No. 8

THE KINGDOM OF NEPAL

DETAIL DESIGN REPORT ON THE ESTABLISHMENT PROGRAMME OF MEDIUM WAVE RADIO BROADCASTING NETWORK

VOLUME II

TECHNICAL SPECIFICATIONS FOR BUILDINGS AND TOWERS

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JAPAN INTERNATIONAL COOPERATION AGENCY

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C O N T E N T S

REMARKS

(1) Relevant standards, specifications, and rules

Standards, specifications, laws and regulations, etc., set out by the Japanese Standards Association, the American Society for Testing Materials, the British Standards Institution, and the ministries, bureaus, and other organizations of His Majesty's Government of Nepal are referred to in many paragraphs of this specification. These standards, specifications, laws and regulations, etc., shall mean the latest editions of these documents at the time of tendering.

(2) Abbreviations of standards, specifications, etc.

This specification uses abbreviations for standards, specifications, laws and regulations, etc., including those given in Table A.

Table A

Abbreviation	Description
JIS	Japanese Industrial Standards set out by the Japanese Standards Association.
JASS	Japanese Architectural Standard Specifications set out by the Architectural Institute of Japan.
ASTM	ASTM Standards set out by the American Society for Testing Materials.
BS	British Standards by the British Standards Institution.

(3) Nominal equivalents

Nominal equivalents given in Table B are used throughout this specification.

Table B

Inch size	Metric size (mm)	Inch size	Metric size (mm)
1/16	1.5	1	25.0
1/8	3.0	11/8	29.0
3/16	5.0	11/4	32.0
1/4	6.0	13/8	35.0
5/16	8.0	11/2	38.0
3/8	9.0	15/8	41.0
7/16	11.0	13/4	45.0
1/2	13.0	17/8	48.0
9/16	14.0	2	50.0
5/8	16.0	21/4	57.0
11/16	17.0	21/2	64.0
3/4	19.0	23/4	70.0
13/16	21.0	3	75.0
7/8	22.0	31/2	89.0
15/16	24.0	4	100.0

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

(4) Gauges

Metal plate thicknesses and wire diameter are given by the United States Standards Gauge (USSG), unless otherwise specified.

(5) Units of weights and measures

All documents and drawings to be submitted by the contractor shall use meters and kilograms for the units of length and weight, unless particularly specified by the Engineer.

2-1 TEMPORARY WORK

2-1-1 Land Survey

Prior to the commencement of the construction work, land survey shall be accomplished and survey drawings which illustrate the shape, difference in elevation shall be prepared according to the Engineer's instructions.

2-1-2 Materials for Temporary Work

Unless otherwise stated, used materials workable in practical use may be adopted for materials for temporary work.

2-1-3 Temporary Enclosures

The contractor shall provide through consultation with the Engineer proper, decent-looking temporary enclosures around the construction site so as to prevent unauthorized persons from entering into the site thereby standing in the way of construction work or being exposed to danger.

2-1-4 Staking Out

The contractor shall under instructions from the Engineer stake out according to the relevant plot plan to confirm the building area, request for the presence of the Client and Engineer, and gain their approval.

2-1-5 Scaffolding and Scaffold Boards

Scaffolds and scaffold boards shall be designed to be robust by adopting materials and methods suitable for the type, scale, period, etc., of the construction work so as to assure convenience for construction work and management and safety, with due care to be given for maintenance. The materials and construction of scaffolds and scaffold boards shall meet the provisions of relevant laws and regulations.

2-1-6 Temporary Buildings

The allocation of storage yards for materials, stores, offices, etc., shall be determined through consultation with the Engineer.

2-1-7 Temporary Privies

Privies shall be provided at proper locations and kept clean.

2-1-8 Storage Facilities for Dangerous Articles and Voltage Transformation Facilities

Storage facilities for explosives, oils, and other inflammable materials and voltage transformation facilities shall be located as much separate from buildings and other storage yards for materials and shall have such construction as specified in relevant laws and regulations, kept completely under lock and key, and provided with proper fire extinguishing facilities.

2-1-9 Engineers' Office

The area of the Engineers' office in Kathmandu shall be 25~30m^2 times the number of Engineers. (The Engineers' office site may be selected according to circumstances).

Engineers' office shall be provided with electric lamps, water supply and drainage facilities, lavatory, and other necessary facilities. It shall also be furnished under instructions from the Engineer with desks, chairs, drawing boards, sample shelves, blackboard, lockers, maximun/minimun thermometers, clocks, airconditioner, telephone, fire extinguisher, kettles cleaner or dusting things, rubber boots, raincoats, tools and equipment for inspection, and safety equipment.

Engineers' offices in other places than Kathmandu shall under instructions from the Engineer be built according to

circumstances and be furnished with proper facilities.

2-1-10 Contractor's Office and others

Contractor's office, workers' resting place, privy, etc., shall be provided according to circumstances through consultation with the Engineer.

2-1-11 Temporary Power Supply, Water Supply, Drainage and Other Facilities for Construction Work

Power supply, telephone, water supply, drainage, gas and other facilities necessary for construction work shall be led in at necessary locations at the cost of the contractor who shall pay directly for these works. After completion of the construction work, these facilities shall be completely removed through necessary procedures. For power and water supply to be used for construction work

after laying the power and water supply facilities, basic charges for that period shall be paid by the client and rate charges shall be paied by contractors concerned. The charge for sealing water in the water tank and pipes shall be paied by the contractor.

2-1-12 Disaster Prevention

Proper measures shall be taken for preventing hazards, fire, storm, flood, etc., from occurring in connection with construction work, in accordance with relevant laws and regulations. When there is any fear of endangering life, properties, etc., both inside and outside the construction site, the contractor shall prevent hazardous conditions from being encountered due to the drop of materials by providing protective steel nets or protective sheets and fences or by other equivalent methods so as not to endanger life and properties.

2-1-13 Caution against Fire

By setting a hot-water service spot, trash burning place, and smoking area at given locations, strict control shall be exercised over fire. Fire shall not be made at any other place than specified ones. Cigar and cigarette stubs and cinders of a fire made shall be kept under strict control by a responsible person to be assigned separately. In particular, care shall be exercised for blowlamps, spark in welding, naked lamps, etc. All electric wires to be layed temporarily shall periodically undergo insulation test, inspection and maintenance.

2-1-14 Curing

When there is a fear of damaging or soiling any part of completed work, proper protection or curing should be effected by boarding or plasting paper or polyethylane film.

2-1-15 Clearing up and Cleaning

The site and buildings in the site shall always be kept in order without accumulated waste, trash or dust which may be produced by workers or during construction work. After completion of construction work, tools and equipment, scaffold members, remaining materials, etc., shall promptly be cleared away from inside and outside the building and thus the site and buildings shall be cleaned up.

2-2 EARTHWORK

2-2-1 Scope of Work

(1) Extent

This paragraph stipulates excavation, grading, filling, back filling, and related earthwork necessary for completing the work specified in the relevant drawings and specifications.

1) Rough grading of each site shall be accomplished by HMG of Nepal, and the contractor shall accomplish excavation for buildings and structures, removal of underground obstacles as specified in the relevant drawings or by the Engineer, and back filling, filling, and rolling as specified in the relevant drawings or deemed necessary.

2) Such excavated materials that have been approved to be suitable by the Engineer may be used for filling or back filling. All unsuitable materials and surplus excavated materials shall be removed to and abandoned at the place specified by the Engineer.

3) When additional fill is still necessary for the required grads or subgrades, bring it about from outside the construction site. Such fill to be brought in from outside the construction site shall meet the quality requirements

set out by this specification and be from such a place as approved by the Engineer.

