# Employer’s requirements

## Introduction

Providing affordable housing is a one of the key pledge of the Government. As part of this pledge, the Government formulated the 10,000 housing program, under which 3000 housing units was allocated to Male’, while the remaining 7000 housing units was allocated to 7 different provinces. The “*Construction of 500 Housing Units in Maldives on Design Build Basis project*” aims to construct 500 housing units out of which 400 units or flats would be constructed in Male’ while the remaining 100 units would be constructed in Gaafu Dhaalu Thinadhoo.Drawings of the sites allocated for the construction of the housing units is shown in section 4.6.

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## Minimum Design Requirements

These minimum requirements are given as a guideline to the contractor. Contractor could choose to make improvements on the requirements and specifications provided below. The bid shall consist of description of specifications to the level given below with modifications / improvements proposed by the contractor, if any. The contractor is also required to adhere to the planning regulation of Male’.

### Flats:

* + - Sitting, Dining, Kitchen and laundry area.
    - 03 bedrooms (one master room & two small room).
    - 02 toilets (one attached & one common).
* Roof of the building
  + A Timber framed sloped roof or a concrete slab terrace

* Minimum area for each flat shall be 92.89 Sq m (1000 Sq ft)
* There shall be specified setbacks provided at the front and rear sides.
* *Bedrooms:*
  + Area & dimensions:
    - Minimum size of a bedroom shall be 12 Sq m.
    - Minimum clear height (floor to ceiling height) for all areas (except toilets) shall be 2.85m.
* Finishes:
  + Walls shall have preparatory sealer and two coats of emulsion paint finish as specified by the manufacturer.
  + Ceiling shall be smoothed and finished with preparatory sealer and two coats of emulsion paint as specified by the manufacturer.
  + Floors shall be of ceramic tile finish.
* Services:
  + Adequate lighting must be provided for each room. (preferably two light points)
  + A fan and three socket outlets shall be provided for each room (one 15A socket shall be provided at 2.4m height for possible future air-conditioning need).
* Ventilation:
  + Each room shall have window(s), with the opening area equal to 15% of the floor area of the room.
  + In places where balcony is used, doors for balcony access may be considered as openings for ventilation.
* *Toilets:*
  + Area & dimensions:
    - Minimum size of a toilet shall be 3.0 sqm. (approximately 1.5m x 2.0m inside)
    - Minimum clear height (floor to ceiling height) for toilets shall be 2.5m.
* Finishes:
  + Interior of walls shall have ceramic wall tiling up ceiling level.
  + A suspended ceiling, concealing the plumbing pipeline shall be smoothed and finished with preparatory sealer and two coats emulsion paint as specified by the manufacturer.
  + Floors shall be of ceramic tile finish.
* Services:
  + Adequate lighting must be provided for each toilet (minimum one light point).
  + All relevant fixtures (WC, wash basin, Muslim shower, water tap, etc.) must be provided.
  + Water connection must be provided to relevant toilet fixtures.
  + Well water connection shall be provided to WC
* Ventilation:
  + Each toilet shall have window(s), with the opening area equal to 10% of the floor area of the toilet.
* *Space for washing machine:*
  + Area & dimensions:
    - * Washing space shall be provided to accommodate one washing machine.
    - Minimum clear height for shall be 2.4m.
* Finishes:
  + Walls shall have ceramic wall tiling upto 1.8m high from floor finish level. The rest of the walls may be paint finished with preparatory sealer and two coats of emulsion paint as specified by the manufacturer.
  + A suspended ceiling, concealing the plumbing pipeline shall be smoothed and finished with preparatory sealer and two coat emulsion paint and as specified by the manufacturer.
  + Floors shall be of ceramic tile finish.
* Services:
  + Adequate lighting must be provided (minimum one light point).
  + Water connection shall be provided.
  + Weather proof two socket outlets (13A) shall be provided.
* Ventilation:
  + Laundry space shall have window(s), with the opening area equal to 10% of the floor area.
* *Sitting, Kitchen and Dinning* 
  + Area & dimensions:
    - Minimum area for sitting area shall be 9 sqm.
      * Minimum area for Kitchen & Dining shall be 12 sqm. (Preferably separated area for Kitchen)
    - Minimum clear height for shall be 2.85m (floor to ceiling eight).
* Finishes:
  + Walls shall have preparatory sealer and two coats of emulsion paint finish as specified by the manufacturer.
  + Ceiling shall be smoothed and finished with preparatory sealer and two coat of emulsion paint as specified by the manufacturer.
  + Floors shall be of ceramic tile finish.
* Services:
  + Adequate lighting must be provided for the entire area.
  + Fans and sockets outlets at relevant location shall be provided for the general home appliances at sitting, kitchen and dining area.
  + Kitchen fixtures, such as sink, bench, cupboards, etc. must be provided.
  + Water connection must be provided to relevant kitchen fixtures.
* Ventilation:
  + Each space shall have window(s), with the opening area equal to 15% of the floor area of that space

