GRENADA

STATUTORY RULES AND ORDERS NO. 42 OF 2016

THE MINISTER IN EXERCISE OF THE POWERS CONFERRED ON HIM PURSUANT TO SECTION 51(1) OF THE PHYSICAL PLANNING AND CONTROL ACT NO. 23 OF 2016 HEREBY MAKES THE FOLLOWING ORDER–

(Gazetted 29th July, 2016).

1. Citation. This Order may be cited as the

PHYSICAL PLANNING AND DEVELOPMENT CONTROL (ADOPTION OF BUILDING CODE) ORDER, 2016.

2. Adoption of the OECS Building Code. The OECS Building Code contained in the Schedule to this Order is hereby adopted.

SCHEDULE

OECS Building Code

Grenada
St Vincent & the Grenadines
St Lucia
Montserrat

June 2015

Contents

APPENDICES

PREFACE

The chain of islands which comprise the Organisation of Eastern Caribbean States is historically subject to the frequent invasions of destructive hurricanes, and in some islands the additional hazard of earthquakes. Volcanic eruptions are also hazards in at least two of the islands of the group. Unfortunately also many houses, generally owned or occupied by the poor, are sited in gullies or in flood plains and are especially vulnerable to floods caused by high rainfall resulting from the frequent tropical depressions and hurricanes.

The Governments of the OECS have recognised that the damage caused by these extreme natural events affect the poor to a significant extent, and have placed emphasis on the development of building standards which would prevent or mitigate the damage so caused. The Governments are also revising existing planning and building regulations so as to more responsive to the current needs, and to ensure as far as it possible to do so that all buildings are constructed in a "safe" manner and resistant to the natural hazards.

The OECS Secretariat has therefore, with the assistance of the United Nations Development Programme and through the UNCHS/UNDP Project for Programme Support to the Human Settlements Sector in the OECS (CAR/89/006), developed standard building codes and guidelines which speak directly to the specific requirement of each OECS country. The codes and guidelines are based on the Caribbean Uniform Building Code (CUBiC) and other regional codes such as the Bahamas Building Code, the draft Jamaica National Building Code and the Turks and Caicos Islands Building Code. A list of codes and standards quoted is appended. The codes and guidelines so developed should become part of each country's regulatory mechanisms for ensuring adequate building standards.

It is recognised that the large amount of informal housing present in most countries will be outside of the regulatory stream, and that other mechanisms must be devised to improve such housing. It is recognised also that the imposition of building code and guidelines may appear to lead to higher costs of buildings especially for those persons who cannot afford the costs required to construct or upgrade a house to the minimum acceptable standard. It is recommended that each country encourage house owners and occupiers to improve their housing to the minimum standards of safety and structural integrity and that technical advice be offered to such persons who may be applying for permission to construct a new home or to renovate an existing one. The cost of upgrading a house to the minimum acceptable standard will in most cases be very small when compared to the costs of complete rebuilding which may be necessary in the event of damage by a hurricane, flood or earthquake.

The development of an adequately staffed building inspectorate is necessary to ensure that the minimum standards stated in the code and guidelines are maintained. The inspectorate will be expected to ensure compliance with the minimum standards set out in the code and also to assist home owners where possible in understanding the requirements of the code and guidelines.

No code can be expected to provide answers to all of the problems faced by builders. It is considered however that the code and guidelines produced for the OECS countries are responsive to the environmental concerns of the countries and in keeping with the accepted building practices in the Region. The code provides administrative and enforcement requirements relating to the building

practices and use of acceptable materials and building systems. The code also provides for approval of any system or material which can be demonstratively proven to be resistant to the natural hazards. In this way new building systems which may be more efficient than the ones in current use can be accepted without endangering the integrity of the buildings or the lives of the occupants.

The OECS Secretariat is grateful to the UNDP for its assistance in this vital area of the principles of design and construction of the housing sector.

PREFACE TO THE SECOND EDITION

This edition of the Code results from reviews of and comments on the draft Building Code by some of the Planning Authorities/Boards of the OECS with the assistance of the UNCHS Consultant.

Since the draft Code was circulated in 1992, there have been other parallel efforts by the OECS and UNCHS to improve the standard of building and infrastructure in the Region. It is to be noted that the OECS Secretariat has prepared and circulated an Environmental Impact Assessment Procedures Handbook and the UNCHS has assisted the OECS in the preparation of planning and infrastructure standards. A draft Model Physical planning Act has also been circulated to the OECS.

These documents provide planning and environmental guidelines, which along with the Building Code will provide the Planning Authorities with the tools needed for examination of development proposals to ensure that all developments are in concert with the physical, social and economic environment of the States. There are other laws of Antigua and Barbuda which must be adhered in the construction and maintenance of developments. Of particular interest to designers and developers are those laws which control the use of land and any developments on the land, public health electricity and the generation and distribution of electricity. Developers are required to contact the relevant Ministry for copies of the legislation which affects the proposed developments.
The use of the Caribbean Uniform Building Code (CUBiC) as the preferred code of reference has been emphasised. CUBiC was developed specifically for use in the Caribbean and contains the design and construction standards applicable to the environment. It is therefore recommended that designers of structures consult CUBiC where indicated in the Antigua and Barbuda Building Code. As CUBiC does not yet include standards for foundations and building services, the appropriate US and UK standards have been used and are so noted.

The changes and amendments in this edition have generally been to clarify certain specifications, particularly in the use of concrete block for load bearing walls, and in the construction of steel framed building systems. Designers are given some latitude in submitting alternate designs for approval of the Board provide the designs submitted meet with basic criteria set out in the Building Code and in the Environmental Impact Assessment Procedures Handbook.

Additional appendices have been added to provide more specific information on:

- the construction requirements of each Occupancy Group and for each Construction Type
- weights of building material commonly used in the Caribbean
- general guidelines for fire resistive construction
- Accessibility guidelines for handicapped persons

The committees which reviewed the draft Building Code and Building Guidelines considered that there should be provision made for access to public buildings by handicapped persons. This appendix provides basic information and other references for the construction of access ways and facilities for handicapped persons.This information has also been included in the Planning and Infrastructure Standards prepared by UNCHS/OECS.

It is recommended that the Planning Authority arrange for periodic reviews of the Code. The primary objectives of these reviews will be to ensure that the Code is responsive to the environmental needs of Antigua and Barbuda and is in keeping with current design and construction technology.

March 1995

PREFACE TO THE THIRD EDITION
(ANTIGUA AND BARBUDA)

This edition includes changes and amendments resulting from discussions in Antigua and Barbuda with the Ministry responsible for planning and with engineers, architects, and planning officials.

The main changes have been to introduce development standards as Section 19 of the Code. This has been done in response to the request of the Development Control Authority and to ensure that applicants for development permission have all of the relevant information in one document. This new Section however, does not replace the need for developers to follow the requirements laid down in the Planning and Infrastructure Standards Manual, in the same way that the other Sections of the Code require engineers to examine other relevant Codes and Standards for technical information.

Other amendments have been made to include technical information now in the Land Development (Interim Control) Regulations 1976. This has been done as a preliminary to amending the Regulations to include and mandate the use of the Antigua and Barbuda Building Code.

Amendments have been also made to Sections 1, 2, 3, 5, 7, 8, 10, and 11. The amendments to these Sections are noted on every other page of the documents amended.

June 1995

PREFACE TO THE FOURTH EDITION
(COMMONWEALTH OF DOMINICA)

This edition includes the changes and amendments resulting from the UNCHS mission to the Commonwealth of Dominica in November, 1996.

The changes have been made to customize the documents to the procedures and practices of the Planning Authority of Dominica and to include information on the relevant legislation applicable to Dominica.

The maximum size of building for which the Building Guidelines have been developed has been reduced from 3,000 square feet to 2,500 square feet. It must be recognised however that the requirements of the Building Code govern the construction of all buildings and that the information given in the Building Guidelines is consistent with that given in the Code.

The use of a Special Inspector has been made more specific. All buildings which are accessible to the public must be carefully designed and constructed and it is mandatory that a Special Inspector be employed for certain classes of buildings as described in the Code.

Discussions with most of the Planning Authorities of the OECS have indicated that there is a great difficulty in attracting and keeping the cadre of experienced engineers and technicians required to staff a functioning Authority. It is recommended that the Authority examine other management models for ensuring effective control of developments. One model used in France and in the neighbouring Islands of Martinique and Guadeloupe is worthy of examination for possible adoption in the OECS.

The amended Sections are dated on every other page of the Section amended.

November 1996

PREFACE TO THE 5TH EDITION
(ST. LUCIA)

This preface provides information on the amendments made to include more details on the procedure for the review of plans and inspection of construction, and on the design of exterior windows and doors for important buildings.

It should be noted that the Caribbean Uniform Building Code (CUBiC) was approved for use by the Caricom Heads of Government in 1986, and in the recent meeting in Barbados in May 1997 between the Caricom Heads of Government and the US Government, it was agreed that the Caribbean nations will take steps to reduce damage by hurricanes and other natural disasters, by encouraging effective building design and construction standards through the promotion of CUBiC. The provisions of the St Lucia Code reflect the content and thrust of CUBiC to ensure effective building design and construction standards, while recognising that the regulatory provisions must reflect the laws of St. Lucia with respect to the control of developments.

The reviews of damage by the recent hurricanes have shown the need to be specific about the design and installation of exterior doors and windows and other non-structural items. The Code requires that such doors and windows be designed by experienced structural engineers or architects to resist hurricane winds in accordance with Section 12 of the Code. This may require a reconsideration of the traditional responsibilities of the architect and structural engineer, but it is considered important that despite the procedural problems that may result, building failures be minimised by improving the system of delivery of the buildings.

Discussions with the executives of the Professional Engineers Association of St. Lucia and with the Executive Secretary of the Development Control Authority of St. Lucia (DCA) have indicated that until the DCA is equipped with the staff required to carry out the review of plans and inspection of construction as mandated by the Code, there should be self regulation by the engineering fraternity as required in CUBiC Part 1 and in Section 1 of this Code. The St. Lucia Code therefore while providing for the review of plans and inspection of construction by the DCA staff and also by a Check Consultant for certain projects, also allows inspection and reporting by the engineers and architects employed by the owner, with the DCA reserving the discretionary power to carry out detailed reviews of the plans and inspection of construction at any time deemed necessary. This provision applies principally to the design and construction of public, institutional, commercial and hazardous use buildings, and for ll buildings to which the public have access as defined in Section 3 of the Code. The DCA staff will continue to review the plans and inspect construction of all residential buildings.

Financial assistance for the review of this Code was provided by the UNDP and by the Caribbean Disaster Mitigation Project (CDMP) which is funded by the United States Agency for International Development and executed by the Organisation of American States.. The printing of copies of the Code was also financed by the CDMP.

May 1999

PREFACE TO THE 6TH EDITION

(GRENADA, ST VINCENT & THE GRENADINES, ST LUCIA, MONTSERRAT)

Four of the Governments of the OECS are desirous of revising and updating existing technical standards and corresponding building regulations so as to be more responsive to the current needs and to reduce the vulnerability of buildings to the natural hazards.

After the publishing of the original OECS Code in 1992 the nine affected states undertook minor amendments. In some cases additional appendices have been added to provide more specific information on certain topics. This approach is also adopted for the 6th Edition. The Code remains essentially uniform across the entire OECS. The most-comprehensive edition of the OECS Code was the St Lucia Building Code of 2002. This was used as the base Code for the 6th Edition which covers specifically Grenada, St Vincent & the Grenadines, St Lucia and Montserrat, although it is probably relevant all of the original nine states .

The project for the 6th Edition had to be executed under severe time constraints of eleven weeks. This did not permit a comprehensive revision of the OECS Building Code. However, there were aspects of the Code which were amenable to revision in the available time frame and which demanded revision because of research findings and developments in the twenty-three years since the original publication of the OECS Building Code in 1992. These were the topics addressed and concluded in the 6th Edition.

As stated above, the 6th Edition is not a complete revision of the entire St Lucia Building Code of 2002. This was not feasible in the short time available and the constraints of funding. Since the original OECS Code was prepared in 1992 there have been studies and other developments which were sufficiently important that every effort was made to incorporate them in the updated Building Codes for the four states which participated in the 6th Edition. These included new Caribbean wind hazard maps USAID-PAHO: 2008), affects of climate change on Eastern Caribbean wind speeds (World Bank-CCCCC-ICC: 2008), new Eastern Caribbean seismic hazard maps (EUCENTRE-SRC: 2010), new rainfall and flood hazard information for St Vincent & the Grenadines and Montserrat (CDB-HRW-CIMH: 2011), guidance on mitigation of climate change and adaptation to climate change (DFID-PAHO: 2013), enhanced requirements for persons with disabilities, certain sanitation services eg requirements for toilets, new ventilation and air-conditioning requirements, updating of fire prevention, suppression and egress from buildings, building safety as it refers to hotel occupants. In addition, the sections of the earlier OECS Codes dealing with the reviews of designs have been reviewed and revised to facilitate wider implementation. This is seen as critical to success of the OECS Building Code.

June 2015

HOW TO USE THIS DOCUMENT

1. Determine the building purpose and occupancy requirements -see Table 3-1 and minimum areas for habitable rooms -Table 5.1 and Appendices H and I.

2. Determine Construction Type by Classification - see Table 3-2.

3. Permissible heights and areas for specific classifications of buildings -Table 3-3

4. Fire resistance ratings for buildings -Tables 3-4 to 3-7 and Appendix G.

5. Protection of structural plans required -Tables 4-1 to 4-3.

6. Design of the structure to withstand loads -Section 12.

7. For specific requirements for small buildings such as size and spacing of floor and roof members see Section 18 and Building Guidelines.

8. Design of exit doors and windows -Section 5. Attention must be paid to 503.7 and 504t7 for the design of windows and doors to resist hurricane forces and to other non-structural items which may be affected by earthquake forces.

9. For arrangements for disabled persons see Appendix F of the Code or Section F of the Building Guidelines

SOME CONVERSION FACTORS FOR THE UNITS USED IN BUILDING CONSTRUCTION.

METRIC TO IMPERIAL

a) LENGTH

Ikm	= 0.621 371 mile
1m	= 1.09361 yd

b) AREA

I km^2	= 0.386 101 $mile^2$
I ha	= 2.471 04 acre
$1m^2$	= 10.7639 ft^2
I mn^2	= 0.001 550 in

c) MASS

1 kg	= 2.204 62 Ib
1 metric ton	= 1.102 31 ton (short 2000 Ib)
1g	= 0.035 274 oz

d) MASS PER UNIT AREA

1 kg/m^2	= 0.204 816 Ib/ft^2
1 g/m^2	= 0.029 494 oz/yd'

e) FORCE

1MN	= 112.404 tonf (ton-force)
1 kN	= 224.809 lbf (pound-force)
1N	= 0.224 809 lbf

f) FORCE PER UNIT LENGTH

I N/m	= 0.068 522 lbf/ft
I K/m	= 0.034 261 tonf/ft

g) PRESSURE. STRESS, MODULUS OF ELASTICITY

I Mpa	= 145.038 lbf/in^2
I kPa	= 20.8854 lbf/ft^2

SECTION 1

ADMINISTRATION OF THE CODE

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SECTION 1

ADMINISTRATION OF THE CODE

(The overall contents of Section 1 include several clauses related specifically to St Lucia, since the base document for this updating is the St Lucia Building Code. Most of those state-specific clauses have not been amended in this updating exercise. Those amendments will be the undertaken by the relevant agencies and authorities in the individual states.)

101 TITLE

This compilation of rules shall be known as "The OECS Building Code", and may be cited as such, or as the "Building Code," and will be referred to hereinafter as "this Code."

102 SCOPE

102.1 General

(a) The provisions of this Code shall apply to the design and construction of new buildings, and the alteration, reconstruction, demolition, removal, relocation, maintenance and occupancy of existing buildings or any appurtenances connected or attached to such buildings or structures.

(b) The appendices included in this Code are not intended for enforcement unless specifically referenced in this Code text. The latest edition of referenced Standards and Codes shall be used where appropriate. The principal reference Code is the Caribbean Uniform Building Code (CUBiC) published by the Caricom Secretariat, Georgetown, Guyana.

(c) This Code is administered by the Development Control Authority of St. Lucia. Unless otherwise authorized by the Authority, the St. Lucia Building Code takes precedence over any other Building Code or Standard.

102.2 Applicable Legislation

a) The provisions of this Code are not intended to supersede or amend any legislation in force in St. Lucia which affects the design and construction of developments or the responsibilities or authority of the Authority.

b) Owners and developers should be aware of and consult the following legislation and other relevant legislation in force unless amended or repealed by subsequent legislation:

i) Land Development (Interim Control) Act 1971

ii) Electricity Supply Act No. 10 of 1994

iii) Public Health Act (Sewage and Disposal of Sewage and Industrial Waste) Regulations, 1978

iv) Water and Sewage Regulations, 1995

v) Industrial and Commercial Buildings (Fire Safety) Act, 1973

c) Developers/owners should also consult the Planning and Infrastructure Standards Manual prepared by UNCHS and the Manual for Developers prepared by the Development Control Authority of the Central Planning Unit of the Government of St. Lucia for guidance with respect to the layout and infrastructure requirements of a development, and other legislation affecting the safety and health of workers and occupants of a building or development.

103 PERMITS AND FEES

a) A permit is required whenever work regulated by this Code is to be undertaken. To obtain a permit the owner shall file an application with the Authority as described in 109 "APPLICATION TO BUILD".

b) After issuance of a permit an application may be made by the owner for a revision of the permit and such application shall be made in the same manner as for the original permit.

c) The approval of the Authority of proposed work shall be deemed to have lapsed and the right of the owner under the permit terminate if:

i) the work authorized by the permit is not commenced within 12 months from the date of issuance of the permit, or

ii) work is suspended for a period of 24 months or more, or

iii) the applicant does not comply with all the conditions regarding payment of fees as required by the applicable legislation in force.

d) Permit fees payable and all procedures and conditions applicable thereto shall be established by the Authority in accordance with the applicable Regulations.

104 EXISTING BUILDINGS

(a) Alterations, repair or rehabilitation work may be made to any existing building without requiring the building to comply with all of the requirements of this Code provided that the alteration, repair or rehabilitation work conforms to the requirements of this Code for new construction. The Authority shall determine the extent, if any, to which the existing building shall be made to conform to the requirements of this Code for new construction

(b) Alterations, repairs or rehabilitation work shall not cause an existing building to be weakened unless in its weakened state it complies with the structural requirements of the Code .

(c) If the occupancy classification of an existing building is changed, the building shall be made to conform to the intent of this Code for the new occupancy classification as established by the Authority.

(d) Repairs and alterations, not covered by the preceding paragraphs of this Section, restoring a building to its condition previous to damage or deterioration, or altering it in conformity with the provisions of this Code or in such manner as will not extend or increase an existing non-conformity or hazard, may be made with the same kind of materials as those of which the building is constructed; but not more than twenty-five percent of the roof covering of a building shall be replaced in any period of twelve (12) months unless the entire roof covering is made to conform with the requirements of this Code for new buildings.

(e) No building shall be removed or demolished without the approval of the Authority.

105 HISTORIC BUILDINGS

Repairs, alterations and additions necessary for the preservation, restoration, rehabilitation or continued use of a building or structure may be made without conformance to all the requirements of this Code when authorized by the Director and approved by the Authority, provided:

(a) The building or structure has been designated by official action of the legally constituted authority as having special historical or architectural significance.

(b) The restored building or structure will b no more hazardous based on consideration of life, fire, sanitation and safety, than the original building.

(c) The owner has submitted for the approval of the Authority plans and specifications for the work to be carried out. These plans and specifications must be provided by an engineer or architect engaged by the owner and approved by the Authority.

(d) The Authority in the public interest of health, safety and welfare has required all necessary corrections to be made before use and occupancy.

(e) The decision of the Director is transmitted in writing to the Authority within thirty days, where the Authority at its next regularly scheduled meeting may on its own initiative review the decision of the Director to ensure that adequate criteria have been utilized. The Authority may modify, rescind or confirm the decision of the Director.

106 HURRICANE PRECAUTIONS

During such periods of time as are designated by the Government as being a hurricane watch, the owner, occupant or user of a property shall take precautions for the securing of buildings and equipment. Fabric awnings and swing signs shall be lashed to the ground, and such other precautions shall be taken for the securing of buildings or structures or material or equipment as may be reasonably required.

107 ALTERNATE MATERIALS AND TYPES OF CONSTRUCTION

107.1 General

The provisions of this Code are not intended to prevent the use of types of construction or materials or methods of designs as alternates to the standards herein set forth. Such alternates may be offered for approval and their consideration shall be as specified in this Section.

107.2 Standards

The types of construction or materials or methods of design referred to in this Code shall be considered as standards of quality and strength. New types of construction or materials or methods of design shall be at least equal to these standards for the corresponding use intended.

107.3 Application

a) Any person desiring to use types of construction or materials or methods of design not specifically mentioned in this Code shall file with the Authority proof in support of claims that may be made regarding the safety and sufficiency of such types of construction or materials or methods of design, and request approval and permission for their use.

b) The Authority shall approve such alternate types of construction or materials or methods of design if it is clear that the standards of this Code are at least equalled. If, in the opinion of the Authority, the standards of this Code will not be satisfied by the requested alternate, it shall refuse approval.

108 UNSAFE BUILDINGS

When any building, construction or excavation or part thereof is in an unsafe condition as a result of being open or unguarded, or because of danger from fire or risk of accident because of its ruinous or dilapidated state, faulty construction or otherwise, due notice to correct such condition shall be given by the Director. When such notice has not been complied with the Authority may:

a) demolish, remove or make safe such building, construction, excavation or part thereof at the expense of the owner.

b) take such other measures as it may consider necessary to protect the public.

109 APPLICATION TO BUILD

109.1 General

A person wishing to erect a building or structure, or to carry out a development as defined in the applicable legislation in force, shall comply with the requirements of the said legislation and also with the requirements of this Code. All buildings covered by the requirements of Section 1 to 17 of this Code shall be designed and constructed under the general supervision of a professionally qualified architect or an engineer registered to practise engineering in the relevant Eastern Caribbean State.

109.2 Form of Application to Build

a) A person wishing to build shall apply in the manner prescribed in the legislation and the established procedures of the Authority and as herein set forth.

b) Each application shall be accompanied by the required number and type of plans appropriate to the particular type of development project for which planning permission is sought.

c) Three copies of the relevant plans shall be submitted with each application. These plans include the location plan, the site plan, the subdivision plan and the building detail plan; but the plans for a particular type of development shall be those specified in the Manual for Developers.

d) The information to be contained in a location plan, a site plan, a subdivision plan, a building detail plan and the scales to which these plans are to be drawn shall be as set out in Sub-Section 110 of this Code.

e) Every drawing, specifications and accompanying data which accompanies an application for planning permission shall be legibly signed by the maker thereof and shall bear his full address.

f) All drawings shall carry the names and addresses of the persons shall be individually numbered for ease of reference. Revisions shall carry revision numbers.

g) The Authority may require structural and other details, computations, stress diagrams, the basis of the calculations and other data necessary to describe the construction and they shall bear the signature of the person responsible for the design. The qualifications of the person or persons responsible for these details shall be stated.

h) Where an alteration or extension to an existing building is applied for, any part of the existing building to be demolished must be clearly indicated and distinguishable from the new construction.

110 PLANS

110.1 General

The plans to be submitted with an application for development permission are as set out in the Manual for Developers and detailed in this Section.

110.2 Outline Permission

The plans required are:

a) Location Plan

i) Where it is available, a copy of the Director of Overseas Surveys Plan must be used the basis for the location plan. These plans are available for most areas of the island and are obtainable at the Land Registry office or at the office of the Authority.

ii) The location plan must be drawn to a scale of:

- For towns at 1:25000
- For villages and rural areas at 1:500

iii) The location plan must show the name and locations of existing roads and fixed and easily identifiable points such as streams, road junctions, bridges, and nearby houses.

b) Site Plan

i) At the option of the applicant, site plans may be drawn to a scale of 1:200 (1" to 20') or 1:500 (1" to 40') or 1:1000 (1" = 100') as may be appropriate.

ii) The Site Plan must show:

- The area, boundaries and principal dimensions of the land.
- The location of existing buildings on the land and on the lands immediately adjacent.
- The location and spread of any existing mature trees on the land.
- The location of any new proposed building and the relevant dimensions of appropriate setbacks.
- Such contours or spot levels as are necessary for determining the grade of any proposed road and for the proposed drainage.
- Location and width of existing and proposed means of access including roads adjacent to the property.
- Water and sanitary drainage systems.
- The proposed landscaping plan.

○) Any land reserved for public access or for public use.

c) Subdivision Plan

i) The scale of subdivision plans shall be at least:

- For subdivided areas of 1/2 acre or more, 1:1250
- For subdivided areas of less than 1/2 acre, 1:200

ii) The subdivision plan must show:

- All relevant physical features related to the proposed development such as water courses, rock outcrops, trees, swamps, and existing buildings, roads and walks.
- Such contours or spot elevations as are necessary for determining the grade of any proposed road and for proposed drainage.
- The boundaries, area, and principal dimensions of the land.
- At least one boundary must be connected to the trigonometrical control station or alternatively, to identifiable points of detail on the national map sheets (scale 1:5000) available at the Survey Department.
- The dimensions and area of each proposed subdivided lot.
- The location of proposed building, if any.
- The roads, walks, and utility services proposed to be made available to each lot.
- The use to which each lot is proposed to be put, e.g. residential, commercial or industrial purposes, or for churches, schools or parks. Residential lots shall be designated as high, medium, or low density.
- Any land reserved for public access or other public use.
- The proposed location of fire hydrants.

d) Building Plans

i) Conceptual drawings to include:

- Floor Plan generally to Scale 1/8" or 1/4" to 1' 0" or metric equivalent

  To show:

  - room sizes
  - materials used in construction

- Elevations and Sections generally to Scale 1/4" to 1' 0" or metric equivalent.

  To show:

  - roof heights (floor to ceiling) and pitch
  - height of main floor above ground
  - positioning of doors and windows

e) Sewage disposal

General statement of the type of plant or septic tank to be used and its location where the development is not or will not be connected to a public system.

e) Water catchment

If the development is not on a public supply, a statement on the type and location of catchment proposed where the development is not or will not be connected to a public supply.

110.3 Detailed Permission

In addition to the plans required for the outline permission the following plans must be supplied:

a) Foundation Plan

To show:

- general foundation type proposed
- type of soil on which the foundation will rest

b) Structural Plan

To show:

- details of beams, columns and slabs
- details of all walls
- roof design and construction details
- foundation details, piling etc
- details of water cisterns and catchments where required
- all reinforcement details

c) Plumbing

To show:

- location of inspection boxes, grease traps etc
- sizes and slopes of the pipes used in the sewer lines
- location of shut-off valves
- size and location of pumps

d) Water Supply

- sizes of water lines
- water storage and catchment details

e) Sewerage

- details of septic tanks and soakaways where needed

f) Electricity

To show:

- electrical layout
- amount of wires in conduit and wire gauges
- numbers of circuits
- panel sizes and locations

g) For the grant of a Building Permit, the Director may also require submission of all calculations for the determination of sizes of structural members and walls, water catchments, sewage treatment and disposal facilities where required.

111 APPROVAL IN PART

a) Where approval of a portion of a building or development is desired prior to the issuance of a permit for the whole project, application shall be made for the complete development, and detailed plans for the which immediate approval is desired shall be filed with the Authority.

b) Should a permit be issued for a part of a building or development the holder of such permit may proceed with construction without the assurance that the permit for the entire building or development will be granted. The granting of such permit will depend on the approval of the Authority of the application including all requirements as set out in Sub-section 109.

112 USE OF OTHER CODES AND STANDARDS

a) The Director shall require that the laws, rules and regulations of any other regulatory body or authority having jurisdiction, where such laws, rules and regulations are applicable and are known to the Authority, shall be satisfied before a permit shall be issued.

b) The Director shall require such evidence, as in his opinion is reasonable, to show such other approvals. The Director or the Authority shall not thereby be held responsible for enforcement of such regulations that it is not specifically authorised to enforce.

c) All tests required by the Director to show that materials and methods of construction proposed by the applicant meet the requirements of this Code shall be carried out by the applicant at his expense. The testing agency to be used by the applicant must be approved by the Director.

d) The Director shall publish in the Official Gazette a list of the Codes and Standards approved for use in this Code, and the Director shall make such lists available to the applicant.

113 INSPECTIONS

113.1 Procedure

a) The Director, upon receipt of 48 hours notice from the builder, exclusive of Saturdays, Sundays and declared Public Holidays, is authorised to make the following inspections and either approve the portion of the works completed or shall notify the builder in writing where such work does not meet with his approval:

(i) SETTING OUT

(ii) FOUNDATIONS BEFORE CONCRETING

(iii) STRUCTURAL FRAME AND ROOF

(iv) RING BEAMS CASING AND REINFORCEMENT

(v) PLUMBING AND DRAINS

(vi) ELECTRICAL WORKS - IN ASSOCIATION WITH THE GOVERNMENT ELECTRICAL INSPECTOR

(vii) OTHER INSPECTIONS TO BE MADE AS THE OWNER, BUILDER OR DIRECTOR MAY REASONABLY REQUIRE

(viii) SPECIAL INSPECTIONS OF ALL MECHANICAL INSTALLATIONS

(ix) FINAL INSPECTION FOR GRANTING OF AN OCCUPANCY CERTIFICATE

b) All inspections shall be carried out by persons employed as Building Inspectors or by suitably qualified persons approved by the Authority and appointed to carry out such inspection.

c) *(During the construction stage of a project it is expected that the routine inspections of the works will be undertaken by members of the developer's design team or by an inspection agency employed by the developer. The Check Consultant's role will be to review and approve the systems being used for quality control by the constructor and those carrying out the routine inspections and to make period checks during construction to confirm that the approved systems are being implemented.)* Inspections shall be carried out by a professionally qualified architect for architectural work, or by an engineer registered to practise engineering in the relevant Eastern Caribbean State for engineering work.

d) Work shall not be done on any part of a building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the Director or Check Consultant or engineer or architect where permitted to do so. Such written approval shall normally be given only after an inspection shall have been made of each successive step in the construction as indicated by each of the foregoing nine inspections where appropriate.

e) Reinforcing steel or structural frame work of any part of any building shall not be covered or concealed in any manner whatsoever without first obtaining the approval of the Director or the engineer or the architect responsible for the routine inspections.

f) If circumstances warrant, the Director in his discretion may waive such inspection in writing to the applicant and builder, but this does not absolve the applicant and builder from the responsibility of any construction in contravention of the Building Permit, the Building Regulations and this Code.

114 CHECK CONSULTANT

114.1 Requirement

a) Where the proposed construction is complex or falls within the categories listed at 114.1 c) the Authority shall impose a condition on the grant of detailed permission requiring the applicant to employ a Check Consultant (technical controller) to review the designs (plans, calculations and specifications), and to review and approve the systems being used for quality control by the constructor and those carrying out the routine inspections and to make period checks during construction to confirm that the approved systems are being implemented.

b) The Check Consultant is engaged by the applicant and provides advice about technical problems to the Director and to the applicant during the design and construction of the works to ensure that the works are being carried out in accordance with the Code. *(In order to prevent or reduce abortive work or delays, it is important that the Check Consultant carry out the reviews of the designs in a multi-stage manner starting at the beginning of the design team's work and continuing pari passu with the design team's work. In other words, the Check Consultant is best appointed at the same time as the design team.)*

c) The Check Consultant shall be employed for the following projects:

(i) Buildings or structures (or part thereof) of unusual design or method of construction.

(ii) Foundations and structural engineering for the installation of equipment such as elevators, power plants and water and sewage treatment plants.

(iii) Buildings listed in the Excerpt from Section 3 as amended and reproduced at the end of this Section and other buildings so designated by the Authority.

d) For certain other projects such as those listed under, the .Director may impose the condition requiring the use of a Check Consultant as follows:

(i) Major foundations and/or pile driving.

(ii) Major site works.

(iii) Drainage and waste disposal works for buildings.

114.2 Qualifications of the Check Consultant

a) The Check Consultant shall be employed at the expense of the applicant and to the approval of the Director who may obtain a recommendation from :

i) the organisation of engineers of the relevant Eastern Caribbean state in consultation with the Secretary General of the Council of Caribbean Engineering Organisations or

for the review of architectural plans[1]

ii) the society of architects of the relevant Eastern Caribbean state in consultation with the Chairman of the Association of Commonwealth Societies of Architects in the Caribbean.

b) The Check Consultant shall be an experienced and professionally qualified engineer or architect of the relevant discipline for developments listed at 114.1. *(In practice Check Consultant would be on a par with, or more knowledgeable and experienced than, the designers. In such a circumstance the system works best. The Check Consultant does not seek to discredit the designers or to "score points". Indeed the Check Consultant performs his (her) role best when aiding in the execution of better designs and construction. This is why, in Martinique and Guadeloupe, the involvement of Check Consultants (bureaux de contrôle) is seen as having a developmental purpose.)*

114.3 Responsibility of the Check Consultant

(The terms of reference of the Check Consultant may include any or all aspects of the building. However, the minimum requirement is for the terms of reference to include structural safety, fire safety and aspects related to accommodating persons with disabilities – those aspects critical for the protection of the occupants.)

a) The Check Consultant shall:

- review and assess all designs (plans, calculations and specifications) relating to the development in accordance with the Code and acceptable building practices,

[1] *Inserted October 2001 edition*

- review and agree with the design team and the constructor the systems of quality control to be employed during the construction stage,
- make periodic checks during the construction stage to confirm that the agreed systems of quality control are being implemented,
- report to the applicant and to the Director on compliance of the design and construction quality control with the terms of the Building Permit.

b) The Check Consultant shall advise whether the project is in compliance with this Code and shall submit periodic progress reports and inspection reports to the Director and to the applicant.

c) At the completion of the construction work, the Check Consultant shall submit a Certificate of Compliance to the Director if he considers that the work was done in compliance with the Building Permit and this Code. His duties shall end with the submission of such certificate.

Note: A Building Permit will not be granted until the designs have been reviewed by the Check Consultant and a certificate granted to the effect that the designs conform to the requirements of the Code.

114.4 Independence of the Check Consultant

The Check Consultant shall be an independent consulting engineer or architect and shall not have been engaged in any capacity in the development for which he is being engaged as a Check Consultant.

114.5 Procedure for the Appointment of the Check Consultant

The procedure to be followed by applicants for a Building Permit for the construction of developments which would require the services of a Check Consultant is as follows:

a) The developer should first apply to the Authority for Outline Permission with conceptual drawings and information on the proposed development as per 110.1. The Authority may in approving the outline permission place conditions on the approval requiring, as may be appropriate, the carrying out of an environmental impact assessment and an economic feasibility study. *(As suggested earlier in this section, it would be advisable for the Check Consultant to be employed at the same time as the design team.)*

b) The Authority on the recommendation of the Director may require that a Check Consultant be engaged in accordance with 114.1 before a Building Permit can be granted. The applicant shall supply the following information to the Director:

i) The name and qualifications of the engineer (or architect where applicable) who will be employed as a Check Consultant for the review of the designs and the quality control systems to be used during construction. This nomination is subject to the approval of the Director.

ii) The terms of reference for the employment of the Check Consultant. These are subject to the approval of the Director.

iii) Where relevant, a certificate from an institution as required at 114.2 a).

iv) The Director shall review the information submitted by the Developer and if deemed satisfactory shall approve the engagement of the Check Consultant.

c) When the Authority grants this outline permission the developer should then proceed to provide drawings and other information required for detailed Development Permission as per 110.2.

115 INSPECTION BY ENGINEER OR ARCHITECT EMPLOYED BY THE OWNER

a) It is required that the engineer and/or architect employed by the owner carry out inspections of construction of those buildings listed at 114.1 c), and of any other building so designated on the development permission.

b) This sub-section requires the designer to make copies of all inspection and review reports available to the Director, and for the Director to be notified and given the opportunity to inspect the site before excavation, before a foundation is placed and before a superstructure is placed on a foundation.

c) The engineer and/or architect employed by the owner shall carry out the inspection of construction to ensure compliance with the Code.

d) The Director retains the authority to carry out an audit on any development. This audit shall include a review of the design, analysis, detailing and material and construction specifications of any building for which a building permit is requested and for any building under construction.

e) All plans and specifications must be certified by a professionally qualified architect or registered engineer to the effect that the plans have been developed in accordance with the relevant provisions of the Code. In accordance with 109.2, the plans and specifications must be presented to the Director for consideration of the DCA before development permission or a building permit can be granted.

f) The engineer or architect must report to the Director on the inspections carried out at the stages listed in 113.1 and on any changes to the works or materials to be incorporated in the works.

g) Any minor alteration of the plans of any building for which a building permit has been granted must be reviewed and certified by the architect or engineer responsible for the works. The altered plans shall be deposited with the Director with a certificate from the engineer or architect to the effect that the altered plans do not affect the structural integrity of the building nor the terms of the development permission.

h) Where the engineer and/or architect employed by the owner carries out inspections in accordance with this Section, the architect and/or engineer assumes the responsibilities for the approval of construction standards and materials as required in Section 4 of this Code.

116 CERTIFICATE OF OCCUPANCY

a) A new building shall not be occupied or a change made in occupancy or the nature of the use of a building or part of a building until after the Director shall have issued a Certificate of Occupancy.

b) Upon completion of a building erected in accordance with approved plans and after final inspection herein referred to, and upon application therefor, the Director shall issue a Certificate of Occupancy stating the nature of the occupancy permitted.

c) A temporary certificate of occupancy may be issued for a portion or portions of a building which may safely be occupied prior to final completion of the building.

d) Final inspection shall be made by the Director before a Certificate of Occupancy is issued.

Note: A Certificate of Occupancy will not be issued until necessary Certificates of Completion have been issued by the Electrical Inspector in accordance with electricity regulations in force.

117 COMPLIANCE

a) The issuance and granting of a permit shall not be deemed or construed to be a permit for, or an approval of, any violation of this Code.

b) The issuance of a permit upon plans and specifications, shall not prevent the Authority from thereafter requiring the correction of errors on such plans and specifications, or from preventing building operations being carried on thereunder when in violation of this Code or any Regulations applicable thereto.

c) When during the construction of the work carried out under the permit, from issuance of permit to issuance of Certificate of Occupancy, the Director reasonably believes that approved plans are in violation of this Code, he shall notify the permit holder and the permit holder shall correct the drawings or otherwise satisfy the Director that the design and/or working drawings are in compliance with this Code.

d) The permit granted for the construction of the work shall be available at the construction site during normal working hours for inspection by the Director.

Excerpt from
SECTION 3 – GENERAL REQUIREMENTS

301.2 **Group A. Public Buildings**

Being buildings in which 50 or more persons regularly congregate for civic, educational, religious, social or recreational purposes and including:

Assembly halls
Auditoria
Cinemas
City and town halls
Clubs, excluding residential accommodation
Court houses
Dance halls
Permanent exhibition buildings
Games buildings
Lecture halls
Passenger assembly buildings
Public baths
Public art galleries, libraries and museums
Restaurants
Religious buildings of all types
Teaching facilities of all types
Theatres

301.3 **Group B. Institutional Buildings**

Being buildings in which inmates' liberties are restricted for civic, medical, charitable or correctional purposes including:

(a) Asylums
Hospitals
Infirmaries

Old and handicapped persons homes
Sanatoria

(b) Prisons
Reformatories

(c) Public health centres and clinics

301.4 Group C. Commercial and Industrial Buildings

Being buildings used for manufacture, assembly, servicing, repair and factory operations or for the storage except for display purposes of materials or finished products where no hazardous processes or materials are involved and including:

(a) Aeroplane hangers
Cold storage buildings
Freight depots
Parking garages

Warehouses greater than 5,000 square feet

(b) Factories greater than 5,000 square feet
Commercial laboratories
Laundries greater than 5,000 square feet
Processing plants greater than 5,000 square feet
Power stations
Telephone exchanges
Workshops greater than 5,000 square feet

301.5 Group D. Office, Administrative and Retail Service Buildings

Being buildings used for business or professional transactions or the display or sale of materials or finished products and including:

(a) Banks
Civic administration buildings
Radio stations
Television stations
Office buildings greater than 5,000 square feet

(b) Markets, Supermarkets greater than 5,000 square feet
Shops greater than 5,000 square feet
Showrooms greater than 5,000 square feet
Stores greater than 5,000 square feet

301.6 **Group E. Residential Buildings**

Being all buildings in which sleeping accommodation is a necessary or major provision, except buildings classified under Group B in 301.3 of this Code and including:

(a) Apartment buildings accommodating more than 50 persons.
Guest houses accommodating more than 50 persons.
Residential club accommodating more than 50 persons.
Terrace houses accommodating more than 50 persons.

(b) Halls of residence accommodating more than 50 persons.
Hotels accommodating more than 50 persons.
Motels accommodating more than 50 persons.
Residential club accommodating more than 50 persons.

(c) Tenement buildings accommodating more than 50 persons.
Dormitories accommodating more than 50 persons.

(The areas of buildings and the numbers of occupants in clauses 301.4 to 301.6 are subject to review by each Eastern Caribbean state.)

301.7 **Group F. Hazardous Occupancy Buildings**

Being buildings or parts of buildings for the storage or handling or use or processing of any of the hazardous materials or for the housing or carrying out of any of the hazardous processes listed and attached to this Code as Appendix D, or buildings used for any other purpose which, in the opinion of the Director, creates hazardous or noxious conditions.

SECTION 2

DEFINITIONS

In the interest of brevity, words in singular where applicable, shall be constructed to include the plural, and words in plural shall, where applicable, be construed to include the singular.

Access	Entrance or opening.
Accessible	Adequate clearance for inspection, service, repair, and replacement, and within physical reach.
Accessory use	A building or structure, the use of which is incidental to the main building structure.
Accessible Guestroom	A guestroom which minimally meets internationally recognized accessible design guidelines which should be provided close to guest elevators and at lower floor levels. In the absence of any prevailing local codes, it is recommended that 1% of the total room count be incorporated as accessible rooms.
Addition	Any extension or increase in floor area or height of a building or structure.
Alley	Any public space, or thoroughfare, 20' 0" or less in width, with public right of way.
Alteration	Any change or modification of construction, arrangement of space, and/or occupancy of a building; or change in the area of cubic contents; a change in equipment.
Apartment	One or more rooms occupied as a home or residence for an individual or a family or a household. The existence of, or the installation of sink accommodations and/or cooking facilities within a room or suite of rooms shall be deemed sufficient to classify such room or suite of rooms as an apartment.
Apartment building	A building which is used or intended to be used for human habitation as a residence for two or more families living in separate quarters.
Application	An application to the Authority for permission to carry out development or for an approval required by the Land Development (Interim Control) Act and any subsidiary legislation made hereunder including the Building Code of the St. Lucia.
Approved	Approved by the Authority under the requirements of this Code, including the Director or other designated persons given jurisdiction by this Code.

Architect	A person technically qualified to design and supervise the construction of buildings in accordance with existing laws of the State.
Area of storey	The gross area of such storey measured from the internal faces of external walls or, where there are no walls, to the outside edge of floors.
Area of building	The total of the areas of the storeys comprising that building, measured from inside the face of the external walls.
Attic	Shall be taken to mean any space immediately under the roof rafters and above the ceiling joists of the storey nearest to the roof.
Automatic	Applied to a door, window, or other opening. Not requiring manual operation.
Awning	A projecting canopy.
Authority	The Authority or other body appointed by the Government for the administration of the Code.
Balcony	That portion of a seating space of an assembly room, the lowest part of which is raised four feet or more above the level of the main floor.
Balcony exterior	A landing or porch projecting from the wall of a building. Where serving as a required means of egress the long side shall be at least 50 percent open and the open area above the guard rail shall be so distributed as to prevent the accumulation of smoke or toxic gases.
Basement	Any storey or part of a storey where more than half of the height from the finished floor to the finished ceiling is below the average of associated finished ground levels at external walls.
Boundary line	A line dividing one site from another or from a street reservation or other publicly owned space.
Board	See Authority
Building	Includes any erection, structure or any part of a building erected on or made on or in or under any lands, and where the context so permits, includes the land on, in or under which the building is situated but does not include plant or machinery comprised in a building. Where a building is separated into two or more parts by fire division walls each part may be deemed a separate building for the purpose of this Code.
Building line	A line dividing one site from another or from a street reservation or other publicly owned space

Building operations	Includes rebuilding operations, structural alterations of, or additions to buildings and any other operations normally undertaken by a person carrying on business as a builder.
Bulkhead	A part of a structure enclosing stairs, elevator machinery, or ventilating equipment; the part of an external wall immediately below a shop window; a retaining type structure.
Canopy	A covering to an entrance way or walkway fixed to a building.
Carbon	Carbon dioxide emissions. Other gasses which contribute to global warming represented in terms of an equivalent carbon dioxide level.
Car Port	A covering area for sheltering a motor vehicle, not fully enclosed by walls.
Code	The Building Code of St. Lucia.
Combustible	Any material that will ignite at or below a temperature of 1200 degrees F. and which ignited will continue to burn or glow.
Condominium	Multi-units with individual ownership of single units.
Corridor	An access connecting more than one room; a link at each floor level, open or covered.
Construction	Unit building or component assembly additive process; includes reconstruction and/or alteration and/or addition to building or structure.
Court	An open or occupied space enclosed at any level on two or more sides by the walls of a building or in the case of a rear court enclosed on three sides by the boundaries of the site.
Cubic content of a storey	The volume of enclosed space measured a storey from the internal faces of enclosing walls and from finished floor level to ceiling level or where there is no ceiling to the average of the underside of the roof construction.
Cubic content of a building	The total of the cubic content of the storeys comprising that building
Curtain wall	Any prefabricated assembly of various components to enclose a building usually supported externally from the structural frame, and passing all storeys.
Dangerous building	Any building which constitutes a danger to public safety or to the safety of the occupants or adjacent buildings
Dead load	The weight of all walls, floors, roofs, partitions and other permanent construction.

Deconstruction	Disassembling a structure allowing re-use of its component parts
Developer	See owner
Development	As defined in the Land Development (Interim Control) legislation
Dining room	Any building or part thereof, in which food is dispensed or served.
Director	The Executive Secretary of the Development Control Authority as defined in the Land Development (Interim Control) legislation.
Disability	Any physical or mental impairment which has a substantial and long-term adverse effect on a person's ability to carry out normal dad-to-day activities. In the context of this Code, attention has frequently been granted to people who use wheelchairs. However, the design and management of safe accommodation must consider other forms of disability such as impaired vision, hearing and mobility.
Dormitory	A room in which sleeping accommodation is provided for more than four persons.
Duplex building	A building providing two separate apartments with or without common entrance and/or exit facilities.
Dwelling	A building occupied exclusively for residential purposes; for the purposes of this Code, "dwelling" also includes any verandah or porch attached permanently to the building.
Egress	See Means of Egress.
Elevator	A lift or hoist; a device for carrying persons or goods up or down.
Embodied carbon	Kilograms of carbon dioxide (CO_2) released by generating energy to make, deliver, assemble, and dispose of a material, plus any other CO_2 emissions associated with the process of manufacture (such as the CO_2 released in producing cement).
Engineer	A person technically qualified to design and supervise the construction of building and civil engineering structures, electrical, mechanical and sanitary installations and systems, and who is registered to practice engineering in St. Lucia.
Enclosed	Bounded by walls or floors or roof or ceilings provided that, where a building is not fully enclosed by walls, the external face of the external frame shall be deemed to be the line of enclosure for the purpose of this Code.
Equipment	Fixtures, fittings, appliances or apparatus of any sort within or associated with a building whose installation is covered by the requirements of this Code.

Erection	In relation to buildings includes extension, alteration, re-erection.
Escalator	A moving inclined stairway for persons or goods.
Exit Court	A yard or court providing egress to a further place.
Existing building	Any building constructed or in the course of construction prior to the effective date of this Code.
Fire Assembly	The assembly of a fire door, fire window, or fire damper, including all required hardware, anchorage, frames and sills.
Fire Assembly, automatic closing	A fire assembly which may remain in an open position and which will close automatically if subjected to either of the following: (a) An increase in temperature. (b) Products of combustion. Unless otherwise specified, the closing device shall be one that is rated at a maximum temperature of 165 degrees F.
Fire Assembly, self-closing	A fire assembly which is kept in a normally closed position and is equipped with an approved device to ensure closing and latching after having been opened for use.
Fire division	A portion of a building so separated from the rest by fire-walls that it may be erected to the maximum height and area allowed for the governing Occupancy and the Type of Construction, independently of adjoining Occupancies or Types of Construction.
Fire door	A door and its assembly so constructed and placed as to give protection against the passage of fire.
Fire escape	A single or series of steel framed balconies attached to the exterior walls at windows or doors and connected to each other and to the ground by flights of steel stairs.
Fire resisting	Ability to resist fire and prevent its spread as regulated in this Code. Fire resistant.
Fire retardant treated wood	Wood that has been treated to retard spread of flame.

Flame-proof	The property of a material, usually decorative fabric, whether treated or not treated, to not burst into flames or support combustion when subjected to flames for a period of 30 seconds.
Flooding	An overflow of a large amount of water beyond its normal limits, especially over what is normally dry land. Floods and mudflows may be channeled through river valleys.
Floor area, gross	Gross floor area shall be the floor area within the perimeter of the outside walls of the building with no deduction for corridors, stairs, closets, thickness of wall, columns, or other features.
Floor area, net	Net floor area shall be the actual occupied area, not including accessory unoccupied areas or thickness of walls.
Formation level	Finished ground level, see Grade
Foyer	An area or space within a building located between a lobby and main entrance and the main floor.
Gallery	That portion of the seating capacity of a theatre or assembly room having a seating capacity of more than ten persons and located above a balcony.
Garage	A building, shed or enclosure, or part thereof, in which a motor vehicle containing flammable liquid in its fuel tank is housed or stored or repaired.
Grade	(a) The average elevation of the ground, paved or unpaved, adjoining a building or structure, at the centre of each exterior wall line.
	(b) When used in connection with lumber, means a division of sawn lumber into quality classes with respect to its physical and mechanical properties, as defined by the association under whose rules the lumber is controlled.
	(c) When used in connection with structural or reinforcing steel, means the quality and strength of the material as defined by the relevant ASTM or other recognised international standard.
Ground floor area	The total area of floors of all storeys of the building including common halls, stairways, porches, overhanging balconies, and the thickness of walls.
Ground floor	The lowest storey or part of a storey of a building of which more than 50% of the floor area is above the average of associated finished ground levels at external walls and no part of the floor area is more than 2 feet below such associated ground levels.
Habitable room	A room in a residential unit used for living, eating, sleeping or cooking, but excluding baths, storage spaces or corridors.

Height - building	The vertical distance from grade to the highest finished roof surface of a flat roof or to the average level to a gable or hip roof.
Height - storey	The vertical distance from top to top of two successive floors or floor and roof.
Height - structure	The height of a structure erected on the ground shall be the vertical distance from grade to the highest point thereof, and for roof structures shall be the vertical distance from the mean level of the roof to the highest point of such structure. In general the height of a structure shall be its overall height.
Height of a wall	The vertical dimension measured from top of foundation or beam, to top of highest course, with or without tie beam.
Hazardous operation	A hazardous operation shall be classified as one which is liable to give rise to fire and burning with extreme rapidity, or from which poisonous fumes or explosions are likely in the event of fire or leakage.
Horizontal exit	A means of passage from one building into another building occupied by the same tenant, or from one section of a building to another section of the same building occupied by the same tenant through a separation wall having a minimum fire resistance of 2 hours.
Hotel	Any building or group of buildings (including all structures appurtenant thereto or within the curtilage thereof) used or intended to be used for the accommodation of guests for gain or reward.
Imposed Load	All loads other than dead loads
Incombustible	A material, which in the form in which it is used, meets the following requirements: (a) Material of which no part will ignite or burn when submitted to fire. (b) Material having a structural base of incombustible material as defined in para. (a) above, with a surfacing not more than 3mm (1/8 inch) thick having a flame spread rating not greater than 50 when tested in accordance with the appropriate standards. (c) Incombustible does not apply to surface finish materials or to materials required to be incombustible for reduced clearances to flues, heating appliances or other materials, or (d) No material shall be classed as incombustible which is subject to increase of combustibility or flame spreading rating, beyond the limits herein established, through the effect of age, moisture or other atmospheric condition.
Inspector	A building inspector designated by the Authority under Section 6 of the Land Development (Interim Control) Act.

Joists	Secondary horizontal supporting members in floors, ceilings, or roof construction.
Jurisdiction	The Development Control Authority, or any body appointed by the Government for the administration of this Code.
Landslide	A landslide is a movement of a mass of rock, earth or debris down a slope.
Lintel	The beam or girder placed over an opening in a wall which supports the construction above.
Live load	Any load imposed or capable of being imposed on a structure other than dead load or wind load.
Lobby	An enclosed vestibule directly accessible from the main entrance.
Load bearing	Any part of a building including foundations bearing a load other than that due to its own weight or to wind pressure.
Lot	A portion or parcel of land shown on the land register or in a deed as a piece or parcel of land or an official subdivision.
Lot line	A line dividing one lot from another or from a street or other public space.
Manhole	Defined in Section 9.
Masonry	Brick, stone, plain concrete, hollow block, solid block or other similar materials or units bonded together with mortar. Reinforced concrete is not classified as masonry.
Means of egress	Continuous path of travel from any point in a building or structure to the open air outside at ground level.
	(a) Exit is that portion of a means of egress which is separated by walls, floors, doors or other means from the area of the building from which escape is to be made.
	(b) Note: An interior aisle, corridor, hallway or other means of travel used to reach an exit door is not an exit.
Mezzanine	An intermediate floor placed in any storey or room. When the total area of any such mezzanine floor exceeds 33-1/3 percent of the total floor area in that room or storey in which the mezzanine floor occurs, it shall be considered as constituting and additional storey. The clear height above or below a mezzanine floor shall not be less than 7 feet.
Mudflow	A mudflow consists of soil and water, usually fine grained particles moving downslope. There is a specific type of mudflow made up of volcanic material of varying particle sizes.
Multiple family	As in a building, meaning more than two families or households living independently of each other and cooking within their living quarters; includes apartments, tenements and flats.

Normal dimension	The dimension or size in which such material, part or unit is usually manufactured or supplied.
Non-combustible	See incombustible.
Non-conforming	Applies to any building or structure which does not comply with the requirements set forth in this Code, or amendments thereto.
Occupant load	The total number of persons that may occupy a building or portion thereof at any one time.
Occupancy	As used in this Code, pertains to and is the purpose for which a building is used or intended to be used. Occupancy is not intended to include tenancy or proprietorship.
Occupied	Shall be construed as though followed by the words "or intended, arranged, or designed to be occupied".
Open plan	Open plan buildings are Group D Occupancy buildings having rooms and corridors delineated by the use of furniture, or low (5 feet) partitions.
Owner	A purchaser, developer, property holder or any other person, firm or corporation having a vested or contingent interest, or in the case of leased premises, the legal holder of the lease contract, or his/her legal representative, assign or successor, or duly authorised agent of any of the aforesaid.
Parapet	That part of a wall entirely above the roof line.
Parking garage	Parking garages for passenger vehicles involving only the parking or storing of automobiles and not including automobile repair or service work or the sale of gasoline or oil.
Partition	A non-loading vertical separation between rooms or spaces. If such separating construction closes less than three-fourths of the area from wall to wall and floor to ceiling, it shall be considered a decorative separation and not a partition.
Path of egress	The course taken by an occupant to effect egress from a public space.
Penthouse	An enclosed one-storey structure extending above the roof of a building not exceeding 25 percent of the roof at the level on which such penthouse or penthouses are located.
Permit	A written authorization by the Authority to proceed with construction, alteration, repair, installation or demolition.
Permit holder	The holder of a permit granted for the construction, alteration, repair, installation or demolition of a development.
Person associated with hearing impairment	Includes people who are totally deaf or have some hearing impairment.

Person associated with mobility impairment	Refers to people unable to use one or more of their extremities, or having a lack of strength to walk, grasp or lift objects. Such persons may use wheelchairs, crutches, walkers or other mechanical equipment to aid in mobility.
Person associated with vision impairment	Includes people who are totally blind or partially sighted.
Planning Permission	Development permission. Permission granted pursuant to Section 11 of the Land Development (Interim Control) Act.
Platform	A portion of an assembly room which may be raised above the level of the assembly floor and which may be separated from the assembly space by a wall and proscenium opening provided the ceiling above the platform shall not be more than 5 ft. above the proscenium opening.
Prefabricated	Pre-engineered, fabricated prior to installation or erection.
Primary member	A structural member, such as a column, beam, girder or truss, that carries dead, live and/or wind loads to the foundation.
Private stair	A stairway serving one tenant only and not for general use.
Public space	For the purpose of determining allowable floor areas and/or egress from buildings, such open spaces as public parks, rights-of-way, waterways, public beaches and other permanent unobstructed yards or courts having access to a street and a width of not less than set forth herein for required units of exit width may be considered a public space.
Rafters	Secondary inclined supporting members in roof construction.
Required	Required under this Code.
Repair	The making good to or replacement of existing construction in a similar manner to and of similar materials to the original construction.
Room	Any enclosed part of a building not being a lavatory, corridor, hallway, foyer, staircase, escalator, ramp, service area or store.
Sanitary facilities	The facilities provided in a lavatory in accordance with the requirements of this Code.
Site	A portion of land registered by title as a unit.
Semi-ambulant person	A person who can walk, either unaided with difficulty, or only with assistance.
Solar Water Heater	A Solar Water Heater is a system which converses sunlight into heat for water heating using a solar thermal collector. In tropical areas the hot water storage tank can be horizontally mounted immediately above the solar collector(s) and no pumping is required.

Storey	That portion of a building between the upper surface of a floor and the upper surface of the floor next above it, and if there is no floor above it, that portion between the top of that floor and ceiling above it.
Value	Applied to a building or structure means the estimated cost of construction of such building or structure at the date of valuation.

SECTION 3

GENERAL REQUIREMENTS

Contents

SECTION 3

GENERAL REQUIREMENTS

301 GROUP CLASSIFICATION BY USE AND OCCUPANCY

301.1 Basis of Classification

Certificates of use and occupancy shall be based on the following group classification subject to the special provisions of 306 of this Code and provided that:

(a) Any building having a use or occupancy not specifically mentioned shall be classified in the group it most nearly resembles.

(b) Different buildings on the same property shall be certified separately for use and occupancy even when constructed under one permit.

(c) Adjoining parts of the same building may be certified separately for different use and occupancy provided the division between them satisfies the fire resistance requirements of this Code for the most restrictive use.

(d) More than one use and occupancy shall be permitted in any building without division provided the building conforms to the requirements of this Code for the most restrictive use.

301.2 Group A. Public Buildings

Being buildings in which 50 or more persons regularly congregate for civic, educational, religious, social or recreational purposes and including:

Assembly halls
Auditoria
Cinemas
City and town halls
Clubs, excluding residential accommodation
Court-houses
Dance halls
Permanent exhibition buildings
Games buildings
Lecture halls
Passenger assembly buildings
Public baths
Public art galleries, libraries and museums
Restaurants seating 50 or more persons
Religious buildings of all types
Teaching facilities of all types
Theatres

301.3 Group B. Institutional Buildings

Being buildings in which inmates' liberties are restricted for civic, medical, charitable or correctional purposes including:

(a) Asylums
Hospitals
Infirmaries
Old and handicapped persons homes
Sanatoria

(b) Prisons
Reformatories

301.4 Group C. Commercial and Industrial Buildings

Being buildings used for manufacture, assembly, servicing, repair and factory operations or for the storage except for display purposes of materials or finished products where no hazardous processes or materials are involved and including:

(a) Aeroplane hangers
Cold storage buildings
Freight depots
Parking garages
Warehouses

(b) Factories
Commercial laboratories
Laundries
Processing plants
Power stations
Telephone exchanges
Workshops

301.5 Group D. Office, Administrative and Retail Service Buildings

Being buildings used for business or professional transactions or the display or sale of materials or finished products and including:

(a) Banks
Civic administration buildings
Radio stations
Restaurants seating less than 50 persons
Television stations
Office buildings

(b) Markets, Supermarkets
Shops
Showrooms
Stores

301.6 Group E. Residential Buildings

Being all buildings in which sleeping accommodation is a necessary or major provision, except buildings classified under Group B in 301.3 of this Code and including:

(a) Apartment buildings containing less than 10 apartments.
Guest houses accommodating less than 25 persons.
Private residences and duplex buildings.
Residential club accommodation for less than 25 persons.
Terrace houses.

(b) Apartment buildings containing 10 or more apartments.
Guest houses accommodating 25 or more persons.
Halls of residence.
Hotels.
Motels.
Residential club accommodation for more than 25 persons.

(c) Tenement buildings.
Dormitories.

301.7 Group F. Hazardous Occupancy Buildings

Being buildings or parts of buildings for the storage or handling or use or processing of any of the hazardous materials or for the housing or carrying out of any of the hazardous processes listed and attached to this Code as Appendix D, or buildings used for any other purpose which, in the opinion of the Director, creates hazardous or noxious conditions.

302 OCCUPANCY CONTENT OF A BUILDING

302.1 Basis of Calculation

a) Table 3-1 shall determine the number of persons occupying a building or part of a building subject to the special provisions of 306 of this Code, and except the building or part of the building be planned for a greater number persons than that determined from Table 3-1 then the greater number shall be used, and any enclosed space or room which 50 or more persons regularly congregate shall be considered a place of public assembly regardless of the group classification of the building.

b) Appendix H provides information on the specific requirements of the Occupancy Groups. This appendix is included for guidance to designers. However Table 3-1 must be used to determine the minimum occupancy content of buildings. Designers of public buildings should apply to the Director for permission to alter any of the minimum areas given in the Table 3-1, where there is mixed occupancy or doubt as to the appropriate area to be used.

Table 3-1

Occupancy Content of a Building

Places of public assembly in any building	1 person for each seat, (7 sq.ft required). For the occupancy content of other assembly buildings see Appendix H (1) Section 5.
Group A. Public buildings generally,	1 person for each 100 sq.ft of floor area.
Restaurants, night clubs	1 person for each 12 sq.ft. (net).