4) The contractor shall receive the construction site as it is and shall, where necessary for completing buildings, roads, pavements and any other work, clear away all trash, rubbish, etc., prior to the commencement of excavation.

5) When lawn or surface soil in the site or a neighbouring lot is damaged by the construction work or material storage yard, clear way leftovers, etc., and restore the site on lot to the initial condition.

(2) Work not Included

The following items of related work are specified in other paragraphs of this specification.

1) Excavation and back filling for piping

2) Exterior construction work

2-2-2 Bench Marks

Bench marks shall be provided at places free from shifting or damage or on existing buildings and shall be approved by the Engineer, after determing the standard floor level of the building to be constructed. All bench marks, markings, and other reference points shall be maintained with care during the construction work. If disturbed or destroyed, they shall be corrected under instructions from the Engineer.

2-2-3 Position and Height

Batter boards shall be provided for determining the following positions and heights by using stakes, markings, etc.

1) All corners of buildings and structures

2) Height of fill for slabs on earth

3) All other items necessary for works set out in this paragraph

2-2-4 Excavation

(1) Planning

The contractor shall prepare excavationning drawings and submit them to the Engineer for approval. These drawings shall contain dimensions, procedures, and the method of excavation.

(2) Dimensions

Excavation shall be made to the specified depth by the specified dimension. Extra-excavation necessary for foundation work and inspection shall also be performed.

(3) Foundation supporting ground

The work shall receive the Engineer's approval at the time of completion of excavation to the foundation embedment depth shown in the drawing. When the Engineer determines the foundation supporting ground unsuitable, the contractor shall under instructions from the Engineer excavate the ground to the depth deemed to be suitable for the foundation supporting ground at the cost of the contractor.

(4) Shoring

When necessary, shoring, sheet piling, or walling shall be performed at excavations for securing safety.

Shoring shall be removed as the back filling progresses but only confirming that banks are safe against collapse or caving on slopes.

(5) Drainage

The contractor shall exercise care for the grading of the ground around the building, slope to the ground, surface

and take proper measures so that water should not enter into excavations or damage the building or structures. Trenching or pit excavation at the place of foundation work shall be maintained not to allow water to enter. The contractor shall provide a pump or pumps necessary for allowing water not to be pooled at excavations. When water spring or flow is encountered during excavation, the contractor shall promptly report it to the Engineer and, after digging a channel and leading water to a proper level under instructions from the Engineer, shall drain off.

2-2-5 Disposal of Utilities

(1) Works set out in this specification shall be accomplished in accordance with laws and regulations applicable to respective public utilities.

(2) Active utilities shall be protected, removed or relocated under instructions from the Engineer or in accordance with the specifications. When any public active utilities which may not be shown in drawings is found, report it to the Engineer and support, protect, or relocate it under instructions of the Engineer.

(3) When any unnecessary or unused public utility is found upon excavation or grading, report it to the Engineer and remove, cap or plug it under directions from the Engineer. Unless otherwise stated, such cutting, capping or plugging shall be made at locations at least one meter apart from the outer walls of the building to be constructed or as required by the regulations.

2-2-6 Floor Slabs on Earth and Fill under Floor Slabs

In order to make the level of the ground under concrete floor or terrace floors slabs as indicated, earth or unscreened crushed stone shall be filled, levelled, and tamped as set out in specifications. For filling up to 30cm in

depth, earth or unscreened crushed stone may be used. For filling of more than 30cm in depth, unscreened crushed stone or other approved shall be used. The type and quality of the material to be used for filling shall be approved by the Engineer. Filling and tamping for back filling under slab after casting foundation wall concrete shall be performed at the time of outside back filling or after sufficiently bracing not to damage the wall.

2-2-7 Back Filling for Building and Structures

(1) Back filling around the footing of the external wall shall be performed with the Engineer's approval after placing slab concrete to support the top of the wall. For back filling, earth shall be layed and tamped so that future settling should be minimized and that wall work, waterproofing, and other works already accomplished should not be damaged.

(2) Prior to commencing back filling, ensure that trash and rubbish which may attract termites, corruptible or corrosive wastes and other unsuitable things which may give undesirable influence shall all be removed out of the back filling shall be layed into layers of less than 30cm. Back filling earth shall not contain roots of trees, plaster, brick chips, and any other material unsuitable for back filling. Stones with maximum dimensions of more than 10cm shall not be contained in the portion ranging to the depth of 15cm from the surface of back filled earth. Back filling earth shall be layed in successive layers and each layer shall be back filled loosely to have the above-mentioned thickness and then levelled over the entire width. Each layer shall be tamped sufficiently by rolling or compacting with a pneumatic tamper or the like while lightly springling water over the layer. Fill shall be finished to have the required level and be inclined so that water should not flow toward

the building wall. Where settlement is caused, back filling shall be effected to the required level.

2-2-8 Site Grading

(1) Grading on ground

In the entire site area outside the building, subgrades shall be formed to the following level by cutting, filling, compacting of fill, and rough grading.

(2) Filling

In places where filling shall be made on the existing ground outside the building to the specified subgrade level, fill shall be layed and tamped as required. The quality of the fill material to be used shall be approved by the Engineer.

1) Clear away corruptible and corrosive wastes and rubbish which may attract termites or any material which may give undesirable influence, out of the specified area of filling, plow up the ground to a depth of 15cm so that the plowed earth should be adapted in water content to the fill to be layed on.

2) Fill shall not contain roots, wood chips, or other organic substances. Fill for use in areas to be paved shall not contain clay or loam by more than 15%. Nor shall it contain humus. Stones with dimensions exceeding 10cm shall not be contained in the portion of fill to range up to 15cm from the surface of the fill.

3) Fill shall be tamped by rolling or compacting to 90% of the maximum density at optimum water content. This tamping shall be carried out by using an automatic roller, atuomatic tamper, or other machine approved by the Engineer. When necessary, sprinkle water to earth or dry it prior to tamping so as to maintain a proper water content. Filling

shall not be made on muddy ground.

(3) Curing

Newly graded areas shall be protected from adverse weather. Settlement, runoff, etc., if encountered before handingover of the work shall be corrected so that the ground shall have the required level and inclination.

2-3 REINFORCED CONCRETE WORK

2-3-1 Scope of Work

(1) Extent

The work specified under this paragraph consists of all concrete work and related items of work necessary to complete the work indicated in drawings and described in specifications.

(2) Work not Included

The following items of related work are specified in other paragraphs of this specification.

1) Suspended ceiling hangers and pipe hangers to be fit on concrete floors.

2) Inserts and pipe sleeves for electric piping and equipment installation.

3) Anchors and others for fixing brick, blocks and stones to concrete.

2-3-2 Shop Drawings

Shop drawings for reinforcing steel work and form work shall in advance be submitted to the Engineer for approval. The approval of the Engineer shall be received prior to fabricating any material or proceeding with the work.

(1) Reinforcing steel drawings

Reinforcing steel drawings shall include bending diagrams, assembly diagrams, splicing and lap-joint drawings, and drawings showing bar arrangement and the shapes, dimen-

sions, and details of attachments. The reduced scale of any structural drawing shall not be used for determing reinforcing bar length.

(2) Form Work Drawings

Shop drawings of form work for all reinforced concrete work shall in advance be submitted to the Engineer for approval. These shop drawings shall be completed ones which show the proceedings of the work, dimensions and grades of timber, alignments of panel forms, etc. These shop drawings shall indicate form layout plans, construction, and control joints together with the method of form assembling. Shop drawings shall also specify the locations and others of inserts, tees, sleeves, and other materials to be embedded. Drawings or descriptions indicating the methods of shoring and reshoring for horizontal concrete members shall also be submitted to the Engineer for approval.

