

## Guideline for Standards on Workmanship and Materials

This guideline is provided to support the Contractor's understanding of key aspects of the ECRP IOM Quality Management Plan (QMP) and where applicable, references to the ECRP IOM Project Health and Safety Management Plan (HSMP). Therefore, the instructions in this document are considered supplementary to the QMP and HSMP which are the governing documents on all related requirements.

### **i) Quality of Materials & Technical Specifications.**

The IOM Site Engineer shall check the quality of all materials delivered to site and to meet the minimum requirements and will not be recycled, previously used or repaired. Any material that does not meet the minimum standards shall be rejected. Such materials shall be removed from site and replaced at the Contractors expense with materials of the required quality. Records will be made on Form QM07B – Inspection of Materials on Site.

### **ii) Quantity of Materials**

The IOM Site Engineer shall check that the required quantity of materials has been delivered to site and used in the works. The Engineer will not certify payment for any materials that has been specified in the contract but have not been used in the works, for whatever reason.

### **iii) Quality of Workmanship**

The IOM Site Engineer shall be responsible for checking that the quality of workmanship by the contractor is of an acceptable standard according to this Specification. The IOM Site Engineer will reject any work that has not been executed to the required standard. The Contractor shall redo any rejected works at his own expense and with no time delays to the overall scheme. Records will be made on Form QM18 – Non-conformance Report and tracked on Form QM19 – Non-conformance Register.

### **iv) Excavations**

Excavations shall be clean and free of water. All excavations will be inspected by the IOM Site Engineer before work proceeds as per Check Point #2 in QMP Section 6. The Contractor shall give the IOM Site Engineer *3 days* notice of the inspection date.

Excavations are dangerous and liable to collapse, particularly in wet weather or waterlogged ground. The Contractor shall take all necessary precautions to ensure that all excavations are properly protected to prevent accidental or unauthorized entry. Excavations deeper than 1.2m deep shall not be entered unless they are shored up with wooden or other temporary bracing. The Contractor shall be responsible for safety and be liable for any accidents that may occur. The contractor shall seek

the approval of the IOM Engineer on using either mechanical or manual means as shall be agreed with the contractor. Additional Guidelines are in GHS04 – Excavations in the HSMP.

#### v) Sand

Sand shall be clean and free from contaminants such as oil, silt, soil, wood, metal or vegetable matter (preferable clean river sand). Very fine or smooth sand shall not be used. IOM Site Engineer to check the quality before the commencement of the works.

Coarse Sand (used for concrete) shall have a maximum size of 5mm. Medium Sand (used for masonry mortar and plaster) shall have a maximum size of 2mm.

#### vi) Aggregate

Aggregate used for concrete shall be angular crushed rock varying in size from 5mm to 20mm for Grade 1 Concrete and 5mm to 60mm for Grade 2 Concrete. It shall be clean and free from contaminants such as oil, silt, soil, wood, metal or vegetable matter.

#### vii) Cement

Cement shall be delivered in sealed bags to the site. It shall be kept clean and dry until usage. Partially used bags of cement shall be stored in a dry place until required. Any partially used bags that have become damp shall be rejected.

#### viii) Water

Water used for mixing concrete, mortar, plaster and other construction materials shall be potable, clean and free from organic material. If none is available on site, the contractor shall transport suitable water to site.

#### ix) Concrete Mixes

The below classes of concrete shall be used. Unless otherwise indicated on the drawings, class 25 Concrete shall always be used for the structural concrete. Class 10 shall be used for blinding works. Concrete shall be mixed in the following proportions by volume: -

- C-25 (structural) Concrete: -1: 1: 2 cement: coarse sand: aggregate
- C-20 (structural) Concrete: -1: 1.5: 3 cement: coarse sand: aggregate
- C-15 (structural) Concrete: - 1: 2: 4 cement: coarse sand: aggregate
- C-10 (Mass) Concrete: - 1: 3: 6 cement: coarse sand: aggregate
- C-7.5 (Mass) Concrete: - 1: 4: 8 cement: coarse sand: aggregate

The water cement ratio shall be approximately 0.55 by weight, thus a mix containing 50 kg of cement will require 27.5 L of water. Too much water improves the workability but reduces the strength. Concrete that has too much water added shall be rejected.

#### x) Mixing Concrete

Concrete mixed on site shall be **machine mixed on a clean dry platform of level boards**. Concrete shall not be mixed on the bare ground. Mixing by hand shall be carried out in the following way: First

the cement and sand shall be thoroughly mixed. Second, this mixture shall be thoroughly mixed with the aggregate that has been slightly wetted. When the mixture is completely mixed and uniform in color, the correct quantity of water shall be added, and the concrete thoroughly mixed. (hand mixed concrete cannot to be used for structural works)

If ready mixed concrete is delivered to site, the contractor shall produce certificates from the mixing plant describing the details of the mix. Ready mixed concrete suppliers shall be approved in advance, to be submitted on Form QM06 – Request and Approval for Work/Materials (RFW/RFM). Any ready mixed concrete delivered to site shall be rejected if the supplier had not been previously approved by the IOM Site Engineer.

#### **xi) Placing Concrete**

Once mixed, concrete shall be used immediately. Any concrete that has been allowed to achieve its initial setting shall not be placed. Concrete shall be placed in layers with a maximum thickness of 250mm and a maximum length of 1m. Each layer shall be thoroughly compacted with a wooden rammer. When placing on old or set concrete, the surface of the old concrete shall be thoroughly cleaned and wetted with water/cement paste prior to the placing of new concrete. If the surface is smooth, it must be chipped to form good bonding keys.

