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ST CHRISTOPHER AND NEVIS

CHAPTER 20.07

DEVELOPMENT CONTROL AND PLANNING ACT

and Subsidiary Legislation

Revised Edition

showing the law as at 31 December 2002

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This edition contains a consolidation of the following laws:

Development Control and Planning Act

Act 14 of 2000 in force 3rd October, 2000

Building Regulations

SRO 7 of 2000

CHAPTER 20.07

DEVELOPMENT CONTROL AND PLANNING ACT

ARRANGEMENT OF SECTIONS

PART I – PRELIMINARY	4
1. Short title	7
2. Interpretation	7
3. Act binds the crown	11
4. Objects and purposes of Act	14
PART II – ADMINISTRATION	15
5. Duties of Minister	15
6. Development and Planning Board, Schedule 1	15
7. Chief Physical Planner	16
8. Exercise of functions of Chief Physical Planner	16
9. Limitation of personal liability	17
PART III – DEVELOPMENT PLANS	17
10. Proposal for development plan	17
11. Scope and preparation of development plan	17
12. Environmental protection area	19
13. Environmental protection area plan, No. 5 of 1987	20
14. Public participation	21
15. Consideration of draft development plan	22
16. Approval of development plan	22
17. Deposit of approve plan	23
18. Modification or revocation of a plan	23
19. Legal status of development plans	23
PART IV – MANAGEMENT OF DEVELOPMENT OF LAND	24
20. Permission required to develop land	24
21. Types of development permission	25
22. Application for development permission	25
23. Requirement for further information	25
24. Certificate of ownership	26
25. Publicity for applications	26
26. Environmental impact assessment	27
27. Consultation on applications	28
28. Material planning consideration with respect to applications	29
29. Determination of applications	30

30.	Applications inconsistent with development plan	30
31.	Conditions of development permission	31
32.	Development agreements	33
33.	Performance bonds	34
34.	Lapse of development permission	35
35.	Supplementary provisions as to grant of development permission	35
36.	Minor variation of development permission	36
37.	Modification or revocation of development permission.....	36
38.	Reference of application to Minister	37
PART V – COMPLIANCE		38
39.	Compliance notice.....	38
40.	Material planning considerations with respect to compliance notices	40
41.	Notice to apply for development permission.....	41
42.	Permission for retention of buildings or continuance of use	41
43.	Suspension of effect of compliance notice	41
44.	Stop order	41
45.	Injunctions.....	43
46.	Action by Board for non-compliance with compliance notice.....	43
47.	Continuing operation of compliance notice	43
PART VI – ENVIRONMENTAL PROTECTION		44
48.	Interim preservation orders buildings or sites.	44
49.	Preservation orders in respect of buildings or sites	45
50.	Plant preservation orders.....	46
51.	Amenity orders.....	46
52.	Control of advertisements	47
53.	Supplementary provisions as to advertisements.....	49
54.	Environmental protection area	49
PART VII – BUILDING REGULATION		50
55.	Submission of Application to the Board	50
56.	Building regulations	50
57.	Documents approved for purposes of building regulations.....	52
58.	Appointment of building inspectors	53
59.	Passing and rejection of plans	53
60.	Power to require removal or alteration of work	54
61.	Appeal against notices	55
62.	Lapse of deposit of plans.....	55
PART VIII – COMPENSATION AND ACQUISITION.....		55
63.	Claim for compensation	55
64.	Circumstances where land is subject to mortgage.....	57

Revision Date: 31 Dec 2002

65.	Registration of claim for compensation	57
66.	Acquisition of land in lieu of compensation	58
67.	Public access and rights of way to beaches.....	58
68.	Acquisition of comprehensive planning area	58
69.	Acquisition of buildings or sites for the purposes of preservation	59
70.	Acquisition of land for planning purposes	59
PART IX – APPEALS		60
71.	Establishment of Appeals Tribunal.....	60
72.	Right of appeal.....	60
73.	Notice of Appeal.....	61
74.	Procedure at public Examinations	63
75.	Record of proceedings of public examinations	64
76.	Appeals by written representations	64
77.	Decision and notification of appeal	65
78.	Appeals to the High Court	66
PART X – MISCELLANEOUS		66
79.	Powers of entry	66
80.	Service of notices.....	67
81.	Power to require information	68
82.	Register of planning decisions	68
83.	Notification of Registrar of Titles.....	69
84.	Death of person having claim or right	69
85.	Offences and penalties	69
86.	Regulations	71
87.	Application of Act to National Housing Corporation; WhiteGate Development Corporation.....	72
FIRST SCHEDULE.....		73
SECOND SCHEDULE.....		75
THIRD SCHEDULE.....		78
FOURTH SCHEDULE.....		87
FIFTH SCHEDULE.....		79

Revision Date: 31 Dec 2002

CHAPTER 20.07

DEVELOPMENT CONTROL AND PLANNING ACT

AN ACT to make provision for the orderly and progressive development of land in both urban and rural areas and for the protection of the environment and improvement of the amenities thereof; to provide for the grant of permission to develop land and for other powers of control over the use of land; to confer additional powers in respect of the acquisition and development of land for planning purposes, and for other matters connected therewith.

PART I – PRELIMINARY

1. **Short title.**

This Act may be cited as the Development Control and Planning Act.

2. **Interpretation.**

(1) In this Act, unless the context otherwise requires,

“adjoining land” means that portion of land extending a distance of one hundred feet landward from the spring high water mark or, where the land to that distance includes a cliff, to a distance of fifty feet landward from the seaward edge of the cliff top, and wherever land is extended into the sea, by or as a result of filling, dredging or other man-made alteration, the landward boundary of the adjoining land shall remain at the line established;

“advertisement” means any word, letter, model, sign, placard, board, notice, awning, blind, balloon, device or representation, whether illuminated or not, in the nature of; and employed wholly or partly for the purposes of; advertisement, announcement or direction, or calling attention to any person, matter, object or event, and (without prejudice to the preceding provisions of this definition) includes any hoarding, billboard, wall, fence, or similar structure, used, adapted, designed, or intended for use, for display of advertisement;

“agriculture” includes horticulture, fruit growing, seed growing, dairy farming, the breeding and keeping of livestock (including any creature kept for the production of food, wool, skins or fur or for the purpose of its use in farming the land), the use of land as grazing land, meadow land, for the cultivation of crops, as market gardens and nursery grounds, but does not include the use of land for fish-farming; and “agricultural” shall have a corresponding meaning;

“Amenity order” means an order made under section 51;

“Appeals Tribunal” means the Appeals Tribunal established under section 71;

- “beach” means that area of the coastal zone from the seaward limit of the foreshore running inland to the vegetation line or other natural barrier whichever is closer to the landward limit of the foreshore, and a beach may consist of sand, stones, gravel, shingle, coral fragments or boulders;
- “Board” means the Development Control and Planning Board established under section 6;
- “builder” means a person engaged as a contractor or otherwise in the erection, construction, alteration, improvement, maintenance, repair or demolition of buildings, or works incidental to any of the foregoing;
- “building” includes any erection, structure, chattel or movable structure in, on, over or under any land and any part of a building so defined (but does not include plant or machinery comprised in a building), any erection or structure permanently attached to the seabed or temporarily so attached for the purpose only of the exploitation of minerals in, on or under the seabed;
- “building operations” includes the demolition of buildings or parts thereof, rebuilding operations, structural alterations of or additions to buildings and other operations normally undertaken by a person carrying on business as a builder;
- “building or work” includes waste materials, refuse and other matter deposited on land, and references to the erection or construction of buildings or works shall be construed accordingly;
- “Chief Physical Planner” means the person so appointed under section 7;
- “clearing”, in relation to land, means the removal of buildings or parts thereof from the land, the removal of materials from the land, the leveling or grading of the surface of the land, the removal of vegetation and the carrying out of such other operations in relation to the land as may be prescribed;
- “coastal development set back” means the prescribed distance to a coastal feature, such as the line of permanent vegetation, within which all or certain types of development are prohibited;
- “coastal waters” means the sea, and those waters adjacent to the landward limit of the adjoining land or connected permanently or intermittently with the sea which contain a measurable quantity of sea water, including sounds, bays, lagoons, ponds and estuaries, and the land below and along the banks of the waters;
- “coastal zone” means all lands and waters of Saint Christopher contained within the area bounded by the outer limit of the territorial sea and by the landward limit of the adjoining land, and includes coastal waters;
- “compliance notice” means a notice issued under section 39;

Revision Date: 31 Dec 2002

“Court” means the High Court of Justice;

“Crown land” means land which belongs to and vested in the Crown;

“development” means the carrying out of building engineering, mining or other operations in, on, over or under land, the making of a material change in the use of a building or other land, the subdivision of land, or the use of land or of the external part of a building or structure for the purposes of display of advertisement which is not ordinarily used for that purpose, provided that the following shall not be deemed to constitute development:

- (a) the carrying out of works for the maintenance, improvement or other alteration of a building, if the works affect only the interior, and do not materially affect the external appearance of the building;
- (b) the carrying out by the Government of works for the maintenance or improvement of a road if the works are carried out on land within the boundaries of the road;
- (c) the carrying out by the Government or by a statutory agency or by a utility within the meaning of legislation governing the operation of telephone, electricity and water works for the purpose of inspecting, repairing or renewing sewers, water mains, electric mains, pipes, cables or other apparatus, including the excavation of any road or other land for that purpose;
- (d) the use of a building or other land within the curtilage of a dwelling house for purposes incidental to the enjoyment of that dwelling house as such;
- (e) the use of land for the purposes of agriculture or forestry, but not including
 - (i) any building or engineering operation on the land,
 - (ii) the operation of a sawmill on the land, or
 - (iii) the carrying out of any works or excavation on the land for the purposes of accommodation of livestock (not being livestock kept for the domestic needs or personal enjoyment of the occupants of the land), or for the storage of slurry or sewage sludge, within one hundred yards of the curtilage of a residential building, not being a residential building within an agricultural unit;
- (f) the erection of gates, fences, walls or other means of enclosure, not exceeding three feet six inches in height where adjacent to a road or the sea, or six feet in any other case, and not constructed of asbestos, fibre glass or sheet metal;
- (g) the enlargement, improvement or other alteration of a dwelling house, provided that

- (i) the square footage of the enlargement does not exceed one tenth of the square footage of the ground floor of the house at the date of the development or of the house at the commencement of this Act, whichever is larger,
 - (ii) the enlargement is an integral part of the existing house,
 - (iii) the enlargement complies with the requirements of any planning regulations for the time being in force, and
 - (iv) written notice of intention to carry out such work is given to the Board through the Chief Physical Planner;
- (h) in the case of buildings or other land that are used for a purpose of a class specified in an Order made by the Minister under this section, the use thereof for any other purpose of the same class;

“development permission” means permission for development given under the provisions of Part IV;

“development plan” means any development plan prepared under Part III and includes any modification or amendment thereof, and “plan” shall mean a development plan where the context so admits;

“dwelling house” means a set of premises constructed for use for the purpose of human habitation, but does not include a building containing one or more flats, apartments, condominiums or town houses, or a flat, apartment, condominium or town house contained in such a building;

“engineering operations” include the laying out, building and maintenance of roads, drains, runways and bridges, the preparation of land for carrying out of development, the clearing of land, the excavation of land, the dredging of watercourses or channels, the filling in of any cavity or excavation on land, the reclamation of land and the placing or assembly of a pen, cage, tank, pond or other structure in any part of inland or coastal waters or in, on, over or under any land for the purpose of fish-farming;

“environment” means all or any of

- (a) the media of land, water and air, including all layers of the atmosphere;
- (b) organic or inorganic matter and living organisms including human beings;
- (c) the interacting systems that include components referred to in paragraphs (a) and (b);

within the territorial jurisdiction and sovereign rights of Saint Christopher;

“environmental impact assessment” means the process of collection, analysis, evaluation and review of information on the likely effects of a proposed development on the environment and the means to overcome adverse effects;

Revision Date: 31 Dec 2002

- “environmental impact statement” means a document or series of documents which contains or contain the information on the likely effects of the proposed development on the environment and the means to overcome adverse effects, required by section 26;
- “environmental protection area” means an area so designated in a development plan under section 11, or declared an environmental protection area by Order made under section 54;
- “environmental protection area order” means an order made under section 54;
- “fish-farming” means the breeding, rearing or keeping of fish or shellfish which involves the placing or assembly of a pen, cage, tank, pond or other structure in any part of inland or coastal waters or in, on, over or under any land for the purpose of fish-farming;
- “foreshore” means that portion of the land of Saint Christopher which lies between the mean low watermark and the mean high watermark of the sea;
- “industrial development” means the development of land for the manufacture or partial manufacture of goods, articles or substances of any kind, or the assembly of manufactured goods or the turning into manufactured goods of articles which are partially manufactured or of substances in their natural state, or the repairing, finishing, cleaning, washing, packing or canning, adapting for sale or breaking up of any article;
- “interim preservation order” means an order made under section 48;
- “land” means any corporeal hereditament including a building and other things permanently affixed to land and includes the foreshore, seabed and land covered by water within the boundaries of the territorial sea of Saint Christopher;
- “lawful use” does not include use of any building or other land which was commenced in contravention of the provisions of this Act or of earlier planning control;
- “list” means a list of buildings or sites of special architectural, cultural, historical or archaeological interest provided for under Part VI;
- “listed building” means a building or part thereof which is included in a list made in accordance with the National Conservation and Environment Protection Act, Cap. 11.03;
- “means of access” includes any means of access whether private or public, for vehicles or for pedestrians, and includes a street or road;
- “mineral” means any substance in liquid, solid or gaseous form occurring naturally in, on or under land or on, in or under the seabed and formed by or subject to a geological process, including natural gas, petroleum and related substances such as asphalt, and including coal,

salt, sand, gravel, quarry and pit material, gold, silver and rare and precious metals, but does not include water;

“mining operation” means

- (a) the carrying out, in relation to any mineral, of any activity with a view to working, carrying away, treating or converting that mineral;
- (b) the search or exploration for any mineral with a view to carrying out any activity mentioned in paragraph (a) and the carrying out of any work necessary for such search or exploration;
- (c) the deposit of waste or refuse materials in consequence of or incidental to any activity mentioned in paragraph (a) or (b);

“Minister” means the Minister responsible for the administration of this Act;

“mortgage” includes any charge or lien on any property for securing money or money’s worth;

“owner” in relation to land, means a person who is, for the time being,

- (a) the estate owner in respect of the freehold interest in the land; or
- (b) entitled to a tenancy of the land granted for a term of years certain of which not less than ten years remain unexpired;

“permitted development” means development which is authorised by Order made by the Minister under subsection (2) of section 20;

“plant” includes any flower, shrub, tree and any herb, grass, lichen, moss or other vegetation;

“plant preservation order” means a plant preservation order made under section 50;

“prescribed” except in relation to matters expressly required or authorised by this Act to be prescribed in some other way, means prescribed by regulations;

“preservation order” means an order made under section 48;

“regulations” means regulations made under this Act;

“resources” mean any social, cultural, historical, technological, biological, physical or chemical elements and processes, renewable or non-renewable, tangible or intangible, of economic or aesthetic importance which compose the surroundings of mankind;

“road” means any road whether public or private and includes a street, square, court, alley, lane, bridge, footpath, trace, passage or highway, whether thoroughfare or not, and a reference in this Act to a “road” shall be construed as a reference not only to the carriage way or that

Revision Date: 31 Dec 2002

part of a road which is usually reserved for use by wheeled vehicles, but also to the total road reserve;

“road reserve” means all lands reserved for use for the purposes of bridges, sidewalks, footways, curbs, verges, culverts, drainage or other road works and the adjoining reserves accessory to a road in addition to the carriage way or that part of a road which is usually reserved for use by wheeled vehicles;

“sea” means the Caribbean Sea, the Atlantic Ocean, and all areas subject to tidal action through any connection with the Caribbean Sea or the Atlantic Ocean;

“seabed” means the floor and subsoil of the sea between mean low watermark and the seaward limits of the territorial waters of Saint Christopher;

“stop order” means an order made under section 44;

“subdivision” means the division of a parcel of land, other than buildings held under one ownership, into two or more parts whether such division is by conveyance, transfer, assignment, vesting order, plan of survey, plan of subdivision or any other instrument for the purpose of sale, gift, partition, succession, lease, mortgage or for any other purpose and such subdivision constitutes development whether or not the use for which the subdivided land is intended constitutes development;

“unauthorised development” means any development for which a grant of development permission has not been obtained and which is not permitted development authorised by Order made by the Minister under subsection (2) of section 20, or development which is not in accordance with the conditions or limitations subject to which development permission was granted;

“use”, in relation to land, does not include the use of land by the carrying out of building or other operations on the land;

“utilities” include physical services such as water, sewage and electricity but excluding road;

“waste material” includes garbage, refuse, spoil, mineral, tailings, sludge, effluent and anything of whatever kind which has the appearance of being material abandoned, discarded or intended to be abandoned or discarded by the owner or former owner thereof, or the only value of which appears to be as scrap or for the utilisation or parts thereof or the extraction of the residue of the substance of which it formerly formed part.

- (2) For the avoidance of doubt, it is declared that
 - (a) the use as two or more separate premises, for the purpose of dwelling, of any building previously used as one dwelling house involves a

material change in the use of that building and of each part thereof so used;

- (b) the use for the display of an advertisement, of any land or of the external part of a building, which is not ordinarily used for that purpose, shall be deemed to involve a material change in the use of that land or part of the building;
- (c) the deposit of any waste material on land involves a material change in the use of the land, notwithstanding that the deposit is on a site which has been previously so used, if either the superficial area thereof or the height of the deposit is thereby extended or exceeds the level of any similar deposit on adjacent land.

3. **Act binds the crown.**

This Act binds the Crown.

4. **Objects and purposes of Act.**

The objects and purposes of this Act are:

- (a) to foster the awareness that all persons and organisations owning, occupying and developing land have a duty to use that land with due regard for the wider interest of both present and future society as a whole;
- (b) to maintain and improve the quality of the physical environment within which patterns of human settlement are situated in Saint Christopher;
- (c) to achieve orderly, economical and beneficial development and use of land and patterns of human settlement;
- (d) to assist in the orderly, efficient and equitable planning, allocation and development of the resources of Saint Christopher taking account of all relevant social, economic and environmental factors so as to ensure that the most efficient, equitable and environmentally sustainable use is made of land in the interests of all the people of Saint Christopher;
- (e) to provide for the orderly subdivision of land and the provision of services in relation thereto;
- (f) to protect and conserve the cultural heritage of Saint Christopher as it finds expression in the natural and the built environment;
- (g) to facilitate a process whereby people participate in the development and planning of their communities so far as it is compatible with the public interest;
- (h) to facilitate a continuous improvement in the quality of life of all the people in Saint Christopher.

Revision Date: 31 Dec 2002

(2) In implementing, applying and interpreting this Act, all persons shall have regard to, use their best effort to further and give a broad and purposive interpretation to the matters set out in subsection (1).

PART II – ADMINISTRATION

5. Duties of Minister.

(1) The Minister is responsible for securing the objects and purposes set out in section 4 and in the exercise of the powers conferred on him or her, may do all things necessary for the purpose of carrying out his or her responsibilities under this Act.

(2) In addition to the several duties imposed on him or her by this Act, the Minister is responsible for the framing and implementation of comprehensive policies with respect to the use and development of all land in Saint Christopher in accordance with a development plan prepared under the provisions of Part III and shall, in the framing and implementation of such policies, have regard to the need to secure consistency.

(3) In exercising his or her functions, the Minister shall be guided by the principle that the provisions of this Act shall be applied uniformly, fairly and equally to all persons.

(4) Nothing in this section shall be construed as imposing upon the Minister either directly or indirectly any form of duty or liability enforceable in proceedings before any court.

6. Development and Planning Board.

(1) There is established a body to be known as the Development Control and Planning Board.

(2) The constitution and procedures of the Board shall be in accordance with the First Schedule.

(3) The Board shall

- (a) advance the purpose of this Act as set out in section 4;
- (b) institute, complete, maintain and keep under review a study of matters pertinent to planning the use and development of the land of Saint Christopher;
- (c) prepare or cause to be prepared development plans in accordance with Part III;
- (d) regulate development by the means provided by this Act, having regard to the need to secure consistency and conformity with the development plan;
- (e) prepare, and submit to the Minister subject reports on matters which the Board or the Minister may from time to time consider necessary or desirable having regard to the provisions of section 4; and
- (f) do all other things necessary for carrying out the purposes and provisions of this Act as may be authorised by the Act.

(4) The Board shall remain at all times responsible for the proper performance of its functions under this section, but subject to subsection (1) may, for the purpose of such performance, as it thinks fit,

- (a) consult with or obtain advice from other authorities, persons or bodies of persons;
- (b) engage other persons to carry out work on its behalf;
- (c) delegate any of its functions under section 10 to any of the persons referred to in paragraph (a) or (b).

(5) Without restricting the generality of subsection (4), the Board may delegate any of its duties to the Chief Physical Planning Officer.

(6) The Board shall

- (a) be responsible for the implementation of the policies framed by the Minister under section 5; and
- (b) act in accordance with directions of a general or special nature which may be given from time to time by the Minister as to the policy to be followed in the exercise of its functions.

7. Chief Physical Planner.

(1) A Chief Physical Planner whose office shall be a public office shall be appointed to exercise and perform the duties specified in subsections (2), (3) and (4).

(2) The Chief Physical Planner shall be responsible to the Board for the administration and operation of the system of planning for which this Act provides.

(3) The Chief Physical Planner shall sign and issue all development permissions, refusals of development permission, compliance notices and other documents authorised by the Board to be issued under the provisions of this Act.

(4) The Chief Physical Planner has the powers conferred upon him or her by this Act and the duties that he or she is required by this Act or by the direction of the Board to perform.

8. Exercise of functions of Chief Physical Planner.

(1) Functions assigned to the Chief Physical Planner by or under this Act may be exercised by any planning officer authorised by the Chief Physical Planner, in writing, either generally or specially, in that behalf.

(2) If authorised for the purpose by the Chief Physical Planner, in writing, any person exercising a function assigned to a planning officer by or under this Act shall be deemed, for the purpose of the exercise of that function, to be the proper officer for the exercise of that function, and shall be deemed to have the powers of a planning officer for the purposes of that function.

(3) Neither the Chief Physical Planner nor any planning officer of the Board, shall engage in any work, employment, contract, interest, activity or other involvement which is, or is likely to become, in conflict with his or her duties under this Act.

Revision Date: 31 Dec 2002

9. Limitation of personal liability.

(1) No personal liability shall attach to the Minister, any member of the Board, the Chief Physical Planner or any other officer in respect of anything done or omitted to be done, in good faith, in the implementation of the provisions of this Act.

(2) Any sums of money, damages or costs which may be recovered against the Board or any of its members or officers for anything done or omitted to be done in the implementation of the provisions of this Act shall be paid out of the Consolidated Fund.

PART III – DEVELOPMENT PLANS

10. Proposal for development plan.

(1) The Board may, and if required by the Minister shall, submit to the Minister proposals for the preparation of a development plan.

- (2) A proposal for the preparation of a development plan shall include
- (a) a reasoned statement of the need for the plan;
 - (b) the main headings of the proposed contents of the plan;
 - (c) a suggested timetable for the preparation of the plan;
 - (d) proposals for obtaining representations from persons likely to be affected by or likely to wish to submit representations and views on the proposed plan during the course of its preparation;
 - (e) proposals for obtaining representations on the plan by sectoral agencies; and
 - (f) such other matters as are required by the Minister or are considered by the Board to be necessary for a decision to be made on the proposal.

(3) Where the Minister rejects a proposal submitted under this section, he or she may require the Board to submit a fresh or modified proposal for the same plan or a new proposal for a different plan.

11. Scope and preparation of development plan.

(1) The Board shall prepare or cause to be prepared and thereafter keep under review a development plan for Saint Christopher as a whole, which shall be called the Saint Christopher National Development Plan.

(2) The Board may prepare or cause to be prepared and thereafter keep under review a development plan for any specified part of Saint Christopher, which shall be called by the name of the part of Saint Christopher to which it relates.

(3) A development plan shall comprise a written statement and such maps, plans, drawings, diagrams and other graphic representations as the Board considers necessary to illustrate and explain the plan with the degree of particularity they consider to be appropriate to different parts of Saint Christopher and to the nature of the development plan.

- (4) Without restricting the generality of subsection (3), a development plan shall include
- (a) a statement of the principal aims and objectives with respect to the development and other use of land in the area;
 - (b) a report on the existing conditions of the area, including
 - (i) the principal physical, social, economic and environmental characteristics of the area and the principal purposes for which land is used,
 - (ii) the size, composition and distribution of population of the area,
 - (iii) the communications, transport systems and traffic in the area,
 - (iv) the public services and the physical and social infrastructure provided in the area,
 - (v) any other matters which may affect the development and other use of land in the area,
 - (vi) such other matters as the Minister may in a particular case direct;
 - (c) a statement of the policies, proposals, and programmes for the future development and use of land in the area, including principles for regulating the use and development of land and measures for the maintenance and improvement of the environment;
 - (d) a reasoned justification of the policies and proposals for the future development and use of land in the area having regard to
 - (i) the report of the existing conditions of the area under paragraph (b),
 - (ii) an examination of the likely effects of the proposals on the environment,
 - (iii) any specific policies of the Government which may affect the pattern of development in the area,
 - (iv) the current economic policies of the Government for the development of Saint Christopher,
 - (v) the relationship between the proposals in the plan and other previously approved development plans which may affect the area,
 - (vi) the financial and other resources which are likely to be available for carrying out the proposals of the plan; and
 - (e) a schedule setting out the stages by which the proposals of the plan may be implemented.
- (5) A development plan may
- (a) define the sites of proposed roads, public and other buildings and works or the allocation of land for agricultural, residential, industrial or other purposes of any class, and the conditions under which such development should be carried out;

Revision Date: 31 Dec 2002

- (b) designate any area as being an area which should not be developed due to its susceptibility to aircraft hazard or to flooding, erosion, subsidence, instability or other condition of the physical environment;
- (c) make proposals for the preservation of buildings, sites or other features of special architectural, cultural, historic or archaeological interest;
- (d) provide for any of the matters set out in the Second Schedule as the Board considers appropriate to the nature and scope of the proposed plan;
- (e) subject to the provisions of section 5, designate as a comprehensive planning area any area which in the opinion of the Board needs to be planned as a whole for one or more of the purposes of development, redevelopment, improvement or conservation.

(6) As soon as may be practicable after the designation of land as a comprehensive planning area under subsection (5) (e), the Board shall prepare or cause to be prepared a detailed plan for the relevant area showing the manner in which it is to be developed.

12. **Environmental protection area.**

(1) The Board may, and if so directed by the Minister shall, cause a survey to be made of the whole or any part of Saint Christopher with a view to determining whether any area of Saint Christopher ought to be designated an environmental protection area in a development plan.

(2) Before finally determining whether to recommend to the Minister that any area should be designated an environmental protection area in a development plan, the Board shall

- (a) take such steps as in its opinion will ensure that adequate publicity is given to its proposals in the area to which the proposals relate;
- (b) provide persons living and working in the area and any other persons interested in the area with an opportunity of making representations and comments on the proposals;
- (c) consult the Minister charged with the administration of the National Conservation and Environmental Protection Act, Cap. 11.03 and the Conservation Commission special knowledge on environmental matters; and
- (d) take account of the representations and comments received on the proposals.

(3) In determining whether it is desirable to designate any area as an environmental protection area in a development plan, the Board and the Minister shall have regard to

- (a) the survey prepared under subsection (1);
- (b) any representations or comments submitted by any person, body or authority on the proposals;

- (c) such of the following matters as may be relevant to the area:
 - (i) the flora and fauna of the area,
 - (ii) the natural features and beauty of the area,
 - (iii) any outstanding geological, physiographical, ecological, or architectural, cultural, historic or archaeological features of the area which it is desirable to preserve and enhance,
 - (iv) any special scientific interest in the area,
 - (v) special natural hazards to which the area is or may be subject,
 - (vi) the characteristics, circumstances and interests of the people living and working in the area.

13. Environmental protection area plan.

(1) In consultation and co-ordination with the Minister responsible for the National Conservation and Environment Protection Act, Cap. 11.03 the Board may prepare or management may cause to be prepared an environmental protection area management plan with respect to an area designated to be an environmental protection area in a development plan.

(2) The purpose of a plan prepared under this section shall be to set out the policies and measures for the preservation, enhancement and management of the special features of the environmental protection area, including as may be relevant to the area to which the plan applies, policies and measures for

- (a) the preservation of marine and terrestrial flora and fauna, including the regulation of hunting and fishing;
- (b) the protection of water supplies, water catchment areas and mineral resources;
- (c) the prevention or erosion, landslides and flooding;
- (d) the control of fires;
- (e) the control of pollution;
- (f) the designation of special resource and use areas in the coastal zone;
- (g) the use and development of land so as to sustain the local economy of the environmental protection area;
- (h) the designation of permitted and prohibited land uses, development and other activities;
- (i) the prohibition, restriction or regulation of access to any area and the prevention of squatting;
- (j) the development of facilities for residents and visitors for the enjoyment of the special features of the environmental protection area;
- (k) the development of facilities for educational visits, study and research of the special features of the environmental protection area.

Revision Date: 31 Dec 2002

(3) In consultation and co-ordination with the Minister responsible for the administration of the National Conservation and Environment Protection Act, Cap. 11.03 the Board may designate in an environmental protection area, any area of the foreshore or the sea-bed as a special resource and use area, that is say, an area where public use of certain lands and waters of the foreshore or sea-bed needs to be controlled or protected to ensure the safety and welfare of the public and for the preservation of the costal environment, namely, areas

- (a) designated as protected swimming and surfing areas where other potentially conflicting uses are prohibited;
- (b) designated for
 - (i) anchoring,
 - (ii) mooring,
 - (iii) beaching,
of ships, yachts, motor-boats, boats and other water-craft, including restrictions on the numbers and kinds of ships, yachts, motor-boats, boats and other water-craft, that may be anchored, moored, or beached in any particular bay or other costal area at one time;
- (c) where the use of equipment for
 - (i) wind-surfing,
 - (ii) water-skiing, or
 - (iii) any other water-related sport, including sport-fishing, is prohibited.

(4) Prohibited and permitted activities in special resource and use areas designated pursuant to this section shall be as specified in the development plan, or as prescribed.

14. Public participation.

(1) During the preparation of a development plan and before finally determining its content for submission to the Minister, the Board shall take such steps as, in its opinion, will ensure

- (a) that adequate publicity is given in the area to which the plan relates to the matters which it proposes to include in the plan;
- (b) that persons who may be expected to desire an opportunity of making representations to the Board with respect to those matters are made aware that they are entitled to an opportunity of doing so; and
- (c) that such persons are given an adequate opportunity of making such representations.

(2) The Board shall consider any representations made to it within the prescribed period.

15. Consideration of draft development plan.

(1) When the Board has prepared a draft development plan it shall submit a copy to the Minister and deposit a copy at the offices of the Board and at such other place or places as the Board considers to be most effective for bringing it to the notice of persons residing, working or owning property in the area to which the proposals in the draft development plan relate, or who are likely to be affected by the proposals in the draft development plan.

(2) The Board shall give notice in the *Gazette* and in at least one newspaper circulating in Saint Christopher of the depositing of a draft development plan, and of the places where it may be examined, and shall give such other publicity to and written or oral explanation of the draft development plan as, in its opinion, is best calculated to inform all persons affected or likely to be affected by the proposals in the draft development plan, and all persons of the right to make representations with regard to the proposals in the draft development plan.

(3) Any person may, within eight weeks of the publication in the *Gazette* of the notice referred to in subsection (2), make either oral or written representations on the draft development plan to the Board.

(4) When the Board submits a draft development plan to the Minister, it shall be accompanied with a written explanation of the steps taken by the Board to comply with the provisions of this section and section 14 and the particulars of the consultations held with other persons with respect to the proposals in the draft development plan.

(5) After the expiration of the period prescribed for making representations on a draft development plan, the Board shall meet and consider the draft development plan and the representations and comments made, and shall forward the same together with its own recommendations and comments to the Minister.

16. Approval of development plan.

(1) The Minister, after considering a draft development plan which has been submitted to him or her under section 15 and all comments, representations and recommendations made thereon, shall

- (a) adopt the draft plan and submit it for the approval of the Cabinet;
- (b) require further work on, or revision of, the draft plan; or
- (c) require further consultations on the draft plan in whole or in part.