## Minimum requirement for Civil/Structural Design

This attachment describes the minimum civil and structural requirements to be adopted for the design of new buildings, structures, foundations, and access roads/paved areas. The following information shall is not an exhaustive list and if the contractor proposes an alternative building solution, relevant technical specifications and design documentation carried out according to acceptable standard shall be submitted.

**4.3.1 Loading**

*Dead Load*

Dead loads are vertical loads due to the weights of all permanent building components. Typical components are walls, floors, fixed equipment of all kinds, piping, electrical lighting, suspended ceilings, HVAC components and ductwork. These shall include suitable contingencies for material tolerances. The unit weights of materials and components shall be as defined in BS 648 “Schedule of Weights for Building Materials” or information from the product supplier giving installed weights of materials or components.

*Live Load*

Live loads are all moveable superimposed loads such as furniture, moveable partitions, occupants and moveable equipment, but not including wind, earthquake or equipment dynamic loads. Live loads shall be as specified in BS 6399, Part 1, except where they are not in agreement with the following table giving QP’s minimum live loads. Loads shall be applied as a combined arrangement for the most severe effect.

In addition to the live loads, roofs with a slope less than 30° shall be designed for the following sand loads:

|  |  |
| --- | --- |
| * Roof with parapet | 1 kN/m2 |
| * Corrugated roof without parapet | 0.4 kN/m2 |
| * Other roofs | None |

*Wind Load*

The wind pressures shall be calculated in accordance with BS CP3, chapter V, part 2, 1972 “Basic data for Design of Buildings -Wind Loads”. Structures shall be designed for a Basic wind speed of 45 m/sec.

The following wind factors shall be used:

1. Topography factor S1 = 1.0
2. Ground Roughness, S2, Building size and Height above ground factor from table 3.
3. Statistical factor S3 = 1.0

The prevailing wind direction is WSW, but for design purposes wind shall be assumed to come from any direction.

*Load Combinations*

Members/elements of buildings/structures as well as their supports and fixing points shall be designed for the following load combinations:

|  |  |  |  |
| --- | --- | --- | --- |
| Load Combinations | Dead | Live | Wind |
| D+L | X | X |  |
| D+L+W | X | X | X |
| D+W | X |  | X |

Where "D" is the dead load, "L" is the Live Load, and "W" is the wind load. Where appropriate, load(s) due to earth pressure and/or water pressure should be included in the load combination(s).

**4.3.2 Reinforced Concrete**

*General*

Design and detailing of structural concrete shall be in accordance with BS 8110 and BS8007.

Earth retaining structures shall be designed to resist the raking active earth pressure based on the soil parameters given in the Soil Investigation report. For the passive soil pressure neglect the first 300 mm from the finished grade level in the calculations.

All underground structures shall be statically checked for flotation. In the case of pits, basins, manholes and other soil bearing structures the factor of safety against flotation shall be 1.1 for the empty/construction condition.

The thickness of the blinding layer shall be 75mm minimum. Sulphate resisting cement (SRC) complying with BS 4027:1980 shall be used for blinding concrete.

Types of loads and the load combinations shall be considered as per section 2.4. Load factors shall be applied as per BS 8110 or BS 8007 to obtain the most unfavorable conditions.

In pedestals vertical reinforcing shall be enclosed by complete circumferential ties meeting the size and spacing requirements of BS 8110 for tie reinforcement for compression members.