Group B. Institutional buildings generally Hospital surgical and obstetrical areas	Group B (b): 1 person for each 100 sq.ft of floor area. 1 person for each 120 sq.ft. of floor area.
Group B. Institutional buildings: open wards and dormitories	1 person for each 50 sq.ft. of area.
Group C Commercial and industrial buildings	Group C (a): 1 person for each 200 sq.ft. of floor area for the first 5 persons and 1 person for each 1,000 sq.ft of floor area thereafter Group C (b): 1 person for each 50 sq.ft. of floor area for the first 10 persons. 1 person for each 100 sq.ft. of floor area for the next 10 persons, and 1 person for each 500 sq.ft. of floor area thereafter.
Group D. Offices, administrative and retail service buildings	Group D (a): 1 person for each 100 sq.ft of floor area Group D (b): 1 person for each 50 sq. ft of sales floor area plus 1 person for each 100 sq.ft. of non sales floor area.
Group E. Residential	Group E (a): 1 person for each 300 sq.ft of floor area Group E (b): 1 person for each 150 sq.ft. of floor area Group E (c): 1 person for each 50 sq.ft. of floor area.
Group F. Hazardous occupancy	1 person for each 50 sq.ft. of floor area for the first 10 persons, 1 person for each 500 sq.ft. of floor area thereafter

303 TYPE CLASSIFICATION BY CONSTRUCTION

303.1 General

a) The requirements of Types of Construction in this Sub-section are minima for the various Types of Construction and are intended to represent varying degrees of public safety and resistance to fire. For the purpose of this Code, Type I shall be deemed to be the most fire-resistive and Type 5 the least fire-resistive Type of Construction.

b) All buildings and structures shall be classified into one of the following Types of Construction:

Type I Buildings: Fire Resistive

Type 2 Buildings: Semi-fire Resistive

Type 3 Buildings: Ordinary Masonry (Protected and Unprotected)

Type 4 Buildings: Noncombustible

Type 5 Buildings: Wood Frame

Appendix I provides more information on the specific requirements for each Type.

c) In order that a building or structure may be classified in any specific Type of Construction, it is necessary that all the requirements for that Type shall be at least equalled. No building or portion thereof shall be required to conform to the details of a Type of Construction higher than that Type for which the minimum requirements based on Occupancy are met even though certain features of such building actually conform to a higher Type of Construction.

d) Where specific materials, Types of Construction or fire-resistive protection are required, such requirements shall be the minimum requirements, and any materials Types of Construction or fire-resistive protection which will afford equal or greater public safety or resistance to fire, as specified in this Code, may be used, subject to the requirements of Sub-sections 401 and 402 of this Code covering alternate materials and construction standards.

e) Where two or more Types of Construction occur in the same building and are separated by firewalls as required in the Chapters of Occupancy, each portion so separated may be classified as of the Type of Construction to which it conforms. If firewalls are not provided as required in Sub-section 406.3, the whole building shall be classified as the least fire-resistive Type of Construction used and shall be subject to the restrictions imposed upon that Type.

f) The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and all other members which are essential to the stability of the building as a whole. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.

g) Minor accessory buildings of unprotected non-combustible materials not exceeding 10 percent of the ground floor of the primary building, nor 1,500 square feet, whichever is larger, may subject to the specific approval of the Authority, where separated from the primary building as required in the Code, be constructed without changing the fire-resistive classification of the primary building based on Type of Construction.

303.2 **Existing Buildings**

An existing building which by its construction cannot be definitely classed as of Type I, 2, 3, 4 or 5 as defined in this Code shall be defined for the purpose of this Code, by the Director.

303.3 **Abbreviations**

For the purpose of 303 and in interpretation of Table 3-2 the following abbreviations shall have the meanings given to them hereunder:

FRC	Fire resistance rated construction containing combustible materials
FRTW	Fire resistance rated and fire retardant treated wood
FRW	Fire resistance rated wood
N/A	Not applicable
NFR	Fire resistance rated construction of non-combustible materials
NM	Non-combustible materials
PS	Fire resistance rated protected structural steel
RC	Fire resistance rated reinforced concrete
TW	Fire retardant treated wood
W	Unrated untreated wood

303.4 **Basis of Classification**

Table 3-2 shall be used to establish Type classification by construction of a building subject to the special provisions of 306 of this Code and provided that where any building does not clearly fall into one of the five Types defined it shall be classified under the most restrictive of the Type it resembles.

304 **PERMISSIBLE AREAS AND HEIGHTS**

304.1 **Abbreviations**

For the purpose of 304 and in interpretation of Table 3-3 the following abbreviations shall have the meaning given them hereunder:

Group: Group classification by use and occupancy under 301 of this Code

NL: No limit
NP: Not permitted
Type: Type classification by construction under 303 of this Code.
SS: Single storey
MS: Multi-storey

304.2 Basis of Determination

Table 3-3 shall determine the maximum permitted area and height of a building subject to the special provisions of this Code and provided that where two or more parts of a building are separated from one another by divisions satisfying the fire resistance requirements of this Code for the most restrictive use, then the maximum permitted areas may be applied to each part so divided.

305 FIRE RESISTANCE RATING FOR BUILDINGS

305.1 Basis of Determination

Tables 3-4 to 3-7 inclusive shall determine the minimum fire resistance ratings for the component parts of a building subject to the special provisions of 306 of this Code and provided that the permitted fire resistance ratings of various materials and combinations of materials shall be established in accordance with this Code.

306 SPECIAL PROVISIONS

306.1 Interpretation

The requirements of 306 are to be read and interpreted with 301 to 305 of this Code provided that if the requirement of two or more sections should appear contradictory when applied to a particular building, the more restrictive requirements shall apply.

306.2 General Occupancy

(a) Any building with an occupancy content of more than 1,000 persons as calculated from Table 3-1 shall be of Type 1 construction.

(b) No building of Group A: Table 3-1 with an occupancy content of more than 250 persons as calculated from Table 3-1 shall be of Type 4 or 5 construction.

306.3 Hazardous Occupancy

(a) Buildings used to store highly combustible or highly inflammable materials or liquids shall be of Type 1 or 2 construction, not more than 12' 0" in storey height, not closer than 50' 0" to a site boundary or to an adjacent building on the same site and divided by fire division walls into separate parts, each part not exceeding 5,000 sq. ft. in floor area.

(b) Buildings housing processes using combustible or inflammable liquids with a flash point lower than 190 degrees F shall be of Type 1 or 2 single storey construction not closer than 50' 0" to a site boundary or to an adjacent building on the same site and shall be separated by fire division walls into separate parts, each part not exceeding 10,000 sq.ft. in floor area.

306.4 Areas, Heights and Volumes

(a) A building of Type 1 construction more than 100'-0" high may be required to have higher fire resistance rating for any or all of the component parts and the whole or any part of the building shall be equipped with wet and/or dry risers if required by the Director. These risers and fittings shall be subjected to an acceptance test and be certified by the Director.

(b) The permissible areas given in Table 3-3 may be increased by 25 percent for any building having clear access to public streets on two sides.

(c) The permissible area given in Table 3-3 may be increased by 50 percent for any building having clear access to public streets on three or more sides.

(d) The permissible areas given in Table 3-3 may increased by 100 percent for any multi-storey building equipped with an approved automatic sprinkler system where such system is not specifically required by this Code.

(e) The permissible areas given in Table 3-3 may be increased by 200 percent for any single storey building equipped with an approved automatic sprinkler system where such system is not specifically required by this Code.

(f) Any building more than 250,000 cu.ft. in volume shall, unless equipped with an approved automatic sprinkler system be divided by fire division walls, fire division floors, and or ceilings, into parts not exceeding 250,000 cu.ft.in. volume.

306.5 Special Fire Resistance Ratings

(a) In buildings of Groups A,C,D, and E, not more than 50'0" high and not closer than 50'0" to a site boundary or to an adjacent building on the same site, non-load-bearing exterior walls may be of non rated combustible materials.

(b) Suspended ground floors with less than 3'0" clearance need not be of fire resistance rated construction for Groups A and E. For Types 1,2 and 4, construction shall be of non-combustible materials.

(c) Roofs, where every part of the structural framework is more than 20'0" above the highest part of any floor, need not be of fire resistance rated construction, but for Groups A and F, and for Types 1,2 and 4 construction shall be of non-combustible materials.

(d) Untreated wood or other combustible materials may be used only for wall and floor finishes, skirtings window sills, wall trims, staircase handrails and other minor non-structural decorative purposes.

NOTE: Untreated wood should not be used as wall finishes or handrails on escape routes.

Table 3-2

Type Classification by Construction

Item	Type 1 Fire resistant	Type 2. Semi-fire resistant	Type 3. Ordinary Masonry	Type 4. Non-combustible	Type 5. Wood frame
Exterior structural	RC or PS	RC or PS	RC or PS	NFR, FRTW	NFR
Interior structural frame	RC or PS	RC or PS	NFR or FRTW	NM	NM or TW
Exterior load bearing walls	NFR	NFR	NFR	NFR	NFR or FRTW
Exterior non-load bearing walls	NFR	FRC or NFR	FRW	NFR	FRC or FRW
Interior load bearing walls	NFR	NFR	NFR or FRTW	NM	NM or FRW
Party walls and fire division walls	NFR	NFR	NFR	NFR	NFR or FRW

Interior walls enclosing vertical openings in buildings more than 1 storey high	NFR OR FRTW	NFR or FRTW	FRC or FRTW	NFR	FRC or FRW
Interior walls and/or doors facing on to a means of escape	NFR OR FRTW	NFR	FRC or FRTW	NFR or FRW	FRC or FRW
Fire division floors	NFR	NFR	NFR	NFR	NFR or FRW
Other floors	NFR	NFR OR FRTW	Group C: NFR or FRW Other Groups: NM OR TW	NM	NM or W
Roofs	NFR OR FRTW	NFR OR FRTW	NFR OR FRTW	NM	NFR OR FRTW
Cantilivered projections	NFT	NFR OR FRTW	NFR OR FRTW	NFR	NFR OR FRTW

Note: See 303.3 for abbreviations used

Table 3-3

Permissible Areas and Heights

Group	**Areas and Heights**	**Type 1. Fire resistant**	**Type 2. Semi-fire resistant**	**Type 3. Ordinary masonry**	**Type 4. Non-combustible**	**Type 5. Wood frame**
Group A	Area per storey	NL	15,000	10,000	10,000	10,000
	Height (ft)	100	60	SS	SS	SS
Group B	Area per storey	NL	10,000	7,500	NP	NP
	Height (ft)	100	60	35	NP	NP
Group C	Area per storey	NL	NL for SS 20,000 for MS	15,000	15,000	10,000
	Height (ft)	100	60	35	SS	SS
Group D	Area per storey	NL	20,000	15,000	15,000	10,000
	Height (ft)	100	60	35	SS	SS
Group E	Area per storey	NL	15,000	10,000	7,500	7,500
	Height (ft)	100	60	35	25	25

Group F	Area per storey	15,000	10,000	7,500	5,000	NP
	Height (ft)	60	25	SS	SS	NP

Note: Read this Table with 306 of this Code. For abbreviations used see 304.1

Table 3-4

Fire resistance ratings in hours for buildings within 10'0" of site boundaries or adjacent buildings on the same site

Item	Type 1. Fire resis-tant	Type 2. Semi-fire resistant	Type 3. Ordinary Masonry	Type 4. Non-combustible	Type 5. Wood frame
Exterior structural frame	4	3	2	2	1
Interior structural frame	3	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Exterior load bearing walls	4	2	2	2	1
Exterior non-load bearing walls	3	2	2	1	1
Interior load bearing walls	2	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Party walls	4	3	3	3	2
Fire division walls	3	2	2	2	1
Interior walls enclosing vertical openings in buildings more than 1 storey high	2	1	1	1	1
Interior walls and/or doors facing on to means of escape	1	1/2	1/2	1/2	1/2
Interior walls not otherwise described	Groups A & D only: 1/2	Groups A & D only: 1/2	0	0	0
Fire division floors and/or ceilings	3	2	2	2	1
Other suspended floor and/or ceilings	2	1	1	1	1
Roofs	2	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Cantilevered projections	3	2	2	1	1
Fire check doors	1	1/2	1/2	1/2	1/2

Note: See 303.3 for abbreviations used

Table 3-5

Fire resistance rating in hours for buildings between 10'0" and 20'0" from site boundaries or adjacent buildings on the same site.

Item	Type 1. Fire resistant	Type 2. Semi-fire resistant	Type 3. Ordinary masonry	Type 4. Non-combustible	Type 5. Wood frame
Exterior structural frame	3	2	1	1	1
Interior structural frame	2	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Exterior load bearing walls	3	2	1	1	1
Exterior non-load bearing walls	2	1	1	1	1
Interior load bearing walls	2	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Fire division walls	3	2	1	1	1
Interior walls enclosing vertical opening in buildings more than 1 storey high	2	1	1	1	1
Interior walls facing on to means of escape	1	1/2	1/2	1/2	1/2
Interior walls not otherwise described	Groups A & D only: 1	Groups A & D only: 1/2	0	0	0
Fire division floors and/or ceilings	3	2	1	1	1
Other suspended floors and/or ceilings	2	1	1	1	1
Roofs	2	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Cantilevered projections	2	1	1	1	1
Fire check doors	1/2	1/2	1/2	1/2	1/2

Table 3-6

Fire resistance ratings in hours for buildings over 20'0" from site boundaries or adjacent buildings on the same site and more than 35 '0" high.

Item	Type 1. Fire resistant	Type 2. Semi-fire resistant	Type 3. Ordinary masonry	Type 4. Non-combustible	Type 5. Wood frame
Exterior structural frame	2	2	N/A	N/A	N/A
Interior structural frame	2	1	N/A	N/A	N/A
Exterior load bearing walls	2	2	N/A	N/A	N/A
Exterior non-load bearing walls	2	1	N/A	N/A	N/A
Interior load bearing bearing walls	2	1	N/A	N/A	N/A
Fire division walls	2	2	N/A	N/A	N/A
Interior walls enclosing vertical opening in buildings more than 1 storey high	1	1	N/A	N/A	N/A
Interior walls not other-wise described	Groups A & D only: 1/2	Groups A & D only: 1/2	N/A	N/A	N/A
Fire division floors and/or ceilings	2	1	N/A	N/A	N/A
Roofs	2	1	N/A	N/A	N/A
Fire check doors	1/2	1/2	N/A	N/A	N/A

Table 3-7

Fire resistance ratings in hours for buildings over 20'0" from site boundaries or adjacent buildings on the same site and up to 35' 0' high

Item	Type 1. Fire resistant	Type 2. Semi-fire resistant	Type 3. Ordinary masonry	Type 4. Non-combus-tible	Type 5. Wood frame
Exterior structural frame	2	1	1	1	1
Interior structural frame	1	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Fire division walls	2	2	1	1	1
Interior walls enclos-ing vertical openings in buildings more than 1 storey high	1	1	1	1	1
Interior walls facing on to a means of escape	1/2	1/2	1/2	1/2	1/2
Fire division floors and/or ceilings	2	2	1	1	1
Other suspended floors and/or ceilings	1	1	1	1	1
Roofs	1	1	1	SS: 1/2 MS: 1	SS: 1/2 MS: 1
Cantilevered projec-tions	1	1	0	0	0
Fire check doors	1/2	1/2	1/2	1/2	1/2

SECTION 4

MATERIALS AND CONSTRUCTION STANDARDS

Contents

407 FIRE BARRIERS IN CEILING AND ROOF SPACES

Table 4-1 Minimum Protection of Structural Parts

Table 4-2 Rated Fire Resistive Periods for various Walls and Partitions

Table 4-3 Minimum Protection for Floor and Roof Systems

SECTION FOUR

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)

Minimum 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

SECTION 5

PUBLIC HEALTH AND SAFETY

SECTION 5

PUBLIC HEALTH ENVIRONMENT, ENERGY AND SAFETY

Contents

SECTION 5

PUBLIC HEALTH, ENVIRONMENT, ENERGY AND SAFETY

501 SCOPE*

This Section provides information on the design parameters for provision of buildings which will be environmentally acceptable, energy efficient and which if constructed in accordance with this Code provide reasonable fire resistance of critical elements and allow persons in the building time to evacuate safely.

Note:** ***The Chief Fire Officer shall be consulted when arrangements are being made for the construction of buildings accessible to the public and for any fixed or unfixed seating arrangements.

502 MINIMUM STANDARDS

502.1 Basis of Requirement

a) General

All buildings intended for human use or occupancy shall conform to the requirements of this Section. An energy management system shall be considered in any building exceeding 3,700 m2 (39,828 ft2) in gross floor area..

Preference shall be given to natural lighting and ventilation but provided that where artificial lighting and/or ventilation are permitted as alternative they shall also conform with the pertinent requirements of Section 11 of this Code.

In case of artificial cooling or air conditioning is provided or planned to provide, the building shall conform with the requirement of Section 502.1.d, 503.6.c, 503.7 and Section 11.

Orientation of the building with longer facades facing South and North and shorter facades to West and East is the most effective measure to avoid unnecessary heating from sunlight. By taking into consideration some other *(less important with regard to energy efficiency)* aspects, i.e. direction of winds for natural ventilation, all efforts shall be made to find the optimal orientation. (with regard to fenestration see 503.7)

b) Persons With Disabilities (PWD's)

Provisions for persons with disabilities must be made in accordance with Appendix F of this Code.

c) Ventilation

Every building and its several compartments shall be adequately naturally ventilated having regard to the use for which the building and its individual compartments are intended. An adequate amount of open space shall be provided at the front and back of every building and on any side which includes a door, window or other opening.

d) Resistance to Transmission of Heat

For every building used or intended to be used for human occupation, the building envelope (external walls, the roof, or roof in conjunction with the ceiling of the topmost storey, and the floor nearest the ground), shall be of such materials and be so constructed as to offer adequate resistance to the transmission of heat from the outside of the building to the inside. In this regard the building shall conform with the following requirements:

- Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal shall be either shaded (i.e. by a photovoltaic system or by a second roof both naturally well aerated) to more than 75 % or shall provide with an "Initial solar reflectance index" of 75.

- In case of artificial cooling or air conditioning is provided or planned to provide the insulation of the building envelope shall comply with the following requirements:

  - External walls: Insulated to a minimum U-Factor of 0.048 Btu/h*ft²*F = 0.273 W/m²*K

  - Vertical windows: double glazed with a minimum U-Factor of 0.5 Btu/h*ft²*F = 2.839 W/m²*K (see also section 503.7)

  - Roof: If not shaded (see above) insulation shall be provided to a minimum U-Factor of 0.048 Btu/h*ft²*F = 0.273 W/m²*K

e) Resistance to Transmission of Sound

Every building shall be sufficiently protected against the transmission of sound from adjoining buildings or from adjoining parts of the same building, according to the use for which the building is intended.

f) Reducing Danger from Fire

i) For the purpose of reducing the danger of the outbreak of fire in a building, and having regard to the risk inherent in the use to which a building or part thereof is intended, the size of the building and its proximity to other buildings, every building and its several parts shall be so designed and constructed as to:

(aa) reduce sufficiently the risk of ignition of any part of the building and the spread of fire within the building to other buildings;

(bb) withstand the effects of fire for a sufficient period to avoid such collapse of the building as would increase the risk of the spread of fire.

ii) Every building shall be so designed and constructed that in the event of an outbreak of fire in the building, every person therein may leave the building and its precincts safely.

iii) All heat and flame producing appliances in a building together with their necessary accessories, shall be so constructed and installed as to prevent the ignition of any combustible material forming part of the building, or any combustible material which may be placed against the surface of any wall, or other part of the building enclosing or adjacent to the appliance.

iv) All exterior doors installed in buildings to which the public will have access shall be so hung as to open outwards.

503 FIRE AND SAFETY REQUIREMENTS

503.1 Requirements for Applications

Applications for building permits for buildings intended for public use are required to satisfy the requirements of this Code. The applicant must demonstrate through the information provided in the application, and included on the appropriate drawings in the plans, elevations and sections, that the design and construction of the building or buildings being the subject of this application conforms in principle to this Code and to the latest edition of the National Fire Protection Association Life Safety Code, 1981, NFiPA 101, and Amendments.

503.2 Requirements for Fire Safety in Buildings

(a) All buildings other than private residences or apartment houses referred to in Group E(a) Residential Buildings, shall be provided with approved fire appliances in accordance with the requirements of this Code; the provision of, and the installation of, such appliances shall be approved in writing by the Chief Fire Officer.

(b) All buildings of more than 4 storeys and over 50 feet (15.2 m) in height shall be provided with one or more wet rising mains, as the Authority shall determine; such mains shall be exclusively for fire-fighting purposes.

c) The requirements of Sub-sections 505 and 506 of this Code shall, in particular apply to any part of any building more than 10,000 sq.ft. (929 sq m) in area of any type of occupancy as listed in Table 3-1, where such part is used for, or intended for the use of, the bulk storage of combustible materials or products. **(See Appendix D)**.

(d) Where automatic fire extinguishing protection is provided in other than High Hazard Occupancies, the fire-resistance requirements may be reduced by one hour in the area or portion of the buildings so protected, provided that such a building is not more than 50 feet (15.2 m) or 4 storeys in height.

(e) The installation of fire protection systems shall be carried out in accordance with Part 3 Section 7 of the Caribbean Uniform Building Code.

503.3 Requirements for Building Sites

No building shall be erected on a site which

(a) Consists in whole or part of harmful or offensive animal or vegetable matter until such matter shall have been removed and the site made good to the satisfaction of the Director.

(b) Cannot be put into such a condition as to prevent any harmful effect to the building or to its occupants by storm or flood waters.

(c) Has an average site elevation of less than 4' 0" (1220 mm) above mean sea level.

Adequate provision shall be made for the disposal of storm water so that the effect of increased run-off from the site will not materially affect adjoining sites.

503.4 Service Provisions

Every building shall, having regard to its use or intended use, be provided with:

(a) Adequate natural light and ventilation, (see 503.6, 503.7, 503.8 and Section 11)

(b) A sufficient supply of suitable water. At a reasonable demand of warm/hot service water a solar water heater shall be considered in accordance with Section 9.

(c) Adequate arrangements for the sanitary storage of solid waste (refuse and garbage). (See Section 10).

(d) Adequate facilities for the removal, and where necessary the treatment and disposal of all waste products in such a way as not to affect public health, safety and welfare. (See Section 10).

(e) Efforts shall be made to equip all Public Buildings in Group A and Institutional Buildings in Group B with access ramps and adequately wide entrances and exits for use by persons in wheel chairs. (For other provisions for persons with disabilities see Appendix F).

503.5 **Minimum Areas, Widths and Heights of Habitable Rooms**

Table 5-1 shall determine the minimum areas, widths and heights of habitable rooms and lavatories provided that

(a) The areas given in Table 5-1 shall be measured between the structural faces of walls permitted for such individual uses.

(b) No habitable room used for two or more purposes shall be divided by any wall, partition, screen or fitting into areas less than the minimum areas permitted for such individual uses, unless such division or partition is not more than 4'0" (1220 mm) high.

(c) Any open kitchen recess shall have a minimum floor area of 30 sq.ft (9.14 m).

(d) Every building or apartment of group E(a) shall provide living, dining and sleeping accommodation, together with suitable cooking and sanitary facilities, and adequate storage facilities.

(e) In any building or apartment of group E(a) providing only one habitable room, the area of such a room shall not be less than 200 sq.ft. (18.6 sq m).

(f) Where any building of group E(a) or group E(c) is used or intended to be used for the letting or renting of individual rooms or apartments with common cooking and/or sanitary facilities, the area of any such shall be determined in accord ance with the following:

(i) If shared by two (2) apartments only, the area of the facility shall be not less than 100 sq.ft. (9.3 sq m).

(ii) If shared by more than two apartments the area of the facility shall not be less than 65 sq.ft. (6.0 sq m) per unit of accommodation sharing the facility.

(g) Any room used as a place of public assembly for more than 50 persons shall have a minimum height of 10' 0" (3.05m), except that the minimum clear height under a gallery or balcony or mezzanine of less than 500 sq.ft. (46.5 sq m) may be reduced to 8 ft. (2.4m) provided that the space under the gallery or mezzanine is not separately enclosed.

(h) Where ceiling fans are erected, the minimum height from the floor to the ceiling should not be less than 9'0" (2.7 m).

Note: The minimum areas provided in Table 5-1 may be altered by the Authority to conform to the normal custom provided that the minimum area of any habitable room is approved by the Ministry of Health.

503.6 Light and Ventilation

(a) All efforts shall be made to provide natural lighting and natural ventilation to each space in the building in such a kind that artificial lighting and/or ventilation is not necessary or reduced to a minimum.

(b) To provide enough light and ventilation but prevent excessive solar heat infiltration a habitable room shall be provided with one or more windows or skylights, having an area or combined area of not less than 10 percent of the floor area of the room. Not less than 50 percent of the total area of such window or skylights shall open to permit the free unobstructed passage of fresh air. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed 25 percent of the gross above-grade wall area facing South, West or East and shall not exceed 40 percent facing North.

(c) In the case of buildings provided with mechanical ventilation systems, artificial cooling or air conditioning then the envelope of the treated air space shall be well sealed and be constructed as an air barrier to provide infiltration of warm resp. not conditioned air. Fully air conditioned buildings shall be considered to be tested with regard to the air leakage rate of the building envelope (see also section 11 of this code and IECC C402.4.1.2.3).

(d) In the case of usable rooms or spaces in buildings without natural light and ventilation, then artificial lighting and full mechanical ventilation systems or air conditioning must be provided in accordance with design and installation requirements of Section 11 of this Code.

Table 5-1.

Minimum Areas and Dimensions of Habitable Rooms

Description of Room	Area (sq.ft.)	Min. Width or Length	Min. Height
Living Room	120 (11.15 sq m)	10' 0" (3.05m)	8' 0" (2.4m)
Bedrooms	90 (8.4 sq m)	8' 0" (2.4m)	8' 0" (2.4m)
Dining room	80 (7.4 sq m)	8' 0" (2.4m)	8' 0" (2.4m)
Kitchen	40 (3.8sq m)	5' 0" (1.5m)	8' 0" (2.4m)
Living/dining/bedroom	200 (18.6sq m)	10' 0' (3.05m)	8' 0" (2.4m)
Living/dining/kitchen	180 (16.7sq m)	10' 0" (3.05m)	8' 0" (2.4m)
Living/bedroom	180 (16.7sq m)	10' 0" (3.05m)	8' 0" (2.4m)
Living/dining room	160 (16.7sq m)	10' 0" (3.05m)	8' 0" (2.4m)
Dining room/Kitchen	100 (9.3sq m)	8' 0" (2.4m)	8' 0" (2.4m)
Any other habitable room	80 (7.4 sq m)	7' 0" (2.1m)	8' 0" (2.4m)
Lavatory (W.C. bath & basin)	35(3.2sq m)	4' 6"(1.4m)	7' 6 (2.3m)
Lavatory (W.C. & shower & basin)	30 (2.8sq m)	4' 0"(1.2m)	7' 6" (2.3m)
Lavatory (bath & basin)	25 (3.2sq m)	3' 4" (1.0m)	7' 6" (2.3m)
Lavatory (W.C. & shower)	20 (1.9sq m)	2' 8" (0.81m)	7' 6" (2.3m)
Lavatory (Shower & basin)	20 (1.9sq m)	2' 8" (0.81m)	7' 6" (2.3m)
Lavatory (W.C. & basin)	20 (1.9sq m)	2' 6" (0.76m)	7' 6" (2.3m)
W.C. compartment	12.5 (1.6sq m)	2' 8"(0.81m)	7' 6" (2.3m)
Shower compartment	7.5 (0.7sq m)	2' 6" (0.76m)	7' 6" (2.3m)

Note: The dimensions of any room should be confirmed by the Director before completing the plan of the building.

503.7 Windows

a) Windows shall be located in an external wall and in such a position that light and fresh air are not substantially excluded by adjacent walls of the building or by the walls of adjoining buildings.

b) Windows within toilet facilities shall normally be located 4' 0" (1.22 m) minimum above floor level. The minimum height from the floor to the window head shall be 6' 8" (2.0 m).

c) All Windows or glazed parts of vertical walls not oriented within 45 degrees of True North shall be either (preferred) protected from direct sun by an overhang, eave, or permanently attached shading device or providing spectrally selective low-E (low-emissivity) or reflective coating on glazing or tinted glass.

d) Windows in rooms provided with mechanical ventilation systems, artificial cooling or air conditioning shall be well sealed, double glazed and providing an U-factor not less than 0.5 Btu/h*ft²*F = 2.839 W/m²*K.

e) To ensure resistance to hurricane forces, the design and installation of window assemblies for buildings in Groups A, B, C and F shall be certified by a structural engineer. This certification shall be based on the requirements of Section 12 of the Code and in accordance with Part 2 Section 2 of CUBiC.

503.8 Skylights

Skylights used for provision of natural light or ventilation shall be located in a clear area of roof and shall be designed to prevent the entry of rain water when closed. Where glass is used it shall be safety glass or shall be screened internally with a high tensile steel mesh of area not more than I sq. in.
To prevent excessive solar heat infiltration the maximum skylight area shall not exceed 3 percent of the gross roof area

503.9 Enclosed Courts

Any court enclosed on three or more sides and serving windows providing natural light and ventilation shall have an area for its full height of not less than 150 sq.ft (14 sq m) for each 10' 0" (3.04 m) of its height, and a width of not less than 10' 0"(3.04 m); nor less than 5' 0" (1.5 m)for each 10' 0" (3.04 m) of its height up to 60' 0" (18.3 m), plus 2' 6" (762mm) for each 10' 0" (3.04 m) of its height above 60' 0" (18.3m).

503.10 Rear Courts

Any building of Group E(a) on a site where the rear boundary is a common boundary with an adjoining site shall have a war court of the full length of such boundary and of a width not less than 10' 0" (3.04 m) nor less than 2' 6" (762 mm) for each 10' 0" (3.04 m) of building on the line of such court.

503.11 Rodent Proofing

Special precautions are required for restaurants, buildings where food is prepared, food storage premises and slaughter houses. Applicants for building permits are required to contact the Rodent Control Unit of the Ministry of Health for minimum requirements with respect to the type of surfaces of walls, floors and ceiling and the screening necessary.

503.12 Sanitation

(a) Toilet facilities accessible to the public shall be provided on each floor for each sex for all types of building, except that in a building of two floors and occupied by a single tenant, the combined toilet facilities required may be located on either floor.

(b) Where common sanitary facilities are provided in buildings of Group E(c) used by more than 10 persons, then at the least, separate facilities shall be provided for males and females, and such facilities shall be so located that they are accessible under cover from all of the habitable rooms they serve.

(c) A toilet shall preferably not open directly onto a room intended primarily for human habitation, other than a bedroom or dressing room and never onto any area used for the manufacture, preparation or storage of food for human consumption.

(d) The floor and walls of public toilet facilities, to a height of 5 feet (1.5 m), shall be of tile or other smooth, cleanable, impervious materials.

(e) Shower compartments shall have floors and walls constructed of smooth, corrosion resistant and non-absorbent water resistant materials to a height of not less than 70 inches (1778 mm) above the compartment floor.

f) Tables 3-8 and 3-9 give the number of lavatory fixtures required for various occupancies.

503.13 Storage of Hazardous Material

a) Buildings constructed for the storage and use of hazardous material (Appendix D) must be sited and constructed in accordance with Part 3 Section 7 of CUBiC or in accordance with any other Code or Standard approved by the Authority.

b) Part 3 Section 7 of CUBiC provides information on the following:

- Explosion hazards
- Volatile flammables
- Liquefied petroleum gases
- Pyroxylin plastics
- Use and storage of flammable film
- Use and storage of combustible fibres
- Combustible dusts, grain processing and storage
- Paint spraying and spray booths
- Dry cleaning establishments
- Private garages

- Public garages
- Motor fuel service stations
- Motor vehicle repair shops
- Places of public assembly
- Public assembly and other theatres

504 MEANS OF ESCAPE AND EXITS

504.1 Basis of Requirement

All new buildings, also existing buildings for which a certificate of use and occupancy has been issued, shall be provided with adequate means of escape and exits in accordance with the requirements of this Code. Where the change of use and occupancy of an existing building requires additional or improved means of escape and/or exit, and the exact requirements of this Code cannot reasonably be met, the Authority shall have power to approve alternative proposals for providing adequate means of escape and/or exits, so long as such alternative proposals are also submitted to and approved by the Director.

504.2 Definitions

For the purposes of this Code the following special definitions shall apply:

(a) "Means of escape" shall include any corridor, hallway, lobby, staircase, escalator or ramp by use of which the occupants of a building may proceed safely from within a building to an exit.

(b) "Door" shall include any shutter, cover or other form of protection to an opening in any wall of floor of a building or in the structure surrounding a protected shaft, whether the door is comprised of one leaf or several.

(c) "Exit" shall be a means of egress and shall include:

(i) Any doorway in the ground storey leading directly to a street or to an open space providing free access to a street.

(ii) Any doorway in an upper storey fitted with fire resisting doors and leading through a fire resisting lobby directly to an external staircase terminating at ground level in an open space providing free access to a street.

(iii) Any doorway in an upper storey leading directly to an external balcony or flat roof from which there is further means of escape.

(iv) Any doorway in an upper storey or basement storey, leading directly to an enclosed internal staircase separated from all the storeys through which it passes by fire resisting doors, provided that such staircase leads directly to a ground storey exit, or a ground storey fire-resisting lobby from which there is a further means of escape.

(d) "Fire resisting door" shall mean any door with a fire resistance rating in accordance with the requirements of an approved agency, and which is fitted in such a way that it cannot reasonably be fixed in an open position, and is provided with an approved automatic closing device.

(e) "Fire resisting lobby" shall mean a lobby used or intended to be used as a means of escape in which all of the doors are either fire resistive doors or exits leading directly to open air.

504.3 Basis of Calculation

The occupancy content of a building or a storey of a building used in determining the number and width of means of escape and exits shall be calculated in accordance with Table 3-1 of this Code and it shall be an offence to occupy any building with a greater number of persons than the means of escape and exits provide for.

504.4 Number of Means of Escape and Exits

Table 5-2 shall determine the minimum number of means of escape and exits required for each storey of a building provided that:

(a) The requirements for exits in this clause shall not apply to a single family residence which shall be supplied with at least two doors, preferably on opposite sides of the building.

(b) Exits shall be located as remotely as practicable from one another and shall be reasonably distributed throughout the building.

(c) All corridors, halls or foyers used as a means of escape shall lead directly to an exit from the storey.

(d) Every enclosed space of more than 1,000 sq.ft (93 sq m) with an occupancy content of more than 5 persons shall have at least two means of escape or exits.

(e) Two or more means of escape may serve the same or communicating corridors, halls or foyers provided that the capacity of such corridors, halls or foyers is not less than the capacity of the two nearest exits.

(f) In places of public assembly accommodating more than 500 persons, means of escape or exits shall be provided on at least 3 sides and where fixed seating is provided such means of escape or exits shall be served by permanent aisles and cross aisles.

g) Half of the required main floor exit widths shall be proportioned to the side exits and when more than one side exit is required, shall be equally divided in full units of unit width to each side.

h) The number of side exits shall be not less than that required by distance limitations and as set forth in the following:

Number of Persons	**Number of Side Exits**
0 - 600	1
601 - 999	2
1,000 or More	4

i) Where one or two side exits on each side are required, one of such exits on each side shall be located at the front of the assembly space, remote from the main-floor exits. And where four or more exits on each side are required, the additional exits shall be proportionally spaced along the length of the side walls.

(j) No two means of escape from one place of public assembly shall use a common staircase.

(k) No open staircase from a basement or lower ground floor shall be considered a means of escape unless it leads directly to a ground storey exit or to a ground storey hall or foyer from which there is an exit.

(l) Stairways from the basement to ground floor should be separated from staircases serving upper floors.

Table 5-2

Minimum Number of Means of Escape and Exits Required per Storey

Occupancy content of floor	Means of Escape	Exits
1-10	1	1
11-100	1	2
101-500	2	3
501-1000	3	4
1000 or more	4	5

504.5 Maximum Distance of Travel to Exits

Table 5-3(a) shall determine the greatest permitted distance from any point in a storey measured along the line of travel to the nearest exit from the storey provided that:

(a) Where an area is subdivided into rooms not exceeding 250 sq.ft (23.2 sq m) in individual area the permitted distance may be measured from any door of such room which opens directly to a corridor, hall or foyer.

(b) No dead end of a corridor shall be more than 20'0" (6.0 m) from an exit or from a means of escape leading to at least two exits.

504.6 Widths of Means of Escape and Exits

Table 5-4 shall determine the minimum widths of means of escape and exits provided that in places of public assembly where fixed seats are provided, no means of escape or exit shall be less wide than any aisle leading directly to it.

504.7 Exits and Fire Check Doors

(a) Exit doors shall be kept clear of obstruction at all times.

(b) Exit doors shall be so located that they open only in the direction of escape a full 90 degree swing unobstructed by cross traffic, provided that doors regularly used for entry and fitted with glazed observation panels may also open in reverse to a full 180 degree swing.

(c) Exit doors provided only for emergency use may be fitted with approved internal panic bolts but shall not be fitted with any other locking or closing device.

(d) Fire check doors including doors to enclosed internal staircases, shall be so located that they open in the direction of escape with a full 90 degree swing unobstructed by cross traffic routes and fitted with glazed observation panels; they may also open in reverse to a full 180 degree swing. No fire check door shall be fitted with any kind of latch or automatic locking device. Fire check doors shall be self closing.

(e) Glazed observation panels in fire check doors shall be 1/4" (6 mm) wired glass, or toughened safety glass of equal and approved performance.

f) To ensure resistance to hurricane forces, the design and installation of exit door assemblies for buildings in Groups A, B, C and F shall be certified by a structural engineer. This certification shall be based on the requirements of Section 12 of the Code and in accordance with Part 2 Section 2 of CUBiC.

Table 5-3(a)

Maximum Permitted Distance of Travel to an Exit (ft.)
(Without fire suppression system)

Building Occupancy Group	Type 1 Fire-resistant	Type 2 Semi-fire resistant	Type 3 Ordinary Masonry	Type 4 Non-combus-tible	Type 5 Wood Frame
Groups A,C.D, E(a), E(c)	150	150	100	75	75
Groups B & E(b)	100	100	75	N/A	N/A
Group E (except E(b)	75	75	50	50	N/A
*Group F	300	300	N/A	N/A	N/A

* With fire suppression system

Table 5-3(b)

Exit Capacity: Number of Persons per Unit of Exit Width (22 inches) (559 mm)
(Without fire suppression system)

Occupancy Group		Level Travel (corridors, doors, ramps etc)	Stairs
Group A:	Public Buildings	100	75
Group B:	Institutional Buildings (Generally)	30	22
Group C:	Commercial and Industrial	100	60

Group D: Service Buildings	Offices, Administrative and Retail	100	60
Group E:	Residential Buildings	100	75
*Group F:	Hazardous Occupancy	100	60

* With fire suppression system

See also Tables 3.500 and 3.510 of CUBiC Part 3 Section 5.

Table 5-4

Minimum Required Widths of Means of Escape and Exit Doors

Capacity in Number of Persons	Corridors, Halls and Foyers	Staircases and ramps clear between hand-rails	Exit doors and fire check doors between jambs
1 - 10	3' 4" (1016mm)	3' 0" (914mm)	3' 0" (914mm)
11 - 200	4' 0 (1220mm)	4' 0" (1220mm)	3' 8" (1116mm)
201 - 500	6' 0" (1830mm)	6' 0" (1830mm)	5' 8" (1725mm)
501 or more	8' 0" (2430mm)	8' 0" (2430mm)	7' 8" (2336mm)

504.8 Internal Staircases and Ramps used as Means of Escape

Internal staircases and ramps used as means of escape shall be designed and constructed in accordance with the following requirements:

(a) They shall be considered as enclosed vertical openings and the enclosing structure shall be of fire resistance rating construc tion in accordance with the requirements of Section 4 of this Code.

(b) They shall be designed in accordance with the requirements of Section 4 of this Code and constructed of non-combustible materials.

(c) Flights shall preferably run straight from landing to landing without winders or tight spiral sections.

(d) The number of risers in one flight from landing to landing shall not exceed 16.

504.9 **Fixed Seating in Places of Public Assembly**

In places of public assembly with fixed seating arrangements the seating shall be separated into blocks by aisles in accordance with the following requirements:

(a) The maximum number of seats in a row between two aisles shall be 14 and in a row served by only one aisle shall be 7.

(b) Where bench seats without dividing arms are provided they shall not be longer than 21' 0" (6.4 m) between two aisles or 10' 6" (3.2 m) when served by only one aisle.

(c) The spacing of seats shall not be less than 2' 3" (686 mm) back to back nor less than 1' 0" (305 mm) clear from the back of one seat to the front of the seat immediately behind it.

(d) The maximum number of rows of seats in one block shall be 21 and blocks shall be separated by cross aisles.

(e) The number of seats in a row may be increased to 100 where seats are so spaced that there is an unobstructed space of not less than 18" horizontal projection between the rows of seats, and doorways leading directly to exit corridors are provided along each side of the place of assembly at the rate of one doorway for every 3 rows of seats.

(f) Every aisle shall lead directly to a means of escape or to an exit or to a cross aisle.

Aisles serving up to 50 seats shall be not less than 2' 6" (762 mm) wide.

(g) Aisle serving more than 50 seats shall be not less than 3' 0" 914 mm) wide when serving seats on one side only, and not less than 3' 6" (1066 mm) wide when serving seats on both sides.

(h) Aisles leading directly to a means of escape or an exit shall not be less than 4'0" (1220 mm) wide.

(i) Every cross aisle shall lead directly to a means of escape or to an exit.

(j) Every ramped aisle shall have a non-slip walking surface.

(k) No ramped aisle shall have an average slope of more than 1 in 10 or a maximum slope of more than 1 in 5. No aisle or cross aisle shall be ramped across its widths.

(l) In stepped aisles the risers shall extend the full width of the aisle and each riser shall be illuminated. Treads and risers shall conform with the requirements of Sub-section 504.

505 STAIRCASES AND RAMPS

505.1. Definitions

(a) Private stairway shall mean a stairway of steps intended to be used by only one dwelling.

(b) Common stairway shall mean a stairway of steps which is intended for common use.

(c) The width of a stairway shall mean:

(i) the horizontal distance between the centre lines of handrails, in the case of a stairway with handrails on both sides;

(ii) the horizontal distance between the centre line of handrail and any wall, screen or extremity on the other side of the step, where there is a handrail on one side only;

(iii) the width of the narrowest part if tapered.

(d) Pitch line shall mean a notional line drawn to connect all the nosings of the treads in a particular flight of stairs.

(e) The going of a step shall mean the distance measured on plan between the nosing of its tread and the nosing of the tread of the step or landing next above it.

(f) Parallel step shall mean a step of which the nosing is parallel to the nosing of the steps or landing above it.

(g) Tapered step shall mean a step, the nosing of which, is not parallel to the nosing of the step or landing next above it.

505.2 Basis of Requirements

Staircases and ramps shall be designed and constructed in accordance with the requirements of Sub-section 504 and when used as a means of escape they shall also conform to the pertinent requirements of Sub-section 503 of this Code.

Buildings providing an electric lift or elevator shall also provide staircases for common use (not only as a mean of escape) for a minimum of the first five storeys, easily visible and accessible beside the elevator.

505.3 Private Stairways

Any private stairway shall be so constructed that:

a) Between consecutive floors there is an equal going for each parallel step and an equal rise for every step and landing.

b) Over the whole width of the stairway there is:

(i) headroom of not less than 6' 6" (1981 mm), measured vertically above the pitch line,

(ii) clearance of not less than 5' 0" (1.5 m) measured at right angles to the pitch line,

c) The dimensions of treads and risers conform to Table 5-5.

d) The pitch of the stairway is not more than 42 degrees.

(e) Tapered steps conform to the requirements of Sub-section 50-4.6.

505.4 Common Stairways

Any common stairway shall be so constructed that:

a) It complies with Table 5-5 for the relevant category of use.

b) The pitch of the stairway is not more than 38 degrees.

c) The stairway has not more than 16 risers in any flight.

d) Tapered steps must conform to the requirements of Sub-section 504.6.

e) The sum of the going plus twice the rise should not be less than 24" (610 mm) nor more than 26" (660 mm).

Table 5-5

Tread and Riser Sizes/Dimensions

Occupancy Group	Maximum for Risers (inches)	Minimum for Treads* (inches)
Group A - Public Buildings	7-1/2 (190.5mm)	10 (254mm)
Group B - Institutional Buildings	7-1/2 (190.5mm)	10 (254mm)
Group E - Residential Buildings	8-1/4 (210mm)	9 (227mm)
All others	8 (203mm)	9 (227mm)

* Excluding nosings

505.5 Open Riser Stairways

(a) Stairways which have no risers below the treads and landings shall conform in all respects to the requirements of Sub-sections 504.3 and 504.4 as appropriate.

(b) The nosing of each tread and landing shall overlap on plan, the back edge of the tread of the step below it by not less than 5/8" (16 mm).

505.6 Tapered Steps

(a) In the application of requirements Sub-sections 504.3, 504.4 and 504.5 to tapered steps, the going and pitch of tapered steps shall be measured in the vertical planes of the pitch lines connecting the nosings of consecutive steps at a distance of 10-1/2" (267 mm) from the extremities of the width of such steps.

(b) The sum of the going plus twice the rise shall be:

(i) Not less than 22-1/2" (572 mm).

(ii) Not more than 25" (635 mm) where the angle of taper is 10 degrees or less or 28" (711 mm) in all other cases.

505.7 **Guarding of Stairways and Landings**

(a) Any private or common stairway shall be guarded on each side by a wall, a securely fixed screen, balustrade or railing extending to a height of not less than 2' 9" (838 mm) measured vertically above the pitch line.

(b) The side of any landing or similar space forming part of a stairway or directly overlooking a stairwell shall be guarded by a wall, securely fixed screen, balustrade or railing extend ing to a height above the floor of such landing or space, in the case of private stairways 3' 0" (914 mm) and in the case of common stairways 3' 6" (1066 mm).

(c) Any flight of steps with an aggregate rise of more than 2' 0" (610 mm) shall have a continuous handrail fixed securely at a height of not less than 2' 9" (838 mm) nor more than 2' 11" (889 mm) measured vertically above the pitch line, one on each side if the stairway is more than 3' 6" (1066 mm) wide or on one side only if the width is less.

(d) Easy to grasp handrails with 1-1/2" (38 mm) clearance from a wall shall extend 1'6" (457 mm) at top and bottom of stairs with ends turned down to floor or into walls, but not to create a safety hazard.

(e) All handrailing should have intermediate vertical or longitudinal rails or latticework which would prohibit the passage of a 6" (152 mm) diameter sphere, except for industrial buildings where the intermediate rails or latticework should prohibit the passage of a 12" (304 mm) sphere**.**

505.8 **Guarding of Balconies and External Areas**

a) Any balcony, platform, roof or other external area which is 2'0" (610 mm) or more above ground and to which a person habitually has access other than for maintenance and repair shall have a balustrade, parapet or railing not less than 3' 6" (1066 mm) high and of such extent, construction and material as to afford safety to persons using the balcony, platform, roof or external area.

b) Balustrades, parapets and railings on balconies and platforms for single family dwellings only shall not be less than 3' 0" (914 mm) high.

c) For the structural design of handrails and balustrades see 1201.6

505.9 **Ramps**

No ramp shall be steeper than 1:10 nor more than 40" (1016 mm) wide between handrails, nor more than 8' 0" (2.4 m) wide without a centre handrail and the whole of the walking surface shall be finished with a non-slip material. Minimum headroom for a ramp shall be 6' 6" (2032 mm) measured at right angles to the slope of the ramp.

505.10 **Landings**

Landings shall be at least as deep as the widest staircase, flight or ramp served, and such depth shall be clear of any door swing or other obstruction to free passage. However for straight staircases landings shall be a minimum of 3 ft (914 mm) deep.

506 FIRE SUPPRESSION SYSTEMS

506.1 **Basis of Provision**

When fire suppression systems such as automatic sprinkler systems are installed in accordance with the requirements of this Code or on the advice of the Director they shall be maintained to the satisfaction of the Director. Reference should be made to CUBiC Part 3 Section 7 for the choice of a suitable suppression system for the building.

506.2 **Special Provisions**

Special precautions, and fire protection systems, e.g. halogenated installations, shall be provided if so required by the Authority in any building, or part of a building.

506.3 **General Requirements for Fire Protection and Extinguishing Systems**

All automatic sprinkler or other type of systems shall be of proprietary manufacture. The installation shall be carried out by an experienced specialist contractor and both design and installation shall be in accordance with recognised standards of good practice at least equal to the standard recommended in the latest edition of NFiPA Standards 13, 13A, 13D, 13R and 14 as may be appropriate for the class of building and availability of water supply. Fire protection and extinguishing systems shall consist of any of the following:

a) Automatic Sprinkler System.

Shall be a fully zoned system covering all internal areas and kept pressurized at all times. Pumps are activated when the system pressure falls to a predetermined setting as sensed by pressure switches. Each fire zone shall be provided with a zone shut off valve, valve monitor switch and indicating water flow switch. The location of the Fire Department Connection (FDC), also known as the Siamese Connection, must be coordinated with the local Fire Service.

b) Standpipe System.

Shall be supplied from a dedicated pre-piped water supply fire protection reserve equal to a minimum of two hours operating capacity. All hose reels to be provided in lockable cabinets at intervals not exceeding 100 feet (30 m) throughout all internal and external covered areas. Where required, dry risers may be provided in addition to a standpipe system and the minimum distance between dry risers situated on the same floor shall not exceed 165 feet (50 m)

c) Automatic Extinguishers.

Provide each specialized functional area including service and equipment rooms, with an automatic extinguishing system, completely integrated with the fire alarm system.

d) Portable Extinguishers.

Provide portable extinguishers in each fire hose reel cabinet and in every recessed cabinet, throughout all public areas within the building suited to the class of fire risk in each area.
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506.4 Approval of Installation

The installation of any required fire protection and extinguishing system shall be approved by the Authority in writing on completion; no Certificate of Occupancy shall be issued by the Director until a copy of such approval has been provided.

SECTION 6

PRECAUTIONS DURING BUILDING CONSTRUCTION

Contents

SECTION 6

PRECAUTIONS DURING BUILDING CONSTRUCTION

601. GENERAL

601.1 Scope

a) The provisions of this Section shall apply to all work in connection with erection, alteration, repair, removal and demolition of buildings and structures. It is the duty of all builders to make every effort to provide a safe working environment for workers on building sites. On sites on which more than 30 persons are working the use of hard hats may be enforced by the Board/Authority.

b) The Board/Authority will issue an order to stop work if any provision of the Section is violated. Work will not be allowed to recommence until the owner has complied with the provisions of the Section to the satisfaction of the Board/Authority.

601.2 Erection of Scaffolds and Safeguards

a) The construction, erection, alteration and removal of scaffolds and the application, installation and setting up of safeguards and equipment devices shall be done by skilled workmen under the supervision of a person qualified by experience and training for such work.

b) A safeguard, device or piece of equipment which is unsafe shall be reported to the superintendent or foreman, who shall take immediate steps to remedy such condition or remove such safeguard, device or equipment.

c) Scaffolds, ladders stairs, fuel gas tanks and other devices or equipment regulated by this section shall be maintained in a good, safe and usable condition as long as they are in use.

d) No ladders, scaffold, railing or other devices or equipment required or regulated by this section, or any part thereof, shall be removed, altered or weakened when required by the work, unless so ordered by the superintendent or foreman in charge.

e) Scaffolds, temporary floors, ramps, stairway landings, stair treads, and all other walkway surfaces shall be kept free from protruding nails and splinters. They shall be kept free from necessary obstructions so that the workers may move about safely.

f) Protruding nails and tie wire ends shall be removed, hammered in or bent in a safe condition.

601.3 Electricity Lines and other Hazards

a) Electric lines, moving ropes and cable gears, or similar hazards with which a worker might come in contact, shall be encased or guarded.

b) No person, firm or corporation, either personally or through an employee or agent of another, shall operate or move any machine, equipment, material, scaffolds or assembly closer than six feet to any energized high-voltage overhead electrical facilities except with the approval of the Electrical Inspector.

601.4 Underground Utilities

Prior to making an excavation, drilling or otherwise disturbing the ground, the person doing the work, or causing such work to be done, shall contact all public utility organizations to determine the possible location of underground facilities, to avoid the hazard to public safety, health and welfare caused by inadvertent disruption of such facilities.

601.5 Duty of Care

It is the responsibility of the builder to ensure that all operatives in his/her employ are appropriately trained and that they can operate the equipment safely. It is also his/her responsibility to ensure that no member of the public is exposed to a hazardous act.

602 DEMOLITION AND DECONSTRUCTION

Deconstruction is preferred to demolition because it mitigates climate change. Deconstruction shall be employed if there is sufficient quantity of material in such good condition that it can be re-used and if the components can be safely and easily separated. Refer to section 402.4 of this Code for approval of re-used material.

For reasons of safety, hand demolition methods shall be avoided.

a) Before commencing the work of demolition of a building or structure, all gas, electric, water and other meters shall be removed and the supply lines disconnected, except such as are especially provided or required for use in connection with the work of demolition.

b) Glazed sashes and glazed doors shall be removed before the start of demolition operations.

c) No wall, chimney or other construction shall be allowed to fall in mass, except under competent supervision. Scaffolds or stagings shall be erected for workers if walls or other elements of the structure are too thin or too weak to work on. Heavy structural members, such as beams or columns, shall be carefully lowered and not allowed to fall freely.

d) Chutes for the removal of materials and debris shall be provided in all parts of demolition operations which are more than 6m (20 feet) above the point from which material is to be removed.

e) Chutes shall be completely enclosed and shall be equipped, at intervals of 7.6m (25 feet) or less, with substantial stops to prevent descending material from attaining dangerous speeds.

f) The bottom of each chute shall be equipped with an adjustable gate or stop, for regulating the flow of materials. A danger sign shall be placed at the discharge end of every chute; and except for the discharge of materials, the gate or stop shall be kept closed.

g) Proper tools shall be provided and kept available to loosen material or debris jammed in the chute. Chutes, floors, stairways and other places shall be effectively wet down, at frequent intervals, when the dust from such operations would cause a menace of hardship to adjoining buildings or premises.

h) Stairs and stair railings shall be kept in place and in usable condition as long as is practicable, and steps and landings shall be kept from debris.

i) Floor openings, unless covered or otherwise protected, shall be provided with guard rails and toe boards.

j) All areas of danger in demolition operations shall be properly enclosed and danger signs posted. Sufficient watchmen shall be provided to warn workers of impending dangers, and all unauthorized persons shall be excluded from places where demolition in progress.

603 EXCAVATION

a) The sides of every excavation in connection with building operations, including trenches for pipes or for any purposes, shall be sheet-piled, braced or shored when necessary to prevent the soil from caving in on persons engaged in work within such excavation.

b) Where workers are employed adjacent to an excavation on work other than that directly connected with the excavation, substantial railings or fences shall be provided to prevent such workers from falling into the excavation.

c) Every trench, 1.5m (5 feet) or more in depth, shall have suitable means of exit or escape at least every 7.6m (25 feet) of its length.

d) Excavations shall be drained and kept clear of excess water and debris to the satisfaction of the Ministry of Health

e) The need for all excavations and the probable depths of the excavations and the time such excavations shall be in place shall be reported to the Director for approval before the work commences. It is the duty of the permit holder to ensure that the excavations are completed and covered within the time frame reported to the Director.

604 SIDEWALK SHEDS AND FENCES

604.1 Sheds

a) Where buildings, which exceed 13.7m (45 feet) in height, are to be erected or demolished closer than 3m (10 feet), or buildings which exceed 7.6m (25 feet) in height are to be erected or demolished closer than 1.5m (5 feet), to a street line, there shall be erected and maintained, during such work adjacent to the street line, a shed of sufficient strength and stability to sustain safely the weight of materials that may be placed thereon, and to withstand the shocks incident to the handling of such materials or their preparation for use, and accidental jars from trucks passing or delivering materials.

b) When the roof of such shed is used for the storage of materials or for the performance of work of any kind, substantial railings not less than three feet high and solid toe boards not less than 150mm (6 inches) high shall be placed along the open sides and ends of such roof.

c) Such shed shall be constructed to afford unobstructed walkways, not less than 2.4m (8 feet) high and 1.5m (5 feet) wide. The street side shall be kept open for a height of not less than 2.1m (7 feet) above the curb, and the sheds shall be properly lighted at night with not less than one 100-watt bulb every 6m (20 feet) of its length and at each change of grade or elevation of the sidewalk surface.

d) Such shed shall remain in place until the building is enclosed, or if being demolished, until the building is reduced to 6m (20 feet) in height.

604.2 Construction Fences

Buildings which are erected or demolished closer than 1.5m (5 feet) to a street line and which are not required to have a sidewalk shed shall be provided with protection on the street sides in the form of a substantial fence not less than 2.4m (8 feet) high. Such fence shall not restrict the sidewalk to less than 1.5m (5 feet) in width and shall be built solid for its full length, except for such openings as may be necessary for a proper execution of the work.

604.3 Exceptions

The Director may waive, or may vary, any or all of the provisions of subsection 604 where the safety of the public may otherwise be protected.

605 STORAGE OF MATERIAL

605.1 General

Scheduling an efficient flow of materials will allow full utilization of freight vehicles and minimize storage on site. The sustainable approach is one that favours just-in-time deliveries.

a) Materials to be stored at or near locations where workers are employed or on any public property shall be piled or stacked in an orderly manner to avoid toppling over or being otherwise displaced.

b) No material shall be piled or stacked to a greater height than 1.8m (6 feet) except in yards or sheds intended especially for storage. When piles exceed 1.2m (4 feet) in height, the material shall be so placed that the sides and ends of the piles taper back.

c) The placing of construction materials in a building or structure during building operations shall be done with due consideration of the effect of such loads on the structural members, and such loads shall, in general, be placed as near to the points of support of the structural members as possible. Such loadings shall not cause stresses in any structural member beyond the design stresses.

d) Waste material rubbish resulting from building operations shall be removed as rapidly as possible and shall not be allowed to accumulate on the premises or adjacent thereto. Refer to section 626 on site waste disposal.

605.2 Hazardous Materials

a) When storing hazardous materials (eg flammable, explosive or toxic materials) the manufacturer's recommendations shall be followed. In any event the owner and builder shall construct and maintain safe storage areas in accordance with the requirements given in Part 3 Section 3 of CUBiC.

b) In general hazardous materials should be stored in well ventilated, shaded areas away from naked flames, water courses and high traffic areas. The plans and drawings for such storage areas must be submitted to the Director.

606 HOISTING MACHINERY

The use of oversized machinery shall be avoided. *Efficient use of construction plant and appropriate levels of power for different applications will minimize the embodied carbon of construction.*

a) Every hoisting engine shall be provided with adequate breaks, capable of holding the maximum load at any point of travel.

b) Guards shall be provided for exposed gears and other moving parts and around hoisting cables at all points to prevent workers from tripping or getting clothing caught.

c) Ample room shall be provided around hoisting engines, motors or other machinery or apparatus for the free and safe movement of those who operate or otherwise attend such engines, motors or other machinery apparatus.

d) Hoisting machinery shall be enclosed to exclude unauthorized persons and if placed outside the building, further protection against falling objects shall be provided.

e) When hoisting machinery is set on an elevated platform, such platform shall be of substantial construction, and guard rails and toe boards shall be provided along all open sides platform.

607 DERRICKS AND CRANES

(a) Derricks shall be so designed and assembled that no part shall be stressed beyond the safe-working stress for the material, as specified in this Code, under maximum-rated load in any possible position. Such maximum-rated load shall be conspicuously posted on each derrick.

(b) The foot-block of every derrick shall be firmly secured against motion in any direction.

(c) Guy derricks shall have the top of the mast held by not less than six steel guy cables secured by firm anchorages and so placed that the angle of the guy with the mast shall be as large as possible.

(d) The moving parts of derricks and cranes shall be kept well lubricated, and all parts shall be inspected at least every other day.

607.2 Visibility

Masts and booms of derricks and cranes, where higher than 45m (150 feet) above ground, shall have installed:

(a) At the top in a manner to ensure unobstructed visibility of at least one beacon and one flag from any angle, one or more flashing 300 mm beacons, each equipped with two lamps and aviation colour filters and rectangular flag markers of solid colour not less than two feet on a side.

(b) Along the height of the mast or boom, a pair of lamps of at least 100 watts each, enclosed in aviation-red obstruction light globes, on opposite sides or corners at regular intervals not to exceed 15.2m (50 feet) and, rectangular flag markers of solid colour aviation-surface-orange, not less than two feet on a side at regular intervals not to exceed 15.2m (50 feet).

(c) Where masts and booms are within 15.2m (50 feet), measured horizontally of existing buildings which exceed the maximum heights of such masts or booms, light and flags may be omitted.

607.3 Compliance

(a) Compliance with this Section shall not be construed as satisfying the zoning height requirements or any special provisions needed for safety of flying aircraft etc.

(b) Compliance can be achieved by contacting the Director.

608 CABLES, ROPES, CHAINS AND BLOCKS

a) Cables, ropes, chains and blocks shall be of such size that the maximum load supported by them will not exceed one sixth of their breaking strength.

b) Blocks designed for use with manila ropes shall not be used for steel cables. Blocks used at or near floors or in other exposed places to change the direction of cables shall be enclosed or otherwise effectively guarded.

c) All ropes and cables used in connection with scaffolds, derricks and hoisting apparatus shall be tested before being put to use and at least once every 30 days while in use, to insure their safety and suitability for the purpose to which they are to be put. Any rope or cable found to be unsafe or unfit shall not be used.

d) Chains shall not be used for slings, bridles or other similar purposes, but shall be restricted to only such purposes as require a straight pull.

e) Hooks shall not be used for hoisting buckets, cages or skips.

609 PLATFORM HOISTS

a) No person shall be permitted to ride on any platform hoist unless it has been designed and constructed for passenger service. Elevators used for the transportation of workers during construction shall comply with the requirements of Section 11.

b) Platform hoists for the handling of materials within buildings under construction shall have the car substantially constructed and provided with covers, either solid or wire mesh. Sections of the cover may be arranged to swing upward for the handling of bulky materials, or the covers may be omitted if suitable overhead protection is provided.

c) Hoists shall be equipped with a broken-rope safety device.

d) Where wheel barrows or buggies are used for handling material on platform hoists, cleats shall be nailed to the platform to fix the proper position so that handles shall not project beyond platform edges.

e) Supports for the overhead sheave shall be designed to carry no more than the hoist and its maximum load.

610 HOIST TOWERS

a) Hoist towers, erected in connection with building construction shall be substantially constructed, and all members shall be so proportioned that the stresses shall not exceed those specified for that material, when carrying the dead load of the tower plus two times the weight of the platform or bucket. Hoist towers shall not be used unless the design and construction of the tower is approved by the Director.

b) Every hoist tower shall rest on a sufficiently solid foundation to prevent injurious settlement or distortion of its framework.

c) Every hoist tower shall be secured in not less than four directions against swaying or tipping, at intervals of not more than 9.75m (32 feet) in its height, by steel cable guys adequately anchored or by other satisfactory means. Such towers which are constructed adjacent to buildings shall be secured to the building frame at each floor as the building progresses.

d) Landing platforms in hoist towers or platform connecting a hoist tower to a building or other structure shall be provided with guard rails and toe boards.

e) The bottom of every hoist tower shall be screened or otherwise protected on all sides to a height of not less than 1.8m (6 feet).

f) Hoist towers erected within the building, but not occupying the entire opening through which they pass, shall be completely enclosed on all sides and shall be provided with doors at the unloading points unless the platform hoist is solidly enclosed on all sides to the height to which material is to be loaded or unloaded.

