THE PEOPLE'S REPUBLIC OF BANGLADESH

DETAILS DESIGN REPORT
ON
THE TELEVISION STUDIO CONSTRUCTION PROJECT

VOLUME III

MARCH 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

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C O N T E N T S

PRELIMINARY & GENERAL ITEMS APPLYING TO THE WHOLE OF THE WORKS

P-1 SCOPE OF WORKS:

The works comprize the completion of B.T.V. in Dacca city together with all construction, electrical installations, plumbing installations, ventilation and air conditioning stated in drawings, specifications, and on-site orientations.

P-2 DEFINITION:

"the Supervisor" means the designated engineer of B.T.V., or his representative.
"the Contractor" is that mentioned as such in the Contract Agreement.
"Work" of the Contractor includes labour or materials or both.

P-3 SITE:

The term "Site" in this Contract shall mean the Site of B.T.V., or sites in Dacca as shown on the Site Location Plan Drawing.
The Contractor shall be deemed to have visited the Site, to have taken into consideration all local and existing conditions and to have made himself throughly acquainted with position and accessibility of the proposed work and conditions under which they will have to be carried out. Unless otherwise specified, no claim for want of knowledge in this respect will be entertained.

P-4 PROGRAMME OF WORKS:

the contractor shall submit to the Supervisor for his approval within thirty (30) days of signing the Contract, three (3) copies of a detailed Programme showing the dates of proposed commencement and completion of the various parts of Works and the method in which he proposes to carry out the Works.

P-5 STANDARDS, SPECIFICATIONS, BYE-LAWS:

In various places throughout this specification reference is made to the Standards, Specifications and Bye-laws issued by the Japanese Standards Association, the American Society for Testing Materials, the British Standards Institution, various Ministries and Departments of the Government of Bangladesh and other Authorities. These references shall in every case be deemed to include the latest edition of issue of such Standards, Specifications and Bye-laws, including all revisions, amendments and addenda issued up to the date of invitation to tender.

P-6 ABBREVIATIONS FOR STANDARDS, ETC.:

The following abbreviations for Standards, Specifications, Bye-laws, etc., and the names of institutions issuing same are used throughout this specification:

JIS Japanese Industrial Standards
by the Japanese Standards Association

ASTM ASTM Standards
by the American Society for Testing Materials

BS British Standards
by the British Standards Institution

P-7 NOMINAL EQUIVALENTS:

The following nominal equivalents are used throughout this specification:

INCH SIZE	METRIC SIZE (mm)
1	25.4
12	304.8

In case any indicated or specified number is not available, nearest higher numble will instead be used with the Supervisor's approval.

P-8 GAUGES:

Gauges for indicating sheet metal thicknesses and wire diameters

are by the United States Standards Gauge (USSG).
In case any indicated or specified number is not available, nearest higher number will instead be used with the Engineer's approval.

P-9 MIX PROPORTIONS OF MORTAR:

The terms for mix proportions of mortar described in this specification, "1-part portland cement and x-parts sand", "equal parts of cement and sand", etc. shall be considered as "nominal mix 1:x" stipulated in the following Mixing Table. The Table shall be strictly adhered to in all cases.

Mixing Table

Nominal Mix	Cement kg	Sand cu.m
1:1	1,450	1.0
1:1-1/2	1,000	1.0
1:2	750	1.0
1:2-1/2	600	1.0
1:3	500	1.0
1:4	350	1.0
1:5	300	1.0

P-10 LANGUAGE:

At least one (1) of the Contractor's competent representatives on the Site shall be fluent in the written and spoken English language. In addition the Contractor shall retain, when required by the Supervisor, the services of such personnel who are conversant with both Bengali and English languages in order to ensure the proper progress and supervision of the Works. When required by the Supervisor, any drawing and any documents written in Bengali shall be accompanied by English translation.

P-11 SINGULAR AND PLURAL:

Words in singular shall include the plural wherever the context so indicate, and the plural shall include the singular if so connoted.

P-12 UNIT SYSTEM:

All drawings, documents and all written communications submitted by the Contractor shall be in the metric system of weight and all measures unless otherwise required by the Supervisor.

P-13 SHOP DRAWINGS:

The Contractor shall check and verify all field measurements and shall submit with such promptness as to cause no delay in his own work or in that of any other Contractor, three (3) copies unless required otherwise, checked and approved by him, of all shop or setting drawings and schedules required for the various trades. No work shall be commenced before the approval of the Supervisor on such drawings and schedules.

P-14 SAMPLES:

The contracted shall furnish for approval, with reasonable promptness, all samples as directed by the Supervisor. The work shall be in accordance with approved samples.

P-15 PERMITS, LICENSE, ETC:

Contractor shall, at his own expense, secure the permits and licenses necessary for prosecution of work and shall negotiate and take procedures with the related authorities.
When doing so, should the cooperation of the Supervisor be necessary, a proposal in writing should be made to the Supervisor and his cooperation may be obtained.

P-16 CHANGES IN EXECUTION OF WORK:

Should the need unavoidably arise from the standpoint of work execution which necessitate changes in the design, scheme of execution and temporary works during the course of construction work, the reasons therefor, scope of change(s) and effect on the Programme of Work shall be immediately reported in writing to the Supervisor. The cost arising from such changes shall be borne by the Contractor.
In giving instructions, the Supervisor shall have authority to mako minor changes in the work, not involving extra cost, and not in-

consistent with the purpose of the buildings.

P-17 MATERIALS AND GOODS:

Unless otherwise specified, all materials and goods shall be new and both workmanship and materials shall be of good quality.
The Contractor shall perform inspections of the materials to be used after transportation to the Site and shall report the result thereof to the Supervisor. As the result of such inspections, the Supervisor will judge whether they are unsatisfactory or unacceptable, based on the Technical Specification. The materials and goods so judged must not be used.

P-18 USE AND INSPECTION OF PREMISES:

The Contractor shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Supervisor and shall not unreasonably encumber the premises with his materials.
The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
The Contractor shall visit and examine the premises to fully understand all of the existing conditions relating to his work.

P-19 PROTECTION OF WORK AND PROPERTIES:

The Contractor shall continuously maintain adequate protection of all his work from damage and protect B.T.V.'s property from injury or loss arising in connection with this work. He shall make good any such damage, injury or loss except such as may be due to causes beyond the Contractor's control and not through his fault or negligence. He shall adequately protect adjacent property as provided by law and the Contract Documents.

P-20 STREET REPAIR:

The Contractor shall make all repairs to sidewalks, curbs and streets excavated or otherwise made unserviceable in the performance of his work.

P-21 CUTTING AND PATCHING:

The Contractor shall be held responsible for the conditions and

contents of the buildings, and shall do all cutting, fitting and patching required for his work and which will be required for the installation of the work of all other trades employed on these buildings except as specifically mentioned under those trades.
Sleeves, inserts, boxes, etc. shall be furnished and installed in time according to the process of construction work. In case such sleeves, etc. are not placed in time, the Contractor shall form openings in the work, after coordination with the trades involved, for proper location.
The Contractor shall do all cutting promptly and shall make all repairs necessary to leave the entire work in a condition entirely satisfactory to the Supervisor.

P-22 CLEANING UP:

The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by his employees or work, and at the completion of the work, he shall remove all such from and about the buildings, his tools, scaffolding and surplus materials and shall leave his work "broom-clean" or its equivalent.

P-23 TEMPORARY CONSTRUCTION AND FACILITIES:

The Contractor shall provide and maintain all temporary constructions and facilities necessary to complete the work as shown on drawings and described in specifications.
A programme shall be prepared and submitted to the Supervisor for approval before start of work outlining the temporary office for the Supervisor and the Contractor himself, temporary sheds for materials, tools, etc., construction equipment, tools, plants, temporary light and power, temporary water supply and drainage, scaffolds, staging and safety devices necessary for execution of the work.
Installation used for the temporary work shall be removed after completion of the work.

P-24 TESTS:

Unless otherwise indicated by the Supervisor, the Contractor shall, at his own expense, carry out the inspections and tests to confirm that the requirements for the quality, capacity, performance and other

items indicated or specified on drawings and/or specifications in regard to the materials, goods and works are satisfactory. The Contractor shall compile the results of each inspection and test, and submit tothe Supervisor,if required, three (3) copies.

P-25 COOPERATION:

During the time when the Contractor is carrying out all operations in connection with this Contract, the Contractor shall so conduct his operations as to work in harmony with the various trades involved and so conduct his work as not to danger, damage, or interfere with or delay the operations of the Owner. The Contractor shall do his best to cooperate in installation work of TV broadcasting equipment.

P-26 WELDING AND CUTTING:

Where electric or gas welding on cutting work is done above or near combustible material or above space that way be occupied by persons, interposed shields of incombustible material shall be used to protect against fire damage or injury due to sparks and hot metal.
Suitable fire extinguishing equipment shall be maintained near all welding and cutting operations. A workman shall be stationed near welding and cutting operations to see that sparks do not lodge in floor cracks or pass through floor or wall openings or lodge in any combustible materials. The workman shall be kept at the source of work offering special hazards for 30 minutes after the job is completed, to make sure that smouldering fire have not been started.
A qualified electrician shall be in charge of installing and repairing electric or arc welding equipment.

P-27 PREVENTION OF DAMAGE:

The Contractor shall take due care and provide, at his own expenses, facilites necessary to prevent damage to the work, equipment, his employees, adjacent properties or a third party until the completion of the work. Such facilities shall be appropriate to the work and its surroundings, shall comply with the specifications and relevant laws, ordinances, and shall be subject to approval of the Supervisor.

P-28 DRAWINGS, OPERATING AND MAINTENANCE INSTRUCTIONS, ETC.:

The Contractor shall, upon completion of the work, furnish to the Supervisor a "Handing-Over List" comprising of the following:

(a) Drawings

Bound set of drawings indicating the "as-built" conditions of the building and building utilities at the time of completion. Said drawings shall include the all drawings necessary for maintenance of the building and building utilities, and for future extension. Number of sets to be submitted shall be as follows:

i) Second original drawing ..... 1 set
(Copies from original drawing revised to the foregoing condition, from which blue printed copies could be obtained)

ii) Copies of blue or dark prints on white background ..... 3 sets

(b) List of Material and Goods

Complete bound set listing the names and manufactures of the materials and goods used in the work: ... 3 sets

(c) Keys and Others

Keys for locks, handling tools for manhole covers and all other accessories attached to the work.

(d) Operating and Maintenance Instructions

Complete bound set of step-by-step operating and maintenance instructions covering pump, air conditioning equipment, automatic control systems and other apparatus installed under the work. ..... 3 sets

(e) Photos of Completion

Type of films			Number of Presentation	Remarks
Monochrome film		40 (cabinet size)	Negative 1 Print 4	Pasted to the album
Color photo	Color print (Outside view) (Inside view)	2 3	ditto	ditto
Color photo	Color transparency	40 (35mm)	2	Attached to the color transparency file

SECTION 1

TEMPORARY WORKS

1.1 GENERAL:

1.1.1 Materials for Temporary Works:

Old materials which are not objectionable for use may be used for construction of temporary works.

1.2 STAKING-OUT, BATTER BOARDS, SCAFFOLDINGS, ETC.:

1.2.1 Confirmation of Site Conditions and Staking-out:

The Contractor shall confirm the site conditions, stake out the position of buildings or structures and have them inspected by the Supervisor.

1.2.2 Bench Mark:

(a) The Contractor shall provide bench marks by use of wooden or concrete stakes in such manner that the stakes are protected from movement. Provided, that fixed object may be used as bench marks.

(b) The bench marks shall be subjected to the inspection by the Supervisor.

1.2.3 Batter Board:

(a) Following the staking-out, batter boards shall be erected on the corners of the buildings or structures sufficiently away from the building line so that the work will not be obstructed.

(b) The batter boards shall have their top edge planed and nailed to batter stakes in horizontal position.

(c) The batter board shall clearly indicate the position and grade of the buildings or structures and shall be subjected to the inspection by the Supervisor.

1.2.4 Scaffoldings, etc.:

(a) Scaffoldings, stagings and enclosures shall be made of appropriate materials and shall have appropriate construction.

(b) Stationary scaffoldings and stagings shall be offered for use by other contractors free of charge.

1.3 MATERIAL STORAGE, SHOPS AND OTHER TEMPORARY BUILDINGS:

1.3.1 Material Storage, etc.:

(a) Material storages and shops shall be of appropriate construction.

(b) Storages for cement, etc. shall be of appropriate construction to prevent rain water and moisture.

(c) Yards for sand and gravel shall be of appropriate construction to prevent the mixing of the materials or mixing with earth.

1.3.2 Storage for Inflammables:

Storage for inflammables such as paints and oils shall be provided as far away as possible from the buildings, shops and other storages and shall have its roof, interior or exterior walls and ceiling made of fire-proof or non-inflammable materials. Doors to the storage shall be provided with locks and a sign "Inflammables" posted on them and fire extinguishes placed nearby.

1.3.3 Size and Finish of the Supervisorand:

(a) The Supervisorand shall have a floor space of more or less 35 m^2.

Table 1.3.1 Finishing Schedule of the Supervisorand

Name	Finish
Floor	Flooring board or vinyl floor tile.
Interior wall, Ceiling	Plywood or plaster board painted with synthetic resin emulsion paint.
Roof	Colored iron sheet or iron sheet with ready-mixed paint.

1.3.4 Furnishings of the Supervisorand:

(a) The Supervisorand shall be provided, at the request of the Supervisor, with the facilities such as lighting, water supply and drainage, etc. and with the following furnishings as necessary.

- Desk, chair, book shelf, blackboard, drawing board, clock, thermometer.
- Rubber boots, rain wear, head gear, flash light.
- Extended telephone (where Contractor has parent telephone).
- Locker, extinguisher, boiler tools for cleaning cooler.

(b) The Contractor shall bear the charges for electricity, gas, water, telephone and for cleaning toilet, etc.

1.3.5 Others:

(a) No labor camps shall be provided within the site of construction.

(b) A sign board showing the name of project and owner, etc. shall be posted at appropriate location at the site of construction.

1.3.6 Construction Photographs:

Photographs to be submitted to the Engineer by the Contractor before the commencement of work to record the site conditions shall show the entire features of the site by means of continuous shooting, bird's-eye-view shooting, etc. at not less than 15 places.
At the direction of the Supervisor, topographical features and objects and the relation with the existing structures which may present causes of claims during and after the work shall also be recorded by means of photographs.

SECTION 2

EXCAVATION, GRADING, FILLING AND BACKFILLING

2.1 SCOPE OF WORK:

2.1.1 Extent: The work required under this section consists of all excavation, grading, filling, backfilling and related items necessary to complete the work indicated on drawings and described in specifications.

(a) In general the items of work to be performed under this section shall include but is not limited to: Clearing and grubbing, removal of trees and stumps, protection of trees to remain, excavation for buildings and structures, removal of underground obstructions when indicated or specified, backfilling, filling, fill compaction as indicated on drawings or as required.

(b) Excavated material that is suitable may be used for fills and backfills indicated or required. All unsuitable material and all surplus excavated material not required for site grading or backfill, shall be removed to the dump directed by the Supervisor.

(c) Provide and place any additional fill material from off the site as may be necessary to produce the grades or rough subgrades required. Fill obtained from off site shall be of kind and quality as specified for fills herein, and the source approved by the Supervisor.

(d) The Contractor shall accept the site as he finds it and remove all trash and rubbish from area to be occupied by new buildings, roads, surfaced areas, and other areas required to complete the work prior to starting excavation.

(e) Where adjacent lawn or surface areas within the site and/or adjacent lots are disturbed as a results of building operations or storage of materials under this Contract, they shall be cleaned of all debris and restored to original grades and condition.

2.1.2 Work not Included: The following items of related work are specified and included in other sections of this specification.

(a) Excavation and backfilling for utility lines.

(b) Final shaping of subgrade under outside paved areas.

(c) Placing topsoil and performing finished grading.

2.2 BENCH MARKS AND MONUMENTS:

2.2.1 After determination of the standard level of buildings, the Contractor shall establish the bench mark at places and/or existing structures free from removal and destruction and obtain the confirmation of the Supervisor. Maintain carefully all bench mark, monuments and other reference points; if disturbed or destroyed, replace as directed by the Supervisor.

2.3 LOCATIONS AND ELEVATIONS:

2.3.1 The Contractor's surveyor shall locate by stake and/or mark, the locations and/or elevations for the following:

(a) All building corners and structure corners.

(b) Under-slab elevations for slab on fill.

(c) Lines and grade and/or fill elevations for pavings and sidewalks.

(d) All other items required to execute the work under this section.

2.4 EXCAVATION FOR BUILDINGS AND STRUCTURES:

2.4.1 Planning: The contractor shall submit excavation planning drawings for approval of the Supervisor. The drawings shall indicate the dimensions, procedures and methods of excavation.

2.4.2 Dimensions: Excavate to elevations and dimensions indicated; allow additional space as required for construction operations and inspecting foundations.

2.4.3 Obstructions: Completely remove all existing walls, slabs, curbs, paving, floors, steps, footings, piers and other construction from under new foundations.

2.4.4 Suitable Bearings for Foundations: If suitable bearing is not encountered at the depth indicated on drawings for foundations, the Contractor shall immediately notify the Supervisor; he shall not proceed further until instructions are given and necessary measurements made for purpose of establishing additional volume of excavation.

2.4.5 Shoring: Shore, sheet pile and brace excavations as required to maintain them secure; remove shoring as the backfilling progresses, but only when banks are safe against caving or collapse.

2.4.6 Drainage: The Contractor shall control the grading around buildings so that ground is pitched to prevent water from running into the excavated areas or damaging the structures. Maintain all pits and trenches where footings are to be placed, free of water at all times. Provide all pumping required to keep excavated spaces clear of water during construction. Should any springs or running water be encountered in the excavation, the Supervisor shall be notified and the Contractor shall provide free discharge of it by trenches and drain to an appropriate point of disposal as directed.

2.4.7 Footing Trenches: Where soil conditions will permit, footing trenches may be excavated to the exact dimensions of the concrete, and side forms omitted. Place footings and foundations upon undisturbed and firm bottoms; fill with concrete any excess cut under footings and foundations. Fill excess cut under slabs with gravel and thoroughly compact.

2.5 FILL UNDER FLOOR SLABS ON GRADE:

2.5.1 Where fill is required to raise the subgrade for concrete floor or terrace slabs to the elevations indicated on drawings, such fills shall be of earth or bank-run gravel, placed and compacted as specified. Either earth or bank-run gravel shall be used for fills not exceeding 30 cm deep; only bank-run gravel or other approved material shall be used for fills greater than 30 cm. The type and quality of material for fills shall be approved by the Supervisor. The placing and compaction of fill under slabs after foundation walls are in place shall be coordinated with the backfilling against the outside of the walls, or walls shall be adequately braced to prevent damage.

2.5.2 Before depositing fill, remove all loam, vegetation and other unsuitable material from areas to receive fill. Do not deposit fill until the subgrade has been checked and approved by the Supervisor. In no case shall fill be placed on a subgrade that is muddy. Deposit fill material in horizontal layers not exceeding 30 cm in depth before compacting.

Spread fill evenly and compact each layer by uniformly rolling, pneumatic tamping or by other approved equipment to 90 percent maximum density at optimum moisture content over the entire area.
If necessary, soil shall be moistened, or allowed to dry to the correct moisture content before compaction. The finished compacted areas shall be brought to a reasonable true and even plane at the required elevations and shall be approved by the Supervisor prior to further construction operations thereon.

2.6 BACKFILLING FOR BUILDINGS AND STRUCTURES:

2.6.1 Backfill against foundation walls only after the slab has been poured to support the top of the wall and approval of the Supervisor has been obtained. Place and compact backfill so as to minimize settlement and avoid damage to the walls and to waterproofing and other work in place.

2.6.2 Before placing fill, remove all debris subject to termite attack, rot or corrosion, and all other deleterious materials from areas to be backfilled. Deposit backfill in layers not more than 30 cm thick. All fill material shall be reasonably free from roots, plaster, bats and unsuitable material. Stones larger than 10 cm, maximum dimension shall not be permitted in the upper 15 cm of fill. Place the fill material in successful horizontal layers, in loose depth as specified, for the full width of the cross section.
Thoroughly compact each layer by rolling or pneumatic tamping after a light sprinkling with water. The finished subgrade shall be brought to elevations indicated and sloped to drain water away from the building walls. Fill to required elevations any areas where settlement occurs.

SECTION 3
FOUNDATION WORK

3.1 IN-SITU CONCRETE PILE FOUNDATION WORK:

3.1.1 Scope of Application:

This paragraph applies to in-situ concrete foundation work for mechanical excavation.

3.1.2 Engineer:

(a) An engineer shall be assigned for pile foundation work.

(b) The engineer shall be a person who has sufficient ability to control piling operation and shall be approved by the Supervisor as to his qualification by submitting his past record in support of his ability.

3.1.3 Materials, etc.:

(a) Reinforcing steel

(1) Reinforcing bars shall be as shown in the drawings.

(2) Except for the followings, the fabrication and assembling of reinforcing bars shall comply with the requirements of Section 4.

(i) Reinforcing bars shall be assembled in such manner that the intersections of the principal bars and the hoop iron shall be tied with binding wire of not less than 0.8 mm in diameter and not less than three reinforcing rings made of steel plate 6 mm x 30 mm shall be placed inside of the principal bars per section of bar length. The reinforcing rings shall be welded to the principal bars for their entire width.

(ii) Welding shall be either manual or semi-automatic arc welding and shall be carried out in compliance with the requirements of paragraph 7.5.4. Spot welding or

track welding of the rings to the principal bars shall not be permitted.

(iii) Sections of a length of reinforcing bars shall be spliced with each other with binding wire and welded together wherever necessary to withstand external forces that may be exerted upon when the assembled reinforcing bars are lowered into position in a drilled hole.

(iv) Assembled reinforcing bars shall be provided with spacers to maintain a clearance between the hole wall and the reinforcing bars. The spacers shall be made of steel bars of not less than 13 mm in diameter if a casing tube is used and shall be made of 3.2 mm x 30 mm steel plate if a casing tube is not used.

(b) Concrete

(1) Concrete shall be of the type shown in the drawings.
(2) Air entraining agent shall be used as an additive.

3.1.4 Method of Work;

Except for the followings, the method of work shall comply with the specifications prepared by the specialist contractor.

(a) The wall of the drill hole shall be protected from caving in by use of stabilizing solution (bentonite solution) or a casing tube extending the entire depth of underground water, the application of either of which shall comply with the specific instructions.

(b) The pile tips shall penetrate into the bearing layer for not less than 1 meter.

(c) Confirmation of the depth of drill hole and the bearing layer for correctness.