*Cement*

Cement for structural reinforced concrete and paving shall be ordinary Portland Cement (OPC) to BS 12 or equivalent. Sulphate resisting cement (SRC) complying with BS 4027:1980 shall be used for blinding concrete.

*Concrete Grades*

Concrete works shall be designed using the following grades:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Concrete | Grade  N/mm2 | Minimum cement  content (kg/m3) | Maximum water cement ratio | Applications |
| C40/20 | 30 | 330 | 0.4 | Structural concrete (Reinforced) |
| C20/20 | 20 | 310 | 0.5 | Duct encasement, backing, unreinforced footings |
| C15/20 | 15 | 200 | 0.6 | Blinding |

*Reinforcing Steel*

Reinforcing steel bars shall be uncoated high yield deformed bars of characteristic strength of 420 N/mm² to BS 4449, or equal

Uncoated mild steel plain bars with characteristic strength of 250 N/mm² to BS 4449, or equal

Steel wire fabric shall be of characteristic strength 485 N/mm² in accordance with BS 4483 or equal.

Adjacent sheets of mesh reinforcement shall be overlapped by at least 300mm or 31 times the diameter of the wires lying at right angles to the edges to be lapped, whichever is greater. Laps shall be tied together on both longitudinal and transverse wires.

All steel bars shall be bent in accordance with BS 4466:1989.

Mechanical bar couplers, where required, shall be specified as complying with the requirements of BS 8110.

Reinforcement shall be fixed, supported and maintained in position by the adequate use of chairs, spacers and tying wire.

*Concrete Cover*

Concrete cover is the concrete thickness to all steel reinforcement including links:

|  |
| --- |
| 1. For all concrete (with protection) in contact with soil cover shall be 70 mm. |
| 1. For all above grade concrete exposed to weathering cover shall be 50 mm. |
| 1. For above grade concrete protected from weathering cover shall be: |
| * + Beams and columns: 40 mm   + Slabs and walls : 30 mm |
| 1. Cover to bar couplers shall not be less than the minimum specified for reinforcing bars. |

Note: Blinding concrete is not to be considered as cover.

*Concrete Protection*

Appropriate Concrete Protection system shall be designed as per the soil / environmental condition to which the structural elements are exposed. Under ground concrete protections system shall be proposed based on the soil report. If the soil condition is very hostile to the concrete structure then the contractor shall propose a system of concrete protection including the use of appropriate concrete admixtures (micro silica, corrosion inhibitors etc.), as required. However the following are the minimum requirement as per QP standards.

Clauses 3.39.1 a),b) and c) of QGPC Standard Specification for Civil Works Volume 1 are replaced by the following.

Concrete in contact with soil in foundations shall be protected using BITUTHENE 3000 HC membrane system or equivalent.

For surfaces not exceeding 45° to the horizontal, the BITUTHENE is to be laid on top of concrete blinding, the top surface of the membrane is to be protected with a cement screed at least 40 mm thick.

At junctions and joints the membrane is to be overlapped by a minimum of 75mm, exposed edges of concrete are to be chamfered, propriety angel beads are to be provided where necessary.

Where rising blockwork walls are supported by concrete foundations, the membrane and protection board shall be applied on each side of the rising wall up to ground level. Where a floor slab abuts the rising wall the membrane shall be overlapped by the slab polythene damp proof membrane.

Prior to applying the membrane the contractor shall ensure that the concrete or blockwork surfaces are finished smooth and that any irregularity which might cause the membrane to be punctured has been removed and all edges shall be chamfered, proprietary corner fillets shall be installed. The contractor shall adhere strictly to the manufacturers recommendation when applying the protection system.

**4.3.3 Structural Steel**

*General*

The following provisions shall be applicable to steel structures and buildings, stairways, and other miscellaneous steelwork. The design, details, fabrication and erection of structural steel shall be in accordance with BS 5950. All structural steel shall be Grade 43A to BS 4360:Part 2 or equivalent as a minimum.

Types of loads and the load combinations shall be considered as per section 2.4. Load factors shall be applied as per BS 5950 to obtain the most unfavorable conditions.

