

**REPUBLIC OF LEBANON  
COUNCIL FOR DEVELOPMENT & RECONSTRUCTION**



**Lebanon Emergency Assistance Project  
(LEAP)**

**Rehabilitation of Schools–Shelters  
“LEAP-SH-SW-MEHE- Batch 1 (Lot 3)”**

**Tender Documents**

**Volume 2 – Specifications**

**Part 1**

**Civil, Structural and Architectural**

Prepared By:

Ref. L2026-06  
August, 2026

## **VOLUME 2**

### **SPECIFICATIONS**

#### **Part 1**

#### **Civil and Architectural Works**

#### **TABLE OF CONTENTS**

|                      |                                                |
|----------------------|------------------------------------------------|
| <b>CHAPTER ONE</b>   | - <b>SITE PREPARATION &amp; DEMOLITION</b>     |
| 1.1                  | General                                        |
| 1.2                  | Demolition and Removal of Debris               |
| <b>CHAPTER TWO</b>   | - <b>EXTERNAL WORKS</b>                        |
| 2.1                  | Excavation, Backfilling and Earthwork          |
| 2.2                  | Road Base Course                               |
| 2.3                  | Precast Concrete Pavements and Curbs           |
| 2.4                  | Existing Walkways                              |
| 2.5                  | Planting                                       |
| 2.6                  | Boundary Wall, Fences and Steel Gates          |
| 2.7                  | Recycling Area                                 |
| 2.8                  | Traffic Signs and Signals                      |
| 2.9                  | Ramp for External Existing Sidewalk            |
| 2.10                 | Asphalt Work                                   |
| 2.11                 | Flagpole                                       |
| <b>CHAPTER THREE</b> | - <b>CONCRETE WORKS</b>                        |
| 3.1                  | Cast-In-Place Concrete                         |
| 3.2                  | Concrete Topping (Decorative Stamped Concrete) |
| <b>CHAPTER FOUR</b>  | - <b>MASONRY</b>                               |
| 4.1                  | Hollow or solid concrete blocks and Claustra   |
| 4.2                  | Exterior Stonework                             |
| <b>CHAPTER FIVE</b>  | - <b>METAL WORK</b>                            |
| 5.1                  | Metal Fabrications                             |
| <b>CHAPTER SIX</b>   | - <b>WOODWORK</b>                              |
| 6.1                  | Joinery                                        |
| 6.2                  | High Pressure Laminate (HPL)                   |
| <b>CHAPTER SEVEN</b> | - <b>THERMAL AND MOISTURE PROTECTION</b>       |
| 7.1                  | Roofing                                        |
| 7.2                  | Water Proofing PU Coating                      |
| 7.3                  | Wall Insulation                                |
| 7.4                  | Green Roof                                     |
| 7.5                  | Joint Sealers (Expansion Joint)                |
| 7.6                  | EPDM Insulation Sheet                          |
| <b>CHAPTER EIGHT</b> | - <b>DOORS AND WINDOWS</b>                     |
| 8.1                  | Wood Doors with Steel Frames                   |
| 8.2                  | Aluminum Doors and Windows                     |
| 8.3                  | Glass & Glazing                                |
| 8.4                  | Door Hardware (Ironmongery)                    |
| 8.5                  | Decorative Door for KG Classroom               |
| 8.6                  | Master key                                     |

---

**CHAPTER NINE**

9.1  
9.2  
9.3  
9.4  
9.5

- **FINISHES**

Lath and Plaster  
Tiling Works  
Acoustical Ceilings Works  
Gypsum Works  
Painting Works

**CHAPTER TEN**

10.1  
10.2  
10.3  
10.4  
10.5

- **SPECIALTIES**

Toilet Accessories  
Classroom Specialties  
Epoxy Resin Work  
Round Corner Protector on Aluminum Core  
Internal Curtains

**CHAPTER ELEVEN**

11.1  
11.2

- **EQUIPMENT**

Athletic Court Equipment  
Vacuum Cleaner Machine for Vinyl

**CHAPTER TWELVE**

12.1

- **FURNISHING**

Institutional Furniture

**APPENDICES**

Appendix 1:

General Safety, Health and Environmental Regulations

**CHAPTER ONE**  
**SITE PREPARATION & DEMOLITION**

---

**CHAPTER ONE**  
**SITE PREPARATION & DEMOLITION**

**1.1    GENERAL**

**1.1.1    SCOPE OF WORK**

The work comprises of School Rehabilitation Works (public Schools).

**1.1.2    SITE PROTECTION**

The contractor should take all measures to protect the site and to protect the users during the rehabilitation period as per the Engineer instructions.

**1.1.3    The contractor should not allow or add any load to the existing body to avoid any risk in construction works.**

**1.1.4    At the beginning of the works, the contractor should clean the site and the surrounding from all obstacles and remove all debris to outside the site.**

**1.1.5    After the completion of works, the contractor should clean the site and works location and make good all places related to his works.**

---

## **1.2 DEMOLITION & REMOVAL OF DEBRIS**

### **1.2.1 SUMMARY**

A. This Section includes the following:

1. Demolition and removal of structures.
2. Demolition and removal of site improvements adjacent to a building or structure to be demolished.
3. Disconnecting, capping or sealing, and abandoning in place or removing site utilities.

### **1.2.2 DEFINITIONS**

A. Remove and Salvage: Carefully dismantle and/or detach from existing construction. Store, protect, and transport and deliver to Employer.

### **1.2.3 SUBMITTALS**

A. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

B. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary protection and means of entry and exit for Contractor, and occupants affected by building demolition operations.
5. Coordination of continuing occupancy of adjacent buildings and partial use of premises.

C. Predemolition Photographs: Take photographs to show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.

D. Inventory: After building demolition is complete, submit lists of components and items that have been removed and salvaged or removed for re-use.

E. Predemolition Meeting: Conduct meeting at Project site to review methods and procedures related to building demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.

## **CHAPTER TWO**

### **EXTERNAL WORKS**

---

## **CHAPTER TWO** **EXTERNAL WORKS**

### **2.1 EXCAVATION, BACKFILLING AND EARTHWORK**

#### **SUMMARY**

- A. This section includes the following:
1. Excavating and backfilling for structures, roads and walkways.
  2. Granular base course for support of building slabs is included as part of this work.
  3. Preparation of subgrade for structures.
  4. Preparation of subgrade for roads.

#### **DEFINITIONS**

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, concrete blinding layer, base course or topsoil materials.

#### **PROJECT CONDITIONS**

- A. Use of Explosives: Use of explosives is not permitted.
- B. Protection of Persons and Property.
1. Barricade open excavations occurring as part of this work and post with warning lights.
  2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  3. Perform excavation by hand.

#### **STORAGE OF EXCAVATED MATERIALS**

- A. Stockpile all satisfactory excavated materials which are to be re-used for backfill and fill, where directed. Place, grade, and shape stockpiles for proper drainage, and locate away from edge of excavations.

#### **BACKFILL AND FILL**

- A. General: Place soil material in layers to required subgrade elevations.
1. Under walkways: use satisfactory excavated or imported material, approved by the Engineer.
  2. Under roads: Use satisfactory excavated or imported material having a soaked CBR of not less than 20%.

- B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing and perimeter protection.
  2. Removal of trash and debris from excavation.
  3. Permanent or temporary horizontal bracing is in place on horizontally supported wall.

## **PLACEMENT AND COMPACTION**

- A. Placement and compaction methods and equipment shall be approved by the Engineer. Heavy steel and pneumatic rollers are not allowed to be used inside building areas.
- B. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:

1. Under structures, compact top 300 mm of subgrade and each layer of backfill or fill material at 95 percent maximum density.
  2. Under lawn or unpaved areas, compact top 150 mm of subgrade and each layer of satisfactory soil material at 90 percent maximum density.
  3. Under walkways, compact top 150 mm of subgrade and each layer of satisfactory soil material at 95 percent maximum density.
- C. Under roads: finished subgrade immediately prior to placing subsequent material shall be compacted to not less than 95% maximum dry density to 150 mm depth (modified AASHTO) as determined in the laboratory.
- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction or re-compaction, uniformly apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  2. Stockpile or spread soil material that has been removed because is too wet to permit compaction. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

## **GRADING**

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 13mm when tested with a 3.0 m straightedge.

---

## **BUILDING SLAB BASE COURSE**

- A. General: Base course consists of placement of granular base material, in layers of indicated thickness, over subgrade to support concrete building slabs.
- B. Placing: Place granular base material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Compact to 95% maximum density in accordance with ASTM D 1557.
  - 1. When a compacted granular base course is indicated to be 150mm thick or less, place material in a single layer. When indicated to be more than 150mm thick, place material in equal layers, except no single layer more than 150mm or less than 75mm in thickness when compacted.

## **DISPOSAL**

- A. Unsatisfactory excavated material, trash, debris and other waste materials:
  - 1. Remove from the site and dispose of legally, at Contractor's expense.
- B. Satisfactory excavated material excess, surplus to backfill and fill requirements:
  - 1. Remove from the site and dispose of legally, at Contractor's expense.

---

## **2.2 ROAD BASE COURSE**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. The extent of the work is shown on the drawings and includes providing, spreading and compacting granular road base in compliance with the specifications and in conformity with grade, lines and thickness shown on the drawings.

### **PART 2 - PRODUCTS**

#### **GRANULAR ROAD BASE**

- A. General: Sound, naturally occurring material, or angular crushed stone, clean and free from organic matter and unsuitable material or other deleterious substances and be in such condition that it can be readily compacted under watering and rolling to form a firm and stable base.

### **PART 3 - EXECUTION**

#### **SUBGRADE PREPARATION**

- A. Check subgrade for conformity with elevations and section immediately before placing granular base. Materials are only to be placed on subgrades approved by the Engineer.

#### **PLACING OF GRANULAR BASE**

- A. Deliver granular base material as a uniform mixture and place on the road bed by means of method approved by the Engineer controlled mechanical spreader, and at a uniform quantity per linear metre and at rate which will provide the required compacted thickness specified. Avoid segregation of material and material not uniform in mixture. Place material in compacted layers at optimum moisture content of approximately equal thickness. Unless otherwise approved thickness is not to exceed 150 mm for any one layer. When placed in 2 or more layers, permit first layer to dry just sufficient for stability during placing of the subsequent layer. Permit the completed base to dry just sufficiently for stability during placing of any covering materials.

#### **COMPACTING AND GRADE TOLERANCE**

- A. Carry out plate bearing tests in accordance with ASTM D 1196. At least one (1) Plate bearing test shall be carried out at selected locations for every 200 m<sup>2</sup> of granular base. The bearing value of the granular base is not to be less than 1200 Kp using 300 mm diameter plate for 5 mm deflection and 10 repetitions.
- B. The surface of the finished base shall not vary by more than 10 mm when tested with a 3m straightedge when placed on, and parallel or perpendicular to the centre line of the roadway and the compacted base shall not vary by more than +5/-10 mm from the required elevation. Correct all depressions and humps exceeding the specified tolerances.

## **2.3 PRECAST CONCRETE PAVEMENTS AND CURBS**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. The extent of precast concrete pavements and curbs is indicated on drawings.  
Types include:
  - 1. Tile: walkway and area pavements.
  - 2. Curb: at roadways and car parks.
- B. The Contractor shall engineer and design all precast concrete pavement and curb assemblies, including, sub base, tooling, control joints and locations, and all other details and junctures with other materials and systems, to provide pavements and curb installations.

#### **QUALITY ASSURANCE**

- A. Codes and Standards: conform and comply with ASTM or BS or alternative equivalent standards acceptable to the Engineer which establish minimum qualitative and quantitative standards for the materials, production and installation of precast concrete paves tiles and road curbs.
- B. If units are not produced at precast concrete fabricating plant, maintain quality control procedures and conditions acceptable to Engineer.

#### **DELIVERY, STORAGE AND HANDLING**

- A. Deliver precast concrete units to the site in such quantities and at such times to ensure continuity of installation. Store units at site in such manner as to prevent cracking, chipping, distortion, staining or other physical damage.

### **PART 2 - PRODUCTS**

#### **MATERIALS**

- A. Precast Concrete Materials: Comply with the relevant requirements specified for cast in place concrete materials.
- B. Mortar Bedding and Grout Materials: comply with the relevant requirement specified for unit masonry mortar and grout materials.
- C. Joint Filler: Premoulded bituminous fibreboard.

#### **MIXES**

- A. Tiles and Curbs: Prepare design mixes for each type of precast concrete unit to achieve minimum Class B cast in place concrete characteristics. (Refer to Chapter 3).
- B. Base and Backing: cast in place concrete, Class C. (Refer to Chapter 3).

- C. Mortar Bedding and Grout: Cement and sand proportioned by volume in parts 1:3.

## **FABRICATION**

- A. General: Tiles and curbs may either be obtained from an approved manufacturer or otherwise manufactured on site by the Contractor.
- B. Production cast and cure precast units by approved methods conforming to referenced standards and a manufacturing system which includes:
1. Mechanically vibrated molds.
  2. Hydraulically applied pressure.
  3. Curing by totally immersing in water for at least 24 hours after initial set has taken place, or other approved method.

## **PRECAST CONCRETE PRODUCTS**

- A. Tile Pavers: Plain face with square edges:
1. Surface: Smooth, non-slip.
  2. Dimensions: As indicated:
    - a. 600mm x 600mm x 40mm thick, or
    - b. 250mm x 250mm x 25mm thick
  3. Colour: Grey or as required by the Engineer.
- B. Curbs: plain with square edges and ends.
1. Dimensions: approved uniform lengths to profiles as indicated on drawings or otherwise required.
  2. Colour: Grey.

## **PART 3 - EXECUTION**

### **PREPARATION AND INSTALLATION**

- A. Subgrades: Prepare and compact subgrade formations to 90% maximum density or 70% relative density.
- B. Curbs:
1. Base and Backing: Place compact and cure cast in place concrete curb. Foundation as indicated or required. Place and compact 150mm wide curb backing, up to the under side of adjacent pavements.
  2. Bedding and Jointing: set curb and grout up joints in cement mortar. Point joints smooth and flush with curb.
- C. Tile Pavements:

- 
1. Base: Place, compact and cure cast in place concrete sub base; 100mm thick bed unless otherwise indicated or required.
  2. Bedding and Jointing: Set pavers and grout joints in cement mortar. Points and tool joints grooved, to a uniform depth of 3mm.
- D. Control Joints: Install joint filler as indicated or required at pavement and curb control joint locations.

#### **REPAIR, CLEANING AND PROTECTION**

- A. Remove and replace unit pavers and curbs which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.
- B. Cleaning: Remove excess mortar/grout from exposed surface, wash and scrub clean.
- C. Protect pavements and curbs from damage and wear and maintain conditions in a manner acceptable to the engineer.

---

## **2.4     EXISTING WALKWAYS**

### **2.4.1     SCOPE**

Repair existing walkways at project site boundary; precast concrete paver tiles, bases courses, etc., as necessary, where damaged or disturbed by new construction; make good and joint at junction with new precast concrete paving and/or curbing as required and to Engineer's approval.

To be read in conjunction with Chapter 2 and Chapter 9.

## **2.5 PLANTING**

### **2.5.1 SCOPE**

- A. These Works shall consist of the furnishing of all materials and the construction, installation & completion in all respects of landscape planting.
- B. Landscape planting refers to items associated with preparing areas of planting and the planting of trees, shrubs, ground cover, vines, grass, and turfing.

### **2.5.2 LANDSCAPE PLANTING STANDARDS**

- A. The Contractor shall be responsible for the quality of all items purchased and shall submit and inspection plans for review. The inspection plan shall cover those items intended for shop inspection and the procedures for carrying out such inspections.

### **2.5.3 PRODUCTS AND MATERIALS**

- A. Agricultural Soil
  - A.1 Soil shall be obtained from well-drained arable land approved by the Engineer before its use. It shall be free draining, non-toxic and capable of sustaining healthy plant growth. Soil shall not contain subsoil, refuse, roots, heavy clay, noxious weed, phytotoxic materials, coarse sand, rocks, sticks, brush, litter or other deleterious materials.
  - A.2 Agricultural soil brought on to the Site without prior inspection and approval shall be at the risk of the Contractor, who shall remove it at his own expense unless otherwise instructed by the Engineer.
- B. Fertilizers
  - B.1 Inorganic fertilizers shall be applied to the irrigation water by the use of injection equipment. Fertilizers shall be approved soluble NPK fertilizers in a suitable ratio applied at a dilution rate of one kg fertilizer to 1,000 ltr of water.
  - B.2 Proposals for use of any of the following alternative fertilizer types and composition where injection equipment is not specified for use, may be submitted for consideration: However, the suitable fertilizer type and grade shall be determined, after testing the soil samples, to suit that type of plantation desired.
- C. Plants Generally
  - C.1 All plants shall comply with BS 3936, Part 1, and be of the size specified. No plant shall be less than the minimum size and at least 50% shall be in the upper part of the specified range. Plants that meet the measurements specified but do not possess the normal balance between height and spread will not be accepted.
  - C.2 All planting stock shall be well-balanced and well formed, sound vigorous, healthy and free from disease, sunscald, abrasion, harmful insects or insect eggs and with a healthy unbroken root system. Unless otherwise specified, only nursery-grown plants shall be used.
  - C.3 All plants supplied shall have been grown from the Contractor's own nursery stock or obtained from a reputable nursery, and shall be subject to approval by the Engineer at the source prior to digging for transport to the project site.

- C.4 If specified plants are unobtainable, details of alternatives shall be submitted with the Tender, stating how they differ from the plants specified. Such substitutions shall be subject to approval.

D. Trees (Other Than Palms)

- D.1 Trees shall be symmetrically developed, their structure and habit of growth typical of their species or variety with straight stems and an intact central leader. All trees shall be root pruned at the source prior to shipment to the project site and are to be supplied earthballed and Hessian covered or container grown. Bare root trees shall not be acceptable without prior approval of the Engineer. Trees shall have a minimum height of 1.8 m above planting level.
- D.2 Where trees of 1.8 m height are unobtainable, and subject to the submission of evidence to that effect, the Contractor may, if approved, substitute trees of 1.5 heights.
- D.3 Anti-desiccant shall be applied to all trees no more than 24 hours prior to shipment from the source to the project site. The Anti-desiccant sample shall be submitted to the Engineer for approval in unopened containers of the manufacturer prior to application.

E. Palms

- E.1 Palms shall be balled and burlapped unless container grown palms are available. Offshoots will not be accepted. They shall have a vigorous root system, a crown of new leaves, proper color of leaves of an adult palm and sufficient hardness. Fronds shall exhibit no signs of moisture stress. All palms shall have straight 10 runks. Any tree having a weak or thin trunk not capable of supporting itself when planted in the open will not be accepted. They shall be of a quality equal to heavy trunk type palms designated as "Florida Fancy" in the Florida Department of Agriculture and Consumer Service Publication.
- E.2 Height of palms shall not be less than 1.5 from planting level to the base of the growing tip.  
Palms of 1.5 m height to have a root-ball diameter of 0.75m to 0.9m;  
Palms of 2m heights to have a root ball diameter of 0.90m to 1.10m  
Palms of 2.4m heights to have a root ball diameter of 1.1m to 1.3m.  
Palms of 3.0m heights to have a root ball diameter of 1.3m to 1.5m.
- E.3 Palms trees shall be root pruned one year before removal from the original growing site. The pruning trench shall be backfilled with wet peat or equal and the tree sprayed with anti-desiccant.
- E.4 Palms shall be dug and prepared for shipment in a manner that will not cause any damage to the fronds, bud, shape, root system and future development of the plants after replanting.
- E.5 Care shall be taken that the root ball is planted intact and the terminal bud is undamaged. Damaged palms shall be replaced at the Contractor's expense.
- E.6 Guying of the palm trees shall be specified by the Engineer.
- E.7 Palms shall be irrigated and basins shall be prepared to retain the water. The Contractor shall provide sub-soil drainage to the palm growing area in case the palm pits do not drain properly.
- E.8 The Contractor will be required to replace, at his own expense, planting material that does not grow and fails to survive while in the site nursery or holding area. All plants that show signs of failure to grow at any time, as determined by the Engineer, shall be removed and replaced. The Engineer will inspect the nursery growing grounds once a week or at longer intervals, at his discretion and will mark or indicate the plants to be replaced. Any plant requiring replacement should be replaced with a plant of equal size and age as the plant found unsuitable should have been at the date of replacement, removal, transporting and installing of the plants shall be performed by the Contractor at his own expense.

- E.9 If the palms have been temporary heeled-in or held in a project nursery for more than 45 days. The following procedures shall be followed immediately prior to relocation for final planting:
- Trim off matured fronds using a very sharp knife.
  - Trim semi-mature fronds by leave a total of 10 to 14 fronds, either mature or semi-mature, to protect the growth bud.
  - Trim off all suckers and fruiting stalks.
  - The remaining frond shall be tied upright with twine to surround the growth bud. The fronds shall be then trimmed to about 2/3 of their original length. These tied fronds shall then be neatly wrapped with burlap and tied again to hold the burlap in place.
  - After wrapping fronds, the soil around the palm tree will be irrigated to field capacity. The palm will not be dug until the soil is in a friable condition. If the palms must remain in the ground in a wrapped condition for more than two days, repeat this irrigation procedure daily.
  - Excavate a trench approximately one meter from trunk to a depth of 1.25 meters. Break the root ball loose from the ground by prying. (Use of a backhoe to excavate around the palm is permissible. It can also be used to remove the palm). The Contractor shall be especially careful not to bump the palm near the growth bud.
  - Use a front loader, backhoe or crane and a heavy duty nylon or canvas sling to lift the palm vertically from the pit, with the palms suspended in the vertical position, using sharp machetes, shovels and shears, remove all the dirt and trim the roots to 0.50 meter from the trunk.

F. Tree Stakes and Ties (Excluding Palm Stakes)

- F.1 All stakes shall be of timber, straight, free of projections and pointed at one end. The lower ends shall be coated with a non-injurious wood preservative to a minimum height of 0.15m above ground level, to be applied at least 2 weeks before use. Stakes shall be 50mm thick, the minimum length below ground to be 1.3m and the length above to be for the full height of the stem or half full height for feathered species.
- F.2 Alternatively, tree stakes shall be mild steel tubes protected by a PVC coating in mid-green or similar approved color. The tops and bottoms of the steel tubes shall be sealed with plastic caps. The external covering shall have horizontal ridges at regular intervals to facilitate the fixing of tree ties. Steel tube shall have a diameter of 35 mm and a height as the timber stakes.
- F.3 Wooden and steel stakes shall not be used on the same site.
- F.4 Trees Ties: Synthetic rubber compound hose, approved plastic, adjustable strap type or neoprene type approximately .03m in diameter and 0.3 in length, with rubber or Hessian buffer.

G. Guy Wires for Palms

Palms shall be stabilized with four 7-strand galvanized guy wires of 6mm diameter and of a length suited to each tree, fixed to approximately two thirds of the tree height. The wire guy shall be looped around the palm stem and protected by an approved tree tie.

H. Turnbuckles and Ground Anchors

Each guy wire shall be connected via a 50mm galvanized turnbuckle to a 150mm malleable iron ground anchor fixed by 1.2m long drive rods.

I. Trunk Wrapping Material

Trunk wrapping material shall be Hessian bands 75 mm wide and of lengths as necessary for wrapping tree trunks and main branches. Alternatively, purpose made,

double thickness heavy kraft crepe paper in rolls not less than 100mm wide with a stretch factor of 33% may be used.

J. Burlap

Burlap shall be jute of 0.20kg/m<sup>2</sup> or cloth having same strength and resistance to tearing and capable of rotting in the ground.

K. Twine for Tying

Twine for tying shall be lightly tarred medium or coarse sisal yarn.

L. Plant Labels

Plant labels shall be durable, weatherproof and to state legibly the correct plant and size.

M. Chafing Guards

Chafing guards shall be two-ply reinforced rubber or plastic garden hose of uniform color throughout the work.

N. Cast Iron Tree Grating Frame and Cover

The frame and cover should be of heavy-duty quality and galvanized. The pattern, the overall size and opening as specified on drawings. The finish colour to be black once painted with 3 coats of epoxy paint. Sample must be submitted to obtain approval before placing order with supplier.

O. Wrought Iron Tree Guard

The overall sizes as specified on drawing.

The galvanized finish to have 3 coats of black paint.

---

## **2.6 BOUNDARY WALLS, FENCES AND STEEL GATES**

### **Boundary Walls and Fences**

Construct boundary walls and fences complete; fully in accordance with the requirements and provisions of the Specification and as shown and detailed on the Drawings. Including for but not necessarily limited to additional excavation and earthworks below baseline levels, reinforced concrete foundations and substructures, above ground construction and assemblies, including formed and applied finishes, and complete in every respect. Refer to details on drawings to be read in conjunction with Chapter 2, 3 and 9 of the specifications.

Shop drawing required for Engineer's Approval.

### **Steel Gates**

Steel entrance gate assemblies and components as specified and detailed, fabricated and installed complete; INCLUDING for additional excavation, concrete footings, supports, anchorages and fixings; hardware, accessories, trim, finish painting; and all other related ancillaries as indicated or required on drawings. To be read in conjunction with Chapter 5.

Shop drawing required for Engineer's Approval.

---

## **2.7     RECYCLING AREA**

### **RECYCLING ROOM**

Construct recycling room adjacent to the school fence of 20 cm hollow concrete block walls 200 cm high. The room shall be 360 cm long by 220 cm wide and partitioned by 20 cm by 150 cm high hollow block walls. A new opening shall be made on the fence to allow the transfer of materials from the school to the appropriate vehicles. The room shall be rooted by brick tiling.

Price to include: Hollow concrete walls, concrete, steel reinforcements, steel structure for roof, brick tiling, mortar, plaster, labor equipment, windows, doors, and all requirements as per drawings and engineers approval.

### **RECYCLING CONTAINERS**

Provide at least four PVC containers with wheels and cover, each to hold separate recyclable material: metal, glass, paper and plastic.

## **2.8 TRAFFIC SIGNS AND SIGNALS**

### **Part 1 - GENERAL**

#### **1.1 SUMMARY**

A. Section Includes: Traffic signs as shown on the drawings or inferable there from and/or as specified in accordance with requirements of the Contract Documents, work includes but not limited to the following:

1. Ceiling hung signs including illuminated signs
2. Wall mounted signs including illuminated signs
3. Post mounted signs including illuminated signs.
4. Fabrication of sign and sign post.
5. Graphic/Lettering.
6. Foundation.
7. Installations.

#### **1.2 REFERENCES**

A. British Standards Institute (BSI):

1. BS 381: "Specification for Colours for Identification Coding and Special purposes"
2. BS 873: "Road Traffic Signs and Internally Illuminated Bollards"

B. American Society for Testing and Materials (ASTM):

1. ASTM A 53: "Specification for Pipe, Steel, Black and Hot Dipped Zinc Coated Welded and Seamless.
2. ASTM A 366: "Specification for Steel, Carbon, Cold Rolled Sheet, Commercial Quality"
3. ASTM A 512: "Specification for Cold Drawn Buttweld Carbon Steel Mechanical Tubing"
4. ASTM A 568 "Specification for General Requirements for Steel Carbon and High Strength Low-Alloy Hot Rolled Sheet and Cold Rolled Sheet"
5. ASTM D 790: "Test Methods for Flexible Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials"
6. ASTM D 1003: "Test Method for Haze and Luminous Transmittance of Transparent Plastics"

C. Comply with the relevant schedules and requirements with local regulations.

D. Unless otherwise stated, the design, materials, construction and erection of signs shall comply with the standards in the General Specification for Hospital signage.

#### **1.3 SYSTEM DESCRIPTION**

A. Design Requirements:

1. Unless otherwise stated, all road signs shall be of the types used for 85% ile speed of under 45 km/hr. category in the Traffic Signs Manual by Local Municipality.

2. Sign plates or boards employing any method of construction, irrespective of their size and shape, shall be capable of passing the rigidity tests stated in the relevant standards.

#### **1.4 SUBMITTALS**

- A. Manufacturers Data: Submit to the Engineer, in accordance with the requirements of the Contract Documents, copies of manufacturer's specifications and installation instructions and other data as may be required to show compliance with these Specifications.
- B. Shop Drawings: Submit shop drawings for the fabrication and erection of traffic sign work outdoor sign board and indoor sign board. Include details of sections and connections at not less than 1:4 scale. Show anchorage and accessory items and finishes.
- C. Samples: Submit to the Engineer, in accordance with the requirements of the Contract Documents, samples as follows:
  1. 150 x 150mm Samples of each metal and finish required.
  2. 300 x 300mm Samples of each type of acrylic sheet.

#### **1.5 QUALITY ASSURANCE**

- A. Provide traffic sign work (outdoor and indoor) fabricated by a firm specializing in the fabrication of traffic and similar signs and who are capable of producing work of the highest standard of quality in the industry.
- B. Locate all signs as required. However, the final arrangement and number of signs shall be subject to the approval of the Owner and the Engineer.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver all components to project site completely identified. Store in accordance with manufacturer's instructions, protected from the weather, construction activities and other possibility of damage or loss.

### **Part 2 - PRODUCTS**

#### **2.1 METALS**

- A. Materials and Surfaces: For the fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes. Do not use materials which have stains and discolourations including welds which do not match the materials.
- B. Flatness and Edges: For exposed work provide materials which have been cold-rolled, cold finished, cold-drawn, extruded, stretcher levelled, machine cut and otherwise produced to the highest commercial standard for flatness with edges and corners sharp and true to angle or curvature as required.
- C. Welding Electrodes and Filler Metal: Provide the alloy and type required for strength, workability, compatibility and colour match after grinding smooth and finishing the fabricated product.

- D. Ferrous Metal (Steel): Provide the forms and types shown and specified complying with the following or other equal and approved standards and finish.
1. Cold-Rolled Sheet Steel: ASTM A 366 and ASTM A 568, commercial quality with type E matt finish.
  2. Steel Pipe: ASTM A53, standard weight (Schedule 40), galvanized, type as required to meet the assigned performance.
  3. Steel Tubing: ASTM A512, sunk drawn, butt welded, cold-finished and stress relieved.
  4. Base Plates, Anchor Bolts, etc.: Non-corrosive, zinc coated of the type and sizes approved and required to withstand the imposed load.
- E. Fasteners: Manufactured from the following and as approved by the Engineer:
1. Brackets: Strip aluminum alloy.
  2. Clips: Aluminum extruded sections.
  3. Screws, bolts, nuts and washers shall be of steel, stainless steel, aluminum alloy or of a high tensile non-corroding metal. Steel screws, bolts, nuts and washers which are in contact with aluminium shall be coated with zinc or cadmium.
- F. Sign Plate and Stiffening Frame:
1. Sign Plate
    - a. Steel Construction: Sheet steel not less than 1.25mm thick.
    - b. Aluminum Construction: Aluminum sheet not less than 3mm thick.
  2. Stiffening Frame: Manufactured from approved aluminum sections.  
Provide stiffening frames for plate signs having the following dimensions:
    - a. Circular signs size over 600mm diameter.
    - b. Triangular signs with base width over 600mm.
    - c. All other signs where:
      - i) The horizontal or vertical dimension of the sign exceeds 1000mm.
      - ii) The maximum dimension is greater than 600mm and the ratio W/D or D/W is equal to or greater than 2.5; where D is the depth and W is the width of the sign.
- G. Mounting Posts for Plate Signs
1. Circular hollow section steel of approved size.
  2. Post Caps: Cast or sheet metal, or a suitable weather resistant type of plastic, as approved.
- H. Height Limit Gauge Frame: Fabricated from continuous circular hollow section steel complying with B.S. 873 or other approved standards; size 75mm diameter for frame spanning up to 5.00m and size 100mm diameter for frames spanning over 5.00m.
- I. All steel used for the complete work shall be of hot dipped galvanized and all aluminum shall be of anodized finish, as approved.

## Part 3 - **EXECUTION**

### 3.1 INSTALLATION

- A. General: Locate sign units. Use mounting methods in compliance with manufacturer's instructions. Install sign units level, plumb and at heights indicated or required, with sign surface free from distortion or other defects or appearance.
- B. Metal Signs: Attach metal signs to vertical surfaces of walls, poles, etc., using bolting system, clamping system or other fastening devices recommended by the manufacturer and approved by the Engineer.

- C. Acrylic Plastic Signs: Mount the acrylic plastic signs in the light fittings as recommended by the manufacturer and approved by the Engineer.
- D. Comply with the relevant requirements for placements and mounting heights for post mounted signs. Mounting height shall be 2100 mm from the kerb level to the lower edge of the sign unless shown or approved otherwise. Provide mounting posts with breakaway joints where required.
- E. Treat all sign posts located in areas used by pedestrians with alternate 150mm wide bands of black paint and white reflective tape.
- F. Protect aluminum by a bituminous coating where it is in contact with concrete. Protect portions of posts which are buried below ground by coating internally and externally with bitumen.

### **3.2 CLEANING**

- A. Upon completion of installations, clean soiled sign surfaces in accordance with manufacturer's instructions prior to handing over to the Employer.

### **3.3 PROTECTION**

- A. Delay the installation of work with exposed painted metal finishes, acrylic and graphics, wherever possible until other work which might damage such finishes has been completed. When such delay of installation is not possible, or would delay the project, protect such exposed work by maintaining suitable temporary coverings to ensure that no damage thereto will result from other work being performed.

---

## **2.9 RAMP FOR EXTERNAL SIDEWALK**

External pedestrian ramp as per approved shop drawing to be submitted by the contractor based on site levels and conditions.

Work to include:

- Remove parts of sidewalk including curbstone and existing tiles
- Remove the debris to outside the site
- Supply and install concrete curbstone for the ramp
- Supply and install floor tiles identical to the existing with mortar and all layers
- All needed items as per the Engineer instructions

## **2.10 ASPHALT PAVING**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. The extent of asphalt paving work and ancillaries is indicated on drawings.
- B. This section includes:
  - 1. Asphaltic concrete paving for roadways and car parks.
  - 2. Line markings.

#### **QUALITY ASSURANCE**

- A. Codes and Standards: Conform and comply with ASTM, AASHTO, BS or alternative equivalent standards acceptable to the Engineer, which establish minimum acceptable qualitative and quantitative requirements for asphalt concrete materials and paving execution.
- B. Testing and Inspection Service: Contractor shall employ and pay for a qualified independent testing laboratory acceptable to the Engineer to perform specified testing and inspection as required by the Engineer in connection with asphalt.
- C. Testing Laboratory Qualifications: To qualify for acceptance, the concrete materials and paving works testing laboratory must demonstrate to Engineer's satisfaction, that it has the experience and capability to conduct required field and laboratory testing without delaying the progress of the Work.

### **PART 2 - PRODUCTS**

#### **MATERIALS**

- A. Coarse Aggregate (retained on No. 8 ASTM Sieve) shall be first grade crushed rock conforming to the quality requirements of AASHTO M78-64 (1974) and of such grading that when combined with other required aggregate fractions in proper proportions, the resultant mixture will meet the grading required for the mix.
- B. Fine aggregate (passing No. 8 ASTM Sieve) shall consist of stone screenings, natural sand or a combination of these two conforming to the quality requirements of ASTM D 1073-63 (1969) of such grading that when combined with other required aggregates in the proper proportions, the resultant mixture will meet the grading required for the mix.
- C. Mineral filler, if used, shall meet the requirements of ASTM D 242 (AASHTO M17-70) and of the following grading:

| <u>ASTM Sieve</u> | <u>Percentage Passing</u> |
|-------------------|---------------------------|
| No. 30            | 100                       |
| No. 50            | 95 - 100                  |
| No. 100           | 90 - 100                  |
| No. 200           | 70 - 100                  |
- D. Asphalt cement shall conform to the requirements of AASHTO M20-70 and the amount required shall be between 3.5 and 7.0 percent of the total mix by weight. It shall be 85-to 100-penetration grade approved by the Engineer.

## ASPHALT CONCRETE MIXES

- A. Sample mixes and trial areas will be required to confirm the suitability of the Contractors proposals to achieve the pigmentation and authorization will be given by the Engineer in writing when a satisfactory method has been established and successful trials have been concluded.
- B. The mix shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fraction shall be sized, uniformly graded and combined in such proportions that the resulting mixture meets the following grading requirements.