2-3-3 Samples

1) The contractor shall at his own cost submit samples of the cement, aggregates, and reinforcing bars that he proposes to use for the work to the testing laboratory specified by the Engineer after signing the contract and whenever necessary.

2) After the primary test of concrete the contractor shall prior to starting concrete work submit sand and crushed stone he proposes to use in the work to the Engineer for approval. The quantities of sand and crushed stone to be submitted to the Engineer are as follows.

Sand: 6kg

Crushed stone (coarse aggregate): 9kg

The samples to be submitted shall be specimens of materials delivered to the site. When any sample is rejected, all the material delivered contractor proposes shall

be carried out from the site promptly. The Engineer will periodically perform test to determine whether the quality of the material used meets the specifications of the sample approved.

3) The contractor shall submit samples in duplicate of all kinds of reinforcing bars, and the manufacturer's test certificates.

4) Sampling shall be performed by the Engineer or under instructions from the Engineer.

2-3-4 Materials

(1) Portland Cement

Portland cement to be used for this work shall be of an approved brand and meet the requirements of JIS R5210. Cement in a bag shall have a net weight of 50kg±1%. Cement shall be put in branded bags or vessels and sealed by the manufacturer and carried into the site in batches of not exceeding 100 tons. In the site cement shall be stored separate from the ground in a proper manner in a fully closed room with a roof to prevent solidification. Cement shall be used in the order of arrival. Cement produced more than 6 months before the expected date of use or stored at the site for more than 3 months, or cement which may have been moistened shall be retested at the presence of Engineer.

(2) Aggregates

Natural aggregates shall be used for concrete work. Crushed stone shall be used as the coarse aggregate. For the fine aggregate, river sand shall be used and crushed sand can be mixed. Crushed stone shall have the quality, grading, and shape specified hereunder. The aggregate shall be clean, hard, solid, and shall not contain dust, soil, slag, or any harmful object. Sea sand shall not be used at all.

1) Coarse Aggregate

a) Crushed stone shall have nominal dimensions of less than 20mm and shall meet the requirements of JIS A5005.

b) The maximun dimension of the coarse aggregate to be used shall be less than 1/5 of the minimum crossection of the concrete forms and shall not exceed 3/4 of the maximum clear spacing between reinforcing bars.

2) Fine Aggregate

The nominal dimension of the fine aggregate shall be less than 2.5mm.

3) The grading of the aggregate shall be such that shall allow proper dense concrete with the required strength to be obtained. The final grading approved by the Engineer shall not be changed without permission. The standard gradings of coarse and fine aggregates are given in Table 2-3-1 and 2-3-2, respectively.

Table 2-3-1 Grading of Coarse Aggregate

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

Table 2-3-2 Grading of Fine Aggregate

Nominal Size of Sieve (mm) / Size of Fine Aggregate	Percentage by Weight Passing Sieves (%)						
	10	5	2.5	1.2	0.6	0.3	0.15
Sand, 2.5mm or smaller	100	100 ~ 90	100 ~ 80	90 ~ 50	60 ~ 25	30 ~ 10	10 ~ 2

4) Selection and provision of aggregate store yards, the number of stock piles and their sizes, measures to be taken for preventing different aggregates from mixing, etc., shall be approved by the Engineer. Coarse aggregates with different gradings shall be stocked separately. When stock piles with different gradings are to be located near each other, they shall be pertitioned with bulkheads or the like. The bottom of stock pile yeards shall be made of concrete or a hard material which shall be constructed to have a sufficient inclination not to allow water to stay. In taking out aggregate from a stock pile, its typical grading shall be maintained and due care should be taken not to brake aggregate or mix foreign matters.

(3) Water

The contractor shall at his own cost provide necessary water for concrete, mortar, etc. Water shall be clean and shall not contain dust, vegetables, salt, and any other impurity.

(4) Admixture

Air-entraining and water-reducing admixture of the standard type shall be used with the Engineer's approval.

(5) Reinforcing Bars

Reinforcing bars for concrete shall be clean, involve no defect, and be free from loose rust, scale, or any sticking object which may reduce bond of reinforcing bars to concrete.

1) Reinforcing bars

Deformed bars shall meet the requirements of JIS G3112.

2) The contractor shall submit manufacturer's test certificates for reinforcing bars. The contractor shall pick up as many test pieces as necessary for conducting 3 times of tension test and 3 times of bending test at normal

temperature for every 10 tons of reinforcing bars carried in and its fractions and for every type and every dimension, under control of the Engineer. These tests shall be performed in compliance with the requirements of JIS Z2241 and JIS Z2248. When the average test value of a lot does not meet the requirements of specifications, the whole lot shall be rejected.

3) Unless specifically approved by the Engineer, the whole quantity of reinforcing bars to be used shall be those produced by one manufacturer.

(6) Attachments

Attachments for concrete work shall be of those types approved by the Engineer and shall include all spacers, chairs, bolsters, ties and others necessary for supporting and wiring forcing bars in position. Metal sections of which legs or bases will expose on the finished concrete surface shall be galvanized.

(7) Reinforcing bars and other materials shall be secured sufficiently before they are used.

2-3-5 Forms

(1) Forms shall be made of wood, sufficiently withstand all loads to be applied during the work, and be applicable to such shapes and dimensions of concrete as indicated in drawings. Forms shall be arranged along required lines or inclined as required, constructed and secured for concrete to be finished in required shapes, and have such construction as robust and does not cause leakage of paste. A particular care should be paied for preventing forms from bulging. Any such material that may spoil or damage concrete surface shall not be applied to forms.

(2) Access openings shall be provided for cleaning and inspecting forms and reinforcing bars. Before placing

concrete, remove woodchips and other undesirable matters on forms, clean the forms carefully, and spray water on the forms sufficiently except in freezing weather.

(3) Shoring under forms shall be sufficiently strong for supporting all working loads applied to the forms under the construction work and reshoring shall be made under all slabs after removing forms under slabs. Support for forms shall be made of wood or steel and have sufficient dimensions and be used at proper intervals for supporting the loads of forms, reinforcing bars, and concrete and working load. Every support shall be provided with an ample brace or braces. Reshoring of supports shall be performed upon removing forms. The number of supports for reshoring and their layout shall be determined on the responsibility of the contractor. Supports for second floor slab forms will, in general, be mounted on a compressible material and due care should be given so that these supports should not subside. Forms shall not be removed until the Engineer approves that the slab strength obtained as the result of all tests is sufficient for the expected loads.

]) Forms

The minimum periods before removing forms are given in Table 2-3-3.

Table 2-3-3 Minimum Periods before Removing Forms

	Position	Period (days)		
		Mean Air Temperature		
		More than 15°C	More than 5°C	More than 0°C
Forms	Foundation. Sides of beams/ girders, colums, walls.	3	5	8
	Soffits of beams and slabs	6	10	16
	Under slabs	17	25	28
Support	Under beams/ girders		28	

2) Forms shall be left longer before being removed than the period mentioned above when so determined by the Engineer because of particular condition of concrete, adverse weather or improper heating or unsuitable curing. However, the contractor shall under all circumstances be responsible for all damage and loss which may be cuased by disassembling or removing forms, supports, etc.

