SECTION 4

MATERIALS AND CONSTRUCTION STANDARDS

Contents

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MATERIALS AND CONSTRUCTION STANDARDS

401 SCOPE

a) This Section sets out the requirements for use of materials and construction methods to conform to the minimum standards provided in the Code.

b) The construction standards are based on the ability of buildings to resist fire hazards and to accommodate safely the imposed dead and live loads including the hurricane and earthquake loads. This Section provides Tables of fire resistance of various materials and assemblies and gives the requirements for minimum protection of floor and roof systems.

c) This Section must therefore be read with the following:

Section 3 - General Requirements,
Section 12 - Dead and Live Loads,
Appendix G - Fire Safety Requirements.
Appendix H - Requirements of Groups A to F
Appendix I - Classification by Types of Construction

402 MATERIALS STANDARDS

402.1 Approval for Use

The requirements of this Code are not intended to exclude the use of any material not specifically described or recognised herein Any such material shall be approved provided it can be shown to be satisfactory for the purpose intended and be at least equal to the requirements of this Code for quality, strength, effectiveness, fire resistance rating, durability and safety where applicable, and provided that if special knowledge or experience is required in its use it shall only be used by an approved specialist.

402.2 Form of Application

Any person desiring to use a material not recognised in this Code shall make application to the Authority for permission to use such material. The application shall be adequately supported by evidence that the material is at least equal to the standards required by this Code and the Authority shall have power to require additional tests to be made if in its opinion these are necessary for proper consideration of the application.

402.3 Storage and Use

All materials shall be stored on site in such a way as to prevent deterioration or impairment of their quality or strength or effectiveness and no material which has been seriously damaged or permitted to deteriorate shall be used in/for construction.

402.4 Re-use of Used Material

The re-use of used material shall be permitted provided that it can be clearly shown to the satisfaction of the Director that such material is suitable for the purpose intended and meets fully the requirements of this Code for quality, strength, effectiveness, fire resistance rating, durability and safety.

402.5 Required Standards of Materials

All materials used in construction shall conform to the requirements of this Code and shall at least be equal to the requirements of the applicable standards, the list of which is at Appendices A and B.

403 CONSTRUCTION STANDARDS

403.1 Approval for Use

The requirements of this Code are not intended to exclude the use of any method of construction not specifically described or recognised herein. Any such method of construction shall be approved provided it can be shown to be satisfactory for the purpose intended and at least equal to the requirements of this Code for quality, strength, effectiveness, fire resistance rating, durability and safety and provided that if special knowledge is required in its use, it shall only be used by an approved specialist.

403.2 Form of Application

Any person desiring to use a method of construction not specifically described in or recognised by this Code shall make application to the Authority for permission to use such method. The application shall be adequately supported by evidence that the method proposed is at least equal to the standards required by this Code and the Authority shall have power to require additional tests to be made at the expense of the applicant, if in his opinion it is necessary for proper consideration of the application.

403.3 Required Standards for Construction

Standards of construction shall be in accordance with the requirements of this Code and shall at least be equal to the requirements of the list of standards attached to this Code as Appendices A and B or to any other standard or Code approved by the Authority.

403.4 Applicable Codes of Practice

A list of codes of practice applicable to standards of construction is attached to this Code as Appendices A and B.

404 FIRE RESISTANCE RATINGS FOR MATERIALS

404.1 Scope

This Sub-section provides information on the fire resistance of materials and construction assemblies. The information provided must be used with the Use and Occupancy Tables in Section 3 in order to determine the appropriate type of structure and the appropriate materials of construction that should be used.

404.2 Basis of Ratings

a) The fire resistance ratings for materials and combinations of materials recognised by this Code are based on standard ratings presented by recognised international agencies such as British Standards Institution (BSI), or The American Society for Testing and Materials (ASTM).

b) The requirements of this Section constitute the minimum functional performance standards for fire protection purposes, and are not intended to indicate the structural strength of materials or assemblies. It is the responsibility of the architect or engineer to ensure that a building is constructed in a manner which would limit the spread of a fire and that exits are adequately designed in accordance with Section 5 of the Code, and at the same time to ensure that the building is structurally adequate to accommodate safely the imposed loads.

c) The following Tables 4-1 to 4-3 give fire ratings of various materials and assemblies commonly used in construction in the OECS. Other materials and assemblies may be used provided that tests show that the fire-resistive ratings of the materials are acceptable for the uses intended, and provided the materials or assemblies are used in accordance with the conditions of this Code.

