be checked and remedial

action taken if readings indicate that displacement has occurred.

Each stoplog block shall be erected in accordance with the "FOR WORK DRAWINGS".

8.5.9 Tests on completion

After completion of installation work at the Site, the following tests shall be performed by the Contractor in accordance with the approved test procedure:

(1) Inspection of satisfactory installation of all components, and
(2) Check of satisfactory operation of handling tool.

After completion of final test, the Contractor shall store the stoplogs at the storage yard designated by the Employer.

8.5.10 Measurement and payment

Measurement, for payment, of stoplogs, handling tool and slings will be made on the basis of actual installed number thereof in sets as shown on the Drawings or as directed by the Engineer.

Payment shall be made for the number of sets measured as provided above at the Contract unit price per set stated in the Bill of Quantities, which unit price for stoplogs, handling tool and slings shall constitute full compensation for the cost of all labour, tools, equipment and materials including designing, furnishing, fabricating, transporting, painting, preparing and submitting shop drawings and other necessary documents, and installing stoplogs and other items necessary to complete the Works.

Measurement, for payment, of embedded guide frame for stoplog slot will be made on the basis of the actual installed weight of steel in kilograms determined by the "FOR WORK DRAWINGS" or as directed by the Engineer.

Payment shall be made for the kilograms measured as provided above at the respective Contract unit price per kilogram stated in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labour, tools, equipment and materials including designing, furnishing, fabricating, transporting, installing the embedded metals, painting, preparing and submitting shop drawings and other necessary documents, and other items necessary to complete the Works.

9. OTHER METALWORK

9.1 General

This Chapter covers fabrication, erection and other general requirements incidental to metalworks other than Chapter 8, Gates and Related Hydromechanical Equipment, as listed below :

(1) Steel trap
(2) Steel handrail
(3) Steel access bridge
(4) Steel ladder
(5) Repair of existing sluiceway gate, if any

Except as included in the Contract Documents, no detailed drawings for metalworks of steel traps, steel handrails, steel access bridges, etc., will be provided by the Engineer. The Contractor shall perform the necessary designs and provide the complete drawings required for the fabrication of the metalworks in accordance with the Drawings and the Specifications provided herein or the instructions given by the Engineer.

All the metalwork supplied by the Contractor for Permanent Works shall conform to the applicable standards stipulated in Sub-clause G6.1 of Vol. III, Part I - General Specifications and Sub-clauses 8.1.2 and 8.2.3. (7) of Vol. III, Part II - Technical Specifications, unless otherwise specified.

Any fabrication or procurement prior to approval of the manufacturing or shop drawings and data shall be at the Contractor's risk. The Engineer shall have the right to require the Contractor to make any change in the equipment design which the Engineer determines necessary to make the equipment conforming to the requirements of these Specifications without additional cost to the Employer.

Before fabricating the equipment, the Contractor shall submit three (3) sets of manufacturing or shop drawings and data showing complete details, sections and plans of all parts, assemblies, materials lists, components, connections and supports, and relations to the structures in accordance with the requirements in Sub-clause 8.1.3 of Vol. III, Part II - Technical Specifications. Cost of submitting such drawings and data to the Engineer shall be included in the unit price stated in the Bill of Quantities for furnishing and installing the metalworks.

The Contractor shall be responsible for the correctness and completeness of the shop drawings and for shop fit and field connections, although the shop drawings have been approved by the Engineer. When structural members are fabricated by bolting, a fabrication procedure including a list of equipment to be used will be required for all fabricated components, if it is deemed necessary in the opinion of the Engineer.

The work shall be shop fitted and shop assembled where possible, and shall conform to the details on approved shop drawings.

Where necessary, metal shall be insulated to prevent corrosion due to contact between metals and masonry or concrete. Insulation shall be made by means of bituminous paint or other approved means.

All fastenings, anchors and accessories required for fabrication and erection of the work under this Chapter shall be provided by the Contractor. Exposed fastenings shall be kept to an absolute minimum, evenly spaced and neatly set out. Wooden plugs shall not be permitted

All steel traps, handrails and steel ladders shall be painted in accordance with the requirements of paragraph (10) in Sub-clause 8.1.5 of Vol. III, Part II - Technical Specifications. The cost of painting shall be included in the respective unit prices for the items related in the Bill of Quantities.

9.2 Worksmanship

Workmanship and finish shall be first class and equal to the best practice in modern fabrication and machine shops, and generally conform to the applicable provisions stipulated in Clauses 8.1 and 8.2

Shearing shall be accurately done, and all portions of the work neatly finished. Corners shall be square and true unless otherwise shown on the Drawings. Bends, except for minor details, shall be made by approved bending rollers. The metal shall not be heated unless approved by the Engineer. Heating, when permitted, shall be limited to an extent up to producing a dark, cherry red colour on the metal surface. Heated metal shall be gradually cooled and be accepted unless otherwise welding is definitely specified on the Drawings. All bolts, nuts, and screws shall be tight.

The end of pipe, except for handrailing, shall be reamed. Holes for drainage shall be provided in

such horizontal or inclined members as may be subject to retention of entrapped water, as shown on the Drawings, or as directed by the Engineer.

All joint and intersecting members shall be accurately fitted and all works shall be fabricated in true planes with adequate fastenings.
Machine-finished surfaces shall be thoroughly cleaned of foreign matter and coated with an approved rust preventive compound prior to removal from the shop. Finished surfaces of metals to be in bolted contact shall be washed with a rust inhibitor, and those to be exposed after installation shall be painted.

Zinc coatings shall be applied to the materials as required in a manner and of a thickness and quality conforming to the requirements of JIS H 8641-82, Zinc Hot Dip Galvanizings, or other approved equivalent. In all cases where zinc coating is destroyed by cutting, welding, or other causes, the affected areas shall be regalvanized by an approved repair compound.

Full size drawings of the steel members at the shop shall be subject to inspection by the Engineer wherever practicable.

Any error, omission, deformity, defect, or the like in the shop assembly work shall be thoroughly corrected and remedied before despatching the steels from the shop. The Contractor shall execute temporary shop erection work wherever reasonably required to satisfy himself with the work.

The steel members shall be properly protected and bundled or put in crates for transportation against expected shocks and loads effected during transportation,loading and unloading. The steel members shall be assembled in the shop to as large components as possible before despatching as the transportation conditions allow, to minimize field connection work. All steel members and assembled components shall be match-marked at the shop to facilitate smooth erection in the field.

Any serious damage in the steel members in the opinion of the Engineer found in those delivered to the Site shall be replaced with new ones immediately without causing delay in the field assembly and erection works. Minor damage may be remedied in the field by proper method approved by the Engineer. The steel members shall be properly stock piled near the work site to facilitate easy identification and handling of the members. They shall be laid on wood or other suitable base to protect them from smear with mud.

The Contractor shall, before commencing erection, install all anchor bolts and anchor connections to an accurate alignment and elevation in accordance with the details and instructions as shown on the Drawings. The Contractor shall again check the alignment and elevation of the anchor connections with the colums or other structures where fabricated metalwork is to be erected and, if necessary, move the connections and bases to the correct position as shown on the Drawings.

The Contractor shall then notify the Engineer of the position of alignment, elevation and plumb of all columns and structures and shall have approval of the Engineer, prior to embedding the bases in concrete.