(1) The first drill hole shall be regarded as a trial excavation. Drilling of holes shall be carried out with reference to the known soil data. After completion of drilling, the depth of drill hole and the bearing layer shall be inspected by the Supervisor for correctness.

(2) The entire drill hole shall be confirmed of their depth and bearing layer and the records of these data shall be submitted to the Supervisor.

(d) After the data mentioned in (3) above have been confirmed of their correctness, slime accumulated at the drill hole bottom shall be completely removed. The assembled reinforcing bars shall then be lowered into position and concrete placed immediately.

(e) Removal of slime shall be subject to the approval of the Supervisor, relative data being submitted to him in advance.

(f) Assembled reinforcing bars shall be protected and held in place against upward displacement.

(g) Concrete shall be placed with a tremmie pipe in such manner as to prevent the stabilizing solution, ground water and soil from mixing with concrete. The end of the tremmie pipe shall be kept in concrete for not less than 2 m deep at all times during placing of concrete.

(h) Concrete shall be placed continuously to prevent voids from developing in the pile.

(i) An extra fill of not less than 1 m thick shall be placed at the pile head if a large amount of water exists in the drill hole and an extra fill not less than 500 mm thick, if small amount of water exists in the drill hole.

(j) Control of stabilizing solution

(1) A dispersing solution shall be used as the stabilizing solution.

(2) Items of quality test for stabilizing solution shall comprise viscosity, specific gravity, pH value, sand contents and salt contents (where the project is near the beach).

(3) The quality test for the stabilizing solution to be used for trial drill hole shall cover the entire items mentioned in (ii) above. For the subsequent holes, the stabilizing solution shall be tested only for viscosity and specific

gravity. If the quality of the stabilizing solution changes remarkably or if the soil conditions change remarkably, the stabilizing solution shall be tested for the entire items.

(4) After completion of the quality test, the test results shall be submitted to the Supervisor for his approval.

(k) Mud contents in the stabilizing solution shall be trapped by settling basin and shall be disposed of according to the pertinent laws and regulations.

3.1.5 Treatment of Pile Heads:

After the concrete has been curved for more or less 14 days, the pile heads shall be chipped off flat at the specified elevation in such manner as shall not damage the pile proper.

3.2 GRAVEL FOUNDATION WORK:

Gravel shall be crushed stones with the maximum size of 45 mm. Gravel shall be spread over the excavated bottom in specified thickness. Compaction shall comprise three passes of rammers followed by two passes of soil compactors or one pass of vibrating roller. Compaction shall be performed within the width of the equipment used for compaction. Surface irregularities caused by compaction shall be finished flat with filling gravel.

3.3 BRICK FOUNDATION WORK:

Bricks shall be of the first class product.
Sand shall spread in specified thickness over the excavated bottom and shall be compacted with a hand tamper or a rammer. Bricks shall be laid on the sand base by tapping them into place with a wooden hammer in one layer and the joints filled with sand.

3.4 CONCRETE ON GRADE:

The strength and the thickness of concrete on grade shall be as shown on the drawings.

SECTION 4

REINFORCED CONCRETE WORK

4.1 SCOPE OF WORK:

4.1.1 Extent: The work required under this section consists of all reinforced concrete work and related items necessary to complete the work indicated on drawings and described in specifications.

4.2 SHOP DRAWINGS:

4.2.1 General: Submit shop drawings for reinforcing steel and formwork to the Supervisor for approval. Obtain approval of drawings prior to fabricating any material or proceeding with the work.

(a) Reinforcing Steel Drawings: Shop drawings for reinforcing steel shall indicate bending diagrams; assembly diagrams, splicing and laps of rods; shapes, dimension and details of bar reinforcing and accessories. Scaled dimensions from structural drawings shall not be used in determining the lengths of reinforcing rods.

(b) Formwork Drawings: Shop drawings of formwork for all reinforcing concrete constructions shall be submitted for approval. Shop drawings shall be complete in all respects and shall show the general arrangement, sizes and grades of lumber, panels, alignments, etc. They shall indicate schedules of placement, construction and control joints with their methods of forming; locations of inserts, tees, sleeves, and other items. The Contractor shall also submit for approval drawings or description of the method of shoring and reshoring and other horizontal concrete members.

4.3 SAMPLES:

4.3.1 Upon signing the Contract and from time to time as required the Contractor shall provide and deliver to the testing laboratory

indicated by the Supervisor, at his own expense, samples of the cement aggregates and reinforcements he proposes to use.

(a) After the initial test of concrete and before the commencement of work, samples of sand and aggregate intended to be used are to be submitted to the Supervisor for approval. The quantities to be submitted are to be as follows:

Sand - 6 kg, gravel (coarse aggregate): 9 kg

which should be representative of consignment. Where a sample is rejected as unsuitable, all material from that consignment must be immediately removed from site. Periodical tests will be taken by the Supervisor to see that the quality of material is maintained and conforms to the standard of the approved samples held.

(b) Submit samples in duplicate of all classes of reinforcement with manufacturer's test certificates.

(c) All sampling shall be done by or under the supervision of the Supervisor.

4.4 MATERIALS:

4.4.1 Portland Cement: All cement used in the works is to be portland cement of an approved brand and is to comply with BS 12, ASTM C 150 or JIS R 5210 or equivalent equal.
The bags shall contain 50 kg net ±1% and barrels or containers shall contain multiples thereof.
The cement shall be delivered to the site by the Contractor in the original sealed and branded bags or containers of the manufacturer in batches not exceeding 100 tons and shall be stored in a proper manner off the ground and in fully closed room with roofing to prevent deterioration. Each batch shall be stacked separately and used in the order of delivery. No cement shall be used which has been manufactured more than six (6) months prior to its proposed use on the site.

4.4.2 Aggregates: The aggregates for use in the production of concrete shall be naturally-occuring materials, crushed or uncrushed, and shall be of quality, grading and shape as specified hereinafter. It is to be clean, hard, durable and free from dust, earth, slag or any other deleterious matter.

(a) Coarse aggregate:

(1) Brick chip shall be the first grade brick material.

(2) Crushed stone shall be 20 mm or smaller in nominal size.

(3) The maximum size of the coarse aggregate shall be not larger than one-fifth of narrowest dimensions between the sides of forms of the member for which the concrete is to be used, nor larger than three-fourths of the maximum clear spacing between reinforcing bars.

(b) Fine aggregate:

Fine aggregate shall be 2.5 mm or smaller in nominal size.

(c) The grading of the aggregate shall be such as to permit the production of sound dense concrete of the strength specified. The final grading approved by the Supervisor shall not varied without his permission.

Following tables indicate standard grading of aggregate;

(1) Coarse aggregate

Coarse Aggregate Nominal Size	Sieves(mm)	Percentage by Weight Passing Sieves								
		50	40	30	25	20	15	10	5	2.5
Crushed stone 20 mm or smaller					100	100 ∫ 90	-	55 ∫ 20	10 ∫ 0	5 ∫ 0

(2) Fine aggregate

Fine Aggregate, Nominal Size	Sieves(mm)	Percentage by Weight Passing Sieves						
		10	5	2.5	1.2	0.6	0.3	0.15
Sand 2.5 mm or Smaller		100	100 ∫ 90	100 ∫ 80	90 ∫ 50	60 ∫ 25	30 ∫ 10	10 ∫ 2

(d) The choice and preparation of sites for stockpilling of

aggregates, the number and sizes of stockpiles and the method adopted to prevent segregation of component sizes shall be agreed with the Engineer.

Coarse aggregate shall be stockpiled in separate gradings. When aggregates of different gradings are stockpiled close together, the stockpiles shall be separated by bulkheads. Stockpiles are to be on concrete or other hard surface sufficiently sloped so that water is not retained in the base of the stockpiles. All aggregates are to be handled from the stockpile in such a manner as to secure a typical grading of the material, care being taken to avoid crushing the aggregates and contamination with extraneous matter.

4.4.3 Water: To be clean, free from dirt, vegetable matter, mineral salts or other impurities.

4.4.4 Steel Reinforcement: The steel reinforcement to concrete shall be clean and free from all defects, loose rust, scale or coating that will reduce bond.

(a) Reinforcing

Reinforcing bars to be used shall be deformed bars specified below.

Deformed bar with D16 and over	To comply with SD35 (JIS G 3112)
Deformed bar with D10 and D13	To comply with SD30 (JIS G 3112)

Where so specified on drawings, mild steel bars of local make shall be used.

(b) Manufacturer's test certificates for all classes of reinforcement shall be supplied. Specimens sufficient for three tensile tests and three cold-bend tests per ten tons of bars or fraction thereof and for each different size of bar shall be sampled under the supervision of the Supervisor. Testing shall be in accordance with BS 785 or other approved standard and batches shall be rejected if the average results for each batch are not in accordance with the specifications.

(c) Unless otherwise approved by the Supervisor, all reinforcing bars shall be obtained from one manufacturer.

4.4.5 Accessories: Accessories for concrete work shall be of the types approved by the Supervisor and include all spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place. Metal accessories shall be galvanized where legs will be exposed in finished concrete surfaces.

4.4.6 Asbestos Cement Pipes and P.V.C. Pipes: Asbestos cement pipes to be installed in foundation for water circulation shall conform to JIS A 5301 or shall be of material approved by the Supervisor. P V.C. pipes to be installed for air and water circulation, and drain shall conform to JIS K 6741 or shall be of material approved by the Supervisor. They shall be fixed to the forms prior to depositing of concrete. Dimensions and locations shall be as shown on drawings.

4.4.7 Expansion Joint Fillers: Expansion joint fillers shall be asphalt impregnated fiberboard as "Maruesu Board" manufactured by Nisshin Kōgyō Co., Ltd. or equal. Joint sealer shall be asphalt conforming to JIS A 6011, Type 4 or materials approved by the Supervisor. Expansion joint fillers may be of wood boards of a species appropriate for the purpose and approved by the Supervisor.

4.4.8 Protect all reinforcement and other materials until used.

4.5 FORMWORK:

4.5.1 Forms shall be of wood, well constructed and of sufficient strength to safely sustain construction loads and shall conform to the shape, lines and dimensions of the concrete as shown on the drawings. Forms shall be set to line and grade and so constructed and secured as to produce true lines, and shall be substantial and sufficiently tight to prevent leakage of mortar, special care shall be used to prevent bulging.
Forms for all concrete work shall be constructed with special care

to secure a smooth workmanlike finish on all surfaces for concrete work which is to remain exposed.

Do not coat forms with material that will stain or cause injury to exposed concrete surfaces or to plaster applied direct to concrete.

4.5.2 Provide access openings for cleaning and inspecting forms and reinforcing. Before placing concrete, the forms shall be throughly cleaned of all shavings, wood blocks and other undesirable matter, and shall be wet down before concrete is deposited.

4.5.3 Forms for exposed concrete beams, girders and columns shall provide for a 2.5 cm radius or flat bevel on external corners. Form materials for fair face finish surfaces shall be of wrought timber/board, mortised and tenoned, or other approved materials to make the uniformly smooth concrete surfaces. Where indicated, provide the forms with wrought wood ribs of shape, and in sizes and spaces as shown on drawings to produce the decorative grooved surface finish. Form ties used for exposed concrete surfaces shall be of type approved by the Engineer. Construct forms for beams, girders and lintels so that sides may be removed without disturbing bottom of form or its support.

4.5.4 Where soil conditions will permit excavation to accurate sizes without bracing, side forms for footings may be omitted and the sides of excavation shall be lined with waterproof paper, or 0.15mm thick polyethylene film.

4.5.5 Proper shoring shall be provided under the forms for concrete work to support all construction loads, and reshoring shall be provided for all floor slabs after stripping. Supports for forms shall consist of wood or steel posts of a size and spacing as required to support the weight of the forms, concrete, reinforcement and construction live load. Each post shall be well braced. Reshoring shall be installed simultaneously with stripping. The Contractor shall be responsible for the adequacy of the number and location of reshores. As the support of the ground floor form work will, in general, rest on compressible material, particular

care must be exercised to prevent settlement of those support. Forms shall not be removed until a through examination indicates that the floors have developed ample strength to carry the load put upon them, as approved by the Supervisor.

(1) The formwork shall be left in position before easing and removal for the following minimum period:

	Position	Period (days) Mean air temperature More than 15°C
Forms	Foundation, Sides of Beams/Girders Columns, Walls	3
	Soffits of Beams and Slabs	6
Supports	Under Slabs	17
	Under Beams/Girders	28

(2) Formwork shall be left in place and not disturbed for a longer period than above stated if so required by the condition of the concrete, by severe weather conditions or by the lack of adequate protection, as determined by the Supervisor, however, the Contractor shall be responsible for any injury to the work and any damages caused by or arising from the removal or striking of moulds, centering and supports.

4.6 INSERTS AND FASTENING DEVICES FOR OTHER WORK:

4.6.1 Provide for installation of inserts, conduit, pipe sleeves, drains, hangers, metal ties, shelf angle supports, anchors, bolts, angle guards, stair nosings, dowels, thimbles, anchor slots, metal reglets, nailing strips, blocking, grounds and other fastening devices required for attachment of other works. Properly locate in cooperation with other trades and secure in position before concrete is poured. Where openings are left in concrete for the passage of ducts, the openings shall be made slightly larger than the duct size as directed by the Supervisor. Do not install sleeves in any concrete girder, beam, joist or column except after approval of the Supervisor.

4.7 PREPARING AND PLACING REINFORCEMENT:

4.7.1 Reinforcement shall conform accurately in size and position to the requirements of the drawings.

Place reinforcement accurately in position shown, securely fasten and support to prevent displacement before or during pouring.

4.7.2 Reinforcement shall be supported on wire chairs or other approved supports. At intersections, the rods shall tightly bound together by use of annealed iron binding wire.

4.7.3 Before being placed, all reinforcement shall be cleaned loose of rust, scale or coating of any kind which will reduce the bond between the steel and concrete.

4.7.4 Before pouring concrete, the reinforcement shall be inspected by the Supervisor for approval.

4.7.5 Concrete Covers to Reinforcement: Minimum concrete covers to reinforcement shall be as shown on drawings.

4.8 STRUCTURAL CONCRETE:

4.8.1 Concrete shall be a mixture of cement, fine aggregates, coarse aggregates and water, and as specified hereinafter.

4.8.2 Mix proportions of concrete shall be planned on the basis of the table of concrete strength (Table 4.8.3) and be approved by the Supervisor.

For inspections, tests and other matters necessary for the control of concrete strength the Supervisor instructions shall be followed.

4.8.3 Concrete strength:

Table 4.8.3

Marking	Type of concrete	Aggregate	28-day minimum compressive strength of test piece kg/cm^2
FC210	CAST IN SITU	Crushed store	210
FC180	EXCEPT ABOVE	Brick chip	180

4.9 BATCHING AND MIXING OF CONCRETE:

4.9.1 All materials for concrete shall be accurately measured. Cement shall be batched by weight and the water by weight or volume. Each size of aggregate shall be measured in by means of gauge boxes/containers of sizes approved by the Supervisor.

4.9.2 Concrete shall be mixed in a batch mixer of a type approved by the Supervisor and in good condition having a drum rotating about a horizontal or inclined axis. Continuous mixers shall not be used. Each mixer is to be fitted with a water measuring device having an accuracy within one percent (1%) of the quantity of water required for the batch. The water measuring device shall be such that its accuracy is not affected by variations in the water supply pressure.

The batch shall be so charged into the mixer that some water (about 10%) enters the drum in advance of the cement and aggregates. Water shall then be added gradually while the drum is in motion such that all required water shall be in the drum by the end of the first quarter of the mixing time. The concrete shall be mixed until a mixture of uniform color and consistency is obtained. Where double-drum, high performance mixers of a type approved by the Supervisor are used, a minimum mixing time of 70 sec. may be allowed.

The amount of concrete mixed in any one batch is not to exceed the

rated capacity of the mixer. The whole of the batch is to be removed before materials for a fresh batch enter the drum.

4.9.3 On cessation of work, including all stoppages exceeding 20 minutes, the mixers and all handling plant shall be washed with clean mixing water. If old concrete deposits remain in the mixer drum, it shall be rotated with clean aggregate and water prior to production of new concrete.

Concrete mixed as above is not to be modified by the addition of water or in any other manner to facilitate handling or for any other reason.

4.10 DEPOSITING CONCRETE:

4.10.1 Preparation: Before placing concrete, all debris and water shall be removed from the places to be occupied by the concrete. Wood forms shall be thoroughly wetted or oiled, and the reinforcement cleaned of oil or other coatings. Formwork and the placement of reinforcement, pipes, sleeves, conduit, hangers, anchors and other inserts shall be inspected and approved by the Engineer.

4.10.2 Placing: Concrete shall be rapidly handled from mixer to forms and deposited as nearly as possible in its final position to avoid segregation due to rehandling or flowing. In concrete placing, special care shall be taken not to disturb or displace the reinforcements, pipes, wooden bricks and other items to be embedded. Concrete work for high columns shall not be rushed out to the top within a short space of time. In normal cases, concrete for the beams shall be placed simultaneously up to overall depth of beam from the bottom to the slab top. Concrete shall be spadded and worked by hand and vibrated to assure close contact with all surfaces of forms and reinforcement and leveled off at proper grade to receive finish. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used. All concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud or dry porous earth. Concrete in bearing walls and

columns shall be placed and allowed to settle two (2) hours before placing concrete superimposed thereon.

4.10.3 Vibration: Concrete shall be placed with the aid of mechanical vibrating equipment. Vibration shall be applied directly to the concrete unless otherwise approved by the Supervisor. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete into place.

Vibration shall be applied at the point of deposit and in the area of freshly placed concrete. It shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures but shall not be long enough to cause segregation of the mix. To secure even and dense surfaces, free from aggregate pockets or honeycomb, vibration shall be supplemented by hand spading in the corners and angles of forms and along form surfaces while the concrete is plastic under the vibratory action. Caution must be exercised when using vibrators and hand spades to prevent any injury to the inside face of the forms or any movement of the reinforcement.

4.11 CONSTRUCTION JOINTS:

4.11.1 Construction joints shall be formed as indicated on drawings, or as approved or directed by the Engineer. Dowels and keys shall be used where indicated or required.

4.11.2 The rate and method of placing concrete and the arrangement of construction joint bulkheads shall be such that the concrete between construction joints shall be placed in a continuous operation.

4.11.3 Joints in reinforced slabs, joists, beams and girders shall be perpendicular to the axis or surface of the member jointed and at the center of the span. If an intersecting member occurs at the point, the joint shall be located at a point of minimum shear.

4.11.4 Unless otherwise indicated by the Supervisor, construction joints in walls, columns, or piers shall be at the top of floor. Whenever it is necessary to stop a day's work, or for any reason, such stops

shall be located at center of slabs and of beams or as directed by the Supervisor.

4.11.5 A temporary wood bulkhead shall be erected so that the jointing will follow a vertical plane at right angles with the direction of the main reinforcement. To this bulkhead fasten a wood strip 5 cm thick and of width equal to one-third the depth of the concrete slab to form a tongue and grooved joint.

4.11.6 Before concreting is resumed, the surfaces of previously placed concrete shall be roughened, cleaned, wetted and slushed with grout immediately before additional concrete is placed. Grout shall be 1-part portland cement and 2-parts sand.

4.12 WEATHER CONDITIONS:

4.12.1 When the shade temperature is about 37°C and rising, special precautions shall be observed during concreting to the satisfaction of the Supervisor regarding the cooling of aggregates, the maintenance of the correct water-cement ratio, and the proper supervision of the work. Concreting shall not be permitted when the shade temperature is above 43°C.

4.12.2 Records shall be kept by the Contractor to show the date of placements, the mix used and the air temperature at time of concreting for the various portions of the work. These records shall be available to the Supervisor when requested.

4.13 PROTECTION AND CURING:

4.13.1 Freshly placed concrete shall be protected from rain, dust storms, chemical attack, and the harmful effects of heat, wind, flowing water, vibrations and shocks. This protection shall continue until the concrete is sufficiently set such that it is no longer damaged by these factors. The Supervisor shall determine when the protection is no longer required, but in any case this shall not be less than 24 hours after the time of placing.

4.13.2 Concrete shall be cured for at least seven (7) days and as required by the Supervisor. Concrete and cement finishes shall be

sprayed during the curing period as frequently as drying conditions may require. Cover the surfaces of the concrete and the cement finishes with cotton mats, canvases or other approved membrances within 24 hours after placing or finishing and maintain in good condition until the installation of permanent floor covering unless otherwise directed. Covering shall be of a type that will not stain or discolor finished concrete surfaces.

Timber formwork covering the concrete shall be moistened with water at frequent intervals to keep it from drying during the curing period. Metal formwork exposed to the sun must be shaded from its direct rays, painted white or otherwise protected during the curing period.

4.14 PATCHING FORMED SURFACES OF EXPOSED CONCRETE:

4.14.1 After the forms have been removed, all concrete surfaces shall be inspected and any pour joints, voids, stone pockets or other defective areas permitted by the Supervisor to be patched, and all tie holes, shall be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 25 mm with the edges perpendicular to the surface. The area to be patched and a space at least 15 cm wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. Do not fill or patch construction joints or surfaces to receive metallic waterproofing, unless specifically authorized by the Supervisor.

4.14.2 A grout of equal parts of portland cement and sand with sufficient water to produce a brushing consistency shall then be well brushed into the surface, followed immediately by the patching mortar. The patch shall be made of the same material and of the same proportions as used for the concrete except that the coarse aggregate shall be omitted. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one hour during which time it

shall be mixed with a trowel to prevent setting.

4.14.3 The mortar shall be thoroughly compacted into place and screeded off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of one to two hours to permit initial shrinkage before being finally finished. The patch shall be finished in such manner as to match the adjoining surface. Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted. For holes passing entirely through the wall, a plunger-type grease gun or other device shall be used to force the mortar through the wall.

4.14.4 Unexposed formed surfaces of concrete shall be patched as directed by the Supervisor.

4.15 FLOOR SLABS ON EARTH:

4.15.1 Concrete floor slabs on earth shall be placed over a well compacted subgrade. Fill under floor slabs shall be 15 cm thick after compaction, consisting of bank run gravel containing not more than 5% clay.

The bed shall be rolled until compacted to required thickness and leveled off to the correct elevation before placing leveling concrete to the thickness indicated on drawings.

4.15.2 Over concrete mats lay 0.15 mm thick polyethylene film, or lap joints 15 cm. Stretch and weight edges and laps to maintain their positions until concrete is placed. Do not displace the film. Immediately place concrete of required thickness and strike off at proper levels to receive finishes specified.

4.15.3 Except where otherwise specified or indicated, set continuous expansion joint strips where edge of slab abuts vertical surface; seal joint tightly around strips and spaces around pipes penetrating floors. Use coaltar pitch for sealing joints.