1. Grading of Total Aggregate (coursing plus fine plus filler) Percentage passing by weight:

| <u>Sieve Size</u><br><u>ASTM E 323</u> | <u>Base</u><br><u>Course</u> | <u>Wearing</u><br><u>Course</u> |
|----------------------------------------|------------------------------|---------------------------------|
| 1-1/2 inch                             | 100                          | -                               |
| 1 inch                                 | 80 - 100                     | -                               |
| 3/4inch                                | 70 - 90                      | 100                             |
| 1/2 inch                               | -                            | 80 - 100                        |
| 3/8 inch                               | 55 - 75                      | -                               |
| No. 4                                  | 44 - 62                      | 50 - 70                         |
| No. 10                                 | 33 - 48                      | 32 - 47                         |
| No. 40                                 | 16 - 27                      | 16 - 26                         |
| No. 80                                 | -                            | 10 - 18                         |
| No. 200                                | 3 - 10                       | 4 - 10                          |

- C. The Contractor shall submit to the Engineer for approval, at least 30 days before commencement of the asphalt operations a mix test results to conform to the following criteria.

1. Asphalt Concrete Base Course:
- Stability: 300 kg minimum (75 blows)
  - Flow: 2.4 - 5.0 mm
  - Air Voids: 3.0 - 7.0%
  - Voids Filled with Asphalt: 60 - 75

2. Asphalt Concrete Surface Course:
- Stability: 450 kg minimum (75 blows)
  - Flow: 2.4 - 4.0 mm
  - Air Voids: 3.0 - 5.0%
  - Voids filled with Asphalt: 70 - 80%

- D. Loss of material stability by submerging specimens in water at 60°C for 24 hours as compared to stability measured after submersion in water at 60°C for 20 minutes not to exceed 25%, for each asphalt concrete mix designation.

- E. The mix submitted shall establish single percentages for the coarse aggregate, fine aggregate, aggregate passing the No. 200 Sieve, the amount of asphalt cement, the temperature leaving the mixer and the temperature delivered on the road. The mixture subsequently furnished by the Contractor shall conform to this job-mix formula within the following range of tolerances.

1. Maximum variations of material passing: Sieve
- |                         |       |
|-------------------------|-------|
| No. 4 and larger        | ±5%   |
| Sieve No. 10 to No. 100 | ±5%   |
| Sieve No. 200           | ±1.5% |

|                              |       |
|------------------------------|-------|
| Asphalt content              | +0.3  |
| Temperature at mix discharge | ±10°C |
| Temperature at laying        | +5°C  |

- F. If unsatisfactory results make it necessary or when a new source of material is proposed, the Engineer may establish a new job-mix formula and so notify the Contractor in writing before the new material is used.

### APPLICABLE CODES AND STANDARDS

|            |                                                                          |
|------------|--------------------------------------------------------------------------|
| ASTM D5    | Test for Penetration of Bituminous Materials                             |
| ASTM D242  | Mineral Filler for Bituminous Paving Mixtures                            |
| ASTM D979  | Sampling of Bituminous Paving Mixtures                                   |
| ASTM D2172 | Quantitative Extraction of Bitumen from Bituminous Paving                |
| ASTM C136  | Sieve Analysis of Fine and Coarse Aggregate                              |
| ASTM D1188 | Bulk Specific Gravity of Compacted Bituminous Mixtures                   |
| ASTM D1559 | Resistance to Plastic Flow of Bituminous Mixtures                        |
| ASTM D3549 | Thickness of Height of Compacted Bituminous Paving Mixtures              |
| ASTM D3203 | Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures |

## **PART 3 - EXECUTION**

### **MIXING PLANT**

- A. The asphalt mixing plant that is used for heating, proportioning and mixing the aggregates and asphalt cement, which may be of either the batch type or continuous mixing type, shall be capable of producing a uniform mixture in the quantities required within the job-mix tolerance specified previously, and shall be subject to approval by Engineer.
- B. The plant shall be provided with an accurate mechanical means and positive control for drying, heating and feeding the mineral aggregate at a uniform temperature. The feeder or feeders shall be capable of delivering in precise proportions the aggregate or aggregates required.
- C. Tanks used for storage of asphalt cement shall be of sufficient capacity and be provided with a device for controlled heating of the material temperature between 220°F and 270°F (105°C and 130°C). Heating shall be accomplished so that no flame shall come in contact with the heating tank. A circulating system of adequate size to insure proper and continuous circulation between the storage tank and mixer during the entire operating period shall be provided. When possible, the discharge end of the circulating pipeline shall be kept below the surface of the asphalt in the tank while the pump is in operation.
- D. Means shall be provided to obtain the required percentage of asphalt in the mix within the tolerances specified, either by weighing or measuring volumetrically. Where the quantity of asphalt is controlled by metering, provisions shall be made for the amount of asphalt delivered through the meter to be readily checked by weight. Steam jacketing or other insulation, which will maintain the specified temperature of asphalt in pipelines, meter, weigh buckets, spray bars, flow lines or other containers, shall be provided.

### **MIXING**

- A. The aggregate for the mixture shall be dried and heated to the required temperature. Flames used for drying and heating shall be properly adjusted to avoid damage to and root on the aggregate.

- B. The dried heated aggregates shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured and introduced into the mixer in the amounts specified. After the required amounts of aggregates and bituminous material have been introduced into the mixer, the material shall be mixed until a complete and uniform coating of the particles throughout the aggregate is secured. Wet mixing time will be approved by the Engineer for each type of plant and for each type of aggregate used. The mixture shall be produced as closely as practicable to the lower temperature, which will produce a workable mix within the specified temperature range.

#### **TRANSPORTATION, LAYING AND COMPACTION OF ASPHALT**

- A. Before laying the bituminous concrete base course check road base to ensure that the surface is within the specified tolerance and is in all respects fit for laying the pavement. The surface is then to be sprayed with bituminous prime coat.
- B. The bituminous prime coat shall be cut-back bitumen MC30 or MC70 applied at the rate of 0.5 to 1.5 litres/m<sup>2</sup>.
- C. The prime coat shall be applied only when the road base has been approved by the Engineer and the surface is dry or slightly damp.
- D. The cut-back bitumen shall be applied by a pressure distributor so that uniform distribution is obtained at all points. A disposable protective covering such as thick paper or polythene shall be spread back from the end of each application to cover the existing surfaces. The flow through the nozzles shall be started and stopped on the disposable protective covering so that all nozzles are operating properly on the entire length being treated. During application to surfaces adjacent to walkways and other structures all objects shall be protected so as to prevent their being spattered or marred. No bituminous material shall be allowed to discharge into a ditch or stream.
- E. Laying of the base course shall not be commenced until the prime coat has been absorbed by the surface and approval given by the Engineer.
- F. The tack coat between the base course and wearing course is to be rapid curing cut-back Bitumen RC250 (AASHTO M81-70) applied at a rate of 0.5 to 1.5 litres/sq.m or as directed by the Engineer.
- G. The asphalt concrete mixtures shall be transported from the mixing plant to the laying plant in metal lined lorries, or such other vehicles as may be approved by the Engineer. No loads shall be delivered so as to prevent completion of the spreading and compaction during daylight hours. The mixture shall be delivered at a temperature between 220°F and 270°F (105°C and 130°C) and within 20°F (10°C) of the temperature specified in the job-mix formula. No segregation of the material or excess loss of heat is to occur during transport.
- H. Unless otherwise approved by the Engineer, asphaltic concrete is to be laid by paving machine in layers indicated or as otherwise required. The machine must be capable of producing a level and even running surface and must correct for any irregularities in the base. Paving machines must be capable of feeding material from the hopper across the full width of the screed.
- I. When making longitudinal joints, the layer should overlap the existing strip by about 50 mm. Sufficient depth of material is to be left on the overlap to allow for compaction. The excess material is to be removed by brooming or raking but care is to be taken to avoid over-raking. As soon as raking is complete, the joint is to be well rolled. If the abutting lane is not placed on the same day, the joint is to be cut back to an even line, preferably by

means of a cutting blade attached to the roller. The joint is then to be given a very light coat of bitumen before the next strip is placed.

- J. After spreading, the mix is to be thoroughly compacted by rolling. The initial "breakdown" rolling is to be carried out by three wheeled rollers with a weight per mm width of rear wheel between 4.4 and 6.5 kg. The rollers are to proceed onto fresh material with rear or driven wheels leading. When the rollers are reversed at the end of pass, the steering wheels are to be on compacted material and their movement in changing direction is not to displace the mix. After the initial rolling, compaction is to be achieved by pneumatic tyred rollers which are to be self propelled having a weight of between 15 and 30 tonne and tyre pressure which can be varied between 0.05 and 0.08 kg/mm<sup>2</sup>. This pneumatic tyre rolling to be carried out immediately following the initial rolling and while the mix is still warm between 175°F and 220°F (80°C and 105°C). After the pneumatic tyre rolling, a final finish may be given by tandem roller.
- K. Each pass of the roller is to overlap the preceding one by half the width of the roller wheel. Alternate passes of the roller are to be slightly varying lengths. The rolling speed is to be about 3km per hour, and the number of passes is to be about 5 or 6 over the same area. The roller wheels are to be clean and smooth and care is to be taken to ensure that the mixture does not adhere to the wheels. Rolling is to commence as soon as the freshly spread mix will bear the weight of the roller without any endure movement or displacement and on no account are the rollers to be allowed to stand on the finished surface until it has thoroughly cooled. Immediately following initial rolling, the surface to be checked with a straight edge to ensure that it meets with the tolerance requirements. Minor variations may be corrected by rolling, but larger imperfections are to be adjusted by adding or taking away mix while it is still hot and workable.

## TESTING OF ASPHALT MATERIALS AND SURFACES

- A. Perform the following tests as directed by the Engineer:

1. Uncompacted Asphalt Concrete Mix:
  - a. Sampling ASTM D 979
  - b. Asphalt cement content ASTM D 2172
  - c. Sieve analysis of extracted mineral matter ASTM D 313  
ASTM C 136
  - d. Penetration of recovered asphalt cement ASTM D 5
  - e. Ductability of recovered asphalt cement ASTM D 113
  - f. Marshall stability and flow ASTM D 1159
  - g. Perform at least one test for each day's paving.
2. Compacted Asphalt Concrete Mix:
  - a. Bulk density ASTM D 1188
  - b. Marshall stability and flow ASTM D 1559
  - c. Thickness or height of compacted mix ASTM D 3549
  - d. Air voids in compacted mix ASTM D 3203

- B. Compacted mix cut samples as directed by the Engineer from installed paving. Supply and compact new material in the voids left by the sampling. The samples will be tested as directed by the Engineer and the specific gravity shall be not less than 95% of the specific gravity of laboratory compacted specimens composed of the same materials in like proportions.

- 
- C. Uncompacted mix test the bituminous mixture. daily to ensure compliance with the approved job-mix formula. Submit copies of the test results to the Engineer.
  - D. Finished Surfaces: Test with a 3 meter straight edge applied both parallel and at right angles to the centerline of the road. Check and test surfaces under the direction of the Engineer. Variation of the surface from the testing edge of the straight edge between any two contacts with the surface shall not exceed 3mm.

#### **LINE MARKINGS**

- A. Preparation: Sweep clean surface to eliminate loose material and dust.
- B. Material: Factory mixed quick drying and non-bleeding purpose made chlorinated rubber based traffic and lane marking paint approved by the Engineer.
  - 1. Suitability: for road surface temperatures of up to 80 deg. C.
  - 2. Color: white.
- C. Execution: Apply markings and lines strictly in accordance with manufacturer's instructions to the approval of the Engineer.

---

## **2.11 FLAGPOLE**

### **PART 1: GENERAL**

#### **SUMMARY**

- A. Aluminum flagpole as shown on attached drawing with all components as needed for a complete installation.

#### **PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads according to ANSI/ NAAMM FP 1001-07, "Guide Specifications for Design of Metal Flagpoles", which specifies the winds loads on the pole with flag flying, to a specified wind speed 140 km/hr minimum with unflagged windspeeds of 160 km/hr.
- B. Flagpole Design: Design shall be based on standard size polyester flag suitable for use with pole.

#### **SUBMITTALS**

- A. Product Data: For each type of flagpole required, submit manufacturer's technical data and standard instructions.
- B. Shop Drawings: Show general layout, jointing anchorage, support systems, foundations and accessories.
- C. Structural Calculation and Structural Analysis Data: Required to be provided if requested by consultant / owner. Detailed calculations performed in accordance with ANSI/NAAMM FP 1007-01 are necessary for any alternative proposed flagpole with geometry differing from recommended specifications.
- D. Samples: Finish samples for each finished metal used on flagpoles, as may be required

#### **QUALITY ASSURANCE**

- A. Source: Obtain each flagpole as a complete unit from flagpole manufacturer / authorized dealer, including fittings, accessories, bases, and anchorage devices.
- B. Installer Qualifications:
  - a. Five years' experience installing flagpoles of similar height and complexity in locale of the project.
  - b. Authorized and trained by flagpole manufacturer.

### **PART 2: PRODUCTS**

## **FLAGPOLE TYPE AND CONSTRUCTION**

### **A. Aluminum Flagpole Construction**

Fabricate flagpole shaft from extruded aluminum tubing with no visible seam, complying with ASTM B221. Flagpole shafts shall be fabricated from 6063 alloy in a T4 temper, tapered, and welded with 4043 filler alloy (for base plate, door assembly, and cap), and heat treated to a T6 temper after fabrication and welding.

- a. Flagpole shaft shall be cone-tapered, per manufacturer's standard rate of taper.
- b. Shoe-type Base Plate: Base Plate shall be appropriately sized for the flagpole, and shall be welded to the shaft at the factory prior to heat treating to T6 Temper.
- c. Shaft shall be fitted with a cast aluminum top plug, drilled and threaded for connection of truck assembly; and shall include reinforced handhold opening with flush fitting aluminum door with locking style closure; and internal plate for mounting a cam-cleat.

### **B. Assembly Features / Model: Internal Rope Halyard, Revolving Truck Assembly with Cam Cleat - Shoe Base Mounting, and flush access door. Designed in accordance with ANSI/NAAMM FP-1001-07 for performance requirements.**

## **MOUNTING**

Shoe Base: Cast aluminum shoe base will be anchored to a concrete foundation block using four hot-dipped galvanized steel anchor bolts, M24 x 550mm Grade 8.8 or Equivalent, to be cast into the foundation.

## **FITTINGS**

### **A. Finial Ball (Ornament) and Revolving Cone-Style Top Hat Truck Assembly for Internal Halyard:**

- a. Ball (Ornament): Spun Aluminum, Gold Tone Anodized spherical ball, size to match pole butt diameter.
- b. Cone Style Top Hat Truck Assembly: Internal Halyard, revolving truck assembly, made of a cast aluminum housing; with dual sealed stainless steel spindle bearings; and aluminum internal pulley assembly, and bronze halyard exit bushing.

### **B. Internal Halyard Cam Cleat System: Provide one (1) complete internal halyard cam cleat rope assembly with plastic coated counterweight and beaded sling assembly.**

### **C. Flash Collar: Provide Spun Aluminum Collar to match flagpole. Aluminum collar is to be the same finish as the flagpole shaft, to cover the base plate and bolts to provide a more decorative appearance.**

## **PART 3: EXECUTION**

### **PREPARATION**

Foundation: Provide cast-in-place foundation as per Manufacturer's recommended design. Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Secure anchor bolts in position with templates and brace to prevent displacement during concreting. Place concrete

immediately after mixing. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks and uniform in texture and appearance. Provide positive slope for water runoff to base perimeter.

### **FLAGPOLE INSTALLATION**

- A. General: Install flagpoles where shown and according to shop drawings.
- B. Shoe Base Installation: Place flagpole on top of the installed anchor bolts / leveling nut and washer, and fix using flat washer, and hex nut. Tighten nut and verify that all threads are fully engaged. Cover with decorative flashing collar.
- C. Test halyard system / flag hoisting mechanism in accordance with manufacturer's written instructions. Ensure that counterweight, retaining ring, and other components are installed correctly and that the truck assembly rotates properly.

**CHAPTER THREE**  
**CONCRETE WORKS**

---

## **CHAPTER THREE** **CONCRETE WORKS**

### **3.1 CAST IN PLACE CONCRETE**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Extent of cast in place concrete work is shown on Drawings.

##### **PROJECT CONDITIONS**

- A. Protect adjacent finish materials against spatter during concrete placement.
- B. Protection of fresh concrete against hot weather: Cover completed fresh concrete with temporary cover as required to protect newly cast elements from direct sun light in hot weather - above 35 deg. C; maintain cover for time period until curing starts.
- C. Protect surfaces from rain, wind and sun, detention and physical damage.
- D. Protect immature concrete from physical shock, movement, thermal shock and cold water.

#### **PART 2 - PRODUCTS**

##### **REINFORCING MATERIALS**

- A. Reinforcing Bars: ASTM A 615; BS 4449, 4461
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 185; BS 4483
- D. Supports for Reinforcement; Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.
1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected or stainless steel protected.

##### **CONCRETE MATERIALS**

- A. Ordinary Portland cement: ASTM C 150 Type I; BS12.
- B. Sulphate-Resisting Portland cement: ASTM C 150 Type V; BS 4027
- C. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
- D. Normal Weight Aggregates: ASTM C 33; BS 882 and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Do not use fine or coarse aggregates containing spalling-causing deleterious substances and this should have a sand equivalent more than 70.
  2. Local aggregates not complying with the standards stated but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.
- E. Hourdi Blocks for hollow concrete suspended slabs: Machine made vibrated hollow concrete (cement and fine sand aggregate) blocks, withstanding compressive force applied at the ends of 40kg/cm<sup>2</sup> based on the gross sectional area of the block (without deducting voids).
- F. Water: Potable, free from foreign material in amounts harmful to concrete or embedded steel.

## RELATED MATERIALS

- A. Epoxy Adhesive: ASTM C 8891, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

## PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
- B. For information, submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until the acceptability of each mix has been adequately substantiated by the Contractor according to ACI 301, as judged by the Engineer.
- C. Design mixes in accordance with the following table. Ensure quantity of water used does not exceed that required to produce a concrete with sufficient workability to be placed and compacted where required.

| Designed Mixes                                                                            |          |          |          |                  |
|-------------------------------------------------------------------------------------------|----------|----------|----------|------------------|
| Class of Concrete                                                                         | AA       | A        | B        | C                |
| Minimum cement content (kg) per m <sup>3</sup> of concrete                                | 450      | 400      | 350      | 250              |
| Water cement ratio                                                                        | 0.48     | 0.48     | 0.49     | 0.58             |
| Preliminary Test Cylinders: Minimum Compressive Strength at 28 Days (kg/cm <sup>2</sup> ) | 400      | 350      | 280      | 180              |
| Works Test Cylinders Minimum: Compressive Strength at 28 Days (kg/cm <sup>2</sup> )       | 350      | 300      | 250      | 175              |
| Method of compacting of concrete when placed                                              | Vibrated | Vibrated | Vibrated | Rodded or Tamped |
| Keep slump to the minimum compatible with approved placing requirements.                  |          |          |          |                  |

- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested from Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Employer and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps, slabs, and sloping surfaces: Not more than 100mm.
  2. Reinforced foundation systems: Not less than 25 mm and not more than 125 mm.
  3. Concrete containing HRWR admixture (super-plasticizer): Not more than 230 mm after addition of HRWR to site-verified 50-75 mm slump concrete.

### **CONCRETE MIXING**

- A. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required and shall be subject to the Engineer's approval.

## **PART 3 - EXECUTION**

### **GENERAL**

- A. Coordinate the installation of joint materials and water proofing membranes with placement of forms and reinforcing steel

### **FORMS**

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
- B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- D. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

### **PLACING REINFORCEMENT**

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

1. Avoid cutting or puncturing water proofing membranes during reinforcement placement and concreting operations.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials, which reduce or destroy bond with concrete
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surface.
- E. Install welded wire fabric in as long lengths as practicable. lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

## JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.
  1. Where specific slab-on-ground construction joints are not shown on Drawings, cast slab on ground in strips, each strip width not to exceed 5 m or the typical bay width whichever is less.
  2. Construction joint spacing in basement walls and slabs on ground should not exceed 8m unless acceptable to Engineer.
  3. Locate construction joints in framed slabs within the middle third of any slab or beam span length, unless otherwise indicated on drawings.
  4. Lightly roughen face to expose coarse aggregate unless otherwise instructed. Wet and cover with 1:1 cement and sand grout immediately prior to placing fresh concrete. Stop roughening 25 mm from faces to surfaces exposed to view in finished work. Remove small mortar lips from exposed faces with carborundum stone. Face is to be clean and damp before fresh concrete is placed against it.
- B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- C. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instruction.
- D. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
  1. Joint filler and sealant materials are specified in elsewhere in the specifications.

---

## CONCRETE PLACEMENT

- A. Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
  - 1. Apply temporary protective covering to lower 600 mm of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 600 mm and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not further than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 150 mm into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- H. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- I. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- J. Maintain reinforcing in proper position during concrete placement operations.
- K. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
- L. When air temperature has fallen to or is expected to fall below 36 deg F (2 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.

- M. Do not use-frozen material or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- N. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- O. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
- P. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
- Q. Cover reinforcing steel with water-soaked burlap it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- R. Fog spray forms, reinforcing steel, and sub grade just before concrete is placed.
- S. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

#### **CONCRETE CURING AND PROTECTION**

- A. General: Protect freshly placed concrete from direct exposure to wind, from premature drying and from excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist and covered for not less than 7 days.
- C. Begin final curing procedures immediately following initial curing and before concrete have dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
- E. Provide moisture curing by following methods.
  - 1. Keep concrete surface continuously wet by covering with water.
  - 2. Continuous water-fog spray.
  - 3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 100 mm lap over adjacent absorptive covers.
- F. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 74 mm and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- G. Provide membrane curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- H. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp proofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting and other coatings and finish materials, unless otherwise acceptable to Engineer.
- I. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above as applicable.
- J. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
- K. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

#### **SHORES AND SUPPORTS**

- A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.
- B. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stree or deflection.
- C. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

#### **REMOVAL OF FORMS**

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at no less than 50 deg F (10 deg C) for 36 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days and not until concrete has attained 28 day design strength unless authorized by Engineer. Determine potential compressive strength of inplace concrete by testing field- cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

---

## RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

## MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer machines and equipment.
- D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in-safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled.

## QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Contractor will employ a testing laboratory approved by the Engineer to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Engineer.
- C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
  - 1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
  - 2. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 degC) and above; and each time a set of compression test specimens is made.
  - 3. Compression Test Specimen: ASTM C 31; one set of 6 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field - cured test specimens are required.

- 
4. Compressive Strength Tests: ASTM C 39, one set for each day's pour exceeding 4 cu.m plus additional sets for each 40 cu.m over and above the first 20 cu.m of each concrete class placed in any one day; two specimens tested at 7 days, three specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
  5. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
  6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  7. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results exceed 10% of specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 3.5 MPa (500 psi)
- D. Test results will be reported in writing to Engineer within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct test to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such additional tests.

### **3.1.1 WATERSTOPS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Extent CONTRACTOR shall furnish and securely install expanding rubber waterstops where shown or specified in the DRAWINGS. The WORK includes cleaning of concrete surfaces and installation of expanding rubber waterstop.

##### **1.2 SUBMITTALS**

- A. Provide product data for the following:
1. Waterstop Product.
  2. Adhesive.

##### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver the waterstop materials to the PROJECT site in the manufacturer's unpacked containers with all labels intact and legible at time of use. Materials shall be stored in a secure, indoor, dry area. Maintain the waterstops in a dry condition during delivery, storage, handling, installation, and concealment.

#### **PART 2 - PRODUCT**

##### **2.1 MATERIALS**

- A. Hydrophilic Rubber Waterstop:

1. The waterstop shall have the minimum performance standard of:

| Property                                                | ASTM Standard | Results             |
|---------------------------------------------------------|---------------|---------------------|
| Tensile Strength (MPa)                                  | D412          | 0.98                |
| Elongation                                              | D412          | 550                 |
| Hardness (Hs)                                           | D2240         | 30 Durometer Type A |
| The time period to maximum volume expansion is 35 days. |               |                     |

2. Materials approved for use are:

- a. Adeka Corporation; MC-2010M.
- b. Adeka Corporation; KM-3030M.
- c. Adeka Corporation; P201 (except in contact with potable water).
- d. Adeka Corporation; KC Series.

- B. Adhesive:

1. The adhesive shall be 3M-2141 as manufactured by the 3M Company, or Adeka Corporation H-1000 Ultra Bond or an approved equivalent.

---

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Ensure proper execution of the waterstop installation.
- B. The components and installation procedures shall be in accordance with the manufacturer's printed specifications and recommendations. Installation shall be performed by skilled workers who are trained in procedures and methods required for proper performance of the waterstop.

### **3.2 EXAMINATION**

- A. Examine the concrete surface and correct any surface imperfections which may prevent proper installation and performance of the waterstop. The finished concrete surface, prior to surface preparation, shall be equal to a steel trowel finish.

### **3.3 SURFACE PREPARATION**

- A. Concrete surfaces shall be clean and free of dirt, saw dust, laitance, grease, form oils, form release agent, or other contamination to ensure proper adhesion of the waterstop to the concrete surface. Use a wire brush to lightly roughen the surface. Remove all concrete dust with a soft brush.

### **3.4 WATERSTOP PLACEMENT**

- A. Measure and cut an exact length of waterstop. Splices are not permitted in the waterstop in vertical wall joints of structures. Splices in horizontal joints are acceptable, however, only one (1) splice is permitted in twenty five (25) feet. Splice of waterstops in horizontal joints shall be made by butting and gluing the ends of the waterstop with an approved adhesive.
- B. Refer to the manufacturer's recommendations for minimum clearance to a concrete face. Unless a greater clearance is recommended by the manufacturer, the minimum clearance shall be two (2) inches. Use the greater clearance if the recommended clearance is more than two (2) inches.
- C. Using a brush, apply a uniform coat of adhesive to the concrete surface along the line of placement. Apply a uniform coat of adhesive to the waterstop. Gaps in the glue application shall not be permitted.
- D. After the adhesive has dried to a tacky condition (about fifteen [15] minutes in the summer and thirty [30] minutes in the winter), firmly press the waterstop to the concrete surface. When installing the waterstop on curved surfaces such as pipes, temporary bands (for example, wire or rope) may be used to assist in securing the waterstop to the surface. Any temporary means of securing the waterstop shall be removed prior to placing concrete or grout.
- E. Concrete placement within twelve (12) hours is required. The waterstop shall be protected from water and from displacement prior to concrete placement. During concrete placement, CONTRACTOR shall visually observe the waterstop to ensure proper placement and alignment.

---

### **3.2 CONCRETE TOPPING (STAMPED CONCRETE)**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Decorative stamped concrete floor topping.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: product indicated.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product test reports.

#### **PART 2 - PRODUCTS**

##### **2.1 CONCRETE FLOOR TOPPINGS**

- A. Stamped-Aggregate Concrete Floor Topping: Factory-prepared and dry- packaged mixture of containing mineral oxide; Portland cement; plasticizers; and other admixtures to which only water needs to be added at Project site.
  - 1. Products: Subject to compliance with requirements, provide available products that may be incorporated into the Works and which are deemed in the market.
    - a. Compressive Strength (28 Days): 4000 psi; ASTM C 109/C 109M
    - b. Slump in concrete shall not exceed 10 cm

##### **2.2 CURING MATERIALS**

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap- polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 25 percent solids content, minimum.
- F. Apply a color hardener at the minimum 30 kg / 10 sq.m

## 2.3 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [**epoxy resin with a Type A Shore durometer hardness of 80**] per ASTM D 2240.
- B. Joint-Filler Strips: [**ASTM D 1751, asphalt-saturated cellulosic fiber**].
- C. Portland Cement: ASTM C 150, Type I or II.
- D. Sand: ASTM C 404, fine aggregate passing **No. 16 (1.18-mm)** sieve.
- E. Water: Potable.
- F. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. Epoxy Adhesive: ASTM C 881/C 881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

## 2.4 MIXING

- A. Bonding Slurry: Mix portland cement with water to a thick paint consistency.
- B. Bonding Slurry: Mix 1 part portland cement and [**1-1/2**] parts sand with water [**and an acrylic-bonding agent according to manufacturer's written instructions**] to a thick paint consistency.
- C. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of **(6 mm)**.
  - 1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
  - 2. Saw cut contraction and construction joints in existing concrete to a depth of **(35-50 mm)** and fill with semirigid joint filler.
  - 3. To both sides of joint edges and at perimeter of existing base slab [**mechanically remove a (100-mm-) wide and (0- to 25-mm-) deep, tapered wedge of concrete and retexture surface**].
- B. Install joint-filler strips where topping abuts vertical surfaces.

### 3.2 FLOOR TOPPING APPLICATION

- A. Start floor topping application in presence of manufacturer's technical representative.

- B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Division 03 Section "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.
- C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.
- D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.
- E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
  - 1. Screed surface with a straightedge and strike off to correct elevations.
  - 2. Slope surfaces uniformly where indicated.
  - 3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- F. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
  - 1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
- G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.
  - 1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
- H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut (5-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
  - 1. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
  - 2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
  - 3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than (13 mm) deep.

### 3.3 PROTECTING AND CURING

- A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.
- B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.

- 
- C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture- retaining cover for curing concrete for not less than seven days.
  3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions.

### **3.4 JOINT FILLING**

- A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
- B. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

### **3.5 REPAIRS**

- A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

## **CHAPTER FOUR**

### **MASONRY**

## **CHAPTER FOUR** **MASONRY**

### **4.1 HOLLOW OR SOLID CONCRETE BLOCKS AND CLOSTRA**

#### **PART 1 - GENERAL**

##### **DESCRIPTION OF WORK**

- A. Extent of each type of masonry work is indicated on Drawings.
- B. Types of masonry work required include:
  - 1. Concrete unit masonry.

##### **QUALITY ASSURANCE**

- A. Unit Test Methods: Test the following materials by sampling and batch methods indicated
  - 1. Concrete Masonry Units: Batch test sample blocks for compressive strength whenever required by the Engineer. Each test will comprise the destructive testing of twelve sample blocks selected by the Engineer. The minimum compressive strength for the gross area of any hollow block shall be 20 kg/cm<sup>2</sup>, and the average compressive strength for the gross area of all twelve blocks together shall be not less than 35 kg/cm<sup>2</sup>. If a test does not meet the compressive strength requirements, the entire batch from which the samples were selected will be rejected and removed from the site.
  - 2. Mortars and Grouts: Test no less frequently than is required to evaluate mortars and grouts used to install each batch of masonry units from which samples are taken for testing.

#### **PART 2 - PRODUCTS**

##### **MASONRY UNITS**

- A. General: Comply with referenced standards and other requirements indicated below:
  - 1. Provide concrete masonry unit special shapes where required for corners, jambs, sash, control joints, headers, bonding and other special conditions.
    - a. Provide square-edged units for outside corners, except where indicated otherwise.
- B. Concrete Blocks: Provide units complying with characteristics indicated below:
  - 1. Manufacture: produce blocks from cement and sand 1:5 mix (300 kg cement to 1m<sup>3</sup> sand) in vibrated pressure machine moulds. Adjust the mix as necessary to achieve compressive strength requirements.
  - 2. Size: Manufacturer's standard units with nominal face dimensions of 400mm long x 200 mm high, of thicknesses indicated.
  - 3. Type: unless otherwise shown on the drawings, concrete masonry units shall be hollow blocks of a design approved by the Engineer.

- C. Fireclay bricks: provide bricks made from fireclay containing a high percentage of silica and suitable for the conditions of proposed use.
  - 1. Obtain bricks from a manufacturer approved by the Engineer.
  - 2. Obtain fireclay cement from the brick manufacturer.

#### **MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150, Type I; BS 12.
- B. Hydrated Lime: ASTM C 207, Types S; BS 890 class B.
- C. Sand Aggregate: ASTM C 144; BS 1200 Table I, washed and mechanically graded.
- D. Water: Clean and potable.

#### **JOINT REINFORCEMENT AND TIES**

- A. Materials: Comply with requirements indicated below and obtain approval of the Engineer for each type of joint reinforcement and tie for size and other characteristics.
- B. Wall Ties: galvanized steel ties conforming to BS. 1243.
- C. Joint Reinforcement: Provide approved galvanized steel welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 3000 mm, with prefabricated corner and tee units, and complying with requirements indicated below:
  - 1. Width: Fabricate joint reinforcement in units with widths approximately 50mm less than nominal width of walls and partitions as required to provide mortar coverage of not less than 16mm on joint faces exposed to exterior and 12mm elsewhere.
  - 2. Wire Size: 4 mm diameter.
  - 3. Type: Ladder design, single side rods with perpendicular cross rods spaced not more than 400mm overall centres.

#### **MISCELLANEOUS MASONRY ACCESSORIES**

- A. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60; BS. 4449, 4461.
- B. Premolded Control Joint Strips: Material designed to fit standard sash block and to maintain lateral stability in masonry wall; sizes and configuration as required and approved.
- C. Bond Breaker Strips: Asphalt-saturated organic roofing felt.
- D. Weepholes: Medium density polyethylene plastic tubing, outside diameter and length as required.

#### **MORTAR AND GROUT MIXES**

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.

- B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with ASTM or BS standards for mixing time and water content.
- C. Mortar for Unit Masonry: Comply with ASTM or BS; Proportion mixes, for types of mortar required, unless otherwise indicated.
  - 1. Limit cementitious materials in mortar to Portland cement-lime.
- D. Grout for Unit Masonry: Comply with ASTM or BS for grout used in construction of reinforced and non-reinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

### **PART 3 - EXECUTION**

#### **INSTALLATION, GENERAL**

- A. Do not wet concrete masonry units.
- B. Cleaning Reinforcing: Remove ice and other coatings from reinforcing before placing.
- C. Thickness: Build masonry construction to the full thickness shown. Build single-wythe walls (if any) to actual thickness of the masonry units, using units of nominal thickness indicated.
- D. Build chases and recesses as shown or required for the work of other trades. Provide not less than 200 mm of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- E. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.
- F. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work. Use full-size units without cutting where possible.
  - 1. Use dry cutting saws to cut concrete masonry units.

#### **LAYING MASONRY WALLS**

- A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid use of less-than-half-size units at corners, jambs and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Pattern Bond: Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a Wythe in running bond or bonded by lapping not less than 50mm. Bond an interlock each course of each Wythe at corners. Do not use units with less than nominal 100mm horizontal face dimension at corners or jambs

- D. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.
  - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
  - 2. Where built-in items are to be embedded in cores of hollow concrete masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core
  - 3. Fill cores in hollow concrete masonry units with grout 3 courses under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

### **MORTAR BEDDING AND JOINTING**

- A. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 9 mm joints.
- C. Cut joints flush for masonry walls, which are to be concealed or to be covered by other materials, unless otherwise indicated.
- D. Rake out joints on faces of blockwork, which are to be rendered or plastered, to a depth of 10 mm, as the work proceeds.
- E. Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated, as the work proceeds.
- F. Remove masonry units disturbed after lying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units, which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.
- G. Collar Joints: After each course is laid, fill the vertical longitudinal joint between Wythes solidly and with mortar for the following masonry work:
  - 1. Non-loadbearing interior walls or partitions where metal ties or horizontal reinforcing are required for structural bonding and nominal thickness of wall or partition is required to meet code requirements for height-to- thickness ratio.

### **ANCHORING MASONRY WORK**

- A. General: Provide anchor devices of types indicated and required.
- B. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Anchor masonry to structural concrete members with metal ties (cast into concrete) embedded in masonry joints.
  - 2. Space ties as required, but not more than 600 mm vertically and 1000mm horizontally.

## **LINTELS**

- A. Install steel lintels where indicated.
- B. Provide cast in place reinforced concrete lintels, minimum 200mm deep x full width of wall. Temporarily support lintels.
- C. Provide minimum lintel bearing of 200 mm at each jamb, unless otherwise indicated.

---

## **4.2 EXTERIOR STONework**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. Extent of stonework is indicated on Drawings.
- B. Types of stonework in this section include:
  - 1. Exterior stone veneers and facings.
- C. Interior stone facing and flooring is specified in the Finishes section of the Specification.

#### **SYSTEM DESCRIPTION**

- A. General: Fabricate and install stonework to withstand normal loads from wind, gravity, movement of building structure, and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- B. Provide stonework, which is designed, fabricated and installed, based on the safety factors applied to minimum physical properties of the different stones indicated.
- C. Provide a hand-set stone anchoring system, which results in attachments developing the capability to sustain the following forces generated by the supported element (individual member or assembly) acting separately, based on the yield strength of the material:
  - 1. A total force of 4 times the dead weight of the element supported, applied vertically downward through the element's centre of gravity, combined with loads caused by thermal movements.
  - 2. A total force of 3 times the dead weight of the element applied horizontally outwards through the centre of gravity of the element, combined with loads caused by thermal movements.

