Low Temperature Stiffness, ASTM D 1053, at -40°C, maximum	700 kgf/cm^2
Over aged, 14 days at 70°C, ASTM D 573	
- Hardness, point change, maximum	O to ± 15
- Tensile Strength, % change, maximum	± 15
- Elongation at break, % change, maximum	-40
Ozone Resistance, ASTM D 1149 1 p.p.m. ozone in air by volume, 100 hours, 20% strain at 40 ± 1°C	no crack

The Contractor shall store the elastomeric bearing pads in a manner which will prevent deterioration, as approved by the Supervision.

E.23.3 Measurement and Payment

Measurement, for payment, of furnishing and installing elastomeric bearing pads will be made of the number of the pads and plates in place as shown on the Drawings or directed by the Supervision.

Payment for furnishing and installing elastomeric bearing pads will be made at the unit price per number tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labor, materials and equipment required by these Specifications.

E.24 JOINT FILLER AND SEALER, IF ANY

E.24.1 Joint Filler

The Contractor shall place an elastic joint filler where shown on the Drawings or where directed by the Supervision. The elastic joint filler material shall be of the expanded polystyrene type satisfying the requirements of ASTM D 2125, Class 1, Grade 15 or approved equivalent and shall be thick enough to cover all voids. The Contractor shall cut and fabricate the joint filler to fit around all openings as shown on the Drawings or as directed by the Supervision.

E.24.2 Joint Sealer, if any

Joint sealer shall be used in the concrete structural joints elsewhere as shown on the Drawings or as directed by the Supervision, for establishing water-tightness of the joints.

The material of joint sealer shall be of polysulphide, epoxy or equivalent approved by the Supervision, to be injected in the joint. The composition of the sealer shall be durable and watertight against contraction and expansion of the joint space, chemical variations and loads encountered upon, during and after completion of the work.

The Contractor shall propose the material, structural design and procedure for the construction of joint sealer at least eighty four (84) days prior to beginning of the work for approval of the Supervision.

Sealing work in the joint shall be performed only by skilled workman. Unless inspection is waived by the Supervision in each specific case, the work shall be performed only in the presence of the Supervision, but shall not be made until 28 days after the concrete has been placed.

E.24.3 Measurement and Payment

(1) Measurement, for payment, of furnishing and installation joint filler will be made for the area of joint filler actually placed.

Payment for furnishing and installing joint filler will be made at the unit prices per square meter tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labour, equipment and materials required.

(2) Measurement, for payment, of joint sealer if used will be made on the basis for the length along the center line of the sealer actually constructed in accordance with the Specifications.

Payment of joint sealer will be made at the unit price per linear meter of the sealer tendered therefor in the Bill of Quantities.

E.25 BITUMINOUS COATING FOR CONTRACTION JOINT

E.25.1 General

Contraction joints as indicated on the Drawings or elsewhere as directed by the Supervision shall be provided by the Contractor. The joint material shall consist of a layer of bituminous coating or other approved material on the face of the first concrete.

E.25.2 Measurement and Payment

Measurement for payment of bituminous or other joint material shall be made on the basis of actual coated or installed area in square meters determined by the dimensions as shown on the Drawings or directed by the Supervision.

Payment shall be made for the number of square meters measured as provided above at the unit price per square meter tendered therefor in the Bill of Quantities, which unit price for joint material shall constitute full compensation for the cost of all labour, tools, equipment and materials including furnishing, transporting, fabricating, coating or installing the joint material and other items necessary to complete the works.

E.26 DOWEL BARS

E.26.1 General

The Contractor shall furnish and install dowel bars in contraction and expansion joints in concrete structures at locations as shown on the Drawings or as directed or approved by the Supervision.

Dowel bars shall consist of plain or deformed reinforcement bars of high yield steel complying with the requirements stipulated in Sub-paragraph E.14.1. They shall be free of oil, paint other than bond-breaking compound, dirt, loose rust and scale.

Dowel bars shall be of sizes as shown on the Drawings and directed by the Supervision, and shall be straight, free from burred edges, or other irregularities and shall have their sliding ends sawn or, if approved, sheared.

Bond-breaking compound for dowel bars shall consist of 66 % of 200 pen bitumen blended hot with 14 % light creosote oil and, when cold, brought to the consistency of paint by the addition of 20 % solvent naphtha or other approved compound.

E.26.2 Installation of Dowel Bars

Dowel bars shall be provided as shown on the Drawings parallel to the finished surface and to the longitudinal axis. The half of each dowel bar projecting away from the concrete operation shall be coated with a thin film of bond-breaking compound and provided with a closely fitted sleeve 100 mm long of waterproofed cardboard or other approved material. The end of the sleeve will be packed with a disc of joint filler or pad of cotton waste to a depth of 25 mm.

The assembly of joint filler and dowel bars shall be so supported as to remain rigidly in the correct position while placing and compacting the concrete.

Misalignment of dowel bars shall not exceed 6 mm per 300 mm in length of dowel bar.

E.26.3 Measurement and Payment

Measurement, for payment, for furnishing and installing dowel bars shall be made on the basis of weight in metric tons of bars installed as shown on the Drawings or directed by the Supervision.

Payment for furnishing and installing dowel bars will be made at the appropriate unit price per metric ton tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labour, materials and equipment required for transporting, cutting, placing, and supporting bars, bar treatment, and all other items incidental to the work.

E.27 ANCHOR BARS

E.27.1 General

Wherever shown on the Drawings or directed by the Supervision, the Contractor shall drill holes into rock formation to receive bars for anchoring concrete structures or parts thereof to the formation. The dimensions of anchor bar and the locations, diameters, and depths of the drilled holes shall be as shown on the Drawings or as directed by the Supervision.

E.27.2 Drilling Holes and Placing Bars

The diameter of each anchor bar hole shall be not less than 1.5 times the diameter of the anchor bar specified for that hole. The depth of each hole shall be as shown on the Drawings or as determined by the Supervision depending upon the nature of formation.

Anchor bars shall be cleaned thoroughly before being placed. The holes shall also be cleaned thoroughly and shall be completely and compactly filled with grout or mortar. The anchor bar shall be forced into place before the grout or mortar takes its final set and, where practicable, shall be vibrated or rapped until the entire surface of the embedded portion of bar is in contact with the grout. Special care shall be taken to ensure against any movement of the bar grouted in place, until the grout has completely set.

E.27.3 Measurement and Payment

Measurement, for payment, of grouted anchor bars will be made on the basis of length of bars actually placed and grouted into the holes drilled through the rock formation or concrete surface.

Payment for grouted anchor bars will be made at the respective unit prices per linear meter of bar placed and grouted tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labour, materials and equipment required for drilling holes, furnishing and installing bars, grouting and anchoring, and all other items incidental to the work.

E.28 WELDED MESH AND METAL WIRE LATH

E.28.1 General

Welded mesh to be used for the building works shall be steel mesh reinforcement as shown on the Drawings or as directed by the Supervision, and shall consist of 3.2 mm iron wire which shall comply with JIS G 3532-62 or approved equivalent, and shall have a mesh opening of 100 mm by 100 mm or approved by the Supervision.

Metal wire lath shall be of galvanized expanded metal with diamond mesh having a metal sheet thickness of not less than 0.3 mm.

E.28.2 Measurement and Payment

Measurement, for payment, of welded mesh and metal wire lath for the building works will be made only of the square meter of welded mesh or metal wire lath area actually placed as shown on the Drawings or as directed and approved by the Supervision.

Payment for welded mesh and metal wire lath will be made at the respective unit prices per square meter tendered therefor in the Bill of Quantities, which the unit prices shall include the cost of all labor, equipment and materials, including nails and staples, and other items necessary to complete the works.

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DRAINAGE

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SECTION F DRAINAGE

F.1 GENERAL

The work under the items for drainage in the Bill of Quantities consists of the construction of drains with concrete pipes, steel pipes, plastic pipes, drain ditches and drain pits as a part of the various permanent structures.

The Contractor shall furnish all materials required for drainage. The pipe to be used for drains shall be subject to the approval of the Supervision.

Care shall be taken to avoid clogging drains during the progress of the work, and if should any drain become clogged or obstructed from any cause before final acceptance of the Work, it shall be cleaned out in a manner approved by the Supervision or replaced by and at the expense of the Contractor. No pipe which has been damaged shall be used for the Work.

F.2 DRAINS WITH CONCRETE PIPE

F.2.1 General

The Contractor shall construct drains with in situ concrete or reinforced precast concrete pipes in the location as shown on the Drawings or as directed by the Supervision. The precast concrete shall be produced as stipulated in Paragraph E.20.

All precast concrete pipe drains shall be sealed with approved material and constructed with open joints or closed joints as shown on the Drawings or as approved by the Supervision.

The items of the Bill of Quantities for drains with concrete pipe shall be constructed in the following manner:

Pipe Descriptions	Construction Sequence
150-millimeter-diameter precast perforated concrete pipe with open joint.	Place gravel filter bedding on covering sheets in excavated trench; install pipes; place gravel covering; cover the sheets.
300-millimeter-diameter precast concrete pipe with collar joints.	Install pipes in excavated trench; place concrete for protection.
600-,800-and 1,000-millimeter-diameter precast reinforced concrete pipes with collar joints.	Excavate trench; place sand bedding; cover with random backfill and compaction.

The gravel filter material shall consist of screened natural gravel or crushed rock, lean and well graded from 20 to 50 mm in size.

F.2.2. Measurement and Payment

Measurement, for payment, of drains constructed with concrete pipes shall be made of the length along the centerline from end to end of the pipe in place, and no allowance will be made for joints. Payment will be made at the respective unit prices per linear meter tendered therefor in the Bill of Quantities, which unit prices shall include the cost of furnishing and installing concrete pipes with jointing and other works required. Provided that payment for trench excavation, gravel filter material, covering sheets if any, random backfill with compaction and concrete works will be made separately under the appropriate items in the Bill of Quantities.

F.3 DRAINS WITH STEEL PIPE

F.3.1 General

All steel pipe to be used for drains shall be furnished and installed as shown on the Drawings or as approved by the Supervision.

Pipe shall be placed to the prescribed lines and grade. Joints of pipe shall be connected with appropriate couplings or connectors to provide watertight connections or as approved by the Supervision.

F.3.2 Measurement and Payment

Measurement, for payment, of drains with steel pipe will be made for the length of pipes installed. Payment will be made at the unit price per linear meter tendered therefor in the Bill of Quantities, which unit price shall include the cost of all works and materials required. Provided, that payment for trench excavation, random backfill with compaction and concrete works will be made separately under the appropriate items in the Bill of Quantities.

F.4 DRAINS WITH PLASTIC (PVC) PIPE

F.4.1 General

All plastic pipe to be used for drains shall be furnished and installed as shown on the Drawings or as approved by the Supervision.

Drains with plastic pipe shall be constructed in the following manner:

Pipe Descriptions	Construction Sequence
50-and 75-millimeter-diameter plastic pipes, for weep holes	Pipe shall be wrapped with PVC sheet and holes shall be drilled into the rock at

Pipe Descriptions	Construction Sequence
in concrete facing, walls of inlet and outlet, and shotcrete.	least 5 cm deep after placing surrounding concrete, through the pipe opening.
100-millimeter-diameter perforated plastic pipe.	Place gravel filter bedding on covering sheets in excavated trench; install pipes; place gravel covering; cover the sheets.
200-millimeter-diameter perforated plastic pipe.	Place gravel filter bedding in excavated trench; install pipes; place gravel covering; cover with random backfill and compaction.
100-millimeter-diameter plastic pipe.	Install pipes; place concrete for covering.

The pipe shall be placed to the prescribed lines and grades. The gravel filter material shall consist of screened natural gravel or crushed rock, lean and well graded from 20 to 50 mm in size.

F.4.2 Measurement and Payment

Measurement, for payment, of drains with plastic pipe will be made for the length of pipes in place. Payment for drains with plastic pipe will be made at the respective unit prices per linear meter tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all works and materials required, except earth works including gravel filter material and concrete works.

F.5 DRAIN DITCHES AND DRAIN PITS

F.5.1 General

The Contractor shall perform trench excavation, fill or backfill, and concrete work to construct drain ditches and drain pits to the lines, grades and dimensions as shown on the Drawings.

Drain ditches and drain pits will be made of reinforced concrete or non-reinforced concrete as shown on the Drawings. The precast concrete frumes stipulated in Paragraph E.20 may be used for the reinforced concrete ditches upon approval of the Supervision.

F.5.2 Measurement and Payment

Measurement, for payment, of drain ditches and drain pits will be made on the basis of the actual volume in cubic meters of the concrete placed as stipulated in Paragraph E.12. Payment for drain ditches and drain pits will be made at the respective unit prices per cubic meter tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all

labor, equipment and materials as stipulated in Paragraph E.12. Provided, that payment for trench excavation, gravel bedding and backfill will be made separately under the appropriate items of the Bill of Quantities.

F.6 DRAIN PIPE WITH STOP VALVE

F.6.1 General

A drain pipe with a stop valve shall be installed in the bottom of the Severino head tank.

The steel drain pipe shall be 100 millimeters in diameter and shall be embedded in the concrete as shown on the Drawings or as directed by the Supervision.

At the downstream end of the drain pipe, a cast-iron stop valve shall be provided.

F.6.2 Measurement and Payment

Measurement and payment for drain pipe with stop valve shall be made in accordance with the provisions stipulated in Sub-paragraph H.11.2.

F.7 COBBLED DITCH, IF ANY

F.7.1 General

Cobbled ditches, if any, for the permanent access roads shall consist of wet cobble or rubble masonry and shall be constructed to the lines, dimensions and at the location shown on the Drawings or as directed by the Supervision. Cobbles or rubbles to be used for the ditch shall be of selected, hard and block, not less than 15 centimeters in length and not less than 180 square centimeters in area. Cobbles or rubbles shall be carefully arranged in relation to one another so as to have a pleasing appearance with a minimum of voids or empty spaces to be filled with mortar.

Mortar shall consist of three parts of clean fine aggregate to one part of Portland cement (ordinary type) by volume. The cement, fine aggregate, and water shall conform to the requirements specified in Sub-paragraph E.2.1 and E.3.2 and Paragraph E.4.

The wet cobble or rubble masonry work shall be performed by experienced masons, duly qualified in their trade. The rock shall be laid carefully so that the exposed faces form an uniform surface and are true to the dimensions, lines and levels shown on the Drawings or as directed by the Supervision. Prior to setting, the cobbles or rubbles shall be wetted sufficiently to take up its surface absorption.

F.7.2 Measurement and Payment

Measurement, for payment, of the cobbled ditches will be made on the basis of the volume in cubic meter of the ditches actually constructed at the location and to the lines and dimensions. Payment for the cobbled ditches will be made at the unit price per cubic meter of the ditches tendered therefor in the Bill of Quantities, which unit price shall include the costs of all labor, materials and equipment required to perform the work specified in this Paragraph.

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ROAD WORKS

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SECTION G ROAD WORKS

G.1 GENERAL

The Contractor shall carry out, as shown on the Drawings and/or as directed by the Supervision, the construction and maintenance of permanent and temporary access roads as specified herein. In addition, the Contractor shall be responsible for designing, constructing and maintaining his various temporary construction roads as outlined in Paragraph G.15.

Items of work pertaining to road work such as control and renioval of water, excavation and backfill, embankment, drainage, concrete work, improved subgrade and graded crushed stone subbase, and surface courses, guard railing, etc. shall comply with the stipulations of this Section as well as the other applicable Section of these Specifications.

Unless otherwise specified in this Section, the Contractor shall construct the access roads in conformity with the applicable provisions of the Ecuadorian standards such as " Manual de Diseño de Carreteras, Ministerio de Obras Públicas y Comunicaciones " (Main Road Standard) and " Manual de Diseño de Caminos Vecinales, MOP-1984, Ministerio de Obras Públicas y Comunicaciones " (Second Road Standard).

G.2 ROAD DESIGN STANDARDS

The Severino access road (permanent), the Caña Dulce inlet access rod (temporary), the La Seca access road (permanent), the Los Cuyuyes access road (permanent) and the Poza Honda inlet access road (permanent) shall conform to the following standards:

(1) The total roadway width is six (6) m for permanent roads and four (4) m for temporary roads.