2-3-6 Inserts and Anchors for Other Work

Fit inserts, pipesleeves, hangers, metalties, rack-angle supports, anchors, bolts, corner guards, stair-nosings, dowels, thimbles, anchor slots, metal flashings, nailing strips, wood brick, grounds, and other necessary for attachment of other works to forms. These things shall be mounted securely and in place prior to casting concrete in cooperation with other contractors and workmen. Open-ing for passing ducts shall be made slightly larger than actual dimensions through instructions from the Engineer. Sleeves shall not be fit to guarders, beams, joists or columns without the Engineer's approval.

2-3-7 Processing and Arrangement of Reinforcing Bars

(1) Reinforcing bars shall strictly meet dimensional and positional requirements specified in drawings. Reinforcing bars shall be placed accurately at positions shown, supported securely, and wired to prevent shift prior to or while casting concrete.

(2) Reinforcing bars shall be supported by wire chairs or other approved supports. The intersecting points of rein-forcing bars shall be wired by annealed iron binding wires.

(3) Prior to bar arrangement, loose rust, scale, and other such foreign materials that may reduce the bond between bars and concrete shall be cleared away.

(4) Reinforcing bars shall after completion of assembly be inspected by the Engineer. If there is any corrections, it shall be made and the bars shall be re-inspected by the Engineer for approval prior to placing concrete.

(5) The minimum covering of bars by concrete shall be as shown in drawings.

2-3-8 Concrete for Structures

(1) Concrete shall be made by mixing fine and coarse aggregates, cement, and water and shall meet the following requirements.

(2) Concrete mixing plan shall be made in compliance with the following general requirements, the properties of the materials to be used, and instructions from the Engineer. Adjustment in mixing, inspection and testing to be made for concrete strength control, and other necessary inspection and testing shall be performed under instructions of the Engineer.

(3) General requirements for different types of concrete are given in Table 2-3-4.

Table 2-3-4 General Requirements for Different Types of Concrete

Type of concrete	Fc 210	Fc 180	Fc 150
Nominal mix. by volume	1:2:4	1:2 1/2:5	1:3:6
Water/cement ratio	0.45～0.50	0.50～0.55	0.55～0.60
Cement, kg/cu.m of concrete	More than 325	More than 290	More than 250
Slump, cm	8～13	8～13	8～13
Required volume of air entrained	4±1	4±1	4±1
Works test cubes, minimum compressive strength at 28 days. kg/sq.cm	210	180	150
Method of compacting concrete for placing	Vibration	Vibration	Vibration or rodding

(4) Concrete to be adopted

For all building structures, concrete with a 28-day compression strength (Fc) of 180 kg/cm^2 shall be used. For steel tower foundations and additional concrete on floor slabs concrete with Fc=150 kg/cm^2 shall be used. For guy-wire anchors and leveling concrete, concrete with Fc=150 kg/cm^2 shall be used. When using other types of concrete than above, the contractor shall receive the approval of the Engineer.

(5) Mixing Plan

The contractor shall determine to employ such a water-cement ratio that will allow a proper workability to be obtained for casting and finishing concrete with the specified strength and the dimensions and accuracy set out in drawings and specifications by having, at the time of tendering, knowledge on the manufacturers, types, and plants of cement and aggregates and casting methods to be adopted. Under any circumstances, the water-cement ratio shall not exceed the upper limit given in Table 2-3-4. Furthermore, the amount of cement to be used for 1 m^3 of concrete shall not be less than the minimum value given in the table under any circumstances. The contractor shall, as promptly as practicable after singing the contract, perform necessary trial mix for obtaining the required concrete strength by adopting the above-mentioned materials and mixing rate and receive the Engineer's approval. The amount of cement shall be increased when necessary for obtaining the required concrete strength.

2-3-9 Batching and Mixing

(1) All concrete materials shall be batched accurately. Cement shall be batched by weight and water by weight or volume. Aggregates shall be measured by gauge boxes or vessels with dimensions approved by the Engineer for different dimen-

sions of aggregates.

(2) Concrete shall be mixed by such batch mixers in good condition that have been approved by the Engineer and that have a drum to rotate around a horizontal or inclined axis. No continuous mixer shall be employed. Each mixer shall be provided with a water measuring device capable of measuring necessary amount of water for each batch at an accuracy of within ±1% without being subject to water pressure variation. For mixing concrete materials, a slight amount of water (about 10% of the total amount of water to be used) shall be poured prior to throwing in cement and aggregates. By rotating the drum, add water little by little, finish pouring the required amount of water by 1/4 of the specified mixing time. Concrete shall be mixed until it becomes uniform in both colour and density. When double-drum high-performance mixers approved by the Engineer are used, the minimum mixing time is about 70 seconds for each mixer. The amount of concrete mixed in any one batch shall not exceed the specified capacity of the mixer. The whole of the batch shall be removed before materials for a new batch to enter the mixer.

(3) When mixing operation is complete or to be interrupted for more than 20 minutes, the mixer and all concrete transporting and placing tools shall be cleaned up with water. Concrete thus mixed shall not be changed in property by adding water or by any other method for ease handling or any other reason.

(4) Slight concrete can be hand mixed with the Engineer's approval when circumstances require it. In such cases, however, the amount of cement shall be increased by 10%.

(5) Testing

1) Compression strength test

Seven-day compression strength test and 28-day compression strength test shall be performed. However, when the required strength is obtained by 7-day compression strength test, 28-day compression strength test may not be performed. When the required strength is obtained by 28-day compression strength test even if the requiered strength is not obtained by 7-day compression strength test, the concrete shall be determined good. Sampling for compression strength test shall be performed as per JIS A1115.

2) Slump test

Slump test shall be performed as per JIS A1101.

3) Concrete air content test

Concrete air content test shall be performed as per JIS A1128, JIS A1118, or JIS A1116.

4) Frequency of test

The frequency of test shall be determined on the basis of the concrete placing plan of the day through instructions from the Engineer.

2-3-10 Placing Concrete

(1) Preparation

Prior to placing concrete, clear away dust, rubbish, water and other foreign matters out of the place where concrete is to be cast. In the case of wood forms, sufficiently

splay water on them or apply a remover to them. Reinforcing bars shall be cleaned so that no sticking substances such as oil shall remain. Forms, reinforcement arrangement, pipes, sleeves, conduits, hangers, anchors, inserts, etc., shall be inspected and approved by the Engineer.

(2) Placing

Concrete shall be handled as much promptly as practicable from the mixer to forms. In order to prevent segregation of concrete due to flowing and others, concrete shall be transported as much near the final position as practicable. While placing concrete, take due care so that reinforcing bars, pipes, wood brick or others to be embedded in concrete shall not shift. Concrete of high columns shall not be placed up rapidly in short periods of time. In normal cases, concrete for beams shall be placed by one operation from the bottom to the slab top. Concrete shall be moved to the required place by a hose or the like, sufficiently contacted to all surfaces of forms and bars by hand or a vibrators, and levelled to have a flat surface suitable for finish. Concrete having partially hardened or contained foreign matters shall not be used. All concrete shall be placed on clean, wet surfaces and shall not be deposited on ground with standing water, on soft muddy earth or on dry porous ground. For bearing walls and columns, concrete shall be placed and allowed to settle 2 hours before the succeeding placing. For placing concrete, more than 2 vibrator operators plus more than 5 personnel for spudding and tamping shall be provided. Concrete parapets, eaves, etc., shall in principle be cast monolithically with the supporting body.

(3) Placing with vibrator

Concrete shall be placed with vibrators (more than 2 sets). Vibration shall be given directly to concrete unless specifically directed by the Engineer. The strength of vibration

shall be such that allows concrete to be flown to the required position and set there. Vibration shall be given only to places where concrete has been deposited and places where concrete has been newly placed.