#### **QUALITY ASSURANCE**

- A. Single Source Responsibility for Stone: obtain each color, grade, finish, type and variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the work.

### **PART 2 - PRODUCTS**

#### **MATERIALS, GENERAL**

- A. Comply with relevant standards and other requirements indicated, as applicable to each type of material required.
- B. Provide matched blocks from a single quarry for each type similar to existing or where applicable, variety, color and quality of stone required. Extract blocks from a single bed of quarry stratum, unless stones from randomly selected blocks are acceptable to Engineer for aesthetic effect.

- C. Provide stones, which are free from vents, cracks, fissures, discoloration or other surface defects, which may adversely effect strength or appearance.

### **STONE FABRICATIONS**

- A. General: fabricate stonework in sizes and shapes required to comply with requirements indicated, including details on Drawings and final shop drawings.
- B. Cut and drill sinkages and holes in stones for anchors, fasteners, supports and lifting devices as indicated or needed to set stonework securely in place; shape beds to fit supports.
- C. Cut stones to produce pieces of thickness, size and shape indicated or required and within fabrication tolerances recommended by applicable codes or standards or, if none, stone source, for faces, edges, beds, and backs.
  - 1. Quirk-miter corners, unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.
- D. Finish exposed faces and edges of stones to comply with requirements indicated for finish under each type and application of stone required and to match approved samples.

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Examine surfaces to receive stonework and conditions under which stonework will be installed. Do not proceed with installation until surfaces and conditions comply with requirements indicated in specifications or elsewhere for execution of other work, which affects stonework.

### **SETTING STONE, GENERAL**

- A. Execute stonework by skilled masons, and stone fitters at the site to do necessary field cutting, as stones are set.
  - 1. Use power saws to cut stones; for exposed edges, produce edges, which are cut straight and true.
- B. Contiguous Work: Provide chases, reveals, reglets, openings and other spaces as required for accommodating contiguous work. Close-up openings in stonework after work is in place with stonework which matches that already set.
- C. Set stones to comply with requirements indicated on drawings and final shop drawings. Install anchors, supports, fasteners and other attachments indicated or necessary to secure stonework on place. Shim and adjust anchors, supports and accessories to set stones accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationship and indicated tolerances.
- D. Construction Tolerances: set stones to comply with the following tolerances:
  - 1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 6mm in 3m, 10mm in a story height or 6m maximum, nor 15mm in 12m or more. For external corners, expansion joints and other conspicuous lines, do not exceed 6mm in any story or 6m maximum, nor 15mm in 12m or more.

2. Variation from Level: For grades indicated for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 15mm in any bay or 6m maximum, nor 20mm in 12m or more.
3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 15mm in any bay or 500mm maximum, nor 20mm in 12m or more.
4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls from dimensions indicated, do not exceed minus 6mm nor plus 15mm.

#### **ADJUSTING AND CLEANING**

- A. Remove and replace stonework of the following description:
  1. Broken, chipped, stained or otherwise damaged stones.
  2. Defective joints.
  3. Stones and joints not matching approved samples.
  4. Stonework not complying with other requirements indicated.
- B. Replace in manner which results in stonework matching approved samples, complying with other requirements and showing no evidence of replacement.
- C. Clean stonework not less than 6 days after completion of work, using water and stiff bristle fiber brushes. do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods which could damage stone.

#### **PROTECTION**

- A. Provide final protection and maintain conditions in a manner acceptable to the Engineer, which ensures stonework being without damage or deterioration at time of final handing over.

**CHAPTER FIVE**  
**METAL WORKS**

## **CHAPTER FIVE** **METAL WORKS**

### **5.1 METAL FABRICATIONS**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Definition: Metal fabrications includes components and assemblies from ferrous and non-ferrous metal shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.
- B. Extent of metal fabrications is indicated on drawings, and includes but is not necessarily limited to the following:
  - 1. Ladders
  - 2. Floor drain covers
  - 3. Water tank access covers
  - 4. Steel gates
  - 5. Aluminum handrails and railing systems
  - 6. Miscellaneous steel pipe railings
  - 7. Miscellaneous checker plate fabrications
  - 8. Miscellaneous supports for overhead doors and the like.

##### **PROJECT CONDITIONS**

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrications; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
  - 1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

#### **PART 2 - PRODUCTS**

##### **MATERIALS**

- A. Ferrous Metals
  - 1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes and including pitting, seam marks, roller marks, rolled trade names and roughness.
  - 2. Steel Plates, Shapes and Bars: ASTM A 36 or BS 1449.
  - 3. Rolled Steel floor plates: ASTM A 786.
  - 4. Steel Bar Grating: ASTM A 569 or ASTM A 36.
  - 5. Steel Tubing: Cold formed, ASTM A 500; or hot-rolled, ASTM A 501, BS 4848, or BS 2994.

6. Structural Steel Sheet: Hot-rolled, ASTM A 570; or cold-rolled ASTM A 611, of grade required for design loading.
7. Galvanized Structural Steel Sheet: ASTM A 446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.
8. Steel Pipe: ASTM A 53 or BS 4848. Type and grade as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.
9. Grey Iron Castings: ASTM A 48, Class 30, or BS 1452.
10. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.
11. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
12. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

**B. Aluminum**

1. All aluminum works should be as manufactured by Sidem Type 2000

**C. Grout**

1. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified and required.

**D. Fasteners**

1. General: Provide stainless steel fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
2. Bolts and Nuts: Regular-hexagon head type.  
Lag Bolts: Square head type.  
Machine Screws: Cadmium plated steel.  
Wood Screws: Flat head carbon steel.  
Plain Washers: Round, carbon steel.  
Anchorage Devices: Drilled in expansion anchor bolts.  
Toggle Bolts: Tumble-wing type, class and style as required.  
Lock Washers: Helical spring type carbon steel.

**E. Paint**

1. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, "Epoxy" primer; selected for good resistance to aggressive atmospheric corrosion, for compatibility with finish paint systems indicated and for capability to provide a sound foundation for field applied topcoats despite prolonged exposure.
2. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel.
3. Bituminous Paint: Cold applied asphaltic mastic.
4. Zinc Chromate Primer.

**F. STAINLESS STEEL**

Where stainless steel is specified it shall be what is known to the trade as Austentic 18-8, type 316, with a content of from 17% to 19% chrome, 7% to 9% nickel and a maximum, carbon content of 0.11%.

Stainless steel shall be free from scale and all surfaces shall be polished to a No.4 commercial finish where specified.

---

## **PART 3 - EXECUTION**

### **PREPARATION**

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

### **INSTALLATION**

A. General:

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.
2. Cutting, Fitting and Placement: Perform cutting drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.
3. Fit exposed connections accurately together to form tight hairline joints. Weld connections, which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units, which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
4. Field welding: Comply with relevant codes for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
5. Corrosion Protection: Coat concealed surfaces of Aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.

B. Railings and Handrails:

1. Adjust railing prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as indicated on drawings and as required.
  - a. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed, placed and sealed to comply with grout manufacturer's directions.
2. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 37mm clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required for design loading. Secure wall brackets and wall return fittings to building construction as required.

## **ADJUST AND CLEAN**

1. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780, or BS 729.

### 5.1.1 **NON-STRUCTURAL METAL FRAMING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

Section Includes:

Non-load-bearing steel framing systems for interior gypsum board assemblies.  
Suspension systems for interior gypsum ceilings and soffits.

#### **PART 2 - PRODUCTS**

##### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than **[25]** percent.

##### **2.2 FRAMING SYSTEMS**

- A. Steel Studs and Runners: ASTM C 645.[Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.]

Minimum Base-Metal Thickness: **[As indicated on Drawings]** Depth: **[As indicated on Drawings]**.

- B. Slip-Type Head Joints: Where indicated, provide[ one of] the following in thickness not less than indicated for studs and in width to accommodate depth of studs:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with (51-mm) deep flanges, installed with studs friction fit into top runner and with continuous bridging located within (305 mm) of the top of studs to provide lateral bracing.
  - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2- inch- (51-mm-) deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
  - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
  - 4. Products: Subject to compliance with requirements, **[available products that may be incorporated into the Work]**:
- C. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance- rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Products: Subject to compliance with requirements, **[available products that may be incorporated into the Work]**:

- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: **[As indicated on Drawings]**.
- E. Cold-Rolled Channel Bridging: Steel, (1.34-mm) minimum base-metal thickness, with minimum (13-mm-) wide flanges.
  - 1. Depth: **[As indicated on Drawings]**.  
Clip Angle: Not less than (38 by 38 mm), (1.72-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: **[As indicated on Drawings]**. Depth: **[As indicated on Drawings]**.
- G. Resilient Furring Channels: (13-mm-) deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: **[hat shaped]**.
- H. Cold-Rolled Furring Channels: (1.34-mm) uncoated-steel thickness, with minimum (13-mm-) wide flanges.
  - 1. Depth: **[As indicated on Drawings]**.  
Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of (0.8 mm).  
Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, (1.59-mm-) diameter wire, or double strand of (1.21-mm-) diameter wire.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of [(31.8 mm)], wall attachment flange of (22 mm), minimum uncoated-metal thickness of (0.45 mm), and depth required to fit insulation thickness indicated.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Capable of sustaining a load equal to **[5]** times that imposed as determined by ASTM E 488.  
Type: **[Postinstalled, expansion anchor]**.
  - 2. Powder-Actuated Fasteners: Capable of sustaining, a load equal to **[10]** times that imposed as determined by ASTM E 1190.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Flat Hangers: Steel sheet, [in size indicated on Drawings].
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of (1.34 mm) and minimum (13-mm) wide flanges.
  - 1. Depth: **[As indicated on Drawings]**.
- F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: (1.34-mm) uncoated-steel thickness, with minimum (13-mm-) wide flanges, (19 mm) deep.
2. Steel Studs and Runners: ASTM C 645. **[ Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.]**
  - a. Minimum Base-Metal Thickness: **[As indicated on Drawings]**
  - b. Depth: **[As indicated on Drawings]**.
3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, (22 mm) deep.
  - a. Minimum Base-Metal Thickness: **[As indicated on Drawings]**.
4. Resilient Furring Channels: (13-mm-) deep members designed to reduce sound transmission.
  - a. Configuration: **[hat shaped]**.

## 2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide [foam gasket].

## **PART 3 – EXECUTION**

### 3.1 INSTALLATION, GENERAL

- A. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- B. Install bracing at terminations in assemblies.
- C. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire- resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  - 6. Curved Partitions
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs (150 mm) o.c.
- E. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced (610 mm) o.c.
- F. Z-Furring Members:
  - 1. Erect insulation vertically and hold in place with Z-furring members spaced [600 mm] o.c.
  - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced (610 mm) o.c.
  - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw- attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than (305 mm) from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than (3 mm) from the plane formed by faces of adjacent framing.

### 3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

- 
- a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counters playing, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  - 3. Do not attach hangers to steel roof deck.
  - 4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems [**with hangers used for support**].
- F. Installation Tolerances: Install suspension systems that are level to within [(3 mm in 3.6 m)] measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

## **5.1.2 METAL DOOR AND FRAMES**

### **PART 1 - GENERAL**

#### **DESCRIPTION**

- A. General
  - 1. Furnish all labor, materials, tools, equipment, and services for metal doors and frame, in accord with provisions of Contract Documents.
  - 2. Completely coordinate with work of other trades.
  - 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
  - 4. See Division 1 for General Requirements.
- B. Related work specified elsewhere:
  - 1. Finish hardware: Section 8.5.
  - 2. Wood doors: Section 8.2.
  - 3. Glass and glazing: Section 8.4.

#### **SUBMITTALS**

- A. Product Data:
  - 1. Manufacturer's technical information including specifications and catalog cuts for all products specified herein.
- B. Shop Drawings:
  - 1. Show details of each frame type and elevations of each door type. Show conditions at openings and details of construction.
  - 2. Show gages, location of reinforcements, anchorage and accessory items.
  - 3. Submit schedule of doors and frames. Use same scheduling system as that shown in the Door Schedule.

### **PART 2 - PRODUCTS**

#### **MATERIALS - GENERAL**

- A. Steel sheet and strip: Commercial quality carbon steel, ASTM A568.
- B. Galvanized steel sheets: ASTM A525, G90 coating, phosphatized.
- C. Supports and anchors: Not less than 1.5 mm (16 ga) sheet steel. Galvanize items to be built into exterior walls after fabrication, ASTM A153, Class B.
- D. Inserts, bolts and fasteners: Manufacturer's standard units. Galvanize items to be built into exterior walls ASTM A153, Class C or D as applicable.
- E. Primer: Suitable for Galvanized metal sheets enamel or paint, air-drying or baked, suitable as base for specified finish paints.
- F. Galvanized repair paint: Mil. Spec. DOD-P-21035.

- G. Lead sheet: ASTM B29, free from imperfection affecting performance, thickness as indicated.

## **DOORS AND FRAMES**

- A. Doors, Timber or Melamine.
- B. Vision panels:
  - 1. Fixed, integral stops on exterior face, screwless snap-in stops or stops secured with countersunk Phillips head machine screws on interior face.
  - 2. Glass: Section 8.4.
- C. Frames, Timber or Melamine, types as indicated.
  - 1. Split-type frames are not acceptable.
  - 2. Conceal all fastenings.
  - 3. All joints: Tightly butted and fully welded.
  - 4. All frames should be painted from the back & bottom 15 cm with asphalt.

## **FABRICATION**

- A. General:
  - 1. Fabricate rigid, neat in appearance and free from defects.
  - 2. Form to indicated sizes and profiles.
  - 3. Fit and assemble in shop, where practical.
  - 4. Mark work that cannot be fully assembled in shop, to assure proper assembly at site.
- B. Prepare for finish hardware, in accord with hardware schedule, templates provided by hardware supplier, and ANSI A115 series "Specifications for Door and Frame Preparation".
  - 1. Locate finish hardware in accord with SDI 100.
  - 2. Locate patient latches in accord with manufacturer's recommendations.
- C. Clean off mill scale and foreign materials, touch-up damaged steel and galvanized surfaces.
- D. Shop prime.

## **PART 3 - EXECUTION**

### **INSPECTION**

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

### **INSTALLATION**

- A. Place frames prior to construction of enclosing walls and ceilings.

- 
- B. Separate structural lintels are to be installed over all doorframes in masonry. Do not use doorframes as lintels to carry masonry.
  - C. Plumb, align, and brace securely until permanently anchored.
  - D. After completion of walls, remove temporary braces and spreaders.
  - E. Install minimum of 3 anchors of type appropriate to wall construction per jamb. Minimum acceptable anchors: 1.5 mm (16 ga), 25 mm (1 IN) wide corrugated steel.
  - F. Provide removable spreaders at bottom of frame.
  - G. Coordinate building-in of anchors and frame grouting with other trades.
  - H. Grout all frames.
  - I. Leave work complete and in proper operating condition.
  - G. Remove defective work and provide new acceptable products.

**CHAPTER SIX**  
**WOOD WORKS**

---

## **CHAPTER SIX** **WOOD WORKS**

### **6.1 JOINERY**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Types of joinery and architectural woodwork included in this Section include the following:
  - 1. Wood casework.
  - 2. Plastic laminate clad casework.
  - 3. Countertops, including stonework counter tops.
  - 4. Hardware, ironmongery, accessories and miscellaneous trim incorporated into joinery in accordance with Drawings.
- B. "Rough Carpentry" for grounds, blocking, framing, furring, and other carpentry work that is not exposed to view is specified elsewhere.
- C. Wood Doors are specified elsewhere.

##### **QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Firm experienced in successfully producing joinery and architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standard" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.
- C. Hardware Coordination: Distribute copies of approved schedule for cabinet hardware to manufacturer of joinery and architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.
- D. Except for stonework, proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude products of other manufacturers.

#### **PART 2 - PRODUCTS**

##### **MATERIALS**

- A. General: Provide materials of premier quality grades that comply with requirements of the relevant woodworking standard for each type of woodwork and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
  - 1. Hardboard.
  - 2. Plastic Laminate Facing: BS 3794, Class 1, 1.5 mm thick.
  - 3. Plywood: BS 1455; WBP bonding; Grade 1 where polished / varnished.
  - 4. Blockboard (Latte): BS 3444; WBP bonding.

5. Face Veneers: Hard, durable and capable being finished to a smooth surface; free from knots, holes splits, stains, filling or any other defects.
6. Adhesives for Face Veneers: BS 1203.

## **WOOD TYPES**

- A. General: Provide first quality premier grade wood types where indicated on Drawings and as specified herein.
  1. Softwood: Douglas Fir, Longleaf Pine, European Redwood, or other equal approved.
  2. Pine: (where shown on Drawings) South American Parana Pine.
  3. Hardwoods and Veneers:
    - a. Generally: Canadian Yellow Birch, Meranti, Zan, or other equal approved.
    - b. Teak: Burmese teak.
    - c. Mahogany: Honduran mahogany.

## **PART 3 - EXECUTION**

### **INSTALLATION GENERALLY**

- A. Quality Standard: Install woodwork to meet or exceed AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 6.25 mm in 2400 mm for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Casework and Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated and required. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- F. Tops: Anchor securely to base units and other support systems as indicated.
- G. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

### **ADJUSTMENT AND CLEANING**

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.

- C. Clean woodwork on exposed and semi exposed surfaces. Touch up factory applied finishes to restore damaged or soiled areas.

#### **PROTECTION**

- A. Provide final protection and maintain conditions, in a manner acceptable to the Engineer that ensures that woodwork is undamaged at time of Taking-Over.

## **6.1.1 CABINETWORK**

### **6.1.1.1 GENERAL**

**A. Description:**

1. Furnish all labor, materials, tools, equipment, and services necessary for architectural cabinetwork, in accord with provisions of Contract Documents.
2. Completely coordinate with work of other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

**B. See drawings for types of countertops required.**

**C. Submittals:**

1. Shop drawings:
  - a) Complete details of construction and elevations of all cabinets.
2. Product data:
  - a) Wall cabinet load test reports.
3. Samples:
  - a) Each finish for pattern, finish and color selection.

**D. Conditions:**

1. Verify dimensions at site.
2. Verify locations of items related to cabinetwork but specified in other sections.
3. If necessary, to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect.

### **6.1.1.2 PRODUCTS**

**A. General**

A.1 Cabinetwork: Custom, shop- or factory-built casework, complete with all hardware, accessories, countertops and bases, in sizes and configurations indicated.

1. Style: Flush overlay, with square cornered doors and drawer fronts overlapping case front with minimum reveal.

**B. Hardware**

**B.1 Hardware for hinged doors:**

1. Hinges: Institutional (hospital tip), 5 knuckle, wrap-around type (screwed to back of door and side of divider/end), with barrel only projecting beyond face of cabinet.
  - a. Not less than 62 mm (2-1/2 IN) long.
  - b. Minimum 3 screws each leaf.
  - c. For doors up to 1200 mm (48 IN) high: 2 hinges.
  - d. For doors over 1200 m (48 IN) high: 3 hinges.
  - e. Finish: Dull chrome.
2. Pull: Wire, 7.9 mm (5/16 IN) diameter x 33.3 mm (1 5/16 IN) projection x 100 m (4 IN) centers, satin chrome finish.

3. Catch: Magnetic, adjustable, 2.7 to 3.2 KG (6-7 LB) pull, provide 2 on each door over 0.37 SM (4 SF), provide 1 on each door 0.37 SM (4 SF) and smaller.

B.2 Hardware for drawers:

1. Slides: Zinc-plated cold-rolled steel, side slides, 45 KG (100 LB) capacity, nylon wheels/rollers, stainless steel ball bearings, positive closing and pull-out stops, drawer removable without use of tools, file drawers: Full extension. Required clearance 19 mm (3/4 IN).
2. Pull: Wire, 7.9 mm (5/16 IN) diameter x 33.3 mm (1 5/16 IN) projection x 100 mm (4 IN) centers, satin chrome finish. Provide 2 on drawers over 457 mm (18 IN) wide.
3. For file drawers: Label holder and file hanger frame.

B.3 Shelf supports (drilled hole type):

1. Holes drilled at 25 to 50 mm (1 to 2 IN) OC.
2. Shelf clips: Nylon, ABS plastic, or steel, designed to engage securely in holes.

B.4 Shelf supports (recessed standard type):

1. Standards: Aluminum or zinc-coated or plated steel, slotted at 25 to 50 mm (1 to 2 IN) OC, for recessed installation.
2. Shelf clips: Plated or zinc-coated steel, designed to engage securely in slots.

B.5 Clothes rod:

Chrome plate or stainless steel tube, 25 mm (1 IN) diameter minimum, manufacturer's standard end bracket supports.

B.6 Coat hooks:

Stainless steel or satin aluminum, single, double or ceiling style as indicated.

B.7 Grilles: Aluminum, satin finish.

1. Type 1: 70 percent free area, 2.5 mm (0.1 IN) WG maximum, total static pressure loss.
2. Type 2: Opposed blade damper, 70 percent free area, maximum neck velocity 914.4 M/Min (3000 FPM), 2.5 mm (0.1 IN) WG maximum total static pressure loss.

C. Fabrication-Case Components-Plastic Faced

C.1 Case body members (except backs not exposed): 18 mm (3/4 IN) minimum thick plywood.

1. Base unit top: Use either full sub-top or web frame.
2. Web frames: Lumber.
3. Provide drawer lock rails at all drawers.
4. Provide backs on all cabinets.

C.2 Unexposed case back: 6 mm (1/4 IN) minimum thick hardboard or plywood.

C.3 Shelves: 18 mm (3/4 IN) minimum thick plywood, 25 mm (1 IN) thick over 91 mm (36 IN) between supports.

C.4 Doors: Plywood.

1. Up to 650 mm (26 IN) wide or 1220 mm (48 IN) high: 18 mm (3/4 IN) thick.
2. Up to 900 mm (36 IN) wide or 1680 mm (66 IN) high: 30 mm (1 1/4 IN) thick.
3. Over 900 mm (36 IN) wide or 1680 mm (66 IN) high: 35 mm (1 3/8 IN) thick, solid-core.

C.5 Drawers:

1. Fronts: 18 mm (3/4 IN) thick Plywood.
2. Sub-front (if used) sides and backs: 12 mm (1/2 IN) thick hardwood.
3. Bottom: 6 mm (1/4 IN) thick, minimum, hardboard, over 45 mm (18 IN) wide provide intermediate reinforcing rails.

C.6 Case base: Separate or integral.

C.7 Small compartment dividers and dust panels: 6 mm (1/4 IN) thick hardboard.

C.8 Filler panels and scribe pieces: Plywood, provide as required to fit standard size units to space.

C.9 Plastic laminate countertops: 18 mm (3/4 IN) thick Plywood, built up to 31 mm (1-1/4 IN) at all edges. Backsplash 102 mm high.

C.10 Finishes:

1. All exposed surfaces: Plastic laminat (1.5mm Thick).
2. All semi-exposed surfaces not covered with plastic laminate backer sheet (except hardwood): Plastic overlay. (1.5mm Thick)
3. Edges of doors, drawer fronts and case body members: Hardwood strips as shown on Drawings.

C.11 Finishing hardwood:

1. Set all nails.
2. Fill holes.
3. Sand smooth.
4. Apply stain.
5. Sand after stain is dry.
6. Apply varnish in 3 coats.
7. Sand between coats.

## **6.2 HIGH PRESSURE LAMINATE (HPL)**

### **6.2.1 GENERAL**

Constructed from layers of high quality kraft paper, reinforced by thermosetting resins under high pressure and temperature with one decorative surface. The result is a hygienic 0.8 mm thick flexible sheet material.

HPL is bonded onto a high density coreboard to produce a strong finished panel. Panels can be post-formed to create a seamless, curved edge detail.

HPL is suitable for use in areas of high traffic and reasonably demanding conditions.

### **6.2.2 PANEL CUBICLES**

#### **A. SCOPE OF SECTION**

This section deals with proprietary panel cubicles assembled on site from factory finished kits of parts including, panels, doors, privacy screens, framing, stiffening, connecting and fixing devices, door ironmongery, coat hooks, toilet roll holders, bench and other accessories.

#### **B. PANEL CUBICLES GENERALLY**

- ✓ Manufacturer: Refer to appendix A.
  - Product reference: To the Engineer's selection.
- ✓ Panels:
  - Height (overall): As indicated on the contract drawings.
  - Floor clearance: As indicated on the contract drawings.
  - Core material: High pressure solid compact laminate.
  - Thickness: 12 mm.
  - Facings: To Engineer's selection from the manufacturer's standard range.
  - Color/ Pattern/ Species: To the Engineer's selection from the manufacturer's standard range.
  - Edge treatment: Chamfered and finished without trim.
  - Wall support: Aluminum satin anodized pedestals/shoes on the floor and aluminum satin anodized angles on the walls.
- ✓ Pilasters:
  - Core material: High pressure solid compact laminate.
  - Thickness: 12 mm.
  - Facings: To the Engineer's selection from the manufacturer's standard range.
  - Color/ Pattern/ Species: To the Engineer's selection from the manufacturer's standard range.
  - Edge treatment: Chamfered and finished without trim.
- ✓ Doors:
  - Height: As indicated on the contract drawings.
  - Core material: High pressure solid compact laminate.
  - Thickness: 12 mm.
  - Facings: To the Engineer's selection from the manufacturer's standard range.
  - Color/ Pattern/ Species: To the Engineer's selection from the manufacturer's standard range.
  - Edge treatment: Chamfered and finished without trim.
  - Ironmongery: Aluminum satin anodized.
  - Color: To the Engineer's selection from manufacturer's standard range.
- ✓ Fittings:

- Headrails: Aluminum satin anodized.
- Pedestals/ Shoes: Aluminum satin anodized.
- ✓ Accessories: Aluminum Satin Anodized heavy duty.
- ✓ Other requirements: All accessories to be of bacteria resistant Aluminum satin.

#### C. SAMPLES

- ✓ General: Before placing orders submit representative samples of the following:
  - Panel material and complete color chart.
  - All ironmongery/ accessories.
- ✓ Delivered materials/ products: To match samples.

#### D. CONTROL SAMPLES

- ✓ General: Complete samples as part of finished work and obtain approval of appearance before proceeding.
- ✓ Types: All items specified in this section and applicable to the project.
  - Locations: As agreed with the Engineer.

#### E. INSTALLATION

- ✓ Programming: Do not install cubicles or duct/ wall panels before building is weathertight, wet trades have finished their work, wall and floor finishes are complete, and the building is well dried out.
- ✓ Accuracy: Set out to ensure frames and/ or panels and doors are plumb, level and accurately aligned.
- ✓ Modifications: Do not cut, plane or sand prefinished components except where shown on drawings.
- ✓ Fixing: Secure components using methods and fasteners recommended by the cubicle/ panel manufacturer. Prevent pulling away, bowing or other distortions to frames, panels and doors.
- ✓ Moisture and thermal movement: Make adequate allowance for future movement.

### 6.2.3 FABRICATION: Anodized Aluminum Accessories for Toilet Partitions

Aluminum alloys are anodized to increase corrosion resistance and to allow dyeing (coloring), improved lubrication, or improved adhesion. However, anodizing does not increase the strength of the aluminum object. The anodic layer is non-conductive.

Aluminum alloy parts are anodized to greatly increase the thickness of this layer for corrosion resistance. The corrosion resistance of aluminum alloys is significantly decreased by certain alloying elements or impurities: copper, iron, and silicon.

Although anodizing produces a very regular and uniform coating, microscopic fissures in the coating can lead to corrosion. To combat this, various techniques have been developed either to reduce the number of fissures or to insert more chemically stable compounds into the oxide, or both.

Anodized coatings have a much lower thermal conductivity and coefficient of linear expansion than aluminum.

**CHAPTER SEVEN**  
**THERMAL AND MOISTURE PROTECTION**

---

## **CHAPTER SEVEN**

### **THERMAL AND MOISTURE PROTECTION**

#### **7.1 ROOFING**

##### **7.1.1 ROOF WATERPROOFING**

###### **PART 1 - GENERAL**

###### **SUMMARY**

- A. Extent of each type of sheet waterproofing work is indicated on Drawings.
- B. Types of sheet waterproofing specified in this Section include the following:
  - 1. Polyethylene sheet membrane.
  - 2. SBS modified bituminous sheet waterproofing membrane.

###### **QUALITY ASSURANCE**

- A. Installer: Perform sheet waterproofing membrane installations by skilled operations or specialist contractor experienced and regularly engaged in the type of work.

###### **PART 2 - PRODUCTS**

###### **MATERIALS**

- A. General: Provide sheet-waterproofing materials recognized to be generic to the types indicated and complying with required performances. Other similar materials certified in writing to be equal to or better than specified in every significant respect may be used if acceptable to Engineer.

###### **POLYETHYLENE SHEET MEMBRANE**

- A. Chlorinated polyethylene formed into uniform flexible sheets, minimum 40 mil. thickness. Manufacturers offering products which may be incorporated in the work include but are not limited to:-
  - 1. MONYACO International: Lebanon.
- B. Applications:
  - 1. Vapour Barrier: Under concrete slabs cast on ground or granular base at sub-grade elevations.

###### **SBS MODIFIED BITUMINOUS SHEET WATERPROOFING MEMBRANE**

- A. Torch applied, self-adhering, sheet membrane of SBS (Styrene Butadiene Styrene) modified bitumen, reinforced with 160 - 200 g/m<sup>2</sup> spun bonded, non woven, polyester, formed into uniform flexible sheets of thickness appropriate for application intended, but not less than 4 mm thick.
  - 1. Smooth surfaced.
- B. Applications:

1. Basement Tanking: Membrane waterproofing to underside / outside surfaces of underground concrete slabs and walls enclosing basement structures.
  2. Planter Linings: Membrane waterproofing to inside of concrete planters and the like, as indicated.
  3. Unless otherwise specified or indicated provide protective coverings as recommended by the membrane manufacturer for application intended.
- C. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to:
1. Bitufa (Netherlands): 'Standard Plus', or approved equal.

### **MISCELLANEOUS MATERIALS**

- A. Adhesives: Provide types of adhesive compounds, tapes and the like as recommended by sheet manufacturer, for bonding to substrate, for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashings, adjoining surfaces and projections through membrane.
- B. Primers: Provide type of concrete primer recommended by manufacturer of sheet material for applications required.
- C. Coatings: Provide coating recommended by sheet manufacturer, for improvement of weathering resistance on exposed areas of membrane, including areas extended as flashing (if any). Provide black coating except as otherwise indicated.
- D. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by sheet manufacturer.
- E. Protection Course: Unless otherwise indicated provide type recommended by sheet manufacturer, and acceptable to Engineer.
1. Available Manufacturers: Manufacturers offering products which may be incorporated into the work include but are not limited to:
    - a. Cartonal (Lebanon) or approved equal.

## **PART 3 - EXECUTION**

### **PREPARATION**

- A. Examine substrates, areas and conditions under which sheet membranes will be installed, for compliance with manufacturers recommendations and installation requirements.
- B. On concrete decks and walls, immediately before placement of waterproofing sheet, grind surface lightly with terrazzo grinder or similar device, to ensure removal of projections, which might penetrate sheet. Clean deck of loose material.
- C. Apply primer to concrete (and masonry where applicable) surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area, which will be covered by waterproof membrane in same working day; reprime areas not covered by membrane within 24 hours.

---

## INSTALLATION

- A. Comply with manufacturer's instructions for handling and installation of sheet membrane materials.
- B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of sheet materials.
- C. Extend sheet and flashings as shown and to provide complete membrane over area indicated to be waterproofed. Seal to projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.
- D. Polyethylene Sheet Vapor Barrier: Lay, lap edges, seal joints with adhesive type, protect and repair vapor barrier sheet membrane according to manufacturer's instructions.
- E. SBS Modified Bituminous Sheet Waterproofing: Install sheet waterproofing membrane system according to manufacturer's instructions.
  - 1. Roll out sheets to minimize wrinkles and bubbles; prime base, fix cants and accessories.
  - 2. Torch apply to substrate; lap sides and ends and reinforce with multiple thickness at joints and angles; all in accordance with manufacturer's recommendations and instructions.
- F. Install protection course of type indicated over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.

## PERFORMANCE REQUIREMENTS

- A. It is required that waterproof membranes are watertight and not deteriorate in excess of limitations published by manufacturer.
- B. In-place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with 50mm depth of water maintained for 24 hours. Repair any leaks revealed by examination of substructure and repeat test until no leakage is observed.

## PROTECTION

- A. Institute required procedures for protection of completed membrane during installation of work over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

### **7.1.2 SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. This Section includes the following:
1. Single-ply, modified bituminous membrane roofing.
  2. Polystyrene board roof insulation.
  3. Precast concrete roof pavers.
  4. Precast terrazzo roof pavers.
  5. Aggregate ballast.

##### **PERFORMANCE REQUIREMENTS**

- A. General: Install a watertight, modified bituminous membrane roofing and upstand base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

##### **SUBMITTALS**

- A. Product Data: For each type of membrane and roofing product specified. Include data substantiating that materials comply with requirements.
- B. Shop Drawings: Include plans, sections, thicknesses and details, including attachments to other work for the following:
1. Upstand base flashings, cants, and membrane terminations.
- C. Samples: For verification and approval of the following products:
1. 300 x 300mm square of each modified bituminous membrane specified.
  2. 300 x 300mm square of polystyrene board roof insulation.
  3. Full-sized roof paver units, for each type, dimension, color and texture indicated or required.
  4. 2.5kg of aggregate ballast in color and gradation indicated.
- D. Installer Certificates: Signed by roofing membrane manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing membrane and is eligible to receive the roofing manufacturer's standard warranty.
- E. Manufacturer Certificates: Signed by roofing membrane manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.
- F. Warranty: Sample copy of roofing manufacturer's standard warranty stating obligations, remedies, limitations, and exclusions of warranty.

##### **DELIVERY, STORAGE, AND HANDLING**

- A. Store roofing materials in a dry, well-ventilated, weather tight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing membrane

manufacturer's written instructions. Store rolls of sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
- B. Do not leave unused sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture.
- C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing membrane manufacturer.
- D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

## **PROJECT CONDITIONS**

- A. Weather Limitations: Proceed with roofing work only when existing and forecast weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

## **WARRANTY**

- A. General Warranty: The warranties specified in this Article shall not deprive the Employer of other rights the Employer may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Roofing Manufacturer's Standard Warranty: Submit a written warranty, without monetary limitation, signed by roofing membrane manufacturer agreeing to promptly repair leaks in the roof membrane and upstand base flashings resulting from defects in materials or workmanship for the following warranty period:
  1. Warranty Period: Five (5) years from date of completion of the whole of the Works.

## **PART 2 - PRODUCTS**

### **MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. SBS-Modified Bituminous Sheet:
    - a. Bitufa (Netherlands), 'Standard Plus', or approved equal.

### **SBS-MODIFIED BITUMINOUS SHEET**

- A. SBS-Modified Bituminous Sheet: SBS-modified bituminous sheet, smooth surfaced, dusted with fine parting agent on both sides; suitable for installation method specified; manufacturer's recommended thickness and weight for use and application intended, but not less than 4mm thick, and of reinforcing type as follows:

1. Use: Single ply membrane roofing and upstand base flashings.
  2. Reinforcing: Woven or nonwoven polyester mat.
- B. Physical Properties: Provide SBS-modified bituminous membrane material with a minimum mass of 4.5 kg/m<sup>2</sup> and the following properties when tested to ASTM D 5147:
1. Thickness: 4 mm, minimum.
  2. Tensile Strength: 700 N/50mm in each direction.
  3. Elongation at Maximum Load: 4.5 percent minimum in each direction.
  4. Tear Strength: 100 N minimum.
  5. Water Absorption: Less than 0.2 percent mass change.
  6. Low-Temperature Flexibility: Pass at minus 20 deg.C.

#### **AUXILIARY MEMBRANE MATERIALS**

- A. General: Furnish primers, bitumen adhesives, sealants, cants, fasteners, etc., and other auxiliary materials, as recommended by roofing membrane manufacturer for intended use and application, and compatible with SBS- modified bituminous membrane roofing.

#### **PROTECTION SHEET**

- A. Protection Sheet: Woven or nonwoven polypropylene or polyester fabric mat, water permeable and resistant to UV degradation. Type and weight as recommended by roofing membrane manufacturer for use and application intended.