(2) Where the Minister determines that before a draft development plan is adopted, further work on, or revision of, or consultation on, the draft plan is required, he or she may require the Board to undertake such further work, revision or consultation as may be necessary and to give such publicity to the matter as will enable persons likely to be affected or interested to make representations or comments on the draft plan.

(3) Unless the Minister otherwise directs, the provisions of section 15 shall apply to any modifications, work or revision undertaken by the Board under this section and to the resubmission of the draft plan or any modification thereof.

(4) Where a draft development plan (called a Saint Christopher National Physical Development Plan) is approved by the Cabinet under subsection (1)(a) with or

Revision Date: 31 Dec 2002

without modifications, the approved plan shall be subject to an affirmative resolution of the National Assembly.

17. Deposit of approved plan.

(1) When a development plan for a specified part of Saint Christopher has been approved by the Cabinet, or a Saint Christopher National Physical Development Plan has been approved by the National Assembly, as the case may be, a copy of the plan shall be deposited at the Registry of Titles and Deeds, and at public libraries, police stations, and post offices in Saint Christopher, and the substance of the plan shall be publicised in the area or areas to which it applies, in such manner as the Board may direct.

(2) Notice of the approval by the Cabinet of a development plan for a specified part of Saint Christopher or the approval by the National Assembly of a Saint Christopher National Physical Development Plan, as the case may be, shall be published in the *Gazette* and the plan shall come into effect on the date of such publication.

(3) Copies of a plan shall be available for inspection and purchase at all reasonable times at the offices of the Board, at such price as may be prescribed.

18. Modification or revocation of a plan.

(1) The Minister may at any time when he or she considers it appropriate, require the Board to review or to prepare proposals for the modification or revocation of any plan or part thereof.

(2) Without prejudice to subsection (1), it shall be the duty of the Board to keep under review the operation of any plan in light of changing circumstances in Saint Christopher and in the area to which it applies, and the Board may prepare proposals for the modification or revocation of any plan as it sees fit and shall submit the same to the Minister.

(3) The provisions of this Part with respect to the participation in, preparation, consideration and approval of, a development plan shall apply *mutatis mutandis* to the participation in, preparation, consideration and approval of the modification or revocation of a plan.

(4) The modification or revocation of an approved development plan for a specified part of Saint Christopher shall be submitted by the Minister for the approval of the Cabinet.

(5) The modification or revocation of an approved Saint Christopher National Physical Development Plan shall be subject to an affirmative resolution of the National Assembly.

(6) Notice of the modification or revocation of an approved plan shall be published in the *Gazette* and at least one newspaper circulating in Saint Christopher.

19. Legal status of development plans.

(1) Where two or more development plans have been approved which apply in whole or in part to the same area and there is any conflict or discrepancy between them, then

- (a) the plan drawn to the larger scale shall have precedence;
 - (b) if the plans are drawn to the same scale, the later plan shall be deemed to have modified the earlier plan, unless there is an express provision to the contrary.
- (2) When a development plan has been approved
- (a) it may be the reason for the compulsory acquisition of land designated in that approved development plan as a comprehensive planning area;
 - (b) it shall be the duty of all public officers to have due regard to, and so far as is practicable, be guided by the plan in formulating and preparing any project of public investment and development in Saint Christopher;
 - (c) the Board shall, in considering any application for development permission, give principal consideration to and be guided by the plan.
- (3) When a plan has been prepared but is not yet approved, subsection (2)(b) and (c) shall apply as if the plan had been approved.
- (4) An approved development plan remains in effect until the date of the publication of a notice in the *Gazette* announcing its revocation.

PART IV – MANAGEMENT OF DEVELOPMENT OF LAND

20. Permission required to develop land.

(1) No person shall carry out any development of land except under and in accordance with the terms of a development permission granted in that behalf prior to the commencement of such development, on an application made in accordance with the regulations made under section 86, unless the development is permitted development authorised under subsection (2).

(2) The Minister may by Order published in the *Gazette* grant permission to any class of development (hereinafter referred to as “permitted development”) specified in the Order either unconditionally or subject to such conditions or limitations as may be specified in the Order, without the requirement for the making of an application for grant of express development permission.

(3) Every Order made under subsection (2) shall be subject to an affirmative resolution of the National Assembly.

(4) No department of Government, statutory body, or other agency of Government having responsibility for the issuing of any licence, permit, approval, consent or other document of authorisation pursuant to any other written law in connection with any matter related to or affecting the development of land, shall issue such licence, permit, approval, consent or other document of authorisation unless it has established that express development permission with respect to the proposed development has been granted under this Act, or is not required.

Revision Date: 31 Dec 2002

(5) A notice of the grant of development permission shall be displayed prominently and maintained on land on which development as defined in this Act is taking place, unless that development is permitted development authorised by an Order made by the Minister under subsection (2).

(6) This Act does not exempt any development from the requirements imposed upon such development by any other written law.

21. Types of development permission.

(1) The Board may grant development permission expressed to be an outline development permission subject to the conditions and limitations therein, the effect of which shall be to grant approval in principle to erect buildings but not to permit the commencement of building operations until detailed development permission has been granted in respect of the details of the development or part thereof, for which outline development permission was granted, and those details shall not form part of the grant of outline development permission.

(2) Where the Board is of the opinion that an application for outline development permission ought not to be considered separately from further information required under section 23(1)(a) and (b), it shall, within thirty days of the receipt of the application, notify the applicant that it is unable to entertain the application and shall invite the applicant to submit the required further information under that section.

(3) Notwithstanding subsection (1) and without restricting the generality of subsection (2), the Board shall not entertain applications for outline development permission for development for which it is determined that environmental impact assessment is required under section 26 or for development which is subject to the provisions of Part VI.

(4) The Board may grant development permission expressed to be a detailed development permission the effect of which is to permit the carrying out of operations in, on, over or under any land, the making of a material change in the use of any building or land or the subdivision of land, subject to the terms and conditions of the grant of detailed development permission.

22. Application for development permission.

An application for a grant of development permission shall

- (a) be submitted to the Board through the Chief Physical Planner;
- (b) be made in such manner as may be prescribed under section 109 of the Building Code;
- (c) include such information as may be required by the regulations or by directions given by the Board or the Chief Physical Planner; and
- (d) be accompanied by the prescribed fee.

23. Requirement for further information.

(1) Within such time as may be prescribed by the Chief Physical Planner, by notice in writing, an applicant for development permission shall

- (a) furnish the Chief Physical Planner with such further information as may be specified in the notice;
- (b) at his or her own expense, cause an environmental impact statement provided for under section 26, or economic feasibility study, to be prepared of the proposed development and submitted to the Chief Physical Planner.

(2) Where any further information required under subsection (1)(a) and (b) is furnished, the application shall be treated as having been made on the date when the information was received and the ninety day period provided for the determination of applications in section 28(2) shall not commence until the date of receipt of the further information.

(3) Where an applicant does not furnish the Chief Physical Planner with the further information required under subsection (1)(a) and (b) within the period prescribed in the notice or such longer period as may be granted by the Chief Physical Planner, the Board may decline to determine the application and may return the application to the applicant with a notice to that effect, or the Board may refuse to grant development permission, as it thinks fit.

24. Certificate of ownership.

Every application for permission to develop land shall be accompanied by a certificate signed by the applicant that he or she has notified the owner of the land to which the application relates, or the owner's duly authorised representative, of the application and that the owner or his or her duly authorised representative does not object to the application.

25. Publicity for applications.

(1) With respect to applications for certain classes of development which the Minister may, by Order published in the Gazette, designate as likely to derogate from the amenities of the public or of adjacent or nearby properties, the Chief Physical Planner may, by written notice served on an applicant for a grant of development permission, require the applicant to do one or more of the following:

- (a) publish details of his or her application at the times, places and in the manner specified in the notice;
- (b) give details of his or her application to the persons of authorities specified in the notice;
- (c) affix a notice in a secure manner and in a prominent position on the land to which the application relates notifying passers-by that an application to develop land has been submitted to the Board and giving details of the application;
- (d) invite comments and representations on the application to be submitted to the Authority in writing within twenty-eight days of the publication or provision of the details of the application or the affixing of the notice on the land, as the case may be.

Revision Date: 31 Dec 2002

(2) Without restricting the generality of subsection (1), the notice referred to in that subsection shall be served by the Chief Physical Planner in respect of any application

- (a) for permission to carry out development of a listed building or listed site, or for consent to carry out works which will demolish, alter, or add to, in whole or in part a listed building or, destroy, damage, remove or disturb the features of special interest of a listed site, as the case may be, or to carry out similar development or works to a building or site to which an interim preservation order or a building preservation order applies;
- (b) for permission to develop land in an environmental protection area;
- (c) which is determined by the Board that environmental impact assessment is required;
- (d) for permission to carry out mining operations or mineral processing;
- (e) for permission to deposit, store or otherwise deal with toxic or hazardous waste;
- (f) for permission to develop any manufacturing process which will involve, either directly or as waste, the production of toxic or other hazardous substances;
- (g) for permission to carry out development for the keeping of poultry, pigs, goats or other livestock;
- (h) for permission to carry out development for the purposes of an auto-repair shop, garage, or gas station;
- (i) for permission to carry out development for the purposes of a slaughter house, premises for the plucking of poultry or the processing of fish;
- (j) for permission to carry out development for the purposes of a casino, gambling hall, bingo hall, recreation club, music hall, dance hall, discotheque, theatre, cinema or sports hall, premises for the sale and consumption of intoxicating liquor, or premises for the sale of food.

(3) The Board shall take into account any report, representation or comment submitted or made to it under this section.

(4) The Board shall not determine an application for development permission falling within subsection (2), or otherwise prescribed, until all comments and representations received within the period specified in subsection (1)(d) have been considered.

26. Environmental impact assessment.

(1) Unless the Board otherwise determines, environmental impact assessment shall be required in respect of any application for development permission to which the Third Schedule applies.

(2) The Board may require environmental impact assessment of any development, other than a development set out in the Third Schedule, where it is of the opinion that significant adverse environmental impact could result.

(3) On receipt of an application for development permission, the Board shall determine whether environmental impact assessment of the proposal is required having regard to

- (a) the nature of the development activity proposed;
- (b) the geographical extent, scale and location of the proposed development;
- (c) the extent and significance of the changes to the environment likely to be caused by the proposed development;
- (d) the extent of general knowledge about the nature of the proposed development and its likely impact on the environment;
- (e) any development plan for the area;
- (f) any other matter as may be prescribed.

(4) Where it determines that environmental impact assessment is required, the Board shall, within thirty days of the receipt of an application for development permission, issue a written notice notifying the applicant or the person responsible of the determination that environmental impact assessment is required of the development proposal and setting out the terms of reference for the preparation of an environmental impact statement on the development proposal and the period within which the environmental impact statement shall be submitted to the Board.

(5) Where the Board issues a notice under subsection (4), the applicant, or as the case may be, the person responsible, shall submit to the Board an environmental impact statement on the development proposal in such form and containing such information as may be prescribed, and the applicant or, as the case may be, the person responsible, shall comply with this requirement.

(6) In this section, “person responsible” includes any person at whose order or on whose behalf the development will be or is being undertaken.

(7) The Minister may make Regulations prescribing the qualifications, skills, knowledge and experience which shall be possessed by persons preparing environmental impact statements and may cause a register of persons so qualified to be compiled and a person who is on such a register shall be deemed to be approved by the Minister to prepare environmental impact statements in respect of Saint Christopher.

27. Consultation on applications.

(1) The Chief Physical Planner may consult in writing any public officer or other person who appears to him or her to be able to provide information relevant to an application for development permission to enable the Chief Physical Planner to advise the Minister or the Board, as appropriate, with regard to the application and shall consult any organisation as may be prescribed under section 82.

(2) An organisation which receives a request in writing from the Chief Physical Planner for its comments on an application for development permission shall reply to that request within twenty-eight days or such other period as may be agreed between the Chief Physical Planner and the organisation.

Revision Date: 31 Dec 2002

(3) Where the Chief Physical Planner has not received a reply to a written request for comments on an application from an organisation within the time specified or agreed, he or she may proceed to determine the application notwithstanding the absence of a reply from the organisation.

(4) The Board shall not determine the application for development permission until all comments requested and received in respect of the proposed development have been considered.

(5) Any public officer or other person such as is mentioned in subsection (1), or his or her representative may be invited by the Board to attend and speak at any meeting called to consider the relevant application.

28. Material planning consideration with respect to applications.

(1) In considering an application for development permission, the Board shall give principal consideration to

- (a) an approved Saint Christopher National Physical Development Plan, if any;
- (b) an approved development plan applicable to the land to which the application relates, if any.

(2) In Addition to the considerations referred to in subsection (1), the Board shall take into account any of the following matters as appear to it to be relevant in order to make a proper decision on an application:

- (a) representations made with regard to the application or the probable effect of the proposed development;
- (b) views expressed by any organisation consulted under section 27;
- (c) any statement of policy issued by the Minister;
- (d) any information, study or report provided by the applicant in response to a notice served under section 24;
- (e) the likely impact of the proposed development on the natural or built environment;
- (f) the likely impact of the proposed development on public health and safety;
- (g) the susceptibility of the land to any natural or man-made hazards;
- (h) the social and economic costs and benefits likely to accrue to the community as a result of the proposed development;
- (i) policies on the use of land for agricultural purposes which have been issued by the Minister responsible for agriculture;
- (j) the suitability of the land for the purposes intended;
- (k) the quality and economy of the proposed development and of its design;

- (l) the proposals made in the application for the means of access to, from and with the development, and for the provision of utility services to the development;
- (m) the availability of water, electricity and waste disposal services;
- (n) road traffic considerations;
- (o) the area of land required for the proposed development;
- (p) such other planning matters as the Chief Physical Planner may advise as being relevant to the determination of the particular application.

(3) Advice given to the Board by the Chief Physical Planner under this section shall be in the form of a report on each application, summarising any relevant factors recommended to be taken into account in respect of that application and the suggested appropriate decision to be given on the application.

(4) The Board may, in addition to the matters set out in subsection (2), take into account any other material planning considerations notwithstanding that the Chief Physical Planner has not advised the Board on such planning considerations.

29. **Determination of applications.**

- (1) The Board may
 - (a) grant development permission unconditionally;
 - (b) grant development permission subject to such conditions as it thinks fit; or
 - (c) refuse development permission.

(2) Within ninety days of receipt of the application for development permission the Chief Physical Planner shall notify the applicant in writing, of the determination of the application, providing in the case of paragraph (b) or (c) of subsection (1)

- (a) a full and clear statement of the reasons for the determination;
- (b) information on the opportunities available to the applicant for appeal against the determination.

(3) Where no decision has been made within ninety days of receipt of the application, the Chief Physical Planner shall notify the applicant of the progress made on the application and the extended date by which the decision is likely to be made.

(4) Where no decision is made within ninety days of receipt of the application and no notification of an extended date has been issued to the applicant, that application shall be deemed to have been refused for the purposes of section 89(2)(a).

(5) For the avoidance of doubt, it is declared that a development permission granted after the expiration of the ninety day period referred to in subsection (4) is effective as a development permission for all purposes except those of section (89)(2)(a).

30. **Applications inconsistent with development plan.**

(1) If it appears to the Board that an application is inconsistent in some material respect with an approved development plan applicable to the area in which the

Revision Date: 31 Dec 2002

development is proposed, but nevertheless it considers that permission should be granted, the Board shall

- (a) publish a notice in the *Gazette* and at least one newspaper circulating in Saint Christopher notifying the public
 - (i) that an application which departs from an approved development plan has been received,
 - (ii) of the places where the application may be inspected by persons interested, and
 - (iii) that a public inquiry to examine the application will be held at a place specified in the notice, and at a time not being less than twenty-eight days from the date of the notice;
- (b) invite comments and representations on any such application to be submitted to the Board either orally at the public inquiry or in writing within a notice; and
- (c) take into account any report, representation or comment submitted to it under this section, including the findings of the public inquiry held under this section.

(2) When the Board has concluded its consideration of the comments received and the findings of the public inquiry held in respect of an application, it shall advise the Minister of its findings and recommendations thereon, giving its reasons therefor in writing, and shall determine the application in accordance with the views of the Minister, which shall be given to the Board in writing together with the reasons therefor.

31. Conditions of development permission.

(1) Without prejudice to the generality of section 29(1)(b), the Board may impose conditions on a grant of development permission which relate to any matter referred to in section 28 or which arrange for

- (a) regulating the manner in which the development authorised by the permission is to be carried out, including
 - (i) the timing and phasing of the implementation of the development,
 - (ii) the dimensions, design, structure or external appearance of any buildings or the number or disposition of any buildings on the land which is the subject of the development permission,
 - (iii) the location, design or materials of construction of any means of access from the development to a public road,
 - (iv) the disposal of sewage, effluent or trade waste from the development,
 - (v) the supply of water to the development,
 - (vi) the landscaping of the development,
 - (vii) the preservation of trees, vegetation or other natural features of the land where the development is to take place,

- (viii) the preservation of any buildings or sites of importance to the cultural heritage of Saint Christopher,
 - (ix) the preservation of any part of the land on which the development is to take place for roads, open space or other public or communal purposes reasonably incidental to the development,
 - (x) the nature of the materials to be used in any building or engineering operations in the development,
 - (xi) the routing of any vehicles or vessels to be used for the purpose of or in connection with the development,
 - (xii) the removal of materials or waste from such land or adjacent land used for the purpose and the carrying out of any works required for the reinstatement, restoration or preservation of the land and the environment when the development is completed;
- (b) regulating the development or use of any land under the ownership or control of the applicant (whether or not it is land in respect of which the application was made, provided that where such land is not included in land which is the subject of the development permission it shall be adjacent to the land which is the subject of the development permission) including the discontinuance of any existing uses of the land or requiring the carrying out of works including the demolition of any buildings on such land or the removal of plant and machinery from the land so far as appears to the Board expedient for the purposes of or in connection with the development authorised by the permission;
 - (c) requiring the removal of any buildings or works authorised by the permission, or the discontinuance of any use of land so authorised at the expiration of a specified period, and the carrying out of any works required for the reinstatement of the land at the expiration of that period;
 - (d) regulating the use which may be made of any building or use of land authorised by the development permission notwithstanding an order made under section 20(2);
 - (e) controlling or prohibiting the display on the land comprising the development, of any advertisement, including the size, shape, colour or location of any such advertisement;
 - (f) requiring continuous environmental monitoring of the development authorised by the development permission;
 - (g) regulating the hours of work during which the development authorised by the permission may operate;
 - (h) the retention of any existing development or use of land to which the application relates, for a specified period;

Revision Date: 31 Dec 2002

- (i) the payment of money or money's worth or the conveyance of land to the Crown in lieu of works required under the development permission;
- (j) the entering into a performance bond by the applicant with the Minister to guarantee the implementation of any of the conditions subject to which the grant of development permission is made.

(2) A condition may, in the case of development for commercial purposes, be imposed under this section requiring the developer to carry out any works or other development on land (including public roads) in the ownership or under the control of the Crown even if the effect of the imposition of such a condition would be to require the developer to carry out works or development at his or her own cost for the public benefit.

(3) A development permission granted subject to any condition referred to in subsection (1)(c) is in this Act referred to as "permission granted for a limited period only".

(4) The Board shall not, by virtue of anything said in or following discussions or negotiations which may have taken place between any proposed developer and the Chief Physical Planner or any person acting on his or her behalf as to any proposed or contemplated development, be bound to grant development permission in relation to any such development and, if development permission is granted in respect of any such development, nothing so said shall in anyway preclude the Board from granting it subject to any conditions that the Board may consider proper.

(5) No claim to compensation or damages shall lie against the Government, the Minister, the Board, the Chief Physical Planner or other public officer in respect of, or arising out of, or in connection with, any refusal of permission for development in relation to which subsection (4) applies, nor shall any such claim lie in respect of, or arising out of, or in connection with, the grant of any such permission subject to such conditions as the Minister or the Board considers proper.

(6) No claim to compensation shall lie against the Government, the Minister, the Board, the Chief Physical Planner or any other public officer in connection with or arising out of the grant by the Board of development permission subject to conditions.

32. Development agreements.

(1) On the advice of the Board and the Chief Physical Planner, and with the agreement of any other Government authority who may be a party to the agreement, the Minister may enter into an agreement containing such terms and conditions as he or she thinks fit with an applicant for development permission or with any other person interested in that land for the purpose of regulating the development of the land proposed by the application.

(2) Without restricting the generality of subsection (1), terms and conditions may be included in an agreement

- (a) covering any matter in respect of which conditions may be imposed on a grant of development permission;
- (b) providing for contribution (whether of works, money or land) by the applicant towards the provision of services, facilities (including their

future maintenance) and amenities in the area in which the proposed development is to be carried out;

- (c) for the provision of security by the applicant for ensuring due compliance with the agreement.

(3) An agreement made under this section with any person interested in land may be enforced by the Minister against persons deriving title under that person in respect of that land as if the Minister were possessed of adjacent land and as if the agreement had been expressed to be made for the benefit of such land.

(4) An agreement made under this section shall not be entered into except by an instrument executed as a deed.

33. **Performance bonds.**

(1) Where the Board requires in a condition imposed on a grant of development permission under section 31, or where the Minister requires as a term of an agreement made under section 32, that an applicant or, as the case may be, a person with whom the Minister makes an agreement, provide a bond as security for the performance of any condition subject to which permission to develop land was granted or for the performance of the agreement, the Board or the Minister, as the case may be, shall require a charge on the land to which the permission or agreement relates as appears expedient and proper to ensure that the bond is enforced.

(2) The Minister may enforce a bond entered into by an applicant for permission to develop land under section 31, or by a person with whom the Minister has made an agreement under section 32, by all appropriate legal and equitable remedies.

(3) The charge provided for by subsection (1) shall be registered on the Register of Titles under the Title by Registration Act, Cap. 10.19 or, as the case may be, recorded as a deed.

(4) A charge securing the performance of conditions of a development permission or of the terms of an agreement under section 32 may not be discharged prior to the performance of the conditions of the permission or the terms of the agreement except by agreement made by deed between the Minister and the person or persons against whom it is enforceable.

(5) A person against whom a performance bond is enforceable may, when the performance is satisfied, apply to the Board for the performance bond to be released.

(6) Where an application is made to the Board under subsection (5), the Board may determine

- (a) that the performance bond shall continue to have effect without modification;
- (b) that the performance bond shall continue to have effect with modifications; or
- (c) that the performance bond shall be released.

(7) On receipt from the Board of a statutory declaration in the prescribed form that the property has been released from the charge, the Registrar of Titles or, as the case

Revision Date: 31 Dec 2002

may be, of deeds shall enter a memorandum of satisfaction and release on the Register of Titles or Deeds, and thereupon the charge shall be deemed to have ceased accordingly.

(8) Where the Registrar of Titles or, as the case may be, of Deeds enters a memorandum of satisfaction in whole, he or she shall furnish the person against whom it was enforceable with a copy of it.

34. Lapse of development permission.

(1) An outline development permission shall be granted subject to a condition that if detailed development permission covering the same development has not been applied for within one year of the grant of outline development permission, or such longer period as may be specified in the grant of outline development permission or as may be authorised by the Board in any particular case, that outline development permission shall lapse and cease to have any force or effect.

(2) Where in accordance with the provisions of this section an outline development permission has expired, an application for detailed development permission in respect of that expired outline development permission may be refused without any liability to pay compensation under section 80.

(3) A detailed development permission may be granted subject to a condition that it shall lapse and cease to have effect if the development to which it relates has not been completed within three years of the grant of detailed development permission, or such longer period as may be authorised by the Board in any particular case.

(4) Detailed development permission may provide for different parts of the development to commence at different times, and in such a case the provisions of subsection (3) shall apply to those separate parts of the development as if a grant of detailed development permission was made for each separate part or stage of the development.

(5) The Board may serve written notice on a person who has commenced, but has not completed, within the time prescribed therefor, the development for which he or she has obtained permission, requiring that person to complete the development within the time specified in such notice, and stating that if the development is not completed within that period, the development permission will cease to have effect after the expiration of a further period specified in the notice.

(6) Upon expiration of the further period specified in a notice served under subsection (5), the grant of development permission shall cease to be valid or to have any effect and any further development or work carried out with respect to that development permission shall be a breach of planning control.

35. Supplementary provisions as to grant of development permission.

(1) Without prejudice to the provisions of this Part as to the lapse or modification or revocation of any grant of development permission such grant shall, except in so far as the grant otherwise provides, enure for the benefit of the land concerned and of all persons for the time being entitled to an interest in the land.

(2) Where a grant of development permission is made for a limited period only in accordance with section 31(1)(c), at the expiration of that period, the use of the land for

the purpose for which it was used before the grant of such permission for a limited period, may be resumed without express grant of development permission only if that use was a lawful use.

(3) Where a grant of development permission is made for the erection of a building, the grant shall specify the purposes for which the building may be used.

(4) A grant of development permission may include permission, with or without conditions, to retain on land, buildings or works constructed or carried out thereon before the date of the application or for the continuance of any use of land instituted before that date (whether without permission granted under this Part or in accordance with permission granted for a limited period only).

36. Minor variation of development permission.

(1) The Chief Physical Planner, acting on behalf of the Board, may approve in writing a variation to a grant of development permission which he or she considers to be minor, in that it does not affect the terms and conditions of the grant of development permission in any material respect, and in such event, the Chief Physical Planner shall inform the Board of the action which he or she has taken in that particular case.

(2) A request for an approval of variations to a grant of development permission shall be submitted to the Chief Physical Planner in writing and shall be recorded in the register of planning decisions.

(3) The approval of a minor variation shall be recorded in the register of planning decisions.

(4) Where the Chief Physical Planner is requested to approve a variation under subsection (2) but is of the opinion that the variation proposed is not a minor one, he or she shall refer the request to the Board for determination and shall inform the applicant of that fact in writing.

37. Modification or revocation of development permission.

(1) Subject to the provisions of this section, if it appears to the Board, after consideration of such advice as may be given by the Chief Physical Planner, that it is desirable that any grant of permission ought to be modified or revoked, the Board may, with the consent of the Minister, by written notice to the person entitled to the benefit of the permission, revoke or modify the development permission to such extent as it considers desirable.

(2) The power conferred on the Board by this section may be exercised

- (a) where the grant of permission relates to the carrying out of building or other operations, at anytime before those operations have been completed;
- (b) where the grant relates only to the making of a material change in the use of building or other land, at anytime before the change of use has taken place;
- (c) where the grant relates only to subdivision of land at anytime before the registration under the Title by Registration Act of the instrument

Revision Date: 31 Dec 2002

affecting the subdivision or of the deed of subdivision, as the case may be, in the Deeds and Lands Registry has taken place.

(3) The modification or revocation of a grant of development permission for the carrying out of building or other operations shall not affect so much of the operations as has been previously carried out.

(4) A notice of the modification or revocation of a grant of development permission under this section shall include

- (a) a statement of the reasons for the modification or revocation;
- (b) such directions as the Authority considers necessary for the bringing to an end any development to which the notice relates;
- (c) information as to any claim for compensation that may arise in consequence of the modification or revocation, and the procedure for making any claim for compensation;
- (d) information as to the right of appeal under Part VIII; and
- (e) such other matters as may be prescribed.

(5) Upon the service of a notice under subsection (1), to the extent to which the modification or revocation so requires, the grant of the development permission concerned shall cease to be valid or to have effect, and any further development or work carried out contrary to such notice shall be a breach of planning control.

(6) Notwithstanding subsection (5), the Board, after considering any representations made in respect of such a notice, may at anytime cancel or withdraw that notice.

(7) An appeal shall lie under Part VIII against the issue of a notice by the Board under subsection (1), or against the refusal of the Board to cancel or withdraw such notice under subsection (6).

(8) Pending the determination of any such appeal referred to in subsection (7), the notice concerned shall be deemed to be suspended in its operation, save that any further development or work carried out shall be a breach of planning control.

38. Reference of application to Minister.

(1) The Minister may, by notice in the *Gazette* and at least one newspaper circulating in Saint Christopher, direct that the Board refers to him or her

- (a) any application for development permission;
- (b) all such applications of any class specified.

(2) The Board shall refer to the Minister for his or her decision any application for development permission to which a direction made under subsection (1) relates.

(3) Where an application is referred to the Minister under this section, the provisions of this Part shall apply with necessary modifications as they apply to any application for development permission which falls to be determined by the Board.

(4) In determining an application referred to him or her under this section, the Minister may consult with any body or person he or she sees fit.

(5) A determination of the Minister under this section shall be accompanied by a full and clear written statement of the reasons for the determination of the application.

(6) Notice of the determination by the Minister of an application referred to him or her under this section, and of the place at which the application and the decision may be examined, shall be published in the *Gazette* and at least one newspaper circulating in Saint Christopher.

(7) The decision of the Minister on any application referred to him or her under this section shall be final.

PART V – COMPLIANCE

39. **Compliance notice.**

(1) Where it appears to the Board that a breach of planning control has taken place, that is to say,

- (a) that any development of land has been carried out without the grant of development permission required under Part IV; or
- (b) that any conditions or limitations subject to which development permission was granted, have not been complied with;

the Board may, if it considers it expedient to do so having regard to any development plan applicable to the land where the breach of planning control is alleged to have taken place, and to other material planning considerations such as are set out in sections 28 and 40, serve a notice (in this Part referred to as a “compliance notice”, in accordance with subsection (2) requiring the breach to be remedied.

(2) A copy of the compliance notice shall be served on the owner and on the occupier of the land to which it relates, and may be served on

- (a) any other person having a material interest in the land, that is to say, an interest which in the opinion of the Board is materially affected by the notice;
- (b) the authorised representatives of the persons referred to in paragraph (a); and
- (c) any other person carrying on, or who is in control of a person carrying on, activities on the land which are alleged to constitute the breach of planning control.

(3) The fact that the Board fails to serve a compliance notice on any one or other of the persons mentioned in subsection (2) shall not invalidate any action or proceedings against any other of such persons.

(4) A compliance notice shall take effect on the date specified in it as the date on which it will take effect (in this Part referred to as “the specified date”).

(5) A copy of a compliance notice shall be served not later than fourteen days from the date of issue and not less than twenty-eight days before the specified date.

(6) A compliance notice shall state clearly

Revision Date: 31 Dec 2002

- (a) which breaches of planning control referred to in paragraphs (a) and (b) of subsection (1) are alleged to have taken place;
- (b) the particulars of development which appear to constitute the breach;
- (c) the person or persons on whom it is served in accordance with subsection (2);
- (d) the steps which the board requires to be taken to remedy the breach and the time within which they must be taken;
- (e) the powers of the Board, in case of default in compliance with the notice, to enter upon the land and take the steps specified in accordance with paragraph (d);
- (f) the penalties which may be incurred if the steps specified in accordance with paragraph (d) are not taken; and
- (g) the opportunities which are available to the person or persons on whom the copy of the compliance notice was served, to appeal the notice.

(7) The steps which the Board may require to be taken by a person on whom a compliance notice has been served, to remedy the breach to which the compliance notice relates, may be one or more of the following:

- (a) to submit an application for development permission for retention of the unauthorised development;
- (b) to cease any specified operations on the land which are alleged to be in breach of planning control;
- (c) to restore the land as nearly as may be to the appearance and state that it had before the breach took place, including replacement of soil or water, planting or replanting of trees and other vegetation;
- (d) to comply with any limitation or condition in a grant of development permission;
- (e) to demolish, remove or modify a building or works in whole or in part;
- (f) to carry out any building or other operations on the land to which the notice relates;
- (g) to discontinue any use of land or buildings;
- (h) to remove anything placed on the land without development permission;
- (i) to remove any advertisement or to display it in the place permitted by a grant of development permission;
- (j) to remove any unauthorised marks of identification in, on, or over land which have as their purpose the identification of a boundary of a sub-division alleged to constitute a breach of planning control;
- (k) to remove or prevent any damage to the land or amenities to the area which has been or is likely to be caused by the development which constitutes the breach of planning control;

(l) to do or to refrain from doing or to take or to refrain from taking any actions similar to those listed in paragraphs (a) to (k) which would assist in the ending of the unauthorised development.