The steels shall be erected true to the alignment shown on the Drawings. Temporary bracings, supports and reinforcement to a member which is likely to be deformed during erection shall be employed wherever required. The bracing, support and reinforcement and temporary bolt connections shall be strong enough to carry the load exerted by the dead load of the steel work, wind and others.

Final alignment of each completed and entire section of the work between adjacent expansion joints shall be made, as far as practicable, before assembly of the next section of the work.

Any misalignment of members shall be brought to the attention of the Engineer for approval of corrective measures and all remedial work shall be performed at the Contractor's expense.

The Contractor shall do the work of erection under normal and ordinary job conditions and not necessarily under those which he considers most desireble. Inclement weather, work carried on by others in the immediate vicinity, the necessity of moving materials from storage to the site of erection, and all other circumstances characteristic of construction work, are to be expected and shall not be the basis for a claim for extra compensation.

The Contractor shall take necessary safety measures to protect the steels, workmen, equipment, property of not only his but other parties to the satisfaction of the Engineer.

9.3 Steel Trap

The Contractor shall furnish and install the steel traps on the sluiceway wing walls as shown on the Drawings or as directed by the Engineer. The trap shall be made of nineteen (19) mm in diameter steel bar of JIS G 3112, SNI 2052-89-A or better and be well bent and fabricated to make the

proper shapes. The pitch of trap shall be three hundred (300) mm in vertical and the protrusion from the wall shall be two hundred (200) mm. The material of the steel bar shall be approved by the Engineer. The steel trap shall be installed at the positions designated when concrete is placed.

9.4 Steel Handrail

The Contractor shall furnish and install the steel handrails with fittings, bolts, flanges and other accessories required on and around the hoist decks and bridges as shown on the Drawings or as directed by the Engineer. The handrails shall consist of forty (40) mm in diameter galvanized steel pipes, sixteen (16) mm in diameter steel bars and the entrance gate with hinges, stopper, clasp plate and key, if any, and all welded construction. All shop and field connections shall be welded and ground smooth. Handrail to be set in concrete shall be completely assembled and installed when concrete is placed, or reccesses shall be left or holes shall be drilled in the concrete for anchorage, and the handrails shall be assembled and mortared in position at some later time.

The parts shall be new and of best grade and quality for the purpose of use and shall be standard commercial products of reputable manufacturers. Welding of the galvanized steel pipes shall be performed only where shown on the Drawings or authorized. The materials of steel pipes and bars shall be approved by the Engineer.

9.5 Steel Access Bridge, if any

9.5.1 General

The Contractor shall design, furnish, fabricate, transport, install and paint the steel access bridges to be installed at sluiceway structures. The work shall include any incidental works called for in the Specifications or on the Drawings and for the complete and satisfactory installation of the steel access bridge.

Applicable provisions in Chapter 8 Gates and Related Hydromechanical Equipment Vol. III, Part II - Technical Specifications, shall be applied to the work where those are not specified herein. If a provision in Chapter 8 is contrary to a provision stipulated in this Clause, a provision in this Clause shall govern.

The Contract Drawings show the number, type and governing dimensions, but are not intended to define the details of the structures, nor to exclude modifications of such details, if made with the prior approval of the Engineer. The thickness and size of any member, however, shall not be less

than the thickness and size indicated in the Drawings.

The Contractor shall design the structures in details in accordance with the design data herein and/or the Drawings, and provide shop drawings of all the components of the bridge structures called for in the Specifications and the Drawings.

The Contractor shall submit three (3) copies of the shop drawings including assembly drawings, structural calculations and painting specifications to the Engineer for approval in accordance with Sub-clause 8.1.3 of Vol. III, Part II - Technical Specifications. Any work done prior to the approval of the drawings and documents shall be at the Contractor's risk, and the Contractor shall also be understood that the Engineer's approval will not relieve the Contractor from any his responsibility for the work.

Design of temporary structures necessary for the work shall also be completed by the Contractor.

9.5.2 Design data

The steel access bridges shall be designed for the following conditions;

Type	:	Simply supported H-beam bridge structures with ribbed checkered floor plate
Effective width	:	1.0 m
Span length	:	As shown on the Drawings
Live load	:	250 kgf/m^2, no impact load
Earthquake coefficient	:	Kh = 0.12 with increment of allowable stresses by fifty (50) percent
Maximum deflection of main girder	:	1/400 of supporting span
Materials	:	JIS G 3101, SS 400, SNI 0722-89-A or equivalent
Allowable stress	:	1,400 kgf/cm^2

9.5.3 Bridge details

The steel access bridges shall be welded steel construction consisting of main girder, lateral bracings, sole plates, bed plates, floor plate, anchor bolts and all other necessary components.

The main girder shall be of H-beam or built-up plate girder construction. The lateral bracing shall

be of channel beam and steel plate girder construction. The sole plate and bed plate shall be of mild steel of JIS G 3101, SS 400, SNI 0722-89-A or equivalent. The levee side sole plate shall be rigidly fixed by the anchor bolts, nuts and washers through the bed plate while the hoist deck side sole plate shall be movable type so as to absorb the expansion and contraction of the main girder due to temperature difference. The floor plate shall be of checkered plate having thickness more than six (6.0) mm.

The bridge as well as the handrails shall be assembled at the shop. While assembled, the bridge shall be checked for dimensions, tolerances and accuracy of alignment. Any error and misalignment discovered shall be promptly corrected.

The bridge complete with the handrails shall be assembled and erected in accordance with the details shown on the "FOR WORK DRAWINGS". After installation of the bridge, the level and straightness shall be checked and remedial action shall be taken if the readings indicate that displacement has occurred.

9.6 Steel Ladder

The Contractor shall furnish and install the steel ladders on the parapet walls or elsewhere as shown on the Drawings or as directed by the Engineer. The ladder shall be made of angle-beam and twenty two (22) mm in diameter steel bars of JIS G 3112 or better for the rungs and dowel bars, and all welded construction. The angle - beam shall be well bent to make smooth curve. The pitch of rung shall be three hundred (300) mm. Steel ladders shall be completely fabricated in sections convenient for handling and transporting. Field anchors and anchor bolts shall be assembled by bolting or welding. Anchors and anchor bolts shall be embedded in the concrete at the proper positions while the concrete is placed, or reccesses shall be left in the concrete and the anchors and anchor bolts shall be thoroughly mortared or concreted in place. The materials of the angle-beam and steel bars shall be approved by the Engineer.

9.7 Tie Bar

The Contractor shall furnish and install tie bars with nuts and washers for tightening the precast concrete girder of the bridges as shown on the Drawings or as directed by the Engineer. Tightening work shall be performed in a suitable sequence and by using a wrench as directed and in the presence of the Engineer.

9.8 Repair of Existing Sluiceway Gates, if any

The Contractor shall repair the existing sluiceway gate as directed by the Engineer. The Engineer will inform the repair items to the Contractor in writing without any drawing. The Contractor shall develop the repairing procedure after due investigation of the Site and submit the same with the quotation of the works for the approval of the Engineer. The repair shall include all necessary works such as designing, manufacturing, painting, removing and reinstalling the existing gate, guide frame and hoist, replacing the parts including improving gate sealing system, chipping the concrete, packing, transporting, site testing, etc., where applicable.