(2) The grade along the centerline of the roads shall not exceed ten (10) percent.

(3) The minimum radius of curvature shall be fifteen (15) m.

The horizontal and vertical alignments, are shown on the Drawings indicating the locations of the points of intersection of tangents and grades lines.

The Contractor shall stake out the alignment of access roads and secure the Supervision's approval of the stake-out before proceeding with construction. If, in the opinion of the Supervision, any modification of the line or grade is advisable, either before or after stake-out, the Supervision will issue detailed instructions to the Contractor for such modification and the Contractor shall revise the stake-out for further approval. These requirements shall be met without additional payment.

Provisions for drainage shall include the construction of drainage ditches, cross drains and culverts in accordance with the provisions of Paragraph G.5 herein and Section F.

Sufficient templates and straightedges shall be furnished by the Contractor for use in checking the finished surface of the graded crushed stone subbase. These templates and straightedges shall be submitted to the Supervision for his approval and shall be maintained by the Contractor at all times in a condition to produce the correct cross-sectional profile. These templates and straightedges shall be checked at intervals and, if necessary, repaired or adjusted as directed by the Supervision. The furnishing and maintenance of the templates and straightedges will not be paid for directly, but all costs therefor shall be included in the applicable unit prices tendered in the Bill of Quantities for road construction.

The gradation, moisture control, density, placing and compaction for the embankment, improved subgrade and graded crushed stone subbase shall be as stipulated herein; however, the Supervision reserves the right to adjust these requirements as he deems best, and in such case no change will be allowed in the unit prices for such work as tendered in the Bill of Quantities.

G.3 CONTROL AND REMOVAL OF WATER

G.3.1 General

Control and removal of water during construction of the permanent and temporary access roads shall be accomplished in accordance with the stipulations of Section B of these Specifications.

G.3.2 Measurement and Payment

No separate payment will be made for control and removal of water during excavation and embankment work. All costs incurred from the works for control and removal of water shall be deemed to be included in the unit prices or lump sum prices for the corresponding items in the Bill of Quantities.

G.4 CLEARING AND STRIPPING

G.4.1 General

The ground over which the road is to be built, to a width of one (1) m outside the tops of all cut sections and one (1) m outside the toes of the roadway embankments as the case may be, and the ground along the lines of the drain ditches shall be cleared of trees, brush, rubbish and other objectionable matter as required. The ground surface under the roadway embankment shall be cleared of all stumps, roots, and non-perishable objects except for those which will be a minimum of one (1) m below subgrade or slope of the embankment. All cleared material shall be disposed of in the same general manner as provided for in Sub-paragraph C.2.1 of Section C, or as ordered by the Supervision.

All the surfaces which are to be stripped will be directed by the Supervision. This work shall comply with the stipulations of Sub-paragraph C.2.2 of Section C.

G.4.2 Measurement and Payment

Measurement and payment of the clearing and stripping works will be made according to the provisions stipulated in Sub-paragraph C.2.3.

G.5 DRAINAGE AND CONCRETE WORK

G.5.1 General

All drainage work for the permanent and temporary access roads such as drain ditches and catch basins, concrete pipe culverts and cross drains including related concrete headwalls, side walls and aprons, P.V.C. drain pipe, etc. shall be constructed as shown on the Drawings. The detailed specifications which pertain to drainage ditches, catch basins, pipe culverts and cross drain's head walls, etc. for the permanent access roads shall comply with the provisions in Section F, Drainage and Section E, Concrete Works. The stipulations in these Sections shall be fully applied, where applicable.

The Contractor shall construct ditches and culverts as shown on the Drawings. In order to keep water away from the embankment, improved subgrade and graded crushed stone subbase during construction, the Contractor shall at all times ensure adequate drainage by scheduling ditch and culvert construction work so that the drainage is operative before work is begun on the embankment and surfacing. He shall clean and trim all such drainage ditches from time to time so that there may be a free flow of water throughout the whole Contract period. Damage to the work due to unfavorable drainage or through failure to provide adequate drainage will result in an order by the Supervision to repair the damage at the Contractor's expense.

The Contractor shall construct retaining walls along the access roads using a rubble concrete as shown on the Drawings or as directed by the Supervision. The rubble concrete shall composed of concrete, class E, and hard and durable rubbles/boulders of which the maximum size is 300 mm. The rubble stones and boulders shall be placed by hand one by one into the concrete during placing and well embedded and compacted individually.

G.5.2 Measurement and Payment

Measurement and payment for the drainage and concrete work including rubble concrete for retaining walls in the permanent and temporary access roads shall be made at the respective unit prices tendered therefor in the Bill of Quantities, in accordance with the corresponding work items in Section E, Concrete Works and Section F, Drainage, hereof.

G.6 EXCAVATION

G.6.1 General

All classes of materials (common, weathered rock and rock) encountered in the road excavation shall be excavated to the grades and lines shown on the Drawings or as directed

by the Supervision. The detailed specifications which pertain to excavation for the permanent and temporary access roads, including measurement and payment thereof, are stipulated in Section C, Earth Works. The stipulations in Section C shall be fully applied, where applicable.

If the subgrade line is to be excavated in common including weathered rock, it shall be formed to the correct transverse and longitudinal profiles as required but at a grade higher than the final grade in order to allow for the effect of compaction. The material shall be compacted with approved rollers, and prior to compaction the moisture content shall be adjusted by watering with sprinkler trucks or other approved methods, or by drying out, as may be required in order to attain the specified compaction. If the nature of the common and weathered rock material is such as to make it impossible to obtain the required compaction, the unsuitable material shall be removed and paid for at the unit price per cubic meter of common including weathered rock excavation as tendered therefor in the Bill of Quantities.

When the subgrade line is to be excavated in rock, the rock shall be excavated neatly to the correct transverse and longitudinal profiles and checked by straightedges. There shall be no payment for excavation in rock below the grade level. The Contractor shall remove all loose rock and if necessary bring the grade up to the correct level by the addition of approved granular material compacted by rolling. No rock shall project more than four (4) cm above the grade level.

Suitable material excavated within the limits of the access roads shall, unless provision is expressly made to the contrary by the Supervision, be used in the most effective manner of the formation of the roadway embankment as for the improved subgrade material. The excavated material which is surplus to these requirement shall be dispose of in accordance with the provisions of Paragraph C.17.

G.6.2 Measurement and Payment

Measurement, for payment, of common including weathered rock material, and rock material removed from the excavation for the permanent and temporary access roads will be made to the lines and grades shown on the Drawings or as directed by the Supervision and such measurement shall be based on the original ground surface before excavation and the actually excavated surface as approved by the Supervision, in accordance with the provisions of Sub-paragraph C.5.5 of Section C. The class of the excavated material will be determined based solely on the Supervision's analysis and judgement.

Payment for each class of material excavated for the access road will be made at the unit prices per cubic meter tendered therefor in the Bill of Quantities, in accordance with the provisions of Sub-paragraph C.5.5 of Section C. Provided that the payment for open-cut excavation for the structures to be constructed in the access roads will be made as an open-cut excavation, all classes of materials.

G.7 EMBANKMENT

G.7.1 General

The embankment for the access roads shall be constructed at the locations and to the lines, grades and dimensions as shown on the Drawings or as directed by the Supervision.

The earthfill material for the access road embankment shall consist of suitable material excavated from cut sections of the access roads or from any other area as directed by the Supervision and shall be free from brush, roots, vegetation, large boulders and other unsuitable material. The embankment materials shall not be placed in the road embankment until the foundation for it has been suitably prepared and approved by the Supervision.

After being compacted, the gradation of the embankment material shall conform to the following:

(1) The maximum particle size shall be thirty (30) cm.

(2) Less than fifty (50) percent of the material shall be in the range of plus No. 4 (4.76 mm) to thirty (30) cm.

(3) The material shall contain minus No. 200 sieve fraction in the amount of less than ten (10) percent.

G.7.2 Moisture Control and Density

Unless otherwise approved or directed by the Supervision, the moisture content of the embankment material during and after compaction shall be within the range from minus four (4) % to plus two (2) % of the optimum moisture content, and this moisture content shall be uniform throughout each layer which is placed.

The optimum moisture content of the embankment material shall be that moisture content which is required to produce the maximum dry density obtained from the compaction test in accordance with Sub-paragraph C.8.4 of Section C. The moisture content and optimum moisture content of the material placed in the road embankment shall be determined by the Supervision from selected samples at random. If the moisure content as determined from the samples does not meet the Specifications, the Contractor shall treat the material in such a manner that the moisture content is brought within the required range, as indicated by a further series of tests.

It is the Contractor's responsibility to obtain the specified moisture content for the access road embankment, and this shall be accomplished by a method which has been approved by the Supervision.

Each layer of the embankment shall be compacted to not less than 92 % of the maximum dry density in accordance with ASTM D 698, JIS A-1210 or other approved standards.

G.7.3 Placing and Compaction

The road embankment shall be built in approximately horizontal layers carried across the entire width of the embankment to the required slopes. The depth of each layer before compaction shall not exceed thirty (30) cm. Each layer shall be compacted to the satisfaction of the Supervision by means of vibratory or other approved rollers. The road embankment shall not be widened with loose materials dumped from the top. Any travel of equipment over the road embankment during construction shall be routed so as to obtain maximum consolidation of the embankment.

The Contractor's operations in handling, spreading and compacting the material for the roadway embankment shall be such as those which will result in an acceptable distribution and gradation of the materials throughout the embankment. The density shall be uniform throughout each compacted layer. Rock pockets and clusters of rock which would interfere with the proper compaction of the material will not be permitted.

When each layer of the material has been conditioned to have the specified moisture content, it shall be compacted with rollers until the dry density throughout the layer is equal to or in excess of the specified dry density. Full details on the type of rollers to be used by the Contractor shall be submitted to the Supervision for approval.

The loading, operation and speed of travel of the rollers shall be such as required to obtain the specified compaction. The immediately proceeding and adjacent roller tracks shall be lapped by at least fifty (50) cm. If more than one roller is used on any one layer of fill, all rollers so used shall be of the same type and essentially of the same dimensions. Tractors used of pulling rollers shall have sufficient power to pull the rollers satisfactorily when the drum are fully loaded.

If, in the opinion of the Supervision, the rolled surface of a layer of material is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or worked with a harrow, scarifier, or other suitable equipment, in an approved manner to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of material is placed. If, in the opinion of the Supervision, the rolled surface of a layer of material in place is too wet for proper compaction of the layer of material to be placed thereon, it shall be removed and dried or be worked in place with a harrow, scarifier, or other suitable equipment to reduce the moisture content to the required amount. It then shall be recompacted before the next succeeding layer of material is place. No adjustment in the unit price will be made on account of any operation of the Contractor in regard to work which may be required as described in this Sub-paragraph.

When the Contractor is reasonably sure that the necessary number of passes by the roller has been made to obtain the specified density, he will request that the Supervision make a field density test to verify as such.

This test will be in accordance with JIS A-1214, ASTM D 1556 or other approved methods. After the test has been made, the Supervision will inform the Contractor of the results and if

the specified density has been obtained, the Supervision will allow the Contractor to start placing and compacting the next layer.

Where embankment material is to be deposited on only one side of the culvert headwalls, wingwalls, etc., such care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it causes overturning of or excessive pressure against the structure.

The roadway embankment material shall be placed to the design subgrade line shown on the Drawings and shall be trimmed to a surface tolerance of ± 3 cm in 5 m. Any part of the subgrade line that has been completed shall be protected against drying out and cracking and any damage resulting from default of the Contractor shall be repaired as directed by the Supervision without additional payment.

G.7.4 Measurement and Payment

Measurement, for payment, of the compaction of original ground to be placed the embankment material will be made for the actual compacted plan area in square meters according to the Drawings or as directed and approved by the Supervision.

Payment for the compaction of original ground will be made at the unit price per square meter tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labor, equipment and materials required for completion of this work.

Measurement, for payment, of the access road embankment will be made for the material compacted in place in the embankment to the lines and grades shown on the Drawings or as directed by the Supervision.

Payment for the access road embankment will be made at the respective unit prices per cubic meter tendered therefor in the Bill of Quantities, which unit prices shall be for all related costs of labor, equipment and materials including loading the previously excavated material, hauling (up to 500 m and more than 500 m), placing, spreading, wetting or drying as required, compacting, levelling, all required testing in accordance with the Specifications, and maintenance during the Contract period.

G.8 IMPROVED SUBGRADE

G.8.1 General

The Contractor shall construct the improved subgrade course using materials excavated from the cut sections of the access roads or other materials approved by the Supervision. The material for the improved subgrade course shall be placed and compacted in layers not to exceed twenty (20) cm after compaction. The overall thickness of the improved subgrade course shall be as shown on the Drawings or as directed by the Supervision. The improved subgrade course shall not be placed in cut sections of rock unless otherwise directed by the Supervision.

After being compacted, the gradation of the improved subgrade course material shall conform to the following:

(1) The maximum particle size shall be less than five (5) cm.

(2) Less than fifty (50) percent of the material shall be in the range of plus No. 4 (4.76 mm) to five (5) cm.

(3) The material shall contain minus No. 200 sieve fraction in the amount of less than ten (10) percent.

G.8.2 Moisture Control and Density

The Specifications for the moisture control and density of the improved subgrade material shall be the same as stipulated in Sub-paragraph G.7.2, except that the moisture content shall be within the range of minus three (3) percent to plus one (1) percent of the optimum moisture content and the required dry density for each layer of the improved subgrade material shall not be less than ninety-five (95) percent of the maximum dry density in accordance with ASTM D 698, JIS A-1210 or other approved standards.

G.8.3 Placing and Compaction

The Specifications for the placing and compaction of the improved subgrade material, including testing, shall be the same as stipulated in Sub-paragraph G.7.3, except that the depth of each layer after compaction shall not exceed twenty (20) cm. The CBR value shall not be less than corrected CBR 12.

G.8.4 Measurement and Payment

Measurement, for payment, of the improved subgrade course will be made on the basis of actual compacted volume in cubic meters determined by the design lines and grades shown on the Drawings or as directed by the Supervision.

Payment for the improved subgrade course will be made at the unit price per cubic meter tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, equipment and materials including placing, spreading, wetting or drying as required, compacting, shaping and finishing, testing and other items necessary to complete this work.

Measurement, for payment, of the transportation of improved subgrade material will be made on the basis of volume of the material and distance of transportation in m3.km determined by the Drawings and approved by the Supervision.

Payment for the transportation of improved subgrade material will be made at the unit price per m^3.km tendered therefor in the Bill of Quantities, which unit price shall constitute full

compensation for the cost of all labor, equipment and materials including loading and hauling and other items necessary to complete this work.

G.9 GRADED CRUSHED STONE SUBBASE

G.9.1 General

The graded crushed stone subbase course is the portion of the road which lies on the top of the improved subgrade course. The Contractor shall construct the graded crushed stone subbase course to the thickness shown on the Drawings or as directed by the Supervision.

G.9.2 Moisture Control and Density

The Specifications for the moisture control of the graded crushed stone subbase course material shall be the same as stipulated in Sub-paragraph G.7.2, except that it will be within the range of minus three (3) percent to plus one (1) percent of the optimum moisture content. The material for the graded crushed stone subbase course shall be compacted to at least sixty (60) % of the CBR value as determined in accordance with ASTM D 1883, JIS A-1211 or equivalent standards.

G.9.3 Processed Material

All graded crushed stone subbase course material shall consist of material excavated from the Picoazá quarry or other approved areas which has been processed through the crushing/classifying plant so as to meet the required gradation specifications. Such material shall be approved before being incorporated in the work and may be inspected by the Supervision at any time during the progress of their processing and use. Questionable materials which are pending laboratory testing and subsequent approval shall not be unloaded and incorporated with materials previously approved and accepted. If, the grading and quality of the materials do not conform to the grading or quality as previously inspected or tested, or do not comply with the Specifications, the Supervision reserves the right to reject such materials.