#### **AGGREGATE BALLAST**

- A. Aggregate Ballast: Provide aggregate that will withstand weather exposure without significant deterioration and will not contribute to degradation of insulation or membrane, and of the following type and size:
1. Type: Smooth, washed, riverbed gravel or crushed stone acceptable to Engineer.
  2. Size: Ranging from 16 to 25 mm.

#### **ROOF PAVERS**

- A. Roof Pavers: Factory-cast, square-edged units, specially manufactured for use as roof pavers and acceptable to the Engineer:
1. Precast Concrete:
    - a. Size: 300 x 300 mm, unless otherwise indicated.
    - b. Thickness: 30 mm, unless otherwise indicated.
  2. Precast Terrazzo:
    - a. Size: 300 x 300 mm, unless otherwise indicated.
    - b. Thickness: 30 mm, unless otherwise indicated.
  3. Paver Colors and Textures: To Engineer's approval.
  4. Paver Supports: Manufacturer's standard proprietary high-density neoprene or polyethylene paver support pads.

---

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Examine substrates, areas, and conditions under which roofing will be applied, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced and that roof drains, if any, are properly clamped into position.
- C. Verify that wood blocking, curbs, and nailers, if any, are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.
- D. Do not proceed with installation until after the minimum concrete curing period recommended by roofing membrane manufacturer.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **GENERAL INSTALLATION REQUIREMENTS**

- A. Install modified bituminous membrane roofing system according to roofing membrane manufacturer's written instructions and applicable recommendations.
  - 1. Clean substrate of dust, debris, and other substances detrimental to membrane roofing installation. Remove sharp projections.
- B. Cant Strips: Install 45-degree cant strips at junctions of modified bituminous membrane roofing with vertical surfaces, or angle changes greater than 45 degrees.
- C. Coordinate installing roofing system components so roofing membranes and insulation are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

### **ROOF MEMBRANE INSTALLATION**

- A. General: Install modified bituminous membrane over area to receive roofing, according to manufacturer's written instructions. Extend modified bituminous membrane over and terminate beyond cants.
- B. Modified Bituminous Membrane: Install single ply modified bituminous membrane starting at low point of roofing system.
  - 1. Application: Torch apply to substrate.
- C. Laps: Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

### **UPSTAND BASE FLASHING INSTALLATION**

- A. Install modified bituminous membrane upstand base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing membrane manufacturer's written instructions and/or as indicated on Drawings.

1. Upright base Flashing Application: Torch apply to substrate.
- B. Unless otherwise indicated, extend upright base flashing vertically, a minimum of 200 mm above roof membrane and 100 mm onto field of roof membrane.
- C. Securely fasten modified bituminous membrane at top of upright base flashing, and at terminations and perimeters of roofing.
1. Seal top termination of upright base flashing as indicated.

#### **PROTECTION SHEET INSTALLATION**

- A. Install protection sheet over modified bituminous membrane and/or board insulation as indicated, according to manufacturer's written instructions.

#### **AGGREGATE BALLAST INSTALLATION**

- A. Deposit and spread ballast over protection sheet, and evenly to uniform thickness, taking care to avoid damage to bituminous roof membrane. Install ballast as soon as practicable after installing modified bituminous roof membrane, upright base flashings and roof accessories.
1. Thickness: Minimum 50 mm layer.

#### **ROOF PAVERS INSTALLATION**

- A. Install roof pavers over protection sheet, loose laid with well aligned joints, on paver support pads.

#### **PROTECTING AND CLEANING**

- A. Protect modified bituminous membrane roofing and installed roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove modified bituminous roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair upright base flashings to a condition free of damage and deterioration at time of Taking- Over and according to warranty requirements.

---

### **7.1.3 TILES ROOFING**

Clay (Marseille butterfly type) or approved equal or similar to existing roofing tiles, on and including treated alum. Battens with single layer modified bituminous membrane and clay tile accessories, flashing and counter flashing as indicated or required at roof perimeters and abutments. Shop drawing required for Engineer's approval.

### **7.1.4 METAL ROOFING**

Pitched roofing comprising: Stone enamel galvanized steel sheet, non- combustible, insulated sandwich panel roofing, on and including metal purlins; Single layer modified bituminous membrane with Metal panel roofing accessories, flashing and counter flashing as required at roof perimeters and abutments. Shop drawing required for Engineer's approval.

### **7.1.5 ROOF DRAINAGE**

Aluminum sheet, eaves box gutter as indicated; on and including bedding laid to falls; include ends, joints, sealants and outlets. Shop drawing required for Engineer's approval.

### **7.1.6 ROOF ACCESSORIES**

#### **GENERAL**

Proprietary roof accessory units, factory fabricated and assembled; installed complete as detailed and necessarily required; including sub frames and frames, kerbs, upstands and supports; anchorages; fixings and fasteners; flashings, counter-flashings and sealants; hardware, devices, accessories, trim, finishes and finishing; and all other related ancillaries as indicated or required.

#### **SKY DOME**

The characteristic of sky dome is according to BS or DTU or any equivalent approved regulations, it must be permanently closed & easy open in case of fire from the lower level by an electronic system or hydraulic or any system approved by the engineer.

## **7.1.7 FLASHING AND SHEET METAL**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. The extent of flashing and sheet metal is indicated on Drawings and may include the following:
1. Metal counter flashing and base flashing (if any).
  2. Metal wall flashing and expansion joints.
  3. Exposed metal trim/fascia units.
  4. Miscellaneous sheet metal accessories.
  5. Elastic roof/wall expansion joint systems.
- B. Roofing accessories installed integral with roofing are specified in "Membrane Roofing".

#### **PROJECT CONDITIONS**

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

### **PART 2 - PRODUCTS**

#### **SHEET METAL FLASHING AND TRIM MATERIALS**

- A. Sheet Aluminum: Designation NS3, temper grade 0; BS 1470; flashings and cappings 22 SWg.

#### **MISCELLANEOUS MATERIALS**

- A. Miscellaneous Materials and Accessories:
1. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
  2. Bituminous Coating: Solvent-type bituminous mastic, nominally free of sulfur, compounded for 0.4 mm dry film thickness per coat.
  3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
  4. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed.
  5. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
  6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
  7. Paper Slip Sheet: Sized building paper.
  8. Polyethylene Underlayment: Carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.
  9. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.

10. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
11. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

### **PART 3 - EXECUTION**

#### **INSTALLATION REQUIREMENTS**

- A. Underlayment: Where or aluminum is to be installed directly on cementitious or wood substrates, install a paper slip sheet of red rosin paper and a course of polyethylene underlayment.
- B. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 150mm centres Fabricate seams at joints between units with minimum 75mm overlap, to form a continuous, waterproof system.

#### **CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Upon completion of flashing and sheet metal work institute appropriate procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of final hand over.

---

## **7.2     WATER PROOFING PU COATING**

### **PART 1 - GENERAL**

#### **DESCRIPTION**

##### **A.    General**

1.    Furnish all labor, materials, tools, equipment & services for PU water proofing coating as indicated, in accord with provisions of Contract Documents.
2.    Completely coordinate with work of all other trades.
3.    Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

#### **QUALITY ASSURANCE**

- A.    Manufacturer qualifications: Active in the manufacturing of similar type water proofing roof coating for a minimum of 3 years.
- B.    Installer qualifications:
1.    Approved by manufacturer.
  2.    Labor to be with minimum of 3 years experience in similar application.

#### **SUBMITTALS**

- A.    Manufacturer's product data, including physical properties.
- B.    Manufacturer's installation instructions, certificate indicating that all materials are in compliance with specifications, recommendations for slab preparation prior to installation and recommendations for length of curing time after installation.
- C.    Manufacturer's written approval of installer.
- D.    Manufacturer's instructions for maintenance.
- E.    Guarantees.

#### **GUARANTEES**

- A.    Upon completion of work submit written guarantees.
1.    Guarantee against manufacturing defects for a period of three years from date of acceptance.
  2.    Guarantee installation for three years from date of acceptance.
- B.    Remove and replace defective work, which does not comply with requirements at no additional expense to Owner.

---

## **PART 2 - PRODUCTS**

### **MATERIALS**

- A. PU is a hybrid elastomeric waterproofing roof coating, new technology based on acrylic polyurethane emulsion. It forms a highly elastic, seamless membrane, offering excellent protection from moisture and standing water up to 10 years. It has excellent adhesion to most commonly used roof substrates such as concrete, asphalt membranes, cement tiles, acrylic, polyurethane paints etc. Shows very low water uptake and crack bridging ability

### **B. CHARACTERISTICS**

1. Initial Total Solar Reflectance SR = 88% (300-2500nm) (ASTM 903-96 and ASTM G 159-98)
2. Solar Reflectance Visual SR<sub>vis</sub> = 93% (ASTM E903-96 & ASTM G159- 98)
3. Solar Reflectance near Infrared SR<sub>nir</sub> = 89% (ASTM E903-96 & ASTM G159-98)
4. Infrared Emittance Factor  $\epsilon$  = 0,87 (ASTM E 408-71-2002) Solar Reflectance Index SRI = 111 (ASTM E 1980-01)

### **C. SPREADING RATE**

Total recommended consumption at least 1L/m<sup>2</sup> (two coats) on properly prepared surfaces.

### **D. LOW VOC (Volatile Organic Compounds) CONTENT**

EU maximum VOC content limit values (Directive 2004/42/CE) for this product.

## **PART 3 - EXECUTION**

### **INSPECTION AND PREPARATION**

Surfaces should be smooth, clean and dry, free from grease, dust, loose or flaking material. Cracks or joints should first be filled with Elastomeric Putty by Vitex.

New or weathered surfaces should be primed with Hyroof Primer for the stabilization of the substrate.

### **APPLICATION**

- A. Stir well before use. Applied with roller, emulsion brush or spay gun in two layers crosswise without dilution, with a total consumption of at least 1 Lt/m<sup>2</sup> all over the flat surface and on perimeter vertical parapets at least 30-40 cm in height. For protection and increase the lifetime of the waterproofing up to 10 years is required to use a polyester fabric 50-100 gr/ m<sup>2</sup> as a reinforcing material which is incorporated between the layers while the underlying surface is still wet. Recommended consumption of HyRoof Hybrid PU is 1,1 Lt/m<sup>2</sup> under reinforcement, topcoat 0,8Lt/ m<sup>2</sup>, reaching a total consumption of at least 1,9 Lt/m<sup>2</sup>.
- B. Do not apply at temperature below 5°C, above 35°C and / or relative humidity above 70%.

- C. Avoid application when rain or frost is expected in the next 48 hours.
- D. It is touch-dry after 2-3 hours and can be recoated after 16 to 24 hours. Drying time depends on weather conditions (humidity and temperature).
- E. Tools must be cleaned immediately after use with water and if needed with soapy water or a detergent.
- F. After resilient athletic flooring is installed, and game lines are painted, spaces with this flooring shall be closed to all traffic by the Contractor to provide curing time for the adhesive and paint. This shall be for a specific period of time identified by the flooring manufacturer as part of required submittals.
- G. Closely coordinate installation of resilient athletic flooring with floor sleeve systems specified in Section 11486. Floor sleeve system cover plates are removable/replaceable. Resilient athletic flooring shall be cut out to cover plate profiles at all locations and shall be adhesive attached to cover plate tops. Provide key access cutouts in resilient athletic flooring for all floor sleeve system cover plates.

#### **PROTECTION**

- A. Provide protection for finished work until building is ready for occupancy.

#### **FINAL CLEANING**

- A. Clean as recommended by manufacturer when building is ready for occupancy.

---

### 7.3 **WALL INSULATION**

Provide the necessary damp proof coarse protection for the underground walls (Basements, etc.) work to include the following:

- All materials and equipment applying one layer of plaster as specified.
- Applying one Bituminous layer of tack coat.
- Applying one layer of SBS sheet 4mm thick with Cartonal protection.
- Construct 10cm hollow concrete block work wall.
- The cost of labor.
- All necessary excavation and backfilling with proper materials.
- All needed works for a proper insulation as per manufacturer's instructions.

### 7.4 **GREEN ROOF**

Green planted roofs to be executed and provided by specialized technicians and companies. The contractor to provide shop drawings and samples for approval before the start of these works.

## **7.5 JOINT SEALERS**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. The extent of joint sealers and fillers is indicated or otherwise implied on Drawings and/or by the provisions of this Section.

#### **SYSTEM PERFORMANCES**

- A. Provide joint sealers that have by long term production and installation been proved to establish and maintain watertight and airtight continuous seals on a permanent basis.

#### **QUALITY ASSURANCE**

- A. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each type of product required.
- B. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicated below:
1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.
    - a. Perform tests under normal environmental conditions that will exist during actual installation.
  2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
  3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
  4. Investigate materials failing compatibility or adhesion tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
- D. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Engineer.
1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
  2. For all exterior sealant systems, furnish test results performed on joint sealers after they have cured 1 year.
- E. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Engineer.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Arrange for tests to take place in presence of Engineer.
  4. Test Method: Test joint sealers by hand pull method described below:
    - a. Install joint sealants in 1500mm joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
    - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 50mm long at side of joint and meeting horizontal cut at top of 50mm cuts. Place a mark 25 mm from top of 50 mm piece.
    - c. Use fingers to grasp 50mm piece of sealant just above 25mm mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
  5. Report whether or not sealant in joint connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  6. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants which fail to adhere to joint substrates during testing.
- F. Field-Constructed Mock-Ups. Prior to installation of joint sealers, apply elastomeric sealants to the following selected building joints as indicated below for further verification of colors selected from sample submittals and to represent completed work for qualities of appearance, materials, and application:
1. Joints in field-constructed mock-ups of assemblies specified in other sections, which are indicated to receive elastomeric joint sealants specified in this section.
  2. Retain mock-ups during construction as standard for judging completed construction.

## **PART 2 - PRODUCTS**

### **MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Engineer from manufacturer's standard colors.

### **ELASTOMERIC JOINT SEALANTS**

- A. Elastomeric Sealant Standard: Select and provide manufacturer's standard chemically curing, elastomeric sealants of base polymer which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and appropriate for purpose, condition and application of use.

---

## **MISCELLANEOUS JOINT SEALANTS**

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

## **COMPRESSION SEALS**

- A. Preformed Foam Sealant: Manufacturer's standard preformed, pre-compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in pre-compressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
1. Properties: Permanently elastic, mildew-resistant, nonmigratory, non-staining, compatible with joint substrates and other joint sealers.
  2. Impregnating Agent: Manufacturer's standard.
  3. Density: manufacturer's standard.
  4. Backing: Pressure sensitive adhesive, factory applied to one side, with protective wrapping.
  5. Backing: Coated on one face with release agent serving as bond breaker for primary joint sealant.

## **MISCELLANEOUS MATERIALS**

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer- substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.
- D. Accessory Materials for Fire-Stopping Sealants: Provide forming, joint fillers, packing and other accessory materials required for installation of fire stopping sealants as applicable to installation conditions indicated.

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Examine joints indicated to receive joint sealers, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

---

## PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers.

## INSTALLATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture, or tear joint fillers.
    - c. Remove absorbent joint fillers, which have become wet prior to sealant application and replace with dry material.
  2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
  3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents, which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated or required.
  2. Provide flush joint configuration per Figure 6B in ASTM C 962, where indicated or required.
    - a. Use masking tape to protect adjacent surfaces of recessed tooled Joints.
  3. Provide Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated or required.
- F. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.

## **CLEANING**

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

## **PROTECTION**

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

---

## **7.6     EPDM INSULATION SHEET**

### **EPDM SYSTEM DESCRIPTION**

Product provided by this Section is 1.5mm – 1.6mm thick EPDM Ethylene Propylene Diene Terpolymer based elastomeric homogenous membrane.

### **PRODUCT**

EPDM Membrane Waterproofing: Shall be Sure-Seal EPDM Membrane, sheet, between 1.5mm – 1.6mm thick, and shall meet or exceed the following requirements:

1. Tensile Strength: 1630 psi minimum, ASTM D 412
2. Ultimate Elongation: 520% minimum, ASTM D 412
3. Thickness Tolerance: + 10%, ASTM D 412
4. Tear Resistance: 230 lbf/in minimum, ASTM D 746
5. Brittleness Temperature: -45 F maximum, ASTM D 746
6. Water Absorption: 2% maximum, ASTM D 471, 7d at 158F
7. Permeance: 0.05 Perm maximum, ASTM E-96 B
8. Factory Seam Strength: Membrane rupture, ASTM D 816
9. Resistance to Heat Aging: Properties after 168 hrs. at 240F, ASTM D 573:
  - Tensile Strength: 1600 psi minimum
  - Ultimate Elongation 310% minimum
  - Linear Dimensional Change: -0.4 mass % maximum
10. Ozone Resistance: ASTM D 1149
  - No cracks after 100 ppm ozone, 168 hrs at 104F,
  - 50% strain
11. Meets ASTM D 6134 specification

**CHAPTER EIGHT**  
**DOORS AND WINDOWS**

---

## **CHAPTER EIGHT** **DOORS AND WINDOWS**

### **8.1 WOOD DOORS WITH STEEL FRAMES**

#### **PART 1 - GENERAL**

##### **DESCRIPTION OF WORK**

- A. Extent and location of each type of wood door is shown on Drawings and in schedules.
- B. Types of doors required include the following
  - 1. Flush wood doors with plastic laminate faces.
  - 2. Melamine doors and partitions.
- C. Shop finishing of wood doors is included in this section.
- D. Factory-preparation for door hardware (pre-machining) for wood doors, melamine doors and partitions are included in this section.
- E. The following related work is specified elsewhere:
  - 1. Door hardware installation.
  - 2. Painting.

##### **APPLICABLE CODES AND STANDARDS**

|                 |                                                                           |
|-----------------|---------------------------------------------------------------------------|
| ANSI/NWMA       | I.S.I Industry standards for wood flush doors.                            |
| AWI             | Quality Standard; Section 1300. Architectural woodwork quality standards. |
| BS 1186         | Quality of timber and workmanship.                                        |
| BS 4787: part 1 | Dimensions of wood doorsets.                                              |
| BS 5359         | Methods of testing doors.                                                 |

#### **PART 2 - PRODUCTS**

##### **MATERIALS AND COMPONENTS - GENERAL**

- A. General: Provide wood doors, melamine doors and partitions complying with applicable requirements for kinds and types of doors indicated on drawings and as scheduled and specified.
- B. Face Panels: Manufacturer's standard 2 or 3-ply face panels, unless otherwise indicated.
- C. Exposed Surfaces: Provide decorative picture on of the shown on drawings or scheduled and as further specified and approved by the Engineer. The picture should be fixed by glue on boards on every door to be used printed on vinyl sheets 3 mm thick.

##### **GENERAL FABRICATION REQUIREMENT**

- A. Transom and Side Panels: Wherever transom panels or side panels of wood are shown in same framing systems as wood doors, provide panels which match quality and

appearance of associated wood doors, unless otherwise indicated. Fabricate matching panels with same construction, exposed surfaces and finish as specified for associated doors or by adding a picture on each door.

- B. Openings: Cut and trim openings through doors and panels as shown. Comply with applicable requirements for kind(s) of doors required.
  - 1. Openings: Factory cut openings. Trim openings with solid wood edgings and mouldings as indicated or required.
  - 2. Factory install vision panel glass in prepared openings.

#### **FLUSH DOORS: PLASTIC LAMINATE FACED**

- A. Typical Standard Doors:
  - 1. Facing: Plastic laminate, premium grade complying with BS 3794; 1.5mm thickness.
    - a. Color, Texture and Pattern: as indicated or as selected by the Engineer from manufacturer's standard range with picture on.
  - 2. Core: Precision planed softwood blockboard, butt-jointed and glued edge to edge to form a solid laminated construction.
  - 3. Edge: exposed hardwood framed stiles, top and bottom rails; tongued and grooved to core.
  - 4. Vision Panels: 6m thick glass as detailed.

#### **ADHESIVE**

- A. Adhesive for all interior doors shall be of MR grade.

#### **SHOP FINISH**

- A. Prefinish wood doors requiring transparent finish at factory or finish shop.
- B. Doors requiring paint finish shall be sandpapered smooth, filled and primed at factory, ready for site painting.
- C. Comply with recommendations of Applicable Codes and Standards for factory finishing of doors, including final sanding immediately before application of finishing materials.
  - 1. Provide finishes of type indicated or agreed with the Engineer, to match samples held by the Engineer.

#### **PRE-FITTING AND PREPARATION FOR HARDWARE**

- A. Pre-machine wood doors at factory.
- B. Machine doors for hardware requiring cutting of doors.

---

## **PART 3 - EXECUTION**

### **INSPECTION**

- A. Examine door frames and verify that frames are correct size and type and have been installed as required for proper hanging of corresponding doors. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **INSTALLATION**

- A. Condition doors to average prevailing humidity in installation area prior to hanging.
- B. Hardware: For installation refer to Door Hardware (Ironmongery) section of these specifications.
- C. Manufacturer's Instructions: Install wood doors in accordance with manufacturer's instructions and as indicated and required.
- D. Shop-Finished Doors: Restore finish on edges of shop finished doors before installation, if fitting or machining is required at the job site.

### **ADJUST AND CLEAN**

- A. Final Check:
  - 1. Replace doors damaged during installation or which are warped, bowed or otherwise unacceptable.
  - 2. Rehang or replace doors, which do not swing freely or operate smoothly and satisfactorily.
- B. Protection: Provide protection and maintain conditions in a manner acceptable to the Engineer that will ensure doors and door hardware, are undamaged at time of Taking Over.

## **8.2 ALUMINUM DOORS AND WINDOWS**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. Extent of aluminum doors and windows is indicated on Drawings and schedules.
- B. Types required for the project include:
  - 1. Exterior entrance doors and screens.
  - 2. Interior doors and screens.
  - 3. Exterior and interior windows.
  - 4. Louvers.
- C. Glass and glazing is specified elsewhere.
- D. Lock cylinders are specified in the Door Hardware (Ironmongery) of the specification. Cost is included within the cost of each item.

#### **SYSTEM DESCRIPTION**

- A. Performance Requirements: Provide aluminum assemblies that have been designed and fabricated to comply with the following specified performance characteristics. Compliance may be demonstrated by testing manufacturer's corresponding stock systems according to methods indicated.
- B. Thermal Movement: Provide exterior systems capable of withstanding thermal movements resulting from an ambient temperature range of 5 deg C. to external maximum in direct sunlight of 70 deg. C.
- C. Wind Loading: Provide assemblies capable of withstanding a uniform test pressure of 0.96 kPa (20 psf) inward and 0.96 kPa (20psf) outward when tested to ASTM E 330.
- D. Exterior Entrances Transmission Characteristics: Provide entrance doors with jamb and head frames that comply with requirements indicated for transmission characteristics.
  - 1. Air Leakage: Provide doors with an air infiltration rate per linear foot of perimeter crack, of not more than 0.0025 m3/s/m2 (0.50 CFM) for single doors and 0.005 m3/s/m2 (1.0 CFM) for pairs of doors when tested in accordance with ASTM E 283 at pressure differential of 75 Pa (1.567 psf).
- E. Exterior Windows (and internal windows where applicable): Except as otherwise indicated, comply with air infiltration tests, water resistance tests, and applicable load tests, specified in ANSI/AAMA 302.9 for type and classification of window units required in each case; or, comply with applicable British Standards, i.e. BS 4873, 4315, Part 1.
- F. Applicable Codes and Standards:
  - ASTM E 330 Structural Performance
  - ASTM E 331 Water Penetration
  - BS 1470 Aluminum Plate Sheet and Strip
  - BS 1474 Aluminum Bars, Extrusions
  - BS 4315 Methods of Tests for Resistance to Air and Water Penetration

---

## SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications, technical data, standard details, and installation recommendations for each type of product required. Include the following information:
  - 1. Fabrication methods.
  - 2. Finishing.
  - 3. Hardware.
  - 4. Accessories.
- B. Shop Drawings: submit shop drawings for fabrication and installation of Aluminum doors and windows, including the followings:
  - 1. Elevations.
  - 2. Details section of typical composite members.
  - 3. Hardware, mounting heights.
  - 4. Anchorages and reinforcements.
  - 5. Expansion provisions.
  - 6. Glazing details.
- C. Samples: submit pairs of samples of each type and colour of Aluminum finish, on 300mm long sections of extrusions or formed shapes and on 150mm square sheets. Where colour or texture variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of variations.
- D. Certification: Provide certified test results showing that systems have been tested by a testing laboratory or agency acceptable to the Engineer, and comply with specified performance characteristics.

## QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Unless otherwise acceptable to the Engineer provide doors and windows produced by a single manufacturer with not less than 5 years successful experience in the fabrication of assemblies of the type and quality required.
- B. Design Criteria: Drawings indicate sizes, spacing of members, profiles and dimensional requirements of doors and windows. Minor deviations will be accepted in order to utilize manufacturer's standard products when, in the Engineer's sole judgment; such deviations do not materially detract from the design concept or intended performances.

## PROJECT CONDITIONS

- A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

---

## **PART 2 - PRODUCTS**

### **MANUFACTURERS**

- A. Available Manufacturers: subject to compliance with requirements, manufacturers offering products which may be incorporated in the work of a good factory.

### **MATERIALS**

- A. Aluminum Members: Provide alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221; BS 1474 for extrusions and ASTM B 209; BS 1470 for sheet or plate.
- B. Fasteners: Provide fasteners of Aluminum or non-magnetic stainless steel (316) and fully compatible with Aluminum components, hardware, anchors and other components.
1. Reinforcement: Where fasteners screw-anchor into Aluminum less than 3mm thick, reinforce the interior with Aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non corrosive pressed- in splined grommet nuts.
  2. Exposed Fasteners: Use of exposed fasteners will not be acceptable unless specifically approved by the Engineer. For the application of hardware and subject to approval by the Engineer, use fasteners that match the finish of member or hardware being fastened.
    - a. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Brackets and Reinforcements: Where feasible, provide high- strength aluminum brackets and reinforcements; otherwise provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386; BS 729.
- D. Concrete/Masonry Inserts: Provide concrete and masonry inserts fabricated from cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386; BS 729.
- E. Compression Weather-stripping: Provide the manufacturer's standard replaceable compressible weather-stripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.
- F. Sliding Weather-stripping: Provide the manufacturer's standard replaceable weather-stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.
- G. Glass and Glazing Materials: Comply with requirements of Glass and Glazing section of the specifications.

### **COMPONENTS**

- A. Aluminum Door, Window and Louver Frames: Fabricate from manufacturer's standard tubular and channel frame assemblies, with welded or mechanical joints in accordance with manufacturer's standards; reinforce as necessary to support required loads. Provide and incorporate all Aluminum components, accessories, and anchorages as indicated and required.
1. Design: Provide doors and windows of thickness and design indicated.
  2. Glazing: Fabricate doors and windows to facilitate replacement of glass or panels, without disassembly of frames. Provide snap-on extruded aluminum glazing stops,

with exterior stops anchored for non-removal, or heat-resisting PVC glazing sections of a type approved by the Engineer.

- B. Glass: Provide manufacturer's standard glass of the type and thickness indicated on drawings, or otherwise approved by the Engineer.

## **HARDWARE**

- A. General: Refer to Door Hardware section of the specification for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.
- B. Provide manufacturer's heavy-duty hardware units as indicated, scheduled, or required for operation of each door, of sizes, number, and type recommended by manufacturer and approved by the Engineer, for service required, finished to match door.
  - 1. Keyed Cylinders: Provide mortise type, 5-pin tumbler, outside cylinder units with cast aluminum face;
    - a. co-ordinate and comply with master keying requirements specified in Door Hardware section of the specification.
  - 2. Exterior Entrance Thresholds: Provide extruded aluminum threshold or size and design indicated in mill finish, complete with anchors and clips, coordinated with pivots and floor-concealed closers.

## **FABRICATION**

- A. General: Sizes of door, frame and window units, and profile requirements, are indicated on drawings. Variable dimensions are indicated, with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
- B. Prefabrication: Before shipment to the project site, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble components only as necessary for shipment and installation.
  - 1. Preglaze door, and window units to greatest extent possible.
  - 2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
  - 3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.
- C. Welding: Grind exposed welds smooth and restore mechanical finish.
- D. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.
- E. Dissimilar Metals: Separate dissimilar metals with bituminous paint, or other separator that will prevent corrosion.
- F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
  - 1. Uniformity of Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.
- G. Fasteners: Conceal fasteners.

- H. Weather-stripping: For exterior doors and windows, provide compression weather-stripping against fixed stops; at other edges, provide sliding weather-stripping retained in adjustable strip mortised into door or window edge.

## **FINISHES**

- A. General: Refer to drawings/schedules for type of finish required.
- B. Natural Anodized Finish: Provide non-specular as fabricated mechanical finish; chemical etch, medium matte; minimum thickness 0.025 mm clear anodic coating.
  - 1. Provide natural anodized finish for flush aluminum unless otherwise indicated.

## **PART 3 - EXECUTION**

### **INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation.

### **ADJUSTING**

- A. Adjust operating hardware to function properly, for smooth operation without binding, and for weather tight closure.

### **CLEANING**

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

### **PROTECTION**

- A. Institute protective measures required throughout the remainder of construction period to ensure that aluminum doors, screens and windows will be without damage or deterioration, other than normal weathering, at time of Taking- Over.

---

## **8.3 GLASS AND GLAZING**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. Extent of glass and glazing work is indicated on Drawings and schedules.
- B. Work in this section include glass and glazing for:
  - 1. Aluminum doors and screens.
  - 2. Aluminum windows.
  - 3. Wood doors.
- C. Mirror glass units are specified elsewhere.

#### **SYSTEM DESCRIPTION**

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.

#### **QUALITY ASSURANCE**

- A. Glass and Glazing Standards: Conform and comply with relevant ASTM, ANSI, BS or alternative equivalent codes and standards acceptable to the Engineer which establish minimum qualitative and quantitative requirements for glass and glazing products and methods of installation for the types indicated and required.
- B. Where the following products are indicated or required, provide glass which complies with relevant testing requirements of specific standards, and which are labeled and listed as such by a testing and inspection agency acceptable to the Engineer.
  - 1. Safety glass.
  - 2. Fire resistance rated wire glass.
- C. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer for each and condition of glass and glazing indicated or required.

### **PART 2 - PRODUCTS**

#### **GLASS PRODUCTS, GENERAL**

- A. Primary Glass Standard: Provide primary glass which complies with specific referenced standard requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
- B. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

### **PRIMARY GLASS PRODUCTS**

- A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), to FS DD-G-451 or BS 952: Section I: Part 3.
- B. Tinted Float Glass: Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select).
- C. Wired Glass: Type II (patterned and wired glass, flat), Class 1 (translucent), Quality q8 (glazing); complying with for resistance requirements; 6mm thick; of form and mesh pattern indicated below:
  - 1. Polished Wire Glass: Form 1 (wired, polished both sides), Mesh m2 (square).

### **GLAZING SEALANTS, TAPES AND GASKETS**

- A. General: Provide manufacturer's standard products of types indicated or required and complying with specific referenced standards and the following requirements:
  - 1. Compatibility: Select glazing sealants, tapes and gaskets of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
  - 2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants, tapes and gaskets which have performance characteristics suitable for applications indicated and conditions at time of installation.
  - 3. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Engineer from manufacturer's standard colors.

### **MISCELLANEOUS GLAZING MATERIALS**

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.
- F. Compressible Filler Rods: Closed-cell or waterproof jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 35-69 kPa compression strength for 25 percent deflection.

---

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Inspect work of glass framing assembling for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

### **PREPARATION**

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings, which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

### **GLAZING, GENERAL**

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge, which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant substrate testing.

### **GLAZING**

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 150 mm from corner, unless otherwise required. Set blocks in thin course of sealant, which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 1250 mm length plus height, except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 3 mm minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set glass units in each series with uniform pattern, draw, bow and similar characteristics.

- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes/gaskets to protrude out of channel and eliminate dirt & moisture pockets
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- I. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- J. Lock-Strip Gasket Glazing: Comply with gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

#### **PROTECTION AND CLEANING**

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove non permanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

## **8.4 DOOR HARDWARE (IRONMONGERY)**

### **PART 1 - GENERAL**

#### **DESCRIPTION OF WORK**

Section includes: Hardware for steel & Wooden Doors.

#### **STANDARDS**

|                  |                                                                                                                                                            |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BS EN 1303: 1998 | Building Hardware Cylinders for Locks.                                                                                                                     |
| BS 7352: 1990    | Specification for strength and durability performance of metal hinges for side hung applications and dimensional requirements for template drilled hinges. |
| BS 3621: 1980    | Defines what constitutes a minimum standard of good security within a lock.                                                                                |
| BS 5872: 1980    | Specifications for locks and latches for doors in buildings.                                                                                               |
| BS EN 1125       | Panic exit devices – requirements and test methods.                                                                                                        |
| BS 1154: 1997    | Controlled door closing devices requirements & test methods.                                                                                               |
| BS 476           | Applicable to all fire rated building materials and structures. This test is a must whenever fire rated elements are requested                             |
| Fire Rating      | All hardware used on fire rated doors should comply to same standards of fire rating as doors and of same fire rating hours.                               |

#### **SUBMITTALS**

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
  - 1. Details of electrified door hardware. Include location, sequence of operation, and interface with other building control systems.
  - 2. Indicate type, locations and mounting heights of each type of hardware as scheduled, catalogue cuts, electrical characteristics and connection requirements.
  - 3. Submit manufacturers parts, lists and templates.
- C. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.
- D. Samples for Approval: For exposed door hardware, representative of each type required, in specified or selected finish, full size. Tag with identification for coordination with the Door Hardware Schedule.
  - 1. Submit samples before submission of the Door Hardware Schedule.
- E. Door Hardware Schedule: Prepared by or under the supervision of door hardware supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
- F. Keying Schedule: Prepared by or under the supervision of door hardware supplier, detailing final keying instructions for locks. Include keying diagram and index each key set to unique door designations.

- G. Manufacturers Installation Instruction: Submit special procedure, perimeter conditions, requiring special information.

## **QUALITY ASSURANCE**

- A. Source Limitations: Obtain all door hardware from a single manufacturer or supplier, unless otherwise indicated.

## **PART 2 - PRODUCTS**

### **MATERIALS AND FABRICATION - GENERAL**

- A. Hand of door: The Drawings show the direction of slide, swing or hand of each door leaf. Provide each item of hardware for proper installation and operation of the door swing as shown.
- B. Manufacturer's Name Plate: Do not use products which have manufacturer's name or trade name displayed in a visible location.
- C. Products: Provide manufacturer's standard catalogue products, conforming to templates, and generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws.
- D. Provide screws for installation with each hardware item. Provide Phillips flathead screws except as otherwise required or approved by the Engineer. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible.
- E. Concealed Fasteners: Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other work.
- F. Tools for Maintenance: Furnish two complete sets of any specialized tools as needed for Employer's continued adjustment, maintenance, and removal and replacement of hardware.
- G. **HARDWARE FINISHES**
1. General: Exposed surfaces of hardware shall have manufacturer's standard satin anodized or stainless steel finish as indicated by the components listed in the Door Hardware Schedule.

## **COMPONENTS**

### **A. GENERAL HARDWARE REQUIREMENTS**

Where not specifically indicated, comply with applicable BS standards for each type of hardware required. Provide each type of hardware with accessories as required for the applications indicated and for complete, finished operational door.

1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently to avoid delay in work.

2. Reinforcement Units: Furnished by door and frame manufacturers; coordinated by hardware supplier.
3. Fasteners: Furnished as recommended by hardware manufacturers to comply with application involved (steel, wood, etc.), and as required to secure hardware.
4. Hand of door: The drawing shows the direction of swinging or hand of each door leaf. Furnish each item of ironmongery for proper installation and operation of the door movement as shown.
5. Product finishes: the product finish to be as indicated in schedule as selected from manufacturers wide range of finishes.

**B. HINGES, BUTTS AND PIVOTS:**

Provide hinges, Butts and pivots as follows:

**Number of Hinges:** Unless otherwise indicated, supplier should provide number of hinges per leaf to comply with his product fire rating test / certificate. A proof of such test should be presented.

As a general recommendation, three hinges should be provided for net leaf size of 2135mm X 915mm and a fourth hinge for bigger size.