611 TEMPORARY FLOORING

a) In buildings of skeleton construction, the permanent floor, except for necessary hoistway openings, shall, when possible, be constructed as the building progresses. There shall be not more than three unfilled floors above the highest permanent floor.

b) In buildings of skeleton construction, the entire working floor shall be planked over, except spaces required for construction work, for raising or lowering materials, and for stairways or ladders. Planks shall be placed so that they cannot tip under the weight of a worker at any point and secured so that they cannot slip out of place.

c) In buildings of wood joist construction, the underfloor shall be laid for each floor as the building progresses.

612 FLOOR OPENINGS

a) All floor openings, used as hoistways or elevator shaftways, shall be guarded on all sides, except the side being used for loading or unloading. Guards shall be barricades not less than 1.2m (4 feet) high along or near the edges of such openings, or guard rails not less than 1m (3 feet high), placed not less than 600mm (2 feet) distant at all points from the edges of such openings. If guard rails are used, toe boards shall be provided along the edges of the openings. Sides left open for loading or unloading shall be guarded by similar solid doors or gates.

b) All floor openings used as stairways, or for the accommodations of ladders or runways, shall be guarded by railings and toe boards.

c) All other floor openings shall be guarded on all sides by solid barriers not less than three feet high, or by railings and toe boards or shall be planked over or otherwise covered over by temporary construction capable of sustaining safely such loads as are likely to come thereon.

d) Barriers for the guarding of openings used as hoistways or elevators shall be constructed so that workers cannot thrust head, arm or legs through them, and loose material cannot fall or be pushed into the shaftway.

e) Barriers and guard rails around floor openings shall remain in place until permanent enclosures or protection are otherwise provided.

613 RUNWAYS AND RAMPS

a) Runways and ramps in connection with scaffolds or extending from story to story or otherwise located and maintained for an extended period of time or for the transfer of bulky material shall be constructed of at least three 250mm wide planks laid closely side by side and substantially supported and braced to prevent unequal deflection and springing action.

b) Runways and ramps shall have a slope not steeper than one in three, and the total rise of a runway or ramp between landings shall not exceed 3.65m (12 feet).

c) When the rise is steeper than one in six, or when the rise is more than six feet and steeper than one in eight, runways or ramps shall be provided with cleats spaced not more than eight inches apart.

d) Runways and ramps, having a total rise of more than 1.8m (6 feet), or passing over or near floor openings, high-tension wires or other dangerous places, shall be provided with guard rails and toe boards.

614 TEMPORARY STAIRWAYS

a) In all buildings, the permanent stairways shall be installed as soon as conditions will permit. When the work on a building has progressed to a height in excess of 11m (36 feet) and it has not been practicable to install the permanent stairways, at least one temporary stairway shall be provided for the full height and continued upward as rapidly as the work progresses.

b) Stairs and stairways shall be of sufficient strength to support a load of at least 4.8kPa (100 pounds per square foot), and all stairways shall be guarded on all open sides with hand rails and toe boards.

c) Temporary stairs shall be constructed so that treads and risers are uniform in width and height in any one flight. The sum of the height of the two risers and the width of one tread shall be not less than 610mm nor more than 660mm. Temporary stairways shall be not less than 914mm (36 inches) wide. Landings shall be not less than 760mm (30 inches) long.

d) No flight of stairs of a temporary stairway shall have a vertical rise in excess of 3.65m (12 feet), and when necessary, intermediate landings shall be provided.

e) Temporary and permanent stairways shall be adequately lighted as set forth in 618.

f) No door shall open directly onto a flight of stairs, but a landing equal to at least the width of the door shall be provided

between the door and the stairs. Temporary doors higher than 1371mm (4 ft. 6 ins) shall be fitted with wire glass panels.

g) Permanent stairs that are to be used during construction and on which treads are to be filled in later shall have wooden treads firmly fitted in place for the full area of the tread. The top surface of the temporary treads shall be maintained above the tops of the risers or nosings.

h) The storage of materials on stairs or in stairways or adjacent to stair openings shall not be permitted.

615 LADDERS

a) Except where either permanent or temporary stairways or runways are required, ladders shall be provided to give access to all floors, stagings or platforms where work is being done more than five stories above ground or above a permanent or temporary floor.

b) Ladders required by this Code shall be left in place until the permanent stairways are ready for use or until temporary stairways are installed, and stairways shall be erected as soon as the building exceeds 18.2m (60 feet) in height.

c) All ladders, when in use, shall be set up in a manner to be secure and to prevent slipping; and ladders, except stepladders or other self-supporting ladders, shall be securely fastened to a permanent support at the top, and if necessary, at the bottom, and braced to prevent swaying, bending or shaking.

d) Ladders, leading to floors, stagings or platforms, shall extend at last three feet above the level of such floors, stagings or platforms.

e) No single ladder shall exceed 6m (20 feet) in length. When greater heights are to be reached, intermediate platforms shall be erected. Ladder landings shall be at least 1.2m (4 feet) square and equipped with handrails and toe boards.

f) Ladder rungs shall be spaced uniformly as near to 300mm (12 inches) as is practicable.

g) When used temporarily, in place of stairways or runways, ladders serving traffic in both directions simultaneously shall be at least 1m wide. If separate ladders are provided for going up and coming down, they shall be marked "UP" and "DOWN" respectively at each floor and platform level.

h) Ladders, other than sectional or extension ladders, shall not be extended by joining two or more together.

i) Ladders shall not be placed or used in shafts of operative elevators or hoists except by workers engaged in the erection, construction, alteration or repair or any such shafts, hoistways or equipment.

j) Ladders shall not be painted, but may be oiled or otherwise treated with preservative so as to permit the detection of faults. Every ladder shall be inspected by the superintendent or foreman in charge before being put to use on a building operation and thereafter at least once every 30 days while continued in use. Broken or weak ladders with weak or missing rungs, shall not be used or permitted to remain on the site of building operations, but shall be repaired and made safe or destroyed.

k) The angle of any access ladder shall be at not less than 60 degrees nor more than 80 degrees to the horizontal.

616 SCAFFOLDS

a) Properly constructed scaffolds shall be provided for all work which cannot be done safely by workmen standing on permanent or solid construction, except when such work can be done safely from ladders. All such scaffolds shall be substantially constructed, to support at least four times the maximum load and shall be secured to prevent swaying.

b) Planks used in the construction of stationary scaffolds shall be not less than 50mm (2 inches) nominal thickness. Where such planks overlap at the ends, the overlap shall be not less than 150mm (6 inches).

c) Planks shall be so placed that they cannot tip under the weight of the worker at any point. Nails used in the construction of scaffolds shall be of ample size and length to carry the loads they are intended to support, and all nails shall be driven full length. No nails shall be subject to direct pull.

d) Ropes, cables and blocks used in the support of swinging scaffolds shall be of sufficient size and strength to sustain at least six times the maximum loads to which they will be subject. Where acids are likely to come into contact with them, ropes shall not be used in the support of scaffolds, but steel cables properly protected by grease or oil or other effective method shall be used instead.

e) Every scaffold, the platform level of which is more than 1.8m (6 feet) above the ground or above a permanent or temporary floor, other than iron workers' scaffolds and carpenters' bracket scaffolds, shall be provided with guard rails and toe board extending the full length of the scaffold and along the ends except where ramps or runways connect with them, unless otherwise enclosed or guarded. On suspended, swinging and pole scaffolds, the space between guard rails and toe boards shall be fitted with wire mesh screens securely attached.

f) Where objects are likely to fall on a scaffold from above, a substantial overhead protection shall be provided. Not more than 3m (10 feet) above the scaffold platform, and at doorways, passageways or other points where workers must pass under scaffolds, a substantial overhead protection shall be provided. No materials or equipment, other than required by the workers, shall be placed on scaffold platforms.

g) Roof brackets, roof scantling, crawling boards and similar forms of support shall be substantial in construction and securely fastened in place when in use.

h) Barrels, boxes or other similar unstable objects shall not be used as supports for planking intended as scaffolds or places of work.

i) When used over public sidewalks or other places of public use, scaffolds used for minor building repairs, alterations, or painting shall be equipped with drop cloths to effectively prevent the falling of paint or debris.

j) Scaffolds used for sandblasting and guniting operations shall be entirely and effectively enclosed, and the determination of effective enclosure shall be the complete absence of particles of material of operation in the air at a horizontal distance of 15.2m (50 feet) from the point of operation.

617 SAFEGUARDS

617.1 Railings

(a) Railings, where required during construction, shall comply with the Standards of the Occupational Safety and Health Administration (OSHA), Part 1926, or as provided herein.

(b) The top rail of such railings shall be not less than 1066mm (42 inches) above walking surfaces.

(c) Such railings shall be provided with an intermediate rail midway between the walking surface and the top rail and shall be constructed to resist a load of 0.73kN/m (50 pounds per lineal foot) at the top rail.

617.2 Toeboards

Toeboards, where required during construction, shall comply with the Standards, referenced in 617.1 (a) herein, or any approved alternate design.

618 TEMPORARY LIGHTING AND ENERGY EFFICIENCY

a) All parts of buildings under construction, or other operations covered by the general provision of this Section, and all sheds, scaffolds, covered walks, other work or storage areas, and equipment in connection with such operations shall have sufficient light to ensure safety and protection of life and property. In passageways, stairways and corridors, the average light intensity measured at the floor level shall not be less than 21.5 lumen/sqm (two foot candles).

b) At locations where tools and/or machinery are used, the average light intensity measured at the floor level shall not be less than 53.8 lumen/sqm (five foot candles). Natural or artificial illumination shall be provided in such a manner that glare and shadows will not adversely affect the safety protection of workers and property.

c) Temporary wiring for light, heat and/or power shall be adequately protected against mechanical or overcurrent failures. All conductive materials enclosing fixed or portable electrical equipment, or forming a part of such equipment, shall be grounded by one or more of the methods permitted by Section 11 of this Code.

d) Temporary electric service poles shall be self-supporting or adequately braced or guyed at all times.

(e) The installation of temporary lighting and power must be done in accordance with the electricity supply regulations of the State. The developer must obtain a permit for this installation from the Electrical Inspector before electricity can be supplied to the site.

(f) Early connection to the grid shall be sought after for reasons of climate change mitigation.

(g) Site accommodation shall be constructed to be energy efficient[1]. Where mechanically cooled accommodation is provided the building shall be properly sealed, and insulated.

(g) Maximise the use of renewable energy sources, and utilise waste heat, to reduce the consumption of fossil fuels.

619 FIRST AID

a) On every building operation, arrangements shall be made for prompt medical attention in case of accidents, and an ample supply of suitable antiseptic solution and sterile gauze bandages shall be provided and maintained in a clean, sanitary cabinet, and at all times available under the direction of the superintendent or a person designated by him.

b) Unless competent medical attention is otherwise quickly available, where more than 200 workers are employed, a properly equipped first-aid room or field hospital shall be provided, and a physician or nurse shall be available on call.

620 SANITATION AND WATER SUPPLY

a) Adequate toilet facilities, maintained in a clean, sanitary condition, shall be provided as set forth in Section 9.

b) An adequate supply of pure, drinking water shall be provided for workers during hours of employment, and adequate, sanitary washing facilities shall be provided for workers within reasonable access.

c) Grey water re-use and rainwater harvesting shall contribute to non-potable water supplies on site. Special precautions shall be taken to

[1] *Motion sensors and energy efficient lights can contribute to efficiency. Refer to section 5 and section 11 of this code for further guidance.*

prevent the breeding of mosquitoes and cross contamination between potable and non-potable water supplies.
A rainwater first flush device shall be installed on rainwater harvesting systems providing clean water.
Where water closets and sinks are installed, low flow specifications shall be chosen.

621 WELDING AND CUTTING

a) Gas welding and cutting and arc welding in building construction and demolition operations shall be restricted to experienced workers acceptable to the Director. Suitable goggles or helmets and gloves shall be provided for and worn by workers engaged in gas welding or cutting or welding.

b) Incombustible shields shall be provided to the worker when exposed to falling hot metal or oxide.

c) Unless unavoidable, gas welding or cutting or arc welding shall not be done above other workers. When unavoidable, an incombustible shield shall be provided between the work and the workers below; or a watchman shall be stationed to give warning at places where workers, in the course of their employment are likely to pass under a gas welding or cutting or an arc welding operation.

d) Unless unavoidable, gas welding or cutting shall not be carried on in any place where ample ventilation is not provided, or from which quick escape is difficult. When unavoidable, workers engaged in such work in confined spaces shall be allowed frequent access to fresh air and a relief worker shall be stationed close at hand to assist the worker in case of accident and to shut off the gases.

e) Tanks of fuel gas shall not be moved or allowed to stand for any extended period when not in use unless the caps of such tanks are place. Suitable cradles shall be used for lifting or lowering oxygen or fuel tanks, to reduce to a minimum the possibility of dropping tanks. Ordinary rope slings shall not be used.

f) Tanks supplying gasses for welding or cutting shall be located at no greater distance from the work than is necessary for safety. Such tanks shall be securely fastened in place and in an upright position. They shall be stored, or set in place for use, so that they are not exposed to the direct rays of the sun or to high temperature.

g) Before steel beams or other structural shapes or elements of construction are cut by means of a gas flame, they shall be secured by cables or chains to prevent dropping or swinging.

622 OPEN FIRES

a) Open fires, for the purposes of disposing of waste materials, the heating of roofing or other materials, or for any other purpose whatsoever, shall not be allowed except with the permission of the Director.

b) Wherever any enclosed flame heaters or open fires are used, there shall be a workman in constant attendance, whose duty it shall be to have such heater or fire under proper control at all times.

623 FIRE PROTECTION

a) Storage of combustible material shall not be permitted under or near welding operations. No part of the building shall be used for the storage of combustible materials until such fireproofing of the part has been installed.

b) In every building of reinforced concrete construction, forms of combustible materials shall be stripped from the concrete and removed from the building as soon as practicable. No part of the building shall be used for the storage of combustible materials until such forms have been removed in that part of the building.

c) In every building operation wherever a tool house, storeroom or other shanty is placed, or a room or space is used for storage, dressing room or workshop, at least one approved hand pump, tank or portable chemical extinguisher shall be provided and maintained in an accessible location.

d) During building operations, free access from the street to fire hydrants where installed and to outside connections for stand pipes, sprinklers or other fire-extinguishing equipment, whether permanent or temporary, shall be provided and maintained at all times.

e) No material or construction equipment shall be placed within ten feet of such hydrant or connection, nor between it and the central line of the street.

624 SPECIAL HURRICANE PRECAUTIONS

a) During such periods of time as are designated by the Government being a hurricane watch, all construction materials or equipment shall be secured against displacement by wind forces; provided that where a full complement of personnel is employed or otherwise in attendance, or engaged for such protection purposes, normal construction procedures or use of materials or equipment may continue allowing such reasonable times as may be necessary to secure such materials or equipment before winds of hurricane force, as advised by the Government, are anticipated.

b) Construction materials and equipment shall be secured by guying and shoring, and by tying down loose materials, equipment and construction sheds.

625 ADAPTATION TO TEMPERATURE RISE

Additional care shall be exercised in ventilating the temporary works in light of rising temperatures due to climate change.

Certain construction materials are vulnerable to high temperatures, particularly adhesives, fuel and asphaltic material. These shall be

maintained and installed or used at the manufacturer's recommended temperatures.

626 **SITE WASTE DISPOSAL**

Processing of site waste is carbon intensive. Mitigation of climate change requires that the amount of site waste shall be minimized, and its transportation shall be limited to the nearest suitable site for disposal, recycling or reuse.

a) Excavated spoil shall be re-used whenever this is feasible, either on the same site or at a nearby location
b) Sediment contained in stormwater run-off shall be filtered or otherwise contained within the site boundaries
c) Packaging materials and off cuts shall be separated for recycling purposes wherever possible.
d) Consider setting up a centralized, off-site, materials handling facility to remove packaging and arrange for recycling[2]. Using pre-cut materials (e.g. cut and bent reinforcement for concrete) is also a part of this strategy.

A building site generates pollution, which for health, safety and welfare of both the public and site employees needs to be controlled. This includes the contribution of the site to the heat island effect in urban areas.

[2] *The approach facilitates just in time deliveries and reduces the storage of materials generally, and especially flammable materials, on the site.*

SECTION 7

WATER SUPPLY SERVICES

Contents

WATER SUPPLY SERVICES

701 SCOPE

This Section provides guidance to persons who are submitting development proposals to the Authority and outlines the requirements for the provisions of water supply services for these developments. It is recommended that persons wishing to construct developments for buildings used by the public or housing developments of more than 10 units contact the Ministry of Health for advice on the appropriate regulations affecting such developments in addition to the requirement of this Section.

702 ADEQUACY, DESIGN AND CONSTRUCTION OF THE WATER SUPPLY SYSTEM

a) The developer is responsible for providing an adequate and potable water supply to his development. This will include the provision, as may be necessary, of a source(s) of supply, treatment facilities, pipeline system and storage facilities.

b) Developers shall be fully responsible for the design and construction of water supply systems for their developments and all work shall be carried out on accordance with the requirements of the Public Health Regulations 1978 and te Water and Sewerage Regulations 1995.

SECTION 8

SEWAGE AND WASTE WATER DISPOSAL

Contents

801 PROVISION OF SEWERAGE FACILITIES

801.1 General

a) Every building intended for human habitation, or in which human beings are to be employed shall be designed to provide for an appropriate sewerage system of a design to be approved by the Ministry of Health and the agency responsible for water and sewerage.

b) For any development, the developer shall provide a system or systems to fully satisfy the need for sewage collection, treatment and disposal of effluent and sludge.

801.2 Design and construction of the system

Plans for the treatment system proposed should be developed in consultation with the Ministry of Health and the agency responsible for water and sewerage prior to formal submission of the plans for approval of the Development Control Authority.

In particular the developer shall satisfy the Ministry of Health that the quality of the effluent from the system meets with the standards accepted by the Ministry[1]. The construction of the system must be approved by the Ministry of Heath.

The system(s) proposed shall direct special attention to the layout of the development, roadways, the proposed use of the land inside and outside of the development and the location of treatment plants and outfalls.

802 DEVELOPER TO MEET TOTAL COST OF THE WORK

The total cost of the work associated with the development of the sewerage system shall be payable by the developer.

803 NEEDS OF TOTAL DEVELOPMENT

Where the development is phased, the system proposed for sewage and waste water disposal shall address the needs of the total development to ensure an orderly solution to those problems.

804 JOINT SYSTEMS

(a) Where two or more developments are adjacent or in close proximity to each other, consideration shall be given to a joint system in order that sewage disposal facilities may be integrated without detriment to any of the developments.

(b) In any event, the proposed sewage disposal system shall not adversely affect adjoining developments particularly with respect to the location of treatment facilities and outfalls.

[1] *Guidance on effluent quality is given below*

805 CONFORMITY WITH BUILDING CODE

The arrangement for collection and disposal of sewage and waste water from buildings is subject to this Code and to any additional requirements imposed by the Authority.

806 POWER SUPPLY AND EMERGENCY POWER FACILITIES

Wherever possible the plant shall be powered by a renewable energy source for normal operation. This includes the use of components such as solar water pumps.

Subject to the provision of the Electricity Ordinance in force and unless specifically exempted by the Authority, all treatment plant and pumping stations shall be provided with an alternate source of electricity to allow continuity of operation during power failure.

807 ENVIRONMENTAL FACTORS

(a) All systems shall be located and constructed so that with proper maintenance the systems will function in a sanitary manner, will not create sanitary nuisance or health hazards, and do not endanger the safety and water quality of any fresh ground water lens or surface water supply.

(b) Arrangements for the management and treatment of sewerage and waste water shall take into account the best use of the topography, the ecology, the nature of the sub-soils, and the relative locations of the sea, surface waters and ground water sources.

808 PERCOLATION TESTS

(*a*) Percolation tests shall be carried out if required by the Authority whenever it is planned to use absorption pits or septic tanks with soakaways or land drains to dispose of the sewerage. The approval of the Authority for the use of such systems will depend on the percolation rates found.

(*b*) The percolation criteria[2] to be used in determining whether soakaways can be efficient in a given area must be based on the rate of absorption of liquid waste and the area of the absorption surface. In general, soils with absorption rates of less than 1 inch in 30 minutes are unsuitable for soakaways.

809 EFFLUENT QUALITY

The quality of the effluent after treatment shall satisfy the following minimum criteria:

(a) BOD not to exceed 20 milligrams per litre based on effluent samples collected in a period of 7 consecutive days.

(b) Suspended solids not exceeding 30 milligrams per litre based on samples collected in a period of 7 consecutive days.

(c) Coliform content not exceeding 400 per 100 millilitres based on effluent samples collected in a period of 7 consecutive days.

[2] Percolation criteria for soakaways are given in Table F-3 of section F of the Building Guidelines.

(d) Other standard criteria as may be required by the Authority and Ministry of Health and depending on the environment in which the effluent will be placed.

810 RE-USE OF THE EFFLUENT

(1) This code encourages treatment of the effluent from an activated sludge plant or from an intermittent sand filter with the appropriate chlorine dosage to reduce the B.O.D to acceptable proportions for re-use in gardens or water closets. Alternatively the code provides for disposal of the treated effluent into tile drains, or by means of a properly designed sea outfall.

(2) *The re-use of effluent can mitigate climate change and is part of a water conservation strategy.* Such effluent shall be treated to reduce both suspended solids and the E.coli bacteria to an approved standard.

(3) The Ministry of Health must approve the plans for re-use of effluent.

811 DISPOSAL OF TREATED EFFLUENT BY SEA OUTFALLS

(a) The type, location, and design of the sea outfalls shall be based on a detailed study of the character of the sea in which the outfall is placed, the current flows, the present ecology of the area, the predicted effects of climate change particularly on sea level rise and the chemical composition of the effluent. Effluent shall not have a detrimental effect on the ecology of the buffer zone, including mangroves, coastal vegetation, reefs and sea grass beds.

(b) The approval of the Authority is required for the disposal of effluent by sea outfall. The study shall be carried out at the expense of the Developer by experienced professionals, and the result of the study shall be forwarded to the Authority. Conditions imposed by the Authority based on the recommendations of the study shall be implemented, so that construction of the outfall meets the requirements of the Authority.

812 DETAILS OF THE TREATMENT SYSTEM

The design and construction of all treatment plants (including package plants, septic tanks and disposal facilities) shall be capable of producing an effluent to the standards in this Code and to the standards required by the Ministry of Health.

The treatment system includes the pipe system, treatment facilities, manholes, and effluent disposal facilities. The choice of an appropriate sewerage system for a building or group of buildings depends on the amount of sewerage to be treated and the economics of the treatment process.

Complete data on the proposed treatment system must accompany all applications, including:

(i) engineer's report,

(ii) detailed drawings of the plant,

(iii) specifications of equipment,

(iv) data sheet giving full details of design loading i.e.: flows, hydraulic loading and organic loading,

(v) maintenance schedule,

(vi) method of disposal of effluent.

(a) Soakaways or absorption pits[3] are acceptable for the final disposal of grey water (i.e. water that does not contain any hazardous or faecal waste). These systems shall not be constructed unless approved by the Ministry of Health.

(b) Septic tanks shall be used to provide primary treatment to sewage from buildings with sewage flows of no greater than 10,000 Imperial gallons (45461 litres) per day.

Sewerage may be discharged into a septic tank linked with a biological filter or with land drains or soakaway pit provided that:

(i) The system is connected to a proprietary tank or disposal system discharging an effluent approved by the Ministry of Health. Such effluent may be discharged directly from such tank or system and recycled for approved use as noted above.

OR

(ii) The system is connected into land drains or soakaway pits constructed in accordance with the requirements of the Ministry of Health.

Septic soakaways shall not be placed where there is a likelihood of contaminating underground water supplies, fresh water lenses, or surface water sources. The soakaway shall be located downstream of any nearby water cistern, and the area selected for construction of a soakaway shall be large enough to allow for additional pits in the event of a failure.

(c) For flows above 15,000 Imperial gallons (68191 litres) per day, the owner shall examine another system (such as an Upflow Anerobic Sludge Blanket or a proprietary aerobic treatment plant).

Facilities shall be provided for the removal of grit and debris prior to the effluent entering a pumping station or treatment plant. Pumps shall be equipped with strainers capable of removing solids greater than provided for in the design of down-stream processes.

(d) Detailed plans and technical data will be reviewed by the Ministry of Health. Approval of the Development Control Authority for the installation of the sewerage treatment system will be given only if all of the technical data supplied by the owner is satisfactory, and if satisfactory arrangements have been made for the maintenance and repair of the system. The Development Control Authority shall require that standby systems for major components such as power plant be supplied and maintained.

813 ***DISCUSSION OF ALTERNATIVES***

(1) Sewage may be discharged into a septic tank linked with a biological filter or with land drains or a soakaway pit as noted above. The capacity of sand filters for treating the discharge of septic tanks which collect household waste is estimated at 50,000 gallons per acre.

(2) It can be seen from Table 8-1 that for large systems and where there are no special requirements such as disposal of hazardous substances, nuclear waste and the like, the conventional activated sludge treatment preceded and followed by plain sedimentation will provide a significant reduction in B.O.D., suspended solids and E. coli.

(3) Intermittent sand filtration will yield slightly better results. About ninety-eight per cent of the E. coli bacteria are removed along with ninety to ninety-five per cent of the suspended solids.

(4) Chlorination of raw sewerage does not remove suspended solids but removes ninety to ninety-five per cent of E. coli bacteria.

[3] Absorption pits have a low embodied carbon.

(5) The use of chemical precipitation (mixing chemicals such as ferric chloride with the sewerage) removes seventy to ninety per cent of the suspended solids and forty to eighty per cent of the E. coli bacteria.

TABLE 8-1

*Approximate Efficiencies of Sewerage Systems and Plants**

Treatment, Operation or process	*Per cent removal*		
	B.O.D.	Suspended solids	E. coli, (coliform)
Fine screening	5 – 10	2 – 20	10 – 20
Chlorination of raw or settled sewerage	15 – 30	–	90 – 95
Plain sedimentation	25 – 40	40 – 70	25 – 75
High rate trickling filtration preceded and followed by plain sedimentation	65 – 95	65 – 92	80 – 85
Low-rate tricking sedimentation preceded and followed by plain sedimentation	80 – 95	70 – 92	90 – 95
Conventional activated sludge treatment preceded and followed by plain sedimentation	75 – 95	85 – 95	90 – 98
Intermittent sand filtration	90 – 95	85 – 95	95 – 98
Cholrination of biologically treated sewerage	–	–	98 – 99

* From Data Book for Civil Engineers, Third Edition – Elwyn E. Seelye

814 IMPACT OF CLIMATE CHANGE

Climate change mitigation has resulted in the installation of low flow sanitary facilities. Design of treatment facilities and pipework shall be functional in spite of reduced liquid flows in the system. This particularly relates to pipe gradients in gravity systems and the alternative operation of networks with pumps or suction.

The buoyancy of buried pipework will be increased by rising sea levels and rising ground water levels. Design of buried pipework shall provide adequate anchorage against buoyancy for present conditions[4] and expected conditions over the design life of the system.

More intense rain storms will increase the load on drainage systems. Stormwater from roofs, basement and foundation drains, and surface run-off shall be excluded from entering septic tanks (*as large volumes of clear water will stir up the contents, reduce the retention time and carry solids to the disposal field*). Soakaways may be used for the disposal of excess rainwater or run off from buildings that is not of a septic nature.

[4] Appendix J contains the latest available rainfall hazard information.

SECTION 9

PLUMBING

Contents

SECTION 9

PLUMBING

901 SCOPE

This section sets out the requirements for plumbing and drainage in buildings and the disposal of waste to a septic tank or main sewer where this exists.

902 GENERAL REQUIREMENTS

902.1 Prohibited fittings and connections

a) No soil or waste pipe shall be fitted with double hubs, double tees or double y's (without an access door).

b) No waste pipe shall discharge into a bend attached to a water closet bowl.

902.2 Dead Ends

a) Wherever a dead end exists or is proposed for a soil or waste system it shall be laid so as to prevent any accumulation of waste.

b) All unconnected openings in a drainage system with the exception or a vent pipe shall be properly capped so as to be both air and water tight.

902.3 Changes in Direction

a) All horizontal changes in direction of soil or waste pipes shall be provided with an accessible inspection chamber or clean out.

b) 22-1/2 degree bends and sanitary tees shall be used for changes in direction of flow in the horizontal plane.

c) Bends, tees, y's and crosses may be used to effect changes in direction in vent and water distribution pipes.

902.4 Supports and Hangers

a) All vertical piping shall be supported, anchored and adequately fixed with spacing not exceeding 5 feet.

b) All horizontal piping shall be supported, anchored and adequately fixed to prevent sagging at each hub. For cast iron and copper piping, this shall be at 6 foot intervals, and for PVC and pitch fibre piping through-out its length.

c) Pipe hangers shall be fixed to stone, brick work, block work or concrete by means of expansion type plugs.

d) Hangers shall be of the same material as the pipe, or if of different material be insulated at areas of contact with the pipe to prevent electrolysis.

e) Drains laid in unstable ground shall be adequately supported so as prevent fracture of the pipe or loosening of the joints in the event of ground movement.

902.5 Service Water Heater

a) Solar

Buildings in which the demand of warm/hot service water is on average more than 10 gallons (45 l) per day shall provide a solar water heating equipment at an adjusted size to serve not less than 75% of the average hot water demand of one day. Exemptions are only permitted by providing an economical evaluation that shows the economic disadvantage of such.

b) Pipe Insulation

If service water is permitted to be heated by using electricity or gas (see 902.5 a)) all hot water piping and equipment shall be insulated with not less than 1 inch (25 mm) of insulation.

903 SOIL AND WASTE PIPES

903.1 General

Soil and waste pipes shall be located and fixed in accordance with the following requirements:

(a) Branch pipes shall be located to provide for drainage of sanitary fixtures into vertical stacks or directly into manholes.

(b) Vertical stacks shall be located to provide for drainage from branch pipes directly to manholes.

(c) Connections to pipes shall be located to prevent cross flow from one connection to the other.

(d) Connections to pipes and between pipes shall be made in direction of the flow.

(f) Open ends shall terminate not less than one foot above the building eaves level nor less than three feet above the head of any window ten feet away or less and shall be protected with a wire balloon of durable material.

(g) Pipes shall be fixed with suitable brackets or straps and at a minimum distance of 6 inches from the wall surface. At least one fixing shall be provided for each unit length of pipe.

(h) Sufficient cleaning eyes and access points shall be provided to enable all pipe work to be cleaned by rodding. They shall be located to allow proper clearance for the easy entry of cleaning roads and be provided with suitable tight covers.

903.2 Pipe Materials

a) Generally these shall be of suitable material, hard, smooth, impervious and non-corrosive, such as copper, PVC, cast iron or other material which may be approved by the Authority if there is evidence that the material is suitable.

b) Black iron, galvanised iron or concrete pipes are not recommended for use as soil pipes.

903.3 Pipe Sizes

a) The diameter of pipes shall be consistent with the maximum load, but soil pipes shall not be less than 3 inches (75 mm) in diameter.

b) Waste water pipes shall not be less than 1-1/4 inches (32 mm) in diameter.

c) Table 9-1 establishes the maximum fixture unit load permitted for a given size of waste pipe under various conditions and shall be used to determine the required size of waste or soil pipe provided that:

(1) The total unit load on the pipe is calculated from Table 9-2.

(2) Not more than one WC shall be connected to any one 3" diameter soil pipe.

(3) No branch pipe shall be smaller than the size of the fixture trap that it serves.

(4) No vertical stack shall be smaller than the largest branch pipe that it serves.

(5) The gradient of a branch pipe shall be not less than 1 in 48.

(6) Not more than 4 WCs shall be connected to a branch pipe of diameter less than 4 inches (100 mm) with a gradient less than 1 in 12.

(7) Not more than 4 WCs shall be connected to any 3" (75 mm) diameter branch pipe or vertical stack.

(8) Not more than 50% of the maximum discharge unit load permitted for vertical stacks serving more than 2 storeys shall be discharged into the stack from any one branch pipe or in any one storey height.

903.4 Fixture Unit Ratings

Table 9-2 establishes the relative load value of various fixture units and shall be used in determining the required size of pipes for the fixtures being served.

903.5 Workmanship

a) All plumbing shall be installed in a workmanlike manner.

b) After laying, soil and ventilating pipes shall be capable of withstanding smoke or air tests under pressure, have no bends, except where unavoidable, in which case bends shall be as obtuse as possible so as not to reduce the internal diameter of the pipe.

c) Soil/waste pipes shall not discharge effluent so as to cause dampness to any foundation or wall of a building.

903.6 Gradients and Self Cleaning Velocities

a) Soil pipes shall be laid at a minimum gradient of 1:48 for 4 inch (100 mm) pipes and 1:60 for 6 inch pipes (150 mm).

b) Waste pipes shall be laid at a minimum gradient of 1:30.

c) Self cleaning velocities would be achieved if velocities are approx. 2.5 feet (7.6 m) per second with the pipe flowing 1/4 full.

903.7 Joints and Connections

a) All joints and connections shall be of the same material as the main pipe and shall be air and water tight. They shall be constructed so as to allow the free flow of waste, and before commissioning, be swabbed and cleaned inside to avoid obstructions of the bore.

b) In joining soil pipes the spigot or plain end of the pipe shall be laid in the direction of the flow or downstream.

c) Joints to soil pipes shall be as follows:

i) for lead - wiped or burned.

ii) for cast iron - socket made with hemp or yarn and metallic lead properly caulked.

iii) for pitch fibre - tapered couplings.

iv) for PVC - with a suitable rubber joint fitting or welded with solvent cement.

v) for vitrified clay/salt glazed ware - socket made with tarred hemp or gasket and the remaining space filled with cement/sand mixture.

d) No coating or paint shall be applied before testing.

e) Where waste pipes are connected to soil pipes, all pipes are to be constructed in the same way as specified for soil pipes.

904 PLUMBING FIXTURES

904.1 General

Generally these shall be of smooth, hard, durable impervious and corrosion resistant materials free from flaws and blemishes.

904.2 Water Closets

a) Water closet bowls shall be of vitreous china, vitreous glazed earthenware or other suitable material.

b) Water closet bowls shall be attached to the floor and/or wall and be fitted with a seat of smooth non-absorbent material.

c) The use of a separate well flushing system will reduce the use of fresh water from the cistern. All components of the salt water system shall be plastic or other suitable material non-corrosive.

904.3 Flushing Cisterns

Water closet systems shall have flush valves which are easily accessible for repairs, and flush pipes of not less than 1-1/4 inches (32mm) in diameter. When low level cisterns are used, larger flush pipes are necessary.

904.4 Lavatory Basin/Sinks

a) The top edge of every lavatory basin or sink shall be fixed at a height above finished floor level suitable for the persons using the fixtures.

b) Fixtures for special use, such as for handicaps and for children, shall be mounted at the appropriate height for the particular application.

c) Every lavatory basin shall be provided with an overflow, connected to the building or inlet side of the trap.

904.5 Shower Baths

Shower and tub outlets must be not less than 1-1/2 inches (38 mm) in diameter and be fitted with removable strainers. Shower outlets are normally 2" (50 mm). The use of "water saver" shower heads is encouraged.

904.6 Drinking Fountains

Drinking fountains shall have orifices located above the highest overflow level of the receptacle and be shielded so that the drinker cannot put his/her lips on the orifice.

904.7 Traps

a) Traps forming an integral part of plumbing fixtures shall be supplied with the fittings to which they are to be attached.

b) All fixtures connected to foul drainage shall be trapped as closely as possible to the fixture outlet.

c) No trap with partitions shall be used, and crown venting off the upper curve of an "S" trap is not permitted as this results in accumulations in the vent.

904.8 Water Seals

All traps shall have a minimum water seal of 3 inches (75 mm) for soil and 2 inches (50 mm) for waste and be not less than 3 inches (75 mm) diameter for soil fixtures and 1-1/4 inches (32 mm) for waste water.

904.9 Clean-outs

Every clean-out shall be equal in wall thickness to that of the pipe, be readily accessible, shall open opposite to the direction of flow or at right angles to it, and shall provide adequate space for cleaning.

904.10 Venting Systems

a) All water closets shall have a vent pipe of not less than 1-1/2 inches (38 mm) in diameter. Vent pipes shall also be used when two or more waste fittings are connected to a soil or waste pipe.

b) Vent pipes shall be installed in accordance with 903.1(f) or extend to a greater distance as may be prescribed by the Director for unusual situations such as roof gardens. Vent pipes shall be connected above the flood level rim of the highest fixture served and graded to drip back to the soil or waste pipe.

c) Venting systems shall be in accordance with the National Plumbing Code approved by the American Standards Association ASA A 40-8-1955 or any other Code approved by

the Authority.

d) Flashings at vent terminals shall be water tight. Vents shall preferably be fitted with a wire cage so as to permit free passage of air.

e) Drains shall be ventilated to prevent the accumulation of foul air and to maintain equal pressure inside and outside the system.

904.11 Floor Drains

Floor drains connected to sanitary sewers shall be equipped with extra deep traps to prevent the seal from drying out. Drains in seldom used areas shall be equipped with an automatic filling device to keep the trap filled with water.

904.12 Number of Sanitary Fixtures Required

Tables 9-4 and 9-5, shall determine the minimum number of sanitary fittings required in a building provided that:

a) Where separate facilities are required for employees and public use the total number of persons to be provided for shall be proportioned on the most realistic basis possible.

b) The number of public facilities to be provided by drive in cinemas, drive-in restaurants or similar establishments shall be based on 3 persons for each parking bay.

c) For any residence or apartment the minimum provision shall be l water closet (WC), l lavatory basin and 1 bath or shower and 1 kitchen sink or tub.

d) For any building providing sleeping accommodation the minimum provision shall be l WC, l lavatory basin and 1 bath or shower for each 10 beds or each 10 persons accommodated.

e) For any building where the use or occupancy involves the employment of staff, facilities shall be provided for employees in accordance with Table 9-4 except that where the total number of employees is less than 10 the minimum provision shall be for 1 WC and 1 L.B. serving both sexes where facilities are accessible only through private offices and shall be additional to the required minimum provision.

f) Where facilities for the public are required they shall be additional to and separate from facilities required for employees, and shall be provided and maintained in clean condition in accordance with Table 9-5 for:

(i) Any place of public assembly as defined in Section 2 of this Code.

(ii) Any building or part of a building where the major

use or occupancy is the regular provision of food or drink for consumption by the public on the premises or on drive - in service system.

(iii) Any shop, store or market with more than 5,000 sq.ft (465 sq m) of sales area.

(iv) Any building providing more than 500 sq.ft (46 sq m) of public waiting space.

(v) Gas stations with 4 or more service pumps.

(g) In any building of Group A,B,D,E,(b) and E(c) (Table 3-1) of more than 5,000 sq.ft. (465 sq m) in total area, at least one cleaner's sink shall be provided for each floor of more than 2,500 sq.ft (232 sq m) in area.

(h) For buildings of Group B such additional facilities shall be provided as may be required by the Public Health Department.

(i) For buildings of Group C such additional facilities shall be provided as may be required by the Public Health Department.

(j) For schools, colleges or other educational buildings such additional facilities shall be provided as may be required by the Public Health Department.

(k) Except for private residences a minimum of one facility for male and one for female must be provided for handicapped persons.

905 PIPES UNDER FLOORS AND WALLS

a) No part of a drain shall be laid under a building unless approved by the Authority.

b) Where a drain is laid under a floor, not being a suspended floor, it shall be laid in a straight line for its entire length beneath the building. But in no case shall the drain under the building be longer than 40 ft (12 m).

c) Where drains are laid on piers, care must be taken to ensure that the piers are on sound foundation and be spaced not more than eight feet (2.4 m) apart.

d) Rodding and flushing eyes shall be easily accessible, shall open opposite to the direction of flow, and adequate space for rodding and flushing shall be provided.

Table 9-1

Capacity of Pipes in Fixture Units

Size of pipe (diameter in inches)	Each horizontal branch (capacity)	Each vertical stack serving 2 storeys in height	Each vertical stack serving more than 2 storeys in height
1 - 1/4 (32mm)	1	2	-
1 -1/2 (38mm)	4	4	-
2 (50mm)	8	10	20
2 - 1/2 (64mm)	12	20	40
3 (75mm)	24	30	60
4 (100mm)	200	240	500
5 (127mm)	400	540	1,100
6 (150mm)	800	960	1,900

Table 9-2

Fixture Unit Ratings

Description of Fixture	Unit Rating	Description of Fixture	Unit Rating
Bathtub (with or without shower)	2	Lavatory basin (over 1-1/4"/32mm trap)	2
Bidet	2	Showers (per shower head)	2
Drinking fountain	1	Urinal (flush valve operated)	6
Flushing sink (cistern operated)	3	Water closet (cistern operated)	4
Floor Drain	3	Water closet (flush valve operated)	6
Kitchen sink (up to 1-1/2"/38mm trap)	1-1/2	Washing machine (domestic)	4
Kitchen sink (commercial)	2	Continuous flow fixture for each gal. per min (0.06L/sec).	2
Laundry tub	2	Unspecified to 2" (50mm) trap or drain	3
Lavatory basin (up to 1-1/4"/32mm) trap)	1	Unspecified to 3" (75mm) drain or tap	5

Table 9-3.

Minimum Sizes of Traps (inches)

Bathtub	1-1/2 (38mm)	Shower (with accessible trap)	1-1/2 (38mm)
Bidet	1-1/2 (38mm)	Shower (with concealed trap)	2 (50mm)
Drinking fountain	1-1/4 (32mm)	Shower stall (2 to 4 heads)	2-1/2 (64mm)
Flushing sink	3 (75mm)	Shower stall 5 to 12 heads	3 (75mm)
Floor drain	3 (75mm)	Shower stall (over 12 heads)	4 (100mm)
Kitchen sink	1-1/2 (38mm)	Urinal	2 (50mm)
Kitchen sink (commercial)	2 (50mm)	Water closet (siphonic action)	3 (75mm)
Laundry tub	1-1/2 (38mm)	Water closet (wash down bowl)	3-1/2 (89mm)
Lavatory basin (domestic)	1-1/2 (38mm)	Washing machine	1-1/2 (38mm)
Lavatory basin (commercial)	1-1/2 (38mm)		

Table 9-4

Number of Sanitary Fixtures Required for Employees in offices, shops, factories and other non-domestic premises used as place of work

A. Male Employees				
Number of employees	**WCs**	**Urinals**	**Lavatory Basins**	**Showers**
1 -15	1	- 1	1	-
16 - 30	2	1	2	-
31 - 45	2	2	4	1
46 - 60	3	2	6	1
61 - 75	3	3	7	1
76 - 90	4	3	9	1
91 - 100	4	4	10	1
Above 100	1 urinal for each additional 1 to 50 males; 1 WC for each additional 1 to 50 males; 1 lavatory basin for each additional 1 to 50 males.			2

B. Female Employees			
Number of employees	**WCs**	**Lavatory Basins**	**Showers**
1 - 5	1	1	1
6 - 25	2	2	2
26 - 50	3	3	3
51 - 75	4	4	4
76 - 100	6	6	5
Above 100	1 WC for each additional 1 to 30 females; 1 lavatory basin for each additional 1 to 60 females.		

Table 9-5

Minimum Requirements for Sanitary Facilities

A. General use or occupancy (males)			
Number	**WCs**	**Urinals**	**Lavatory Basins**
1 - 30	1	1	1
31 - 120	2	2	1
121 - 240	3	3	2
241 - 360	4	3	3
361 - 480	4	4	4
Above 480	1 urinal for each additional 1 to 200 males; 1 WC for each additional 1 to 200 males; 1 Lavatory basin for each additional 1 to 300 males.		

B. General use or occupancy (females)		
Number	**WCs**	**Lavatory Basins**
1 - 15	1	1
16 - 30	2	2
31 - 120	4	3
121 - 240	5	3
241 - 360	6	3
Above 360	1 WC for each additional 1 to 100 females; 1 lavatory basin for each additional 1 to 200 females.	

C. Service of food or drink (males)			
Number	**WCs**	**Urinals**	**Lavatory Basins**
1 - 30	1	-	1
31 - 60	1	1	2
61 - 90	2	2	2
91 - 120	3	3	3
120 - 180	3	3	3
Above 180	1 Urinal for each additional 1 to 240 persons; 1 WC for each additional 121 to 240 persons; 1 Lavatory basin for each additional 1 to 240 persons.		

Table 9-5 (Cont'd)

Minimum Requirements for Sanitary Facilities

D. Service of food or drink (females)		
Number	**WCs**	**Lavatory Basins**
1 - 15	1	1
16 - 30	2	1
31 - 60	2	2
61 - 90	3	2
91 - 120	4	3
121 - 180	5	3
Above 180	1 WC for each additional 1 to 120 females; 1 Lavatory basin for each additional 1 to 240 persons.	

E. Shops, Stores, Shopping Malls and Markets (males)					
Area of sales space in square feet (sq m)	**WCs**	**Urinals**	**Lavatory Basins**	**PWD's**	**Baby Changing Facilities**
1,000 - 10,000 (93 - 930 sq m)	1		1	1 unisex compart-ment unit.	-
10,000 - 15,000 (930 - 1,394 sq m)	1	1	1		
15,000 - 20,000 (1,394 - 1,858sq m)	2	1	1		
Above 20,000 (1,858sq m)	2	2	2		1

F. Shops, Stores, Shopping Malls and Markets (females)				
Area of sales space in square feet (sq m)	**WCs**	**Lavatory Basins**	**PWD's**	**Baby Changing Facilities**
1,000 - 10,000 (93 - 930 sq m)	1	1	1 unisex compartment unit.	-
10,000 - 15,000 (930 - 1,394 sq m)	2	1		
15,000 - 20,000 (1,394 - 1,858sq m)	3	2		1
Above 20,000 (1,858sq m)	4	2		1

G. Gas Stations (males)			
Equipment	**WCs**	**Lavatory basins**	**PWD's**
2 or more pumps	1	1	1 compartment unit.

H. Gas Stations (females)			
Equipment	**WCs**	**Lavatory basins**	**PWD's**
2 or more pumps	1	1	1 compartment unit.

Table 9-5 (Cont'd)

Minimum Requirements for Sanitary Facilities

I. Restaurants, Cafés, Canteens and Fast-food Outlets (Assume 50%-50% male/female)		
Sanitary Fixtures	**Provisions for Male Customers**	**Provisions for Female Customers**
WC's	1 per 100 up to 400; Above 400 - 1 for each additional 1 to 250.	2 per 50 up to 200; Above 200 - 1 for each additional 1 to 100.
Urinals	1 per 50	-
Lavatory Basins	1 per WC and in addition 1 per 5 urinals	1 per WC
PWD's Suites	1 unisex compartment shall be within close proximity to public washrooms but may be shared by other facilities including retail shop units,	
Janitor's Sinks	Allow adequate provision, in close proximity to public washrooms, preferably within washroom area. Shall include area for cleaner's sink and storage of mop buckets, cleaning supplies and equipment	

J. Licensed Bars (Assume 75%-25% male/female)		
Sanitary Fixtures	**Provisions for Male Customers**	**Provisions for Female Customers**
WC's	1 for up to 150 males plus 1 for each additional 150	1 for up to 12 females plus 1 for each additional 25
Urinals	2 for every 75 plus 1 for each additional 75	-
Lavatory Basins	1 per WC and in addition 1 per 5 urinals	1 per every 2 WC's
PWD's Suites	1 unisex compartment shall be within close proximity to public washrooms.	
Janitor's Sinks	Allow adequate provision, in close proximity to public washrooms, preferably within washroom area. Shall include area for cleaner's sink and storage of mop buckets, cleaning supplies and equipment	

K. Theatres, Cinemas, Multiplexes and Concert Halls (Assume 50%-50% male/female)		
Sanitary Fixtures	**Provisions for Male Patrons**	**Provisions for Female Patrons**
WC's	1 for up to 250 plus 1 for each additional 500	1 for up to 40; 3 for 41-70; 4 for 71-100; plus 1 for each additional 40
Urinals	2 for every 75 plus 1 for each additional 75	-
Lavatory Basins	1 per WC and in addition 1 per 5 urinals	1 plus 1 per every 2 WC's
PWD's Suites	1 unisex compartment shall be within close proximity to public washrooms.	
Janitor's Sinks	Allow adequate provision, in close proximity to public washrooms, preferably within washroom area. Shall include area for cleaner's sink and storage of mop buckets, cleaning supplies and equipment	

Table 9-5 (Cont'd)

Minimum Requirements for Sanitary Facilities

L. Stadia and Sporting Facilities (Assume 50%-50% male/female)		
Sanitary Fixtures	**Provisions for Male Spectators**	**Provisions for Female Spectators**
WC's	1 for up to 600 but min. of 2 per toilet area	1 for up to 35 but min. of 2 per toilet area
Urinals	1 for every 70	-
Lavatory Basins	1 for up to 300 but min. of 2 per toilet area	1 for up to 70 but min. of 2 per toilet area
PWD's Suites	1 unisex compartment shall be provided for every 12-15 spectators with disabilities. Compartments shall be within 40m travel distance of each other.	
Janitor's Sinks	Allow adequate provision, in close proximity to public washrooms, preferably within washroom area. Shall include area for cleaner's sink and storage of mop buckets, cleaning supplies and equipment	

M. Swimming Pool Facilities (Assume 50%-50% male/female users)		
Sanitary Fixtures	**Provisions for Male Users/Spectators**	**Provisions for Female Users/Spectators**
WC's	2 for up to 100; plus 1 for each additional 100	1 per 5 up to 50 plus 1 for every additional 10
Urinals	1 for every 20	-
Lavatory Basins	1 per WC and in addition 1 per 5 urinals	1 plus 1 per every 2 WC's
Shower Stalls	1 for every 10	1 for every 10
PWD's Suites	1 unisex compartment shall be within close proximity to public washrooms.	
Janitor's Sinks	Allow adequate provision, in close proximity to public washrooms, preferably within washroom area. Shall include area for cleaner's sink and storage of mop buckets, cleaning supplies and equipment	

SECTION 10

SOLID WASTE DISPOSAL

Contents

SECTION 10

SOLID WASTE DISPOSAL

1001 SCOPE

This Section provides general guidelines to developers and builders on the disposal of solid waste (garbage and constructor's waste material) from building sites and from new developments. This Section is not intended to replace existing Regulations for the handling and disposal of waste.

1002 GENERAL

a) The developer shall submit proposals for the provision of solid waste storage, collection, transportation and disposal. Such proposals shall conform to the environmental health standards established by the Ministry of Health and those of the community.

b) Every building in which garbage or trash is produced or from which solid, liquid, or gaseous waste is issued which in the opinion of the Authority, may be detrimental to the environment of the neighbourhood, shall provide a system of disposal satisfactory to the Authority.

1003 COLLECTION SYSTEM

The developer is responsible for providing an adequate system for the collection, transportation and disposal of garbage and other solid wastes from the development. In areas where there are public collection systems the developer should make proper arrangements with the relevant agency for the collection and disposal of solid waste.

1004 STORAGE

Adequate facilities must be established to the satisfaction of the Solid Waste Management Authority for the storage of garbage on site prior to collection. The facility for garbage storage must be shown on the plans which accompany the application for development permission.

1005 DISPOSAL

a) Garbage and solid wastes must be disposed of at locations specified or approved by the Ministry of Health and the St. Lucia Solid Waste Management Authority.

b) Waste should be disposed of at a properly established waste disposal facility and not by ordinary dumping.

c) Disposal shall be carefully carried out and in a manner which avoids creation of a nuisance through breeding of files and vermin. The dump should not present an unsightly appearance.

1106 HAZARDOUS WASTE

a) The handling of hazardous waste must be carried out in an environmentally sound manner to the approval of the Ministry of Health and the Solid Waste Management Authority.

b) Special attention must be paid to the storage, treatment, transport and disposal of hazardous waste. In the application for development permission, the developer should provide details of the equipment that will be used in the collection of hazardous waste and the manner in which such waste will be collected, stored, treated, transported and disposed of.

1107 GRANTING THE PERMIT

No permit for construction of the development will be issued unless the plans show adequate arrangements for the storage of all waste, and unless the developer undertakes to make arrangements satisfactory to the Solid Waste Management Authority for the disposal of waste at sites approved by the Ministry of Health.

SECTION 11

ELECTRICAL AND MECHANICAL INSTALLATIONS

Contents

SECTION 11

ELECTRICAL AND MECHANICAL INSTALLATIONS

1101 GENERAL

a) All electrical installations must be carried out in accordance with the electricity regulations in force and in accordance with good practice as required by the latest edition of the standards fixed by the Regulations for the Electrical Equipment in Buildings issued by the Institution of Electrical Engineers of Great Britain.

b) All electrical installations must be certified by the electrical inspector in accordance with the relevant regulations in force.

1102 INSTALLATION OF EQUIPMENT

1102.1 Air Conditioning

Air Conditioning and other mechanical ventilating systems shall be done in accordance with the manufacturers' instructions and in accordance with recognised practice. The standard of installation must be equal to that approved by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals, and in accordance with the requirements of the "2012International Energy Conservation Code" (IECC 2012) or other Code approved by the Authority.

The design, installation and operation requirements of mechanical systems for building interiors including heating, ventilation, and air conditioning (HVAC) are:

a) To provide a building environment that is safe, energy-efficient, cost-effective, healthy and comfortable;

b) To be sustainable, energy efficient, conserve water, minimize waste and reduce harmful emissions into the environment;

c) To ensure the requisite space to install, upkeep and replace all parts of the system according to manufacturer's specifications.

d) The interior design temperature used for cooling load calculations shall be a minimum of 75°F (24°C)

e) In case of artificial cooling or air conditioning is provided or planned to provide the entire envelope of the treated space or building must be sealed and insulated in accordance to section 503.6 c) and 502.1 d).

f) At least 2 complete air changes per hour shall to be induced for any normally occupied room or enclosed space.

g) At least 3 complete air changes per hour shall to be induced for any internal lavatory or bathroom and at least 12 complete air changes per hour for any kitchen, and in both cases the ventilating systems shall be separate and distinct from any other ventilating system installed in the building.

h) Extract systems shall to be capable of handling at least 75 percent of the total fresh air supply per hour.

i) Ensure that all equipment shall to be installed in such a way that it is readily accessible for inspection and repair, and all refrigerant condensers and/or receivers installed in association with systems containing more than 10 lb. (4.5 kg) of refrigerant shall be supplied with relief valves of adequate size ventilating to open air at a suitable protected point.

1102.2 Elevators and Escalators

a) Requirement

All electric lifts, elevators and escalators shall be of proprietary manufacture. The installation shall be carried out by an approved specialist contractor and the construction, installation and maintenance shall be in accordance with recognised standards of good practice and shall conform with the "Standard Safety Code for Elevators, Dumb-waiters, Escalators, and Moving Sidewalks - ANSI A 17.1", except as may otherwise be approved by the Authority.
Buildings providing an electric lift or elevator shall also provide staircases for common use (not only as a mean of escape) for a minimum of the first five storeys, easily visible and accessible beside the elevator.

b) Design and Construction Requirements

1) Lift well enclosures, pits and machine rooms shall form part of the building construction and shall provide for the clearance and other requirements shown on the manufacturer's drawings.

2) No lift well shall form part of a ventilating system or accommodate any services other than those ancillaries to the installation and operation of the lift.

3) Lift well enclosures shall extend from structural floor to structural ceiling and shall be constructed in accordance with the fire resistance rating requirements of Section 3 of this Code.

4) A smoke escape vent shall be provided within 1ft. (305 mm) of the highest point of each lift well enclosure leading directly to open air.

5) Where a machine room is located on the roof of a building more than 60' 0" (18.3 m) high, provision shall be made for lightning protection.

6) Escalators shall not be less than 2'0" (610 mm) in clear width and shall have horizontal treads. They shall have solid balustrades on both sides, each balustrade being furnished with a handrail moving at the same speed as the escalator. The maximum angle of inclination of the escalator with the horizontal shall be 30 degrees and emergency stop buttons shall be located at the top and bottom landings of each escalator flight.

1102.3 Service Water Heater

a) Requirement

Use of an electrical (or gas-fuelled) service water heater is not permitted in buildings in which the demand of warm/hot service water is on average more than 10 gallons (45 l) per day (see section 9).

1103 EQUIPMENT IDENTIFICATION AND INSTALLATION

1103.1 General

a) All equipment shall be provided with a legible and securely attached permanent sign giving the names and addresses of the manufacturer and the installing contractor.

b) All equipment shall be installed in such a way that it is readily accessible for inspection, servicing and repair.

1104 DUCTS

1104.1 Basis of Requirement

No void or concealed space within a building shall be used as an integral part of a duct system unless it conforms fully with the requirements of this Code.

1104.2 Service Ducts

a) All service ducts passing through floors and walls other than chases and pipe sleeves of not more than 50 sq. in. (323 sq cm) in area shall conform with the fire resistance requirements of Section 3 for such floors and walls unless the whole of the free space within the duct is filled to the thickness of the floor or wall with non-combustible barrier material to give a fire resistance rating not less than that of the floor or wall through which the duct passes.

b) Common ducts may be used for the accommodation of different services provided that adequate precautions are taken in the location of services in relation to one another and provided that the spacing and arrangements of pipes and cables is such that one does not interfere with access to another.

c) All service ducts shall be large enough to give adequate access to all cleaning eyes, stop cocks and other controls, for the inspection modification or repair of all services accommodated.

1104.3 Air Ducts

a) All air ducts shall be constructed of non-combustible materials with no openings other than those essential to the proper functioning and servicing of the system.

b) Any air duct passing through fire division walls or fire division floors and/or ceilings shall be provided with automatic fire doors or shutters having a fire resistance rating not less than that of the wall or floor through which the duct passes.

1105 ARTIFICIAL LIGHTING

a) Artificial lighting where required shall be in accordance with the requirements of the electricity regulations in force.

b) Each area enclosed by walls or partitions with walls higher than 50 percent of the ceiling height shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.

c) In addition to the control just specified in b) one control shall be provided for each principal task location assigned an area of 14 sq m or more. For spaces with more than one task, the ask area need not exceed 50% of the total area of the space.

SECTION 12

LOADS

Contents

SECTION 12

LOADS

1201 GENERAL

1201.1 Definitions

(a) Corridor means a path of egress connecting more than one room or occupied space on any floor - a hallway.

(b) Dead load means the weight of walls, floors, roofs, partitions and other permanent constructions.

(c) Flat roof means a roof having no inclination or having an inclination of not more than 10 degrees with the horizontal.

(d) Live loads means all loads other than dead loads, wind loads and earthquake loads.

(e) Load bearing means any part of a building (including the foundation) bearing a load other than that due to its own weight.

(f) Pitched roof means a roof having an inclination of more than 10 degrees with the horizontal.

g) Class of Load defines the minimum uniformly distributed load to be applied for floors with the occupancy as stated for each particular class.

1201.2 Basis of Design

(a) Any system or method of design or construction shall admit of a rational analysis in accordance with well established principles of mechanics and sound engineering practices.

(b) All buildings and structures and all parts thereof shall be designed and constructed to be of sufficient strength to support the estimated or actual imposed dead, live, wind and any other loads both during construction and after completion of the structure,

without exceeding the stresses for the various materials specified in this Code. The designer shall consider the possibility of extraordinary concentrated loads being applied to the system.

(c) All floor and roof systems shall be designed and constructed to transfer horizontal forces to such parts of the structural frame as are designed to carry these forces to the foundations.

1201.3 Unit Dead Loads

The unit weights of basic materials used in the calculation of dead loads shall preferably be based on properly substantiated information. Where this is not available, the values given in the latest addition of BS 648 "Schedule of weights of building materials" or an equivalent authoritative standard shall be used. Appendix E provides the approximate weight of building material commonly used in the Caribbean. It should be noted that the weight of concrete block, plain and reinforced concrete varies with the type of aggregate and with the amount of reinforcement used.

1201.4 Unit Live Loads

Table 12-1 shall be used to determine the minimum live loads to be imposed on various types of floors. These loads shall be applied in such a manner as to produce the most severe stresses.

In designing floors of classes 30 and 40, provision shall be made for a concentrated load of 315 lbs. placed on any 1 ft. square area wherever this load will produce stresses greater than those caused by the uniformly distributed load.

1201.5 Special Loads

(a) No building or part thereof shall be designed for live loads less than the loads specified in 1201.4.

(b) The live loads set forth therein shall be assumed to include ordinary impact but where loading involves unusual impact the necessary allowance shall be made by increasing the assumed live load.

(c) Provisions shall be made in designing office floors and class 50 garage floors for a load of 2,000 lb. placed upon any area 2' 6" square wherever this load upon an otherwise unloaded floor would produce stresses greater than those caused by a uniformly distributed load of 50 lbs per sq.ft.

(d) In designing floors, not less than the actual live load to be imposed shall be used in the design. Special provision shall be made for machine or apparatus loads. Consideration should be given in the design of living rooms where crowded conditions are likely to occur during parties and dances.

(e) Tanks and their contents should normally be treated as dead load.

(f) Where partitions are shown on the plans their actual weights should be included in the dead load. To provide for partitions where their positions are not shown on the plans, the beams and the floor slabs where these are capable of effective lateral distribution of the load, should be designed to carry in addition to other loads, a uniformly distributed load per sq.ft. of not less than 10 percent of the weight per foot run of the finished partition, but not less than 20 lb. per sq.ft. if the floor is used for office purposes. Where such effective distribution is not provided (e.g. in the case of precast slabs without topping concrete) special provisions shall be made.

(g) Floors in garages or portions of buildings used for the storage off motor vehicles shall be designed for the uniformly distributed live loads shown in Table 12-1 or the following concentrated loads: (See Table 12-1(A). From ANSI A 58.1 1982)

i) for passenger cars accommodating not more than nine passengers, 2,000 lbf acting on an area of 20 sq.in.

ii) mechanical parking structures without slab or deck, passenger cars only, 1,500 lbf per wheel.

iii) for trucks or buses, maximum axle load on an area of 20 sq.in.

(h) Corridors and balconies shall normally be designed for the same class of loading as the floor or other space to which they give access.

(i) Table 12-2 shall be used to determine design live loads on stairs and landings.