Samples must meet all tests required under these Specifications to the satisfaction of the Supervision. The Contractor shall permit any designated representative of the Supervision to inspect and/or test any material being used or desired to be used, at any time during or after its preparation, or while being used during the progress of the work or after the work has been competed. All such materials not complying with these Specifications, whether in place or not, shall be rejected and shall be promptly removed from the work. The Contractor shall supply all necessary materials, labor, tools, and equipment necessary to perform the testing.

Materials shall be stored so as to ensure preservation of their specified quality and fitness for the work. They shall be placed on a hard and clean ground surface approved by the Supervision and located so as to facilitate prompt inspection. The center of the storage area shall be raised and sloped to the sides as required so as to provide proper drainage. The

materials shall be stored in such manner as to prevent segregation and to ensure proper gradation and moisture content. Storage piles shall be built up and removed in each layer of not exceeding one meter. The height of such stock piles shall be limited to five meters unless otherwise approved by the Supervision.

All processed aggregates shall consist of clean, tough, durable, sharp-angled fragments free of any excess of thin or elongated pieces, and reasonably free of soft, disintegrated or decomposed stone, dirt or other deleterious matters.

The material for the graded crushed stone subbase course shall consist of processed material conforming to the following gradation requirement.

Nominal Sieve Size (mm)	20	10	5	2.5	0.4	0.074
Percentage Passing	100	66-90	35-75	20-50	5-25	1-7

G.9.4 Placing, Mixing and Compaction

The Contractor shall deliver the graded crushed stone subbase course materials from the crushing plant and place it on the previously prepared improved subgrade. After material for each layer has been placed, the material shall be mixed, at the required moisture content, by means of motor graders or other approved equipment until the mixture is uniform throughout. The material shall be placed and compacted in layers of thickness not to exceed fifteen (15) cm, after compaction.

When hauling is done over previously placed material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer, to minimize rutting or uneven compaction.

Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of smooth wheel power rollers, pneumatic-tired rollers or other approved compaction equipment which is suitable and capable of compacting the material to the specified density. Full details for each specific type of compaction equipment shall be submitted to the Supervision for approval.

The loading, operation and speed of travel of the roller shall be such as required to obtain the specified compaction. The immediately preceding and adjacent roller tracks shall be lapped by at least fifty (50) cm. If more than one roller is used, all rollers so used shall be of the same type and dimensions.

Rolling shall progress gradually from the sides to the center, parallel to the centerline of the road, and shall continue until all the surface has been rolled. Any irregularities or

depressions that develop shall be corrected by loosening the material at these places and adding or removing material until the surface becomes smooth and uniform. At all places not accessible to the roller, the material shall be compacted thoroughly with approved tampers or hand-held compactors. The material shall be both bladed and rolled until a smooth and even surface has been obtained.

The Contractor's operations in handling, spreading and compacting the material for the roadway embankment shall be such as those which will result in an acceptable distribution and gradation of the materials throughout the embankment. The density shall be uniform throughout each compacted layer. Rock pockets and clusters of rock which would interfere with the proper compaction of the material will not be permitted.

If, in the opinion of the Supervision, the rolled surface of any layer of the road embankment is too dry or too wet or too smooth, it shall be treated in such a manner as specified in Sub-paragraph G.7.3.

Testing of the graded crushed stone subbase course shall be done in accordance with JIS A-1214, ASTM D 1556 or equivalent standards.

The finished surface shall be true to the level shown on the Drawings, or as directed by the Supervision, with a tolerance of ± 3 cm in 5m.

G.9.5 Measurement and Payment

Measurement, for payment, of the graded crushed stone subbase course will be made on the basis of actually placed and compacted volume in cubic meters to the design lines and grades shown on the Drawings or as directed by the Supervision.

Payment for the graded crushed stone subbase course will be made at the unit price per cubic meter tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, equipment and materials, including procuring and hauling to the roadway, spreading, compacting, wetting or drying as required, finishing, testing and other items necessary to complete the work and to maintain during the Contract period.

G.10 SURFACE COURSE FOR PUMPING STATION YARD

G.10.1 General

The Contractor shall construct the surface course of asphalt concrete to the lines and grades shown on the Drawings or as directed by the Supervision. Work concerning this will include but is not limited to production of required aggregate, spreading and shaping, applying bituminous materials including prime coat and tack coat, compacting, finishing, testing and other pertinent operations. The Contractor shall be responsible to maintain all sections of the completed pavement until the end of the Contract period, the time as they are offically accepted by the CRM.

The Contractor shall perform the asphalt concrete pavement in accordance with the applicable provisions of Ecuadorian standards such as "Manual de Diseño de Carreteras, Ministerio de Obras Públicas y Comunicaciones" (Main Road Standard) "Manual de Diseño de Caminos Vecinales, MOP-1984, Ministerio de Obras Públicas y Comunicaciones" (Second Road Standard) and "Especificaciones Generales para Construction de Caminos y Puentes" (General Specification for Construction of Roadway).

G.10.2 Prime Coat and Tack Coat

A prime coat means an application of low viscosity bituminous binder to an absorbent non-bituminous surface. If the prime coat is to be trafficked, it shall be covered with blinding material.

For the application of the prime coat and tack coat, the following shall be required:

(1) Equipment

All equipment, tools and machines to be used in the performance of the work required in this Sub-paragraph shall be subject to the approval of the Supervision and shall be maintained in satisfactory working condition at all times.

The distributor truck shall be of the type so designed and equipped as to distribute the bituminous material uniformly on the various widths of the surface.

(2) Approval of Materials

The Contractor shall select the sources from which the specified bituminous materials are to be obtained well in advance of the time when the materials will be required in the work. These materials shall be subject to the approval of the Supervision. A certified refinery analysis prepared by the manufacturer shall accompany each shipment of the materials, and shall be submitted to the Supervision for approval not less than fifty-six (56) days prior to the time scheduled for use in the work.

(3) Weather Limitations

The prime coat and tack coat shall be applied with the approval of the Supervision only when the surface of the stabilized subbase course is dry and rain is not expected. In the event of a sudden rain, all work shall be stopped immediately.

(4) Condition of Subbase Course

Before applying the prime coat, all loose material, dirt or other objectionable materials shall be removed from the surface to be treated, and the surface condition shall be smooth as approved by the Supervision.

(5) Prime and Tack Coat Material

For prime coat, the binder shall be a medium-curing cut-back MC 70 unless otherwise instructed by the Supervision.

Blinding material if required shall consist of fine aggregate, or sand, or crushed dust and shall contain not more than 15 percent retained on a 6.3 mm sieve.

(6) Application of Prime Coat and Tack Coat

The surface to be sprayed shall be thoroughly cleaned by sweeping with mechanical brooms and/or washing or other approved means. All laitance and soil or binder material, loose and foreign material shall be removed. All loose material shall be swept clear of the layer to expose the full width of the layer.

The surface to be sprayed shall be checked for line, camber and level, and the surface corrected, made good as necessary and approved by the Supervision before any bituminous spray is applied.

Unless otherwise directed by the Supervision, immediately prior to the application of prime coat, the surface of the layer shall be lightly sprayed with water to give complete coverage of the layer, but in no case saturated.

As soon as possible after the surface to be sprayed has been prepared and approved by the Supervision, the prime coat shall be sprayed on to it at the specified rate. Spraying shall be carried out not later than 12 hours after the surface has been prepared.

Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount. Excess bituminous material shall be squeezed from the surface. Skipped areas or other deficiencies shall be corrected. Building paper or other approved material shall be placed over the end of the previous application and the joining application shall start on the building paper which shall be removed and satisfactorily disposed of after being used.

(7) Measurement and Payment

Measurement, for payment, of the prime coat and tack coat shall be made on the basis of volume in liters of each type of bituminous binder calculated as the product of the area in square meters instructed to be sprayed and the instructed rate of application in liters per square meter, corrected to 15.6°C.

Payment of the prime coat and tack coat will be made at the respective unit prices per liter tendered therefor in the Bill of Quantities, which the unit prices shall include for the cost of all labor, equipment and materials including providing, hauling and spraying the bituminous binder at the instructed application rate, blinding and other works necessary to complete the works.

G.10.3 Asphalt Stabilised Subbase Course

(1) General

The material for asphalt stabilised subbase course shall be the same as that for graded crushed stone subbase stipulated in Paragraph G.9.

The graded crushed stones shall be sound and hard rock procured from the Picoazá quarry or other approved area. The crushed stones shall be clean, durable and free from clay, mud and other foreign matters. All processed materials shall be stored and inspected/tested as specified in Sub-paragraph G.9.3.

The Contractor shall constructed the asphalt stabilized subbase course in accordance with the provisions stipulated in Paragraph G.9 and Sub-paragraph G.10.2, respectively.

(2) Measurement and Payment

Measurement, for payment, of the asphalt stalibized subbase course will be made on the basis of actually placed and compacted volume in cubic meters to the design lines and grades shown on the Drawings or as directed by the Supervision.

Payment for the asphalt stabilized subbase course will be made at the unit price per cubic meter tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, equipment and materials, including procuring, hauling, spreading, compacting, wetting or drying as required, finishing, testing and other items necessary to complete the work, except prime coat and tack coat.

G.10.4 Asphalt Concrete

(1) General

The asphalt concrete surface course is the portion of the road in pumping station yard which lies on the top of the asphalt stabilized subbase course. The Contractor shall construct the asphalt concrete surface course to the thickness shown on the Drawings or as directed by the Supervision.

(2) Material for Asphalt Concrete

This material shall be manufactured off-site by an approved supplier. On-site mixing will not be permitted.

The Contractor shall select the source from which the specified asphalt concrete materials are to be obtained well in advance of the time when the materials will be required in the work. These materials shall be subject to the approval of the Supervision.

(3) Weather Limitations

The asphalt concrete surface course shall be constructed only in dry weather. Work for the surface course shall not be scheduled during possible rainy periods. If a sudden rain occur, paving work shall be stopped immediately, and shall be resumed only when approved by the Supervision.

(4) Equipment

All equipment, tools and machines to be used for roadwork shall be approved by the Supervision, and shall be maintained in a satisfactory working condition at all times. The specific type of equipment to be used shall be proposed by the Contractor for the Supervision's approval and shall consist of such items as a asphalt concrete finisher, self-powered rollers (3-wheel or tandem weighing in the vicinity of 8 tons) and/or pneumatic-tired roller and equipment for heating bituminous material.

(5) Construction

The Contractor shall prepare a plan for constructing the surface course and submit it to the Supervision for approval at least twenty-eight (28)days prior to such work beginning.

The prime coat and tack coat shall be applied in accordance with the provisions stipulated in Sub-paragraph G.10.2. Prior to placing the surface course, the primed and tacked surface of the subbase course shall be free of all loose and foreign matters and shall be smooth as approved by the Supervision.

The surface course shall be constructed using an asphalt concrete finisher. After being properly placed, the surface course shall be rolled thoroughly until the surface is fully compacted and bonded to the full width of the surface course, to the satisfaction of the Supervision.

During compaction, the material shall be bladed to the line and grade shown on the Drawings. Segregation of the fine and coarse materials shall be avoided and the surface of the material kept free from corrugations during compaction. The finished surface shall be true to levels shown on the Drawings or as directed by the Supervision with a tolerance of 1 cm in 5 m in width as measured by straightedge.

(6) Measurement and Payment

Measurement, for payment, of the asphalt concrete surface course will be made on the basis of actual volume in cubic meters constructed to the design grades and lines shown on the Drawings or as directed by the Supervision.

Payment for the asphalt concrete surface course will be made at the unit price per cubic meter tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, equipment and materials including procurement of asphalt concrete,

hauling to the pumping station, spreading, compacting, shaping, finishing, testing, maintaining and all other items necessary to complete the work and maintain until the end of the Contract period as specified herein.

G.11 CONCRETE RETAINING WALL AND WET RUBBLE MASONRY WALL

G.11.1 Concrete Retaining Wall

Concrete retaining wall for the access roads shall be constructed to the lines, dimensions and in the location shown on the Drawings or as directed by the Supervision.

Before work of the concrete retaining wall is commenced, the leveling concrete shall be placed on surface of open excavation for leveling base of the retaining wall as shown on the Drawings or as directed by the Supervision.

Placing of concrete and installing of reinforcing bars for the wall shall be fully conformed to all the Specifications provided hereinbefore in Paragraph E.10 and E.14 of Section E, Concrete Works, where applicable. Surface of concrete to be permanently exposed and to be covered with embankment materials shall be formed for Finishs F2 and F1, respectively, as stipulated in Paragraph E.13 of Section E.

G.11.2 Wet Rubble Masonry Wall

Wet rubble masonry wall shall be built to the lines, dimensions and in the locations shown on the Drawings or as directed by the Supervision. Rock to be used for the wall shall be of selected, hard and blocky, not less than 30 centimeters in length and not less than 400 square centimeters in area. Rock shall be carefully arranged in relation to one another so as to have a pleasing appearance with a minimum of voids or empty spaces to be filled with mortar.

Mortar shall have the mix ratio of three parts of clean fine aggregate to one part of Portland cement (ordinary type) by volume. The fine aggregate, cement and water shall conform to the requirements specified in Sub-paragraphs E.2.1 and E.3.2 and Paragraph E.4 of Section E. Concrete for this wall consists of the placement of the concrete for foundation leveling and backfill shall be placed as shown on the Drawings. The Specifications in Section E which are applicable to the concrete for the foundation and backfill shall be complied with.

Free drain backfill shall be placed to the lines and dimensions shown on the Drawings. The free drain backfill shall conform to the requirements specified in Sub-paragraph C.7.2 of Section C. In the course of setting and mortaring the rocks, 50-millimeter diameter of P.V.C. drain pipe shall be installed in the wall at every four (4) square meters as shown on the Drawings or directed by the Supervision.

The wet rubble masonry wall shall be performed by experienced masons, duly qualified in their trade. The rocks shall be laid carefully so that the exposed faces form an uniform surface and are true to dimensions, lines and levels shown on the Drawings or as directed by

the Supervision. Prior to setting, the rocks shall be wetted sufficiently to take up its surface absorption.

G.11.3 Measurement and Payment

(1) Measurement, for payment, of the concrete retaining wall will be made to the neat lines of wall in accordance with the measurement appropriate for concrete, formwork and reinforcing bars provided in Paragraph E.12 and Sub-paragraphs E.13.8 and E.14.3 of Section E, or established by the Supervision.

Payment for the concrete retaining wall will be made at the unit prices per cubic meter of concrete placed, per square meter of formwork finished and per metric ton of reinforcing bars installed tendered therefor in the Bill of Quantities, which unit prices shall include the costs of all labor, materials and equipment required to perform the work prescribed in this Paragraph.

(2) Measurement and payment of the wet rubble masonry wall will be made according to the provisions stipulated in Sub-paragraph C.19.2 of Section C.

G.12 GUARD RAILING

G.12.1 General

The Contractor shall furnish and install guard railing, including concrete foundations for the posts, as shown on the Drawings or as directed by the Supervision.

Material to be used for the steel guard railing shall conform to the requirements of JIS G 3101 (Structural Rolled Steel for General Use), ASTM A 36-70 a (Structural Steel), or equivalent standards. Steel pipe used for the posts shall conform to the requirement of JIS G 3452 (Steel Gas Pipes), ASTM A 53-73 (Welded and Seamless Steel Pipe), or equivalent standards. Materials for concrete shall conform to the requirements of Section E, Concrete Works of these Specifications.

The guard railing shall be constructed to the lines and grades, and at the locations shown on the Drawings. Posts shall be set plumb in the concrete footings. Rail elements shall be erected in a manner resulting in a smooth and continuous installation. All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend beyond the post at least 0.6 cm but not more than 1.2 cm. Painting of all components of the guard rail which has been erected shall be made in accordance with the provisions of Section H.

G.12.2 Measurement and Payment

Measurement, for payment, of furnishing and installing the guard railing and posts shall be made for the length along the centerline of the railing.

Payment for furnishing and installing the guard railing and posts will be made at the unit price per linear meter tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labor, equipment and materials required for installing the guard railing and posts including excavation for post foundations, placing of concrete for post foundations, backfilling around the posts, painting and other necessary work.

