# TECHNICAL SPECIFICATIONS

## A. "CIVIL WORKS"

**SHELTER FOR VICTIMS OF TRAFFICKING & VULNERABLE SMUGGLED MIGRANTS IN LAC ASSAL- DJIBOUTI.**

**OCTOBER 2018**

# 1. GENERAL

## 1.1 Background

United Nations Office on Drugs and Crime (UNODC) was approached by the Djibouti government to build shelter for refugees stranded in the Ethio-Djibouti boarder. These migrants are coming from Ethiopia, Somalia and Eritrea. Currently Djibouti is also facing reverse migration problem from Yemen and Somalia. The project aims to construct a shelter for victims of trafficking and vulnerable smuggled migrants in Djibouti. The shelter will include two residential units for the victims with two separate pit latrines and clinic. The shelter will be located next to the police station at Lake Assal, around the coordinates 11°32'22.30"N 42°29'40.97"E about 115 km from the capital Djibouti in the North direction.

The United Nations Office for Project Services (UNOPS) is providing project management services from design to construction work of the emergency shelter for victims of trafficking and vulnerable smuggled migrants in Djibouti.

## 1.2 Project Objectives

UNOPS will construct a shelter that help victims of trafficking and smuggled migrants to get appropriate care and support until they go to country of origin. This is intended to provide the desired outcome for an improved health, social and psychological status of victims of trafficking and smuggled migrants in Djibouti.

## 1.3 Scope of Works

The scope of work has included the design and construction of the following facilities at Lac Assal, Djibouti:

- A clinic comprising of Doctor and Nurse's room, examination room, reception, pharmacy, accessible toilet including waiting and circulation area having a total area of about 109m2.
- Two residential units each having an area of 135 m2 including 2.2m wide veranda and hosting 25 users accommodating a total of 50 migrants.
- Two pit latrines each with two regular stalls and an open shower serving for the migrants.

*(Please refer details in the designs attached)*.

## 1.4 Description of Works

The construction of shelter and clinic will include the following works:

**i) Mobilization**

- Site preparations, sign board, site safety and security works;

**ii) Civil Works**

- **Earthwork**: Setting out of the building structures, site clearing and excavation, backfill with selected material (95% Proctor) and cart away as directed by the site supervisor;
- **Foundation work**: Reinforced concrete footings for the residential units and clinic, strip masonry foundations for the pit latrine;
- **Concrete Ground Floor**: Reinforced concrete floor for the buildings on top of well compacted fill material and crushed stone hardcore as detailed on the drawings;
- **Concrete structural Frame**: Reinforced concrete for ground beams, vertical columns, intermediate and top tie beams of C-25 concrete grade and high strength reinforcement bars;
- **Hollow Concrete Block walls**: 3.0m high hollow concrete block walls around the perimeter of the shelter and partition walls for the clinic and pit latrine;
- **Steel Roof Structure**: Supply and fix steel truss and purlins for the shelter, clinic and pit latrines;
- **Roof Sheeting**: EGA sheet roofing cover for the residential unit, clinic and pit latrines all as per the drawings;

- **Finishing**: Cement screed finish for the floors of the residential unit, Terrazzo floor tiles for the clinic and ceramic for the toilets. Plastered and painted for the walls of the clinic and residential units. Chip wood ceiling for the clinic all as per the drawing.
- **Door and Windows**: 38mm thick LTZ steel framed metal door and windows with 4mm glazing fixed for windows and top of doors.

#### iii) Mechanical, Electrical and Plumbing (MEP) Works

- Water Supply: Water supply to the pit latrines and accessible toilet in the kitchen through 1.5 m high elevated 2,000 liter capacity plastic tank situated on stone masonry wall including galvanized piping works between the tank and the fixtures that include hand wash basin and bib taps at the latrine and shower;
- Supply and fix sanitary fixtures such as hand wash basin and squatting pan at the pit latrines;
- Waste Water Drainage: Construction of septic tank for the toilet in the clinic and connection of UPVC pipes between the fixture and the septic, manholes using stone masonry and vent pipes for the pit latrine;
- Storm water Drainage System: Construction of gutter, downpipes from roof of the buildings. Since site is dry and sandy soil, water will be absorbed by soil. Hence water from down pipes will be left away from the pavement to be eventually absorbed by the soil. No major storm water drainage system required.
- Fire extinguishers: Supply and fix powder type fire extinguishers in the clinic and residential units.
- Power Supply: No grid power in the vicinity. DC Solar kits will be used for power source to provide lightings, USB power sockets and ceiling fan.
- Electrical Installation: Installation of cables between the solar panels, batteries and wiring in the buildings for lighting, and power sockets all as per the drawing;
- Electrical fixtures: Supply and fix fittings for lighting in buildings and external compound lightings and power sockets.

### 1.5 Site Description

- The site with a total area of about 1 hectare (10,000 m2) is located at Lac Assal about 115 Km from capital Djibouti along the Djibouti- Obock highway with coordinates 11°32'22.30"N 42°29'40.97"E. The site can be accessed from the main road in the East direction.
- There exist a police station occupying part of the land, majority is open land left for the construction of shelter for the migrants according to the programme herein.
- No Major infrastructure development in the vicinity except few structures serving for police station and are to remain during construction. Currently no utility (water and power supply) in the vicinity;
- No vegetation, trees or grass coverage on the land. It is open flat land with gentle slope towards a valley at North-East corner;
- The topographic map developed to the site indicated that site has gentle slope ranging between 1.0% to 1.5%. Open land with no fencing and structure. The site is bounded with Obock-Dibouti Road to the East.

The geo-technical investigation conducted to the site has revealed two layers.

- Layer-1: Loose SANDY SILT with some gravel. This is a thin layer encountered on the surface under all test pits with thickness varying between 0.2m - 0.4m.
- Layer-2: Hard rock layer with difficulty to excavate. This layer is encountered in all test pits with varying thickness and considered as foundation soil.

Topographic Map of the site

### 1.6 PRE-CONSTRUCTION WORK

The Engineer and Contractor will carry out a joint condition-in survey using video or digital photographs to record the condition of the site upon handover to the Contractor. This will determine the state of the site that the Contractor must hand back upon completion of the works. The Contractor will carry out a detailed site set out survey for the works.

A Pre-Construction Meeting will be held between the Engineer and the Contractor to review the following information:

- Condition-in Survey
- Site Survey
- Work Method Statement
- Program
- Schedule of Materials and Installed Equipment

**Site restrictions**
Generally no access restrictions to the site. Discussions to be held with the inhabitants of the police station in order not to affect their task and accessibility to the facilities.

**Occupied areas of site or buildings**
For the occupied parts of the site:

- Allow occupants to continue using the area for the required period.
- Make available safe access for occupants.
- Arrange work to minimize nuisance to occupants and ensure their safety.
- Protect occupants against weather, dust, dirt, water or other nuisance, by such means as temporary screens.

**Protection of persons and property**
Temporary works: Provide and maintain required barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic flagging as necessary and under a discussion with the Engineer.

Access ways, services: Do not obstruct or damage roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services. If damage occurs, immediately repair it at the Contractors cost.

Property: Do not damage property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site. If damage occurs, immediately repair it at the Contractors cost.

**Existing services**

Attend to existing services as follows:

- If the service is to be continued, repair, divert or relocate as required.
- If the service is to be abandoned, cut and seal or disconnect, and make safe.

Submit proposals to the Engineer for action for existing services before starting this work. Minimize the number and duration of interruptions.

## 1.7 CONSTRUCTION PLANT

**Use of existing services**

Existing services may be used as temporary services for the performance of the contract subject to the conditions stated by the Engineer.

**Contractors Facilities and Work Practices**

The Contractor is required to provide adequate toilet and washroom facilities for his staff. These facilities shall be kept clean and serviceable at all times.

The Contractor is required to provide adequate first aid equipment on-site, failure of the Contractor to ensure the availability of first aid equipment on-site will result in an immediate „stop work" order being issued. All costs and time delays resulting from any such „stop work" order is entirely the Contractors responsibility.

The Contractor is to maintain a safe, healthy and tidy worksite at all times and all work activities are to be performed with protective and safety equipment appropriate for the task. The Contractor is entirely responsible for workplace safety and unsafe work practices will be identified and recommendations made for revised work methods as appropriate.

**Project signboards**

Provide project-specific signboards and the following:

- Location, size and wording as directed by Engineer.
- Maintain in good condition for duration of the work.
- Remove on completion.

Obtain approval before display of advertisements or provision of other signboards

## 1.8 BUILDING THE WORKS

**Contractor's representative**

The contractor must employ a suitably experienced person as the Site Manager. This person must be on site during working hours, and fluent in English and technical terminology. The Contractor"s Site Manager will have the authority to make all decisions concerning the project

**Program of work**

The Contractor is to provide a construction program which has the following information:

- Sequence of work.
- Allowance for holidays.
- Activity inter-relationships.
- Periods within which various stages or parts of the work are to be executed
- Time scale: Working days.

**Site meetings**

Hold and attend weekly site meetings throughout the contract and ensure attendance of appropriate subcontractors, the Site Manager and Engineer. The meeting schedule may be modified by the Engineer.

The Engineer is to keep minutes of site meetings. Within 3 working days after each meeting, submit to each party written copies of the minutes.

## 1.9 COMPLETION OF THE WORKS

**Final cleaning**
Before Practical Completion, clean throughout, including interior and exterior surfaces exposed to view. Clean carpeted and soft surfaces. Clean debris from the site, roofs, gutters, down pipes and drainage systems. Remove waste and surplus materials.

**Reinstatement**
Before practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

**Post construction Works**

The Contractor will provide the following documentation after all site construction has been completed:

- Warranty Statement
- Material Test Certificates
- As - Built Drawings

A condition-out survey will be conducted with the Contractor and Engineer at which damages caused by the Contractor will be identified. The Engineer will determine if the Contractor is to make repairs or if the damage will be deducted from the Contractor"s final invoice.

**Removal of plant**
Within 10 working days after practical completion, remove temporary works and construction plant no longer required. Remove the balance before the end of the defects liability period.

## 2.1 CONTRACT DOCUMENTS

**Drawings**

Large scale drawings take precedence over small scale drawings. Written or calculated dimensions take precedence over scaled dimensions.

If there are any errors in dimensions, set out or size, immediately notify the Engineer.

**Bill of Quantities**

If there are any errors in description of items or omissions in the BOQ, immediately notify the Engineer.

If there are any items which are unclear or are not available within the project program, immediately notify the Engineer.

