

TECHNICAL SPECIFICATIONS FOR THE CONSTRUCTION WORKS:

HOUSING APARTMENT BLOCKS USING ROW LOCK BOND TECHNOLOGY
AT

INFORMAL SETTLEMENTS FOR THE REHOUSING UPGRADING PROJECT

2. TECHNICAL REQUIREMENTS

2.1. General Note

The General contractor is required to work in strict compliance with the rules of art. It is also subject to all terms and conditions of the general conditions currently in force in the Republic of Rwanda. All work with defects will be denied and all the consequences of such refusal shall be borne by the General contractor.

2.2. For the foundation for 2 blocks and retaining wall, and the construction of the ground floor and retaining wall

2.2.1. This contract for the general contractor encompasses the supply of materials and labor for the objective of completing the foundation for 2 blocks and the retaining wall, and the completion of the ground floor and retaining wall for Sanctuary Hills:

2.2.1.1. Site installation including site fencing, moving on road boards

2.2.1.2. Buildings setting out. Foundation trenches

2.2.1.3. Foundation masonry

2.2.1.4. Foundation footings steel bars arrangement and form works before pouring the concrete

2.2.1.5. Ring beams form work and steel bar reinforcement arrangement, plumbing waiting pipes and waiting bars for vertical reinforcement

2.2.1.6. Brick walls elevation including some electricity & plumbing pipes within the walls and reinforcements

2.2.1.7. Slab form works and steel bar reinforcement arrangement, Plumbing & Electricity & Mechanical waiting pipes and waiting bars for vertical reinforcement.

2.2.1.8. Slabs concrete pouring

The General contractor is responsible for the site during construction until provisional acceptance. The General Contractor shall allow the client and any person authorized by the client access to the site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

The General contractor must ensure the cleanliness of the site by ensuring regular cleaning.

2.2. Civil Work

2.2.1. Site Clearance

The site clearance includes clearing site of all unwanted materials including trees, shrubs, etc, from site premises to suitable location as per direction of Engineer.

2.3. Earthworks

2.3.1. Earthworks in excavation

The earthworks include excavating over site for leveling, cut away and the manual excavation for strip foundations and any type of footings, up to required depth in mix soils including shoring, dewatering, stacking of required earth for re-filling trenches/ floors, transportation of excess earth to within 50 m distance, as per drawing, specification, and direction of Engineer.

2.3.2 Earthworks in filling

Earthwork in back filling in foundation in trenches and floor with materials from associated excavation including manual compaction in multiple layers of thickness not more than 150 mm with sprinkling water required to obtain 90% density as per specification and instruction by Engineer.

2.3.3 Soiling

The soiling includes the flat dry brick soiling or stone soiling on floor including sand filling in joints, leveling, ramming manually to required depth as per designed thickness and as per specification and as per instruction by Engineer.

2.4. Plain cement concrete (PCC)

Plain cement concrete (PCC) in 1:2:4 (1cement: 2coarse sand: 4aggregate) ratio for leveling course in flooring as per defined thickness in drawing with approved quality of cement and sand and crushed stone aggregate including mixing, laying, curing etc. All complete in approval of site engineer.

2.5. Stone Masonry

The stone work is in foundation with proper laying of stone in 1:4 cement sand mortar with bond stone in regular interval including supply of block & bond stone & transportation up to 30 meters, as per designed drawing and specification.

3. Specifications of Materials

3.1 Cement

The cement shall be 42.5 Grade ordinary Portland cement conforming (**RWANDAN STANDARD**). The cement should come from the Rwanda CIMERWA. Any other type of cement should be subject to the prior approval of the Employer and site Engineer appointed by client.

The cement should be delivered in bags of fifty (50) kg with six leaves packing. Bags ripped during shipping or transportation will not be used and will be immediately removed from the site.

The intensive care should be provided in storage of cement. The cement bags should be stored in dry, well-ventilated shelter. Bags from different deliveries should be stored separately with a notice board with supply date and relevant information of cement delivery. All cement stored for more than two (2) months or with traces of moisture taken at the time of application will be removed from the site.

3.2. Sand/ Fine aggregate

The sand/fine aggregate must comply with the quality specification of **RWANDAN STANDARD-Building code in force**. Sand must be natural, hard, clean, and free of any organic or earthy detritus. It shall free of alkalis, carefully screened and washed with water as directed.

The weight of voided shell is fine aggregate should not exceed the five percent by weight of dry fine aggregate.

3.3. Aggregate

Aggregates must comply with the quality specification of **RWANDAN standard for building material and building code**. The aggregates for concrete must be crushed aggregates. The lateritic materials will not be accepted as aggregates.

The nominal maximum size of coarse aggregate should be as large as possible within the limits specified but in no case greater than one-fourth of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the comers of the form.

For most work, 20 mm aggregate is suitable. Where there is no restriction to the flow of concrete into sections, 40 mm or larger size may be permitted. In concrete elements with thin sections, closely spaced reinforcement or small cover, consideration should be given to the use of 10 mm nominal maximum size.