G.13 WARNING SIGNS

G.13.1 General

All warning signs shall comply with the requirements of the Ecuadorian standards such as "Manual de Diseño de Carreteras, Ministerio de Obras Públicas y Comunicaciones" (Main Road Standard), "Manual de Diseño de Caminos Vecinales, MOP-1984, Ministerio de Obras Públicas y Comunicaciones" (Second Road Standard) and "Especificaciones Generales para Construcción de Caminos y Puentes" (General Specification for Construction of Roadway).

Warning signs shall be obtained from a manufacturer approved by the Supervision and before placing any order for the manufacture of the warning signs, the Contractor shall submit to the Supervision two copies of the following information;

(1) Name of the firm from which he proposes to obtain the signs together with place of manufacture or fabrication.

(2) A description of the items to be supplied with manufacturer's specifications together with a description of quality, grade, weight and strength.

(3) Manufacturer's "type" test certificates, or recent test results carried out on similar items.

(4) A sample sign, post and fittings which sample shall be stored on site for the Supervision.

All colors on the warning signs, with the exception of black and grey, shall be reflectorized, unless otherwise specified or instructed by the Supervision. The reflective sheeling shall be applied by mechanical vacuum- heat application method to the approval of the Supervision. The sign plate shall be covered by clear lacquer of a make recommended by the manufacturer of the reflective material.

Unless directed otherwise posts, frames, fittings and the backs of signs shall be painted with a finish coat of grey. Bolts and nuts shall be spot welded after erection to prevent theft, and a grey epoxy paint shall be applied to all areas so treated.

The Contractor shall excavate in any material for the foundation of the warning signs, provide and place foundation concrete, embedded all round and under the posts and backfill the remaining excavations as directed by the Supervision.

The Contractor shall cut back trees and vegetation to permit visibility and shall not permit material to be dumped so as to obscure the signs.

All signs shall be maintained in a clear and legible conditions and shall be washed down when necessary.

G.13.2 Measurement and Payment

Measurement, for payment, of constructing the warning signs shall be made on the basis of number of signs actually constructed.

Payment for constructing the warning signs will be made at the unit price per number of signs tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labor, equipment and materials required for constructing the warning signs including excavation, concreting, backfilling, painting, and other necessary work required for the maintenance by the end of the Contract period.

G.14 BEARINGS AND ANCHOR ROD

G.14.1 General

The Contractor shall furnish and install bearings (fixed and movable types) and anchor rods with steel pipes for supporting the bridge as shown on the Drawings or as directed by the Supervision.

The materials to be used for bearings shall be the elastomeric bearing pads as stipulated in Paragraph E.23 of Section E, Concrete Works.

The anchor rods to be embedded in the bridge abutment concrete shall be D. 32 mm and those to be inserted into the concrete beams of bridge shall be capped with D. 60 mm steel pipes as shown on the Drawings or as directed by the Supervision. The materials of steel rods and pipes shall conform to the applicable requirements of Paragraph H. 2 of Section H, Miscellaneous Metal Works.

G.14.2 Measurement and Payment

(1) Measurement, for payment, of furnishing and installing bearings, fixed type and movable type, will be made of the number of the bearing in place as shown on the Drawings or directed by the Supervision.

Payment for furnishing and installing fixed type and movable type of bearing will be made at the respective unit prices per number tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labor, materials and equipment required by these Specifications.

(2) Measurement, for payment, for furnishing and installing anchor rods with steel pipes shall be made on the basis of weight in kilograms of steel rods and pipes installed as shown on the Drawings or directed by the Supervision.

Payment for furnishing and installing anchor rods with steel pipes will be made at the unit price per kilogram tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labour, materials and equipment required for complete this work.

G.15 CONTRACTOR'S TEMPORARY CONSTRUCTION ROADS

G.15.1 General

The Contractor shall be responsible for designing, constructing and maintaining various temporary construction roads which he will have to use basically as "haul roads" during the time the Project work is in process. The exact route and location of these temporary construction roads shall be determined based on the Contractor's design and layout drawings as approved by the Supervision.

The temporary construction roads include but not limited to;

(1) Contractor's temporary construction road to borrow areas, if any.

(2) Contractor's temporary construction road to crushing and concrete plants.

(3) Contractor's temporary construction roads in the construction areas and to the Contractor's camp sites.

The Contractor's design of his temporary construction roads shall be based on generally acceptable standards and shall be submitted to the Supervision for approval at least forty-five (45) days prior to starting the work on the roads.

The method of construction for the Contractor's temporary construction roads including but not limited to alignment, excavation, embankment, surfacing (if any), drainage, guard rails, etc. shall be submitted in writing to the Supervision for approval at least twenty-eight (28) days prior to starting the construction of such roads.

The Contractor shall be responsible to maintain all his temporary construction roads throughout the time they are in use, to the satisfaction of the Supervision.

G.15.2 Measurement and Payment

Measurement and payment for the Contractor's temporary construction roads will be made in accordance with the provisions stipulated in Section A, General Items.

CONSTRUCTION OF CIVIL WORKS

PACKAGE 2

LA ESPERANZA~POZA HONDA TRANSBASIN
AND
POZA HONDA~MANCHA GRANDE TRANSBASIN

VOLUME III - GENERAL AND TECHINICAL SPECIFICATIONS

SECTION H

MISCELLANEOUS METAL WORKS

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SECTION H MISCELLANEOUS METAL WORKS

H.1 GENERAL

The works for the following items shall comprise the supply of all labor, materials and equipment, and performance of all work necessary for the supplying and installation of the following works, as shown on the Drawings or as directed by the Supervision and as specified herein:

(1) Furnishing and installing steel pipe handrails;

(2) Furnishing and installing steel ladders with safety cage;

(3) Furnishing and installing steel steps (round bar);

(4) Furnishing and installing checkered steel covers and gratings;

(5) Furnishing and installing embedded steel pipes;

(6) Furnishing and installing wire net fence with gate;

(7) Furnishing and installing embedded and non-embedded metals other than items (1) to (6) and (8);

(8) Furnishing and installing steel trash rack;

(9) Furnishing and installing steel lifting hooks, if any; and

(10) Installation of metal items supplied by other contractor, if any.

All welding shall conform to the requirements of Paragraph H.4. Metalwork shall be erected as specified in Paragraph H.3. All joints in metalwork which are to be galvanized after fabrication shall be seal welded, if not already welded.

Painting shall be performed as prescribed in Paragraph H.5. For painting metalwork, red lead prime painting will not be required except for welded joints, and one coat of approved epoxy resin paint shall be applied. When galvanizing has been damaged, the area affected shall be cleaned and coated with approved zinc-rich paint or zinc metalling.

Metalwork to be embedded in concrete shall be so embedded when the concrete is being placed, as shown on the Drawings, or as directed by the Supervision, recesses or blockouts shall be made in the concrete and the metalwork shall be grouted in place or embedded in concrete. The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of scale, rust, dirt, oil, paint, and any objectionable materials which will reduce the bond between embedded metalwork and grout or concrete immediately before the grout or

concrete is placed. Metalwork shall be accurately positioned and aligned in accordance with the tolerances as directed by the Supervision or as shown on the Drawings and shall be held securely in the correct position during placing and setting of the concrete.

Grout for metalwork shall be mixed in the proportions and to the consistency prescribed by the Supervision. The Contractor shall furnish cement and fine aggregate complying with the requirements of Paragraph D.2 for all grout. The cost of materials for and the mixing and placing of grout shall be included in the unit prices tendered in the Bill of Quantities for furnishing and installing the various items of metalwork for which the grout is required. Before placing grout, the surfaces of existing concrete on which the grout will be placed shall be roughened and shall be cleared of all laitance, loose or defective concrete coating 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 grout.

H.2 MATERIALS

All materials shall be new, and materials of metalwork shall comply with following standards or approved equivalent:

Steel	JIS G 3101-76
Steel bar	JIS G 3112-75
Steel plate	JIS G 3194-66
Shaped steel	JIS G 3192-71
Steel pipe	JIS G 3444-74 and JIS G 3452-76 as appropriate
Steel square pipe	JIS G 3466-75
Steel forging	JIS G 3201-64
Steel bolt, nut and washer	JIS G 3123-75

H.3 ERECTION MANUALS FOR METAL WORKS

The erection manuals shall be submitted to the Supervision for approval, and when they are finally approved, seven (7) copies and three (3) copies shall be prepared and forwarded to the CRM and the Supervision, respectively.

The manuals shall describe in detail the procedure for assembling and erecting of each components and the use of all erection equipment, tools and measuring devices.

H.4 STANDARD AND WORKMANSHIP FOR METAL WORKS

(1) General

All materials shall be new, of a first-class nature, and of such as are usual and suitable for work of like character. All materials shall comply with the latest Japanese Industrial Standard (JIS) or the equivalent unless otherwise specified or permitted by the Supervision.

All workmanship shall be of the highest class throughout to ensure smooth and vibration free operation under all possible operating conditions, and the design, dimensions and materials of all parts shall be such that the stress to which they may be subjected shall not render them liable to distortion, undue wear, or damage under the most severe conditions encountered in service.

All parts shall conform to the dimensions shown on the approved Drawings. All joints, datum surfaces, and matching components shall be machined and all castings shall be spot faced for nuts. All machined finishes shall be shown on the approved Drawings. All screws, bolts, studs and nuts and threads for pipe shall conform to the latest JIS or standards of the International Organization for Standardization covering these components and shall all conform to the standard for metric sizes.

(2) Standard Specifications

Japanese standards issued by the Japanese Industrial Standards Association have been used throughout the Specifications. Other national or international standards may be accepted, provided that the requirements therein are, in the opinion of the Supervision equivalent to the current issue of the Japanese standards.

If the Contract Documents conflict in any way with any or all of the above standards or codes, the Contract Documents shall have precedence and shall govern.

All electrical equipment, material and details of installation shall comply with the requirements and latest revisions of the following codes and standards where applicable:

(A) Japanese Industrial Standards (JIS)
(B) Japanese Electro-Technical Committee's Standard (JEC)
(C) Japanese Engineering Standards (JES)
(D) Japanese Electric Machine Industry Association's Standards (JEM)
(E) Japanese Cable-makers Association Standards (JCS)
(F) International Electrotechnical Commission (IEC)
(G) Local regulatory bodies having jurisdiction over installation
(H) Local codes

(3) Shop Assembly

All items of equipment shall be assembled in the shop prior to shipment, and tests shall be performed by the Contractor as may be required to demonstrate to the satisfaction of the Supervision the adequacy of the equipment and its component parts. All tests shall simulate normal operating conditions as closely as possible. All dismantled parts shall be properly match-marked and dowelled as required to ensure correct assembly in the field.

(4) Castings

All casting shall be dense, sound and true to pattern, of workmanlike finish and of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, cracks or other injurious defects and shall be satisfactorily cleaned for their intended purpose. All castings shall be checked for defects before final machining.

Castings shall not be repaired, plugged, or welded without permission of the Supervision. Such permission will be given only when the defects are small and do not adversely affect the strength, use, or machinability of the casting. Excessive segregation of impurities or alloys at critical points in a casting will result in its rejection. The largest fillets compatible with the design shall be incorporated wherever a change in section occurs.

Surfaces which do not undergo machining and are exposed in the final installation shall be dressed to provide a satisfactory appearance so that they will not require surface smoothing at the Site prior to painting. Casting shall be in accordance with the following standards:

(A) Iron Castings

Iron castings shall be in accordance with JIS G 5501, FC 25 or approved equivalent.

(B) Steel Castlings

Steel castings shall be fully annealed and shall be in accordance with JIS G 5101, SC 42 or approved equivalent.

(C) Bronze Castings

Bronze castings shall be in accordance with JIS H 5111, BC 2 or approved equivalent.

(D) Phosphor Bronze Castings

Phosphor bronze castings shall be in accordance with JIS H 5113, PBC 2 or approved equivalent.

(5) Forgings

Forgings shall be made in accordance with JIS G 3201, SF 50 or approved equivalent. The ingots from which the forgings are made shall be cast in metal moulds, the workmanship shall be first-class in every respect and the forgings shall be free from all defects affecting their strength and durability, including seams, pipes, flaws, cracks, scales, fins, porosity, hard spots, excessive nonmetallic inclusions and segregations.

The largest fillets compatiable with the design shall be incorporated wherever a change in section occurs. All finished surfaces of forgings shall be smooth and free from tool marks.

(6) Steel Plates and Bars

(A) Steel plates for steel conduits shall be in accordance with JIS G 3106, SM 41 or approved equivalent.

(B) Steel plates for general structure shall be in accordance with JIS G 3101 SS 41, or approved equivalent.

(C) Steel bolts, nuts and washers shall be in accordance with JIS G 3123 or approved equivalent.

(D) Corrosion-resisting steel plates and bars shall be in accordance with JIS G 4303, G 4304, G 4305, G 4306, G 4307 or approved equivalent.

(7) Checkered Plate

Checkered plate shall be of an approved raised pattern. All edges of plate and joints shall be planned and cut so as to maintain continuity of pattern.

(8) Machine Work

(A) General

All tolerance, allowances and gauges for metal fits between plain cylindrical parts shall conform to Japanese Industrial Standards or other approved equivalent standard for the class of fit as shown or otherwise required. Sufficient machining stock shall be allowed on locating pads to ensure true surfaces of solid material. Bearing surfaces shall be true and exact to secure full contact. Journal and sliding surfaces shall be polished, and all surfaces shall be finished with sufficient smoothness and accuracy to ensure proper operation when assembled. Parts entering any machine shall be carefully and accurately machined. All drilled holes for bolts shall be accurately located and drilled from templates.

(B) Finished Surfaces

Finished surfaces shall be indicated on the Contractor's drawings and shall be in accordance with Japanese Industrial Standards or equivalent. Compliance with specified surface will be determined by sense or feel and by visual inspection of the work compared to the standard roughness specimens, in accordance with the provision of the above stated standards.

(C) Unfinished Surfaces

So far as is practicable, all work shall be arranged to obtain proper matching of adjoining unfinished surface. When there is a large discrepancy between adjoining unfinished surfaces, they shall be chipped and ground smooth, or machined, to secure proper alignment. Unfinished surfaces shall be true to the lines and dimensions shown on the Drawings and shall be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts may be filled in an approved manner.

(D) Keys and Keyways

Keys and keyways shall conform to the requirements of Japanese Industrial Standards or other approved equivalent standard, unless otherwise specified or required.

(E) Pins and Pin Holes

Pin holes shall be bored to gauge, smooth and straight, and at right angles to the axis of the member. The boring shall be done after the member is securely fastened in position. Pins shall be of hardened and ground steel and positively held in position. Wheels or rollers for gates shall be mounted on removable pins and have self-lubricating bushings and brass washers.

(F) Lubrication

Before assembly, all bearing surfaces, journals and oil grooves shall be carefully cleaned and lubricated with an approved oil or grease. Before operation, each lubricating system shall be checked. Self-lubricating metal bearings shall be cleaned with clean rags, and greased with an approved lubricant before assembly. Solvents shall not be used on self-lubricating metal bearings. The specification of all approved lubricants must be mentioned in the operating and maintenance instruction.

(G) Balancing

All revolving parts shall be truly balanced both statically and dynamically so that when running at normal speeds and at any load up to the maximum, there shall be no vibration due to lack of such balance and the mechanical equipment shall operate with the least possible amount of noise.

(9) Miscellaneous Materials

(A) Self-lubricating metal bearings shall be in accordance with ASTM B 22, Alloy E, with L-Lubricant.

(B) Stranded wire ropes shall be in accordance with JIS G 3525, galvanized or approved equivalent.

(C) Wire rope fittings shall be manufacturer's standard fittings for the type of wire rope used.

(D) Conduit shall be in accordance with JIS C 8305 or approved equivalent.

(E) Sealing rubbers shall be moulded from a high-grade, tread type compound. The basic polymer shall be natural rubber, a co-polymer of butadiene and styrene, or a blend of both. The compound shall contain not less than 70 per cent by volume of the basic polymer, and the remainder shall consist of reinforcing carbon black, zinc-oxide accelerators, antioxidants, vulcanizing agent and/or plasticizers. The compound shall have the following physical properties:

Property	Limits
Tensile strength	210 kgf/cm^2 minimum
Ultimate Elongation	450 per cent minimum
Duramater Hardness (Shore, Type A)	50 to 70
Specific Gravity	1.1 to 1.3
Water Absorption (70°C for 48 hours)	5 per cent maximum by weight
Compression Set (as a per cent of total original deflection)	30 per cent maximum
Tensile Strength (after oxygen bomb aging for 48 hours at 70°C)	80 per cent minimum of tensile strength before aging

(10) Welding

All welding shall be done either manually by the shielded metallic arc welding or automatically by the submerged arc welding.