(8) The Board may, at anytime,

(a) withdraw a compliance notice (without prejudice to its power to issue another one in respect of the same breach of planning control) and shall if it does so, serve a notice of withdrawal on every person who was served with a copy of the compliance notice and the compliance notice shall cease to have effect as from its date of withdrawal;

(b) modify a compliance notice and if it does so, the provisions of this section shall apply to any modification of a compliance notice made under this section as they apply to the compliance notice.

(9) The powers conferred by subsection (8) may be exercised whether or not the compliance notice has taken effect.

40. **Material planning considerations with respect to compliance notices.**

In considering whether or not a compliance notice shall be served and the terms of any such notice, the Board shall, in addition to the matters specified in section 28, take into account such of the following matters as may be relevant in the circumstances of the particular case:

- (a) any development plan applicable to the land where the breach of planning control is alleged to have taken place;
- (b) any statement of policy issued by the Minister which is relevant to the development;
- (c) the nature and extent of the development which constitutes the alleged breach;
- (d) the extent or likely extent of damage to the natural or built environment;
- (e) the extent to which the development constitutes a nuisance or a threat to public health and safety;
- (f) any objections and representations made by persons in the neighbourhood;
- (g) the length of time the breach of control has continued;
- (h) the benefits to the community (if any) resulting from the development;
- (i) any possible alternative measures which could be taken to remedy the unauthorised development;
- (j) the effect of the development on any public works;
- (k) whether it is necessary, desirable and convenient having regard to the public interest to serve or confirm a compliance notice;
- (l) any other material planning considerations.

Revision Date: 31 Dec 2002

41. Notice to apply for development permission.

Where it appears to the Chief Physical Planner that a breach of planning control has taken place, he or she may by written notice, served on the person or persons referred to in subsection (2) of section 39, require that an application shall be submitted for development permission, and if such an application for development permission is submitted within twenty-eight days of the service of the notice, or such extended period as may be granted by the Chief Physical Planner, the Chief Physical Planner shall refrain from issuing a compliance notice pending the determination of the application.

42. Permission for retention of buildings or continuance of use.

(1) Any person on whom a compliance notice is served may, within the period specified in subsection (4) of section 39, apply to the Board for development permission in accordance with Part IV

- (a) for the retention on the land of any building or works to which the compliance notice relates; or
- (b) for the continuance of any use of the land to which the compliance notice relates.

(2) Where the Board grants development permission in respect of an application made under subsection (1), or in respect of an application made in conformity with a notice issued under section 41, the Board may grant development permission with retrospective effect to the date when the development commenced, or such other date as the Board considers to be appropriate in the particular case.

(3) Where the Board grants development permission under this section, the provisions of subsection 35(5) shall apply.

43. Suspension of effect of compliance notice.

Where, before the specified date,

- (a) an application is made to the Board for permission for the retention on the land of any buildings or works to which the compliance notice relates, or for the continuance of any use of the land to which the compliance notice relates; or
- (b) notice of an appeal is given under section 68 by a person on whom the compliance notice was served;

the compliance notice shall be suspended and shall not take effect pending the determination of the application or appeal.

44. Stop order.

(1) Where the Board considers it expedient in the interests of public health, public safety or the integrity of the environment that a breach of planning control should cease before the expiry of the period for compliance with a compliance notice, the Board may, at the same time that it serves a copy of the compliance notice or afterwards, being at anytime before the specified date in the compliance notice, serve an order (in this Act referred to as a “stop order”) to stop the breach.

(2) A stop order shall refer to, and have annexed to it, a copy of the compliance notice to which it relates and shall prohibit any person on whom the stop order is served from carrying out or continuing any specified activities on the land, being activities either alleged in the compliance notice to constitute a breach of planning control or so closely associated therewith as to constitute substantially the same activities, and shall direct that person to immediately cease and desist from the prohibited activities.

(3) The activities which may be the subject of a stop order shall include the depositing of refuse or waste materials on land or causing environmental damage or activities affecting the health or safety of persons where such activities constitute a breach of planning control alleged in the compliance notice.

(4) A stop order may be served by the Board on any person who appears to it to have an interest in the land or to be concerned with the carrying out or the continuance of any activities thereon.

(5) A stop order shall

- (a) take effect from the date of its service;
- (b) without prejudice to subsection (7), cease to have effect when
 - (i) the compliance notice to which it relates is withdrawn or quashed,
 - (ii) the compliance period expires,
 - (iii) notice of the withdrawal of the stop order is served under subsection (7).

(6) A stop order shall not be invalid by reason that the compliance notice to which it relates was not served as required by section 40 if it is shown that the Board took all such steps as were reasonably practicable to effect proper service.

(7) The Board may at anytime withdraw a stop order (without prejudice to its power to serve another) by serving notice to that effect on the person on whom the stop order was served and the stop order shall cease to have effect as from the date of its withdrawal.

(8) It is declared that

- (a) the Board need not provide any person with an opportunity to make representation prior to the making of a stop order;
- (b) there shall be no right of appeal to the Appeals Tribunal against the making of a stop order;
- (c) an appeal against the compliance notice to which it relates shall not suspend the operation of a stop order;
- (d) a person on whom a stop order is served may appeal to the Court against the making of the stop order within twenty-eight days of the service of the stop order and the Court may confirm the stop order with or without modification, or quash it in whole or in part;
- (e) the making of an appeal referred to in paragraph (d) shall not suspend the operation of a stop order, and the stop order shall remain in full force and effect pending the determination of the appeal;

Revision Date: 31 Dec 2002

- (f) no compensation shall be payable in respect of the prohibition in a stop order of any activity which at anytime when the order is in force, constitutes, or contributes to, a breach of planning control.

45. Injunctions.

Whether or not the Board has exercised or is proposing to exercise any other remedy under this Act, the Minister may in any case that he or she thinks fit, apply to the Court

- (a) for an injunction to restrain any violation of the provisions of this Act;
- (b) for an order to enforce any compliance notice or stop order issued under this Act.

46. Action by Board for non-compliance with compliance notice.

(1) If a person on whom a compliance notice was served, fails or refuses to take the steps required by the compliance notice to remedy the breach of planning control within the period specified in the compliance notice, the Board may authorise the Chief Physical Planner to enter the land with such assistance as may be necessary and take those steps in respect of the unauthorised development to enforce the compliance notice as it may see fit.

(2) When the Board has exercised any power under subsection (1), the Minister may recover, as a civil debt, from the person on whom the notice has been served, those expenses reasonably incurred by the Board in the exercise of such power.

(3) If the person referred to in subsection (2), having been entitled to appeal under section 72 has failed to make such an appeal he or she shall not be entitled in any proceedings to dispute the validity of the action taken by the Board or the Chief Physical Planner upon any ground that could have been entertained on such an appeal.

(4) Nothing in this Part shall be construed as requiring development permission to be obtained for the resumption of a previous use of the land to which the compliance notice relates, being a purpose for which it could lawfully have been used if the development in respect of which a compliance notice was served under section 39 had not been carried out.

47. Continuing operation of compliance notice.

(1) Compliance with the requirements of a compliance notice shall not discharge the compliance notice.

(2) Without restricting the generality of subsection (1), where development is carried out by way of reinstating or restoring buildings or works that have been demolished or altered in accordance with a compliance notice, the compliance notice shall, notwithstanding that its terms are no longer wholly apt for the purpose, be deemed to apply in relation to any buildings or works so reinstated or restored as it applied in relation to such buildings or works before they were demolished or altered, and sections 46 (1), (2) and (3) shall apply accordingly.

(3) Without affecting the operation of section 46, a person who carries out any development on land by way of reinstating or restoring buildings or works that have been demolished or altered in accordance with a compliance notice commits an offence.

PART VI – ENVIRONMENTAL PROTECTION

48. Interim preservation orders.

(1) Where it appears to the Board, on its own initiative, or on a representation made to the Board or to the Minister by a person or body of persons, that it is desirable, having regard to the importance of preserving the architectural, cultural, historic or archaeological heritage of Saint Christopher, to make provision for the preservation of any building, group of buildings, or site of special architectural, cultural, historic or archaeological interest in Saint Christopher, not being a building, group of buildings or sites listed under section 52 of the National Conservation and Environment Protection Act, Cap. 11.03, the Board may for that purpose make an interim preservation order restricting

- (a) the demolition, alteration or extension of a building, or group of buildings; or
- (b) the destruction, damage, removal or disturbance of the features of a site that is of special interest.

(2) A copy of an interim preservation order shall

- (a) be served on every owner and occupier of the building, group of buildings, or site concerned;
- (b) be affixed in a prominent place on each building or site to which the order applies;
- (c) specify the building, group of buildings or site to which it relates;
- (d) state the effect of the interim order and when it comes into effect; and
- (e) invite the owners and occupiers and any other person with an interest in the building, group of buildings or site to make representations within twenty-eight days of the service or the affixing of the interim preservation order.

(3) An interim preservation order shall be in force for a period of ninety days and shall cease to have any effect at the termination of that period unless it is confirmed by the Minister before the termination of that period.

(4) Where an interim preservation order has been made in respect of a building, group of buildings or site and while it is in force, any person who executes or causes or permits the execution of

- (a) works for the demolition, alteration or extension of that building or group of buildings;
- (b) works which would destroy, damage, remove or disturb the features of the site that are of special interest;
- (c) any other works other than essential repairs or maintenance on that building, group of buildings or in, on, under or over that site;

Revision Date: 31 Dec 2002

without first obtaining permission from the Board, commits an offence.

(5) In considering whether to grant, with or without conditions, or to refuse consent for the works set out in subsection (4), in addition to any other matters which, under the provisions of this Act, it is required to take into account, the Board shall have regard to

- (a) the matters mentioned in section 48(3) and subsection (1) of this section;
- (b) the desirability of allowing such economic activity within the building, group of buildings or site as will facilitate its continued preservation and use;
- (c) the quality of architectural design of any proposed additions to, or new buildings within the curtilage of, the building, group of buildings or site.

(6) Notice of the service of an interim preservation order and of the opportunity for any member of the public to make written representations on, or objections to the interim preservation order within twenty-eight days of the date of the notice, shall be published in at least one newspaper circulating in Saint Christopher.

(7) After considering the representations of the owners and occupiers and any other representation made under subsection (6) and the comments of the Board on any such representation, the Minister may confirm with or without modifications, or cancel, the interim preservation order.

49. Preservation orders in respect of buildings or sites.

(1) An interim preservation order shall, from the date of its confirmation, with or without modifications thereto, become a preservation order.

(2) Notice of the making of a preservation order shall be published in the *Gazette* and at least one newspaper circulating in Saint Christopher.

- (3) A preservation order shall
- (a) be served on every owner and occupier of the building, group of buildings or site to which it applies;
 - (b) specify the building, group of buildings or site to which it applies;
 - (c) state the effect of the order and when it comes into effect; and
 - (d) inform the owner and occupier of the building, group of buildings or site of the opportunities for making an appeal against the order under section 67.

(4) Where an appeal is made against a preservation order, the order shall remain in full force and effect notwithstanding the making of the appeal.

(5) The provisions of section 48(4) apply to a preservation order as they apply to an interim preservation order.

50. Plant preservation orders.

(1) Where the Board, after consultation with the Minister responsible for the environment is of the opinion that it is desirable for amenity, environmental, landscape, scientific or similar reasons that any plant or group or species of plants, ought to be preserved, the Board may make a provisional plant preservation order or a plant preservation order with respect to such plant, group or species of plant.

(2) A provisional plant preservation order shall be in force for a period of ninety days and shall cease to have any effect at the termination of that period unless it is confirmed by the Board before the termination of that period.

(3) A person who, without the permission of the Board, cuts down, tops, lops, digs up or destroys the plant, group or species of plant, to which a provisional plant preservation order or a plant preservation order applies, commits an offence.

(4) No provisional plant preservation order or plant preservation order made under this section shall apply to the cutting down, topping or lopping of plants or trees that are dying or dead or have become dangerous, or the cutting down, topping or lopping of any plants or trees in compliance with any obligation imposed by or under any written law or so far as may be necessary for the prevention or abatement of a nuisance.

(5) A copy of a provisional plant preservation order shall

- (a) be served on every owner and occupier of the land on which the plant, group or species of plant, to which the order applies is situated;
- (b) specify the plant, group or species of plant, to which it applies;
- (c) define the position of the plant, group or species of plant, by reference to a map which shall be available for inspection at a place specified in the order;
- (d) state the effect of the provisional plant preservation order and when it comes into effect; and
- (e) inform the owner and occupier and any other person with an interest in the land on which the plant, group or species of plant, is situated, of the opportunities for making an appeal against the provisional plant preservation order under section 76.

(6) Where an appeal is made against a provisional plant preservation order, the order shall remain in full force and effect notwithstanding the making of the appeal.

(7) The Board before determining whether to confirm the provisional plant preservation order shall take into consideration any appeal made in accordance with section 76.

(8) Notice of the confirmation of a provisional plant preservation order shall be published in the *Gazette* and in at least one newspaper circulating in Saint Christopher.

51. Amenity orders.

(1) In any case in which the Board considers that any land is

Revision Date: 31 Dec 2002

- (a) unsightly and injurious to the amenity of the area, and visible to persons using a public road or any other area to which the public has a right of access; or
- (b) likely to be or is offensive to persons residing in the immediate neighbourhood of such land, by reason of any waste, rubbish, derelict or abandoned machinery or articles or materials of any kind, or the dilapidated state of any structure or building thereon,

it may prepare and submit to the Minister a draft amenity order.

- (2) An amenity order shall state clearly
 - (a) the land to which it applies, and the owner or occupier thereof;
 - (b) any matter that is required to be cleared;
 - (c) in the case of an order requiring clearance, the matter which must be destroyed, or the place, being an authorised place for the disposal of rubbish, to which it must be removed, as appropriate;
 - (d) if screening is required to be carried out, the requirements to effect the screening;
 - (e) in the case of a building, the manner in which the building is required to be repaired, painted or demolished, in whole or in part;
 - (f) where the Board is aware that the occupier of land to which an amenity order relates is not the owner, the action that is required to be taken by the occupier and the action to be taken by the owner;
 - (g) the time, not being less than twenty-eight days from the date of service of the order upon the owner or occupier, for compliance with the order;
 - (h) the opportunities for making an appeal against the order under section 72(2)(h).

(3) A draft amenity order prepared by the Board under subsection (1) shall be accompanied by a statement of the Board in support of the proposed action.

(4) Where the order is approved by the Minister, copies shall be served on the owner or occupier of the land concerned, or if no such person can be found, may be served by affixing a copy of the order in a conspicuous place on the land concerned.

(5) If any person upon whom an amenity order is served fails to comply with the requirements of the order, within the time specified in that order or any extension thereof approved by the Board, the Board may arrange for the work to be carried out at the expense of the person who is in default, and the Minister may recover the cost of so doing as a civil debt from the person in default.

52. Control of advertisements.

(1) Subject to this section, provision may be made by regulations for restricting or regulating the display of advertisements so far as appears to the Minister to be expedient in the interest of amenity or public safety, and without restricting the generality of the foregoing, any such regulations may provide

- (a) for regulating the dimensions, appearance and position of advertisements that may be displayed, the sites on which the advertisements may be displayed, and the manner in which they may be affixed to land;
- (b) for the Minister to grant permission for the display of any class of advertisement specified in the regulations, either unconditionally or subject to such conditions or limitations as may be specified in the regulations, without the requirement for the making of an application for express grant of development permission;
- (c) for enabling the Board to require the removal of any advertisement that is being displayed in contravention of the regulations, or the discontinuance of the use for the display of advertisements of any site that is being used for that purpose in contravention of the regulations, and for that purpose for applying any of the provisions of Part V with respect to compliance notices, subject to such adaptations and modifications as may be specified in the regulations;
- (d) for the constitution, for the purposes of the regulations, of such advisory panels as may be prescribed by the regulations, and for determining the manner in which the expenses of any such panels are to be defrayed.

(2) Regulations made under this section may be made so as to apply to advertisements that are being displayed on the date on which the regulations come into force, or to the use for the display of advertisements of any site that was being used for that purpose on that date.

- (3) Regulations made under this section may provide for exempting therefrom
 - (a) the continued display of any such advertisement as referred to in subsection (2);
 - (b) the continued use for the display of advertisements of any such site as referred to in subsection (2);

during such period as may be prescribed in that behalf, and different periods may be so prescribed for the purposes of different provisions of the regulations.

(4) Regulations made under this section may direct that any enactment affecting the display of advertisements in force on the day when the regulations made under this section come into operation, shall not apply to the display of advertisements in any area to which the regulations made under this section apply.

(5) Regulations made under this section may make different provisions with respect to different areas, and, in particular, may make special provision

- (a) with respect to environmental protection areas;
- (b) with respect to areas defined for the purposes of the regulations as areas of special control, being areas which appear to the Minister to require special protection on the grounds of amenity.

- (6) In exercising the powers conferred by this section the Minister shall,

Revision Date: 31 Dec 2002

- (a) in the interests of amenity, determine the suitability of sites for the display of advertisements having regard to any development plan applicable to the area and to the general characteristics of the locality including the presence of any feature of architectural, cultural, historic, archaeological, scientific or similar interest and the natural beauty or scenic value of the locality;
- (b) in the interest of public safety, have regard to the safety of persons who may use any road, dock, harbour or airfield and, in particular, shall consider whether any display of advertisements thereon is likely to hinder or obscure any road or traffic sign or any aid to navigation by air or water.

53. Supplementary provisions as to advertisements.

(1) Without prejudice to the generality of sections 52 and 85, the Board may remove or obliterate any billboard, placard, poster, wall painting or other advertisement which in its opinion is displayed in contravention of the regulations.

(2) Every billboard, placard, poster, wall painting or other advertisement shall display legibly and prominently and identify at all times

- (a) the name of the person who displayed it or caused it to be displayed;
- (b) the date and permit number of the grant of development permission to use the building or other land for the purposes of the display of advertisement.

(3) Where a billboard, placard, poster, wall painting or other advertisement identifies the person who displayed it or caused it to be displayed, the Board shall not exercise the power conferred by subsection (1) unless it has first given that person notice in writing that

- (a) in the opinion of the Board it is displayed in contravention of the regulations;
- (b) the Board requires him or her to remove or obliterate it within a period specified in the notice not being less than two days from the date of service of the notice;
- (c) that on the expiry of the period specified in the notice, if steps have not been taken to remove or obliterate it, the Board intends to take those steps.

(4) Where the Board has exercised the power conferred by subsection (1), the Minister may recover as a civil debt from the person on whom the notice was served, the expenses reasonably incurred by the Board in the exercise of the power.

54. Environmental protection area.

(1) Where the Minister is of the opinion that it is desirable to afford special protection to an area designated as an environmental protection area in a development plan on account of the matters set out in section 11(3), he or she may, by Order published in the *Gazette* and a newspaper circulating in Saint Christopher, declare that area an environmental protection area.

- (2) An Order made under subsection (1) may
- (a) prohibit any development within the area or any part thereof;
 - (b) designate any part of the environmental protection area as being an area in which, subject to the grant of development permission, only certain development or classes of development may be permitted;
 - (c) authorise the carrying out in the environmental protection area of such works and the doing on the land of such other things as may be expedient for the protection of the area as an environmental protection area;
 - (d) provide for control over the use of land within the environmental protection area for purposes of agriculture or forestry;
 - (e) without prejudice to the provisions of Part IV, require that any person who proposes to undertake any activity or enterprise in the environmental protection area (not being an activity or an enterprise involving development) of a description or category as may be prescribed shall, not less than sixty days before commencing, notify the Board of his or her proposals and furnish the Board with such documents and information as it may require;
 - (f) require that environmental impact assessment be undertaken with respect to any proposal to carry out in the environmental protection area any activity, enterprise, works or development referred to in paragraphs (b) to (e);
 - (g) restrict or prohibit the entry the area of any person, or the movement of, or any activity carried out by, any person in the area.

PART VII – BUILDING REGULATION

55. Submission of Application to the Board.

(1) Subject to the provisions of this Part, no person shall construct or commence the construction of a building except in accordance with the specifications of a building permit issued by the Board in respect of that building prior to the commencement of construction.

(2) A person who intends to erect a building shall conform to the standards specified in the Building Code and Building Guidelines referred to in Schedules 5 and 6, respectively, to this Act.

56. Building regulations.

(1) The Minister may make regulations hereinafter referred to as “building regulations” with respect to the design and construction of buildings and the provision of services, fittings and equipment in or in connection with buildings and particularly with respect to the following matters:

- (a) as to new buildings
 - (i) the preparation and foundation of the site,

Revision Date: 31 Dec 2002

- (ii) the method of construction, structural strength and stability,
 - (iii) the suitability and durability of the materials, of construction including material of short life and their preservation from decay and infestation,
 - (iv) the space about buildings,
 - (v) the insulation, lighting, and ventilation of rooms,
 - (vi) the dimensions of rooms and spaces for specific purposes,
 - (vii) fire precautions and safety,
 - (viii) plumbing and water supply,
 - (ix) drainage,
 - (x) sanitation,
 - (xi) sewage disposal,
 - (xii) electrical installations and wiring, gas installations and piping, and telecommunications services,
 - (xiii) lifts and other mechanical means of conveyance for access,
 - (xiv) refuse disposal, storage, treatment and removal of waste, and emission of noxious or offensive substances,
 - (xv) hurricane and earthquake precautions and protection,
 - (xvi) means of access to and egress from buildings,
 - (xvii) low cost housing,
 - (xviii) matters connected with, or ancillary to, any of the foregoing matters;
- (b) as to existing buildings, such of paragraph (a) as are applicable to
 - (i) structural alterations or extensions to buildings,
 - (ii) building so far as affected by alterations or extensions,
 - (iii) buildings or parts of buildings in cases where the purposes for which, or the manner or circumstances in which, a building or part of a building is used, changed or changes in a way that constitutes a material change of use of the building or part as defined, within the meaning of this section;
 - (c) so far as they relate to the matters mentioned in this paragraph, regulations made under paragraph (a), may be made to apply to buildings erected before the date on which the building regulations came into force, but except as aforesaid shall not apply to buildings erected before that date; and
 - (d) generally, for carrying the purposes or provisions of this Part of the Act into effect.

(2) For the purposes of this Part, there shall be deemed to be a material change in the purposes for which a building or part of a building is used where

- (a) a building, or part of a building, being a building or part of a building which was not originally constructed for occupation as a house, or which though constructed, has been appropriated to other purposes, becomes used as a house;
 - (b) a building, or part of a building, being a building or part of a building which was originally constructed for occupation as a house by one family only, becomes occupied as separate establishment by two or more families; or
 - (c) building regulations contain special provisions with respect to buildings used for any particular purpose, a building not previously used for that purpose, becomes so used.
- (3) Building regulations may
- (a) exempt any building, part of a building or class of building from any of the requirements of the regulations;
 - (b) provide for different regulations to apply to different buildings, parts of building or classes of buildings;
 - (c) provide for the imposition of or impose conditions on any permit to construct a building.
- (4) Regulations made under this section may include provisions as to
- (a) the depositing of plans, sections, specifications and written particulars;
 - (b) the giving of notices and certificates, the inspection and testing of work, (including the power to prohibit the covering of work prior to inspection and to require the uncovering of work which has been covered prior to inspection), the testing of drains and sewers, and the taking by the Board or a building inspector of samples of materials to be used in the construction of buildings or in the execution of other works;
 - (c) the power to order that construction cease, and the power to demolish or order the demolition of unsafe buildings;
 - (d) the prescribing and payment of fees.

57. Documents approved for purposes of building regulations.

Where it appears to the Minister to be suitable to the structural safety of buildings, or the safety, health and convenience of persons in and about buildings, the Minister may, by notice published in *Gazette*.

- (a) approve and issue a document which provides guidance with respect to building regulations, whether or not prepared by him or her or by another body designated by him or her for the purposes of this section;
- (b) specify the date from which the approval of the document takes effect;

Revision Date: 31 Dec 2002

- (c) specify the provisions of the building regulations for the purpose for which the document is approved.

58. Appointment of building inspectors.

It shall be a function of the Board to enforce building regulations and the Board shall appoint such persons as it shall deem appropriate, as building inspectors, to assist the Chief Physical Planner in the performance of such functions.

59. Passing and rejection of plans.

(1) Where plans of any proposed work are, in accordance with building regulations, deposited with the Chief Physical Planner, the Chief Physical Planner shall pass the plans, unless

- (a) they are defective;
- (b) they contravene any provision of building regulations;
- (c) there is a failure to comply with the provisions of this Part; or
- (d) there is a failure to comply with the provisions of Part IV or Part VI;

in which case he or she shall refer those plans to the Board together with his or her advice thereon.

(2) If the Chief Physical Planner on referring plans in accordance with subsection (1) considers that the operation of any requirement contained in building regulations would be unreasonable in relation to that particular case, he or she may recommend that the Board relaxes or dispenses with that requirement.

(3) Building regulations may provide, as regards any requirement contained in the regulations, that subsection (2) shall not apply.

(4) On receipt of any plans on a referral by the Chief Physical Planner under subsection (1), the Board may

- (a) reject those plans;
- (b) pass the subject to either or both of the following conditions, namely,
 - (i) that such modifications shall be made to the deposited plans as the Board may specify, and
 - (ii) that such further plans shall be deposited within such time as the Board may specify,

in order to bring the plans into conformity with building regulations;
or

- (c) if it is advised by the Chief Physical Planner in the manner indicated by subsection (2), it may relax or, dispense with the requirements of building regulations mentioned in that recommendation and pass those plans.

(5) A person by whom, or on whose behalf, plans have been deposited shall, within 60 days or such extended time as may before the expiration of the period be agreed

between him or her and the Board, be notified in writing by the Chief Physical Planner whether those plans are passed or rejected.

(6) A notice of rejection of plans shall state the defects on account which, or the building regulation or section of this Act for non-conformity with which, or under the authority of which, the plans have been rejected.

(7) A notice that plans have been passed shall

- (a) specify any condition subject to which they have been passed;
- (b) if the plans have been passed by the Board in the exercise of any power to relax or dispense with any requirement of building regulations, or this Part, state the requirements of the building regulations or this Part relaxed or dispensed with;
- (c) in any case state that the notice that plans have been passed operates as an approval thereof only for the purposes of the requirements of building regulations and this Part, and does not constitute development permission.

(8) Any question arising between the Board or the Chief Physical Planner and the person by whom or on whose behalf plans are deposited as to whether

- (a) the plans are defective;
- (b) the work would contravene the building regulations or this Part; or
- (c) a relaxation of or dispensing with the requirements of the building regulations ought to have been granted under subsection (4);

may on the application of that person be determined by the Appeals Tribunal, but no such application may be made unless it is made before the proposed work has been substantially commenced.

(9) If the question arising under subsection (8) is a failure on the part of the Chief Physical Planner or the Board to decide whether the plans deposited are defective, the Minister may order the Board to pass or reject the plans within a time to be specified by the Minister.

60. Power to require removal or alteration of work.

(1) If any work to which building regulations apply, contravenes any provision of this Part or of the regulations, the Board, without prejudice to any prosecution under this Part, may by notice require the owner either to pull down or remove the work, or to effect such alteration therein as may be necessary to make it comply with building regulations or this Part.

(2) If a person to whom a notice has been given under the foregoing provisions of this section fails to comply with the notice before the expiration of the period specified in the notice, or such longer period as the Board may on his or her application allow, any department or officer of the Government or contractor engaged by the Government may pull down the work, or effect such alterations therein and the Minister may recover from that person the expenses reasonably incurred in so doing as contract debt.

Revision Date: 31 Dec 2002

(3) Nothing in this section shall affect the right of the Minister or of the Attorney-General or any other person to apply for an injunction for the removal or alteration of any work on the grounds that it contravenes the building regulations or any provision of this Part.

61. Appeal against notices.

(1) A person aggrieved by the giving of a notice under section 59 may appeal to the High Court.

(2) An appeal under this section, the Court shall

(a) if it determines that the Board was entitled to give notice, confirm the notice; and

(b) in any other case, give the Board direction to withdraw the notice.

(3) An appeal under this section shall be brought within 28 days of the giving of notice under section 59 and the notice shall be of no effect pending the final determination or withdrawal of the appeal.

62. Lapse of deposit of plans.

Where plans of any proposed work have been deposited in accordance with building regulations or this Part, and either the plans have been passed or notice of rejection of them has not been given in accordance with this Part, and the work to which the plans relate has not been completed within three years of the deposit of those plans, the deposit of the plans shall be invalid and of no effect.

PART VIII – COMPENSATION AND ACQUISITION

63. Claim for compensation.

(1) Where development permission has been revoked or modified by notice under section 36, a claim for compensation may be made to the Minister in the manner prescribed, by

(a) the holder of that permission or his or her successor in title in respect of developing in accordance with the permission, that is rendered abortive by the revocation or modification for

(i) expenditure incurred necessarily arising out of commencing to develop or developing in accordance with the permission, that is rendered abortive by the revocation or modification,

(ii) loss or damage sustained by the claimant which is directly attributable to such revocation or modification;

(b) any person with an interest in the land or who has lent money on the security of the land, in respect of loss or damage sustained by the claimant which is directly attributable to such revocation or modification.

(2) Compensation payable shall be assessed in respect of loss or damage consisting of the depreciation in value of any interest in land directly attributable to the revocation or modification of a development permission if

- (a) the development permitted by the development permission revoked or modified has not been carried out; or
- (b) the person claiming compensation acquired an interest in the land or building to which the development permission relates for valuable consideration, after the grant of that development permission and such development permission, at the material time, had not lapsed under the provisions of section 34.

(3) For the purposes of this section, any expenditure incurred in the preparation of plans for the purposes of any work, or upon similar matters preparatory thereto, shall be taken to be included in the expenditure incurred in carrying out that work.

(4) No compensation shall be payable under this section

- (a) in respect of any work carried out before the grant of development permission which is revoked or modified;
- (b) in respect of any other loss or damage (not being loss or damage consisting of depreciation in the value of an interest in the land) arising out of anything done or omitted to be done before the grant of that permission; or
- (c) where the development permission which is revoked or modified was based on incorrect or misleading information submitted in the application for development permission or by the applicant for compensation.

(5) A claim may be made to the Minister, in the manner prescribed, by a person with an interest in the land in respect of loss or damage sustained by the claimant in respect of loss or damage by depreciation in the value of an interest in land by virtue of

- (a) the refusal of the Board, where a building which was in lawful use has been destroyed by fire, hurricane or other natural disaster, to allow a building of similar cubic content to be erected in the same position, as near as can be, to the destroyed building and for the same purposes for which the destroyed building had been used prior to the fire, hurricane or other natural disaster; or
- (b) any restriction imposed on the existing lawful use of land by reason of the declaration of an environmental protection area under section 54, in a case where the Minister does not acquire private land included in the environment protection area.

(6) A claim for compensation alleged to be payable under this Part shall be made in writing to the Minister within six months of the date upon which notice of the decision which gave rise to the claim was served upon the claimant.

(7) When a claim is made under this Part, the Minister, by written notice served on the claimant, may require the claimant to provide such further information in support of

Revision Date: 31 Dec 2002

the claim as may be specified in the notice, and a decision on the claim may be deferred until such further information has been supplied by the claimant.

(8) Where a claim for compensation has been made to the Minister he or she shall consult the views of the Board, who after making such enquiries as it thinks fit shall submit its own recommendation on the matter to the Minister.

(9) Where it appears to the Minister that the decision which gave rise to the claim for compensation might properly be withdrawn or modified, he or she may refer the matter to the Appeals Tribunal for its determination as if the claim for compensation had included an appeal against the decision which gave rise to the claim.

(10) Where such a claim for compensation cannot be settled through negotiation between the claimant and the Minister, the Minister shall refer the question as to whether any compensation is payable to the claimant, or as to the amount thereof, for decision by a Board of Assessment which for the purpose shall be constituted as provided by the Land Acquisition Act, Cap. 10.08 and the provisions of that Act shall apply to the assessment of compensation payable under this Part as they apply in the case of compensation payable under the Land Acquisition Act, Cap. 10.08.

(11) In constituting a Board of Assessment for the purposes of this section, the reference in section 12(2)(c) of the Land Acquisition Act, Cap. 10.08 to the words “a member to be nominated by the owner of the land to be acquired” shall be construed as if the reference were to “a member to be nominated by the claimant”.