The vibration time shall be such as to sufficiently set concrete and completely embed reinforcing bars and other materials to be embedded and shall not be so long that may cause segregation of any material. In order to guarantee a uniform, dense surface with no honeycomb, vibrating operation shall be aided by tamping rods along the corners or surfaces of forms while concrete is in its plastic condition by means of vibration. While using vibrators and tamping rods, take due care not to damage the inside of forms or shift reinforcing bars and other materials to be embedded.

2-3-11 Construction Joints

(1) Construction joints shall be formed according to drawings or with the approval of or under instructions of the Engineer. Dowels or keys may be provided as specified or when necessary.

(2) The amount of concrete to be placed, method of placing, and the arrangement of bulkheads on joints shall be planned so that the day's concrete work can be continued without interruption.

(3) Joints in reinforced concrete slabs, joists, beams, and girders shall be at right angles to the axis or surface of the member jointed and at the center of the span. When there is intersecting member at the point of jointing, the joint shall be located at a point of minimum shearing stress.

(4) Unless particularly directed by the Engineer, joints in walls, columns and piers shall be made at the top of floor. When it is necessary to stop the work of the day or when the work is to be interrupted by some reason or other, the work shall be stopped at the center of the slabs or beams or at

the position specified by the Engineer. Concrete of cantilever slabs and cantilever beams shall be placed monolithically with the main body and shall not be jointed.

(5) Temporary wooden bulkheads shall be applied so that joints shall become at right angles to the main bar axis. By applying a wood strip with a thickness of 5cm and a width equal to 1/3 of the concrete slab thickness to each wooden bulkhead, form a tongue and groove joint.

(6) Prior to restarting concrete placing work, the surfaces of previously placed concrete shall be roughened, cleaned, wetted with grout immediately before placing concrete newly. Grout shall be made with Portland cement to sand ratio of 1:2.

2-3-12 Weather Condition

(1) When, during temperature drop, the atmospheric temperature falls below 3°C in the shade, all concreting work shall be stopped. Concreting shall not be restarted until the rising temperature becomes 2°C in the shade. When the temperature in the shade reaches about 37°C and is still rising, care shall be exercised particularly for the followings in placing concrete.

1) Cement at high temperatures shall not be used.

2) Aggregates exposed to intense heat for a long time shall not be used as they are. Coarse aggregates shall be used after spraying water or the like.

3) Water to be used shall be as much low in temperature as practibable.

4) When necessary, consult with the Engineer on the use of air-entraining and water-reducing admixture of delay type depending on the required time before placing after the mixing of concrete.

5) water spray on shuttering before placing shall be elaborated.

6) The time from the start of mixing concrete to the end of placing shall be less than one hour.

7) Concrete shall not be casted directly on hot concrete fill.

8) During the period of 28 days after placing concrete, in case of the supposed average temperature is below 15°C, the strength of the concrete shall be corrected by the followings.

standard design strength Fc	: 180kg/cm^2
when below than 15°C, above than 9°C	: 219kg/cm^2
when below than 9°C, above than 5°C	: 225kg/cm^2

(2) The contractor shall record dates of placing concrete, mixing rate to be employed and atmospheric temperatures at the time of placing concrete for different sections of the work. This record shall be kept so that it can be submitted to the Engineer when requested.

2-3-13 Protection and Curing

(1) Concrete placed newly shall be protected from rain, sand storm, chemical change, and other harmful heat and wind actions, water flow, shocks and vibration, etc. Protection and curing shall be continued until concrete becomes sufficiently hardened not to be subject to the above-mentioned factors. The Engineer will determine the time of releasing protection and curing, but under any circumstances it shall be more than 24 hours after placing concrete.

(2) Concrete shall be cured by water spraying for at least 7 days through instructions from the Engineer. Concrete and cement finishes shall be wetted while adjusting the frequency of water spraying depending on the dryness of the sur-

faces during the curing period. Concrete and cement finishes shall, unless specifically directed, be covered with cotton mat, canvas, and other approved covering within 24 hours after placing or finishing and shall be kept under desirable condition until final finish work will be elaborated. Any covering material shall not spoil or discolour concrete. Wood forms shall also be frequently wetten by water spray to prevent being dry during the period of curing.

2-3-14 Concrete Floor slabs on Earth

(1) Concrete floor slabs on earth shall be placed on well-compacted subgrade. Fill under floor slabs shall, in principle, be compacted to 1/2 in thickness at every layer of 30cm. For this purpose, unscreened crushed stone not containing clay by more than 5% shall be used. Crushed stone fill shall be sufficiently rolled until the required thickness and height can be obtained.

(2) On crushed stone fill polyethylene film of 0.15mm in thickness or reinforced waterproof kraft paper shall be laid with edges being folded by 15cm. For the paper and film, the specified product of large size shall be used. Spread the film or paper by stretching edges, and place weights on the edges and folds until concrete is placed, so as not to disturb the film or paper. Immediatelyafter laying film or paper, place concrete of required thickness and finish at proper level to receive final finish specified.

(3) Unless specifically directed, a continuous expansion joint material shall be laid at sections where edge of floor slab abuts vertical surface. Joint materials and portions around pipes penetrating floor slabs shall be completely sealed. For the joint seal material, coal-tar pitch shall be used. At sections where floor waterproof is necessary, no expansion joint shall be used but the slab shall be connected to the wall.

2-3-15 Steel Work

(1) Items to be approved by the Engineer:

The contractor shall in advance submit instruction manuals for fabrication, a work plan and a construction schedule, etc., to the Engineer for approval.

The contractor shall also submit the historical record of a manufacturer, explanations about the scale or facilities of his factory, etc., to the Engineer for approval.

(2) Materials, connection method in general, welding and painting:

These items shall meet the requirements of common items described in the paragraph 2-16.

(3) Erection:

1) Erection shall be made in proper order according to the work plan.
At the time of erecting frames, in principle, diagonal members shall also be fixed to them at necessary parts simultaneously.

2) In process of erection, members shall be assembled temporarily with required numbers of bolts or tack weld.

3) The erection work shall be proceeded with amendment through plumbing test of the structure even in each stage of the work.

4) An inspection of plumbing of the structure shall be made after completion of framing.
Final connection shall be done after plumbing and distortion of the structure will be amended perfectly.

(4) Setting anchor bolts:

1) Position: Positions to set anchor bolts shall be determined accurately by shop drawings.
Due care shall be taken not to move the bolts

or not to do damage to them during concrete placing.

2) Due care shall be taken for exposed portions of bolts not to be bended, or, for threaded portions of them not to be crushed before the erection work starts. If necessary, proper protective measures shall be considered for them.

(5) Inspection:

1) Inspection of full-size drawings

When full-size drawings are prepared, inspect major dimensions, members arrangement, assembled condition, etc., by referring to the manufacture drawings for comparison.

2) Inspection of component parts:

Inspect bolts, nuts and washers for appearance, shape, dimensions, threading accuracy and mechanical properties by referring to the relevant JIS standards.

3) Inspection of erection:

Inspect apprearance of members, assembly procedures and methods in each stage of the work.

4) When bolting is complete, inspect tightening condition of anchor bolts and nuts.

2-4 BRICK MASONRY

2-4-1 Scope of Work

The work specified under this paragraph consists of all brick masonry work and related items of work necessary to complete the work indicated in drawings and described in specifications.

2-4-2 Shop Drawings

All shop drawings shall be submitted to the Engineer for approval. Shop drawings shall illustrate reinforcements, masonry joints, lintels, and details of the work including accurate dimensions, materials to be used, and other related items. Detailed and accurate drawings shall be submitted to the Engineer sufficiently prior to commencing the work so that the Engineer can give approval for the dimensions of door frames and other items.