9.9 Chekered Steel Covers and Gratings, if any

Hatches including checkered steel covers, gratings, frames and embedded frames, and anchorages shall be procured and installed by the Contractor as shown on the Drawing or as directed by the Engineer. Cover plates shall be made of checkered steel plate with welded reinforcing steel angles or channels as shown on the Drawings, and shall be provided with lifting slots. When cover plates are being laid in proper position, the clearance between the cover plate and the frame shall not exceed five (5) mm at each side. The frame shall be composed of steel shaped sections and shall be anchored to the concrete with steel bolts or straps spaced at a maximum length of sixty (60) cm. Steel gratings with frames of an approved type shall be provided as shown on the Drawings or as directed by the Engineer.

9.10 Lifting Hook, if any

The Contractor shall furnish and embed the steel lifting hooks as shown on the Drawings or elsewhere as directed by the Engineer. The lifting hooks shall be round steel bar which shall conform to the applicable JIS standards or equivalent securely fixed and safe for the loads to be carried.

9.11 Embedded or Non-embedded Metalwork, if any

The Contractor shall furnish and install miscellaneous embedded or non-embedded metalworks, such as, anchoring and handling hooks, turn-buckle anchors, anchor bolts with accessories, handrail post sockets, metal safety treads for concrete stairs, screens and nets for open culvert, etc., as shown on the Drawings or elsewhere as directed by the Engineer.

The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of scale,

rust, dirt, oil and paint, and any objectionable materials which will reduce the bond between embedded metalwork and mortar concrete immediately before the mortar or concrete is placed. Metal work shall be accurately positioned and aligned in accordance with the tolerances as directed by the Engineer or as shown on the Drawings and shall be held securely in the correct position during placing and setting of the concrete.

Mortar for metal work shall be mixed in the proportions and to the consistency prescribed by the Engineer. The Contractor shall furnish cement and fine aggregate complying with the requirements of Chapter 3 for all mortar. Before placing mortar, the surfaces of existing concrete on which the mortar will be placed shall be roughened and shall be cleared of all laitance, loose or defective concrete coatings and other foreign material by effective means followed by thorough washing. Such surfaces shall be kept moist for at least 24 hours immediately prior to the placing of the mortar.

9.12 Measurement and Payment

Measurement, for payment, of steel trap, steel handrail, steel access bridge, steel ladder, tie bar, checkered steel cover and grating, lifting hook and embedded or non-embedded metalwork will be made on the basis of the actual installed weight of structural steel in kilograms determined by the approved Drawings or as directed by the Engineer.

Payment for steel trap, steel handrail, steel access bridge, steel ladder, tie bar, checkered steel cover and grating, lifting hook and embedded or non-embedded metalwork shall be made for the number of kilogram measured as provided above at the respective unit price per kilogram stated in the Bill of Quantities, which unit prices shall constitute full compensation for the cost of all labour, tools, equipment and materials including furnishing, fabricating, transporting, installing the structural steels, painting, preparing and submitting shop drawings and other necessary documents, and other items necessary to complete the works.

Measurement, for payment, of repair of the existing sluiceway gate, if any, will be made by the Provisional Sum determined by the approved repairing procedure or as directed by the Engineer.

Payment for repair of the existing sluiceway gate, if any, shall be made for the works as provided above at the unit price mutually agreed between the Engineer and the Contractor, which unit prices shall constitute full compensation for the cost of all labour, tools, equipment and materials including designing, manufacturing, painting, removing and reinstalling the existing gate, guide frame and hoist, replacing the parts, chipping the concrete, packing, transporting, site testing,

preparing and submitting shop drawings and other necessary documents, and other items necessary to complete the works.

10. MISCELLANEOUS WORKS

10.1 General

This Chapter cover the miscellaneous works listed below ;

(1) Wet rubble masonry
(2) Gabion
(3) Concrete stair
(4) Weep holes
(5) Rubble mound
(6) Gravel filling
(7) Sand and gravel filling
(8) Palm fibre for revetment
(9) Geotextile
(10) Rubber flexible joint
(11) Bamboo mat, walling and pile

The Contractor shall furnish all necessary materials, manpower and equipment required for the construction and completion of the above miscellaneous works.

10.2 Wet Rubble Masonry

10.2.1 Classification

The wet rubble masonry for slope protection has been typified into the following two (2) types as shown on the Drawings;

- Type I comprising of a rubble layer of varying thickness generally between thirty (30) cm to forty (40) cm which is placed on the foundation concrete of type 4. This type of wet rubble masonry shall be provided for a variety of structures such as inlet / outlet channel for drainage facility, drainage canal, cross-drain, relocation of drainage channel, approach road and inspection road on the earth embankment, and

- Type II comprising of a rubble layer of varying thickness generally between thirty (30) to forty (40) cm, which is laid over a foundation concrete of type 4. The top of masonry wall

forms just like as parapet wall. This type of wet rubble masonry shall be provided for revetment works along the inspection road.

10.2.2 Material

Rubble stone for wet rubble masonry shall be natural angular rubbles having sufficient strength and durability, being free from seams and other defects. Particle size shall be uniform, about twenty (20) cm to forty (40) cm for both Types. Only where and when approved by the Engineer, the use of round cobbles will be allowed in limited amount and in combination with angular rubbles. The rubble stones shall be obtained from supplyer and shall have a specific gravity of not less than two and half (2.5).

Cement mortar used for jointing is typified according to the cement - sand ratio of the mortar. The cement - sand ratios by volume are shown below ;

Type	Mixing Ratio (by volume) Cement	:	Sand	Application
A	1	:	3	For common use such as rubble jointing in revetments
B	1	:	2	For finishing of surface
C	1	:	1	For structures requiring special high strength

All the materials except water shall be mixed, either in a tight box or in an approved mortar mixer, until the mixture assumes a uniform colour, after which water shall be added and the mixing continued.

Mortar shall be mixed only in those quantities required for immediate use. Mortar that is not used within forty five (45) minutes after the water has been added shall be discarded.

Cement, sand and water used in the mortar shall conform to the respective requirements as laid out in Chapter 3, Concrete Work, of these Technical Specifications.

10.2.3 Placement

Wet rubble masonry shall be placed to the lines, grades and dimensions as shown on the Drawings or as directed by the Engineer. Prior to construction of the rubble masonry, depressions, if any, on the sloped surface shall be filled with approved material. Before placing, the rubble stone shall be cleaned and kept moistened appropriately. The rubble shall be so placed by hand that each rubble is completely surrounded by mortar. The rubble shall be fitted into place in such a manner that the mortar is in complete liaison with the rubble in all joints.

The rubbles shall be struck and consolidated by means of a small steel hammer and those thereafter broken shall be removed, cleaned and re-used with new mortar. The joints shall liberally be provided with mortar and shall be tightened by driving and wedging rubble chips into joints. Care shall be taken that each rubble is completely enveloped in mortar.