**Services diagrammatic layouts**

Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- Obtain measurements and other necessary information.
- Coordinate the design and installation in conjunction with all trades.

## 2.2 INSPECTION

**Inspection Notification Schedule**

The Contractor is to notify the Engineer when items are ready for inspection.

**Notice**

Minimum notice for inspections to be made on site is 24 hours for offsite personnel, 4 hours for onsite personnel.

If notice of inspection is required in respect of parts of the works that are to be concealed, advise when the inspection can be made before concealment.

## 2.3 SUBMISSIONS

**Samples**

Submit nominated samples for approval of the Engineer.

If it is intended to incorporate samples into the works, submit proposals for approval. Only incorporate samples in the works which have been approved. Do not incorporate other samples.

Keep endorsed samples in good condition on site, until practical completion.

**Shop drawings**

General: If required, submit dimensioned drawings showing details of the fabrication and installation of services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and submit dimensioned set-out drawings.

# 3. DEMOLITION

## 3.1 GENERAL

### 3.1.1 INTERPRETATION

**Demolished materials classes**
Salvaged for re-use: Demolished materials scheduled for re-use in the works.
Salvaged for disposal: Demolished materials scheduled for re-use elsewhere.
Demolished for re-use: Non-scheduled demolished materials proposed by contractor for re-use in the works.

Demolished for removal: Other demolished materials.

### 3.1.2 INSPECTION

Give sufficient notice so that inspection may be made of the following:

- Adjacent structures before commencement of demolition.
- Propping of structures prior to demolition works.
- Structure after stripping and removal of roof coverings and other external cladding.
- Underground structures after demolition above them.

## 3.2 PRODUCTS

### 3.2.1 DEMOLISHED MATERIALS

**Demolished materials**
Ownership: Ownership of demolished materials remains vested with the Employer or Client.
Reuse: If it is proposed to reuse demolished materials in the works, submit proposals.
Salvage: Recover without damage materials to be salvaged, for reuse in conformance with the prevailing site conditions or as specifically proscribed in the Contract Documents.

Removal: Remove from the site demolished materials which are the property of the contractor. Do not burn or bury on site.

Transit: Prevent spillage of demolishing materials in transit.

## 3.3 EXECUTION

### 3.3.1 SUPPORT

**Temporary support**
If temporary support is required, certification for its design and installation is required from a professional engineer engaged by the contractor.

Until permanent support is provided, provide temporary support for sections of existing buildings which are to be altered and which normally rely for support on work to be demolished.

Support excavations for demolition of underground structures. Provide supports to adjacent structures where necessary, sufficient to prevent damage resulting from the works.

**Permanent supports**
If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

### 3.3.2 PROTECTION

**Encroachment**
Prevent the encroachment of demolished materials onto adjoining property, including public places.

**Weather protection**
If walls or roofs are opened for alterations and additions or the surfaces of adjoining buildings are exposed, provide temporary covers to prevent water penetration. Provide covers to protect existing plant and equipment and materials intended for re-use.

**Dust protection**
Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

**Security**

If a wall or roof is opened for alterations and additions, provide security against unauthorized entry to the building.

### 3.3.3 DEMOLITION

**Explosives**

Do not use explosives in the demolition process.

### 3.3.4 HAZARDOUS MATERIALS

**General**

General: Give notice immediately hazardous materials or conditions are found, including the following:

- Asbestos or material containing asbestos.

### 3.3.5 COMPLETION

**Notice of completion**

Give at least 3 working days" notice of completion of demolition so that adjacent structures may be inspected following completion of demolition.

Make good any damage arising out of demolition work. Obtain written acceptance from the owner of each adjoining property of completeness and standard of making good.

# 4. SITE PREPARATION

## 4.1 GENERAL

### 4.1.1 AIMS

**Responsibilities**

The aim of this work section is to clear the site and put in place adequate environmental controls to allow the commencement of earthworks and/or building works.

### 4.1.2 SUBMISSIONS

**Execution**

Submit the methods and equipment proposed for the earthworks, including the following:

- Dewatering and groundwater control and disposal of surface water.
- Control of erosion and contamination of the site, surrounding areas and drainage systems.
- Dust control.
- Noise control.

## 4.2 EXECUTION

### 4.2.1 TREES

**Work near trees**

Keep the area within the drip line free of construction material and debris. Do not place bulk materials and harmful materials under or near trees. Do not place spoil from excavations against tree trunks. Prevent wind-blown materials such as cement from harming trees and plants.

Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

If excavation is required near trees to be retained, give notice and obtain instructions. Open up excavations under tree canopies for as short a period as possible.

Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods such that root systems are preserved intact and undamaged.

Backfill to excavations around tree roots with backfill free from weed growth and harmful materials. Place the backfill layers, each of 300 mm maximum depth, compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 300 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Water trees as necessary, including where roots are exposed at ambient temperature > 35°C.

### 4.2.2 EXISTING SERVICES

**Marking**

Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

**Excavation**

Do not excavate by machine within 1 m of existing underground services.

### 4.2.3 ENVIRONMENTAL PROTECTION

**Dust protection**

Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

**Dewatering**

Keep ground works free of water. Provide and maintain slopes and drains on excavations and embankments to ensure free drainage. Place construction, including fill, masonry, concrete and services, on ground from which free water has been removed. Prevent water flow over freshly laid work.

### 4.2.4 SITE CLEARING

**Extent**

Clear only the following site areas:

- Areas to be occupied by works such as buildings, paving, excavation, re-grading and landscaping.
- Other areas designated to be cleared.

Contractor"s site areas: If not included within the areas specified above, clear generally only to the

extent necessary for the performance of the works.

**Clearing and grubbing**

Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Remove tree stumps and roots over 75 mm diameter to a minimum depth of 500 mm below subgrade under buildings, embankments or paving, or 300 mm below finished surface in unpaved areas. Holes remaining after grubbing shall be backfilled with sand material to prevent ponding of water. The material shall be compacted to the relative density of the existing adjacent ground material.

Old works: Remove old works, including slabs, foundations, pavings, drains and manholes found on the surface unless identified on the drawings to remain intact.

**Topsoil**

All topsoil shall be stripped over the area on which construction or grading takes place. This topsoil shall be carefully stockpiled to be reused for landscaping on completion of the building operations or otherwise disposed of as directed.

### 4.2.5 DISPOSAL OF MATERIALS

**Disposal**

General: Remove cleared and grubbed material from the site.

# 5. EARTHWORK

## 5.1 GENERAL

### 5.1.1 INTERPRETATION

**Definitions**

For the purposes of this work section the definitions given below apply.

- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Line of influence: A line extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.

### 5.1.2 RECORDS OF MEASUREMENT

**Excavation and backfilling**

Do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.

Method of measurement: To be jointly agreed between the Engineer and Contractors Site Manager unless otherwise agreed.

### 5.1.3 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

- Excavation completed to contract levels or founding material.
- Filling completed to contract levels.

## 5.2 FILL MATERIALS

**Fill material generally**

Fill material is to be inorganic, non-perishable material.

Excluded materials:

- Organic soils.
- Materials contaminated through past site usage.
- Silts or silt-like materials.
- Fill containing wood, metal, plastic, boulders or other deleterious material

**Re-use of material recovered from excavation**

Re-use excavated material elsewhere on site if approved by the Engineer.

## 5.3 EXECUTION

### 5.3.1 REMOVAL OF TOPSOIL

**General**

Remove topsoil to all areas to be cut, areas to be filled, areas to be occupied by structures, pavements, embankments and the like.

Maximum depth: 200 mm.

**Re-use of removed topsoil**

Re-use removed topsoil elsewhere on site as directed by the Engineer if suitable for fill..

### 5.3.2 EXCAVATION

**Extent**

Excavate over the site to give correct levels for construction, pavements, filling and landscaping.

Excavate for footings, pits and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate.

**Disposal of excess excavated material**

Remove excess excavated material from the site and dispose of legally.

### 5.3.3 BEARING SURFACES

**General**

Provide flat bearing surfaces for loadbearing elements including footings. Step to suit changes in levels. Make the steps to the appropriate courses if supporting masonry.

### 5.3.4 REINSTATEMENT OF EXCAVATION

Where excavation is deeper than the required depth, fill and consolidate to the correct depth.

### 5.3.5 SUPPORTING EXCAVATIONS

**Provision of supports**

Provide temporary supports to all excavations greater than 1.8m deep. Confirm type of supports and level of protection required with the Engineer.

**Removal of supports**

Remove temporary supports progressively as backfilling proceeds.

### 5.3.6 ADJACENT STRUCTURES

**Temporary supports**

Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works. This applies to all structures where the line of influence is interfered with by the proposed excavation works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

**Permanent supports**

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

### 5.3.7 PREPARATION FOR FILLING

**General**

Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements. Shape to assist drainage. Compact the ground exposed after stripping or excavation.

### 5.3.8 PLACING FILL

**General**

Layers: Place fill in maximum 15cm horizontal layers across the fill area.

Mix: Place fill in a uniform mixture.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

### 5.3.9 COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE

**Density**

Compact the subgrade exposed by excavation to a minimum depth of 15cm. Compact each layer of fill to the required depth and density, as a systematic construction operation. Shape surfaces to provide drainage and prevent ponding.

Density of all layers of filling are to be approved by the Engineer before subsequent layers are placed. Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

**Moisture content**

Adjust the moisture content of fill during compaction in order to achieve the required density. Do not allow subgrade or fill layers to dry out after compaction before placing subsequent layers of fill. Do not over water filling to greater than moisture content of adjoining undisturbed ground.

## 5.4 SERVICE TRENCHING

### 5.4.1 GENERAL

#### 5.4.1.1 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made at the following stages:

- Service trenches excavated before laying the service.
- Services laid in trenches and ready for backfilling.

### 5.4.2 EXECUTION

#### 5.4.2.1 EXCAVATING

**Excavation**

Excavate for underground services, to required levels and grades. Generally, make the trenches straight between inspection points and junctions, with vertical sides and uniform grades.

**Trench widths**

General: Keep trench widths to the minimum required for laying and bedding of the relevant service and construction of pits.

**Trench depths**

If excavation is necessary below the zone of influence of the underside of adjacent footings, give notice, and provide support for the footings as instructed.

**Obstructions**

Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

**Dewatering**

Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

**Excess excavation**

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilized with 1 part of cement to 20 parts of sand by weight.

#### 5.4,2.2

**BACKFILLING General**

Backfill service trenches as soon as possible after the service has been laid and bedded, if possible on the same working day. Place the backfill in layers maximum150 mm thick and compact to approval of Engineer.