1201.6 Parapets, Balcony Handrails and Balustrades.

a) The minimum specified load applied horizontally and normal to the span at the top of every required guard shall be:

USE	**Horizontal Load lb/ft run**
Light access stairs, gangways and the like not more than 2 ft. wide	15
Light access stairs, gangways and the like more than 2 ft. wide, stairways, landings and balconies	40 plus concentrated load of 60 lbs
All other stairways, landings and balconies and all parapets and handrails to roofs	40 to 60 (exits and stairs)
Grandstands and stadia	250

b) For the loading on vehicle barriers for car parks see 2.109 of CUBiC.

c) In all cases, the wind load, if greater in effect, must be allowed for.

1201.7 Roof Live Loads*

(a) Table 12-3 shall be used to determine roof live loads for design purposes. A part of the roof (not oriented North) shall be constructed as to withstand the load of the solar water heater equipment (including the tank) adjusted to the size of it as described in section 9.

(b) The combined effect of dead and live loads on roofs shall be taken into account.

(c) Roof covering. To provide for loads incidental to maintenance, all roof covering (other than glass) at a slope less than 45 degree should be capable of carrying load of 200 lb. concentrated on any 8" square at normal stress.

***Note:** **Live loads do not include wind and earthquake loads.**

1201.8 Live and Dead Load Reductions

(a) Table 12-4 shall be used to determine the permitted reductions in assumed total live floor loads to be taken in design of columns, piers, walls, their supports and foundations, except as provided for in (b) and (c).

(b) No reduction should be made for floors of factories and workshops designed for less than 100 lb. per sq.ft. live loading or for any buildings for storage purposes, warehouses and garages. For factories and workshops designed for 100 lb. per sq. ft. or more, the reductions shown in Table 12-4 may be taken provided that the loading assumed for any column, etc. is not less than it would have been if all the floors had been designed for 100 lb/sq.ft with no reductions.

(c) Where a single span of a beam or girder supports not less than 500 sq. ft of floor at one general level the live load taken in the design on the beam or girder may be reduced by 5 percent for each 500 sq.ft

supported, subject to a maximum reduction of 25 percent. This reduction or that given in Table 12-3, whichever is greater, may be taken into account in the design of columns etc. supporting such beam but should not be made where the floors are used for storage purposes nor in the weight of any plant or machinery which is specifically allowed for.

1201.9 Posting of Live Load Notices

In all cases of Group A buildings (301.2) the Director may require the owner(s) to fix in a conspicuous position on each floor, plaques stating the permitted live load and the permitted occupancy intent of that floor or of that part of that floor.

1202 WIND LOADS

1202.1 Basis of Design

(a) Buildings and structures shall be designed and constructed to resist the forces due to wind pressure. The forces exerted by the wind on a building are the result of a combination of factors such as wind speed, corresponding velocity pressure, exposure factor, aerodynamic shape of the structure, and dynamic response factor.

(b) Such forces shall be applied with all possible combination of loadings, such combinations shall include the case of dead loads plus wind loads, live loads and rain loads. In the special case of roofs, in no case shall any roof be designed for live loads less than those specified in Table 12-3 but the said live load need not be considered to act simultaneously with the wind load.

(c) Structural systems shall be designed and constructed to transfer wind forces to the ground.

1202.2 Wind Pressure

(a) The effect of wind pressure on buildings and structures and parts thereof shall be determined from Part 2 Section 2 of the Caribbean Uniform Building Code. In using CUBiC Part 2 Section 2 the following values shall replace those in TABLE A200.1:

	Wind Pressure (kPa)		Wind Speed (m/sec)
	q_{ref}	q_{100}	V_{ref}
Grenada	0.89	1.06	38
St Vincent	0.90	1.09	38
St Lucia	0.90	1.11	38
Montserrat	0.97	1.11	40

(b) The design engineer may utilise a design based on other internationally recognised and accepted information on the effects of wind on structures subject to the approval of the Director.

(The standard "Wind Loads for Structural Design" has been widely used by Caribbean engineers since it was first published by the Barbados Association of Professional Engineers (BAPE) in 1970 on behalf of the Council of Caribbean Engineering Organisations. The later edition in 1981 was a publication of the BAPE and the National Council for Science & Technology, funded by the Organisation of American States. This became designated as BNS CP28 and later BNS/DPC2010-001.)

When using BNS/DPC2010-001 the following values shall be adopted for the Basic Wind Speed V:

Grenada 54 metres/sec
St Vincent 55 metres/sec
St Lucia 55 metres/sec
Montserrat 57 metres/sec

(It is likely that the CDB-CROSQ Caribbean building standards project will base its wind load provisions on the American Society of Civil Engineers "Minimum Design Loads for Buildings and Other Structures" ASCE 7-05.)
When using ASCE 7-05 the following values shall be adopted for the Basic Wind Speed V for Category II Buildings:

Grenada	122 miles/hour
St Vincent	122 miles/hour
St Lucia	123 miles/hour
Montserrat	127 miles/hour

and for Category III and IV Buildings:

Grenada	133 miles/hour
St Vincent	135 miles/hour
St Lucia	136 miles/hour
Montserrat	136 miles/hour

which includes the Importance Factor I.

(ASCE -05 has now been replaced by ASCE 7-10.)
When using ASCE 7-10 the following values shall be adopted for the Basic Wind Speed V for Category II Buildings:

Grenada	154 miles/hour
St Vincent	155 miles/hour
St Lucia	155 miles/hour
Montserrat	161 miles/hour

and for Category III and IV Buildings:

Grenada	168 miles/hour
St Vincent	171 miles/hour
St Lucia	172 miles/hour
Montserrat	172 miles/hour

(The above values are 700-year return period for Category II Buildings and 1700-year return period for Category III and IV Buildings.)

(c) In order to take into account climate change, all of the wind speeds listed in 1202.2 (a) and (b) shall be increased by factors of:

(i) 1.13 for most buildings or for Category II Buildings when using ASCE 7 (= factor of 1.28 for pressures)

(ii) 1.10 for critical facilities or for Category III and IV Buildings when using ASCE 7 (= factor of 1.21 for pressures)

1202.3 Overturning Moment and Uplift

(a) Where the overturning moment on a building or other structure exceeds two-thirds of the moment of stability computed from dead load only, anchorage to resist the excess over two-thirds of the dead load moment of stability shall be provided.

(b) Where the uplift on a building or other structure, or portion thereof, exceed two-thirds of the dead load only, anchorage to resist the excess uplift over two-thirds of the dead load shall be provided.

1202.4 Stresses due to Wind Loading

For members carrying wind stresses only, and for combined stresses due to wind and other loads, the allowable unit stresses and the allowable loads on connections may be increased by one-third of the maximum working stress specified in this Code for the materials used, except for the provisions of Section 16 - Plain and Reinforced Concrete. Such increases shall not apply to towers, cantilevered projections or metal sheathing where vibrating or fluttering action could be anticipated. In no case shall the section be less than required if the wind stresses be neglected. The special case of pre-stressed concrete structures is dealt with under Section 16 of this Code.

When using load standards other than CUBiC Part 2 Section 2 (*eg* ASCE 7) the requirements for increased allowable stresses due to wind loads shall comply with those in the alternative standards.

1203 EARTHQUAKE LOADS

1203.1 Basis of Design

(a) The record of seismic activity within the last 100 years shows that there have been earthquakes which have created significant damage in some of the islands in the Eastern Caribbean. In the past fifty years Islands such as Antigua, St. Kitts, Montserrat, Guadeloupe, Dominica and Martinique have experienced earthquakes which have caused damage to buildings and other property.)

b) It is necessary therefore that every building and structure and every portion thereof be designed and constructed in accordance with Part 2 Section 3 of the Caribbean Uniform Building Code (CUBiC) or in accordance with any other Code or Standard approved by the Director.

In CUBiC Part 2 Section 3 TABLE 2.305.1 the Z VALUES shall be:

Grenada – 0.64
St Vincent – 0.51
St Lucia – 0.56
Montserrat – 0.75

(It is likely that the CDB-CROSQ Caribbean building standards project will base its earthquake load provisions on the American Society of Civil Engineers "Minimum Design Loads for Buildings and Other Structures" ASCE 7-05.)

When using ASCE 7-05 the following values shall be adopted for the seismic hazard:

	Spectral Accelerations (with a 2% probability of exceedance in 50 years)	
	0.2 sec	1.0 sec
Grenada	1.441	0.414
St Vincent	1.113	0.367
St Lucia	1.227	0.393
Montserrat	1.643	0.485

In CUBiC Part 2 Section 3 $C_T = 0.035$ for steel frames.

In CUBiC Part 2 Section 3 equation 13 in Clause 2.306.8 is:

$$w_m = \frac{[\sum w_j v_{im}]^2}{\sum w_j v_{im}^2}$$

c) For the design of small buildings to resist seismic forces see Section 18 of this Code and Section A of the Building Guidelines.

1203.2 Building Response Data from Future Earthquakes

In order to develop earthquake resistant design recommendations more specific to each of the Eastern Caribbean States, building response data must be obtained from future earthquakes. The installation of at least three strong motion accelerographs is recommended in all buildings six storeys or more in height. Where provided, accelerographs are to be distributed between ground and roof.

1204 LOAD TESTS

1204.1 Conditions Requiring Load Tests

Whenever there is insufficient evidence of compliance with the provisions of this Code or evidence that any material or any construction does not conform to the requirements of this Code, or in order to substantiate claims for alternate materials or methods of construction, tests as proof of compliance shall be made by an agency approved by the Authority and at the expense of the owner.

1204.2 Acceptability Criteria

a) Where there is no recognised standard test procedure for the material or assembly in question, the material or assembly under dead plus live vertical load shall deflect not more than 1/240 of the span, nor more than 1/360 where required to support a plaster ceiling or brittle partitions, and that the material or assembly shall sustain dead plus twice the live load for a period of 24 hours, with a recovery of at least 80 percent.

b) Where elements, assemblies or details of structural members are such that calculation of their load-carrying capacity, deformation under load or deflection cannot be made by rational analysis, their structural performance shall be established by tests in accordance with test procedure as developed by the design engineer based on consideration of all probable conditions of loading.

1205 DIFFERENCES BETWEEN WIND AND EARTHQUAKES

Table 12-5 shows the main differences between wind and earthquakes on the design of a building. It will be noticed that the predictability of loads from wind pressures is usually good, while the loads from earthquakes cannot be readily assessed. The building frames to accommodate earthquake loads must be provided with ductility while for wind the buildings do not have to be designed on the basis of the same criteria.

Table 12-1

Floor Loads

Loading Class Number	**Types of Floors**	**Minimum Imposed Loads**	**Alternative Imposed Loads (lb)**	
		Slabs	**Beams**	**Beams**
		lb. per sq.ft.of floor area	**Uniformly distributed over span, per ft width**	**Uniformly distributed over span**
30	Floors in dwelling houses of not more than 2 storeys	30	240	1,920
40	Floors (other than those of class 30) for residential purposes including dwelling houses of more than one occupation: residential flats; hospital wards; hotel bedrooms and sitting rooms; rest rooms institutional establishments of Group B occupancy.	40	320	2,560

50	Floors of light work rooms without storage; floors of garage for passenger cars with gross weight not exceeding 2-1/2 tons.	50	As required by 1201.5 (c)	As required by 1201 (c)
60	Floors of school class rooms; office ground floor and office floors below ground floor; floors of banking halls; floors of library reading rooms: marques, hospital operating theatres	60	480	3,840
70	Office floors	70	560	4,480
80	Shop floors used for the display and sale of light merchandise; workrooms generally; garages for vehicles exceeding 21 tons gross weight; places of assembly with fixed seating; churches and chapels. restaurants; circulation space in machinery halls, power stations etc. where not occupied by plant or equipment; theatre balconies with fixed seating; city halls, court houses; art galleries.	80	640	5,120

Note: Fixed seating implies that the removal of the seating and the use of the space for other purposes is impossible.

Table 12-1 (Cont'd)

Floor Loads

Loading Class Number	Types of Floors	Minimum Imposed Loads	Alternative Imposed Loads (lb)	
		Slabs	Beams	Beams
		Lb. per sq.ft. of floor area	Uniformly distributed over span, per ft. width.	Uniformly distributed over span
100	Floors of warehouse, workshops, factories, and other buildings or parts of buildings of similar categories for light-weight loads; places of assembly without fixed seating; public rooms; dance halls; theatre balconies without fixed seating; gymnasiums. Assembly platforms; composing and linotype rooms in printing plants; reviewing stands and bleachers; drill rooms; fire escapes; hospital X-ray rooms; laboratories, cinemas public auction rooms not used for storage of goods.	100	800	6,400
100A	Areas used for general storage and filing purposes in offices of loading class 50 and 70. Note: Special consideration shall be given to the average and the localized floor loadings Class 70, used for heavy filing and storage equipment (such as card cabinets and rolling storage units, and for centralized security and storage.)	100	800	6,400
150	Floors of warehouses, workshops, factories and other buildings or parts of buildings of similar categories for light weight loads; floors of garages for vehicles not exceeding 4 tons gross weight; stages; armouries .	150	-	-
200	Floors of warehouses, workshops, factories, other buildings or part of buildings of similar categories for heavy weight loads (unless actual loading is greater than 200 lb per sq.ft); floors of book stores; museums.	200	-	-

Table 12-1(A)

Minimum Concentrated Loads

Location	Load (lb.)
Elevator machine room grating (on area of 4 sq.in)	300
Finish Light floor plate construction (on area of 1 sq. in)	200
Garages	(see 1201.5(g)
Office Floors	2,000
Accessible ceilings	200
Sidewalks	8,000
Stair treads (on area of 4 sq.ins at centre of tread)	300

Note: Table 12-1(A) taken from ANSI A58.1 1982

Table 12-2

Design Loads for Stairs and Landings (other than fire escapes)

Class of Floor Served	Live Load (lb/sq.ft.)
30	30
40, 50, 60, 70	60
Other classes	100

Consideration shall be given to increasing the design loading where there is a possibility of heavy equipment being transported on stairs or landings.

The following minimum concentrated loads shall be considered on stairs and landings at the most unfavourable positions for bending moment and shear.

Loading Class 30: 400 lb.

Class 40,50 & 60 : 600 lb.

Class 70 : 600 lb.

Class 80,100, 150 & 200: 1,000 lb.

Table 12-3

Roof Live Loads. Design Loading lb/sq ft of Plan Area

Slope of Roof	With Access	No Access
Up to 10 degrees	30	15
Over 10 degrees up to 30 degrees	15	Nil
Over 75 degrees	Nil	Nil

For slopes between 30 degrees and 75 degrees the imposed load to be allowed for shall be obtained by linear interpolation between 15 lb. per sq. ft for a 30 degree slope and nil for a 75 degree slope.

NOTE:

"With access" means access in addition to that necessary for cleaning and repair

"No access" means no access other than that necessary for cleaning and repair.

The design loading in this Table does not include wind or earthquake loads.

Table 12-4

Reductions of Total Live Floor Loads on Columns.

Number of floors carried by member under consideration	Percent reduction of live load on all floors above the member under consideration
Roof	0
Roof and two floors	0
Roof and three floors	10
Roof and four floors	30
Roof and five floors	40

Table 12-5

Main Differences between Wind and Earthquakes

Item	Wind	Earthquakes
Source of loading	External forces due to wind pressure	Applied movements from ground vibration
Type and duration of loading.	Wind storm of several hour's duration; loads fluctuate, but predominantly in one direction	Transient cyclic loads of at most a few minutes' duration; loads change direction repeatedly
Predictablity of loads	Usually good, by extrapolation from records or by analysis of site and wind patterns	Poor; little statistical certainty of magnitude of vibrations or their effects
Influence of local soil conditions on response	Unimportant	Can be important
Main factors affecting building response	External shape and size of building; dynamic properties unimportant except for very slender structures	Response governed by building dynamic properties: fundamental period, damping and mass
Normal design basis for maximum credible event	Elastic response required	Inelastic response Permitted, but ductility must be provided; design is for small fraction of the loads corresponding to elastic response
Design of non-structural elements	Loading confined to external cladding	Entire building contents shaken and must be designed appropriately

SECTION 13

EXCAVATIONS AND FOUNDATIONS

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SECTION 13

EXCAVATIONS AND FOUNDATIONS

1301 EXCAVATIONS

1301.1 General

Until provisions for permanent support have been made all excavations shall be properly guarded and protected so as to prevent the same from being dangerous to life and property. Such protection is to be provided by the person causing the excavation to be made. Excavations, for any purpose, shall not extend within one foot of the plane of the natural slope of the soil under any existing footing or foundation, unless such footing or foundation is first properly underpinned or protected against settlement.

1301.2 Permanent and Temporary Construction Excavations

No permanent excavations shall be made nor shall any construction excavations be left on any lot or lots which will endanger adjoining property or buildings or be a menace to public health or safety. Any such excavations made or maintained shall be properly drained and such drainage provisions shall function properly as long as the excavation exists.

Permanent excavations shall have retaining walls of steel, masonry, concrete or similar approved material of sufficient strength to retain the lateral thrust of the surrounding material together with any surcharged loads.

1301.3 Enforcement

Where, in the opinion of the Director, an unsafe condition may result or damage may occur as the result of an excavation, he may order the work stopped or may approve the work of excavation subject to such limitations as he may deem necessary.

1302 BEARING CAPACITY OF SOIL

1302.1 Soil Investigations

Plans for new buildings or additions shall bear a statement as to the nature and character of the soil under the structure. Where the bearing capacity of the soil is not known or is in question, the design engineer shall arrange for an examination of sub-soil conditions such as by borings and other tests. Plate load tests shall be used only to supplement other sub-soil investigations. The design bearing capacity of the soil shall be substantiated by recognised tests, analyses and procedures. For the purposes of conceptual design only, Table 13-1 may be used as a guide in estimating the allowable bearing capacities of supporting soils.

Table 13-1

For conceptual design only: maximum safe bearing capacities for horizontal foundations at depth 2 ft. under vertical static loading. (Materials not listed in this Table shall be tested for bearing capacity).

Types of Rocks and Soils	Maximum Safe bearing Capacity – kN/sqm	Maximum Safe bearing Capacity - tons per sq.ft.	Remarks	
1. Massively-bedded limestones and hard sandstones.	4000	40	Values refer to sound, unweathered rock.	
2. Strong shales, strong mudstones and strong siltstones	2000	20	Beware of deterioration and hollows caused by water	
3. Thinly-bedded limestones and sandstones	1000	10	Thinly bedded or shattered rocks shall be assessed after inspection	
	Dry	**Dry**	**Submerged kN/sqm; tons/sqft**	
4. Compact well-graded sands and gravel sand mixtures	400	4	200	2
5. Loose well graded sands mixtures	200	2	100	1
6. Compact uniform sands	200	2	100	1
7. Loose uniform sands	100	1	50	1/2
8. Stiff clays and sandy clays	200	2	100	1
9. Firm clays and sandy clays	100	1	50	1/2
10. Soft clays and silts	50	1/2	-	-

1302.2 Wind and Earthquake

a) All allowable soil-bearing values specified in Table 13-1 may be increased by one-third in calculations for wind or earthquake loading when combined with vertical loads. No increase shall be allowed for vertical loads acting alone. Wind and earthquake loads need not be assumed to act simultaneously.

b) It should be noted that in certain types of soils, for example, silty water-logged soils, liquefaction might occur under certain earthquake conditions. The possibility of the occurrence of liquefaction should be investigated, bearing in mind that ground water levels may rise over time due to climate change.

1302.3 Climate change considerations

a) *Deep foundations*[1] *are less vulnerable to destabilization by changes in rainfall patterns and ground water levels. Soil bearing foundations may be affected by increasing subsidence (in clay or chalk soils) and lowered bearing capacities (due to rising ground water levels in granular soils).*

b) *A common climate change mitigation strategy is to re-use existing foundations, and to build on sites where there has previously been human activity – in preference to 'green field sites'.* In such cases there shall be an investigation of possible contaminants in the ground, and provisions for their safe containment. Foundation designers shall bear in mind that present designs may well become bases for structures that they have not conceived.

1303 SOIL BEARING FOUNDATIONS

1303.1 General

Footings shall be so designed that the soil pressure should be reasonably uniform to minimise differential settlement. The preferred material for the construction of footings is concrete.

1303.2 Continuous Footings

(a) Footings under walls shall be continuous or continuity otherwise provided and shall not be less than required to keep the soil pressure within that set forth in Table 13-1 nor less than the minimum sizes set forth in Table 13-2.

(b) All concrete footings shall be adequately reinforced, the minimum allowable amount of steel reinforcement being 0.15 percent of the gross cross-sectional area of the concrete in both horizontal directions. Reinforcing bars shall be provided with a minimum concrete cover in accordance with Table 16-3.

(c) Excavations for continuous footings shall be cut true to line and level and the sides of footings shall be shuttered, except where soil conditions are such that the sides of the excavation stand firm and square. Excavations shall be made to firm bearing.

[1] See 1305.1 (i) below

(d) Continuous footings shall be placed level and any changes in the level of such footings shall be made with a vertical tie of the same cross-section and design as the footings.

(e) Continuous footings on which the centre of gravity of the loads falls outside of the middle one-third shall be considered eccentric, and provision shall be made to limit the soil pressure at the edges to allowable values by means of counter-balancing or by other approved methods.

1303.3 Isolated Footings

(a) Isolated footings in soils having low lateral restraint shall be provided with adequate bracing to resist movement.

(b) An isolated footing on which the centre of gravity of the load falls outside the middle one-third of any line passing through the centre of gravity of the footing shall be considered eccentric, and provision shall be made to limit the soil pressure at the edges by means of straps or other approved methods.

(c) Where isolated footings support reinforced concrete columns, starter bars, equivalent in number and area to the column reinforcement, and having lengths not less than 30 diameters above and below the joints, shall be provided in the footing. Where the footing depth does not allow straight bars, standard bends will be allowed. Such starter bars, or anchor bolts as are required for steel columns, shall be held to proper level and location during the concreting of the footing by templates or by other approved methods.

Table 13-2

Minimum Dimensions for Continuous Footings

Allowable bearing capacity (Tons per sq.ft.)	Allowable bearing capacity (kN/sqm)	Number of storeys	Depth and width (mm)	Depth and width (ins)
Up to 1/2	Up to 50	1 2	300 x 765 300 x 900	12 x 30 12 x 36
Over 1/2 but less than 1	Over 50 but less than 100	1 2	230 x 600 300 x 600	9 x 24 12 x 24
1 or more	100 or more	1 2	230 x 400 230 x 600	9 x 16 9 x 24

Note: The sizes given in the Table are to be used with caution as the characteristics of soils vary considerably and all soils should be analysed before designing the foundation.

Based on soil investigations as set forth in 1302.1 the footing sizes may be changed when the allowable bearing values and loads are taken into account, but the minimum width of a footing under the main wall of a building shall not be less than 600mm (24") nor less than 200mm (8") more than the width of the foundation wall whichever is greater.

1304 CONCRETE SLABS ON FILL

(a) Where it is proposed to place concrete slabs directly on the supporting soil, a sub-grade shall have first been prepared by removing all top soil, organic matter and debris, and the sub-grade and fill shall be thoroughly compacted by approved mechanical methods. All fill placed under slabs shall be clean, free of debris and other deleterious materials. The maximum size of rock in compacted fill shall be 100mm (4") in diameter. For cases of heavy loading special compaction tests may be required.

(b) Concrete floor slabs placed directly on the supporting soil shall be of an appropriate thickness for the loads intended but in any case not less than 100mm (4"), and shall be reinforced with steel reinforcement not less than 0.15 percent of the gross cross-sectional area of the concrete in the slab. The reinforcement shall be placed in the upper half of the slab.

(c) It is acceptable to use anchored-in-place, buoyant raft foundations in flood prone areas or in areas where ground water levels are high, as a climate change adaptation strategy.

1305 PILED FOUNDATIONS

1305.1 General

(a) Piled foundations shall be designed and supervised by a professionally qualified engineer approved by the Authority and suitably qualified and experienced in such design.

(b) Piles used for the support of any building or structure shall be driven to a resistance and penetration in accordance with the plans and/or specifications and as set forth herein.

(c) Piles may be jetted only if permitted by the engineer. Immediately after completion of jetting, the pile shall be driven below the depth jetted to the required resistance but not less than 300mm (1ft). No jetting will be permitted that may be detrimental to existing adjacent structures or to piles that have been driven.

(d) **Column action**. All piles standing unbraced in air, water, or in material not capable of providing lateral support, shall be designed as columns. Such piles driven into firm ground may be considered fixed and laterally supported at 1.5m (5' 0") below the ground surface unless otherwise prescribed by the design engineer after a foundation investigation by a competent agency approved by the Authority.

(e) When isolated columns and other loads are supported on piles a minimum of three piles shall be used for such support unless lateral bracing is provided at the pile cap to ensure stability. Should a pile be loaded eccentrically so as to produce an overload on any pile more than 10 per cent of the allowable load, footing straps or other approved methods shall be required to counteract the effect of eccentric loading.

(f) The minimum centre-to-centre spacing of friction piles shall be not less than 1066mm (3' 6") or the perimeter of the piles whichever is greater. For piles deriving their resistance from end bearing, the minimum centre spacing of the piles shall be not less than 760mm (2' 6") or twice the least width, whichever is greater. The spacing of piles shall be such that in no case the average load on the supporting stratum may exceed the safe bearing value of that stratum.

(g) It is advisable that piles shall not be driven closer than 1.2m (4' 0") to an existing building or structure, unless special consideration is given to the properties of the soil and to the structure of the existing building.

(h) **Group action**. Consideration shall be given to the reduction of allowable pile load when piles are placed in groups. Where soil considerations make such load reductions advisable or necessary, the allowable axial load determined for a single pile shall be reduced by any rational method or formula.

(i) **Piles in subsiding areas**. Where piles are driven through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces which may be imposed on the piles by the subsiding upper strata.

(j) The engineer or other competent person approved by the Director supervising the pile-driving operations shall be required to keep an accurate record of the material and the principal dimensions of each pile; the weight and fall of the hammer,- if a single-acting or drop hammer; the size and make, operating pressure, length of hose, number of blows per minute and energy per blow - if a double-acting hammer; together with the average penetration of each pile for at least the last five blows, and the levels at tip and cut-off. A copy of these records shall be filed and kept with the plans.

(k) All piles shall be designed so that lifting and handling stresses shall not exceed allowable working stresses, as specified. Stresses during driving may exceed these stresses by not more than 100 percent.

1305.2 Allowable Loads

(a) The allowable axial and lateral loads on piles shall be determined by an approved formula, by load tests, or by a foundation investigation by a competent agency.

(b) Where a dynamic pile formula is used the ultimate resistance shall be calculated in accordance with the method given in BS 8004 or such other formula as the engineer shall consider suitable.

(c) When the allowable axial load of a single pile is determined by a load test one of the following methods shall be used to determine the ultimate resistance.

(d) The ultimate resistance shall be defined as:

(1) The load at which an increase in load produces a dramatic increase in settlement; or

(2) The maximum load which during a 48-hour period of continuous load application causes settlements at a rate not exceeding 0.25mm/hr (0.01 in/hr).

In any event, the maximum settlement should not exceed 0.28mm/tonne (0.01in/ton) gross settlement or 0.64mm (0.025ins) net settlement (where net settlement is the difference between gross and recovery).

(e) Where the ultimate resistance of a friction pile is determined by soil tests, the soil investigation and laboratory tests shall be carried out by a competent agency.

(f) Table 13-3 shall be used to determine the minimum factor of safety to be used in calculating the allowable axial load on a pile.

Table 13-3

Minimum Factor of Safety for Piles

Type of Ground	Test Load	Dynamic Formula Resistance not Reduced on Driving	Dynamic Formula Resistance Reduced on Re-driving	Soil Investigation and Soil tests
Rock	2.0	1.5	-	2.0
Non-cohesive soil	2.0	2.0	2.5	2.0
Hard cohesive soil	2.0	2.0	2.0 or more	2.0
Soft cohesive soil	2.0	N/A	N/A	2.0

* Test load should be used in the circumstances

1305.3 Timber Piles

(a) Timber piles shall be of one piece of approved timber containing no evidence of decay, free from short kinks or reverse bends and having uniform taper from butt to tip. A straight line drawn from the centre of the butt to the centre of the tip shall lie wholly within the body of the pile. The diameter of round piles shall be not less than 150mm (6ins) at the tip and not less than 250mm (10ins) at one metre (three feet) from the butt, for piles which are 7.62m (25ft) or less in length. For piles which exceed 7.62m (25ft) in length, the diameter at the tip shall be not less than 200mm (8ins); and at one metre (3ft) from the butt, the diameter shall not be less than 300mm (12ins).

(b) No piles which have a spiral grain exceeding one complete turn in 12.2m (40ft) shall be used. Squared timber piles less than 200mm (8") square shall not be used.

(c) Untreated wood piles shall not be used, except piles made of timber which has been shown to be resistant to termites and wood borers. The approval of the Director shall be sought for the use of all timbers for piling.

(d) All other piles shall be pressure-treated in accordance with the requirements of Section 14 of this Code.

(e) The allowable stress in compression parallel to the grain under maximum working load shall not exceed 60 percent of the basic stress as determined by the US National Forest Products Association or any other Agency approved by the Authority, and in no case shall stress exceed 4826kN/sqm (700 lb. per sq.in).

1305.4 Precast Concrete Piles

(a) The manufacture of precast concrete piles shall conform in all respects to Section 16 of this Code; concrete shall conform to not less than the requirements of standard mix ST4[2] for normal or easy driving and of mix ST5 for hard driving, and for all piles used in marine work.

(b) All piles shall be reinforced with not less than 4 longitudinal steel bars having an area of not less than 1.25 percent and not more than 4.0 percent of the gross cross-sectional area of the pile. All the main longitudinal bars shall be of uniform size and length. Joints in longitudinal bars, if unavoidable, shall be made by full-strength butt-welding.

(c) Lateral reinforcement in the form of hoops or links shall be not less than 5mm (3/16") diameter. In the body of the pile the lateral reinforcement shall be not less than 2 percent of the gross volume, spaced at not more than half the least width of the pile. For length of 3 times the least width of the pile at each end of the pile the volume of lateral reinforcement shall be not less than 6 percent of the gross volume. The transition between the close-spacing at the ends and the maximum spacing shall be made gradually over a length of 3 times the least width.

(d) All reinforcement, including binding wire, shall be protected by the concrete cover designated in section 16 of this code.

(e) The compressive stress imposed on driven piles shall not exceed 5171kN/sqm (750 lb. per sq.in.) on the nominal minimum cross-sectional area of the pile.

(f) Precast concrete piles shall be not less than 250mm x 250mm (10" x 10") in section.

[2] Concrete grades are defined in Section 16.

(g) All precast concrete piles shall have their date of manufacture and the lifting points clearly marked on the pile. Concrete piles shall not be driven until they have attained their specified 28-day strength as verified by tests, nor shall the piles be removed from the forms until 50 percent of the specified 28-day strength has been attained. Piles shall not be transported nor driven until they have been cured not less than seven days.

1305.5 Prestressed Concrete Piles

(a) Prestressed concrete piles shall conform to 1608 of this Code except as specifically detailed in 1305.5.

(b) Longitudinal pre-stressing tendons shall have the cover specified in section 16 of this code.

(c) Lateral reinforcement shall be as specified in 1305.4(c) for the precast concrete piles.

(d) Piles shall have a minimum pre-stress of 4137kN/sqm (600 lb. per sq.in.) at time of driving.

(e) No tension shall be allowed in the concrete under working load conditions.

(f) The compressive stress in the pile under working load combined with the prestress in the pile at the time of loading shall not exceed one-third of the compressive strength of the pile.

1305.6 Cast-in-place Concrete Piles

(a) Concrete piles cast in place against earth in drilled or bored holes shall be made in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft.

(b) **Allowable stresses**. The allowable compressive stress in the concrete shall not exceed 0.225 times the specified 28-day cube strength. The reinforcing steel shall conform to ASTM A706 - "Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement" or to the equivalent British standard.

(c) Cased cast-in-place concrete piles may consist of a steel or concrete shell driven in intimate contact with the surrounding soil and left in place and filled with concrete. Steel shells may be uniformly tapered, step-tapered, cylindrical or a combination of such shapes and may be laterally corrugated, spirally corrugated, longitudinally fluted or plain.

(d) Pile shells and end closures shall be of sufficient strength and rigidity to permit their driving in keeping with the driving method used, and to prevent harmful distortion caused by soil pressure or the driving of adjacent piles until filled with concrete. A reduction of cross-sectional area in excess of 15 percent shall be cause for rejection. The shells shall also be sufficiently water-tight to exclude water during the placing of concrete. The minimum diameter shall be 200mm (8").

(e) Concrete for cast-in-place piles shall conform to not less than the requirements of Grade ST4, Table 16-2.

(f) Reinforcement including binding wire shall have not less than 50mm (2") of concrete cover in uncased piles and 25mm (1") where piles are completely encased.

(g) Where the shell has a thickness of 3mm (0.12") or more the shell may be considered as carrying part of the load.

(h) Adequate allowance for corrosion shall be considered in the design but not less than the outer 1.5mm (1/16") of a steel shell shall be deducted before computing the area of the shell considered as carrying load. The load carried by the shell shall not exceed 62MPa (9,000 lb. per sq.in.) based on the net steel area deducting the allowance for corrosion.

1305.7 Steel Piles

(a) The quality of the steel in joints, tubes, box piles and other plain or built up sections shall comply with the specification for structural steel in conformance with the relevant ASTM or British standard.

(b) No section shall have a nominal thickness of metal of less than 9.5mm (3/8").

(c) The allowable stress under working load shall not exceed 25 percent of the minimum guaranteed yield stress of the steel.

(d) Where adequate corrosion prevention is not provided 1.5mm (1/16") shall be deducted from each surface in determining the area of the piles section.

1305.8 Special Piles or Special Conditions

The use of types of piles or conditions not specifically covered herein may be considered upon examination of acceptable test data, calculations or other information relating to the properties and load-carrying capacity of such piles.

1306 FOUNDATION BEAMS

(a) Foundation beams, supporting loads between piles, shall be reinforced concrete, or structural steel protected by at least 2" of concrete cover.

(b) The width of foundation beams shall be at least equal to the thickness of the wall they support but never less than 200mm (8").

(c) Foundation beams shall be suitably designed and reinforced around access openings and vents.

1307 SEA WALLS AND SHORELINE PROTECTION

1307.1 General

Sea walls, bulkheads, groynes and other retaining walls along an ocean front, bay, creek, canal, or water-way shall be designed by a professionally qualified and approved engineer.

1307.2 Design Criteria

a) The structure shall retain the adjoining earth from the surface of the ground to a point sufficiently deep to retain the base against surcharge pressures, with due design considerations for wave action and currents.

b) Timber shall not be used, other than where located below mean low water, except that bore-resistant or appropriately treated woods may be approved by the Director.

c) Structures shall be classed as gravity types when the resultant of the acting forces falls within the middle third of the base. Boulder-type walls shall be considered as gravity type where the base width equals or exceeds the height of the wall. Structures which are not of gravity or cantilever type shall be secured to properly designed anchors.

d) Where structures are constructed of a combination of lime rock boulders and concrete, the minimum percentage of cross-section area of the concrete to the total cross-section area of the structure shall be 40 percent, not including concrete used for copings or decorative purposes.

e) The design shall take account of the projected rise in sea level due to climate change. Predicted wave heights and wave energy shall be based on forecast design wind speeds in conjunction with the latest Caribbean Basin wind hazard maps (refer to section 12 of this code for guidance on the wind hazard)

1307.3 Climate change adaptation

a) Non-elevated buildings close to the shoreline are most vulnerable to damage by waves. In such locations, the ground floor structure shall be at least 3ft above the predicted high tide level, with additional allowance for wave action[3]. Acceptable alternatives include a suspended floor structure or a ground bearing floor placed upon an embankment. This does not apply to structures where there is direct access to the water within the confines of the enclosure, such as boathouses.

b) Forms of shoreline protection appropriate for individual properties include sea walls, gabions and revetments (rock armour placed on the slope). These structures can be subject to scour, and promote erosion due to reflected wave energy. They can also adversely affect the deposition of sand in areas further down the coast. These factors shall be considered in the design.

Set-backs for construction shall be as ordained by the Government.

c) *Property owners can contribute to mitigation of the impact of sea level rise.* With the protection of the buffer zone in mind, design of sewer outfalls shall be in accordance with the relevant clauses of section 8 of this code. Similar considerations apply for stormwater discharge points. Measures include but are not restricted to - separation of the sediment out of storm water, and treatment of sewage to a standard that does not promote the growth of invasive species, nor cause die back of the vegetation.

1308 CAISSONS

1308.1 General

The footings of any structure may be carried down to a firm foundation by isolated piers of reinforced concrete or by open or pneumatic caissons either with or without enlarged base or bell at the bottom.

1308.2 Design Criteria

a) The safe-carrying capacity of such shafts or caissons shall not exceed the allowable unit bearing capacity of the soil multiplied by the area of the base or bell at the bottom, provided such bell shall have at least a 12" thickness of concrete at its edge and the sides shall slope at an angle of not less than 60 degrees with the horizontal.

b) In no case shall such piers or caissons be of less than 2' 0" minimum horizontal dimension.

[3] *This strategy is also recommended for flood prone areas away from the coastline. However there is the potential for creating a 'soft storey' and increasing the vulnerability of the building to earthquake, unless the vertical supports are carefully designed.*

1309 STABILITY OF SLOPES

1309.1 General

When building on an existing slope the stability shall be assessed by means of a soils investigation supervised by a qualified geotechnical engineer. A similar preparatory investigation shall be undertaken for the creation of new slopes by means of cut and fill.

1309.2 Climate change influences on slope stability

Land slippage can be triggered by human intervention, earthquakes and volcanic activity, which are independent of climate change[4]. However, precipitation patterns are also responsible for landslides and mudflows. These effects can be expected to worsen under climate change scenarios.

a) Drought reduces the vegetative cover on slopes making them vulnerable to erosion and weathering.
b) Wetting and drying shrinkage of clay soils can weaken the structure of the slope.
c) Heavy rainfall, rising ground water levels, and moisture introduced onto planes of weakness can all cause sliding.
d) Erosion at the toe of certain slopes due to wave or river action can trigger a landslide.
e) Sudden changes in ground water levels adjacent to the slope – whether on the coast or alongside rivers and reservoirs – can also initiate slippage.

Indirectly human activities in response to climate change can also be detrimental. These include draw down of reservoirs affecting the adjacent slopes, and irrigation of slopes in response to dry conditions.

Designers shall be aware of the potential hazards associated with these conditions.

1309.3 Slope stabilization techniques - general

Designers shall use appropriate methods of stabilizing existing slopes and creating stable configurations for new slopes. These methods generally fall into three categories, viz. creating a safe geometry, reducing or limiting soil pore water pressures, and mechanical or chemical intervention. Some of them are listed below.

Geometrical
a) Construction of a retaining wall designed for the height and nature of the retained material. Drainage of the retained

[4] *At the time of drafting this revision, landslide hazard maps were being prepared for some OECS member countries by the University of Twente ITC Holland.*

material is an important contributor to stability

b) Removal of material from the top of the slope[5]

c) Terracing or cutting benches on the slope incline[6]

d) Adding the weight of a soil or rock berm at the base of the slope[7]

Mechanical

e) Installing ground anchors or use of soil nailing

f) Plastic geo-grids placed on the slope surface to increase its bearing capacity

g) Concrete sprayed onto the slope

h) Planting drought resistant, native species of vegetation

1309.4 Slope stabilization techniques – drainage

As a rule, sustainable drainage infrastructure increases the proportion of infiltration at the expense of surface runoff. However, slope stabilization techniques involving drainage are aimed at preventing the entry or build up of water within the landmass. Designers shall take account of this conflict and use appropriate measures of slope drainage including:

a) Covering the slope with an impermeable material

b) Diverting surface runoff from the slope and especially from the slip surface (shallow drainage)

c) Drainage of ground water and control of the pore water pressures, particularly at the toe of the slope (deep drainage)

d) Minimizing irrigation in the area of the slope.

In adapting to climate change extra capacity shall be provided in storm drainage systems, or as a minimum, there shall be provision for short term storage and overflow during periods of heavy rain. The design shall also provide silt traps and screens, or similar devices to limit the amount of debris and sediment carried by the flow.

[5] *Care is needed with excavating clay slopes which may have more than one slip surface*

[6] *Effective for shallow sliding surfaces*

[7] *Rock is freely draining and is preferable to soil for the construction of the berm*

SECTION 14

TIMBER CONSTRUCTION

Contents

SECTION 14

TIMBER CONSTRUCTION

1401 GENERAL

Timber members used for structural purposes shall be designed by methods admitting of rational analysis according to established principles of mechanics.

1402 STANDARDS

(a) Standards of construction shall be at least equal to standards in the latest edition of CUBiC Part 2 Section 8 - Structural Timber; or the American Institute of Timber Construction - AITC 100; or BS 5268 - Structural Use of Timber; or other Standard approved by the Authority for environmental conditions in the OECS.

(b) CUBiC Part 2 Section 8, is hereby adopted as being part of this Code and supplements, but does not supersede the specific requirements set forth herein.

1403 QUALITY OF TIMBER PRODUCTS

1403.1 Preservative Treated or Durable Species Timber

(a) Wood used for structural purposes shall be pressure treated or have natural resistance to termites. The approval of the Director is required for the use of any timber for structural purposes that has not been pressure treated.

(b) Approved wood having natural resistance to termites include greenheart, redwood, or red cedar*.

(c) The standard of the American Wood Pressures Bureau and/or the American Wood Pressure Association shall be deemed as approved in respect of pressure treated wood.

(d) The soil should be treated against termites, as a protection against the termite infestation in the area in which the building is being constructed. This treatment should be carried out by experienced contractors using methods and materials approved by the Director.

Note: The developer should confirm the natural resistance of the timber to be used by providing test certificates or other relevant information for the approval of the Director.

1403.2 Use of Lumber, Plywood, Hardboard, and other Timber Products.

a) All lumber, including end-jointed lumber, used for load supporting purposes shall be identified by Grade Mark of a Lumber Grading or Inspection Bureau or Agency approved by the Authority.

b) Structural glued laminated timber shall be manufactured in accordance with AITC 117 "Standard Specification for Structural Glued Laminated Timbers of Softwood Species, Manufacture and Design or BS 5268 Part 2, "Structural Use of Timber".

c) All plywood when used structurally (including among others, used for siding, roof and wall sheathing, sub flooring, diaphragms and built-up members), shall conform to the performance standards for its type as determined by the American Plywood Design Specifications for Plywood-Lumber Components or other Standard approved by the Authority.

d) Plywood components shall be designed and fabricated in accordance with the applicable standards and identified by the trademarks of a testing and inspection agency approved by the Authority, and indicating conformance with the applicable standard. In addition, all plywood when permanently exposed in outdoor applications, shall be of exterior type.

e) Wood Shingles and/or shakes shall be identified by the grade mark of a grading or inspection bureau or agency recognized by the Authority as being competent.

f) Fibreboard for its various uses shall conform to "Voluntary Product Standard, Cellulose Fibre Insulating Authority PS-57". Fibreboard sheathing when used structurally shall be so identified by an approved agency conforming to the Product Standard. Fibreboard should not be used for exterior structural purposes without specific approval of the Director.

g) Hardboard shall conform to the applicable Product Standard, "PS-58 Basic Hardboard", "PS-59 Prefinished Hardboard Panelling" or, "PS-60 Hardboard Siding", and shall be identified as to classification. Hardboard siding when used structurally shall be identified by an agency approved by the Authority as conforming to the Product Standard.

h) Particle board shall conform to American National Standard for Mat-Formed Wood Particleboard - ANSI A208.1. Particleboard shall be identified by the grade mark or Certificate of Inspection issued by an agency approved by the Authority.

i) Particle board sub floor or combination subfloor-underlayment shall conform to one of the Grades in Table 14-4.

j) Particle board should be used with caution. Particleboard used for sub flooring or roof decking or for wall sheathing should be moisture and termite resistant.

k) All lumber and plywood required to be treated shall bear an approved AWPB Quality Mark or that of an inspection agency approved by the Authority, that maintains continuing control, testing and inspection over the quality of the products.

l) Wood flooring of the various types shall be manufactured and identified as required in an appropriate standard such as:

- Laminated Hardwood Block Flooring - Interim Industry Standard HPMA-LF 1971.

- Flooring Grading Rules (Oak, Pecan Beech, Birch, Hard Maple) - National Oak Flooring Manufacturers Association.

- Hard Maple Flooring Standard Specification (Hard Maple, Beech and Birch) - Maple Flooring Manufacturers Association.

m) It is recommended that where rainwater is collected from a shingled roof a filter be installed at the inlet pipe to the storage tank.

1403.3 Sustainable timber mitigates climate change

Some guidance on specifying sustainable timber is given below:

(a) Timber must be specified from an appropriate source to be categorized as renewable.

(b) Wherever possible use timber from nearby sources.

© Select timber products with volatile organic compound limits, e.g. wood products that do not contain urea-formaldehyde resin.

1404 SIZES

(a) All timber structural members shall be of sufficient size to carry the dead and required live loads without exceeding the allowable deflections or working stresses specified. Adequate bracing and bridging to resist wind and other forces shall be provided.

(b) Sizes of timber members referred to by this Code are nominal sizes. The minimum acceptable net sizes conforming to normal sizes shall be within 2 percent of the minimum net sizes specified in AITC 100 at 19 percent moisture content. Computations to determine the required sizes of members shall be based on the net sizes contained in the standard.

1405 ALLOWABLE UNIT STRESSES

1405.1 General

(a) Timber joists and rafters shall be designed using the allowable unit stresses in AITC 100.

(b) Timber members supporting plastered ceilings shall be so proportioned that their deflection under full live load shall not exceed 1/360 of the span; and timber members, not supporting plastered ceilings, shall be

so proportioned that their deflection under full live load shall not exceed 1/240 of the span.

(c) The span of roof rafters shall be measured horizontally from bearing to bearing.

(d) Where there is an accessible space having a clear vertical height of 30" or more, ceiling joists shall be designed as having usable attic space.

1405.2 Plywood Stresses

(a) Working stresses of plywood other than those covered by the American Plywood Association Standard shall be determined according to the (APA) species.

(b) All plywood permanently exposed in outdoor locations shall be of exterior type, and where used for roof or exterior wall sheathing shall meet the performance standards for exterior type plywood in the APA standard

(c) Walls or roofs sheathed with plywood may be considered as diaphragms to distribute horizontal forces, based on structural analysis and/or tests; and where so used plywood shall be bonded with approved exterior adhesive. Adhesives are temperature sensitive and the potential for weakening of the adhesive due to global temperature rise shall be considered when plywood is specified.

(d) All plywood used structurally shall bear the identification of an approved agency as to type and grade, species of veneer used and conformance with the appropriate standard.

1405.3 Glued Laminated Members

(a) The Authority may require tests to determine the strength, permanence, effect of temperature, moisture and insect-resistance of adhesives; and only approved adhesives may be used.

(b) The Authority may limit or otherwise regulate the use of glued-laminated members after consideration of the manufacture, location and service conditions, including temperature..

1405.4 Timber Trusses

(a) Trusses shall be designed by methods admitting of rational analysis.

(b) Where metal is used for connecting wood members such metal shall be not less than 18 gauge and shall be galvanised.

(c) The allowable deflection under live load, for trusses shall be 1/360 of the span for plastered ceilings, 1/240 for unplastered finished ceilings, and 1/180 for trusses without a ceiling.

(d) The design of metal plate connected wood trusses shall comply with the "Design Specifications for Light Metal Plate Connected Wood Roof Trusses" - Truss Plate Institute, 2400 East Devon, Des Plaines, Illinois 60018, or other Standard approved by the Authority.

(e) Where trusses are to support mechanical or other equipment, the trusses shall be designed for such additional load.

1406 CONSTRUCTION DETAILS

An allowance shall be provided for differential movement at joints and interfaces between timber elements and other materials. The separation shall take into account the likelihood that global temperatures are increasing

1406.1 Roof Joists and Rafters

(a) Maximum spans for roof joists and rafters shall be in accordance with "Span Tables for Joists and Rafters", as published by the National Forest Products Association, or other acceptable design method.

(b) Joists shall be supported laterally at the ends by solid blocks or diagonal struts. Such bridging may be omitted where ends of joists are nailed to a header, band joist or to an adjoining stud.

(c) Notches on the ends of joists shall not exceed one-fourth (1/4) the depth. Holes bored for pipes or cable shall be on the neutral axis and at least two (2) inches from the top or bottom of the joist. The diameter of any such hole shall not exceed one-third (1/3) the depth of the joist. Holes shall not be less than three diameters apart. Notches for pipes in the top or bottom of joists shall not exceed one-sixth (1/6) the depth and shall not be located in the middle one-third (1/3) of the span.

1406.2 Roof Sheathing

(a) All rafters and roof joists shall be covered with sheathing such as:

1. **Lumber**

   Solid sheathing - Wood boards of three quarter (3/4) inch (net) minimum thickness

2. **Plywood**

   Applied in accordance with the provisions of Table 14-1(b).

3. **Insulating Roof Deck**

   Fibreboard insulating roof deck not less than one (1) inch nominal thickness.

(b) Joints in lumber sheathing shall occur over supports unless end-notched lumber or approved clips are used, in which case each piece shall bear on at least two rafters.

1406.3 Floor Joists

a) Maximum spans for floor joists shall be in accordance with the "Span Tables for joists and Rafters", as provided by the National Forest Products Association; or may be designed in accordance with other standard criteria.

b) Spans for field-glued plywood lumber floor systems using adhesives shall be as set forth in "APA Glued System", as published by the America Plywood Association. Adhesives for the APA Glued Floor System shall be those meeting the requirements of AFG-01, "Adhesives for Field Gluing Plywood to Wood Framing", as published by the American Plywood Association.

c) Except where supported on a one by four inch (1" x 4") ribbon strip and nailed to the adjoining stud, the ends of each joist shall have not less than one and one-half (1-1/2) inches of bearing on wood or metal nor less than three (3) inches of masonry.

d) Floor joists having a depth to thickness ratio exceeding six and the design live load is in excess of forty (40)pounds per square foot, shall be supported laterally by bridging or blocking installed at intervals not exceeding eight (8) feet.

e) Joists shall be supported laterally at the ends by solid blocks or diagonal struts except where the ends of joists are nailed to a beam (wood or steel with an attached nailer) header, band joists or to an adjoining stud.

f) Notches on the ends of joists shall not exceed one-fourth (1/4) the depth. Holes bored for pipes or cables shall not be within two (2) inches of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third (1/3) the depth of the joist. Notches for pipes in the top or bottom of joists shall not exceed one-sixth (1/6) the depth and shall not be located in the middle one-third (1/3) of the span.

g) Joists framing from opposite sides of a beam, girder or partition shall be lapped at least four inches and

fastened, or the opposing joists shall be tied together in an approved manner.

h) Joists framing into the side of a wood girder shall be supported by framing anchors, on ledger strips not less than two (2) by two (2) inches, or by other approved methods.

Table 14-1 (a)

Spans of Plywood Sub-floor Continuous over Two or More Supports

Panel Identification Index	Maximum Span (in)
32/16,36/16	16
42/20	20
48/24	24

Table 14-1(b)

Allowable Spans for Plywood Roof Sheathing Continuous over Two or More Supports (in.)

Panel Identification Index	Maximum span if block or other edge support (in.)	Maximum span with-out edge support (in.)
24/0 (1/2" only)	24	20
30/12	30	26
32/16	30	28
36/16	32	30
42/20	36	32
48/24	42	36

Notes:

(1) These values apply for Structural 1 and 11, C-D Sheathing and C-C grades only. Spans shall be limited to values shown because of possible effect of concentrated loads.

Edges may be blocked with lumber or other approved type of edge support.

(2) Identification Index appears on all panels in the construction grades listed in footnote (1).

(3) For roof live load of 40 psf, decrease span by 13 percent or use panel with next greater identification index.

(4) Plywood edges shall have approved tongue and groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finished floor is 25/32" wood strip. Allowable uniform load based on deflection of 1/360 of span is 165 psf.

(5) For joists spaced 24" on plywood sheathing with Identification Index numbers 42/20 or greater can be used for subfloors when supporting 1-1/2" lightweight concrete.

Table 14-2

Allowable Spans for Plywood Combination Subfloor-Underlayment

Plywood Continuous over Two or More Spans and Face Grain Perpendicular to Supports - Thickness in inches			
Species Groups	**Maximum Spacing of Joists (inches)**		
	16	**20**	**24**
1	1/2	5/8	3/4
2,3	5/8	3/4	7/8
4	3/4	7/8	1

Notes:

(1) Applicable to Underlayment grade, C-C (Plugged) and all grades of sanded exterior type plywood. Spans limited to values shown because of possible effect of concentrated loads. Allowable uniform load based on deflection of 1/360 of span is 125 psf. Plywood edges shall have approved tongue and groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32" wood strip.

(2) If wood strips are perpendicular to supports, thickness shown for 16" and 20" spans may be used on 24" spans. Except for 1/2 inch,

(3) Underlayment Grade and C-C (plugged) panels may be of nominal thickness 1/32 inch less than the nominal thickness shown when marked with the reduced thickness.

Table 14-3

Minimum Thickness of Lumber Sub-flooring

Joist spacing (in.)*	**Minimum net thickness for lumber placed (in.)**	
	Perpendicular to joists	**Diagonally to joists**
24	1-1/16	3/4
16	5/8	5/8
12	5/8	5/8

Note: **Joists in sub-flooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on at least two (2) joists.*

1406.4 Sub-flooring

a) All floor joists shall be covered with sub-flooring such as lumber, plywood or particle board. Sub-flooring may be omitted when tongue and groove boards are used as per 1406.4 (d)

b) The minimum thickness of lumber used as sub-flooring shall be in accordance with Table 14-3.

(c) Plywood shall be applied in accordance with the provisions of Table 14-2.

(d) Sub-flooring may be omitted when joist spacing does not exceed sixteen (16) inches and nominal one (1) inch tongue and grooved wood strip flooring is applied perpendicular to the joists.

(e) When resilient flooring is applied directly to plywood subfloor, it shall be applied in accordance with the provisions of Table 14-3 and fastened in accordance with a standard fastening system.

(f) Particleboard should be applied in accordance with the provisions of an acceptable fastening system in accordance with NPA - 1969 "How to Install Particleboard Underlayment" . When resilient flooring is applied directly to the particle board sub-floor, it shall be applied in accordance with the provisions of Table 14-4 and fastened in accordance with a standard fastening system.

Table 14-4

Allowable Spans for Particleboard Subfloor and Combined Subfloor-underlayment (1), (4)

Grade	Thickness (in.)	Maximum spacing of supports (2), (3)	
		Subfloor (in.)	Combined subfloor underlayment (in.)
2-M-W	5/8	16	16
2-M-W	21/32 3/4	16 19	16 19
2-M-F	3/4	19	19
2-M-F	3/4	19	19

Notes: *(1) All panels continuous over two (2) or more supports and the tongue-and-groove panels are installed with the long dimension perpendicular to supports.*

(2) Uniform deflection limitation: 1/360th of the span under 100 psf minimum load.

(3) Edges shall have tongue-and-groove joints or shall be supported with blocking unless 1/4" minimum thickness underlayment is installed, or finish floor is 25/32" wood strip.

(4) Floor sheathing conforming with this Table shall be deemed to meet the design criteria of 1406.4

1406.5 Post and Beam Framing

a) Where post and beam framing is used in lieu of stud and joist construction, the posts shall be located to support the beams above and shall be designed in accordance with sound engineering principles.

b) Intermediate framing shall be attached to the posts and braced so that the frame is capable of accepting lateral loads in addition to loads transferred by the sheeting.

1406.6 Stair Framing

a) Stair framing shall be supported adequately on floor framing or on walls or partitions.

b) Except in public stairs where the number and size of stringers shall be determined by engineering analysis, two (2) rough stringers shall be provided for each set of stairs, cut to receive finish treads and risers of uniform width and height.

c) Unless stringers are supported on partitions, and except for open staircases, the minimum effective depth at each notch shall be not less than three and one-half (3-1/2) inches.

1406.7 Joists Supporting Partitions

Bearing partitions parallel to joists shall be supported on beams, girders, walls, or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, wall or partitions more than the joist depth, unless such joists are of sufficient size carry the additional load.

1406.8 Exterior Wall Framing

Stud size and spacing of studs in one-and-two storey buildings shall be not less than two (2) by four (4) inches with the wide face perpendicular to wall. In three-storey buildings, studs in the first storey shall be not less than three (3) by four (4) inches or two (2) by six (6) inches. Studs shall be spaced not more than as shown in Table 14-5. However, the walls

shall be designed to resist the dead and live loads as per Section 12.

Table 14-5

Maximum Spacing of Studs (inches)

Stud size (in.)	Supporting roof and ceiling only	Supporting 1 floor, roof and ceiling	Supporting 2 floors, roof and ceiling
2 x 4	24	16	16
3 x 4	24	24	16
4 x 4	24	24	16
2 x 6	24	24	16

1406.9 Bracing of Exterior Stud Walls

a) Not less than three (3) studs shall be installed at every corner of an exterior wall, except that a third stud may be omitted through the use of continuous wood spacer or backup cleat of 3/8 inch thick plywood, 1 inch thick lumber or other approved devices which will serve as an adequate backing for the attachment of facing materials.

b) Stud walls shall be braced by one of the following methods:

1. Nominal one (1) inch by four (4) inch continuous diagonal strips set into the face of the studs and top and bottom plates at each corner of the building.

2. Wood boards of five-eighths (5/8) inch (net) minimum thickness, applied diagonally.

3. Wood sheathing panels two (2) by eight (8) feet of five-eighths (5/8) inch minimum thickness applied horizontally.

4. Plywood sheathing panels not less than forty-eight (48) inches wide and ninety six (96) inches long applied vertically or horizontally.

c) Sheathing shall be applied on the exterior walls of all Type 5 buildings (Table 3-2), more than one (1) storey in height except when back plastered stucco construction is used. However, where sheathing is not being used the method of applying the waterproof wall finish shall be carried out to the approval of the Director.

d) Sheathing, where required for exterior walls, shall be applied solidly over the wall surface and shall be one or more of the following materials and shall be installed in accordance with the manufacturers' recommendations:

1. Wood and sheathing panels five eighths (5/8) inch minimum thickness.

2. Plywood complying with Table 14-5 shall be not less than five-sixteenths (5/16) inch thick for sixteen (16) inch stud spacing or not less than three-eighths (3/8) inch for twenty-four (24) inch stud spacing. Plywood of exterior type complying with 1406.8, may also serve as siding.

Table l4-6

Allowable Spans for Plywood Wall Sheathing

Panel identification	**Maximum stud spacing and construction (in)** **Exterior covering nailed to:**	
	Stud	**Sheathing**
5/16	16	16
3/8 and 1/2	24	16
3 ply	24	24
1/2 (4 and 5 ply)	24	24

Notes: *a)* *When plywood sheathing is used, building paper and diagonal wall bracing can be omitted.*

b) *When siding such as shingles is nailed only to the plywood sheathing, apply plywood with face grain across studs.*

1406.10 Interior Bearing Partitions

a) Studs in one (1) two (2) storey buildings shall be not less than two (2) x four (4) inches with the wide face perpendicular to the partitions. In three (3) storey buildings, studs in the first storey shall not be less than three (3) by four (4) inch or two (2) by six (6) inches.

b) Studs shall be spaced not more than shown in Table 14-5.

c) Headers shall be provided over each opening in interior bearing partitions.

d) Studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with exterior walls. End joints in double top plates shall be offset at least twenty four (24) inches. For platform frame construction, studs shall rest on a single bottom plate.

Exception: A single top plate may be installed but must be designed so as to provide continuity of the capping.

1406.11 Exterior Wall Coverings

Exterior wall coverings of other than the following shall be of material approved for exterior use and shall be applied in accordance with the manufacturers' recommendations when not otherwise covered in this Code. Exterior wall coverings shall provide weather protection for the building at the walls.

(a) **Weather-boarding.** Wood siding patterns known as rustic drop siding or shiplap shall have an average thickness in place of not less than nineteen-thirty seconds (19/32) inches and shall have a minimum

thickness of not less than three-eighths (3/8) inches. Bevel siding shall have a minimum thickness measured at the butt section of not less than seven-sixteenths (7/16) inches and a tip thickness of not less than three-sixteenths (3/16) inches. Siding of lesser dimensions may be used provided such wall covering is placed over sheathing which conforms to the provisions of 1406.9.

(b) **Wood Shingles or Shakes.** Wood shingles or shakes attached to sheathing other than wood or plywood shall be secured with approved mechanically-bonding nails or by corrosive resisting common nails on shingle nailing boards securely nailed to each stud with two 8d nails. Wood shingles or shakes may be applied over fibreboard shingle backer and fibreboard sheathing with approved non-corrosion annular grooved nails or may be nailed directly to fibreboard sheathing with non-corrosion annular grooved nails. The minimum thickness of wood shingles or shakes between nailing boards shall be not less than three-eighths (3/8) inches.

(c) **Plywood.** Plywood shall be of the exterior type and shall have a minimum thickness of three-eighths (3/8) inches. All plywood joints shall be backed solidly with nailing pieces not less than two (2) inches in width, unless wood or plywood sheathing is used, or joints are lapped horizontally, or otherwise made waterproof.

(d) **Stucco.** Stucco or exterior plaster shall conform to requirements of Section 15.

(e) **Metal**. Exterior wall coverings may be of formed metal not less in thickness than 18 gauge. For aluminum siding, the instructions of the manufacturers are to followed.

(f) **Flashing** shall be provided as necessary to prevent the entrance of water at openings in, or projections through exterior walls; at intersections of exterior wall coverings of different materials, unless such materials are provided with self-flashing joints; at

other points subject to the entrance of water. Caulking shall be provided where such flashing is determined by the Director to be impractical.

1406.12 Roof Covering

(a) Any roof covering permitted in this Code may be applied to dwellings. Whenever composition roofing is used, solid sheathing shall be applied.

(b) Flashings shall be placed around openings and extensions of mechanical appliances or equipment through the roof and otherwise as necessary to provide adequate drainage.

(c) All roof coverings shall be installed in accordance with standard approved practices and in accordance with manufacturer's instructions.

(d) The fire resistive rating of the roof covering shall be approved by the Director for the specific application desired.

1407 VENTILATION

(a) The space between ceiling joists and roof rafters shall be effectively ventilated. Openings shall be located to provide effective cross-ventilation, and such openings shall be covered with a corrosion-resistant mesh.

(b) The space between the bottom of wood-floor joists and the ground of any building, except such space as is occupied by a basement or cellar, shall have ventilating openings through foundation walls, and such openings shall be covered with a corrosion-resistant wire mesh. Where practicable, ventilating openings shall be arranged on three sides. The minimum total area of ventilating openings shall be 2 sq.ft. for each 15'0" of exterior wall. Such openings need not be placed in the front of the building.