10.2.4 Finishing

Each rubble shall be laid so that the longer dimensions are perpendicular to the sloped surface. PVC pipes of five (5) cm in diameter at the required spacing and of appropriate length shall be provided in the masonry to serve as weep holes as shown on the Drawings or as directed by the Engineer. The surface of the rubble masonry shall be finished smooth and clean to ensure smooth flow conditions. For achieving a smooth finish, joints on the face of all masonry exposed to view shall be neatly finished. The mortar in the joints of the rubble masonry shall be removed to a depth of three (3) cm and the joint cleaned thoroughly with a wire brush and filled with cement mortar of Type B. The surface of all rubbles shall be cleaned of all mortar after completion of the finishing operations.

10.2.5 Contraction joint

Vertical contraction joints shall be provided in the wet rubble masonry as shown on the Drawings or as directed by the Engineer.

10.2.6 Curing

During the construction of the wet rubble masonry works, the surface of masonry will be kept wet at least for five (5) days after completion of cementing work.

10.2.7 Measurement and payment

Measurement, for payment, of wet rubble masonry will be made on the basis of actual volume placed in cubic metres to the specified lines, grades and dimensions as shown on the Drawings or as directed by the Engineer.

Payment for wet rubble masonry shall be made for the number of cubic metres measured as provided above at the unit price per cubic metre stated in the Bill of Quantities and duly certified by the Engineer in the Bi-Monthly Statement of Account. The unit price for wet rubble masonry shall constitute full compensation for the cost of all labour, tools, equipment and materials required including obtaining these materials and items necessary to complete the works.

10.3 Gabion

10.3.1 Material

Gabions are wire mesh boxes which are filled with rubble stones. The size of rubble stones shall be fifteen (15) cm to twenty five (25) cm and the quality of stone shall be in accordance with the provisions stipulated in Sub-clause 10.2.2 herein above.

10.3.2 Execution of work

The Contractor shall construct gabions for the protection of levee and channel bed at places where such structures as revetments, sluiceways and others are specified on the Drawings or as directed by the Engineer.

If not otherwise clearly specified on the Drawings, the Contractor shall submit a proposal of the type and dimension of gabions, schedule for delivery and construction. The Contractor shall not commence the construction of gabions before the approval of the Engineer.

Standard gabions shall conform to the following specifications ;

(a) The size of gabion shall be 3.0 m x 1.5 m x 0.5 m.

(b) All wires shall be flexible hot-dip galvanized or PVC sheathed steel wires having minimum tensile strength of 40 kg/mm^2 and a minimum weight of zinc coating of 275 kg/m^2.

(c) The mesh shall be hexagonal woven mesh and the knots shall be formed by twisting each pair of wires three and half (3.5) turn.

(d) The size of the mesh shall conform to the nominal size of mesh approved by the Engineer and shall not be greater than one third (1/3) the size of the smallest stone filled in the gabion.

(e) The diameter of the wire shall be two point seven (2.7) mm or else three point two (3.2)mm.

All edges of the standard gabion including end panels and diaphragms, if any, shall be mechanically salvaged in such a way as to prevent unraveling of the mesh and to develop the full strength of the mesh. The wire used for selvage shall have diameter greater than that of the wire used to form the mesh, namely ;

(a) For wire mesh made of wire having diameter of three point two (3.2) mm, the selvage shall be of wire having diameter equal to or greater than three point nine (3.9) mm.

(b) For wire mesh made of wire having diameter of two point seven (2.7) mm, the selvage shall be of wire having diameter equal to or greater than three point four (3.4) mm.

Sufficient lacing and connecting wire shall be supplied with gabions for all wiring operations to be carried out in the construction of the gabion work. The quantity of such wire is estimated to be eight (8) percent by weight of the wire for gabiosn. The diameter of lacing wire shall be ;

(a) Two point seven (2.7) mm for the gabion made of wire of three point two(3.2) mm in diameter.
(b) Two point two (2.2) mm for the gabion made of wire of two point seven (2.7) mm in diameter.

The length of the gabion is subject to a tolerance of around two and half (2.5) percent and the height and the width to a tolerance of around five (5) percent.

10.3.3 Measurement and payment

Measurement, for payment, of gabions will be made on the basis of actual volume placed in cubic

metre to the specified lines, grades and dimensions as shown on the Drawings or as directed by the Engineer.

Payment shall be made for the number of cubic metres of gabions measured above at the unit prices per cubic metre stated in the Bill of Quantities and duly certified by the Engineer in the Bi-Monthly Statement of Account. The unit price for gabion shall constitute full compensation for the cost of all labour, tools, equipment and materials for mesh and rubbles including furnishing, transporting, fabricating, placing the gabions and all other items necessary to complete the works.

10.4 Concrete Stair, if any

10.4.1 Classification

Concrete stair shall be of the following two (2) types for this Project ;

- Concrete stair constructed over the levee embankment which shall comprise of plain cement concrete steps constructed over a five (5) cm thick layer of levelling concrete placed over the levee surface, and

- Concrete stair constructed over the revetment which shall comprise of plain cement concrete steps constructed over a five (5) cm thick layer of levelling concrete, which in turn, has been placed over a fifteen (15) cm thick gravel bedding.

10.4.2 Execution of work

The concrete work for the stair shall be carried out in accordance with the provisions of Chapter 3, Concrete Work, and the gravel bedding shall conform to the requirements of Clause 3.15, Gravel and Rubble Bedding.

10.4.3 Measurement and payment

Measurement and payment for the concrete stair will be made under separate work items stated in the Bill of Quantities.

10.5 Weep Holes

10.5.1 General

Revetments, bridge abutments, slope protection works for approach roads, etc. shall be provided with weep holes as shown on the Drawings or as directed by the Engineer.

Weep hole shall comprise of a PVC pipe of adequate length embedded in the structure with its earth-side end provided with a geo-textile square, 300 x 300 mm as shown on the Drawings or as directed by the Engineer.

10.5.2 Material

Polyvinyl chloride (PVC) pipes shall conform to JIS K 6741 VP or approved equivalent. Unless otherwise specified, the internal diameter of the pipe shall be fifty (50) mm.

Geo-textile shall conform to the provision of Clause 10.11.

10.5.3 Placement

PVC pipe of appropriate length shall be cleaned thoroughly with water and one end of the pipe shall be covered with the geo-textile square. The geo-textile square shall be secured in position by using GI wire of one (1) mm in diameter in sufficient length with gravel filter. The entire assembly shall be so placed in the structure that the free end of the PVC pipe is exposed to the view while the treated end abuts with the earthfill behind the structure.

10.5.4 Measurement and payment

Measurement, for payment, of PVC pipe will be made to the actual number of linear metres of the pipe placed in position and as certified by the Engineer in the Bi-Monthly Statement of Account.

Measurement, for payment, of geo-textile squares will be made to the total number of square metres placed in position and so certified by the Engineer.

Payment for the PVC pipe shall be made at the unit price per linear metre and that for the geo-textile squares shall be made at the unit price per square metre stated in the Bill of Quantities. The above unit prices shall constitute full compensation for the cost of all labour, tools, equipment and

materials including furnishing, transporting, fabricating, placing the weep holes in position and all other items necessary to complete the works.

10.6 Rubble Mound, if any

10.6.1 General

Rubble mound shall be placed to the lines, grades and levels as shown on the Drawings or as directed by the Engineer for foot protection work of the drainage channel revetment. Gabions shall be placed over the top of the rubble mound so constructed.