1. **Type of Hinges:**
  - a. Provide full mortise 5-knuckle, Two ball bearing hinges standard weight, stainless steel in compliance with BS7352: 1990 class 9.
  - b. Provide full mortise rising hinges, standard weight, stainless steel.
2. **Hinge size:** Unless otherwise indicated, or specified provide door hinge that comply with the requirements of and are sized in compliance with BS7352: 1990, being 4" x 3" x 3mm.
3. **Screws:** Furnish Philips Flat – Head machine screws for installation of units, except furnish Philips flat-head all purpose or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
4. **Hinge pins:** Unless otherwise specified, provide hinge pins as follows:
  - a. Interior doors: removable stainless steel pin
  - b. Exterior doors: non-removable pin
5. **Pivots:** As recommended by manufacturer for size and weight and thickness of door, also check related drawings for further details.

**C. LOCKS AND LATCHES:**

1. Unless otherwise indicated or specified, provide locks and latches that comply with BS 5872: 1980.
2. Strikes: Provide manufactures standard strikes for each latch or lock bolt: with curved lip executed to protect frame, finish to match ironmongery sets.
3. Rabbeted doors: where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.
4. Provide 76mm Euro profile mortise Sashlock case, 57mm backset 57mm centers, brass follower to suit 8mm spindle, with adjustable tension spring to suit heavy unsprung or sprung lever furniture meeting BS5872 and fire rated to BS476, Stainless steel finish.
5. Provide 76mm Euro profile mortise dead lock case 57mm back set, to meet BS5872 and fire rated to BS 476, stainless steel finish.
6. Provide 76mm mortise bathroom lock, 57mm backset centers with reversible latch bolt, to suit 8mm spindle with adjustable tension spring, and dead bolt follower 5mm, stainless steel.
7. Provide 76mm Euro profile mortise nightlatch lock case, 57mm backset 57mm centers, brass follower to suit 8mm spindle, brass latchbolt, automatic locking action

without key,when door is closed with latch bolt out,reversible latch bolt,cylinder and lever handle,to suit either hand of door.

8. Equip locks with euro profile double cylinder, 5 pins with length to match with the door thickness and the related installed accessories.
9. Equip locks with Euro-profile single cylinder,5 pins with length to match with the door thickness and the related installed accessories.
10. Equip locks with Euro-profile single cylinder plus thumbturn,5 pins with length to match with the door thickness and the related installed accessories.
11. All locks are to differ and are ensuite to grand master key, with 5 pin cylinders.
12. Provide 3 keys for each lock, finish as manufacturers standard unless otherwise indicated.
13. Provide thumbturn with indicator monitor and emergency release to comply with the provided bathroom lock, stainless steel finish.

D. FLUSH BOLTS AND DUST PROOF STRIKES:

1. **Flush Bolts:**
  - a. Lever action manual flush bolt to comply with steel leaf application and fire rating. Manufacturer standard finish unless otherwise indicated.
  - b. Automatic flush bolt to comply with steel leaf application and fire rating. Manufacturer standard finish unless otherwise indicated.
  - c. Lever action manual flush bolt to comply with wooden leaf application and fire rating. Manufacturer standard finish unless otherwise indicated.
  - d. Automatic flush bolt to comply with wooden leaf application and fire rating. Manufacturer standard finish unless otherwise indicated.
2. **Dust proof strike:** provides dust proof strikes for foot bolts except where special threshold construction requires specific type. Finish as requested by the Engineer unless otherwise indicated.

E. LEVER HANDLES:

1. Provide one set 19mm diameter 130mm length, 71mm projection lever handle on 50mm diameter rose manufactured from stainless steel.
2. Provide lever handle with half-spindle on one side to comply with the provided night latch lockset and to be 19mm diameter 130mm length 71mm projection on 50mm diameter rose,spring loaded,manufactured from stainless steel.

F. PULL HANDLES / PUSH PLATES/MIDPLATES/KICKPLATES:

1. **Pull Handles:** Provide 19mm diameter 225mm C/C pull handle bolt through. Manufactured from stainless steel sheet rolled. Mounting location as indicated on shop drawings.
2. **Push Plate:** Provide 350mm x150mm,1.2mm thick, stainless steel satin finish push plate. Round cornered with counter sunk screws. Mounting location as indicated on shop drawings.
3. **Midplates:** Provide 1.2mm thick, stainless steel satin finish with size to comply with the door width (DWx150mm) mid plate. Midplates to be round cornered with counter sunk screws. Mounting location as indicated on shop drawings.
4. **Kickplates:** Provide 1.2mm thick, stainless steel satin finish with size to comply with the door width (DWx200mm) kickplate. Kickplates to be round cornered with counter sunk screws. Mounting location as indicated on shop drawings.

G. EXIT DEVICES:

1. **General:** Unless otherwise indicated or specified, emergency exit devices shall comply with BS EN 1125 specification requirements for panic bolts and panic latches. And fire rated to BS 476.
  - a. Cross bar exit device for single leaf with reversible panic latch and outside trim, silver finish. Location as indicated on hardware schedule.
  - b. Cross bar Vertical rod panic bolt to be installed on double leaf doors with outside trim location as indicated on hardware schedule, silver finish.

H. DOOR CLOSER:

1. **General:** Unless otherwise indicated or specified, closers and door control devices shall comply with the applicable requirements of BS EN 1154: 1997 and finish shall be subject to the approval of the engineer.
2. **Specification of Unit:** Door closer with silver cover which features a cast iron body with a hardened steel rack and pinion incorporating needle roller bearing housed beneath a precision zinc die cast cover. And to have the following.
  - a. Template and quick-fit back plate
  - b. 2-4 adjustable strength size or size to suit door weight and dimensions
  - c. Non-handed.
  - d. 180 deg. Opening/controlled closing
  - e. Separate adjustment of latch action & closing speed.
  - f. Temperature compensation –15deg C to +40deg C.
  - i. Matching arms.
  - j. Quick release arm assembly
  - k. Pre assembled arm assembly
  - l. Tripacked for applications
    1. Regular, closer is fitted to the pull (hinge knuckle) face of the door.
    2. Transom mounted, closer is fitted to the transom on push face of the door. Bracket fitted to the door face.
    3. Parallel arm, closer is fitted to the push (opposite to hinge knuckle) face of the door. Bracket is fitted to underside of head frame.
  - m. Closer Cover design and finish is to be approved by the engineer in charge.

I. DOOR SELECTOR (DOOR COORDINATOR):

Provide door selector to comply with Application involved and the BS requirements for fire rating and performance. Type and finish to be approved by the Engineer in charge.

J. DOOR STOP

1. **General:** Unless otherwise indicated or specified door stops shall comply with the latest British standard applicable.
2. Door Stop Units shall include but shall not be limited to door ironmongery as follows:
  - a. Dome Stop
  - b. Wall Bumpers
  - c. Security Door Stop

K. DOUBLE ACTING FLOOR SPRING;

1. **General:** Unless otherwise indicated or specified, double acting floor springs shall comply with the applicable requirements of the European standards for controlled door closing devices **BS EN 1154:1997**. Finish shall be subject to the approval of the engineer in charge.

**L. ACCESSORIES:**

- Provide Escutcheon for euro profile cylinder finish to match ironmongery sets.
- Provide room identification signs to comply with the application involved, shape and finish as approved by the Engineer in charge.
- Provide Hat and Coat Hook buffered, finish to match ironmongery sets.
- Provide: Rubber door silencer manufacturer standard type.
- Provide rubber seals for groove type frames manufacturer standard type.

**PART 3 - EXECUTION**

**EXAMINATION**

- A. Administrative requirements: coordination and project condition
- B. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings.

**INSTALLATION**

- A. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in other sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- B. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- C. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

**ACTIVE LEAF OF PAIRS OF DOORS**

- A. Active leaf of pairs of doors shall be RHRB except that where door leaves are unequal, active leaf shall be larger leaf.

**HARDWARE MOUNTING HEIGHTS**

- A. Mount hardware units at heights generally in accordance with the following, except as otherwise required by the Engineer, or specifically indicated on drawings or required to comply with governing regulations, or avoid interferences
  - 1. Lock Sets and Latches: 950 mm to center of lever or knob from floor.
  - 2. Butt Hinges: 250 mm to bottom of lowest hinge from floor; 125 mm to top of upper hinge from top of door; space other hinges equally between lower and upper hinges.
  - 3. Door Pulls: 1140 mm finish floor to center of pull; center line in 125 mm from edge of flush doors, and centered on stile of narrow stile glass doors.
  - 4. Deadlocks: Center line of cylinder to align with center line of cylinder for lock sets, except where location conflicts with pull handle or push plate, then provide at 1520 mm from finished floor to centerline of cylinder.
  - 5. Cross Bar Exit Devices: 910 mm for standard installations.

6. Push Rail Exit Devices: 1040 mm for standard installations.
  7. Push Plate: 1220 mm finish floor to center of plate through mounted to pulls.
  8. Flush Bolt Operating Mechanisms: Top bolt 1675 mm to 1830 mm above finished floor, bottom bolt 300 mm above finished floor.
- B. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.
- C. Install each ironmongery item in compliance with the manufacturers instruction and recommendations whenever cutting and fitting is required to install ironmongery onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection. Do not install surface mounted items until finishes have been complete the substrates.
- D. Set Units plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. Separate aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials. Drill and countersink units which are factory prepared for anchorage fasteners, space fasteners and anchors in accordance with manufacturer's instructions or as directed.

#### **ADJUST AND CLEAN**

- A. Adjust and check each operating hardware item and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Instruct Employer's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

#### **HARDWARE SCHEDULE FOR DOORS**

Refer to Wooden Door Schedule, LEGEND & IRONMONGERY.

---

## **8.5 DECORATIVE DOOR FOR KG CLASSROOM**

### **1. PROTECTION AND COVERING PANEL WITH DECORATIVE CUT OUTS**

#### **DESCRIPTION**

Half-height decorative one colour door protection (Iron, Wave, Mountain or Cubic masks from antibacterial PVC achieving Bs2d0 fire rating with solid colour. Lightly textured surface finish, 2 mm thick. A protective film is specified to minimize cleaning before acceptance.

#### **ENVIRONMENT**

No heavy metals are used in its formulation, including lead or tin (insignificant levels, less than 50 ppm) or any CMR Cat. 1 or 2 substances. The calcium-zinc thermal stabilization process is used. The emission level of volatile substance in inside air has been tested according to ISO 16000 and is very low (A+) according to the French regulation (23 March 2011 No. 2011-321 Decree and 19 April 2011 Order). 100% of the product are recyclable.

#### **COLOUR**

Selected by Architects from manufacturer's standard range.

#### **INSTALLATION METHOD**

Glue, as per manufacturer's instructions.

### **2. INLAYED SIGNAGE DESCRIPTION**

Inlayed signage in half-door protection from rigid and antibacterial PVC achieving BS2d0 fire rating with solid color and textured surface 2 mm thick.

#### **ENVIRONMENT**

No heavy metals are used in its formulation, including lead or tin (insignificant levels, less than 50 ppm) or any CMR Cat. 1 or 2 substances. The calcium-zinc thermal stabilization process is used. The emission level of volatile substance in inside air has been tested according to ISO 16000 and is very low (A+) according to the French regulation (23 March 2011 No. 2011-321 Decree and 19 April 2011 Order). 100% of the product are recyclable.

#### **COLOUR**

Selected by Architects from manufacturer's standard range.

#### **INSTALLATION METHOD**

Glue, as per manufacturer's instructions.

---

## 8.6 **MASTER KEY**

### A. LOCKSET KEYING

1. General: Unless otherwise indicated all locksets shall be master keyed to a system of grand master, master and sub-master. Keying provisions and specific requirements are to be reviewed, agreed and approved by Employer, prior to incorporation into final keying schedule
  - a. Grand Master: Each entire building.
  - b. Master: Each department of each building.
  - c. Sub-Master: Each floor level of each building.
2. Construction Keying: Provide all locksets construction keyed.
  - a. Turning a master key in a lockset shall negate all construction keys.
3. Keys: Provide and deliver the following keys, tagged and labelled, in a sealed container to the Employer:
  - a. Lockset Keys: Three, plus one blank.
  - b. Sub-Master Keys: Three.
  - c. Master Keys: Three.
  - d. Grand Master Keys: Two.

## **CHAPTER NINE** **FINISHES**

## **CHAPTER NINE** **FINISHES**

### **9.1 LATH AND PLASTER**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Extent of lath and plaster is indicated on Drawings and Schedules.
- B. Types of work include:
  - 1. Metal lathing.
  - 2. Portland cement plastering.

##### **QUALITY ASSURANCE**

- A. Field Construction Mock-up: Prior to installation of plaster work, fabricate mock-up panels for each type of finish and application required using materials, including lath accessories and support system (if any) indicated for final work. Build panels 1.2 m x 1.2 m x full thickness in location indicated, or if not otherwise indicated, as directed by Engineer. Demonstrate the proposed range of colour, texture and workmanship to be expected in completed work. Obtain Engineer acceptance of panel's visual quality before start of work. Retain panel during construction as a standard for judging completed work.

##### **APPLICABLE CODES AND STANDARDS**

|           |                                                                                              |
|-----------|----------------------------------------------------------------------------------------------|
| ASTM C150 | Specification for Portland Cement.                                                           |
| BS 12     | Specification for ordinary and rapid hardening Portland cement.                              |
| BS 890    | Building limes.                                                                              |
| BS 1198,  |                                                                                              |
| BS 1199,  |                                                                                              |
| BS 1200   | Building sands from natural sources.                                                         |
| BS 1369   | Metal lathing (steel) for plastering.                                                        |
| BS 4049   | Glossary of terms applicable to internal plastering, external rendering and floor screeding. |
| BS 4721   | Specification for ready-mixed building mortars.                                              |
| BS 5262   | Code of practice for internal plastering.                                                    |
| BS 6452   | Beads for internal plastering and dry lining.                                                |

#### **PART 2 - PRODUCTS**

##### **LATH**

- A. Expanded Metal Lath: Fabricate expanded metal lath from galvanized steel sheet to produce lath complying with BS 1369 for type, configuration and other characteristics indicated below, with uncoated steel sheet painted after fabrication into lath.
  - 1. Diamond Mesh Lath: Comply with the following requirements:
    - Configuration: Flat.
    - Weight: 1.60 kg/m<sup>2</sup>.

---

## **PLASTER ACCESSORIES FOR PORTLAND CEMENT PLASTER**

- A. General: Comply with material provisions of BS 1369 and BS 5262; coordinate depth of accessories with thicknesses and number of coats required.
- B. Metal Corner Reinforcement: Expanded large mesh diamond mesh lath fabricated from tight coat galvanized sheet steel to comply with BS 5262, with weight 2.25 kg/m<sup>2</sup> and formed to reinforce external corners of Portland cement plaster on exterior exposures while allowing full plaster encasement.
- C. Metal Corner Beads: Small nose corner beads fabricated from tight coat galvanized sheet steel, synthetic coated fitted with PVC strip.
- D. Casing Beads: Square-edged style, with expanded flanges and removable protective tape, of the following material:
  - 1. Material: Zinc-coated steel with PVC strip.
  - 2. Two-Piece type: Pair of casing beads with back flanges to provide slip joint action, adjustable for joint widths from 3 mm to 15 mm, with PVC edging.

## **PORTLAND CEMENT PLASTER MATERIALS**

- A. Base Coat Cements: Type as indicated below:
  - 1. Portland cement, ASTM C 150, Type I or III; BS 12.
- B. Finish Coat Cement: Type as indicated below:
  - 1. Portland cement, ASTM C 150, Type I; BS 12.
- C. Factory-Prepared Finish Coat: Manufacturer's standard product requiring addition of water only.
  - 1. Product: Subject to compliance with requirements and approval of the Engineer.
- D. Lime: Special hydrated lime for finishing purposes, ASTM C 206, Type S; or BS 890 Type.
- E. Sand Aggregates: ASTM C 897; BS 1199.

## **MISCELLANEOUS MATERIALS**

- A. Water for Mixing and Finishing Plaster: Drinkable, free of substances capable of affecting plaster set or of damaging plaster, lath or accessories.
- B. Bonding Agent for Portland Cement Plaster: ASTM C 932.
- C. Plasticiser: Manufacturer's standard product, subject to compliance with requirements and approval of the Engineer may be used in accordance with manufacturer's recommendations and instructions.

## **PORTLAND CEMENT PLASTER MIXES AND COMPOSITIONS**

- A. General: Comply with ASTM C 926 or BS 5262 for Portland cement plaster base and finish coat mixes as applicable to plaster bases, materials and other requirements indicated.

- B. Portland Cement Plaster Base Mixes and Compositions: Proportion materials for respective base coats in parts by volume for cementitious materials and in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.
1. Three-Coat Work over Metal Lath: Base coats as indicated below: Scratch Coat: 1 part Portland cement,  $\frac{1}{2}$  part lime, 4 parts sand. Brown Coat: 1 part Portland cement,  $\frac{1}{2}$  part lime, 4 parts sand.
  2. Two-Coat Work over Concrete Unit Masonry: Base coats as indicated below. Base coats: 1 part Portland cement,  $\frac{1}{2}$  part lime, 4 parts sand.
- C. At Contractor's option, provide one of the following:
1. Job-Mixed Portland Cement Plaster Finish Coats: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials for aggregates to comply with the following:
    - a. 1 part Portland cement,  $\frac{3}{4}$  -  $1\frac{1}{2}$  parts lime, 3 parts sand.
  2. Factory-Prepared Portland Cement Finish Coats: Add water only; comply with finish coat manufacturer's directions.
- D. Mixing: Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and recommendations of plaster manufacturer.

### **PART 3 - EXECUTION**

#### **INSTALLATION OF LATHING AND FURRING, GENERAL**

- A. Portland Cement Plaster Lathing and Furring Installation Standard: Install lathing and furring materials indicated for Portland cement plaster to ANSI A42.3 or BS 5262.

#### **METAL LATHING**

- A. Install expanded metal lath for the following applications where plaster base coats are required. Provide appropriate type, Configuration and weight of metal lath selected from materials indicated which comply with referenced lathing installation standards.
1. At junctions and joints between differing materials and forms of construction, and at all chases and other places where making good occurs.
    - a. Install minimum 150 mm wide strip of lath, fixed to substrate on both edges at minimum 600 mm centres.

#### **INSTALLATION OF PLASTERING ACCESSORIES**

- A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Mitre or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
- B. Accessories for Portland Cement Plaster:
1. Corner Bead: Install at all external corners.
  2. Casing Beads: Install at termination of plasterwork unless otherwise indicated.

3. Control joints: Install control joints at location indicated, or if not indicated, at locations complying with the following criteria and approved by the Engineer.
  - a. Where an expansion or control joint occurs in surface of construction directly behind plaster membrane.
  - b. Where distance between control joints in plaster surfaces exceeds 5.5 m in either direction.
  - c. Where area within Portland cement panels exceeds 10 m<sup>2</sup>.
  - d. Where Portland cement plaster panels sizes or dimensions change. Extend joints full width or height of plaster membrane.

### **PLASTER APPLICATION, GENERAL**

- A. Prepare monolithic surfaces for bonded base coats and use bonding compound or agent to comply with requirements of referenced plaster application standards for conditioning of monolithic surfaces.
- B. Tolerances: Do not deviate more than 3 mm in 1.8 m from true plane in finished plaster surfaces, as measured by a 1.8 m straightedge placed at any location on surface.
- C. Grout hollow metal frames, bases and similar work occurring in plastered areas, with base coat plaster material and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout 150 mm lengths at each anchorage.
- D. Sequence plaster application with the installation and protection of other work, so that neither will be damaged by the installation of the other.
- E. Apply thicknesses and number of coats of plaster as indicated; or as required by reference standards.
- F. Concealed Plaster: Where plaster application will be concealed above suspended ceilings and similar locations, finish-coat may be omitted; where used as a base for adhesive application of tile and similar finishes, omit finish-coat and coordinate thickness with overall dimension as shown, and comply with tolerances specified.

### **PORTLAND CEMENT PLASTER APPLICATION**

- A. Portland Cement Plaster Application Standard: Apply Portland cement plaster materials, compositions, and mixes to comply with ASTM C 926 or BS 5262.
- B. Number of Coats: Apply Portland cement plaster, of composition indicated, to comply with the following requirements:
  1. Use three-coat work over metal lath.
  2. Use two-coat work over the following plaster bases:
    - a. Concrete unit masonry.
    - b. Concrete cast-in-place or precast when surface complies with ASTM C 926 or BS 5262 for plaster bonded direct to solid base.
  3. Finish Coat: Floated finish unless otherwise indicated; match Engineer sample.
- C. Thickness:
  1. Thickness of external plaster (render) shall be 25 mm, 3 coat application over metal lath, having smooth wood float finish.
  2. Thickness of internal plaster shall be 15 mm, 2 coat application. Having smooth steel float finish.

- 
- D. Moist cure Portland cement plaster base and finish coats to comply with ASTM C 926 or BS 5262, including recommendations for time between coats and curing.

#### **CUTTING AND PATCHING**

- A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to the substrate has failed.
- B. Sand smooth troweled finishes lightly to remove trowel marks and arises.

#### **CLEANING AND PROTECTION**

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces, which are not to be plastered. Repair floors, walls and other surfaces, which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.
- B. Provide final protection and maintain conditions, in a manner acceptable to the Engineer, which ensures plasterwork being without damage or deterioration at time of Taking-Over.

---

## **9.2 TILING WORKS**

### **9.2.1 CERAMIC WALL & FLOOR TILE**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Definition: Tile includes ceramic surfacing units made from clay or other ceramic materials.
- B. Extent of tile works is indicated on Drawings and Schedules.
- C. Types of tile work in this section include the following:
  - 1. Non slip ceramic floor tile and base (full mass ceramic).
  - 2. Glazed ceramic wall tile.
- D. Portland cement plaster scratch coat is specified in Lath and Plaster specification section.
- E. Sealing expansion and other joints in tile work with elastomeric joint sealers is specified in Joint Sealers section of the specification.

##### **QUALITY ASSURANCE**

- A. Source of Materials: Provide materials obtained from one source acceptable to Engineer for each type and color of tile, grout and setting materials.
- B. Field-Constructed Mock-Up: Before installing tile, erect mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

#### **PART 2 - PRODUCTS**

##### **PRODUCTS, GENERAL**

- A. Standard for Ceramic Tile: comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated or BSCP 202 Tile Flooring and BS 6431 Ceramic Floor and Wall Tiles.
- B. Standard for Tile Installation Materials: Comply with standard referenced with installation products and materials indicated or with BS 6431.
- C. Colors, Textures and Patterns: For tile and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated or, if not otherwise indicated, as selected by the Engineer from manufacturer's standard range.
  - 1. Provide tile trim and accessories, which match color and finish of adjoining flat tile.

---

## TILE PRODUCTS

- A.      Vitrified Ceramic Floor Tile: Provide factory-mounted flat tile to BS 1286 type B.
1.      Wear Surface: Smooth, non-slip.
  2.      Nominal Facial Dimension: As indicated.
  3.      Nominal thickness: As indicated, or 10 mm if not.
  4.      Face: Plain with square edges.
- B.      Glazed Ceramic Wall Tile: complying with BS 1281.
1.      Wearing Surface: Smooth
  2.      Nominal Facial Dimensions: As indicated.
  3.      Nominal Thickness: As indicated, or 8 mm if not.
  4.      Face: Plain with cushion edges.
- C.      Base (Skirting): Cove base with square top edge; to match floor tiles; height as indicated, or 100 mm if not.
- D.      Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
1.      Size: as indicated, coordinate with sizes/coursing of adjoining tile where applicable
  2.      Shapes: As follows, selected from manufacturer's standard shapes:
    - a.      Base: Coved with square top edge, unless otherwise indicated.  
Provide external and internal corner angles as required.
    - b.      External Corners: Rounded, unless otherwise indicated.
    - c.      Internal Corners: Field-buttet square corners.

## SETTING MATERIALS

- A.      Thin-set Portland Cement Mortar: Use the following unless otherwise recommended by manufacturer or required by the Engineer:
1.      Latex-Portland cement mortar.
  2.      Epoxy mortar.
  3.      Organic adhesive.

## MISCELLANEOUS MATERIALS

- A.      Tile Cleaner: Product specifically acceptable to tile manufacturer and grout manufacturer for application indicated.

## MIXING MORTARS AND GROUT

- A.      Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

---

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Examine substrates and areas where tile will be installed, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **FLOOR INSTALLATION METHODS**

- A. Ceramic Floor Tile and Base: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types.
  - 1. Portland Cement Mortar: ANSI A108.1
    - a. Bond Coat: Portland cement paste on plastic bed; or thin-set portland cement on cured bed, ANSI A108.5, at Contractor's option.
    - b. Concrete Subfloors, Interior: TCA F112.
    - c. Grout: Latex-portland cement.
  - 2. Organic Adhesive: ANSI A108.4
    - a. Concrete Subfloors, Interior: TCA F116.
    - b. Grout: Latex-portland cement.

### **WALL TILE INSTALLATION METHODS**

- A. Install types of tile designated for wall application to comply with requirements indicated below for setting bed methods, TCA installation methods related to subsurface wall conditions, and grout types:
  - 1. Organic Adhesive: ANSI A108.4.
    - a. Solid Backing, Interior: TCA W223.
    - b. Grout: Latex-portland cement, with waterproofer.

### **CLEANING AND PROTECTION**

- A. Cleaning: Upon completion of placement of grouting, clean all ceramic tile surfaces so they are free from foreign matter.
  - 1. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finish Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.
- C. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft

---

paper or other heavy covering during construction period to prevent staining, damage and wear.

1. Prohibit foot and wheel traffic from using tiled floor for at least 7 days after grouting is completed.
2. Before final inspection, remove protective coverings and rinse neutral cleaning from tile surface.

---

## **9.2.2 VINYL FLOORING AND BASE**

### **9.2.2.1 VINYL FLOORING**

#### **PART 1 - GENERAL**

##### **DESCRIPTION**

- A. General:
1. Furnish all labor, materials, tools, equipment, and services for sheet vinyl flooring, in accord with provisions of Contract Documents.
  2. Completely coordinate with work of other trades.
  3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

##### **QUALITY ASSURANCE**

- A. Fire rating classification test: ASTM E84.
- B. Abrasion resistance test: Use one of the following:
1. ASTM D1044: No wear thru with 1000 gram weight at 20,000 cycles.
  2. Taber abraser using H-22 wheel under a 1000 gram load, depth of wear at 5000 cycles not to exceed an average of 0.178 mm (0.007 IN).
- C. Applicator must be approved in writing by materials manufacturer.
- D. Colors and patterns: The color and pattern of respective products specified in the section shall match appearance and as per the Engineering instruction.

##### **SUBMITTALS:**

- A. Shop drawings:
1. Layout showing joint pattern and orientation of directional patterns.
  2. Detail through integral coved base, base cap, and transition strip.
- B. Product data:
1. Manufacturer's literature for flooring and installation materials.
  2. Manufacturer's instructions for installation.
- C. Samples:
1. Samples of colors of flooring, transition strip, welding rod, and base cap strip.
- D. Project data:
1. Certification of applicator qualifications. The applicator should be qualified.

---

## **PART 2 - PRODUCTS**

### **MATERIALS**

- A. Sheet vinyl flooring (SV): F.S. SS-T-312, Type III (Vinyl), smooth face, not less than 3 mm thick and type (Creation 70 Clic System) or approved equal, not less than 6mm thick. Sheet flooring shall conform to material requirements specified for vinyl tile. Foam backed sheet flooring is not acceptable.
  - 1. Flame spread (ASTM E84): Not more than 75.
  - 2. Smoke developed (ASTM E84): Not more than 450.
  - 3. Size: Maximum size produced by the manufacturer to provide the minimum number of joints.
    - a. Furnish material in roll form, not less than 180 cm wide.
  - 4. Color and pattern of sheet flooring shall be of the same production run.
- B. Base accessories:
  - 1. Fillet strip: 19 mm radius fillet strip compatible with the resilient sheet material.
  - 2. Cap strip: Extruded flanged, zero edge, vinyl reducer strip approximately 25 mm exposed height with 12.7 mm flange.
- C. Base: as shown on drawings.

## **PART 3 - EXECUTION**

### **INSPECTION**

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Installation indicates acceptance of substrates and responsibility for performance.

### **PREPARATION**

- A. Test concrete substrate to assure moisture content of less than 3 percent. Assure that substrate is dry, clean and level prior to installation.
- B. Remove foreign matter that would prevent adhesion. Remove curing compounds.
- C. Sand concrete substrates with No. 3 sandpaper.
- D. Remove projecting irregularities by chipping or grinding smooth. Grind off high spots.
- E. Fill depressions and level the uneven surfaces with leveling compound.
- F. Rinse subfloor and allow to dry thoroughly before applying adhesive.

### **INSTALLATION**

- A. Install flooring and base as scheduled for rooms, and under and behind movable casework and equipment. Don not install resilient flooring under fixed floor- mounted casework.

- B. Provide integral radius coved at walls, columns, plasters, furred spaces, and other vertical surfaces.
  - 1. Install cove fillet strip behind integral bases.
  - 2. Provide cap strip at top of base.
  - 3. Form internal and external corners to the geometric shape generated by the cove at both square and radius corners.
- C. Install material in accord with manufacturer's instructions, and approved layout drawings.
- D. Install flooring in possible.
  - 1. Apply adhesive to substrate per manufacture's recommendations.
  - 2. Provide transition as required flooring abuts other flooring materials.
- E. Install flooring in adhesive with accurate, tight seams. Reverse alternate sheets.
- F. All sheets in one room or area shall be from same production run.
- G. Mismatched materials will be rejected.
- H. Welding seams: Heat welds all joints of and base using equipment and procedures developed by the flooring manufacturer.
  - 1. Welding shall consist of routing the joint, inserting a vinyl-welding rod into the routed space, and thermally fusing the rod into a homogeneous joint.
  - 2. Upon completion of welding, the surface across the joint shall finish flush, free from voids, and recessed or raised areas.
  - 3. Fusion of material: Joint shall be fused a minimum of 65 percent through the thickness of the material, and after welding shall meet the specified characteristics for the flooring.

#### **CLEAN**

- A. When final building cleanup is being accomplished, clean flooring by mopping with detergent and water. Rinse with clean water. Apply no soap, wax, polish or other coating on conductive sheet floors. Buff floor and base.
- B. Remove damaged flooring and provide new acceptable flooring at no additional expense to Owner.

---

### **9.2.2.2 VINYL RESILIENT BASE**

#### **PART 1 - GENERAL**

##### **DESCRIPTION**

- A. General:
  - 1. Furnish all labor, materials, tools, equipment, and services for resilient base in accord with provisions of Contract Documents.

##### **QUALITY ASSURANCE**

- A. Base st: F.S. SS-W-4(1).
- B. Base (Creation 70 Clic system) or approved equal.

##### **SUBMITTAL**

- A. Samples:
  - 1. Material, pattern and color of each type base to match selections in Color Schedule and Color Palette.

##### **PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in manufacturer's unopened containers indicating name, brand, color and pattern.

##### **JOB CONDITIONS**

- A. Protect adjacent work from damage.

##### **GUARANTEE**

- A. Written guarantee that material will not:
  - 1. Buckle, crack, lift, warp, shrink, change color, or disintegrate.
  - 2. Exude adhesives through joints or show any other defects attributable to materials or workmanship.
- B. Remove defective areas and provide new acceptable material as approved by the Architect at no additional expense.

#### **PART 2 - PRODUCTS**

##### **MATERIALS**

- A. Resilient base:
  - 1. Rubber top set, coved type; F.S. SS-W-40A (1), Type I, Style B.
  - 2. 3 x 100 mm x 6 mm wide at bottom.
  - 3. Factory formed external and internal corners.
  - 4. Provide continuous rolls.

- B. Resilient base at carpet:
  - 1. Rubber top set, straight type; F.S. SS-W-40A (1), Type I, Style A. 2. 3  
x 100 mm.
  - 3. Factory formed external and internal corners.
  - 4. Provide continuous rolls.
- C. Leveling compound: As recommended by resilient material manufacturer, compatible with adhesives.
- D. Adhesives and primers: As recommended by resilient material manufacturer for type of substrate and location, free from lingering odor.

#### **EXTRA MATERIAL**

- A. 150 cm of each color and type of base.
- B. Provide materials in clearly labeled containers.

#### **PART 3 - EXECUTION**

##### **INSPECTION**

- A. Verify that substrates are clean, free from moisture, and materials which may affect adhesion.
- B. Carefully examine surfaces for defects and irregularities.
- C. Installation constitutes acceptance of surfaces.

##### **PREPARATION**

- A. Fill cracks, joints, with a water resistant non-crumbling patching compound. Trowel level.

##### **INSTALLATION**

- A. Do not start in a room or space until work of other trades is complete. Coordinate with other floor and wall work and with ceiling installation.
- B. Apply primer and adhesive as recommended by manufacturer.
- C. Install base after wall material has dried out thoroughly.
  - 1. Provide base at intersections of floor and all vertical surfaces in areas shown or scheduled to receive base, where intersection is exposed to view.
  - 2. Set base straight and true.
  - 3. Fit into breaks and recesses.
  - 4. Neatly set or form all corners.
  - 5. Scribe to trim at door frames.
  - 6. Make joints tight.
  - 7. Install with top and bottom edge in firm contact with wall and floor.

#### **ADJUST AND CLEAN**

- A. Immediately after application, remove surplus adhesive.
- B. When materials have sufficiently seated, clean resilient base and adjoining surfaces in accord with manufacturer's recommendations.
- C. Leave smooth and clean.

### **9.2.2.3 ANTI-SHOCK RUBBER WORKS**

#### **PART 1- GENERAL**

##### **1.1 DESCRIPTION**

###### **A. General:**

1. Furnish all labor, materials, tools, equipment, and services for Anti-shock rubber tiles flooring, in accord with provisions of Contract Documents.
2. Completely coordinate with work of other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

###### **B. Scope**

The complete installation of a prefabricated tiles rubber sports surfacing system as manufactured.

###### **C. Related work specified under other section.**

1. Concrete Subfloors
  - a. Slab Depression: Equal to thickness of selected flooring.
  - b. Concrete Finish: shall be steel troweled, dense and finished smooth, not polished.
  - c. Slab Tolerance: A tolerance of 1/8" (3mm) radius shall be maintained throughout. Floor Flatness and Floor Levelness (FF and FL) numbers are no recognized.
  - d. No concrete curing, hardening or sealing agents shall be applied to the concrete subfloor.
2. Membrane Waterproofing
  - a. Concrete subfloors on or below grade shall be adequately waterproofed, beneath, at perimeter walls, and on earth side of below grade walls.
  - b. Type and extend of membrane shall be determined by the Project Engineer and installed by the General Contractor.

##### **1.2 QUALITY ASSURANCE**

American Society for Testing & Materials.

1. ASTM D 2047: Standard Test Method for Static Coefficient of Friction of Floor Surfaces.
2. ASTM D 2240: Standard Test Method for Rubber Property – Durometer Hardness.
3. ASTM E 648: Standard Test Method for Critical Radial Flux of Floor-Covering Systems Using a Radiant heat Energy Source.
4. ASTM E 662: Standard Test Method for Standard Test method for Specific Optical Density of Smoke Generated by Solid Materials.
5. ASTM F 970: Standard Test Method for Static Load Limit
6. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride.

##### **1.3 SUBMITTALS**

###### **A. Shop drawings:**

1. Layout showing joint pattern and orientation of directional patterns.
2. Detail through integral coved base, base cap, and transition strip.

- B. Product data:
  - 1. Manufacturer's literature for flooring and installation materials.
  - 2. Manufacturer's instructions for installation.
- C. Samples:
  - 1. Samples of colors of flooring, transition strip, welding rod, and base cap strip.
- D. Project data:
  - 1. Certification of applicator qualifications. The applicator should be qualified.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Materials must be delivered in manufacturer's original, unopened and undamaged packaging with identification labels intact.
- B. The general contractor shall provide an area where stored materials can be maintained at 20 to 28 degrees C).
- C. Store material upright in a secured area protected from exposure to harmful weather conditions on a clean, dry, flat surface protected from possible damage.