(c) Where wood-floor joists are used, there shall be not less than 18" distance between the bottom of such floor joists and the ground beneath.

SECTION 15

CONCRETE BLOCK AND MASONRY CONSTRUCTION

Contents

SECTION 15

CONCRETE BLOCK AND MASONRY CONSTRUCTION

1501 SCOPE

(a) All masonry construction shall conform to the provisions of this Section and other applicable Sections of this Code. The principal reference Codes and Standards are CUBiC Part 2 Section 4 - Structural Requirements - Block Masonry, and ACI 530-92 - Building Code Requirements for Masonry Structures.

(b) In all cases masonry shall be of adequate thickness, strength and proportions to support all superimposed loads within the allowable working stresses prescribed.

(c) All masonry materials are required to meet the specifications as outlined in 1502. If the Director has reason to doubt that the materials meet the applicable specifications he may require tests on the materials.

(d) Masonry units may be re-used when clean, whole and conforming to the other requirements of this Section, except that the allowable working stresses shall be fifty (50) percent of those permitted for new masonry units.

(e) Masonry units to be reused as structural units in areas subject to the action of the weather or soil shall not be permitted unless representative samples are tested for compliance with the applicable requirements of Section 1502.

(f) The wall thickness and other specified dimensions are nominal dimensions. The actual masonry or wall dimensions may vary from the nominal dimensions by not more than one-half (1/2) inch.

(g) Where masonry units are used as veneer, weepholes shall be provided at four (4) feet on centers by omitting mortar in the vertical joints at the bottom course of the veneer or at the lintels in multi-storey buildings. A shield or insect barrier shall be provided having openings or louvers one-sixteenth (1/16) inch or less which drains and dries the inner cavity but will retain poured insulation.

(h) All brick masonry units, except hollow clay and shale brick, shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled. The average thickness of head and bed joints shall not exceed one-half (1/2) inch.

1502 QUALITY, TESTS AND APPROVALS

1502.1 General

(a) Quality. The quality of materials assembled into masonry and the method and manner of their assembly shall conform to the requirements of 1502.

(b) Other material of masonry, other than set forth herein, which is incombustible and otherwise sufficiently embodies the characteristics and satisfies the requirements of one of the materials herein may be specified by the designer of the building, but the use of such material shall be subject to the approval of the Director.

1502.2 Brick

The structural use of brick shall be avoided except where special provision can be made for reinforcement and/or for composite behaviour with other members of materials such as steel or reinforced concrete.

(a) General. Bricks shall include masonry units up to 4-1/4" thick, 4-1/4" wide and 8-3/4" long not less than 75 percent solid.

(b) Tests. Tests shall be made in accordance with BS 1257, or other standard approved by the Director.

(c) Quality. Bricks shall conform to the relevant British or American Standard.

1502.3 Hollow and Solid Concrete Masonry Units

(a) Hollow concrete masonry units shall be of a quality at least equal to that required by "Specifications for Hollow Load-Bearing Concrete Masonry Units, ASTM C90", or "Specifications for Solid Load-Bearing Concrete Masonry Units, ASTM C145", when used for bearing walls or piers or when in contact with the ground or exposed to the weather, or equal to "Specifications for Hollow Non-Load-Bearing Concrete Masonry Units" ASTM Cl29 when used for non-load bearing purposes and not exposed to the weather.

(b) Structural concrete filler-block or floor tile when included in strength calculations in ribbed floor construction shall have webs and shells not less than one inch thick, unless otherwise designed, and shall develop an average compressive strength on the net area not less than that of the rib concrete.

c) Concrete in-fill shall be in accordance with Table 15-3 (A) or with CUBiC Table 2.405.1.

1502.4 Mortar and Grout Materials, Proportions and Workability.

(a) Mortar and its ingredients shall be of a quality at least equal to that required by "Standard Specifications for Mortar for Units Masonry", ASTM C270, or "Stan-

dard Specifications for Mortar and Grout for Reinforced Masonry", ASTM C476 or the relevant British standard.

(b) Masonry cement shall be of a quality at least equal to that required by "Masonry Cement, ASTM C91".

(c) The type of mortar used for any specific job shall be as required in Table 15-2.

(d) Grout for non-reinforced and reinforced masonry shall conform to "Standard Specifications for Mortar and Grout for Reinforced Masonry", ASTM C476.

(e) Where mortar type is determined in accordance with Table 15-1 the volume of aggregate in mortar shall be not less than two and one-fourth (2-1/4) times but not more than three times the volume of cementitious material. When mortar type is determined by proportions, the aggregate ratio shall comply with Table 15-3.

1503 WORKING STRESSES

1503.1 General Requirements

(a) In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

(b) The thickness of masonry walls shall be sufficient at all points to withstand all vertical and horizontal loads as specified in Section 12.

(c) Stresses shall be calculated on actual rather than nominal dimensions.

(d) The maximum allowable stresses in masonry shall not exceed those set out in this Section, unless it can be determined by accepted engineering analysis that the design meets all safety requirements.

1503.2 Working Stresses in Un-reinforced Masonry

Except as may be permitted by the Director on the basis of a rational engineering design, the compressive stresses in un-reinforced masonry shall not exceed the values given in Table 15-4.

1503.3 Higher Working Stresses

Higher stresses than herein specified may be used, but only if it is clearly established to the satisfaction of the Director, by tests, or other approved evidence, that material of a higher grade or a superior workmanship than is generally provided in accepted practice will be employed under approved inspection. Higher stresses, however, shall not be used unless approval is given by the Director in writing.

1503.4 Allowable Stresses in Composite Walls

In composite walls or other structural members composed of different kinds or grade of masonry units or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the units and mortars of which the wall or member is composed.

1503.5 Allowable Stresses in Plain Concrete

Unless designed in accordance with the provisions of Section 16, structural members of plain concrete shall be proportioned for allowable stresses not to exceed twenty-five (25) percent for compression and three (3) percent for tension in extreme fiber in flexure of the compressive strength of the concrete. When the ratio of height to thickness exceeds ten (10), the percentages for compression stress shall be reduced proportionately to eighteen percent for a ratio of height to the thickness of 20.

1503.6 Shear

The shear in unit masonry shall not exceed one tenth the allowable compressive stress.

1503.7 Tension

Un-reinforced unit masonry shall be assumed to have no value in resisting tension.

1503.8 Concentrated Loads

Walls of hollow masonry units shall not directly support concentrated loads. Such loads shall be carried by concrete padstones or capping beams.

1504 CONSTRUCTION DETAILS

1504.1 General

(a) Masonry walls of hollow or solid units or plain concrete shall be constructed as specified in Part 2 Section 2.400 of CUBiC, or in accordance with alternative rational design and detailing based on the fundamental principles of structural engineering.

(b) Reinforced concrete shall comply with the requirements of Section 16 of this Code.

(c) Part 2 Section 2.445 of CUBiC is applicable for the construction of small single or two storey buildings to resist seismic and hurricane loads.

1504.2 Walls

(a) Load-bearing walls of unit masonry shall have a minimum thickness of 6" except as otherwise approved by the Director on the basis of engineering calculations showing that the wall can resist adequately the calculated vertical and horizontal forces.

(b) No roof or other members shall be so placed that they will develop direct horizontal thrust on walls unless such walls are specifically designed to withstand such thrust.

(c) The maximum area of wall panels of 6" or 8" thick unit masonry, as measured between the concrete members which frame the panel such as the beams and its columns, shall not exceed 256 sq.ft. unless otherwise approved by the Director on the basis of engineering calculations provided by the design engineer.

(d) For resistance to seismic and lateral forces, walls of hollow concrete block shall be designed in accordance with CUBiC Part 2, Section 4 - Structural Design Requirements Block Masonry, or in accordance with any other Code approved by the Director.

(e) Wall reinforcement shall be as required by Seismic Performance Category C for buildings in seismic zones with peak ground accelerations of 0.2g to 0.3g. (These zones include Grenada, St Vincent, St Lucia and Montserrat.) Police stations and buildings housing emergency medical facilities and other buildings as required by the Director shall be designed in accordance with Seismic Performance Category D. (See CUBiC 2.424).

(f) A check shall be made to establish if the minimum reinforcement in block walls is adequate for walls under wind or earthquake loads.

1504.3 Stiffener columns

(a) Concrete stiffener columns shall be required in walls of unit masonry as follows:

(i) The maximum area of wall panels of 6" or 8" thick concrete block as measured between the concrete members which frame the panels, such as the beams and stiffener columns shall be 256 square feet.

(ii) At intervals not exceeding 20' 0" between columns.

(iii) At corners and junctions of load bearing walls, unless the walls are properly bonded into one another and no opening occurs within 1' 4" of the nearest wall face at the corner.

(iv) At the end of load bearing walls

(v) Notwithstanding the above, concrete stiffener columns shall also be required adjacent to any wall opening if the omission of the columns would result in stresses in the block work greater than that permitted under 1503.4 at the ends of free standing walls.

(b) Structurally designed columns may be substituted for the stiffener columns herein required. When interior

cross-walls are properly bonded into the external wall these may be assumed to act as ties to the columns, provided no openings occur in either the exterior walls or the interior cross walls within 1' 4" of the nearest wall face.

Note: A corner or junction shall be considered to be properly bonded if all holes in all hollow blocks forming the junction are filled with concrete as per CUBiC Part 2 Section 4 Table 2.405.1, and reinforced with No 4 bars. Concreting of the cavities shall be in accordance with CUBiC 2.409.17.

(c) Stiffener columns shall not be less than 12" in width unless otherwise approved by the Director. Stiffener columns having an unbraced height exceeding 15' 0" shall be not less in thickness than the wall and not less than 9". The column shall be designed to resist applicable lateral loads based on rational analysis. The unbraced height shall be taken at the point of positive lateral support.

(d) Stiffener columns shall be reinforced in accordance with Part 2 Section 4 of CUBiC (2.413) and with not less than 0.010 times the gross cross-sectional area of the concrete, nor less than four 1/2" diameter bars, with 1/4" diameter links spaced at 12 " centres generally and in accordance with 2.413.8 of CUBiC. Vertical reinforcing shall be tied to the footing and splices shall be lapped 30 bar diameters. The cover to the reinforcement (including links) shall be not less than 1".

(e) The concrete stiffener columns set forth herein are a minimum to limit masonry panel areas and provide an integrated framework for masonry. The spacing of concrete columns for skeleton frame construction may exceed the spacing herein set forth provided the masonry panels have an area of less than 256 sq.ft, and the structural system is designed to transmit horizontal wind loads to the columns.

(f) Concrete stiffener columns designed to limit masonry panel areas may be offset at tie beams or other horizontal members to avoid openings, but the maximum spacing shall not be exceeded.

(g) Concrete stiffener columns in load-bearing walls shall normally be poured only after the masonry units are in place. Where masonry walls in skeleton frame construction are laid up after the frame has been erected they shall be properly tied to the frame with vertical bars at 16" centres and horizontal bars at 24" centres. Where structural steel members are fire-protected with masonry units the panel walls shall be bonded into such units.

(h) For small masonry buildings the requirements set forth in CUBiC Part 2 Section 4 or those set forth in the Building Guidelines apply.

1504.4 Tie Beams or Belt Courses

(a) Tie beams of reinforced concrete shall be placed in all walls of unit masonry, at each floor or roof level and at such intermediate levels as may be required to limit the vertical heights of the masonry units to 12' 0". For external walls of 6" concrete block the vertical height shall be no greater than 9' 0".

(b) A tie beam shall be not less in dimension than required for the conditions of loading nor less than the following minimums: the width of a tie beam shall be not less than the width of the wall supporting it; the depth of such a beam shall be not less than 8".

(c) The tie beam shall be continuous. Continuity of the reinforcing in straight runs shall be provided by lapping splices not less than 30 diameters for deformed bars. Continuity shall be ensured at corners by providing positive anchorage to the main reinforcement. Continuity at columns shall be provided by continuing horizontal reinforcing through columns or by bending horizontal reinforcing in the columns a distance of 30 diameters.

(d) Changes in level of tie beams shall be made at columns.

(e) A tie beam may follow the rake of a gable or shed end.

(f) The concrete in tie beams shall be bonded to the masonry units immediately below and shall not be separated therefrom by wood, felt, or any other material which may prevent bond.

1504.5 Parapet Walls

Masonry parapet walls shall be reinforced with minimum stiffener columns as previously specified and shall be coped with a concrete beam not less than 24 sq.in. in cross-section, reinforced with two 3/8" diameter reinforcing bars.

A parapet wall exceeding 5' 0" in height above a tie beam or other point of lateral support shall be specifically designed to resist horizontal wind and other loads.

1504.6 Piers

(a) In any section of a load-bearing masonry wall where openings are arranged to leave a load-bearing section of wall less than 16" wide, such section shall be of steel or reinforced concrete.

(b) Isolated masonry piers shall be so construct-ed that the height of any such pier shall not exceed ten times the least dimension.

1504.7 Brick and Stone Walls

Load bearing walls of brick and stone shall be laterally supported by stiffener columns and tie beams, or the equivalent thereof, as detailed in 1504 and shall meet these additional requirements:

(1) In all brick walls at least every sixth course on both sides of the wall shall be a header course or there shall be at least one full header in every 72 sq.in of each wall surface. In walls more than 12" thick, the

inner joints of header courses shall be covered with another header course which shall break joints with the course below.

(2) Rubble stone walls shall be 4" thicker than is required for solid brick or concrete walls of the same respective heights but no part shall be less than 16" thick.

1504.8 Partitions

(a) The requirements specified herein shall apply to non load bearing partitions, other than fire walls, of unit masonry construction.

(b) The lateral distance between vertical supports of non load bearing interior partitions of unit masonry shall not exceed 36 times the actual thickness of the partition, excluding plaster, and the height shall not exceed the length.

(c) A partition which does not extend to full storey height shall be capped with a concrete beam at least 4" high and of width at least equal to the width of the partition. The beam shall be reinforced with a single 3/8" diameter bar to which all vertical reinforcing bars shall be anchored.

1504.9 Decorative Masonry Screens

Decorative grills or screens constructed of masonry laid with cells through the wall shall be non load bearing, and shall have units so bonded and reinforced as to resist all overturning moments.

1505 CHANGE IN WALL THICKNESS

Except for permissable chases and recesses, walls shall not vary in thickness between their lateral supports. Where cavity walls or walls of hollow masonry units are decreased in thickness, a course of solid masonry not less than four (4) inches in thickness shall be interposed between the wall below and the thinner wall above, or the hollow units in the top course of the thicker wall shall be filled solidly with

concrete (of 1:3:6 mix) or with Type S mortar or grout in accordance with ASTM 476C.

1506 CHASES

Chases in masonry walls shall be in accordance with 2.409.24 to 2.409.26 of CUBiC.

1507 SUPPORTED STRUCTURAL MEMBERS

When combustible structural members frame into walls of thickness not greater than twelve (12) inches, they shall project not more than four (4) inches into the wall and shall be so spaced that the distance between embedded ends is not less than four (4) inches. The space above, below and between such members shall be filled solidly with mortar, grout, concrete, or equivalent fire-resistive material to a depth of not less than four (4) inches on all sides of the members.

1508 SUPPORT ON WOOD

a) Masonry shall not be supported on combustible construction, except that prefabricated partitions weighing not more than thirty (30) pounds per square foot, properly strapped or reinforced and provided with proper nailing devices for attachment, may be supported on combustible construction, provided the supporting construction has been designed to carry such loads.

b) Concrete decks for roofs or floors may be supported on timber columns provided such decks and their supporting members have been designed in accordance with accepted engineering practices and that special provision is made to provide resistance to wind and earthquake forces.

c) When exposed to the weather the wood supporting members shall be of approved wood of natural decay resistance and pressure treated against termites and

shall be separated from the concrete by the use of a membrane covering.

1509 ARCHES AND LINTELS

The masonry above openings shall be supported by well buttressed arches or lintels of non combustible materials which shall bear on the wall at each end for not less than four (4) inches. In addition, the bearing area shall be sufficient to prevent a concentration of compressive stresses greater than those allowed in Table 15-4.

1510 CONSTRUCTION PRECAUTIONS

a) Except when carried independently by girders at each floor, a masonry wall shall not be built up more than twenty-five (25) feet in height in advance of other walls of the building. Walls shall be adequately braced during erection.

b) Masonry walls in locations where they may be exposed to high winds during erection shall not be built higher than ten (10) times their thickness unless adequately braced or until provision is made for the prompt installation of permanent bracing at the floor or roof level immediately above the story under construction.

c) Back fill shall not be placed against foundations walls until they have been braced to withstand the horizontal pressure.

1511 GROUTED AND FILLED MASONRY

Grouted and filled masonry blocks is a form of construction made with clay, or concrete units in which the interior vertical spaces are filled with grout. The interior vertical spaces shall consist of continuous cavity space between unobstructed vertical cells of hollow units. Grouted masonry shall conform to all requirements this Code.

1512 MORTAR AND GROUT

(a) Mortar shall conform to "Specification for Mortar for Unit Masonry ASTM C270". Grout shall conform to the applicable requirements of "Specifications for Mortar and Grout for Reinforced Masonry - ASTM C476," or shall be Type M or Type S mortar to which sufficient water has been added to produce pouring consistency. Mortar and grout for reinforced masonry shall be in accordance with ASTM C476.

(b) Where the minimum continuous clear opening of a grout space exceeds six (6) inches, it may be filled and treated as unreinforced monolithic concrete. Masonry shall be laid in mortar of the types specified in Tables 15-2 and 15-3.

Table 15-1

Minimum Compressive Strength of Mortar

Type	**Minimum Compressive Strength at 28 days (psi)**
M	2,500
S	1,800
N	750
O	350

Note: Average of three 2 inch cubes of laboratory prepared mixed mortar, in accordance with ASTM C270. "Standard Specifications for Mortar for Unit Masonry".

Table 15-2

Types of Mortar Required

Type of Masonry	**Type of mortar permitted**
Foundations: (below grade masonry)	
Footings	M or S
Walls of Solid Units	M,S or N
Walls of Hollow Units	M or S
Hollow Walls	M or S
Masonry: Other Than Foundation Masonry	
Piers of Solid Masonry	M, S or N
Piers of Hollow Units	M or S
Walls of Solid Masonry	M, S, N or O
Walls of Hollow Masonry	M, S, or N
Hollow Walls and Cavity Walls	
(a) Design Wind Pressure Exceeds 20 psf.	M or S
(b) Design Wind Pressure 20 psf or less	M, S or N
Glass Block Masonry	M, S or N
Non-Load Bearing Partition	M, S, N, O
Fire Brick	Refractory air setting mortar
Masonry Other Than Above	M, S or N

Note: Type S mortar is to be preferred whenever Type M mortar is not required in order to meet the structural requirements.

Table 15-3

Mortar Proportions by Volume

Minimum Compressive Strength of concrete block on Gross Cross Sectional Area. (psi)	**Mortar Mix (Cement:lime:sand)**	**Minimum Compressive Strength of mortar (psi)**
1,500	1:0-1/2:3	2,500
1,000	1:0-1/2:4	1,800
*700	1:0-1/2:4	750

Note:

(a) The compressive strengths used have been converted from SI units. Tables 2.403.1 and 2.404.1 of Part 2 Section 4 of CUBiC should be read for the compressive strengths based on test results.

*(b) This grade of concrete blocks to be used for non-loadbearing walls only.

(c) For the purpose of these specifications, the weight of one (1) cubic foot of the respective materials used shall be considered to be as follows:

Portland Cement	94 pounds
Hydrated Lime	40 pounds
Sand	80 pounds of dry sand

Table 15-3 (A)
Properties of In-fill Concrete

Minimum Compressive Strength on 6" cubes at 28 days	**Concrete Mix for Cavity In-fill (cement: sand: coarse aggregate)**	**Minimum Compressive Strength of Concrete Block**
2,300	1:3:6	1,000
3,300	1:2:4	1,800

Note: *Aggregate size should not be greater than 3/4". See CUBiC Part 2 Section 4.*

Table 15-4

Allowable Compressive Stresses for Empirical Design of Masonry*

Construction: Compressive Strength of Unit, gross area, (psi)	**Allowable compressive stresses gross cross section area (psi)**	
	Type M or S Mortar	**Type N Mortar**
Solid masonry of brick and other solid units of clay or shale, sand lime or concrete brick		
	350	300
8,000 or greater	225	200
4,500	160	140
2,500	115	100
1,500		
Grouted solid masonry of clay or shale, sand lime or concrete		
4,500 or greater	225	200
2,500	160	140
1,500	115	100
Masonry of solid concrete masonry units		
3,000 or greater	225	200
2,000	160	140
1,200	115	100
Masonry of hollow load bearing units		
	140	120
2,000 or greater	115	100
1,500	75	70
1,000	60	55
700		
Piers of hollow units, cellular spaces filled as in Section 15.	95	90

Hollow walls (non-composite masonry bonded)		
Solid units		
2,500 or greater	160	140
1,500	115	100
Hollow units	75	70

*** Masonry Structures Building Code (ACI 530-92/ASCE 5-92/TMS 402-92)**

Notes: *Linear interpolation for determining allowable stresses for masonry units having compressive strengths which are intermediate between those given in the Table.*

The allowable shear and tension working stresses are given in Table A102-2 of Part 2 Section 4 Appendix 1 of CUBiC.

Table 15-5

Specified Compressive Strength of Masonry Based on Specifying the Compressive Strength of Masonry Units*

Compressive Strength of Concrete Masonry Units (psi)	**Specified Compressive Strength of Masonry**	
	Type M or S Mortar	**Type N Mortar**
4,800 or more	3,000	2,800
3,750	2,500	2.350
2,800	2,000	1,850
1,900	1,500	1,350
1,250	1,000	950

***See ACI 530-92 Masonry Structures Building Code**

SECTION 16

PLAIN AND REINFORCED CONCRETE

Contents

SECTION 16

PLAIN AND REINFORCED CONCRETE

1601 GENERAL

(a) Reinforced and plain concrete shall be of materials, proportions, strength and consistency as set forth in this Section and shall be designed by methods admitting of rational analysis according to established principles of mechanics.

(b) Standards of design and construction for reinforced concrete shall be in accordance with the provisions of the "Building Code Requirements for Reinforced Concrete, ACI 318.1 M-89", or in accordance with BS 5328 "Concrete", and for plain concrete in accordance with the "Building Code Requirements for Structural Plain Concrete ACI 322."

(c) All members to be constructed of plain or reinforced concrete shall be designed to resist effectively the loads imposed in accordance with Section 12.

1602 CONCRETE QUALITY

(a) Concrete mixes shall conform generally to those set out in Table 16-1. Where required by this Code, tests of concrete to determine suitable proportions of fine and coarse aggregates shall be carried out under the supervision of a qualified engineer. Where laboratory tests show that the required strengths may be obtained using higher water/cement ratios, the ratios given in Table 16-1 may be varied accordingly subject to the approval of the Director.

(b) The Director may accept concrete mixed by volume provided the use of the concrete so mixed is limited to minor building works.

(c) The Director may request that all plans submitted for approval or used for construction of a building or other works show clearly the class of concrete used in the design of all parts of the structure.

(d) For grading of concrete mixes in accordance with BS 5328: "Concrete", see Table 16-2.

1603 MATERIALS AND TESTS

1603.1 General

(a) The Director shall have the right to order testing of any materials used in concrete construction to determine if the materials are of the quality specified.

(b) Tests of materials and of concrete shall be made in accordance with standards of the American Society for Testing and Materials. All tests are at the expense of the owner.

(c) A complete record of tests of materials and of concrete placed shall be available for inspection by the Director during progress of work and for 2 years after completion of the project, and shall be preserved by the inspecting engineer or architect or owner (where no professionally qualified architect or engineer has been employed) for that purpose.

1603.2 Cements

(a) Cement shall conform to one of the following specifications for Portland cement:

(1) "Specification for Portland Cement" ASTM C150.

(2) "Specification for Blended Hydraulic Cements" ASTM C595, excluding Types S and SA which are not intended as principal cementing constituents of structural concrete, or to any other equivalent standard approved by the Authority.

(b) *Reducing the Portland cement content of the concrete mix is a significant contribution to the mitigation of climate change.* Cement replacement materials have been found within the OECS and used to make Portland-pozzolanic blended cements.[1] Their use depends on the lifespan and exposure conditions of the structural element. When combining Portland cement with cement substitutes, designers shall be guided by test results from an approved research laboratory.

Almost all concrete properties are affected by the combination of Portland cement with a cement substitute. Designers shall optimize[2] their choice in view of the fact that the strength class is typically lowered and early strength gain is typically hindered by reduction of

[1] *Tarrish from Dominica and Nevis, Pumice from St Lucia and Martinique, and Volcanic ash from Montserrat all have the potential to be cement replacement materials. It is important to be cautious until the material properties are well defined. Exploitation depends on uniformity and extent of the deposit, and particularly its pozzolanic properties.*

[2] *Increasing the dimensions of the concrete element counterbalances the reduction in embodied carbon associated with cement replacement.*
The durability of the structure is also affected and must be examined in terms of the exposure level and whole life cost of the project. Fresh concrete properties such as heat of hydration must also be considered, as well as potential reactions with the aggregate used.

the Portland cement content.

(c) Cement and cement substitutes used in the work shall correspond to those used in the concrete mix design.

(d) *Admixtures are used to change the properties of fresh or hardened concrete, by means of adding a small quantity of material to the concrete mix. The amount used is so small that there is no noticeable increase in carbon footprint.* In lieu of cement replacement, admixtures may be used in accordance with BS 8500 to lower the cement content of the mix. In the presence of admixtures, the minimum cement content specified in BS8500 for the given exposure condition[3] and specified cover to the reinforcement, shall be provided.

1603.3 Aggregates

(a) The use of natural aggregates for normal structural concrete shall be in accordance with Appendix F of CUBiC Part 2 Section 6 and with ASTM C33 "Specification for Concrete Aggregates". *The grading of aggregates is particularly important since loose dust in significant proportions can be detrimental.*

The use of recycled concrete aggregates[4] in concrete mixes, whether for structural purposes or not, shall be in the proportions stated in BS 8500-2 or a later version of the same code. They should only be used if the material is locally available, and if the cement content does not have to be increased to compensate for the use of recycled material.

The use of recycled aggregates in concrete mixes is for non-structural concrete only[5], and shall be in accordance with BS 8500-2 or a later version of the same code.

(b) Aggregates failing to meet the specifications listed in 1603.3 (a), but which have been shown by special tests or actual service to produce concrete of adequate strength and durability may be used where authorized by the Director. This includes the use of secondary aggregates[6]

Concrete produced with some regionally occurring aggregates has deteriorated due to alkali-silica reaction. The accelerated mortar bar test ASTM C1567, or the mortar bar test ASTM C1260, shall be used whenever the potential for alkali-silica reactivity must be investigated.

[3] *Admixtures can increase the durability of hardened concrete*

[4] *Recycled concrete aggregates are obtained mainly by crushing concrete components of existing construction. Typically a RCA replaces some of the coarse aggregate in the mix, but little if any of the sand component.*

[5] *Recycled aggregates are obtained by crushing inorganic material previously used in construction, e.g. masonry, and their composition is more variable than for recycled concrete aggregates.*

[6] *Secondary aggregates include crushed material that was not formerly construction waste. A range of granular inorganic material falls into this category, provided that the particle size, strength, surface texture and chemical stability are suitable. For example crushed glass has been used to replace sand in the concrete mix.*

As a safeguard, a low alkali cement or low alkali blended cement (having less than 0.6% sodium oxide) shall be used with aggregates of volcanic origin.

Where there is a significant lifespan, or severe exposure condition (eg. tunnels, bridges or dams), the potential for deterioration due to environmental factors and mix design shall be investigated to the satisfaction of the Director.[7]

(c) Nominal maximum size of coarse aggregate shall be not larger than:

(1) 1/5 the narrowest dimension between sides of forms nor

(2) 1/3 the depth of slabs, nor

(3) 3/4 the minimum clear spacing between individual pre-stressing tendons or ducts.

These limitations may be waived if, in the judgement of the Director, workability and methods of consolidation are such that concrete can be placed without honeycombs or voids.

1603.4 Water

(a) Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or reinforcement.

(b) Mixing water for pre-stressed concrete or for concrete that will contain any aluminum embedment, including that portion of mixing water contributed in the form of free moisture on aggregates, shall not contain deleterious amount of chloride ions.

(c) Non-potable water may be used in concrete if the following are satisfied:

(1) Selection of concrete proportions shall be based on concrete mixes using water from the same source.

(2) Mortar test cubes made with non-potable mixing water shall have 7-day and 28-day strengths equal to at least 90 percent of strengths of similar specimens made with potable water. Strength test comparisons shall be made on mortars, identical except for the mixing water, prepared and tested in accordance with ASTM C109 - "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50 mm Cube Specimens)".

[7] *Rising sea levels or rising ground water levels may increase the severity of exposure for these critical structures. Consider the potential for sulphate attack.*

1603.5 Reinforcement

(a) Deformed reinforcement shall conform to one of the specifications of the relevant ASTM standard except as provided in ACI 318. Reinforcement conforming to other standards may be permitted by the Director provided that tests carried out by a laboratory approved by the Authority show that the reinforcement to be used is at least equal in quality to that specified in ACI 318.

(b) Prestressing tendons shall conform to the relevant ASTM standard. Wire strands, and bars not specifically listed in ASTM A421, A416, or A722 may be used provided they conform to minimum requirements of these specifications and do not have properties that make them less satisfactory than those listed in ASTM A416, A421, or A722.

(c) Reinforcement consisting of structural steel, steel pipe, or steel tubing may be used as specified in ACI 318.

(d) All welding of reinforcement shall conform to the "Structural Welding Code-Reinforcing Steel, AWS D1.4" of the American Welding Society or equivalent standard approved by the Authority.

Reinforcement to be welded shall be indicated on the drawings and welding procedures to be used shall be specified. The Director may require the owner to provide a report (with appropriate tests) on the welding carried out.

Note: The designation of reinforcing bars is in conformance with US standards unless otherwise stated.

1603.6 Tests on concrete

(a) The Director may require tests to be made during progress of the work, or may specify and set forth in writing such rules for requiring tests to be made by an approved agency as he may consider necessary to ensure compliance with the Code. Not fewer than three specimens shall be made for each standard test, nor fewer than one test for each 38 cubic metres (50 cubic yards) of concrete or for each day's pour of concrete used at any job site, where pours may be less than 38 cubic metres (50 cubic yards). Tests shall be carried out in accordance with ASTM C172 or other approved standard. All tests will be carried out at the expense of the owner.

(b) Three test cubes or cylinders should be made for each stage at which tests are required. The cube or cylinder strength should be calculated from the maximum load sustained by the cube or cylinder at failure. The appropriate strength requirement may be considered to be satisfied if none of the strengths of the three cubes or cylinders are below the specified strength or if the average strength of the cubes or cylinders is not less than the specified strength and the difference between the greatest and the least strengths is not more than 20 percent of that average.

(c) In addition, where there is question as to the quality of the concrete in the structure, the Director may order load tests for that portion of the structure where the questionable concrete has been placed.

(d) The maximum allowable slump of concrete shall be 100mm (4inches). This may be varied by the Director provided the design engineer can demonstrate that concrete of greater slump will produce an acceptable result.

(e) No water shall be added at the job site to concrete delivered by truck as ready for use except under the control of a supervising engineer or other authority acceptable to the Director, and then only when slump tests are made and the concrete so delivered is found to have less than the maximum slump required.

1604 ALLOWABLE UNIT STRESSES

1604.1 Working Stresses

(a) The allowable working stresses in concrete shall not exceed those set forth in ACI 318 (or equivalent standard) for the value of compressive strength of concrete used.

The normal minimum quality of structural concrete recognized by this Code shall be concrete having a design strength of 21N/sqmm (3,000 lbs per sq inch) after 28 days based on 6" x 12" cylinder tests or 25.8N/sqmm (3,750 lbs per sq inch) at 28 days based on 6" cubes.

(b) The determination of the proportions of cement, aggregate, and water to attain strengths shall be made by one of the following methods:

Method 1 - Without preliminary tests

Where preliminary test data on the materials to be used in the concrete have not been obtained, the water-cement ratio for a given strength of concrete shall be based on those shown in Table 16-1. The designer and builder shall take every care to ensure that the water- cement ratio is kept at a minimum consistent with the type of aggregate being used. When tests have been carried out on the local aggregates, the relevant water- cement ratios shall be specified.

Method 2 - For combinations of materials previously evaluated or to be established by trial mixtures

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Water-cement ratios greater than those shown in the Table 16-1 may be used provided that the relationship between strength and water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the strength requirements.

(d) When the structural design is based on a 28 day compressive strength in excess of 21N/sqmm (3,000 psi) by 6" x 12" cylinder test, proportioning, mixing and placing of concrete shall be under the supervision of a competent engineer, architect or concrete technician, approved by the Director.

(e) Concrete that will be exposed to sulfate containing or other chemically aggressive solutions shall contain cements specially formulated to resist chemical action and be proportioned in accordance with the concrete proportions given in the Standards and Codes listed in Appendices A and B. Care shall be taken in using water containing hydrogen sulphide.

1605 MIXING AND PLACING

1605.1 Forms and Equipment

(a) Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris removed from the spaces to be occupied by the concrete, forms shall be thoroughly wetted or oiled, masonry filler units that will be in contact with concrete shall be well drenched, and the reinforcement shall be thoroughly cleaned.

(b) Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Director.

1605.2 Mixing of Concrete

(a) Unless otherwise authorized by the Director, the mixing of concrete shall be done in a batch mixer of approved type.

(b) All concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.

(c) For job mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least 1-1/2 minutes after all materials are in the drum. For batches larger than one cubic yard, mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

(d) Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the Standards adopted in the Appendices to this Code.

(e) Re-tempering concrete with the addition of water after the concrete has taken an initial set shall not be permitted.

(f) No concrete shall be deposited in forms or used more than a maximum of 1-1/2 hours after the mixing of that particular batch has been commenced, or after water has been added to the batch. The Director has the right to reject all such concrete or order any such mobile equipment off the job site, if in his opinion, mixing has taken place longer than can be allowed to ensure the appropriate concrete

strength. The Director may approve the use of a suitable concrete retarder to delay the setting action provided that the builder can prove by tests that the retarder used will not affect the strength of the concrete.

(g) In cases where there is a delay in the completion of placing of concrete which is in progress, the builder must make suitable arrangements for completion of the pour or for the removal of the concrete already placed.

1605.3 Conveying

(a) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent separation or loss of the materials.

(b) Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of the materials.

1605.4 Depositing

(a) Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to re-handling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has been contaminated by foreign materials shall be deposited in the structure.

(b) When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed.

(c) All concrete shall be thoroughly consolidated by suitable means during placement, and shall be thoroughly worked around the reinforcement and embedded fixtures and into the corners of the forms. Where concrete is placed in columns or walls, the placing shall be so conducted that the concrete will not be placed in lifts greater than 8 feet. Separate lifts shall be thoroughly compacted.

d) Vibrators may be used to aid in the placement of the concrete, provided that the forms are designed to withstand their action, and that the vibrators do not touch the reinforcement. Vibrators should not be used to transport concrete within the forms.

(e) Where conditions make consolidation difficult or where reinforcement is congested, the Director upon application of the builder, may approve alternative methods of placing of the concrete or redesigning the steel in the member affected.

(f) Special care shall be taken in depositing concrete from heights greater than 4 feet to avoid segregation or separation.

1605.5 Curing

In all concrete structures, concrete made with normal Portland cement shall be maintained above 10 degrees C. and in a moist condition for at least the first seven days after placing. High-early -strength concrete shall be so maintained for at least the first three days. Other curing periods or methods of curing may be used if the specified strengths are obtained. (See CUBiC Part 2 Section 6 Article 5.5).

1605.6 Bonding

Before new concrete is deposited on or against concrete which has set, the forms shall be re-tightened, the surface of the set concrete shall be cleaned of all foreign matter and washed before the new concrete is placed.

1605.7 Hot Weather

During hot weather (temperatures in excess of 29 degrees C), steps shall be taken to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protection and curing. *Global temperature rise due to climate change will emphasise the importance of this directive*[8].

1606 FORMS AND DETAILS OF CONSTRUCTION

1606.1 Design of Forms

(a) Forms shall conform to the shape, lines and dimensions of the members as called for on the plans, and shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be properly braced or tied together so as to maintain position and shape. Temporary openings at the bottom of columns shall be provided to facilitate cleaning and inspection before depositing concrete.

When the concrete has attained sufficient strength, forms shall be removed from at least two faces of all reinforced members, other than where placed in contact with the soil.

(b) Design of formwork shall include consideration of the following factors:

(1) Rate and method of placing concrete.

(2) Loads, including live, dead, lateral and impact.

(3) Selection of materials and stresses.

(4) Deflection, camber, eccentricity and uplift.

[8] *Refer to http://climate.nasa.gov/vital-signs/global-temperature/ for evidence of temperature rise over the last century.*

(5) Horizontal and diagonal shear bracing.

(6) Splices.

(7) Cross grain compression.

(8) Loads on ground or on previously placed structure.

1606.2 Removal of Forms

The removal of forms shall be carried out in such a manner as to ensure the complete safety of the structure. Vertical forms may be removed in 24 hours, provided that the concrete has hardened sufficiently so that it is not injured. Bottom forms and shoring for slabs, beams and girders shall not be removed in less than 14 days. Where tests indicate that the concrete has attained sufficient strength to safely support itself and any imposed loads in less time, adjustments in the above waiting periods may be approved by the Director in conformance with the results obtained.

1606.3 Placing of Reinforcement

a) Skeletal reinforcement and welded wire fabric shall be accurately placed and adequately secured in position by concrete or metal chairs or spacers, or by other acceptable methods. The minimum clear distance between parallel bars, except in columns, shall be equal to the nominal diameter of the bars. In no case shall the clear distance between bars be less than 25mm, nor less than one and one-third times the maximum size of the coarse aggregate.

b) When reinforcement in beams or girders is placed in two or more layers, the clear distance between layers shall not be less than 25mm nor less than the diameter of the bars, and the bars in the upper layers shall be placed directly above those in the bottom layer.

c) Groups of parallel reinforcing bars bundled in contact to act as a unit are permitted but shall be limited to four bars in any one unit. Bars larger than #11 cannot be bundled in beams. Individual bars within a bundle terminated within the span of flexural members shall terminate at different points with stagger at least 40 bar diameters. Bundled bars shall be enclosed within stirrups or ties.

1606.4 Splices in Reinforcement

In slabs, beams, and girders, splices in reinforcement at points of maximum stress shall be welded, lapped or otherwise fully developed, but in any case, shall transfer the entire stress from the bar without exceeding the allowable bond and shear stresses. The minimum overlap for a lapped splice shall be calculated in accordance with ACI 318, but in no case shall the overlap be less than 35 bar diameters. The clear distance between bars shall also apply to clear distance from a contact splice and adjacent splices or bars.

1606.5 Concrete Protection for Reinforcement (See Table 16-3)

(a) The reinforcement of footings and other principal structural members in which the concrete is deposited against the ground shall have not less than 75mm of concrete between it and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 50mm of concrete.

(b) The concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather shall be not less than 25mm for slabs and walls; and not less than 35mm for beams, girders and columns. In concrete ribbed or joist floors in which the clear distance between ribs or joists is not more than 750mm, the protection of reinforcement shall be at least 25mm.

(c) Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion by concrete or other adequate covering.

(d) The above protective coverings are minimums but protection shall not be less than elsewhere set forth for required fire resistive ratings and for insurance against corrosion.

(e) In extremely corrosive atmospheres, such as in locations near the sea, or other severe exposures, the amount of protection (concrete cover) shall be suitably increased but not so much as to allow excessive crack widths at the surface.

1606.6 Construction Joints

(a) Joints not indicated on the plans shall be so made and located as to least impair the strength of the structure. Where a joint is to be made, the surface of the concrete shall be thoroughly cleaned and all laitance removed. Vertical joints shall be thoroughly wetted before placing of new concrete.

(b) A delay of at least one day must occur in columns or walls before concreting beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

(c) Construction joints shall be located in areas of minimum shear. Provision shall be made for transfer of shear and other forces through the construction joint.

1606.7 Concrete Walls

a) The design of concrete walls subject to axial loads with or without flexure shall be carried out in accordance with Part 2 Section 6 Subsection 14 of CUBiC.

b) The minimum vertical and horizontal reinforcement required for walls shall be in accordance with Part 2 Section 6 Sub-section 14.3

of CUBiC, unless a greater amount of reinforcement is required for shear or other loads.

c) The minimum ratio of the area of vertical reinforcement to the gross concrete the area shall be:

i) 0.0012 for deformed bars not larger than No.15 with a specified yield strength of not less than 400 MPa, or

ii) 0.0015 for other deformed bars, or

iii) 0.0012 for welded wire fabric not larger than W31 or D31

d) The minimum ratio of the area of horizontal reinforcement area to the gross concrete are shall be:

i) 0.0020 for deformed bars no larger than No 15 with a specified yield strength not less than 400 MPa, or

ii) 0.0025 for other deformed bars or

iii) 0.0020 for welded wire fabric not larger than W31 or D31.

e) Vertical and horizontal reinforcement shall not be spaced further than three times the wall thickness, nor 500 mm (20 inches).

f) In addition to the minimum reinforcement required by 1606.7 d) and e), not less than two No. 4 bars shall be provided around all window and door openings. Such bars shall be extended to develop the bar beyond the corners of the openings but not less than 600mm (24 inches).

1607 PRECAST CONCRETE FLOOR AND ROOF UNITS

1607.1 General

(a) Precast concrete units shall comply with the minimum requirements set forth in this Section, and the Standards set forth in the Appendices.

(b) All precast structural items shall be designed by an engineer approved by the Authority.

(c) Only the material cast monolithically with the units at the time of manufacture shall be used in computing stresses unless adequate and approved mechanical shear transfer is provided.

(d) The Director may require tests to be made by an approved testing laboratory as he may consider necessary to ensure compliance with this Code or uniformity of the products produced. The quantity of tests shall be based on consideration of safety or volume of output.

(e) The Director shall have free access to the plant of any producer at all hours of normal operation, and failure to permit such access shall be cause for revocation of approval.

(f) Failure of any product to satisfy in every respect the quality prescribed, or failure to conform with plans and specifications, shall be cause for rejection of the products.

1607.2 Strength of Concrete

Concrete for precast structural units made of crushed stone or other heavy aggregate shall have a compressive strength of not less than 21N/sqmm (3,000 psi) at 28 days based on standard 6 inch cylinder test.

1607.3 Workmanship

(a) The mix, the gradation of the aggregate and the workability shall be such as to ensure complete filling of the form and continuous intimate bond between the concrete and all steel.

(b) The use of precast structural units not complying with the relevant Standards and Codes listed in the Appendices, or having visible cracks, honeycomb, exposed reinforcing except at ends or, with a compressive section more than 3mm (one-eighth inch) less than specified dimension shall not be permitted.

1607.4 Identification and Marking

All joists, beams and girders, and other units shall show some mark plainly indicating the top of the unit and its location and orientation in the structure. Identification marks shall be reproduced from the placing plans. This mark or symbol shall also indicate the manufacturer, the date of the manufacture and the lengths, size and type of reinforcing.

1607.5 Cutting of Holes

No openings not provided for in the structural design shall be made on the job without the specific approval of the engineer and the Director and in accordance with the engineer' written detailed instructions covering such work.

1607.6 Anchorage

Anchorage of all precast concrete units shall be designed based on rational analysis to transmit loads and other forces to the structural frame.

1607.7 Bridging

Joists shall be secured against lateral displacement by cast-in-place bridging, and such bridging shall be spaced not to exceed 32 times the width of the compression flange of the joist; except that for roof systems, cast-in-place Portland cement concrete slabs embedding the top flanges not less than 12mm (1/2 inch), or steel decks which are

welded, shall be accepted in lieu of bridging.

1607.8 Connections

(a) All joints and connections shall perform their function at all stages of loading without over-stress and with proper safety factors against failure due to overload.

(b) Loading conditions to be considered in the design of joints and connections are: service loads, including wind and earthquake forces, volume changes due to shrinkage, creep, and temperature change, erection loads, and loading encountered in stripping forms, shoring and removal of shores, storage and transportation of members.

(c) *During the lifetime of the structure, there is the potential for increased movement at joints due to rising global temperatures.*

1607.9 Transportation, Storage and Erection

(a) Units shall be so stored, transported, and placed that they will not be overstressed or damaged.

(b) Precast concrete units shall be adequately braced and supported during erection to ensure proper alignment and safety and such bracing or support shall be maintained until there are adequate permanent connections.

1608 PRESTRESSED CONCRETE

1608.1 General

(a) The term "prestressed concrete" refers to pretensioned concrete in which the reinforcing is tensioned before hardening of the concrete; or to post-tensioned concrete in which the reinforcing is tensioned after hardening of the concrete or combinations of both pre-tensioning and post-tensioning.

(b) All prestressed structural items shall be designed by an engineer approved by the Authority. Openings not provided for in the structural design shall not be made on the job without the specific approval of the engineer and the Director.

(c) Allowable stresses, temporary and at design loads, shall not exceed the allowable stresses set forth in the relevant Standards and Codes of Practice listed in Appendices A and B. Stresses and ultimate strength shall be investigated at service conditions and at all load stages that may be critical during the life of the structure from the time prestress is first applied.

(d) The Director may require tests to be made by an approved testing laboratory as he may consider necessary to ensure compliance with these Standards or uniformity of the product.

(e) The Director shall have free access to the plant of any producer at all hours of normal operation, and failure to permit such

access shall be cause for revocation of approval.

(f) Failure of any product to satisfy the quality prescribed or failure to conform with plans and specifications shall be cause for rejection of the product.

1608.2 Design and Construction

(a) Deflection under live load shall not exceed L/240 and where plaster ceilings are to be applied shall not exceed L/360, where L = the span length of the member.

(b) Calcium chloride shall not be used in concrete for prestressed members.

(c) When specifying the quality, durability and ease of separation of components designers shall, as far as possible, provide for deconstruction of buildings at the end of their lifespan and re-use of selected structural elements. Simple mechanical fixings such as bolted connections are preferred. Sufficient information about load paths and structure shall be handed over to the building owner to facilitate safe deconstruction.

1608.3 Handling and Installation

Prestressed members must be maintained in an upright position at all times and must be picked up from points as shown on the approved plans or as approved by the engineer and the Director.

(Note: Disregard of this requirement may lead to collapse of the member).

1609 FIBRE REINFORCED CONCRETE

1609.1 General

The development of reinforced concrete using fibre glass materials has led to the construction of structural panels and other primary non load-bearing members. The principal ingredients of glass reinforced cement (GRC) are ordinary Portland cement., silica sand and water, mixed with alkali resistant glass fibres to produce the inorganic GRC composite. Glass fibres constitute 5% by weight.

The advantage of GRC is its ability to produce elements which are much thinner and lighter than can be made with ordinary concrete reinforced with steel. GRC elements of 12mm in thickness are possible while with steel reinforced concrete, the thickness of any slab must be at least 35mm to provide cover for the reinforcement. In the OECS, where the cover should be at least 25mm for exposed elements, the minimum thickness of a slab will be 65mm.

1609.2 Physical Properties

Some of the physical properties of typical spray de-watered GRC with a density of 2.0 tonnes per sq.m. are:

Property	At completion of cure
Impact strength	15 -20 Nmm/mm^2
Compressive strength	60 - 100 N/mm^2
Young's Modulus	20 - 25 KN/mm^2
Bending - elastic limit	14 - 17 N/mm^2
Bending - ultimate strength	35 - 40 N/mm^2
Tension - elastic limit	9 - 10 N/mm^2
Tension - ultimate strength	14 - 17 N/mm^2

Note: 1N = 0.224809 lbf.

N/mm^2 = 0.00689476 lb/in^2 x 10

1609.3 Uses

GRC technology has been used in the production of semi-structural units and complex shapes such as cladding panels, roofing, fire doors and partitions, bus shelters, storage tanks and other units such as corrugated sheeting which can be produced by the spray method.

Other smaller units are constructed by premix GRC such as sewer pipes, manhole covers, etc.

1609.4 Manufacture

GRC members are manufactured under licence. Information on the manufacture, properties and uses of GRC can be obtained from the Building Research Establishment, Wallingford, England.

Table 16-1

Maximum Permissible Water Cement Ratios (1) for Concrete (Without Preliminary Tests)

Maximum Permissible Water Cement Ratio - Non Air Entrained Concrete (2)			
Specified Compressive strength at 28 days, (6" cube test)	**Specified Compressive Strength at 28 days, (6" x 12" cylinder)**	**Litres / U.S. gals per 42.6kg (94 lb) bag of cement**	**Absolute ratio by weight**
21.5 MPa or 3,125psi	17.2 MPa or 2,500psi	27.4 / 7-1/4	0.67
25.8MPa or 3,750psi	21MPa or 3,000psi	24.6 / 6-1/2	0.58
30MPa or 4,375psi	24MPa or 3,500psi	21.8 / 5-3/4	0.51
34.5MPa or 5,000psi	27.5MPa or 4,000psi	18.9 / 5	0.44

Notes: 1) The minimum cement content shall be not less than six and a half bags per cubic metre or five bags per cubic yard (a bag weighing not less than 42.6kg (94 pounds) unless the mix is designed specifically for the project.

2) Including free surface moisture on aggregates.

3) Results shown in this table are based on the use of aggregates with equivalent specification of BS 882 Part 1. For local limestone aggregates tests are required to arrive at the appropriate water cement ratio.

Table 16-2

Grading of Concrete Mixes in accordance with BS 5328

Grade	Approx. minimum compressive strength at 28 days
ST1	7.5MPa or 1,090psi
ST2	10MPa or 1,490psi
ST3	15MPa or 2,175psi
ST4	20MPa or 2,900psi
ST5	25MPa or 3,625psi

Table 16-3

Minimum Cover to be provided to Concrete

A. Cast in Place Concrete (Non-prestressed)	
Description	**Minimum Cover (mm)**
Concrete cast against and permanently exposed to earth	75
Concrete exposed to earth and weather:	50
Concrete not exposed to weather or in contract with the ground:	
Slabs, Walls, Joists	25
Beams, Columns	35
Shells, Folded plate members	20
B. Precast Concrete Manufactured under Plant Control Conditions	
Concrete exposed to earth or weather	
Wall Panels:	
No 14 and No 18 bars*	35
No 11 bar and smaller	25
Other members	
No. 14 and No 18 bars	50
No 6 through No 35 bars	35
No 5 bar, W31 or D31 and smaller	35
Concrete not exposed to weather or in contact with the ground	
Slabs, Walls, Joists	
No 14 and No 18 bars	30
No 11 bar and smaller	20
Beams, Columns:	
Primary reinforcement	Bar diameter, but not less than 20mm and not more than 45mm
Ties, Stirrups, Spirals	12
Shells, Folded Plate members:	
No 6 bar and larger	20
No. 5 bar, W31 or D31 wire and smaller	12

C. Pre-stressed Concrete	
Description	**Minimum Cover (mm)**
Concrete cast against and permanently exposed to earth	75
Concrete exposed to earth or weather:	
Wall Panels, Slabs, Joists	35
Other Members	40
Concrete not exposed to weather or in contact with ground:	
Slabs, Walls, Joists Beams, Columns Primary Reinforcement Ties, Stirrups, Spirals	25 40 40 25
Shells, Folded plate members	12
No 5 bar, W31 or D31 wire and smaller	12
Other Reinforcement	Bar diameter but not less than 25mm

Note: See Table 16-3(A) for equivalent SI bar designations

Table 16-3(A)

Bar Designations

SI Units		**US Standard Units**	
Bar Designation	**Diameter (mm)**	**Bar Designation**	**Diameter (ins)**
10	11.3	3	0.375
15	16.0	4	0.500
20	19.5	5	0.625
25	25.2	6	0.750
30	29.9	7	0.875
35	35.7	8	1.000
45	43.7	9	1.128
55	56.4	10	1.270
		11	1.410
		14	1.693
		18	2.257

Table 16-4

Requirements for Special Exposure Conditions

Exposure Condition	**Maximum Water-cement ratio normal density aggregate concrete**	**Minimum specified compressive strength, low density aggregate (MPa)**
Concrete intended to be water-tight:		
a) Concrete exposed to fresh water	0.50	25
b) Concrete exposed to seawater	0.45	30
For corrosion protection for reinforced concrete exposed to brackish water, seawater, or spray from these sources	0.40	33

*** If minimum concrete cover required by Table 16-3 is increased by 10mm, water-cement ratio may be increased to 0.45 for normal density concrete, or specified compressive strength reduced to 30MPa for low density concrete.**

Note: 1 Megapascal (MPa) equals 145.038 lbs force per sq.in.

SECTION 17

STRUCTURAL STEEL

Contents

1716 LIGHT GAUGE STEEL CONSTRUCTION

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1716.2 Duties of the Developer
1716.3 General Standards
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1717 STRUCTURAL SHEETS

SECTION 17

STRUCTURAL STEEL

1701 SCOPE

a) This Section deals with the design and construction of steel buildings which must be carried out in accordance with Part 2 Section 7B "Structural Design Requirements - Structural Steel" of the Caribbean Uniform Building Code, CUBiC.

b) The construction of small steel framed buildings using standard steel sections is dealt with in Section 18 Subsection 1804 of the Code.

c) The general requirements for construction of light gauge steel framed structures are given in Sub-section 1714, while the requirements for the construction of small houses using light steel frame construction are given in Section D of the Building Guidelines.

1702 BASIS OF DESIGN

a) Steel and iron members shall be designed by methods admitting of rational analysis according to established principles of mechanics.

b) The quality, design, fabrication and erection of steel and iron used structurally in buildings or structures shall conform to the provisions of this Code and to Part 2 Section 7 "Structural Design Requirements - Structural Steel" Caribbean Uniform Building Code (CUBiC) or to any other relevant standard approved by the Authority.

1703 APPLICATION

The requirements set forth in 1701 to 1713 inclusive, herein, are applicable to structures and do not apply to members

formed of flat-rolled sheet or strip steel, light gauge steel construction, (except structural frames) or other miscellaneous light steel construction.

1704 MATERIAL STANDARDS

Steel for structural applications in buildings shall conform to the "Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use" by the American Society for Testing and Materials, ANSI/ASTM A6.

1705 COLD FORMED STAINLESS STEEL CONSTRUCTION

The design, fabrication and erection of cold-formed stainless steel construction shall conform to the "Specification for the Design of Cold-Formed Stainless Structural Members" of American Iron and Steel Institute.

1706 COLD FORMED STEEL STRUCTURAL MEMBERS

a) The design and construction of cold formed steel structural members shall be in accordance with Part 2 Section 7B Sub-section 14 of CUBiC. This Sub-section provides information on the working stress design for structural members formed from the shaping of flat rolled steel at ambient temperature to form a structural section.

b) The developer may utilise any other method of design provided the material used, and the design developed, will lead to a building which is resistant to hurricane and earthquake forces and to the corrosive environment of the OECS. The materials used and design adopted must be approved by the Director.

c) Other references are:

i) ANSI/ASTM A446-76:

Steel Sheet, Zinc Coated (Galvanised) by the Hot-Dip Process, Structural (Physical) Quality (Grades A, B, C, D and F)

ii) ANSI/ASTM A525-79:

Steel Sheet, Zinc Coated (Galvanised) by the Hot-Dip Process, General Requirements.

iii) ANSI/ASTM A606-75:

Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High Strength, Low Alloy, with Improved Corrosion Resistance.

(iv) AISI

Cold-Formed Steel Design Manual, 1986

1707 OPEN WEB STEEL JOIST CONSTRUCTION

The design, fabrication and erection of open web steel joist construction shall comply with the following specifications: "Standard Specifications for Open Web Steel Joists, H - Series" adopted by American Institute of Steel Construction and Steel Joist Institute or to Part 2 Section 7B Sub-section 17 of CUBiC.

1708 WELDING

Details of design, workmanship and technique for welding, inspection of welding, and qualification of welding operators shall conform to the following specifications:

a) "Structural Welding Code" by American Welding Society.

b) "Specifications for Welding Sheet in Buildings" by American Welding Society.

1709 HIGH TENSION BOLTS

The design and assembly of structural joints and connections using high strength steel bolts shall conform to the "Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts" approved by the Research Council or Riveted and Bolted Structural Joints of the Engineering Foundation.

1710 TESTS

The owner shall provide the Director with test results and/or mill records to determine the quality of materials and assemblies.

1711 DESIGN LOADS

Designs shall be based on the dead, live, wind and other loads set forth in Section 12 and the additional stress considerations set forth in Section 17.

1712 MINIMUM THICKNESS OF MATERIAL

(a) The minimum thickness of steel and iron used in buildings or other structures or to resist wind forces, shall be not less than as set forth in BS 5950 "Structural Use of Steelwork in Buildings" or equivalent American standard and where structural members are exposed to industrial fumes, salt water, salt water spray and other corrosive agents, such members shall have a minimum web thickness of 0.25 inches unless the steel used is an atmospheric corrosion-resistant grade approved by the Director. It is recommended that in the corrosive atmosphere of the OECS, all steel members be protected against corrosion by encasing the steel in concrete or by other approved forms of protection.

(b) In the main structural framework of buildings primary members shall be construed to include any steel member used as a column, beam or to support walls or partitions including trusses, isolated lintels spanning openings of 8 feet or more and any member required to brace a column or a truss or to support 200 or more sq.ft of floor or roof area.

(c) Secondary members shall be construed to include all other steel members, including filling-in beams of floor systems which individually support less than 200 sq.ft of floor or roof area.

(d) For primary members of the structural frame all steel used shall be at least 0.20 inches in thickness for interior work. All steel in exterior walls of structures except lintels spanning an opening of less than 8 feet shall be at least 0.20 inches in thickness when protected as required in 1710 and at least 0.25 inches thick when not so protected.

(e) Unless otherwise determined by tests, the thickness of fire-resistive members shall be assumed to have the resistance ratings detailed in Table 17-1.

Table 17-1

Fire resistance of Concrete Members

Inches of	**1 Hr.**	**2 Hr.**	**3 Hr.**	**4 Hr.**
Cement concrete over 2,000 psi.	1	1-1/2	2	2
Cement concrete 1,600 - 2,000 psi	1-1/2	2	3	4
Cement concrete 1,600 - 2,000 psi with wire fabric	1-1/2	2	2	3
Concrete block (nominal dimensions)	-	-	4	4

1713 CONNECTIONS

(a) Any suitable mechanical fastener, special device or other means may be used to join component parts provided that the type of fastening device is compatible with the service connections. *Mechanical connections facilitate deconstruction and re-use of structural elements at the end of life.* Re-use is encouraged to mitigate climate change. Refer to section 402.4 of this code.

(b) High strength steel bolts, may be used in lieu of rivets.

(c) Welded connections shall be in accordance with BS 2642 "General Requirements for the Arc Welding of Steel" and/or CSA Standard W59, "Welded Steel Construction (Metal-Arc Welding)".

(d) A competent welding supervisor, who shall be approved by the Director or by the design engineer where employed by the owner, shall be present at all times when welding is in progress.

(e) It shall be permissible to use ribbed or spliced bolts in place of rivets or ordinary bolts. The diameter of the bolt shall be identical to that of the rivet.

(f) *Movement at joints and interfaces with other materials will become more of an issue with rising global temperatures.* Allowance shall be made for temperature related movement with this consideration in mind.

1714 PIPE COLUMNS

1714.1 General

(a) Steel or wrought-iron pipes may be used as compression members. The pipes shall be new material, the shell shall be straight and the wall thickness shall be not less than 3/16".

(b) Where pipe columns support loads in excess of 1,000 lb or are required to be fire-resistive, the pipe shall be filled with 1:3:6 concrete.

1714.2 Allowable load

(a) Only the load-bearing capacity of the shell shall be considered in determining the allowable load on a pipe compression member when filled with concrete.

(b) Load-bearing pipe columns shall be provided with steel bearing plates so designed that the bearing stresses of the material on which the column is to be placed shall not be exceeded and so that the bending stresses in the steel plate shall not exceed those permitted.

1715 COMPOSITE BEAMS

1715.1 Definition

a) Composite beams shall be the term used to apply to any rolled or fabricated steel floor beam entirely encased in a poured concrete haunch supporting a concrete slab on either side. At its narrowest point the concrete haunch shall be at least 4 inches wider than the flange of the beam. The top of the beam shall be at least 2" above the bottom of the slab and at least 1-1/2" below the top of the slab. There should be no openings in the slab adjacent to the beam. The concrete casing shall be adequately provided with mesh or other reinforcement throughout its depth and across its soffit.

b) Uncased beams may be designed as composite beams provided that this is based on the requirements of BS 5950 or equivalent standard approved by the Authority.

1715.2 Basis of Design

The design of composite beams shall be carried out by a professionally qualified engineer using a method acceptable to the Director. Particular attention shall be paid to the design of shear connectors, and to the provision of adequate resistance to end shear forces.

1715.3 Protection of the Metal

All field rivets and bolts and abrasions to the shop coat shall be spot-painted. Buildings or structures not encased in concrete shall be field painted, in addition to the shop coats, with not less than 1 coat of lead, graphite, asphalt paint or other approved paint which will not act as a solvent for the shop coat.

1716 LIGHT GAUGE STEEL CONSTRUCTION

1716.1 Application

a) Light gauge steel construction shall include structural decks or members formed of sheet or strip steel less than 3/16" thick, and used for load bearing purposes.

b) The use of light gauge steel construction shall be reserved for single or two storey buildings in Group E Occupancy or in Group D(b) Occupancy provided the building is not greater than 2,000 square feet in floor area.

c) Section 18 provides information on the framing requirements for small steel structures using standard sections, and Section D of the Building Guidelines provides outline performance specifications for small single storey buildings.

1716.2 Duties of the Developer

a) For the design, fabrication and erection of prefabricated steel buildings composed of light gauge steel members, the developer shall file with the Director duplicate copies of a certificate from a recognised testing laboratory to the effect that tests have been made on this particular type of prefabricated construction. The test results should show the dead loads, live loads and wind loads sustained by the construction in pounds per sq.ft together with a physical description of the building and a description of the tests.

b) Panels and other elements tested for loads shall sustain without failure a superimposed load equal to two times the live load. Recovery within 24 hours after removal of the full test load, shall be not less than 75 percent of the observed deflection. The measured deflection for any panel or element under full live load shall not be greater than 1/360 of the span for panels that will be plastered or 1/240 of the span for other panels and 1/180 of the span for roof decks without ceilings.

c) All tests must be carried out in accordance with the applicable standard of the ASTM or the relevant British Standard.

d) It is the responsibility of the developer to prove by calculations or test results that the design proposed will provide a building that is resistant to the wind and earthquake forces and other loads given in Section 12, and that the corrosion protection of the steel members will be adequate over the projected life of the building. The building must have the fire resistance required for the class of use.

e) It is expected that the developer will supply the following information when applying for a building permit:

i) complete structural drawings of the building. The drawings and written information must give the sizes and thickness of all members, the connections used, and methods of field assembly.

ii) test results required under 1716.2 a).

iii) test data and specifications of the corrosion method to be used.

iv) other standard information required by the Authority as per Section 1 of the Code.