**Backfill material**

General fill with no stones greater than 25 mm occurring within 150 mm of the service, or other materials as required for particular services or locations.

Under roads and paved areas and within 4 m of building: Coarse sand, controlled low strength material or fine crushed rock.

In topsoil areas: Complete the backfilling with topsoil for at least the top 100 mm.

#### 5.4.2.3 REINSTATEMENT OF SURFACES

**General**

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work.

# 6. CONCRETE

## 6.1 GENERAL

### 6.1.1 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

- Base or subgrade before covering.
- Membrane or film underlay installed on the base.
- Completed formwork, and reinforcement, cores, fixings and embedded items fixed in place.
- Surfaces or elements to be concealed in the final work before covering.
- Commencement of concrete placing.

### 6.1.2 SUBMISSIONS

**Products – proposals**

Curing by the covering sheet method: Submit details of the proposed covering material.
Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

## 6.2 EXECUTION

### 6.2.1 PRODUCTS

**Reinforcement**

All reinforcing shall be supported and wired together to prevent displacement by construction loads, or the placing of concrete. Any tack or spot welding of reinforcement shall not be performed without approval from the Engineer.

Reinforcement shall be free of loose rust and of any other coating which may adversely affect the bond.

Splices in bar reinforcement shall be located and lapped as shown on the design drawings. Bars in lapped splices shall be in contact unless otherwise shown on the design drawings. Additional splices, if required, shall be made only at locations, and in a manner approved by the Engineer. Welded splices shall not be used.

Welded wire fabric used in concrete paving shall have lapped splices made so that the overlap between the outermost cross wires of each fabric sheet is at least 50 mm.

Concrete spacers, metal or plastic bar spacers i.e. chairs, shall be used for obtaining proper spacing of reinforcement from the bottom and sides of formwork.

**Formwork**

Construct formwork with timber or steel elements to support the concrete for full duration of critical curing period. Construct in a durable manner with sufficient props and fixings to ensure that the formwork remains in position at all times.

**Aggregate**

Aggregate size:

- For fixed form placement: < 40 mm.
- For slip form placement: To be a size compatible with the paving machine.

Washing: Wash aggregate as necessary or as directed to remove significant dust or achieve requirements for soluble salt content or concrete drying shrinkage.

**Cement**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

Cement shall be free from any hardened lumps and foreign matter. It shall have a minimum of 90% of particles by weight passing the 75-micron sieve, an initial setting time in excess of 30 minutes and a final setting time of less than 7 hours.

Cement shall be stored in a waterproof shaded area. The cement stacks shall be placed at a minimum distance of 300mm from the walls. The damp proof floor shall be constructed by raising it minimum 300mm above the ground.

**Curing products**

Covering sheet materials: To be opaque polyethylene film, or burlap-polyethylene sheet, or equivalent material.

**Concrete**

Ready-mixed concrete shall comply with M-150 (1:2:4) for non-reinforced mass concrete and M-200 (1:1.5:3) for reinforced concrete and the requirements of these standards.

On site batch, mixed concrete shall have characteristics and proportions of concrete ingredients which conform to those specified in M-150 (1:2:4) and M-200 (1:1.5:3).

Admixtures: Introduce in solution in a portion of the mixing water. Ensure a uniform distribution of the admixture in the batch within the mixing period.

Mixing time: Measure the mixing time after solid materials are in the mixer, provided that mixing water is introduced before a quarter of the mixing time has elapsed. Increase mixing time if necessary to obtain the required uniformity and consistence of concrete. Do not over mix such that additions of water are needed.

Transport: Transport and discharge the concrete without segregation.

## 6.3 EXECUTION

### 6.3.1 PLACING- GENERAL

**Hot weather**

Avoid premature stiffening of the mix and reduce water absorption and evaporation losses. If the temperature of the surrounding air is higher than 32°C:

- Mix, transport, place and compact the concrete as rapidly as possible, and cover with an impervious membrane or hessian kept wet until moist curing begins.
- Hold the concrete to a temperature < 32°C when placed.

Hot weather concreting shall be in accordance with the following:

a. Concrete temperatures shall be kept within desirable limits using recommended methods.

b. For mass concrete, i.e., concrete sections having a minimum dimension of 750mm or greater, the maximum acceptable concrete temperature is 21°C at time of discharge.

c. For other concrete structures, the maximum acceptable concrete temperature is 32°C at time of discharge.

d. If ice is used as part of the mixing water, mixing should be continued until the ice is completely melted.

e. Re-tempering shall not increase the water content above that in the mix design.

**Placing in fixed forms**

Place concrete uniformly over the width of the slab and so that the face is generally vertical and normal to the direction of placing. Hand spread concrete using shovels, not rakes.

Compact concrete using internal mechanical vibration of sufficient amplitude to produce noticeable vibrations at 300 mm radius. Insert vibrators into the concrete to the depth which will provide the best compaction, but not deeper than 50 mm above the surface of the sub-base, and for a duration sufficient to produce satisfactory compaction, but not longer than 30 seconds in any one location.

**Elapsed delivery time**

General: Ensure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge below 10°C or above 32°C.

**Finishing**

Immediately after placement and spreading and compaction of the plastic concrete, start finishing operations to achieve finish shown on the drawings.

**Curing**

Protect fresh concrete from premature drying and from excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

- Temperature: Maintain the concrete at a temperature > 5°C for at least 7 days.

Covering sheet method: Immediately after finishing operations cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep the mats continuously damp until covered by the covering sheet material. Repair tears and the like immediately.

- Joint sawing: Sheet materials may be removed for the minimum distance and period to permit joint sawing, provided the concrete is kept moist by other means.

Moist curing method: Immediately after finishing operations keep the concrete surface continuously damp by spraying constantly with water, fog, or mist, using suitable spraying equipment.

Minimum curing time: 7 days.

### 6.3.2 CORES, FIXINGS AND EMBEDDED ITEMS

**Adjoining elements**

For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings. If required, provide for temporary support of adjoining elements during construction of the concrete.

### 6.3.3 COMPACTION

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove air bubbles and to fully compact the mix.

Vibrators: Do not allow vibrators to come into contact with partially hardened concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the forms. Avoid over-vibration that may cause segregation.

**Placing**

Use placing methods which avoid segregation and loss of concrete, and which minimize plastic settlement. Maintain a generally vertical and plastic concrete edge at faces of a pour.

Layers: Place concrete in layers ≤ 300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set.

**Rain**

General: Do not expose concrete to rain before it has been placed and set.

***Finishing, Curing, Form Removal and Patching***

Finishing - Unless otherwise required on the design drawings or specifications for the project, concrete surfaces shall be finished as follows:

Pavement and Walks

a. Top surfaces shall be brought to proper level with a screed.

b. After the water sheen has disappeared, the surface shall be floated with wood or metal floats or with a finishing machine using float blades.

c. Before the concrete has thoroughly hardened, the surface shall be roughly scored using a steel wire or stiff coarse fibre broom. The depth of scoring shall not exceed 3 mm.

d. Control joints may be formed by saw cut or cast-in-place plastic strips. Joints to be sawed shall be done as soon as the concrete surface is firm enough not to be torn or damaged by the blade.

Building Floor and Roof Slabs

a. Screed and float as specified in Paragraph 4.4.8.1.1 for pavements and walks.

b. All roof slabs and floor slabs receiving a tile-floor or other type of finish shall be steel trowel finished.

c. Other building floors shall be given a wood float finish.

**Curing**

Curing to maintain a satisfactory moisture content and concrete temperature shall be performed using the applicable methods and procedures recommended in ACI 305R, ACI 306R, and ACI 308.

Curing by any of the methods specified shall continue for a minimum of 7 days for concrete at a temperature of 50°F (10°C) or more. When high early strength concrete is used, the curing period may be reduced to a minimum of 3 days.

During the curing period, the concrete shall be protected from damage by construction equipment, materials, rain, running water, heavy shock, and vibration.

In cold weather, when the mean daily temperature is less than 4°C, the concrete shall be maintained between 10°C and 21°C for the required curing period. Necessary arrangements shall be made in advance for heating, covering, insulating, or enclosing the concrete work to maintain the required temperature and moisture conditions. When heaters using, combustible fuels are used in an enclosure, the heaters shall be vented to the outside of the enclosure.

In hot weather, necessary arrangements shall be made in advance for protective measures needed to prevent rapid drying of the concrete. These protective measures shall be started as quickly as finishing and hardening will allow.

**Backfill**

Unless otherwise specified on the design drawings or specifications, backfill around foundations shall be Class II structural fill.

**Formwork**

Formwork shall be designed, erected, supported, braced, and maintained so that it will sustain all vertical and lateral loads until such loads can be supported by the concrete structure itself.

Forms shall conform to the shape and dimensions of the members shown on the design drawings. Forms and their supports shall be designed so as not to damage previously placed concrete. Forms shall be true, rigidly constructed, and sufficiently tight to prevent leakage of cement paste.
All forms for exposed work shall be free of defects likely to cause imperfections on the surface of the concrete.

Forms shall be suitable for the work to be performed and may be of dressed lumber, plywood, metal, or other suitable materials.

Chamfer strips are required for all exposed corners.

Form material which is to be reused shall have damaged parts repaired and the concrete side thoroughly cleaned before reusing.

Temporary openings shall be provided at the base of column and wall forms to facilitate cleaning and inspection.

Adjustable type shoring can be used for supporting roof forms or elevated floors.
Tolerances for forms shall be as follows:
Variations from plumb in columns, piers and walls is 6 mm in 3 m, but not to exceed 25 mm total.

Variation from level in slab and beam soffits (horizontal undersides) 6 mm in 3 m but not more than 18 mm unless otherwise noted on the design drawings. Where necessary to maintain this tolerance, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.

Form ties shall be standard shop ties or screw ties. The holes left by the removal of the tie ends shall be patched with mortar.

The form release agent shall be applied before any bar supports and reinforcing steel is placed. Excess form release agent shall not be allowed to stand in puddles in the form or come in contact with concrete against which fresh concrete will be placed.

Forms shall be constructed to facilitate their removal without damage to the concrete. Forms shall be preferably removed in the following order (1) columns, (2) sides of beams and girders, (3) bottom of slabs, beams, and girders.

**Reinforcement and Anchor Bolts**

**Reinforcement**

All reinforcing shall be supported and wired together to prevent displacement by construction loads, or the placing of concrete.