64. Circumstances where land is subject to mortgage.

Where any compensation is payable under this Part in respect of the depreciation of the value of an interest in land which is subject to a mortgage

- (a) the amount of the compensation payable shall be assessed as if the interest was not subject to the mortgage;
- (b) a claim for any part of such compensation may be made by any mortgagee of that interest, but without prejudice to the making of a claim by the person entitled to the interest;
- (c) no compensation to which this section applies shall be payable in respect of the interest of the mortgagee (as distinct from the interest which is subject to the mortgage); and
- (d) any compensation to which this section applies which is payable in respect of the interest which is subject to the mortgage shall be paid to the mortgagee, or, if there is more than one mortgagee, to the first mortgagee, and shall in either case be applied by him or her as if it were proceeds of sale.

65. Registration of claim for compensation.

(1) Where a claim for compensation is made under section 63 notice of the fact shall

- (a) be recorded in the register of planning decisions; and
- (b) be deposited with the Registrar of Titles.

- (2) Notices deposited under this section shall specify
 - (a) the land to which the claim for compensation relates;
 - (b) the relevant planning decision, notice, or order to which the claim for compensation relates; and
 - (c) the amount of the compensation and any apportionment of it among claimants.

66. Acquisition of land in lieu of compensation.

Where a claim for compensation under this Part in respect of any interest in land has been determined in accordance with section 63, the Minister may, within one month after the date of determination of such compensation and instead of having the compensation paid, cause to be made an offer in writing to purchase the interest in the land to which the claim for compensation relates, and if the person entitled to that interest is unwilling to sell the same, the Minister may forthwith cause the interest to be acquired compulsorily under and in accordance with the provisions of the Land Acquisition Act, Cap. 10.08.

67. Public access and rights of way to beaches.

(1) There shall be at least one public landward access to every beach in Saint Christopher.

(2) Where there is no alternative public access, traditional public use of a private landward access through an existing private development shall be sufficient grounds for establishing a public way over that access for the purposes of access to the beach by the public.

(3) Where the only landward access to a beach is through an existing private development where traditional public use pursuant to subsection (2) has not been established, the Crown may acquire the right to public use of that beach access by gift, agreement, compulsory acquisition, or in exchange for other property, interest, financial, exemption, or by such other means as the Minister may recommend.

(4) Where a proposed development is likely to adversely affect the public's ability to access a beach from the landward side, any development permission shall require as a condition, a landward public access to the beach through the development at all times free of charge.

(5) In this section "traditional public use" means peaceable, open and uninterrupted enjoyment for a period of twenty years or more or such shorter period as the Minister by Notice published in the *Gazette* may prescribe.

68. Acquisition of comprehensive planning area.

(1) Where any land is designated in a development plan made under Part III as a comprehensive planning area, that land may be acquired compulsorily by the Minister for a public purpose within the meaning of the Land Acquisition Act, Cap. 10.08.

Revision Date: 31 Dec 2002

(2) A development plan shall not designate any land as a comprehensive planning area if it appears to the Board that the acquisition is not likely to take place within seven years from the date on which the plan is approved.

(3) Where any land is designated by a development plan as a comprehensive planning area, then if at the expiration of seven years from the date on which the plan, or the amendment of the plan, by virtue of which the land was first so designated came into operation, any of that land has not been acquired by the Minister, any owner of an interest in the land may serve on the Minister a notice requiring the interest of the owner in the land to be acquired and if, within six months after the service of that notice the interest of the owner in the land has not been so acquired, the development plan shall have effect, after the expiration of the six months, as if the land in which the interest subsists was not subject to compulsory purchase.

69. Acquisition of buildings or sites for the purposes of preservation.

(1) Where it appears to the Minister that reasonable steps are not being taken for the proper preservation of a listed building or listed site, or for the proper preservation of a building or site which is the subject of a preservation order, the Minister may either by agreement with the owner, or compulsorily, acquire the building or site and any contiguous or adjacent land which appears to him or her to be required for preserving the building or site and its amenities or for affording access to it or for its proper control or management.

(2) The compulsory purchase of a building or site under subsection (1) shall not commence unless at least two months previously, the Board has served a notice on the owner of the building or site, and has withdrawn it

- (a) specifying the works which the Authority considers reasonably necessary for the proper preservation of the building or site;
- (b) explaining the effect of subsection (1).

(3) The Minister shall consult with the Minister responsible for national heritage and with the Conservation Commission before he or she confirms a compulsory purchase order for the acquisition of a listed building or listed site under this section.

(4) The Minister shall not make or confirm a compulsory purchase order under this section for the acquisition of any listed building or listed site, or a building or site which is the subject of a preservation order, unless he or she is satisfied that it is expedient to make provision for the preservation of the building or site and to authorise its compulsory acquisition for that purpose.

70. Acquisition of land for planning purposes.

(1) Without prejudice to the provisions of sections 87, 88 and 89, the Minister may acquire by agreement or compulsorily any land within Saint Christopher which is suitable for and is required in order to secure one or more of the following purposes:

- (a) the provision of public open space;
- (b) the making of a new road or the widening of an existing road designated in an approved development plan made under Part III;
- (c) for giving in exchange for land appropriated for other planning purposes;

(d) for a purpose which it is necessary to achieve in the interests of the proper planning of an area in which the land is situated.

(2) In considering whether or not to acquire any land for planning purposes, the Minister shall have regard to

- (a) the provision of any approved development plan so far as material;
- (b) whether planning permission for any development of the land is in force;
- (c) any other consideration such as are set out in section 28 so far as would be material for the purpose of determining an application for development permission on the land.

(3) Land required for any purposes specified in this Part, may be acquired compulsorily by the Minister as land “required for a public purpose” within the meaning of the Land Acquisition Act, Cap. 10.08.

PART IX – APPEALS

71. Establishment of Appeals Tribunal.

(1) There is hereby established an Appeals Tribunal which has the jurisdiction, power and authority conferred upon it by this Part and by any Regulations made hereunder.

(2) It shall be the primary function of the Appeals Tribunal to examine the issues between the parties and to determine the merits of an appeal having regard to the purposes of this Act set out in section 4, the need to secure consistency in the execution of policy, any approved development plan relevant to the issues and any other material planning considerations.

(3) The constitution and procedures of the Appeals Tribunal shall be in accordance with the Fourth Schedule.

72. Right of appeal.

(1) Any applicant who is dissatisfied with a decision of the Board set out in subsection (2), or an owner or occupier of land that is the subject of the decision or other person whose interest in that land may be affected by a decision of the Board set out in subsection (2), may appeal to the Appeals Tribunal against that decision in the manner prescribed in this Part.

(2) An appeal shall lie to the Appeals Tribunal against any decision made by the Board under this Act

- (a) refusing a grant of development permission;
- (b) imposing conditions on a grant of development permission;
- (c) modifying or revoking a grant of development permission;
- (d) requiring the completion of a development within a time limit;

Revision Date: 31 Dec 2002

- (e) refusing listed building consent or listed site consent under section 51;
- (f) imposing a preservation order, except that no appeal shall lie against an interim preservation order;
- (g) making a provisional plant preservation order under section 50(1);
- (h) making an amenity order on any of the grounds mentioned in section 69(3);
- (i) issuing a compliance notice or as to the terms thereof.

(3) Subject to any provisions to the contrary in this Act, any person wishing to appeal under subsection (2) shall,

- (a) within forty-two days of the determination of the decision which is to be appealed against under subsection (2)(a), (b) or (e);
- (b) within forty-two days of the date on which the notice or order which is to be appealed against under subsection (2)(c), (d), (f), (g) or (h) was served;
- (c) within the period specified in the notice as the period at the end of which this notice is to take effect in the case of a notice which is to be appealed against under subsection (2)(i);

send a notice of appeal to the secretary of the Appeals Tribunal who shall forthwith on receipt thereof send a copy of such notice to the Minister and the Board.

(4) Where notice is given of an appeal to the Appeals Tribunal against a compliance notice within the period ending with the specified date in the compliance notice, or against an amenity order within the period specified in subsection (3), the compliance notice or the amenity order, as the case may be, shall be of no effect pending the determination of the appeal.

73. **Notice of Appeal.**

- (1) A notice given under section 72(3) shall set out
 - (a) concisely the decision appealed against;
 - (b) a description of the land affected by the decision;
 - (c) the name of the appellant;
 - (d) the interest of the appellant in the land affected by the decision; and
 - (e) concisely the grounds on which the appellant wishes to appeal against the decision.

(2) An appeal against a compliance notice may be made on any of the grounds that

- (a) permission was granted under Part IV for the development to which the compliance notice relates;
- (b) no such permission was required in respect thereof; or
- (c) the conditions subject to which such permission was granted have been complied with.

(3) An appeal made against an amenity order may be on any of the following grounds:

- (a) the person upon whom an order has been served is not an owner or occupier of the land to which the order applies;
- (b) the person upon whom the notice has been served has no control over and no authority to remove, destroy or demolish any matter or building referred to in the order;
- (c) the time within which the order must be complied with is not reasonably sufficient for the purpose;
- (d) the work specified in the order is unreasonable in character or extent or is unnecessary;
- (e) that having regard to the character and condition of land and buildings in the immediate neighbourhood, the order is unreasonable.

(4) A notice given under section 72(3) shall be accompanied by

- (a) a copy of all papers and documents submitted by the appellant or any person acting on his or her behalf to the Board;
- (b) a copy of the decision appealed against; and
- (c) a plan sufficiently identifying the location and boundaries of the land affected by the decision.

(5) On receipt of a copy of the notice given under section 72(3), the Appeals Tribunal shall reject the notice of appeal if

- (a) it appears not to comply with subsection (1);
- (b) the appellant appears not to have any sufficient interest in the land to justify him or her appealing against the decision.

(6) Where a notice of appeal is not rejected under subsection (5), the Appeals Tribunal may direct that the appeal be dealt with by public examination or by written representations and shall, within twenty-eight days of receipt of the notice of appeal, notify the appellant and the Board accordingly.

(7) The Appeals Tribunal shall take the following matters into consideration before deciding whether the appeal may be dealt with by written representations or by public examination:

- (a) whether the public interest requires that all persons (including the appellant) who may have a view to express in relation to the matter to which the appeal relates should have an opportunity of having their views taken into account, of submitting evidence and of examining witnesses called by others;
- (b) without prejudice to the generality of paragraph (a), whether it would be reasonably practicable to deal with the appeal by way of written representations;
- (c) the public importance of the matter to which the appeal relates.

Revision Date: 31 Dec 2002

(8) Where the Appeals Tribunal decides that a public examination shall be held, it shall

- (a) notify the appellant and the Board of that fact and of the time and place at which the public examination shall be held;
- (b) notify the Board of the time within which the Board must serve on the appellant and on the Appeals Tribunal a statement of its case;
- (c) notify the appellant of the time within which must serve on the Board and on the Appeals Tribunal his or her response to the Board's statement of its case;
- (d) publish a notice in the *Gazette* and in at least one newspaper circulating in Saint Christopher announcing the public examination and the time and place at which it will be held.

(9) Unless the Appeals Tribunal directs that a public examination shall be held in relation to an appeal, the appeal shall be dealt with by written representations.

74. **Procedure at public Examinations.**

(1) Subject to the provisions of this Act and any regulations, the Appeal Tribunal may determine the procedure to be followed at any public examination directed under section 73 as appears to it convenient to enable the functions referred to in section 72(2) to be fulfilled without being bound to adopt such procedure as might be appropriate in a court, provided that the Appeals Tribunal shall

- (a) at all times have regard to the rules of natural justice in the conduct of the proceedings for the determination of the appeal; and
- (b) ensure, when hearing evidence of one party, that the other party has had an opportunity to consider that evidence and to make comment or representation on it.

(2) Without prejudice to the generality of subsection (1),

- (a) the Appeals Tribunal may hold a pre-examination review of the issues with the Board and the appellant and may issue directions in writing to both parties concerning
 - (i) the form and procedure to be adopted at the examination,
 - (ii) the dates and likely duration of the examination,
 - (iii) the Appeals Tribunal's identification of the issues to be examined,
 - (iv) the evidence required,
 - (v) whether third party agencies and persons who made representations or were consulted on the application are required to give evidence,
 - (vi) the incidence of the burden of proof, and the standard of proof required,
 - (vii) the exchange of proofs of evidence,

- (viii) the dates of any proposed site visits, giving both parties an opportunity to be present at the site visits,
- (ix) any other matters which the Appeals Tribunal considers necessary for the fair and expeditious examination of the appeal;
- (b) there may be given and received in evidence at a public examination any material which the Appeals Tribunal may consider relevant to the subject matter of the examination whether or not it would be admissible in a court of law;
- (c) evidence at a public examination may be given on oath or affirmation or as unsworn evidence or partly as unsworn evidence, as the Appeals Tribunal may think fit;
- (d) any interested party may appear in person or may be represented by another person acting with his or her authority, whether or not that other person is a legal practitioner.

75. Record of proceedings of public examinations.

- (1) A record shall be kept of all public examinations held by the Appeals Tribunal.
- (2) The record under this section shall contain:
 - (a) the name and address of any person heard at the public examination and, where any such person was represented by another, the name and address of that representative;
 - (b) the name and address of any person giving evidence at the public examination;
 - (c) a summary of the evidence given by each person at the public examination;
 - (d) an inventory of all exhibits (including models, maps, plans, drawings, sketches, diagrams, photographs, petitions, and written statements) received in evidence at the examination;
 - (e) the Appeals Tribunal's findings of fact in relation to any relevant matter;
 - (f) a full and clear account of the reasoning of the Appeals Tribunal on which its decision is based; and
 - (g) the determination of the Appeals Tribunal as to the manner in which the appeal should be disposed of.
- (3) Every record under this section shall be accompanied by all documents referred to in paragraph (d) of subsection (2);

76. Appeals by written representations.

- (1) Whenever the Appeals Tribunal has directed that an appeal to which section 68 relates shall be dealt with by written representations, the secretary to the Appeals

Revision Date: 31 Dec 2002

Tribunal shall send a copy of the direction to the appellant and to the Board and each of them shall within thirty days thereafter send to the Appeals Tribunal and to the other of them such written representations as they wish to make in relation to the appeal (hereinafter referred to as “written representations”).

(2) Within twenty-eight days of the receipt of the written representations of the other, or within the thirty days period specified in subsection (1), whichever is the later, the appellant and the Board shall send to the Appeals Tribunal and to the other of them in writing such further representations as they may wish to make arising out of the written representations of the other.

(3) The Appeals Tribunal in deciding an appeal by written representations, shall not

- (a) receive any oral evidence; or
- (b) consider any representations in writing other than those provided for by subsections (1) and (2) unless it has given the appellant or the Board (as the circumstances require) a full and sufficient opportunity of answering them in writing.

(4) The record to be kept of the proceedings under this section shall contain:

- (a) the names and addresses of the parties;
- (b) a summary of the written representations submitted;
- (c) an inventory of all models, maps, plans, drawings, sketches, diagrams, photographs, petitions, and written statements submitted with the written representations;
- (d) the Appeals Tribunal’s findings of fact in relation to any relevant matter;
- (e) a full and clear account of the reasoning of the Appeals Tribunal on which its decision is based; and
- (f) the determination of the Appeals Tribunal as to the manner in which the appeal should be disposed of.

(5) The Appeals Tribunal shall, following the expiration of the period specified in subsection (2), decide the appeal and in doing so shall have like powers to those under section 94(1).

77. Decision and notification of appeal.

(1) The Appeals Tribunal, after hearing an appeal, may

- (a) allow the appeal in part, or in whole and quash the decision, notice or order of the Board;
- (b) if it allows the appeal in part, do so by varying the decision, notice or order of the Board in any manner and subject to any conditions or limitations it thinks fit;
- (c) correct any procedural defect or error of law in the decision, notice or order of the Board appealed against;

- (d) dismiss the appeal and confirm the decision, notice or order of the Board.

(2) As soon as reasonably practicable after the decision of the Appeals Tribunal, the secretary of the Appeals Tribunal shall send to the appellant, the Board and the Minister, written notification of the determination of the appeal together with full and clear reasons for the determination.

(3) Where an appeal made under section 72(2) (i) is dismissed, or the compliance notice is varied, the Appeals Tribunal may, if it thinks fit, direct that the compliance notice shall not come into force until a specified date, not being later than twenty-eight days from the determination of the appeal.

78. Appeals to the High Court.

(1) Subject to the provisions of this Act, no appeal shall lie against a decision of the Board in a matter to which section 72 relates otherwise than as provided for by sections 72 to 77 nor shall any such decision or order be reviewable in any manner by any court.

(2) Save as otherwise provided in this section, the decision of the Appeals Tribunal shall be final.

(3) An appeal shall lie to the Court from a decision of the Appeals Tribunal on a point of law but not on any matter of fact and not in any manner upon the merits of the policies applied by the Board or the Appeals Tribunal in reaching the relevant decision.

(4) An appeal to which subsection (3) relates shall be filed in the Court within twenty-eight days of the notification of the decision of the Appeals Tribunal.

PART X – MISCELLANEOUS

79. Powers of entry.

(1) Subject to subsection (2), the Minister, any member of the Board, the Chief Physical Planner or any person authorised by him or her in writing, may during reasonable hours enter on any land or in any building

- (a) to inspect or survey the land, or any building for the purpose of the preparation of any development plan, or to decide on whether or not any development plan should be prepared under the provisions of Part III;
- (b) to obtain information relevant to the determination of any application for development permission or for any other consents, or permits provided for under this Act;
- (c) to determine whether any breach of planning control is being or has been undertaken on the land or in any building thereon;
- (d) to determine whether any order or interim order should be made under Part VI or for the exercise of any powers conferred by any such order;

Revision Date: 31 Dec 2002

- (e) for the purposes of determining whether or not any compensation is payable under Part VII, or as to the amount thereof;
- (f) to ensure compliance with this Act and any Regulations.

(2) Any person who intends to enter on any land or building for the purposes of subsection (1) shall, except where the circumstances are such that giving a written notice would defeat the purpose for which entry is sought, give the owner or occupier not less than twenty-four hours written notice of his or her intention so to do and the intended purpose of such entry, and if the person entering requires to search and bore for the purpose of examining the nature of the sub-soil, that fact shall be stated in the notice.

(3) Before exercising any powers under this section, the Chief Physical Planner or any other person concerned, shall provide evidence of his or her identity and authority to the occupier or other person who is or appears to be in control of the land or building concerned.

(4) The powers conferred by this section shall be deemed to extend to permit the Chief Physical Planner or other person concerned to make such examination and inquiries as are necessary to achieve the purposes for which the entry was authorised.

(5) If any damage is caused by reason of the exercise of any right of entry conferred by this section, or in the making of any survey for the purpose for which such right of entry was conferred, or by the wrongful or negligent use of powers conferred, or alleged to have been conferred, by this section, the Board as soon as may be after such entry, shall pay compensation to the person injured thereby.

(6) If the amount of compensation referred to in subsection (5) cannot be agreed, the amount payable shall be determined in the same manner as compensation payable under section 63 (10), and the Chief Physical Planner shall refer the matter accordingly.

80. Service of notices.

(1) Any notice or other document required or authorised to be given or served under this Act or under any regulation, order, direction or other instrument made under this Act may be served on or given to the person concerned

- (a) by delivering it to that person;
- (b) by leaving it at the usual or last known place of abode of that person;
- (c) by sending it in a prepaid registered letter addressed to that person at his or her usual or last known place of abode or business or, where an address for service has been given by that person, to that address;
- (d) in the case of a body corporate, or unincorporated body, by delivering it to the secretary or other officer of that body at its registered or principal office in Saint Christopher, or by sending it in a prepaid registered letter addressed to the secretary or other officer of that body at that office;
- (e) where a facsimile number has been provided by a person, by a facsimile transmission which provides confirmation of receipt.

(2) Where the notice or other document is required to be served on or given to a person as having an interest in premises, or on any person as the owner or occupier of premises and either the name of that person cannot be ascertained after reasonable inquiry, or it appears that any part of the land is unoccupied, the notice shall be deemed to be duly served if it

- (a) is addressed to “the owner of”, “the occupier of”, “the owner and occupier of”, or “any person having an interest in”, as the case may be, the premises or that part of the land (describing it); and
- (b) is marked in such a manner that it is plainly identifiable as a communication of importance; and
- (c) is sent in a prepaid registered letter to the premises and is not returned to the Authority; or
- (d) is delivered to some adult person on those premises; or
- (e) is affixed securely and prominently to some conspicuous part of the premises.

(3) In any case where a notice or other document has been served by a means other than personal delivery, it shall be deemed to have been served, given or delivered four days after it was left, mailed or affixed, as the case may be, or if it was sent by facsimile transmission, on the day after it was so sent.

81. Power to require information.

For the purpose of enabling the Minister, the Board or the Chief Physical Planner to make an order or serve a notice or other document under the provisions of this Act, the Chief Physical Planner may require the owner or the occupier of any premises, and any person who either directly or indirectly, receives rent in respect of any land or premises, to state in writing the nature of his or her interest therein, and the name and address of any other person known to him or her to have an interest therein, whether as a freeholder, mortgagee, lessee or otherwise.

82. Register of planning decisions.

- (1) The Chief Physical Planner shall maintain a register of all
 - (a) applications for a grant of development permission;
 - (b) decisions on applications referred to in paragraph (a) and any conditions attached to development permissions;
 - (c) development agreements under section 32;
 - (d) performance bonds under section 33;
 - (e) notices of modification or revocation of grant of development permission;
 - (f) compliance notices, stop orders, and injunctions;
 - (g) any decisions made, orders or notices served under Part VI;
 - (h) claims for compensation under section 63;

Revision Date: 31 Dec 2002

- (i) decisions on appeals against any decisions, orders or notices made or actions taken under this Act.

(2) Any person who so requests shall be provided by the Chief Physical Planner with a copy of any entry in the register upon payment of the prescribed fee.

(3) The register required to be maintained by subsection (1) shall include an index which shall be in the form of a map and both the register and the index may be kept in an electronic data storage and retrieval system whether by use of a computer or otherwise.

83. Notification of Registrar of Titles.

(1) The Chief Physical Planner shall notify the Registrar of Titles, decisions to giving full details, with respect to the parcels of land affected, of every

- (a) decision on applications for grant of development permission and any conditions attached to development permissions;
- (b) development agreement;
- (c) performance bond;
- (d) modification or revocation of a grant of development permission;
- (e) compliance notice;
- (f) listed building or listed site;
- (g) preservation order or interim preservation order;
- (h) plant preservation order;
- (i) amenity order;
- (j) claim for compensation;
- (k) decision on appeals against decisions, orders or notices made or actions taken under this Act.

(2) The Registrar of Titles shall duly record the matters referred to in subsection (1) on the Land Register.

84. Death of person having claim or right.

Any reference in this Act to any person having a claim for or a right to the payment of compensation, or to appeal against any decision given under this Act, upon the death of that person before the determination of the matter at issue, shall be construed as if such reference were a reference to that person's personal representatives.

85. Offences and penalties.

- (1) A person commits an offence if he or she
 - (a) without reasonable excuse, fails to comply with the requirements of
 - (i) a compliance notice issued under section 39;
 - (ii) a stop order issued under section 44;
 - (iii) an amenity order made under section 51;

- (iv) the advertisement regulations made under section 52;
- (b) assaults, hinders or obstructs the Board, a public officer or any other person in the exercise of any powers, or the performance of any duties, under this Act;
- (c) wilfully gives false information, relating to any matter in respect of which he or she is required to give information under this Act;
- (d) having been required to give information in pursuance of section 81, without reasonable excuse, fails to give that information within twenty-eight days of being so required, or such longer period as the Chief Physical Planner may allow in any particular case;
- (e) having been given information under this Act, or having obtained any information in the course of his or her duties under this Act, makes any unauthorised disclosure of that information to any person who is not required to receive that information;
- (f) fails to comply with any regulations made with respect to the control of any activities in any environmental protection area;
- (g) contravenes any other provisions of this Act or the regulations made under it.

(2) A person who commits an offence under subsection (1) is liable,

- (a) on summary conviction, to a fine not exceeding twenty-five thousand dollars and on a second or subsequent offence to a fine not exceeding fifty thousand dollars; and
- (b) on conviction or indictment, to a fine not exceeding fifty thousand dollars, and on a second or subsequent offence, to a fine not exceeding one hundred thousand dollars.

(3) In determining the amount of any fine to be imposed on a person convicted of an offence under subsection (1), the Court shall, in particular, have regard to any financial benefit which has accrued or appears likely to accrue to the person in consequence of the offence.

(4) For the purposes of subsection (1)(a)(v), a person shall be deemed to display an advertisement if

- (a) the advertisement is displayed on the land of which he or she is the owner or occupier; or
- (b) the advertisement gives publicity to his or her goods, trade, business or other concerns.

(5) A person shall not be guilty of an offence under subsection (1)(a)(iv) by reason only that an advertisement is displayed on land of which he or she is the owner or occupier, or that his or her goods, trade, business or other concerns are given publicity by the advertisement, if he or she proves that it was displayed without his or her knowledge or concern.

(6) Where an offence under this Act is committed by a body corporate and is proved to have been committed with the consent or connivance of any director, manager,

Revision Date: 31 Dec 2002

secretary or other similar officer of the body corporate, or of any person who was purporting to act in such capacity, he or she, as well as the body corporate, shall be guilty of that offence and are liable to be proceeded against and punished accordingly.

(7) Proceedings in respect of an offence alleged to have been committed under this Act may be brought, with the approval of the Board, by the Chief Physical Planner, provided that if it is considered that the gravity of the offence requires that it be tried on indictment, proceedings shall only be brought by the Director of Public Prosecutions.

86. **Regulations.**

(1) The Minister may make regulations for carrying into effect the provisions of this Act.

(2) Without prejudice to the generality of subsection (1), the Minister may make regulations for

- (a) development which may be permitted by Order made by the Minister under section 20(2), without the requirement of express grant of the development permission;
- (b) the designation of use classes by all Order made by the Minister under paragraph (h) of the definition of “development” in section 2(1);
- (c) the procedures to be followed and the form of any form, notice, order or other document authorised or required by this Act to be served, made or issued, in connection with
 - (i) applications for a grant of development permission,
 - (ii) consultations on applications for development permission,
 - (iii) the modification or revocation of a grant of development permission,
 - (iv) compliance notices,
 - (v) claims for compensations;
- (d) the procedures for environmental impact assessment and the form of environmental impact statements;
- (e) the regulation of subdivision of land;
- (f) the making up of undeveloped private streets;
- (g) the procedures for the conduct of public inquiries held under section 29;
- (h) the fees payable under this Act;
- (i) the qualifications required of persons signing forms, plans and drawings on behalf of any applicant for development permission and the qualifications required of persons preparing environmental impact statements;
- (j) the control of advertisements;
- (k) the preservation of buildings, sites or plants;

- (l) the form of the register to be maintained under section 82.

87. Application of Act to National Housing Corporation; WhiteGate Development Corporation.

Notwithstanding anything contained in the National Housing Corporation Act, Cap. 23.18 and the WhiteGate Development Corporation Act, Cap. 20.50 the Corporations referred to in this section shall be subject to the jurisdiction and powers of the Development Control and Planning Board established under this Act.

Revision Date: 31 Dec 2002

FIRST SCHEDULE

(Section 6)

CONSTITUTION AND PROCEDURES OF THE SAINT CHRISTOPHER DEVELOPMENT AND PLANNING BOARD

1. Membership of Board

(1) The Board shall consist of thirteen members appointed by the Minister of whom

- (a) the following persons shall be *ex-officio* members:
 - (i) the Chief Physical Planner,
 - (ii) the Director of the Planning Unit,
 - (iii) the Chief Environmental Health Officer,
 - (iv) the Chief Technical Officer of the Department of Lands and Housing,
 - (v) the Director of Public Works Department,
 - (vi) the Director of Environment,
 - (vii) the Chief Water Engineer,
 - (viii) the Chief Engineer/Manager of Electricity,
 - (ix) the Commissioner of Police, and
 - (x) the General Manager of St Kitts Sugar Manufacturing Corporation.
- (b) three members shall be persons not in the public service who shall be appointed from among persons who have knowledge and experience in
 - (i) commerce and industry,
 - (ii) economic and financial matters,
 - (iii) any other area of public interest that the Minister considers relevant to physical planning.

(2) The Minister shall by instrument in writing appoint a chairperson and a deputy chairperson of the Board from amongst the *non-ex officio* members and the deputy chairperson shall in the absence, for any reason, of the chairperson, perform the functions of the chairperson.

(3) A member appointed under sub-paragraph (1)(b) shall hold office for a period of three years, but shall be eligible for reappointment upon the expiry of his or her period of office.

(4) Every appointment made under sub-paragraph (1) and (2) shall be notified in the *Gazette*.

(5) The Chief Physical Planner shall be the chief executive officer of the Board.

(6) In the event of the temporary incapacity of a member, whether by reason of illness or other sufficient cause, or the temporary absence from Saint Christopher of any member, the Minister may appoint some other person to act as a temporary member for so long as the incapacity or absence continues.

(7) Any member, save an *ex-officio* member, of the Board may at anytime, by notice in writing to the Minister, resign his or her office.

(8) The Minister may remove from office any member of the Board for inability, misbehaviour, or on the ground of any employment or interest which is incompatible with the functions of a member of the Board or for any other good cause.

2. **Meetings of the Board**

(1) The Board shall meet at least once in every month and at such other times as may be necessary for the transaction of business, at such places and times and on such dates as the Board may determine.

(2) The chairperson shall convene a special meeting of the Board within seven days of receipt of a requisition or that purpose addressed to him or her in writing and signed by any five member of the Board, and on any other occasion when he or she is directed in writing by the Minister so to do.

(3) The chairperson shall preside at meetings of the Board.

(4) The chairperson and seven other members shall form a quorum, provided that where any member is disqualified by virtue of paragraph 4 from taking part in any deliberation or decision at any meeting of the Board, that member shall be disregarded for the purpose of constituting a quorum or decision.

3. **How decisions to be taken**

The decision of the Board with regard to any question shall be determined by a majority of votes of the members present and voting at a meeting of the Board, and in the event of an equality of votes the chairperson shall, in addition to his or her own original vote, have a casting vote.

4. **Declaration of interest**

(1) There shall be an item of business on the agenda of each meeting which shall be named "declaration of interest" and under this item

- (a) the chairperson shall draw the attention of members and officers in attendance, to the law relating to conflict of interest; and
- (b) members and officers in attendance shall declare their interest in any item of business on the agenda.

(2) In respect of any item of business on which they have declared an interest, the Chairperson, or where he or she has taken the chair, the vice-chairperson, or where a member has taken the chair, that member, shall vacate the chair for that item of business.

(3) A member or an officer in attendance who has declared an interest in an item of business to be discussed at a meeting shall, when that item of business is reached on the

Revision Date: 31 Dec 2002

agenda, leave the meeting while that item of business is being discussed and shall take no part directly or indirectly in any decision, deliberation, discussion, consideration or other like activity on that matter.

(4) Where, owing to the number of members who have declared an interest in an item of business at a meeting, the Board lacks a quorum to transact that item of business, that item of business shall be deferred to the subsequent meeting, and the fact shall be recorded in the minutes and reported to the Minister.

5. Validity of Boards actions

The validity of anything done under this Act shall not be affected solely by reason of

- (a) the existence of any vacancy in the membership, or any defect in the constitution of the Board; or
- (b) an omission or irregularity in respect of any meeting or proceedings of the Board.

6. Defraying of expenses

The expenses of the Board shall be defrayed out of sums provided for the purpose in the annual estimates of revenue and expenditure for Saint Christopher and shall be a charge on the Consolidated Fund.

7. Definition of chairperson

In this Schedule “chairperson” includes a person appointed or elected, as the case may be, to act temporarily in place of the chairperson.

SECOND SCHEDULE

(Section 11(5)(d))

**MATTERS FOR WHICH PROVISION MAY BE MADE IN
DEVELOPMENT PLANS**

PART I – ROADS

- 1. Reservation of land for roads and establishment of public rights of way including public rights of way to and over beaches.
- 2. Closing or diversion of existing roads and public and private rights of way.
- 3. Construction of new roads and alteration of existing roads.
- 4. The line, width, level, construction, access to and egress from and the general dimensions and character of roads, whether new or existing.
- 5. Providing for and generally regulating the construction or execution of works incidental to the making or improvement of any road, including the erection of

bridges, culverts, gullies, fencing, barriers, shelters, the provision of artificial lighting, and seats and the planting or protecting of grass, trees and shrubs on or adjoining such road.