#### **xii) Formwork**

Formwork shall be adequately braced and supported to withstand the pressure of the wet concrete before it sets. The faces of the formwork shall be smooth and clean, so that the faces of the fresh concrete are not marked. The joints should be very tight to avoid honey combing. Mould oil may be used to prevent the concrete sticking to the formwork. Side formworks should be struck 3 days after concreting, and underside formworks should be removed after 28 days.

#### **xiii) Reinforcement**

Steel reinforcement shall be the correct diameter as shown on the drawings and to BS4449. The bars shall be clean and free from rust and oils. They shall be securely fixed with binding wires before placing the concrete. The reinforcement's overlaps shall be 50x bar diameter. The minimum concrete cover to reinforcement shall be;

- 50mm in all substructure (below ground level) concrete works
- 25mm in column concrete works
- 25mm in beams concrete works
- 20mm in slabs concrete works.

#### **xiv) Curing Concrete**

Sufficient water is required for concrete to harden through hydration. The concrete must be kept moist or “cured” to ensure that it does not dry out. Poorly cured concrete will shrink or crack, and not achieving its full strength. Concrete shall be cured by covering in plastic sheets, spraying with water, covering with wet sand or other methods proposed by the Contractor and approved by the IOM Engineer. The Contractor shall ensure that all concrete is properly cured.

Curing shall start as soon as the concrete has been poured and shall continue until curing is complete after 28 days.

#### xv) Concrete Finishing

Concrete shall be finished to a smooth uniform surface and finished using a metal or wooden float. The surface texture shall be flat and smooth with no irregularities or air bubbles. When formwork is removed, the face of the concrete shall be flat and smooth. If there are signs of voids, air bubbles or inadequate compaction, the concrete shall be removed, disposed of and re-laid with a fresh mix.

#### xvi) Mortar

Mortar for block-work and floors screeds shall be mixed in the proportion 1 cement: 4 medium sand by volume. Sufficient water shall be added to achieve the desired workability.

The surfaces of the blocks shall be wetted before placing. Mortar shall be placed on all horizontal and vertical faces between the blocks, with no gaps. Each block shall be placed to the correct **line and level, and shall be level in all directions**. Any gaps shall be filled with additional mortar rammed in with a small wooden rammer. The outside faces of block-work walls shall be pointed. No excess mortar shall be allowed to stain the faces of the blocks.

#### xvii) Plaster

Plaster for internal walls and external rendering shall be mixed in the proportion 1 cement: 4 medium clean sand by volume. Sufficient water shall be added to achieve the desired workability.

The walls shall be wetted before applying the plaster. The plaster shall be *15mm thick*, and shall have a uniform **flat finish free of irregularities and blemishes**. When the internal plaster is still damp, the wall shall be sprinkled liberally with semi dry cement powder and floated to a smooth finish with a wet steel float.

At corners and between walls and ceilings, the finish shall be clean and precise in a straight line. **Untidy or poorly finished plaster shall be rejected**. All floor screeds to be done in same level and required slope. Roughening and cleaning the concrete slab before putting the floor screed. Cement and water paste shall be applied before the screed to ensure good bonding with the floor slab and proper curing to be done.

#### xviii) Block work

Blocks shall be of uniform size and shape, with material specifications submitted for approval on Form QM06 – Approval for Work/Materials (AFW/M) prior to delivery on site.

Walls shall be **straight, perpendicular and dimensionally correct**, constructed as shown on the drawings. The lines of mortar shall be horizontal with no excess mortar staining the faces of the walls. The faces of walls shall be regular and even, with no irregular blocks.

#### xix) Roofing screws

Roofing screws shall be of appropriate size for their specified application.

## xx) Corrugated Iron Sheets (CGI)

Corrugated iron sheets shall be gauge 28 as in accordance with the BoQ and specification. The Contractor will ensure that they are of the specified standard.

## xxi) Painting

All the metal work shall be primed and painted with *two coats of antirust paint and finished with one coat of enamel paint*. The finish shall be clean and uniform in color with no blemishes. All surfaces shall be covered uniformly. Adjacent surfaces that have not been painted shall be protected from splashing. Any paint splashes shall be cleaned off at the contractor's expense.

All the walls to be painted shall be clean and dry. Any dirt shall be removed through scrubbing. Specified color coats on the BoQ shall be applied to the satisfaction of the IOM site Engineer. Spills on the floors, walls and roof shall be avoided under all the means and if any, should be thoroughly cleaned to a **state that can't be seen**. The walls shall be painted with *1 coat of emulsion under coat, and finished with 3 coats of matte vinyl paint for interior walls or 3 coats of emulsion weather guard paint for exterior walls*). The wooden fascia board shall be painted with *1 coat of emulsion under coat and finished with 3 coats of an oil based gloss paint in white*. Paint color and where to apply to be coordinated with the IOM Site Engineer.

## xxii) Steel works

All the metal work shall be as specified on the drawings and the BoQ. The steel tubes shall not be under gauge and should be checked by the IOM Site Engineer before the works starts. All the tubes to be free of bend cracks and dents. All alignments to be straight and level. Iron sheets to be fixed on the purlins and not on the other iron sheets. All the steel work tubes and plates to be coated with antirust oil based paint as specified on the BoQ. Steel doors and windows sample to be submitted to IOM Site Engineer for approval. All welds to be continuous and even, to the satisfaction of the IOM Site Engineer.