*Design Data*

Types of loads and load combinations shall be in accordance with section 2.0. The Allowable deflections for some of the members are given below. For other members reference shall be made to BS 5950.

|  |  |  |  |
| --- | --- | --- | --- |
| Category | Member type | Vertical Deflection | Horizontal Deflection |
| Steel members | Purlins  Primary Floor beams  with equipment  without equipment  Cantilever beams | L/200  L/500  L/300  L/400 |  |
| Steel frames | without equipment  With equipment;  - without wind allowance  - with wind allowance |  | H/200  H/300  H/200 |

H is the height of frames, and L is the span of beams

*Connections*

Standard simple beam connections, unless otherwise noted, shall be designed and detailed by the fabricator as shown in Part 3 of “BCSA Structural Steelwork Handbook”.

Where bolts are permitted in structural connections (beam/column connections, moment connections, bracing connections, etc) they shall be black bolts grade 8.8 conforming to BS 3692 in normal tolerance holes with minimum of two M20 bolts. Whenever bolted connections are used, the reduced strength due to holes shall be computed.

Connections shall be designed taking into account of the effects of any eccentricity on the component parts of the connection, including welds and bolts.

The minimum leg length of any stressed weld shall be minimum 6mm or in accordance with the following table;

|  |  |
| --- | --- |
| Thickest part to be connected (mm) | Leg Size (mm) |
| Up to and including 20  20 to 35 | 6  8 |

Size of fillet welds shall refer to the leg length. The effective length of fillet welds shall be the length excluding the first and last 25mm of the weld.

*Minimum Material Thickness*

Minimum dimensions of load carrying members shall be as follows;

Structural members Expect for the webs of rolled steel sections, steel used for external construction shall not be less than 8mm thick, and in construction not so exposed, not less than 6mm thick.

Gusset plates No thinner than 10mm.

*Soil Properties*

Where specified, soil characteristics for all the foundations shall be established through appropriate soil investigation carried out in accordance with BS 5930. The scope shall cover the soil bearing capacity considering the strength and settlement, durability and stability of the foundation soils with regard to water erosion, soil corrosion characteristics, and problems with respect to excavation/construction.

**4.3.4 Underground Utilities**

All reinforced concrete underground foundations, manholes, and chambers shall be protected externally on horizontal and vertical surfaces, as per Section 3.1.2.5 of this document.

All underground utilities, pipes, structures, culverts and covers shall be designed to accommodate imposed loading from service loading, and construction traffic.

**4.3.5 Foundations, Footings and Floor Slabs**

Floor slabs shall be laid flat with no crossfalls. The top level of slab shall not deviate more than ±3mm in 2m when measured in any direction. All floor joints shall be sealed with an approved two-part polysulphide sealant.

Foundation slabs shall be laid on one layer of 1200 gauge polythene sheet lapped minimum 300 mm at each edge on top of 50mm concrete blinding on compacted free draining imported granular material.

In stability analysis calculations the foundation shall be designed to have a minimum factor of safety of 2.0 against overturning and 1.5 against sliding. The weight of soil overburden may be taken into account when calculating factor of safety. The minimum factor of safety against floatation shall be 1.1. In determining the factor of safety against floatation allowance shall be made for removal of soil overburden and possible loss of skin friction from the sides.

**4.3.6 Concrete Blockwork**

Blockwork shall be designed to BS 5628. External walls shall be cavity type comprising 100mm solid concrete externally, a 50mm insulated cavity and 150mm hollow concrete block internal skin or 200mm solid block work.

Walls dividing storage areas from office areas, walls surrounding electrical rooms shall be minimum 200mm hollow concrete block. Other internal blockwork walls shall be minimum 150mm hollow concrete block.

Blockwork walls shall be tied to structural columns and beams using a proprietary stainless steel system that complies with the requirements of BS 5628.

Where joints are required, stainless steel plaster stops shall be used either side of each joint for all external wall joints. Wall joints formed using plaster stops shall be filled using an approved two-part polysulphide sealant.