PART II – BUILDING AND OTHER STRUCTURES

1. Regulating and controlling, either generally or in particular areas, all or any of the following matters:
 - (a) the size and height of buildings and fences;
 - (b) building lines, coverage and the space about buildings;
 - (c) the objects which may be affixed to buildings;
 - (d) the purposes for and the manner in which buildings may be used or occupied, including in the case of dwelling houses, the letting thereof in separate tenements;
 - (e) the prohibition of building or other operations on any land, or regulating such operations.
2. Regulating and controlling the design, colour and materials of buildings and fences.
3. Allocating any particular land, or all land in any particular area, for buildings of a specified class or classes or prohibiting or restricting either permanently or temporarily, the making of any building or any particular class or classes of buildings on any specified land.
4. Limiting the number of buildings or the number of buildings of a specified class which may be constructed, erected or made, on, in or under any area.

PART III – COMMUNITY PLANNING

1. Providing for the control of land by zoning or designating specific uses.
2. Regulating the layout of housing areas, including, density, spacing, grouping and orientation of houses in relation to roads, open spaces and other buildings.
3. Determining the provision and siting of community facilities including shops, schools, churches, meeting halls, play centres and recreation grounds in relation to the number and siting of houses.

PART IV – AMENITIES

1. Allocation of lands as open spaces, whether public or private.
2. Allocation of land for burial grounds and crematoria.
3. Allocation of lands
 - (a) for communal parks;
 - (b) for game and bird sanctuaries;
 - (c) for the protection of marine life;

Revision Date: 31 Dec 2002

- (d) for national parks and environmental protection areas.
4. Preservation of buildings, caves, sites and objects of artistic, architectural, cultural, historic or archaeological interest.
 5. Preservation or protection of forests, woods, trees, shrubs, plants and flowers.
 6. Protection of coastal zone, designation of marine parks, special resource and special use areas.
 7. Prohibiting, restricting or controlling, either generally or in particular places, the exhibition, whether on the ground, or any building or any temporary erection, whether on land or in water, or in the air, of all or any particular forms of advertisement or other public notices.
 8. Preventing, remedying or removing injury to amenities arising from the ruinous or neglected condition of any building or fence, or by objectionable or neglected condition of any land attached to a building or fence, or abutting on a road or situated in a residential area.
 9. Prohibiting, regulating and controlling the deposit or disposal of waste materials and refuse, the disposal of sewage and the pollution of rivers, lakes, ponds, gullies, beaches and seashore.

PART V – PUBLIC SERVICES

Facilitating the establishment, extension or improvement of works by statutory or other undertakers in relation to power, lighting, water supply, sewerage, drainage, sewage disposal, refuse disposal or other public services.

PART VI – TRANSPORT AND COMMUNICATIONS

1. Facilitating the establishment, extension or improvement of systems of transport whether by land, water or air.
2. Allocating sites for use in relation to transport, and the reservation of land for that purpose.
3. Providing for the establishment, extension or improvement of telegraphic, telephonic, wireless or radar communication, the allocating of sites for use in relation to such communication, and the reservation of land for that purpose.

PART VII – MISCELLANEOUS

1. Providing for and regulating the making of agreements for the purpose of a development plan by the Minister with another body or owners and other persons, and by another body with such persons and by such persons with one another.
2. Sub-division of land and in particular, but without restricting the generality of the foregoing,

- (a) regulating the type of development to be carried out and the size and form of plots;
 - (b) requiring the allocation of land for any of the public services referred to in Part V or for any other purposes referred to in this Schedule for which land may be allocated;
 - (c) prescribing the character and type of public services or other works which shall be undertaken and completed by any applicant for permission to sub-divide as a condition of the grant of such permission;
 - (d) co-ordinating the sub-division of contiguous properties in order to give effect to any scheme of development appertaining to such properties.
3. Making any provision necessary for
- (a) adjusting and altering the boundaries and areas of any towns;
 - (b) enabling the establishment of satellite towns and new towns;
 - (c) effecting such exchanges of land or cancellation of existing sub-division plans as may be necessary or convenient for the purposes referred to in subparagraphs (a) and (b).

THIRD SCHEDULE

(Section 26(1))

MATTERS FOR WHICH ENVIRONMENTAL IMPACT ASSESSMENT SHALL BE REQUIRED

1. Hotels of more than twelve rooms;
2. Sub-divisions of more than six plots;
3. Residential development of more than six units;
4. Any industrial plant which in the opinion of the Board is likely to cause significant adverse environmental impact;
5. Quarrying and other mining activities;
6. Marinas;
7. Land reclamation, dredging and filling of ponds;
8. Airports, ports and harbours;
9. Dams and reservoirs;
10. Hydro-electric projects and power plants;
11. Desalination plants;
12. Water purification plants;

Revision Date: 31 Dec 2002

13. Sanitary land fill operations, solid waste disposal sites, toxic waste disposal sites and other similar sites;
14. Gas pipeline installations;
15. Any development projects generating or potentially generating emissions, aqueous effluent, solid waste, noise/vibration or radioactive discharges;
16. Any development involving the storage and use of hazardous materials;
17. Coastal zone developments;
18. Development in wetlands, marine parks, national parks, conservation areas, environmental protection areas or other sensitive environmental areas.

FOURTH SCHEDULE

(Section 71(3))

CONSTITUTION AND PROCEDURES OF THE APPEALS TRIBUNAL

1. Membership of Appeals Tribunal

(1) The Appeals Tribunal shall consist of five members appointed by the Governor-General of whom the chairperson shall be a legal practitioner of not less than ten years standing, and the other four members shall be appointed from among persons trained and experienced in

- (a) physical planning;
- (b) architecture;
- (c) engineering;
- (d) environmental, coastal and marine matters.

(2) A member of the Appeal Tribunal shall hold office for a period not exceeding two years but such a member shall be eligible for reappointment.

(3) The names of all members of the Appeals Tribunal as first constituted and every change in the membership thereof shall be published in the *Gazette*.

(4) Any member of the Appeals Tribunal may resign his or her office at anytime by notice in writing to the Governor-General.

(5) The Governor-General may remove from office any member of the Appeals Tribunal for inability, misbehaviour, or on the ground of any employment or interest which is incompatible with the functions of a member of the Appeals Tribunal.

2. Staff of Appeals Tribunal

(1) The Governor-General shall appoint a secretary to the Appeals Tribunal and such other officers as may be necessary to provide assistance to the Appeals Tribunal.

(2) The acts of the Appeals Tribunal shall be authenticated by the signature of the chairperson or secretary of the Appeals Tribunal.

3. Meetings of Appeals Tribunal

(1) The Appeals Tribunal shall meet on such occasions as may be expedient for the hearing of appeals and at such places, times and on such days as the Appeals Tribunal may determine.

(2) The chairperson shall preside at all meetings of the Appeals Tribunal.

(3) A quorum of the Appeals Tribunal shall consist of a majority of members, that is to say, three members, which shall include the chairperson.

(4) The decisions of the Appeals Tribunal shall be by a majority of votes of members present and voting, and in the event of an equality of votes, the chairperson shall have a casting vote.

4. Declaration of interest

(1) It shall be the duty of a member of the Appeals Tribunal who is in any way directly or indirectly interested in a matter coming before the Appeals Tribunal to declare the nature of his or her interest in the matter as soon as it is practicable for him or her to do so, and he or she shall remove himself from any meeting of the Tribunal on that matter, and take no part directly or indirectly in any decision, deliberation, discussion, consideration or similar activity of the Appeals Tribunal on that matter.

(2) Where the Appeals Tribunal lacks a quorum in relation to an appeal owing to the number of members, who have declared an interest in that appeal, the Governor-General shall, for the purpose of that appeal, revoke the appointment of those members and appoint other persons in their stead.

5. Remuneration

For each sitting of the Appeals Tribunal the members, other than *ex-officio* members, shall be paid such remuneration as may be prescribed by the Governor-General, and such remuneration shall be a charge on the consolidated Fund.

6. Validity of proceedings

The validity of any proceedings of the Appeals Tribunal shall not be affected by any vacancy among the members thereof or by any defect in the appointment of a member thereof.

7. Procedure of the Appeals Tribunal

Subject to the provisions of this Schedule, the procedures of the Appeals Tribunal shall be such as may be determined by the Tribunal.

Revision Date: 31 Dec 2002

FIFTH SCHEDULE

(Section 55(2))

BUILDING CODE

1. Short Title

These Regulations may be cited as the Building Regulations.

2. Interpretation

In these Regulations, unless the context otherwise requires,

“Act” means the Development Control and Planning Act, Cap. 20.07;

“Board” means the Board established under Section 4 of the Building Act, Chapter 284;

“building” means a structure roofed in and capable of affording protection or shelter;

“building lot” means the land exclusively belonging or intending to belong to any building in respect of which an application is made to the Board at any time, whether such land at the time of the application has buildings on it or not;

“dwelling house” means any building used or constructed or adapted to be used for human habitation and, in case of a building used partly as a dwelling house and partly for other purposes, that part used as a dwelling house;

“living room” means any room which is ordinarily used for living or sleeping purposes;

“new building” means any building or part of a building or addition to a building erected wholly or partially or converted into a dwelling house;

“public place” means any place to which the public have access;

“storey” means that portion of a building contained between any two floors, and if there be no upper floor, that portion of a building contained between the floor and the top of the wall or roof-plate, except that the space between the lowest floor and the ground if not exceeding 6 feet and 6 inches in height, or a cellar beneath a building or a garret in a building of two or more storeys shall not be deemed a storey within the meaning of these Regulations.

3. Submission of Applications to the Board

- (1) A person who intends to undertake any work in relation to the
 - (a) erection;

- (b) re-erection;
- (c) removal; or
- (d) external structural alteration;

of a building shall, before doing so, apply in writing in the Form set forth in the First Schedule to these Regulations, to the Board for the approval of the proposed work.

- (2) The Board shall, before granting approval, require the applicant to submit to it
 - (a) a certified copy of title or deed showing his or her ownership of land;
 - (b) a plan of the site;
 - (c) a plan of the proposed work; and
 - (d) an estimate of the cost of the work.

(3) The applicant shall not commence any work without the approval of the Board in writing.

4. **Documents to be submitted in Duplicate**

The applicant shall submit in duplicate all the documents referred to in sub-regulation (2) of regulation 3, and the Board shall retain one copy of each document, and return the other copy of each document to the applicant.

5. **Consideration of Applications**

The Board shall, within fourteen days after the receipt of an application and subject to the provisions of the Development Control and Planning Act, Cap. 20.07 and these Regulations,

- (a) approve or disapprove the application; or
- (b) require any alteration to be made in the plan of any building intended to be
 - (i) erected,
 - (ii) re-constructed, or
 - (iii) altered,

as to its height or size or as may be necessary for the purpose of securing uniformity in the appearance of the street on which such building is intended to be erected.

6. **Communication of Decision to the Applicant**

The Board shall communicate to the applicant its decision by endorsing the same upon the copy of the application returned to the applicant and, in the case of disapproval, shall indicate its reasons for the disapproval.

7. **Period in which work must be started**

(1) The applicant shall commence work approved by the Board within six months of the date of the approval.

Revision Date: 31 Dec 2002

(2) The approval of the Board of any proposed work shall lapse if the work is not carried out within the six months period.

8. Building Lots

(1) A building lot in any prescribed urban area shall not measure less than 1750 square feet, and in the case of a building lot in any prescribed rural area shall not measure less than 2500 square feet.

(2) A person shall not erect more than one dwelling house on a building lot referred to in this regulation.

(3) The street frontage of any building lot shall be at least 39 feet.

(4) A dwelling house and outhouse on a building lot shall not cover more than two thirds of the surface of the building lot.

(5) No building work shall be done on any building already existing on such a building lot other than such repairs as do not involve replacement of more than 25% of the structure.

9. Building Line

The building line of a building abutting on a public place shall, unless the Board requires a greater distance, be set back 16 feet from the

- (a) center of the road, street or other public place;
- (b) center of any projected
 - (i) road,
 - (ii) street, or
 - (iii) other public place.

10. Frontage

A building shall not have a frontage which is less than 18 feet to any public place.

11. Air Space in front of Buildings

(1) Each building shall have an open space of at least 24 feet extending throughout the whole frontage of the building.

(2) The open space referred to in sub-regulation (1) of this regulation shall be measured from the front of the building to the boundary of any land or premises immediately opposite or to the opposite side of any public place on which the building immediately abuts.

(3) The Board may, in its discretion, reduce the above requirements in respect of buildings containing premises on the ground floor which are exclusively of a commercial nature.

12. Air Space at back of Buildings

(1) Each building shall have an open space of at least 16 feet to its site boundary at the rear extending the whole width of the building.

(2) The open space at the rear of a dwelling house referred to in this regulation shall, in addition, be at least two thirds of the height of the building from the ground to the eaves.

(3) Notwithstanding sub-regulations (1) and (2) of this regulation, outbuildings approved by the Board may be erected at the rear of a dwelling house.

13. Distance of Buildings from side Boundaries

(1) A person shall not erect a building that has eaves, projecting part or external wall, as the case may be, within 6 feet from its site boundary at either side of any building, wall, or fence used or constructed to be used for the separation of adjoining building or adjoining lands that belong to different owners.

(2) For the purposes of this regulation, connected buildings or group of buildings shall be regarded as one building.

14. Projection

A person shall not erect a building such that any portion of or attachment to the building permanently projects on or over any public place in such a manner that in the opinion of the Board it would cause an obstruction or danger to vehicles or pedestrians.

15. Encroachment

No person shall erect any new building without first removing any encroachment or obstruction which may be in or on the public place in front of the site where the building is to be erected.

16. Height of Building

A person who erects a building intended for human habitation,

- (a) if the building is of one storey, shall ensure that the storey is not less than 9 feet in height from the floor to the ceiling or underside of the roof;
- (b) if the building is of two storeys or more, shall ensure that the lowest storey is at least 9 feet, and the average height of each of the upper storeys is at least 8 feet from the floor to the ceiling or the underside of the roof.

17. Height of Dwelling Houses above ground

(1) A person who erects a building that is intended to be used as a dwelling house shall ensure that

- (a) the lowest floor is raised from the ground at least 18 inches; and

Revision Date: 31 Dec 2002

- (b) the floor is supported on a masonry with proper and sufficient ventilation beneath the floor.

(2) Notwithstanding sub-regulation (1) of this regulation, where the frontage of the building abuts on any public place the building shall be on a continuous dwarf wall or concrete pillars.

18. Drainage

The Board may require that

- (a) the site of any new building intended to be used as a dwelling house has its drains properly laid to a suitable outfall for the efficient drainage of any rain or surface water from the site;
- (b) the sub-soil of the site of the building referred to in paragraph (a) of this regulation be effectually drained, whenever the possibility of dampness of the site renders such a precaution necessary.

19. Living Rooms

A person shall not erect a building intended to be used as a dwelling house

- (a) with any living room whose floor area is less than 90 square feet;
- (b) with any living room which is not provided with windows open to external air; and
- (c) having any living room with an average height of less than 8 feet.

20. Kitchens

(1) A person shall not erect a building that is to contain a kitchen or in which building fire is intended to be used unless

- (a) the floor of the kitchen or room where fire is to be used is tiled, paved, concreted, or otherwise made fireproof to the satisfaction of the Board; and
- (b) the chimney of the building referred to in this regulation is above the continuous roofs to such height as the Board may specify when granting the application for the erection of the building.

21. Latrine Accommodation

(1) Any building intended for use as a dwelling, shop, factory, or as a place of business shall be provided with any of the latrine facilities specified in sub-regulation (2) of this regulation, as the Board may approve.

(2) The latrine facilities referred to in sub-regulation (1) of this regulation are the following:

- (a) a water-flush toilet erected on the premises which toilet shall be connected to a septic tank or proper sewerage system, and constructed in such a manner as shall be specified in the application approved by the Board;

- (b) a dry earth closet of a type as may be approved by the Board;
- (c) a pit latrine of a type approved by the Board.

22. Garages

Each garage shall be made of concrete, stone, iron or some other non-inflammable material as far as practicable, and shall have at least two ventilation openings, each of which shall not be less than 1½ square feet, placed in such manner so as to effect cross ventilation.

23. Water Supply

The Board may require to be satisfied that an adequate and safe water supply is available within a reasonable distance of the building.

24. Demolition of Buildings

(1) A person shall not demolish any building or part of the building from any site without the permission of the Board at least 48 hours before demolition of the building.

(2) It shall be stated in any application for permission to demolish a building the present site of the building and the site where it is intended to be re-erected.

25. Dilapidated or Dangerous Premises

(1) Where any building is in a dilapidated state or in such a condition, as in the opinion of the Board is likely to endanger life or property, the Board shall

- (a) give notice in writing to the owner of the building; or
- (b) in the case of a vacant building, affix a notice to the front door or some conspicuous part of the building to repair or demolish the building.

(2) If after the expiry of 30 days from the date of the notice referred to in this regulation the work ordered by the Board to be done is not commenced and diligently proceeded with, the Board may enter upon the land and do all such matters and things for the carrying out of orders contained in the notice at the expense of the owner.

(3) Notwithstanding sub-regulation (2) of this regulation, where the owner of the building is a destitute person and cannot afford the cost of pulling down or repairing the building as required by the Board, the Board may cause the necessary work to be performed at its own cost and expense.

26. Buildings Unfit for Human Habitation

(1) If on the representation of the Chairperson of the Board of Health for the District, the Board is of the opinion that any dwelling house is in a state so dangerous or injurious to health as to be unfit for human habitation such dwelling house shall be vacated by any persons inhabiting it within 28 days of the service of a notice issued by the Board.

(2) It shall be indicated in the notice served under sub-regulation (1) of this regulation the cause of unfitness to vacate that dwelling house.

Revision Date: 31 Dec 2002

(3) The building referred to in this regulation shall not be used for human habitation until the Board is satisfied it has been rendered fit for human habitation and issues a certificate to that effect.

27. Building Standards

A person who intends to erect a building shall conform to the standards specified in the Building Code and Building Guidelines set out in Schedule 2 and Schedule 3 to these Regulations, respectively.

SCHEDULES

SCHEDULE 1 TO THE REGULATIONS

(Regulation 3)

Form of application to the Building Board

To the Building Board.

I, the undersigned, apply for permission to execute, in accordance with the Building Regulations, the work herein particularised:

- | | | |
|-----|------------------------|-----|
| *1. | Description. | (a) |
| 2. | Frontage. | (b) |
| 3. | Drainage. | (c) |
| 4. | Sanitation. | (d) |
| 5. | Water Supply. | (e) |
| 6. | Supply of Electricity. | (f) |

Dated theday of,

(Signed).....

(Occupation).....

**Notes*

- (a) Give a general description of the proposed work, and in particular the type, the purpose for which it is to be used and the number of storeys.
- (b) Give full particulars and measurement of frontage.
- (c) Give full particulars of sanitary arrangements.
- (d) State source of and manner of conveying water supply.

(e) State source of and manner of conveying supply of electricity.

ENDORSEMENT BY BUILDING BOARD

Dated theday of,

(Signed).....

Clerk to the Building Board.

SCHEDULE 2 TO THE REGULATIONS

(Regulation 27)

BUILDING CODE

PREFACE

The Eastern Caribbean 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 Eastern Caribbean 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 be more responsive to the current needs, and to ensure as far as is 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, developed standard building codes and guidelines which address 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 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

Revision Date: 31 Dec 2002

cannot afford the costs required to construct or upgrade a house to the minimum acceptable standard. It is recommended that each country encourages 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 sets suggested administrative and enforcement requirements relating to the building practices and use of acceptable materials and building systems. The code 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 housing sector.

May 1995 Edition

The draft St. Kitts-Nevis Building Code and Building Guidelines were circulated for comment in late 1994. UNCHS consultant, Mr Gil Williams ARAIA, MAIBS, visited St. Kitts-Nevis in March 1995 to review the comments received and discuss proposed amendments with Government and industry representatives. A further visit took place in May 1995 to discuss the amendments to be included in the May 1995 edition.

Consultations on the content of the Building Code and Building Guidelines took place with a number of organisations including the following:

St Kitts

- Department of Land and Housing Physical Planning Unit
- Building Board
- Electricity Department
- Water Authority
- Fire Brigade
- St. Kitts-Nevis College of Further Education

Nevis Island Administration

Premier's Department:
 Division of Planning and Development
 Physical Planning Unit
Department of Communications and Works:
Building Board
Tourism Adviser (CFTC project)
Housing and Land Development Corporation
Electricity Department
Water Authority
Fire Brigade
Legal Adviser

and during seminars in Nevis, representatives from:

 Banking and other finance institutions
 Architects and building designers
 Engineers
 Building Contractors

In June 1995, the Code was reviewed by UNCHS-Nairobi and in August, further amendments, mainly editorial in nature were made to the Code and Guidelines.

Comments

Any comments or inquiries on the content of the St. Kitts-Nevis Building Code or Building Guidelines should be addressed to the Building Boards of St. Kitts or Nevis as appropriate, or to UNCHS c/- UNDP Barbados.

SECTION 1 – ADMINISTRATION OF THE CODE

101 TITLE

This publication shall be known as “The St. Kitts-Nevis Building Code”, and may be cited as such, or as the “Building Code,” and will be referred to hereinafter as “this Code.”

102 SCOPE

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

103 PERMITS AND FEES

- (a) A permit is required whenever building work, including demolition, which is regulated by this Code is to be undertaken.

See 109 APPLICATION TO BUILD.

Revision Date: 31 Dec 2002

- (b) The Board shall require that the laws, rules and regulations of any other regulatory authority having jurisdiction, where such laws, rules and regulations are applicable and are known to the Board, shall be satisfied before a permit shall be issued. The Board shall require such evidence, as in its opinion is reasonable, to show such other approvals. The Board shall not thereby be held responsible for enforcement of such regulations which it is not specifically authorised to enforce.
- (c) After issue 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.
- (d) The approval of the Board of proposed work shall be deemed to have lapsed and the right of the owner under the permit terminate if:
 - (i) the work authorised 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 12 months or more, or
 - (iii) the applicant does not comply with all the conditions regarding payment of fees as required by the regulations.

104 **EXISTING BUILDINGS**

- (a) Alterations, repair or rehabilitation work may be made to any existing building without requiring the whole of the building to comply with all of the requirements of this Code if that part of the existing building subject to the alteration, repair or rehabilitation work conforms to the requirements of this Code for new construction. The Board 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 become unsafe.
- (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.
- (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 25% of the roof covering of a building shall be replaced in any period of 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 Board.

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 complete compliance with all the requirements of this Code when approved by the Board, provided:

- (a) The building or structure has been designated by official action of the legally constituted body as having special historical or architectural significance.
- (b) The restored building or structure will be 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 Board plans and specifications for the work to be carried out prepared by an engineer, architect or other suitably qualified person approved by the Board.
- (d) The Board in the public interest of health, safety and welfare has required all necessary corrections to be made before use and occupancy.

Note See guidelines issued by the Beautiful Basseterre Committee, and Nevis Island Administration.

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 design alternative to those set out in this Code. 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 acceptable 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) An application to use types of construction or materials or methods of design not specifically mentioned in this Code may be filed with the Board together

Revision Date: 31 Dec 2002

with evidence in support of claims that may be made regarding their safety and sufficiency.

- (b) The Board 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 Board, 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 Board. When such notice has not been complied with the Board 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**

Plans and specifications of proposed building work must be approved in accordance with this Code before a permit may be issued.

109.2 **Form of Application to Build**

- (a) An Application to Build shall be submitted to the Board in the manner prescribed in the regulations and as set out in this Code.
- (b) 3 sets of completed application forms and plans are to be provided. The plans shall be signed legibly by the person responsible for the preparation of the plans, and shall include the following:
 - (1) Location Plan – normally at a scale of 1:2500 showing the location of the lot sufficient to identify the site. Streets should be named and lots numbered where applicable.
 - (2) Site Plan – normally at a scale of between 1:500 and 1:250 showing the dimensions of the site and its relationship to abutting lots, roads and public utilities; the location of the proposed building in relationship to the site boundaries; the existing and proposed contours of the site, and the relationship of the lowest floor of the building with the levels of the adjoining street; and proposed site installations, drainage and paths.

(3) Building Plans to include:

1 Floor Plan to Scale 1/8" or 1/4" to 1'-0" (1:100 or 1:50), including:

- room sizes
- positioning of doors and windows
- materials used in construction
- thickness of each wall
- size of closets

2 Elevations and Sections to Scale 1/8" or 1/4" to 1'-0" (1:100 or 1:50), including:

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

3 Foundation Plan, including:

- foundation layout
- cross sections

4 Electricity, including:

- electrical lines in floor plan
- amount of wires in conduit and wire gauges
- circuit numbers
- panel sizes

5 Structural Plan, including:

- details of beams, columns, slabs, walls, cisterns
- reinforcement details
- roof design and construction details

6 Plumbing, including:

- location of inspection boxes
- location and details of grease traps
- sizes and slopes of the pipes used in the sewer lines
- details of septic tanks and soakaways
- water storage and catchment details

(4) All drawings shall be individually numbered for ease of reference. Revisions shall carry revision numbers.

(5) The Board 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 and state the qualifications of the person responsible for the design.

Revision Date: 31 Dec 2002

- (6) All tests required by the Board to show that materials and methods of construction proposed by the owner meet the requirements of this Code shall be carried out by the owner at his or her expense. The testing agency to be used by the owner must be approved by the Board.
- (7) All drawings, specifications and accompanying data shall bear the name and address of the designers.
- (c) In the case of an application for approval of the erection of a structure, or the demolition, removal or relocation of a building or structure, the Board may waive any of the requirements of paragraph (b) as it considers appropriate.

109.3 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 which immediate approval is desired shall be filed with the Board.
- (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 Board of the application including all requirements as set out in 109.

110 USE OF CODES AND STANDARDS

The Standards and Codes called up in this Code are listed in Appendices A and B. Wherever appropriate, the latest edition of the referenced Standards and Codes shall be used. Unless otherwise authorised by the Board, this Code takes precedence over any other Code or Standard.

111 INSPECTIONS

111.1 Procedure

- (a) The Board, upon receipt of 48 hours notice from the builder, exclusive of Saturdays, Sundays and declared Public Holidays, is authorised to make the following inspections:
 - 1 SETTING OUT
 - 2 FOOTINGS, SLABS BEFORE CONCRETING
 - 3 STRUCTURAL FRAME AND ROOF
 - 4 RING BEAMS CASING AND REINFORCEMENT
 - 5 PLUMBING AND DRAINS
 - 6 ELECTRICAL WORK (in association with the electrical inspector)
 - 7 OTHER INSPECTIONS (as the Board may reasonably require).
 - 8 SPECIAL INSPECTIONS OF ALL MECHANICAL INSTALLATIONS

9 FINAL INSPECTION (Occupancy Certificate)

- (b) All inspections shall be carried out by persons employed by the Board as Building Inspectors or by suitably qualified persons approved by the Board and appointed to carry out such inspections.
- (c) The Inspector shall note the progress in the construction and may notify the builder in writing where such work does not appear to meet the requirements of this Code.
- (d) Reinforcing steel or structural frame work shall not be covered or concealed, and work shall not be done on any part of a building or structure beyond the point indicated in each successive inspection stage unless the inspection has been carried out, however an inspection does not absolve the owner and builder from responsibility for any construction in contravention of the regulations or this Code.
- (e) In the case of the erection of a structure, or otherwise if circumstances warrant, the Board in its discretion may waive such inspection in writing to the owner and builder, but this does not absolve the owner and builder from responsibility for any construction in contravention of the regulations or this Code.

111.2 Special Inspector

- (a) When site conditions, size or complexity of the work warrants, the Board may impose a condition on the permit requiring the owner to employ a Special Inspector for the inspection of the structural framework, or any part thereof, for the installation of equipment and for the review of all plans relating to such work, as herein required.
 - (i) Buildings or structures or part thereof of unusual design or method of construction and with critical structural connections.
 - (ii) Marine construction.
 - (iii) Major foundations and/or pile driving.
 - (iv) Installation of equipment such as elevators, power plants and water and sewage treatment plants.
 - (v) Major site works.
 - (vi) Drainage and waste disposal.
- (b) Such Special Inspector shall be a qualified Engineer or Architect with the relevant experience, or other suitably qualified person approved by the Board. The Special Inspector shall ensure compliance with this Code and shall submit regular progress reports and inspection reports to the Board.
- (c) At the completion of the construction work or project, the Special Inspector shall submit a Certificate of Compliance to the Board stating that the work was done in compliance with this Code and in accordance with the approved plans. The Special Inspector's duties shall end with the submission of such certificate. Final inspection shall be made by the Board before a Certificate of Occupancy is issued.

Revision Date: 31 Dec 2002

112 **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 Board has issued a Certificate of Occupancy stating the nature of the occupancy permitted.
- (b) An application may be made by the owner for a Certificate of Occupancy. A temporary Certificate of Occupancy may be issued for a part of a building which may safely be occupied prior to final completion of the remainder of the building.

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.

113 **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 laws or regulations in force in St. Kitts-Nevis, or this Code.
- (b) The issuance of a permit upon plans and specifications, shall not prevent the Board 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 Board reasonably believes that approved plans are in violation of this Code, it shall notify the permit holder and the permit holder shall correct the drawings or otherwise satisfy the Board that the design and/or working drawings are in compliance with this Code.
- (d) Compliance with this Code is the responsibility of the permit holder until the issuance of a Certificate of Occupancy, at which time it shall become the responsibility of the owner.
- (e) The permit granted for the construction of the work shall be available at the construction site during normal working hours for inspection by the Board.

SECTION 2 – DEFINITIONS

In the interest of brevity, words in singular where applicable, shall be construed 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.
- Addition – Any extension or increase in floor area or height of a building or structure.
- 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 installation of a kitchen sink and/or cooking facilities within a room or suite of rooms shall be sufficient to classify such room or suite as an apartment.
- Apartment building – A building made up of 3 or more apartment units each with direct access, or access via a lobby, stairway or other common space.
- Approved – Approved by the Board under the requirements of this Code, including the Director or other designated persons with jurisdiction under this Code.
- Architect – A person technically qualified and approved by the Board to design and supervise the construction of buildings.
- Area of storey – The gross area of such storey measured from the external 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 uppermost storey.
- Automatic – Applied to a door, window, or other opening, not requiring manual operation.
- Awning – A projecting canopy.
- Authority – The relevant Planning, Development or Building Control Authority of St. Kitts or Nevis, as the case may be.
- Balcony – The portion of the seating space of an assembly room, the lowest part of which is raised 4 ft. (1200 mm) 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% open and the open area above the guard rail shall be so distributed as to prevent the accumulation of smoke or toxic gases.

Revision Date: 31 Dec 2002

- Basement – Any storey or part of a storey where more than 1/2 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.
- Branch drain – Defined in Section 8.
- Branch pipe – Defined in Section 9.
- Building – A structure enclosing or partially enclosing space and used and occupied temporarily or permanently by any person, including a part of a building or structure. Where a building is separated into 2 or more parts by fire division walls, each part may be deemed a separate building for the purpose of this Code.
- Building line – The line established by law beyond which no building shall extend except as provided for by the requirements of this Code, the relevant planning legislation or statutory plan, or as specified in the relevant planning or development permission.
- 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.
- Car port – A covered area for sheltering a motor vehicle, not fully enclosed by walls.
- Combustible – Any material that will ignite at or below a temperature of 1200°F and which ignited will continue to burn or glow.
- 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 2 or more sides by the walls of a building or in the case of a rear court enclosed on 3 sides by the boundaries of the site.
- Cubic content of a storey – The volume of enclosed space measured 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 – A prefabricated assembly of various components to enclose a building usually supported externally from the structural frame, and passing all storeys.

Dead load – The weight of the actual structure and all permanent parts incorporated in the construction.

Dining room – Any building or part thereof, in which food is consumed, dispensed or served.

Director – Public Officer appointed by the Government and responsible for the administration of this Code.

Dormitory – A room in which sleeping accommodation is provided for more than 4 persons.

Duplex building – A building providing 2 separate apartments with or without common entrance and/or exit facilities.

Dwelling – A building used exclusively for residential purposes as a single family occupancy. For the purposes of this Code a 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.

Enclosed – Bounded by walls or floors or roof or ceilings. 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.

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 approved by the Board.

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.

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°F.

Revision Date: 31 Dec 2002

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, external – 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, fire resistant.

Fire retardant treated wood – Wood that has been treated to retard spread of flame.