4.16 CEMENT FLOOR AND SLAB FINISHES:

4.16.1 General: Cement finished for floors and other slabs shall be of type specified for the various locations. Where the specific type of finish is not indicated or specified, provide a standard integral monolithic finish for slabs where a separate topping is not required, and provide a standard topping finish for slabs where a delayed separate topping finish is required.

4.16.2 Float Finish: Surfaces of slabs to receive membrane waterproofing shall have a floated finish. Screed surface of base slab and remove surface water and laitance. Floating shall be minimum necessary to produce a smooth even texture surface. Perform floating by hand using a wood float or by power driven float of the metal disc type. Slabs shall be accurately sloped to drains as required.

4.16.3 Separate Topping Finish: Separate delayed topping finish of 30 mm thickness shall be applied to the hardened base slab for all locations where a separate cement topping finish is required.

(a) Treatment of Base Slabs: Where a delayed separate cement topping is applied to the hardened and cured slab, strike the base slab below the finished floor elevation as noted on drawings. Before slab hardens, remove all dirt, laitance and excess water from surface and roughen slab with wire broom or lightly rake to provide bond for the topping.
Where waterproofing is required between the base slab and topping, the base slab shall have a floated finish. Just prior to placing topping, remove loose particles of sand and dirt with stiff broom or wire brush. If required, roughen slab by an approved method to provide a mechanical bond. Remove oil or grease spots by washing with 10% solution of muriatic acid or strong washing sode. After cleaning, hose down slab with pressure hose and keep wet for at least six (6) hours. Allow slab to dry until surface water has disappeared. On the wet slab surface, apply a thin neat cement grout, broomed into slab surface a short distance ahead of topping mixture. Spread topping mixture as hereinafter specified to proper thickness.

(b) Mixes: Standard topping mix shall consist of 1-part portland cement and 3-parts sand. Not more than 15.14 liters of mixing water shall be used for each bag of cement.

(c) Mixing: Except as otherwise specified, mixing shall be done in a mechanical batch type mixer and mixing shall continue for at least 1-1/2 minutes after all ingredients are in the mixer. The concrete shall be of the driest consistency possible to work with a sawing motion of the strike-off board, or straightedge. The mix may be slightly varied as directed by the Supervisor, but in no case shall the volume of the coarse material be less than 1-1/2 times the volume of the fine; in no case shall the specified amount of mixing water be exceeded.

(d) Finish: Compact topping and float to true surface with wood or power driven disc floats. After concrete has hardened sufficiently to prevent excess fine material from working to the surface, it shall be steel troweled to a smooth even finish free from defects and blemishes. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of topping to absorb moisture or to stiffen the mix. After the concrete has further hardened, floors that will be left exposed or uncovered shall have additional trowelling to produce a dense hard finish, free of trowel marks. The finished floor surface shall be sufficiently even to the satisfaction of the Supervisor.

4.16.4 Integral Monolithic Finish: Integral monolithic finish shall be provided for floors indicated on drawings. Apply an integral monolithic finish of mix and workmanship as specified herein to the base slab after it has dried firm, but not yet set.

(a) Produce standard integral finish by striking surfaces of 30 mm thick concrete added on structural slabs at proper level. Roll or tamp the concrete to force aggregate away from surface and then screed. After screeding and while the concrete is still plastic, float the surface with wood, cork, or metal

floats or with a power finishing machine. During this operation the surface shall be brought to a true grade by cutting down high spots and filling low spots. Care shall be taken not to overwork the plastic concrete. When the concrete has hardened so that water and fine material will not be worked to the surface, finish with a steel trowel to a smooth and even surface within the tolerances specified and suitable to receive the floor covering specified. Exterior steps and platforms shall be given a float or brushed finish as directed. Do not sprinkle dry cement or a mixture of dry cement and sand directly on the surface to absorb moisture or to stiffen the mix.

(b) The finished surface for integral finished floors shall be sufficiently even to the satisfaction of the Supervisor.

4.17 CEMENTED CHIP BOARD:

4.17.1 Cemented chip board cast onto the soffits of concrete floor slabs shall b 50 mm in thickness, and the product as approved by the Supervisor.

4.17.2 Cemented chip board shall be fixed onto the horizontal surfaces of form for slabs, butt jointed, horizontally, rectangular or parallel to lines of girders/beams.

4.17.3 Forms to receive cemented chip board shall be so constructed that the concrete floor slab should have correct elevations and thickness as shown on drawings.

4.17.4 Anchors as indicated on drawings shall be fixed at more than four points in each wood concrete slab to prevent peeling off due to defective placing of concrete.

4.17.5 Other
Drawings shall be referred to for wood cement slabs 80 mm in thickness.

4.18 PRECAST CONCRETE WORK:

4.18.1 Scope of work:

This section applies to manufactured simple precast concrete such as that for use in parapet copings.

4.18.2 Materials:

(a) Materials for precast concrete shall comply with the specifications set forth in Section 4.

(b) Deformed bars and round bars shall comply with JIS G3112 (Round steel for reinforced concrete) where so specified on drawings, mild steel bars of local make may be used.

(c) Reinforcing wires shall be 3.2 mm and over in diameter.

(d) Formworks shall have adequate resistance to such external forces as construction loads, weight of concrete lateral pressures and vibrations, shall be of such type as will not produce excessive strain, warping and other harmful effects, and shall provide an adequate finish.

(e) Fixtures shall be installed as shown on drawings.

4.18.3 Method of placing:

(a) Mix

(1) Mix proportions of concrete shall be such that adequate strength, workability, uniformity, and durability may be obtained.

(2) Standard design strength (F_O) of concrete shall be compressive strength at 28 days as specified.

(3) Required slump shall be not more than 8 cm.

(b) Fabricated shuttering boards shall have surfaces finished smooth and free from unevenness, warping, scratches, openings and other defects.

(c) Fabrication of reinforcing bars

(1) Bar arrangement shall be determined in accordance with shop drawings and if necessary, calculations shall be submitted to the Supervisor for approval.

(2) Reinforcing bars shall be arranged in the specified shape, and the intersections of bars shall be fastened sufficiently tight and, if necessary, welded.

(3) Protective coverings for reinforcing bars shall be more than 20 mm in thickness.

(d) Mixing of concrete shall be done in accordance with the provisions of Section 4.

(e) Before placing concrete the interiors of formwork shall be cleaned, and concrete shall be deposited with a vibrator in all parts of the formwork.

4.18.4 Curing, etc.:

(a) Precast concrete shall be cured by spraying of water or submersion until it attains sufficient strength.

(b) Precast concrete shall be protected with sheeting or other means until it attains sufficient strength. If necessary the concrete shall be cured with steam.

(c) Supports shall be used for storage of precast concrete, and care shall be exercised to prevent stains, twists, cracking and breakage.

SECTION 5
STEEL WORK

5.1 GENERAL:

5.1.1 Scope of Work:

This section applies to the works for which rolled steel shapes are used as principal structural members.

5.1.2 In-house test:

(a) Rolled steel shapes which have passed the in-house test by the manufacturers shall be used. The test results shall be submitted to the Supervisor for his approval. Provided however, rolled steel shapes not for heavy duty use may be exempt from the in-house test and the test results only may be submitted to the Supervisor with his prior consent.

(b) Criteria for the in-house tests by the manufacturers shall be approved by the Supervisor.

5.2 MATERIALS:

5.2.1 Rolled Steel Shapes:

Rolled steel shapes shall conform to the requirements of the following standards and the quality and designation of standard products shall be as shown on the drawings.

JIS G3101 (Rolled steel shapes for ordinary structures)
JIS G3444 (Carbon steel pipes for ordinary structures)
JIS G3466 (Square steel pipes for ordinary structures)

where so specified on drawings, mild steel bars of local make may be used.

5.2.2 High-tension bolts:

(a) High-tension bolts shall be classified into "High-tension bolts specified by JIS" and "Special High-tension bolts".

(b) High-tension bolts specified by JIS

(1) A set of bolt, nut and flat washer shall be the product satisfying the requirements of JIS B1186 (A set of hexa-

gonal bolt, nut and flat washer of high-tension bearing).

(2) The kind of the bolt set shall be type 2 (F10T) and the kind by tightening torque shall be such as to be suitable for the work.

(c) Special high-tension bolts

(1) Special high-tension bolts shall be high-tension bolts capable of being tightened easily which are not specified by JIS.

(2) The kind of the special high-tension bolts and that of the bolt set shall be as specifically instructed.

(3) The bolt set shall pass the in-house test by the manufacturers according to their in-house standards, which shall be equivalent to JIS B1186.

5.2.3 Welding Materials:

Welding materials shall comply with the requirements of Table 5.2.1 and shall be of good quality suitable for welding purpose selected according to the welding conditions.

Table 5.2.1 Welding Materials

Nomenclature	Standards
Covered electrode	Standard products conforming to JIS Z3211 (Covered electrode for soft steel) Standard products conforming to JIS Z3212 (Covered electrode for high-strength steel)
Carbon dioxide arc welding wire	Standard products conforming to JIS Z3312 (Carbon dioxide arc welding wire)
Submerged arc welding wire	Standard products conforming to JIS Z3311 (Submerged arc welding wire)

5.2.4 Ordinary Bolts:

(a) Material for bolts, nuts and washers shall be standard product conforming to JIS G3101 Type 2 (SS41).

(b) Bolts and nuts shall be standard product of class 3 medium

of the following standards.

JIS B1180 (Hexagonal bolts)

JIS B1181 (Hexagonal nuts)

JIS B0205 (Ordinary metric pitch threads)

(c) Washers shall be standard product of polished finish conforming to JIS B1256 (Flat washers).

5.2.5 Anchor Bolts:

(a) Quality of anchor bolts shall conform to the requirements of paragraph 5.2.1.

(b) Threads on the bolts shall be class 3 ordinary metric pitch threads specified by JIS B0205.

5.2.6 Material Tests:

(a) In principle, JIS standard products shall not be subjected to material tests. Rolled steel shapes of JIS standard shall be approved by the Supervisor by means of standard quality certificate submitted to him.

(b) Rolled steel shapes other than JIS standard products shall be subjected to tests specified below. Test shall be made on the rolled steel shapes of different sectional area. Provided, however, test may be omitted for any steel shape weighing less than 2 tons a piece.

(1) Method of test shall be such as to be suitable for the material designated according to JIS.

(2) Frequency of tests shall be such that one test shall be made for steel shapes weighing 20 tons or less a piece and one test for each 20 tons or fractions exceeding the first 20 tons for each different sectional area.

(3) Kinds of tests and number of test pieces to be prepared per test shall be as shown in Table 5.2.2.

Table 5.2.2 Kind of test and number of test piece required

Kind of steel shapes \ Kind of test	Tensile test	Bending test	Elongation test
Rolled steel shapes other than below	1	1	-
Steel pipe	1	1	1
Square steel pipe	1	-	-

(c) Special high-tension bolts shall be tested according to JIS B1186. Provided, however, test may be omitted in the following cases.

(1) When the production control method and the results of control tests of the product are submitted to and approved by the Supervisor.

(2) When the product is used for light-duty work and the approval of the Supervisor is obtained as to omission of the tests.

(d) Principal welding materials other than the standard products of JIS shall be approved by the Supervisor by submitting to him data certifying that the materials are of good quality suitable for welding. Provided, however, minor welding materials may be exempt from submitting the data with the consent of the Supervisor.

5.3 FUBRICATION, GENERAL:

5.3.1 Shop Drawings:

(a) Shop drawings of the part to be fabricated shall be prepared based on the drawings and submitted to the Supervisor for his approval.

(b) Full-size drawings (including templates and rulers) shall be prepared for test by the Supervisor.

(c) Gauges, pitches and clearance of high-tension bolts and rivets

shall be as shown in the drawings .

5.3.2 Confirmation of the basic tape measure for correctness:
In large scale steel construction, basic tape measure used for shop fabrication of rolled steel shapes shall be checked against the basic tape measure for field use to confirm that error, if any, does not cause any trouble in steel construction.

5.3.3 Marking-off:

(a) Marking off shall be carried out accurately by use of shop drawings, full-size drawing, templates and rulers.

(b) High-strength steel shapes and the outside of steel shape to be bent shall not be injured by chisels and punches. Provided,however, marking by chisels and punches may be permitted at the part to be fused by welding or to be cut off.

5.3.4 Cutting and Bending:

(a) Unless designated, the cutting face of steel shapes shall be perpendicular to the axis.

(b) Gas cutting shall, in principle, be automatic gas cutting. If manual gas cutting is carried out by unavoidable reasons, cutting shall be done accurately true to shape and size and trimmed with a grinder .

(c) Shearing shall be permitted for steel plate of not more than 9mm thick.

(d) Injurious irregularities, burrs and notches on cut surface shall be trimmed or removed.

(e) Bending shall be performed under normal temperature or by heating. Bending by heating shall be performed in red-heated condition and quick cooling shall not be permitted.

5.3.5 Correction of Strain:

Strain in the unfabricated steel shapes or in the assembled component shall be corrected during fabricating process in such manner as shall not damage the material.

5.3.6 Holes for Reinforcing Steel Bars:

(a) Holes through which reinforcing steel bar passes shall be as small as possible and shall be 3 to 6 mm larger than the diameter of the steel bar passing.

(b) Holes shall be drilled in the shops.

5.3.7 Fixing of temporary Members:

If it is necessary to fix a temporary members on rolled steel shapes or if it is necessary to drill holes on rolled steel shapes for temporary works, such operation shall be approved by the Supervisor.

5.4 HIGH-TENSION BOLTING:

5.4.1 Confirmation of Torque Coefficient

High-tension bolts specified by JIS and special high-tension bolts brought to the project site shall be subjected to torque coefficient tests. Provided, however, if the bolts are used for light duty work, torque coefficient test may be omitted with the consent of the Supervisor.

5.4.2 Bolt Length:

(a) The length of high-tension bolts shall be that of the shank which shall be the sum of tightening length and the values shown in Table 5.4.1. Variety of length shall be kept to a minimum.

Table 5.4.1 Values to be added to tightening length

Designation	Values to be added to tightening length
M16	Not less than 30
M20	" " " 35
M22	" " " 40
M24	" " " 45

(b) The length of special high-tension bolts shall be such as to be suitable for tightening length and the variety of the length shall be kept to a minimum.

5.4.3 Standard Bolt Tension:

Standard bolt tension shall be as shown in Table 5.4.2.

Table 5.4.2 Standard Bolt Tension (t)

Designation / Type of Bolt	M16	M20	M22	M24
Type 2 (F10T)	11.7	18.2	22.6	26.2

5.4.4 Bolt Holes:

(a) The diameter of bolt holes shall be the sum of the bolt diameter and the value shown in Table 5.4.3

Table 5.4.3 Value to be added to Bolt Diameter (mm)

Bolt diameter	Value to be added to bolt diameter
Less than 20	1.0
Exceeding 20	1.5

(b) Bolt holes shall be drilled at the shop.

5.4.5 Handling of Bolts:

(a) Bolts shall be stored with care and kept free from damage, rust, sticking of foreign matter and spoils.

(b) Bolts shall be delivered to the project site with their package unbroken and unpacked immediately before use.

(c) Bolts used for test and adjustment of equipment shall not be re-used.

5.4.6 Treatment of Friction Surface:

(a) Friction surface shall be cleaned of mill scales by means of sand blast or grinding and shall have rust developed uniformly

on the entire surface.

The friction surface shall also be kept free from burrs, warps and depressions caused by grinding.

(b) Filler plates shall be treated in the same manner as the friction surfaces. Development of rust shall be confirmed on the filled plates welded to structural members.

(c) Burrs and warps on the contact face of bolt heads and washers shall be finished smooth by grinding.

5.4.7 Assembling:

(a) Friction surfaces shall be protected with care. Scales, oil, paints and dusts which may cause reduction of friction shall be removed before assembling.

(b) Clearance exceeding 1mm caused by the difference in the thickness of members to be joined shall be filled with filler plates.

(c) If the surface of the member to be joined has a slope larger than 1/20 against the bolt head or nut, a tapered washer shall be used.

(d) Bolt holes which do not match after assembling shall be matched with a reamer. Burrs left by reamer operation shall be carefully removed. For matching the bolt holes, use of drift pins that may cause burrs or deformation of the member shall not be allowed.

5.4.8 Tightening and Test Equipment:

(a) Tightening and test equipment shall be of the type suitable for the bolts and shall be inspected and maintained in good condition at all times.

(b) Equipment liable to changes in torque such as torque control impact wrenches shall be adjusted of their tightening force in the morning and in the afternoon before the start of the work. Adjustment shall continue until the torque error becomes ±7% of the required torque. Record of adjustment shall be submitted to the Supervisor for his approval.

5.4.9 Tightening:

(a) General

(1) Before the members are joined together, they shall be bolted together temporarily so that the members come to a close contact. This temporary bolting shall be performed with care when special high-strength bolts are used. The number of temporary bolts shall be not less than 1/3 of the permanent bolts or not less than two.

(2) Prior to tightening, bolts shall be confirmed of their length, quality and nominal size for their fitness to the work.

(3) Tightening of bolts shall be commenced outward from the center.

(b) High-tension bolts specified by JIS

(1) Bolts shall be fit into the hole and tightened first by hand. Then preliminary and final tightening by equipment shall follow.

(2) Preliminary tightening shall be performed with 70% of the standard bolt tension. Final tightening shall be performed with 100% of the standard bolt tension.

(3) Bolts which have been tightened preliminarily shall be marked together with nuts, washer and members.

(c) Special high-tension bolts

(1) Tightening shall be performed by use of equipment suitable for the bolts in a manner recommended by bolt manufacturers.

(2) When a large number of bolts are to be tightened, preliminary tightening stipulated in (b) above shall be performed.

5.4.10 Tightening Test:

(a) Tightening test for high-tension bolts specified by JIS

(1) Test shall be conducted after final tightening.

(2) By the change in the position of the matching mark made at the time of preliminary tightening, completion of final tightening or loosening of bolts shall be confirmed.

(3) Tightening test shall be performed with a torque wrench by tightening the nut and the torque shall be measured when the nut starts to turn.

(4) Number of bolts to be tested shall be not less than 10% of the entire number of the bolts or not less than one. If the test shows a satisfactory result, number of the bolts to be tested thereafter may be reduced with the consent of the Supervisor.

(5) Torque shall be regarded as passing the test if it satisfies formula 5.4.1

$$0.9\ To \leq T \leq 1.1\ To \quad \ldots\ldots\ldots\ (5.4.1)$$

$$To = \frac{k \times d_1 \times No}{1{,}000} \quad \ldots\ldots\ldots\ (5.4.2)$$

Where; T : Torque at time of test (kg·m)

To : Standard torque (kg·m)

K : Torque coefficient

d_1 : Outside diameter of threads on bolt (mm)

No : Standard bolt tension in Table 5.4.2 (kg)

(6) If a bolt of unsatisfactory torque is found, the entire group of the bolts shall be re-tightened. Overtightened bolts shall be replaced.

(7) Bolts loosened while other bolts are tightened shall be re-tightened.

(b) Tightening test for special high-strength bolts

(1) Test shall be conducted after final tightening.

(2) Completion of final tightening shall be confirmed by partial breakeage or deformation of the bolts.

(3) After final tightening, bolts shall be confirmed of their shape and size for their appropriatness. Grip bolts shall be confirmed by measuring gauge.

(c) Test records shall be submitted to the Supervisor for tightening test.

5.5 WELDING WORK:

5.5.1 Scope of work:

This paragraph applies to manual arc welding (hereafter called manual welding), semi-automatic gas shield arc welding (hereafter called semi-automatic welding) and automatic submerged arc welding (hereafter called automatic welding).

5.5.2 Welding Control and Facilities:

(a) Before manual welding and semi-automatic welding are carried out, document showing past records of welding works, welding work control organization, equipment and facilities and in-house standards for workmanship and test shall be submitted to the Supervisor for his approval as to performance and control ability of the welding shop.

(b) Before automatic welding is carried out, documents mentioned in (a) above shall be submitted to the Supervisor and a test suitable for the welding work to be performed, where necessary, shall be performed for his approval.

5.5.3 Welding Specialist:

(a) A welding specialist charged with guidance and supervision of the welding work shall be stationed on the job. Provided however, if the welding work is of simple nature, the welding specialist need not be present with the consent of the Supervisor.

(b) The welding specialist shall be a qualified person for the work certified by the Japan Welding Association, whose qualification certificate shall be submitted to and approved by the Supervisor.

5.5.4 Welder:

(a) A welder shall be a person who possesses the following skills suitable for the work, whose workmanship certificate and other required data shall be submitted to and approved by the Supervisor.

(1) For manual welding, the requirements of JIS Z3801 (Method of test and its judging standards for welding test).

(2) For semi-automatic welding, the requirements of JIS Z3841 (Method of test and its judging standards for semi-automatic welding test).

(3) For automatic welding, the basic class of (1) above and records of works certifying the workmanship and welding skill.

(b) If any doubt arises as to the workmanship and skill of the welder, a test suitable for the work shall be given to find his qualification.

5.5.5 Preparation of Parent Metal:

(a) Depending on the experience of the shop, shape of beveling may be changed slightly with the consent of the Supervisor.

(b) Beveling shall be performed either by automatic gas cutting or by machine. Inaccurate beveling or irregular beveling shall be corrected.

(c) Welding rods and electrodes shall be handled with care and shall be kept free from pealing of coat, damage, deterioration, moisture and remarkable rust. Welding rod shall be carefully protected against moisture.
Welding rods exposed to moisture shall not be used.

5.5.6 Clamping of Parent Metals:

(a) Clamping of parent metals shall be done by use of suitable clamps. Special care shall be exercised in maintaining the roof width and contact part. Defective contact shall be corrected.

(b) Sequence of clamping shall be such as to minimize the deformation and restraints caused by welding and inverse straining method shall be adopted as much as possible.

(c) If high-strength bolts are concurrently used, high-strength bolting shall precede the welding operation.

(d) Tack welding shall be performed as follows.

(1) Tack welding shall be avoided from such places as may cause difficulties in welding operation or may weaken strength of weld, for example ends of joint, corners, starting and finishing point of permanent welding.

(2) Minimum number of tack welding shall form a part of permanent weld, and defective welding shall be grounded off completely.

(3) Tack welding shall avoid short bead and the minimum length shall be as shown in Table 5.5.1.

Table 5.5.1 Minimum length of tack welding (mm)

Plate thickness	Minimum length of welding	
	Manual and Semi-Automatic Welding	Automatic welding
Less than 3.2	Not less than 30	Not less than 40
Exceeding 3.2 but less than 25	Not less than 40	Not less than 50
Exceeding 25	Not less than 50	Not less than 70

5.5.7 Cleaning of Parent Metals:

Parent metals to be welded shall be cleaned of objectionable matter such as water, oil, slug and paint. Provided however, scale mills and paint which is not objectionable to welding and not removed with a tough wire brush need not be removed.