**4.3.7 Detailed Engineering Design Documents**

|  |
| --- |
| 1. Detail of design and calculations shall be shown on sketches showing structural arrangements, loads, member sizes, etc. Computer printout of input data files shall be supplemented with analysis model plots, illustrating node/element numbers, support type (fixed, pinned, spring), member property/size, member orientation, member length, and member loading. Computer model plots shall not be altered by hand. |
|  |
| 1. For Structural analysis STAAD III Release 23W or similar approved software shall be used and the input file, on CD, shall be submitted for design approval. Shrink command shall be used for presentation of model plots. This command enables each individual beam and/or finite element in the model to be clearly identified for checking/review purposes. |
|  |
| 1. All calculations shall be in SI units. |
|  |

1. Levels shall be related to MSL and Co-ordinates shall be related to MNG (Maldives National Grid).

**4.3.8 Earthworks**

*Fill*

The controlled earth filling shall be done using ‘selected fill’ material imported from an approved area.

Maximum water soluble salts content shall be limited to maximum 2% by dry weight. Liquid limit shall be less than 35% and the plasticity index shall be limited to a maximum value of 10%.

Any fill shall be spread in layers of maximum 250 mm compacted thickness and with a minimum density equal to 95% of the maximum dry density (MDD) as determined by BS 1377 Test 13.

The first layer of fill shall be limited to 200 mm loose thickness. After placement but prior to compaction the area shall be scarified to a depth of 300 mm (100 mm into the natural soil) to break up any weathered crust and mixed with the new fill.

The contractor shall ensure that prior to transportation, coral rock fragments in excess of 100 mm which may exist in the fill material shall be removed by screening or other appropriate method.

*Excavation*

The contractor shall obtain the relevant excavation permits as required to commence work. Materials to be excavated are not specifically classified and the work shall include excavation of all types of soil and rock, whether water bearing or not.

Excavated materials suitable for fill shall be transported to and replaced in fill areas within the limits of workspace. Suitable material for fill is desert fill. The gradation limit shall be within the gradation limits specified below.

Excavated material unsuitable for fill shall be disposed off in spoil approved areas. Unsuitable material for fill includes organic clay or silt, wood or other material subject to decomposition, dune sand or desert fill not conforming to the gradation curve or to maximum allowed salt content, materials obtained during site clearance, e.g. concrete, steel, etc.,

The contractor shall liaise with QC with respect to the work near utility services and shall establish safety procedures and clearance requirements at the start of the excavation work.

Finished excavation slopes in the permanent works shall be free from debris and loose material.

The contractor shall pay special care to ensure no damage occurs to the any existing pipes/ducts or culverts or surrounding buildings during the excavation. Should the contractor in the course of excavation or subsequently, uncover any previously uncovered services, He shall notify QC in writing, description, dimensions and level above datum and other appropriate details on an appropriate drawing.

The contractor shall be responsible for all damage, which may arise from the entry of water into the excavations and shall provide all necessary labour and equipment to bale, de-water, or drain as required keeping the excavations clear of water arising from whatever source.

## Contractor’s Documents

The following is the Contractor’s Documents as per Clause 5.2 that are required to be submitted for review and/or approval upon awarding of contract.

* + - 1. Preliminary architectural design drawings
      2. Preliminary structural design drawings
      3. Preliminary M&E design drawings
      4. Detailed architectural design drawings
      5. Detailed structural design drawings
      6. Detailed M&E design drawings
      7. Detail structural design calculation

For the purpose of bid submission a concept design of the proposed housing units comprising of the following shall be submitted.

Floor plan of individual housing unit(s).

Floor plan of the whole building

Land utilization plan based on the given plot and development guidelines

A graphic presentation of the finished building(s)

## Specific Notes:

* Monthly material testing and quality monitoring must be carried out by the contractor, and this information shall be provided accordingly, including concrete compression tests.
* A monthly progress report (sample provided) shall be submitted by the contractor.
* Materials, fixtures and fitting used on exterior wall and surfaces shall be weather proof external finishing materials including fixtures and fittings.
* All the major materials, fixtures and fittings with their specification shall be approved prior to installation/application.
* As per Maldivian regulation, an Architect and Engineer who is registered in the Maldives would be required to sign the building permit application.

## Sites allocated for the housing units.

Provided separately