Flameproof – 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.

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 10 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 category of sawn lumber classified 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 British Standard, ASTM or other recognised international standard.

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 ft. (600 mm) 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. However, the Board may, for purposes not included in this Code, define the height of a building to include the distance between the ground and the highest point of the structure including any projections such as chimneys, etc.

Height, storey – The vertical distance between the top of the floor surfaces of 2 successive floors or between the topmost floor surface 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 fire resistance of at least 2 hours.

Hotel – A residential building containing 10 or more rooms intended, designed or used, rented, hired out or occupied for sleeping purposes by paying guests.

Incombustible – see Non-combustible.

Joists – Secondary horizontal supporting members in floors, ceilings, or roof construction.

Jurisdiction – The district or area, or subject matter, administered by the Development Control Authority, Planning Authority, or any other

Revision Date: 31 Dec 2002

body appointed by the Government for the administration of this Code.

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 considered as one unit.

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 1/3 of the total floor area in that room or storey in which the mezzanine floor occurs, it shall be considered as constituting an additional storey. The clear height above or below a mezzanine floor shall not be less than 7 ft (2130 mm).

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.

Nominal dimension – The dimension or size in which such material, part or unit is usually manufactured or supplied.

Non-combustible – 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 1 8"

(3 mm) 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.

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 part thereof at any one time.

Occupancy – The purpose for which a building is used or intended to be used. Occupancy does not relate to the status of tenancy or proprietorship.

Occupied – Shall be construed as though followed by the words “or intended, arranged, or designed to be occupied”.

Open plan office – Group D Occupancy having rooms and corridors delineated by the use of furniture, or low (5 ft. – 1500 mm high) 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 the duly authorised agent of the owner.

Parapet – The part of a wall 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 3/4 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% of the roof at the level on which such penthouse or penthouses are located.

Revision Date: 31 Dec 2002

Permit – A written authorisation issued by the Board to proceed with construction, alteration, repair, installation or demolition work regulated by this Code.

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. (1500 mm) above the proscenium opening.

Prefabricated – Pre-engineered or 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 occupier or tenant only and not for common or public 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 – An enclosed part of a building not being a corridor, hallway, foyer, stairway, escalator, ramp, service area, or the like.

Sanitary facilities – The facilities provided in a lavatory in accordance with the requirements of this Code.

Site – The part of land on which a building is constructed or other work regulated by this Code is carried out.

Structure – A building or other construction including a fence, roadway, bridge, mast, advertising support, retaining or freestanding wall, swimming pool, or the like.

SECTION 3 – OCCUPANCY CLASSIFICATION AND FIRE PROTECTION 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 – Assembly Buildings

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

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

301.3 Group B – Institutional Buildings

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

- (a) Asylums Old and handicapped persons homes
Hospitals Sanatoria
Infirmaries
- (b) Prisons Reformatories

Revision Date: 31 Dec 2002

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
Office buildings
Radio stations | Restaurants seating less than 50 persons
Television stations |
| (b) | Markets
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 of 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

Group A Assembly buildings: 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.
Public buildings generally,	1 person for each 100 sq.ft (10 m ²) of floor area.
Restaurants, night clubs	1 person for each 12 sq.ft (1.1 m ²) net.
Group B Institutional buildings: generally	1 person for each 100 sq.ft (10 m ²) of floor area.
Hospital surgical and obstetrical areas	1 person for each 120 sq.ft (11 m ²) of floor area.
Open wards and dormitories	1 person for each 50 sq.ft (5 m ²) of floor area.
Prisons and Reformatories	1 person for each 100 sq.ft (10 m ²) of floor area.
Group C Commercial and industrial buildings:	

Revision Date: 31 Dec 2002

Group C(a)	1 person for each 200 sq.ft (20 m ²) of floor area for the first 5 persons and 1 person for each 1,000 sq.ft (100 m ²) of floor area thereafter
Group C(b)	1 person for each 50 sq.ft (5 m ²) of floor area for the first 10 persons, 1 person for each 100 sq.ft (10 m ²) of floor area for the next 10 persons, and 1 person for each 500 sq.ft (50 m ²) of floor area thereafter.
Group D Offices, administrative and retail service buildings:	
Group D(a)	1 person for each 100 sq.ft (10 m ²) of floor area
Group D(b)	1 person for each 50 sq. ft (5 m ²) of sales floor area plus 1 person for each 100 sq.ft (10 m ²) of non sales floor areas
Group E Residential:	
Group E(a)	1 person for each 300 sq.ft (30 m ²) of floor area
Group E(b)	1 person for each 150 sq.ft (15 m ²) of floor area
Group E(c)	1 person for each 50 sq.ft (5 m ²) of floor area.
Group F Hazardous occupancy:	1 person for each 50 sq.ft. (5 m ²) of floor area for the first 10 persons. 1 person for each 500 sq.ft (50 m ²) of floor area thereafter

303 TYPE CLASSIFICATION BY CONSTRUCTION

303.1 General

(a) The requirements of Types of Construction in this Sub-section are minimal 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 1 Construction – Fire Resistive
- Type 2 Construction – Semi-fire Resistive
- Type 3 Construction – Ordinary Masonry (Protected and Unprotected)
- Type 4 Construction – Noncombustible
- Type 5 Construction – Wood Frame

Note 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% of the ground floor of the primary building, nor 1,500 sq.ft (150 m²), 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 1, 2, 3, 4 or 5 as defined in this Code shall be defined for the purpose of this Code, by the Board.

303.3 Abbreviations

The following abbreviations are used in Table 3-2:

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

Revision Date: 31 Dec 2002

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**

The following abbreviations are used in Table 3–3:

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 ft. (3600 mm) in storey height, not closer than 50 ft. (15 m) 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 (500 m²) in floor area.
- (b) Buildings housing processes using combustible or inflammable liquids with a flash point lower than 190°F shall be of Type 1 or 2 single storey construction not closer than 50 ft. (15 m) 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 (1000 m²) in floor area.

306.4 **Areas, Heights and Volumes**

- (a) A building of Type 1 construction more than 100 ft. (30 m) 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 Board. These risers and fittings shall be subjected to an acceptance test.
- (b) The permissible areas given in Table 3-3 may be increased by 25% for any building having clear access to public streets on 2 sides.
- (c) The permissible area given in Table 3-3 may be increased by 50% for any building having clear access to public streets on 3 or more sides.
- (d) The permissible areas given in Table 3-3 may be increased by 100% for any multistorey 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% 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 (7000 m³) 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, as equal in volume as practicable but each part not exceeding 250,000 cu.ft (7000 m³) in volume.

Revision Date: 31 Dec 2002

306.5 Special Fire Resistance Ratings

- (a) In buildings of Groups A, C, D and E, not more than 50 ft. (15 m) high and not closer than 50 ft. (15 m) to a site boundary or to an adjacent building on the same site, non-loadbearing exterior walls may be of non-rated combustible materials.
- (b) Suspended ground floors with less than 3 ft. (900 mm) clearance need not be of fire resistance rated construction for Groups A and E, but for Types 1, 2 and 4, construction shall be of non-combustible materials.
- (c) Where every part of the structural framework is more than 20 ft. (6 m) above the highest part of any floor, a roof 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

Revision Date: 31 Dec 2002

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
Cantilevered 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 sq.ft 1400 m ²	10,000 sq.ft. 950 m ²	10,000 sq.ft 950 m ²	10,000 sq.ft 950 m ²
	Height	100 ft 30 m	60 ft. 18 m	SS	SS	SS
Group B	Area per storey	NL	10,000	7,500 sq.ft 700 m ²	NP	NP
	Height	100 ft. 30 m	60 ft. 18 m	35 ft. 10 m	NP	NP
Group C	Area per storey	NL	NL for SS 20,000 for MS	15,000 sq.ft 1400 m ²	15,000 sq.ft 1400 m ²	10,000 sq.ft 950 m ²
	Height	100 ft. 30 m	60 ft. 18 m	35 ft. 10 m	SS	SS
Group D	Area per storey	NL	20,000 sq.ft 1800 m ²	15,000 sq.ft 1400 m ²	15,000 sq.ft 1400 m ^{2d}	10,000 sq.ft 950 m ²
	Height	100 ft. 30 m	60 ft. 18 m	35 ft. 10 m	SS	SS
Group E	Area per storey	NL	15,000 sq.ft 1400 m ²	10,000 sq.ft 950 m ²	7,500 sq.ft 700 m ²	7,500 sq.ft 700 m ²
	Height	100 ft. 30 m	60 ft. 18 m	35 ft. 10 m	25 ft. 7.5 m	25 ft. 7.5 m
Group F	Area per storey	15,000 sq.ft 1400 m ²	10,000 sq.ft 950 m	7,500 sq.ft 700 m ²	5,000 sq.ft 460 m ²	NP
	Height	60 ft. 18 m	25 ft. 7.5 m	SS	SS	NP

Note See 306.

Table 3–4 Fire resistance ratings in hours for buildings within 10 ft. (3 m) of site boundaries or adjacent buildings on the same site

Revision Date: 31 Dec 2002

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	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 ft. and 20 ft. (3-6 m) 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
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Revision Date: 31 Dec 2002

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 ft. (6 m) from site boundaries or adjacent buildings on the same site and more than 35 ft. (10 m) 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

Revision Date: 31 Dec 2002

Exterior non-load bearing walls	2	1	N/A	N/A	N/A
Interior load 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 otherwise 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 ft. (6 m) from site boundaries or adjacent buildings on the same site and up to 35 ft. (10 m) 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	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 enclosing 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 projections	1	1	0	0	0

Fire check doors	1/2	1/2	1/2	1/2	1/2
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307 STORAGE AND MAINTENANCE FACILITIES

307.1 Fire Protection Requirements

Table 3–8 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 Appendix H6 for the design of buildings storing flammable materials, to provide the material types that can be used for the construction of the facilities.

Table 3–8

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 5,000 sq.ft (465 m ²) other than refuse storage areas	Robust construction having a minimum standard of fire resistance of 1 Hr.
2 Engineering services installations rooms (other than those covered in items 6, 7, and 8)	
3 Repair and Maintenance workshops	Robust solid non-combustible construction having a minimum standard of fire resistance of 2 Hr.
4 Storage areas greater than 5,000 sq.ft (465 m ²) other than refuse storage areas.	
5 Refuse Storage 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 2 Hr.
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.	

308 FIRE SAFETY SYSTEMS

308.1 Requirements for Applications

Applications for building permits for buildings intended for public use must demonstrate through the information provided in the application, and included on the appropriate drawings in the submitted plans, elevations and sections, that the design and construction of the building or buildings being the subject of the application conforms in principle to the National Fire Protection Association Life Safety Code, 1981, NFIPA 101, and Amendments.

Revision Date: 31 Dec 2002

308.2 Fire Suppression Systems

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 Board they shall be maintained to the satisfaction of the Board. See Appendix J for recommendations on suitable suppression systems for building occupancies.

308.3 Special Provisions

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

308.4 General Requirements for Sprinkler 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 NFPA Standards 13, 13A, 13D, 13R and 14 as may be appropriate for the class of building and availability of water supply.

308.5 Approval of installation

The installation of any required sprinkler system shall be approved by the Fire Authority and Water Supply Authority in writing on completion. A Certificate of Occupancy shall not be issued by the Board until a copy of such approval has been provided.

308.6 Requirements for Buildings

- (a) All buildings other than private residences or apartment houses referred to in Group E(a) Residential Buildings, should be provided with approved fire appliances in accordance with the requirements of this Code. The provision, and installation, of such appliances shall be as approved by the Board.
- (b) All buildings of more than 4 storeys and over 50 ft. (15 m) in height shall be provided with one or more wet rising mains, as the Board shall determine. Such mains shall be exclusively for fire fighting purposes.
- (c) These requirements shall, in particular, apply to any part of any building more than 10,000 sq.ft (900 m²) 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 ratings may be reduced by 1 hour in the area or portion of the buildings so protected, provided that such a building is not more than 50 ft. (15 m) or 4 storeys in height.
- (e) The installation of fire protection systems shall be carried out in accordance with relevant international Standards and Codes of Practice.

SECTION 4 – 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 AND CONSTRUCTION METHODS

402.1 Approval for Use

The requirements of this Code are not intended to exclude the use of any material or method of construction not specifically described or recognised herein. Any such material or method shall be approved if—

- (a) 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
- (b) if special knowledge or experience is required in its use it will only be used by an approved specialist.

402.2 Form of Application

Any person desiring to use a material or construction method not recognised in this Code shall make application to the Authority for permission to use such material or method. The application shall be adequately supported by evidence that the material or method is at least equal to the standards required by this Code and the Board 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.

Revision Date: 31 Dec 2002

402.4 **Re-use of Used Material**

The reuse of used material shall be permitted provided that it can be clearly shown to the satisfaction of the Board 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.

403 **STANDARDS AND CODES OF PRACTICE**

Materials and construction methods shall be in accordance with the requirements of this Code and shall at least be equal to the applicable Standards and Codes of Practice listed in Appendices A and B or to any other Standard or Code approved by the Board.

404 **FIRE RESISTANCE RATINGS FOR MATERIALS**

404.1 **Scope**

This Section provides information on the fire resistance of materials and construction assemblies for use with the Use and Occupancy Tables in Section 3 in order to determine the appropriate type of structure and the appropriate materials of construction.

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 the 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 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) Tables 4-1 to 4-3 give fire ratings of various materials and assemblies commonly used in construction in the Eastern Caribbean. 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.

- (b) Where required by Table 3–2 for fire protection of openings, fire-resistive assemblies shall comply with the standards set out in the relevant ASTM or BSI standard for fire tests of building materials.
- (c) All fire assemblies required to have fire-protection rating of 1/2 hr 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 materials or an assembly of component materials which meet the test requirements of ASTM or BSI, and the fire resistance ratings required by this Code.
- (b) A 3/4 hr labelled fire assembly door may be used where a 1 hr rating is required provided the door is tested, together with the frame and type of hardware, for a period of 3/4 hr in accordance with the relevant standard specified in 404.2 (a).
- (d) Doors from patient rooms of Group B(a) Occupancy, shall have a minimum 1 hr 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 hr.

405.3 **Hardware and Frames**

- (a) Every fire assembly required to have a 1/2 hr, 3/4 hr, 1 hr, 1–1/2 hr, or 3 hr fire protection rating shall be automatic or self-closing type.
- (b) Exit doors shall have closing devices as required by 601.7.
- (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 3 ft. (900 mm) above the opening.
- (e) Devices detecting products of combustion shall meet the approval of the Board as to installation and location, and shall be subject to such periodic tests as may be required by the Board. The tests must be carried out by an experienced testing laboratory approved by the Board.

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" (6 mm) thick wired glass labelled for fire protection purposes.

Revision Date: 31 Dec 2002

- (ii) The panel shall be not more than 100 sq.in (0.06 m²) without either dimension exceeding 12" (300 mm).
- (iii) The builder shall provide the Board 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 hr fire-resistance rating intended for use in fire separation walls, provided that the glass panels are not greater than 100 sq.in (0.06 m²) in area.
- (c) The area of glazed openings in a fire door required to have 1-1/2 hr or 1 hr fire-resistive ratings shall be limited to 100 sq.in (0.06 m²) with a minimum dimension of 4" (100 mm).
- (d) Where both leaves of a pair of doors have vision panels, the total area of the glazed openings shall not exceed 100 sq.in (0.06 m²) for each leaf.

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 hr 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 ft (3 m).
- (d) Maximum width of hollow-metal-frame window shall be 6 ft. (1.8 m) 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 an area not exceeding 84 sq.ft (8 m²) with neither width nor height exceeding 12'-0" (3.6 m), except that when used with unprotected steel mullions, the width shall not exceed 7'-0" (2.1 m).
- (f) Solid-section mullions, where used in lengths exceeding 12 ft. (3.6 m), 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 in Table 3-2.

406.2 Vertical Separation

Except in 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. (900 mm) 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 1'-8" (500 mm) 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" (900 mm) above the lower roof, if any part of the lower roof within 20 ft. (6 m) from the wall does not have a fire resistance rating of at least 2 hrs.

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 sq.ft (10 m²) 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 sq.ft (300 m²).
- (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 Non-combustible Insulating Materials

Structural part to be protected	4 Hr	3 Hr	2 Hr	1 Hr
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Revision Date: 31 Dec 2002

A Steel Columns and all Members of Primary Trusses				
Grade A concrete, members 6" x 6" (150 x 150 mm) or greater (not including sandstone, granite, and siliceous gravel).	2-1/2" 65 mm	2" 50 mm	1-1/2" 38 mm	1" 25 mm
Grade A concrete, members 8" x 8" (200 x 200 mm) or greater, (not including sandstone, granite, and siliceous gravel).	2" 50 mm	2-1/2" 65 mm	1" 25 mm	1" 25 mm
Grade A concrete, members 12" x 12" (300 x 300 mm) or greater (not including sandstone, granite and siliceous gravel).	1-1/2" 38 mm	1" 25 mm	1" 25 mm	1" 25 mm
Grade B concrete and Grade A concrete excluded above. Members 8" x 8" (200 x 200 mm) or greater.	2-1/2" 65 mm	2" 50 mm	1" 25 mm	1" 25 mm
Grade B concrete and Grade A concrete excluded above. Members 12" x 12" (300 x 300 mm) or greater.	2" 50 mm	1" 25 mm	1" 25 mm	1" 25 mm
Portland cement plaster over metal lath wired to 3/4" (18 mm) cold-rolled vertical channels with No. 18 gauge wire ties spaced 3" to 6" (75 to 150 mm) on centre. Plaster mixed 1:2-1/2 by volume, cement to sand.	-	-	2-1/2" 65 mm	7/8" 22 mm
Multiple layers of 1/2" (12 mm) gypsum wallboard adhesively secured to column flanges.	-	-	2" 50 mm	1" 25 mm
B Wide flanges of steel beams and girders				
Grade A concrete (not including sandstone, granite and siliceous gravel) with 3" (75 mm) or finer metal mesh placed 1" (25 mm) from the finished surface anchored to the top flange with not less than .025 sq.in/ft. of steel (50 mm ² /m) in each direction.	2" 50 mm	1-1/2" 38 mm	1" 25 mm	1" 25 mm
Grade B concrete and Grade A concrete excluded above with 3" (75 mm) or finer metal mesh placed 1" (25 mm) from the finished surface anchored to the top flange with not less than .025 sq.in/ft. of steel (50 mm ² /m) in each direction.	2-1/2" 65 mm	2" 50 mm	1-1/2" 38 mm	1" 25 mm
Portland cement plaster on metal lath attached to 3/4" (18 mm) cold rolled channels with No. 18 gauge wire ties spaced 3" to 6" (75 to 150 mm) on centre Plaster mixed 1:2-1/2 by	-	-	2-1/2" 65 mm	7/8" 22 mm

Revision Date: 31 Dec 2002

volume, cement to sand.				
C Bonded Tendons in pre-stressed concrete				
Grade A Concrete: Beams or girders	4" 100 mm	3" 75 mm	2-1/2" 65 mm	1-1/2" 38 mm
Grade A Concrete: Solid slabs	—	2" 50 mm	1-1/2" 38 mm	1" 50 mm
D Reinforcing steel in reinforced columns, beams, girders and trusses				
Grade A concrete, members 12" (300 mm) or larger, square or round (Size limit does not apply to beams and girders monolithic with floors)	1-1/2" 38 mm	1-1/2" 38 mm	1-1/2" 38 mm	1-1/2" 38 mm
Grade B concrete, members 12" (300 mm) or larger, square or round (Size limit does not apply to beams and girders monolithic with floors)	2" 50 mm	1-1/2" 38 mm	1-1/2" 38 mm	1-1/2" 38 mm
E Reinforcing steel in reinforced concrete joists				
Grade A concrete	1-1/4" 32 mm	1-1/4" 32 mm	1" 25 mm	3/4" 19 mm
Grade B concrete	1-1/4" 32 mm	1-1/4" 32 mm	1" 25 mm	3/4" 19 mm
F Reinforcing steel and tie rods in floor and roof slabs				
Grade A concrete	1" 25 mm	1" 25 mm	3/4" 19 mm	3/4" 19 mm
Grade B concrete	1-1/4" 32 mm	1" 25 mm	1" 25 mm	3/4" 19 mm

- Notes**
- 1 Re-entrant parts of protected members to be filled solidly.
 - 2 An approved adhesive qualified under the standards for fire resistive materials
 - 3 Cover for end anchorages shall be twice that shown for the respective ratings. Where lightweight Grade A concrete aggregates producing structural concrete having an overdried weight of 110 lb/cu.ft (1762 kg/m³) or less are used, the tabulated minimum cover may be reduced 25%.
 - 4 For Grade B concrete increase tendon cover 20%.
 - 5 Adequate provisions against spalling shall be provided by U-shaped or hooped

Revision Date: 31 Dec 2002

- stirrups spaced not to exceed the depth of the member with a clear cover of 1" (25 mm).
- 6 Prestressed slabs have a thickness not less than required in Table 4-3 for the respective fire-resistive time period
 - 7 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

A Concrete Masonry Units	4 Hr	3 Hr	2 Hr	1 Hr
Expanded slag or pumice	4-3/4" 120 mm	4" 100 mm	3-1/4" 85 mm	2-1/8" 53 mm
Expanded clay or shale	5-3/4" 146 mm	4-7/8" 122 mm	3-7/8" 98 mm	2-5/8" 67 mm
Limestone	6" 150 mm	5" 125 mm	4" 100 mm	2-3/4" 70 mm
Calcareous gravel	6-1/4" 158 mm	5-3/8" 136 mm	4-1/4" 108 mm	2-7/8" 73 mm
B Solid Concrete				
Horizontal reinforcement not less than 0.25% and vertical reinforcement not less than 0.15%. (3/4 as much for welded wire fabric).				
Grade A Concrete	6-1/2" 165 mm	6" 150 mm	5" 125 mm	3-1/2" 88 mm
Grade B Concrete	7-1/2" 190 mm	6-1/2" 165 mm	5-1/2" 140 mm	4" 100 mm
C Non-combustible Studs Interior Partition with Plaster Each Side				
3-1/4" (80 mm) x No. 18 gauge (1.2 mm) steel studs spaced 24" (600 mm) on centre, 5/8" (16 mm) gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	-	-	-	4-3/4" 120 mm
3-5/8" (90 mm) No. 16 gauge (1.6 mm) approved nailable studs spaced 24" (600 mm) on centre, 5/8" (16 mm) neat gypsum wood fibred plaster each side over 3/8" (10 mm) rib metal lath nailed to studs 8" (200 mm) on centre. Nails driven 1-1/4" (30 mm) and bent over.	-	-	5-5/8" 143 mm	-

Revision Date: 31 Dec 2002

<p>2-1/2" (65 mm) steel studs 16" (400 mm) on centre formed with No. 16 gauge wire diagonals. 3/8" (10 mm) perforated gypsum lath attached to the studs each side with No. 12 gauge wire clips at horizontal and vertical joints. 1/2" (12 mm) gypsum plaster applied each side mixed 1:2 by weight, gypsum to sand aggregate.</p>				<p>4-1/4" 108 mm</p>
<p>2-1/2" (65 mm) steel studs 16" (400 mm) on centre formed with No. 16 gauge (1.6 mm) angle flanges and No. 7 gauge wire diagonals. 3/8" (10 mm) 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" (18 mm) perlite or vermiculite gypsum plaster applied each side.</p>			<p>4-3/4" 121 mm</p>	
<p>D Incombustible Studs, Interior Partition with Gypsum Wallboard Each Side</p>				
<p>No.25 gauge channel-shaped studs 16" (400 mm) on centre with one hull-length layer of 5/8" (16 mm) Type "X" gypsum wallboard applied vertically attached with 1" (25 mm) long No. 6 drywall screws to each side.</p>	<p>4-7/8" 124 mm</p>			
<p>E Wood studs-Interior Partition with Gypsum Wallboard Each Side</p>				
<p>2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with two layers 3/8" (10 mm) regular gypsum wallboard each side. First layers applied full length vertically, second layer applied horizontally or vertically</p>				<p>5-1/8" 130 mm</p>
<p>2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with space between filled with mineral wool batts nailed to studs and full-length 1/2" (12 mm) regular gypsum wallboard applied vertically.</p>				<p>5-5/8" 143 mm</p>
<p>2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with two layers 1/2" (12 mm) regular gypsum wallboard applied vertically or horizontally each side, joints staggered. Nail base layer with 5 cooler nails at 8" (200 mm) on centre, face layer with 8 cooler nails at 8" (200 mm) on centre.</p>				<p>5-5/8" 143 mm</p>
<p>2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with 5/8" (16 mm) Type "X" gypsum wallboard applied vertically or horizontal nailed with 6" (150 mm) nails 7" (175 mm) on centre with end joints on nailing members.</p>				<p>4-7/8" 124 mm</p>

Revision Date: 31 Dec 2002

2" x 4" (50 x 100 mm) fire-retardant treated wood studs spaced 16" (400 mm) on centre with one layer of 5/8" (16 mm) thick Type "X" gypsum wallboard applied with face paper grain (long dimension) parallel to studs.			4-7/8" 124 mm	
F Exterior or Interior Walls				
2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with two layers 5/8" (16 mm) Type "X" gypsum wallboard each side. Base layers applied vertically or horizontally and nailed 7" (175 mm) on centre. Face layers applied with coating of approved wallboard adhesive and nailed 12" (300 mm) on centre.			6-1/8" 155 mm	
3/4" (18 mm) drop siding or 3/8" (10 mm) exterior type plywood over 1/2" (12 mm) gypsum sheathing on 2" x 4" (50 x 100 mm) wood studs at 16" (400 mm) on centre, or exterior surface with interior surface treatment as required for 1-hr rated extension, or interior 2" x 4" (50 x 100 mm) wood stud partitions.				Varies
2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with 1/2" (12 mm) metal lath and 3/4" (18 mm) exterior cement plaster on each side.				5" 125 mm
2" x 4" (50 x 100 mm) wood studs 16" (400 mm) on centre with 7/8" (22 mm) 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" (90 mm) No. 16 gauge non-combustible studs 16" (400 mm) on centre with 7/8" (22 mm) exterior cement plaster (measured from the face of the studs) on the exterior surface with interior, non-bearing, non-combustible 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

Construction and Minimum Thickness of Floor/Ceiling (ins)	4 Hr	3 Hr	2 Hr	1 Hr
Concrete-(Excluding Expanded Clay Shale or Slag)				
No ceiling required	6-1/2" 165 mm	5-1/2" 140 mm	4-1/2" 112 mm	3-1/2" 88 mm

Revision Date: 31 Dec 2002

Reinforced Concrete Joists				
No ceiling required				
Slab with suspended ceiling of gypsum plaster over metal lath attached to 3/4" (18 mm) cold-rolled channels spaced 12" (300 mm) on centre. Ceiling located 6" (150 mm) minimum below joists.	3" 75 mm	2" 50 mm	–	–
Steel Joist Construction with a Reinforced Concrete Slab on Top Poured on a Metal Lath Form				
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" 56 mm	2" 50 mm	–	–
Minimum Thickness of Ceiling				
Ceiling of 5/8" (16 mm) Type "X" wallboard attached to 7/8" (22 mm) deep by 2-5/8" (65 mm) x No. 25 gauge furring channels 12" (300 mm) on centre.	–	–	5/8" 16 mm	5/8" 16 mm
Plywood Stressed Skin Panels				
1/2" (12 mm) thick wood fibreboard weighing 15 to 18 lb./cu.ft. installed with long dimension parallel to stringers. Second layer of 5/8" (16 mm) Type "X" gypsum wallboard applied with long dimension perpendicular to joints.	–	–	–	–
Minimum thickness of ceiling	–	–	–	3/4" 19 mm
Wood Trusses at Max. 24" (600 mm) centres, sheathed with a min. 1/2" (12 mm) plywood and covered with approved roofing materials				
1" x 3" (25 x 75 mm) furring 16" (400 mm) o.c. flat expanded metal lath (3.4 lb./sq.yd.) and 3/4" (18 mm) sanded vermiculite or perlite gypsum plaster.	–	–	–	–
Minimum thickness of ceiling	–	–	–	3/4" 19 mm

SECTION 5 – PUBLIC HEALTH AND SAFETY

501 GENERAL REQUIREMENTS

Any building intended for human use or occupancy shall, having regard to its use or intended use, be provided with:

Revision Date: 31 Dec 2002

- (a) Adequate light and ventilation.
- (b) A sufficient supply of suitable water.
- (c) 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.
- (d) Adequate arrangements for the sanitary storage of solid waste (refuse and garbage).
- (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 handicapped persons see Appendix F).

502 BUILDING SITES

502.1 Site Conditions

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 Board.
- (b) Cannot be put into such a condition as to prevent any harmful effect to the building or to its occupants by earth slide, storm or flood waters.
- (c) Has an average site elevation of less than 4'-0" (1.2 m) above mean sea level.

502.2 Stormwater Drainage

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.

502.3 Roof Drainage

Roof drainage and the disposal of rainwater shall be designed and constructed to prevent entry of water to the building. 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 appropriate Standards.

503 LIGHT AND VENTILATION

503.1 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" (1.2 m) high.
- (c) Any open kitchen recess shall have a minimum floor area of 30 sq.ft (3 m²).
- (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 m²).
- (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 accordance with the following:
 - (i) If shared by 2 apartments only, the area of the facility shall be not less than 100 sq.ft (10 m²) in area.
 - (ii) If shared by more than 2 apartments the area of the facility shall not be less than 65 sq.ft (6 m²) 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 m), except that the minimum clear height under a gallery or balcony or mezzanine of less than 500 sq.ft (46 m²) may be reduced to 8 ft. (2.4 m) provided that the space under the gallery or mezzanine is not separately enclosed.
- (h) Where ceiling fans are being erected, the minimum height from the floor to the ceiling should not be less than 9'-0" (2.7 m).

Table 5-1 Minimum Areas and Dimensions of Habitable Rooms

Description of Room	Area		Min. or Width Length		Min. Height	
	Min. sq.ft	Area m ²	Min. or	Width Length	Min.	Height
Living Room	120	11	10'-0"	3.0 m	8'-6"	2.4 m
Bedrooms	90	8	8'-0"	2.4 m	8'-6"	2.4 m
Dining room	80	7.5	8'-0"	2.4 m	8'-6"	2.4 m
Kitchen	40	3.75	5'-0"	1.5 m	8'-6"	2.4 m
Living/dining/bedroom	200	18	10'-0"	3.0 m	8'-6"	2.4 m
Living/dining/kitchen	180	16.75	10'-0"	3.0 m	8'-6"	2.4 m
Living/bedroom	180	16.75	10'-0"	3.0 m	8'-6"	2.4 m
Living/dining room	160	15	10'-0"	3.0 m	8'-6"	2.4 m

Revision Date: 31 Dec 2002

Dining room/Kitchen	100	9	8'-0"	2.4 m	8'-6"	2.4 m
Any other habitable room	80	7.5	7'-0"	2.1	8'-6"	2.4 m
Lavatory (W.C. bath & basin)	36	3	4'-6"	1.35 m	8'-6"	2.3 m
Lavatory (W.C. & shower & basin)	30	2.75	4'-0"	1.2 m	8'-6"	2.3 m
Lavatory (bath & basin)	25	2.5	3'-4"	1.0 m	8'-6"	2.3 m
Lavatory (W.C. & shower)	20	2	2'-8"	800 mm	8'-6"	2.3 m
Lavatory (Shower & basin)	20	2	2'-8"	800 mm	8'-6"	2.3 m
Lavatory (W.C. & basin)	20	2	2'-6"	750 mm	8'-6"	2.3 m
W.C. compartment	12.5	1.2	2'-8"	800 mm	8'-6"	2.3 m
Shower compartment	7.5	0.7	2'-6"	750 mm	8'-6"	2.3 m

503.2 Windows

- (a) A habitable room shall be provided with one or more windows or skylights, having an area or combined area of not less than 10% of the floor area of the room. Not less than 50% of the total area of such windows or skylights shall open to permit the free unobstructed passage of fresh air.
- (b) In the case of buildings provided with full mechanical ventilation systems, the area of opening window or skylight may be reduced to not less than 1/3 of total window or skylight area, at the discretion of the Board.
- (c) Usable rooms and spaces in buildings without natural light and ventilation shall have artificial lighting and mechanical ventilation systems or air conditioning in accordance with the design and installation requirements of Section 11 of this Code.
- (d) Windows used for the provision of natural light or ventilation 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. Windows within toilet facilities shall normally be located 4'-0" (1.2 m) minimum above floor level. The minimum height from the floor to the window head shall be 6'-7" (2 m).