10.6.2 Material

Stones for rubble mound shall be natural angular stones and shall conform to the requirements of Sub-clause 10.2.2 hereinbefore. Weight of each selected stone shall be between thirty (30) and seventy (70) kg.

10.6.3 Placement

Rubble stone shall be placed in position by depositing the selected stones in the depressions or on the channel bed below the mean water level so as to attain a stable slope of 1: 1.5 on the channel side as shown on the Drawings or as directed by the Engineer. Top surface of the rubble mound shall be finished slightly below the mean water level and shall be sufficiently leveled so as to receive gabions.

10.6.4 Measurement and payment

Measurement, for payment, of rubble mound will be made on the basis of actual volume of stone placed in cubic metres to the specified lines, grades and dimensions as shown on the Drawings and certified by the Engineer.

Payment shall be made for the number of cubic metres of rubble mound measured above at the unit price per cubic metre stated in the Bill of Quantities and duly certified by the Engineer in the Bi-Monthly Statement of Account. The unit price for rubble mound shall constitute full compensation for the cost of all labour, tools, equipment and materials including procuring, transporting, placing the rubble stones in position and all other items necessary to complete the works.

10.7 Gravel Filling and Gravel Filter

10.7.1 General

Gravel fill or gravel filter shall be placed for the protection of foundations in inlet and outlet channels for drainage facility, revetments, etc.; in the corners and wedges created at the junction points of sloped and horizontal surfaces; and behind the gabions and weep holes as shown on the Drawings or as directed by the Engineer.

10.7.2 Material

Material required for gravel filling shall be in accordance with the provisions of Sub-clause 3.3.3, Coarse aggregate, of these Technical Specifications.

10.7.3 Placement

Gravel fill shall be hand placed and lightly tamped in the corners and wedges created, because of placement of gabions or other foot protection works are made on unequal slopes. Care shall be taken so as not to force the material into the corners and wedges. The work shall be carried out concurrently with the placement of gabions so that no corners or wedges remain unfilled.

10.7.4 Measurement and payment

Measurement, for payment, of gravel fill or gravel filter will be made on the basis of actual volume of materials placed in cubic metres as shown on the Drawings or as determined by the Engineer.

Payment shall be made for the number of cubic metres of gravel fill or gravel filter measured above at the unit price per cubic metre stated in the Bill of Quantities and duly certified by the Engineer in the Bi-Monthly Statement of Account. The unit price for gravel filling shall constitute full compensation for the cost of all labour, tools, equipment, and materials; and all other items required for completing the work.

10.8 Rubble Filling

10.8.1 General

Where directed by the Engineer or elsewhere shown on the Drawings, gravel fill described under

Clause 10.7 hereinabove shall be replaced by rubble fill.

Size of rubbles for the fill shall be between thirty (30) and twenty (20) cm.

All other Sub-clauses under Clause 10.7 hereinabove for material, placement, measurement and payment shall be applicable to the rubble fill in the same manner prescribed above.

10.9 Sand and Gravel Filling, if any

10.9.1 General

Sand and gravel mix shall be filled behind the gabion type revetments of drainage channel as shown on the Drawings or as directed by the Engineer.

All other applicable Sub-clauses for material, placement and measurement and payment shall be the same as those for Clause 10.7, Gravel Filling and Gravel Filter, hereinbefore.

10.10 Palm Fibre for Revetment, if any

10.10.1 General

Natural palm fibre shall be placed over the dressed slope, such as gabions are to be laid for the revetment, as shown on the Drawings or as directed by the Engineer.

10.10.2 Material

Palm fibre shall be natural material which is locally available in Indonesia. Thickness of the palm fibre mat shall be sixty (60) mm. Palm fibre shall be furnished in rolls of one (1) m approximate width which can be easily spread over the dressed slopes.

10.10.3 Placement

Before spreading the palm fibre, any depressions on the slopes shall be filled to the lines, grades and dimensions and neatly dressed and finished.

Palm fibre shall be kept moist so as to remain supple at the time of spreading and to prevent it from cracking. An overlap of ten (10) cm shall be provided between any two adjoining strips of palm

fibre mat.

Gabions shall be placed over the palm fibre as soon as after laying the fibre at site so as to prevent damage from being trampled it under the human feet. Should any delay occur in the placement of gabions, palm fibre shall be protected from traffic and shall be kept moistened to prevent its cracking.

10.10.4 Measurement and payment

Measurement, for payment, of palm fibre will be made to the number of square metres of the area covered by the palm fibre and as certified by the Engineer.

Payment for the palm fibre shall be made to the number of square metres measured above at the unit price per square metre stated in the Bill of Quantities. No extra payment shall be made for the overlap at the joints of palm fibre strips. The unit price shall include all costs incurred from the labour, tools, equipment, material and all other items required for completing the works.

10.11 Geotextile

10.11.1 General

Where shown on the Drawings or elsewhere directed by the Engineer, palm fibre described under Clause 10.10 hereinabove shall be replaced by geotextile. All other Sub-clauses under Clause 10.10 hereinabove shall be applicable to the geotextile in the same manner prescribed above, except material.

10.11.2 Material

The Contractor shall furnish and install geotextile, t = 1.5 mm, under the gabions as shown on the Drawings or as directed by the Engineer.

The geotextile shall be approved polyvinyl chlorite compound to protect and drain the soil foundation. The Contractor shall submit to the Engineer for approval sixty (60) day before use details of the proposed method for manufacture and test specimens of geotextile. Geotextile shall have the following physical properties :

Tensile strength : more than 70 (kg/cm^2)

Elongation ratio	:	at least	12 (%)
Density	:	at least	100(%)
Specific gravity	:	at least	0.055

The Contractor shall store geotextile in a manner which will prevent deterioration, as approved by the Engineer.

10.11.3 Measurement and payment

Measurement, for payment, of geotextile will be made to the number of square metres of the area covered by the geotextile sheeting and as certified by the Engineer.

Payment for geotextile shall be made to the number of square metres measured as provided above at the unit price per square metre stated in the Bill of Quantities. No extra payment shall be made for the overlap at the joints of geotextile strips. The unit price shall include all costs incurred from the labour, tools, equipment, material and all other items required for completing the works.

10.12 Rubber Flexible Joint, if any

10.12.1 General

The rubber flexible joint shall be provided on the embedded drainage pipes crossing over the levee for absorbing the differential settlement as shown on the Drawings or as directed by the Engineer. The specifications for the rubber flexible joint shall be as follows ;

Type	:	Bellows type flange end flexible joint
Diameter	:	200 mm - 450 mm (50 mm pitch)
Quantity	:	As stated in the Bill of Quantities
Internal pressure	:	5 kgf/cm^2
External pressure		
Earth covering	:	1 - 3 m
Dynamic load	:	20 tonf
Negative pressure	:	0.2 kgf/cm^2
Shear deflection	:	Not less than 100 mm
Number of grooves	:	3
Expansion	:	Not less than 50 mm
Contraction	:	Not less than 25 mm

10.12.2 Material

The rubber flexible joint shall be connected with the PVC pipes by means of bolted flange connections. The Contractor shall submit the flange connection detail for each size to the Engineer for approval. The rubber flexible joint shall consist of inner layer rubber, outer covering rubber, reinforcing steel rings, reinforcing wire cords, reinforcing cords, base metal pipes, both end flanges and other necessary components.