1716.3 General Standards

The design and construction of light gauge steel structures shall be carried out in accordance with the relevant standards set forth by the American Iron and Steel Institute or the British Standard or other relevant standard or Code approved by the Authority.

The design requirements given in 1716.3 may be varied by the developer, provided that tests on the materials and assemblies show that the structure can accommodate the imposed loads safely and can resist the wind and earthquake forces in accordance with the requirements of Section 12.

1716.4 Structural Members other than Decks

Design and fabrication shall be as set forth in 1716.2. Special attention shall be paid to the following:

(a) All primary and secondary members must be designed in accordance with the standards given in 1716.1 and 1716.2 or in accordance with any other standard approved by the Authority. Except that the minimum thickness of steel of primary members shall be 16 gauge, and the spacing of studs shall be no greater than 24 inches on centres and provision shall be made to resist horizontal wind forces by diagonal members or diaphragm panels attached to the studs.

(b) Light-gauge steel for the treads, risers, stringers and landings of stairways shall have a minimum thickness of 12 gauge.

(c) Light-gauge steel studs for non-bearing partitions shall have a minimum thickness of 18 gauge.

(d) Light gauge steel joists or rafters shall be designed with due consideration for wind pressure and suction at the relevant level.

(e) Unless otherwise provided for in the design, the joist or rafter members shall have not less than 4" of bearing on reinforced concrete nor less than 2" on steel supports, except that where opposite joists butt over a steel support and positive, approved means of attachment to the steel is furnished, a shorter bearing

length may be used. Each end of each member shall be anchored. Resistance to diaphragm action shall be provided by the deck or by diagonal members. Bridging shall be provided, spaced not further apart than 32 times the flange width. Such bridging shall be solid sections of the joist material or be cross bridging formed from approved open-welded joists.

(f) Light-gauge steel used in sandwich construction for wall panels for the exterior or enclosing walls of buildings shall have a minimum thickness of 24 gauge for the sheeting. The minimum thickness for secondary members supporting exterior panel construction shall be 18 gauge.

(g) Light-gauge steel members resisting lateral stresses in interior partitions of buildings two storeys or more in height shall be not less than 16 gauge.

(h) Light-gauge steel structural members shall not be used in locations subject to corrosive agents or continuous dampness.

1717 STRUCTURAL SHEETS

Structural sheet-metal sections may be used for floor decks, roof decks and wall cladding to span between supports; provided the design is based on rational analysis, and design and fabrication comply with the standard set forth in 1703 or with any other standard approved by the Authority and as follows:

(a) Sheet-metal sections shall have a minimum thickness of 18 gauge for floors, or 24 gauge[1] for roof and walls and shall be protected as set forth in this subsection.

(b) The span of sheet-metal sections used for floor systems shall not exceed 40 times the overall depth of the section.

[1]*Note: United States Standard Gauge used throughout*

(c) No structural value shall be allowed for any fill material used with deck systems except in the case of composite floor systems which shall be designed to the approval of the Director.

(d) The shape of the sections as placed in buildings shall be such as to eliminate any possibility of lateral displacement for compression area.

(e) Where large openings occur, the perimeter of the openings shall be framed with adequate supports for the floor panels. Small openings shall be reinforced so that the allowable stresses in adjoining materials are not exceeded.

(f) Positive anchorage for sheet-metal roofs or decks shall be provided by proven mechanical connectors. The anchorage must be capable of resisting the uplift forces caused by hurricane winds and other loads described in Section 12.

(g) Bolts and rivets shall be not less than 3/16" in diameter. Lead, neoprene, or other approved washers not less than 1/2" in diameter shall be provided under the heads of all bolts and rivets.

(h) Roofing sheets and other structural sheet metal sections spanning between supports shall be designed to support the live load without deflecting more than 1/180 of the span and without permanent deformation.

(i) All members formed of light-gauge strip or sheet-metal shall be treated with protective paint coatings or shall be galvanised. The anti-corrosion treatment must be approved by the Authority.

(j) Valley fixings for corrugated roof sheets are stronger than ridge fixings, and are recommended provided that measures are taken to avoid leaks, such as the use of suitable washers and the use of self aligning tools for the installation of fixing screws in accordance with the manufacturer's instructions.

SECTION 18

SMALL BUILDINGS

Contents

SECTION 18

SMALL BUILDINGS

1801 SCOPE

a) Small buildings are defined as single storey buildings of no more than 2,500 square feet in floor area in Occupancy Group E(a) Residential Buildings. This Section provides information on the design and construction of small wood framed and steel framed buildings using traditional methods of design.

b) The latest edition of the Building Guidelines is hereby adopted as an addendum to this Code for the design and construction of buildings falling within the scope of this Section. The Guidelines contain graphical illustrations of the construction principles recommended in this Section. It is intended that the Guidelines be completely prescriptive and can be used for construction of simple buildings. However, where it may be necessary to deviate from the prescriptions given in the Guidelines, reference must be made to this Section and to the other relevant Sections of this Code.

c) Section 17 provides information on the requirements for the design and construction of light gauge steel structures while outline specifications for the design and construction of small light gauge steel framed buildings (systems) is dealt with in the Section D of the Building Guidelines.

d) This Section is to be read with the following where appropriate:

i) OECS Building Code:

Section 14 - Timber Construction
Section 15 - Concrete Block Masonry
Section 16 - Plain and Reinforced Concrete
Section 17 - Structural Steel

ii) Caribbean Uniform Building Code (CUBiC):

Part 2 Section 8 - Structural Timber
Part 5 Section 1 - Small Buildings (Draft only)

iii) OECS Building Guidelines:

e) Information on pre-cast concrete construction is given in Part 2 Section 6 sub-section 16 of CUBiC. Information is provided in that Section on the design of pre-cast wall panels, details of construction, identification and marking, and transportation, storage and erection.

f) All materials and systems used shall be based on the requirement to resist the dead and live loads imposed, especially wind and earthquake loads as provided for in Section 12 - Dead and Live Loads. Materials shall also be chosen for their resistance to corrosion and to rot. It is therefore necessary that current methods of corrosion resistance for steel members and wood preservatives for timber be employed. The developer must provide information on the standards being used for corrosion resistance and wood preservation for the approval of the Authority.

g) Sizes of timber members given in this Section are the recommended minimum sizes. It is the responsibility of the designer to determine the appropriate sizes to be used in any situation based on based on rational calculations. The sizes of timber members given in this Section are nominal sizes.

h) The Director reserves the right to ensure that the design and construction of all buildings conform to all of the relevant Sections of the Building Code, and developers and designers shall design and construct all buildings accordingly.

1802 WOOD-FRAME CONSTRUCTION

1802.1 Scope

The requirements for wood-frame construction shall conform to the provisions of Section 14 - Timber Construction and to Part 2 Section 8 of CUBiC and to this Section.

1802.2 Nails

a) Nails specified shall be common steel wire nails or common spiral nails. All nails shall be long enough so that they penetrate the second member a distance equal to the thickness of the member being nailed thereto. Splitting of wood members shall be minimised by staggering the nails in the direction of the grain and by keeping nails well in from the edges.

b) Nailing of framing and wood members shall conform to Part 2 Section 8 of CUBiC.

1802.3 Sizes, Spacing and Allowable Spans

The spans for wood joists, rafters and beams shall conform to the spans shown in Table C-1 of the Building Guidelines, and in Table 2.825.1 in Part 2 Section 8 of CUBiC for the uniform live loads shown in the Table.

1802.4 Notching and Drilling

a) Holes drilled in roof, floor or ceiling framing members shall be not larger than 1/4 of the depth of the member and shall be located not less than 2" from the edges, unless the depth of the member is increased by the size of the hole.

b) Floor, roof and ceiling framing members may be notched provided the notch is located on the top of the member within 1/2 of the joist depth from the edge of bearing and is not deeper than 1/3 the joist depth, unless the depth of the member is increased by the size of the notch.

c) Wall studs shall not be notched, drilled or otherwise damaged so that the undamaged portion of the stud is less than 2/3 the depth of the stud if the stud is loadbearing, or 1-1/2" if the stud is non-loadbearing, unless the weakened studs are suitably reinforced.

d) The top plates in loadbearing walls and partitions shall not be notched, drilled or otherwise weakened to reduce the undamaged width to less than 2" unless the weakened plates are suitably reinforced.

e) Roof truss members shall not be notched, drilled or otherwise weakened unless such notching or drilling is allowed for in the design of the truss.

f) Bird mouth connections (rafter to roof plate) are not recommended as the timber rafters are reduced in section and the remaining section may not be adequate to prevent failure by shear.

1802.5 Anchorage

a) Building frames shall be suitably anchored to the foundation walls to resist wind and earthquake forces, unless a structural analysis shows that such anchoring is not necessary.

b) Anchorage shall be provided in conformance with the provisions of 1802.14 and Part 2 Section 8 of CUBiC.

1802.6 Sill Plates (see also 1802.10)

a) Where sill plates provide bearing for the floor system they shall be not less than 2" by 4" material.

b) Sill plates shall be levelled by setting them on a full bed of mortar.

1802.7 Beams to Support Floors

a) Beams shall have even and level bearing and the length of bearing at end supports shall not be less than 4 inches.

b) Steel beams shall be shop primed.

c) Where a beam is made up of individual pieces of lumber that are nailed or otherwise permanently fixed together, the individual members shall be 1-1/2 in. or greater in thickness and installed on edge.

d) Where the individual members of a beam described in 1802.7 c) are butted together to form a joint, each joint shall occur over a support, except that where the beams are continuous over more than one span, the joints may be located at or within 6" of the end quarter points of the clear span of the beam.

e) Joints in individual members of beams that are located at or near the end quarter points described in 1802.7 d) shall not occur in adjacent members at the same quarter point and shall not reduce the effective beam width by more than half. Members joined at quarter points shall be continuous over the adjacent supports.

f) Except as provided in 1802.7 g), where 1-1/2" members are laid on edge to form a built-up beam, individual members shall be nailed together with a double row of nails at least 2-1/2" in length, spaced not more than 18" apart in each row with the end nails located 4" to 6" from the end of each piece.

g) Where 1-1/2" members in built-up wood beams are not nailed together as provided in 1802.7 f), they shall be bolted together with at least 1/2" diameter bolts equipped with washers and spaced not more than 4 ft. on centres, with the end bolts located not more than 2 ft. from the ends of the members.

1802.8 Floor Joists

a) Except when supported on ribbon boards, or when supported by appropriate joist hangers as in 1802.8 c), floor joists shall have not less than 4" length of end bearing. Ribbon boards shall be not less than 1" by 4" lumber let into the studs.

b) Floor joists may be supported on the top of beams or may be framed into the sides of beams.

c) When framed into the side of a wood beam, the joists shall preferably be supported on joist hangers or other acceptable mechanical connectors, or on ledger strips of minimum dimensions of 1-1/2" by 3" nailed to the side of the supporting beam.

d) When framed into the side of steel beams, the joists may be supported on the bottom flange of the beam or on not less than 1-1/2" by 2" lumber bolted to the web with not less than 1/4" diameter bolts spaced not more than 2 ft. apart.

e) Unless ceiling furring or plywood cladding is installed on the underside of floor joists, floor joists shall be restrained from twisting at the end supports and at intervals between the supports not exceeding 7 ft. End restraint should be provided by a suitably designed steel connection to the support. Restraint at intermediate locations shall be obtained by 1-1/2" by 2" cross bridging.

Blocking tightly fitted between joists and securely nailed in place is also acceptable for restraining joist twisting.

f) Header joists around floor openings shall be doubled when they exceed 4 ft. in length. The size of header joists exceeding 10 ft. in length shall be determined by calculations.

g) Trimmer joists around floor openings shall be doubled when the length of the header joist exceeds 32". When the header joist exceeds 6ft. 6in. in length the size of the trimmer joists shall be determined by calculations.

h) When tail joists and header joists are supported by the floor framing, they shall be supported by suitable joist hangers or nailing.

i) Non-loadbearing partitions parallel to floor joists shall be supported on beams, loadbearing walls or doubled joists where the partition is over 6 ft. in length and contains openings that are not full ceiling height. Where such partitions contain no openings or openings that are full height, the joists need not be doubled. Non-loadbearing partitions less than 6 ft. in length need not be supported on framing but may be supported by the subfloor.

j) Doubled joists may be separated not more than 8 in. by blocking, if the blocking is not less than 1-1/2" by 4" lumber spaced not more than 4 ft. apart.

k) Non-loadbearing partitions at right angles to the floor joists are not restricted as to location.

l) Loadbearing interior walls parallel to floor joists shall be supported by beams or walls of sufficient strength to transfer safely the design loads to the vertical supports.

m) Loadbearing interior walls at right angles to floor joists shall be located not more than 3 ft. from the joist support when the wall does not support a floor, and not more than 2 ft. from the joist support when the wall supports one or more floors, unless the joist size is designed to support such loads.

n) Floor joists supporting roof loads shall not be cantilevered more than 10" beyond their supports where 2" by 8" joists are used, and not more than 2' 6" beyond their supports where 2" by 10" or larger joists are used. The cantilevered portions shall not support floor loads from other storeys unless calculations are provided to

show that the allowable design stresses of the cantilevered joists are not exceeded.

o) Table C-1 in Section C of the Building Guidelines gives the recommended joist sizes for various spans of domestic loading using standard pitch pine lumber available in the OECS. Table 2.825.1 of CUBiC should be read for more precise information on recommended spans for various loadings and spans.

p) While minimum dimensions are given in 1802.8 n), the designer is responsible for calculating the length of cantilever that can be accommodated safely with various sizes of joists, taking into account the wind loads and other loads on the building.

1802.9 Wall Studs

a) Studs shall be not less than 2" by 4" and where supporting more than one floor and a roof shall be not less than 2" by 6" or 3" by 4".

b) Maximum allowable height of 2" by 4" and 3" by 4" stud framing shall be 14 ft., and of 2" by 6" stud framing shall be 20 ft unless the wall is otherwise laterally supported. Solid wood bridging shall be placed at intervals of not over 8 ft.

c) No studding shall be spaced more than 2 ft on centres unless vertical supporting members in the walls are designed as columns.

d) Studs in exterior and bearing walls shall be placed with the longer dimension perpendicular to the wall.

e) Wall studs shall preferably be continuous for the full storey height except at openings.

f) Corners and intersections shall be designed to provide support for the vertical edges of interior and exterior cladding materials and in no instance shall exterior corners be framed with less than the equivalent of two studs. Where the vertical edges of interior cladding at wall intersections are supported at vertical intervals by blocking or other acceptable method, the vertical distance between such supports shall not exceed the maximum distance between supports.

g) Studs shall be doubled on each side of openings so that the inner studs extend from the lintel to the bottom wall plate and the outer studs extend from the top wall plates to the bottom wall plate.

h) Single studs may be used on either side of openings in non-loadbearing partitions not required to be fire separations with fire-resistance ratings provided the studs extend from the top wall plate to the bottom wall plate.

i) Recommended sizes of studs are given in Table 18-1.

Table 18-1

Recommended Sizes of Studs

Size (in.)	Spacing (in.)	Maximum Height (ft-in.)
2 x 4	16	7-6
3 x 4	16	8-0
3 x 6	16	9-0
2 x 4	24	7-0
3 x 4	24	7-6
3 x 6	24	9-0

The recommended sizes and heights given are for standard lumber normally available in the OECS. It is recommended that designers ensure that the specifications of the lumber being used are such that the bending and shear stresses of the lumber can meet the conditions given in the table above.

1802.10 Base Plates

a) Base plates for wall studs shall conform to the requirements of Part 2 Section 8 of CUBiC.

b) The following provisions must be made:

i) In stud bearing walls:

- double plates must be used around the entire exterior walls
- the top plate must be doubled or lapped at each intersection with walls and partitions,
- joints in the upper or lower members of the top plates must be lapped not less than 4 inches.

ii) Plates on masonry or concrete walls:

Plates or sills resting on masonry or concrete walls must be treated with a suitable preservative and must not be less than 3" by 6", bolted to the masonry or concrete at the corners and at not more than 4 ft intervals with 18 in. long 1/2" bolts.

iii) Base plates on concrete or masonry must have a suitable damp proof course under the plate.

1802.11 **Framing over Openings**

a) Openings in non-loadbearing walls shall be framed with not less than 2" thick material the same width as the studs and securely nailed to adjacent studs.

b) Openings for doors in non-loadbearing walls required to be fire separations with a fire-resistance rating shall be framed with the equivalent of at least two 2" thick members that are the same width as the wall plates.

c) All openings in loadbearing walls shall be provided with headers or lintels of not less than 2" nominal thickness placed on edge. Such headers or lintels shall have not less than 2" solid bearing at each end.

1802.12 **Roof and Ceiling Framing**

a) Figures 14 and 18 in the Building Guidelines show typical roof framing for small buildings. Such rafters are generally placed at intervals of 2 ft. depending on the size of purlins and sizes of rafters. Roof framing shall be doubled on each side of openings greater than 2 rafters or joist spacings.

b) Rafters shall be located directly opposite each other and tied together at the peak, or may be offset by their own thickness if nailed to a ridge board not less than 3/4" thick.

c) Framing members shall be connected by gusset plates or suitable steel connectors, except that where the roof framing on opposite sides of the peak is assembled separately, such as in the case of factory built houses, the manufacturer shall supply adequate fixings made up of 18 gauge steel plate with bolts or screws to ensure that both sides of the roof structure are firmly attached to each other. The design of the fixings and the procedure for installation of the roof must be approved by the Director

d) Hip and valley rafters shall be not less than 2" greater in depth than the common rafters and not less than 2" thick, actual dimension.

e) Dwarf walls and struts may be used to provide intermediate support to reduce the span for rafters and joists. When struts are used they shall be not less than 2" by 4" material extending from each rafter to a loadbearing wall at an angle of not less than 45 degrees to the horizontal.

f) When dwarf walls are used for rafter support, they shall be framed in the same manner as loadbearing walls and securely fastened top and bottom to the roof and ceiling framing to prevent over-all movement. Solid blocking shall be installed between floor joists beneath dwarf walls that enclose finished rooms.

g) Except as provided in 1802.12 h), the ridge of the roof shall be supported by a loadbearing wall extending from the ridge to suitable bearing or by a ridge beam of not less than 1-1/2" by 6" material. Such ridge beam shall be supported at intervals not exceeding 4ft by not less than 1-1/2" by 4" members extending vertically from the ridge to suitable bearing.

h) When the roof slope is 1 in 3 or more, the ridge support may be omitted provided the lower ends of the rafters are adequately tied to prevent outward movement. These may consist of tie rods or ceiling joists forming a continuous tie for opposing rafters and nailed in accordance with Part 2 Section 8 of CUBiC.

i) Roof trusses shall be designed by an experienced engineer or architect in accordance with the appropriate requirements in Part 2 Section 8 of CUBiC.

j) Roof joists supporting a finished ceiling other than plywood shall be restrained from twisting along the bottom edges by means of furring, blocking, cross bridging or strapping conforming with 1802.8 e).

k) Ceiling joists support the loads of the ceiling and should not be made to support rafter loads. In general practice, joists supporting a plaster ceiling shall be spaced not more than 16" on centres. They shall be not less than 2" x 2" lumber spanning not more than 24 inches for ceilings of 1/2" plaster board. Where the ceiling joists are used to support fibre board or plywood ceilings the spacing and size of joist shall be as follows:

Table 18-2

Spans and Sizes of Ceiling Joists

Maximum Span (ft. 1n.)	Maximum Spacing (in.)	Width & Depth (in.)
7-0	16	2 x 4
6-0	24	2 x 4
11-6	16	2 x 6
10-0	24	2 x 8

1802.13 Bearing

Joists and rafters shall bear on wood plates and shall have not less than 4" of bearing except as provided in Part 2 Section 8 of CUBiC.

1802.14 Anchorage

Anchorage for joists and rafters shall conform with the requirements of Part 2 Section 8 of CUBiC. Anchorage must be continuous from the foundations to the roof, to ensure that all parts of the building are securely fastened to the foundations.

The anchorage systems recommended are shown in Figures C-1, C-2 and C-3 , of the Building Guidelines. The anchorage for the base plates consist of bolts fixed into the concrete or masonry as in 1802.10. The anchorage for the roof structure consists of galvanised hurricane straps or steel plates bolted to the rafters and to the plates. The steel plates or patented galvanised hurricane anchors must not be less than 18 gauge thick.

1802.15 Sheathing

a) Floor sheathing requirements shall conform with the provisions of Sub-Section 1406.4.

b) Roof sheathing requirements shall conform with the provisions of Sub-Section 1406.2.

c) Storm sheathing of exterior stud walls shall conform with the requirements of Sub-Section 1406.9c) and d) and to Part 2 Section 8 of CUBiC.

1803 POST, BEAM AND PLANK CONSTRUCTION

1803.1 General

a) The size and spacing of posts and beams and the span and thickness of floor and roof decking shall be calculated in conformance with Part 2 Section 8 of CUBiC except when specific dimensions are provided in this Sub-Section.

b) Requirements for nails, lumber, notching and drilling, anchorage and sill plates shall conform to Sub-section 1802.

1803.2 Decking

a) Floor and roof decking shall consist of not less than 1" lumber laid on the flat or on edge.

b) Plank floor decking laid on the flat shall be not more than 8" wide and shall be tongued-and-grooved or splined, unless a separate underlay is installed or the flooring consists of wood strips at right angles to the decking.

1803.3 Beams

a) Loadbearing beams shall be solid, built-up, glued-laminated or plywood web beams. Where glued assemblies extend to the exterior waterproof glue shall be used, except that where the exposed portion is adequately protected against wetting water-resistant glue may be used.

b) Loadbearing roof beams shall be securely connected to the exterior wall framing and the centre loadbearing wall or centre beams to resist adequately the uplift forces due to wind.

c) The length of end bearings for loadbearing beams shall not be less than 4".

d) When loadbearing beams are supported by mechanical connectors, the connectors shall be capable of supporting the design loads.

e) Joints in loadbearing beams occurring not over solid supports shall be designed in accordance with the provisions of CUBiC Part 2 Section 8.

f) Opposing loadbearing beams shall be tied together at the joints by means of splices or suitable mechanical connectors.

1803.4 Posts (see 1406.5)

a) Posts shall be solid, built-up or laminated.

b) Where wall sheathing does not provide suitable anchorage, exterior wall columns shall be anchored to the wall plate by suitably engineered anchors of not less than 16 gauge thick steel angles.

c) Solid posts and individual members in built-up posts shall extend in one piece the full height of the wall storey.

d) Intermediate studs or blocking shall be provided between posts in post and beam walls for the support of exterior and interior cladding.

1803.5 Plank Frame Wall Construction

a) Thickness of plank framing in plank frame walls shall conform to Table 18-1. The unsupported height of 1-1/2" vertical plank non-loadbearing partitions shall not exceed 12 ft.

b) Vertical framing in plank frame walls shall consist of not less than 10" wide planks spaced not more than 8 ft. on centres.

c) Vertical framing in plank frame walls shall not bear on wood members with the grain at right angles to the vertical framing except where bearing on sills.

Table 18-3

Nominal Thickness of Plank Framing

Supported Load (Including dead load and ceiling)	**Minimum Plank Thickness,(in)**
Roof with or without attic storage	1-1/2
Roof with or without attic storage plus 1 floor	1-3/4
Roof with or without attic storage plus 2 floors	2-1/2

d) Corners of plank frame walls shall be formed by butting and fastening together the face and edge of 2 planks.

e) Vertical framing in plank frame walls shall be provided on each side of every opening, except that a window opening not more than 2ft. 6in. in width may be supported on one side only by a vertical member. In such cases the opposite jamb of the window or short upright to which it is attached shall bear on the filler wall plank immediately below, which in turn shall be notched into the vertical structural members on each side.

f) Where horizontal planks act as loadbearing lintels or headers they shall be framed into vertical members by dovetailing so that not less than a 2" length of bearing is provided.

g) Openings in loadbearing plank frame walls shall be bridged with lintels designed to carry superimposed loads to adjacent vertical members.

h) In buildings of residential occupancy where spans of supported joists do not exceed 16 ft and the spans of trusses do not exceed 32 ft. the spans for wood lintels shown in Table 18-2 may be used for plank frame walls.

i) Planks laid diagonally will reduce the tendency of the building to be pushed out of shape by lateral forces. Such planking shall be trimmed at the edges to fit the wall or floor plate or vertical edge framing members and nails should not be closer to the edge of the plank than 1 inch.

j) Non-loadbearing horizontal members (fillers) in plank frame walls shall be securely fastened to the vertical framing.

Table 18-4

Lintel Spans

Lintel Size, (in.) (nominal)	Maximum Span, (ft)
2 x 6	5.0
2 x 8	6.0
2 x 10	7.0
3 x 8	7.0
3 x 10	9.0

1804 SHEET STEEL STUD WALL FRAMING

1804.1 Application

This Sub-section applies to sheet steel studs for use in non-loadbearing exterior walls and interior partitions. Information on the design and construction of steel framed structures using cold formed steel sections can also be found in the Cold Formed Steel Design Manual, August 1986 Edition, with December 11, 1989 Addendum, published by the American Iron and Steel Institute.

1804.2 Design Criteria

a) Where loadbearing steel studs are used they shall be designed in conformance with Part 2 Section 7 of CUBiC.

b) Steel studs and runners shall conform to ASTM C645-76, "Non-load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screws", or equivalent standard.

c) Screws for the application of cladding materials to steel studs, runners and furring channels shall conform to ASTM C 646-78a, "Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gauge Steel Studs", or equivalent standard.

d) Steel stud framing shall be clad on both sides with lath and plaster or sheet-type material, fastened with screws or other acceptable fasteners at the appropriate spacing as required for interior finishes. Screws used for attaching wall finishes shall penetrate at least 3/8" through the metal.

e) Except as required in 1804.2 g), steel studs in non-load bearing partitions shall have a metal thickness of not less than 24 gauge.

f) Runners for interior and exterior non-loadbearing walls shall have a thickness of at least 24 gauge exclusive of coatings and shall have at least 1" flanges. Note that except otherwise approved by the Director, where the runners and other members are required to resist lateral loads the minimum thickness of the material shall be as set forth in Section 17.

g) Where openings for doors in non-loadbearing fire separations required to have fire-resistance rating do not exceed 4ft in width, the width of steel studs shall be at least 2-1/2". Where openings exceed 4 ft in width, the stud width shall be at least 3-1/2". The metal thickness of the studs must be adequate for the size of stud being used.

h) The distance of the first stud beyond the jamb of any door opening in a fire separation required to have a fire-resistance rating shall not exceed 16". Where the distance between the framing over the opening at the top runner exceeds 16" in such walls, intermediate support shall be installed at intervals of not more than 16" above the opening.

i) The size of spacing of non-loadbearing steel studs for exterior walls shall be in conformance with Table 18-6.

Table 18-5

Steel Studs for Non-Loadbearing Partitions

Minimum Stud Size (in.)	Maximum Stud Spacing (in.)	Maximum Wall Height (ft-in)
1-1/4 x 1-1/2	16 24	9-6 8-6
1-1/4 x 2-1/2	16 24	13-0 11-6
1-1/2 x 3-1/2	16 24	17-0 16-0

1804.3 Size of Framing

Except as required in 1804.2 f) and h) the size and spacing of steel studs for non-loadbearing partitions shall conform to Table 18-5.

1804.4 Installation

a) Runners shall be provided at the top and bottom of walls and partitions. Such runners shall be securely attached to the building at approximately 2" from the end of the runners, and at intervals of not more than 2 ft on centres for interior studs and 12" for exterior studs. Such fasteners shall consist of the equivalent of 2-1/2" nails or 1" screws.

b) Studs at openings and which are not full wall height shall be supported by a runner at the ends of the studs, securely fastened to the full length studs at the sides of the opening.

c) Steel studs used in walls required to have a fire-resistance rating shall be installed so that there is at least a 1/2" clearance between the top of the stud and the top of the runner to allow for expansion in the event of fire. Except as provided in 1804.2, studs in such walls shall not be attached to the runners in a manner that will prevent such expansion.

d) Door openings in non-loadbearing fire separations required to have a fire-resistance rating shall be framed with 2 runner sections back to back.

e) Steel studs shall be installed with webs at right angles to the wall face and except at openings shall be continuous for the full wall height.

f) Corners and intersections of walls and partitions shall be constructed to provide support for cladding materials.

g) Studs shall be doubled on each side of every opening where such openings involve more than one stud piece, and shall be tripled where the openings in exterior walls exceed 7ft. 9in. in width. Such studs shall be suitably tied together to act as a single structural unit in resisting transverse loads.

h) Studs shall be attached to runners by screws, crimping, welding or other suitable method around wall openings, and elsewhere where necessary to keep the studs in alignment during construction.

Table 18-6

Steel Studs for Non-loadbearing Exterior Walls

Minimum Stud Dimensions (in.) (Nominal)	**Minimum Metal Thickness (excluding coatings) (in)**	**Minimum Stud Length (ft-in)**		
		Spacing of Studs (in) - centre to centre.		
		12	**16**	**24**
1-1/4 x 4	0.021	9-6	8-0	-
1 -1/4 x 4	0.027	11-0	8-10	7-10
1-1/4 x 4	0.033	11-6	10-0	8-10
1-1/4 x 4	0.039	13-0	10-10	10-0

APPENDICES

Contents

APPENDIX A

BRITISH STANDARDS AND CODES APPLICABLE

Item	Code No. or Standard	Description
A1	BS 144	Wood preservation using coal tar creosotes
A2	BS 373	Testing small clear specimens of timber
A3	BS 405	Expanded metal (steel) for general purposes
A4	BS 497	Manhole covers, road gully gratings and frames for drainage purposes
A5	BS 5911	Precast concrete pipes, fittings and ancillary products
A6	BS 648	Schedule of weights of building materials
A7	BS 690	Asbestos-cement slates and sheets
A8	BS 8004:1986	Code of practice for foundations
A9	BS 915	High alumina cement
A10	BS 6925	Mastic asphalt (limestone aggregate)
A11	BS 1187	Wood blocks for floors
A12	BS 1191	Gypsum building plasters
A13	BS 1200	Sands for mortar for plain and reinforced brickwork, block walling and masonry
A14	BS 1230	Gypsum plasterboard
A15	BS 1282	Guide to the choice, use and application of wood preservatives
A16	BS 1297	Grading and sizing of softwood flooring
A17	BS 1369	Metal lathing (steel) for plastering
A18	BS 1370	Low heat Portland cement
A19	BS 1521	Waterproof building papers
A20	BS 1579	Timber connectors
A21	BS 6323	Seamless and welded steel tubes
A22	BS 1876	Automatic flushing for urinals
A23	BS 1881	Methods of testing concrete
A24	BS 5135	Arc welding of steels
A25	BS 2994	Cold rolled steel sections

APPENDIX A (Cont'd)

Item	Code No. or Standard	Description
A26	BS 3260	PVC (vinyl) asbestos floor tiles
A27	BS 3261	Unbacked flexible PVC flooring
A28	BS 3284	Polythene pipe (type 50) for cold water services
A29	BS 3921	Clay brick and blocks
A30	BS 4360	Specification for weldable structural steels
A31	BS 4482	Hard drawn steel wire for the reinforcement of concrete
A32	BS 4483	Steel fabric for the reinforcement of concrete
A33	BS 8000 Part 3	Code of practice for masonry
A34	BS 5268	Structural use of timber
A35	BS 5628	Structural recommendations for load bearing walls
A36	BS 5655	Lifts and service lifts
A37	BS 5950	Structural use of steelwork in building
A38	BS 8110	The structural use of concrete in buildings
A39	BS 8214:1990	Code of practice for fire door assemblies with non-metallic leaves
A40	BS 6399 Part 1	Dead and imposed loads
A41	BS 8000 Part 3	Code of practice for masonry
A42	BS 8000 Part 2	Code of practice for concrete work
A43	BS 8005 Part 1: 1987	Guide to new sewerage construction

APPENDIX B

U.S. AGENCIES

Designation	Institution
ACI:	American Concrete Institute, 818 Connecticut Ave. N.W. Washington, D.C. 20006
AITC:	American Institute of Timber Construction Inc. 333 West Hampden Ave, Englewood, Colorado 80110
AISC:	American Institute of Steel Construction Inc. Wrigley Building 44 N. Michigan Ave., Chicago, Illinois 60611
ANSI:	American National Standards Institute 1430 Broadway, New York, New York 10018
AISI:	American Iron and Steel Institute 100 16th St. N.W., Washington, D.C. 20036
APA:	American Plywood Association 1119 A St., Tacoma, Washington 98401
ASTM:	American Society for Testing and Materials 1916 Race St. Philadelphia, Pennsylvania 19103
AWS:	American Welding Society, Inc. 2501 N.W. 7th St. Miami, Florida 33125
NBS:	National Bureau of Standards U.S. Dept. of Commerce Washington D.C. 20402
NFiPA:	National Fire Protection Association 470 Atlantic Ave., Boston, Massachusetts 02210
NPA:	National Particleboard Association 2306 Perkins Place, Silver Springs, Maryland
SJI:	Steel Joist Institute 1703 Parham Rd, Richmond, Virginia 23229
TPI:	Truss Plate Institute 2400 East Devon, Des Plaines, Illinois 60018, USA
AWPB:	American Wood Preservers Bureau, PO Box 6085, Arlington, Virginia 22206, USA

APPENDIX B (1)

U.S. STANDARDS AND CODES QUOTED

Item	Code No	Description
B1	ACI 318	Building code requirements for reinforced concrete
B2	ACI 315	Manual of standard practice for detailing reinforced concrete structures
B3	ACI 530-92	Building code requirements for concrete masonry structures
B4	ASTM C90	Specifications for hollow load-bearing concrete masonry units
B5	ANSI A41.1	Standard requirements for reinforced masonry
B6	AITC 101 to 115	Timber construction standards
B7	NLMA	National design specification for stress grade lumber and its fastenings
B8	NBS R 16	American lumber standards for softwood lumber
B9	NBS-CS	Douglas fir plywood, commercial standard
B10	AISC-SJI	Standard specification for open web long span steel joist construction
B11	AISC	Specifications for design, fabrication and erection of structural steel for buildings
B12	ANSI A59.1	Specifications for reinforced gypsum concrete
B13	SJI AISC	Specifications and load tables for J series and H series joists
B14	AWS D1.1	Structural Welding Code
B15	AWS D1.3 78	Specifications for Welding Sheet Steel in Buildings
B16	AISC	Specifications for Structural Joints using ASTM A325 or ASTM A490 Bolts
B17	ANSI/ASTM A6	Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
B18	AISI	Specification for the Design of Cold-Formed Stainless Steel Members
B19	AISI A151	Structural Specifications for the Design of Light Gauge Structural Members
B20	TPI. 1978	Design Specifications for Light Metal Plate Connected Wood Trusses

APPENDIX B (2)

OTHER CODES

C1	Caribbean Uniform Building Code (CUBiC) Caricom Community Secretariat, Georgetown, Guyana
C2	National Building Code of Jamaica Ministry of Finance and Planning, Kingston, Jamaica
C3	Standard Building Code Southern Building Code Congress International Birmingham, Alabama, USA.
C4	South Florida Building Code Board of County Commissioners, Metropolitan Dade County, Florida, USA.
C5	Bahamas Building Code Ministry of Works, Nassau, Bahamas
C6	National Building Code of Canada National Research Council of Canada, Montreal Rd, Ottawa, Ontario, Canada

APPENDIX C

STEEL SHEET METAL GAUGES

British Imperial or US Standard Gauge
(Uncoated Steel Sheets)

Wire Gauge	British Standard Thickness (inches)	US Standard Thickness (inches)
4 6 8	0.2242 0.1943 0.1644	0.232 0.192 0.160
10 12 14	0.1345 0.1046 0.0747	0.128 0.104 0.080
16 18 20	0.0598 0.0478 0.0359	0.064 0.048 0.036
22 24 26	0.0299 0.0239 0.0179	0.028 0.022 0.018
28 30	0.0149 0.0120	0.0148 0.124

APPENDIX D (1)

HIGH HAZARD MATERIALS

1. Acetylene gas and gasses under pressure and in quantities of greater than 70 cubic metres including hydrogen, natural ammonia, carbon monoxide, chlorine, methyl oxide and all gasses subject to explosion, fume or toxic hazard.

2. Ammunition, explosives and fireworks manufacture
3. Apparel manufacture
4. Artificial flowers and synthetic leather manufacture
5. Celluloid and celluloid products
6. Cereal, feed, flour and grist mills

7. Cotton batting and cotton waste processes
8. Dry cleaning establishments
9. Fruit ripening processes
10. Grain elevators
11. Industries employing substances which ignite or produce flammable gasses on contact with water

12. Kerosene, fuel, lubricating or any oil storage with a flash point under 80 degrees C.
13. Match manufacture or storage
14. Metal enamelling
15. Nitro-cellulose film exchanges and laboratories
16 Paint and varnish manufacture or spraying or dipping

17. Petroleum manufacture
18. Processing of paper or cardboard in loose form
19. refrigerating systems using high hazard refrigerants
20. Shoe polish manufacture
21. Smoke houses (industrial)

22. Straw goods manufacture or broom storage
23. Sugar and starch pulverising mills
24 Tar, pitch or resin processing
25. Tyre storage warehouses
26. Waste paper sorting or shredding, storage or baling

APPENDIX D (2)

MODERATE HAZARD MATERIALS

1. Bags, cloth burlap and paper
2. Bamboo and rattan baskets
3. Belting, canvas and leather
4. Books and paper in rolls or packs
5. Boots and shoes

6. Buttons, including cloth covered, pearl and bone
7. Cardboard and cardboard boxes
8. Clothing
9. Cordage
10 Fibre board

11. Furniture
12. Glue, mucilage and paste
13. Linoleum
14. Livestock shelters
15. Lumber yards

16. Motor vehicle repair shops
17. Petroleum warehouses for storage of lubricating oils with a flash point of 150 degrees C. or higher

18. Photo engraving
19. Soap
20. Sugar
21. Tobacco, cigars, cigarettes
22. Upholstering and mattress manufacturing
23. Wax candles

APPENDIX D (3)

LOW HAZARD MATERIALS

1. Asbestos
2. Chalk and Crayons
3. Food products
4. Glass
5. Metals

6. Motor car spares (excluding upholstery)
7. Plumbing wares
8. Porcelain and pottery
9. Talc and soapstones

Note: See Tables 3.107.2, 3.111.2, and 3.111.3 of Part 3, Caribbean Uniform Building Code

APPENDIX E

WEIGHTS OF BUILDING MATERIAL

Material	Weight - lbs/sq.ft
Ceilings	
Plasterboard, unplastered	3
Plaster, 3/4 in, and wood lath	8
Plaster on tile or concrete	5
Suspended, metal lath and plaster	10
Floors	
Hardwood flooring, 7/8 in thick	4
Sheathing, yellow pine 1 in. thick	4
Spruce	2-1/2
Wood block, creosoted 3 in thick	15
Cement finish per in. thick	12
Terrazzo tile per in. thick including base	12
Gypsum Slab, per in thick	5
Roofs	
Corrugated metal, galvanised:	
20 gauge 1.66	1.66
24 gauge 1.16	1.16
28 gauge 0.78	0.78
Roofing felt, 3 ply and gravel	5.5
Roofing felt, 5 ply and gravel	6.5
3 ply ready roofing	1
Shingles, wood	3
Tile or slate	5 to 20

Partitions	
Channel Studs, metal lath, cement plaster, solid 2" thick	17.5 18
Studs, 2" x 4", wood or metal lath, 3/4 in. plaster both sides	18
Studs, 2" x 4", plaster board, 1/2" plaster both sides	4
Plaster, 1/2" on clay tile (one side)	

APPENDIX E (Cont'd)

Material	**Weight - lbs/sq.ft**
Mortar Rubble Masonry	
Limestone	150
Dry Rubble Masonry	
Limestone	125
Earth etc Excavated	
Sand, gravel, dry, loose	90 to 105
Sand, gravel, dry, packed	100 to 120
Clay, dry	63
Clay, damp, plastic	110
Clay, and gravel, dry	100
Earth, dry, loose	76
Earth, dry, packed	95
Earth, moist, packed	96
Earth, mud packed	115
Riprap, limestone	80 to 115
Excavations in Water	
Sand or gravel	60
Sand or gravel and clay	65
Clay	80
River mud	90
Soil	70
Stone riprap	65

Concrete Block	
8" x 8" x 16" (from the US) 8" x 8" x 16" (from the Dominican Republic or other areas with igneous or extrusive rock)	35 to 40 lbs per block 45 to 50 lbs per block
Concrete	
With aggregate (basalt or other extrusive rocks)	155 to 160 lbs/cu.ft
With aggregate (sedimentary rock), from Jamaica, Bahamas and other quarries	145 to 150 lbs/cu.ft
With aggregate from limestone (local sources)	140 to 145 lbs/cu.ft

APPENDIX F

ACCESSIBILITY GUIDELINES FOR PERSONS WITH DISABILITIES

1. Scope

1.1 The following guidelines are intended to introduce designers and builders to the minimum provisions required for safe access for persons with disabilities to building facilities. The guidelines should be used in conjunction with the Building Code provisions and in conjunction with the specific recommendations of the bodies and institutions engaged in assisting persons with disabilities with the minimum provisions needed for access to all facilities.

1.2 Designers should also be aware of the United States Americans with Disabilities Act (ADA) Appendix A to Part 1191 Accessibility Guidelines for Buildings and Facilities which was signed into law in July 1990, and which determines the minimum provisions for persons with disabilities in public institutions.

The Act includes:

a) Title 1: Employment
b) Title 11: State and Local Government services, regardless of the receipt of federal funds
c) Title 111:Public Accommodation - hotels, retail establishments etc
d) Title 1V: Telecommunications
e) Title V: Miscellaneous Provisions - includes attorney's fees.

1.3 Designers of public buildings in Groups A and B(a) would therefore be expected to consult the relevant bodies such as the local chapters of the National Council of and for Persons With Disabilities for specific information based on the research being carried out by these bodies. In accordance with 501.2(e), the Director will examine the plans for new public facilities to ensure that adequate provisions have been made for persons with disabilities.

1.4 The following should be considered as minimum provisions for facilities for persons with disabilities in wheel chairs using public buildings.

a) All public buildings - post offices, hospitals, asylums, sanatoria, airport terminals and sea port terminals - and all other buildings in Group B (a) shall have provisions for persons with disabilities including those persons in wheel chairs.

b) It is desirable that other public buildings such as banks, theatres, assembly halls, hotels and cinemas, have some provisions which would allow barrier-free access by persons in wheel chairs.

c) Hotels and other establishments offering accommodation to the public should have at least one Accessible Guestroom for every 25 guestrooms, or a fraction thereof, made accessible for persons with disabilities.

d) In new housing developments consideration should be given to constructing at least one (1#) dwelling unit in every twenty five (25) units (or a fraction thereof) to be accessible to persons with disabilities.

2. Relevant Guidelines

2.1 The following Guidelines and Codes provide detailed information on the design of barrier free facilities:

- BS 5588 Means of Escape for disabled persons
- Caribbean Uniform Building Code, Sections 3.125 and 3.126
- Barrier Free Design - A National Standard for Canada; Canadian Standards Association, June 1990
- Access Needs of Blind and Visually Impaired Travellers in Trans portation Terminals: A Study and Design Guidelines, Canadian Institute of the Blind, December 1987.
- National Building Code of Canada - Section 3.7 - Barrier Free Design; National Research Council of Canada, Ottawa.
- The 'Green' Guide to Safety at Sports Grounds - Fourth Edition 2003, Chapter Thirteen, Section 13.1 - *Spectator Accommodation - Disabilities*
- For further guidance, users may refer to the Football Stadia Advisory Design Council (FSADC) publication *Designing for Spectators with Disabilities*. Written primarily for football grounds, the publication provides much general advice applicable to all sporting facilities.

2.2 It is suggested that designers also read the following:

- "Building without barriers for the disabled" - Sarah P. Harkness and James N. Groom Jr.; Whitney Library of Design, 1515 Broadway, New York, New York 10036.

3. Building Approaches and Entrances

a) In every public building, at least one (1#) primary entrance at ground floor level shall be accessible from the street entrance or parking lot by means of a walkway or ramp a minimum of 4' 0" (1220mm in width) with a gradient of not more than one in twenty 1 : 20. There shall be no steps or abrupt changes in grade of the access way.

b) At every entrance there should be a level platform at least 3' 0" by 4' 0" (914mm x1220mm) to afford the opening and closing of doors by persons in wheelchairs. (Figure 26 in TCI Building Guidelines). Such platforms should also be constructed at every change of grade or direction of the ramp and at 30 foot (9.14 metres) intervals on a long ramp.

c) A clear space of 4' 0" x 4" 0" (1220mm x 1220mm) would allow access for both forward and side approaches to doors. A clear space of 5' 0" x 5' 0" (1524mm x 1524mm) is required for a wheelchair to pivot 180 degrees.

d) Kerbs intended to be crossed by persons with disabilities in wheel chairs should be cut to provide a passage of not more than 4 inches (100mm) high at the kerb

and at least 4 feet (1200mm) wide. The lip of the kerb should not be greater than 1" (25mm) high. Such ramps should be of contrasting colour and texture.

e) Access ramps should be provided with handrails on both sides at a height of 2' 8" (812mm) measured from the ramp surface to the top of the rail.

f) Gratings across entrances and walkways must be avoided. Where gratings are absolutely necessary for drainage the apertures of the gratings should not be greater than 3/4" (19mm) and the bars at least 1/2" (12mm) wide set at right angles to the direction of travel. Gratings and manholes covers should fit securely and be flush with the walk way or street.

g) Catch basins should be constructed outside of pedestrian crossings.

4. Walkways and Sidewalks

a) The surfaces of walkways should be constructed of non-slip covering.

b) Walkways in passages and courtyards should be 4' 6" to 6' 6" (1372mm x 1982mm) wide with shoulders about 4' 0" (1220mm) wide.

c) Slopes should be no greater than 5%

d) Cross slopes no greater than 2%.

e) Walkway widths for persons using crutches or service dogs should (d) above be a minimum of 3' 0" (914mm) wide

f) Sidewalks should be 5' 0" (1524mm) wide

g) Slopes for sidewalks should be 2-1/2% to 5% maximum

5. Doors and Corridors

a) Doors should be openable in a single motion with one hand and with a force of no greater than 5 pounds (22.24N), and should have a clear swing of at least 90 degrees. For sliding doors the force required to operate the door should not be greater than 8.5 pounds (37.8N).

b) Doorways should be a minimum of 32 inches (812mm) clear.

c) Door latches, handles and pull bars should be easy to grasp and between 2' 0" and 4' 0" (610mm x 1220mm) high. Knobsets should not be used.

d) Corridors should be at least (4' 0") 1220mm wide and should be equipped with an easy to grasp hand rail along one side. The handrail should be at a height of 2' 8" to 2' 11" (812mm - 900mm) and be 1-1/2" (38mm) clear off the wall.

e) Except in confined spaces and except for doors to toilets and washrooms, all doors in corridors should open into rooms.

f) The minimum clear floor space or ground area for wheel chairs is 3' 6" x 4' 0" (1016mm x1220mm). An area 4' 0" x 4' 0" (1220mm x 1220mm) allows

access to doors for both forward and side approaches.

g) The space required for manoeuvring wheel chairs at doorways is given in the Table F-1

Table F-1
Applicable Dimensions for Wheel Chair Space at Doorways

Description	Floor depth mm (ft.-in.)	Space width (ft.-in.)	Required space beside latch (ft.-in.)
Front Approach Side hinged Pull Push	 5-0 (1524mm) 4-0 (1220mm)	 4-0 (1220mm) 4-0 (1220mm)	 2-0 (610mm) 1-0 (305mm)
Latch Side Approach Pull Side Push Side	 4-0 (1220mm) 3-6 (1067mm)	 5-0 (1524mm) 5-0 (1524mm)	 2-0 (610mm) 2-0 (610mm)
Hinged Side Approach Pull Side Push Side	 5-0 (1524mm) 3-6 (1067mm)	 5-0 (1524mm) 4-6 (1372mm)	 2-0 (610mm) 1-5 (432mm)
Sliding Door Front approach Side approach	 4-0 (1220mm) 3-6 (1067mm)	 3-0 (914mm) 4-6 (1372mm)	 1-9 (533mm) 1-10 (559mm)

6. Elevators

Where elevators are required to access upper floors at least one elevators should be constructed to meet the requirements given below:

a) Elevators should be accessible from the ground floor entrance

b) The elevator cab shall have a clear area of not less than 20 square feet (1.86 sq metres), with a minimum dimension of 4.5 feet (1372mm).

c) The elevator door should be at least 32 inches (812mm) in clear width

d) Elevators should be self-levelling with a maximum tolerance of 1 inch.

e) Control buttons should be located no more than 4' 5" (1372mm) above the floor.

f) Handrails height should be between 2' 8" and 2" 11" (812mm - 900mm).

g) Where a passenger lift is not provided in a building, it may be a requirement to provide a wheelchair stairlift. However the provision of a wheelchair stairlift should in no circumstance impede the function of the stair as a means of escape.

7. Theatres, Cinemas, Auditoria, Sporting Arenas and Stadia

a) There should be accommodation for persons in wheel chairs attending functions at all public buildings as follows:

Table F-2
Spaces Required For Wheel Chairs

Number of Fixed Seating	Number of Spaces Required for Wheel Chairs
Up to 200	2
201 to 300	3
301 to 400	4
401 to 500	5
501 to 600	6
600 to 10,000 10,000 to 20,000	Minimum of 6, or1 in 100 of seated capacity (whichever is greater). 100 plus 5 per 1,000 above 10,000
20,000 to 40,000 40,000 or more	150 plus 3 per 1,000 above 20,000 210 plus 2 per 1,000 above 40,000

b) Wheel chair spaces should be not less than 4' 4" (1320mm) deep by 2' 6" (762mm) wide and should preferably be integrated into the regular seating and it is recommended that accommodation for spectators with disabilities should be dispersed throughout the sports facility also applies to the provision of space for spectators and patrons using wheelchairs.

c) Each space should be accessible with minimum of assistance and should be on an aisle and should be on the same level and near to an exit.

d) Where a public address communication system is installed, headphones outlets should be provided for persons in wheel chairs at a ratio of 1 such outlet for every 100 seats with a minimum of two.

e) In sporting arenas and stadia, where possible, wheelchair spaces should be provided in both home and away spectator viewing areas that provide adequate shelter. Where separate shelter is provided (eg. for an area specifically for wheelchairs), the roof or canopy should not hinder views of other spectators, but should be sufficiently high to allow able-persons, such as companions and assistants, easy access and circulation.

8. Ground and Floor Surfaces

a) The surfaces of the ground and floor on which disabled persons must walk should be firm, slip resistant and free of glare. Any change in level should be treated as per Table F-3.

b) The floor surface of detectable warning surfaces should be about 3' 0" (914mm) long and be of contrasting colour.

c) Floor surfaces should be slip resistant as far as possible. The slip resistance of common surfaces is given in Table F-4.

Table F-3
Changes in Level

Vertical Rise (in.)	Edge Treatment
0 - 6mm (0 - 1/4)	May be vertical
6mm - 12mm (1/4 - 1/2)	Should be bevelled. Max slope 1:2.
Over 12mm (1/2)	Treat as ramp.

Table F-4
Slip Resistance of Floor Finishes

Slip Resistance Classification	Ramp Inclination	Typical Application	Type of Surface Finish
R9	< 9º	Low risk internal areas, customer areas, reception areas	Plain/Matt Tile/ Sheeting/Sheet Carpet*/ Carpet Tiles*
R10	10º to 19º	Toilet and washroom areas, self-service cafeterias and restaurants	
R11	20º to 27º	Cold stores, dish washing area	Plain/Matt Tile;
R12	28º to 35º	Liquid spillage areas, large commercial kitchens	Small Stud/ Rock Textured Raised Surface Profile**
R13	Above 35º	High risk of spill, oil spillage or similar present	Grit inclusion/ Textured**/ Raised Surface Profile

Notes: * The soft weave of the carpet may make travel in a straight line difficult
** Textured finish to concrete improves its resistance when wet.

9. Protruding Objects

It is recommended that designers consult Section 3 of the National Building Code of Canada for the proper placing of protruding objects. Objects protruding from walls with their leading edges between 2' 6" (762mm) and 6' 6" (982mm), shall protrude not more than 4" (100mm) into pedestrian areas such as sidewalks, halls, corridors, etc.

10. Walls

a) Wall surfaces should not be rough or uneven and should have contrasting colours.

b) Mirrored walls should not be used as they may be confusing to the visually impaired.

c) Glass panels may be confused as egress routes.

11. Detectable Objects

The following guide should be considered in the placing of objects on walls or in rooms to be traversed or used by the physically handicapped.

a) Objects with their leading edges 2' 4" (712mm) from the floor may protrude any amount.

b) Objects between 2' 4" (712mm) and 6' 8" (1982mm) from the floor shall not overhang more than 1' 0" (305mm).

c) The maximum height of the bottom edge of an object with a space of more than 1' 0" (305mm) between supports shall be 2' 3" (686mm) from the floor.

d) Freestanding objects shall not overhang more than 1' 0" (305mm) foot between 2' 3" (686mm) and 6' 5" (1956mm).

12. Headroom

The minimum headroom - clear height from the floor to ceiling (or any supporting beam or member) - is 7' 0" (2134mm).

13. Bathroom and Toilet Facilities

a) All public buildings shall have at least one toilet specially constructed for use by handicapped persons. Such toilet compartments shall carry on the door to the compartment the international sign indicating that such a compartment has been specially constructed for use by handicapped persons. The sketches (Figure 26 in TCI Building Guidelines) show planning arrangements for the toilet compart ments and the international signs used for handicapped facilities.

b) Toilet fixtures should be so placed as to facilitate the turning of a wheelchair.

c) Handrails of not less than 1 inch (25mm) and not more than 1-1/2 inches (38mm) O.D. shall be provided on both sides of the water closet, and mounted 34 inches (864mm) above and parallel to the floor. The handrail should be placed with the front end about 2 feet (610mm) in front of the water closet.

d) Toilet seats should be 18 inches (457mm) to 24 inches (610mm) off the floor. They should be equipped with:

i) hand operated flushing controls that can be reached by persons in a wheel chair and

ii) a back support.

e) Wash basins should be placed a maximum of 2' 10" (864mm) high with a clear space of at least 2' 3" (686mm) high by 3' 0" (914mm) under the basin. The washbasin should be equipped with faucet handles of the lever type without spring loading. The soap and towel dispensers should be located not more than 4 feet (1220mm) above the floor and be accessible to persons on a wheel chair.

f) The bottom edge of a mirror should not be more than 3' 0" (914mm) above the floor.

g) Where showers are provided in public assembly buildings at least one shower for each sex should be constructed for use by persons with disabilities. Such showers should not be less than 5' 0" by 3' 0" (1524mm by 914mm) with a threshold no higher than 1/2" (12mm) and a curtain hung 3' 0" (914mm) from the back wall.

h) Doors to toilet facilities should always open outwards and be equipped with self closing hinges or door closers.

i) Vertical and horizontal grip rails should be installed and readily accessible from the toilet and shower.

14. Parking Lots

a) Any parking lot servicing an entrance described in 506.1 shall have a number of level parking spaces identified by the appropriate international signs as reserved for persons with disabilities. Each reserved parking space shall not be less than 12' 0" (3658mm) wide.

b) Table F-5 gives the suggested number of reserved parking spaces for persons with disabilities. Such parking spaces shall be within easy reach of an exit, and shall be so placed that the person using the space would not be compelled to pass behind other parked vehicles to access the building entrance, ramp or walkway.

Table F-5
Accessible Parking Spaces for Persons With Disabilities

Total Number of Parking Spaces in Lot	**Required Number of Spaces Reserved for Persons With Disabilities**
1 - 50	1
51 - 75	2
76 - 100	3
101 - 200	4
201 - 500	5
above 500	1 percent of the total number of spaces

15. Illumination

For persons with visual impairment, passages and concourses require good lighting and contrasting colours. All spaces to be used by persons associated with visual impairment should be provided with at least the lighting level of 100 lux.

16. Signs

All signs for entrances/doors/walls/*etc* must be in large print, with good contrasting letters against a pale background, and should have tactile/braille on signs in front of exits, stairwells, elevators that can be seen and/or felt (by the foot) upon approach.

Provision for elevators should include the use of contrast/tactile buttons and elevators shall be provided with audio (to tell you what floor you have reached) systems. Entrance doors must be provided with large good-contrast signs on with tactile (engraved) references.

For adequate recognition of signs by persons associated with visual impairment the signs should be constructed and placed in accordance with the following Table F-6.

Table F-6
Placing of Signs

Minimum Character Height mm (in.)	Maximum Viewing Distance mm (ft.-in.)
8" (200mm)	20'-0" (6096mm)
5" (127mm)	15'-0" (4572mm)
4" (100mm)	8'-0" (2438mm)
3" (75mm)	7'-10" (2388mm)
2" (50mm)	5'-0" (1524mm)
1" (25mm)	2'-6" (762mm)

17. Provisions for access to service in Supermarkets, Banks and other Public Places

a) Aisles.

The minimum width of aisles for persons to allow safe manoeuvring by persons in wheel chairs should be 3' 4" (1016mm) for travel in a straight line and 5' 0" (1524mm) to provide for a 180 degree turn. In supermarkets and other public places such as assembly halls, banks and theatres it is recommended that provision be made for 2 persons in wheel chairs to pass each other, and for persons in wheel chairs to make a 180 degree turn. The recommended minimum width for aisles is therefore 5' 0" (1524mm).

b) Counters

It is recommended that special seating arrangements be made at banks, work places and lunch counters for persons in wheel chairs. Adequate room must be provided for safe manoeuvring to approach the counter.

Seating spaces at counters should have a clear floor space of not less than 2' 6" (762mm) by 4' 0" (1220mm). Where a forward approach is possible there should be a clear knee space of at least 2' 6" (762mm) wide by 1' 8" (457mm) deep by 2' 4" (711mm) high.

At lunch counters and at places where it is necessary to stand or sit to be served, there should be at least one such special seat available for every 30 places. There should be at least one special counter available in banks for persons in wheel chairs.

c) Shopping Malls

The design of shopping malls should be in accordance with BS 5588 Part 10: 1991 Code of practice for shopping complexes.

18. Public Telephones

a) Wherever public telephones are installed provision shall be made for at least one telephone to be accessible by persons in wheel chairs.

b) The maximum height of the telephone controls should be 4' 6" (1372mm) and a clear floor space of not less than 3' 0" (914mm) by 4' 0" (1220mm) shall be provided in front of the telephone. If a clear height of 2' 6" (762mm) is available for knee space, then the allowable floor space can extend into the knee area a maximum of 4' 0" (1220mm).

c) The minimum cord length should be 3' 4" (1016mm).

d) The telephone assembly including the enclosures shall not reduce the minimum width required for safe passage in corridors, aisles or walkways.

19. Emergency Evacuation of Persons with Disabilities

a) Stairways
Stairways designated for the emergency evacuation of persons with disabilities, should comply with requirements for internal stairs in the Building Code. A stairway with a minimum width of 3' 7" (1100mm) [4' 0" (1200mm) in new construction] should be adequate to allow a person in a wheelchair to be carried down safely.

b) Evacuation or Fire-fighters Lifts
In cases of emergency, and only under the direct supervision of fire-fighters /mandatory or volunteer CERT registered emergency personnel, passenger lifts may only be used for evacuation of persons with disabilities, provided that they are designed to meet the requirements of an evacuation lift such as having additional protection, controls and signals that enable them to be used under the direct control of the fire service to be able to operate even when there is a fire in the building.

c) Wheelchair Stairlifts
Wheelchair stairlifts installed in stairways should not be used for emergency evacuation. Stairways designated for emergency evacuation, should not be reduces in width by any part of the stairlift to less than 3' 7" (1100mm) [4' 0" (1200mm) in new construction]

d) Ramps
Where ramps are used in emergency evacuation routes, the gradient should be no steeper than 1 in 20 and small changes in level should be avoided.

20. Fire and Emergency Warning Systems

The emergency management plan for public buildings should take into account the special needs of users and persons with disabilities. Where separate emergency evacuation routes for persons with disabilities are provided, as is recommended, the plans should allow for able-bodied persons and persons with disabilities to be evacuated simultaneously.

Where the separation of escape routes for able-bodied persons and persons with disabilities cannot be provided, for practical reasons, the plans may be based on the use of two-stage warning system. Preferably, the first stage should take the form of a coded message alerting designated emergency personnel to an impending evacuation. This process allows for persons with disabilities to be moved to refuges, from which they are moved either to evacuation lifts or are assisted down staircases to the ground floor level.

The second stage should take the form of a general alert in which warning systems and announcements are made over a public address system to signal an evacuation. Where appropriate, a signal can be visual instructions on electronic screens placed in strategic locations within the building.

21. Management of Accommodation for Persons with Disabilities

The management of public buildings must ensure the proper accommodation for persons with disabilities, to ensure the safety of all users at all times. In addition therefore to the guidelines which preceded this section, the following factors should also be considered when designing and for persons with disabilities.

a) Good and Safe Design

Many persons with severe impairments who have acute sensory perception, also tend to rely on other persons in times of emergency. Many persons with disabilities may not need, or desire, special attention or assistance. Therefore the proper and safe design of buildings should always seek to make it possible for persons with disabilities to enjoy barrier-free access to public buildings without the need for high levels of stewarding or intervention.

b) **Provision of Amenities**

Management of public buildings should, where possible, make necessary provision for the safe parking and access of persons with disabilities. Wherever possible, separate entrances should be provided for semi-ambulant people and persons with wheelchairs.

c) **Provision for Special Vehicles**

Where public buildings have to admit persons with disabilities in special vehicles (invalid cars), management of such buildings should ensure that the passage of these special vehicles and designated parking, does not hinder the safety of other users to the building. In addition, the location of these vehicles should not obstruct or restrict access to the building by emergency or medical personnel of vehicles.

d) **Provisions for Older Persons**

Whereas older persons do not regard themselves as having disabilities, it is not unusual for older persons to be semi-ambulant or to experience impaired vision, hearing or mobility. Given the increasing reported cases of diabetic and hypertensive cases in the region, this may be reflected in the increasing number of older persons afflicted by impaired vision, hearing or mobility. Management of public buildings should therefore be constantly aware of the needs of older persons when planning and training personnel for emergency evacuation procedures.