2-4-3 Samples of Materials

The contractor shall prior to commencing the work submit to the Engineer three sample pieces of each material he proposes to use in the work.

2-4-4 Materials of Brick Masonry (Brick)

High-quality brick made by hand or machine shall be used. The surfaces of brick shall be free from streaks, hollows, cracks or the like. Brick shall be baked completely so that the bulk should become uniform.

The dimensions of brick shall not differ greatly from the following.

Brick dimensions: 220mm(length) x 105mm(width) x 65mm(height)

2-4-5 Material for Mortar

(1) Portland cement

See Paragraph 2-3-4 "Materials."

(2) Sand

Sand to be used for mortar shall be clean, be stable both chemically and in construction, and shall meet the grading given in Table 2-4-1.

Table 2-4-1

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

(3) Water for mixing

See Paragraph 2-3-4 "Materials, "item (3) "Water."

2-4-6 Storage of Materials

Materials shall be stored at dry places with covers and in such ways that prevent damage or entry of foreign matters. Under such weather conditions that may cause icing, brick shall be covered with sheets or other proper materials and stored under covers or the like which will permit circulation of air and not cause excessive absorption of moisture. Cement shall be stored in a watertight warehouse with an elevated floor.

2-4-7 Mortar

(1) Mortar mixing shall be made at a Portland cement to sand volume ratio of 1:4. When a plasticizer for mortar is employed, the Portland cement to sand ratio shall be 1:6.

(2) For the plasticizer for mortar, the product of a manufacturer approved by the Engineer shall be used in accordance with instructions of the manufacturer.

2-4-8 Mixing of Mortar

All cement and sand shall be mixed by a mechanical batch mixer for at least 5 minutes. The consistency of mortar shall be such that the bricklayers are satisfied. Minimum amount of water shall be used for achieving good condition in using mortar and adjustment for this, shall be made using only water. When mortar begins to harden partly because of the vaporization or absorption of a part of the mixing water, add water and retemper the mortar promptly. All mortar shall

be used within one hour and a half from the time of initial mixing. Mortar having begun to set shall not be used.

2-4-9 Cautions and General Remarks

(1) When the outside temperature is below 5°C, masonry shall not be laid unless the materials are heated, the work is protected from the cold and freezing, and measures are taken to allow mortar to set without freezing under instructions of the Engineer.

(2) Prior to closing a pipe, duct, or similar space or shaft, insure to clear away rubbish and foreign matters in it and clean it.

(3) Brick masonry joints having partially or completely hardened shall be cleaned and lightly wetted by water spraying to obtain the best possible bond with new work. Loose units and mortar shall be removed. When a horizontal run of masonry is to be interrupted on the way, brick shall be racked back at a length of a half brick in each course.

(4) Measures shall be taken through consultation with other trades concerned so that their items of work to be followed can be performed without chipping and patching. In the work related to this work and specified in other paragraphs, materials indicated to be assembled shall be processed as required according to the proceeding of the work. Fill sufficient spaces around the vertical and upper frames of doors with mortar. Window anchors and clips shall also be embedded.

2-4-10 Brick Masonry

(1) English bond shall be employed for all brick masonry unless otherwise specified. Broken brick shall not be used except where required.

(2) All bricks shall be laid after applying mortar. Joints shall have a width of 10mm and shall be filled with mortar

completely over the whole wall thickness at each course,

(3) All brick shall be used after being impregnated with water. The top bricks of wall left by the interruption of brick laying shall be wetted with water prior to restarting brick laying. Wall surfaces shall all be kept clean by removing mortar droppings and splashes.

(4) Unless specifically directed, check level and plumbing at each 4 brick courses.

(5) For walls, bricks shall be laid uniformly so that any part of them shall not be left more than 1.5 meters lower than another part unless approved by the Engineer. When the work is interrupted at different levels left, racking back shall be employed for the stepped section.

2-5 WATERPROOFING

2-5-1 Scope of Work

(1) Extent

The work specified under this paragraph consits of all roofing, gutter application, and related items of work necessary to complete the work indicated in drawings and described in specifications.

(2) Work not included

The following item of related work is specified in the other paragraph of this specification.

Roof steel work

2-5-2 Shop Drawings

The shop drawings of roofing and gutter application shall be submitted to the Engineer for approval. The approval shall be gained prior to commencing the work. The shop drawings shall specify the thickness, dimensions, and fitting and fixing methods of respective sections.

2-5-3 Samples

The contractor shall submit to the Engineer each 2 samples of the following materials for approval. The approval shall be gained prior to carrying in materials or commencing the work.

1) Precoated galvanized steel sheet
2) Asphalt roofing
3) Hard cemented chip board
4) Hard PVC gutters

2-5-4 Batten seam roofing with precoated galvanized steel sheet (without axle strip)

(1) A precoated galvanized steel sheet to be used for a batten seam roofing shall be roll type and 0.4mm thick (JIS G3312). And a roof is covered by this steel sheet using caps and continuous clips with the same thickness. The continuous clips shall be fixed by specialized galvanized bolts (6mm in diameter and 45∿60mm in length) at intervals of steel purlins.

Accessories not specified shall meet the specification by a maker well fitted for a roofing method.

(2) An asphalt roofing (JIS A6006) for backing use shall be 22kg/21m^{2}and layed using nails of 19mm in length with washers.

Roofings shall be lapped at each joint (width of lapping, about 100mm) and layed using the nails said above at intervals of 300mm and at other necessary spots, so as not to be crumpled and loose.

(3) Hard cemented chip boards (JIS A5417) shall be 18mm thick, and fixed to purlins (light gauge steel, type-C) with tapping screw (4mm in diameter, 45mm in length, unichrome-plate) at intervals of less than 300mm.

Tapping screws on the surrounds shall be driven more than 10mm inside the edges of board. In arrangement of boards, each joint of the shorter side of board shall be set on purlins in principle.

2-5-5 Cap Flushing

(1) Cap flushing shall be provided at locations indicated in drawings. Cap flushing shall be made of precoated galvanized steel sheet having a thickness of 0.4mm(JIS G 3312).

(2) At other locations than requiring short cap flushing, cap flushing shall be processed to a minimum length of 1.2m with the edge overlapped 7.5cm without soldering.

(3) Cap flushing at corners shall be embodied monolithically.

2-5-6 Hard PVC Gutters

(1) Hard PVC gutters and their adhesives shall be products of a manufacturer, in compliance with JIS A5706.

(2) Gutter hooks shall be made of galvanized steel with a thickness of 2.8mm and a width of more than 25mm or shall be a product already manufactured.

(3) Gutter hooks shall be fitted at intervals of less than 1.5m in the case of down pipes and at intervals of less than 1m in the case of eaves gutters.

(4) Gutter hook work

1) For down pipe clips, steel rings shall in principle be hinged with each steel ring being tightened to the steel anchors with 2 small bolts.

2) For fitting down pipe clips, anchor shall in principle be split, bended at both edges and embedded to a depth about 60mm in the case of reinforced concrete construction.

(5) After completion of fitting gutters, clean and perform water running test.

2-6 PLASTERING

2-6-1 Scope of Work

The work specified under this paragraph consists of all plaster work and related items of work necessary to complete the work indicated in drawings and described in specifications. A mixing table for the nominal mix of cement and sand is given in Table 2-6-1.

Table 2-6-1

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

2-6-2 Thickness and Number of Coats

(1) Thickness

Unless otherwise specified, plaster thickness ranging from the lath, brick or concrete face to the plaster finish face shall be at least as follows.