Any tack or spot welding of reinforcement shall not be performed without approval by the UNOPS Site Supervisor.

Reinforcement shall be free of loose rust and of any other coating which may adversely affect the bond.

Splices in bar reinforcement shall be located and lapped as shown on the design drawings. Bars in lapped splices shall be in contact unless otherwise shown on the design drawings. Additional splices, if required, shall be made only at locations, and in a manner approved by Engineering. Welded splices shall not be used.

Welded wire fabric used in structural concrete shall have lapped splices such that the overlap between the outermost cross-wires of each fabric sheet is not less than the spacing of the cross-wires plus 50 mm. Fabric shall be supported, in the same manner as reinforcing bars, to place the fabric in its proper location within the concrete member.

Welded wire fabric used in concrete paving shall have lapped splices made so that the overlap between the outermost cross wires of each fabric sheet is at least 50 mm.

In lieu of adequate support of the welded wire fabric, the fabric shall be lifted during placing of concrete to ensure proper positioning in the concrete.

Unless specifically indicated on the design drawings, splicing by means of proprietary mechanical splices shall not be used.

Concrete spacers, metal or plastic bar spacers i.e. chairs, shall be used for obtaining proper spacing of reinforcement from the bottom and sides of formwork.

# 7. BLOCK WORK

## 7.1 GENERAL

### 7.1.1 INSPECTION

**Notice**
Give sufficient notice so that inspection may be made of the following:
- Set out of block work to lintels, arches and other architectural features.
- Damp-proof courses, in position.
- Lintels, in position.

## 7.2 PRODUCTS

### 7.2.1 MATERIALS

**Blocks**
Concrete blocks for walling shall comply with B.S. 6073 part 1, solid or hollow two-hole type as specified, and made in approved block making machines, under cover, of a composition as follows:-

a) Portland cement 1 $M^3$
b) Fine aggregate (graded up to 5 mm) 3 $M^3$
c) Course aggregate (graded up to 10 mm) 6 $M^3$

The compressive strength of non load bearing blocks shall be not less than:-
d) Average 10 blocks 3.5 N/sq mm, gross area
e) Lowest individual block 2.8 N/sq mm, gross area

When load bearing, the compressive strength of blocks shall be:-

f) Average of 10 blocks 5.0 N/sq mm, gross area
g) Lowest individual block 4.0 N/sq mm, gross area

All testing shall be in accordance with B.S. 2028.

Newly made blocks shall be carefully deposited on racks under sheds and then left for three days and kept thoroughly wet the whole time, after which they shall be put out in the open on racks and protected with approved matting, sacking or straw and kept wet for a further five days, then kept in the same position and under same mat cover, but without wetting, for a further seven days to season.

Blocks to be subsequently covered with an in-situ finishing may be slightly rough in texture. Fair-face blocks shall be perfectly smooth.

**General**
The Engineer prior to use in the Works shall approve the use of blocks. Blocks not meeting the above requirements shall not be used in brickwork.
Blocks should have the following dimensions: 400mm x 200mm x 200mm.
Blockwork shall only commence when the Engineer has approved the blocks. The Contractor may then only change the source of supply of blocks after samples from the new supplier have similarly been

Blocks should be free from saline deposits, be regular and uniform in size with sharp square edges and parallel faces.

Blocks shall be homogenous in texture and shall emit a clear metallic ringing sound when struck one against the other.

All blocks used shall be free from cracks, chips, flaws and other blemishes.

**Mortar materials**
Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts. River or pit sand should be sharp, angular, hard, clean uncoated particles free from clay and organic impurities.

Water: Water to be used for the mixing of mortar should be clean and free from oil, acid, alkali, salts, organic materials or other substances that are harmful to the mortar mix.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Mortar**

Ratio of mix for brick masonry shall be 1:4, cement-sand.

Mortar joints shall not exceed 10mm in thickness; all joints shall be fully filled with mortar. All sand and cement for mortar shall be mixed in the correct proportion by the use of:

a. Wooden box.
b. Bucket, plastic or steel.

All sand and cement for block masonry shall be fully mixed prior to the addition of water on a water proof surface. The mortar shall be fully mixed by turning at least 3 times following addition of the water.

Every course of blockwork shall be horizontal and the resulting constructed wall shall be vertical. Under no circumstances will vertical joints in consecutive layers of blockwork be accepted.

No broken or damaged blocks are to be incorporated into the masonry.

Blockwork constructed during the course of one shift (8 hours) shall not exceed 1m in height. When stopping incomplete blockwork, the blocks shall be stepped at an angle not to exceed 45°. All joints shall be raked and the blockwork faces cleaned at the end of each shift (8 hours).

All blockwork is to be kept wet for a period of not less than 10 days following its construction. At the end of each shift the top of all blockwork being cured is to be flooded with water.

All sand, lime and cement for plaster masonry shall be fully mixed prior to the addition of water on a water proof surface. The mortar shall be fully mixed by turning at least 3 times following addition of the water.

Plaster mortar is to be applied in layers not to exceed 12mm in thickness.

The cement to be used in the work should be ordinary Portland cement complying with ASTM C-150 or BS-12.

All cement should be protected from moisture and damage in transit any deteriorated or hardened cement will not be permitted in the works and is to be removed from site at the contractors" expense.

**Sand**

River or pit sand should be sharp, angular, hard, clean uncoated particles free from clay and organic impurities.

Well graded sand must be used for all cement work. Sand required for blockwork must be finer than that for stone work.

For ordinary masonry work, concrete and first coat of plaster, the sand should pass through a 2.00 mm sieve.

## 7.3 EXECUTION

### 7.3.1 GENERAL

**General**

Blockwork shall be built plumb, curved or battered as shown on the Drawings or as may be required, by skilled masons and properly supervised workmen. Blocks shall be clean and if necessary, they shall be scrubbed. Blcoks shall be soaked in water for at least one hour before use.

Unless otherwise specified blocks shall be laid in English Bond, with frogs downward. All horizontal joints shall be parallel and level. Vertical joints in alternate courses shall come directly over one another. Joint thickness shall be 8mm and shall in no case exceed 10mm

**Mortar mix**

Mortar mixing shall be done in a mechanical mixer unless the Engineer specifically permits hand mixing. If hand-mixing is done, the operation shall be carried out on a clean watertight platform and cement & sand shall be first mixed dry in the required proportion to obtain a uniform color and then the mortar shall be mixed for at least two minutes after addition of water.

**Wall Reinforcement**

Where walls or partitions are constructed of blocks less than 150 mm thick, they shall be reinforced with a 25 mm wide strip of 2 mm thick hoop iron built into alternate horizontal joints in the wall centre. The hoop iron shall be lapped and hooked at running joints, angles and intersections and carried at least 115 mm into abutting walls and junctions.

**Bedding and pointing**

All blocks shall be bedded on a solid bed of mortar; vertical faces of block shall be well buttered before being laid and the whole well grouted at each course. Joints of blockwork to be plastered shall be roughly raked out to form a key. Joints of air face blockwork shall be either finished flush or finished recessed 6 mm as specified

**Holes and chases**

Where walling is cut, holed or chased for conduits, pipes or the like, all such chases shall be filled in solid with cement mortar mix (1:4) prior to the application of finishes. In no case shall a vertical chase be deeper than one third the thickness of the wall and in no case shall a horizontal chase be deeper than one sixth of the thickness of the wall.

Putlog holes shall be not less than one course deep, afterwards filled with a block cut neatly fit.

# 8. STEELWORK

## 8.1 GENERAL

### 8.1.1 INSPECTION

**Notice**

Give notice so that inspection may be made of steel framing erected before lining or cladding.

### 8.1.2 SUBMISSIONS

**Design**

The Contractor is to confirm that all proposed member sizes are available for the project in accordance with the drawings and BOQ. If selected sizes are not available, seek alternatives and obtain approval from the Engineer.

## 8.2 EXECUTION

### 8.2.1 CONSTRUCTION GENERALLY

**Fabrication**

Length: Cut members accurately to length so that they fit firmly against abutting members. Service holes: Form holes by drilling or punching if needed.

- Bushes: Provide plastic bushes or grommets to site cut holes.
- Swarf: Remove swarf and other debris from cold-formed steel framing immediately. Site work: Do not fabricate on site where welded connections are required.

**Fastening**

Select from the following:

- Bolting.
- Self-drilling, self-tapping screws.
- Blind rivets.

**Welding**

Burning: Avoid procedures that result in greater than localized “burning” of the sheets or framing members. Protect other adjoining materials from damage during welding activities.

Other workers: Protect other workers on site from welding flash, sparks and other potential injuries during welding activities.

**Prefabricated frames**

Protect frames from damage or distortion during storage, transport and erection.

**Protection**

Coatings which have been damaged by welding or other causes shall be restored. Thoroughly clean affected areas to base metal and coat with zinc rich organic primer.

### 8.2.2 TRUSSES

**Fabrication**

Factory assemble trusses and transport to site where possible. Obtain approval from the Engineer if it is required to fabricate trusses on site.

**Installation**

Fix to support structures, plumb to within H/200, where H is the height at the apex.

### 8.2.3 COMPLETION

**Cleaning**

On completion of framing remove debris from any gaps between members

## 8.3 STEELWORK PAINTING

### 8.3.1 GENERAL

#### 8.3.1.1 INSPECTION

**Notice**
Give sufficient notice so that inspection may be made of the following:

- Surfaces after preparation prior to application of first coating.
- Coating after application of final coat.

#### 8.3.1.2 SAMPLES

**Painting and coating colour**
Submit a sample of the finished product for each different coating system. Size of each sample: 200 x 200 mm.

### 8.3.2 PRODUCTS

#### 8.3.2.1 GENERAL

**General**
All protective coatings must be handled, stored, mixed and applied strictly in accordance with the manufacturer"s instructions and Product Data Sheets.

### 8.3.3 EXECUTION

#### 8.3.3.1 PROTECTION

**Surroundings**
Provide protection of the surroundings to the coating works and ensure that no abrasive, overspray or paint waste debris is released either to air, ground or to any watercourse. Repair or clean damage as appropriate.

**Contamination**
Ensure protection of sensitive items during surface preparation and coating works. Do not permit surface preparation debris to contaminate coated surfaces which are not yet dry, nor cause damage to any other services or equipment.

**Repair of coating damage**
If damage occurs repair so as to ensure that the full corrosion protection ability of the system is reinstated.

#### 8.3.3.2 SURFACE PREPARATION

**General**
Coatings shall be applied only to properly prepared and cleaned surfaces.

**Surface preparation**
Ensure all surfaces are free from oil, grease, dirt, bird droppings or any other contaminants, particularly soluble contaminants.