3.4. Steel

The steel must comply with the quality specification of **RWANDAN standard for building material and building code**. Steel for the reinforcement must have following quality standards:

- Yield strength (for five to twenty diameter) $\geq 42 \text{ kgf / mm}^2$
- Yield strength (for twenty-fifth to forty diameter) $\geq 40 \text{ kgf / mm}^2$

The steel shall be clean and free from material that may cause corrosion of the reinforcement or the disintegration of the concrete and form pitting, loose rust mill scale, paint, oil, grease and other material that may impair the bond between the concrete and reinforcement.

The steel shall be stored properly at least 15 cm above the ground. The method of the storing steel shall be such as to prevent contamination or damage by weather or accidents. The steel shall be protected from humidity.

3.5. Stones

The stones must be hard stones, compact, without cracking, not subject to flaking, with sharp edges. Their form will be as close as possible to a cube and be adapted to the type of structure to be built. The quality and shape of the stones shall be approved by the site Engineer appointed by employer.

The stone must be a metamorphic rock (metamorphic quartzite, metamorphic sandstone, etc.). Schistose rocks, with pocket mica to chipping or signs of a kaolinization must not be used, if found in site it will be immediately removed from site.

3.6. Water

The quality of mixing water must comply with the quality specification for **RWANDAN standard for building material and building code**. The mixing water will be provided by the General Contractor: it must be running water WASAC. Any other source shall be subject to the prior approval of the client.

In addition, the mixing water should not contain more than two (2) grams per liter of suspended solids, or more than two (2) grams per liter of dissolved salts. It will include free of sulfates, organic chlorides.

3.7. Timber

The quality of timber must comply with the quality specification of **RWANDAN standard for building material and building code**. The structural or nonstructural timber must be straight, well-seasoned and free from prohibited defects. The list of prohibited defects as below:

3.7.1. Prohibited defects

All grades of timber with the following defects shall not be used for structural purposes:

- a) Loose grain, splits, compression wood in coniferous species, heartwood rot, sap rot, and

crookedness;

b) Worm holes made by powder post beetles and pitch pockets.

3.7.2. Permissible defects

The following defects are permitted for all grades of timber:

a) Wanes, provided **(i)** they are not combined with knots and reduction in strength due to this is not more than reduction with the maximum allowable knots and **(ii)** there is no objection to its use as bearing area or with, respect to nailing edge distance and the general appearance.

b) Worm holes other than those due to powder post beetles; reduction in strength to be evaluated in the same way as for knots depending upon location and grouping of such holes.

c) All other defects unlikely to affect any of the mechanical strength properties.

4. Specification of Cement Mortar and Cement Concrete

4.1. Cement Mortar

4.1.1. Mixing

The cement mortar should be mixed mechanically as far as possible. In case of manual mixing the mixing should be at least mixed with three times of dry mix and three times after mixing of water. The mixed mortar must be used only after the approval from site engineer.

4.1.2. Application

The cement mortar should be used immediately after its preparation within 30 minutes. The mortar that is dried out more than 30 minutes or has begun to plug must be removed immediately from the site and will not be allowed to mix with fresh mortar.

The composition of mortar should comply the following standards:

Mortars	Weight of cement / m ³ of sand	Sand gradation	Destination
M3	500 kg	0 – 2 mm	waterproof coating inside
M2	400 kg	0 – 2 mm	Maxpan masonry
M1	300 kg	0 – 2 mm	ordinary Coatings

4.2. Cement concrete

The cement concrete mix specification and its application are shown in the table below:

	Destination	Quantity of minimum cement, kg/m³	Compressive strength at 28 days (bar)
B0	Pcc/blinding concrete (béton de propreté)	250	230
B1	Concrete foundation underneath the stone masonry	300	280
B2	slabs, gutters, culvert, etc	300	280
B3	Reinforced concrete. Retaining walls	350	300
B4	Reinforced Concrete for highly stressed components: slabs manholes, septic receiving wastewater	400	330

The concrete compositions B0 and B1 are as follows:

DESCRIPTION	WEIGHT BINDER Kg	SAND kg	AGGREGATES (kg)
B0	150	500	1400
B1	250	500	1300

4.2.1. Mixing

The cement concrete must be mixed mechanically with volumetric ratio or ratio by weight as per the guidance provided by site engineer appointed by employer.

The water cement ratio should be within the range of 0.5 to 0.6 for concrete mixing process. The concrete mix should be approved by the site engineer prior to the application. Abrams cone are between twenty-five and to forty millimeters (25 and 40 mm).

4.2.2. Application

The concrete should be laid within the 30 minutes of mixing. The concrete mix beyond the 30 minutes from the mixing will not be allowed to apply.

The concrete must be applied using mechanical vibration. The vibration time must be controlled as well as the dropping of concrete height should not be greater than 2 m to avoid the segregation. The application of concrete must be done in presence and approval of site engineer.

4.2.3. Curing

Exposed surfaces of concrete should be kept continuously in a damp or wet condition by bonding or by covering with a layer of sacking, canvas, hessian or similar materials, mats or fabrics kept dripping day and night by repeated watering as often as necessary to keep constantly wet for at least seven days from the date of placing concrete in case of ordinary Portland Cement. The period of curing should not be less than 10 days for concrete exposed to dry and hot weather conditions.

Similarly, the curing should be provided to mortar and plasters and wherever there is use of cement, at least for one week of curing should be provided the curing time should be increased to 10 days if the application is exposed to hot climatic condition.