The Contractor shall develop a welding procedure for the approval of the Supervision. After the welding procedure has been approve, the Contractor shall record it on a special Drawing which shall thereupon become one of the Drawings of the Contract. Welding symbols shall be shown on all Contractor's drawings where welding is required.

Radiographic inspection shall be carried out by the Contractor when required by the standards, these Specifications or the design criteria employed. All important welds which, in the opinion of the Supervision, may be subject to the full stress induced in the adjacent plate, or which in the opinion of the Supervision, do not appear to conform to the welding standards, shall be radiographer when required by the Supervision.

Suitable meters shall be provided to show the welding current and the arc voltage at all time during the welding operations.

Unless otherwise specifically stated, welded parts requiring machine finish shall be completely welded before being finished.

All welds shall be made continuous and watertight. The minimum throat dimension of fillet welds shall be 4.5 millimeters.

All defects in welds shall be chipped out to sound metal and such areas shall be magnafluxed or ultrasonically tested to ensure that the defect has been completely removed before repair welding.

Plates to be joined by welding shall be accurately cut to meet size. The dimensions and shape of the edges to be joined shall be such as to allow thorough fusion and complete penetration and the edges of plates shall be properly formed to accommodate the various welding conditions. The surfaces of the plates for a distance of 25 millimeters from the edge to be welded shall be thoroughly cleaned of all rust, grease and scale, to bright metal.

(11) Qualification of Welding Procedure

The technique of welding employed, the appearance and quality of the welds made and the methods used in correcting defective work, shall conform to the American Welding Society (AWS) Standard D 1.1, or other approved equivalent standard.

(12) Qualification of Welders and Welding Operators

All welders and welding operators assigned to the work shall be able to perform flat and vertical welding positions in a qualification test, within the preceding six months, for welders and welding operators in accordance with JIS Z 3801 or other approved equivalent standard. The Contractor shall furnish the Supervision with certified copies of report of the results of physical tests of specimens welded in the qualifications tests. If, in the opinion of the Supervision, the work of any welder at any time appears questionable, he shall be required to pass the appropriate requalification test. All costs of qualification tests shall be borne by the Contractor.

(13) Welding Electrodes

The welding electrodes shall conform to JIS Z 3211 or 3212, low hydrogen type or approved equivalent standards.

Stainless type weld metal, where used in the water passes for protection against pitting, shall be of chromium nickel steel. The type, chemical composition and JIS number of welding rods used for this purpose shall be subject to the approval of the Supervision.

(14) Material Inspection and Testing

Materials, parts and assemblies thereof entering into the Work shall be tested, unless otherwise directed, according to the best commercial method for the particular type and class of work. When the manufacturer desires to use stock material not manufactured specifically for the equipment furnished, satisfactory evidence that such material conforms to the requirements herein stated, shall be furnished, in which case tests on these materials may be waived. Certified mill test reports of plates and sections will be acceptable. In addition to the mechanical tests required by the Specifications, all materials shall be examined in the shop for laminations and imperfections before incorporating them into the work and any defective material shall be rejected.

Witness tests and inspection of materials may be made at the place of manufacture by the Supervision, unless otherwise specified. Such witnessing and inspecting will be conducted so as to interfere as tittle as possible with manufacturing operation. The Contractor shall however comply with any reasonably request made by the inspector concerning the method of test or correction of defective workmanship.

All casting weighting 226.8 kilograms (500 pounds) or more shall have test coupons attached from which test specimens may be prepared.

The number, size and location of the test coupons shall be subject to the approval of the Supervision. Faulty material or materials found to be inferior to that specified shall be rejected and removed at once, and shall not be used in any part of the work.

Test pieces of other structural materials shall be provided as required by the Supervision.

The ultimate strength, limit of elasticity, ductility, hardness, etc. will be determined from such test pieces.

The Contractor shall furnish, free of charge, all such test pieces, blankets, etc., cut and machined to the sizes, shapes and dimensions as directed by the Supervision. The testing of the specimens will be carried out by the Contractor at his own expense, and shall be performed as directed by the Supervision.

Test pieces which represent rejected materials shall be preserved and become the property of the CRM. Copies of all test reports shall be submitted to the Supervision.

The Contractor shall supply to the Supervision, as requested, certified test reports giving the chemical analysis and physical properties of materials used.

Waiving of inspection by the Supervision shall not relieve the Contractor of the responsibility for supplying material and workmanship acceptable to the Supervision.

H.5 PROTECTION, CLEANING AND PAINTING FOR METAL WORKS

(1) General

All parts which will ultimately be embedded in concrete shall be cleaned and protected by a cement wash or other approved method before forwarding from the manufacturer's shop. Before being installed, they shall be thoroughly descaled and cleaned of all rust and adherent matter. Such cleaning shall not detrimentally affect the strength or final operation and function of the equipment.

All machined parts or bearing surface shall be cleaned and protected from corrosion by the application of an approved rust preventive lacquer, or an adhesive plastic film before forwarding from the manufacturer's shop. Where the latter is impracticable such parts shall be heavily covered with high melting point grease. After erection, such parts shall be cleaned with solvent and wiped or polished.

The final colour of all equipment shall be approved by the Supervision under the confirmation of the CRM, therefore the Contractor shall propose a colour scheme for the equipment and shall submit colour chips or paint samples. A colour chip shall be included with the approved colour schedule, for each type of finish to be applied at the site.

All equipment shall be painted as specified herein. The painting of equipment shall include the preparation of the metal surfaces, paint application, protection and drying of the paint coatings, as well as the supplying of all tools, labour and material necessary for the entire painting work.

Sufficient paint shall be provided for field painting and touch-up of shop painting by the Contractor.

Paint shall be the product of reputable manufacturer and its selection shall be approved by the Supervision.

(2) Surface Preparation

All oil, paraffin, grease and dirt shall be removed from the surfaces to be painted using solvents. All weld spatters, slags, burrs, loose rusted mill, scale and other foreign substances shall be removed by shot or sandblasting to "white" metal. The interior surface of the steel pipe shall be mechanically cleaned or sandblasted to a commercial standard. Special attention shall be given to cleaning of corners and converging angles. If rust forms or the surfaces become contaminated in the interval between cleaning and painting, recleaning to the same degree shall be required. Surfaces not to be painted shall be protected by appropriate and adequate masking during the cleaning and painting of adjacent metalwork. Effective means shall be provided for removing all free oil and moisture from

the air supply lines of blasting equipment. All surface preparation shall be subject to approval of the Supervision before any paint is applied.

(3) Application Procedure

All paint, when applied, shall provide a satisfactory film and a smooth and even surface. Paint shall be thoroughly stirred, strained, and kept at the uniform consistency during application. Paint shall not be applied when the temperature of the metal or of the surrounding air is below 10∞C. Surfaces which will be coated shall be free from moisture at the time of painting. Painting shall be performed by brushing or spraying. The first coat shall be applied immediately after surface preparation. Each coat shall be allowed to dry or harden thoroughly before the succeeding coat is applied.

(4) Surfaces not to be Painted

Bronze, brass, surfaces of gear teeth, finished ferrous surfaces, surfaces in rolling or sliding contact after field assembly and wire ropes shall not be painted.

All corrosion-resisting steel surfaces for bearings and machinery parts shall not be painted.

On completion of cleaning, such surfaces shall be coated with an adhesive plastic film to protect the surfaces from minor mechanical damage and corrosion during shipment and storage at the site. The film shall be stripped of immediately prior to field erection of the equipment.

(5) Paint Schedule

The painting shall be performed as follows:

(i) Tar-epoxy paint, total thickness of 0.45 - 0.60 millimeters, shall be applied to the following items.

(A) Exposed surface of all frames and pipes,
(B) Interior surface of steel conduits, and
(C) Items directed by the Supervision.

(ii) Epoxy resin paint, total thickness of 0.15 - 0.25 millimeters, shall be applied to the followings items.

(A) External surface of steel conduits,
(B) Stoplog, and
(C) Items directed by the Supervision.

(iii) All furnished surfaces of ferrous metal except those specified in the above be given phthalic acid resin paint or alkyed resin enamel or other approved paints.

Total thickness of these paints including primer coat shall be 0.12 - 0.15 millimeters.

Comercial equipment shall be painted in accordance with the manufacturer's standard practice.

All finished surfaces of ferrous metals including screw threads that will be exposed during transportation or while awaiting installation shall be cleaned and given a heavy uniform coating of gasoline soluble, rust-preventive compound.

II.6 PACKING FOR METAL WORKS

Each item shall be packed properly or protected for transportation from the place of manufacture to the Site.

Each crate or package shall contain a packing list in a waterproof envelope and copies in triplicate shall be forwarded to the Supervision prior to dispatch. All items of package shall be clearly marked for easy identification against the packing list.

All cases, packages, etc. shall be clearly marked on the outside to indicate the total weight, to show where the weight is bearing and the correct position of the slings and shall bear an identification mark relating them to the appropriate shipping documents.

The Supervision shall reserve the right to inspect and approve the equipment and the packing before the items are dispatched. The Contractor shall be entirely responsible for ensuring that the packing is suitable for transit and such inspection will not relieve the Contractor of responsibility for any loss or damage due to faulty packing.

All packing materials shall remain the property of the Contractor and shall be removed from the Site at the earliest opportunity and disposed to the satisfaction of the Supervision.

II.7 STEEL PIPE HANDRAIL

II.7.1 General

Steel pipe handrails, movable and fixed types, shall be installed as shown on the Drawings. The Contractor shall furnish all pipes, fittings, bolts, flanges and other accessories required for the steel pipe handrails.

Handrails to be set in concrete shall be completely assembled and installed when concrete is placed, or recesses shall be left or holes shall be drilled in the concrete for anchorage, and the handrails shall be assembled and grouted in position at some later time.

H.7.2 Measurement and Payment

Measurement for payment of steel pipe handrails shall be made on the basis of installed weight of the handrails in kilograms determined by the approved Drawings or directed by the Supervision.

Payment will be made for the number of kilograms measured as provided above at the unit price per kilogram tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, tools, equipment and materials including furnishing, fabricating, transporting, installing and painting the handrail, preparing and submitting manufacturing drawings and other items necessary to complete the work.

H.8 STEEL LADDERS WITH SAFETY CAGE

H.8.1 General

Steel ladders with safety cage shall be installed as shown on the Drawings or as directed by the Supervision.

Steel ladders and safety cage 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 recesses shall be left in the concrete and the anchors and anchor bolts shall be thoroughly grouted or concrete in place.

H.8.2 Measurement and Payment

Measurement and payment for furnishing and installing the steel ladders with safety cage will be made, as same manner as stipulated in Sub-paragraph H.7.2, at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labour, equipment, materials and painting required.

H.9 STEEL STEPS (ROUND BAR)

H.9.1 General

The Contractor shall furnish and install steel steps as shown on the Drawings or as directed by the Supervision. The steel steps shall be installed at the positions designated when concrete is placed.

H.9.2 Measurement and Payment

Measurement and payment for furnishing and installing steel steps will be made at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labour, equipment and materials required.

H.10 CHECKERED STEEL COVERS AND GRATING

H.10.1 General

Hatches including checkered steel covers, grating, frames and embedded frames, and anchorages shall be procured and installed by the Contractor as shown on the Drawings or as directed by the Supervision. 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 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 the maximum length of 60 cm. Steel gratings with frames of an approved type shall be provided as shown on the Drawings or as directed by the Supervision.

H.10.2 Measurement and Payment

Measurement and payment, for furnishing and installing checkered steel plate or grating will be made, as same manner as stipulated in Sub-paragraph H.7.2, at the respective unit prices per kilogram tendered therefor in the Bill of Quantities, where unit prices shall include the cost of all work and materials required.

H.11 EMBEDDED STEEL PIPES

H.11.1 General

The Contractor shall furnish and install miscellaneous embedded steel pipes for air vent, drainage of water, cable conduits or water level gauge wells and inlet pipes with screens as shown on the Drawings or as directed by the Supervision.

H.11.2 Measurement and Payment

Measurement, for payment, of embedded steel pipes will be made on the basis of installed weight of embedded steel pipes in kilograms actually installed in accordance with the approved drawings or as directed by the Supervision.

Payment will be made at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit prices shall include the cost of all labor, tools, equipment and materials including furnishing, fabricating, transporting and installing the embedded steel pipes, and the relevant work to comple the work.

H.12 WIRE NET FENCE WITH GATES

H.12.1 General

Wire net fence shall consist of steel wire fabric, steel framing, concrete foundation and gates as shown on the Drawings or as directed by the Supervision. The steel wire fabric shall be of 50 mm mesh woven with 3.2 mm dia. galvanized steel wire . The fence posts shall be L-100 x 100 x 7 steel section galvanized, set 40 cm in concrete foundations, and at a maximum spacing of 2.0 m.

At the top of the fence, three stands of galvanized braved wire B.W.G. No. 14 which is inclined and upward sloping shall be provided. Sub-posts, tension wires, barbed wire and accessories shall be as approved. All miscellaneous ferrous metalwork shall be galvanized. Guard gates shall be of steel, complete with all necessary fittings for hanging and fastening. The Contractor shall submit shop drawings of gates and posts to the Supervision for approval before starting fabrication. Gates and fittings shall be galvanized after manufacture or given two coats of zinc-rich paint.

The concrete entrance walls shall be constructed to the dimensions shown on the Drawings. The respective work for concrete walls and finishing works shall be performed in accordance with the Specifications for such work.

H.12.2 Measurement and Payment

Measurement, for payment, of wire net fence with gates shall be made on the basis of weight in kilograms actually installed in accordance with the Drawings and Specifications and/or as directed by the Supervision.

Payment for wire net fence with gates will be made at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit prices shall include the costs of all labour, equipment and materials including wires, steel frames, posts, gates, and painting if required, and other relevant work necessary to complete the wire net fence with gates.

Payment for trench excavation, backilling and concrete works for posts will be made separately under the appropriate work items in the Bill of Quantities.

H.13 EMBEDDED AND NON-EMBEDDED METALS

H.13.1 General

The Contractor shall furnish and install miscellaneous embedded and non-embedded metal work as shown on the Drawings or as directed by the Supervision.

H.13.2 Measurement and Payment

Measurement for payment of embedded metal work and non-embedded metal work shall be made on the basis of installed weight of embedded metal or non-embedded metal in kilograms determined by the approved Drawings or directed by the Supervision.

Payment will be made for the number of kilograms measured as provided above at the respective unit prices per kilogram tendered therefor in the Bill of Quantities, which unit price for embedded metal work or non-embedded metal work shall constitute full compensation for the cost of all labor, tools, equipment and materials including furnishing, fabricating, transporting, and installing the embedded metal work or non-embedded metal work, preparing and submitting manufacturing drawings and other necessary documents, and other items necessary to complete the work.

Unless otherwise specified or directed by the Supervision, the cost of painting for embedded metal work and non-embedded metal work shall be included in the respective unit prices as specified above.

H.14 STEEL TRASH RACK

H.14.1 General

Steel trash racks shall be installed as shown on the Drawings or as directed by the Supervision. The Contractor shall furnish all steel plates, angles, pipes bolts and nuts, fittings and other accessories required for the steel trash racks.

Trash racks to be set in concrete shall be completely assembled and installed when concrete is placed, or recesses shall be left in the concrete for anchorage, and the trash racks shall be assembled and grouted in position at some later time.

H.14.2 Measurement and Payment

Measurement for payment of steel trash racks shall be made on the basis of installed weight of the trash racks in kilograms determined by the approved Drawings or directed by the Supervision.

Payment will be made for the number of kilograms measured as provided above at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit price shall constitute full compensation for the cost of all labor, tools, equipment and materials including furnishing, fabricating, transporting, installing and painting the trash rack, preparing and submitting manufacturing drawings and other items necessary to complete the work.