The inner layer rubber shall be made of natural rubber of superior quality. The outer covering rubber shall be made of synthetic rubber of chloropren or better with excellent weather resistance. The reinforcing rings shall be made of mild steel of JIS G 3101, SS 400 or better and be embedded in the rubber to withstand the external pressure. The reinforcing wire shall be made of steel wire of JIS G 3532 or better and be embedded in the rubber to secure the reinforcing cords tightly in their proper position as well as providing reinforcement against the internal pressure. The reinforcing cord shall be made of vinylon cord or synthetic fiber and be embedded in the rubber as well as affording the maximum flexibility. The base metal pipes and the end flanges shall be made of mild steel of JIS G 3101, SS 400 or better and coated with tar-epoxy resin paint for inside and coal-tar enamel paint for outside.

10.12.3 Handling and installation

The Contractor shall pay attention to handle the flexible joint so as not to damage the rubber under the loading, unloading, transportation and storing at the Site. Before installation of the flexible joint, the sand bedding shall be compacted thoroughly around the joint. The rubber packing shall be furnished for flange connection. Backfilling after installation shall be done with selected material and compacted thoroughly as well as the adjacent pipes. The sharp-edged stones and other sharp-edged objects which may damage the rubber shall not be used for backfilling materials.

10.12.4 Measurement and payment

Measurement, for payment, of the rubber flexible joint will be made on the basis of actual number of joints placed as shown on the Drawings and duly certified by the Engineer in the Bi-Monthly Statement of Account.

Payment for the rubber flexible joint shall be made for the actual number of joints so measured by

the Engineer at the unit price stated in the Bill of Quantities for each size. The unit price shall include the cost incurred from all labour, tools, equipment, accessories, nuts, bolts, washers, all materials and all other items required for completing the works.

10.13 Bamboo Mat, Walling and Pile

10.13.1 General

Bamboo fences shall be provided for construction of the earth dump-fill levees downstream of Jl. Tol Prof. Sediyatmo along the Tanjungan Drainage Channel as shown on the Drawings or as directed by the Engineer.

Bamboo fences shall be made of bamboo mats, bamboo wallings and piles, both diam. 80 to 100 mm, and the materials shall be approved by the Engineer.

10.13.2 Measurement and payment

Measurement, for payment, of bamboo mats will be made to the number of square meters of the area covered by the bamboo mat sheeting and as certified by the Engineer.

Payment for bamboo mat shall be made to the number of square meters measured as provided above at the unit price per square meter stated in the Bill of Quantities. No extra payment shall be made for the overlap at the joint of bamboo mats. The unit price shall include all costs incurred from the labour, tools, equipment, material and all other items required for completing the works.

Measurement, for payment, of bamboo wallings and piles will be made on the basis of total installed length in linear meters to the designated lines, grades and dimensions as shown on the Drawings or as directed by the Engineer.

Payment shall be made for the total installed length of bamboo wallings and piles forming part of the completed structures by the Contractor and measured as provided above at the unit prices per linear meter stated in the Bill of Quantities and duly certified by the Engineer in the Bi-Monthly Statement of Account. The unit prices so stated shall include full compensation for the cost of all labour, tools, equipment and materials and all other items necessary to complete the works. No payment shall be made for extra length of bamboo walling and pile cut-off.

11. SITE INVESTIGATION

11.1 General

This Chapter covers the exploratory boreholes, exploratory excavations, tests and other investigations required to supplement existing knowledge of subsurface ground conditions for the structural sites in the drainage channels.

The exact locations for the exploratory boreholes, exploratory excavations, tests and other investigations are not provided herein nor in any part of the Tender Documents, but will be instructed by the Engineer when he deems necessary before and during the construction works.

11.2 Exploratory Excavation

For the purpose of this Chapter of the Specifications, exploratory excavation shall be defined as pits and trenches excavated solely for the detailed examination and logging of the soils, for the extraction of samples of the materials encountered for subsequent laboratory testing, and for performing in situ testing.

Pits shall be defined as holes excavated to depths of up to 5 m below ground surface and being not less than 1.5 m^2 in area at their base.

Trenches shall be defined as elongated holes having a length exceeding 5 m, a width of not less than 3 m, and excavated to depths of up to 5 m below ground surface, generally by bulldozer or other method.

Excavation of pits shall be by a method approved by the Engineer which shall generally be by any method considered suitable by the Contractor provided such method is consistent with the Engineer's requirements for sampling and in situ testing. Where required, excavation shall be temporarily halted at points or levels to be defined by the Engineer, for performing in situ tests.

Strutting and support shall be provided in pits by the Contractor and the excavations adequately protected to ensure that persons, livestock or adjacent structures are not endangered. The supports shall be of steel or timber as may be necessary or as may be directed by the Engineer. The Contractor shall comply with all instructions of the Engineer regarding the supporting of the sides

of pits which shall however in no way relieve the Contarctor of his responsibility for safety of the Works.

Where support or strutting is installed in any pit an adequate strip of ground shall be left exposed for the full depth or length of the excavation to permit detailed logging of the materials encountered. This requirement shall only be relaxed when, in the opinion of the Engineer, the stability of the pit is being adversely affected by such strips being left exposed.

Access to all excavations for inspection, sampling or testing shall be provided by the Contractor on a permanent basis or as otherwise directed by the Engineer. Sloping ladders and accesses are to be maintained by the Contractor in a safe condition until the end of the Contract or until otherwise directed by the Engineer. The Engineer shall require some or all excavations to be backfilled before the Contractor leaves the Site, and for the ground to be restored to its original condition. Backfilling shall be carried out using the excavated material which shall be adequately compacted, or by some other method to be proposed by the Contractor and approved by the Engineer.

The Contractor shall provide and operate such pumps as are necessary to keep the excavation dry during sampling and testing.

Soil samples shall be taken from excavations as directed by the Engineer. All samples shall be clearly labelled by the Contractor with details of the location, orientation and date of sampling. The Engineer may instruct the samples to be sealed in bags or coated with a layer of microcrystal-line wax immediately following sampling.

All samples shall be transported immediately to the core shed referred to in Clause 11.5 hereof, and thereafter those samples which are to be tested shall be transported to the laboratory referred to in Clause 11.8 hereof.

11.3 Boreholes

11.3.1 General

The total number of boreholes, the location and the depth are subject to modification and will be confirmed by the Engineer as work proceeds.

Boreholes shall be vertical unless otherwise directed by the Engineer, but certain boreholes may be required to be inclined.

Casing shall be used to support the sides of boreholes where necessary, and shall be solid mild steel flush screw-jointed and shall comply with the provisions of BS 1387, Heavy Tubes or approved equivalent. Casing shall not be driven below any level at which sampling or testing is to be carried out, until the sampling or testing has been carried out.

The Contractor shall provide a sufficient number of core barrels and casing sizes to permit core of not less than the minimum specified size to be recovered from the full depth of all boreholes. When, in order to obtain the specified core diameter at the base of the borehole, the Contractor drills stages of the hole at a larger diameter and recovers core of a larger diameter than specified, the rate for drilling shall be that corresponding to the core size instructed by the Engineer and shall apply to the full depth of the hole. Payment at a rate for obtaining larger diameter cores shall not be applied unless such core sizes are instructed by the Engineer. Unless otherwise directed by the Engineer all casing shall be removed on completion of the borehole.