1) External Portland cement plaster and floor plaster finish: 30mm

2) Interior Portland cement plaster (excluding ceilings): 20mm

3) Interior Portland cement plaster on ceilings: 15mm

(2) Number of coats

Apply 3 coats of plastering to brick, block and concrete surfaces excluding floors and ceilings. Give 2 coats to the soffits of concrete ceiling.

2-6-3 Materials

(1) Basic materials

1) Portland cement

See Paragaraph 2-3-4, item (1) "Portland cement."

2) White Portland cement to be used shall be such a product of Nepal that meets the requirements of JIS R5210 or a product approved by the Engineer.

3) Slacked lime to be used shall be such a product of Nepal that meets the requirements of JIS A 6902 or the equivalent.

(2) Sand

Sand to be used in plastering shall be clean, fine and chemically and physically stable. Sand shall pass sieves and shall have such grading as given in Table 2-6-2.

Table 2-6-2

Table of Grading - (Percentage by Weight Passing Sieves)							
Nominal Size of Sieve (mm)		5	2.5	1.5	0.6	0.3	0.15
Sand (%)	Scratch coat, Brown coat	100	100∿60	85∿35	60∿20	35∿10	10∿2
	Finish coat		100	100∿50	80∿30	45∿15	10∿2

(3) Water

See Paragaraph 2-3-4, item (3) "Water."

2-6-4 Carrying in and Storage of Materials

(1) All products shall be carried in packed in packages, containers or the like branded with the name and trademark of the manufacturer. Unless specifically stated herein, mixing and application of all products shall strictly meet the requirements of the specification of the manufacturer or manufacturers.

(2) Cement, laths, and all other plastering materials shall be protected against moisture until they are used. These materials shall be stored under a roof and separated from walls which may cause dew condensation and other moist surfaces. Metals shall be stored not to cause rust. Rusted metals shall not be used in the work.

2-6-5 Samples

The contractor shall submit 2 samples of each lath, etc., he proposes to use in plastering to the Engineer for approval.

2-6-6 Metal laths

(1) Application

Metal laths shall be used at all locations indicated in drawings as plaster bases.

When concrete and adjacent brick surfaces to be plastered are on a line with each other, metal laths shall be applied

so as to cover at least 15 cm over each surface.

(2) Type and weights of laths

Laths to be used shall be such flat metal laths that meet the requirements of JIS A5505, Type 2 and have thickness of 0.4∿0.7mm and weight of more than 0.5kg/m^2 or equivalent.

2-6-7 Types and Mix Proportion of Scratch and Brown Coats

For all scratch coats under all cement plaster, standard portland cement plaster shall be used. The Portland cement-sand ratio to be employed for scratch coats shall be 1:2 in volume ratio. The Portland cement-sand ratio to be employed for brown coats shall be 1:3 in volume ratio.

2-6-8 Application of Plaster Base Coats

(1) Preparation

By inspecting the plaster base, confirm that plastering can be achieved at the required thickness. Inspect metals, corner laths, and bridging laths, etc., to confirm that they are mounted securely. Check whether there is rust or whatever may discolour plastered surface and, if any, effect corrective plastering as required. When necessary, wet the brick, block, or concrete surface to be plastered with a brush or spray prior to starting plaster work.

(2) In the case of 2-coat work, apply scratch coat with sufficient material and pressure to adhere firmly to the plaster base. Before this first coat has set, form a sufficiently smooth surface by using a wood float and leave the plaster rough to become ready to receive the finish coat.

(3) In the case of 3-coat work, apply scratch coat with sufficient material and pressure to adhere firmaly to the plaster base. Before this first coat has set, scratch it with a scarfier to produce a suitable coat for

brown coat. Apply brown coat to form a smooth surface, screed the surface to less than 3mm in both horizontal and vertical directions, and apply a wood float to make the surface ready for the application of finish coat. Brown coat shall be applied after the scratch coat has been dried.

2-6-9 Types, Coats and Mix Proportion of Finish Plaster

For finish coat, Portland cement plaster shall be applied on brown or scratch coat. The mix proportion of finish coat shall be 1:3 (Portland cement : sand) by volume. For interior work, a proper amount of admixture shall be used in addition. The amount of admixture shall be such that shall not give any remarkable influence to the strength of the plaster.

2-6-10 Application of Finish Coat

(1) General

Finish coat shall be applied at a thickness of about 3mm. Finish coat shall be applied after the base coat dries partially or completely and then wetted uniformly but not excessively. In general, the base coat is properly dampened in compliance with the specification of the manufacturer of the base coat and finish coat materials. Finish coat shall be cured in wet condition for at least 48 hours after application.

(2) Trowel finish

After applying finish coat uniformly on the base coat, wait until water disappears. When water disappears, finish with a trowel not to cause blemishes and irregularities, by using a proper amount of water.

2-6-11 Application of Waterproofed Plaster

(1) Waterproof agent

For the waterproofing agent, the product of the specified manufacturer shall be used.

(2) Mix proportion

The mix proportion of cement to sand shall be 1:2 by volume and the waterproof agent shall be used as specified in the specification of the manufacturer of the waterproof agent.

(3) For waterproofed plaster, materials shall be measured accurately and mixed sufficiently. Waterproofed plaster shall be applied to a thickness of 15mm with a trowel elaborately. For walls, waterproofed plaster shall be applied in two coats.

2-6-12 Cautions and Preparation for Plastering

(1) Temperature and ventilation

While plastering and curing, a maximum temperature of 65°C shall be kept in places to be plastered for at least 7 days. Plaster shall be protected from freezing, non-uniform or abrupt drying. Plaster shall not be applied on any freezed surface. After the plaster has set, proper ventilation shall be effected to prevent dew condensation.

(2) Concrete surface

When applying plaster directly on a concrete surface with no metal lath, ensure to remove foreign matters such as rubbish and plaster dregs on the concrete surface with a wire brush and remove grease, oil, efflorescence, etc., by a solution of hydrochloric acid (1) : water (10) or an alum solution approved by the Engineer.

(3) Masonry surfaces

Masonry surfaces on which plaster is to be applied shall be cleaned free from mortar chips, brick chips, grease, oil, acids, etc. Masonry surfaces shall be properly dampened as required to prevent excessive suction.

(4) Plastering procedure

Plastering of rooms or areas requiring sound absorbing treatment shall be performed prior to applying sound absorbing materials. For rooms to be tiled with ceramic tiles by using plaster, finish plaster on walls shall not be applied until the tiling work is complete.

(5) Curing of adjacent surfaces

Prior to applying plaster, sufficiently cure such adjacent sections already finished as tiles, stone, frames, doors, windows, and partitions and protect these sections from damage and loss, soil, and stain. For curing, cover these sections with damp-proofing kraft paper or polyethlane sheets and seal joints with tape or adhesives. For metal frames, masking tape which can be removed later or stain preventing material approved by the Engineer may be used in compliance with instructions given in the specification of the manufacturer. The curing material shall be maintained sufficiently during the plaster work and shall be removed after completion of the plaster work.

(6) Inspection of plaster base

Prior to plastering, inspect the plaster base of each room or section elaborately. When any imcomplete section or condition is found, report it to the Engineer. Plastering shall not be performed unless necessary base treatment is completed.

2-6-13 Mixing of plaster

Plaster shall be mixed by machine mixers, although it can be mixed by hand when approved by the Engineer. As many mixers as necessary for the plaster work shall be used. Plaster shall be measured by volume or by weight, whichever specified. Freezed, hardened, or solidified materials or partially hardened materials shall not be used. Nor partially set materials shall be retempered for use.

2-6-14 Corrections

After completing the plaster work, effect corrections on flaved or defective portions.