Surface defects: Remove or correct other surface defects, including cracks, laminations, deep pitting, undercutting, weld spatter, slag, burrs, fins and sharp edges.

Remove all weld spatter by grinding or chipping.

**Priming**
Prime coat all surfaces with zinc rich primer on the same day as the completion of surface preparation works. In every case, the specified surface preparation standard, in both cleanliness and profile, shall be evident at the time that the primer coating is applied.

#### 8.3.3.3 COATING APPLICATION

**General**
Apply the coatings in accordance with the **drawings or manufacturer recommendations**.

**Final surface preparation or coating application**

Defects: Apply materials so as to produce an even coating free from film defects.

Detail: Stripe coat all welds, bolt holes, sharp edges and difficult to spray areas by brushing in with the prime coat and intermediate coat material prior to the full coating application.

**Subsequent coats**

Ensure that before any subsequent coating layer is applied, the surface condition of the preceding coat is complete and correct in all respects, including its cleanliness and freedom from defects. Correct any defects before the next coating layer is applied.

# 9. WATERPROOFING

## 9.1 GENERAL

### 9.1.1 INTERPRETATIONS

**Definitions**

For the purposes of this work section the definitions given below apply.

- Substrates: The surfaces on which membrane systems are laid.
- Bitumen: A viscous material comprising complex hydrocarbons which is soluble in carbon disulphide, softens when it is heated, is waterproof and has good powers of adhesion. It is produced as a refined by-product of oil.
- Bond breakers: Layers which prevent membranes from bonding to the backgrounds.
- Membranes: Impervious barriers to liquid water which may be:

. Liquid applied: Membranes applied in liquid or gel form and air cured to form a seamless film.

. Sheet applied: Membranes applied in sheet form with joints lapped and bonded.

- Membrane systems: Combinations of membranes, flashings, drainage and accessories which form waterproof barriers and which may be:

. Loose-laid.

. Bonded to backgrounds fully or partially.

### 9.1.2 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made as follows:

- Background preparation completed.
- Before membranes are finished, covered up or concealed.

## 9.2 PRODUCTS

### 9.2.1 MEMBRANES

**Membrane systems**

To be proprietary membrane systems where possible having certification from an international testing organization.

**Internal roof outlets for membrane roof**

Proprietary funnel shaped sump cast into the roof slab, set flush with membrane, with a flat removable grating and provision (e.g. clamp ring) for sealing the membrane into the base of the outlet.

## 9.3 EXECUTION

### 9.3.1 PREPARATION

**General**

Prepare backgrounds as follows:

- Fill all cracks in backgrounds wider than 1.5 mm with a filler compatible with the membrane system.
- Fill voids and hollows in concrete backgrounds with a concrete mix not stronger than the background.
- Remove excessive projections.
- Remove deleterious and loose material.
- Leave the surface free of contaminates, clean and dust free.

**Moisture content**

Concrete backgrounds: Cure for > 21 days.

**Joints and fillets**

Internal corners: Provide 45° fillets. External corners: Round edges.

Movement control joints: Prepare all background joints to suit the membrane system.

**Priming**

**9.3.2 APPLICATION**

**Protection**

Protect membrane from damage during installation.

**Drains**

Prevent moisture from tracking under the membranes at drainage locations.

Drains and cages: Provide grates or cages, to prevent blockage from debris.

Overflows: Turn the membranes into the overflow to prevent moisture from tracking behind the membrane.

**Sheet joints**

Bituminous sheet membranes:

- Side laps > 50 mm.
- End laps > 100 mm. Synthetic rubber membranes:
- Factory–vulcanized laps > 40 mm.
- Field side laps > 50 mm for side laps.
- Field end-laps > 100 mm for end laps.

**Curing of liquid applied systems** to the manufacturers" instructions.

**Movement control joints**

Locate over movement control joints in the substructure.

Fillets and bond breakers: Provide of sufficient dimension to allow the membrane to accommodate the movement.

Bonded membranes: Carry movement joints in the substrate through the surface finish.

**Membrane terminations**

Edge protection: Provide upturns above the maximum water level expected from the exposure conditions of rainfall intensity and wind.

- Minimum height of 200mm for all upturns above membrane level unless noted otherwise on the drawings.
- Anchoring: Secure sheet membranes along the top edge.
- Edge protection: Protect edges of the membrane.
- Waterproofing above terminations: Waterproof the structure above the termination to prevent moisture entry behind the membrane using cappings, waterproof membranes or waterproof coatings.

**Membrane vertical penetrations**

- Pipes, ducts, and vents: Provide separate sleeves for all pipes, ducts, and vents and have them fixed to the substrate. Minimum height of 200mm for all sleeves above membrane level unless noted otherwise on the drawings.

**Overlaying finishes on membranes**

Compatibility: If a membrane is to be overlayed with another system such as tiles, pavers, ballast, insulation, soil, and the like, provide an overlaying system that is compatible with and not cause damage to the membrane.

Ensure that no damage is caused to the membrane during the laying of the overlay material. If any damage occurs immediately stop work and repair the damage before proceeding with the overlay process.

Bonded or partially bonded systems: If the topping or bedding mortar requires to be bonded to the membrane, provide sufficient movement joints in the topping or bedding mortar to reduce the movement over the membrane.

# 10- ROOFING

## 10.1 GENERAL

### 10.1.1 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of:

- Roof framing during construction.
- Those parts of the roofing, vapour barrier, insulation and roof plumbing installation which will be covered up or concealed.

### 10.1.2 SUBMISSIONS

**Samples**

Submit samples of the following showing the range of variation available:

- Corrugated and flat metal roof sheeting
- Roof cappings, flashings, gutters, downpipes

## 10.2 PRODUCTS

### 10.2.1 MATERIALS AND COMPONENTS

**Fasteners**

Self-drilling screws: Corrosion resistant screws to approval of Engineer. Nuts and bolts: Corrosion resistant fastenings to approval of Engineer.

Fastenings to timber battens or purlins: Provide fastenings just long enough to penetrate the thickness of the timber without piercing the underside.

### 10.2.2 CORRUGATED METAL ROOFING AND CLADDING

**General**

Provide a proprietary system of preformed corrugated sheets and all purpose-made accessories required to complete the installation to roof framing or wall framing. Refer to **detailed drawings** for details.

### 10.2.3 FLAT SHEET METAL ROOFING AND CLADDING

**General**

Provide a system of flat metal sheets and all purpose-made accessories required to complete the installation to roof framing or wall framing.

## 10.3 EXECUTION

### 10.3.1 INSTALLATION

**Protection**

Keep the roofing and rainwater system free of debris and loose material during construction, and leave them clean and unobstructed on completion. Repair damage to the roofing and rainwater system.

If it is necessary to repair minor damage to metal roofing, do so immediately after the damage has occurred. The Contractor is take care to not damage other surfaces during the repair works.

**Thermal movement**

Provide for thermal movement in the roof installation and the structure, including movement in joints and fastenings.

### 10.3.2 SHEET METAL ROOFING AND CLADDING

**Roofing sheet installation**

Fixings: Provide all fixings required to fix the roof sheeting to the framing so that the entire roof covering is waterproof and secure. All loose edges are to be fixed down to ensure that they cannot get loose in high winds.

Expansion joints: refer to drawings for locations of expansion joints in roofs and details of construction.

**Ridges and eaves**

Treat ends of sheets as follows:

- Project sheets 50 mm into gutters.
- Close off ribs of ribbed sheeting at bottom of sheets using mechanical means or with purpose-made end caps.
- Turn pans of ribbed sheeting up at tops and down into gutters by mechanical means.
- Provide pre-cut notched eaves flashings and bird proofing wire mesh where necessary.

**Ridge and eaves capping**

Finish off along ridge and side eaves edges with purpose-made ridge capping and eaves cappings.

**End laps**

Where end laps are unavoidable in roof sheeting, and the sheet profile is not suitable for interlocking or contact end laps, construct a stepped type lap. Refer to details on drawings as required.

Length of lap (mm): Laps to ends of sheets should not be less than 150mm and sealed with a continuous line of silicone sealant between the sheets of roofing.

**10.3.5 ROOF PLUMBING**

**General**

Provide the flashings, cappings, gutters, rainwater heads, outlets and downpipes necessary to complete the roof system.

**Jointing sheet metal rainwater goods**

Butt joints: Make joints over a backing strip of the same material. Soldered joints: Do not solder aluminium or aluminium/zinc-coated steel.
Sealing: Seal fasteners and mechanically fastened joints. Fill the holes of blind rivets with silicone sealant.

**Flashings and cappings**

Installation: Flash roof junctions, upstands, abutments and projections through the roof. Preform to required shapes where possible. Cut, notch, bend or dress down as necessary to follow the profile of adjacent surfaces. Lap joints 150 mm in running lengths. Provide matching expansion joints at 6 m maximum intervals.

Upstands: Flash projections above or through the roof with two part flashings, consisting of a base flashing and a cover flashing, with at least 100 mm vertical overlap. Provide for independent movement between the roof and the projection.

Wall abutments: Provide overflashings where roofs abut walls, stepped to the roof slope in brickwork.

- In masonry: Build cover flashing at least 100mm into the wall at least 250mm above the roof level. Provide base flashing on roof and provide at least 100mm vertical overlap.
- In concrete: Turn cover flashing at least 30 mm into sawcut grooves at least 250mm above the roof level, wedge at 200 mm centres with compatible material and render over top of flashing. Provide base flashing on roof and provide at least 100mm vertical overlap.

Fixing to pipes: Solder, or seal with neutral cured silicone rubber and either of the following:

- Secure with a clamping ring.
- Provide a proprietary flexible clamping shoe with attached metal surround flashing.

**Gutters**

Prefabricate gutters to the required shape where possible. Form stop ends, bends and returns. Provide overflows to prevent back-flooding.

Gutter and sump support: Provide framing and lining to support valley gutters, box gutters and sumps. Line the whole area under the gutters and sumps.

Support: Steel straps as shown on drawings or as approved by the Engineer.

Lining: Timber boards or plywood as shown on drawings or as approved by the Engineer.

Valley gutters: Profile to suit the valley boarding. Nail or screw to the valley boarding at the top end to prevent the gutter creeping downwards.

Gratings and guards: Provide removable gratings over rainwater heads and sumps:

- Type: Wire mesh cages reinforced with steel bars where required due to size and expected snow loads. Refer to drawings for details.