APPENDIX G

GENERAL GUIDELINES FOR FIRE RESISTIVE CONSTRUCTION AND *FOR SOUND TRANSMISSION CONTROL*

1. Scope

This appendix is designed to assist in the coordination of design requirements for ensuring the safety of occupants of all classes of buildings in the event of a fire. Information on the fire resistance of materials and assemblies used in construction is provided in Section 4 of this Code and in Section E of the Building Guidelines. Sub-sections 502, 504 and 505 of the Code also provide information on the design of building components for fire safety and on the fire safety equipment required.

The main objective in the design of buildings must be to limit the spread of fire so that occupants can escape safely and so that the fire will not be spread to adjacent buildings before fire fighting efforts to contain the fire can be effective. The design on buildings must also take into account the need for access to the buildings by fire fighting apparatus and in the cases of buildings with their own water supply to the nearest suitable water connection.

This appendix also provides information on the design of walls, and floor structures for the control of sound transmission in buildings.

2. Other Codes

This Appendix does not repeat the standards given in other Codes of practice as it is recommended that designers of institutional buildings and all buildings in Groups A, B, C, D, E (b) and (c), and F consult the codes listed in this paragraph. Where a conflict arises in the interpretation of the Codes, Part 3, Section 7 of the Caribbean Uniform Building Code takes precedence.

The reference codes are:

- **Caribbean Uniform Building Code (CUBiC)** - Part 3 Sections 6 and 7

- **BS 5588.**

  Part 1 Code of Practice for residential buildings
  Part 2 Code of Practice for shops

Part 3	Code of Practice for office buildings
Part 6	Code of Practice for places of assembly
Part 8	Code of Practice for means of escape for disabled people
Part 10	Code of Practice for shopping complexes

- **National Building Code of Canada**

Section 2.5	Fire Department Access to Buildings
Section 2.7	Safety to Life
Section 2.8	Emergency Planning
Section 2.10	Day Care Centres
Section 2.11	Boarding and Lodging Houses
Section 2.15	Construction Sites

Ontario Building Code

Section 9

Barbados National Building Code

Section 4.5

3. Fire Resistant Construction for Important Buildings

Table G-1 gives the fire resistant periods required for institutional buildings, for shops and supermarkets, for assembly halls, theatres and stadiums, and for other public buildings such as post offices, general office buildings and banks.

Table G-1

Required Fire Resistant Periods

Buildings	**Period in Hours**
Assembly Halls	1-1/2
Hospitals	***2-1/2***
Infirmaries	***2-1/2***
Hotels, condominiums	***2***

Prisons	1-1/2
Theatres	3
Office Buildings	1/2
Banks	1/2
Shops and Shopping Centres	3/4

The fire resistant periods given are based on the need of occupants to exit the buildings safely under the conditions which obtain in the OECS Islands. ***In this Table it is assumed that the buildings will be no more than two storeys with single loaded corridors with an exterior walkway.***

It is important to recognise that while it may be possible to exit buildings in much less time than indicated in the Table, yet the conditions for safe exit may not be in place, and caution must be used in the design of hospitals and infirmaries where the occupants will not be completely mobile and staff may not be available to offer assistance to the immobile or bedridden occupants. ***Building designers should therefore base their designs and choice of materials on the information provided in Section 4 Table 4-2 and in Section 5 Table 5-3(a) or in the relevant British, American or Canadian standards.***

4. Fire Protection Requirements for Storage and Maintenance Facilities

Table G-2 gives the type of construction required for the construction of buildings or rooms housing maintenance and storage facilities. This Table must be read with Tables 4-1 to 4-3 and with Part 3 Section 3 of CUBiC for the design of buildings storing flammable materials, to provide the material types that can be used for the construction of the facilities.

Table G-2

Structural Fire Protection of Certain Facilities

Facility	**The facility should be separated from other parts of the complex by:**
1. Storage areas not greater than 450 sq.m. (other than refuse storage areas) 2. Engineering services installations rooms (other than those covered in items 6, 7, and 8)	Robust construction having a minimum standards of fire resistance of 60 min.
3. Repair and Maintenance workshops 4. Storage areas greater than 450 sq.m. (other than refuse storage areas)	Robust solid non-combustible construction having a minimum standard of fire resistance of 120 min.
5. Refuse Storage Areas 6. Rooms housing fixed internal combustion engines 7. Boiler and fuel storage spaces 8. Transformer and switchgear rooms 9. Central control room, fire control centre, enclosed car parks and enclosed servicing areas.	Robust solid non-combustible construction having a minimum standard of fire resistance equivalent to that required for the elements of construction of the complex, and in no case less than 120 min.

The Board/Authority will not approve the design and construction of any building which does not comply with the minimum requirements for fire safety as given in this Code.

5. Storage of Flammable Liquids and Gases

Section 3 of Part 3 of the Caribbean Uniform Building Code (CUBiC) provides details for the construction and occupancy of facilities with hazardous and volatile materials such as petroleum (gasoline), liquefied petroleum gases, flammable film, and combustible fibres.

CUBiC gives limiting distances from buildings for the location of facilities such as paint spraying booths, private and public garages, and motor fuel service stations depending on the capacity of the storage facility and the type of service proposed. Designers are advised to consult CUBiC and other Codes such as NFiPA 30 - Flammable and Combustible Liquids to ensure that the design of the facility conforms to the safety standards approved by the Board.

6. Sound Transmission - Residential Buildings

To inhibit the transmission of noise in from one room to another, the walls, partitions, ceilings and floors of all buildings in Group E, must be constructed to satisfy the applicable ASTM standard. Table G-3 provides information on typical wall assemblies with the corresponding Sound Transmission Class (STC). Partitions within units must have a minimum STC of 45, while partitions between units must have a minimum STC of 50. The quality of construction needed to satisfy the STC rating required has to be sound.

Building designers of residential buildings such as hotels, condominiums, hospitals and the like occupancies must examine the relevant ASTM, British or Canadian standards. Table G-3 gives the fire resistance rating and sound transmission class of some materials and assemblies used in the OECS.

Concrete walls and floors are generally required to have adequate insulation against impact or structure borne noise. Floor coverings which are used to dampen the effect of impact noise or for aesthetic purposes must have fire ratings adequate for the use of the space.

7. General

It is emphasised that building designers must examine the fire resistive periods of materials and assemblies as given in Tables 4-1, 4-2 and 4-3 of this Code and Tables E-1, E-2, E-3, E-4 and E-5 of Section E of the Building Guidelines to determine the component assembly and materials appropriate for the building to be constructed.

For example the use of 1/2 inch fibreboard for cladding of partitions or ceiling in institutional buildings would be inappropriate as Table E-4 of Section E of the Building Guidelines assigns a fire resistance period of 5 minutes to 1/2" fibreboard. The minimum timber assembly for a one-hour fire resistive period is given in Table 4-2. This assembly is described as 2" x 4" wood studs 16" on centre with two layers of 3/8" regular gypsum wallboard on each side. This assembly must be 5-1/4" thick.

Two storey institutional buildings or condominiums or hotels are required to be in Type 1construction. This will normally require the use of solid concrete or hollow concrete block walls or fire resistant rated steel construction. (See Section 3 Tables 3-2 to 3-7)

Table G-3

Fire and Sound Resistance of Building Components

Component	*Description*	*Finish on each side*	*Fire resistance rating*	*Typical Sound Transmission Class (STC rating)*
Hollow concrete block walls	*6 inches thick*	*No finish*	*1 hr*	*45*
	8 inches thick	*No finish*	*1.5 hr*	*50*
	6 inches thick	*½" gypsum sand plaster*	*2 hr.*	*51*
	8 inches thick	*½" gypsum sand plaster*	*2 hr.*	*50*
Solid concrete walls	*6 inches thick*	*None*	*3 hr.*	*55*
	8 inches thick	*None*	*4 hr.*	*58*
Timber stud frame interior walls	*2" x 4" studs @16 " o.c.*	*2 layers of ½" fire resistant gypsum board with joints taped and filled*	*1 hr*	*34*
	2" x 4" studs @ 16" o.c.on separate 2" x 4" plates set 1" apart with absorptive material on both sides	*2 layers of 5/8" special fire resistant gypsum board with joints taped and filled*	*1hr*	*57*
Concrete floors	*4" thick at least of 2,500 lbs/sq.in 6" thick at least of 2,500 lbs/sq.in*	*No finish*	*1 hr.*	*48*
		No finish	*2 hr.*	*52*
Timber floors	*Wood floor joists spaced 16" o.c. , sub-floor of 3/4" T & G lumber of 5/8" plywood, with an additional layer of ½" sanded plywood*	*5/8" special fire-resistant gypsum board with joints taped and filled*	*45 min*	*50*

APPENDIX H (1)

REQUIREMENTS OF GROUP A OCCUPANCIES

1. DEFINITION

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

3. LOCATION ON PROPERTY

4. EXIT FACILITIES

5. OCCUPANCY CONTENT

6. WIDTH OF EXITS

7. MAIN FLOOR EXITS

8. BALCONY EXITS

9. EXIT DOORS

10. AISLES AND SEATING

11. LIGHT AND VENTILATION

12. HAZARDS

13. ENCLOSURE OF VERTICAL OPENINGS

14. STAGES

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c) Accessory rooms
d) Proscenium walls
e) Proscenium curtains
f) Stage ventilators
g) Flame retarding requirements
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i) other requirements

15. PLATFORMS

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16. MOTION PICTURE MACHINE BOOTHS

17. FIRE PROTECTION AND HAZARDS

18. PLUMBING AND TOILET FACILITIES

19. EXCEPTIONS AND DEVIATIONS

20. SCHOOLS AND CHURCHES

a) Special provisions
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c) Widths of exits
d) Arrangement of exits
e) Corridors
f) Balconies
g) Floors
h) Doors

21. MIXED OCCUPANCIES

APPENDIX H (1)

REQUIREMENTS OF GROUP A OCCUPANCIES

1. DEFINITION

Group A occupancy is defined in 301.2 and includes assembly uses such as theatres, auditoria, motion-picture houses, exhibition halls, skating rinks, gymnasiums, bowling alleys, pool rooms, restaurants, churches, dance halls, night clubs, meeting rooms, passenger rooms, recreation facilities, and similar uses. having an occupant content of 50 or more persons.

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

Buildings or parts of buildings, classed in Group A because of use or Occupancy shall be Type 1 construction. Exterior walls shall have fire-resistance and opening protection, determined by location on property, as set forth for the Type of Construction in Tables 3-4 to 3-7.

Buildings in this Group shall not be limited as to occupant content, height or area except as may be required by the Director of Planning and as provided in the Development Manual issued by the Department of Planning.

3. LOCATION ON PROPERTY

See Development Manual for location

4. EXIT FACILITIES

Exit facilities for Group A Occupancy shall be as set forth in Section 5 and in Table 5-2.

5. OCCUPANCY CONTENT (See Section 3 Table 3-1)

For places of public assembly with fixed seats, a space of seven square feet shall be allowed per person. For places of assembly with moveable seats, a space of ten square feet shall be allowed per person. For night clubs and restaurants with tables, a space of twelve square feet shall be allowed per person. Aisles or gangways shall not be included in these areas.

Notwithstanding the above areas required, the occupant content shall be taken as not more than one person per fifteen square feet of aggregate gross area of all floors or parts of the building used for assembly purposes including lobbies, corridors, dressing rooms, toilets, and other commonly used connecting rooms and service areas used in conjunction with the assembly occupancy.

Such areas as swimming pools, bowling alleys, may be excluded or other uses separately considered.

6. WIDTHS OF EXITS

Every place of assembly and every individual room used as a place of assembly shall have exits of a number and width sufficient to provide for the total occupancy as given in Tables 5-2 and 5-4. The widths can be calculated by the following:

a) Areas served by doors or horizontal exits leading to the outside of the building or 22 inch unit of exit width for each one hundred persons or fraction thereof.

b) Areas served by stairs or other type of exit not as set forth in (a) above, one 2 inch unit of exit width for each 75 persons or the fraction thereof. The minimum exit width shall be 36 inches in all cases.

However, the number and widths of exit shall not be less than those set out in Tables 5-2 and 5-4.

7. MAIN FLOOR EXITS

a) Not less than half of the required main floor exit widths shall be to a main entrance and exit, and the remainder shall be proportioned to the side exits. All required exits of Group A Occupancy shall serve no other Occupancy.

b) Exits no less in width than the full width of the aisles or gangway leading thereof shall be provided at the rear of the main-floor assembly and such exits hall lead into a foyer or into a passage-way to the outside of the building. Any change in elevation from a public footpath to the back of the main floor assembly or foyer shall be made by ramps having a slope of not more than one in ten. The most obvious and direct exit to the public street shall be and remain unobstructed.

c) The width of the foyer at any point shall not be less than the combined width of the aisles, gangways, stairways and passageways leading thereto. The foyer shall be separated from the assembly spaces with partitions having a fire rating of not less than two hours. There shall be not less than two remote exits from any Groups A Occupancy.

d) Half of the required main floor exit widths shall be proportioned to the side exits and when more than one side exit is required, shall be equally divided in full units of unit width to each side. The number of side exits shall be as in 502.4 g).

e) Exits shall be so arranged that the maximum distance as measured along the line of travel to the nearest floor exit from any point shall not exceed 150 feet. (See Table 5-3).

8. BALCONY EXITS

Exits from a balcony shall be as specified for main-floor exits except as follows:-

Balconies having an occupancy content of less than thirty persons may be served by one 44 inch stair, and for thirty persons or more at least two exits shall be provided.

9. EXIT DOORS

All doors in the paths of egress, normally closed and latched, shall be equipped with full sets of panic hardware. No single door shall be more than 3'8" in width and no double door ways shall be less than 3'9" in width.

10. MARKING OF EXIT DOORS

Above every exit door there shall be a lighted sign marked EXIT in letters at least 4" high lit normally by an electric bulb and in addition fitted with an emergency battery or power source to give light in the event of power failure. The letters shall be green and the background white. Doors which may be confused as leading to exits, shall clearly be marked "PRIVATE."

11. AISLES AND SEATING

a) Section 503.9 provides information on fixed seating in places of public assembly.

b) Fixed seats shall be securely fastened to the floor; moveable or folding seats for the assembly of five hundred (500) persons or more shall be fastened together in banks of six or more.

c) Where seating is at tables as in restaurants and night clubs, aisles or gangways shall be located so that there is not more than twenty-eight (28) feet between aisle or gangways nor more than fourteen (14) feet between an aisle or gangway and a wall. At each side exit there shall be a cross aisle or gangway leading to the centre of the width of the building. Aisle or gangway widths shall be rigorously maintained.

12. LIGHT AND VENTILATION

a) General

All portions of Groups A Occupancies customarily used by human beings and all dressing rooms shall be provided with light and ventilation by means of windows or skylights with an area of not less than one-eighth of the total floor area, one-half of which shall be openable, or shall be provided with electric light and mechanically operated ventilating system as set forth in Section 11.

Ducts for the mechanical ventilation system shall serve no other Group of Occupancy.

b) Artificial lighting

Auditorium light shall be as set forth in accordance with the requirements of the Section 11, and emergency lighting shall be provided in all paths of egress to the approval of the Director.

13. HAZARDS

Registers or vents supplying air back stage, supplying a projection booth or passing through a fire wall shall be equipped with automatic closing devices activated by smoke detectors located in the registers or vents, and supplying air fans shall be controlled with a smoke sensing device.

14. ENCLOSURE OF VERTICAL OPENINGS

a) Vertical openings shall be enclosed as set forth in Part 3 Section 3.612 of CUBiC.

b) Elevators which serve dressing rooms, gridiron and fly galleries need not be enclosed above the sage level.

15. STAGES

Stages, platforms and accessory features thereof shall be designed and constructed as set forth herein.

a) Stage construction

All parts of the stage shall be designed to support not less than 125 pounds per square foot and shall be of Type 1 construction or fire retardant timber. The room directly under the stage shall not be used for any purpose other than the working of traps and mechanical apparatus necessary for a performance on the stage.

Openings through stage floors shall be equipped with tight-fitting trap doors or non-combustible materials or of wood not less than two inches thick.

b) Gridirons

Gridirons, fly galleries and pin rails shall be constructed of non-combustible materials, but fireproofing of metal shall not be required.

c) Accessory rooms

Dressing rooms, workshops, and store rooms shall be located on the stage side of the proscenium wall and shall be separated from each other and from the stage by two-hour fire-resistive construction.

d) Proscenium walls

The proscenium wall separating the stage portion from the auditorium shall be not less than four-hours fire-resistive construction and shall extend not less than four feet above the roof. The proscenium wall shall not be finished or covered with combustible materials.

Proscenium walls may have in addition to the main proscenium opening, one opening at the orchestra-pit level and not more than two openings at the stage-room level, each of which shall be not more than 25 square feet in area. Such openings shall be equipped with self-closing fire-resistive doors.

e) Proscenium curtains

The main proscenium opening shall be provided with a self-closing, tight-fitting, dirt-resistive curtain composed largely of heat-resistive material with no more than ten percent of weight of cotton or other combustible materials.

Such curtain shall be of one-ply thickness and shall weight not less than three pounds per square yard and shall be painted with a mineral pain so brushed into the cloth that no light or smoke can come through. Proscenium curtains of non-combustible materials other than fabric may be used, with the approval of the Director.

Proscenium curtains, 35 feet or less in width, shall have a rigid metal member, not less than the equivalent of a two-inch standard steel pipe, at the top and bottom edges, protected by the fabric on both the stage and auditorium sides. Curtains over 35 feet in width shall have a rigid metal frame, protected on both sides against fire and such frame shall be designed for a wind pressure of not less than 15 pounds per square foot.

The proscenium curtain shall extend into non-combustible and smoke-proof guides at the sides, a distance of not less than 12 inches. The curtain shall overlap at the top of the proscenium opening not less than 24 inches, and the bottom edge shall have a yielding pad of non-combustible materials not less than four inches deep to form a seal against the floor.

The proscenium curtain shall be rigged and counter-balanced with not less than six three-eighths-inch flexible steel cables and six safety stop chains of one-quarter-inch straight link-welded chain and shall be so arranged that it can be quickly released to descend by gravity and completely close the opening.

The releasing device and its location shall be approved by the Director.

f) Stage ventilators

There shall be one or more ventilators constructed of metal or other non-combustible materials near the centre and above the highest point of any permanent stage, raised above the roof and having a total ventilating area equal to at least five percent of the floor area within the stage walls, doors or covers for ventilators shall open by gravity and shall be held closed and manually operated by means of cords extending to each side of the stage.

These cords shall be equipped with three fusible links, one of which shall be placed in the ventilator above the mains roof level and the other two at approved points, no affected by sprinkler heads. Such links shall fuse and separate at 160 degrees Fahrenheit. Glass, if used in such ventilators, shall be wire glass.

g) Flame-retarding requirements

No combustible scenery, drops, decorations, or other combustible effects shall be placed on any stage or enclosed platform unless it treated with an effective fire-retardant solution and maintained in a non-flammable condition as approved by Department of Government responsible for fire protection and control.

h) Stage exits

At least one exit two feet six inches wide shall be provided from each side of the stage opening, directly or by means of a passageway not less than three feet in width, to a street or exit court. An exit stair not less than two feet six inches wide shall be provided for egress from each fly gallery.

Each tier of dressing rooms shall be provided with two remote paths of egress, each not less than two feet six inches wide, and where dressing rooms are provided more than one tier above the stage floor, stairways to all tiers shall be enclosed.

Stage exits shall be as set forth in Section except as otherwise required in this Sub-section.

i) Other requirements

There shall be no enclosed structure for human occupancy located above a stage.

16. PLATFORMS

a) Platform construction

The platform shall be constructed entirely of non-combustible materials except that where the auditorium floor extends under the full area of such platform, construction may be of Type 2, omitting the fire-proofing on the beams and girders.

b) Size of platform

The platform shall not extend from the rear wall a distance greater than 18 feet, measured to the greatest projection of the platform, nor shall the ceiling over any platform be more than five feet above the screen except that platforms for schools and churches may extend from the rear wall a distance not greater than 25 feet.

c) Accessory rooms

No dressing or other rooms for human occupancy shall be located on, under or above such platform unless such rooms shall be completely separated therefrom by not less than two-hour fire-resistive construction.

d) Screen

The screen shall be rigidly attached to the platform and to the rear wall, and a clear passageway, not less than 20 inches wide, shall be provided between the screen or sound equipment and the rear wall.

17. MOTION PICTURE MACHINE BOOTHS

All booths constructed for the projection or showing of motion picture films shall be as set forth herein:

a) Every motion-picture machine, using nitro-cellulose or other inflammable films together with all electrical devices, rheostats and sewing machines used in connection therewith, and all such films, shall be enclosed in a booth large enough to permit the operator to

walk freely on either side or back of the machine; and such room shall be not less than seven feet high and shall have a floor area of not less than 50 square feet for each motion picture machine in such booth.

b) The floors, walls and ceiling of such book shall be of non-combustible materials of not less than two-hour fire-resistive construction as specified in Section 4.

c) The entrance to the booth shall be equipped with tight-fitting, self-closing doors of fire-resistive construction. Such door shall open outward and shall not be equipped with any latch. Booths exceeding 200 square feet in area shall have two means of exit therefrom, and doors shall be remotely located. Any required exit door from the motion picture booth shall be not less than two feet six inches in width.

d) Machine and observation ports in machine booth walls shall be of three kinds: projection ports, observation ports and combined observation and spotlights ports. These ports shall be limited in size and number as follows: there shall be not more than one projection port for each machine head, having an area of not more than 120 square inches.

e) There shall be not more than three combination observation and spotlight ports, and they shall not exceed 30 inches by 24 inches.

f) There shall be not less than one foot of wall space between openings. Each port in the projection booth wall shall be completely covered with a single pane of plate glass; and each such opening, together with all fresh air inlets, shall be provided with automatic shutters of not less than ten U.S. gauge sheet metal and enough to overlap at least one inch on all sides and arranged to slide shut by gravity without binding.

g) These shutters shall be held normally open by means of chains equipped with approved 160 degree-fahrenheit fusible links, all so arranged that the shutters may be easily released by hand or automatically by the fusible links and close smoothly without noise.

h) Every booth shall be equipped with a ventilating inlet not less than 30 inches square in area, placed near the floor and protected by two layers of copper gauze, one of 18 meshed per inch and the other of ten meshed per inch, in addition to the shutter specified above.

i) At the top of every booth, there shall be at least a ten-inch diameter vent for each motion-picture machine. Such vent shall be constructed of not less than #4 U.S. gauge sheet metal and shall connect into a masonry flue or go directly through the roof and 12 inches above, and shall be provided with an exhaust fan which will produce a complete change of air in the booth every two minutes.

j) No wood or other combustible materials shall be allowed closer than four inches to such vent, and there shall be not more than one elbow or change of direction of this metal vent in any attic space. No such vent shall pass through any occupied room unless encased in not less than four inches of solid masonry.

k) All shelves, furniture and fixtures within the booth shall be constructed of metal or other non-combustible materials.

l) Every motion-picture machine shall be securely fastened to the floor to prevent overturning.

m) The rewinding machine shall be located in a fire-proof compartment within the booth, and all films not in actual use shall be kept in individual metal boxes with tight-fitting covers and must be stores, each in its individual box, in a fire-proof cabinet, which cabinet shall be divided into compartments having a capacity of not more than ten such films boxes in each compartment.

n) Each compartment shall have a separate tight-fitting, self-closing cover of not less than ten U.S. gauge sheet metal, arranged to close automatically.

No solder shall be used in the construction of such metal boxes, compartments or cabinets.

18. FIRE PROTECTION AND HAZARDS

The installation of fire alarm and fire suppression systems shall be in accordance with Sub-section 505.

19. PLUMBING AND TOILET FACILITIES

The installation of plumbing and toilet facilities shall be in accordance with Sections 3 and 9.

20. EXCEPTIONS AND DEVIATIONS

Existing buildings not fully complying with the requirements of the Appendix may be used for Group A Occupancies, if they meet the requirements of:

a) The construction Type, height and area as per Tables 3-1, 3-2 and 3-3.

b) Exit facilities as per Sub-section 503

c) Fire and Safety requirements as per Section 5 and

d) Plumbing and sanitation as per Section 9,

and providing that there is not less than a two-hour fire separation between such buildings and any other occupancies.

21. SCHOOLS AND CHURCHES

a) Special provisions

i) A fire-resistive ceiling shall not be required in the assembly space of churches and gymnasiums in one-storey buildings, every part of the roof structure of which is 18 feet or more above any floor or above any balcony or gallery seating 50 or more persons.

ii) Rooms having an occupancy content of more than 100 persons and rooms used for kindergarten, first, and second grade pupils, shall not be located above the first storey above grade except in buildings of Type 1 construction.

iii)) Where there is useable space under the first floor of two storey Type 3 buildings, basements, including the first floor shall be of Type I construction.

b) Occupancy content

For determining exit requirements of Group A, schools and churches, the occupant content shall be the area within the perimeter of the

building, or fire division at any floor level, with no deduction for corridors, divided by the area per person as specified below:

Occupancy	**Area (sq. ft per person)**
Auditoriums	7
Dining Rooms	10
Gymnasium seating areas	6
Classrooms	16
School Libraries	40
Other Uses	40

c) Widths of exits

Exits shall be provided as per Section 5

d) Arrangement of exits:

i) Classrooms and similar small room occupied by less than 40 persons may have one door thereof, provided such door is not less than 36 inches in width and located at the teacher end of the room.

ii) Classroom, shops and similar rooms occupied by 41 or more persons shall have not less than two exit doors, not less than 36 inches in width, the combined width of which shall be not less than one 20 inch unit of exit width for each 100 persons or fraction thereof, which doors shall be remote from each other.

iii) Rooms with occupant content exceeding 300 persons shall have exits as specified for Group A Occupancies and as shown in Section 5.

iv) Classroom exits may be to corridors.

v) Rooms in basements shall have not less than 50 percent of the required paths of egress therefrom opening directly to the exterior.

e) Corridors

i) Classrooms, assemblies to less than 300 persons, and other subdivisions shall open directly to floor exits or shall connect thereto by means of corridors.

ii) Corridors shall have a width of not less than six feet nor less than four inches for every 300 square feet, or major fraction thereof, of floor area served.

iii) Room doors or locker doors swinging into corridors shall not at any point in their swing reduce the clear effective width of the corridor to less than six feet, nor shall drinking fountains or other equipment fixed or moveable, be placed to obstruct the required minimum six feet width.

f) Balconies

Used as exits shall not be less than five feet in width at any point.

g) Floors

i) There shall be not less than two remote paths of egress from each floor.

ii) Floor exits shall be by means of stairways, ramps, horizontal exits, passageways or by doors at or near grade, directly to te exterior.

iii) The upper floors of two storey buildings may have enclosed interior stairways or open exterior stairways.

iv) The upper floors of three storey buildings shall have enclosed interior stairways for not less than one-half of the required floor exits. Other upper floor exits may be open exterior stairways or enclosed interior stairways.

v) The upper floor of building exceeding three stories shall have smokeproof towers for not less than one half the required

floor exits. Other upper floor exits shall be enclosed interior stairways.

h) Doors

i) Doors in paths of egress, normally closed and latched, shall be equipped with panic hardware except that doors leading from classrooms directly to the outside of the building may be equipped with the same knob-operated schoolhouse type lock as is used on classroom doors leading to corridor with not provision whatsoever for locking against egress from the classroom.

ii) The minimum width of any required door in a path of egress shall be 36 inches.

iii) Doors of classrooms serving as required exits may swing against the direction of exit travel when serving an occupant load of less than 40 persons.

iv) Travel distance

The exits shall be so arranged that the maximum travel distance from any point or from the door of the separated spaces loss than 800 square feet, to the nearest floor exit shall not exceed 100 feet except that eh not distance in any room where one exit door is permitted shall not exceed 40 feet.

i) Fire protection and hazards

Automatic sprinkler systems, fire extinguishers, fire alarm systems and standpipes shall be as set forth in Section 5.

j) Plumbing and toilet facilities.

i) Plumbing shall be installed as set forth in Section 9.

ii) The number of toilet units shall be provided as in Section 3.

k) Exceptions and deviations

Except in buildings of Type 1 Construction, school classrooms used for kindergarten, first and second-grade pupils shall be located on the ground floor.

22. MIXED OCCUPANCIES

Separation of Group A Occupancies or division thereof from all other Occupancies or Divisions of Occupancies shall be as set forth in Table 3.208 of Part 3 Section 3 of CUBiC.

APPENDIX H (2)

REQUIREMENTS OF GROUP B OCCUPANCIES

1. DEFINITION

2. TYPE OF CONSTRUCTION

3. LOCATION

4. EXIT FACILITIES

a) exit capacity
b) Travel distance

5. FIRE PROTECTION AND HAZARDS

6. PLUMBING AND TOILET FACILITIES

7. ELECTRICITY AND AIRCONDITIONING SERVICES

APPENDIX H (2)

REQUIREMENTS OF GROUP B OCCUPANCIES

1. DEFINITION

Group B occupancy is defined as Institutional Buildings in which persons are incapacitated or their movements are physically restrained. The buildings under this classification are listed in 301.3

2. TYPE OF CONSTRUCTION

Buildings in this Group can be of Types 1, 2, 3 or 4 construction. Construction in wood frames (Type 5) is not permitted.

The permissible heights and areas under each classification are given in Table 3-3.

3. LOCATION

The limiting location of such buildings is given in Tables 3-4 to 3-7. The location with respect to the boundaries or to adjacent buildings depend on the fire resistance rating of the structure.

4. EXIT FACILITIES

a) Exit capacity

The number of persons per unit (22 inches of exit width) from a sprinklered or non-sprinklered building shall be as per Table 5-3(b)

b) Travel Distance

The maximum permitted travel distance shall be as per Table 5-3(a), except that for a sprinklered building the maximum travel distance may be increased to 150 ft.

5. FIRE PROTECTION AND HAZARDS

a) Buildings in this Group may be either sprinklered on non-sprinklered. To qualify for the sprinkler option, buildings must be protected in accordance with NFiPA 13 and the system must be supervised in accordance with NFiPA 71.

b) Buildings such as hospitals and nursing homes must be:

i) divided into areas not exceeding 750 sq.m. by 1 hour fire rated construction and

ii) further subdivided into areas not exceeding 375 sq.m by construction which is smoke proof.

c) For prison institutional buildings, each cell must be bounded with separating construction of block masonry or concrete with a fire rating of at least 1 hour and doorways to cells and other openings in construction bounding cells must be protected with 1 hour fire doors.

d) Institutional buildings not equipped throughout with complete automatic sprinkler system shall have an approved automatic smoke detection system installed in all corridors in accordance with NFiPA 72E. All automatic smoke detection systems shall be connected electronically to the fire alarm system.

6. PLUMBING AND TOILET FACILITIES

The installation of plumbing and toilet facilities shall be in accordance with Section 3 and Section 9.

7. ELECTRICITY AND AIRCONDITIONING SERVICES

Section 11 provides guidance on the installation of electricity and airconditioning services. Designers are advised to consult the specialist handbooks for the provision of these services to institutional buildings.

APPENDIX H (3)

REQUIREMENTS FOR GROUP C OCCUPANCY

1. DEFINITION

2. CONSTRUCTION, HEIGHT AND AREA AVAILABLE

3. LOCATION ON PROPERTY

4. EXIT FACILITIES

a) General
b) Content
c) Width of exits
d) Arrangement of exits
e) Doors
f) Travel distance
g) Parking garages

5. LIGHT AND VENTILATION

6. FIRE PROTECTION HAZARDS

7. PLUMBING AND TOILET FIXTURES

APPENDIX H (3)

REQUIREMENTS OF GROUP C OCCUPANCY

1. DEFINITION

Group C Occupancy shall include storage and industrial uses as listed in Section 301.4.

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

General

a) Buildings, or parts of buildings classed in Group C because of use or occupancy shall be limited in height and area as shown in Table 3-3.

b) Motor vehicle service stations shall be Types 1, 2, or 3 (Protected) or 4 Construction. The canopies over the pumps may, at the discretion of the Director, be of exposed steel columns and fire treated timber roofing. Motor vehicle service stations shall not be of Type 5 Construction.

c) Aircraft hangars shall be of Type Construction as approved by the Director and shall comply with the requirements of the Ministry responsible for Civil Aviation.

d) Parking garages used exclusively for parking and storing of passenger motor vehicles shall be of Type 1 construction, except that garages not exceeding four stories may have framework and floors unprotected and exterior walls of not less than two-hour fire resistive construction.

e) Floors in motor service stations, garages and aircraft hangars shall be non-combustible materials protected against saturation.

f) Where ramps are used for the transfer of vehicles or materials from one floor to another, such ramps shall meet the ground floor level at a point not less than 25 feet from the exit of such building.

3. LOCATION ON PROPERTY

a) Buildings with Group C Occupancy shall comply with the requirements of the Department of Planning as given in the Development Manual or as determined by the Director.

b) Exterior walls of Group C Occupancy buildings shall have fire-resistance and opening protection, determined by location on property, as set forth for Type of Construction in Tables 3-4 to 3-7.

4. EXIT FACILITIES

a) General

Exit facilities for Group C Occupancies shall be as set forth Section 5, except that exit facilities for parking garages where no persons other than parking attendants are permitted on upper floors there shall not be less than one stairway for each 10,000 sq.ft. or fraction thereof. (see 4 g) below).

b) Occupant content

For determining exit requirements of Group C Occupancy, the occupant content shall be the area within the perimeter of the building, or fire division, at any floor level with not deduction for corridors, divided by an area of 100 square feet per person.

c) Width of exits:

Exits shall be provided as follows:

Street floor exits shall be provided based on one 22 inch of exit width for each 100 persons or fraction thereof on the street floor plus one and one-half units for each two units of stairway or ramp from upper or lower floor where such floors discharge through eh street floor.

d) Arrangement of exits:

i) Interior spaces: Rooms or spaces shall have not less than two remote exits except that where having an occupant content of less than 5 persons having direct exit to public space and with travel distance not exceeding 50 feet a single exit may be provided.

ii) Floors: There shall be not less than two remote paths of egress from each floor except that floors or mezzanines of buildings not exceeding two stories and having an occupant content of not more than 25 persons, may have a single door, or an enclosed stairway, exiting directly to the exterior.

iii) Floor exits shall be by means of stairways, ramps, horizontal exits, and passageways as specified in Section 5, or by doors, at or near grade, directly to the exterior.

iv) Dead ends in exit corridors, beyond a floor exit or other corridor having two remote exits, shall not exceed 20 feet.

v) The upper floor of two-storey buildings may have interior stairways, enclosed where required under Types of Construction, or open exterior stairways.

vi) The upper floors of three-storey buildings shall have enclosed interior stairways for not less than one-half of the required floors exits. Other upper exits may be open exterior stairways or enclosed interior stairways.

vii) The upper floors of buildings which exceed three stories shall have enclosed interior stairways, except that buildings which exceed five stories shall have not less than one-half of the required floors exits by smokeproof towers.

viii) Where floors are divided in fire divisions, one exit from each such division may be a horizontal exit.

e) Doors

Doors in paths of egress, normally closed and latched, and serving more than 50 persons, shall be equipped with panic hardware.

f) Travel distance

The exits shall be so arranged that the maximum travel distance from any point, or from the door of separated spaces having and occupant content of less than 50 persons, to the nearest floor exit shall not exceed 150 feet.

g) Parking garages

i) Where persons other than parking attendants are permitted, stairs and exits shall be as otherwise set forth herein.

ii) Where no persons other than parking attendants are permitted, and a ramp for transporting vehicles is constructed, or where cars are mechanically lifted and parked without attendants or passengers, there shall be not less than one stairway for each 10,000 square feet or fraction thereof.

iii) Where cars are mechanically lifted and parked by attendants, one additional exit shall be provided where such ramp is omitted. Such ramps shall be considered an exit, and exits shall be remotely located so that the maximum travel distance from any point to a floor exit shall not exceed 100 feet.

iv) Stairs shall be not less than three feet wide and shall be enclosed if more than 50 percent of the periphery of the building is enclosed or if the structure exceed three stories in height.

5. LIGHT AND VENTILATION

All portions of Group C Occupancies customarily used by human beings shall have light and ventilation as set forth in Section 11. All portions of buildings where flammable liquids are used or stored or where automobiles are stores or handled shall be provided with mechanical ventilation as set forth in Chapter 40, except that the Buildings Control Officer may waive this requirement when the building is provided with unobstructed openings and/or cross ventilation.

6. FIRE PROTECTION AND HAZARDS

a) Automatic-sprinkler systems, fire extinguishers and standpipes shall be as set forth in Section 5.

b) The storage of flammable material shall be as set out in Part 3 Section 3.303 of CUBiC.

c) The service of hazardous utilities shall be as set forth in Section 5 and in Part 3 Section 3.300 of CUBiC.

7. PLUMBING AND TOILET FIXTURES

a) Plumbing shall be installed as set forth in Section 9.

b) Toilet accommodation shall be as set forth in Section 3.

APPENDIX H (4)

REQUIREMENTS FOR GROUP D OCCUPANCIES

1. DEFINITION

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

3. LOCATION ON PROPERTY

4. EXIT FACILITIES

a) Occupant content
b) Widths of exits
c) Arrangement of exits
d) Travel distance
e) Special restriction

5. LIGHT AND VENTILATION

6. FIRE PROTECTION AND HAZARDS

7. PLUMBING AND TOILET FACILITIES

APPENDIX H (4)

REQUIREMENTS OF GROUP D OCCUPANCIES

1. GROUP D DEFINITION

Group D Occupancy is defined in Section 301.5 as being buildings used for business or professional transactions or for the display of materials or finished products. This Group is divided into two divisions in which markets and shops are separated from the other office buildings and small restaurants.

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

General

Buildings, or parts of buildings classed in Group D because of use or occupancy, shall be limited in height and area as given in Table 3-3.

Special provisions

a) Basements shall be of Type 1 construction.

b) Buildings on open lots, if used for the dispensing of gasoline, shall be as set forth in Appendix H (2) paragraph 2 (b).

3. LOCATION ON PROPERTY

Buildings with Group D Occupancy shall comply with the requirements of the Director of Planning as given in the Development Manual and with Tables 3-4 to 3-7.

4. EXIT FACILITIES

Exit facilities for Group D Occupancies shall be as set forth in this Appendix and in Section 5.

a) Occupancy content

For determining exit requirements of Group F Occupancy, the occupant content shall be the area within the perimeter of the building, or fire division, any floor level with no deduction for corridors, divided by the specified area per person as given in Table 3-1.

The occupancy content of floors or spaces used for assembly purposes shall be computed as set forth in Table 3-1. The occupant content shall be the reasonable maximum capacity based on the intended use as determined by the Director.

b) Widths of exits

Street floor exits shall be provided based on 22 inch of exit width for each 100 persons or fraction thereof on the street floor plus one and one-half units for each two units of stairway or ramp from upper or lower floors where such floors discharge through the street floors.

c) Arrangement of exits

i) Interior spaces

Rooms or spaces shall have not less than two remote exits except where having an occupant content of less than 25 persons, having direct exit to public space and with travel distance not exceeding 50 feet a single exit may be provided.

In self-service stores, no check out stand or association railing turnstile or barrier shall obstruct exits, aisles or approaches thereto.

Not less than one half of the required exits from the first or ground floor of a mercantile occupancy shall be to the main entrance and exit.

In self-service stores where wheeled carts or buggies are used by customers, adequate provision shall be made for the transit and parking of such carts to minimize the possibility that they may obstruct exits.

ii) Floors

There shall be not less than two remote paths of egress from each floor except that floors of buildings not exceeding two stories and having an occupant content of not more than 25 persons may have a single door, or an enclosed stairway, exiting directly to the exterior.

Floor exits shall be by means of stairways, ramps, horizontal exits, passageways as specified in Section 5 or by doors at or near grade, directly to the exterior. Dead ends in exit corridors beyond a floor exit or other corridor having two remote exits shall not exceed 20 feet.

The upper floor of two-storey buildings shall have enclosed interior stairways for not less than one-half of the required exits by smokeproof towers.

Where floors are divided in fire divisions, one exit from each such division may be a horizontal exit.

iii) Doors

Doors in paths of egress, normally closed and latched, and serving mor than 50 persons, shall be equipped with panic hardware.

d) Travel distance

The exits shall be so arranged that the maximum travel distance from any point or from the door of separated spaces having an occupant content of less than 50 persons, to the nearest floor exit shall not exceed 150 feet except that if high hazard commodities are displayed or handled without protective wrappings or containers the travel distance shall not exceed 75 feet.

(e) Special restriction

Smokeproof towers and enclosed interior stairways shall not be taken down to basement level. Basement exits shall be separate.

5. LIGHT AND VENTILATION

All portions of Group D Occupancies customarily used by human beings shall have light and ventilation as provided in Section 11.

6. FIRE PROTECTION AND HAZARDS

a) Automatic sprinkler systems, fire extinguishers and standpipes shall be as s et forth in Section 5.

b) The service of hazardous utilities shall be as set forth in Section 3 Part 3 of CUBiC.

c) Electrical installations hall be as required herein and as specified in Section 11.

d) The storage of flammable materials shall be as set forth in Part 3 Section 3 of CUBiC.

7. PLUMBING AND TOILET FACILITIES

a) Plumbing shall be installed as set forth in Section 9

b) Toilet accommodation shall be as set out in Section 3.

APPENDIX H (5)

REQUIREMENTS OF GROUP E OCCUPANCIES

1. DEFINITION

2. CONSTRUCTION HEIGHT AND AREA ALLOWABLE

3. LOCATION ON PROPERTY

4. EXIT FACILITIES

a) General
b) Occupant content
c) Widths of exits
d) Arrangement of exits
e) Travel distance
f) Special restriction

5. LIGHT AND VENTILATION
a) General
b) Rooms

6. FIRE PROTECTION AND HAZARDS

7. PLUMBING AND TOILET FACILITIES

APPENDIX H (5)

REQUIREMENTS OF GROUP E OCCUPANCIES

1. DEFINITION

Group E Occupancy shall include multiple-residential uses such as private residences, hotels, motels and other buildings as listed in 301.5,

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

a) Buildings, or parts of buildings classed in Group E because of use or occupancy shall be limited in height and area as given in Table 3-1.

b) EXCEPTION: Type 3 (Protected) buildings may be three stories in height if the floor level of the third flood is not more than 20 feet above the grade adjacent thereto, but where this exception is use, load bearing walls shall be of non-combustible materials.

c) Basement shall be of Type 1 construction.

3. LOCATION ON PROPERTY

a) Buildings with Group E Occupancy shall comply with the requirements of the Director of Planning as given in the Development Manual and the requirements herein stated, whichever are the more restrictive.

b) Exterior walls of buildings of Group E Occupancy shall have fire resistance and opening protection, determined by location on property as set forth for the Type of Construction given in Table 3-3.

4. EXIT FACILITIES

a) General

Exit facilities for Group E Occupancies shall be as set forth in this Appendix and in Section 5.

b) Occupant content

For determining exit requirements of Group E Occupancy, the occupant content shall be the area within the perimeter of the building, or fire division, any floor level, including all floors of residential apartments, with no deduction for corridors, divided by an area of 125 square feet per person except that dormitory room shall be computed at 30 square feet per person.

c) Widths of exits

i) Exits from street or ground floors shall be provided on the basis of one unit (22-inches) of exit width for each 50 persons or fraction thereof on the ground floor plus one unit for each unit of exit width exiting through the ground floor from other floors.

ii) Exits from upper or lower floors other than the ground floor shall be provided on the basis of one 22-inch unit of exit width for each 30 persons or fraction thereof.

iii) All required paths of egress from floors shall be not less than 44 inches in width, except that where serving floors having not more than four apartment units or eight hotel rooms, one such required path of egress may be no less than 36 inches in width.

iv) The minimum width of exit doors from dwelling units or hotel rooms shall be not less than as given in Table 5-2.

v) Residential apartment units in multiple apartment buildings, having a second floor or balcony contained wholly within the unit not exceeding 1,000 square feet and an additional exit not less than 30 inches in width fro upper areas exceeding 1,000 square feet. Width of exits from main floors of residential apartment units shall be as otherwise set forth in this Appendix.

vi) Exit courts on lot lines shall have a clear width, not less than required by Town Planning but not less than 44 inches, and inner courts shall have a clear width of not less than ten feet.

d) Arrangement of exits:

i) Unit exits:

Dwelling units and hotel rooms, 800 square feet or more in area, shall have not less than two remote exits, except as otherwise provided for the upper floors of residential-type apartment.

The landing on the upper floor of residential apartment units shall be directly accessible from all rooms on such upper

floors, and the stairway shall discharge on the main floor of the unit in close proximity to a path of egress from the unit. Where the upper floor of such unit has a gross floor area in excess of 1,000 square feet, not less than two exits shall be provided, one of which shall be enclosed and shall discharge directly to a path of egress from the floor.

ii) Floors

There shall be not less than two remote paths of egress from each floor except for two floor building containing only three apartments.

Floor exits shall be by means of stairways, ramps, horizontal exits and passageways as specified in Section 5 or by doors at or near grade, directly to the exterior.

Dead ends in exit corridors beyond a floor exit or other corridor having two remote exits shall not exceed 20 feet.

The upper floor of two-storey buildings may have enclosed interior stairways for not less than one-half of the required floor exits. Other upper floor exits may be open exterior stairways or enclosed interior stairways.

The upper floors of three-storey buildings shall have enclosed interior stairways for not less than one-half the required floor exits. Other upper floor exits may be open exterior stairways or enclosed interior stairways.

EXCEPTION

Where the floor level of the third floor does not exceed 220 feet above grade, all floor exits may be open exterior stairways.

The upper floors of buildings which exceed three stories shall have enclosed interior stairways, except that buildings which exceed five stories shall have not less than one-half of the required exits by smoke-proof towers.

Where floors are divided in fire divisions, one exit from each such division may be a horizontal exit.

iii) Doors

Doors in paths of egress, normally closed and latched, and serving mor than 50 persons, shall be equipped with panic hardware.

e) Travel distance

i) General

The exits shall be so arranged that the maximum travel distance from any point or from the door of separated spaces less than 1,000 square feet to the nearest floor exit shall not exceed 100 feet except that the travel distance in any room where one exit is permitted shall not exceed 50 feet.

ii) Apartments

Exits and means of access thereto shall be so located that it will not be necessary to travel more than 50 feet nor traverse more than one flight of stairs, within any individual living unit to reach the nearest exit, or to reach an entrance of the apartment.

iii) Doors and windows

(aa) Every sleeping room below the eighth floor in Group E Occupancies shall have at least one openable windows or exterior door to permit emergency exit or rescue.

(bb) Where such windows are provided, such windows shall have a sill height of not less more than 48 inches above the floor and shall provide not less than five square feet of openable area with no dimension less than 22 inches.

iv) Transoms and ventilating openings

Buildings more than one storey in height shall have no transoms or ventilating openings from guest rooms to enclosed public corridors.

f) Special provisions

Where Group D Occupancy buildings exceed three stories in height and where the distance between floor exits exceeds 100 feet, smoke doors shall be provided in the corridors. These smoke doors shall be centrally located between the exits and shall take the form of doors hung in recesses in the corridor walls. The doors, when in the open position, shall be flush with the wall of the corridor.

Smoke doors shall be kept in an open position at all times, when not in use, by means of magnetic catches. These catches shall be connected to the fire alarm system in such a manner that the doors will be released when the alarm is activated. When the doors are in a closed position they shall not be secured by any means that impeded easy passage through the doorway. The doors shall be of such size or framed in such a manner that when closed they effectively control the spread of smoke in the corridor.

The doors shall be a minimum of 6 feet 8 inches in height and shall be of a width deemed necessary to meet the exit requirements and shall be of 1 3/8 inches solid construction with a 10 inches by 10 inches wired glass panel. These doors shall be tested in the presence of the Director at six month intervals.

g) Special restriction:

Smoke proof towers and enclosed interior stairways shall not be taken down to basement level. Basement exits shall be separate.

5. LIGHT AND VENTILATION

a) General

i) Rooms used for sleeping or living purposes shall be provided with light and ventilation by means of widows in exterior walls with an area not less than one eighth of the floor area of such rooms and not less than one-half of the required widows area shall be openable.

ii) Other spaces for human occupancy such as lobbies, locker rooms, dining rooms, kitchens, and toilet rooms shall be provided with light by means of windows as herein set forth

or shall be provided with electric light and a mechanically operated ventilating system as set forth in Chapter 40.

iii) Rooms used for sleeping and living purposes where located as the first occupied space below a roof, shall be protected from extreme temperatures. The overall coefficient of heat transmission or "U" factor of such roof construction shall not be greater than 0.22.

iv) The floor area for an apartment shall be not less than required by applicable Physical Planning and Ministry of Health Regulations.

b) Rooms

i) Sleeping rooms

Rooms used for sleeping shall have a minimum width of eight feet and a minimum floor area with the immediate enclosing walls, exclusive of closets and toilets, as required by the Minister of Health.

Rooms, the floor of which is more than three feet below grade and which depend of natural ventilation, shall not be used for sleeping purposes. The minimum average height of each sleeping room shall be 7 feet 6 inches, and least height of the WC and bath shall be seven feet.

ii) Living and dining rooms

Living and Dining rooms shall have a minimum average height of eight feet. Where fans are being used the minimum height should be nine feet.

iii) Kitchens and corridors

Kitchens and corridors shall have a minimum height of seven feet six inches.

iv) Toilet rooms

Toilet rooms shall have a minimum height of seven feet, a minimum width as given in Table 5-1.

6. FIRE PROTECTION AND HAZARDS

a) Automatic sprinkler systems, fire extinguishers and standpipes shall be as set forth in Section 5.

b) the service of hazardous utilities shall be as set forth in Section 5 and in Part 3 Section 3.300 of CUBiC.

c) The storage of flammable materials shall be as set forth in Part 3 Section 3.303 of CUBiC.

7. PLUMBING AND TOILET FACILITIES

a) Plumbing and toilet facilities shall be as provided in Section 9 and Section 3.

b) Toilet rooms serving one-family unit shall have outside openings screened with 18-mesh wire screening. The minimum openable area shall be 2 square feet.

c) For occupancies with an occupant content of ten or more persons, separate facilities shall be provided for employees.

d) Separate facilities consisting of water closet, a lavatory, and a bath or shower shall be contiguous thereto and directly accessible from each hotel room.

e) Lavatories may be located in rooms provided there is no conflict with minimum requirements otherwise set forth in Section 3.

APPENDIX H (6)

REQUIREMENTS OF GROUP F OCCUPANCIES

1. DEFINITION

2. CONSTRUCTION, HEIGHT AND AREA ALLOWABLE

3. LOCATION ON PROPERTY

4. EXIT FACILITIES

a) Occupant content
b) Widths of exits
c) Arrangement of exits
d) Travel distance

5. LIGHT AND VENTILATION

6. ENCLOSURE OF VERTICAL OPENINGS

7. FIRE PROTECTION AND HAZARDS

8. PLUMBING AND TOILET FACILITIES

APPENDIX H (6)

REQUIREMENTS OF GROUP F OCCUPANCIES

1. DEFINITION

Group F Occupancy is defined in 301.7 and shall include such hazardous uses as storage and use of highly combustible materials or explosives and is listed in Appendices D (1), D (2) and D (3) of this Code.

2. CONSTRUCTION, HEIGHT AND AREA ALLOWANCE

a) General

Buildings, or parts of buildings classed in Group F because of use or occupancy shall be limited in height and area as given in Tables 3-1 and 3-3.

b) Other Laws

Developers must examine the Development Manual and the laws of the Turks and Caicos Islands which affect the manufacture and/or storage of flammable or hazardous material.

c) Special provisions

Floors shall be of non-combustible materials protected against saturation and basements shall be Type 1 construction.

3. LOCATION ON PROPERTY

Buildings with Group F Occupancy shall comply with the requirements of Development Manual and be in accordance with Tables 3-4 to 3-7.

4. EXIT FACILITIES

Exit facilities for Group F Occupancies shall be as set forth Section 5 and the following:

a) Occupant content

For determining exit requirements of Group F Occupancies, the occupant content shall be calculated in accordance with Table 3-1 The area within the perimeter of the building, or fire division at any floor level, with no deductions for corridors shall be used as the basis for the calculation.

b) Width of exits

Exits shall be provided as follows: (a) Street floor exits shall be provided based on one 22 inch of exit width for each 100 persons or fraction thereof on the street floor plus one and one half units for each two units of stairway or ramp from upper or lower floors where such floors discharge through the street floor.

Upper or lower floors other than street shall have one 22 inch of exit width for each 60 persons or fraction thereof except that horizontal exits and smoke towers may serve 100 persons for each 22 units of exit width.

c) Arrangement of exits

i) Interior spaces

Occupied rooms, including mezzanines, shall have paths of egress so located that travel from such rooms to a floor exit is not subjected to hazardous exposure.

Rooms including mezzanines, 400 square feet or mor in area, shall have not less than two remote exits.

ii) Floors

There shall be not less than two remote paths of egress from each floor.

Floor exits shall be by means of stairways, ramps, horizontal exits, passageways as specified in Section 6, or by doors, at or near grade, directly to the exterior.

The upper floors of two storey buildings may have enclosed interior stairways or exterior open stairways.

The upper floors of three storey buildings shall have enclosed interior stairways for net less than one half the required floor exits.

Other upper floor exits may be open exterior stairways or enclosed interior stairways.

The upper floors of buildings which exceed three stories shall have smokeproof towers for not less than one half the required floor exits. Other upper floor exits shall e enclosed interior stairways.

Where floors are divided in fire divisions, one exit from each such division may be a horizontal exit.

iii) Doors

Doors in paths of egress, normally closed and latched, and serving mor than 50 persons, shall be equipped with panic hardware.

d) Travel distance

Exits shall be so arranged that the maximum travel distance from any point to the nearest floor exit shall be not mor than 75 feet.

EXCEPTION: The travel distance in any room, including mezzanines, where one exit door is permitted, shall not exceed 25 feet.

5. LIGHT AND VENTILATION

a) All portions of Group F Occupancies customarily used by human beings shall have light and ventilation as set forth in Section 11. All portions of buildings where flammable liquids are used or stored shall be provided with mechanical ventilation.

b) In all buildings where flammable liquids are used or stored, mechanical exhaust ventilation shall be provided, sufficient to produce one complete change of air every 10 minutes. Such exhaust ventilation shall be taken from a point at or near floor level and shall be in operation when the building is occupied by human beings.

6. ENCLOSURE OF VERTICAL OPENINGS

Vertical openings shall be enclosed and shall be of non-combustible materials of not less than one hour fire resistive materials. Walls adjacent to open interior stairways and the soffits thereof shall be constructed of not less than one hour fire resistive materials.as specified in Section 4.

7. FIRE PROTECTION AND HAZARDS

a) Automatic sprinkler systems, fire extinguishers, and standpipes shall be as set forth in Section 5.

b) Electrical installations shall be as required herein and as specified in Section 11.

c) The storage or use of flammable materials shall be as set forth in Part 3 Section 3 of CUBiC or any other Code approved by the Board.

d) No combustion heater shall be installed in Group F Occupancies.

e) Each machine in dry-cleaning plants which use a flammable liquid shall have an adequate steam line connected to it, so arranged as to automatically fill the machine with steam in case of fire.

f) Paint spraying and dipping shall comply with the requirements set forth in CUBiC Part 3 Section 3.312.

8. PLUMBING AND TOILET FACILITIES

a) Plumbing shall be installed as set forth in Section 9.

b) Toilet accommodation shall be as set forth in Section 3.

APPENDIX I (1)

TYPE 1 BUILDINGS - FIRE RESISTIVE

Contents

APPENDIX I (1)

CLASSIFICATION BY TYPES OF CONSTRUCTION

TYPE 1 BUILDINGS (FIRE RESISTIVE)

1. DEFINITION

The structural frame of Type I buildings or structures shall be of steel or reinforced concrete or masonry as noted below. Walls, permanent partitions, roofs and floors shall be of noncombustible fire-resistive construction, except as otherwise set forth herein.

2. GENERAL

a) Allowable height and area shall be as specified in Section 3 Table 3-3.

b) Loads and material stresses shall be as specified in Section 12.

3. STRUCTURAL FRAMEWORK

a) The primary structural framework shall be of not less than the following fire-resistive construction: exterior frame four hours; interior frame three hours as per Table 3-4, Section 3.

b) Unless specifically designed as a structural frame, the walls shall be considered as load-bearing and shall be constructed of masonry or reinforced concrete except that 8 inch masonry block walls shall be limited to 20 feet in height and 12 inch masonry block walls shall be limited to 30 feet in height. Bearing walls shall be of fire-resistive construction as set forth in Tables 3-4 to 3-7.

4. WALLS AND PARTITIONS

a) Distance separations shall be measured at right angles from the wall or opening to the building line of continuous lot or any building on the same lot. The building line of a continuous lot shall be taken as that for the use of the contiguous lot which requires the least set back from the property line, and in no case shall this setback be taken as more than five feet from and parallel to the common lot line.

b) Main exterior walls shall be of noncombustible four hour fire resistive construction as per Tables 3-4 to 3-7.

c) Openings in main exterior walls shall be as follows:

i) Walls having a distance separation of less than five feet, or walls, except on street fronts, which are less than five feet from the building line of continuous lot, shall have no openings.

ii) Openings in walls of buildings having a distance separation of from five to ten shall be protected by fire-resistive doors or windows. The total area of openings in any storey shall be limited to 30 percent with no single opening more than ten percent of such wall area. Walls having a distance separation of mor than ten feet but less than 30- feet shall be protected by ordinary doors or windows not exceeding 50 percent of the wall area in any storey.

d) Buildings having exterior walls without openings shall be provided with access panels along street fronts or walls otherwise accessible for fire-fighting entrance to the building as follows:

i) The access openings in each accessible side of a building not over 65 feet in height shall be not less than one suitably marked access opening not less than 32 inches wide and 48 inches high with still not over 32 inches above the floor spaced not more than 50 apart on each floor each side.

ii) The access openings in each accessible side of a building over 65 feet in height shall be not less than

(aa) windows spaced not more than 50 feet apart and equivalent to 10% or more of the wall area, on each floor of each such side, or

(bb) Smokeproof towers spaced not over 100 feet apart on each such accessible side. The smokeproof towers may serve as a required exit way.

e) Fire walls shall be of the fire-resistive rating as required in Section 4.

f) Interior bearing walls shall be of three-hour fire-resistive construction as per Tables 3-4 to 3-7, except that:

i) Corridor partitions shall also comply with Sub-section 503 Means of Escape.

ii) Partitions subdividing offices, stores, apartments and similar uses within the area occupied by a single tenant may be constructed without a fire-resistive rating provided the materials of construction are:

(aa) Noncombustible or

(bb) Fire-retarded treated wood or

(cc) Of other wood provided a space of not less than 18 inches, as measured down from the ceiling, shall be open or of transparent non-combustible material.

g) i) Underground structures exceeding 2500 square feet in area shall be provided with at least two means of access so located and of such size as to permit their use by firemen at the time of fire.

ii) Where 10 or mor occupants use the underground structure and the required exits involve upward travel, a smoke proof tower shall be provided.

5. FLOORS

a) Material

i) Floor systems shall be of noncombustible materials. Poured-in-place concrete slabs shall be not less than 2-1/2 inches thick where removable forms are used nor less than 2 inches thick where tile, metal decking or similar structural form element is to remain as a permanent component of the structure.

ii) Where wood floors are laid over concrete slabs, the space between the floor slab and the underside of the finish floor shall be filled with noncombustible materials.

b) Fireproofing

Floors for buildings more that eight stories or more than 100 feet in height shall be of not less than three-hour fire-resistive construction; floors for buildings eight stories or less or 100 feet or less in height shall be of not less than two-hour fire-resistive construction. The use of bar joists shall be limited to buildings for four stories.

6. ROOFS

a) Materials

Roof systems shall be of noncombustible materials. Poured-in-place concrete slabs shall be not less than 2-1/2 thick where removable forms are used nor less than 2 inches thick where tile, metal decking or similar structural-form element is to remain as a permanent component of the structure.

ii) Where wood floors are laid over concrete slabs, the space between the floor slab and the underside of the finish floor shall be filled with noncombustible materials.

b) Fireproofing

Roofs for buildings more than eight stories or more than 100 feet in height shall be of not less than three-hour fire-resistive construction; roofs for buildings eight stories or less or 100 feet or less in height shall be of not less than two-hour fire-resistive construction.

c) Roof Coverings

Roof coverings shall be fire-retardant in accordance with the test [procedure of the BSI or ASTM. (See Part 3 Section 3.605.4 of CUBiC)

d) Roof Drainage

Roof drainage and the disposal of rainwater shall be as specified in Section 9 - Plumbing. In general, roof systems not designed to support accumulated water shall be sloped for drainage. Rain water drains or leaders where required shall be used and sized in conformance with the Section 9. (Chapter 36).

e) Furred Spaces above a Ceiling

Access trap doors, not less than 16 inches by 30 inches, shall be provided to all spaces above a furred ceiling having an minimum vertical distance of 36 inches. Such access trap doors shall be from common spaces such as corridors and no part of such furred space shall be more than 100 feet from an access trap door. Walkways shall be provided in such furred spaces above the ceiling.

7. ENCLOSURE OF VERTICAL OPENINGS

Enclosure of vertical openings shall be of noncombustible materials and not less than one hour fire-resistive construction, and where such openings exceed eight square feet in area shall be of not less than two-hour fire-resistive construction, with fire-resistive doors and/or windows.

8. STAIRWAYS

a) Stairways shall be as required in Section 5.

b) Stairs, stair platforms, treads and riser shall be constructed of non-combustible materials. Unprotected steel or iron stairways may be used only when enclosed.

9. DOORS AND WINDOWS

a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected or entirely prohibited. Section 4 Sub-section 404 provides information on the requirements for fire doors and fire windows assemblies.

b) Doors and windows shall not project over public property or restricted areas.

10. PROJECTIONS FROM THE BUILDING

a) Cantilevering projections outside of the main exterior walls of the building shall be of non-combustible materials and of not less than one-hour fire-resistive construction.

b) Canopies, awnings and marquees forming part of the construction but outside of the main exterior walls of the building but not cantilevered from the building shall be constructed of non-combustible materials but need not have fire-resistive protection.

11. ROOF STRUCTURES AND SKYLIGHTS

a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of noncombustible materials.

b) Roof structures, including bulkhead area, shall be limited in total combined area to 30 percent of the area of the roof, shall extend not more than 50 feet above the roof and any enclosure having a floor area of more than 15 square feet, shall be constructed as required for the main portion of the building.

c) Minor roof structures having an area of 15 square feet or less, housing ventilating shafts or similar openings shall be constructed of non-combustible materials.

d) Storage tanks, having a capacity of over 500 gallons, shall not be located over stairways or elevators.

e) Skylights shall be constructed of non-combustible materials and transparent or translucent materials shall be fire-resistive.

f) Where required to control rain water runoff, a curb not less than eight inches in height shall be provided.

g) Where the public has access to roof areas, a guard rail not less than 36 inches above the roof shall be provided around all open wells or shafts and at all exterior walls.

h) Skylights placed over shafts, vent shafts, stair enclosures, and exit ways, shall be glazed with glass or other approved non-combustible material which may be easily pierced by fire-fighting personnel.