405 FIRE-RESISTIVE ASSEMBLIES FOR PROTECTION OF OPENINGS

405.1 General

(a) The design and construction of fire-resistive assemblies and openings shall be carried out in accordance with this Code and in accordance with Section 6 Part 3 of CUBiC.

(b) Where required by this Code (Table 3-2) for fire protection of openings, fire-resistive assemblies shall comply with the standards set forth in the relevant ASTM or BSI standard for fire tests of building materials.

(c) All fire assemblies required to have fire-protection rating of one-half hour or more shall bear a label or other identification showing the rating thereof, issued by an approved testing agency.

405.2 Fire Doors

(a) Approved fire door assemblies shall be constructed of any material or assembly of component materials which meets the test requirements of the ASTM or BSI, and the fire resistance ratings required by this Code.

(b) The identification, testing hardware, frames glazing and installation of fire doors shall be as set forth in paragraph 3.617 of Section 6, Part 3 of CUBiC.

(c) A three-fourths-hour labelled fire assembly door may be used where a one-hour rating is required provided the door is tested, together with the frame and type of hardware as set forth in this Code, for a period of three-fourths hour in accordance with the standard set forth in Section 4 Sub-section 404.2 (a).

(d) Doors from patient rooms of Group B (a) Occupancy, shall have a minimum one hour fire protection rating. The corridor through which the patients have to exit shall be constructed of materials and assemblies with minimum fire resistant ratings of not less than 1 hour.

405.3 Hardware and Frames

(a) Every fire assembly required to have a half hour, three-fourths hour, one hour, one and a half hour, or three hour fire protection rating shall be automatic or self-closing type.

(b) Exit doors shall have closing devices as provided in Section 5 Sub-section 503.7 of this Code.

(c) Where required to be a rated fire assembly, doors shall be equipped with approved steel frames or such frames shall be of the material as used in the test assembly.

(d) Heat-activated devices used in automatic fire assemblies shall be installed, one on each side of the wall at the top of the opening or one on each side of the wall at ceiling height where the ceiling is more than three feet above the opening.

(e) Devices detecting products of combustion shall meet the approval of the Authority as to installation and location, and shall be subject to such periodic tests as may be required by the Authority The tests must be carried out by an experienced testing laboratory approved by the Authority.

405.4 Glazed Openings in Fire Doors and Windows

(a) Glazed openings in a fire assembly shall conform to the following:

i) Where the door serves as a horizontal exit, the self-closing swinging doors may be provided with a wired glass vision panel, preferably vertical, made of 1/4" thick wired glass labelled for fire protection purposes.

ii) The panel shall be not more than 100 square inches, without either dimension exceeding 12 inches.

iii) The developer shall provide the Director with test results from a recognised testing laboratory or institution showing that the fire assembly would have the fire resistance required.

(b) Wired glass vision panels may be used in fire doors of 1-1/2 hour fire-resistance rating intended for use in fire separation walls, provided that the glass panels are not greater than 100 square inches in area.

(c) The area of glazed openings in a fire door required to have 1-1/2 hour or one-hour fire-resistive ratings shall be limited to 100 square inches with a minimum dimension of four inches.

(d) Where both leaves of a pair of doors have vision panels, the total area of the glazed openings shall not exceed 100 square inches for each leaf.

(e) Glazed openings shall be limited to 1200 square inches in wood and plastic faced composite or hollow metal doors, per light, when fire-resistive assemblies are required to have a 3/4 hour fire-resistive rating.

(f) Windows required to have a 3/4 hour fire-resistive rating may have an area not greater than 84 square feet with neither width nor height exceeding 12 feet.

405.5 Fire Windows

Where windows are provided in openings required by this Code to be protected rating by a fire-resistive assembly having a 3/4 hour fire-protection rating, such window shall be labelled or shall be as follows:

a) Windows shall have frames and sash of solid steel section or of hollow steel or iron shapes and be fabricated by pressing, riveting, interlocking, welding, or crimping together, but not by the use of solder or other fusible alloy.

b) Wire glass and glazing shall comply with acceptable standards for fire resistive assemblies.

(c) Maximum height of hollow-metal-frame window shall be 10 feet.

(d) Maximum width of hollow-metal-frame window shall be six feet for double-hung, counter-weighted, counter-balanced, and fixed-sash type windows and shall be five feet for all other types.

(e) Solid-section-frame windows shall have a maximum area of 84 square feet with neither width nor height exceeding 12 feet, except that, when used with unprotected steel mullions, the width shall not exceed seven feet.

(f) Solid-section mullions, where used in lengths exceeding 12 feet, shall be fire-protected.