H.15 STEEL LIFTING HOOK, IF ANY

H.15.1 General

The Contractor shall furnish and embed the steel lifting hooks on the ceiling of the pumping station and inlet valve house if required or as directed by the Supervision. The lifting hooks shall be round steel bar or steel plate which shall conform to the applicable JIS standards or equivalent.

H.15.2 Measurement and Payment

Measurement, for payment, of furnishing and installing the lifting hooks will be made on the basis of installed weight in kilograms actually used for the work. Payment for the lifting hooks will be made at the unit price per kilogram tendered therefor in the Bill of Quantities, which unit price shall include the cost of all labour, equipment and materials required to complete the work.

H.16 INSTALLATION OF METAL ITEMS SUPPLIED BY OTHER CONTRACTOR, IF ANY

H.16.1 General

The Contractor shall embed all metal items such as anchor plates, hooks, bolts, etc. supplied by the other contractor and so specified on the Drawings to be installed by the Contractor at the locations, lines and grades shown on the Drawings.

H.16.2 Measurement and Payment

Measurement, for payment, of embedding metal items supplied by the other contractor will be made on the basis of installed weight of embedded metal items in kilograms actually embedded, and payment for these items will be made at the unit prices per kilogram tendered therefor in the Bill of Quantities, which unit price shall include all the costs to complete the work.

CONSTRUCTION OF CIVIL WORKS

PACKAGE 2

LA ESPERANZA-POZA HONDA TRANSBASIN
AND
POZA HONDA-MANCHA GRANDE TRANSBASIN

VOLUME III - GENERAL AND TECHNICAL SPECIFICATIONS

SECTION I

BUILDING WORKS

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SECTION I BUILDING WORKS

I.1 GENERAL

I.1.1 SCOPE OF WORKS

The works in this Section shall comprise the complete construction of buildings and related architectural works as listed below including architectural finishing for the entire pump house, domestic water supply, drainage, ventilation and air conditioning facilities for the buildings.

Buildings	Floor Area	Q'ty
Pump House		
Ground floor (EL.70.20)	755 m^2	1
Second floor (EL.)	48 m^2	1
First basement (EL.65.00)	431 m^2	1
Second basement (EL.60.00)	431 m^2	1
Third basement (EL.55.00)	530 m^2	1
Fourth basement (EL.50.00)	906 m2	1
Fifth basement (EL.46.00)	618 m2	1
Diesel Engine Generator House	27 m^2	1

Electrical facilities shall be provided under Section J Electrical Works in these Specifications.

Building construction shall include structural works such as earth works and concrete works with all architectural finishing works.

Domestic water shall be obtained from the cooling water supply system for motor units which will be constructed by other contractor.

Storm water from the building roof and surface runoff shall be conducted to nearby open ditches or streams. Waste water may be conducted to the storm water drainage system; however, grease and solid living wastes from kitchen shall be intercepted before being discharged into the drainage system. Sanitary sewage shall be disposed of in a septic tank and discharged into a subsoil drainage system.

The work shall be complete in every respect including supply of all labor, materials, tools and equipment and testing. The work shall be constructed and completed in accordance with the Drawings and Specifications and as directed by the Supervision.

I.1.2 Relevant Provisions

All relevant provisions in other Section of these Specifications shall be applied here where applicable, provided that they do not conflict those specified hereafter.

I.2 WALL, ROOFING, CEILING AND FLOOR WORKS

I.2.1 Concrete Works

Except as otherwise provided herein or directed by the Supervision, the concrete, reinforcing steel bars and formworks shall be performed in accordance with the provisions of concrete works as stipulated in Section E of these Specifications.

The class of concrete to be used for the building and other structures shall be of class C, and levelling concrete shall be of class H. All concrete shall be made with ordinary Portland cement specified hereto.

I.2.2 Masonry Works

(1) Concrete Hollow Block Masonry

(a) Materials

(i) Concrete Hollow Block Units

Concrete blocks shall consist of three (3) core units with nominal face 190 mm x 390 mm x either 100 mm or 150 mm thick conforming to the requirements of JIS A 5406 TYPE B, ASTM C 67 and C 126 or approved equivalent.

All units shall have the minimum compressive strength of not less than sixty (60) kgf/cm2. The Contractor shall furnish such stretcher, corner, jamb and bond beams required to complete the work as indicated. All units shall be true to size, without cracks, chips, splits, or other defects which may impair their strength and/or durability.

(ii) Mortar

Mortar to be used for laying hollow block units shall be proportional by volume of one (1) part Portland cement and three (3) parts of well graded, clean coarse sand, and with addition of hydrated lime not to exceed one- tenth (1/10) the combined volume of cement and sand for cavity walls. Add 0.912 liters of water-proofing admixture per sack of cement for mortar in cavity walls. The water for mortar shall be clean and free from injurious amount of acid, alkali or organic matters. Only sufficient water to make a workable mixture will be permitted.

(iii) Grout

Grout for filling cells in masonry units shall be one (1) part of Portland cement, three (3) parts sand, two (2) parts pea gravel, and one- tenth (1/10) lime putty. Add admixture as specified in item (ii) above for grout in cavity walls only.

(iv) Reinforcing Bars

Blocks shall be reinforced with mild steel deformed bars. Vertical reinforcement shall be D 10 bars at two (2) units interval for 150 mm and 100 mm thick blocks to form as vertical reinforced studs. Horizontal reinforcement shall be D10 bars at three(3) units interval (every third course)

The vertical bars shall have no joints as a rule and the ends shall be anchored into concrete beams to a length of at least forty (40) times the bar diameters. The horizontal bar joints shall have an overlap of at least forty (40) times the bar diameters. Intersection of the bars shall be securely tied with wires. The reinforcing bars for the perimeters of the opening shall be of D 12.

(b) Samples and Testing

Samples of concrete hollow block shall be submitted for the approval of the Supervision before the beginning of the work. If required by the Supervision, masonry units shall be tested.

Five (5) samples from every 500 units shall be taken at random for testing. The testing shall be performed by a laboratory approved by the Supervision and the cost thereof shall be charged to the account of the Contractor. Concrete hollow blocks, represented by such samples failing to meet the requirements under ASTM C 67 and C 126 or approved equivalent shall be rejected.

(c) Laying

Concrete surface to receive the concrete hollow block shall be cleaned and thoroughly wetted prior to laying the masonry units. All masonry units shall be cleaned and all dust or dirt removed from the surface before laying and shall be laid dry. Fractional parts of units will not be permitted as long as complete units can be used. All masonry shall be laid true to plumb and to a plane surface.

Every cell where reinforcing bars are inserted and block are joint, shall be compactly filled with the specified grout.

Joints shall be 10 mm thick, with full mortar coverage on the face shells and on the webs surrounding the cells. Joint shall be as uniform as possible.

Perpends shall be flush jointed, straight, clean and uniform in thickness and shall be executed by pressing the mortar firmly and tightly into place with a bent 6 mm rod. This operation shall be done after the initial set has taken place.

Laying of block shall not exceed 1.6 meters in height per day.

Partition walls shall be carried up to the underside of the slab or beams except where otherwise noted in the Drawings. Pipes and conduits to be inserted on the concrete hollow block walls shall be embedded in such a manner as not to cause any damage to the block. In no case, shall the blocks be chipped for embedding the pipes.

(d) Lintels

Opening in masonry walls over 600 mm wide shall be provided with concrete lintels, reinforced with at least two D 12 bars, being extended at least 200 mm into the adjoining walls.

All cells of the blocks directly below the extended lintels shall be filled with specified grout.

(e) Cleaning

The block work shall be cleaned down on completion by removing all surplus mortar to the satisfaction of the Supervision.

I.2.3 PLASTERING WORKS

(1) Cement Mortar

The sand to be used in the cement mortar shall be clean, hard, solid and durable and shall not contain harmful amounts of dust, mud, organic matters or other objectionable matter. The sand shall be well graded within the following limits:

For first and second coat	Max. granule size: 5 mm
For finish coat	Max. granule size: 2.5 mm
For tile bed	Max. granule size: 5 mm

The mix proportion of the cement mortar by volume shall be as follows:

For first and second coat	Cement : Sand = 1 : 3
For finish coat	Cement : Sand = 1 : 3
For tile bed	Cement : Sand = 1 : 4 or 1 : 3

Lime powder may be mixed in the mortar for finishing coat at 10% of sand by volume, excessive use shall not be allowed. Lime shall be sufficiently hydrated before use.

(2) Waterproof Cement Mortar

Waterproof cement mortar shall be made by mixing a waterproof agent into ordinary cement mortar. The Contractor shall be responsible for selection and quality of the waterproof agent and obtain approval of the Supervision. The mixing and application shall be in accordance with the manufacturer's instructions.

(3) Expanding Grout

An expanding grout shall be used around any pipe or embedded metals passing through a concrete wall where water may stand on one or both sides of the wall and where the pipe or embedded metals are not embedded in the initially constructed structure. The grout shall expand upon setting to effect bonding of the grout to the main concrete and the pipe or embedded metals. An approved expanding agent shall be mixed in cement mortar conforming to the manufacturer's instructions.

(4) Metal Wire Lath

Metal wire lath shall be of galvanized expanded metal with diamond mesh having a metal sheet thickness of not less than 0.3 mm.

(5) Application

The surfaces which are to receive scratch coat shall be free from all laitance, scum, loose carbonate scale, loose aggregate, dirt and other foreign matters. In case of cement mortar or concrete block surface, they shall be sufficiently and uniformly dampened immediately before the application of mortar. Concrete surfaces shall be kept wet for 24 hours prior to the application of mortar.

Where shown on the Drawings or directed by the Supervision, metal wire lath shall be fixed to the brick, concrete block or concrete walls before applying cement mortar plaster. The metal wire lath shall be fixed to the structure with staples.

Cement mortar shall be used within 90 minutes from the time of mixing. Retempering shall not be permitted.

The rendering for tile works shall be made in 2 coats to 18 mm thick and its surface shall be cross scratched. In case of cement mortar finish, mortar shall be applied in 3 coats making the total thickness of 30 mm for floors and 20 mm for other areas. Concrete floors may be plastered in one coat if the surface are smooth and level upon approval of the Supervision. Reduction of number of coats and total thickness in other areas if proposed by the Contractor shall be subject to approval of the Supervision. Cement mortar finish shall be metal trowel finished unless otherwise specified. When the finish coat is applied, the entire surface or a bay of floor, wall or ceiling shall be finished in one operation in order to minimize joint marks.

Where expansion and control joints exist in the base structure, provision shall be made to prevent cracking of the cement mortar by inserting metal expansion beads within the coating thickness in a manner approved by the Supervision.

The finished surface shall be perfectly plumb or level as the case may be except otherwise specified without any bulging, runs, bruises or stains.

Scratch coat shall be applied as soon as possible after construction of the base structure to allow at least 1 week drying time until the finish coat.

After application of each coat, the surfaces shall be kept continuously damp for not less than 48 hours, and then allowed to become thoroughly dry. Moistening shall be started as soon as the surface has hardened sufficiently not to cause displacement or damage.

(6) Colored Cement Mortar Spray

The sand to be used shall have the same quality and grading as specified in this Sub-paragraph. The mix proportion of the colored cement mortar shall be 1:2:6:9 in ratios by volume of white cement, ordinary Portland cement, slaked lime and sand. Water proofing admixture and pigment of an approved brand shall be added to the above mix proportions to be approved by the Supervision. Colored cement mortar spray shall be applied in two coats. The first coat shall be applied thinly and the second coat in sufficient thickness to produce a uniform appearance in color and texture. The second coat shall be applied 24 hours after the first coat.

I.2.4 Bituminous Waterproofing Works

(1) General

Waterproofing for roof, and toilet and shower room floor shall be of 3-ply and 2-ply built-up asphalt waterproofing respectively consisting of the following from the bottom in order to the top:

<u>3-Ply built-up roofing</u>
- Asphalt primer
- Asphalt compound
- Asphalt felt (1st layer)
- Asphalt compound
- Special asphalt felt (2nd layer)
- Asphalt compound
- Asphalt felt (3rd layer)
- Asphalt compound

<u>2-Ply built-up roofing</u>
- Asphalt primer
- Asphalt compound
- Asphalt felt (1 st layer)
- Asphalt compound
- Asphalt felt (2nd layer)
- Asphalt compound

(2) Material

Asphalt primer shall be of factory mixed primer composed of blown asphalt, solvent naphtha and benzine in an approximate weight ratio of 4.5:3.0:2.5.

Asphalt compound shall be of blown asphalt having the following characteristics:

Penetration index	:	15 - 25
Melting point	:	100°C or over
Malleability (Daw Smith 25°C)	:	2 or over

Asphalt felt shall be a bituminous sheeting with a coating of high penetration index asphalt with fabric reinforcement.

The Contractor shall submit specification sheets and sample of the roofing materials to the Supervision for approval.

(3) Application

Substrate for the roofing shall be made by applying cement mortar plastering on concrete surface. All external and internal angles shall be made round in a radius of not less than 50 mm.

Asphalt primer shall be applied only on the base cement mortar completely dried at not less than 0.3 kg/m^2. Then the first layer of asphalt felt shall be fixed using asphalt compound applied hot at not less than 1.0 kg/m^2. The second and third layers shall be fixed following the first layer with asphalt compound at not less than 1.0 kg/m^2. Top asphalt coat shall be applied not less than 2.0 kg/m^2 over the entire face of roofing.

All laps shall run parallel to the slope of the roof and joints staggered with 50 mm side laps and 75 mm end laps. Care shall be exercised not to leave air bubble inside the layers of roofing.

Roofing work shall be performed by skilled workmen in this trade. The work shall not be performed on a damp or rainy day or at any time considered unsuitable by the Supervision.

(4) Protection Concrete on Built-up Roofing

Materials such as cement, aggregate and sand, mixing, casting and curing of concrete shall comply with applicable provisions in Section E Concrete Works hereto.

The concrete shall cover the entire faces of the roofing in a thickness of 10 cm.

The concrete shall be provided with expansion joints to the full depth in a grid pattern of not larger than 3 m. Top of the joint shall be filled up with asphalt compound to a thickness of 25 mm on top of bituminous or foamed plastic board.

(5) Alternative Waterproofing

The Contractor may use an alternative waterproofing upon approval of the Supervision submitting him required data and information. Total unit weight of the alternative roofing system shall not be heavier than the one specified.

(6) Guarantee

The Contractor shall guarantee that if any leakage should develop in the areas treated by him within two (2) years from the date of completion of construction due to defective materials or workmanship, the Contractor shall promptly make repairs thereto including the protection concrete at his own expense.

I.2.5 Carpentry and Joinery Works

(1) Materials

Timber shall be of suitable kinds for the purposes and the best grade of each kind which are available locally. Selection of timber shall be subject to the approval of the Supervision.

All timber shall be well-seasoned and shall be free from large knots, flaws, shakes or blemishes of any kind. Timber with loose, rotten or dead knots will not be accepted. Sawn timber shall have the shape and size shown on the Drawings; twisted or warped materials shall not be used.

Timber that splits, shrinks or warps after construction from want of seasoning, unsoundness or bad workmanship shall be removed and replaced at the Contractor's expense.

The whole of the timber stored on the Site must be protected from the weather and properly stickered and stacked to afford free circulation of air around all faces.

(2) Workmanship

All work, whether factory made or job made, shall be executed by qualified workmen, well skilled in the trade, and shall be strongly, neatly and accurately fitted, framed and finished throughout, in keeping with the best trade practice.

All work shall be accurately spiked, nailed, anchored, strapped or bolted, using hardware of ample gauge and length. All finishing lumber shall be secured with approved quality finishing nails, well and truly sets.

Running members shall be in the longest lengths attainable, aligned and carefully matched for grain and colour.

Mechanical and electrical work shall be checked so that important framing timbers shall not be cut. The wood members shall be properly framed together so that pipe shall run between them.

Wood members not to be painted and having direct contact with concrete or cement mortar shall receive a coat of approved wood preservative.

(3) Wooden Door Frames

All wooden door frames shall be made of hard wood and mortise jointed. The door frames shall be moulded as shown on the Drawings or as directed by the Supervision, and sanded and putty applied to a smooth surface to receiving oil paint.