503.3 Skylights

Skylights used for the 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 1.0 sq.in (625 mm²).

503.4 Enclosed Courts

Any court enclosed on 3 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 m²) for

each 10'-0" (3 m) of its height, and a width of not less than 10'-0" (3 m) nor less than 5'-0" (1.5 m) for each 10'-0" (3 m) of its height.

503.5 **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 rear court of the full length of such boundary and of a width not less than 10'-0" (3 m) nor less than 2'-6" (750 mm) for each 10'-0" (3 m) length of building on the line of such court.

504 **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 Ministry of Health for minimum requirements with respect to the type of surfaces of walls, floors and ceiling and vermin screening necessary.

505 **SANITATION**

- (a) In a public building, toilet facilities shall be provided on each floor, or on a mezzanine between floors, for each sex, except that in a building of 2 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, consumption, preparation or storage of food.
- (d) The floor and walls of public toilet facilities shall be of tile or other smooth, cleanable, impervious materials to a height of 5 ft. (1.5 m).
- (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 5 ft. (1.5 m) above the compartment floor.
- (f) Sanitary fixtures required for various occupancies are specified in 904.12.

506 **STORAGE OF HAZARDOUS MATERIAL**

- (a) Buildings constructed for the storage and use of hazardous material (Appendix D) must be sited and constructed as directed by the Board.
- (b) In addition to the requirements of this Code, the Board may impose special safety requirements in relation to the following:
 - Explosion hazards
 - Volatile flammables

Revision Date: 31 Dec 2002

- 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
- Public garages
- Motor fuel service stations and vehicle repair shops
- Theatres and other places of public assembly

507 **SOLID WASTE DISPOSAL**

507.1 **Scope**

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

507.2 **Collection System**

The developer is responsible for providing an adequate system for the collection 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.

507.3 **Storage**

Adequate facilities must be established to the satisfaction of the Board for the storage of garbage on site prior to collection. Refrigerated storage should be provided where there are large quantities of semi-liquid waste.

The storage of all waste, including refrigerated waste must be carried out to the approval of the Ministry of Health.

507.4 **Disposal**

- (a) Garbage and solid wastes must be disposed of at locations specified or approved by the Ministry of Health.
- (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 flies and vermin. The dump should not present an unsightly appearance.

SECTION 6 – MEANS OF EGRESS

601 MEANS OF ESCAPE AND EXITS

601.1 Basis of Requirement

All new buildings, also existing buildings for which a Certificate of 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 Board shall have power to approve alternative proposals for providing adequate means of escape and/or exits.

601.2 Definitions

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

- (a) **Means of escape** – includes 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** – includes 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** – part of a means of egress, including:
 - (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 door** – A 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** – 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.

Revision Date: 31 Dec 2002

601.3 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.

601.4 Number of Means of Escape and Exits

Table 6–1 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 2 external doors.
- (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 (90 m²) with an occupancy content of more than 5 persons shall have at least 2 means of escape or exits.
- (e) 2 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 2 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 1 or 2 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 4 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.

Revision Date: 31 Dec 2002

- (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 6-1 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

601.5 Maximum Distance of Travel to Exits

Table 6-2 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 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 m) from an exit or from a means of escape leading to at least 2 exits.

Table 6-2 Maximum Permitted Distance of Travel to and from Exit

(Without fire suppression system)

Building Occupancy Group	Type 1 Fire Resistant	Type 2 Semi-fire Resistant	Type 3 Ordinary Masonry	Type 4 Non-Combustible	Type 5 Wood Frame
Groups A, C, D, E(a), E(c)	150 ft. 45 m	150 ft. 45 m	100 ft. 30 m	75 ft. 22 m	75 ft. 22 m
Groups B, E(b)	100 ft. 30 m	100 ft. 30 m	75 ft. 22 m	N/A	N/A
Group E (except E(b))	75 ft. 22 m	75 ft. 22 m	50 ft. 15 m	50 ft. 15 m	N/A
Group F	300 ft 90 m	300 ft. 90 m	N/A	N/A	N/A

*With fire suppression system

Revision Date: 31 Dec 2002

601.6 Widths of Means of Escape and Exits

Tables 6–3 and 6–4 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.

Table 6–3 Exit Capacity: Number of Persons per Unit of Exit Width
(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 – Offices, Administrative and Retail service Buildings	100	60
Group E – Residential Buildings	100	75
*Group F – Hazardous Occupancy	100	60

Note* With fire suppression system

Unit of Exit Width = 22 in. (550 mm).

Table 6–4 Minimum Required Widths of Means of Escape and Exit Doors

Capacity in Number of Persons	Corridors, Halls and Foyers	Staircases and ramps clear between handrails	Exit doors and fire check doors between jambs
1 – 10	3'–4" (1 m)	3'–0" (900 mm)	2'–8" (800 mm)
11 – 200	4'–0" (1.2 m)	4'–0" (1.2 m)	3'–8" (1.1 m)
201 – 500	6'–0" (1.8 m)	6'–0" (1.8 m)	5'–8" (1.7 m)
501 or more	8'–0" (2.4 m)	8'–0" (2.4 m)	7'–8" (2.3 m)

601.7 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° 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° 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° swing unobstructed by cross traffic routes and fitted with glazed observation panels. They may also open in reverse to a full 180° 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. (See 405.4).

601.8 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 construction 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.

601.9 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 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 28'-0" (8.4 m) between two aisles or 14'-0" (4.2 m) when served by only one aisle.
- (c) The spacing of seats shall not be less than 2'-3" (675 mm) back to back nor less than 1'-0" (300 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 1'-6" (450 mm) horizontal projection between the rows of seats, and doorways leading directly to exit corridors are provided along each

Revision Date: 31 Dec 2002

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" (750 mm) wide.
- (g) Aisle serving more than 50 seats shall be not less than 3'-0" (900 mm) wide when serving seats on one side only, and not less than 3'-6" (1050 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" (1.2 m) 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 602.

602 STAIRCASES AND RAMPS

602.1 Definitions

- (a) **Private stairway** – A stairway of steps intended to be used by only one dwelling.
- (b) **Common stairway** – A stairway of steps which is intended for common use.
- (c) **Width, of a stairway**—
 - (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** – A notional line drawn to connect all the nosings of the treads in a particular flight of stairs.
- (e) **Going, of a step** – The horizontal distance between the nosing of a tread and the nosing of the tread of the step or landing next above it.
- (f) **Parallel step** – A step of which the nosing is parallel to the nosing of the steps or landing above it.
- (g) **Tapered step** – A step, the nosing of which, is not parallel to the nosing of the step or landing next above it.

602.2 Basis of Requirements

Staircases and ramps shall be designed and constructed in accordance with the requirements of 602 and when used as a means of escape they shall also conform to the pertinent requirements of 601 of this Code.

602.3 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" (1950 mm) measured vertically above the pitch line,
 - (ii) clearance of not less than 5'-0" (1500 mm) measured at right angles to the pitch line,
- (c) The dimensions of the treads and risers conform to Table 6-5.
- (d) The pitch of the stairway is not more than 42°.
- (e) Tapered steps must conform with the requirements of 602.7.

602.4 Common Stairways

A common stairway shall be so constructed that:

- (a) It complies with Table 6-5 for the relevant category of use.
- (b) The pitch of the stairway is not more than 38°.
- (c) The stairway has not more than 16 risers in any flight.
- (d) Tapered steps must conform with the requirements of 602.7.
- (e) The sum of the going plus twice the rise should not be less than 24" nor more than 26" (650 mm).

Table 6-5 Tread and Riser Sizes/Dimensions

Occupancy Group	Maximum for Risers	Minimum for Treads excluding nosings
All occupancies	7-1/2" 190 mm	10" 255 mm

602.5 Open Riser Stairways

Stairways which have no risers below the treads and landings shall conform in all respects with the requirements of 602.3 and 602.4 as appropriate.

Revision Date: 31 Dec 2002

602.6 Nosings

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).

602.7 Tapered Steps

In the application of requirements 602.3, 602.4 and 602.5 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" (265 mm) from the extremities of the width of such steps.

602.8 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" (840 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 extending to a height above the floor of such landing or space—
 - (i) in the case of private stairways – 3'–0" (900 mm), and
 - (ii) in the case of common stairways – 3'–6" (1050 mm).
- (c) Any flight of steps with an aggregate rise of more than 2'–0" (600 mm) shall have a continuous handrail fixed securely at a height of not less than 2'–9" (840 mm) nor more than 3'–0" (900 mm) measured vertically above the pitch line, one on each side if the stairway is more than 3'–6" (1050 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" (450 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" (150 mm) diameter sphere, except for industrial buildings where the intermediate rails or latticework should prohibit the passage of a 12" (300 mm) sphere.

602.9 Guarding of Balconies and External Areas

- (a) Any balcony, platform, roof or other external area which is 2'–0" or more above ground and to which a person has access other than for maintenance and repair shall have a suitable balustrade, parapet or railing not less than 3'–6" (1050 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" (900 mm) high.

602.10 Ramps

No ramp shall be steeper than 1:10 nor more than 3'-4" (1.0 m) 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" (1950 mm) measured at right angles to the slope of the ramp.

602.11 Landings

Landings shall be at least as deep as the widest stairway 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. (900 mm) deep.

603 ACCESS FOR PEOPLE WITH DISABILITIES

The design of access ways and means of egress in buildings required to be accessible by people with disabilities shall comply with Appendix F of this Code.

604 EMERGENCY LIGHTING

604.1 Requirements for Emergency Lighting

Emergency lighting to assist egress shall be provided in—

- (a) all fire-isolated exit ways, smoke-proof lobbies and all exit ways from any storey required to have emergency lighting;
- (b) all basement storeys and all windowless storeys regardless of Occupancy Group; and
- (c) occupancy areas listed in Table 604.1 as follows:

Table 604.1

REQUIREMENTS FOR EMERGENCY LIGHTING

Occupancy Group	Areas Required to have Emergency Lighting
A Assembly Theatres, schools, restaurants with 50 or more patrons	all interior public areas and exit ways. [Concessions for Theatres, Public Halls, Churches and Schools are given in 604.3.]
B Institutional Hospitals, prisons	in every storey.
C Commercial Warehouses, factories	(a) in every storey with floor area more than 3,225 sq.ft (300 m ²); and (b) any storey above ground floor.
D Office Administrative and retail services, including banks, restaurants seating fewer than 50 patrons, shops, stores	(a) in every storey with floor area more than 3,225 sq.ft (300 m ²); and (b) any storey above ground floor.

Revision Date: 31 Dec 2002

E Residential		
E(a)	Houses	no requirement.
E(b)	Hotels	interior exit ways of buildings with more than 12 bedrooms.
E(c)	Apartments	interior exit ways of buildings with more than 12 dwelling units.
F Hazardous		(a) in every storey with floor area more than 540 sq.ft (50 m ²); and
		(b) any storey above ground floor.

604.2 Level of Illumination

Emergency lighting shall—

- (a) be supplied from batteries or other independent emergency power source, and ensure continued illumination in case of emergency or loss of primary power for a duration of 1 hour;
- (b) be located within occupancies and exit ways as necessary to light egress paths, and exit signs if they are not internally illuminated; and
- (c) achieve an intensity on the centre line of exit way routes of not less than 0.2 lux, and this level of lighting shall be provided immediately, or at most within 5 seconds of failure of the normal lighting.

604.3 Theatres, churches and schools

Emergency lighting—

- (a) in places of assembly such as theatres for motion picture projection or performing arts, where 0.2 lux illumination of emergency lighting is likely to affect such activities, may be reduced to a maintained level of 0.02 lux provided that in the event of failure of the normal lighting, the level of emergency lighting is immediately and automatically restored to a minimum of 0.2 lux;
- (b) in churches, public halls and schools, may be omitted if the public or occupancy area of each room or space is not more than 540 s.ft (50 m²) opens directly to the outside.

605 EXIT SIGNS

605.1 Buildings required to have exit signs

All required means of egress shall be indicated with internally illuminated exit signs, and at each change in direction in corridors and passageways, a directional sign indicating the direction and way of egress, in—

- (a) all buildings required to have emergency lighting under 604.1, in which case the exit signs shall be either internally illuminated or externally illuminated by an emergency light fixture; and

- (b) all buildings with an occupancy load of more than 50 persons.

605.2 **Location of exit signs**

Exit signs shall be located—

- (a) adjacent to fire-isolated stairway and external stairway access doorways;
- (b) except in buildings of Occupancy Group R-Residential, adjacent to doorways opening from assembly rooms and tenancies or occupancies to public corridors or smoke-proof lobbies; and
- (c) adjacent to exit doors opening from occupancies or exit ways to the outside.

605.3 **Design of exit signs**

Exit signs shall be clearly visible by any occupant seeking egress, with green lettering at least 6" (150 mm) high and 3/4" (20 mm) thickness on a white background, on materials such that the letters are clearly discernible without internal illumination or when it is not energised.

SECTION 7 – WATER SUPPLY SERVICES

701 **INTRODUCTION**

This Section sets out the regulations established for the guidance of persons who are submitting development proposals to the Board and outlines the requirements for the provisions of water supply services for these developments.

701.1 **Responsibility**

Developers shall be fully responsible for the design and construction of water supply and sewerage systems for their developments and shall satisfy the Board that there is adequate provision for the operation and maintenance of such systems, including the provision of an adequate and potable water supply to the development, source of water, treatment facilities, pipeline system and storage facilities, all in accordance with the requirements of the Water Supply Authority and the Health Department.

701.2 **Connection to public supply**

In areas where there is a public water supply adjacent to or in close proximity to the development, the Developer will carry out such work as may be required by the Board and Water Supply Authority for connection to the development.

702 **ADEQUACY OF WATER SUPPLY**

702.1 **General**

- (a) The Developer is to include in his or her proposal complete arrangements for providing an adequate quantity and quality of water to meet fully the needs

Revision Date: 31 Dec 2002

of the development, including the per capita consumption rate assumed for design purposes.

- (b) Suggested minimum daily potable water consumption rates are as follows:

Dwelling house	40 gallons (150 litres) per person per day
Hotels	150 gallons (567 litres) per room
Offices	8 gallons (30 litres) per employee per day

The Board, in consultation with the Water Supply Authority and the Health Department, may permit small dwellings and other buildings in Group E which are wholly dependent on rain water catchment to install facilities which would provide an average less than the 40 gallons (150 litres) per day recommended.

702.2 Source of supply

The source of supply must be established with the approval of the Board as follows:

- (a) Unless otherwise approved by the Board every building not connected to the public water supply service shall be provided with a water supply system using fresh water derived from its roof catchment and stored in a cistern.

Note The construction of cisterns to store water collected from the roof is encouraged in all cases irrespective of connection to the public mains supply.

- (b) Unless otherwise approved by the Board rainwater cisterns for buildings in Groups B and E shall have a minimum capacity based on 10 gallons of storage per sq.ft (400 litres per sq.m) of roof catchment area. The Board may reduce the required capacity where appropriate, such as for buildings of large roof area.
- (c) For multi-family dwellings the capacity of the tank must be based on 4,000 gallons (15,000 litres) per bedroom.
- (d) For buildings in Groups A, C and D where there is no public supply, or where a desalination water supply plant is not installed, the capacity of the rain water storage cistern must be based on a minimum daily usage of 7 gallons (26 litres) per employee per day plus 3 gallons (11 litres) per person using the facility on an average day. The Developer must show in the plans the size of storage to be constructed and the basis for the determination of the size of storage cistern.
- (e) Paragraphs (a), (b), (c) and (d) do not apply if:
- (i) the building is to be supplied with potable water by means of desalination; and
 - (ii) an adequate back-up system or 7 days storage is provided against the possible break down of the primary supply. The back up system is required to be in full working order at all

times. Any fault or breakdown in the primary system shall be repaired without delay.

- (f) Abstraction from a ground water source by drilling, pumping or via a private borehole is generally prohibited.
- (g) Desalination plants must be designed and constructed with the approval of the Board. Full details of the proposed plant including location of the source of raw water, analysis of the raw water, capacity of the plant, main features of the treatment process, method of disposing of the effluent and future arrangements for operation and maintenance must accompany the proposal.
- (h) There shall be no cross-connection between a potable supply and a non-potable supply.
- (i) Sea water can be used for flushing of toilets and other such uses, but the water system carrying sea water must be kept separate from the system carrying potable water.

702.3 **Treatment Facilities**

- (a) The water supply must be treated as necessary and disinfected by chlorination or other approved process to ensure that the quality satisfies the Guidelines for Drinking Water Quality as published by the World Health Organisation, or other acceptable standard guidelines that are approved in writing by the Health Department.
- (b) The treatment facilities shall be designed and constructed to the satisfaction of the Board.

702.4 **Storage Facilities**

Unless exempted by the Board, buildings in Occupancy Groups A and B not connected to the public water service should be provided with at least 3 days storage of treated water for each building. This is in addition to any storage provided at the source of a common water supply for collection of rain water or desalination water.

703 **INSTALLATION OF WATER SUPPLIES**

703.1 **General**

As far as possible all pipelines should be laid underground and in a manner as not to interfere with future development and other services.

703.2 **Water Pressure**

If the water pressure from the water supply source is insufficient to supply all fixtures continuously, the supply shall be supplemented by a gravity tank or a surge tank linked to an auxiliary pumping system.

Revision Date: 31 Dec 2002

703.3 Gravity and Surge Tanks

- (a) Gravity and surge tanks shall be equipped with over flow pipes not less than 4" (100 mm) below the supply point and not less than twice the diameter of the supply and discharging directly to outside the building line.
- (b) Supply pipes from storage tanks may not connect to any public water mains supply system.

703.4 Backflow

The water distribution system shall be fully protected against backflow either by use of air gap fittings or where it is not possible to provide an air gap, by non return valves or other means approved by the Board.

703.5 Stop Valves and Drain Taps

- (a) A screw stop valve shall be provided within 5'-0" (1.5 m) of the point of entry of the main supply pipe to the building and a drain tap shall be provided within 1'-0" (300 mm) of this valve on the distribution side. Such valve shall be plainly labelled.
- (b) Stop valves shall be provided on the supply within 1'-0" (300 mm) of the supply connection to all storage tanks and water heaters and on all branch distribution pipes from such storage tanks and water heaters and to isolate all sanitary fixtures in groups of not more than 5 fixtures.

703.6 Supply Pipes to Individual Fixtures

Table 7-1 shall determine the minimum size of water supply pipe to a sanitary fixture provided that no supply pipe shall be smaller than the connection to a fixture and this shall determine the minimum size of supply pipe to fixtures not listed in Table 7-1.

Table 7-1 Minimum Size of Water Supply Pipes to Individual Fixtures

Description	Size of Pipe	Description	Size of Pipe
Bath tub	1/2" 12 mm	Water closet (cistern operated)	3/8" 10 mm
Bidet	1/2" 12 mm	Laundry tub	1/2" 12 mm
Drinking fountain	3/8" 10 mm	Shower	1/2" 12 mm
Flushing sink (cistern operated)	1/2" 12 mm	Slop sink	1/2" 12 mm
Flushing sink (flush valve operated)	1" 25 mm	Urinal (cistern operated)	3/8" 10 mm
Hose connection (flush valve operated)	1/2" 12 mm	Urinal (flush valve operated)	1" 25 mm

Revision Date: 31 Dec 2002

Kitchen sink (domestic)	1/2" 12 mm	Water closet (flush valve operated)	1" 25 mm
Kitchen sink (commercial)	3/4" 19 mm	Water heater	1/2" 12 mm
Washing machine	1/2" 12 mm		

Table 7–2 Minimum Size of Water Supply Pipes to Individual Fixtures
(Imperial dimensions)

Description	Size of Pipe (in)	Description	Size of Pipe (in)
Bath tub	1/2	Water closet (cistern operated)	3/8
Bidet	1/2	Laundry tub	1/2
Drinking fountain	3/8	Shower	1/2
Flushing sink (cistern operated)	1/2	Slop sink	1/2
Flushing sink (flush valve operated)	1	Urinal (cistern operated)	3/8
Hose connection (flush valve operated)	1/2	Urinal (flush valve operated)	1
Kitchen sink (domestic)	1/2	Water closet (flush valve operated)	1
Kitchen sink (commercial)	3/4	Water heater	1/2
Washing machine	1/2		

703.7 Distribution Pipes

Table 7–2 establishes the maximum fixture unit load permitted for a given size of water distribution pipe and shall be used to determine the minimum sizes of water distribution pipe provided that:

- (a) Individual fixture unit ratings shall be taken from the Table.
- (b) Where the incoming central water supply pressure regularly falls below 50 lb./sq.in the next large size of pipe shall be used.
- (c) Where flush valve operated water closets are installed the minimum size of the main incoming supply shall be 1–1/2"
- (d) No section of distribution pipe shall be smaller than the largest branch pipe taken from it.
- (e) Not more than 3 fixtures shall be supplied by one 1/2" cold water pipe.
- (f) The trench should be excavated in straight lines between changes in direction and be carefully graded so that there is a minimum number

Revision Date: 31 Dec 2002

of high points along its length. Air valves are to be installed at high points in the line subject to prior approval of the location and size of the air valve in each case. Where the trench has been excavated too deep, it shall be filled to grade with thoroughly rammed approved granular material, subject to paragraph (c) below.

- (g) Subject to para. (e) below a 4" (100 mm) depth of the bottom of the trench should be of selected material having no particle larger than that indicated in Table 7-4 for pipelines of the material as shown in the Table.
- (h) In peaty or boggy ground the bottom of the trench should be excavated to an approved depth below grade and refilled with broken stone, and bedding as in Table 7-4 should be laid over the broken stone and thoroughly rammed to grade.
- (i) In rocky ground a 6" (150 mm) depth of the bottom of the trench should have no particle larger than stated in Table 7-4.

Table 7-3 Minimum Depth of Cover to the Crown of the Pipe

Pipe Diameter	Depth of Cover
Up to 6" (150 mm)	2'-6" (750 mm)
Over 6" (150 mm) up to 10" (250 mm)	2'-9" (840 mm)
Over 10" (250 mm) up to 20" (500 mm)	3'-0" (900 mm)

Table 7-4 Maximum Particle Size

Pipe material	Maximum particle size of selected material
Grey Cast Iron or Ductile Iron	1" (25 mm)
Steel or Copper	3/4" (18 mm)
PVC	1/4" (6 mm)

704.3 Pipe Laying

- (a) Pipes must be laid in straight lines between changes in direction. The entire length of the barrel of the pipe must be supported on the bottom of the trench. Care must be taken to ensure that the inner surface of each pipe is left clean after laying. When pipe laying is not in progress the ends of the pipeline should be plugged to prevent ingress of foreign matter.
- (b) Pipes laid under high ground water conditions must be plugged and backfilled between joints before testing so as to avoid floating of pipelines. The location of pipes must be marked.
- (c) Pipes laid under drains, water courses, channels, concrete slabs, culverts, or other conduits should be laid in a sleeve extending at least 2 ft. (600 mm) on each side of the conduit, beyond the side wall of the conduit or toe of

embankment supporting the conduit. The sleeve may be of steel or ductile iron pipe or other material approved by the Board and be surrounded in concrete if the cover to the pipe is less than 18" (450 mm) or provided with such other protection as maybe required by the Board.

704.4 **Jointing of the Pipe**

The Developer must conform to the manufacturers' instructions as regards the procedure for proper laying and jointing of the particular type of pipe and joint being used in the development. Other basic requirements for a satisfactory joint are:

- Cleanliness of all parts
- Correct location of components
- Centralisation of spigot and socket sleeve.
- True alignment in vertical and horizontal planes.

704.5 **Anchoring of Pipes**

- (a) Thrust blocks must be provided at tees, crosses, dead ends and at all bends (except concave vertical bends). In the case of bends, the blocks should be located symmetrically with the pipe fitting which should be symmetrical with the radial centre line. The thrust blocks should be constructed of 2,500 psi (10 MPa) concrete, reinforced if required, and must rest firmly on the solid ground.
- (b) The required area of bearing on the solid earth will vary with the type of soil, and the area of bearing on the pipe fitting must be sufficient to safely transmit the thrust through the block. Information on the soil bearing and shear capacity must be submitted with the request for design approval.
- (c) Pipelines of PVC or other flexible materials must use thrust blocks as required by the manufacturers' specifications.

704.6 **Hydraulic Testing of Pipe Lines and Joints**

- (a) After all work in connection with the laying of the pipeline system has been completed, the Developer shall issue to the Board a certificate of final inspection and testing. The testing shall be carried out by qualified engineers or technicians approved by the Water Supply Authority.
- (b) The Developer shall be responsible for meeting the cost and carrying out the testing of the pipeline system as required by the Authority and as set out hereunder:
 - (i) Air vents must be provided at the upper end of the section of pipeline to be tested and at other locations as required. The line should be slowly filled, preferably from the lower end. The pressure should be increased to 150% of the anticipated working pressure and be sustained for 2 hours.
 - (ii) The pipeline and joints will be accepted as having satisfied the test if the leakage does not exceed 1 gallon per inch of pipe

Revision Date: 31 Dec 2002

diameter per mile of pipeline for each 100 ft. of test pressure (30 ml per mm of pipe diameter per 1000 m of pipeline per 100 kPa of test pressure). The measure of leakage is the volume of water required to be pumped into the pipeline so as to re-establish the test pressure.

704.7 **Disinfection of the Pipe line**

- (a) The Developer must provide and fix a valve of the same diameter as the pipeline, in a suitable location for the effective flushing of the line.
- (b) After the pipe line has been flushed it shall then be charged with water to which has been added chlorine at the rate of 50 parts per million parts of water. After 24 hours the pipe line will be thoroughly flushed after which samples will be collected and tested by the Developer. If the laboratory examination shows that the pipe line has not been adequately disinfected, the disinfection shall be repeated until satisfactory samples have been obtained.
- (c) All tests are to be carried out at the expense of the Developer and to the approval of the Health Department.

Note Paper and charcoal filters placed in the domestic water supply line will help in reducing colour and odour in the water supply. However, no reliance shall be placed on passive filters to remove disease organisms from contaminated water.

704.8 **Back filling of Trenches**

Selected material should be firmly tamped by hand rammers around and to a height of 12" (300 mm) above the top of the pipe. Natural excavated material should then be tamped by hand rammers to a height of 2 ft. (600 mm) over the top of the pipe, thereafter the remainder of the backfill composed of natural excavated material may be tamped by mechanical tamper.

704.9 **Connection of Accessories**

- (a) Methods for connecting water pipes and fittings of dissimilar materials are subject to approval by the Water Supply Authority.
- (b) The methods of connecting to the pipeline such accessories as service or communication pipes, hydrants, sluice valves and air valves are to be approved by the Authority. Particular attention should be paid to the material to be used and method to be employed in backfilling the trench or supporting the accessory.
- (c) Service or communication pipes of 1/2" (12 mm), 3/4" (19 mm) and 1" (25 mm) diameter may be either of copper equivalent to relevant BSI or ANSI standards or PVC Schedule 40 or otherwise as approved by the Authority. The pipe shall be laid to a minimum depth of 18" (450 mm) below the surface of the carriage way and terminate on the pavement (sidewalk), the end of the pipe being securely plugged pending final connection into the

premises to be supplied with water. The backfill material should be thoroughly tamped by hand rammers.

- (d) Air valves shall be either single or double orifice type as may be required. They shall be fitted with a lock test pressure of 400 ft. head of water (1.2 MPa) without leakage.

704.10 **Colour Code**

Where water supply pipelines and sewers are laid in close proximity to each other a colour code or other means of identification must be adopted to ensure that each can be readily identified.

705 **DOMESTIC WATER PUMPS**

Where a water pump is provided as part of a private domestic water supply it shall be sized to maintain a minimum of 15 psi. (100 kPa) pressure under all conditions of water use. A pressure tank of adequate capacity shall be installed.

Note It is recommended that the plumbing within 3 ft. (900 mm) of the water pump be of galvanised steel to prevent melting of the plastic pipe fittings if the pump should run dry.

706 **SAFETY DEVICES**

A pressure relief valve shall be installed for all equipment used for heating or storing hot water. Hot water shall be run in copper or CPVC pipe. Regular PVC pipe shall not be used.

707 **FIRE HYDRANTS**

In new developments, connection to the water main must be provided at locations as required by the Board in consultation with the Water Supply Authority and Fire Brigade, suitable for use to fight fires. In areas where fire appliances cannot reach the building, dry mains should be provided. Cisterns should also be made accessible to fire hoses, if necessary by constructing a special basin outside of the cistern for receiving a fire hose.

SECTION 8 – SEWAGE AND WASTE DISPOSAL

801 **PROVISION OF SEWERAGE FACILITIES**

- (a) The Developer must provide a system or systems to fully satisfy the need for sewage collection, treatment and disposal of effluent and sludge, in accordance with the requirements of the Board and the Health Department and this Code.
- (b) It is advisable that the plans for the treatment system proposed be developed in consultation with the Health Department and the Board prior to formal submission of the plans for approval.

Revision Date: 31 Dec 2002

802 NEEDS OF TOTAL DEVELOPMENT

- (a) Sewage flows of 80% of the average daily water consumption rates given in Section 7 should be provided for.
- (b) Where the development is phased the system proposed for sewage and waste water disposal must address the needs of the total development to ensure an orderly solution to those problems. However, construction and operation of facilities may be carried out in an incremental/phased manner when technically feasible.

803 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.

804 JOINT SYSTEMS

- (a) Where two or more developments are adjacent or in close proximity to each other consideration should 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 must not adversely affect adjoining developments particularly with respect to the location of treatment facilities and outfalls.

805 ENVIRONMENTAL FACTORS

- (a) All systems shall be located and constructed so that with proper maintenance the systems will function in a sanitary manner, do not create sanitary nuisance or health hazards and do not endanger the safety and water quality of fresh ground water lens or domestic water supply.
- (b) Arrangements for the management and treatment of sewage and waste water shall take into account the topographical conditions, environmental factors, the proposed use of the land inside and outside of the development, and the relative locations of the sea, surface waters and ground water sources.

806 USE OF EFFLUENT

The use of effluent for agricultural or any other purpose must be approved by the Health Department.

807 PERCOLATION TESTS

Percolation tests shall be carried out if required by the Board whenever it is planned to use absorption pits or septic tanks with soakaways or land drains to dispose of the sewage. Approval for the use of such systems will depend on the percolation rates found. Percolation criteria are given in 815.6.

808 EMERGENCY POWER FACILITIES

Unless specifically exempted by the Board, all treatment plant and pumping stations shall be provided with an alternate source of electricity to allow continuity of operation during power failure.

809 EFFLUENT QUALITY

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

- (a) BOD not to exceed 45 mg/litre based on effluent samples collected in a period of seven consecutive days.
- (b) Suspended solids not exceeding 45 mg/litre based on samples collected in a period of seven consecutive days.
- (c) Coliform content not exceeding 400 per 100 ml based on effluent samples collected in a period of seven consecutive days.
- (d) Other criteria as may be required by the Health Department.

810 DISPOSAL OF TREATED EFFLUENT BY SEA OUTFALLS

- (a) The type, location, and design of the sea outfalls must 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, and the chemical composition of the effluent.
- (b) 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 Health Department.
- (c) The disposal of effluent by sea outfall is permitted only where approved, and subject to any conditions imposed, by the Health Department.

811 SEWER SYSTEM

811.1 General

The sewer system must be designed and constructed to the satisfaction of the Health Department and in accordance with the conditions outlined in this Code.

811.2 Excavation

- (a) Sewer trenches shall be excavated true to line and grade. The width at the top of the trench will vary with the depth but should not be more than the minimum required to accommodate shoring when required, and to provide adequate working space. The width at the bottom of the trench should not be less than the diameter of the pipe plus 12" (300 mm).
- (b) The depth of the trench should be such as to provide a minimum cover of 3'-6" (1050 mm) over the socket of the pipe measured from the finished road surface.