12. COMBUSTIBLE MATERIALS

Combustible materials shall be permitted for the following uses unless otherwise specifically prohibited:

a) Show-window bulkheads shall be of non-combustible materials, but show cases and other moveable appurtenances of stores or other buildings may be of wood.

b) Trim, picture mouldings, furniture, and permanent seats, chair rails, wainscotting, baseboards, furring strips and blocking, handrails, show window backing, temporary partitions conforming to Sub-section 4 of this Appendix, floor finishes and sleeper may be of combustible materials. Wood doors or windows or frames may be used except where fire-resistive protection is required.

c) Loading platforms, and roofs over loading platforms, for warehouses, freight depots and buildings of similar use may be of heavy timber construction provided such heavy timber construction does not penetrate the exterior walls.

d) All materials used for interior finishes shall be in accordance with Part 3 Section 6 Paragraph 3.606.2 of CUBiC.

e) In places of public assembly, all draperies, hanging and other decorative materials suspended from walls or ceilings shall be non-combustible or flame-resistant meeting the requirements of the code as herein specified:

Non-combustible: The permissible amount of non-combustible decorative hangings shall not be limited.

Flame-resistant: The permissible amount of flame-resistant decorative hangings shall not exceed ten (10) percent of the total wall and ceiling area.

APPENDIX I (2)

TYPE 2 BUILDINGS - SEMI-FIRE RESISTANT

Contents

APPENDIX I (2)

TYPE 2 BUILDINGS (Semi-Fire-Resistive)

1. DEFINITION

a) The structural frame of Type 2 buildings or structures shall be of steel or reinforced concrete or masonry as noted below.

b) Walls, permanent partitions, roofs and floors shall be of non-combustible fire-resistive construction, except that permanent non-load-bearing partitions of one-hour fire resistive construction may use fire-retardant treated wood within the assembly.

2. GENERAL

a) Allowable height and area shall be as specified in Section 3.

b) Loads and material stresses shall be as specified in Section 12.

c) Required fireproofing shall be as set forth in Section 4.

3. STRUCTURAL FRAMEWORK

a) The primary structural framework shall be of not less than three-hour fire-resistive construction for members in exterior walls and of not less than one hour fire-resistive construction for members in the interior frame as per Tables 3-4 to 3-7.

b) Unless specifically designed as a structural frame, the walls shall be considered as load-bearing and shall be constructed of masonry or reinforced concrete except that 8 inch masonry block walls shall be limited to 20 feet in height and 12 inch masonry block walls shall be limited to 30 feet in height. Bearing walls shall be of fire-resistive construction as set forth in Table 3-2.

4. WALLS AND PARTITIONS

a) Exterior walls shall be as set forth in Tables 3-4 to 3-7.

b) Fire walls shall be of the fire-resistive rating as required in Tables 3-2 and 3-4 to 3-7.

c) Interior bearing walls shall be of noncombustible one-hour fire-resistive construction as per Tables 3-4 to 3-7.

d) Partitions shall be of not less than one-hour fire resistive construction except as provided in Tables 3-4 to 3-7.

5. FLOORS

a) Material

i) Floor systems shall be of noncombustible material or fire-retardant treated wood.

Exception: Fire retardant treated wood may not be used in buildings exceeding two stories in height.

ii) Wood joists shall not be used to support concrete and cement-base tile or terrazzo floor surfaces other than for bathrooms or less than 100 square feet in area.

iii) Spaces under a ground floor shall have the clearance and ventilation as set forth in the Section 14. Openings shall be provided to all space under the building.

b) Fireproofing

Floors and all parts thereof shall be of not less than two-hour fire-resistive construction as per Tables 3-4 to 3-7, except that where the space under a ground floor has clearance of less than three feet, such fire protection for the ground floor may be omitted.

6. ROOFS

a) Materials

Roof systems shall be of noncombustible materials or of fire-retardant treated wood.

b) Fireproofing

Roofs and all parts thereof shall be of not less than one-hour fire-resistive construction as per Tables 3-4 to 3-7, except as follows:

i) Roofs, where every part of the structural framework is 20 feet or more above any part of the floor, balcony or gallery, may be on unprotected non-combustible materials or fire-retardant treated wood.

ii) Roofs of one-storey open sheds not more than 75 percent enclosed by walls, in which the travel distance to the nearest exit does not exceed 40 feet, may be of unprotected noncombustible materials.

c) Roof Coverings

Roof coverings shall be fire-retardant and as specified in Part 3 Section 6 of CUBiC.

d) Roof Drainage

Roof drainage and the disposal of rainwater shall be as specified in the Section 9. In general, roof systems not designed to support accumulated water shall be sloped for drainage.

e) Attic Spaces

Attic spaces shall not be required, but where attic spaces are provided such spaces shall have a minimum vertical dimension of 18 inches clear distance and where unprotected combustible material is exposed, shall be divided, by fire-stops, into areas not exceeding 2500 square feet, or less depending on individual occupancy. Access trap doors, not less than 16 inches by 30 inches, shall be provided to all attic spaces. Such access trap doors shall be from common spaces such as corridors, and no part of an attic space shall be more than 100 feet from an access trap door.

7. ENCLOSURE OF VERTICAL OPENINGS

a) Enclosure of vertical openings shall be of noncombustible materials and where such openings exceed eight square feet in area shall be not less than one hour fire-resistive construction, with fire-resistive doors and/or windows.

(b) Where the enclosure of vertical openings is required to be of not less than one-hour fire-resistive construction the materials of construction shall be noncombustible or fire-retardant treated wood.

8. STAIRWAYS

a) Stairways shall be as required in the Section 5.

b) Stairs, stair platforms, treads and riser shall be constructed of non-combustible materials. Unprotected steel or iron stairways may be used only when enclosed.

9. DOORS AND WINDOWS

a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected or entirely prohibited as set forth in Section 5.

b) Doors and windows shall not project over public property or restricted areas.

10. PROJECTIONS FROM THE BUILDING

a) Cantilevering projections outside of the main exterior walls of the building shall be of non-combustible construction or fire-retardant treated wood, and shall be of not less than one-hour fire-resistive construction.

b) Canopies, awnings and marquees forming part of the construction but outside of the main exterior walls of the building but not cantilevered from the building shall be constructed of non-combustible materials but need not have fire-resistive protection.

11. ROOF STRUCTURES AND SKYLIGHTS

a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of noncombustible materials. Roof structure extending more than 25 feet above the roof or signs more than 100 square feet in area shall be supported to the ground by a non-combustive frame, unless already incorporated into the building frame design.

b) Roof structures, including bulkheaded areas, shall be limited in total combined area to 30 percent of the area of the roof, shall extend not more than 20 feet above the allowable height and any enclosure having a floor area of more than 15 square feet shall be constructed as required for the main portion of the building.

c) Minor roof structures having an area of 15 square feet or less, housing ventilating shafts or similar openings shall be constructed of non-combustible materials.

d) Storage tanks, having a capacity of over 500 gallons, shall not be located over stairways or elevators.

e) Skylights shall be constructed of non-combustible materials and transparent or translucent materials shall be fire-resistive.

f) i) Parapets shall be required on exterior walls except where the roof is of noncombustible, fire-resistive construction.

ii) Parapets shall be not less than 20 inches above the roof immediately adjacent thereto where located 20 feet or less to\from the building line of a contiguous lot or any building on the same lot, and shall be constructed as set forth in Section 15.

iii) Where required to control rain water runoff, a curb not less than eight inches in height shall be provided.

g) Where the public has access to roof areas, a guard rail not less than 36 inches above the roof shall be provided around all open wells or shafts and at all exterior walls.

12. COMBUSTIBLE MATERIALS

a) Combustible materials shall be permitted except where specifically prohibited in this Appendix.

b) Loading platforms for warehouses, freight depots and buildings may be of heavy timber construction with wood floors not less than one and five-eighths inches thick. Such wood construction shall not be carried through the exterior walls.

c) Interior finishes shall be as set forth in Part 3 Section 6 of CUBiC.

APPENDIX I (3)

TYPE 3 BUILDINGS - ORDINARY MASONRY

Contents

APPENDIX I (3)

TYPE 3 BUILDINGS - ORDINARY MASONRY

1. DEFINITION

a) i) Type 3 buildings or structures shall have an exterior structural frame of steel or reinforced concrete or of fire-retardant treated wood, or shall have exterior loadbearing walls of non-combustible, fire-resistive construction.

ii) Type 3 buildings or structures shall have an interior structural frame of steel, reinforced concrete, wood, or interior load bearing walls of non-combustible materials or wood.

iii) Partitions, floors and roof framing may be of wood.

b) Walls, permanent partitions, roofs and floors shall be of non-combustible fire-resistive construction, except that permanent non-load-bearing partitions of one-hour fire resistive construction may use fire-retardant treated wood within the assembly.

2. GENERAL

a) Allowable height and area shall be as specified in Section 3.

b) Loads and material stresses shall be as specified in Section 12.

c) Required fireproofing shall be as set forth in Section 4.

3. STRUCTURAL FRAMEWORK

a) Materials

i) Unless specifically designed as a structural frame with panel walls, the exterior walls shall be considered as load-bearing and shall be constructed of masonry or reinforced concrete, except that 8 inch masonry walls shall be limited to 20 feet in height and 12 inch masonry block walls shall be limited to 30 feet in height. Where designed as a structural frame, the materials shall be as specified in Sections 14,15,16 and 17.

ii) The interior structural support shall be of steel, reinforced concrete, or interior bearing walls of noncombustible materials or wood studs. (Tables 3-4 to 3-7).

b) Fireproofing

i) Fireproofing shall be as required in Sections 3 or 4. Where required, or where otherwise referred to in this Code as being protected, the structural framework or supports shall be of not less than one-hour fire-resistive construction except that members in the exterior walls shall have the fire protection as set forth in Tables 3-4 to 3-7.

ii) All steel members supporting masonry in buildings over one storey in height shall be fire-proofed with not less than one-hour fire-resistive construction.

iii) Heavy timber structures, designed and constructed in accordance with Section 14, shall be considered the equivalent of one-hour fire-resistive protection.

c) Heavy Timber Construction

i) General

Heavy timber construction is that type in which fire resistance is attained by placing limitations on minimum sizes of wood structural members including the thicknesses and compositions of wood floors and roofs and by the use of approved fastenings and construction details.

ii) Heavy Timber Framing

Heavy timber columns, floors sizes and framing, roof sizes and framing, and construction details shall be as specified in Section 14.

iii) Heavy Timber Floors

Heavy timber floors shall be constructed as specified in Section 14.

iv) Heavy Timber Roof Decks

Heavy timber roof decks shall be constructed as specified in Section 14.

4. WALLS AND PARTITIONS

a) Exterior walls shall be as set forth in Tables 3-4 to 3-7.

b) Fire walls shall be of the fire-resistive rating as required in Tables 3-4 to 3-7.

c) Interior bearing walls shall be of noncombustible materials or of wood studs, and for Type 3 (protected) buildings, or for Type 3 (unprotected) buildings where supporting upper floors or where adjacent to common corridors shall be of one-hour fire-resistive construction.

5. FLOORS

a) Material

i) Floors shall be of noncombustible material or woods.

ii) Wood joists shall not be used to support concrete and cement-base tile or terrazzo floor surfaces other than for bathrooms or less than 100 square feet in area.

iii) Wood post and girder construction shall not be permitted for a ground floor of buildings used by the public, and spaces under ground floors shall have the clearance and ventilation as set forth in Section 14.

b) Fireproofing

Floors and all parts thereof of Type 3 buildings shall not be constructed of materials and assemblies of less fire resistance than shown in Tables 3-4 to 3-7, except that where a ground floor has clearance of less than three feet, such fire protection may be omitted.

6. ROOFS

a) Materials

Roof systems shall be of non-combustible materials or wood.

b) Fireproofing

Roofs and all parts thereof of unprotected Type 3 buildings and protected Type 3 buildings shall be of not less than one-hour fire-resistive construction, except as follows:

i) Roofs, where every part of the structural framework is 18 feet or more above any part of any floor, may be of unprotected non-combustible materials or protected combustible materials

ii) Roofs of one-storey open sheds not more than 75 percent enclosed by walls, in which the travel distance to the nearest exit does not exceed 40 feet, may be of unprotected noncombustible materials or protected combustible materials.

c) Roof Coverings

Roof coverings shall be fire-retardant and as specified in CUBiC Part 3 Section 6.

d) Roof Drainage

Roof drainage and the disposal of rainwater shall be as specified in Section 9. In general, roof systems not designed to support accumulated water shall be sloped for drainage.

e) Attic Spaces

Attic spaces shall not be required, but where attic spaces are provided such spaces shall have a minimum vertical dimension of 18 inches clear distance and where unprotected combustible material is exposed, shall be divided, by fire-stops, into areas not exceeding 2,500 square feet, or less depending on individual occupancy. Access trap doors shall be from common spaces such as corridors, and no part of an attic space shall be more than 100 feet from an access trap door.

7. ENCLOSURE OF VERTICAL OPENINGS

Enclosure of vertical openings shall be of noncombustible materials and where such openings exceed eight square feet in area shall be not less than one hour fire-resistive construction. Walls adjacent to open interior stairways and the soffits thereof shall be of not less than one hour fire-resistive construction.

8. STAIRWAYS

Stairways shall be as required in Section 5.

9. DOORS AND WINDOWS

a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected as per Section 4 Sub-section 405.

b) Doors and windows shall not project over public property or restricted areas.

10. PROJECTIONS FROM THE BUILDING

Cantilevering projections outside of the main exterior walls of the building shall be of non-combustible construction and be fire-resistive as specified in this Appendix, except that the projection of wood roof rafters of residential occupancies over private property shall be permitted.

11. ROOF STRUCTURES AND SKYLIGHTS

a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of noncombustible materials. Roof structures extending more than 25 feet above the roof or signs more than 100 square feet in area shall be supported to the ground by a incombustible frame, unless already incorporated into the building frame design.

b) Roof structures, including bulkheaded areas, shall be limited in total combined area to 30 percent of the area of the roof, shall extend not more than 20 feet above the allowable height and any enclosure having a floor area of more than 15 square feet shall be constructed as required for the main portion of the building.

c) Minor roof structures having an area of 15 square feet or less, housing ventilating shafts or similar openings shall be constructed of non-combustible materials.

d) Storage tanks, having a capacity of over 500 gallons, shall not be located over stairways or elevators.

e) Skylights shall be constructed of non-combustible materials and transparent or translucent materials shall be fire-resistive.

f) Parapets shall be required on exterior walls except:

i) Where the roof is of non-combustible, fire-resistive construction.

ii) Where the walls of buildings for other than residential occupancy are 20 feet from the building of a continuous lot or any building on the same lot.

iii) Where the building is of residential occupancy.

g) Parapets shall be not less than 20 inches above the roof immediately adjacent thereto and shall be constructed as set forth in Sections 15 or 16.

h) Where required to control rain water runoff, a curb not less than eight inches in height shall be provided.

12. COMBUSTIBLE MATERIALS

a) Combustible materials shall be permitted except where specifically prohibited in Section 3 and/or Section 4.

b) Loading platforms for warehouses, freight depots and buildings may be of heavy timber construction with wood floors not less than 1-3/4 inches thick. Such wood construction shall not be carried through the exterior walls.

c) Interior finishes shall be as set forth in CUBiC Part 3 Section 6.

APPENDIX I (4)

TYPE 4 BUILDINGS - NON-COMBUSTIBLE

Contents

APPENDIX I (4)

TYPE 4 BUILDINGS - NON-COMBUSTIBLE

1. DEFINITION

All structural and other elements of Type 4 buildings shall be of non-combustible materials.

2. GENERAL

a) Allowable heights and areas shall be as specified Section 3.

b) Loads and material stresses shall be as specified in Section 12.

c) Required fireproofing shall be as set forth in Sections 3 and 4.

3. STRUCTURAL FRAMEWORK

The structural framework shall be of steel, aluminum, or reinforced concrete, and fireproofing of structural members shall be required only when such members are a part of an exterior wall as set forth Tables 3-4 to 3-7.

4. WALLS AND PARTITIONS

a) Distance separation shall be measured at right angles from the wall or opening to the building line or a continuous lot or any building on the same lot. The building line of a continuous lot shall be taken as that for the use of the continuous lot which requires the least set back from the property line, and in no case shall this set back be taken as more than five feet from and parallel to the common lot line.

b) The main exterior walls shall be of non-combustible materials and such walls shall be of fire-resistive construction with opening protection where located as follows:

i) Main exterior walls having a distance separation of from five to ten feet shall be of not less than one-hour fire resistive construction and openings therein shall be protected by fire-resistive doors and windows and shall be limited in area to 30 percent of the wall area with no single openings or more than ten percent of such wall area.

c) Fire walls shall be of non-combustible materials and shall be of the fire-resistive rating as required in the Section 3.

d) Interior bearing walls shall be of non-combustible materials.

5. FLOORS

Floors shall be of non-combustible material, provided, however that a wood surface or finish may be applied over such non-combustible materials.

6. ROOFS

a) Roof systems shall be of non-combustible materials and fire-proofing shall not be required.

b) Roof coverings shall be as specified in the CUBiC Part 3 Section 6.

c) Roof Drainage

Roof drainage and the disposal of rainwater shall be as specified in Section 9. In general, roof systems not designed to support accumulated water shall be sloped for drainage.

7. DOORS AND WINDOWS

a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected or entirely prohibited as set forth in Sections 3 and 4.

b) Doors and windows shall not project over public property or restricted areas.

8. PROJECTIONS FROM THE BUILDING

Projections from the building shall be of non-combustible materials.

9. ROOF STRUCTURES AND SKYLIGHTS

a) Roof structures may extend above the allowable height not to exceed 20 feet and shall be of non-combustible materials.

b) Skylights shall be constructed of non-combustible materials and transparent or translucent materials shall be fire-resistive.

c) Where the public has access to roof areas, a guard rail not less than 36 inches above the roof shall be provided around all open wells or shafts and at all exterior walls.

10. COMBUSTIBLE MATERIALS

A loading platform may be constructed of heavy timber with wood floors not less than 1-3/4 inches thick. A Type 4 building or structure erected over such platform shall be supported by non-combustible materials to the foundation.

APPENDIX I (5)

TYPE 5 BUILDINGS - WOOD FRAME

Contents

APPENDIX I (5)

TYPE 5 BUILDINGS - WOOD FRAME

1. DEFINITION

All structural and other elements of Type 5 buildings shall be of non-combustible materials or wood or any materials allowed by this code.

2. GENERAL

a) Allowable height and area shall be as specified in Section 3.

b) Loads and material stresses shall be as specified in Section 12.

c) Required fireproofing shall be as set forth in Sections 3 and 4.

3. WALLS AND PARTITIONS

a) Distance separation shall be measured at right angles from the wall or opening to the building line or a continuous lot or any building on the same lot. The building line of a continuous lot shall be taken as that for the use of the continuous lot which requires the least set back from the property line, and in no case shall this set back be taken as more than five feet from and parallel to the common lot line.

b) The main exterior walls shall be of non-combustible materials and such walls shall be of fire-resistive construction with opening protection where located as follows:

i) Main exterior walls having a distance separation of less than five feet, or walls except of street fronts which are less than five feet from the building of a contiguous lot, shall be of not less than two hour fire-resistive construction and have no openings therein.

ii) Main exterior walls having a distance separation of from five to ten feet shall be of not less than one-hour fire resistive construction and openings therein shall be protected by fire-resistive doors and windows and shall be limited in area to 30 percent of the wall area with no single openings or more than ten percent of such wall area.

c) Fire walls shall be of non-combustible materials and shall be of the fire-resistive rating as required in Section 3.

d) Interior bearing walls shall be of non-combustible materials or wood.

4. FLOORS

a) Floors shall be of steel, concrete or wood.

b) Wood posts shall not be permitted under a girder supporting a ground floor and spaces under ground floors shall have the clearance for ventilation.

c) Access openings shall be provided to all space under the building.

5. ROOFS

a) Roof systems shall be of noncombustible materials or wood.

b) Roof coverings shall be as specified in CUBiC Part 3 Section 6.

c) Roof drainage and the disposal of rainwater shall be as specified in Section. In general, roof systems not designed to support accumulated water shall be sloped for drainage.

d) Attic spaces shall not be required, but where attic spaces are provided, such spaces shall have a minimum vertical dimension of 18 inches clear distance and, where unprotected combustible material is exposes, shall be divided by fire stops into areas not exceeding 5500 square feet or less depending on occupancy. Access trap doors shall be from common spaces such as corridors, and no part of an attic space shall be more than 100 feet from an access trap door. Minimum vertical dimension shall not be required for hip or gable roof construction.

6. FIREPROOFING

Bearing walls supporting floors shall not be less than one-hour fire-resistive protection except that where a ground floor has clearance of less than three feet, such protection may be omitted.

7. STAIRWAYS

a) Stairways shall be as required in Section 3 and in Section 4.

b) Stairways may be of non-combustible or combustible materials.

8. DOORS AND WINDOWS

a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected or entirely prohibited as set forth in Sections 3 or 4.

b) Doors and windows shall not project over public property or restricted areas.

9. PROJECTIONS FROM THE BUILDING

Projections from the building may be of wood.

10. COMBUSTIBLE MATERIALS

No materials more combustible than wood shall be permitted in the construction of permanent portions of Type 5 buildings.

Appendix J
The Rainfall Hazard

(For the rational design of rainfall drainage systems the necessary tool is the family of Intensity-Duration-Frequency (IDF) graphs or tables. The readily-available information includes IDF graphs for St Lucia from circa 1979, and IDF tables for Montserrat and St Vincent from 2010. No information is readily available for Grenada. For the time being the values for St Vincent may be used for Grenada.)

For critical facilities the 50-year return period values shall be used. For agricultural buildings the 15-year return period values shall be used. For temporary facilities the 5-year return period values shall be used. For all other buildings the 25-year return period values shall be used.

On the following two pages Intensity-Duration-Frequency tables are provided for two locations in Montserrat and three locations in St Vincent. *(The tables are from the 2010 study by H R Wallingford of the United Kingdom and the Caribbean Institute for Meteorology and Hydrology based in Barbados.)*

Montserrat – Volcano Observatory North									
Return period (years)	Duration (minutes)								
	1440	720	360	120	60	30	15	10	5
	Rainfall intensity (mm/hour)								
2	4.4	6.8	10.5	21.0	32.4	50.0	77.3	99.7	154.0
5	6.0	9.1	13.6	25.8	38.6	57.8	86.6	109.8	164.5
10	7.7	11.2	16.4	29.9	43.7	64.0	93.6	116.9	171.0
15	8.8	12.7	18.3	32.7	47.1	67.9	97.9	121.2	174.7
25	10.6	15.0	21.2	36.7	51.9	73.3	103.7	127.0	179.6
50	13.7	18.9	26.0	42.2	59.4	81.7	112.5	135.6	186.6

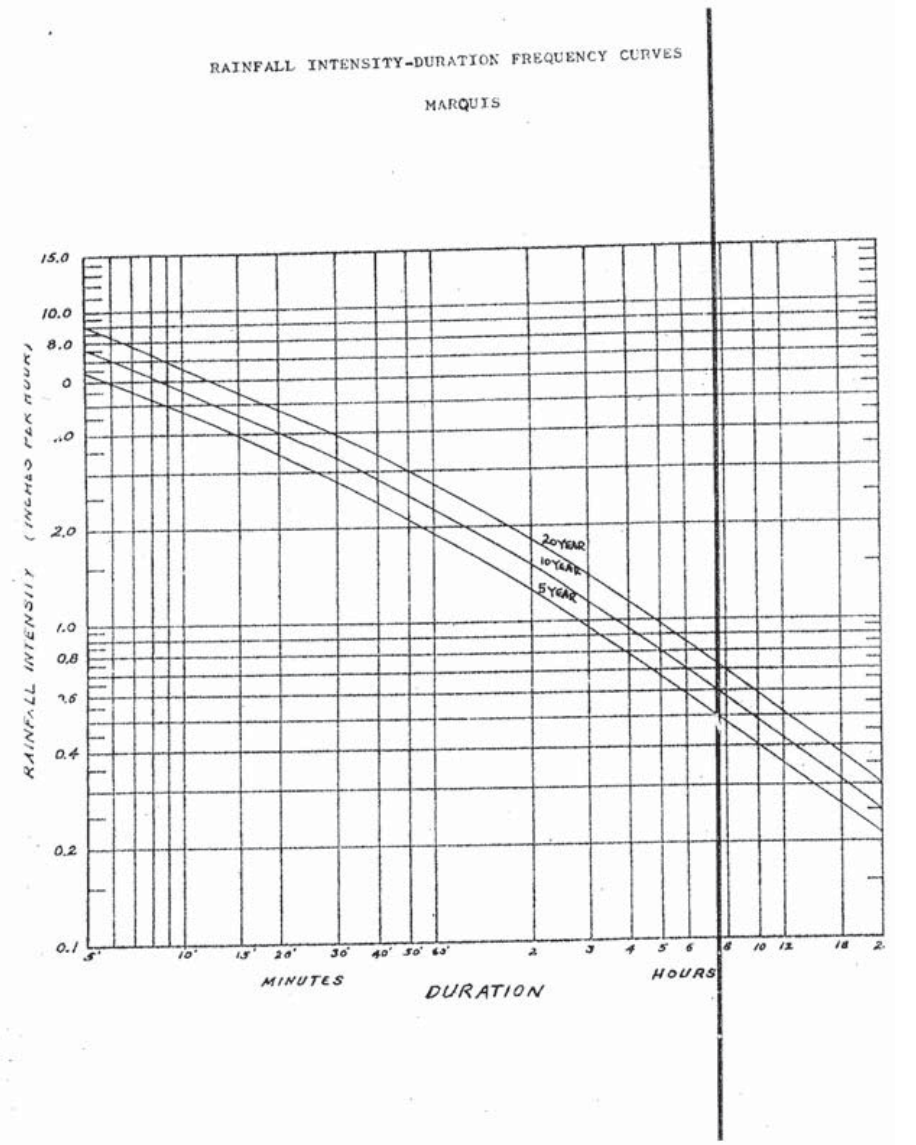
Montserrat – Botanical Gardens									
Return period (years)	Duration (minutes)								
	1440	720	360	120	60	30	15	10	5
	Rainfall intensity (mm/hour)								
2	3.6	5.7	9.1	19.2	30.8	49.2	78.8	103.7	166.0
5	5.6	8.9	14.0	28.8	45.5	71.7	113.1	147.6	232.8
10	7.6	11.8	18.4	37.2	58.1	90.6	141.4	183.4	286.1
15	8.9	13.8	21.4	42.8	66.3	102.8	159.3	205.8	318.9
25	10.9	16.7	25.7	50.9	78.2	120.3	184.9	237.8	365.7
50	14.1	21.5	32.8	63.9	97.4	148.4	226.2	289.5	441.2

St Vincent – E T Joshua Airport									
Return period (years)	Duration (minutes)								
	1440	720	360	120	60	30	15	10	5
	Rainfall intensity (mm/hour)								
2	4.0	6.5	10.4	21.8	35.0	55.9	89.5	117.9	188.6
5	5.8	9.1	14.4	29.5	46.6	73.5	115.9	151.2	238.5
10	7.3	11.3	17.7	35.7	55.7	86.9	135.6	175.9	274.5
15	8.2	12.8	19.8	39.6	61.3	95.0	147.3	190.3	294.9
25	9.6	14.8	22.7	45.0	69.1	106.3	163.4	210.2	323.3
50	11.8	18.0	27.4	53.4	81.4	124.0	188.8	241.5	367.8

St Vincent – Botanical Gardens									
Return period (years)	Duration (minutes)								
	1440	720	360	120	60	30	15	10	5
	Rainfall intensity (mm/hour)								
2	3.5	5.6	9.0	19.0	30.5	48.7	78.0	102.7	164.3
5	4.6	7.3	11.5	23.7	37.4	58.9	92.9	121.3	191.2
10	5.5	8.6	13.3	27.0	42.1	65.7	102.5	132.9	207.4
15	6.0	9.3	14.4	28.9	44.8	69.4	107.5	138.9	215.2
25	6.7	10.3	15.9	31.4	48.3	74.3	114.2	146.9	225.8
50	7.8	11.8	18.0	35.1	53.5	81.5	124.1	158.8	241.8

St Vincent – Agricultural School									
Return period (years)	Duration (minutes)								
	1440	720	360	120	60	30	15	10	5
	Rainfall intensity (mm/hour)								
2	3.4	5.5	8.8	18.5	29.6	47.4	75.8	99.8	159.7
5	4.5	7.1	11.2	23.0	36.3	57.3	90.3	117.9	186.0
10	5.2	8.1	12.6	25.6	39.9	62.3	97.1	126.0	196.6
15	5.6	8.6	13.4	26.8	41.6	64.4	99.8	129.0	199.8
25	6.1	9.3	14.3	28.3	43.5	66.9	102.8	132.3	203.4
50	6.7	10.2	15.5	30.2	46.0	70.0	106.6	136.4	207.7

On the following nine pages Intensity-Duration-Frequency graphs are provided for nine locations in St Lucia. *(They are from a 1979 study by F C Farnum of the Caribbean Meteorological Institute.)*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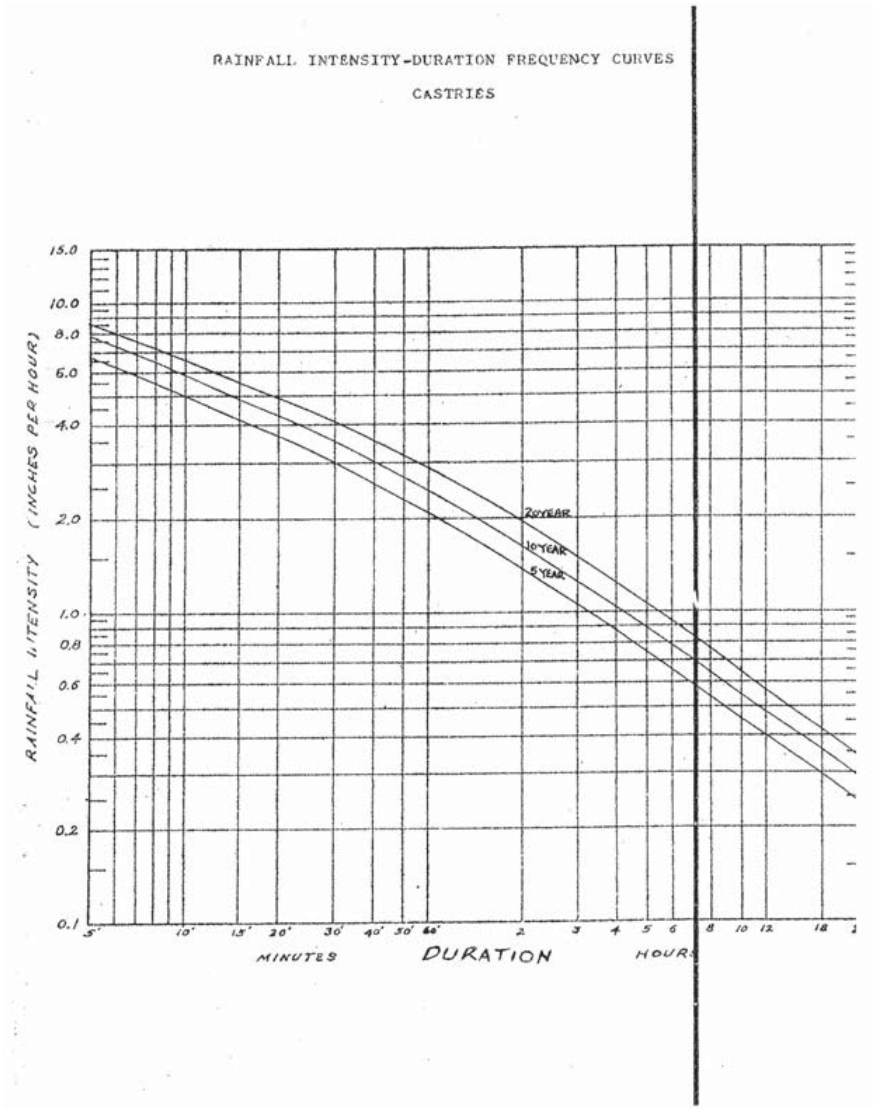
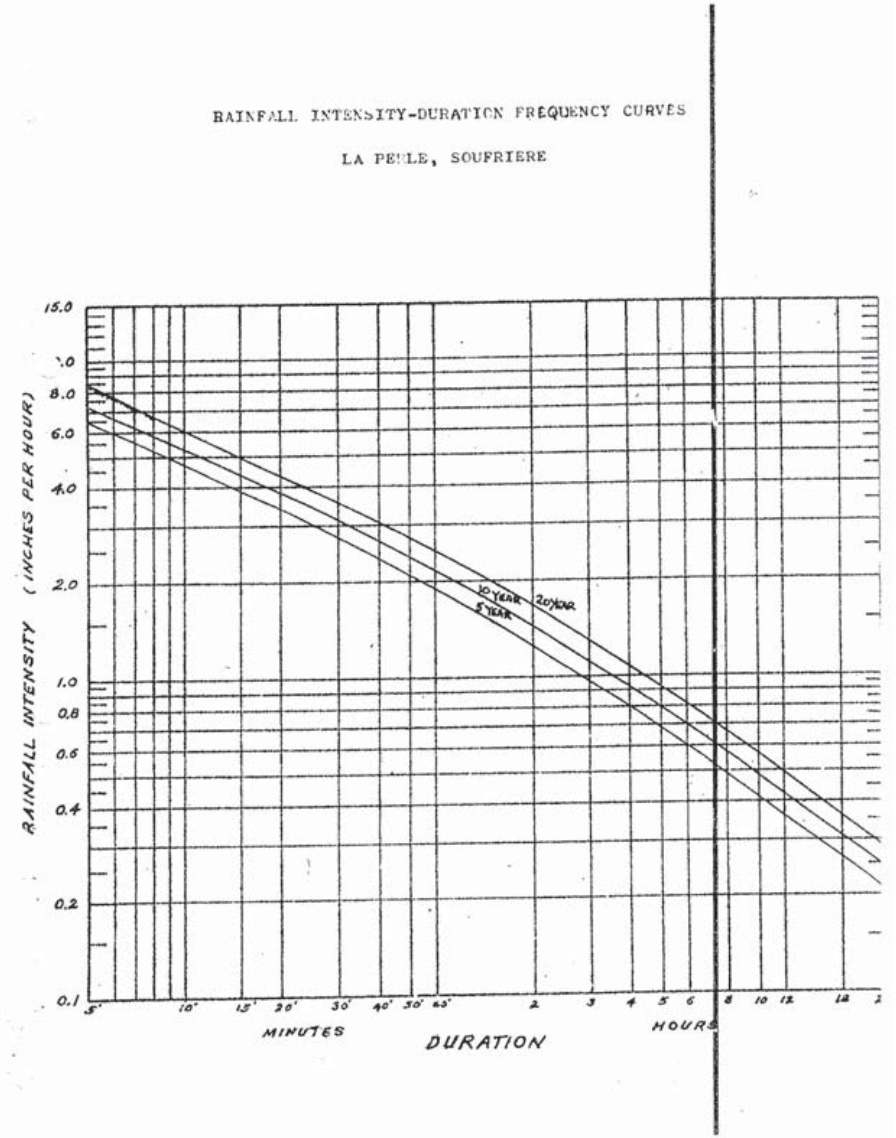
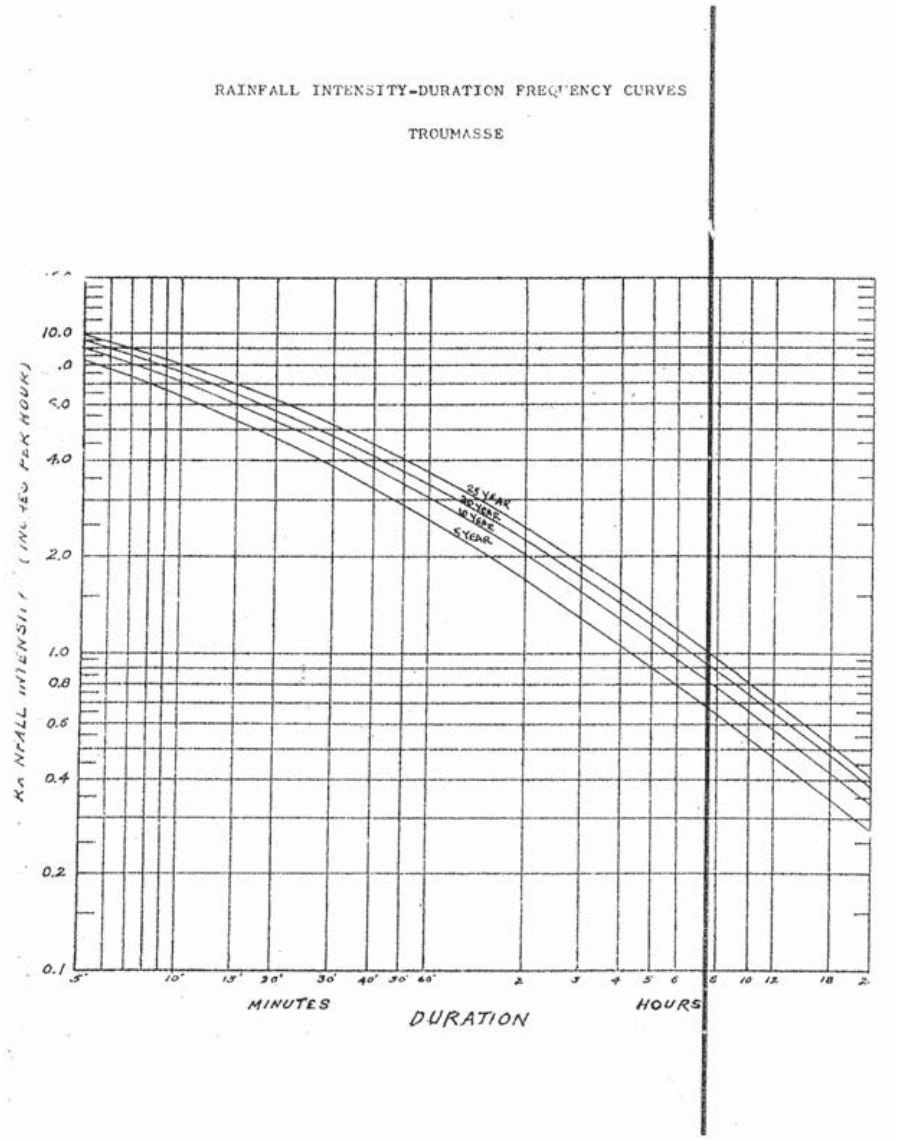
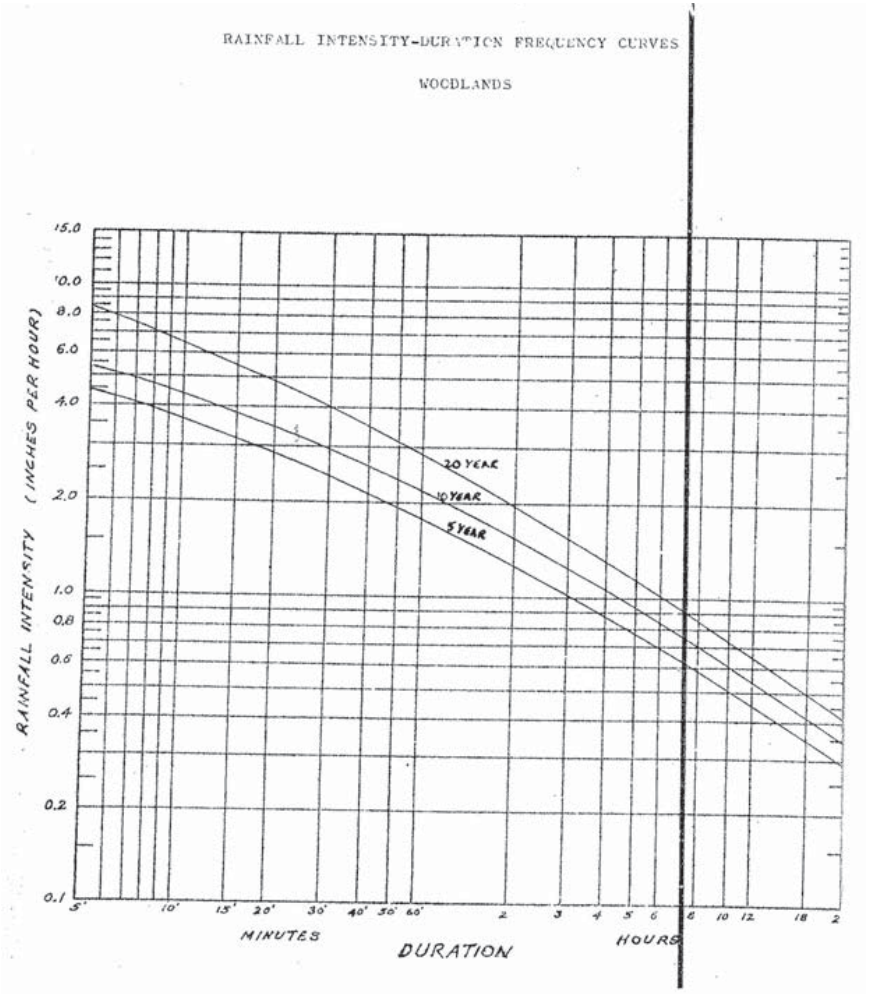
MARQUIS
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
8.0
0
.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
20 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
2
MINUTES
DURATION
HOURS


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
CASTRIES
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
20 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
MINUTES
DURATION
HOURS


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
LA PELE, SOUFRIERE
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
10-YEAR
20-YEAR
5-YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
24
MINUTES
DURATION
HOURS


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
TROUMASSE
10.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
25 YEAR
10 YEAR
5 YEAR
MINUTES
DURATION
HOURS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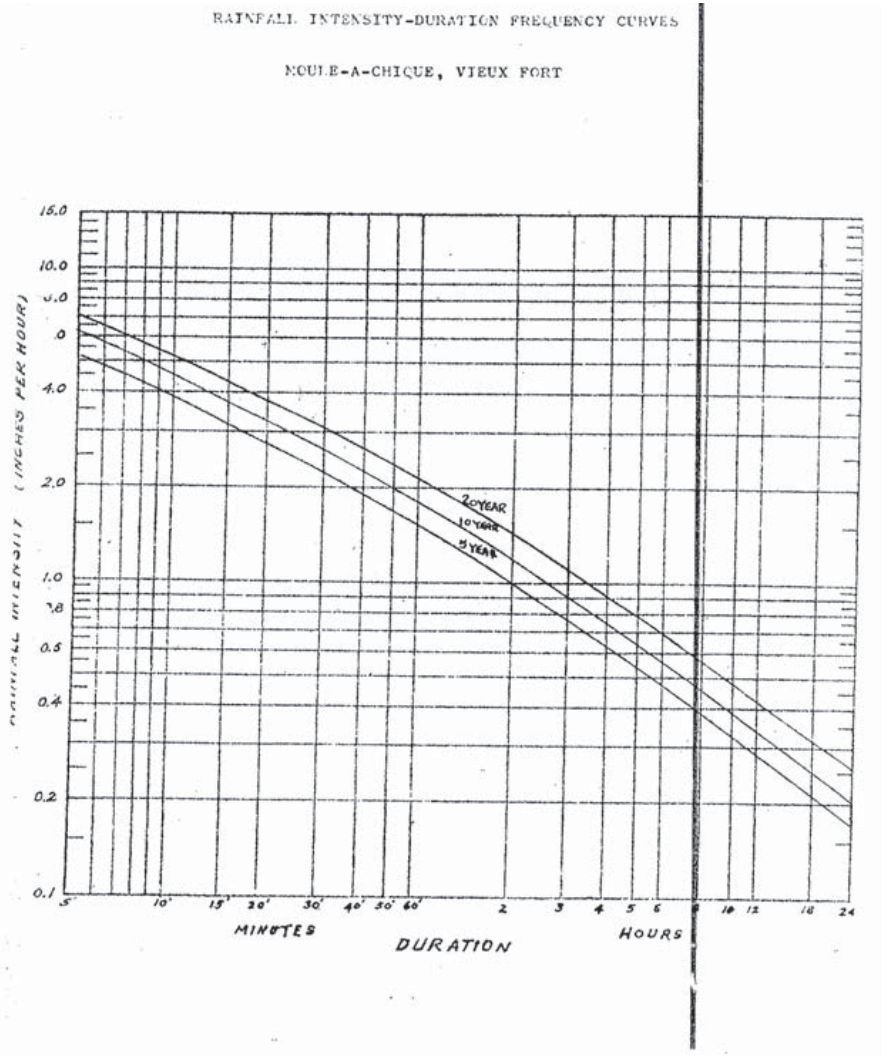
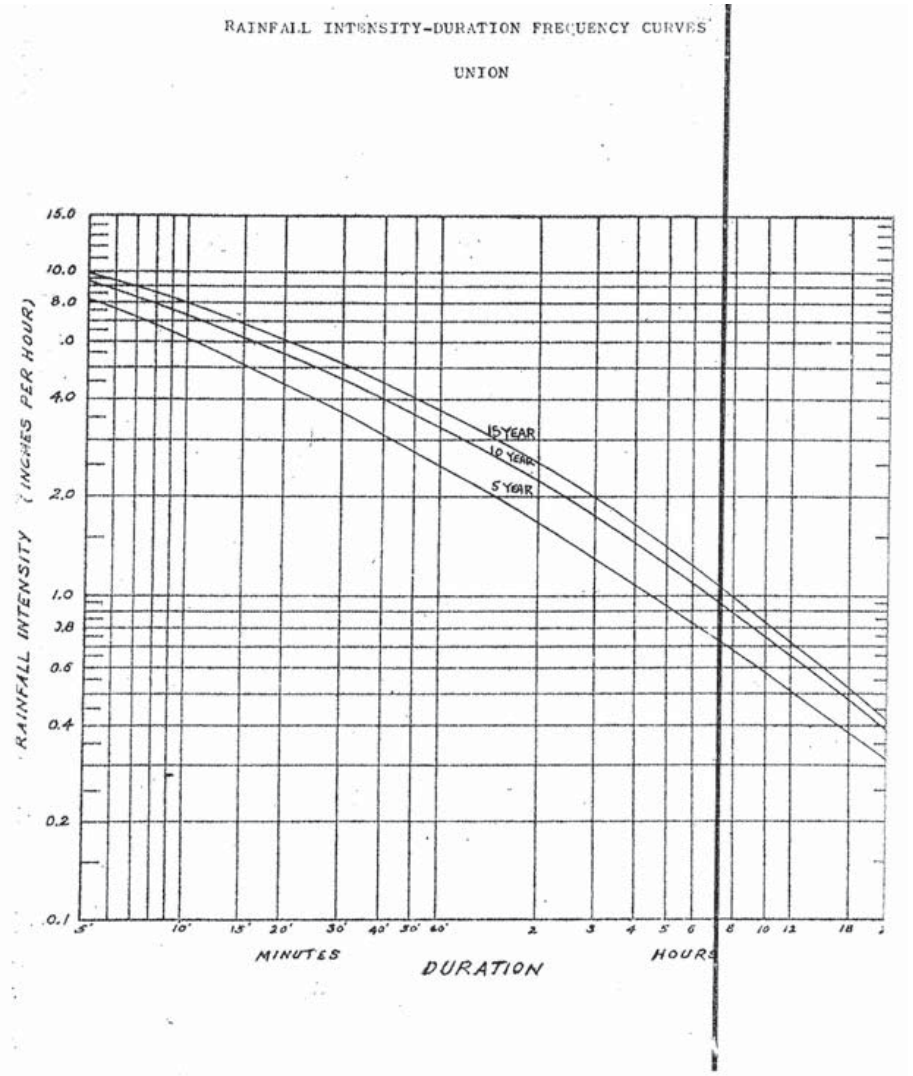
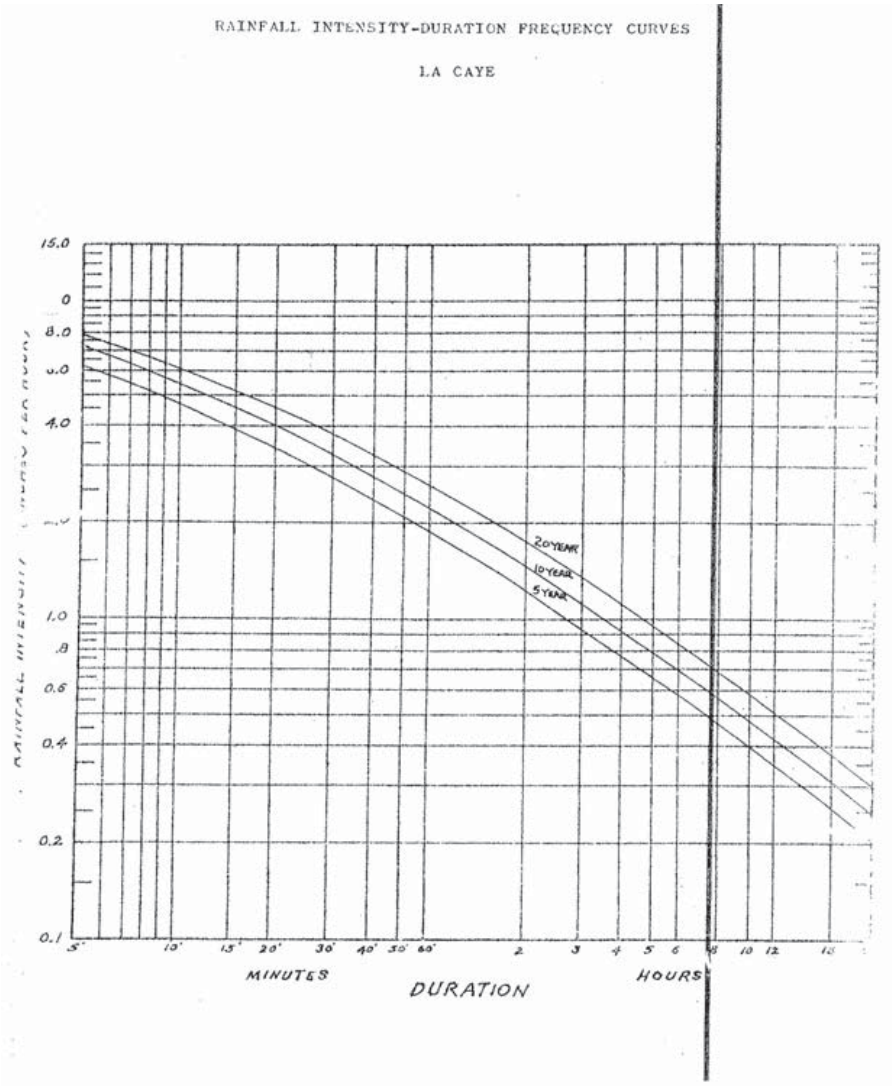
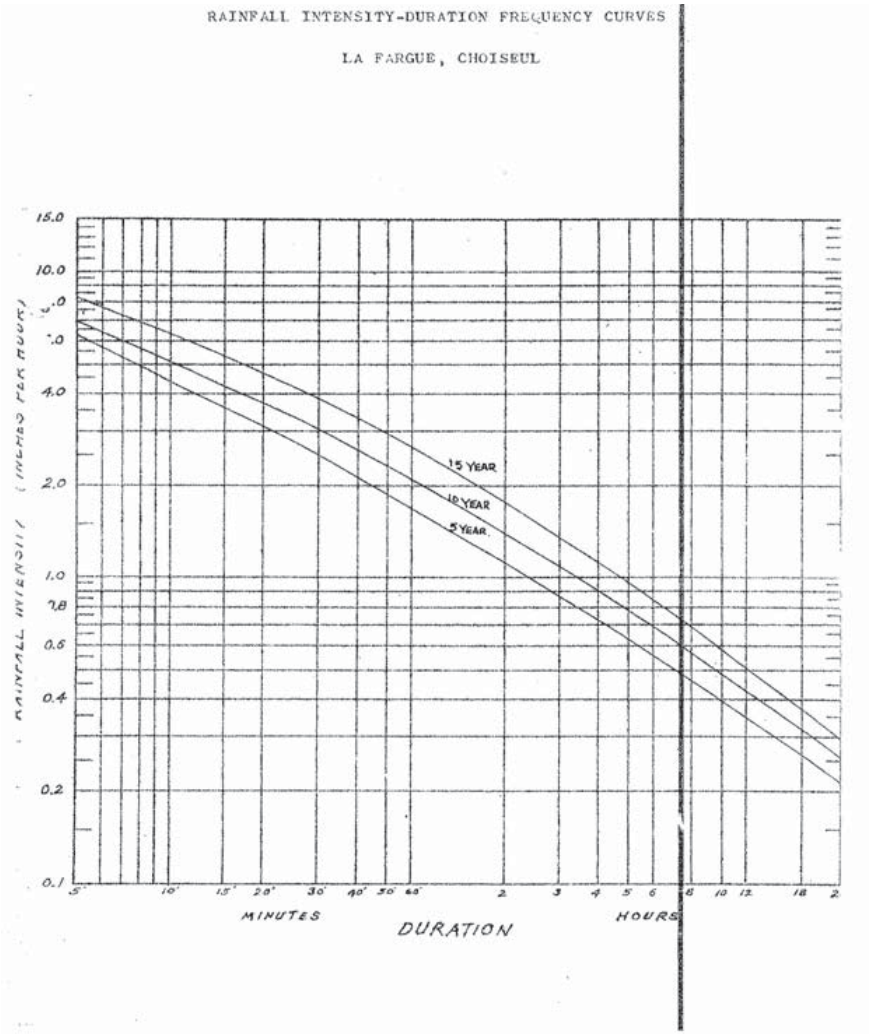
WOODLANDS
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
20 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
2
MINUTES
DURATION
HOURS


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
MOULE-A-CHIQUE, VIEUX FORT
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
4.0
2.0
1.0
0.5
0.4
0.2
0.1
2 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
12
18
24
MINUTES
HOURS
DURATION


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
UNION
RAINFALL INTENSITY (INCHES PER HOUR)
15.0
10.0
8.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
15 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
MINUTES
DURATION
HOURS


RAINFALL INTENSITY-DURATION FREQUENCY CURVES
LA CAYE
15.0
0
8.0
4.0
1.0
.8
0.6
0.4
0.2
0.1
20 YEAR
10 YEAR
5 YEAR
5'
10'
15'
20'
30'
40'
50'
60'
2
3
4
5
6
8
10
12
18
MINUTES
DURATION
HOURS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LA FARGUE, CHOISEUL
15.0
10.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
15 YEAR
10 YEAR
5 YEAR
MINUTES
DURATION
HOURS

Appendix K

Safety of Hotel Occupants

(There has been an increasing frequency of hotel guests taking legal action against hotels and travel tour companies. This has had an impact on the cost of public-liability insurance. More importantly, injuries affect the wellbeing and enjoyment of visitors and impact negatively on the image of the states where the hotels are located. This Appendix seeks to address some of the issues which may lead to the most common causes of injury.)

Glazing

Areas that are prone to accidents shall be fitted with what is known as Grade A safety glass. *(The use of safety glass reduces the risk of injury as it is tougher to break and will not fracture into dangerous shards if broken.)*

Safety glass shall be used in:

- all glass doors;
- bathrooms (for all areas up to 2 metres high);
- door side panels (if less than 300mm away from the door and positioned 1200mm or less above the floor);
- around stairs (for a distance of 1000mm from either side of the stairs and 2000mm from the bottom of the stairs);
- areas that can be mistaken for openings (*eg* full height glass);
- low level glass (if larger than 1.2 metres - areas under 1.2 metres require a minimum of 5mm thick glass).

(While these are the minimum areas that require safety glass consideration should be given to using it in additional spaces, especially where children are active.)

(Types of safety glass:
There are two types of safety glass available – toughened and laminated glass. Alternatively, glass safety film can be applied to existing windows and glass areas. While laminated glass, toughened glass and window film can all be used to meet required standards, it is worth selecting the most appropriate one to meet your needs.

Laminated glass *The high strength and unique design of laminated glass prevents it from shattering into large shards when broken. It is made from two or more sheets of glass bonded together with a flexible interlayer. In the event of breaking, the glass is held in place by the vinyl interlayer and forms a web-like pattern. The interlayer does not impact the transparency of the glass but will reduce damaging UV rays fading interior furnishings. Laminated glass is your best option for security. It generally takes two blows to break laminated glass with several further blows to create a hole. In contrast, toughened glass can be accessed with a single blow of a hammer.*

Toughened glass *Used in various applications for its safety benefit, toughened glass is four to five times stronger than ordinary glass of the same thickness. It is treated in a heat furnace to induce internal stresses which give the glass strength. If broken, toughened glass fractures into small blunt pieces. Toughened glass is considered a cheaper alternative to laminated glass but it does not provide the same security providing easy entry if broken.*

Window film *There are many types of window film available for a wide variety of uses from solar heat reduction to UV protection, privacy to safety and security. Safety films can be used to bring ordinary glass up to Grade A safety glass requirements. It works in a similar fashion to laminated glass by holding shattered glass pieces to the film if broken. There are restrictions on using film instead of toughened or laminated glass and this depends on the size of the glass pane and its thickness. For example, a 3mm thick glass pane may be fitted with safety filmed to attain Grade A status but only if the pane is less than 2m^2. As the thickness of the glass increases, so does the size of the pane that is acceptable to be filmed. If the glass is 6mm thick then window film can be applied to a glass pane of up to 3m^2 in size to qualify as Grade A safety glass.*

Added benefits of safety glass *All three forms of safety glass are available with added functionality such as the use of toned glass or double glazing, or in the case of film, solar control, allowing you to achieve more than just complying with safety standards.)*

Making glass visible *(Large areas of glass have been known to cause injury when mistaken for a doorway or opening. Under certain lighting conditions glass panes can appear 'invisible' and if children or adults collide with the pane this can cause serious injuries.)* If there are large glass areas such as doors and side panes that are not easily visible as glass, they shall be marked to reduce the risk of accidental injury. Glass areas are considered not easily visible if they do not have:

- decorative treatments (such as opaque or patterned glass);
- transoms;
- colonial bars;
- other components making the glass pane noticeable.

When none of the elements above are present, glass doors and side panes shall be marked with an opaque band spanning the width of the pane. The band itself shall be a minimum of 20mm wide. The height of the band shall also be located between 700mm and 1200mm from floor level.

Balcony handrails and balusters

The height and spacing between bars is dealt with in 505.7 – Guarding of Stairways and Landings and 505.8 – Guarding of Balconies and External Areas

Add:

505.8 (d) All hand-rails shall have intermediate vertical or longitudinal rails or latticework which would prohibit the passage of a 6-inch diameter sphere, except for industrial buildings where the intermediate rails or latticework shall prohibit the passage of a 12-inch sphere.

Stair Risers

There shall be noticeably equal heights for risers in a flight of stairs.

From the International Building Code:

1009.4.2 Riser height and tread depth. *Stair* riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured vertically between the leading edges of adjacent treads. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. *Winder* treads shall have a minimum tread depth of 11 inches (279 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the *stair*.

Exceptions:

1. *Alternating tread devices* in accordance with Section 1009.10.
2. Ship ladders in accordance with Section 1009.11.
3. *Spiral stairways* in accordance with Section 1009.9.
4. *Aisle stairs* in assembly seating areas where the *stair* pitch or slope is set, for sight-line reasons, by the slope of the adjacent seating area in accordance with Section 1028.11.2.

5. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; the maximum riser height shall be $7^{3}/_{4}$ inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum *winder* tread depth at the walkline shall be 10 inches (254 mm); and the minimum *winder* tread depth shall be 6 inches (152 mm). A *nosing* not less than $^{3}/_{4}$ inch (19.1 mm) but not more than $1^{1}/_{4}$ inches (32 mm) shall be provided on *stairways* with solid risers where the tread depth is less than 11 inches (279 mm).
6. See Section 3404.1 for the replacement of existing *stairways*.
7. In Group I-3 facilities, *stairways* providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m^2) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).

Floor Surfaces

(There have been several instances of injuries to hotel guests because of slippery or uneven surfaces. No clear-cut Code directives are provided herein. Guidance and cautionary notes are quoted below.

***United States Access Board** article from Chapter 4.5 Ground and Floor Surfaces:*

"Many variables affect the performance of a given walking surface, including slope and cross slope, its material, jointing, texture, and finish, the presence of moisture or contaminants, the material that contacts it and the method of ambulation. Design guidelines cannot encompass all criteria contributing to the safety of a walking surface. ADAAG addresses surface material, texture, and finish and requires them to be 'stable,' 'firm,' and 'slip resistant.'

"No standard or method of measurement exists for these characteristics except for slip resistance. A 'stable' surface is one that is not permanently changed by ordinary contaminants or applied force so that when a contaminant or force is removed, the surface returns to its original condition under normal use. A 'firm' surface is resistant to deformation by indentations or particles moving on or across it."

***Tile Council of North America** cautions as follows:*

"Tiles with a dynamic coefficient of friction (DCOF) of 0.42 or greater are not necessarily suitable for all projects. The specifier shall determine tiles appropriate for specific project conditions, considering by way of example, but not in limitation, type of use, traffic, expected contaminants, expected maintenance, expected wear, and manufacturers' guidelines and recommendations. Tile installations exposed to elements which reduce traction can create slippery conditions where the risk of a slip cannot be completely eliminated. Tiles with a DCOF of less than 0.42, shall only be installed when the surface will be kept dry when walked upon and proper safety procedures will be followed when cleaning the ties."

Floor finishes testing as "slip resistant" when installed should be maintained and cleaned periodically in order to maintain their intended slip resistance and moreover the Tile Council of North American recommends that installed tile floor finishes should be tested and checked periodically to verify slip resistance and that surfaces that have lost their slip resistance over time can be treated with a slip resistant treatment, however, experience has shown that if this treatment (top coat) is itself not cleaned and replaced form time to time a buildup of the treatment (top coat) can result in an even less slip resistance.)

Lighting of Stairwells and Outdoor Pathways

Lighting shall comply with Section 1205 of the International Building Code 2009 of the International Code Council.

Signage for means of egress for emergencies (power cuts, fires)

Signs shall comply with Sections 1007.9 to 1007.11 inclusive of the International Building Code 2009 of the International Code Council.

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Made by the Minister this 28th day of July, 2016.

GREGORY BOWEN
Minister responsible for Communications and Works.

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