#### **1.5 SITE CONDITIONS**

- A. The prefabricated rubber tiles flooring specified herein shall not be installed until all trades including, but not limited to, masonry, painting, plaster, tile, marble, terrazzo, carpentry, overhead mechanical trades, goals, scoreboard, electrical, and painters have finished in the installation area.
- B. The area will be closed and secured from all foot traffic and trades for duration of the installation and curing period.
- C. The building shall be enclosed, weather-tight, with permanent windows and lockable doors.
- D. Permanent heat, light and ventilation shall be installed and operating prior to, during and after installation.
- E. Subfloors shall be broom clean, dry and free from dirt, dust, oil, grease, paint, and alkali, concrete curing agents, hardening and parting compounds, old adhesive residue or other foreign materials.
- F. Concrete tolerance of 1/8 inch (3mm) in ten foot (3m) shall be maintained throughout. High spots shall be ground level and low spots filled with a Portland base compound such as Ardex Feather Finish. No concrete curing hardening or sealing agents shall be applied to concrete.
- G. Concrete must dry for a minimum of 30 days and "Determining Relative Humidity in Concrete with In-Situ Probes" not to exceed 85% respecting ASTM F2170. HVAC must be operational and with a constant temperature for 7 days prior to testing.
- H. After completion, area to be kept locked by general contractor. No other trades or personnel to be allowed on floor until accepted by owner.

---

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material shall be prefabricated tiles rubber athletic flooring and highly resistant to UV or atmospheric agents.
1. Only vulcanized, dual durometer tiles rubber with each layer having independent physical properties and biomechanical attributes will be accepted.
  2. Flooring must be highly resistant to UV and atmospheric agents.
  3. The Shore Hardness of the top layer surface will be greater than that of bottom layer with differentiated elasticity between the two.
  4. The surface layer shall be free recycled rubber granules and free of any different color fillers.
  5. Flooring surface shall be manufactured to maintain performance criteria, as stated by manufacturer, without defects, damage, or failure.
  6. Thickness shall be not less than 3 cm.
  7. Color shall be by Engineer instruction.
  8. Material shall be provided in tiles shape.

### 9.2.3 **PRECAST TERRAZZO**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Types of precast terrazzo work include:
1. Precast terrazzo tile flooring.
- B. The Contractor shall engineer and design all precast terrazzo tile assemblies and installations, including under bed reinforcement, control joint and cold joint locations, and all other details and junctures with other materials and systems, to provide precast terrazzo tiling free from cracks, spalling, and other defects.

##### **QUALITY ASSURANCE**

- A. Precast Terrazzo Tiles: Provide precast terrazzo tiles products obtained from a single source acceptable to the Engineer.
- B. Setting and Grouting Materials: Provide materials obtained from one source for each type and colour of grout and setting materials.
- C. Standards: Unless otherwise approved by the Engineer comply with specified provisions and recommendations of:
1. National Terrazzo and Mosaic Association, Inc. (NTMA).
  2. Tile Council of America (TCA).
- D. Manufacturer's Instructions: In addition to specified requirements, comply with precast terrazzo manufacturer's instructions and recommendations for substrates preparation, materials storage, mixing and application, finishing, and curing.

#### **PART 2 - PRODUCTS**

##### **PRECAST TERRAZZO TILE PRODUCTS**

- A. Provide precast terrazzo tiles conforming with the following characteristic requirements:
- |    |                         |                                                 |
|----|-------------------------|-------------------------------------------------|
| 1. | Dimensional Tolerances: | Face: + or -1 mm                                |
| 2. | Warpage: Along any edge | +/- 1.5%                                        |
|    | on either diagonal      | +/- 1.5%                                        |
| 3. | Wedging: Not to exceed  | 1.0%                                            |
| 4. | Water Absorption:       | ASTM C 373                                      |
|    | Tile Face:              | 10%                                             |
|    | Whole Tile:             | 66% maximum                                     |
| 5. | Abrasive Hardness:      | ASTM C 501, 14-28 depending on aggregates used. |
| 6. | Breaking Strength:      | ASTM C648, 1.72 MPa [250 psi]                   |
| 7. | Mohs Hardness:          | 4-5 depending on aggregates used.               |
| 8. | Impact Resistance:      | Very high resistance to damage by impact        |

9. Precast Terrazzo Tile Production: Tile shall be produced from a manufacturing system, which includes the following:
  - a. Mechanically vibrated in the molds.
  - b. Hydraulically pressed by 13.80 MPa [2,000 psi].
  - c. Curing totally immersing in water for at least 24 hours, after the initial set was taken place, or
  - d. Steam curing with 100% humidity for 14 hours at 150 degrees F.
10. The face layer of terrazzo tile shall have a minimum depth of 10 mm and shall include minimum 70% coverage of the tile face with marble aggregate.

### **SETTING MATERIALS**

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1.

### **GROUTING MATERIALS**

- A. Latex-Portland Cement Grout, ANSI A118.6. Colours to match matrix of each area of tile.

### **ACCESSORIES**

- A. Divider Strips: White zinc alloy. Width as required or as indicated.
- B. Cleaner: Liquid, natural chemical cleaner, of formulation recommended by sealer manufacturer of type of precast terrazzo tiles used, and complying with NTMA requirements.
- C. Interior Floor Sealer: Colourless, slip and stain resistant penetrating sealer with Ph factor between 7 and 8, that does not affect colour or physical properties of precast terrazzo tiles surface.

### **TERRAZZO FORMULATIONS**

- A. Aggregate: Provide natural, sound, crushed white Italian carrara marble chips, irregular in size and roughly cuboid in shapes without excessive flats or flakes, obtained from a source or supplier acceptable to the Engineer.
  1. Samples: propose and submit samples of marble chippings for approval of size, colour gradation and composition, by the Engineer.
- B. Backing: Ordinary Portland cement and sand mix in parts proportion of 1:5 by volume.
- C. Face Matrix: White Portland Cement; ASTM C 150, Type I; or BS 12.
  1. Use one brand of cement throughout, unless otherwise acceptable to the Engineer.

## **PART 3 - EXECUTION**

### **PREPARATION**

- A. Clean and prepare substrate. Examine substrates to verify that surfaces are within required tolerances.

- B. Prior to precast terrazzo tile installation, remove dust, curing compounds, oil and other foreign substances from substrates.

#### **INSTALLATION, GENERAL**

- A. Perform all aspects of precast terrazzo tiles installation in accordance with any agreements reached at the pre-construction conference and any subsequent agreements reached as part of on-site review. Construction details shall be consistent with final submittals.
- B. Place precast terrazzo tiles around obstructions to achieve continuous colour, pattern and finish.
- C. Install divider strips and accessories in accordance with patterns indicated on drawings.
- D. Install 5mm width control joint strips with sealant in patterns as required or as indicated on drawings, except not to exceed 9000mm centres maximum. Contractor should submit control joints location layout for approval.
- E. Install abrasive inserts at locations shown on drawings, in accordance with insert manufacturer's instructions.
- F. Straightness and flatness tolerance: 3mm in any 3 m span.

#### **INSTALLATION**

- A. Install precast terrazzo tile in accordance with referenced standards for tile installation methods.
- B. Jointing Pattern: Lay precast terrazzo in pattern shown. Align joints when adjoining tiles on floor, base, and walls. Provide uniform minimum joint widths.
- C. Expansion and Control Joints: Provide openings for joints in locations as required. Comply with recommendations in referenced standards.
- D. Cutting: Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.
- E. Install mortar beds in accordance with ANSI A108.1. Install square edged precast terrazzo tile on cured mortar beds with latex-Portland cement mortar in accordance with ANSI A108.5.
  - 1. Floors: Concrete - Methods F111.
- F. Grout joints with latex Portland cement grout.

#### **GRINDING AND POLISHING**

- A. Surfacing: Delay final fine grinding and finishing until heavy trade work is completed and construction traffic through the area is restricted. finish by fine grinding with abrasive grit of size required to match achieve a surface finish to approved sample.

#### **CLEANING, SEALING, AND PROTECTION**

- A. Clean precast terrazzo units after installation, grouting and fine grinding operations are completed, complying with sealer manufacturer's instructions.
- B. Apply sealer to cleaned precast terrazzo units surfaces to comply with sealer manufacturer's instructions.
- C. Protect precast terrazzo units from damage and wear during construction operation.

#### **FINAL CLEANING**

- A. Clean precast terrazzo units as recommended by manufacturer of sealer and machine buff if required by the Engineer, when building is ready for Taking-Over.

## **9.2.4 INTERIOR STONework**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. Extent of interior stonework is indicated on Drawings and in schedules.
- B. Interior stonework includes the following:
  - 1. Marble tile flooring including stair treads and risers.
  - 2. Marble bases and thresholds.
  - 3. Marble cladding facing to walls and columns.
  - 4. Marble partitions at WC cubicles and urinals.
- C. Stonework incorporated into joinery and architectural woodwork is specified in Section 6.2 - Joinery.
- D. Sealing joints in interior stonework is specified in Joint Sealers section.

#### **QUALITY ASSURANCE**

- A. Single Source Responsibility for Stone: Obtain each color, grade, finish, type and variety of stone from a single source with adequate resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the Work.
- B. Single Source Responsibility for Setting Materials: Obtain mortar ingredients of uniform quality and from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Standards: Unless otherwise approved by the Engineer, comply with the recommendation of:
  - 1. Marble Institute of America (MIA), or the Stone Federation of the UK.
- D. Field-Constructed Mock-Up: Prepare mock-ups for the following types of interior stonework. Purpose of mock-ups is further verification of selections made for color and finish under sample submittals and establishing standard of quality for aesthetic effects expected in completed work. Build mock-ups to comply with following requirements:
  - 1. Locate mock-ups on site where indicated or, if not indicated, as directed by Engineer.
  - 2. Build mock-ups for the following types of interior stonework:
    - a. Marble flooring including base in form of panel as per drawings.
    - b. Marble wall cladding in form of panel as indicated on drawings, incorporating one vertical external corner.
  - 3. Erect mock-ups in presence of Engineer.
  - 4. Retain mock-ups during construction as a standard for judging completed stonework. Do not alter, move or destroy mock-up until work is completed.

---

## **PART 2 - PRODUCTS**

### **MATERIALS, GENERAL**

- A. Comply with referenced standards and other requirements indicated applicable to each type of material required.
- B. Provide premier quality matched stones obtained from an approved a single quarry for each type, variety, color and quality of stone required. Extract blocks from a single bed of quarry stratum, unless stones from randomly selected blocks are acceptable to Engineer for aesthetic effect.
- C. Provide stones, which are free from vents, cracks, fissures, discoloration or other surface defects, which may adversely effect strength or appearance.

### **INTERIOR MARBLE**

- A. Match Engineer's approved sample for each marble type, including variety, group, color, surface finish, and other characteristics relating to aesthetic effects.
  - 1. Marble: white Italian Carrara first choice; Polished finish
    - a. Tile flooring, and staircase treads and risers.
    - b. Bases, thresholds, etc.
    - c. Fronts and partitions at Wc cubicles and urinals.
  - 2. Marble: Greek Thassous, Crystal; polished finish
    - a. Cladding and facing to wall and columns, including copings, returns, reveals, etc.

### **MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150 Type I; or BS.12. Provide gray or white cement as needed to produce mortar color required.
- B. Hydrated Lime: ASTM C 207 Type S; or BS. 890
- C. Aggregate: ASTM C 144; or BS. 1198/1200; non-staining and as indicated below:
  - 1. For joints narrower than 6 mm use aggregate graded with 100 percent passing the No. 8 sieve and 95 percent the No. 16 sieve.
  - 2. For pointing mortar use aggregate graded with 100 percent passing the No. 16 sieve.
  - 3. White Aggregates: Natural white sand or ground white stone.
- D. Colored Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in stone mortars.
- E. Latex-Portland Cement Grout: ANSI A118.6, of the following composition and requirements:
  - 1. Latex additive (water emulsion) serving as a replacement for part or all of gauging water, added at job site to prepackaged dry grout mix.
  - 2. Manufacturers standard. Prepackaged latex Portland cement dry mix grout specified or supplied by latex manufacturer.

3. Provide grout colours approved by the Engineer to match colour of stone.

F. Water: Clean, non-alkaline and potable.

### **STONE ACCESSORIES**

- A. Stone Anchors: Stainless steel, type and size shown or, if not shown, as required and approved by the Engineer for securely anchoring and fastening interior stonework in place.
- B. Setting Buttons: Lead or resilient plastic buttons, non- staining to stone, sized to suit joint thicknesses and bed depths of stonework involved.
- C. Metal Edge Strips: Stainless steel strips, 3 mm wide at top edge, with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.
- D. Cleaner: Provide stone cleaners of proper formulation for kinds of stones, finishes and applications indicated, as recommended by stone producer and, if sealer specified, by sealer manufacturer. Do not use acid-type cleaning agents or other cleaning compounds containing caustic or harsh fillers, except where expressly approved by stone producer for type of condition involved.
- E. Sealer for Floors: Colorless, slip and stain resistant sealer which will not affect color or physical properties of stone surface, as recommended by sealer manufacturer and by stone producer for application intended.

### **MORTAR AND GROUT MIXES**

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds, or calcium chloride, unless otherwise indicated.
- B. Mixing: Combine and thoroughly mix cementitious materials, water and aggregates in a mechanical batch mixer; comply with ASTM, ANSI, BS or other acceptable standard, as applicable, for mixing time and water content.
- C. Spotting Plaster: Stiff mix of molding plaster and water.
- D. Setting Mortars and Grout for Flooring: Comply with mixing requirements of referenced ANSI or other acceptable standards for materials and installation methods.
- E. Pointing Mortar: Provide pointing mortar mixed to match Engineer's approved sample and complying with requirements indicated above for setting mortar including type and the following:
  1. Colored Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1-to-10, by weight.

## **PART 3 - EXECUTION**

### **EXAMINATION**

- A. Examine surfaces to receive stonework and conditions under which stonework will be installed. Do not proceed with installation until surfaces and conditions comply with requirements indicated or for execution of other work which affects stonework.

---

## PREPARATION

- A. Advise installers of other work about specific requirements relating to placement of inserts, reglets and similar items which will be used by Stonework Installer for anchoring and supporting stonework. Furnish Installers of other work with drawings or templates showing locations of these items.
- B. Prior to setting, clean stone surfaces to remove soil, stains and foreign materials. Clean stones by thoroughly scrubbing stones with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh filler or abrasives.

## SETTING STONE, GENERAL

- A. Execute stonework by skilled tradesmen, and employ skilled stone fitters at the site to perform any necessary field cutting, as stones are set.
  - 1. Use power saws to cut stones; produce exposed edges, which are cut straight and true.
- B. Set stones to comply with requirements indicated on drawings and final shop drawings. Install anchors, supports, fasteners and other attachments indicated or necessary to secure stonework in place. Shim and adjust anchors, supports and accessories to set stones accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
- C. Construction Tolerances: Set stones to comply with the following tolerances:
  - 1. Variation from Plumb: For lines and surfaces of columns, walls and arises. Do not exceed 6mm in 3m, 10mm in a story height or 6m maximum, nor 15mm in 12m or more. For external corners, expansion joints and other conspicuous lines, do not exceed 6mm in any story or 6m maximum, nor 15mm in 12m or more.
  - 2. Variation from Level: For grades indicated, horizontal grooves and other conspicuous lines, do not exceed 15mm in any bay or 6mm maximum, nor 20mm in 12m or more.
  - 3. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 15mm in any bay or 500mm maximum, nor 20mm in 12m or more.
  - 4. Variation in Surface Plane of flooring: Do not exceed 3mm from level or slope indicated, when tested with 3m straight edge.
  - 5. Variation in Cross-Sectional Dimensions: For columns and thickness of walls from dimensions indicated, do not exceed minus 6mm nor plus 15mm.
- D. Expansion and Control Joints: Provide for expansion and control joints of widths and at locations indicated, or as required.
  - 1. Sealant for expansion and other joints is specified Joint Sealers section.

## INSTALLATION OF STONE FLOORING

- A. Extend flooring into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

- B. Accurately form intersections and returns. Perform cutting and drilling of stones without marring visible surfaces. Carefully grind cut edges of stones abutting trim, finish or built-in items for straight aligned joints. Fit stones closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap stones.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of stone flooring meets carpet, wood, or other flooring which finishes flush with top of stones.
- D. Jointing Pattern for Tile: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area.
- E. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.
- F. Match tiles for color and other appearance characteristics by using tiles in same sequence as manufactured and packaged.
- G. Stone Flooring Set in Portland Cement Mortar Bed:
  - 1. Saturate concrete subfloor with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
  - 2. Apply slurry of cement grout over surface of concrete subfloor about 15 minutes prior to placing setting bed. Limit area to avoid its drying out prior to placing setting bed. Mix slurry to a consistency similar to that of thick cream and consisting of either neat cement and water, or cement, sand and water. Do not exceed 1.5mm thickness for slurry coat.
  - 3. Mix setting bed in proportions of 1:2:6 cement/lime/sand to quantity of water to produce a stiff mixture with a moist surface when setting bed is ready to receive stone flooring.
  - 4. Spread and screed setting bed to uniform thickness indicated to produce subgrade elevations required for accurate shown. Mix and place only the amount, which can be covered with stone prior to initial set. Cut back, bevel edge, remove and discard setting bed material, which has reached initial set prior to placing stone.
  - 5. Butter backs of stone flooring units until firmly bedded to proper finished floor elevation indicated. Set and level each stone unit in single operation, prior to initial set of cement bed; do not return to areas already set and disturb stone for leveling purposes.
- H. Grouting Stone Flooring:
  - 1. Mix grout consisting if factory prepared color pigmented grout and liquid latex admixture in proportions recommended by manufacturer.
  - 2. Grout joints in stone flooring units, except at expansion and control joints indicated as required to be filled with sealant. Finish grout flush with finished surface of stone. Fill all gaps and skips to produce a finished joint which is uniform in color, smooth and without voids, pinholes, or low spots.
  - 3. Remove grout spillage from face of stone as work progresses.
  - 4. Cure grout by maintaining in a moist condition for 7 days.
  - 5. Do not permit traffic on stone flooring during setting of units for at least 24 hours after final grouting of joints.

## **INSTALLATION OF INTERIOR WALL FACING AND TRIM; AND PARTITIONS**

- A. Erect interior wall facing and trim plumb and true with joints uniform in width and accurately aligned. Provide setting buttons as required to maintain joint width.

- 
- B. Erect interior WC cubicle fronts/ partition and urinal partitions plumb, true and accurately aligned as indicated.
    - 1. Provide all necessary metal supports, brackets, anchors, fixings, fasteners and the like; chromium plated or stainless steel exposed finish.
  - C. Point joints after setting with pointing mortar of color indicated, mixed in proportions of 1-part Portland cement, 1-part lime and 3-parts sand, unless otherwise indicated. Rub joints smooth with plastic tool.

#### **ADJUSTING, CLEANING, AND SEALING**

- A. Remove and replace stonework of the following description.
  - 1. Broken, chipped, stained or otherwise damaged stones.
  - 2. Defective joints.
  - 3. Stones and joints not matching approved samples and field constructed mock-ups.
  - 4. Stonework not complying with other requirements indicated.
- B. Replace in manner which results in stonework matching approved samples and field-constructed mock-ups, complying with other requirements and showing no evidence of replacement.
- C. Clean interior stonework after setting, pointing, grouting and curing is complete; use procedures recommended by stone producer for types of application indicated.
- D. Apply stone sealer to cleaned interior stone flooring in compliance with sealer manufacturer's instructions.
- E. Protect interior stone flooring during construction period with Kraft paper or other heavy covering of type that will not stain or discolor stone.
- F. Before inspection for substantial completion, remove protective covering and clean sealed surfaces using procedures and materials recommended by sealer manufacturer.

### **9.3 ACOUSTICAL CEILINGS WORKS**

#### **PART 1 - GENERAL**

##### **SUMMARY**

- A. Extent of each type of acoustical ceilings is shown on Drawings and schedules.
- B. Types of ceilings specified in this section include the following:
  - 1. Mineral fiber panel ceilings, exposed suspension.
  - 2. Aluminum snap-in linear strip ceilings with sound absorption blanket.

##### **QUALITY ASSURANCE**

- A. Fire Performance Characteristics: Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, or BS 476 equivalent alternative by a testing and inspecting agency acceptable to the Engineer.
  - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84.
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 50 or less.
- B. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by, or penetrating through ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition systems (if any), etc.

#### **PART 2 - PRODUCTS**

##### **ACOUSTICAL CEILING UNITS, GENERAL**

- A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with ASTM, BS or equivalent alternative standard requirements, acceptable to the Engineer, including those indicated by reference to type, form, pattern, grade (NRC or NIC' as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).
- B. Colors, Textures, and Patterns: Provide products to match appearance characteristics indicated or, if not otherwise indicated, as selected by Engineer from manufacturer's standard colors, surface textures, and patterns available for acoustical ceiling units and exposed metal suspension system members of quality designated.
- C. Sound Absorption (Acoustical) Pads or Blanket: Provide manufacturer's standard sound absorptive pads or blanket, of thickness indicated, installed over metal grid or suspension components, and wrapped in or laid on black PVC sheet.

##### **ACOUSTICAL CEILING TYPES**

- A. Mineral fiber Composition Panels; water felted, with standard washable finish: Manufacturer's standard plain texture and perforated pattern designs to be selected by Engineer; with other characteristics as follows:

1. Color/Light Reflectance: White/LR 1 (75% and over).
  2. Grade: NRC 65 - 75.
  3. STC Range: 40-44.
  4. Edge Detail: Tegular.
  5. Size: 600 mm x 600 mm x 19 mm.
- B. Aluminum Snap-in Linear Metal Panels: Provide manufacturer's standard 100 mm wide unit as referenced. Colour to be selected by Engineer.
- C. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to the following:

#### **METAL SUSPENSION SYSTEMS, GENERAL**

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 or equivalent alternative requirements and approved by the Engineer.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated. For exposed suspension members and accessories with painted finish, provide color indicated or, if not otherwise indicated, as selected by Engineer from manufacturer's full range of standard colors.
- C. Miscellaneous Materials:
1. Attachment Devices: Type recommended by suspension system manufacturer for attachment or anchorage of ceiling hangers to structure, sized for 5 times design load (ASTM C635, Table 1, Direct Hung).
    - a. Concrete Inserts: Inserts formed from hot-dipped galvanized sheet steel and designed for attachment to concrete forms and for embedment in concrete, with holes or loops for attachment at hanger wires.
  2. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, pre-stretched, Class 1 coating, sized so that stress at 3- times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12-gage (2.7mm).
  3. Edge Moldings and Trim: Metal or extruded plastic of types and profiles indicated or, if not indicated, provide manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.
    - a. For lay-in panels with reveal edge details, provide stepped edge molding which forms reveal of same depth and width as formed between edge of panel and flange at exposed suspension member.
    - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
    - c. For narrow faced suspension systems, provide suspension system manufacturer's standard edge moldings, which match width and configuration of exposed runners.
  4. Hold-Down Clips for Non-Fire-Rated Ceilings: For interior ceilings composed of lay-in panels weighing less than 4.9 kg/m<sup>2</sup>, provide hold- down clips spaced 600 mm centres on all cross tees.
  5. Impact Clips: Where required provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels as recommended by panel manufacturer.

6. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.

### **PART 3 - EXECUTION**

#### **PREPARATION**

- A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
  1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- B. Pre-Installation Conference: Prior to start of acoustical ceiling installation, meet at project site with installers of related work, including lighting, ductwork, and similar work in ceiling plenum. Review areas of potential interference and resolve conflicts before proceeding with work. Co-ordinate ceiling layout with layout of other work, which penetrates or is supported by ceiling in each space of project.
- C. Plan each layout to balance border widths at opposite edges of each ceiling area. Avoid use of less-than-half width units wherever possible. Comply with Engineer's approved reflected plans to greatest extent possible.

#### **INSTALLATION**

- A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, as indicated, and industry standards applicable to work.
- B. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.
- C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 150 mm from each end and spaced 1200 mm along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 3 mm in 3.60 m.
  1. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
  2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum, which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, counters playing or other equally effective means.
- D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
  1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
  2. Screw-attach moldings to substrate at intervals not over 400 mm centres and not more than 75 mm from ends, leveling-with ceiling suspension system to tolerance of 3 mm in 3.60 m. Miter corners accurately and connect securely.

- 
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
    - 1. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.
  - F. Scribe and cut metal acoustical units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling.
  - G. Install snap-in acoustical units in coordination with suspension system and any exposed runner moldings.
  - H. Install metal acoustical panels in coordination with suspension system, with edges concealed by support of suspension members.
  - I. Install sound attenuation pads or blanket in areas indicated by approved reflected ceiling plans or room finish schedules. Lay directly on ceiling system in manner directed by the manufacturer in co-ordination with the ceiling installation.

#### **CLEANING**

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work, which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented or bent units.
- B. Institute required protection for acoustical ceilings, including temperature and humidity limitations and dust control, so that work will be without damage and deterioration at time of Taking-Over.

---

## 9.4 **GYP SUM WORKS**

### **PART 1 - GENERAL**

#### **SUMMARY**

- A. Section Includes:
1. Interior gypsum board.
  2. Tile backing panels.
  3. Texture finishes.

#### **ACTION SUBMITTALS**

- A. Samples:
1. Textured Finishes: **[Manufacturer's standard size]** for each textured finish indicated and on same backing indicated for Work.

### **PART 2 - PRODUCTS**

#### **PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### **GYP SUM BOARD, GENERAL**

- A. Regional Materials: Gypsum panel products shall be manufactured within (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within (800 km) of Project site.
- B. Regional Materials: Gypsum panel products shall be manufactured within (800 km) of Project site.

#### **INTERIOR GYP SUM BOARD**

- A. Manufacturers: Subject to compliance with requirements.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M

- 
1. Thickness: (12.7 mm)
  2. Long Edges: [**Tapered**]
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M:
1. Thickness: (12.7 mm)
  2. Long Edges: [**Tapered**]
- D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.
1. Core: [**As indicated on Drawings**] [ (12.7 mm), **regular type**].
  2. Long Edges: Tapered.
  3. Mold Resistance: ASTM D 3273, score of 10.
- E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: [As indicated] [ (12.7 mm), regular type] [ (15.9 mm), Type X].
  2. Long Edges: Tapered.
  3. Mold Resistance: ASTM D 3273, score of 10.

#### **EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS**

- A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements.
  2. Core: [As indicated] [ (12.7 mm), regular type].
    - a. Waterproofing
    - b. Moisture and mold resistance
    - c. Fire resistance
    - d. Impact resistance

## **9.5 PAINTING WORKS**

### **PART 1- GENERAL**

#### **SUMMARY**

- A. Extent of painting work is indicated and Drawings, schedules and herein, and includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
  - 1. Surface preparation, priming, & finish coats specified in this section are in addition to shop priming & surface treatment specified in other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Engineer will select from standard manufacturer's colors or finishes available.
  - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
  - 1. Prefinished items not to be painted include all factory-finished components such as:
    - a. Prefinished metal fabrications.
    - b. Acoustic ceilings.
    - c. Joinery and architectural woodwork.
    - d. Elevator equipment.
    - e. Finished mechanical and electrical equipment.
    - f. Light fixtures.
    - g. Switchgear.
    - h. Distribution cabinets.
  - 2. Finished metal surfaces not to be painted include:
    - a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
  - 3. Operating parts not to be painted include moving parts of operating equipment such as the following:
    - a. Valve and damper operators.
    - b. Linkages.
    - c. Sensing devices.
    - d. Motor and fan shafts.
  - 4. Labels: Do not paint over regulation or code-required labels or equipment name, identification, performance rating, or nomenclature plates.

#### **DEFINITIONS**

- A. "Paint" includes coating systems materials; primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

---

## **QUALITY ASSURANCE**

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

## **PART 2 - PRODUCTS**

### **MATERIALS, GENERAL**

- A. Material Quality: Provide only best quality grades low VOC (Volatile Organic Compounds) content for the various types of coatings and paint systems required, as regularly manufactured and recommended by acceptable paint manufacturers. Paint material containers not displaying manufacturer's names and product identification will not be acceptable.
  - 1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required or to exclude equivalent products of other manufacturers.
- B. Color Pigments: Pure, non-fading, applicable types to suit substrates & services indicated.
  - 1. Lead contents in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on total non-volatile (dry-film) of paint by weight.

### **FIELD QUALITY CONTROL**

- A. The Engineer reserves the right to request the following test procedure at any time and as often as the Engineer deems necessary during the period when paint is being applied:
  - 1. The Contractor shall engage the services of an independent testing laboratory approved by the Engineer to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
  - 2. The testing laboratory will perform appropriate tests for all or any of the following characteristics as required by the Engineer:
    - a. Quantitative materials analysis.
    - b. Abrasion resistance.
    - c. Apparent reflectivity.
    - d. Flexibility.
    - e. Wash ability.
    - f. Absorption.
    - g. Accelerated weathering.
    - h. Dry opacity.
    - i. Accelerated yellowness.
    - j. Recoating.
    - k. Skinning.
    - l. Color retention.
    - m. Alkali and mildew resistance.
  - 3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove

noncomplying paint from the site and repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible.

### **PART 3 - EXECUTION**

#### **EXAMINATION**

- A. Examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

#### **PREPARATION**

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean/prepare surfaces according to manufacturer's written instructions for each particular substrate condition to be painted.
- D. Materials Preparation: Mix/prepare paint materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

#### **APPLICATION**

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Surface treatments and paint finishes are indicated in the schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Provide finish coats that are compatible with primers used.
  4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  5. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  6. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

## CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

## PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated, to the satisfaction of the Engineer.
- B. Ferrous Metal: Primer is not required on shop-primed items.
  1. Full-Gloss Alkyd Enamel: 2 finish coats over primer.
    - a. Primer: Synthetic Rust-Inhibiting Primer.
    - b. First and Second Coats: Alkyd Gloss Enamel.
  2. Lusterless Alkyd Enamel: 2 finish coats over primer.
    - a. Primer: Synthetic Rust-Inhibiting Primer.
    - b. First and Second Coats: Lusterless Alkyd Enamel.
- C. Zinc-Coated Metal:
  1. Full-Gloss Alkyd Enamel: 2 finish coats over primer.
    - a. Primer: Galvanized Metal Primer.
    - b. First and Second Coats: Alkyd Gloss Enamel.

## INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated, to the satisfaction of the Engineer.
- B. Concrete and Plasters.
  1. Lusterless (Flat) Emulsion Finish: 3 coats.
    - a. Primer: Latex-Based Interior Flat Paint.
    - b. Under Coat: Latex-Based Interior Flat Paint.
    - c. Finish Coat: Latex-Based Interior Flat Paint.
  2. Odorless Lusterless (Flat) Latex Finish: 3 coats.
    - a. Primer: Latex-Based Interior Flat Paint.
    - b. First Coat: Latex-Based Interior Flat Paint.
    - c. Second Coat: Interior Flat Odorless Alkyd Paint.
  3. Semigloss Enamel Finish: 3 coats with total dry film thickness not less than: 0.09 mm, on concrete, 0.06mm on plaster.
    - a. Primer: Latex-Based Interior Flat Paint.
    - b. Undercoat: Interior Enamel Undercoat.

- 
- c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel.
    - 4. Plastic Coating Finish: Multiple coating system including preparation sealer, primer and undercoats; applied in strict accordance with manufacturer recommendations and instructions for substrate and purpose of use.
      - a. Purpose: Provision of a heavy duty washable, monolithic and anti-bacterial surface finish to cement plastered walls and ceilings in hospital rooms and areas requiring a high degree of cleanliness and hygiene.
      - b. Available Products: subject to compliance with requirements, products which may be incorporated, in the work include, but are not limited to:
  - C. Concrete Masonry Units:
    - 1. Lusterless (Flat) Emulsion Finish: 2 finish coats over filled surface.
      - a. Latex Block Filler.
      - b. First and Second Coats: Latex-Based Interior Flat Paint.
    - 2. Semigloss Alkyd Enamel Finish: 2 coats over filled surface with total dry film thickness not less than 0.09 mm, excluding filler coat.
      - a. Latex Block Filler.
      - b. Undercoat: Interior Enamel Undercoat.
      - c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel.
  - D. Painted Wood and Hardboard:
    - 1. Semigloss Enamel Finish: 3 coats.
      - a. Undercoat: Interior Enamel Undercoat.
      - b. First and Second Coats: Interior Semigloss Odorless Alkyd Enamel.
    - 2. Full-Gloss Enamel Finish: 3 coats.
      - a. Undercoat: Interior Enamel Undercoat.
      - b. First and Second Coats: Alkyd Gloss Enamel.
  - E. Ferrous Metal:
    - 1. Lusterless (Flat) Finish: 3 finish coats over primer with total dry film thickness not less than 0.06 mm.
      - a. Primer: Synthetic Rust-Inhibiting Primer.
      - b. First and Second Coats: Latex-Based Interior Flat Paint.
    - 2. Semigloss Enamel Finish: 2 coats over primer with total dry film thickness not less than 0.06 mm.
      - a. Primer: Synthetic Rust-Inhibiting Primer.
      - b. Undercoat: Interior Enamel Undercoat.
      - c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel.
  - F. Zinc-Coated Metal:
    - 1. Lusterless (Flat) Finish: 2 finish coats over primer with total dry film thickness not less than 0.06 mm.
      - a. Primer: Galvanized Metal Primer.
      - b. First and Second Coats: Latex-Based Interior Flat Paint.
    - 2. Semigloss Finish: 2 coats over primer, with total dry film thickness not less than 0.06 mm.
      - a. Primer: Galvanized Metal Primer.
      - b. Undercoat: Interior Enamel Undercoat.
      - c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel.
    - 3. Full-Gloss Enamel Finish: 2 Coats over primer with total dry film thickness not less than 0.06mm.
      - a. Primer: Galvanized Metal Primer.

- 
- b. Undercoat: Interior Enamel Undercoat.
  - c. Finish Coat: Alkyd Gloss Enamel.

**CHAPTER TEN**  
**SPECIALTIES**

---

## **CHAPTER TEN** **SPECIALTIES**

### **10.1 TOILET ACCESSORIES**

#### **PART 1 - GENERAL**

##### **DESCRIPTION OF WORK**

- A. Furnish and install the following toilet accessory items as indicated on Drawings and/or required by Engineer:
1. Toilet roll lockers.
  2. Soap holders and soap box.
  3. Paper holder.
  4. Mirror units.

All as indicated in details on drawings.

#### **PART 2 - PRODUCT**

As stated on drawings.

#### **PART 3 - EXECUTION**

##### **INSTALLATION**

- A. Install toilet accessory and mirror units in accordance with manufacturer's instructions, using purpose concealed fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb, level and square, firmly anchored in locations and at heights indicated.
1. Mirrors: Provide plywood backing panels, filters and other ancillaries as indicated and required.

##### **ADJUSTING AND CLEANING**

- A. Adjust toilet accessories for proper operation and verify that mechanisms functions smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surface not more than 4 days prior to date scheduled for inspections intended to establish date for substantial completion, in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

---

## **10.2 CLASSROOM SPECIALTIES (White Teaching Board and Talkboards)**

### **10.2.1 GENERAL**

#### **10.2.1.1 Description**

##### **A. General**

1. Furnish all labor, materials, tools, equipment, and services for all white boards and tackboards, in accord with provisions of Contract Documents.
2. Completely coordinate with work of other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for General Requirements.
5. Unless otherwise approved, furnish all white boards and tackboards by one manufacturer.

#### **10.2.1.2 Submittals**

##### **A. Samples:**

1. 400 x 600 mm samples of sheet materials. Colors and textures of materials shall match Color Schedule and Color Palette.

#### **10.2.1.3 Product Delivery, Storage and Handling**

- A. Deliver boards completely assembled whenever possible. Where dimensions exceed available panel size, provide 2 or more pieces of length acceptable to Architect. When dimensions require delivery in separate units. Profit at factory, disassemble for delivery, and make final joint at site.
- B. Perform all required unpacking at site.
1. Furnish all labor, materials, tools, equipment, and services for all white boards and tackboards, in accord with provisions of Contract Documents.

### **10.2.2 PRODUCTS**

#### **10.2.2.1 Materials**

##### **A. White Writing Board.**

1. Top quality white writing board for felt Marker Pends.
2. Surface shall be made of highly durable Porcelain board, conform to the International quality standard, with lifetime warranty.
3. No maintenance shall be required through all years of use.
4. The boards surface shall be resistant to stain, ghost, scratch, and dent, and it shall be magnetic, washable, acid resistant and resistant to any other type of cleaning material.
5. Each board is labeled with the factory warranty for intensive use.
6. Anodized-aluminum frame with round corner or with round plastic end.
7. Internal structure of the board to be Honeycomb panel in high density board minimum 8 mm thick or equivalent.
8. At top aluminum Map – holder profile or magnetic holding tools.
9. At bottom an aluminum long tray for holding writing and erasing materials.