5.5.8 Welding Operation:

(a) General

(1) Welding equipment and its accessories shall be of such construction and performance as to be suitable for the welding condition and shall be capable of safe and satisfactory welding.

(2) Parts to be welded shall be free from harmful defects and shall be as smooth as possible.

(3) The effective length of welds shall be from the starting point of uninterrupted welds including crators.

(4) The sequence of welding shall be such as to minimize the deformation and restraints caused by welding operation.

(5) Welding position shall be flat whenever feasible by adjusting the position of the parent metal.

(6) Pre-heating shall be performed, where required, taking into consideration the quality and thickness of the parent metals and temperature.

(7) Treatment of end tabs

(i) In case of butt welding, partial fusion and fillet welding, end tabs of sufficient length shall be used at the weld ends. Provided however, if the weld is not subjected to heavy duty and defects can be avoided by projection welding, end tabs need not be used with the consent of the Supervisor.

(ii) Concealed end tabs shall be cut off, leaving a length of 3 to 5 mm.

(iii) Exposed end tabs shall be removed and the cutting surface finished in such manner as shall not damage the sectional surface.

(8) Removal of slug shall be carried out carefully at each pass and after completion of welding.

(9) Remarkable spatters and the spatters on which paint is applied shall be removed.

(b) Butt welding

(1) When backing metal is not used, welding shall be performed from the front side and after the back chipping has been completed, root running shall be performed. If sufficient weld penetration is insured by automatic welding, back chipping may be omitted with the consent of the Supervisor.

(2) A minimum excess metal shall be left at the welded part. The height of the exess metal shall be made as small as possible to form a gentle slope and shall be not more than 3 mm in manual welding and 4 mm in semi-automatic and automatic welding.

(3) T joints shall be provided with fillets not less than 1/4 the thickness of the metal to be butted and not more than 10 mm in throat.

(4) When there is a slight offset at the buff of the parent metals because of the difference in plate thickness or width, excess metal shall be left for smooth transition of the surfaces. When the offset exceeds 4 mm in manual and semi-automatic welding or when the offset exceeds 3 mm in automatic welding, the thicker parent metal shall be planed off with a slope of not more than 1/5 to match the offset. Provided however, in case of I-bevel the offset shall be a maximum of 3 mm for semi-automatic welding.

(c) Partial penetration welding

(1) Unless shown in the design drawings, partial penetration welding shall not be permitted.

(2) A minimum excess metal shall be left on the welded portion. The height of the excess metal shall be as mentioned in (b)(2) above.

(3) First pass of welding shall be performed with care to insure the required penetration.

(d) Fillet welding

A minimum excess metal shall be left on the welded portion. The height of the excess metal shall be as small as possible and shall be not more than 0.1S + 1m (S being the specified size).

5.5.9 Test after Completion of Welding:

(a) After completion of welding, the welded work shall be tested according to the following particulars and the test results submitted to the Supervisor for his approval.

(1) Removal of slug on the welded surface shall be confirmed.

(2) Welded work shall be inspected to confirm that it is flawless.

(3) The size and shape of the deposited metal shall be measured.

(4) Penetration test shall be carried out if required.

(5) All of part of supersonic test, X-ray test and macro-structure test using end tabs shall be carried out in a limited area if required.

(6) If the tests mentioned above are carried out over an extended area, special instruction shall be observed.

(b) Upon completion of the above tests, inspection by the Supervisor shall be conducted.

5.5.10 Correction of Defective Weldment etc.:

(a) Correction of defective weldment

(1) Harmful defects such as poor fusion, poor penetration, mixing of slug, pits and blow holes which are found on the welded joints shall be removed and re-welded.

(2) Welded joint with cracks shall, in principle, be removed of deposited metal along the entire length of the joint and re-welded. Even when the limit of the cracks is known by appropriate test, deposited metal shall be removed for not less than 50 mm from the end of the crack and the joint re-welded.

(3) Undercuts, insufficient filling of crators, insufficient size of deposited metal and insufficient welding length shall be corrected.

(4) Excessive overlap and deposited metal shall be removed.

(5) Weldment showing remarkably poor appearance shall be corrected.

(b) Parent metal with cracks caused by welding shall be replaced.

(c) The diameter of welding rods or electrodes used for correction of defective weldment shall be not more than 4 mm.

5.5.11 Protection against Weather:

(a) No welding is allowed if the temperature surrounding welding work is below -15°C.

(b) No welding is allowed if the parent metal is wet with rain or snow or when the wind is strong. Provided however, if sufficient protective measure is taken, welding shall be permitted.

5.5.12 Painting of Field-Welded Work:

(a) Shop painting is not permitted for approximately 200 mm on both sides from the part where field welding is to be performed Provided however, painting harmless to welding may be permitted.

(b) Appropriate rust-proofing treatment shall be given on the parts to be field-welded where remarkable rusting is expected.

5.5.13 Accident Prevention:

Sufficient preventive measure shall be taken against accident arising from current leak, electric shock and electric arc and against fire from molten metal and electric arc.

5.5.14 Welding for the Related Works:

Unavoidable welding on the rolled steel shapes for performance of related works shall be carried out by a welder with skills mentioned in paragraph 5.5.4 with the approval of the Supervisor after it has been confirmed that such welding does not give adverse effect on the steel shapes.

5.6 PAINTING:

5.6.1 Painting:

(a) Painting shall conform to the requirements of Section 14.

(b) Steel sleeves welded to steel frame and used for reinforced concrete construction shall have their interior painted with anti-corrosive paint.

(c) No painting is permitted on the following parts.

(1) Part to be embedden in the concrete.
(2) Friction surface where high-tension bolts are used.
(3) Underside of base plates.
(4) Inside of closed section to be enclosed.
(5) Parts where painting is not suitable.

5.7 ANCHOR BOLTS:

5.7.1 General:

(a) Centering of anchor bolts shall be carried out true to base lines by use of a template and appropriate tools.

(b) Bolt holes on base plates shall have diameters not more than the sum of the bolt diameters and 5 mm.

(c) Bolts shall be provided with double nuts and washers. The threads on bolts shall conform with the requirements of 5.2.6. The tip of the bolt shall appear out of the nut by not less than three threads.

5.7.2 Holding of Bolts:

(a) Bolts shall be held in position accurately by use of templates and shall be fixed in place so that no movement or swing of the bolt tip shall occur.

(b) Bolts shall be positioned in place by use of steel bars or fixed to formes by use of appropriate material before placing concrete.

5.7.3 Curing:

Bolts shall be handled in such way that no bending is caused by impact. For prevention of damage to the threads, development of rusts and spoiling, bolts shall be wrapped with cloth and vinyl-tapes.

5.7.4 Finishing of levelling mortar for column base:

(a) Levelling mortar shall be spread with a thickness of 30 mm and the proportion by volume shall be one part cement to one part sand.

(b) Laitance shall be removed from teh concrete surface and the surface shall be roughened.

(c) Levelling mortar shall be spread in such manner that prior to erection of column, hard-mixed mortar shall be placed under the base plate at its center in required thickness and mortar shall be filled sufficiently under the entire underside of the base plate after the column has been erected. Provided however, if the size of the base plate is smaller than 300 m square, mortar shall be spread smooth to the required thickness, on which the column may be erected.

5.8 DELIVERY AND ERECTION OF STEEL FRAMES:

5.8.1 Delivery and Preparation for Erection:

(a) Steel members shall be delivered to the project site in the order of erection. Curing shall be carried out whenever required.

(b) Bends and warps of the members shall be corrected before erection.

5.8.2 Erection:

(a) Erection shall be carried out according to a fully studied program as to the sequence of erection and the need for reinforcement of frame during erection and in such manner as to insure safety of structure until the members are permanently joined against wind pressure, dead weight and special loads.

(b) Temporary bolts shall have the same diameter as for the permanent bolts and rivets. The number of bolts used for temporary tightening shall be not less than 1/3 of the entire number of permanent bolts or rivets and not less than two. High-tension bolts shall serve as temporary bolts mentioned in 5.4.9 (a). For welding, the entire number of the temporary bolts shall be tightened.

(c) If large loads such as materials or equipment is imposed on the steel frame, appropriate reinforcement shall be made.

(d) Steel members liable to bending when lifted shall be appropriately reinforced.

(e) Before the steel members are finally joined, warps shall be corrected and erection inspected by the contractor and the test results shall be submitted to the Supervisor for his approval.

5.8.3 Safety Control:

Equipment and tools of sufficient capacity shall be used for erection. Installation, maintenance and operation of erection equipment shall be properly carried out. Full measure shall be taken for safety of workers and accident prevention by proper maintenance of related facilities and imposition of restriction on the surrounding works.

5.9 LIGHT STEEL CONSTRUCTION:

5.9.1 General:

This paragraph applies to steel construction for which cold-rolled light steel shapes are used.

5.9.2 Materials:

(a) Steel shapes

(1) Light gauge steel shapes shall be the standard products made of SSC41 conforming to the requirements of JIS G3350 (Light steel shapes for ordinary structure) and those of 5.2.7 (a).

(2) Round steel bars shall be the standard products made of SR24 conforming to the requirements of JIS G3112 (Steel bar for reinforced concrete) or the standard products made of SS41 conforming to the requirements of JIS G3101 (Rolled steel shapes for ordinary structure).

(3) Products other than the standard products of JIS shall be subjected to tests mentioned in 5.2.7 (b).

(b) Electrodes for arc welding shall be the standard products conforming to the requirements of JIS Z3211 (Coated electrode for arc welding for soft steel) or to the requirements of JIS Z3210 (Coated electrode for arc welding for steel sheet). The diameters of the electrodes as related to the thickness of parent metals shall be as shown in Table 5.10.1.

Table 5.10.1 Relation between the diameter of electrodes and the thickness of the parent metals (mm)

Diameter of electrodes	Thickness of parent metals
ϕ 3.2	Above 2.3
ϕ 2.6	Below 2.3

5.9.3 Method of Work:

(a) Pitch and bolt hole clearance for high-tension bolts, ordinary bolts and rivets shall be as shown in the drawings.

(b) Light gauge steel shapes shall be cut on a machine.

(c) Tubular members shall be capped at ends with same material as the tube proper.

(d) Ordinary bolting shall be performed as follows.

(1) The diameter of bolt holes shall be not more than 1.0 mm beyond the bolt diameters.

(2) Bolts shall be provided with double nuts to prevent loosening.

(3) Shear bolts shall be provided with washers to prevent the threads from touching the grip. Bolt tip shall extend out of the nut by not less than three threads.

(4) Bolts for fitting purlins and furring strips need not conform to the requirements of (2) and (3) above. Provided however, threades on the bolts shall extend out of the nut by not less than three threads.

SECTION 6
MASONRY

6.1 SCOPE OF WORK:

6.1.1 Extent: The work required under this section consists of all masonry and related items necessary to complete the work indicated on drawings and described in specifications.

6.2 SHOP DRAWINGS:

6.2.1 All shop drawings shall be submitted tothe Supervisor for his approval. These drawings shall show in detail the construction of all points of the work, including reinforcement, masonry joints and lintels, exact dimensions, kind of material to be used, and all other pertinent information. Furnish shop drawings in sufficient time and with such details and accuracy that the Engineer can approve dimensions of door frames and other items in advance of the actual execution of the work.

6.3 SAMPLE MATERIALS:

6.3.1 Samples of Material: Prior to installation, submit to the Supervisor for approval three (3) individual samples.

(a) Burnt clay bricks.
(b) Anchors and ties.

6.4 MASONRY MATERIALS:

6.4.1 Burnt Clay Bricks: Unless otherwise directed by the Supervisor,all bricks shall be made in Bangladesh. They shall be made of clay, and shall be hard, sound, square and clean with sharp well-defined arises and shall have sizes of follows:

Length: 247.65 mm (9'3/4")
Width : 120.65 mm (4'3/4")
Height: 69.85 mm (2'3/4")

6.4.2 Concrete Lintels: Except where steel or precast lintels are indicated, lintels in masonry walls and partitions shall be fabricated of reinforced concrete (M-150) in situ as shown on drawings, linetels shall

be built in place and the jointing of lintel units shall match the adjacent wall units.

6.4.3 Anchors and Ties: Anchors and ties shall be of zinc-coated steel, and shall be as shown drawings. Unless otherwise indicated, the cavity wall ties shall be of the butterfly twist type of 10 gauge mild steel wire zinc-coated. The length of ties shall be approximately 8 cm less than the total thickness of the wall.

6.4.4 Reinforcing Rods: Steel rods for lintels and other reinforcement not specified otherwise shall be as specified in "CONCRETE WORK."

6.5 MORTAR MATERIALS:

6.5.1 Portland Cement: See "CONCRETE WORK"

6.5.2 Sand: Sand to be used for mortar shall be clean and sharp. It shall be chemically and structurally stable and shall comply with the Table of Gradings given below.

Table of Grading - Percentage by Weight Passing Sieves						
Nominal Size of Sieves, mm	5	2.5	1.2	0.6	0.3	0.15
Sand, %	-	100	100∿50	80∿30	45∿15	10∿2

6.5.3 Mixing Water: See "CONCRETE WORK"

6.6 STORAGE OF MATERIALS:

6.6.1 Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Store cement in watertight sheds with elevated floors. Protect reinforcement from the element; immediately before placing reinforcement shall be free from loose rust, ice or other foreign coatings that will destroy or recuce the bond. Masonry units shall be protected against wetting prior to use.

6.7 CEMENT MORTAR:

6.7.1 Cement mortar shall consist of one part of Portland cement to four parts of sand by volume and shall, when a mortar plasticizer is to be used, consist of one part of Portland cement to six parts of sand by volume.

6.7.2 Plasticizers for mortar shall be of a manufacturer approved by the Engineer, and shall be used in strict accordance with the manufacture's instructions.

6.8 MIXING MORTAR:

6.8.1 Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes. Adjust the consistency of the mortar to the satisfaction of the mason but and only as much water as is compatible with convenience in using the mortar. If the mortar begins to stiffen from evaporation or from absorption of a part of the mixing water, retemper the mortar immediately by adding water, and remix the mortar. All mortar shall be used within 1-1/2 hours of the initial mixing. It shall not be used after it has begun to set.

6.9 PRECAUTIONS AND GENERAL REQUIREMENTS:

6.9.1 Before closing up any pipe, duct or similar inaccessible spaces or shafts with masonry, remove all rubbish and sweep out the area to be enclosed.

6.9.2 Where fresh masonry joints masonry that is partially set or totally set, clean the exposed surface of the set masonry and wet it lightly so as to obtain the best possible bond with the new work. Remove all loose units and mortar. If it is necessary to "stop off" a horizontal run of masonry, this shall be done by racking back one-half brick length in each course.

6.9.3 Consult other trades and make provisions that will permit the installation of their work in a manner to avoid cutting and patching. Build in work specified under other sections, as necessary, and as the work progresses. Set lintels in beds of mortar. Fill spaces around jambs and heads of door bucks and frames solidly with mortar. Build-in anchors and clips for windows.

6.10 LAYING BRICKS:

6.10.1 All brickwork shall be set out and built to the dimensions shown on drawings.

6.10.2 All bricks shall be properly spread with mortar before being laid and all joints shall be thoroughly flushed up solid through the full thickness of the wall at each course as the work proceeds.

6.10.3 All burnt clay bricks shall be soaked with water before being used and the tops of walls left off shall be wetted before work is recommenced. The faces of walls shall be kept clean and free from mortar droppings and splashes.

6.10.4 Unless otherwise indicated or directed, the gauge shall be ten courses to 70 cm for burnt clay brick walls.

6.10.5 Walls which are to be mortar shall have the horizontal joints raked out to a depth of 1-1/2 cm to form a key.

6.10.6 Walls shall be carried up regularly without leaving any part more than one meter lower than another unless the permission of the Supervisor is first obtained. Work which is left at different levels shall be racked back.

6.10.7 The courses of brickwork shall be properly levelled. The perpendicular joints shall be properly lined and jambs and other angles plumbed as the work proceeds.

6.10.8 All walls shall be thoroughly bonded in accordance with the best constructional practice and as directed by the Supervisor. Broken bricks shall not be used except where required for bond.

6.10.9 Build-in flashings, flashing blocks, access panels and other work at locations indicated on drawings.

6.11 CAVITY WALLS:

6.11.1 Cavity walls shall be built to the dimensions shown on drawings and the two thicknesses shall be bonded together with cavity wall ties spaced one meter apart horizontally and approximately 40 cm apart vertically and staggered. Extra ties shall be provided at reveals and openings.

6.11.2 Keep cavity air space and cross ties of reinforcing free of mortar drippings by using a continuous wood or metal strip set up temporari-

ly on wall anchors. Raise strip as the wall is built up.

6.11.3 Provide weep holes in horizontal joints of facing wall directly above wall flashings. Space weep holes 60 cm apart horizontally. Form holes by pressing short lengths of oil-soaked 8 mm diameter braided cotton sash cord into the mortar bed while soft. When the mortar has set, pull the cords from wall.

6.11.4 The cavity shall be kept clear by lifting screeds or other means approved by the Supervisor and shall be left clean at completion.

6.12 MISCELLANEOUS ITEMS:

6.12.1 Where cast-in-place lintels are used in masonry unit partitions, or back up, they shall be formed in place with special shaped bond-beam or lintel unit as hereinbefore specified. Lintel shall be reinforced as detailed and filled with Type M-150 concrete. Lintels shall have a minimum of 20 cm bearing at ends. Provide temporary support under lintels as necessary.

6.12.2 All brick walls shall be bonded to columns by means of wall ties of the butterfly type 3.2 mm mild steel wire, zinc coated, or of the type approved by the Supervisor, which are previously cast into concrete. The ties shall be 20 cm long, with 8 - 12 cm inbedded into the wall at rate of one tie each five courses of brickwork.

SECTION 7
WATERPROOFING

7.1 SCOPE OF WORK:

7.1.1 Extent: The work required under this section consists of all waterproofing, and related items necessary to complete the work indicated on drawings and described in specifications.

7.2 GENERAL REQUIREMENTS:

7.2.1 The waterproofing and dampproofing work shall be performed by a contractor who is regularly engaged and specializes in work of the character required by the Contract and in the application of the materials specified herein. Material shall be delivered to the site in manufacturer's original unopened containers with manufacturer's brand and name clearly marked thereon.

7.2.2 The materials and methods shall be as specified herein, unless they are contrary to the manufacturer's directions or to approved trade practice; or unless the Contractor believes they will not produce a watertight job which he will guarantee as required. Where any of the above conditions occur, the Contractor shall notify the Engineer in writing. Deviation from the procedure specified will be permitted only upon the Supervisor's approval and providing the work is guaranteed by the Contractor.

7.2.3 If, prior to beginning work, the Contractor does not notifythe Supervisor in writing of any proposed changes, it will be assumed that he agrees that the materials and methods specified will produce the results desired, and that he will furnish the required guarantee.

7.3 LIME TERRACING:

7.3.1 Lime terracing (7:2:2) = (crushed bricks : lime : brick surky) shall be slowly finished to the illustrated thickness on concrete slab according to the local customs, being followed by finishing into 12 mm thick lime mortar (1:2).

7.4 WATERPROOFING MORTAR FINISHING:

7.4.1 The waterproof agent shall be any product of the following manufacturers or equivalent or better, and samples, reference data, and execution specifications shall be submitted to the Supervisor for approval and selection. The work shall be performed under the resposibility of the manufacturer concerned.
Material shall be the product of the manufacturer designated in Appendix (1) or equivalence thereof.

The work for waterproofing mortar-finish may be altered, upon approval by the Supervisor, by any other locally inherent method (such as lime terracing method) which shall be deemed effective for waterproofing.

SECTION 8
PLASTERING WORK

8.1 GENERAL

8.1.1 Preparation of the Surfaces to Receive Plastering Work:

(a) Concrete surfaces or other layers of plaster to receive plastering work shall be cleaned and appropriately dampened to prepare for the next layer of plaster.

(b) Loose surface to receive plaster shall be immediately repaired.

8.1.2 Curing:

(a) To protect the adjoining part or other finished surface from being soiled, these part or surface shall be covered with paper, wooden boards or canvas sheets.

(b) To prevent the plastered surface from being soiled and from premature drying, room windows shall be glazed or the plastered surface shall be covered with canvas sheets or dampened.

8.1.3 (a) Construction joints of concrete or places where cracks are likely to develop, shall be covered with cement mortar with metal lath.

(b) Joints of plaster work on the surface of different materials shall be provided with joint strips or bordering strips.

8.1.4 Samples:

Color and texture of plastering work shall be approved by the Supervisor by submitting a sample book or sample board.

8.2 TREATMENT OF SURFACE TO RECEIVE PLASTER

8.2.1 Treatment with Cement Mortar of Surface to Receice Plaster:

(a) Deformed or irregular surfaces of walls or floors made at concrete or brick shall be roughened and finished smooth with cement mortar to be left for not less than 7 days. This period may be reduced depending on the weather conditions.

Surfaces of remarkable deformation shall be repaired smooth by applying wire fabric and concrete using fine aggregate (fine pebbles).

(b) Following the treatment mentioned in (a) above, the surfaces shall be treated as follows.

(1) Outdoor concrete surfaces shall be washed with water by means of brushes to remove foreign matter that may be detrimental to bonding of cement mortar.

(2) Indoor concrete wall surfaces shall be washed clean with water by means of brushes. Provided, however, if washing is difficult because of construction time available, the surfaces may be dampened with water and scrubbed clean with brushes with the approval of the Engineer.
Plywood panel surfaces shall be cleaned and applied with cement paste of 1 to 2 mm thickness. If necessary water-retaining agent may be used in the application of cement paste.

(3) Concrete floor surface shall receive cement paste as soon after as the concrete is hardened. If the concrete is left hardened for a long time, the surface shall be washed and applied with cement paste by using brushes, rubbing the cement paste sufficiently on the surface.

8.3 APPLICATION OF MORTAR

8.3.1 Materials:

(a) Cement shall conform with the requirements of 6.2.1. Provided, however, Type B mixed cement may be used for trowel finish of floor mortar.

(b) White cement shall conform with the requirement of JIS R5210 (Portland cement).

(c) Additives shall be slaked lime for plastering, plaster, pozzolan and asbestos powder, etc. Materials affecting the color of the mortar shall not be used as additives for colored mortar.

(d) Sand shall be of good quality and shall be free from salt, mud, dust and organic matter of harmful quantity. Grading shall be such as to have a mixture of fine and coarse grains in appropriate proportion.

Table 8.3.1 Grading of Sand

Grading (°/Wt)	Place of Application
Percentage passing 5 mm sieve 100 0.15 mm sieve less than 10	Scratch coat, lathing, surface smoothing and brown coat.
Percentage passing 2.5 mm sieve 100 0.15 mm sieve less than 10	Finish coat

(e) Water shall be pure and free from injurious amount of salt, iron, sulfur and organic matter.