406 REQUIRED SEPARATION OF CONSTRUCTION

406.1 Separation Between Buildings

a) Where two or more buildings are joined or adjoin, the combined building must comply with the fire resistive requirements and with the height and floor area requirements of this Code and,

b) the buildings must be separated by fire walls having the fire resistivity specified for adjoining classifications of the higher ratings as per Table 3-2.

406.2 Vertical Separation

With the exception of open deck public garages, openings in the external wall in successive storeys in an unsprinklered building required to be Type 1 construction (Fire resistive), must be separated by at least 3 ft. with a spandrel or other member having the same fire rating as required for the wall.

406.3 Party Walls and Fire Walls

Party walls and fire walls separating buildings and compartments must:

a) have sufficient structural stability to allow collapse or burn out of the contents of compartments on the other side of the wall without collapse of the wall,

b) be extended as necessary to the underside of a non-combustible roof covering, with the gap between the top of the wall and the roof covering adequately fire stopped,

c) be extended a minimum of 20 inches above the roof line, if the covering is combustible (eg: asphalt or wood shingles),

d) have the greater of the fire ratings prescribed in Tables 3-4 to 3-7 for the adjoining occupancy classification.

e) Where the roofs of adjoining buildings or of fire compartments are at different levels, the wall must be extended at least 3' 0" above the lower roof, if any part of the lower roof within 20 feet from the wall does not have a fire resistance rating of at least 2 hours.

406.4 Openings in Party Walls and Fire Walls

Doorways and other openings in party walls or fire walls between buildings or fire compartments must·

a) not exceed 100 square feet in area at any one opening and

b) not be greater in aggregate width of all openings in any one storey, than 25% of the length of the wall in that storey.

407 FIRE BARRIERS IN CEILING AND ROOF SPACES

a) Except where the floor/ceiling or roof/ceiling assembly is of non-combustible construction, enclosed roof and ceiling spaces must have fire barriers to divide the space into areas of not more than 3,000 square feet.

b) Fire barriers in roof and ceiling spaces must be of non-combustible construction and located directly above the tenancy separation walls, if the walls do not extend to the floor space above

Table 4-1

Minimum Protection of Structural Parts Based on Time Periods for Various Incombustible Insulating Materials.

(Minimum thickness of insulating material given in inches)

A.

Structural part to be protected. Steel Columns and all Members of Primary Trusses	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Grade A concrete, members 6" x 6' or greater (not including sandstone, granite, and siliceous gravel).	2 -1/2	2	1-1/2	1
Grade A concrete, members 8" x 8" or greater, (not including sandstone, granite, and siliceous gravel).	2	2-1/2	1	1
Grade A concrete, members 12" x 12" or greater (not including sandstone, granite and siliceous gravel).	1-1/2	1	1	1
Grade B concrete and Grade A concrete excluded above. Members 8" x 8" or greater.	2-1/2	2	1	1
Grade B concrete and Grade A concrete excluded above Members 12" x 12" or greater	2	1	1	1
Portland cement plaster over metal lath wired to 3/4 "cold-rolled vertical channels with No. 18 gauge wire ties spaced 3" to 6" on centre. Plaster mixed 1:2 1/2 by volume, cement to sand	-	-	2-1/2	7/8
Multiple layers of 1/2" gypsum wallboard adhesively secured to column flanges.	-	-	2	1

Table 4-1 (Cont'd)

Minium protection of structural parts

B.

Structural part to be protected: Wide flanges of steel beams and girders	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Grade A concrete (not including sandstone, granite and siliceous gravel) with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 025 square inch of steel area per foot in each direction.	2	1-1/2	1	1
Grade B concrete and Grade A concrete excluded above with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than .025 square inch of steel area per foot in each direction.	2-1/2	2	1-1/2	1
Portland cement plaster on metal lath attached to 3/4" cold rolled channels with No 18 gauge wire ties spaced 3" to 6" on centre. Plaster mixed 1.2-1/2 by volume, cement to sand	-	-	2-1/2	7/8

C.

Structural part to be protected: Bonded Tendons in pre-stressed concrete	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Grade A Concrete:				
Beams or girders	4	3	2-1/2	1-1/2
Solid slabs	-	2	1-1/2	1

D.

Structural Part to be Protected: Reinforcing steel in reinforced columns, beams, girders and trusses	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Grade A concrete, members 12" or larger, square or round (Size limit does not apply to beams and girders monolithic with floors)	1-1/2	1-1/2	1-1/2	1-1/2
Grade B concrete, members 12" or larger, square or round (Size limit does not apply to beams and girders monolithic with floors)	2	1-1/2	1-1/2	1-1/2

Table 4-1 (Cont'd)

Minimum Protection of Structural Parts

E.