Where inclined boreholes are instructed the azimuth and inclination of such boreholes shall be determined, by a method to be approved by the Engineer, at intervals of not more than twenty five (25) m on completion of the borehole.

If any borehole cannot be completed according to the Specifications because it has been drilled off line or because tools are jammed in the hole or for any other reason due to the Contractor's negligence, the Engineer may order the work to be discontinued and the hole to be redrilled at a nearby location to be designated by him. No payment shall be made for such rejected boreholes.

All boreholes, except where otherwise instructed by the Engineer shall be backfilled with a cement grout of a mix sufficiently fluid to ensure complete filling of the hole, or with other mixtures as agreed with the Engineer.

11.3.2 Equipment

The Contractor shall provide and use such modern drilling equipment as approved by the Engineer .

The Engineer shall be able to order the Contractor to use core barrels of larger diameter not exceeding ninety (90) mm in core size and/or to re-drill the entire length or a part of hole, in case that the core recovery for every five (5) m section of the hole is less than seventy (70) percent or so low as to render judgement of the geological condition very difficult or impossible.

Details of all equipment which the Contractor intends to use shall be submitted to the Engineer before drilling commences and the use of the equipment shall be subject to the approval of the Engineer.

11.3.3 Flush fluid

Rotary drilling to obtain core shall normally be carried out using clean water. Drilling fluid with a polymer additure as the flushing medium shall be used if directed by the Engineer. The fluid shall be selected to assist the recovery of weathered rock or soil as intact continuous full size cores. In any case, the drilling fluid used in the vicinity of lengths of boreholes to be permeability tested shall be such that, at the time of the test and allowing for decay of the polymer, or alternatively by the addition of chemicals to the borehole, the viscosity of the fluid is within ten (10) percent of that of clean water.

11.3.4 Handling of core

On completion of each drill run the core shall be removed from the core barrel and placed in core boxes in accordance with Clause 11.5 of the Specifications such that no disaggregation or disturbance occurs to it. If a Mylar or other disposable liner is used the liner shall be sealed around the core during extraction from the barrel and core box. If a disposable liner is not provided any weathered or friable core shall be wrapped intact in polythene as it is extracted from the barrel. Whenever recovery is as core cuttings, these shall be wrapped in polythene prior to placement in the core boxes. In no case shall extraction of core from the barrel involve hammering the barrel or water pressure.

After placing the core in the core boxes, the boxes shall be laid out at a location to be designated by the Engineer for his examination and for photographing. When the Engineer has completed his examination the core boxes shall be placed in the core shed specified in Clause 11.5.

11.3.5 Photographing of cores

All cores shall, before the core boxes are stacked, be photographed from the zenith in colour so that details marked on the inside of the box are visible in the photograph. A linear scale and colour scale shall be included in the photograph and the final colour positives shall be provided showing core in clear focus at a scale of not less than ten (10) percent of the actual size of the core. All photographs shall be taken with the cores shaded from direct sunlight and using infill flash. The

Contractor shall supply to the Engineer the colour negative and two (2) colour positives of each photograph.

The cores shall be arranged to reveal the most interesting characteristics such as seams, strata and the like. Any wrapped core shall be unwrapped when photographed.

11.4 Standing Water Levels and Water Sampling

Standing water level measurement shall be made in all boreholes at the beginning and end of each drilling shift unless otherwise instructed by the Engineer. The Contractor shall provide a sufficient number of electrical water level indicators such that there is one at each drilling rig at all times and at least two (2) further instruments in case of malfunction. When drilling is carried out continuously, the Engineer may instruct drilling to cease for periods not exceeding two (2) hours each day to permit water level observations. During such stoppages water level readings shall be taken at least each fifteen (15) minutes.

Samples of groundwater of about zero point five (0.5) litre shall be taken as directed by the Engineer from the boreholes and placed in sealed containers of approved design. A method of sampling water from a known depth shall be provided, which shall be such as to ensure that the sample is not contaminated by flush fluids.

11.5 Core and Samples Handling and Storage

Cores shall be placed in an approved hinged core box in book fashion, that is with the shallower core to the left, deepening to the right; the shallowest row of core shall be placed next to the hinged lid. Individual core boxes shall only contain cores from a single borehole. The box shall be identified both on the inside and outside by the site name, borehole number, core box number, depth of bottom and top of the core included. Where the information is marked on the lid of the box, the borehole and box number shall also be marked on the end and front of the box. All labelling of the core boxes shall be carried out immediately when the box is full and shall normally be carried out by painting or other durable system to be approved by the Engineer. The depth of the top and bottom of the total core contained in each box and of the separate core runs shall be identified in the box by wooden blocks at least twenty five (25) mm thick securely fastened into the box at the appropriate positions and clearly marked with the depth.

All depth markings shall be made with paint, metal or other durable labels securely fixed. Zones of core loss or samples taken shall be similarly identified by wooden blocks fixed either at the zone

of core loss or at the end of the appropriate core run. Such blocked-off sections shall be clearly marked as zones of core loss. Cores shall not be removed from the boxes unless instructed by the Engineer, in which case the space left shall be labelled with details of the section of core removed.

The core boxes shall be as approved by the Engineer and be of robust construction to withstand the weight of core and any full boxes which may subsequently be placed upon them and also sufficiently watertight to protect the core from rain on the Site or in transit. The boxes shall normally be one (1) metre long internally and zero point five (0.5) m wide. They shall be made to hold the particular size of core tightly in place in rows separated by securely fitted partitions. A strong hinged lid fitted with a hasp and staple for closing, and adequate end handles for lifting shall be provided. The top and bottom of the boxes shall be reinforced by cross strips. Where wood is used for construction of the boxes it shall have a minimum thickness of twelve (12) mm.

Whenever full core boxes are transported, packing materials shall be used as necessary to protect the core. At all stages during the movement of the boxes they shall be kept in a horizontal position and shall not be tilted or up-ended. The Contractor shall be responsible for providing experienced personnel to ensure that the cores are not damaged during loading, transportation, unloading and stacking.

The full core boxes shall be stored indoors in a secure weather-proof core shed to the approval of the Engineer. The shed shall be erected in a suitable area and shall be larged enough to accommodate all core boxes. The boxes shall be stacked not more than ten (10) boxes high or placed on racks in such a way as to permit ready identification and removal of selected boxes. The Contarctor shall be responsible for maintaining constant access to the core shed for the Engineer and shall maintain an up-to-date record in the core shed showing the location of all the boxes. An undercover area shall be provided of sufficient size to permit the laying out of not less than ten (10) boxes at a time for logging purposes. This area shall be equipped with adequate lighting for logging. Suitable benches shall be provided as working surfaces.

The Contractor shall provide for laying out such core boxes as requested by the Engineer within not more than two (2) days following the request being received.

Undisturbed, bulk and other samples shall also be stored in the core shed. Only such samples as are required to be tested shall be transported to the laboratory; samples on which no tests are required shall remain in the core shed.

The core shed shall upon the issue of the Certificate of Completion in respect of the Works become the property of the Employer, together with the core boxes, and other contents.