(f) Water retaining agent shall be methyl cellulose of specified manufacturer. Volume of use shall confirm with the manufacturer's specifications.

(g) Pigment shall be of inorganic nature and alkali resistant and shall show little discoloration against direct sunlight and non-corrosive to metal.

(h) Grading of color sand shall conform with the requirements of Table 8.3.1.

8.3.2 Proportioning and Thickness of Coating:

(a) Proportioning of mortar shall conform with the requirements of Table 8.3.2.

(b) Thickness of mortar coating shall be as follows:

(1) For ordinary application, the requirements shall be as shown in Table 8.3.2.

(2) For light application, the thickness may be reduced to 20 mm for floors and 15 mm for indoor walls by special instructions.

(3) For floors overlying water proofing layer or for risers, the thickness shall be not less than 15 mm.

Table 8.3.2 Proportioning (Volumetric Ratio) and Thickness of Coat (mm)

Grounds	Place		Scratch Coat, and Lathing		Smoothing and Brown Coat		Finish Coat			Thickness of Coat (mm)
			Cement	Sand	Cement	Sand	Cement	Sand	Additive	
Concrete, Concrete blocks and Bricks	Floor	Finish	-	-	-	-	1	2.5	-	30
		Grounds	-	-	-	-	1	3	-	
	Interior walls		1	2.5	1	3	1	3	As required	20
	Exterior walls, etc (excl. ceiling)		1	2	1	3	1	3	-	25
Lath sheet, Wire lath, Metal lath	Interior walls		1	3	1	3	1	3	As required	15
	Exterior walls		1	3	1	3	1	3	-	18

(Note) 1. When lathing, fibrous filler may be added where necessary.

2. In case of finish with linoleum sheet or vinyl floor tile, the thickness of floor mortar shall include the thickness of the finishing material.

3. Thickness of lathing shall not be included in the thickness of coat.

(c) Thickness of coat except for floor shall be more or less 7 mm.

(d) Additives shall be used in such quantity as not to give adverse effect to the strength of the mortar.

(e) Mortar shall be machine mixed. Provided, however, if the quantity is small, mortar may be mixed with hand.

8.3.3 Method of Work:

(a) Walls

(1) Scratch coat

(i) If cement paste is applied, treatment mentioned in 8.2.1 shall be given and scratch coat applied before the cement paste is dried.

(ii) Scratch coat shall extend the entire surface.

(iii) Lathing shall be performed with mortar coat approximately 1 mm thicker than the thickness of the lath.

(iv) Scratching shall be carried out with metal comb.

(v) Scratch coat and lathing shall be left for not less than 14 day until cracks are fully developed before applying brown coat. Provided, however, this period may be reduced depending on weather conditions with the approval of the Supervisor.

(2) Correction of uneven coat

(i) Correction shall be carried out if the coat is remarkably uneven.

(ii) If the correction is required locally, it shall be performed while the scratch coat is being applied in accordance with the procedure mentioned in (1) above.

(iii) If the correction is required for a comparatively large area, mortar applied for correction shall be scratched and left for not less than 7 days. Provided, however, this period may be reduced depending on the weather conditions.

(3) Brown coat

Brown coat at internal and external corners and round edges shall be applied with grounds to attain truly flat surfaces.

(4) Finish coat

After the brown coat is properly placed, finish coat shall be applied without trowel marks, paying due attention to the finish at the external and internal corners and around the edges.

(5) Kinds of finish

According to the places where plastering is performed the kinds of finish shall be as shown in Table 8.3.3.

Table 8.3.3 Kinds of Finish

Kinds of Finish	Place
Metal trowel	General plaster base, wall paper, plaster base for spray in office, waterproof plaster base.
Wooden trowel	Scratch coat to receive tiles, plaster base for spray in machine room, etc.
Brush	Cement plaster base for spray.
Wooden trowel or Brush	Plaster base for spray other than above.

(6) When a joint is provided, each section of the surface shall be divided accurately using a joint strip. After the finish is completed, the joint strip shall be removed and the joint finished.

(b) Floors

(1) When cement paste is used for plaster base, mortar plaster shall be applied immediately after the base is treated.

(2) Mortar plaster shall be applied true to lines and grades and shall be finished with a metal trowel. Provided, however, a wooden trowel may be used when the finish coat is of synthetic resin of comparative large thickness.

(3) Joints shall not be provided on the floor as a principle. Provided, however, if joints are provided, joints shall be impressed with an interval of 1.8 m for rooms and 3.6 m for corridors.

(c) Levelling mortar to receive tiles

(1) Thickness of the levelling mortar shall be determined depending upon the thickness of total finish or of tiles.

(2) Wall

(i) When tiles are applied on the mortar by pressure, or mosaic tiles are applied, the levelling mortar shall be applied as far as the brown coat.

(ii) When tiles are laid in stretcher course, the levelling mortar shall have a thickness of 6 mm (including the case in which metal lath is used).

(iii) When the wall is an exterior wall, expansion joints of not less than 10 mm shall be provided depending on the size of the tiles. The expansion joints shall be made of synthetic resin board of foam styrole and shall extend to bearing structure.

8.3.4 Application of Waterproofed Mortar:

(a) This paragraph applies to the places where light waterproofing is required.

(b) Waterproofing agent shall be the product of the manufacturer designated in Appendix (1).

(c) Proportioning shall be one part cement to two parts sand (volumetric) and the use of the waterpoofing agent shall be in conformity with the instructions of the manufacturer.

(d) When waterproofed mortar is applied on concrete surface, defective concrete surface shall be chipped off and patched with waterproofing mortar made of one part cement and two parts cement by volume. After the mortar has hardened, treatment mentioned in 8.2.1 shall be given.

(e) Waterproofed mortar shall be prepared with accurate measuring of materials and shall be well mixed together. Coat shall be applied in thickness of 15 mm with a trowel. For walls, two coats shall be applied.

SECTION 9
CARPENTRY AND JOINERY

9.1 SCOPE OF WORK:

9.1.1 Extent: The work required under this section consists of all carpentry and joinery and related items necessary to complete the work indicated on drawings and described in specifications.

9.1.2 Work not Included: The following items of work are included in other sections of this specification:

(a) Glazing, except as specifically included in this section.
(b) Finishing hardware, except as specified herein.
(c) Acoustical treatment, except as specified herein.
(d) Metal doors and frames, and metal windows.
(e) Concrete formwork.
(f) Cabinet work, except as specified herein.
(g) Folding partition.
(h) Building expansion joint filler.
(i) Finishing hardwares for wood doors and wood windows, except as specified herein.

9.2 SHOP DRAWINGS:

9.2.1 Submit shop drawings to the Supervisor for approval of all items of carpentry and joinery where so required herein. Obtain approval of drawings prior to proceeding with fabrication.

9.2.2 Shop drawings shall indicate the materials and species, matching of panels, arrangement, thicknesses, size of parts, construction, fastenings, blocking, clearances, assembly and erection details, applied finishes and surfacing, built-in hardware and necessary connections to work of other trades.

9.3 SAMPLES:

9.3.1 Submit samples in duplicate of the following materials or assemblies to the Supervisor for approval. Approval must be obtained prior to delivery or fabrication.

(a) Plywood.

(b) Asbestos cement board.

(c) Hardware to be used at toilet compartments.

(d) Insect screen.

9.3.2 Solid and veneered samples shall be typical of those proposed and shall show range, color, and grain to be furnished.

9.4 MATERIALS:

9.4.1 General:

(a) It should be noted that sizes shown on drawings are finished sizes.

(b) All timber shall be properly seasoned and shall be planed square, straight and true and shall be free from splits, shakes, cracks, splits, checks, loose or dead knots, insect attack including pinworm holes, or other defects.

(c) Timber shall be straight and true, and any warped or twisted timbers will be rejected.

(d) Unless otherwise indicated, carpentry work/structural timber work shall be executed in softwoods as follows:

Japanese cedar
(or hemlock
red cedar
white fir)

or other timber for structural use approved by the Supervisor.

(e) Timber to be used for joinery work shall, unless otherwise indicated, be hardwoods approved by the Supervisor.

9.4.2 Moisture Cotent (Average):

(a) Framing, sheathing, and exterior trim: 10%, not to exceed 19%.

(b) Interior finish woodwork: 6%, and not to exceed 12%.

9.4.3 Grades and Species of Wood:

(a) Grades and species of lumber, plywood, and joinery shall be as follows, except that grades and species hereinafter specified under specific items shall govern.

(1) Lumber and plywood shall be identified by the official grade-mark, except where grade-mark will interfere with the natural finish. In such case, the material shall be accompanied by a certificate of inspection issued by a lumber grading or inspection agency acceptable to the Supervisor.

(b) Framing and rough:

(1) Joists, built-up beams shall be first grade softwoods as Japanese cedar (or hemlock, red cedar, white fir) or equal.

(2) Studs, plate, ridge boards bracing, furrings for walls and ceilings, ground, cant strips, nailers, sleepers shall be second class softwoods as Japanese cedar (or hemlock, red cedar, white fir) or equal.

(c) Interior finish:

(1) Trim, door and window frames, window boards, ceiling boards, exposed solid wood parts of cabinet work or similar work shall be first grade hardwood approved by the Supervisor.

(2) Concealed solid wood parts of cabinet work or similar work shall be second grade hardwood approved by the Supervisor.

9.4.4 Plywood:

(a) Plywood shall be first grade imported material, approved by the Supervisor.

(b) Plywood shall consist of an odd number of plies arranged so that the grain of each layer is at right angles to the grain of the adjacent layer or layers. The plies shall be hot pressed during adhesion and shall have a minimum finished thickness of 6 mm, unless otherwise shown or specified.

(c) The face veneers shall be hard and durable and shall be capable of being finished to a smooth surface.

9.4.5 Decorated Plywood:

Decorated plywood faced with teak or equal shall be installed to wall as shown on drawings of V.I.P. room and shall be first grade manufactured in the factory which the Supervisor approves.

9.4.6 Miscellaneous Materials:

(a) Asbestos cement boards shall be 6.3 mm thick unless otherwise indicated on drawings and as manufactured by Nozawa, Corp. or equal.

(b) Gypsum plaster boards shall, unless otherwise indicate, be 9 mm thick and "Tiger Board" as manufactured by Yoshino Sekko Co., Ltd. or equal.

(c) Nailing blocks shall be first grade, Japanese cypress or equal.

(d) Bolts, spikes and other rough hardware, except as otherwise indicated or specified, shall be as required for the proper execution of the work under this section.

(e) Glue and adhesives:

(1) Glue for interior wood use shall be water resistant.

(2) Adhesive for installing cabinet works at damp places shall be waterproof.

(3) Adhesive for fixing nailing blocks on concrete or masonry walls shall be epoxide resin base glue specially fabricated for this sort of purposes.

9.5 WORKMANSHIP AND CONSTRUCTION (CARPENTRY):

9.5.1 Jointing: All framing shall be jointed or as is most appropriate in the circumstances. The joint shall be designed and constructed so that they will transmit the loads, and resist the stresses to which they will subjected, and the execution of all jointing shall be to the satisfaction of the Supervisor.

Unless otherwise indicated, all joints shall be secured with a suitable type and a sufficient number of nails.

A butt joint shall wherever be secured with nails driven from the far side of the flanking member (if any).

Surfaces are to be in good contact over the whole of the joint before fastenings are applied.

No nails, screws or bolts to be placed in any end split. If splitting is likely, to occur, holes for nails are to be pre-bored at diameters not exceeding 4/5 diameter of nail. Lead holes are to be bored for all screws.

Holes for bolts to be bored from both sides of the timbers of diameter 1.6 mm larger than that of the bolt. Nuts are to be brought up tight with care not to crush the timber under the washers.
Members of structural units shall be clamped and spiked together before drilling.

9.5.2 Coverings: Arrange and construct the framework so that all necessary support and fixing is provided for covering.

9.5.3 Frames: Every post, stud, beam, binder, joist, rafter and purlin shall extend in one piece between its supports or fixings, or shall otherwise be jointed in an approved manner to ensure the necessary structural stability.

9.5.4 Plates: Every plate shall, as far as possible, be in one piece between points of change of direction. Joints between continuing lengths, and at corners, shall be halved if the plates are in one thickness, or sufficiently lapped if the plates are in two thickness.
No plates shall be built into walls of masonry.
When the plates are supported over, or let into, the sides of studs, they shall be nailed to every stud. When they are to be laid over bearing walls of masonry or concrete, they shall be solidly bedded in cement mortar to the required level.

9.5.5 Anchors: trusses and other structures that require to be secured against displacement shall be suitably incorporated in the joints or by means of extra fixings at all points of support.

9.5.6 Beams and Binders: The timber is to be in one peace and in one length between supports. Joints between continuing length are to be suitably scarfed or spliced and secured with bolts and plates or metal straps.
Joints into or over posts are to be most appropriate type, and reinforced with metal straps where necessary to prevent displacement.

9.5.7 Strutting and Bracing: Where the framework is not otherwise restrained against lateral deformation, it shall be diagonally braced.
Lateral braces to restrain against winding and buckling shall be fixed to all beams of depth greater than 3 times their breadth and/or of length greater than 50 times their breadth. Lateral braces are to are to be at centres not exceeding 50 times the breadth of the beam.

9.6 FURRING:

9.6.1 Install furrings as shown on drawings and as specified herein.

9.6.2 Install with faces true to line and plumb, using wood shims as necessary.

9.6.3 (a) Metal ceiling suspenders and accessories shall be as follows:

(1) Cast iron inserts for mild steel rods/bolts hangers; Cast Iron Insert, Y-type as manufactured by Marui Sangyo Co., Ltd. or equal.

9.6.4 (b) Cast iron inserts or box type insert cases fabricated of zinc-coated sheet steel to be anchored in structural concrete ceiling slabs at bottoms shall be installed by nailing them onto formwork at the locations of ceiling hangers before concrete depositing. The locations of ceiling hangers shall be decided accurately according to the schedule of panelling shown on shop drawings, and shall be marked on formwork for concrete slabs before placing of reinforcement.

9.7 WORKMANSHIP AND FABRICATION (JOINERY/FINISH CARPENTRY):

9.7.1 All Exposed Faces: All timber that is to be exposed in the finished surfaces of joinery works shall be "wrought" and /or "sanded" on the appropriate face, unless otherwise specified.

9.7.2 Reasonable tolerance shall be provided at all connections between joinery works and the building carcass, whether of masonry or concrete construction, so that any irregularities, settlements or other movement shall be adequately compensated.

9.7.3 The Arrangement, jointing and fixing of all joinery works shall be such that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work, and not cause damage to contiguous materials or structures.

9.7.4 Perform all necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating, and all other works required for correct jointing.

Provide all metal plates, screws, nails and other fixings that may be ordered by the Supervisor,or that may be necessary for the proper

construction of all framings, linings, etc., and for their supports and fixing in the building.

9.7.5 The joinery/finish carpentry shall be constructed exactly as shown on drawings. Where joints are not specifically indicated they shall be the recognized forms of joints for each position. General notes are as follows:

(a) Cut shapes sharp and true.

(b) Built-up items shall be glued as well as nailed.

(c) Blind nail where possible.

(d) Set finishing nails, used on exposed faces, to receive putty.

(e) Install door and window trim in single lengths.

(f) Scribe, miter, and join accurately and neatly to detail.

(g) Machine sand with grain in shop, and finish with hand sanding. Leave free from machine or tool marks that will show through finish.

(h) Leave work free from defects in any exposed parts.

(i) Rout or groove back of flat trim members.

(j) Secure trim with fine finishing nails, using screws and glue where required to assure permanent, tight joints.

(k) Bring interior finish materials into building only after concrete and mortar are thoroughly dry.

(l) Paneling of boards or plywoods shall be as detailed on drawings, and shall be assembled as shown on the shop drawings as to jointing and pattern arrangement. They shall be mounted in straight line and visible joints to be equally wide.

(m) Holes for nails or screws in asbestos cement boards shall be drilles and must be not closer than 10 mm to edges. Nails or screws shall not more than 30 cm on centre apart.

(n) Mounting of gypsum wallboard shall be done with zinc-coated nails. Nails must be applied not closer than 10 mm to edges and not closer than 20 mm to corners.

(o) Plywoods of 9 mm thick and more shall be bonded to wood furrings with an approved synthetic resin adhesive. Unless otherwise indicated, joints shall be butt-joint. Plywood less than 9 mm shall be mounted by nails or screws. Nails and screws for damp place shall be zinc-coated. Nail length shall be at least 25 mm and 2.5 times board thickness. Distance between a nails or a screw and a board edge shall be at least 10 mm.

9.7.6 Except as specified herein, finishing hardwares for doors and windows are included in "DOORS AND WINDOWS".

9.8 DOOR FRAMES:

9.8.1 Door frames shall be shaped, framed, rebated, moulded and grooved in shapes and sizes as shown on approved shop drawings. Frame head shall be housed into jambs. The frames shall be fixed in, and secured to metal anchors.

9.8.2 Door sills, wrought, rebated, weathered, grooved and having the sizes to detail, shall be framed to jambs.

9.8.3 All door linings shall assemble in site and shall have shapes and sizes as shown on approved shop drawings.

9.9 DOORS:

9.9.1 Doors shall have sizes, designs, as shown on drawings, and shall be as detailed to approved shop drawings.

9.9.2 Flush doors:

(a) Doors shall be skelton framed, and shall be covered on both sides with 4 mm thick plywood for painting.

(b) The doors shall be lipped and edged with hardwood strips at the sides and shall be fitted and hung to the frames.

(c) The doors shall have solid blocks suitable for fitting lock devices.

(d) The doors indicated to have glazed openings and/or louvers shall be designed as shown on drawings and shall have glazing beads and/or inclined slats as indicated.

9.10 WALL AND CEILING PANELLING:

9.10.1 Paneling shall be as indicated on drawings.

9.10.2 Paneling of plywoods and asbestos cement panels shall, unless otherwise indicated, be executed with recessed joints at nailing strips, joists, studs or jointing strips finished for paint.
Ceiling plaster board panelling to receive mineral acoustic tile finish shall be butt jointed.

9.10.3 Where indicated on drawings, ceiling panelling shall have access panels and openings for lighting fixtures.

9.11 SKIRTINGS:

9.11.1 Supply hardwood, or laminated hardwood skirtings as detailed to where indicated on drawings. Secure the skirtings to walls and partitions, and perform all necessary butts, and scribed or housed end joints, and scribe the lower edges of the skirtings to the countours of the flooring.

SECTION 10

DOORS, WINDOWS, SHUTTERS AND GLASSES

10.1 SCOPE OF WORK:

10.1.1 Extent: The work required under this section consists of all doors and windows and related items, including glass, glazing and finishing hardware, necessary to complete the work indicated on drawings and described in specifications.

Note: GLASS AND GLAZING and FINISHING HARDWARE specified in this Section are to be applied to WOOD DOORS and WOOD WINDOWS covered under "CARPENTRY AND JOINERY".

10.1.2 Work not Included: The following items of related work are specified and included in other sections of this specification:

(a) Wood doors and windows.
(b) Cabinet hardware.
(c) Toilet compartment.
(d) Drapery curtain hardware and curtain rails.

10.1.3 ACCEPTABLE MANUFACTURES:

Unless specifically provided in this section or approved in writing by the Supervisor, all metallic fittings shall be the products of the manufacturer(s) designated in Appendix (1) and shall meet with the specification.

10.1.4 SHOP DRAWINGS, ETC.:

Shop drawings, hardware schedules and manuals for installation at site shall be submitted, in three (3) copies, to the Supervisor for his approval. When the products of above listed manufactures are to be applied, these documents may be inspected and approved by the representative of the Supervisor in Tokyo at the written request

of the Contractor.

10.1.5 SAMPLES:

Submit samples of the following to the Supervisor for approval, unless otherwise directed by the Supervisor.

(a) Clear sheet glass
(b) Patterned glass
(c) Glazing putty
(d) Lock sets
(e) Hinges
(f) Door stops
(g) Casement turn or fastener/morticed espagnolette bolt
(h) Pulls
(i) Push plates
(j) Flush bolts

10.2 STEEL DOORS:

10.2.1 MATERIALS:

Steel: Steel shall conform to the following requirements or equivalents:

(a) Mild steel: Hot rolled, conforming to JIS G 3131 SPHC.

(b) Cold finished steel: Mild steel, rolled or drawn, free from scale, accurate to size or gauge, conforming to JIS G 3141 SPCC.

(c) Structural steel shall conform to JIS G 3101, G 3106 or G 3350.

(d) Stainless steel sheet shall conform to JIS G 4305, SUS 304, 430.

10.2.2 THICKNESS OF SHEET STEEL:

Except where other thickness are indicated or specified the thickness of sheet steel shall be not thinner than the following thickness.

Thickness of Sheet Steel

Classification	Item Description	Thickness (mm)
Doors	Frame in general	1.6
	Frame of hinged door having inside height of more than 1.8 m	2.3
	Architrave, auxiliary frame, etc.	1.6
	Door saddle	2.3
	Rail, stile, panel plate, flush plate	1.6

10.2.3 SHOP FINISH:

General: After fabrication, all surfaces of steel, except stainless steel, shall be cleaned, electro-galvanized except when zinc-coated steel sheets are used, phosphate treated and followed with prime coat as specified in "PAINTING".

Prime Coat: The type of paint for prime coat shall be compatible with the type of paint specified for application on steel parts at the project site.

Finish of Stainless Steel: Exposed surfaces of all stainless steel shall be satin finished.

10.2.4 GENERAL REQUIREMENTS:

(a) Furnish door and louvers of sizes indicated. Doors shall be 40 mm thick unless designated otherwise. The clearances for hinged doors shall be 3 mm at jambs and heads, 6 mm at meeting stiles of pairs of doors, and 6 mm at bottom unless indicated or specified otherwise.

(b) Construction and Workmanship: Construct windows, doors, grilles, and louvers to produce results specified and to assure neat appearance. Make joints by welding, or by mechanical fastenings. Joints shall be of strength to maintain the structural value of members connected. Welded joints shall be solid, have excess metal removed, and dressed smooth on exposed and contact surfaces. Joints formed with mechanical fastenings shall be closely fitted and made permanently watertight.

(c) Weather Seal for Doors: The top and bottom edges of all hollow metal doors shall be closed to provide a weather seal. This seal may be provided as part of the door construction or by the addition of inverted steel channels or other suitable shapes welded to the face sheets.