-

# 11. WINDOWS

## 11.1 GENERAL

### 11.1.1 INTERPRETATION

**Definitions**

For the purposes of this work section windows also includes louvres, either vertical or horizontal, set into frames.

### 11.1.2 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

- Openings prepared to receive windows (where windows are to be installed in prepared openings).
- Fabricated window assemblies delivered to the site, before installation.
- Commencement of window installation.

## 11.2 PRODUCTS

### 11.2.1 LOUVRE ASSEMBLIES

**General**

Provide louvre blades mounted in a surround frame and able to withstand the wind pressure for that location without failure or permanent distortion of blades, and without blade flutter.

**Adjustable louvres**

Provide louvre blades clipped into holders which pivot, linked together in banks, each bank operated by an operating handle incorporating a latching device, or by a locking bar.

**Screens**

Provide metallic coated steel wire mesh screens behind louvres to prevent the entry of birds, rodents and windblown leaves and papers.

### 11.2.2 INSECT SCREENS

**Aluminum framed screens**

Provide insect screens with mesh frame channel. Provide an extended frame section where necessary to adapt to window opening gear.

- Mesh: Fix the mesh into the frame channel with a continuous resilient gasket, so that the mesh is taut and without distortion.

**Fixed screens**

Provide fixed screens to the window frames with a clipping device which permits removal for cleaning.

**Hinged screens**

Hinge at the side to give access to opening sash.

**Sliding screens**

Provide a matching aluminium head guide, sill runner, and frame stile sections for screens not part of the window frame.

- Hardware: Nylon slide runners and finger pull handle.

### 11.2.3 SECURITY WINDOW GRILLES

**General**

Provide security grilles in accordance with the drawings or proprietary metal security grille screens, fixed to the building structure with tamper resistant fastenings.

### 11.2.4 WINDOW HARDWARE

**Hardware**

Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use and climate and fabricated with fixed parts firmly joined.

## 11.3 EXECUTION

### 11.3.1 INSTALLATION

**General**

Install windows so that the frames:

- Are plumb, level and straight within acceptable building tolerances.
- Are fixed or anchored to the building structure to resist the wind loading.
- Will not carry any building loads, including loads caused by structural deflection.
- Allow for thermal movement.

**Flashing and weatherings**

Install moulds, sealant and cement pointing as required so that water is prevented from penetrating the building between the window frame and the building structure.

**Fixing and fasteners**

Materials: Use materials compatible with the item being fixed and of sufficient strength, size and quality to perform their function.

Concealed fixings: Provide a corrosion resistant finish.

Exposed fixings: Match exposed fixings to the material being fixed.

Support: Provide appropriate back support (for example blocking and backing plates) for hardware fixings.

Window fastener spacing (nominal): 600 mm.

Window fasteners: Conceal fasteners where possible.

Packing: Pack behind fixing points with durable full width packing.

Prepared masonry openings: If fixing timber windows into existing prepared openings with fastenings through the frame face, make the fastener heads finish below the surface and fill the hole for a smooth surface finish.

**Joints**

Make accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.

**Operation**

Ensure moving parts operate freely and smoothly, without binding or sticking and are lubricated.

**Supply**

Deliver window hardware items, ready for installation, in individual complete sets for each window.

- In a separate dust and moisture proof package labelled for the specific window.
- Including the necessary templates, fixings and fixing instructions.

Refer to the drawings for details of windows and for details of window hardware.

### 11.3.2 COMPLETION

**Cleaning**

The Contractor is to clean all frames, glass, hardware at completion. Any damage to frames, or broken glass is to be repaired or replaced to the satisfaction of the Engineer.

**Adjustment**

Leave the hardware properly adjusted with working parts in working order and lubricated where appropriate.

# 12. DOORS

## 12.1 GENERAL

### 12.1.1 INTERPRETATION

**Definitions**

For the purposes of this work section the definitions given below apply.

- Door frame: Includes door trims.
- Door set: An assembly comprising a door or doors and supporting frame, guides and tracks including the hardware and accessories necessary for operation.
. Fire-doorset: A doorset which retains its strength and limits the spread of fire.
. Smoke-doorset: A doorset which restricts the movement of smoke.
- Flush door: A door leaf having two flat faces which entirely cover and conceal its structure. It includes doors with cellular and particleboard cores.
- Joinery door: A door leaf having stiles and rails, framed together. A joinery door may also incorporate glazed panels.
. Louvred door: A joinery door in which the panel spaces are filled in with louvre blades.

### 12.1.2 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

- Door frames standing in place before building in to brickwork.
- Door frames installed before fixing trim.

### 12.1.3 SUBMISSIONS

**Samples**

Submit samples of all hardware items for approval by the Engineer before use in the works.

**Subcontractors**

Automatic sliding door assemblies: Submit names and contact details of proposed supplier and installer.

**Product warranties**

Automatic sliding door assemblies: Submit a warranty from the supplier and installer for the system and its installation, for a period of at least twelve months from the date of completion.

Hardware: Submit the warranties offered by the manufacturer for the hardware items provided in the works.

**Keys**

Key codes: Submit the lock manufacturer"s record of the key coding system showing each lock type, number and type of key supplied, key number for re-ordering, and name of supplier.

Keys: For locks keyed to differ and locks keyed alike, verify quantities against key records, and deliver all keys and records to the Engineer at completion.

## 12.2 PRODUCTS

### 12.2.1 FRAMES

**Aluminium frames**

To be assembled from aluminium sections, including necessary accessories such as buffers, strike plates, fixing ties or brackets, and suitable for fixing specified hardware.

### 12.2.2 DOORS

**Flush doors**

Cellular core flush doors:

- Provide a subframe of 25 mm minimum width timber around openings for louvres and glazing.
- Provide additional material to take hardware and fastenings.
- Cut outs: If openings are required in flush doors (e.g. for louvres or glazing) make the cut outs not closer than 120 mm to the edges of the doors.

Solid core flush doors:

- Core of timber strips laid edge to edge, fully glued to each other and to facings each side of no less than two sheets of timber veneer.
- Single thickness of moisture resistant general purpose particleboard.

Refer to drawings for details.

**Double doors**

Provide rebated meeting stiles unless the doors open in both directions. Chamfer square edged doors to prevent binding between the leaves.

### 12.2.3 LOCKS AND LATCHES

**General Door Hardware**

Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use and climate and fabricated with fixed parts firmly joined.

**Bolts**

Provide bolts including barrel bolts and tower bolts with associated hardware, including lock plates, ferrules or floor sockets.

**Furniture**

Provide lock and latch furniture suitable for use with the lock or latch to which it is installed with the corresponding level of performance.

**Door Controllers Performance**

Provide door controllers, including door closers, floor or head spring pivots which are suitable for the door type, size, weight and swings required and the operating conditions, including wind pressure.

## 12.3 EXECUTION

### 12.3.1 FRAMES

**General**

Install doors so that the frames:

- Are plumb, level and straight within acceptable building tolerances.
- Are fixed or anchored to the building structure to resist the wind loading.
- Will not carry any building loads, including loads caused by structural deflection.
- Allow for thermal movement.

**Flashing and weatherings**

Install moulds, sealant and cement pointing as required so that water is prevented from penetrating the building between the door frame and the building structure.

**Aluminium frames**

Building in to masonry: Screw galvanized steel brackets twice to jambs and build in.

Fixing to masonry openings: Use proprietary expansion anchors and screw through jambs at each fixing.

**Frame fixing**

Brackets: Metallic-coated steel:

- Width: $\geq$ 25 mm.
- Thickness: $\geq$ 1.5 mm.

Jamb fixing centres: $\leq$ 600 mm.

**Fixing and fasteners**

Materials: Use materials compatible with the item being fixed and of sufficient strength, size and quality to perform their function.

Concealed fixings: Provide a corrosion resistant finish.

Exposed fixings: Match exposed fixings to the material being fixed.

Support: Provide appropriate back support (for example blocking and backing plates) for hardware fixings.

Packing: Pack behind fixing points with durable full width packing.

Prepared masonry openings: If fixing timber door frames into existing prepared openings with fastenings through the frame face, make the fastener heads finish below the surface and fill the hole for a smooth surface finish.

**Joints**

Make accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.

**Operation**

Ensure moving parts operate freely and smoothly, without binding or sticking and are lubricated.

**Supply**

Deliver door hardware items, ready for installation, in individual complete sets for each door.

- In a separate dust and moisture proof package labelled for the specific door.
- Including the necessary templates, fixings and fixing instructions.

**12.3.2 COMPLETION**

**Cleaning**

The Contractor is to clean all frames, doors, glass, hardware at completion. Any damage to frames and doors, or broken glass is to be repaired or replaced to the satisfaction of the Engineer.

**Adjustment**

Leave the hardware properly adjusted with working parts in working order and lubricated where appropriate.

# 13. GLAZING

## 13.1 GENERAL

### 13.1.1 INSPECTION

**Notice**

Inspection: Give sufficient notice so that inspection may be made of the following:

- Glass products before they are installed.

## 13.2 PRODUCTS

### 13.2.1 GLASS

**Glass and glazing materials**

Glass and glazing materials generally: Free from defects which detract from appearance or interfere with performance under normal conditions of use.

Glazing plastics: Free from surface abrasions, and warranted by the manufacturer for 10 years against yellowing or other colour change, loss of strength and impact resistance, and general deterioration.

### 13.2.2 GLAZING MATERIALS

**General**

Glazing materials (including putty, glazing compounds, sealants, gaskets, glazing tapes, spacers, setting blocks): Appropriate for the conditions of application and the required performance.

**Jointing materials**

Provide recommended jointing and pointing materials which are compatible with each other and with the contact surfaces and non-staining to finished surfaces. Do not provide bituminous materials on absorbent surfaces.

**Pile weather strips**

Materials: Polypropylene or equivalent pile and backing, low friction silicone treated, ultra violet stabilized.

Finned type: A pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

**Extruded gaskets and seals**

Type: Non-cellular (solid) seals to exclude water from glass/frame junctions.
Material:

- Rubber products to be neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
- Flexible polyvinyl chloride (PVC)

**Priming**

Apply the recommended primer to the surfaces in contact with sealant materials.

**Movement joints**

Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Foamed materials (in compressible fillers and backing rods): Closed-cell or impregnated types which do not absorb water.

Bond breaking: Provide backing rods, and other back-up materials for sealants, which do not adhere to the sealant.