10. The white (Porcelain) boards can also be used as overhead projection screen.
  11. Galvanized protected backside against wall humidity.
  12. Dimensions: minimum 3600 mm x 1200 mm with allowed tolerance of 50 mm in height and in width. (Final dimensions as per site limitation).
- B. Tackboards, vinyl-fabric-faced: Vinyl fabric complying with F.S. CCC-W- 408, Type II, Class 2, laminated to 6mm (1/4 IN) thick cork backing sheet ASTM C640.
1. Laminate under pressure to 6 mm (1/4 IN) thick treated plywood or hardboard backing.
- C. Felt marker pens and erasers: for each chalkboard on the project, provide 12 felt marker pens (6 black, 3 red and 3 green), and 2 pens erasers, all as recommended by white board manufacturer.

### **10.2.3 EXECUTION**

#### **10.2.3.1 Inspection**

- A. Examine substrates and conditions under which work is to be performed.
- B. Correct unsatisfactory Conditions.
- C. Installation Constitutes acceptance of responsibility for performance.

#### **10.2.3.2 Installation**

- A. Unless otherwise indicated, provide factory-built units.
- B. Treat vertical joints in white board as follows:
  1. Steel board units: Use extended aluminum H-type divider bars.
- C. Provide additional backing as indicated or necessary to properly stiffen and support boards.
- D. Install at locations and heights indicated in accord with manufacturer's instructions.
- E. Install with concealed hangers, plumb and level.
- F. Coordinate job-assembled units with grounds, trim, and accessories. Join all parts with neat, precision fit.
- G. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations.

---

## **10.3 EPOXY RESIN WORK**

### **PART 1 - GENERAL**

Countertops, drinking basin and curbs are molded from a modified epoxy resin that has been especially compounded and cured to provide optimum physical and chemical resistance required for a heavy-duty working surface. They are a uniform mixture throughout, and do not depend on a surface coating that can be readily removed by chemical or physical abuse. Tops have a thickness required with a drip groove provided on underside of all sink top exposed edges. All edges shall have a slight radius. Curbs are bonded to the surface on the top to form a square water-tight joint. All joints in tops are bonded with an approved epoxy cement and shall be smooth and water-tight. Counters with integral curbs have a junction with a  $\frac{3}{4}$ " radius, except around columns and special cutouts, which will have a standard bonded curb.

### **PART 2 – PRODUCTS**

#### **2.1 SOLID SURFACE SHEET MATERIAL**

- A. Composition: Acrylic resins, fire-retardant mineral fillers, and proprietary coloring agents. Through-the-body color for full thickness of sheet material.
- B. Material Thickness: 1/2 inch, nominal.
- C. Color, Pattern, and Finish Design: Selected from manufacturer's standard offerings.
- D. Edge Detail: Selected from manufacturer's standard offerings.

#### **2.2 ACCESSORY MATERIALS**

- A. Joint Adhesive: Methacrylate-based adhesive for chemically bonding solid surfacing seams. Color complementary to solid surfacing sheet material.
- B. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications.
- C. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates.
- D. Construction Adhesive: Countertop manufacturer's recommended silicone-based construction adhesive for backsplashes, endsplashes, and other applications according to manufacturer's published fabrication instructions.

#### **2.3 FABRICATION**

- A. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings.
- B. Form joint seams between solid surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.
- C. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.

---

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions that could adversely affect the work of this Section.
- B. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.
- C. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

### **3.2 COUNTERTOP WITH SINK, DRINKING BASIN INSTALLATION**

- A. Install solid surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use steel working and specialized fabrication tools acceptable to manufacturer.
- B. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.
- C. Provide minimum 1/2 inch radius for countertop / drinking basin inside corners.
- D. Fill gaps between countertop / drinking basin and terminating substrates with specified silicone sealant.
- E. Back splashes are manufactured as one piece with countertop / drinking basin as shown on drawings and approved by Engineer.
- F. Vanities are manufactured as one piece with counter top as shown on drawings and approved by Engineer.

---

#### **10.4 ROUND CORNER PROTECTOR ON ALUMINUM CORE**

##### **DESCRIPTION**

90° round corner protector mounted on aluminum core comprising 2.5 mm thick smooth and antibacterial PVC profile achieving Bs2d0 fire rating with solid colour. A protective film is specified to minimize cleaning before acceptance. Wings are 45 mm wide (internal measurement) and snap-fix to a continuous pre-drilled aluminum core. The corner protector is finished with a smooth PVC endcap.

##### **ENVIRONMENT**

No heavy metals are used in its formulation, including lead or tin (insignificant levels, less than 50 ppm) or any CMR Cat. 1 or 2 substances. The calcium-zinc thermal stabilization process is used. The emission level of volatile substance in inside air has been tested according to ISO 16000 and is very low (A+). 100% of the product are recyclable.

##### **COLOUR**

Selected by Architects from manufacturer's standard range.

##### **INSTALLATION METHOD**

Snap-fixes to continuous pre-drilled aluminum core screwed to wall.

---

## **10.5 INTERNAL CURTAINS**

### **GENERAL**

Furnish all labor, materials, tools, equipment, and services for internal curtains in accordance with provisions of Contract Documents.

### **QUALITY ASSURANCE**

- A. Source of Materials: Provide materials obtained from one source acceptable to Engineer for type and color of internal curtains and setting materials.

### **SUBMITTALS:**

- A. Product data:
1. Manufacturer's literature for internal curtains and installation materials.
  2. Manufacturer's instructions for installation.
- B. Samples:
1. Samples of colors of internal curtains.
- C. Project data:
1. Certification of applicator qualifications. The applicator should be qualified.

### **EQUIPMENT**

- A. Roller Tube: The fabric rolls around the metal tube which supports the weight of the shade, is not to be exposed even when the shade is fully lowered.
- B. End Plug: The end plug or rotator to be fit into the installation bracket.
- C. Fabric: Design and color to be approved by the Engineer.
- D. Bottom of Curtain: Add bottom rod and end cap to curtain to hold the fabric in position and add weight to the shade.
- E. Clutch: Provide clutch to curtain to rotate the roller tube to raise or lower the shade.
- F. Curtain Cord: Provide necessary cord items:
1. Beaded cord for continuous loop.
  2. Beaded cord connector to attach the two ends of the beaded cord.
  3. Cord tensioner for enhanced child safety.

## **CHAPTER ELEVEN** **EQUIPMENT**

---

## **CHAPTER ELEVEN** **EQUIPMENT**

### **11.1 ATHLETIC COURT EQUIPMENT**

#### **PART 1 - GENERAL**

##### **DESCRIPTION**

###### **A. General**

1. Furnish all labor, materials, tools, equipment, and services for all sports hall equipment as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

##### **QUALITY ASSURANCE**

- A. Manufacturer's qualifications: Not less than three years successful experience in manufacturing athletic equipment similar to items required, and has sufficient production capacity and experienced personnel to produce the required items without causing delay in the Work.
- B. Basketball backstop, backboard and goal shall all be manufactured by a single manufacturer. Also, game standards/posts and their associated floor sleeve systems shall be manufactured by a single manufacturer.

##### **SUBMITTALS**

- A. Manufacturer's data showing conformance to specifications.
- B. Project data:
  1. Operating and maintenance data.
  2. Guarantees
  3. Wall padding colors: Submit manufacturer's full color range.

##### **JOB CONDITIONS**

- A. Coordinate closely with other work in Sports Court.
- B. Install this equipment prior to the installation of the floor.

#### **PART 2 - PRODUCTS**

##### **MATERIALS**

- A. Basketball backstop: Floor-supported type.
  1. Backstop base frame shall be constructed of heavy structural steel channel sections and shall have overall dimensions of approximately 1.17 M (3.83 FT) wide x 1.93 M (6.33 FT) long and 0.30 M (1 FT) high. Sides of frame shall be minimum 4.8 mm (3/16 IN) thick steel plate full length and height of base

frame. Within the limits of these overall dimensions, the base shall be equipped with a minimum of 435 KG (960 LB) of ballast material situated such that additional weights or floor anchors are unnecessary for use of backstop when in playing position.

2. Base frame shall incorporate four 152.4 mm (6 IN) diameter non-marking, polyurethane casters (2 fixed and 2 swivel) that are actuated to and from the transport position by the hydraulic system. Casters shall swing upward, allowing entire base frame to rest on floor when backstop is in playing position. Entire bottom of base frame shall be equipped with a gray non-marking, neoprene material to help prevent movement of frame while in use.
3. Vertical support mast assembly shall be constructed of four heavy wall 76.2 mm (3 IN) square structural steel tubes welded together. This assembly shall be side braced on each side of the base frame to a height not to exceed 914.4 mm (36 IN) above floor.
4. Backboard support shall be of truss design and shall extend diagonally from top of vertical support mast assembly to composite horizontal support member, which shall extend to a heavy-duty steel mounting plate directly behind goal mounting holes in backboard.  
Backboard support truss and composite horizontal support member shall as a minimum be constructed of heavy wall 76.2 mm (3 IN) square structural steel tubes welded together. Connection between backboard support truss and vertical support mast assembly shall be a pivot joint.  
In addition to a solid attachment of the backboard to the composite horizontal support member mounting plate, the backboard shall also be pivot joint attached near each side near the top to two upper support arms of 60.3 mm (3/8 IN) diameter heavy wall structural steel tubing. There shall be a provision in upper support arm design for plumbing the backboard when in playing position. Bottom end of backboard support truss shall be pivot-joint attached to two structural steel 76.2 mm (3 IN) square tube diagonal rear braces, the bottom of which shall be pivot-joint attached to the base frame. Total unit shall be easily lockable in position when backstop is in playing position.
5. Working dimensions:
  - a. Top of goal shall be 3.05 M (10 FT) above floor.
  - b. Bottom of composite horizontal support member shall be a minimum of 2.88 M (9.46 FT) above floor.
  - c. Horizontal dimension from front face of backboard assembly shall be 2.44 (8 FT) minimum.

B. Goal: Two required. Attach to backstop.

1. Shall conform to NCAA and professional basketball rules.
2. Formed to a 457.2 mm (18 IN) diameter ring, welded closed and welded to heavy gage steel framing which shall extend through glass background without touching it and shall bolt into steel mounting plate on end of horizontal support member. There shall be no strain on glass backboard should a player hang on the goal. This direct mount feature shall conform to NCAA. Recommendation 3-E dated March 1983.
3. "No-tie" die-formed steel hooks shall be welded to bottom of ring for attachment of heavy-duty 120-thread retarding-type, white net.
4. Provide 12 nets for each goal.
5. Closest point of inside face of goal shall be 152.4 mm (6 IN) from face of backboard.
6. Steel portion of goal shall be factory finished with bright orange, gloss enamel.

C. Floor sleeve systems:

1. For volleyball: 6 required (3 pair).
2. For tennis: 2 required (1 pair).
3. See drawings for locations.

4. Sleeves shall be 101.6 mm (4 IN) OD heavy wall steel tubing with inside diameter to accommodate 88.9 mm (3-1/2 IN) OD game standards/posts. Cap sleeve bottom with minimum 2.66 mm (12 gage) thick formed steel plate welded to sleeve. A 9.5 mm (3/8 IN) diameter, U-shaped steel anchor rod shall be welded to bottom edge of sleeve and shall extend 304.8 mm (12 IN) below bottom of sleeve. Total sleeve depth with bottom cap and top cover assembly, but without anchor bar, shall be 228.6mm (9 IN). Top of sleeve cover assembly shall be flush with top of concrete slab.
5. Cover plate assembly shall be provided for use with resilient athletic flooring specified in Section 09667. Cover plate shall consist of cast aluminum recessed mounting flange, cork gasket and a 127 mm (5 IN) diameter chrome plated cover. Cover shall be secured with a special swivel type-retaining pin operable by a key. Provide one key for each cover plate on the project. Coordinate with Section 09667 for cutouts required in resilient athletic flooring for key access; and for attachment of, and cutting of, resilient athletic flooring to fit top of each cover plate.
6. Provide floor sleeve assemblies for casting into concrete floor slab when it is poured. Cast vertically plumb.

D. Game standards/posts:

1. For volleyball: 6 standards required.
2. For tennis: 2 posts required.
3. See drawings for locations.
4. Insertable into and removable from floor sleeve systems specified herein.
5. Standards and sleeves shall be 88.9 mm (3-1/2 in) OD heavy wall steel tubing.
6. Volleyball standards shall accommodate a net height up to 2.4 M (8FT) and shall be adjustable for multi-sport net attachment heights, and for age group settings as prescribed by the United States Volleyball Association.
7. Tennis posts shall accommodate a net height of 0.91 M (3FT) at center of court, plus 25.4 mm (1 IN) clear between net bottom and court surface.
8. Each standard and post shall have a self-locking, worm gear net tensioning winch, coupled with an infinitely – height adjustable lower winch. All reels shall be furnished with high tensile nylon straps feeding out of the winches.
9. Standards and posts shall sit full depth in sleeves of floor sleeve system, and shall be easily lockable into playing position and easily removable.

E. Wall padding: see drawings for number of pads required and locations.

1. Size of each pad: 1828.8mm (72 IN) high×609.6mm (24 IN) wide×50.8mm (2 IN) thick.
2. Each pad shall contain 50.8 mm (2In) thick urethane filler (soft), 59.3 kg/m3 (3.7 LB/CU FT), cemented to 9.5 mm (3/8 IN) thick, exterior glued plywood backing and covered with flame retardant, vinyl-coated nylon fabric. Fabric shall be folded around sides of each pad and securely stapled to back of plywood, and neatly stapled at top and bottom to allow for a 25.4 mm (1 IN) nailing margin along top and bottom of pad for securing pads to the wall, colors of pad fabric shall be a maximum of two colors selected by Architect from manufacturers standard colors. Fabric shall have a tear strength of 281.2 G/SM (400 PSI), shall be mildew and not resistant and shall contain an infection combating fungicide.

F. Electronic scoreboard: Locate scoreboard and control console as indicated on drawings. Capable of operating on 220 volt, single-phase, 50/60-cycle power with low voltage controls.

1. Construction, general requirements:
  - a. Cabinet: Structural aluminum extrusion, 6063-T6 alloy. 177.8 mm (7 IN) deep x 2 mm (0.078 IN) thick. Heli-arc welded corners. Overall dimensions approximately 1.8 M (5.8 FT) high x 2.4 M (8 FT) long. Face panels shall be minimum

- 0.76 mm (22 gage) galvanized steel, and shall be cleaned, coated with a phosphate conversion coating, primed with zinc chromate and finished in a non-reflecting, factory applied, backed enamel finish of color indicated for each component. All captions shall have white letters and shall be in Arabic and English. Cabinet shall include all lamps. Also provide ten extra lamps of each type and color. All numbers shall be in English only.
- b. Service access shall be through front face panels with no need to remove cabinet from wall to service. Score packs and timers shall be modular, plug-in types for ease of replacement.
  - c. Lampbanks shall be bright, 4-lamp horizontal / 7-lamp vertical pattern, each capable of producing every numeral up to its stated capacity. Bright aluminum, individual recessed reflector ring for each lamp. 7-watt lamps with approximately 3000-hour rating.
  - d. Horn shall be resonating type in its own cabinet mounted separately on wall above scoreboard. Horn shall automatically sound at end of each timing period. It shall also be able to be operated manually from control console at any time.
  - e. Period: Four periods shall be displayed by four individually recessed red lamps in recessed, bright aluminum reflector rings.
  - f. Control console: 100% solid-state, electronic. Molded high- impact, low profile with digital switch layout to match scoreboard layout. Console shall operate on low voltage supplied through a 15.2 M (50 FT) control cable. All timing, scoring and other data shall be transmitted to scoreboard from control console. Console size approximately 63.5 mm (2-1/2 IN) high x 381 mm (15 IN) wide x 203.2 mm (8 IN) deep. Timing lamps shall be capable of indicating 99:59 minutes and shall be instantly resettable to any time between 99:59 and 00:00 at any time during usage by ascending or descending timing mode switch on control console.
  - g. Installation shall be by flush mounting brackets with direct attachment to wall.
- G. Masts: 4 nos HDG masts 42 m under platform with titled headframe to carry 80 Megalux and 6 emergency 1500 w halogen floodlights.
- 1. Masts is designed to CP3 TR7 for 160 km / hrs
  - 2. Weight of pole 16 tons
  - 3. Base late dia 1960 mm with 32 anchor bolts 48 x 1820 mm
  - 4. Base dia 1650 mm
  - 5. Access to platform by power lift
  - 6. Access to the floodlights by 4 vertical ladders
  - 7. According to calculation note F 5209 B.

### **PART 3 - EXECUTION**

#### **INSPECTION**

- A. Examine spaces and verify suitability of conditions of spaces for installation.
- B. Report unsatisfactory conditions to the Construction Manager.
- C. Begin installation when unsatisfactory conditions have been corrected.

## **INSTALLATION**

- A. Complete the assembling of each item shipped to the Project premises incompletely assembled. Assemble in accordance with manufacturer's written instructions with parts which shall be supplied by the manufacturer.
- B. Provide items to Project in a timely manner so as to avoid delay of work.

## **CONTRACT CLOSEOUT**

- A. Clean all components.
- B. Restore marred or abraded surfaces.
- C. Adjust for safe, efficient operation.
- D. Submit operating and maintenance data.
- E. Perform demonstration/instruction of operating procedures.

---

## 11.2 **VACUUM CLEANER MACHINE FOR VINYL**

### **GENERAL**

Vacuum for washing, dying and mopping vinyl floors without leaving stains behind.

### **FEATURES**

- A. Soft wheels type that protects the floor and makes maneuvering easier.
- B. Spinscrub brushes technology – patented 360° Counter, rotating, removable, brushes, gently wash, scrub and clean the vinyl floor and leaving no scratches.
- C. Clean boost control allowing to operate and control the vacuum fast and easily.
- D. Wash and dry mode selection.
- E. Dual tank technology (separate reservoir) is required, one for clean water and other for dirty water sucked by vacuum.
- F. Similar to “Hoover Floormate Deluxe FH 40160 Series Hard Floor Cleaner Moondust” or approved equal.

**CHAPTER TWELVE**  
**FURNISHING**

---

## **CHAPTER TWELVE** **FURNISHING**

### **12.1 INSTITUTIONAL FURNITURE**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section includes the following institutional furniture.
  - 1. Classrooms Furniture
  - 2. Conference Room Furniture
  - 3. Office Room Furniture
  - 4. Director Room Furniture
  - 5. First Aid Room Furniture, Equipment and Supply
  - 6. Hooks with Rails for Hats and Coats

##### **1.2 SUBMITTALS**

- A. General Requirements: Requirements for submittal procedures.
- B. Shop Drawings: Indicate dimensions, locations, layout, sections and details, etc.
- C. Samples:
  - 1. Submit two samples, 300 x 300 mm in size illustrating color, finish, texture and pattern of materials, and 300 mm long for frame materials.
  - 2. Submit full size item for review as requested and use in finished application only if undamaged and accepted by the Engineer.
- D. Manufacturer's Literature, Data, and Catalogues: Submit two copies of manufacturer's literature and data for review complete with installation method for each item, and manufacturer's catalogues in order to select the required furniture.

##### **1.3 QUALITY ASSURANCE**

- A. Manufacturer: Provide furniture and related materials from a single manufacturer approved by the Engineer.
- B. Provide new materials and of prime quality and free from defects which would impair strength, durability, or appearance.
- C. Provide materials with structural properties to withstand stresses and strains necessary to maintain safety during normal usage.
- D. Installations: Comply with manufacturer's recommendations for installation of items specified in this section.

##### **1.4 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

---

### 1.5 PRE-INSTALLATION MEETING

- A. General Requirements: Administrative requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this section.

### 1.6 DELIVERY, STORAGE AND HANDLING

- A. General Requirements: Product requirements for product storage and handling.
- B. Accept materials on site in shipping containers with manufacturer's labeling in place; inspect for damage.
- C. Protect materials from damage until installation; repair or replace damaged items at no additional cost to the Employer.

## PART 2 PRODUCTS

### 2.1 FURNITURE

- A. Manufacturers: Any internationally recognized manufacturers having an official technical agreement to conformity with standards for the products.
- B. Furnish materials as specified, as shown on drawings and to Engineer's satisfaction.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. General Requirements: Administrative requirements for coordination and project conditions.
- B. Verify exact location of furniture for installation.
- C. Examine adjacent surfaces, and ensure that work detrimental to installation of work under this section is complete.
- D. Reject surfaces not complying with requirements necessary to installation of Work under this section.

### 3.2 PREPARATION

- A. Clean surfaces to receive furniture.
- B. Protect adjacent surfaces and materials prior and during installation.
- C. Remove furniture packing materials.

### 3.3 INSTALLATION

- A. Install Work as specified, as shown on the drawings, in accordance with manufacturer's recommendations, and to the satisfaction of the Engineer.
- B. Use, where applicable and as necessary, hangers and anchors suitable for type of substrate.

- 
- C. Ensure that work is installed, plumbed, leveled, firmly attached, and ready for occupancy.

#### 3.4 CLEANING

- A. General Requirements: Execution requirements for final cleaning.
- B. Clean furniture using materials for cleaning as recommended by manufacturer prior to final acceptance.
- C. Remove and dispose of all packing materials on completion of installation.

#### 3.5 SCHEDULE

- A. As indicated on drawings and where directed by the Engineer.

**Appendix 1**  
**General Safety, Health and Environmental Regulations**

---

**Appendix 1**  
**General Safety, Health and Environmental Regulations**

**1 Introduction**

- 1.1** The prevention of injury and/or illness to site personnel and the public, damage to the Works and to public and private property, protection of the environment, and compliance with applicable laws, are primary objectives of the Employer, and because of the importance the Employer places on meeting these objectives, selected minimum requirements are outlined in these Safety, Health and Environmental Regulations with which Contractors shall comply while working on Government contracts. Given that these Regulations cannot cover every eventuality, the Contractor shall be expected to exercise good judgment in all such matters, even though not mentioned in these Regulations, and shall take any and all additional measures, as required or necessary, to meet his responsibility for safety, health and environmental matters during the period of the Contract.

The Employer and its representatives shall not be held liable for any actions taken by the Contractor that are attributed to following the minimum requirements stated hereinafter.

- 1.2** The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:
- (a) have full regard for the safety of all persons on the Site and keep the Site and the Works in an orderly state appropriate to the avoidance of danger to any person;
  - (b) know and understand all laws governing his activities along with any site requirements and work site hazards. Such information shall be communicated by the Contractor to his personnel and subcontractors;
  - (c) take all necessary measures to protect his personnel, the Employer's personnel, other persons, the general public and the environment;
  - (d) avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of carrying out the Works.

**2 Compliance with Regulations**

- 2.1** The Contractor shall comply with the requirements of these Safety, Health and Environmental Regulations and all other applicable regulations or requirements under Lebanese laws, laid down by relevant authorities or issued by the Employer or the Engineer concerning safety, health and the environment, in force or introduced or issued from time to time during the period of the Contract.

In so far as these Regulations are applicable, they shall apply to sites and personnel outside the Site associated with the performance of the Contract.

- 2.2** The Regulations equally apply to subcontractors and all other parties engaged by the Contractor and their personnel. The Contractor shall ensure all such parties are fully aware of and comply with the Regulations.
- 2.3** The Contractor shall comply with all notifications and written or verbal instruction regarding safety issued pursuant to these Regulations by the Employer, Engineer or relevant authorities within the time specified in the notification or instruction.

Whenever the Contractor is required to obtain the approval, agreement, permission, etc. of the Engineer, such approval, agreement, permission, etc shall not relieve the Contractor of his responsibilities and obligations under these Regulations or the Contract.

**2.4** The Contractor shall adopt a positive approach, awareness and responsibility towards safety, health and the environment, and take appropriate action, by:

- (a) ensuring the Regulations are enforced and followed by the Contractor's personnel. Any failure by the Contractor's personnel to follow the Regulations, shall be regarded as a failure by the Contractor.
- (b) paying attention to possible injury to unauthorized persons entering the site, particularly children.

**2.5** Whenever in these Regulations the Contractor is required to provide test certificates for equipment and personnel or to comply the relevant authorities' requirements and no independent test facilities are available or no relevant authorities exist in Lebanon, the Contractor shall provide:

- a) in lieu of independent test certificates:
  - for equipment - details of the tests and the date of the tests that have been carried out by the Contractor and a written statement that the Contractor has satisfied himself that the item of equipment is fit and safe for use;
  - for personnel - details of the training and experience and a written statement that the Contractor has satisfied himself that the person has the required level of competency;
- b) in lieu of relevant authorities' requirements - details of the Contractor's own rules, regulations, requirements and procedures regarding safety, health and the environment.

If the Engineer is dissatisfied with the details provided by the Contractor, the Contractor shall provide further details or carry out further tests or provide further written statements as may be reasonably required by the Engineer.

When the Engineer has satisfied himself regarding the Contractor's own rules, regulations, requirements and procedures provided in accordance with (b) above, such rules, etc shall be deemed to form part of these Regulations and to which Clause 3 shall equally apply.

### **3 Failure to Comply with Regulations**

#### **3.1 General**

**3.1.1** Should the Contractor fail to comply with any of the Regulations or requirements:

- (a) the Engineer may suspend the Works or part of the Works until the Contractor has taken necessary steps, to the satisfaction of the Engineer, to comply with the regulations or requirements.
- (b) the Employer may, following written notice to the Contractor, carry out themselves or arrange for another contractor to carry out such measures as they consider appropriate on behalf of the Contractor. Any such actions by the Employer shall not affect or diminish the Contractor's obligations or responsibilities under the Contract.
- (c) the Engineer may, following written notice to the Contractor specifying the breach or breaches of these Regulations by the Contractor, impose the fines stipulated in

Sub-Clause 3.2. All deductions for fines by the Engineer will be subject to the approval of the Employer.

- (d) the Engineer may, by written notice of suspension to the Contractor, suspend all payments to the Contractor under the Contract if the Contractor fails to rectify any breach of the Regulations within the period specified by the Engineer, provided that such notice of suspension:
  - (i) shall specify the nature of the failure or failures; and
  - (ii) shall request the contractor to remedy each such failure within a specified period after receipt by the Contractors of such notice of suspension.

Such suspension of payment will remain in force until such time as the Contractor has rectified the breach or breaches to the satisfaction of the Engineer. No interest shall be paid on the suspended payments.

- 3.1.2 Failure to comply with the Regulations or requirements shall be considered a breach of contract by the Contractor and may result in termination of the Contract by the Employer.
- 3.1.3 In the event of the Employer or Engineer taking action based on Sub-Clause 3.1.1(a) or (b) or 3.1.2, the Contractor shall not be entitled to any additional costs or extension to the Contract Completion Date.
- 3.1.4 All costs incurred by the Employer pursuant to Sub-Clause 3.1.1(b) and the fines imposed on the Contractor by the Engineer under Sub-Clause 3.1.1(c) shall be deducted from amounts otherwise due to the Contractor.

## **3.2 Fines**

- 3.2.1 Failures by the Contractor to comply with the Regulations or requirements are classified as follows:
  - F1 - breaches of Sub-Clause 5.6 (personal protective equipment);
  - F2 - breaches of Clause 7 (work in Public Areas);
  - F3 - breaches other than F1 and F2.
- 3.2.2 The basic fine for each classification in Sub-Clause 3.2.1, is as follows:
  - for F1 - US\$100;
  - for F2 - US\$500;
  - for F3 - US\$200.
- 3.2.3 Fines will be applied as follows:
  - (a) for the first breach of each regulation or requirement - the basic fine. If the same or similar breaches occur in different situations or locations at the same time, the Engineer may apply fines for each situation or location; this will not apply to breaches related to personal protective equipment.
  - (b) for a second or subsequent breach of the same Regulation or requirement or failure to rectify a previous failure within the time specified by the Engineer - twice the basic fine.

## **4 General Requirements**

### **4.1 Preamble**

- 4.1.1 All references to safety shall be deemed to include health and the environment.

## **4.2 Safety Officer**

- 4.2.1 The Contractor shall appoint a competent Safety Officer who shall be responsible for safety, health and the environment. The Safety Officer shall be given sufficient time by the Contractor to carry out his duties; minimum requirements shall be as follows:
- |                               |                                                                                                                    |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Workforce on Site of over 250 | - full time Safety Officer;                                                                                        |
| Workforce on Site of 100-250  | - 50% of Safety Officer's time;                                                                                    |
| Workforce on Site below 100   | - as required for the Works but a minimum of 5 hours per week of Safety Officer's time where more than 20 workers. |
- 4.2.2 The Contractor shall provide the Safety Officer with appropriate identification, including a white hard hat with red cross symbol and a identification badge. The appointment of the Safety Officer shall be in writing and copied to the Engineer. The appointment shall include specific instructions to enforce these Regulations and delegated authority to take any action, measure or to issue instructions regarding their enforcement. All persons on Site shall be made aware of the name and authority of the Safety Officer and instructed to comply with any instruction or direction on safety matters, verbal or in writing, issued by the Safety Officer.
- 4.2.3 The Safety Officer shall be provided with a mobile phone or other similar means of communication. The Safety Officer shall be accessible and available at all times including outside normal working hours.

## **4.3 Safety Training**

- 4.3.1 The Contractor shall provide safety induction training for all site personnel upon starting on site.
- 4.3.2 The Contractor shall provide safety refresher/reinforcement training at regular intervals for his staff.

## **4.4 Safety Meetings**

- 4.4.1 The Contractor shall hold regular safety meetings to provide safety instructions and receive feedback from site personnel on safety, health and environmental matters. A weekly Safety Meeting shall be chaired by the Safety Officer and minutes shall be taken of the meeting. The meeting/minutes shall cover all relevant issues including actions to be taken. A copy of the minutes shall be given to the Engineer. The Safety Officer should attend the Contractor's weekly site meetings and "Safety" should be an item on the agenda.

## **4.5 Safety Inspections**

- 4.5.1 The Safety Officer shall make regular safety inspections of the work site. The Safety Officer shall prepare a report of each inspection. This report shall include details of all breaches of these Regulations and any other matters or situations relating to safety found during the inspection, instructions issued by the Safety Officer and actions taken by the Contractor. A copy of the Safety Officer's inspection reports shall be given to the Engineer.

## **4.6 Control of Substances Hazardous to Health**

- 4.6.1 Hazardous materials shall be stored in approved safety containers and handled in a manner specified by the manufactures and/or prescribed by relevant Authorities (see Sub-Clause 2.5).
- 4.6.2 Only properly trained and equipped personnel shall handle hazardous materials.

---

#### **4.7 Potential Hazards**

- 4.7.1 The Contractor shall inform employees of potential hazards, take appropriate steps to reduce hazards and be prepared for emergency situations.
- 4.7.2 The Contractor shall make an assessment of every operation involving hazardous substances. The assessment shall be recorded on a Hazardous and Flammable Substances Assessment Method Statement which shall be submitted to the Engineer prior to the delivery and use of the substance on Site.

#### **4.8 Accident Reporting**

- 4.8.1 The Contractor shall report all accidents and dangerous occurrences to the Engineer. The Contractor shall prepare a report on each accident or dangerous occurrence and a copy of the report, together with witness statements and any other relevant information, shall be submitted to the Engineer. A reportable accident or dangerous occurrence shall include any accident to any person on Site requiring medical attention or resulting in the loss of working hours or any incident that resulted, or could have resulted, in injury, damage or a danger to the Works, persons, property or the environment.
- 4.8.2 In the event of an accident or dangerous occurrence, the Contractor shall be responsible for completing all statutory notifications and reports. Copies of all statutory notifications and reports shall be passed to the Engineer.
- 4.8.3 All accidents and dangerous occurrences shall be recorded in a Site Accident Book. The Site Accident Book shall be available at all times for inspection by the Engineer.
- 4.8.4 The Contractor shall immediately rectify any situation or condition that could result in injury, damage or a danger to the Works, person, property or the environment. If the situation or condition cannot be corrected immediately, the Contractor shall provide temporary barriers and appropriate warning signs and devices and/or take other appropriate action necessary for the protection of persons, property and the environment.

#### **4.9 Notices, Signs, Etc.**

- 4.9.1 All safety, health, environmental and other notices and signs shall be clearly displayed and written in both Arabic and English. All requirements, instructions, procedures, etc. issued by the Contractor concerning these Regulations shall be printed in both Arabic and English and displayed and readily available to Contractor's personnel.

#### **4.10 First Aid and Medical Attention**

- 4.10.1 The Contractor shall have comprehensive First Aid Kit(s) on Site at all times. First Aid Kits shall be conveniently located and clearly identifiable.
- 4.10.2 The Contractor shall have one employee on site trained in first aid for every 25 employees. Such persons shall be provided with appropriate identification, including a red hard hat with a white "red cross" symbol and a identification badge.
- 4.10.3 The Contractor shall make contingency arrangements for calling a Doctor and transporting injured persons to hospital. The telephone numbers of the emergency services and the name, address and telephone number of the Doctor and nearest hospital shall be prominently displayed in the Contractor's site office.

#### **4.11 Employee Qualifications and Conduct**

- 4.11.1 The Contractor shall employ only persons who are fit, qualified and skilled in the work to be preformed. All persons shall be above the minimum working age.

4.11.2 Contractor's personnel shall use the toilet facilities provided by the Contractor.

4.11.3 The Contractor shall ensure:

- (a) that no firearms, weapons, controlled or illegal substances or alcoholic beverages are brought onto the Site and that no personnel under the influence of alcohol or drugs are permitted on Site.
- (b) that all personnel obey warning signs, product or process labels and posted instructions.
- (c) that drivers or operators of vehicles, machinery, plant and equipment follow the rules for safe operations. Drivers shall wear seat belts and obey all signs and posted speed limits.

## **5 Safety Requirements**

### **5.1 Personal Protective Equipment**

- 5.1.1 The Contractor shall provide personal protective equipment, including hard hats, safety glasses, respirators, gloves, safety shoes, and such other equipment as required, and shall take all measures or actions for the protection and safety of Contractor's personnel.
- 5.1.2 Non-metallic hard hats shall be worn at all times by all personnel at the worksite with the exception of those areas where the Engineer has indicated it is not necessary to do so.
- 5.1.3 Safety glasses shall meet international standards and be available for use and worn in specified worksite areas. As a minimum, safety glasses shall be worn for the following types of work: hammering, chipping, welding, grinding, use of electrically powered or pneumatic equipment, insulation handling, spray painting, working with solvents, and other jobs where the potential of an eye injury exists. Face shields and/or monogoggles shall be worn where possible exposure to hazardous chemicals, cryogenic fluids, acids, caustics, or dust exists and where safety glasses may not provide adequate protection.
- 5.1.4 When handling acids, caustics, and chemicals with corrosive or toxic properties, suitable protection, such as acid suits or chemical resistant aprons and gloves, shall be worn to prevent accidental contact with the substance.
- 5.1.5 Personnel shall not be permitted to work whilst wearing personal clothing or footwear likely to be hazardous to themselves or others.
- 5.1.6 The wearing of safety shoes with steel reinforced toes is recommended for all Contractor's personnel on site. In all cases, Contractor's personnel shall wear substantial work shoes that are commensurate with the hazards of the work and the worksite area.
- 5.1.7 Hearing protection, including muffs, plugs or a combination thereof, shall be provided for all personnel operating in areas where the noise level exceeds 90 decibels. Such protection shall also be provided for operators working with equipment exceeding such a level. This may include equipment such as excavators, shovels, jackhammers, saws, drills, grinders, and the like are being used.
- 5.1.8 The Contractor shall encourage employees to wear substantial work gloves whenever practical and safe to do so.

### **5.2 Fire Protection and Prevention**

- 5.2.1 The Contractor shall comply with fire protection instructions given by the Authorities having jurisdiction in regard to fire protection regulations.