(4) Wooden Ceiling Trim and Casing

Where shown on the Drawings, wooden ceiling trim and casing shall be of well seasoned wood having dimensions covered shape as shown in details on the Drawings. The joints shall be carved to a smooth and true to line. At the corner of walls for ceiling trim, the joint shall be mitered.

(5) Blind Boxes

Blind boxes shall be fabricated and installed as shown on the Drawings using 25 mm thick wooden board with adequate ribs. They shall be carefully fixed to the walls above windows by means of battens fixed on the walls and ceiling joints. The surfaces of the blind boxes shall be oil painted.

(6) Wooden Handrails

Wooden handrails shall be moulded and polished as shown on the Drawings and fixed to the metal base using screws at 30 cm intervals. The surfaces of handrails shall be coated with clear lacquer.

(7) Cupboards

Cupboards shall be fabricated and installed as shown on the Drawings. The cupboards shall be firmly fixed to the wall and ceiling and oil paint finished. Samples of all hardwares shall be submitted for the Supervision's approval.

I.2.6 Terrazzo Works

(1) Materials

The marble stone chips to be used for terrazzo works shall be of hard and durable marble stones and of colors approved by the Supervision. The grading of the stone chips shall be as follows:

Percentage (by weight) passing through 20 mm mesh screen	100%
Percentage (by weight) passing through 5 mm mesh screen	0%

Colour pigments shall be added to produce the required colour pattern. Samples shall be submitted for approval of the Supervision.

The marble chips shall be mixed with white cement paste in a ratio of 1:3 one part of white cement paste and 3 parts of marble chips in volume.

The terrazzo blocks shall be reinforced by No. 10 gauge steel wire with 200 mm interval in both directions.

After sufficient hardening of the terrazzo coat, the surface shall be grounded with emery powder ranging from coarse to fine and polished with wax to a luminous and satisfactory finish.

(2) Terrazzo Tiles and Blocks

Terrazzo tiles and blocks shall be precast to the dimensions as selected by the Supervision.

The precast terrazzo tiles shall be laid over a base cement mortar and laid level and plumb as the case may be with butt joints. Joints shall be made as inconspicuous as possible. White cement paste colored with pigments to the color of the terrazzo shall be filled into the joints.

I.2.7 Tile Works

(1) Materials

All tiles to be used in the works shall be of first class quality. The colors and shapes shall be reasonably uniform. The exposed face of the tile shall be a smooth, even surface uniform in texture, free from warps, laminations, affecting their quality, appearance and strength.

Typical samples of the kind and grades of tiles specified and proposed to be used shall be submitted to the Supervision for approval.

(2) Ceramic Mosaic Tile

Ceramic mosaic floor tiles for toilets and shower room shall be 50 mm x 50 mm x 7 mm unglazed tile.

(3) Ceramic Tile

Ceramic tile for interior wall used in toilets and kitchen shall be 100 mm x 100 mm x 6 mm approximately in size. The ceramic tiles shall have glazed surface and cushion edges. Trimmer shapes such as bulldoze, cove, base, curb, etc. shall be employed as required and as far as available.

(4) Acid-proof Asphalt Blocks

Acid-proof asphalt blocks shall be made of hard asphalt and sand, and have approximate dimensions of 240 mm x 120 mm x 15 mm.

(5) Setting

Surfaces to receive the tile shall be clean, free from dirt, oil, grease and other deleterious substances. Mortar for setting bed shall be mixed in the proportion of one (1) part Portland cement, one (1) part hydrated lime, six (6) parts of clean sharp sand. The mix proportion of scratch coat shall be specified in Sub-paragraph I.2.2 Plastering Work in these Specifications.

(a) Setting of Ceramic Tile to Wall

Concrete and/or concrete hollow block surfaces to receive the tile shall be cleaned free from loose materials and soaked with clean water immediately prior to application of the scratch coat. Scratch coat shall be applied not less than twenty-four (24) hours before starting the tile setting. Scratch coat shall be not less than 6 mm thick and pressed sufficiently to ensure proper bond as the setting bed. While the mortar is still plastic the scratch coat shall be cut with a trowel at all interval vertical angles.

The scratch coat should be moistened thoroughly and then temporary screed shall be applied with mortar to provide for a true plumb surface. The setting bed shall be applied and floated flush with screed less than twenty (20) mm thick. Retempering shall not be allowed.

Wall tile shall be set by trowelling a skim coat of neat, Portland cement on the wall and applying a skim coat to the back of each tile and immediately floating the tile to the wall.

All vertical and horizontal external corners shall be laid trim to tiles. Ceramic tiles joint shall be 2 mm wide with white cement paste and surplus grout shall be cleaned off.

(b) Setting of Ceramic Mosaic Tile to Floor

Mosaic tiles shall be laid with 1:3 volume on a cement-sand mortar in perfect alignment and to slope uniformly for drainage as the case required.

Joints of mosaic tiles shall be 2 mm wide, uniform and true to line and filled with white cement.

I.3 DOOR, WINDOW AND LOUVER

I.3.1 Wooden Doors

(1) Wooden Door Leaves

Before manufacturing wooden doors, the Contractor shall submit shop drawings showing complete details of the door for approval of the Supervision.

All wood surfaces shall be sanded and putty filled to smooth surfaces to receive oil painting.

All wooden door leaves shall be hollow cored flush type, 40 mm thick, with panes or louvers as shown on the Drawings and shall be faced either with 6 mm thick first grade waterproof plywood or natural wood face panel.

The plywood shall be covered with lauan lamina, putty polished and oil painted. Panes or louvers, if provided, shall be fixed with adequate beads.

Frames shall be fixed to the opening in concrete walls using wood wedges, synthetic adhesive, nails and clamps if required.

(2) Hardware

The Contractor shall supply and install the hardware for the wooden door as listed in Drawings.

The Contractor shall submit catalogues or samples of the hardware to the Supervision for approval.

The hardware shall comply with the following requirement:

Hinges	Factory-painted steel or stainless steel, 13 cm in approximate size, 3 hinges for each door leaf
Knobs	Stainless steel
Lock sets	Bronze, cylindrical lock, 3 sets of keys to be furnished

Door closures	Die-cast aluminum body, oil and spring activated with 90∞ stop device
Push and pull handle	For toilets door, plastic made 15 cm x 25 cm in size

The Contractor shall supply master key set as directed by the Supervision.

I.3.2 Metal Doors, Windows and Louvers

(1) Materials

Materials for all doors, windows, louvers and frames shall be free from defects impairing their strength, durability or appearance and shall be the best of their respective kinds. They shall be made to sustain safely strains or stresses to which they may normally be subjected.

(2) Shop Drawings

The Contractor shall submit shop drawings of all work for approval of the Supervision. He shall carefully verify all dimensions at the Site so that proper adjustments can be made. Shop drawings shall show in large scale the details of the various parts indicating the methods of anchoring and securing the work, its reinforcement, and the schedule listing the quantities of each kind of door, window and louver and its location.

(3) Priming

All steel work shall be thoroughly cleaned of rust, oil, grease and other impurities and then given one shop coat of a primer. Parts inaccessible after assembly shall be primed in the shop before assembly.

All shop primed surfaces damaged in the field shall be cleaned and reprimed with the same paint.

(4) Steel Door Leaves and Frames

Hollow steel door leaves shall be fabricated from cold rolled sheet steel. The minimum metal thickness shall be as follows:

Panel	:	1.6 mm
Stiffener plates and anchor plates	:	2.3 mm

The door leaves shall be full flushed seamless panel, 40 mm thick unless otherwise specified.

Doors shall be mortised and reinforced for hinges and locks. Doors shall be reinforced for closures and other surfaces supplied hardware where required.

Door frames shall be formed of cold rolled sheet steel. The minimum metal thickness shall be as follows:

Frame	:	2.3 mm
Architrave	:	1.6 mm
Threshold	:	2.3 mm

The frames shall be blanked, reinforced, drilled and tapped to receive template hinges and locust strikes. They shall be reinforced for surface mounted closures where required. All frames shall be prepared with rubber bumpers.

All frames shall be fixed to the structure with welded or snap-in anchors. The frames shall be furnished with a spreader bar attached to the bottom of the jambs; where no floor finish occur to conceal these spread bars, stainless steel channel shall be used, welded to the back of the jambs.

Frames shall be securely caulked with approved caulking material on exterior walls. The frames shall be extended to accommodate transom where they occur.

(5) Aluminium Doors, Windows, Louvers and Frames

The aluminium doors, windows, louvers and frames shall comply with the requirements JIS A 4702 and A 4706, or approved equivalent industrial standard. Catalogue of the products shall be submitted for approval of the Supervision.

Aluminium doors, windows, louvers and frames shall be fabricated of extruded aluminium sections and aluminium plates.

Fastening devices such as screws, bolts nuts, rivets etc. shall be of aluminium or stainless steel.

Washers shall be neoprene rubber, aluminium or stainless steel.

Sealing materials shall be polysulfide rubber.

All external faces of aluminium shall be applied with peelable protection film or the like before dispatching from the factory.

Where aluminium faces come in contact with steel, masonry, or other materials, they shall be treated with a coat of zinc chromate or alkali-resistant bituminous paint before installation.

(6) Fixed Steel Louvers and Frames

Frames for the louver shall be fabricated in the same manner as steel door frames as specified before and as shown in the details.

Louver blades shall be made of cold rolled steel plate of 1.6 mm thick and properly formed to prevent storm water from driving into the interior space and to allow air flow at an acceptable resistance.

(7) Insect Screens

Insect screen shall be fabricated of extruded aluminium frames with wire secured in frames to the inner side of windows and louvers by means of spline or galvanized screws. Screen unit shall be removable and rewirable. Screen wire shall be aluminium mesh, stainless mesh or other approved wire.

(8) Installation

Along the rims of the opening in concrete, brick and concrete block structures for the door, window and louver anchor metals shall be preembedded in a proper interval as the works progress.

Before installing the frames of door, window and louver, the rim of the opening which come in contact with them shall be cleaned of all loose and foreign matters and the preembedded anchor metals shall be exposed and extended.

The frames shall be set in place with suitable wedges plumb and true to line and then rigidly fixed to the structure through the fixing metals. The space between the frame and the structure shall be plugged with cement mortar. Exterior perimeters of the frame shall be sealed with approved caulking compound.

After glazing and painting works have been completed, all movable parts of the door and window shall be adjusted to ensure proper fitting and functioning.

(9) Steel Rolling Shutter

A steel rolling shutter capable of both electrical and manual operation shall be installed as shown on the Drawings.

All steel plates and angles, welding and riveting shall be performed in accordance with the structural steel works as specified in Section H of these Specifications.

The shutter shall be rolled-up type composed of slats, guiderails, rolling drum and cover case, with a motor, motor control gear, safety switch and all wiring from the safety switch and all other necessary accessories.

Specifications for the various components shall be as follows:

Slat	Hollow type, steel plates 1.2 mm thick, designed against a wind velocity of 25 m/sec.
Guiderail	2.3 mm thick roll-formed steel plates, depth of 65 mm with safety stop at a height of 2.2 m above the floor. The guiderail shall be anchored securely to the concrete jambs and shall be finished flush with the surrounding surfaces.
Cover case	1.6 mm thick steel plate with adequate reinforcement and inspection hole.
Motor	Electric power source: A.C., 400-volt, 3-phase, 60 Hz, operation speed: 3 to 5 m/min. Motor to be installed in the cover case.
Operation box	Install on the side wall at adequate height and provided with both electric and manual operation devices complete with all necessary accessories and provided with a stainless steel door.

The manual operation device shall be suitably geared to allow operation by one man.

The Contractor shall submit detailed shop drawings prior to fabrication. Fabrication shall not be commenced until shop drawings have been approved by the Supervision. Painting shall be as specified in Sub-paragraph I.4.3 hereof.

(10) Finish Hardware

The Contractor shall supply and install all necessary hardware for doors and windows as shown and as specified below. Samples or catalogues of all hardware shall be submitted to the Supervision for approval.

The hardware shall comply with the following requirements:

Hinges	:	Stainless steel pivot hinges, 2 pieces for each door leaf.
Floor hinges	:	Cast iron body with stainless steel cover, oil and spring activated with 90° stop device.
Knobs, lever handles and fasteners	:	Stainless steel or chromium plated bronze.
Lock sets	:	Bronze, cylindrical lock, with 3 sets of key.

Door bolts	:	Chromium plated bronze or stainless steel, surface or flush type.
Door stops	:	Wall or floor mounted type with rubber bumper and holder.
Door closer	:	Die-cast aluminium body, oil or spring activated with hold-open feature.
Push and pull plate	:	Bronze or stainless steel made approximately 230 mm in square.

The Contractor shall supply three (3) master key sets for groups of the key sets as directed by the Supervision.

I.4 GLAZING, CAULKING AND FINISHING WORKS

I.4.1 Glazing Works

(1) Materials

The brand and quality of glass shall conform to JIS R 3201 to R 3204 or approved equivalent and shall be subject to the approval of the Supervision. The Contractor shall, if he proposes alternative products, submit catalogue and samples to the Supervision for his approval.

The type and thickness of glass shall be determined by depending on the service and the dimensions of panes so that they may safely withstand the strains and stresses to which they may normally be subjected and still fulfill their intended purpose.

(2) Installation

All panes shall be accurately cut to fit in the places with 4 mm clearance all around. All panes shall be set in vinyl glazing beads applied on all four sides for the full length and using spacer shims and clips at intervals recommended by the glass manufacturer. Panes for aluminium sashes shall be set evenly in the rebates. Panes for wooden frames shall be fixed with triangular wood stops. All panes shall be cleaned and polished when the building work is completed.

The Contractor shall be held fully responsible for any defective glass, curing of glass and all scratched, damaged or broken glass which shall be immediately removed and replaced.

I.4.2 Caulking Works

(1) Material

Caulking compound shall be of one component polysulfide base compound. Color of the compound shall generally match the color of adjacent materials. Primer and joint filler shall be of types recommended by the manufacturer of caulking compound.

(2) Application

All caulking shall be done in a manner to completely seal the joints against wind, rain and dust.

If caulking spaces exceed 13 mm in depth, their bottoms shall be packed solidly with joint filler or backstop to within 13 mm of the face of the work and then caulked with compound. These backup materials shall not adhere to the caulking compound, otherwise bond breaking tape shall be applied.

Where caulking compound comes in contact with cement, concrete, brick or other porous material, the latter shall be primed to prevent absorption of oils from the compound.

Caulking compound shall be applied with a caulking gun. Excessive caulking materials shall be removed.

I.4.3 Painting Works

(1) Materials

The Contractor shall submit catalogues and specifications of all paints to be used to the Supervision for approval.

(2) Application

All metal surfaces shall be oil painted unless other paints are specified. All steel components other than galvanized steel shall be prepared and primed in the shop and finish painted after erection.

All metal surfaces to be painted shall, prior to application of paint, be prepared in the following manner:

- All soil or other foreign matter (other than grease and oil) shall be removed by brushing or scraping.

- Oil or grease shall be removed by wiping the surface with rags or brushes wetted with an approved solvent.

- Excessive rust scale shall be removed by hand chipping or by power impact tools.

- Rough welds and sharp steel edges shall be ground smooth, and all weld spatter shall be removed.

- The whole surface shall be cleaned by means of sand blast or combination of powered steel scrapers or steel brushes and sand papers.

Immediately after completion of the surface preparation, approved primer shall be applied; two coats for the structural steels and one coat for other steels unless otherwise specified.

All wood surface to receive paint shall be cleaned of all dirt, grease, dust or any other deleterious matters. All surfaces shall be thoroughly sanded and all nail holes, cracks and any other defects shall be puttied, re-sanded to a smooth and flush finish. The putty shall be colored to match the color of the finish paint.

Spray painting equipment shall have suitable air pressure and paint flow controls. Air lines shall be equipped with moisture and dirt traps. The paint shall be continuously stirred during the painting process. The paint shall be mixed and applied in accordance with the manufacturer's recommendations.