# 14. SUSPENDED CEILINGS

## 14.1 GENERAL

### 14.1.1 INSPECTION

**Notice**
Give sufficient notice so that inspection may be made of the framing preparation and setout of suspended ceilings before installation of panels.

### 14.1.2 SUBMISSIONS

**Samples**
Submit samples as follows:

- Ceiling material: Sheet, metal lath, panel, wooden battens, tile, with insulation
- Methods: Methods of jointing, fixing, height adjustment.
- Suspension: Sections proposed for suspension system, including wall angles and trim.

## 14.2 PRODUCTS

### 14.2.1 LININGS

**Fibrous plaster tiles**
Best quality imported fibrous plaster tiles with hard cast plaster face for decorative ceiling sections.

**Plasterboard panels**
Best quality imported glass fibre reinforced gypsum plasterboard panels or tiles.

**Chipwood panels**
Best quality chipwood panels of 8mm thick fixed and screwed to wooden battens

## 14.3 EXECUTION

### 14.3.1 INSTALLATION

**Ceiling grid**
Set out the ceiling grid so that panel joints and centrelines of visible suspension members coincide with grid lines shown on the drawings. If not otherwise shown, set out so that opposite margins are equal.

Pattern and texture: Set out patterned or heavily textured materials to give consistency in direction of pattern or texture.

Special sized panels: Provide special sized purpose-made panels to fill non-standard margins, openings and penetrations.

**Cut tile edges**
General: Conceal, or finish to match prefinished edges.

**Lighting**
Fit lights within the ceiling grid system to ensure that distortion, overloading or excessive vertical deflection is prevented. Support lights on the ceiling primary grid members.

**Proprietary systems**
Provide suspended ceilings as complete proprietary systems, each fabricated by one manufacturer and installed by a specialist installer of demonstrated capacity.

**Protection**
Protect existing work from damage during the installation.

**Stability**
Install the ceilings level; and fix so that under normal conditions there is no looseness or rattling of ceiling components.

### 14.3.2 SUPPORTS

**Bracing**

General: Provide bracing to prevent lateral movement and to resist any imposed horizontal seismic force.

**External suspended ceilings**

Support external suspended ceilings on rigid members capable of carrying the imposed loads. Install members to minimize any eccentricity, and ensure that the upward and downward wind loads are carried through to the supporting structure.

**Movement joints**

Install the ceiling with control joints to correspond in location and direction to those in the structural frame.

**Finishes**

Repair damaged finishes by replacement or refinishing of the item. All repairs are to be completed so no sign of the damage is visible in the completed work.

**Support members**

Grid members: If required, notch grid members at the junction with the perimeter trim to ensure the panels lie flat on the perimeter trim.

Services: Do not suspend from services (e.g. pipework or ductwork) unless the service has been designed to accept the ceiling load. In locations where services obstruct the ceiling supports, provide bridging and suspension on each side of the services.

Spacing: Space the support members as required by the loads on the system and the type of ceiling, and allow for the installation of services and accessories, including ductwork, light fittings and diffusers. Provide additional support or suspension members for the fixing of such items.

**Suspension system**

Height adjustment: Provide height adjustment by means of a length adjustment device at each suspension point, permitting length variation of at least 50 mm.

### 14.3.3 PANELS

**General**

Fitting: Fit panels accurately and neatly, free from air leakage and staining.

Panel lock clips: If panels are exposed to wind loads or if required for security, insert locking clips at the junction of rails and panels.

**Accessories and trim**

Provide accessories and trim necessary to complete the installation.

Plasterboard trim: Provide purpose-made corner beads, casing beads and stop beads.

Metal Trim: Provide trims at junctions with other building elements and surfaces, such as walls, beams and penetrations, consistent with the style, materials and finishes of the ceiling system generally.

**Service penetrations**

Provide openings for, and fit the ceiling system up to, all services elements such as light fittings, ventilation outlets, detectors, sprinklers and loudspeakers.

### 14.3.4 ACCESS PANELS

**Finish**

Match the ceiling panels in appearance and performance and mark the panel for easy identification.

### 14.3.5 COMPLETION

**Spares**

Supply spare matching tiles and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

# 15. PLASTERING

## 15.1 GENERAL

### 15.1.1 INTERPRETATION

**Abbreviations**

For the purpose to this work section the abbreviations given below apply.

- CRF: Cement render – finish.
- CRM: Cement render – medium.
- CRS: Cement render – stronger.
- CRW: Cement render – weaker.
- LF: Lime felting render- weaker.
- GPF: Gypsum plaster – finish.

### 15.1.2 INSPECTION

**Notice**

Give sufficient notice so inspection may be made of the following:

- Backgrounds immediately before applying base coats.
- Finish treatments before decoration.

## 15.2 PRODUCTS

### 15.2.1 MATERIALS AND COMPONENTS

**Accessories**

Beads: To be metal proprietary sections manufactured to be fixed to backgrounds and/or embedded in the plaster to form and protect plaster edges and junctions.

**Aggregates**

Sand: To be fine, sharp, well-graded sand with a low clay content and free from efflorescing salts.

**Bonding products**

To be proprietary products manufactured for bonding cement-based plaster to solid backgrounds.

**Cement**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

**Colouring products**

To be proprietary products manufactured for colouring cement plaster.
Integral pigment proportion: 5% by mass of cement.

**Curing products**

To be proprietary products manufactured for use with the plaster system.

**Gypsum plaster**

To be a proprietary product containing calcium sulfate hemihydrate with additives to modify setting.

**Lime**

Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Preparing lime putty:

- Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency.
Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.
- Using quicklime: Run to putty as soon as possible after receipt of quicklime. Partly fill clean container with water, add lime to half the height of the water, then stir and hoe ensuring that no lime

remains exposed above the water. Continue stirring and hoeing for at least 5 minutes after all reaction has ceased, then sieve into a maturing bin. Leave undisturbed for at least 14 days. Protect from drying out.

**Mixes**

Select a mix ratio to suit the application in conformity to the **Mixes table**.

Measurement: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Plaster mixing: Machine mix for greater than 3 minutes and less than 6 minutes.

Strength of successive coats: Ensure successive coats are no richer in binder than the coat to which they are applied.

**Mixes table**

| **Mix type** | | **Application** | **Upper and lower limits of proportions by volume** | | | |
|---|---|---|---|---|---|---|
| | | | **Gypsum** | **Cement** | **Lime** | **Sand** |
| Cement render coats in:<br>• Single or multi-coat systems with integral finishing treatments<br>• Base coats in multi-coat systems with cement or gypsum finishes | CRS | Dense and smooth concrete and masonry<br>Thrown finishing treatments<br>Tiled finishes<br>Gypsum finishes<br>Cement finishes | -<br>- | 1<br>1 | 0<br>0.5 | 3<br>4.5 |
| | CRM | Clay or concrete masonry | -<br>- | 1<br>1 | 0.5 | 4.5<br>6 |
| | CRW | Lightweight concrete masonry and other weak backgrounds | -<br>- | 1<br>1 | | 6<br>9 |
| Cement finish coats | CRF | Cement render base coats | -<br>- | 1<br>1 | 1 | 1.5<br>2 |
| Lime felting finish coats | LF | Cement render base coats | | | 1 | 3 |
| Gypsum finish coats | GPF | Cement render base coats | 3<br>1 | -<br>- | 1<br>1 | -<br>1 |

**Water**

To be clean and free from any deleterious matter.

## 15.3 EXECUTION

### 15.3.1 PREPARATION

**Substrates**

Ensure substrates have:

- Any deposit or finish which may impair adhesion of plaster cleaned off.
- If solid or continuous, excessive projections hacked off and voids and hollows filled with plaster stronger than the first coat and not weaker than the background.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not plaster backgrounds showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scratching or hacking to remove 2 mm of the surface and expose the aggregate then apply a bonding treatment.

Painted surfaces: Remove paint and hack the surface at close intervals.

Untrue substrates: If the substrate is not sufficiently true to ensure conformity with the thickness limits for the plaster system or has excessively uneven suction resulting from variations in the composition of the background, apply additional coats.

**Bonding treatment**

If bonding treatment is required, throw a wet mix onto the background as follows:

- Cement plaster: 1 part cement to 2 parts sand.
- Gypsum plaster: 1 part gypsum to 2 parts sand.

Curing: Keep continuously moist for 5 days and allow to dry before applying plaster coats.
Thickness: From greater than 3mm but less than 6 mm.

**Embedded items**

If there are water pipes and other embedded items, sheath them to permit thermal movement. Ensure embedded items will have a suitable level of corrosion resistance prior to embedment**.**

**15.3.2 APPLICATION**

**Plastering**

General: Provide plaster finishes as follows:

- Resistant to impacts expected in use.
- Free of irregularities.
- Consistent in texture and finish.
- Firmly bonded to substrates for the expected life of the application.
- As a suitable substrate for the nominated final finish.

Base coats: Scratch-comb each base coat in two directions when it has stiffened.

**Finishing treatments**

Plain:

- Bag: To be a finish mainly free from sand by rubbing the finish coat with a Hessian pad when it has set firm.
- Carborundum stone: To be a smooth finish free from sand by, rubbing the finish coat with a fine carborundum stone when it has set hard.
- Steel trowel: To be a smooth dense surface by steel troweling which is not glass-like and is free from shrinkage cracks and crazing.
- Wood or plastic float: To be an even surface by wood or plastic floating the finish coat on application.

**Incidental work**

Return plaster into reveals, beads, sills, recesses and niches. Plaster faces, ends, and soffits of projections in the background, such as string courses, sills, and other wall features. Trim around openings. Plaster exposed inside of built-in cupboards.

**Joining up**

If joining up is required, ensure joints will not be visible in the finished work after decoration.

**Plaster thickness**

Conform to the **Plaster thickness table**.

**Plaster thickness table**

| **Plaster** | **Application** | **Upper limit of thickness (mm)** | | | |
|---|---|---|---|---|---|
| | | **Single coat systems** | **Multi-coat systems** | | |
| | | | **Base coat(s)** | **Finish coat** | **System** |
| Cement render base coats and cement or gypsum finish coats | On smooth dense concrete | 12 | 10 | 4 | 13 |
| | On clay and concrete brickwork and other backgrounds | 15 | 13 | 4 | 16 |

# 16. TILING

## 16.1 GENERAL

### 16.1.1 INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

- Floor preparation and set out of floor tiles before fixing.
- Wall preparation and set out of wall tiles before fixing.
- Control joints before sealing and grouting.

### 16.1.2 SUBMISSIONS

**Samples**

Submit labelled samples of tiles, including fittings, accessories, grout and sealants, illustrating the range of variation in colour and finish.