(d) Provisions for Hardware: Mortise, reinforce, drill and tap doors at factory to receive all mortise type hardware. Provide reinforcing only for doors to receive surface applied hardware, except push plates and armor plates; drilling and tapping for surface applied hardware will be done in the field. Provide metal reinforcing plates for locks and all mortised hardware; provide reinforcing plates for surface applied hardware as required. The gauges of metal for reinforcing plates shall comply with manufacturer's recommendations for the type of hardware used and the size and thickness of doors, provided that the thickness of steel plate used are not thinner than 3.2 mm.

(e) Accessories: Furnish all necessary fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation of windows and doors. Except as specified otherwise, anchors and fastenings shall be steel, either hot-dipped galvanized or phosphate treated and painted.

10.2.5 FRAMES:

(a) Location and Type: All steel frames shall be formed of steel to sizes and shapes indicated. Frames shall be combination type with integral trim and fabricated with full welded unit or knock-down field assembled type construction at joints as indicated on approved shop drawings.

(b) Reinforcement: Provide concealed steel reinforcements for hardware as required. The gauges of steel for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware and the shapes and sizes of the frames.

(c) Workmanship and Design: The finished work shall be strong and rigid, neat in appearance and free from defects. Fabricate moulded members straight and true with corner joints well formed, in true alignment and fastenings concealed where practicable. Provide plaster flanges and keys as detailed or required, for frames located in plaster walls.

(d) Forming Corner Joints: Joints for welded type frames shall be mitered or butted and continuously arc-welded for full depth and width of frame and trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush. Joints for knock-down type frames shall be designed for simple field assembly of header to jamb members by concealed tenons, splice plates and bolts, or other type of concealed interlocking joint that will produce square and rigid corners and a tight fit; securely lock joints in place during erection and maintain alignment of adjoining members; provide anti-vibration lock nuts for all bolted connections.

(e) Provisions for Hardware: Frames shall be prepared at the factory for the installation of hardware. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised

hardware; frames to receive surface applied hardware shall be provided with reinforcing plates only. Provide cover boxes in back of all hardware cut-outs.

(f) Location of Hardware: The location of hardware for steel frames and doors shall be as specified hereinafter unless otherwise indicated.

(g) Structural Reinforcing Members: Where structural steel members are required at mullions, transoms or other locations, the structural steel shapes shall be provided as part of the frame assembly.

(h) Wall Anchors: Provide metal anchors of shapes and size required for the adjoining type of wall construction.
Fabricate jamb anchors of steel, not lighter than the gauge used for frame. Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 60 cm apart.
For frames set in previously placed concrete or masonry walls: Provide anchors or rough bucks, of design suitable for the purpose, and secure with expansion bolts.

(i) Floor Anchors: Provide floor clips of not less than 1.6 mm thick steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be fixed and drilled for 9 mm diameter anchor bolts.

(j) Shipment: For welded type frames, provide temporary steel spreaders fastened across bottom of frames; where construction will permit concealment, leave spreaders in place after installation; otherwise remove spreaders after frames are set and anchored. In place of spreaders, frames may be strapped together in pairs with heads inverted for bracing during shipment. Ship knock-down type frames in bundles securely strapped, or in packages. Before shipping, label each frame with metal or plastic tags to show their location, size, door swing and other pertinent information.

(k) Installation: Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts, or with power fasteners. Build wall anchors into walls, or secure to adjoining construction. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings, or structural framing above.

10.2.6 FLUSH DOORS:

(a) General Requirement: Doors indicated on drawings as flush doors including flush doors with glazed and louvered openings shall comply with the type of construction as hereinafter specified.

(b) Door Construction:

Construction: Construct doors of two outer steel sheets not thinner than 1.6 mm, with edges welded and finished flush. Seams or joints will not be permitted on door faces or edges. Reinforce the outer face sheets with 2.3 mm thick interlocking vertical channels or Z-shaped members spaced not over 30 cm apart and spot welded to outer face sheets. Provide continuous reinforcing channels welded to face sheets at top and bottom of door. Place cork, fiberboard, mineral wool board, or asbestos fillers in the spaces between reinforcing channels. Mouldings shall be not thinner than 1.2 mm thick steel.

10.2.7 AIRTIGHT DOORS AND FRAMES:

(a) Construction: Frames for doors indicated as airtight shall incorporate a continuous neoprene seal to prevent air leakage through the crevices between doors and frames.

(b) General: Doors provided for auditorium, projection-room, control rooms and sound locks shall be soundproof doors and are to be included in 10.2.9.

10.2.8 INSTALLATION OF DOORS:

(a) General: Doors shall be installed and adjusted by experienced and qualified erectors, and using only skilled mechanics. Install doors and windows in accordance with manufacturer's instructions and approved shop or setting drawings, at the proper elevation and location, plumb, level and in alignment; properly brace frames to prevent distortion and misalignment. Protect doors and operating

parts against accumulation of cement and other building materials by keeping doors tightly closed and wired to frames. After installation doors shall be checked for operation and weathering.

(b) Mastic Sealant: All exterior metal to metal joints between members of doors, frames, mullions, and mullion covers shall be set in a mastic sealant of type recommended by the door manufacturer. Remove excess mastic before it hardens.

(c) Anchors and Fastenings: Anchor door frames to masonry, or to other adjoining or adjacent construction as shown on details and approved shop drawings. Where doors are set in prepared masonry openings, place the necessary anchorage or fins during progress of wall construction. Anchors and fastenings shall be built into, anchored, or bolted to the jambs of openings, and shall be fastened securely to the frames, and to the adjoining construction. Unless otherwise detailed, anchors shall be spaced not more than 45 cm apart on heads, jambs and sills. All anchors shall have sufficient strength to hold the member firmly in position.

(d) Adjustment after Installation: After doors have been installed and before completion of painting, all doors and hardware shall be adjusted to operate smoothly. Hardware and parts shall be lubricated as necessary.

10.2.9 Sound-proof Fixtures:

The sound-proof fixtures provided in this section shall refer to doors and windows to be furnished for the auditorium, gallery, sub-control room, rack room and projection room.

Fabrication and specification of such fixtures shall be same as the air-tight doors provided in 10.9 through 10.16, except that further accuracy shall be required for the fabrication and installation methods.

(a) Fabrication

(1) Approval of drawings

The manufacturer shall prepare the fabrication drawings, with due consideration to fitness of the fixtures, in compliance with the design drawings.

(2) Dimensional accuracy

The tolerance in height, width and diagonal length shall be as indicated in Table 10.5. Any possible distortion and bend of doors and frames shall be restrained below 2 mm.

Hardware	Height	Width	Diagonal length
Steel door	3 mm and below	3 mm and below	4 mm and below
Inspection hole	3 mm and below	3 mm and below	4 mm and below

(3) Shop test

After completion of the product test shall be conducted, at the responsibility of the manufacturer, for construction, configuration, dimension and working condition in general aspect of the product in strict accordance with specifications and drawings. Particular care shall be required to examine adhesiveness of the air-tight material. The test schedule shall be prepared to indicate the shop test items. Any defect or deficiency shall be repaired upon noted in the test list and submitted to the Supervisor.

(b) Method of installation

Full care shall be required for installation by use of reinforcing material or others available in order to protect from

any possible hurt, damage or deformation which may arise from external force.

(1) Fixture to structural body

The fixtures shall be installed rigidly to the reinforcing rod of the structure after full check of the installed position and both horizontal and vertical exactness. All space around the framework shall be filled up with mortar grouting or chips-gravel concrete as indicated by the drawing or directed by the Supervisor. Any portion which should still require such filling shall be plastered with mortar so as to eliminate any gap with the structure.

The work shall undergo inspection by the Supervisor after finish. Any interior work shall not be performed before such inspection.

(2) Adjustment

Full check shall be made to see if the air-tight material as is used between the door and the frame has been adhered to the door face uniformly and solidly to make sure of no sound leakage. Necessary parts such as door stop or stopper shall be installed immediately and then adjustment shall be made carefully by repetition of opening or closing.

(c) Glass setting for inspection window

Polished glass with required thickness shall be used for the inspection window and shall be sheared and figured accurately with full consideration to the size of the H-rubber fitted part. Fixing of glass into the window frame shall be done at such timing that there may be no danger of causing glass breakage.

H-rubber shall be so fixed in place that the joint of the main body shall be at upper center and the joint of the wedge rubber shall be at lower center. H-rubber shall not be set in place at its elongated length.

10.3 FINISHING HARDWARE:

10.3.1 General:

(a) Finishing hardware shall be the products as hereinafter specified or the products of the manufacturers approved by the Engineer. As much hardware as possible shall be by the same manufacturer to maintain continuity of finish and style and to simplify maintenance and replacement.

(b) Include all fastenings with exposed surfaces matching finish of adjacent metal parts of hardware.

(c) Furnish hardware to template and with proper fastening for use with metal frames, and with hollow metal doors.

(d) Use box type strike plates on metal frames.

(e) Screws used in the work covered by this section shall be nickel plated phillips slotted type.

(f) General requirements for lock sets.

(1) The lock case shall be of steel or equally strong and durable material so as to withstand with a reasonable factor of safety, the stresses and effect of wear and tear for extended periods of service. Mechanical parts shall be of such material and design that they also meet the same criteria and are capable of withstanding normal rough usage for extended periods of service.

(2) Lock sets shall be equipped with both latchbolt and deadbolt (except dead locks).

(3) Lock sets shall be suitable for installation in metal or wood doors from 35 mm to 45 mm thickness.

(4) When installed in hollow metal doors, the lock set shall be capable of being equipped with an expansion brace type device to prevent the lock from vibrating or wobbling. This shall be in addition to the mounting screws in the face plate.

equipped with a hardened steel insert that will prevent sawing of the bolt to gain unauthorized entry.

(5) Lever handle spring mechanism shall be of such material and strength to prevent any sag or free play in the lever handle when in the neutral horizontal position.

(6) Cylinder lock set shall be capable of withstanding 100,000 repeated openings and closings without visible or detectable damage to or change in the mechanism, case or key and there shall be no visible or detectable change in the operation or function of the lock set.

10.3.2 Finishes:

(a) Lock and latch sets shall have nickel silver or stainless steel satin finish.

(b) Hinges for doors shall be of bronze with white bronze plated finish or stainless steel satin finished.

(c) Metal push plates shall be of stainless steel with satin finish.

(d) All other hardware shall be of bronze with white bronze plated finish or stainless steel with satin finish on exposed surfaces.

10.3.3 Lock and Latch Sets: Lock and latch sets shall be as manufactured by Hori Lock and Hardware Co., or equal. Handles shall be of lever type.

(a) Furnish a mortise bit key lock set for exterior doors except otherwise specified. Operation of the dead bolt shall be by key from both sides. Key holes shall be covered by movable plates from both sides.
(HORI NO. 1562, or equal)

(b) Furnish a mortise cylinder lock set for interior doors. Operation of the dead bolt shall be by key from outside and by thumb turn from inside.
(HORI NO. 1210-38, or equal)

10.3.4 Dead Locks: Dead locks shall be as manufactured by Hori Lock and Hardware Co., or equal.

(a) Furnish a mortise bit key dead lock for access doors. Operation of the dead bolts shall be by key from outside.
(HORI NO. 1364, or equal)

10.3.5 Hinges: Hinges shall be as manufactured by Hori Lock and Hardware Co., or equal.

(a) Hinges shall have oilite bearings for all doors except access doors.

(b) Hinges for metal doors shall be 150mm x 110mm full-mortise type.
(HORI NO. 2842, or equal)

(c) Hinges for wood doors shall be 127mm x 100mm full-mortise template type.
(HORI NO. 2800, or equal)

(d) Hinges for heavy duty metal doors shall be 150mm x 144mm heavy duty type.
(HORI NO. 2841, or equal)

10.3.6 Push Plates: Push plates for toilet compartment entrance doors shall be stainless steel with hair lined finish, 150mm x 250mm x 2mm in sizes, or the products approved by the Supervisor.

10.3.7 Pulls: Pulls shall be of brass or bronze with dull chrome plated finish and the products approved by the Supervisor.

10.3.8 Flush Bolts: Flush bolts for ordinary door shall be of brass or bronze with dull chrome plated finish, 30 cm in height by 25 mm in width, and the products approved by the Supervisor.
In case that flush bolts are used for the doors without saddle, provide proper metal sockets for floor to receive bolts.

10.3.9 Door Stops: Door stops shall be of brass or bronze with chrome plated finish, furnished with rubber bumper and the products approved by the Supervisor.

(a) Include fastening device appropriate for receiving surface.

(b) Wall type door stops shall be used when floor type door stops are not suitable.

(c) Door stops for exterior doors shall be furnished also with door holders.

10.3.10 Key Cabinet: Key cabinet of wood, paint finished, and of type approved by the Supervisor, shall be furnished by the Contractor.

(a) Cabinet shall be of sufficient capacity to accommodate all units plus 25%.

(b) Tag and file all keys in cabinet.

10.3.11 Hopper Window Hardware: Hinges and casement turns shall be furnished, and the hardware shall be the products approved by the Supervisor.

10.3.12 Casement Window Hardware: Hinges and morticed espagnolette bolts with lever handles shall be furnished, and the hardware shall be the product approved by the Supervisor.

10.3.13 KEYING:

(a) Provide three (3) keys each for all locks. Die stamp each key with number of lock change and set symbol number or letter.

(b) Bit key and cylinder locks shall be master keyed in each lockset type and three (3) master keys shall be furnished for each type.

10.3.14 PACKAGING AND IDENTIFICATION:

(a) Package each item of hardware separately in individual containers, complete with screws, keys, special wrenches, instructions, and installation templates necessary for accurately locating, setting, adjusting, and attaching hardware.

(b) Mark each container with number of door or window to which hardware item is to be applied, and with item number corresponding with hardware item number listed in the Contractor's hardware schedule.

(c) At the completion of the project, the Contractor shall turn over to the Supervisor all installation instructions, templates, and adjusting tools.

10.3.15 RECEIVING AND STORAGE:

(a) Provide adequately locked storage space with necessary open shelves, bins, and counters for assembling and grouping hardware before distribution and installation.

(b) Properly tag, index, and file all keys in key cabinet as directed.

(c) Hardware shall be checked after delivery to the project site before it is installed.

10.3.16 LOCATION:

Before installation of any hardware, obtain the Engineer's verification of the positioning of each type of assembly. This will include the exact location of each element of hardware such as locks, bolts, push plates, pulls and hinges.

Distances from the floor to center line of each hardware item shall be as tabulated below unless indicated or specified otherwise:

(a) Door locks: 950 mm from finish floor to center of strike.
(b) Door pulls: 950 mm from finish floor to center of grip.
(c) Push plates: 1,100 mm from finish floor to center of plate.
(d) Push-pull bars: 950 mm from finish floor to center of bar or center between bars and combination.
(e) Top hinges: To manufacturer's standard, but not greater than 250 mm from head of frame to center line of hinge.
(f) Bottom hinges: To manufacturer's standard, but not greater than 300 mm from finish floor to center line of hinge.
(g) Intermediate hinges: Equally spaced between top and bottom hinges. The space should not be more than 900 mm on center.
(h) Latches: 950 mm from finish floor to center of strike.
(i) Deadlocks only: 950 mm from finish floor to center of strike.
(j) Deadlocks with separate latch-set and/or pull: 1,250 mm from finish floor to center line of strike.

10.3.17 Hardware for Windows: Location of hardware shall be as standardized by the window manufacturer.

10.3.18 INSTALLATION:

(a) Install hardware accurately fitted, securely applied, and carefully adjusted. Install in accordance with manufacturer's instructions. Use care not to injure other work when installing.

(b) Provide and use boring jigs, mortising tools and other special equipment and appliances as required for proper installation of hardware items.

(c) When required, remove and replace doors so that door bottoms or tops may be painted.

(d) Cover visible hardware with masking tape or heavy cloth until painting is completed.

10.3.19 GENERAL SCHEDULE OF HARDWARE FOR DOORS:

Note: Doors more than 2.5 m high and/or more than 1.2 m wide shall be equipped with 2 pairs of hinges.

(a) Exterior Doors in General, Except as Specified Hereinafter:

(1) Metal pair of doors:
3 pairs, butt hinges, 150mm x 110mm (150mm x 144mm for heavy duty doors)
1 lock, mortise bit key lock
2 sets, flush bolts
1 stop with holder, floor type

(2) Wood single door:
1 1/2 pairs, butt hinge, 127mm x 100mm
1 look, mortise bit key lock
1 stop with holder, floor type

(3) Wood pair of doors:
3 pairs, butt hinge, 127mm x 100mm (4 pairs for heavy duty doors)
1 lock, mortise bit key lock
2 sets, flush bolts
1 stop with holder, floor type

(b) Interior Doors in General, Except as Specified Hereinafter:

(1) Metal single door:
1 1/2 pairs, butt hinges, 150mm x 110mm
1 lock, mortise cylinder lock
1 door stop, floor type

(2) Metal pair of doors:
3 pairs, butt hinges, 150mm x 110mm
1 lock, mortise cylinder lock
2 sets, flush bolts
1 stop, floor type

(3) Wood single door:
1 1/2 pairs, butt hinges, 127mm x 100mm
1 lock mortise cylinder lock
1 door stop, floor type

(4) Wood pair of doors:

3 pairs, butt hinges, 127mm x 100mm

1 lock, mortise cylinder lock

2 sets, flush bolts

1 stop, floor type

(5) Swing doors for kettle room entrances: (for each leaf)

1 pairs, double-acting spring hinges

2 push plates

(6) Wood single door for access for pipe shaft, cable ladder space, etc.:

1 pair, butt hinges, 127mm x 110mm

1 lock, mortise bit key dead lock

1 pull

10.3.20 GENERAL SCHEDULE OF HARDWARE FOR WINDOWS:

(a) Hopper windows: (for each ventilator)

1 pair, hinges

2 set, casement turns

(b) Casement windows: (for each ventilator)

1 pair, hinges

1 set, mortise espanolette bolt

10.4 MISCELLANEOUS ITEMS:

10.4.1 Protection of Doors and Windows: Care shall be taken in handling doors and windows during transportation and at job site. Store doors and windows upright on pieces of lumber in a dry location, and under cover. After installation, protect doors and windows from damage during subsequent construction activities. Damaged work will be rejected and shall be replaced with new work.

10.4.2 Cleaning of Metal Doors and Windows: Metal surfaces of doors and windows shall be cleaned on both the inside and outside of all mortar, plaster, paint and other foreign matter to present a neat appearance and prevent fouling of weathering surfaces, weather-stripping or the operation of hardware.

10.4.3 Hardwares and Accessories: Hardwares and accessories shall be of chromium plated yellow brass or of stainless steel. Door hinge shall be lavatory spring hinge of spring tension adjustable type, complete with lower springless hinge. A lavatory strike and door stop, a lavatory rim bolt a coat hook and bumper, and a paper holder shall be fasten fastened properly for each booth. All hardwares and accessories shall be the products approved by the Supervisor,

10.4.4 The doors and panels shall have solid blocks suitable for fitting the hardwares and accessories mentioned above.

10.5 GLASS AND GLAZING:

10.5.1 Kind and Quality of Glasses

(a) Transparent plate glass

(b) Transparent polished glass (Substitutive with frost glass)

(c) Heat absorbing wire glass (Lined)

(d) Figured glass

Glass as specified above shall be the product of the manufacturer designated in Appendix (1) or the equivalence thereof and shall require approval of the Supervisor by presentation of the samples to him.

10.5.2 MATERIALS FOR GLAZING:

(a) Putty: Putty shall be the product conforming to JIS K 5592, oil putty, or the product approved by the Supervisor.

(b) Setting Blocks and Spacer Shims: Fabricate blocks and shims from neoprene, treated wood or lead; shape to the required sizes and thickness. The materials used for blocks and spacers must be compatible with the type of the compounds and sealants used and shall not cause staining or discoloration of the sealant or the frame.

10.5.3 SIZES, DELIVERY AND STORAGE OF GLASS:

(a) The sizes of glass indicated on drawings are approximate only; determine the actual sizes required by measuring frames to receive the glass at the project site, or from guaranteed dimensions provided by the frame supplier. Dimensions for glass and glass holding surrounds shall be coordinated to provide the following minimum clearances:

(1) At perimeter edge of the glass on all four sides provide clearance equal to glass thickness for single glass.

(2) The sealer space between face of glass and fixed or applied glazing stops, both indoors and outdoors, shall be not less than 1.5 mm plus glass and sash tolerance, but a 3 mm minimum.

(b) Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material as directed in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage.

10.5.4 INSTALLATION OF GLASS:

(a) General Requirements: Apply putty, glazing compound, glazing sealant, glazing tape and gaskets uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners and solvents. Do not cut or dilute putty, glazing compounds or sealants without approval from the Supervisor. Make good contact with glass and frame when glazing and facing off. Do not set glass in wood or steel frames until frames have been primed and paint is dry. Do not apply any compound or sealant at temperatures lower than 5°C or on a damp, dirty or dusty surface. After glazing, doors and ventilators in sash shall be fixed so they cannot be operated until compound has set. Remove any excess sealants from glass and adjoining surfaces during the working time of the material; within 2 to 3 hours.

(1) Where setting blocks and spacer shims are required to be set into a glazing compound or sealant, they may be buttered with the compound or sealant, placed in position and allowed to firmly set prior to installation of glass.

(b) Sash and Frame Preparation and Acceptance: Inspect all sash, frames and surrounds to be glazed under this section and notify the Supervisor of any defects, improper materials or workmanship or other conditions which will affect satisfactory installation of glass. Do not proceed with glazing until such conditions have been corrected. Before starting glazing work, the glazier shall verify compliance with the requirements listed.

(1) That sash and frames are firmly anchored in proper position, plumb and square within 3 mm of nominal dimensions on approved shop drawings.

(2) That all rivet, screw, bolt or nail heads, welding fillets and other projections are removed from glazing rabbets to provide the specified clearances.

(3) That all corners and fabrication intersections are sealed and sash and frames are weather-tight.

(4) That rabbets at sills weep to outside and all rabbets are of sufficient depth and width to receive the glass and provide the required overlap of the glass.

(5) That all sealing surfaces of wood and carbon steel sash and frames are prime painted.

(c) Preparation of Glass and Rabbets: Clean the sealing surfaces at perimeter of glass and the sealing surfaces of rabbets and stop beads before applying any glazing compound or sealant. Use only the approved solvents and cleaning agents recommended by the compound manufacturer.

(d) Positioning Glass: Center in glazing rabbet to maintain specified clearances at perimeter on all four sides. Maintain centered position of glass in rabbet and provide the required sealer thickness 3 mm minimum on both sides of glass. Whenever glass dimensions are larger than 1.2 m, provide setting blocks at the sill and spacer shims on all four sides; locate setting blocks one quarter way in from each end of glass.