Structural Part to be Protected: Reinforcing steel in reinforced concrete joists.	**4 Hr.**	**3 Hr.**	**2 Hr.**	**1 Hr.**
Grade A concrete	1-1/4	1-1/4	1	3/4
Grade B concrete	1-3/4	1-1/	1	3/4

F.

Structural Parts to be Protected: Reinforcing steel and tie rods in floor and roof slabs	**4 Hr.**	**3 Hr.**	**2 Hr.**	**1 Hr.**
Grade A concrete	1	1	3/4	3/4
Grade B concrete	1-1/4	1	1	3/4

Notes to Table 4.1:

Re-entrant parts of protected members to be filled solidly.

An approved adhesive qualified under the standards for fire resistive materials

Cover for end anchorages shall be twice that shown for the respective ratings. Where lightweight Grade A concrete aggregates producing structural concrete having an over-dried weight of 110 pounds per cubic foot or less are used, the tabulated minimum cover may be reduced 25 percent.

For Grade B concrete increase tendon cover 20 percent.

Adequate provisions against spalling shall be provided by U-shaped or hooped stirrups spaced not to exceed the depth of the member with a clear cover of one inch.

Prestressed slabs have a thickness not less than required in Table 4-3 for the respective fire-resistive time period

Thickness of material for concrete members applies to bottom steel in slabs and to bottom and side cover over bottom steel in beams and joists.

Table 4-2

Rated Fire-resistive Periods for Various Walls and Partitions (Thickness of units in inches)

A. Concrete Masonry Units	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Expanded slag or pumice	4-3/4	4	3-1/4	2-1/8
Expanded clay or shale	5-3/4	4-7/8	3-7/8	2-5/8
Limestone	6	5	4	2-3/4
Calcareous gravel	6-1/4	5-3/8	4-1/4	2-7/8

B. Solid Concrete	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Horizontal reinforcement not less than 0.25 percent and vertical reinforcement not less than 0.15 percent (Three-fourths as much for welded wire fabric).				
Grade A Concrete	6-1/2	6	5	3-1/2
Grade B Concrete	7-1/2	6-1/2	5-1/2	4

Table 4-2 (Cont'd)

Rated Fire-resistive Periods for Various Walls and Partitions

C. Incombustible Studs-Interior Partition with Plaster Each Side	4 Hr.	3 Hr.	2 Hr.	1 Hr.
3-1/4 by No. 18 gauge steel studs spaced 24" on centre 5/8" gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	-	-	-	4-3/4
3-5/8" No. 16 gauge approved nailable studs spaced 24" on centre. 5/8" neat gypsum wood fibred plaster each side over 3/8" rib metal lath nailed to studs 8" on centre Nails driven 1-1/4" and bent over.	-	-	5-5/8	-
2-1/2" steel studs 16" on centre formed with No. 16 gauge wire diagonals 3/8" perforated gypsum lath attached to the studs each side with No. 12 gauge wire clips at horizontal and vertical joints 1/2" gypsum plaster applied each side mixed 1:2 by weight, gypsum to sand aggregate.	-	-	-	4-1/4
2-1/2" steel studs 16" on centre formed with No 16 gauge angle flanges and No.7 gauge wire diagonals 3/8" perforated gypsum lath attached to the studs each side with No. 12 gauge approved steel wire clips. End joints of lath held by approved end joints clips 3/4 perlite or vermiculite gypsum plaster applied each side	-	-	4-3/4	-

D. Incombustible Studs. Interior Partition with Gypsum Wallboard Each Side.	4 Hr.	3 Hr.	2 Hr.	1 Hr.
No. 25 gauge channel-shaped studs 16" on centre with one hull-length layer of 5/8" Type "X" gypsum wallboard applied vertically attached with 1" long No. 6 drywall screws to each side.	-	4-7/8	-	-

Table 4-2 (Cont'd)