### 16.1.3 INTERPRETATIONS

**Definitions**

For the purposes of this work section the definitions given below apply.

- Substrates: The surfaces on which tiles are bedded.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and dry and cure to adhere tiles to substrates.
. Mortar bedding: Tiling adhered in a cementitious mortar bed.
- Tiles: Thin slabs made from clays and/or other inorganic raw materials used generally as coverings for floors and walls and adhered to continuous supporting substrates.
. Cementitious: Manufactured cement based pre-finished tiles.
. Terrazzo – cementitious: Manufactured cementitious terrazzo tiles formed in a suitable machine to give sufficient compaction and density to the finished surface, and moisture cured before grinding and honed at the place of manufacture. Thickness usually 35 mm.
- Wet areas: Areas within buildings with water supply and drainage systems.

## 16.2 PRODUCTS

### 16.2.1 TILES AND ACCESSORIES

**Tiles**

Coves, nozings and skirtings: To be matching stop-end and internal and external angle tiles moulded for that purpose.

Exposed edges: To be purpose-made border tiles with the exposed edge glazed to match the tile face. If such tiles are not available, round edge with grout.

### 16.2.2 ADHESIVES

**Type**

General: Provide adhesives compatible with the materials and surfaces to be adhered.

Prohibited uses: Do not provide the following combinations:

- Cement-based adhesives on wood, metal, painted or glazed surfaces, gypsum-based plaster.
- Organic solvent-based adhesives on painted surfaces.
- Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.

### 16.2.3 MORTAR

**Materials**

Cement: Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

- White cement: Iron salts content $\leq$ 1%.
- Off-white cement: Iron salts content $\leq$ 2.5%.

Lime: Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Bedding mortar**

Proportioning: Select proportions from the range 1:3 – 1:4 cement: sand to obtain satisfactory adhesion. Provide minimum water.

Terra cotta tiles: Use proprietary polymer modified mortar.

**Water**

General: To be clean and free from any deleterious matter.

### 16.2.4 GROUT

**Type**

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

Terra cotta tiles: Use proprietary polymer modified grout.

Portland cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

- For joints < 3 mm: 1 cement:2 sand.
- For joints ≥ 3 mm: 1 cement:3 sand.

**Pigments**

Pigments for coloured grout: Provide colourfast fillers compatible with the grout material. For cement-based grouts, provide lime-proof natural or synthetic metallic oxides compatible with cement.

## 16.3 EXECUTION

Provide tiling systems to walls, floors and other substrates as follows:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected impacts in use.
- Set out with joints accurately aligned in both directions and wall tiling joints level and plumb.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

### 16.3.1 SUBSTRATES

**Drying and shrinkage**

Before tiling, allow at least the following times to elapse (for initial drying out and shrinkage) for these substrates:

- Concrete slabs: 42 days.
- Concrete blockwork: 28 days.
- Toppings on slabs and rendering on blockwork: A further 21 days.

### 16.3.2 PREPARATION

**Ambient temperature**

If the ambient temperature is less than 5 or more than 35°C, do not lay tiles.

**Substrates**

Ensure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- If solid or continuous, excessive projections are hacked off and voids and hollows are filled with a cement: sand mix not stronger than the substrate nor weaker than the bedding.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scratching or hacking to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

### 16.3.3 TILING GENERALLY

**Sequence**

General: Fix wall tiles before floor tiles.

**Cutting and laying**

Cutting: Cut tiles neatly to fit around fixtures and fittings, and at margins where necessary. Drill holes without damaging tile faces. Rub edges smooth without chipping.

Laying: Return tiles into sills and openings. Butt up to returns, frames, fittings, and other finishes.

**Variations**

Distribute variations in hue, colour, or pattern uniformly, by mixing tiles or tile batches before laying.

**Protection**

Floor tiles: Keep traffic off floor tiles until the bedding has set and attained its working strength.
Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

# 17. PAINTING

## 17.1 GENERAL

### 17.1.1 INSPECTION

**Notice**
Give sufficient notice so that inspection may be made of the substrate immediately before application of paint finishes.

### 17.1.2 SUBMISSIONS

**Clear finish coated samples**
Submit pieces of timber or timber veneer matching the timber to be used in the works, prepared and coated in accordance with the paint system.

**Opaque coated samples**
Provide approx. 600x600mm samples on representative substrates of each paint system showing surface preparation, colour, gloss level and texture. Products

### 17.1.3 PAINTS

**Combinations**
Do not combine paints from different manufacturers in a paint system.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the top coats.

**Delivery**
Deliver paints to the site in the manufacturer"s labelled and unopened containers.

**Tinting**
Provide only products which are colour tinted by the manufacturer or supplier.

**Putty**
Non-timber substrates: Oil-based or polymeric based.
Timber finishes: Lacquer or water based only.

## 17.2 EXECUTION

### 17.2.1 PREPARATION

**Order of work**
Other trades: Before painting, complete the work of other trades as far as practicable within the area to be painted, except for installation of fittings and laying flooring materials.

Clear finishes: Complete clear timber finishes before commencing opaque paint finishes in the same area.

**Protection**
Fixtures: Remove door furniture, switch plates, light fittings and other fixtures before starting to paint, and refix in position undamaged on completion of the installation.

Adjacent surfaces: Protect adjacent finished surfaces liable to damage from painting operations.

**"Wet paint" warning**
Place notices conspicuously and do not remove them until paint is dry.

**Restoration**
Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition. Touch up damaged decorative paintwork or misses only with the paint batch used in the original application.

**Substrate preparation**
Prepare substrates to receive the painting systems

Cleaning: Clean down the substrate surface. Do not cause undue damage to the substrate or damage to, or contamination of, the surroundings.

Filling: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth.

Clear finish: Provide filler tinted to match the substrate.

Clear timber finish systems: Prepare the surface so that its attributes will show through the clear finish without blemishes, by methods which may involve the following:

- Removal of discolourations, including staining by oil, grease and nailheads.
- Puttying.

### 17.2.2 PAINTING

Provide coating systems to substrates as follows and as scheduled:

- Consistent in colour, gloss level, texture and thickness.
- Free of runs, sags, blisters, or other discontinuities.
- Fully adhered.
- Resistant to expected impacts in use.
- Resistant to environmental degradation within the manufacturer"s stated life span.

**Drying**

Ensure that the moisture content of the substrate is at or below the recommended maximum level for the type of paint and the substrate material.

**Paint application**

Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Apply subsequent coats after the manufacturer"s recommended drying period has elapsed.

**Priming before fixing**

Apply one coat of wood primer (2 coats to end grain) to the back of the following before fixing in position:

- Timber door and window frames.
- Bottoms of external doors.
- Associated trims and glazing beads.

**Spraying**

If the paint application is by spraying, use conventional or airless equipment which does the following:

- Satisfactorily atomizes the paint being applied.
- Does not require the paint to be thinned beyond the maximum amount recommended by the manufacturer.
- Does not introduce oil, water or other contaminants into the applied paint.

**Sanding**

Clear finishes: Sand the sealer using the finest possible abrasive and avoid cutting through the colour. Take special care with round surfaces and edges.

**Repair of galvanizing**

For galvanized surfaces which have been subsequently welded, prime the affected area.

# 18. SAFETY MANAGEMENT

### CONSTRUCTION SAFETY

The contractor shall take all necessary steps to provide safety for project workers, the persons residing near the project, to the property of the public or others from the project activities arising as a consequence of his methods of operation.

The Contractor shall comply with all Safety Legislations and its Subsidiary Legislations, Regulations which are in force in the Country and any amendments or re-enactments.

The Contractor shall not permit any person to do anything not in accordance with the generally accepted principles of safe and sound practices. The Contractor shall ensure safe environment on site at all times. The Contractor shall ensure that necessary and sufficient precautions are taken by his workmen when safety provisions are used.

### BARRICADING

The Contractor shall provide and maintain guards, fences or barriers around excavations, pits or other similar potential places of danger to prevent accidents. The barricade should be at least 1.1m high and strong enough to withstand a lateral point load of 50 kg.

### WARNING SIGNS

The Contractor shall display warning signs of sizes 900 mm x 600 mm at a minimum of 4 points around the periphery of the site where the construction activities are located in near the residential area, roads, at locations where there is a chance of children can come to work site and where trespassing is likely to occur. Such signs shall have the words "DANGER - KEEP OUT OF SITE"

### STORAGE OF FUELS

Fuels shall be stored in a room/ enclosed space, the room/ enclosed space shall have impervious platform and berm along the periphery of the storage area to contain spills of the fuels.

### SAFETY OF MACHINERY

The Contractor shall employ only qualified operators for the machinery to be used on Site. All the machinery shall be locked when they are parked to avoid unauthorized operation of the machinery.

### FIRST AID

At least two first aid kits shall be kept at site for attending the emergency treatment to the victims of accidents or chemical poisoning or excessive exposure to toxic substances. The first aid kit shall include a leaflet of standard First-Aid procedure in addition to the medicines and medical tools. At least one staff member who has undergone First Aid training should be posted at site.

### FIRE SAFETY, EMERGENCY AND RESCUE

The Contractor shall establish Fire Safety, Emergency and Rescue arrangements to contain fire and take necessary action during emergency. The contractor should place fire extinguishers at the work site, materials storage area and at site accommodation. The contractor should keep minimum 6 fire extinguishers within the work place

## ELECTRICAL SAFETY

All electrical l equip should be listed and labeled, free from hazards, and used in the proper manner. The electrician should be protected from electrical shocks and provided necessary safetyy equip

All temporary electrical installations in the site should be verified regularly to ensure that all the leaks in the wires are rectified/ faulty wires are replaced. The contractor should also ensure that all electric joints are leak proof.

## PERSONAL PROTECTIVE EQUIPMENT

The Contractor shall provide and maintain suitable personal protective equipment for all workmen employed on the site to provide protection against falling objects and harmful substances which can cause injury. The Personal protective equipment shall include boots, hand gloves, helmet and goggles. The Contractor shall record the issuance of all equipment to his workmen and kept in the site office.

## HOUSEKEEPING

The Contractor shall provide safe working environment by keeping the site neat and tidy, and free from debris. All materials shall be stacked safely. All accesses shall be kept free from hazards and debris.

Housekeeping shall be carried out in such a manner and at such times so as not to cause any inconvenience to either the adjoining owners, occupiers or the public. Debris shall be wetted to minimize the risk of dust. Containers for debris, rubbish and other wastes shall be provided at the designated places.