(e) Stop Bead Glazing - Using Putty or Glazing Compound: Except where other materials or methods are specified hereinafter, use putty for bedding glass in wood frames and use elastic glazing compound for bedding glass in metal frames. Apply as follows:

(1) Apply ample back putty or compound to rabbet so that it will ooze out when pressing glass into position and completely cover glass in rabbet. Place setting blocks and spacer shims as required. Press glass into position.

(2) Secure glass in place by the application of stop beads. Bed stop beads against glass and bottom of rabbet with putty or compound leaving proper thickness between glass and stop beads. Secure stop beads in place with suitable fastenings. Strip surplus compound or putty from both sides of glass and tool at a slight angle to shed water and provide clean sight lines.

(f) Face Glazing:

(1) Apply ample back putty compound or sealant to rabbet in which shims have been set, so that it will ooze out when pressing glass into position.

(2) Secure glass in place with glazing points for wood frames and suitable clips for metal frames.

(3) Face putty front pane edge in rabbet with compound to form a smooth neat bevel 1.5 mm short of sight line and sloping away from glass. Miter bevel at corners. Strip all excess compound or sealant. Strip surplus back putty at a slight angle to slope away from glass.

10.6 STEEL SHUTTER FABRICATION WORK:

10.6.1 Opening and closing functions:

(a) Type: Upper part motor-driven (combined with manual operation)

(b) Operating method of winding shaft: By means of the roller chain.

(c) Operation: Winding-up, descending and stoppage by the push button.

(d) Operation at manual handling: To be normally operated by the encased chain (with the roller clutch).

(e) Safety device: Double-safety device with the emergency switch as well as with the limit switch.

10.6.2 Material:

(a) Steel plate thickness
As shown in the drawing.

(b) Steel plate for slat and shutter case shall be of surface-treated, gulvernized sheet iron.

(c) Guide-rail, lintel, base plate or wrapping plate for base plate, switch cover and switch-box cover shall be made of stainless steel.

10.6.3 Fabrication Method:

(a) The fabrication drawing shall be prepared in accordance with the design drawing and this specification and shall be submitted to the supervisor for his approval.

(b) Manufacturing and fabrication shall be performed to comply accurately with the required shape, size and joint connection.

(c) Slat shall be fitted with the end fitting after insertion.

(d) The guide-rail shall be of embedded type and shall be bent to look like ⊔ . The anchor shall be fixed rigidly at a pitch of less than 600 m/m.

(e) The shutter case shall be fabricated by either welding or small-screw driving. It shall be strengthened rigidly with the frame and metal fittings as may be required for the shape and size of the case.

(f) The engaged length between the slat and the guide-rail shall exceed 100m/m in length totalling both of left and right sides. The supporter to the guide-rail shall be larger than 80 percent of the grooved depth.

(g) Rought coating, rust-preventive coating and finish coating shall be as specified in Section 14.

10.6.4 Others:

(a) The thorough-going shop test shall be conducted prior to shipment. With respect to test items in detail the test procedure shall be submitted, in advance, to the Supervisor for his approval.

(b) Full care shall be taken not to rush into winding operation until the finish coating will have completely been dried up.

10.6.5 Manufacturer:

The manufacturer of the shutter shall be that designated in Appendix (1) or above the equivalence thereof, subjected to approval of the Supervisor.

SECTION 11

CERAMIC TILE

11.1 SCOPE OF WORK:

11.1.1 Extent: The work required under this section consists of all ceramic tile, accessories and related items necessary to complete the work indicated on drawings and described in specifications.

(a) Where tile wainscot is set by conventional mortar method, install tile before finish coat of plaster is applied above wainscots.

11.1.2 Type of Setting Beds: Conventional portland cement mortar setting bed shall be used for installing tile.

11.2 SHOP DRAWINGS:

Submit shop drawings for tile work to the Supervisor for approval.

11.3 SAMPLES:

11.3.1 Submit samples of wall tiles of obtainable colors to the Supervisor for approval. Approval must be obtained prior to delivery.

11.4 GENERAL REQUIREMENTS:

11.4.1 Colors of tiles shall be as selected by the Supervisor after award of contract, the Supervisor will furnish the Contractor with a schedule showing location of tile and color selected.

11.5 MATERIALS:

11.5.1 Wall Tiles: Standard grade glazed tile similar to "Ina Seito's Glazed Wall Tile" as manufactured by Ina Seito Co., Ltd., or equal; not less than 4.0 mm thick with cushion edges, a colored or white matt glazed finish and 98mm x 98mm in nominal face sizes,

unless otherwise indicated. Provide spacer lugs or other similar features on edges of tile.

11.5.2 Wall Tile Trim Shapes: Provide trim shapes as required. Trim shapes shall be of same type, color, thickness and finish as wall tile.

11.6 MATERIALS FOR SETTING TILE:

11.6.1 Portland Cement: See "CONCRETE WORK".

11.6.2 White Cement: See "PLASTERING".

11.6.3 Sand: See "PLASTERING".

11.6.4 Water: See "CONCRETE WORK".

11.7 LAYING OUT WORK:

11.7.1 Where possible, lay out work so that no tile less than half size occurs. For heights metrically stated, maintain full courses to produce nearest attainable heights without cutting tile. Align joints in wall tile vertically and horizontally.

11.8 MIXING AND PROPORTIONS:

11.8.1 Fine aggregates shall be measured in approved gauge boxes on a clean, dry, level surface. The cement shall be measured in one bag (50 kg) units and the water by volume. Materials shall be mixed as previously specified in "CONCRETE WORK".
The following Mixing Table shall be strictly adhered to in all cases. Variations will be permitted only with the prior written consent of the Supervisor.

Mixing Table

Nominal Mix	Cement kg	Fine Aggregate cub.m
1:2	750	1.00
1:4	350	1.00

11.9 INSTALLATION OF TILE: (WALL TILE)

11.9.1 Preparatory Work: Concrete or masonry surface shall be thoroughly cleaned and moistened directly before the scratch coat is applied.

11.9.2 Setting Bed and Installation of Tile: Scratch coat (1:2 mix.) shall be at least 6 mm thick or more. While still plastic, the scratch coat shall be deeply scored or scratched. Plumb or straightening up coat shall be applied if necessary to make an even and true surface at the proper distance from the face of tile.

(a) Floating method: The plumb coat or scratch coat shall be properly moistened before applying mortar setting bed (1:4 mix.). Mortar setting bed shall be applied only in such quantity as can be covered with this before the initial set of the mortar. After the mortar setting bed has been floated flush with the guide strip, a skim of neat portland cement shall be trowelled to the mortar setting bed, or to the back of each tile unit, immediately before the tiles are placed.

(b) Buttering method: The scratch coat shall be properly moistened prior to the installation. The scratch coat shall be spotted with small piece of tile mortared in place to indicate accurately the plane of the tile wall when finished, after that, each tile shall be buttered with the setting mortar (1:4 mix.) tamped in place and brought to a plumb and true surface flush with the spot and other tile. The back of each tile shall be covered with mortar to make the bed full and even.

11.9.3 As soon as the mortar setting bed has sufficiently hardened, the tile surfaces shall be well washed with clean water prior to grouting.

The grout or mortar for pointing all tile shall be forced into the joints by trowelling, or some suitable method, and finished flush and true. All surplus grout or mortar shall be removed, before it has set or hardened, and the face of tile left clean.

11.9.4 Total Thickness of Wall Tile Finish: Total thickness of tiles and setting bed shall be 30 mm for glazed wall tiles and other kinds of tiles of not exceeding 1 cm thickness.

11.10 CLEANING:

11.10.1 Unless otherwise directed by the Supervisor, acid solutions shall not be used for cleaning all tile surfaces. Upon completion of

the work, all exposed surfaces of tiles shall be washed with soap powder and water, applied with a scrubbing brush, and then rinsed thoroughly with clear water. Metal cleaning tools and brushes, or abrasive powders shall not be used.

11.11 INSTALLATION OF SPECIAL PORCELAIN TILES:

The standard size of the tiles shall be 150 mm x 150 mm, which are manufactured by IWAO JIKI Co.,LTD., INA SEITO Co.,LTD., or equal.
Submit sample of the tiles to the Supervisor for approval.

SECTION 12

TERRAZZO

12.1 SCOPE OF WORK:

12.1.1 Extent: The work required under this section consists of all terrazzo cast in place, terrazzo block, terrazzo tile and related items necessary to complete the work indicated on drawings and described in specifications.

12.2 SHOP DRAWINGS:

12.2.1 Submit shop drawings to the Supervisor for approval of all items of the work. Obtain approval of drawings prior to proceeding with fabrication.

12.2.2 Shop drawings shall indicate the following: Type, classification, and procucer's name for variety of Marble chips; layout; elevations; sections; full size profiles of joints; large scale details; thicknesses; dimensions; finish and surface treatments; anchoring; joint compound; and all necessary connections to work of other trades.

12.3 SAMPLES:

12.3.1 Submit samples of the following materials or assemblies to the Supervisor for approval. Approval must be obtained prior to delivery or fabrication.

(a) Terrazzo:

(1) Terrazzo tiles for floors and skirtings.

(2) Finished samples for terrazzo cast in place, not less than 20cm x 20cm.

(3) Finished samples for terrazzo blocks for stairs, lavatories and Make-up Rooms.

12.4 MATERIALS:

12.4.1 General Requirements:

(a) Marble chips for terrazzo shall be the standard quarry products, of sizes, colors and kind as approved by the Supervisor.

(b) Natural variations in color and markings that are characteristic of the quarry from which the stone obtained will be acceptable provided they do not in the opinion of the Supervisor, impair its strength or durability, or mar its appearance.

12.4.2 Terrazzo Block:

(a) Precast terrazzo blocks for skirtings and for sills of toilet compartment and lavatory entrances, and other materials indicated on drawings shall be of sizes, thickness and design indicated.

(b) Terrazzo blocks shall be manufactured by a compression and vibratory process in accurately constructed watertight moulds. After curing, exposed surfaces shall be ground with water by means of a No.80 carborundum stone, unless otherwise indicated by the Supervisor. Filling shall be carried out with a neat cement grout of the same color as the facing mix and this shall be worked into the surface with a wooden scraper to fill all voids and air holes. After a minimum period of 24 hours polishing shall be carried out with water by means of a No.140 carborundum stone.

(c) Reinforce terrazzo blocks with wire mesh and steel pencil rods as required and necessary to prevent breakage.

12.4.3 Setting Materials:

(a) Portland cement: See "CONCRETE WORK".

(b) White portland cement: See "PLASTERING".

(c) Sand: See "PLASTERING".

12.5 MORTAR:

12.5.1 Setting Floors:

(a) Mortar shall be mixed in proportion of 1 part cement to 3-parts sand.

12.5.2 Grouting Terrazzo block Joints:

(a) Mortar shall be 1-part white cement to 3-parts sand.

12.6 SETTING:

12.6.1 General:

(a) Set precast terrazzo straight, level and plumb in solid bedding of cement mortar and with joints tightly fitted and filled flush with cement grout of approved color.

(b) After setting and grouting, remove all surplus material from the face of the stone immediately.

12.7 CAST-IN-PLACE TERRAZZO:

12.7.1 General: Cast-in-place terrazzo used for floor finish shall be bonded onto concrete floor slab. It shall have total thickness of 30 mm in general. The standard topping thickness shall be 12 mm.

12.7.2 Plain Divider Strips: Fabricate strips from 3 mm thick clear sheet glass, 25 mm in height. Place strips to divide floors into square or rectangular sections not larger than 1.2 sq.m.

12.7.3 Edging Strips: Fabricate strips from half-hard brass or stainless steel, 6 mm thick and 15 mm in height with suitable anchorage features and continuous straight edges. Provide edging strips where terrazzo floor adjoin floors with resilient covering.

12.7.4 Preparation of Concrete Slabs: Before placing the underbed for cast-in-place bonded terrazzo floor, sweep slabs clean and remove any plaster, mortar, dirt, oil and other conditions that will interfere with bonding to the concrete slab. On the wet slab slush and broom with neat cement immediately ahead of placing underbed.

12.7.5 Underbed:

(a) Mix: The underbed to receive terrazzo topping shall consist of 1 part portland cement and 4-parts sand; add water and throughly mix to proper consistency.

(b) Placing underbed: The underbed shall be spread and screed to true, level or plumb surface, finishing not less than 9 mm back of finished face of skirtings and other vertical surfaces and not less than 12 mm below finished level for floors, except as indicated otherwise.
Where terrazzo occurs over slabs having membraine water-proofing, wire mesh reinforcement with joints lapped and tied shall be laid before placing the underbed.

12.7.6 Placing Divider Strips: While the underbed is in a semi-plastic state, install divider strips. Set strips accurately and straight, at proper height and tight fitting joints at intersections.
Set edging strips so that the resilient floors will finish flush with the adjoining terrazzo floor; where the joint occurs at door, locate strip under center of door.

12.7.7 Terrazzo Topping:

(a) Mix: The topping mix shall be in proportion of 1 part of white portland cement to 3 parts of marble chips, add mineral color pigment when indicated by the Engineer.

(b) Installation: Place topping after underbed has hardened sufficiently to withstand rolling, but not to exceed one day after placing. Saturate underbed with water, remove excess and then slush and broom surface with neat cement grout immediately ahead of topping mix; use same color of cement and pigment as required for matrix. Place terrazzo topping to thickness specified. Topping shall be uniform in composition and the same marble chips that appear on surface shall be used for entire thickness. Trowel and pack

base with proper form; roll floors with heavy roller until superfluous cement and water have been extracted. Hand trowel to an even surface, exposing the line of strips on a level with the topping.

12.7.8 Curing: Cure terrazzo topping by keeping it damp for a minimum of 6 days after placing. Curing methods shall consist of covering with non-staining reinforced kraft paper, plastic sheets, curing mats or sand; or by coating with a clean liquid curing compound as approved by the Engineer.

12.7.9 Surfacing: After curing, perform initial and final grinding with water and abrasive grit stones of proper size to obtain the finish specified; use No. 24 grit stones for initial grinding and No. 80 for final grinding. Do not reduce height over shelf of recessed edging strips below the height specified. Rub by hand all inaccessible places. After initial grinding or rubbing, grout surfaces with neat portland cement paste of creamy consistency, filling all voids; use cement and coloring corresponding to topping mix for grouting. Let grout remain on surfaces until final grinding, but not less than 2 days. Final grinding shall produce surface of same texture as approved samples. The finished surface shall match approved samples and showing approximately 70 percent of marble chips. Terrazzo shall be level or straight within a tolerance of 3 mm between divider strips, when tested with straight edge. Protect walls, floors and other work adjacent to terrazzo from grinding stones and from splashing while grinding is in progress.

12.8 CLEANING AND FINISHING:

12.8.1 After final grinding, throughly clean all terrazzo surfaces, using a neutral type cleaning solution in accordance with the manufacturer's directions. After surfaces are dry, wash and rinse and apply a coat of penetrating sealing solution. Upon completion, machine buff terrazzo surfaces and leave in clean finished condition.

SECTION 13
METAL WORK

13.1 GENERAL:

13.1.1 Scope of work:

This Section applies to the installation of finished metal articles or metal articles manufactured to order which are made primarily of iron, nonferrous metals (including light metals) or secondary products thereof, for purposes not specified in respect of other types of work, such as decoration, and damage and pilferage prevention.

13.1.2 Materials:

(a) Metal materials

All iron, nonferrous metals (including light metals) or secondary products thereof, whether finished or otherwise, shall conform to the Japan Industrial Standard, if applicable, and where there are no applicable JIS specifications, they shall be approved by the Supervisor, provided, however, that materials or finished products not specified in JIS may be used if they are in the opinion of the Supervisor, equivalent to those complying with the JIS requirements or acceptable.

(b) Preparatory materials for installation

(1) Wood blocks, whether dovetailed or bars, shall be made of Japanese Cypress protected from decay. The decay protective treatment shall be carried out in accordance with the relevant provisions applicable to woodwork. If decay protective treatment is considered to be deleterious to the finishing of wood blocks, such treatment may be dispensed with subject to approval of the Supervisor. Temporary wood blocks shall be of Japanese cedar or pine.

(2) Inserts, anchor bolts, anchor screws, sleeves or drive pins shall have the shapes and sizes adequate for their respective purposes, and samples of the same shall be submitted to the Supervisor for approval as to material, bearing capacity, etc. Preparatory materials to carry suspended loads shall be put to a bearing test using loads more than three times greater than the proposed permanent load, to determine the acceptability for practical use.

13.1.3 Samples, etc.:

(a) Samples of finished metal articles shall be submitted to Supervisor for approval as to materials, shape, size, color, finish, mechanism, etc.

(b) For all articles other than finished metal articles, full-size drawings shall be submitted to the Supervisor for approval as to the manufacturing process. Samples or models shall be submitted, if necessary.

13.1.4 Anticorrosive treatment:

(a) For protection against corrosion steel products shall in principle be galvanized on the external surfaces and applied on the internal faces with anticorrosive paints (a coat at factory, a second coat on the site and final coat on the site).

(b) If nonferrous metal articles are likely to be corroded through contacts with other materials, they shall be protected appropriately from corrosion as required.

(c) If zinc coatings as for white gas pipes and damaged during preparation, they shall be repaired with high-concentration zinc dust anticorrosive paints.

(d) If painted areas are damaged or exfoliated on the site, they shall be made good without delay. In case such damage or exfoliation occurs on galvanized surfaces, repairs shall be done with high-concentration zinc dust anticorrosive paints.

(e) Steel sheets to be galvanized shall conform to JIS G 3310 (cold rolled steel sheets).

13.1.5 Protection and Cleaning:

(a) If metal articles are likely to be damaged or stained after installation, they shall be protected with paper, cloth, wood or other suitable means in accordance with instructions of the Supervisor.

(b) After completion of the work the protective materials shall be removed and the protected hardware cleaned. The metals shall be waxed as necessary.

13.2 COMMON METHOD OF INSTALLATION:

13.2.1 General:

(a) In the case of exceptionally heavy metalwork or metal articles to be installed for safety purposes, drawings showing the proposed method of installation shall be submitted to the Supervisor in advance for approval.

(b) Before installing metal articles or preparatory materials in water-tight areas, reservoirs, lavatories, toilets, the perimeter of external walls shere drainage may be imperfect, or places for embedment under constant vibrations or percussions, drawings showing the proposed method of installation shall be submitted to the Supervisor for approval.

(c) The method of installation shall be either prior installation or posterior installation, and unless otherwise specified, the latter shall be adopted.

13.2.2 Prior Installation:

(a) Before installing hardware, the correct position of installation shall be determined and temporary formwork, platforms, supports or other adequate falsework shall be provided in such manner as to prevent obstructing the formwork and other works.

The hardware shall then be mounted on the falsework and adjusted for correct vertical or horizontal positions with spacers or wedges or other suitable means and shall be welded, bolted, or riveted, as the case may be, to steel frames or reinforcing bars using foot metals or metal fasteners.

(b) Concrete shall be placed in such manner as to prevent movement of the hardware installed.

13.2.3 Posterior Installation:

(a) Correct positioning

Before installation, the preparatory materials shall be positioned or spaced correctly in accordance with the drawings.

(b) Mortar grouting

Mortar to be grouted into the area around foot metals shall be prepared with cement and sand in a mix ratio by volume of 1 : 3. It shall be grouted in such manner as to leave no void. The succeeding work shall not be commenced until after the mortar work has been inspected by the Supervisor.

(c) Preparatory materials for Supervisor providing concrete base, etc.

(1) Wood block

(i) Wood blocks shall be either dovetailed or bars and shall have an adequate size to match the bottom surface of hardware. They shall be embedded in the concrete base to a depth of more than 50 mm.

(ii) For embedment in concrete, wood blocks shall be fitted to formwork. For embedment in hollow concrete blocks, the specified position shall be filled with concrete or mortar in such manner as to prevent interference with the installation of hardwork and after the concrete has set, the bar blocks shall be driven into the concrete securely.

(iii) Temporary wood blocks shall be in inverted dovetail and fitted to formwork.

(2) Insert

Inserts shall be properly bolted to the inside face of concrete formwork and the hollow of the inserts shall be stuffed with cloth to prevent the ingress of cement paste.

(3) Anchor bolt

(i) If an anchor bolt is to be embedded before placing concrete, a hole shall be bored in the formwork to insert the bolt and placing a temporary wood spacer having an adequate thickness on the face of the bolt it shall be tightened with a nut. The tip of the anchor bolt shall be bent to an angle of 90°. The embedded length of the bolt shall be determined according to the size and weight of the hardware to be installed. Anchorage shall be provided by welding the hardware directly or with a metal fastener to an adjacent reinforcing bar or fastening the hardware around the bar with two or three turns of 0.88 mm dia. wire (B.W.G.#20) in such manner as to form the specified angle with the concrete surface.

(ii) Where an anchor bolt is to be embedded after placing concrete, a square formwork corresponding in diameter and length to the bolt shall be buried at the specified position in advance. After concrete has been placed, the formwork shall be removed and the anchor bolt shall be inserted into the hole left and the surrounding area shall be grouted with mortar.
If a hole is bored in the concrete surface to insert an anchor bolt, the hole shall, as far as possible, be dovetailed and its position and size shall be approved by the Supervisor beforehand.

(4) Anchor screw and others

If hardware is to be fixed to the surface of stonework, concrete or brickwork with anchor screws, roll plugs or expansion bolts, the positions where these are to be embedded shall be clearly marked and holes shall be bored with a drill to the specified diameter and depth in such way as to form a right angle to the surface where the hardware is to be fixed. Anchor screws, roll plugs or expansion bolts shall then be inserted into the holes.

(5) Small foot metals

If small foot metals are to be buried in the surface of terrazzo blocks, brickwork and marble, suitable holes shall be bored to insert the metal fixtures and after insertion, the surrounding area shall be grouted with mortar in such way as to leave no void. Where an anchor bolt hole is too small to fill with mortar, it shall be grouted with molten led or sulphur to fix the bolt.

(6) Drive pin

If a small-diameter bolts or screw sleeves as a substitute for anchor bolts are to be shot with a gun into a concrete base for fixing hardware or preparatory materials, the gun shall be pointed correctly to the specified position. Where it is unavoidably necessary to shoot into the concrete base after plastering and painting have been finished, the finished surfaces shall be covered with adequate planks or other suitable materials before shooting to protect the surfaces from stains due to powder smokes.

(d) Preparatory materials for fitting to wood bases

If preparatory materials such as bolts and drive pins are to be fixed to wooden bases, they shall be fixed securely at the correct positions in the same manner as in paragraph c) above.

(e) Installation of hardware

(1) The correct positions of installation shall be determined and marked in accordance with the drawings, and temporary wood blocks shall be removed, the bottom of holes cleaned and anchor bolts and other metal fittings adjusted for correct positions.

(2) The hardware shall be installed at the specified positions securely by means of spacers, wedges, supports, etc. and fixed in such manner as to match the preparatory materials.