- 
- 5.2.2 The Contractor shall, upon moving on site, provide to the Engineer and the Authorities a fire prevention and evacuation plan. This shall include drawing(s) showing the fire assembly points. The fire prevention and evacuation plan and drawing(s) shall be updated from time to time as the Works progress. The Contractor shall ensure all personnel are fully informed on escape routes and assembly points and any changes thereto.
- 5.2.3 Fuel storage will not be permitted in construction work areas. Contractors may establish fuel storage tanks in special areas set aside for the purpose and approved by the Engineer. Storage tanks shall be adequately banded to control spillage. Fire extinguishers shall be provided and installed in a suitable nearby location.
- 5.2.4 Highly combustible or volatile materials shall be stored separately from other materials and as prescribed by relevant authorities and under no circumstances within buildings or structures forming part of the permanent Works. All such materials shall be protected and not exposed to open flame or other situations which could result in a fire risk.
- 5.2.5 No combustible site accommodation shall be located inside or within 10 metres of a building or structure forming part of the permanent Works. Where units have to be used in these circumstances, they shall be constructed of non-combustible materials and have a half-hour fire rating inside to outside and outside to inside. Non-combustible furniture shall be used where practical.
- 5.2.6 All temporary accommodation and stores shall be provided with smoke detectors and fire alarms.
- 5.2.7 Smoking shall be banned in high risk areas.
- 5.2.8 Expanded polystyrene with or without flame retarding additive, polythene, cardboard and hardboard shall not be used as protection materials.
- 5.2.9 Plywood and chipboard shall only be used as protection on floors. Vertical protection shall be non-combustible. Debris netting and weather protection sheeting shall be fire retardant.
- 5.2.10 When using cutting or welding torches or other equipment with an open flame, the Contractor shall provide a fire extinguisher close by at all times. All flammable material shall be cleared from areas of hot works, or work locations prior to welding or oxy/gas burning operations. All hot works shall cease half an hour before the end of a work shift to allow for thorough checking for fires or smoldering materials. Where appropriate, areas of hot works are to be doused in water before the shift ends.
- 5.2.11 An adequate number of fire extinguishers of types suited to the fire risk and the materials exposed shall be provided. These shall be placed in accessible, well-marked locations throughout the job site. Contractor's personnel shall be trained in their use. Extinguishers shall be checked monthly for service condition and replaced or recharged, as appropriate after use.
- 5.2.12 Only approved containers shall be used for the storage, transport and dispensing of flammable substances. Portable containers used for transporting or transferring gasoline or other flammable liquids shall be approved safety cans.
- 5.2.13 Fuel burning engines shall be shut off while being refueled.
- 5.2.14 Adequate ventilation to prevent an accumulation of flammable vapors shall be provided where solvents or volatile cleaning agents are used.
- 5.2.15 Flammables shall not be stored under overhead pipelines, cable trays, electrical wires, or stairways used for emergency egress.
- 5.2.16 Paints shall be stored and mixed in a room assigned for the purpose. This room shall be kept under lock and key.
-

- 5.2.17 Oily waste, rags and any other such combustible materials shall be stored in proper metal containers with self-closing lids and removed every night to a safe area or off site. Every precaution shall be taken to prevent spontaneous combustion.

### **5.3 Electrical Safety**

- 5.3.1 All temporary electrical installations, tools and equipment shall comply with current regulations dealing with on-site electrical installations.
- 5.3.2 The Contractor shall establish a permit-to-work system for work on or in proximity to energized circuits of any voltage. Contractor's personnel shall not commence work on such circuits unless a permit to work has been issued and adequate safety measures have been taken and the work operation has been reviewed and approved by the Engineer.
- 5.3.3 Only authorized personnel shall be allowed to work or repair electrical installations and equipment.
- 5.3.4 Portable tools and equipment shall be 220 V (volt), unless otherwise agreed by the Engineer.
- 5.3.5 When portable or semi-mobile equipment operates at voltages in excess of 110 volts, the supply shall be protected by a Residual Current Device (RCD) regardless of any such device fitted to the equipment. The RCD must have a tripping characteristic of 30 milliamps at 30 milliseconds maximum.
- 5.3.6 All static electrically powered equipment, including motors, transformers, generators, welders, and other machinery, shall be properly earthed, insulated, and/or protected by a ground fault interruption device. In addition, the skin of metal buildings and trailers with electric service shall be earthed. Metal steps, when used, shall be securely fixed to the trailer.
- 5.3.7 Lampholders on festoon lighting shall be moulded to flexible cable and be of the screw in type. Clip on guards shall be fitted to each lamp unit.
- 5.3.8 All tungsten-halogen lamps shall be fitted with a glass guard to the element. These lamps must be permanently fixed at high level.
- 5.3.9 Electrical equipment shall be periodically inspected and repaired as necessary by competent persons.
- 5.3.10 Any work on electrical equipment and systems shall be made safe through locking, tagging, and/or isolation of the equipment before work commences. Prior to the start of the work, the equipment or systems shall be tested to ensure that they have been properly de-energized and isolated.
- 5.3.11 Electrical repair work on energized systems shall be avoided whenever possible.
- 5.3.12 Electrical trouble shooting shall be conducted only after getting written approval of the Engineer.
- 5.3.13 Unauthorized personnel shall not enter enclosures or areas containing high voltage equipment such as switch gear, transformers, or substations.

### **5.4 Oxygen/Acetylene/Fuel Gases/Cartridge Tools**

- 5.4.1 Compressed oxygen shall never be used in the place of compressed air.
- 5.4.2 Flash-back (Spark) arrestors shall be fitted to all gas equipment.

- 5.4.3 Liquid Petroleum Gas (LPG) cylinders shall not be stored or left in areas below ground level overnight. Cylinders must be stored upright.
- 5.4.4 The quantity of oxygen, acetylene and LPG cylinders at the point of work shall be restricted to a maximum of one day's supply. Cylinders shall be kept in upright vertical rack containers or be safely secured to a vertical support.
- 5.4.5 Cartridge tools shall be of the low velocity type. Operators must have received adequate training in the safe use and operation of the tool to be used.

## **5.5 Scaffolding/Temporary Works**

- 5.5.1 No aluminum tube shall be used, except for proprietary mobile towers, unless otherwise agreed with the Engineer.
- 5.5.2 Drawings and calculations shall be submitted to the Engineer, prior to commencement of work on site, for all Temporary Works, including excavations, falsework, tower cranes, hoists, services and scaffolding. Design shall conform to international standards.
- 5.5.3 The Engineer will not approve Temporary Work designs but the Contractor shall take account of any comments on such designs made by the Engineer.
- 5.5.4 The Contractor shall inspect and approve all Temporary Works after erection and before access, loading or use is allowed. Completed and approved Temporary Works shall be tagged with a scaff-tag or similar safety system and the Safe Structure insert displayed. For scaffolding, one tag shall be displayed every 32 m<sup>2</sup> of face area. A central record system shall be kept on all Temporary Work. Temporary Works shall be inspected weekly and similarly recorded.
- 5.5.5 All mobile scaffold towers shall be erected in accordance with the manufacture's instructions and a copy of these shall be submitted to the Engineer prior to any use on site. Additionally, all towers shall be erected complete with access ladder, safety rails and kick boards whatever the height.
- 5.5.6 The Contractor shall repair or replace, immediately, any scaffold including accessories, damaged or weakened from any cause.
- 5.5.7 The Contractor shall ensure that any slippery conditions on scaffolds are eliminated as soon as possible after they occur.
- 5.5.8 All scaffolds used for storing materials, for brick or block laying, for access to formwork or for any other purpose where materials may accidentally fall, shall be provided with wire mesh guards or guards of a substantial material, in addition to kick boards.

## **5.6 Use of Ladders**

- 5.6.1 Manufactured ladders shall meet the applicable safety codes for wood or metal ladders. Metal ladders shall not be used where there is any likelihood of contact with electric cables and equipment. All metal ladders shall be clearly marked: "Caution - Do not use around electrical equipment".
- 5.6.2 Job made ladders shall not be permitted.
- 5.6.3 Extension or straight ladders shall be equipped with non-skid safety feet, and shall be no more than 12 m in height. The maximum height of a step ladder shall be 2 m. Ladders shall not be used as platforms or scaffold planks.
- 5.6.4 Ladders rungs and steps shall be kept clean and free of grease and oil.

5.6.5 Extension and straight ladders shall be tied off at the top and/or bottom when in use. Only one person shall be allowed on a ladder at a time.

5.6.6 Defective ladders shall be taken out of service and not used. Ladders shall not be painted and shall be inspected for defects prior to use.

## **5.7 Elevated Work**

5.7.1 The Contractor shall provide all personnel, while working at an elevated position, with adequate protection from falls. Details of such protection shall be submitted to and approved by the Engineer.

5.7.2 The Contractor shall carry out daily inspections of all elevated work platforms. Defects shall be corrected prior to use.

### **5.7.3 Roofing & Sheet Material Laying**

(a) A Method Statement detailing the procedures to be adopted shall be submitted to and agreed with the Engineer prior to commencement of work on site.

(b) Mobile elevating work platforms or the equivalent shall be used to install roofing and sheet materials wherever practicable and a suitable base is available.

### **5.7.4 Erection of Structures**

(a) A Method Statement detailing the procedures to be adopted shall be submitted and agreed with the Engineer prior to commencement of work on site.

(b) Safety harnesses and lines shall be provided by the Contractor for use by the erection personnel and worn at all times.

(c) Mobile elevating work platforms or the equivalent shall be used to erect structures wherever practicable and a suitable base is available.

### **5.7.5 Mobile Elevating Work Platforms**

Operators shall be trained in the safe use of such platforms and hold a current Certificate of Competence (see Sub-Clause 2.5).

### **5.7.6 Hoists**

(a) A copy of the current Test Certificate (see Sub-Clause 2.5) shall be submitted to the Engineer before any hoist (personnel or material) is brought into operation on the site. Where the range of travel is increased or reduced a copy of the revised Test Certificate shall be submitted.

(b) Each landing gate shall be fitted with a mechanical or electrical interlock to prevent movement of the hoist when any such gate is in the open position.

(c) Safety harnesses must be worn and used by personnel erecting, altering and dismantling hoists.

### **5.7.7 Suspended Cradles**

(a) Suspended cradles shall be installed, moved and dismantled by a specialist contractor.

(b) Suspended cradles shall comply with local regulations.

- (c) All powered suspended cradles shall incorporate independent safety lines to overspeed braking devices and independent suspension lines for personal safety harness attachment.

## **5.8 Use of Temporary Equipment**

- 5.8.1 The safe design capacity of any piece of equipment shall not be exceeded, nor shall the equipment be modified in any manner that alters the original factor of safety or capacity.
- 5.8.2 Mobile equipment shall be fitted with suitable alarm and motion sensing devices, including backup alarm, when required.
- 5.8.3 The Contractor shall ensure that the installation and use of equipment are in accordance with the safety rules and recommendations laid down by the manufacturer, taking into account the other installations already in place or to be installed in the future.
- 5.8.4 The Contractor shall inspect Equipment prior to its use on the Works and periodically thereafter to ensure that it is in safe working order. Special attention shall be given to such items as cables, hoses, guards, booms, blocks, hooks and safety devices. Equipment found to be defective shall not be used and immediately removed from service, and a warning tag attached.
- 5.8.5 Natural and synthetic fiber rope made of material such as manila, nylon, polyester, or polypropylene shall not be used as slings unless approved by the Engineer.
- 5.8.6 Only trained, qualified and authorized personnel shall operate equipment. All drivers and operators shall hold a current Certificate of Training Achievement for the equipment being used (see Sub-Clause 2.5).
- 5.8.7 A safety observer shall be assigned to watch movements of heavy mobile equipment where hazards may exist to other personnel from the movement of such equipment, or where equipment could hit overhead lines or structures. The observer shall also ensure that people are kept clear of mobile equipment and suspended loads.
- 5.8.8 When mobile or heavy equipment is traveling onto a public thoroughfare or roadway, a flagman shall insure that traffic has been stopped prior to such equipment proceeding. While the mobile or heavy equipment is traveling on a public roadway, a trailing escort vehicle with a sign warning of a slow-moving vehicle that is dangerous to pass shall be provided.
- 5.8.9 Cranes:
  - (a) The Contractor shall give a minimum of 48 hours notice to the Engineer prior to bringing a mobile crane on site.
  - (b) No cranes shall be erected on the site without the prior approval of the Engineer. The Engineer may direct the Contractor as to locations where cranes may not be located. The Contractor shall take such directions into account when submitting his proposals for crane location points, base footings, pick up points and swing radius. Compliance with any such direction shall not entitle the Contractor to any extension of the Period of Completion or to any increase in the Contract Price.
  - (c) Safety harnesses shall be worn and used at all times by personnel engaged on the erection, alterations and dismantling of tower cranes.
  - (d) The Contractor shall provide a copy of the current Test Certificate (see Sub-Clause 2.5) to the Engineer before any crane (tower or mobile) is brought into operation on the Site.

- (e) All lifting tackle must hold a current Test Certificate (see Sub-Clause 2.5). All lifting tackle must be thoroughly examined every 6 months and an inspection report raised.
- (f) All fibrous/webb slings shall be destroyed and replaced 6 months after first use.
- (g) All crane drivers/operators shall hold a Certificate of Training Achievement for the class of crane operated (see Sub-Clause 2.5).
- (h) All banksman/slingers shall hold a Training Certificate from a recognized training agency (see Sub-Clause 2.5).
- (i) Only certified slingers/banksmen shall sling loads or guide crane/load movement.
- (j) The maximum weekly working hours of a crane driver or banksman shall be restricted to 60 hours.
- (k) Under no circumstances, shall a crane or load come within 4 m of any energized overhead power line or other critical structure.

## **5.9 Locking-out, Isolating, and Tagging of Equipment**

- 5.9.1 Equipment that could present a hazard to personnel if accidentally activated during the performance of installation, repair, alteration, cleaning, or inspection work shall be made inoperable and free of stored energy and/or material prior to the start of work. Such equipment shall include circuit breakers, compressors, conveyors, elevators, machine tools, pipelines, pumps, valves, and similar equipment.
- 5.9.2 Where equipment is subject to unexpected external physical movement such as rotating, turning, dropping, falling, rolling, sliding, etc., mechanical and/or structural constraints shall be applied to prevent such movement.
- 5.9.3 Equipment which has been locked-out, immobilized, or taken out of service for repair or because of a potentially hazardous condition shall be appropriately tagged indicating the reason it has been isolated and/or taken out of service.
- 5.9.4 Where safety locks are used for locking out or isolating equipment, the lock shall be specially identified and easily recognized as a safety lock.

## **5.10 Installation of Temporary or Permanent Equipment**

- 5.10.1 During installation and testing the Contractor's specialist engineer shall be in attendance.
- 5.10.2 All control mechanism panel and wiring diagrams shall be available and printed in both Arabic and English.

## **5.11 Laser Survey Instruments**

- 5.11.1 Details of the types and use of laser instruments shall be submitted and agreed with the Engineer.

## **5.12 Working in Confined Spaces**

- 5.12.1 Confined spaces, including tanks, vessels, containers, pits, bins, vaults, tunnels, shafts, trenches, ventilation ducts, or other enclosures where known or potential hazards may exist, shall not be entered without prior inspection by and authorization from the Site Safety Officer and the issuance of a Hazardous Work Permit.

- 5.12.2 Prior to entering the confined space, the area shall be completely isolated to prevent the entry of any hazardous substances or materials which could cause an oxygen deficient atmosphere. All equipment that could become energized or mobilized shall be physically restrained and tagged. All lines going into the confined space shall be isolated and/or blanked.
- 5.12.3 Personnel working in a confined space where emergency escape or rescue could be difficult, shall wear a safety harness attached to a lifeline.
- 5.12.4 A qualified attendant(s), trained and knowledgeable in job-related emergency procedures, shall be present at all times while persons are working within the confined space. The attendant shall be capable of effecting a rescue, have necessary rescue equipment immediately available, and be equipped with at least the same protective equipment as the person making entry.
- 5.12.5 All equipment to be used in a confined space shall be inspected to determine its acceptability for use. Where a hazard from electricity may exist, equipment utilized shall be of low voltage type.
- 5.12.6 The atmosphere within the confined space shall be tested to determine it is safe to enter. Acceptable limits are:
- oxygen: 19.5% lower, 22% higher;
  - flammable gas: not to exceed 10% of lower explosion limit;
  - toxic contaminants: not to exceed the permissible exposure limit.
- Subsequent testing shall be done after each interruption and before re-entering the confined space, as well as at intervals not exceeding 4 hours. Continuous monitoring is preferable and may be necessary in certain situations.
- 5.12.7 Adequate ventilation shall be provided to ensure the atmosphere is maintained within acceptable limits.

### **5.13 Demolition**

- 5.13.1 A detailed Method Statement detailing the demolition procedures/techniques to be used shall be submitted to and approved by the Engineer prior to commencement of work on site.

The Method Statement must include full details of measures to be taken to ensure that there are no persons remaining in the building/structure and to distance members of the public and Contractor's personnel from the building/structure prior to demolition.

### **5.14 Use of Explosives**

- 5.14.1 The Contractor shall not use explosives without the written permission from the Engineer and relevant authorities (see Sub-Clause 2.5).
- 5.14.2 The Contractor shall observe all regulations regarding proper purchasing, transportation, storage, handling and use of explosives.
- 5.14.3 The Contractor shall ensure that explosives and detonators are stored in separate special buildings. These secured buildings shall be constructed, located and clearly marked in Arabic and English:

"DANGER - EXPLOSIVES"

all as approved by the Engineer and relevant authorities (see Sub-Clause 2.5).

- 5.14.4 The Contractor shall ensure that all possible precautions are taken against accidental fire or explosion, and ensure that explosives and detonators are kept in a proper and safe condition.

- 5.14.5 The Contractor shall ensure that explosives and detonators are always transported in separate vehicles and kept apart until the last possible moment and that metallic tools are not used to open boxes of explosives or detonators.
- 5.14.6 Blasting Procedure: the Contractor shall carry out blasting operations in a manner that will not endanger the safety of persons and property. The Contractor shall, along with other necessary precautions:
- (a) clear all persons from buildings and the area affected by the blasting. All such persons shall be given adequate notice of the actual time and date of blasting,
  - (b) ensure that police and other local authorities are kept fully informed, in advance, of the blasting programme so that they may be present when blasting takes place if they so require,
  - (c) erect warning notices around the area affected that blasting operations are in progress,
  - (d) carry out a thorough search of buildings and the area affected prior to blasting,
  - (e) ensure that blasting is only carried out by experienced shot firers. Priming, charging, stemming and shot firing shall be carried out with greatest regard for safety and in strict accordance with the rules and regulations of the relevant authorities (see Sub-Clause 2.5).
  - (f) ensure that explosive charges are not excessive, charged boreholes are properly protected and proper precautions are taken for the safety of persons and property,
- 5.14.7 The Contractor shall maintain an up-to-date inventory of all explosives and explosive devices and shall submit a monthly report to the Engineer, detailing the use of all explosives by date and location.

## **5.15 Excavation and Trenching**

- 5.15.1 The Contractor shall obtain an excavation permit from the relevant local authority before commencing excavation in any public place and he shall observe any restrictions imposed by the authority. He shall produce any such permit for the Engineer's inspection when requested to do so. If he fails to produce the permit, the Engineer shall have the right to order cessation of the relevant work.
- 5.15.2 The side of all excavations and trenches exceeding 1.3 meters in depth which might expose personnel or facilities to danger resulting from shifting earth shall be protected by adequate temporary supports or sloped to the appropriate angle of repose.
- 5.15.3 All excavations, slopes and temporary supports shall be inspected daily and after each rain, before allowing personnel to enter the excavation.
- 5.15.4 Excavations 1.3 metres or more in depth and occupied by personnel shall be provided with ladders as a means for entrance and egress. Ladders shall extend not less than 1 metre above the top of the excavation.
- 5.15.5 The Contractor shall provide adequate barrier protection to all excavations. Barriers shall be readily visible by day or night.
- 5.15.6 Excavated or other materials shall not be stored at least 0.65 metres from the side of excavations.

## **5.16 Concrete Reinforcement Starter Bars**

- 5.16.1 The Contractor shall ensure concrete reinforcement starter bars are not a danger to personnel. Where permitted by the Engineer, starter bars shall be bent down. Alternatively, the starter bars shall be protected using either hooked starters, plastic caps, plywood covers or other methods agreed with the Engineer.

## **6 Environmental and Health Requirements**

### **6.1 Protection of the Environment**

- 6.1.1 The Contractor shall be knowledgeable of and comply with all environmental laws, rules and regulations for materials, including hazardous substances or wastes under his control. The Contractor shall not dump, release or otherwise discharge or dispose of any such material without the authorization of the Engineer.
- 6.1.2 Any release of a hazardous substance to the environment, whether air, water or ground, must be reported to the Engineer immediately. When releases resulting from Contractor action occur, the Contractor shall take proper precautionary measures to counter any known environmental or health hazards associated with such release. These would include remedial procedures such as spill control and containment and notification of the proper authorities.

### **6.2 Air Pollution**

- 6.2.1 The Contractor, depending on the type and quantity of materials being used, may be required to have an emergency episode plan for any releases to the atmosphere. The Contractor shall also be aware of local ordinances affecting air pollution.
- 6.2.2 The Contractor shall take all necessary measures to limit pollution from dust and any wind blown materials during the Works, including damping down with water on a regular basis during dry climatic conditions.
- 6.2.3 The Contractor shall ensure that all trucks leaving the Site are properly covered to prevent discharge of dust, rocks, sand, etc.

### **6.3 Water Pollution**

- 6.3.1 The Contractor shall not dispose of waste solvents, petroleum products, toxic chemicals or solutions in the city drainage system or watercourse, and shall not dump or bury garbage on the Site. These types of waste shall be taken to an approved disposal facility regularly, and in accordance with requirements of relevant Authorities. The Contractor shall also be responsible to control all run-offs, erosion, etc.

### **6.4 Solid Waste**

- 6.4.1 General Housekeeping
- (a) The Contractor shall maintain the site and any ancillary areas used and occupied for performance of the Works in a clean, tidy and rubbish-free condition at all times.
- (b) Upon the issue of any Taking-Over Certificate, the Contractor shall clear away and remove from the Works and the Site to which the Taking-Over Certificate relates, all Contractor's Equipment, surplus material, rubbish and Temporary Works of every kind, and leave the said Works and Site in a clean condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's

Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

#### 6.4.2 Rubbish Removal and Disposal

- (a) The Contractor shall comply with statutory and municipal regulations and requirements for the disposal of rubbish and waste.
- (b) The Contractor shall provide suitable metal containers for the temporary storage of waste.
- (c) The Contractor shall remove rubbish containers from site as soon as they are full. Rubbish containers shall not be allowed to overflow.
- (d) The Contractor shall provide hardstandings and clear vehicle access to rubbish containers.
- (e) The Contractor shall provide enclosed chutes of wood or metal where materials are dropped more than 7 metres. The area onto which the material is dropped shall be provided with suitable enclosed protection barriers and warning signs of the hazard of falling materials. Waste materials shall not be removed from the lower area until handling of materials above has ceased.
- (f) Domestic and biodegradable waste from offices, canteens and welfare facilities shall be removed daily from the site.
- (g) Toxic and hazardous waste shall be collected separately and be disposed of in accordance with current regulations.
- (h) No waste shall be burnt on Site unless approved by the Engineer.

#### 6.4.3 Asbestos Handling and Removal

The Contractor shall comply with all local regulations regarding the handling of asbestos materials. In the absence of local regulations, relevant International Standards shall apply.

#### 6.4.4 Pest Control

The Contractor shall be responsible for rodent and pest control on the Site. If requested, the Contractor shall submit to the Engineer, for approval, a detailed programme of the measures to be taken for the control and eradication of rodents and pests.

### 6.5 Noise Control

- 6.5.1 The Contractor shall ensure that the work is conducted in a manner so as to comply with all restrictions of the Authorities having jurisdiction, as they relate to noise.
- 6.5.2 The Contractor shall, in all cases, adopt the best practicable means of minimizing noise. For any particular job, the quietest available plant/and or machinery shall be used. All equipment shall be maintained in good mechanical order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable. Stationary noise sources shall be sited as far away as possible from noise-sensitive areas, and where necessary acoustic barriers shall be used to shield them. Such barriers may be proprietary types, or may consist of site materials such as bricks or earth mounds as appropriate.
- 6.5.3 Compressors, percussion tools and vehicles shall be fitted with effective silencers of a type recommended by the manufacturers of the equipment. Pneumatic drills and other noisy appliances shall not be used during days of rest or after normal working hours without the consent of the Engineer.

- 6.5.4 Areas where noise levels exceed 90 decibels, even on a temporary basis, shall be posted as high noise level areas.

## **7 Additional Requirements for Work in Public Areas**

### **7.1 General**

- 7.1.1 These additional requirements shall apply to all works carried out in Public Areas.
- 7.1.2 Public Areas are defined as areas still used by or accessible to the public. These include public roads and pavements, occupied buildings and areas outside the Contractor's boundary fencing.
- 7.1.3 All work in Public Areas shall be carried out to minimize disturbance and avoid dangers to the public.
- 7.1.4 Before commencing work, the Contractor shall ensure that all necessary resources, including labor, plant and materials, will be available when required and that the works will proceed without delays and be completed in the shortest possible time. Periods of inactivity and slow progress or delays in meeting the agreed programme for the works, resulting from the Contractor's failure to provide necessary resources or other causes within the control of the Contractor, will not be accepted. In the event of such inactivity, slow progress or delays, the Contractor shall take immediate action to rectify the situation, including all possible acceleration measures to complete the works within the agreed programme. Details of the actions and acceleration measures shall be submitted to the Engineer. If the Engineer is dissatisfied with the Contractor's proposals, the Contractor shall take such further actions or measures as required by the Engineer. All costs incurred shall be the responsibility of the Contractor.

### **7.2 Method Statement**

- 7.2.1 The Contractor shall submit to the Engineer a method statement for each separate area of work in Public Areas. The Method Statement shall include:
- (a) a general description of the Works and methodology of how it will be carried out.
  - (b) details of the measures and temporary works to minimize disturbance and safeguard the public. These shall include temporary diversions, safety barriers, screens, signs, lighting, watchmen and arrangements for control of traffic and pedestrians and advance warning to be given to the public.
  - (c) details of temporary reinstatement and maintenance of same prior to final reinstatement.
  - (d) for works involving long lengths of trenches or works to be completed in sections, the lengths or sections of each activity (eg up to temporary reinstatement, temporary reinstatement, final reinstatement) to be carried out at any one time.
  - (e) details of the availability of necessary resources (labour, plant, materials, etc) to complete the work.
  - (f) a programme showing start and completion dates and periods for all activities of each length or section, including temporary works, and the works overall.
  - (g) such further information as necessary or required by the Engineer.
- 7.2.2 The Contractor shall not commence work, including temporary works, until approval of the Contractor's Method Statement by the Engineer.

- 7.2.3 Method Statements shall be updated based on actual progress or as and when required by the Engineer.

### **7.3 Closure of Roads, Etc.**

- 7.3.1 The closure or partial closure of roads, pavements and other public areas will only be permitted if approved by the Relevant Authorities and the relevant closure permit has been issued by the Authority. The Contractor shall detail for each closure the extent of area to be closed, the reasons and duration of the closure and, where appropriate, proposed diversions. The Contractor shall produce the Closure Permit for inspection by the Engineer if requested. The Engineer shall have the right to order cessation of the relevant work if the Contractor does not produce the Closure Permit.

### **7.4 Trench and Other Excavations**

- 7.4.1 The requirements covering trench and other excavations will depend on the location and type of the excavation and the potential risks to the public.

- 7.4.2 The following guidelines apply particularly to trenches but shall also apply to other types of excavations:

- (a) before commencing work the Contractor shall:
- notify the Engineer on the location and duration of the work. An excavation permit signed by the Engineer must be issued in accordance with Sub-Clause 5.15.1 before excavation proceeds in any work location.;
  - obtain permission from relevant authorities including the police when required;
  - erect all temporary works such as barriers, warning signs, lighting, etc;
  - have available adequate materials for temporary supports to sides of excavations and necessary labour, plant and materials to complete the work within the shortest possible time;
- (b) in carrying out the works the Contractor shall, unless otherwise permitted or required by the Engineer:
- not open more than one excavation within a radius of 250 metres;
  - limit the length of trench excavation open at one time to 150 metres;
  - maintain and alter or adapt all temporary works including supports to sides of excavations;
  - remove all surplus excavated material the same day it is excavated;
  - complete the works, including final reinstatement within ten days;
  - where final reinstatement is not achieved within the required time, to carry out temporary reinstatement;
  - ensure that any temporary reinstatement is maintained at the correct level until final reinstatement is achieved.

- 7.4.3 The above guidelines shall not relieve the Contractor of his obligations and responsibilities.

## **7.5 Safety Barriers**

- 7.5.1 Safety barriers shall be provided to the perimeter of work areas and to trench and other types of excavations and to existing openings such as manholes, drawpits and the like. When exposed to the public, safety barriers shall be provided to both sides of trenches and around all sides of openings.
- 7.5.2 The Contractor shall provide details of the type or types of safety barriers for each excavation for the approval of the Engineer prior to commencing work. No work shall commence until the safety barriers are in place.
- 7.5.3 The type of safety barrier used shall be appropriate to the particular location and the potential risks to the public. Examples of different types of safety barriers are given below:
- Type 1 - excavated material;
  - Type 2 - non-rigid barrier of rope or florescent tape strung between metal rods driven into the ground;
  - Type 3 - rigid barrier of timber, steel or concrete. Such barriers could be in the form of horizontal rail(s) or sheet material secured to posts driven or concreted into the ground.
- 7.5.4 The following are guidelines on the type of safety barriers that could be used in differing situations. They apply particularly to trenches but also apply to other types of excavations, existing openings and to the perimeter of work areas:
- areas not subject to vehicular traffic - Types 1 or 2;
  - roadways (low traffic speed) - Types 1 or 2;
  - roadways (high traffic speed) - Types 1 or 3.
- 7.5.5 The above examples of the types of barriers and the guidelines on situations in which they could be used shall not relieve the Contractor of his obligations and responsibilities.

## **8 Contractor's Site Check List**

- 8.1 A sample Contractor's Site Check List is included in Annex 1. This is included to assist contractors should they wish to introduce such a system as part of their site management procedures. The list is not exhaustive and further items will need to be added by the Contractor.
- 8.2 The list is issued for guidance only, and does not, in any way, revise or limit the requirements covered elsewhere in these Regulations.

---

**Annex 1**  
**Sample Contractor's Site Check List**

**Safe Access:**

- arrangements for visitors and new workers to the site
- safe access to working locations
- walkways free from obstructions
- edge protection to walkways over 2m above ground
- holes fenced or protected with fixed covers
- tidy site and safe storage of materials
- waste collection and disposal
- chutes for waste disposal, where applicable
- removal or hammering down of nails in timber
- safe lighting for dark or poor light conditions
- props or shores in place to secure structures, where applicable

**Ladders:**

- to be used only if appropriate
- good condition and properly positioned
- located on firm, level ground
- secure near top. If not possible, to be secured near the bottom, weighted or footed to prevent slipping
- top of ladder minimum 1 metre above landing place

**Scaffolding:**

- design calculations submitted
- proper access to scaffold platform
- properly founded uprights with base plates
- secured to the building with strong ties to prevent collapse
- braced for stability
- loadbearing fittings, where required
- uprights, ledgers, braces and struts not to be removed during use
- fully boarded working platforms, free from defects and arranged to avoid tipping or tripping
- securely fixed boards against strong winds
- adequate guard rails and toe boards where scaffold 2m above ground
- designed for loading with materials, where appropriate
- evenly distributed materials
- barriers or warning notices for incomplete scaffold (ie not fully boarded)
- weekly inspections and after bad weather by competent person
- record of inspections

**Excavation:**

- underground services to be located and marked and precautions taken to avoid them
- adequate and suitable timber, trench sheets, props and other supporting materials available on site before excavation starts
- safe method for erecting/removal of timber supports
- sloped or battered sides to prevent collapse
- daily inspections after use of explosives or after unexpected falls of materials
- safe access to excavations (eg sufficiently long ladder)
- barriers to restrict personnel/plant
- stability of neighboring buildings
- risk of flooding

- materials stacked, spoil and vehicles away from top of excavations to avoid collapse
- secured stop blocks for vehicles tipping into excavations

#### **Roof work:**

- crawling ladders or boards on roofs more than 10 degrees
- if applicable, roof battens to provide a safe handhold and foothold
- barriers or other edge protection
- crawling boards for working on fragile roof materials such as asbestos cement sheets or glass. Guard rails and notices to same
- rooflights properly covered or provided with barriers
- during sheeting operations, precautions to stop people falling from edge of sheet
- precautions to stop debris falling onto others working under the roof work

#### **Transport and mobile plant:**

- in good repair (eg steering, handbrake, footbrake)
- trained drivers and operators and safe use of plant
- secured loads on vehicles
- passengers prohibited from riding in dangerous positions
- propping raised bodies of tipping lorries prior to inspections
- control of on-site movements to avoid danger to pedestrians, etc.
- control of reversing vehicles by properly trained banksmen, following safe system of work

#### **Machinery and equipment:**

- adequate and secured guards in good repair to dangerous parts, eg exposed gears, chain drives, projecting engine shafts

#### **Cranes and lifting appliances:**

- weekly recorded inspections
- regular inspections by competent persons
- test certificates
- competent and trained drivers over 18 years of age
- clearly marked controls
- checks by driver and banksman on weight of load before lifting
- efficient automatic safe load indicator, inspected weekly, for jib cranes with a capacity of more than one tonne
- firm level base for cranes
- sufficient space for safe operation
- trained banksman/slinger to give signals and to attach loads correctly, with knowledge of lifting limitations of crane
- for cranes with varying operating radius, clearly marked safe working loads and corresponding radii
- regularly maintenance
- lifting gear in good condition and regularly examined

#### **Electricity:**

- measures to protect portable electric tools and equipment from mechanical damage and wet conditions
- checks for damage to or interference with equipment, wires and cables
- use of the correct plugs to connect to power points
- proper connections to plugs; firm cable grips to prevent earth wire from pulling out
- "permit-to-work" procedures, to ensure safety

- disconnection of supplies to overhead lines or other precautions where cranes, tipper lorries, scaffolding, etc. might touch lines or cause arcing

**Cartridge operated tools:**

- maker's instruction being followed
- properly trained operators, awareness of dangers and ability to deal with misfires
- safety goggles
- regular cleaning of gun
- secure place for gun and cartridges when not in use

**Falsework/formwork:**

- design calculations submitted
- method statement dealing with preventing falls of workers
- appointment of falsework coordinator
- checks on design and the supports for shuttering and formwork
- safe erection from steps or proper platforms
- adequate bases and ground conditions for loads
- plump props, on level bases and properly set out
- correct pins used in the props
- timberwork in good condition
- inspection by competent person, against agreed design before pouring concrete

**Risks to the Public:**

- identify all risks to members of the public on and off site, eg materials falling from scaffold etc., site plant and transport (access/egress) and implement precautions, eg scaffold fans/nets, banksmen, warning notices etc
- barriers to protect/isolate persons and vehicles
- adequate site perimeter fencing to keep out the public and particularly children. Secure the site during non-working periods
- make safe specific dangers on site during non-working periods, e.g. excavations and openings covered or fenced, materials safely stacked, plant immobilized, ladders removed or boarded

**Fire - general:**

- sufficient number and types of fire extinguishers
- adequate escape routes, kept clear
- worker awareness of what to do in an emergency

**Fire - flammable liquids:**

- proper storage area
- amount of flammable liquid on site kept to a minimum for the day's work
- smoking prohibited; other ignition sources kept away from flammable liquids
- proper safety containers

**Fire - compressed gases, e.g. oxygen, LPG, acetylene:**

- properly stored cylinders
- valves fully closed on cylinders when not in use
- adopt "hot work" procedures
- site cylinders in use outside huts

---

**Fire - other combustible materials:**

- minimum amount kept on site
- proper waste bins
- regular removal of waste material

**Noise:**

- assessment of noise risks
- noisy plant and machinery fitted with silencers/muffs
- ear protection for workers if they work in very noisy surroundings

**Health:**

- identify hazardous substances, e.g. asbestos, lead, solvents etc. and assess the risks
- use of safer substances where possible
- control exposure by means other than by using protective equipment
- safety information sheets available from the supplier
- safety equipment and instructions for use
- keep other workers who are not protected out of danger areas
- testing of atmosphere in confined spaces; provision of fresh air supply if necessary. Emergency procedures for rescue from confined spaces

**Manual handling:**

- avoid where risk of injury
- if unavoidable, assess and reduce risks

**Protective clothing:**

- suitable equipment to protect the head, eyes, hands and feet where appropriate
- enforce wearing of protective equipment

**Welfare:**

- suitable toilets
- clean wash basin, hot/warm water, soap and towel
- room or area where clothes can be dried
- wet weather gear for those working in wet conditions
- heated site hut where workers can take shelter and have meals with the facility for boiling water
- suitable first aid facilities

**Work in Public Areas**

- all risks to the public identified
- method statement approved
- road closures approved
- temporary diversions in place
- safety barriers erected/maintained
- safety signs and lighting installed/maintained
- labor, materials, plant and other resources sufficient to meet programme
- temporary reinstatement completed and properly maintained
- permanent reinstatement completed at earliest possible date