Rated Fire-resistive Periods for Various Walls and Partitions

E. Wood studs-Interior Partition with Gypsum Wallboard Each Side	4 Hr.	3 Hr.	2 Hr.	1 Hr.
2" x 4" wood studs 16" on centre with two layers 3/8" regular gypsum wallboard each side. First layers applied full length vertically, second layer applied horizontally or vertically.	-	-	-	5-1/8
2" x 4" wood studs 16" on centre with space between filled with mineral wool batts nailed to studs and full-length 1/2" regular gypsum wallboard applied vertically.	-	-	-	5-5/8
2" x 4" wood studs 16" on centre with two layers 1/2" regular gypsum wallboard applied vertically or horizontally each side, joints staggered Nail base layer with 5 cooler nails at 8" on centre, face layer with 8 cooler nails at 8" on centre.	-	-	-	5-5/8
2" x 4" wood studs 16" on centre with 5/8" Type "X" gypsum wallboard applied vertically or horizontal nailed with 6" nails 7" on centre with end joints on nailing members.	-	-	-	4-7/8
2" x 4" fire-retardant treated wood studs spaced 16" on centre with one layer of 5/8" thick Type "X" gypsum wallboard applied with face paper grain (long dimension) parallel to studs.	-	-	4-7/8	-

Table 4-2 (Cont'd)

Rated Fire Resistive Periods for Various Walls and Partitions

F. Exterior or Interior Walls	4 Hr.	3 Hr.	2 Hr.	1 Hr.
2" x 4" wood studs 16" on centre with two layers 5/8" Type "X" gypsum wallboard each side. Base layers applied vertically or horizontally and nailed 7" on centre. Face layers applied with coating of approved wallboard adhesive and nailed 12" on centre.	-	-	6-1/8	-
3/4" drop siding or 3/8" exterior type plywood over 1/2" gypsum sheathing on 2" x 4" wood studs at 16" on centre, or exterior surface with interior surface treatment as required for one-hour rated extension, or interior 2" x 4" wood stud partitions	-	-	-	Varies
2" x 4" wood studs 16" on centre with 1/2" metal lath and 3/4" exterior cement plaster on each side.	-	-	-	5
2" x 4" wood studs 16" on centre with 7/8" exterior cement plaster (measured from the face of studs) on the exterior surface with interior surface treatment as required for interior wood stud partitions in this Table. Plaster mix 1 2 scratch coat and 1·3 brown coat, by weight, cement to sand	-	-	-	Varies
3-5/8" No 16 gauge incombustible studs 16" on centre with 7/8" exterior cement plaster (measured from the face of the studs) on the exterior surface with interior, non-bearing, incombustible stud partition Plaster mix 1:2 for scratch coat and 1 3 for brown coat.	-	-	-	Varies

Table 4-3

Minimum Protection for Floor and Roof Systems

A. Concrete-(Excluding Expanded Clay Shale or Slag).

Construction and Minimum Thickness of Floor (ins)	4 Hr.	3 Hr.	2 Hr.	1 Hr.
No ceiling required	6-1/2	5-1/2	4-1/2	3-1/2

B. Reinforced Concrete Joists

Construction and Minimum Thickness of Floor (ins). No ceiling required.	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Slab with suspended ceiling of gypsum plaster over metal lath attached to 3/4" cold- rolled channels spaced 12" on centre. Ceiling located 6" minimum below joists.	3	2	-	-

C. Steel Joist Construction with a Reinforced Concrete Slab on Top Poured on a Metal Lath Form.

Construction and Minimum Thickness of Floor (ins)	4 Hr.	3 Hr.	2 Hr.	1 Hr.
Portland cement plaster over metal lath attached to the bottom chord of joists with single No. 16 gauge or doubled No.18 gauge wire ties	2-1/4	2	-	-
Minimum Thickness of Ceiling				
Ceiling of 5/8" Type "X" wallboard attached to 7/8" deep by 2 5/8" by No. 25 gauge furring channels 12" on centre.	-	-	5/8	5/8

Table 4-3 (Cont'd)

Minimum Protection for Floor and Roof Systems

D. Plywood Stressed Skin Panels

Construction and Minimum Thickness of Floor/Ceiling (ins)	4 Hr.	3 Hr.	2 Hr.	1 Hr.
1/2" thick wood fibreboard weighing 15 to 18 lbs. per cu.ft. installed with long dimension parallel to stringers. Second layer of 5/8" Type "X" gypsum wallboard applied with long dimension perpendicular to joints.	-	-	-	-
Minimum Thickness of Ceiling	-	-	-	3/4

E. Wood Trusses Spaced a Maximum of 24 inches on Centres, Sheathed with a Minimum of one-half-inch Plywood and Covered with Approved Roofing Materials.

Construction and Minimum Thickness of Floor/Ceiling (ins)	4 Hr.	3 Hr.	2 Hr.	1 Hr.
1" x 3" furring 16" o.c.; flat expanded metal lath (3.4 lbs. per sq yd) and 3/4" sanded vermiculite or perlite gypsum plaster.	-	-	-	-
Minimum Thickness of Ceiling	-	-	-	3/4