13.1 METAL COATING:

13.3.1 General:

(a) Types of metal coating

This subsection provides for galvanizing of hardware made primarily of iron and its secondary products.

(b) In respect of matters which may not be governed in part by this Specification, prior consultations shall be held with Supervisor and his instructions shall be followed.

(c) Submission of samples

Samples of zinc coatings shall be submitted in advance to the Supervisor for approval as to coloring, luster and finish.

(d) Inspection of finished articles

If the Supervisor so requires, finished articles shall be inspected by authoritative research institutes or laboratories, or an inspection shall be made of the manufacturing processes at the factories concerned from time to time in the presence of the Supervisor.

13.3.2 Base metals:

(a) Base metals shall besides complying with the applicable special specifications, be suitable for protective coatings and free from any pinholes, cracks or wrinkles which may cause swells or exfoliations on the metal surfaces.

(b) Welded or soldered areas shall be suitable for receiving protective coatings.

13.3.3 Galvanizing:

(a) Treatment of base metal before galvanizing

(1) Removal of oils and fats

Base metals to be galvanized shall be immersed in a caustic soda solution for 90 seconds to remove oils and fats or paints and shall be washed thoroughly after withdrawal.

(2) Treatment with dilute sulphuric acid

Base metals shall be immersed in a bath containing dilute sulphuric acid of nearly 15% at normal temperature for 12 to 24 hours and they shall be washed thoroughly after withdrawal.

(3) Neutralization of acid

Base metals shall be immersed in a bath containing caustic soda and soda cyanide for three to five hours to attain complete neutralization of any acid remaining in the metals. After withdrawing the metals from the bath, their surfaces shall be brushed and washed to facilitate bond between the zinc coating and the metal surfaces.

(b) Electrolytically galvanized iron shall, in principle, undergo chromate treatment in accordance with Table 13.1.

Table 13.1 Electro-galvanizing of Iron

Item \ Surface treatment		Galvanized	Treated with chrome after galvanizing
External appearance		External surfaces should consist of smooth fine particles glued together and be free from burns swells, projections or exposures of the base metal at corners.	
Thickness (mm)		0.013 and over	0.013 and over
Salt water spray test	Time within which white corrosion should not occur		72

(Note) 1. The zinc coating in the above table corresponds to Class 4 complying with JIS H 8610.

2. Salt water spray tests should be conducted in compliance with JIS Z 2371 (Salt Coater Spray Test Method). Spraying time shall be eight (8) hours a day up to a total of 24 hours. Base metals shall be maintained at a temperature ranging from 15 to 37°C while they are not sprayed with salt water.

3. Chromate treatment refers to the immersion of a base metal in a bath containing chromic acid and sulphuric acid.

(c) Galvanizing of iron by the hot-dipping process shall conform to Table 13.2.

Table 13.2 Galvanizing of Iron by Hot-dipping Process

External appearance	External surfaces should consist of smooth fine particles glued together and be free from flaws or exposures of the base metal
Amount of bond	244 and over
Uniformity test	4 times and over

(Notes) 1. The bond test shall be conducted by either of the weight method and the antimony chloride method (3-point method) as specified by JIS A 0401 (Hot-dip Galvanizing Test Method).

2. The uniformity test shall be conducted by the method specified by JIS H 0401 (Hot-dip Galvanizing Test Method).

(d) Galvanizing of metals other than iron shall comply with the applicable.

13.4 KINDS OF HARDWARE:

13.4.1 All hardwares except ready-made items shall be as specified in the table below.

Table 13.4.1

Designation	Material, Shape and Size	Finish	Remarks
Grid and hurdle floor for use in upper part of stage	As specified on drawings.	Anticorrosive painting and OP painting	
Bolt for suspension of above	As specified on drawings.	Ditto	After adjustment of lengths, return stopper to be spot-welded.
Floor wiring pit	As specified on drawings.	Back of finish flooring to be coated with anticorrosive paints and OP	To be divided into lengths of about 600 mm and corresponding numbers to be inscribed on the back.
Riser wiring duct	Conduit dia. 1.6 Cover dia. 2.3 Binding bolt dia. 2.3 width 30 Details shown on drawing.	Internal surface to be coated with anticorrosive and insulating paints. External surface to be sprayed with lacquer enamel	Cover faced, screwed and fitted with facing washers.

Designation	Material, Shape and Size	Finish	Remarks
Handle of cover for wiring pit	Gunmetal 20 x 115 x 3 Fixed to steel base plate.	Coated with white bronze.	Equivalent to products of Hori Shoten, Ltd. Handle to be fitted to every third cover.
Ceiling access door (around auditorium and sub-control room)	Dia. 1.2; flashed; hinged; fitted with fasteners 600 x 600	To be coated with anticorrosive paints and OP.	Airtight; panel to be filled inside with glass wool.
Speaker fittings	To be supplied		To be fitted at positions shown on drawings.
Handrails	As specified.	External surfaces to be galvanized and finish given coat. Internal surfaces to be treated as indicated on drawings (except stainless steel, nonferrous metals and light metals).	Handrails to be welded to reinforcing bars. Handrails for rooftop use to be provided with expansion joints.
Lattices	As specified.	External surfaces to be galvanized and given finish coat. Internal surfaces to be treated as indicated on drawings (except stainless steel, nonferrous metals and light metals).	
Gratings	R.B.-19ϕ, L-50 x 6 As shown on drawings.	To be galvanized and given finish coat.	Foot metals to be welded to reinforcive bars or steel framework.

Designation	Material, Shape and Size	Finish	Remarks
Vertical trough (interior use)	White gas pipe Diameter as indicated on drawings.		Antisweat covering to be fastened around sections indicated.
Grip for vertical trough	F.B.-4,5 x 20 hinged	To be galvanized and given finish coat.	To be welded to reinforcing bars in structure.
Parapet ring	R.B.-19ø inside dia. 100 F.B.-12 x 60	To be galvanized and given finish coat.	Ring joints to be welded.
Edge protector for metal door mat	SUS-27, 6 x 30		
Metal door mat	Synthetic rubber Details as shown on drawings.		To be placed at main entrance
Steel frame pent-roof	Details as shown on drawing.	To be coated with anticorrosive paint and given finish coat.	
Steel frame stairway	Details as shown on drawing.	To be coated with anticorrosive paint and applied with finish coat. Stair plates to be galvanized and given finish coat.	
"Hall Name" lettering	Stainless 1.5 mm Cut-out box letters (Gothic) Details as shown on drawings.	Hairline finish	Stainless foot metals.
Doorwill	SUS-27 Thickness 2.0	Hairline finish	
Suspension hook	As shown on drawing.	To be galvanized and given OP coat.	Before placing concrete weld short hooked bar to structual reinforcing bars.
Expansion strip	Stainless steel. Details as shown on drawings.		

13.4.2 Ready-made items of hardware shall be as specified in the table below.

Table 13.4.2 Ready-made Metal Articles

Designation	Material, Shape and Size	Finish	Remarks
Rib lath	A No. 1 (#28, 1.4 kg/m^2) Clustered rib #18. No anticorrosive coating.		JIS A 5505 Overlap of 100mm at each 300 intersections of rib supports
Flat lath (for prevention of cracks)	For floor No. 3 (#26 ~ 22, 0.7 kg/m^2) For wall No. 1 (#28 ~ 24, 0.45 kg/m^2) No anticorrosive coating.		JIS A 5505 Overlap of 45 mm For each joint in concrete blocks and wood-work
Wire lath (for prevention of cracks)	Diamond shape 0920 (0.54 kg/m^2) Staple #16 18 mm		JIS A 5504
Crimb wire netting	#10 25 mm mesh 40 mm mesh #12 25 mm mesh	PVC sheathed (glasswool retainer)	JIS G 3553
Welded wire netting	Square mesh 3.2 ϕ 100 mm mesh		JIS G 3551
Ceiling insert	As shown on drawing, or where not specified, of cast iron and for use with 9 ϕ suspension bolt	To be galvanized.	Where not specified, concrete to be placed at each 900.
Roof drain	Cast iron as indicated on drawing	To be tarred on both external and internal surfaces.	Concrete to be placed at tip.
Manhole lid	Cast iron and watertight as shown on drawing	To be tarred	To be capable of carrying heavy loads; with antitheft chain.

Designation	Materials, Shape and Size	Finish	Remarks
Drainageway lid	Cast iron as shown on drawing. Edge protector L - 30 x 5	To be tarred.	To be capable of carrying heavy loads; with antitheft chain.
Floor dividing strip	Brass; width 6 mm; or hard aluminum		Fitting base 50 mm; to be mortared within every 1 m.
Non-slip nosing	Stainless steel (containing vinyl) Hard aluminum (containing vinyl) As shown on drawing.		Both adhesive and anchor to be used for fixing.
Lightweight steel base in wall	Lightweight shape steel and other details as shown on drawing.	To be given, anticorrosive coating	
Corner bead	PVC (general section) L - 50 x 4 (perimeter of stage)	To be galvanized and given OP coat	Fitting base 200; all external corners of plaster walls except window stiles to be beaded up to 2,100 above floor
Ceiling mold	Extruded aluminum		For all joints of plastered concrete wall with ceiling.
Light gauge steel backing in ceiling	Suspension bolt 9 ϕ @ 900 Ceiling joint support - 38 @ 900 Board joint @ 300 Bracing - 20@2,000	Anticorrosive coat to be given.	Bracing to be provided where required - 20
Ceiling access door	Hard aluminum 600 x 600	Finishing materials to be provided.	Perimeter to be reinforced adequately.

Designation	Materials, Shape and Size	Finish	Remarks
Ceiling gangway	As shown on drawing.	To be galvanized and given OP coating.	Handrails to be provided at some portion (as shown on drawing)
Joiner	As shown on drawing.		
Hanges for cleaning tools (mop-plate and mop-stick handrails).	Brass	Chrome coated	To be selected on examining samples
Pipe rack for coat hangers	Brass pipe 25 ø	Chrome coated	To be selected on examining samples
Curtain rail	Type C, aluminum or stainless steel		To be selected on examining samples. To be tightened with wood screw every 450; stoppers fitted at both ends; nylon runner @ 120
Pipe rack in lady's toilet	Brass or stainless steel	Chrome coated (brass)	To be selected on examining samples
Vent	As shown on drawing	To be galvanized and given OP coating.	To be selected on examining samples.
Spacer support	Brass	Chrome coated	Screws and other fittings to be chrome coated.
Metallic roof boards	As shown on drawing.	To be galvanized and given OP coating.	Joints to be calked for water tightness.

13.5 LIGHT METALS:

13.5.1 Materials:

Aluminum and its alloys for use in buildings shall have the properties suitable for the intended purposes.

13.5.2 General:

(a) Light metals to be used in buildings shall have adequate strength, hardness and corrosion resistivity.

(b) The standard means of fabrication of light metal structure shall be riveting, bolting and screwing, but where watertightness must be provided, welding, hard soldering, adhesion and watertight painting shall be employed.

(c) Rivets, bolts, screws, nails and washers for use with light metals shall be of light metals or specified materials. If it is unavoidably necessary to use rivets, bolts, screws, nails or washers of iron or brass, they shall be galvanized or chrome-coated before use.

(d) Adequate arrangements shall be made to allow for expansion and contraction of light metals.

(e) If light metals are to come into contact with iron, copper or brass, they shall be appropriately insulated to protect them against corrosion.

(f) Every possible effort shall be made to avoid contacts between light metals and lime, mortar, concrete and other alkaline materials. If light metals are likely to be corroded by such alkaline materials, they shall be insulated suitably.

(g) Light metals shall be protected with paper, vinyl films or other suitable means against adhesion of cement, mortar, lime or other alkaline materials. If they are contaminated with alkalinity, they shall be washed thoroughly with water without delay and dried well. Other metals which may come into contact with light metals shall be galvanized and coated with a zinc chromate paint or other more effective paints.

13.5.3 Working of light metals:

(a) Working of light metals shall take place at a distance from the place where iron materials are prepared, in order to protect the light metals from iron powder.

(b) Light metals shall be worked on wooden benches and every care shall be taken to protect them from damage, as for example, applying a pad of light metal, lead or hard wood to the base of a vice to prevent it from damaging the metals.

(c) In cold-bending a light metal work, it shall be bent to a minimum inside radius greater than the thickness of the metal in such manner as to prevent the occurrence of breakage, snapping, deformation, wrinkles or cracks.

SECTION 14

PAINTING

14.1 SCOPE OF WORK:

14.1.1 Extent: The work required under this section consists of all painting and finishing work and related items necessary to complete the work indicated on drawings and described in specifications.

14.1.2 Work not Included: The following items of work are included in other sections of this specification:

(a) Shop painting of miscellaneous iron and steel.
(b) Factory applied finishes.
(c) Caulking.
(d) Painting and finishing of mechanical, electrical, and plumbing work.

14.2 SAMPLES AND COLORS:

14.2.1 The Contractor shall submit a set of color cards showing all color range of paints and shall make, under the direction of the Engineer, a schedule showing where the various colors shall be used. The Contractor shall then prepare 15cm x 30cm samples in duplicate of each color and finish on hardboard and/or metal plate at the project site as required until the colors and textures are satisfactory. These samples must be approved by the Engineer prior to delivery of paints to the site.

14.2.2 The Contractor shall submit for approval a list of all materials proposed for use.
Before proceeding with painting, the Contractor shall finish one complete room, space, or item of each color scheme required. This shall include selected colors, finished texture, materials, and workmanship. After approval, these sample rooms or items shall serve as a standard for similar work thoroughout the project.

14.3 MATERIALS:

14.3.1 General Requirements:

(a) Paint, varnish, stain, and fillers shall be of types and brands hereinafter specified under "Table of Materials".

(b) Other painting materials required but not specifically described, such as turpentine, thinner, polishing compound, etc., shall be of highest quality and shall have identifying labels on containers.

(c) All paint shall be delivered to the site in manufacturer's sealed container. Label shall give manufacturer's name, type of paint, color of paint, and instruction for reducing.

No Materials other than types specified or approved shall be delivered to the project site.

Paint shall be well ground; shall not settle readily, cake, or thicken in the container; shall be broken up readily with a paddle to a smooth consistency; and shall have good working properties.

(d) Storage of materials:

(1) Store all painting materials and equipment in an assigned area.

(2) Protect floor and wall surfaces against damage.

(3) Take necessary precautions to keep fire hazard to a minimum.

(4) Leave surfaces of storage space clean and in condition required for equivalent spaces in the project.

14.3.2 All painting materials shall be as shown in the following Table of Materials.

Materials	Applicable Specifications	Products
Ready Mixed Paint (Synthetic Resin, Long Oil Type), For Exterior Use	JIS K 5516 K 5517 K 5518	Shinto SP Marine Paint, or equal
Ditto, For Interior Use	Ditto	Shinto SP Paint, or equal
Synthetic Resin Emulsion Paint, For Exterior Use	JIS K 5663-1	Shinto Envy Super #60, or equal
Ditto, For Interior Use	Ditto	Shinto Envy #60, or equal
Vinyl Chloride Resin Enamel	JIS K 5582	Shinto Envy #3000, or equal
Ditto Antiacid Type	Ditto	Shinto Envy #1000, or equal
Lacquer Clear	JIS K 5531	Shinto Lacquer Clear #300, or equal
Etching Primer	JIS K 5633	Shinto Wash L#20, or equal
Anticorrosive Paint, Lead Cyanamide	JIS K 5625-1	Shinto Cyanamide Derust, or equal
Ditto Lead-Zinc Chromate	JIS K 5628-2	Shinto Chrome Coat R, or equal
Putty, Vinyl Resin	-	Shinto Envy Hard Putty #210, or equal
Ditto, Emulsion	-	Shinto Emulsion Putty #100, or equal
Sealer, Vinyl Resin	-	Shinto Envy Sealer #700, or equal
Ditto Emulsion	-	Shinto Latex Primer #1000, or equal
Shellac Varnish	JIS K 5431	Shinto Shellac Varnish, or equal

Note: Shinto: Shinto Paint Co., Ltd.

14.4 GENERAL REQUIREMENTS:

14.4.1 Before starting any work, inspect all surfaces to be painted or finished.

(a) All spaces shall be broom clean before painting is started.

(b) All surfaces shall be dry.

(c) All surfaces shall be free of foreign matter before applying paint or finish.

(d) New woodwork to receive clear finish shall be suitable to receive required finish, needing only a light sanding.

14.4.2 No work shall be done under conditions which are unsuitable for the production of good results.

(a) Do not apply exterior paint in damp, rainy weather. Weather must be dry.

(b) Do not apply paint on surfaces in direct sun, so as to prevent proper application and drying.

(c) Do not apply finishes in spaces where dust is being generated which would speck the finish.

14.4.3 Remove and protect hardware, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide in place protection. Upon completion of each space, carefully replace all removed items. Use only skilled mechanics for removal, replacement and protection.

14.4.4 Remove doors to paint tops and bottoms.

14.5 PREPARATION OF SURFACES:

14.5.1 General:

(a) Surfaces shall be clean, dry, and adequately protected from dampness.

(b) Surfaces shall be smooth, even, and true to plane.

(c) Surfaces shall be free of any material which will adversely affect adhesion or appearance of applied coating.

14.5.2 Wood:

(a) Sandpaper to smooth and even surface, then vacuum off.

(b) Apply shellac varnish to all knots, pitch, and resinous sapwood.

(c) After priming coat has dried, putty all nail holes, cracks, open joints.

14.5.3 Concrete, Cement Plaster:

(a) Fill all minor holes to produce uniform texture over the surface.

14.5.4 Ferrous Surfaces:

(a) Remove dirt and grease with mineral spirits.

(b) Remove rust, mill scale, and defective paint down to sound surface or bare metal, using scraper, sandpat or wire brush as necessary. Grind if necessary to remove shoulders at edge of sound paint to prevent flows from photographing through finish coats.

(c) Touch up all spots and damaged shop coats with specified rust inhibitive primer.

14.6 COLORS:

14.6.1 Colors shall match color control chip approved by the Engineer. Color schedule will be made by the Engineer before commencement of the work. The Contractor shall prepare the color control chip according to the schedule and submit to the Engineer for approval.

14.7 SCHEDULE OF PAINTING:

(a) Ready Mixed Paint (Synthetic Resin, Long Oil Type) ..... OP

(Ferrous Metal Surfaces)

Pretreatment	Etching Primer	0.18 kg/sq.m
Under Coat (2 coats)	Anticorrosive Paint, Lead-Zinc Chromate or Lead Cyanamide	0.11 kg/sq.m
Touch Up	Ditto	
Middle Coat	Ready Mixed Paint, (Middle coat type)	0.08 kg/sq.m
Top Coat	Ready Mixed Paint	0.08 kg/sq.m

Note: Etching primer is to be applied on zinc-coated surfaces.

(b) Ready Mixed Paint (Synthetic Resin, Long Oil Type) ..... OP

(Wooden surfaces)

Sealer	Shellac Varnish	
Under Coat	Ready Mixed Paint (Under coat type, white)	0.09 kg/sq.m
Putty	Putty, Vinyl Resin	
Middle Coat	Ready Mixed Paint	0.08 kg/sq.m
Top Coat	Ditto	0.08 kg/sq.m

(c) Synthetic Resin Emulsion Paint ..... VP

(Cement and Sand Plaster, Concrete, Asbestos Cement Board/Sheet, etc.)

Under Coat	Sealer, Emulsion	0.11 kg/sq.m
Putty	Putty, Emulsion	
Middle Coat	Synthetic Resin Emulsion Paint	0.10 kg/sq.m
Top Coat	Ditto	0.10 kg/sq.m

Note: For exterior surfaces and for indoor damp places paint for exterior use shall be applied.

(d) Vinyl Chloride Resin Enamel ..... VE

(Cement and Sand Plaster Surfaces, etc.)

Sealer	Sealer, Vinyl Resin	
Under Coat	Vinyl Chloride Resin Enamel	0.12 kg/sq.m
Putty	Putty, Vinyl Putty	
Middle Coat	Vinyl Chloride Resin Enamel	0.12 kg/sq.m
Top Coat	Ditto	0.12 kg/sq.m

Note: For antiacid purpose, top coat shall be replaced with vinyl chloride resin enamel of antiacid type.

(e) Stain ..... O.S

(Wooden Surface)

Stain (2 coats)	Stain, Oil Type	

(f) Lacquer Clear CL

(Wooden Surfaces)

Under Coat	Lacquer Wood Sealer	0.08 kg/sq.m

Filler	Wood Filler	
Middle Coat	Lacquer Sanding Sealer	0.12 kg/sq.m
Top Coat	Lacquer Clear	0.15 kg/sq.m
(2 coats)		
(Surfaces of Woodboard Ceiling)		
Under Coat	Lacquer Wood Sealer	0.08 kg/sq.m
Filler	Wood Filler	
Top Coat	Lacquer Clear	0.15 kg/sq.m

14.8 APPLICATION:

14.8.1 General:

(a) Brush paint all work except as specifically scheduled or except as approved by the Engineer.

(b) Each coat shall be brushed on well and worked out evenly to leave no brush marks or "holidays".

(c) Each coat shall be flowed on smoothly and free from sags and runs.

(d) Rate of application shall not exceed average rate of coverage recommended by paint manufacturer for the type of surface involved (less than ten percent allowance for losses, unless manufacturer's printed recommended specifications state that the recommended rate included normal expected losses):

(1) Minimum dry film thickness per coat shall not be less than thickness recommended by the paint manufacturer.

(2) Surface shall be free of skips in any coat, voids, pinholes, etc.

(e) Packaged paint may be thinned immediately prior to application in accordance with the manufacturer's directions.

(f) The Contractor shall apply additional coats of paint or finish as required to completely cover surfaces which are painted or finished to provide uniform color and appearance.

(g) A whole wall shall be refinished rather than spot finishing where a portion of the finish has been damaged or is unsatisfactory.

(h) Minimum drying time shall comply with that recommended by paint manufacturer. Each coat shall be thoroughly dry before application of succeeding coats.

(i) Sand between coats (with abrasive paper of No. partinent to the coats).

(j) Make edges of paint adjoining other materials or colors sharp and clean, and without overlapping.

(k) Apply primer on all work before glazing.

14.9 PROTECTION:

14.9.1 Protect work of other trades against damage, injury, or soiling from materials, tools, or utensils used.

14.9.2 Furniture and other movable objects, equipment, fittings, and accessories shall be moved, protected, and replaced upon completion of an area.

14.9.3 Use drop cloths, free of holes and of adequate size, to cover all finished work of others.

14.10 CLEANING UP:

14.10.1 The Contractor shall, upon completion, remove all paint where it has been splashed, or spattered on surfaces, including fixtures, glass, furniture, fittings, hardware, etc. It shall be removed without marring the surface finish of the item being cleaned.