Samples despatched to the laboratory for testing shall be retained until six (6) months after submission of all reports on such testing to the Engineer; nineteen (19) weeks after the submission of the last report the Contractor shall give seven (7) weeks notice in writing to the Engineer of the Contractor's intention to dispose of all remaining samples in the laboratory. The Engineer will then inform the Contractor of any samples which are to be retained for a longer period.

11.6 Records

The following records in English shall be provided within two (2) weeks of completion of the appropriate part of the work except for the daily drilling record which shall be submitted daily.

11.6.1 Trial pits and trenches

The records of all trial pits and trenches shall include the following information:

(1) Reference number of exploratory excavation,

(2) Job name and names of the Employer, Design Engineer, Supervising Engineer and Contractor,

(3) Location of exploratory excavation (co-ordinates),

(4) Ground level,

(5) Excavation method and progress (dates),

(6) Details of any ground water seepages or outflows observed including measurements of flow and of standing water levels, and

(7) Location and reference numbers of all disturbed and undisturbed samples and in situ tests with dates of sampling and testing.

11.6.2 Drilling records

A daily drilling record shall be kept in triplicate by the drilling foreman for each borehole in progress. The Contractor shall each day provide the Engineer with a copy of the record relating to the previous day and retain a copy on the Site to be available for inspection by the Engineer on request. The record shall be in a form to be approved by the Engineer and include the following information;

(1) Site name,

(2) Reference number of borehole,

(3) Orientation of borehole,

(4) Make and type of drilling machine,

(5) Type of core barrel and bit,

(6) Names of foreman and drillers,

(7) Date,

(8) Depth of hole at start and end of working day or shift,

(9) Depth and size of casing at start and end of working day or shift,

(10) Standing water level in borehole at start and end of each working period,

(11) Simplified description of strata,

(12) Sample types and locations,

(13) Details of delays and breakdowns,

(14) Details of in situ tests,

(15) Backfilling or grouting,

(16) Flush fluid,

(17) Depth of start of each core run,

(18) Depth and size of casing at start and end of each core run,

(19) Core diameters and changes in core size,

(20) State of bit,

(21) Time to drill each core run (this is the time to actually drill the distance and does not include the time taken in running the barrel and rods in and out of the hole),

(22) Flush return - amount and nature, and

(23) Sample (Total core) recovery with information as to possible location of any losses.

On completion of the drilling of a hole, the Contractor shall provide the Engineer with a fresh and complete log of the drilling work in that hole. The log shall be in an approved form and shall contain the information specified for the daily records, together with the coordinates and collar elevation of the hole.

11.7 In Situ Tests

11.7.1 Point load tester

The Contractor shall provide a point load tester of approved design for the use of the Engineer during the period of the Contract, to investigate the compressive strength of a drilled core specimen.

11.7.2 In situ permeability tests

In situ permeability tests shall be carried out in boreholes at the depths to be determined by the Engineer. Only clean water shall be used for the tests.

Permeability tests shall be carried out generally in the manner described in Paragraph 5 of the Test Specification Designation E-18 in the U.S.B.R. Earth Manual or approved equivalent. Tests shall be made during the drilling of the borehole using a single packer installed with its base between two (2) m and five (5) m above the bottom of the borehole unless otherwise directed by the Engineer. The packer shall be of the pneumatic or hydraulic type which shall be capable of effecting a seal against the periphery of the hole and withstanding the pressure applied in the test section. The assembly shall have an air or hydraulic fluid line, an injection standpipe of cross-section giving a head loss of not more than eight (8) kgf/cm^2 over a length of one hundred (100) m at a flow rate of one hundred fifty (150) litres/minute, and in the case of a pneumatic packer a return outlet tube not less than six (6) mm bore.

At the beginning of the test, the packer shall be inflated and the effectiveness of the seal checked. The water level in the standpipe shall then be allowed to stabilise to the piezometric level of the water in the packed off section. Measurements of the water level in the standpipe shall be made at ten (10) minute intervals for two (2) hours or until the level has stabilised whichever is the sooner.

Water under pressure shall be applied to the top of the standpipe by a pump capable of delivering not less than one hundred (100) litres/minute at a pressure of fifteen (15) kgf/cm^2. The quantity and pressure of water being delivered to the test section shall be measured by approved means which shall be accurate within five (5) percent. An air vessel shall be connected to the delivery line sufficient to smooth out all fluctuations in pressure due to the action of the pump. Each test shall generally consist of measurements of inflow of water at seven (7) pressures, four (4) at increasing gauge pressures measured at the top of the standpipe in kgf/cm^2 of 1, 4, 7 and 10 followed by three (3) at decreasing gauge pressures in kgf/cm^2 of 7, 4 and 1.

The rate of inflow at any one (1) pressure shall be measured over a time period sufficient to ensure a steady flow for ten (10) minutes and recorded in litres per minute per metre length of borehole under test.

Before the commencement of any permeability testing, the Contractor shall carry out a test to determine the friction loses which occur in the equipment he proposes to use. The test shall be carried out for the ranges of flow rate likely to occur during the borehole testing. The results of the test shall be in the form of a graph showing friction loss versus flow rate and this shall be submitted to the Engineer for approval before any borehole testing commences. The measured friction losses shall be used in the calculation of the coefficient of permeabilities from the borehole tests. Estimates of friction losses based on manufacturers or other data will not be acceptable.

11.7.3 Records

The Contractor shall maintain full accurate records of all permeability tests carried out and shall supply three (3) copies to the Engineer not later than one (1) day after the completion of the test. The records shall include the following information;

(1) All data necessary for the determination of permeability, including depths from the ground surface of hole and packer setting-up, radius of hole, height of pressure gauge above the ground surface, ground water level or piezometric head for the test section, reading of pressures and corresponding water-take,

(2) A plot of flow against pressure for each test, and

(3) In situ coefficient of permeability in cm/sec determined according to Designation E-18 of Earth Manual by USBR or approved equivalent.

11.8 Laboratory Testing

The Engineer may instruct that certain samples shall be transported to the testing laboratory for the purposes of testing; schedules of tests to be carried out on the samples transported to the laboratory shall be issued during the progress of investigations subject to the prompt receipt by the Engineer of the relevant detailed final logs.

Samples shall be placed in robust containers, to the approval of the Engineer, which shall be clearly labelled "Fragile - Handle with Care".

All storing, preparation, testing, and reporting shall be in accordance with the relevant Specifications of BS CP 2001 or approved equivalent, where applicable. Generally, tests shall be executed and reported on in accordance with the procedure described in BS 1377, BS 812 and the suggested methods for Laboratory Tests published by the International Society for Rock Mechanics or equivalent method. Details of tests will be specified individually according to the type and location of the samples. The dry density and moisture content shall be reported for each specimen used for any test. Results shall include plots of stress-strain, Mohr circles and shear-stress vs normal stress, as appropriate.

11.9 Measurement and Payment

Cost incurred from such site investigation works shall be included in the Provisional Sum for Item 0/11 in the Bill of Quantities and shall be added to the subsequent interim payment.

Payment to the Contractor shall be made to the sum calculated by the Provisional Sum for Item 0/11 and added to the subsequent Bi-Monthly Statement of Account certified by the Engineer. Payment shall be made in accordance with the provisions of Clause 58 (Provisional Sums), in Vol. II, Part I - General Conditions of Contract.