Painting shall not be done in rain, fog or mist, or at any other time considered unsuitable by the Supervision. All the surrounding works shall be protected in a suitable manner from paint drops and overspray.

Color shall be later designated by the Supervision. The color of primer and each finish coat shall be contrasting in order to distinguish the work progress.

Quantities of paint applied in each coat shall not be less than 0.09 kg/m^2.

The finished surface shall show a smooth and uniform finish, free from any stains and shall be uniform in color and shade.

(3) Oil paint to Steel Surface

Painting shall comprise one or two coats of anti-corrosive paint and two coats of oil paint. Sufficient time shall be allowed for drying between each new coat.

Galvanized metal work to be painted shall be first etched with 5% acetic acid and washed clean before priming.

(4) Oil Paint to Wooden Surfaces

Paints shall be applied in 3 coats including one coat of primer paint. Sufficient time shall be allowed for drying between each new coat.

(5) Vinyl Emulsion Paint

The cement mortar shall be left to dry for a minimum period of 3 weeks after application. The vinyl emulsion paint shall be applied in 3 coats including a primer coat. Minimum 12 hours shall be allowed before application of each successive coat.

(6) Acid-Proof Paint

Acid-proof paint shall be applied in three (3) coats in accordance with manufacture's instructions and as approved by the Supervision.

(7) Clear Lacquer Finish

Wood surfaces shall be carefully sandpaper smoothed. Clear lacquer finish shall be applied in 3 coats to a clear and uniform finish in shade and to reveal the grain of the wood.

I.4.4 Spray Tile Finish

Spray tile shall be of a solvent base, polyester resin system reinforced with fibers. The spray tile shall be made of emulsion type epoxy resin as a main component, and asbestos, diatomite, pigment, etc. as sub-components, each conductive to good bonding, waterproofing, malleability and insulation. The spray finished surface shall be ripple, smooth and glossy.

The Contractor shall submit catalogues and samples to the Supervision for his approval.

Concrete, cement mortar or any other surface to receive the spray tile shall be cleaned of dust, laitance, loose particles or any other foreign matters and shall be ground and puttied to a smooth surface. The surfaces shall be completely dry and the surrounding structures, fitting and fixture shall be properly protected from being smeared.

The spray tile shall be applied in strict accordance with the manufacturer's instructions.

I.4.5 Interior Finishing Works

(1) Rockwool Acoustic Tile

Rockwool acoustic tiles shall be of a product of plaster and rockwool having a fissured surface simulating travertine stone with a white finish, and shall be approximately 300 mm x 600 mm x 12 mm in size. The rockwool tile ceiling shall include the complete metal suspending ceiling system including suspending bolts, hangers, clips, main runners, furring strips and 9 mm thick gypsum board. The gypsum board and rockwool acoustic tile shall conform to JIS A 6901 and A 6303 respectively or approved equivalent. The method of installation shall strictly comply with the manufacturer's specifications.

The entire suspended ceiling shall be installed to the level and lines as shown on the Drawings and the completed surface shall not have a deviation on level or lines of more than 3 mm in 4 m.

The suspending bolts shall be fixed to the concrete structure, so that the suspending bolts be systematically and vertically installed.

Ceiling access holes shall be provided in the rooms as directed by the Supervision. The access hole covers shall match the surrounding ceiling and continuity of the ceiling pattern shall be maintained as much as possible.

Main runners shall be provided at intervals of approximately 90 cm, installed with allowance for adequate camber. They shall be designed for ceiling loads of 60 kgf/m^2.

Furring strips shall be provided at intervals of 30 cm according to the ceiling material manufacturer's requirement. Adequate reinforcing and metal framing shall be provided for mounting lighting fixtures, air diffusers and ceiling access holes.

Gypsum board shall be securely fixed to the furring strips with the galvanized screws true to level and line. Completed surface shall not have a deviation in level and line of more than 3 mm as per 4 m in length.

Rockwool acoustical board shall be fixed to the gypsum board by suitable adhesive and galvanized staples recommended by the manufacturer.

Ceiling trims shall be of hard wood and fixed to the wall as shown on the Drawings.

(2) Asbestos Cement Sheet

Asbestos cement sheet shall be of hard asbestos flat sheets, 6 mm thick and shall conform to JIS A 5403 or approved equivalent. The asbestos cement sheet ceiling shall include the complete metal suspending ceiling system same as specified for the rockwool acoustic tile in this Sub-paragraph. The asbestos cement sheet ceiling shall be provided for kitchen, toilet and other places as shown on the Drawings. The sheets shall be fixed securely to the ceiling joist with stainless flat head screws. Joints shall be of open joints 5 mm in width, straight and uniform. Ceiling access holes shall be provided in the same manner as specified for the rockwool acoustic tile. Surface of the sheet shall be finished with vinyl emulsion paint as shown on the Drawings.

(3) Vinyl Floor Tile

(a) Materials

Vinyl floor tiles shall be 300 mm x 300 mm x 2 mm thick conforming to JIS A 5705 or approved equivalent.

The Contractor shall furnish all tiles including such shapes as are necessary to produce the required pattern and surface finish, cover and rounded tiles for corners and salient angles. The color and pattern of tile shall be selected by the Supervision.

Adhesive for laying tiles shall be furnished in sealed containers bearing the manufacturer's label and instructions for application.

(b) Installation

Floor surfaces upon which tiles are to be placed shall be covered with a cement plaster bed 30 mm thick bonded to the structural concrete as specified in Sub-paragraph I.2.3 Plastering Work in these Specifications. The plastered surfaces shall be clean and free from dust, oil and moisture. The back surfaces of the tiles shall be clean.

Vinyl floor tile shall be laid with adhesives upon the plastered surface in such a manner as to produce a tiled surface tightly bonded to the floor. Adjacent tiles shall be butted tightly together to form straight continuous joints and uniform regular patterns as shown on the Drawings or as prescribed by the Supervision.

(4) Vinyl Skirting (Polyvinyl Soft Skirting)

Vinyl skirting shall be installed on a smooth surface, dry and clean. Adhesive shall be applied and vinyl skirting firmly placed with its toe in contact with the finished floor. The skirting shall then be rolled with a hand roller. External and internal corners shall be installed with performed pieces.

I.5 MISCELLANEOUS WORKS

I.5.1 Miscellaneous Metal Works

(1) General

All materials to be used for the miscellaneous metal works shall conform to JIS G 3101, SS 41 or approved equivalent, unless otherwise specified on the Drawings.

All steel faces except where embedded in concrete shall be coated with one coat of primer and two coats of oil paint unless otherwise specified.

The work shall be fabricated in the shop as far as possible. The work shall be erected true to line and straight, accurately fitted with tight joints and intersections. All works shall be reinforced where required.

Catalogues and/or shop drawings for each item shall be submitted for the approval of the Supervision.

(2) Roof Drains and Floor Drains

The building roof and floor drains shall be of cast iron body, heat coated with asphalt. Care shall be exercised in fitting the surrounding waterproofing works to prevent any damage to the water proofing membrane. Caulking shall be applied as required.

Floor drains shall be fitted with flat removal cast iron grate. Roof drain grates shall be convex in profile at least as high as the pipe diameter and the total area of the openings of the grate shall be larger than 1.5 times the cross-sectional area of the drain pipe. Grates shall be fixed with non-corrosive screws.

Roof drains shall have two flanges. The bottom flange shall be integral with the drain body and shall be set to coincide with the waterproof membrane or with top surface of the surrounding concrete. The top flange shall be screwed to the bottom flange and shall be set lower than the surrounding roof finish. The two flanges shall be used to clamp the roof waterproof membrane.

(3) Hatch Covers

Hatch covers to be installed in substructure shall be fabricated and installed with steel plates and frames, anchorages, reinforcing steel angles or channels and lifting devices as shown on the Drawings or as directed by the Supervision.

(4) Stair Non-slip

Stair non-slip shall be of hard aluminium with grooves or plastic tire for non-slip. Non-slip shall be approximately 40 mm wide and installed in full width of each stair tread as detailed on the Drawings. The non-slip shall be secured on the cement mortar or concrete using anchor lugs or suitable adhesive.

(5) Steel Handrails

Steel handrails shall be provided for the stairs and other places as shown on the Drawings. Steel handrails shall be fabricated of mild steel structural pipes. Embedded feet of balusters shall be weld-connected to the reinforcement bars in the structure. Oil paint finish shall be applied to all exposed steel surfaces.

(6) Steel Ladders and Steel Caged Ladders

Steel caged ladders shall be fabricated and installed to concrete structure as shown on the Drawings. Anchor plates shall be embedded in concrete at the proper locations while the concrete is placed, or recesses shall be left in the concrete for anchors and thoroughly grouted with cement mortar after setting anchors. The ladders shall be hot dip galvanized after fabrication.

(7) Expansion Joint Covers

Cover for expansion joints shall be provided along the joints on the roof, wall and floor. Steel angles, steel plates and wood blocks as joint bed materials and stainless steel plate shall be neatly fabricated so as to prevent water infiltration, allow structural movement and also to provide a satisfactory finish appearance as shown on the Drawings.

(8) Door Mats

Stainless steel door mat shall be provided at the porch floor in front of the entrance door. The door mat shall be of grates fabricated of stainless steel flat bars into a depth of not less than 30 mm, set in a recess provided in the floor. The recess shall be trimmed with stainless steel flat bars and provided with a drainage pipe, 50 mm in diameter and applied with asphalt coating. Polyvinyl chloride drain pipe shall be provided under the door mat recess.

(9) Cable Trench Covers

Cable trench cover for floor cable duct shall be of checkered steel plate 4.5 mm thick unless otherwise specified. Bearings shall be fabricated of steel angles with floor trimmings and anchorages. Bearing steel angle framing shall be secured in concrete with steel anchor lugs at maximum 500 mm spacing. The checkered steel plates shall be properly reinforced with steel angles depending on the sizes of the floor duct provided with lifting devices and set flush with the floor finish. Concealed surfaces shall be anti-corrosive painted and surfaces exposed to view, oil paint finished.

(10) Steel Hooks

Steel hooks having the 2.0 ton in suspension capacities shall be provided in the elevator machine room and substructure as shown on the Drawings or directed by the Supervision.

(11) Door Sills

Door sill for steel flush door shall be made of 2 mm thick stainless steel plate with a dimension of 40 mm wide. Door sill shall be provided for in the joint between different floor finishing and installed with steel anchor lugs the full width of each door width as shown on the Drawings.

(12) Floor Dividers

Floor dividers shall be provided in the joint between different floor finishes. Floor divider shall be of brass or stainless strips having 4 mm x 12 mm in dimensions.

(13) Wired Metal Lath and Welded Wire Fabric

Wired metal lath and welded wire fabric shall be provided for the portions as shown on the Drawings or directed by the Supervision. Wired metal lath shall be tightly fixed to the concrete and/or concrete hollow blocks with steel staples at adequate intervals.

I.5.2 Miscellaneous Works

(1) Downspout

Downspouts shall be of bell-end type PVC pipe for heavy use, solvent cement connected and provided with adaptable vent for effective water flow. Downspouts shall be strongly secured to concrete columns and walls with 3.0 mm galvanized wall brackets and 2.3 mm metal straps attached by galvanized lug screws and expansion anchors. Wall brackets shall be provided for within 1,500 mm spacing.

(2) Kitchenette Units

Kitchenette sink unit shall be of composite of a sink unit, cooking table and wood cupboard in the dimensions as shown on the Drawings. The sink unit shall consist of stainless steel sink top, stainless steel strainer and melamine resin or polyester faced plywood cabinet. Stainless steel sink top shall be drawn from one-sheet of more than 0.8 mm in thickness. The cooking table shall be made of stainless steel sheet top and melamine resin or polyester faced plywood cabinet.

Wood cupboards shall be framed with dovetailed, housed, rebated or locked joints and shall be accurately finished to the dimensions as shown on the Drawings.

Shelves and bench tops shall be 25 mm thick. Bench tops and exposed edges shall be covered with melamine of approved color and securely glued in place.

Each cupboard shall be fitted with 25 mm thick solid core door, which shall be hung on a pair of steel butt hinges and fitted with an approved push button catch and circular fly-proof ventilator.

Drawer shall be dovetailed, glued and housed with a 20 mm thick front and 12 mm thick sides and back with a 5 mm plywood bottom. Drawer shall be fitted on tallow wood runners and shall have approved handles.

The Contractor may propose ready-made market products to suit the dimensions of the kitchen by submitting catalogues to the Supervision and obtaining his approval.

(3) Foamed Plastic Board

Joint filler for expansion joints shall be of foamed plastic board 50 mm thick or other approved equivalent materials. The Contractor shall submit samples or catalogues of the joint filler to the Supervision for approval.

(4) Room Name Plates

Where shown on the Drawing or as directed by the Supervision, room name plates shall be provided on the external surfaces of entrance door of each room. The name plates shall be made of acrylic resin plates having approximately 80 mm x 350 mm x 6 mm thick in size and fixed with chromium plated screws to the doors. On the plate shall be engraved the name of the room as directed by the Supervision.

(5) Venetian Blinds

Venetian blind shall be of a vertical type made of incombustible glass cloth. The blind shall consist of a complete set of head roller and aluminium rail, bottom chains and operating devices. The blind shall have an adequate dimensions to cover the whole area of the required window. The blind shall be fixed securely in the wood head box with flat head screws. The Contractor shall submit samples or catalogues of the blind to the Supervision for his approval.

(6) Toilet Partition

The toilet partition shall consist of doors and panels with miscellaneous fittings. The doors and panels shall be 40 mm thick panel surfaced with plastic laminated plywoods. The panel and door shall be installed in accordance with the provisions of Sub-paragraph I.3.1 Wooden Doors, in these Specifications. The panels shall be firmly supported and fixed to the wall and floor with chromium plated or stainless steel plate supporting hardware and clamps. Each panel shall be securely connected together with stainless steel channels. Each shall be equipped with complete fittings consisting of door stop, latch, and combination coat hook and rubber bumper.

(7) Skylights

Skylight shall be of ventilator type consisting of skylight dome and louvered skylight well.

The dome shall be either double or single dome formed of opaline tinted acrylic resin or tempered glass. The dome shall be bolted to the skylight well underneath which shall be constructed of steels. The well shall be louvered to serve as a gravity ventilator.

The dome and the well shall be designed to prevent storm water from driving into the room and flashing, condensation gutter and seepage outlet shall be provided to shed water outside.

Catalogs of skylight shall be submitted to the Supervision for approval.

I.5.3 Elevator

(1) General

An elevator shall be provided in the pump house as shown on the Drawings and further specified hereinafter. The elevator shall be a product of a reliable manufacturer, furnished complete with all standard requirements, and equipped with all first grade quality materials and mechanisms, conforming to the capacity and characteristics as hereinafter specified. Catalogues and shop drawings shall be submitted for the approval of the Supervision.

(2) Design Criteria

The elevator shall be equipped with the following capacity and characteristics.

(a)	Load capacity	450 kg (6 persons)
(b)	Speed	60 m/min.
(c)	Operation system	Collective control
(d)	No. of stops	5 stops
(e)	Jamb	Narrow type, painted sheet steel
(f)	Sill	Hard aluminium
(g)	Landing door	2 panel opening painted sheet steel
(h)	Opening	800 mm width, 2,100 mm height
(i)	Signal	Car position indicator in car and each floor
(j)	Emergency alarm	Interphone between office
(k)	Electric power	A.C., 3-phase, 400 V, 60 Hz
(l)	Emergency lamp	To be provided

(3) Testing and Maintenance

The Contractor shall submit a complete data of test performed at the manufacturer's shop for the approval of the Supervision. The Contractor shall also provide a maintenance service free of charge for a minimum period of twelve (12) months. The manufacturer shall further provide continuous maintenance at a fee to be decided later.

I.6 MEASUREMENT FOR PAYMENT FOR ARCHITECTURAL WORKS

I.6.1 General

Measurement for payment and payment method hereafter specified shall be applied to the architectural work items in the Bill of Quantities. All works shall be complete in every respect finished, installed, constructed and tested in accordance with the Drawings and the Specifications and as directed by the Supervision.

All work items shall include all costs to complete to respective items including those for related works as specified and any other incidental works which are not specifically mentioned but reasonably inferable.