Correction shall be made to assure harmony in texture and finish with adjacent portions and to form flush and smooth surfaces.

2-6-15 Spraying of Plaster for Decoration

(1) Materials

Plaster spray materials to be used shall meet the requirements of JIS A6907 (Plaster spray materials).

(2) Procedure

1) When a crack or cracks are involved on the concrete base and others, chip portions involving cracks in V form as required and patch up cracks with cement paste fill harmless to finishing. Uneveness if found shall be corrected by sandering.

2) Prior to applying finish coat, add water of 50% of the total amount of water to be used to the materials, mix them sufficiently, and then add the remaining water to them. For the base coat, the total amount of water may be added at a time.

3) Such an amount of plaster shall be mixed that can be applied within one hour.

4) Base coat shall be sprayed after the base surface to be sprayed has set sufficiently. When the base is excessively dry, dampen it.

5) Finish coat shall be applied more than 24 hours after applying the base coat.

2-7 CARPENTRY

2-7-1 Scope of Work

(1) Extent

The work specified under this paragraph consists of all carpenter work and related items of work necessary to complete the work indicated in drawings and described in specifications.

(2) Work not included

The following items of related work are specified in other paragraphs of this specification.

Studio interior work

2-7-2 Shop Drawings

(1) Shop drawings for carpentry shall in advance be submitted to the Engineer and approval shall be received for all requirements specified hereunder.

(2) Shop drawings shall specify materials, kinds of trees, matching and arrangement ofpanels, full size profiles of mouldings, thickness, dimensions, construction, fastenings, blocking, clearance, assembly and erection details, finish materials, surface finishes, build-in hardware, connections with associated work, etc.

2-7-3

(1) Samples

The contractor shall submit two samples of each of the following materials and assemblies to the Engineer for approval. Prior to commencing assembly or fabrication, the contractor shall receive the Engineer's approval.

Timber a) Timber for structure (depending on the kind of tree)

b) Timber for fixture (depending on the kind of tree)

(2) Prior to using solid timber or laminated timber, submit samples of the timber to be used to the Engineer for approval.

2-7-4 Materials

(1) General

1) Sizes given in drawings shall be finished sizes.

2) Timber to be used shall be such that are sufficiently seasoned and planned smooth, straight and true and free from cracks, cuts, breaks, loose or dead knots, vermiculation, and any other defect.

3) All timber shall be straight and true, and timber with distortion or twist shall be rejected.

4) Anti-termite treatment shall be effected to all timber specified herein. The method of anti-termite treatment shall be such as authorized in Nepal.

5) Unless otherwise specified, materials for carpentry shall be those available in Nepal, which has the strength to meet the measurements indicated in design drawings and approved by the Engineer.

(2) Moisture content (average)

1) Timber for framework, sheathing and exterior finish woodwork : less than 20%

2) Timber for interior finish woodwork : less than 15%

(3) Grades and kinds of timber

1) The grades and kinds of timber, plywood and fixture shall be as described hereunder, unless otherwise specified. Timber and plywood shall be identified by authorized grade marks given on them so far as there is no hindrance to natural grain finish. In the case of natural grain finish, a certificate or certificates issued by the timber grading organization or inspec-

tion organization approved by the Engineer shall be submitted upon delivery of the materials.

2) Timbers for frames and frameworks

a) For floor joists and beams, first-class timber or equivalent shall be used.

b) For studs, sills, upper plates, ridge diagonal bracings, furrings for walls and ceilings, throating, wood brick, nailing strips, etc., second-class timber or equivalent shall be used.

3) Timber for exterior finish woodwork

For door frames, first-class timber approved by the Engineer shall be used.

4) Timber for interior finish woodwork

a) For trims, door and window frames, window boards, ceiling boards, and exposed wood parts made in finish woodwork and others, first-class timber approved by the Engineer shall be used.

b) For concealed parts made in finish woodwork, second-class timber approved by the Engineer shall be used.

2-7-5 Carpentry for Structure

(1) Jointing

All frameworks shall be jointed by optimum jointing methods. Joints shall transmit required loads and withstand stresses, to which they will be subjected and shall be approved by the Engineer. Unless otherwise stated, all joints shall be fixed with as many nails of a proper type as required. But, joints shall be fixed with side board by nailing from the side board side (when there is a side board). Joint surfaces shall be contacted smoothly over the whole surfaces prior to using fastenings.

Nails, screws, or bolts shall not be used on breaks at the ends of timber. When there is a possibility of causing a break, bore a hole with a diameter not exceeding 4/5 of the diameter of the nail to be driven by using a gimlet prior to nailing. When screws are to be used, bore holes in advance. When using bolts, bore holes with a diameter 1.6mm larger than that of the bolts to be used from both sides of timbers to be jointed.
Nuts shall be tightened securely while taking care not to damage wood immediately under washers.
Holes on structural members shall be bored after fastening with clamps or spikes.

(2) Covering materials

Frames and frame works shall be arranged and assembled so that all supports and fastenings necessary for mounting covering materials shall be fitted as required.

(3) Frames

For columns, studs, beams, binders, joists, rafters, and purlins, one piece of timber extended between the supports or the base on which it is to be fitted shall be used. However, when inevitably it is necessary to joint at an intermediate position, such a method that has been approved to cause no hindrance in structure shall be employed.

(4) Anchors

Structures to be fixed to prevent roof frames, trusses and others from being deviated shall be fitted with proper anchors at joints or fixed by using binding hardware on all supporting sections.

(5) Beams and binders

For beams and binders between supporting points, timber in one piece and one length shall be used. For continuous

joints, scarf joint or splice joint shall be used and reinforcement by bolts, plates or metal straps shall be employed to fix the joints securely.

2-7-6 Furring

(1) Furring shall be fitted as indicated in drawings and described hereunder.

(2) When necessary, use wood shims or the like so that the surface shall become true to line and plumb.

2-7-7 Joinery/Finish Carpentry

(1) Exposed faces

Unless otherwise stated, exposed faces shall be wrought or sanded for finish.

(2) Necessary tolerance shall be considered on all joints between fixture and structure, whether or brick or concrete, to provide allowance against errors in construction or fitting and other movements.

(3) Arrangement, jointing and fitting of all fixtures shall be made not to detract the strength and external view of the finished work and not to give loss or damage to adjacent materials or structures even if shrink is caused in any portion or to any direction.

(4) All such items of work necessary for suitable joints as provision of mortises, tenons, and grooves, ship lap, and tonguing shall be performed.
Metal plates, screws, nails, and other fixings specified by the Engineer, and fixings necessary for proper framing and lining or fitting them to buildings shall all be set as required.

(5) All fixture work and finish wood work shall be performed as indicated in drawings. Unless otherwise specified, joint-

ing shall be performed by the method suitable for the section to be jointed.

Other general requirements to be met are as follows.

1) Cut shall be made accurately and true to line.
2) For assembling, nailing and adhesion shall be used in combination.
3) Blind nailing shall be employed as much as possible.
4) Nailing on exposed surfaces shall be made so as to allow puttying.
5) Trims for doors and windows shall be in single length.
6) Marking-off, mitter joint, and other joints shall be elaborated accurately.
7) After sanding along wood grain at the factory, finish the surface with sandpaper in the site. Traces of the machine or tool shall not remain on the finished surface.
8) Exposed parts shall not involve defects.
9) The rear side of a flat trim shall be more tapered than on the front side or grooved.
10) Trims shall be fitted securely by using thin nails for finish. Those sections to be fitted particularly solid shall be fixed with screws and adhesives in combination.
11) Interior finish materials shall not be carried into buildings before mortar or plaster dries sufficiently.