Revision Date: 31 Dec 2002

- (c) In general, sewers must be sufficiently deep to receive sewage from all adjacent buildings.
- (d) If any portion of the trench has been excavated below grade it must be refilled with approved granular material well rammed in 6" (150 mm) layers. Adequate bedding must be provided as described in 813.3.
- (e) If any portion of the trench is in rocky ground it should be excavated to a depth of 6" below grade and refilled with approved bedding material as described in 811.3.
- (f) If any portion of the bottom of the trench is in peaty or unstable ground which may not provide adequate support for the pipe, the trench should be excavated to a sufficient depth below grade and be refilled with well rammed 6" (150 mm) layers of granular material to provide adequate support for the pipe.

811.3 Bedding of the Sewer Pipe

Subject to the manufacturers' recommendations, sewer pipes constructed of the following material shall be laid on a bed not less than 4" (100 mm) thick composed of material having no particle size larger than as specified below:

Ductile iron or grey cast iron:	1"	(25 mm)
Asbestos cement:	3/4"	(18 mm)
PVC:	3/4"	(6 mm)

811.4 Laying and Jointing of Pipes

- (a) The pipes shall be laid carefully in conformity with the manufacturers requirements. The pipes shall be laid true to line and grade. After each section of the sewer has been laid between successive manhole locations, it shall be cleared of all foreign matter by passing through it a scraper or similar instrument, slightly smaller in diameter than the sewer.
- (b) In the event of an existing pipeline having been fractured, the damaged portion shall be cut and replaced by a length of plain ended pipe and properly jointed.
- (c) All pipes should be clean, correctly located and laid in true alignment in horizontal and vertical planes.

811.5 Protection of Sewer Pipe

- (a) Sewers of any material (except ductile iron and steel the protection of which will be subjected to specific instructions) which are laid at a depth of less than 3'-6" (1050 mm) below the surface shall be completely surrounded with at least 6" (150 mm) of 2500 psi (10 MPa) concrete.
- (b) The manufacturers' requirements for special protection should be observed where there are severe conditions of unstable ground or excessive depth below the surface.

811.6 **Backfilling of Trenches**

- (a) Sewers which have been laid on a bed of concrete or which have been surrounded with concrete shall not be backfilled until the concrete is at least 7 days old.
- (b) The trench shall be backfilled to a height of 12" (300 mm) over the pipe with an approved granular material well compacted by hand rammer in 6" (150 mm) layers. Thereafter the approved backfill material shall be compacted by hand rammer to a height of 24" (600 mm) over the pipe.
- (c) Thereafter the remainder of the backfill of selected excavated material may be rammed to the surface by mechanical means. In the case of sewers which have been surrounded by concrete the selected material shall be rammed in 6" (150 mm) layers. To ensure satisfactory consolidation, the backfill material should be sprinkled with sufficient water while being compacted.

811.7 **House Laterals or Junctions**

- (a) The requirements of the other paragraphs in Section 8 apply to laterals.
- (b) The lateral shall be connected to the sewer by means of a 45° angle branch or a 45° bend. A special fitting incorporating both the branch and the bend may be used provided that adequate stocks are available and can be easily obtained.
- (c) Where the depth of the sewer is less than 9'-0" (2.7 m) but greater than 4'-0" (1.2 m) the Board may in his or her discretion permit the lateral to be laid at a gradient steeper than 1 in 30.
- (d) Where the sewer is more than 9'-0" (2.7 m) deep the lateral shall be connected to the sewer by a single or double vertical riser and the sewer shall be made using a 45° branch set vertically on the sewer and a 45° bend connecting the riser to the branch.

811.8 **Manholes**

- (a) Manholes shall be provided at all horizontal and vertical changes in direction of the sewer and also on the straight sewer at a maximum interval of 300 ft. (90 m). Their internal dimensions shall generally be 3'-6" x 3'-0" (1050 x 900 mm). The materials of construction must be approved by the Board.
- (b) Channels and benchings and all interior surfaces in the manhole shall be smooth and free from obstructions.
- (c) Manholes greater than 5'-0" (1.5 m) deep shall be provided with ladders.
- (d) Each manhole shall be have a heavy duty manhole cover frame and gas tight cover with a clear opening of 8" (200 mm).
- (e) A drop pipe shall be provided for a sewer entering a manhole where the invert of the incoming sewer is more than 3'-0" (900 mm) above the invert of the outgoing sewer.

Revision Date: 31 Dec 2002

- (f) To ensure bonding of the pipe to the concrete, all PVC pipes passing through the walls of the manholes shall be roughened.

812 **TESTING OF SEWERS**

- (a) All sewers shall be tested by the Developer before being backfilled or surrounded with concrete. They shall also be retested after back filling.
- (b) The test shall conform to the following procedure:
 - (i) The sewer shall be tested in length between successive manholes.
 - (ii) The pipe shall be slowly filled with water until the water surface is 4'-0" (1.2 m) above the invert of the pipe or above ground water level at the higher end. In the case of asbestos cement pipe, the water must be allowed to stand in the pipe for 24 hours, at the end of which time sufficient water shall be added for it to reach its original level of 4'-0" (1.2 m) above the invert or ground level.
 - (iii) The criterion for a successful test shall be that the loss of water in 30 minutes should not exceed 0.2 gallons per hour per 100 ft. of pipe per inch diameter (1.5 litres in 30 minutes per 30 m of pipe per 100 mm diameter). Should the result of the test be unsatisfactory, the Developer shall correct the fault. The test shall then be repeated.
- (c) Sewage pumping mains shall be tested in the manner described in 704.6.
- (d) The Developer shall be responsible for meeting the cost of carrying out the testing of the sewer system to the satisfaction of the Board.

813 **TESTING MANHOLES FOR WATERTIGHTNESS**

- (a) All pipes entering and leaving the manholes shall be plugged and the manhole shall be filled with water to 6" (150 mm) to the underside of the cover slab and shall remain filled for 24 hours. Sufficient water shall then be added for the surface of the water to regain its original level.
- (b) The level shall be observed for a period of 12 hours. The criterion for a successful test is that the water level should not fall in 12 hours to a lower level than can be explained by evaporation.
- (c) Should the test result be unsatisfactory the Developer shall correct the defects and the manhole shall be retested until a satisfactory test result has been obtained.
- (d) The Developer shall be responsible for meeting the cost of and for carrying out the testing of the manholes to the satisfaction of the Board.

814 **SEWAGE TREATMENT PLANTS**

814.1 **General Requirements**

- (a) Complete data on the proposed treatment system must accompany all applications including:
 - (i) Engineer's Report
 - (ii) Prints of drawings
 - (iii) Specifications of equipment
 - (iv) Data sheet giving full details of design loading ie: flows, hydraulic loading and organic loading.
 - (v) Maintenance schedule.
 - (vi) Method of disposal of effluent
- (b) Facilities should be provided for the removal of grit and debris prior to the influent entering a pumping station or treatment plant. All pumps should be equipped with strainers capable of removing solids greater than provided for in the design of downstream processes.
- (c) The plant as designed must be capable of treating sewage to produce an effluent to the standards shown in 809.

814.2 **Approval of Plans**

Detailed plans and technical data as required as at 814.1 (a) will be reviewed by the Board in consultation with the Health Department. Approval for the installation of the sewage 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 Board may require that stand-by systems for major components such as power plant be supplied.

815 **SEPTIC TANKS AND SOAKAWAYS**

815.1 **Use of Septic Tanks**

- (a) Septic tanks are used to provide primary treatment to sewage from buildings with sewage flows of no greater than about 10,000 gallons (37850 litres) per day. See 815.2(c).
- (b) Sewage may be discharged into a septic tank linked with a biological filter or with land drains or soakaway pit provided that:
 - (i) If the system is designed to serve less than 20 persons, the sewage may be discharged directly into an absorption pit so long as the absorption area is designed and constructed as per 815.7, 815.8 and 815.9, or land drains are constructed as at 815.10 and 815.11.
 - (ii) If the system is connected to a proprietary tank or disposal system discharging an effluent approved by the Health

Revision Date: 31 Dec 2002

Department such effluent may be discharged directly from such tank or system.

- (iii) The system of disposal of the effluent from the tank or pit is approved by the Health Department.

815.2 Design of Septic Tanks

- (a) The basic function of a plain settling or septic tank is to receive domestic sewage, partially treat it, segregate the solids, and discharge the liquid to a tile field or soakaway.
- (b) In order to provide for maximum solids removal, adequate tank capacity is necessary. The appropriate volume of the tank is a function of the amount of liquid being discharged into the tank, and may be calculated as follows:
 - (i) For flows up to 500 gallons (1900 litres) per day, the net volume to be at least 750 gallons (2840 litres).
 - (ii) For flows of 500 (1900 litres) gallons to 1500 gallons (5600 litres) per day, tank volume to be at least 1-1/2 days sewage flow.
 - (iii) For flows larger than 1500 gallons (5600 litres) per day, the minimum tank liquid volume should equal the following:

Volume (gallons) = 1125 gallons + 0.75 Daily Flow (gallons)

Volume (litres) = 4260 litres + 0.75 Daily Flow (litres)

Note Septic tanks more than 2,500 gallons (9500 litres) capacity are not permitted without special approval.
Tanks of liquid capacity less than 750 gallons (2840 litres) are not recommended.

- (c) The owner must confirm the proposed design and size of the septic tank with the Ministry of Health.

815.3 Location of Septic tanks

- (a) Tanks shall be located not less than 10'-0" (3 m) from any dwelling including any verandah, porch or other projection, and 100 ft. (30 m) from any well or drinking water source.
- (b) Tanks shall be located where the largest possible area is available for the disposal of effluent either by soakaways or by leaching fields (land drains).

815.4 Construction of Septic Tanks

- (a) Tanks shall preferably be of two rather than one compartment to achieve better clarity of effluent.
- (b) Tanks shall preferably be constructed of reinforced concrete block work rendered on the inside and base, or of 2500 psi (10 MPa) reinforced concrete. The cover of the tank should be of reinforced concrete and capable

of withstanding loads of 100 lb./sq.ft (4.8 kPa). There must be removable manhole covers over inlets and outlets.

- (c) Inlets and outlets with sanitary T branches shall be so located as to avoid disturbance of the surface scum. An air space of 12" (300 mm) should be provided.
- (d) The septic tank should be rectangular with the length at least twice the width. The inlet compartment of the tank should have about 75% of the total capacity of the total tank capacity. The minimum depth of the tank should be 4'-0" (1.2 m).
- (e) Septic tanks shall not be undersized or be constructed in series as the velocity of flow through two identical tanks is the same as the velocity through one of them. This type of arrangement virtually doubles the velocity and results in the carry over of 70% of the suspended material. The heavier solids settle to the bottom forming a blanket of sludge and the lighter material rises to the surface to form a layer of scum.

815.5 **Operation**

- (a) Sludge has been found to accumulate at the rate of about 0.92 cu.ft (0.026 m³) per person per year and scum at the rate of about 0.42 cu.ft (0.012 m³) per person per year. Septic tanks should therefore be examined and cleaned when necessary.
- (b) Only small quantities of soap and detergents normally used in the homes should be discharged to the tank. Large doses of chemicals such as bleach will kill or inhibit bacteria.
- (c) Water from roofs, weeping tiles, or foundation drains and surface run-off shall be excluded as large volumes of clear water will stir up the contents, reduce the retention time and carry solids to the disposal field.
- (d) Bacterial action can be started off by seeding with animal manure.
- (e) Paper towels, newspaper, wrapping paper and rags should not be used as they will not decompose in the tank.

815.6 **Maintenance**

- (a) Tanks should be inspected every year with a view to cleaning probably every 3 years.
- (b) Tanks shall not be entered until they are thoroughly ventilated and gases removed in order to prevent accidents from explosions or asphyxiation.

815.7 **Soakaways**

- (a) Soakaways shall be used where sub-surface conditions allow. They shall never be used where there is a likelihood of contaminating underground water supplies and fresh water lenses. The owner may find that land drains or leaching fields (815.10) are suitable in some soil conditions.

Revision Date: 31 Dec 2002

- (b) The percolation criteria to be used in determining whether soakaways can be efficient in a given area is based on the rate of absorption of liquid waste and the area of the absorption surface.
- (c) Soils with absorption rates of less than 1" (25 mm) in 30 minutes are unsuitable for soakaways. The area required for absorption shall be based on the effective vertical wall area of the pit. No allowance shall be made for the pit bottom or the area above the inlet.
- (d) It is important that a test be carried out at each building site as soil types vary widely and the size of the pit depends on the type of soil and the volume of effluent to be absorbed.

815.8 Location of Soakaways

- (a) No soakaway shall be within 6 ft. (1.8 m) of a site boundary or a building. Where two soakaways are to be constructed they shall be located not less than 3 times the largest of the surface dimensions apart.
- (b) The area selected for construction shall be large enough to allow for additional pits in the event of a failure.
- (c) The location of soakaways and the percolation test results must be approved by the Health Department.

815.9 Construction of Soakaways

The soakaway pit is to be lined with stones, or concrete blocks laid up dry with open joints backed with at least 3" (75 mm) with coarse gravel to a depth of at least 1 ft. (300 mm). The cover shall be made of reinforced concrete and be capable of withstanding loads of 100 lb./sq.ft (4.8 kPa).

815.10 Land Drains

Where land drains are used, the drains which are constructed of pipes with open joints or holes linked to septic tanks, shall be laid in open areas not surfaced with impervious materials in accordance with the following requirements:

- (a) Pipe trenches shall be a minimum width of 1'-6" (450 mm), a minimum depth of 3'-0" (900 mm) and maximum length of 100'-0" (30 m).
- (b) No pipe run shall be located within 5'-0" (1.5 m) of another or of a building or a site boundary.
- (c) No pipe run shall be located within 5'-0" (15 m) of any well or stream or open water source.
- (d) Pipes shall be a maximum length of 2'-0" (600 mm) or alternatively shall have perforations or holes equal to not less than 20% of their surface area.
- (e) Pipes shall be laid on a minimum 6" (150 mm) bed of gravel at a gradient not shallower than 1:96.

- (f) Pipes shall be laid with 1/4" (6 mm) open joints and the joints shall be covered with strips of asphalt bonded building paper not less than 4" (100 mm) wide.
- (g) Trenches shall be backfilled with gravel to a minimum of 3" (75 mm) over the cover of the pipes.

815.11 **Recommended Length of Land Drains**

- (a) Where permeability tests on the pipe trenches give a water drop of not less than 4" (100 mm) an hour over a period of 24 hours, 1'-0" (300 mm) run of pipes shall be allowed for each 8 gallons of septic tank capacity.
- (b) Where permeability tests on the pipe trenches give a water drop of 2" to 4" (50 to 100 mm) an hour over a period of 24 hours, 1'-0" (300 mm) run of pipe shall be allowed for each 4 gallons of septic tank capacity.

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 of 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° bends and sanitary tees should 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.

Revision Date: 31 Dec 2002

902.4 **Supports and Hangers**

- (a) All vertical piping shall be supported, anchored and adequately fixed with spacing not exceeding 5 ft. (1.5 m).
- (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 ft. (1.8 m) 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.

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 1 ft. (300 mm) above the building eaves level nor less than 3 ft. (900 mm) above the head of any window 10 ft. (3 m) 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" (150 mm) 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 rods 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" (75 mm) in diameter.
- (b) Waste water pipes shall not be less than 1-1/4" (32 mm) 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" (75 mm) 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" (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.

Table 9-1

Capacity of Pipes in Fixture Units

Size of pipe	Each horizontal branch	Each vertical stack serving 2 storeys in height	Each vertical stack serving more than 2 storeys in height
1-1/4" (32 mm)	1	2	–
1-1/2" (38 mm)	4	4	–
2" (50 mm)	8	10	20
2-1/2" (64 mm)	12	20	40
3" (75 mm)	24	30	60

Revision Date: 31 Dec 2002

4" (100 mm)	200	240	500
5" (125mm)	400	540	1,100
6" (150 mm)	800	960	1,900

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.

Table 9–2

Fixture Unit Ratings

Description of Fixture	Unit Rating	Description of Fixture	Unit Rating
Bathtub (with or without shower)	2	Hand basin – over 1–1/4" (32 mm) shower 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)	6
Kitchen sink – up to 1–1/2" (38 mm) trap	1–1/2	Washing machine (domestic)	4
Kitchen sink (commercial)	2	Continuous flow fixture for each gal, per min.	2
Laundry tub	2	Unspecified to 2" (50 mm) trap or drain	3
Hand basin – up to 1–1/4" (32 mm) trap	1	Unspecified to 3" (75 mm) drain or tap	5

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" (100 mm) pipes and 1:60 for 6" (150 mm) pipes.
- (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 ft. (750 mm) 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.

Revision Date: 31 Dec 2002

- (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" (32 mm) 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 people with disabilities 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" (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 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.

Table 9-3

Minimum Sizes of Traps

Bath tub	1-1/2" 38 mm	Shower (with accessible trap)	1-1/2" 38 mm
Bidet	1-1/2" 38 mm	Shower (with concealed trap)	2" 50 mm
Drinking fountain	1-1/4" 32 mm	Shower stall (2 to 4 heads)	2-1/2" 64 mm

Revision Date: 31 Dec 2002

Flushing sink	3" 75 mm	Shower stall (5 to 12 heads)	3" 75 mm
Floor drain	3" 75 mm	Shower stall (over 12 heads)	4" 100 mm
Kitchen sink	1-1/2" 38 mm	Urinal	2" 50 mm
Kitchen sink (commercial)	2" 50 mm	Water closet (siphonic action)	3" 75 mm
Laundry tub	1-1/2" 38 mm	Water closet (wash down bowl)	3-1/2" 89 mm
Hand basin (domestic)	1-1/2" 38 mm	Washing machine	1-1/2" 38 mm
Hand basin (commercial)	1-1/2" 38 mm		

904.8 Water Seals

All traps shall have a minimum water seal of 3" (75 mm) for soil and 2" (50 mm) for waste and be not less than 3" (75 mm) diameter for soil fixtures and 1-1/4" (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" (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 relevant BSI or ASA Standards, or any other Code approved by the Board. See ASA A 40-8.
- (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.

Revision Date: 31 Dec 2002

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 1 WC, 1 hand basin and 1 bath or shower and 1 sink or tub.
- (d) For any building providing sleeping accommodation the minimum provision shall be 1 WC, 1 hand 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 hand basin 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 (460 m²) of sales area.
 - (iv) Any building providing more than 500 sq.ft (47 m²) of public waiting space.
 - (v) Gas stations with 4 or more service pumps.

- (g) In any building of Group A, B, D, E(b) or E(c) more than 5,000 sq.ft (460 m²) in total area, at least one cleaner’s sink shall be provided for each floor of more than 2,500 sq.ft (230 m²) in area.
- (h) For buildings of Group B and C, and in schools, colleges or other educational buildings, such additional facilities shall be provided as may be required by the Health Department.
- (i) Except for private residences a minimum of one facility for male and one for female must be provided for people with disabilities.

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 8 ft. (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 9-4
Number of Sanitary Fixtures Required for Employees

AMale Employees				
Number of employees	WCs	Urinals	Hand basins	Showers
1-10	1	–	1	–
11 – 30	1	1	2	–
31 – 45	2	1	3	1
46 – 90	2	2	4	1
91 – 120	3	3	6	1
121 – 150	4	3	7	2
Plus: 1 urinal for each additional 1 to 60 males				
Plus: 1 WC for each additional 1 to 60 males				
Plus: 1 Hand basin for each additional 1 to 60 males				
BFemale Employees				
Number of employees	Showers	WCs	Hand basins	
1 – 10	1	1	1	

Revision Date: 31 Dec 2002

11 – 30	1	2	2
31 – 45	2	3	3
46 – 90	2	4	4
91 – 120	2	6	6
121 – 150	2	7	7

 Plus: 1 WC for each additional 1 to 30 females

 Plus: 1 Hand basin for each additional 1 to 60 females
Table 9–5**Minimum Requirements for Sanitary Facilities****AGeneral use or occupancy (Males)**

Number	WCs	Urinals	Hand 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

 Plus: 1 urinal for each additional 1 to 200 males

 Plus: 1 WC for each additional 1 to 200 males

 Plus: 1 Hand basin for each additional 1 to 300 males
BGeneral use or occupancy (Females)

Number	WCs	Hand basins
1 – 15	1	1
16 – 30	2	2
31 – 120	4	3
121 – 240	5	3
241 – 360	6	3

 Plus: 1 WC for each additional 1 to 100 females

 Plus: 1 Hand basin for each additional 1 to 200 females

C Service of food or drink (males)

Number	WCs	Urinals	Hand basins
1 – 30	1	–	1
31 – 60	1	1	2
61 – 90	2	2	2
91 – 120	3	3	3
121 – 180	3	3	3

Plus: 1 Urinal for each additional 1 to 240 persons

Plus: 1 WC for each additional 121 to 240 persons

Plus: 1 Lavatory basin for each additional 1 to 240 persons

D Service of food or drink (Females)

Number	WCs	Hand 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

Plus: 1 WC for each additional 1 to 120 females

Plus: 1 Hand basin for each additional 1 to 240 persons

E Shops, Stores, Markets (Males)

Area of sales space	Number of fixtures
1,000 – 10,000 sq.ft	1 WC
93 – 930 sq.m	1 Hand basin
10,000 – 15,000 sq.ft	1 WC
931 – 1395 sq.m	1 Urinal
	1 Hand basin

Revision Date: 31 Dec 2002

15,000 – 20,000 sq.ft	2 WCs
1396 – 1860 sq.m	1 Urinal 1 Hand basin
Over 20,000 sq.ft	2 WCs
Over 1860 sq.m	2 Urinal 2 Hand basins

FShops, Stores, markets (females)

Area of sales space	Number of fixtures
1,000 – 10,000 sq.ft	1 WC
93 – 930 sq.m	1 Lavatory basin
10,000 – 15,000 sq.ft	2 WCs
931 – 1395 sq.m	1 Lavatory basin
15,000 – 20,000 sq.ft	3 WCs
1396 – 1860 sq.m	2 Lavatory basins
Over 20,000 sq.ft	4 WCs
Over 1860 sq.m	2 Lavatory basins

GGas Stations (Males)

Equipment	Fixtures
2 or more pumps	1 WC 1 Hand basin

HGas Stations (Females)

Equipment	Fixtures
2 or more pumps	1 WC 1 Hand basin

SECTION 10 – ELECTRICAL AND MECHANICAL INSTALLATIONS**1001 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 IEE Wiring Regulations (UK) administered by the Electricity Department.

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

1002 **INSTALLATION OF AIR CONDITIONING EQUIPMENT**

1002.1 **Standards**

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) or other Code approved by the Board.

1002.2 **Design Requirements**

- (a) At least 2 complete air changes per hour shall be induced for any normally occupied room or enclosed space.
- (b) At least 3 complete air changes per hour shall 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.
- (c) Extract systems shall be capable of handling at least 75% of the total fresh air supply per hour.
- (d) All equipment shall 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.

1003 **ELEVATORS AND ESCALATORS**

1003.1 **Standards**

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 relevant BSI, ANSI or other recognised international standards of good practice, as may be approved by the Board.

See ANSI A 17.1 – Standard Safety Code for Elevators, Dumb-waiters, Escalators, and Moving Sidewalks
BNS 162 – Lifts and Service Lifts

1003.2 **Design and Construction Requirements**

- (a) 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.

Revision Date: 31 Dec 2002

- (b) No lift well shall form part of a ventilating system or accommodate any services other than those ancillary to the installation and operation of the lift.
- (c) 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.
- (d) A smoke escape vent shall be provided within 1 ft. (300 mm) of the highest point of each lift well enclosure leading directly to open air.
- (e) Where a machine room is located on the roof of a building more than 60'-0" (18 mm) high, provision shall be made for lightning protection.
- (f) Escalators shall not be less than 2'-0" (600 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° and emergency stop buttons shall be located at the top and bottom landings of each escalator flight.

1004 **EQUIPMENT IDENTIFICATION AND INSTALLATION**

1004.1 **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.

1005 **DUCTS**

1005.1 **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.

1005.2 **Service Ducts**

- (a) All service ducts passing through floors and walls other than chases and pipe sleeves of not more than 50 sq.in (175 x 175 mm) 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.

1005.3 **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 the duct passes.

1006 **ARTIFICIAL LIGHTING**

Artificial lighting where required shall be in accordance with the requirements of the Electricity Regulations.

1007 **LIGHTNING PROTECTION**

- (a) Lightning protection systems must be installed in all public buildings in Groups A, B, C and D and in Group E(b) where parts of the building exceed 60 ft. (18 m) in height. It is prudent also to install such systems in buildings in Group E(c) more than 1 storey where more than 25 persons are being housed.
- (b) Lightning protection systems shall be in accordance with NFIPA Standard 78, or such other standard as determined by the Building Board.

1008 **FIRE ALARM SYSTEMS**

Where required in accordance with Section 5 of this Code, and for buildings in Groups A, B, C, D and E (b) and (c), fire alarm systems shall be installed to standards of the NFIPA standards 72A, B, C, D, F and H.

SECTION 11 – PRECAUTIONS DURING BUILDING CONSTRUCTION

1101 **GENERAL**

- (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 shall be enforced.
- (b) 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.

Revision Date: 31 Dec 2002

- (c) 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.
- (d) 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.
- (e) 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.
- (f) 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.
- (g) Protruding nails and tie wire ends shall be removed, hammered in or bent in a safe condition.
- (h) Electric lines, moving ropes and cable gears, or similar hazards with which a worker might come in contact, shall be encased or guarded.
- (i) 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 organisations 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.
- (j) 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 6'-0" to any energized high-voltage overhead electrical facilities except with the approval of the Electrical Inspector.

1102 **DEMOLITION**

- (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 20 ft. (6 m) above the point from which material is to be removed.

- (e) Chutes shall be completely enclosed and shall be equipped, at intervals of 25 ft. (7.5 m) 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 unauthorised persons shall be excluded from places where demolition in progress.

1103 **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, five feet or more in depth, shall have suitable means of exit or escape at least every 25 ft. (7.5 m) of its length.

1104 **SIDEWALK SHEDS AND FENCES**

1104.1 **Sheds**

- (a) Where buildings, which exceed 45 ft. (14 m) in height, are to be erected or demolished closer than 10 ft. (3 m), or buildings which exceed 25 ft. (7.5 m) in height are to be erected or demolished closer than 5 ft. (1.5 m) 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.

Revision Date: 31 Dec 2002

- (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 3 ft. (900 mm) high and solid toe boards not less than 6" (150 mm) high shall be placed along the open sides and ends of such roof. Such sheds shall be constructed to afford unobstructed walkways, not less than 8 ft. (2.4 m) high and 5 ft. (1.5 m) wide. The street side shall be kept open for a height of not less than 7 ft. (2.1 m) above the curb, and the sheds shall be properly lighted at night with not less than one 100-watt bulb every 20 ft. (6 m) of its length and at each change of grade or elevation of the sidewalk surface.
- (c) Such shed shall remain in place until the building is enclosed, or if being demolished, until the building is reduced to 20 ft. (6 m) in height.

1104.2 **Construction Fences**

Buildings which are erected or demolished closer than 5 ft. (1.5 m) 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 8 ft. (2.4 m) high. Such fence shall not restrict the sidewalk to less than 5 ft. (1.5 m) 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.

1104.3 **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.

1105 **STORAGE OF MATERIAL**

- (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 6 ft. (1.8 m) except in yards or sheds intended especially for storage. When piles exceed 4 ft. (1.2 m) 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.

1106 **HOISTING MACHINERY**

- (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 unauthorised 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.

1107 **DERRICKS AND CRANES**

1107.1 **General**

- (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 6 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.

1107.2 **Visibility**

Masts and booms of derricks and cranes, where higher than 150 ft. (45 m) 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 2 ft. (600 mm) 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 exceeding 50 ft. (15 m) and, rectangular flag markers of solid colour aviation-surface-

Revision Date: 31 Dec 2002

orange, not less than 2 ft. (600 mm) on a side at regular intervals not to exceed 50 ft. (15 m).

- (c) Where masts and booms are within 50 ft. (15 m) measured horizontally of existing buildings which exceed the maximum heights of such masts or booms, light and flags may be omitted.

1107.3 **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 Board.

1108 **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 1/6 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.

1109 **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 10.
- (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.

1110 **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 twice 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 Board.
- (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 4 directions against swaying or tipping, at intervals of not more than 32 ft. (10 m) 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 six 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.

1111 **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 3 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.

1112 **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 4 ft. (1.2 m) high along or near the edges of such openings, or guard rails not less than 3 ft. (900 mm) high, placed not less than 2 ft. (600 mm) distant at all points from the edges of such openings. If guard rails are used, toe boards shall be provided along

Revision Date: 31 Dec 2002

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 3 ft. (900 mm) 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.

1113 **RUNWAYS AND RAMPS**

- (a) Runways and ramps in connection with scaffolds or extending from storey to storey 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 10" (250 mm) 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 1 in 3, and the total rise of a runway or ramp between landings shall not exceed 12 ft. (3.6 m).
- (c) When the rise is steeper than 1 in 6, or when the rise is more than 6 ft. (1.8 m) and steeper than 1 in 8, runways or ramps shall be provided with cleats spaced not more than 8" (200 mm) apart.
- (d) Runways and ramps, having a total rise of more than 6 ft. (600 mm) or passing over or near floor openings, high-tension wires or other dangerous places, shall be provided with guard rails and toe boards.

1114 **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 60 ft. (18 m) 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 100 psf, 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 24" (600 mm) nor more than 26" (650 mm). Temporary stairways shall be not less than 36" (900 mm) wide. Landings shall be not less than 30" (750 mm) long.

- (d) No flight of stairs of a temporary stairway shall have a vertical rise in excess of 12 ft. (3.6 m) and when necessary, intermediate landings shall be provided.
- (e) Temporary and permanent stairways shall be adequately lighted as set forth in 1118.
- (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 4'-6" (1350 mm) 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.

1115 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 5 storeys 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 60 ft. (18 m) in height.
- (c) All ladders, when in use, shall be set up in a manner to be secure and to prevent slipping. 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 20 ft. (6 m) in length. When greater heights are to be reached, intermediate platforms shall be erected. Ladder landings shall be at least 4 sq.ft (0.375 m²) and equipped with handrails and toe boards.
- (f) Ladder rungs shall be spaced uniformly as near to 12" (300 mm) as is practicable.
- (g) When used temporarily, in place of stairways or runways, ladders serving traffic in both directions simultaneously shall be at least 40" (1 m) 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 2 or more together.

Revision Date: 31 Dec 2002

- (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.

1116 **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 two inches nominal thickness. Where such planks overlap at the ends, the overlap shall be not less than 6" (150 mm). 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.
- (c) Ropes, cables and blocks used in the support of swinging scaffolds shall be of sufficient size and strength to sustain at least 6 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.
- (d) Every scaffold, the platform level of which is more than 6 ft. (1.8 m) 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.
- (e) Where objects are likely to fall on a scaffold from above, a substantial overhead protection shall be provided. Not more than 10 ft. (3 m) 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.

- (f) Roof brackets, roof scantling, crawling boards and similar forms of support shall be substantial in construction and securely fastened in place when in use.
- (g) Barrels, boxes or other similar unstable objects shall not be used as supports for planking intended as scaffolds or places of work.
- (h) 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.
- (i) 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 50 ft. (15 m) from the point of operation.

1117 **SAFEGUARDS**

1117.1 **Railings**

- (a) Railings, where required during construction, shall comply with relevant international standards, or as provided herein. See OSHA standards.
- (b) The top rail of such railings shall be not less than 42" (1050 mm) 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 50 lb. per lineal foot (0.7 kN/m) at the top rail.

1117.2 **Toeboards**

Toeboards, where required during construction, shall comply with the Standards, referenced in 1117.1(a) herein, or any approved alternate design.

1118 **TEMPORARY LIGHT AND POWER**

- (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 be not less than 2 foot candles (21.5 lux).
- (b) At locations where tools and/or machinery are used, the average light intensity measured at the floor level shall be not less than 5 foot candles (53.5 lux). 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

Revision Date: 31 Dec 2002

part of such equipment, shall be grounded by one or more of the methods permitted by Section 10 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. The developer must obtain a permit for this installation from the Electrical Inspector before electricity can be supplied to the site.

1119 **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 or her.
- (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.

1120 **SANITATION**

- (a) Adequate toilet facilities, maintained in a clean, sanitary condition, shall be provided as set out 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.

1121 **WELDING AND CUTTING**

- (a) Gas welding and cutting and welding in building construction and demolition operations shall be restricted to experienced workers acceptable to the Board. 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, a non-combustible 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 placed on. 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.

1122 **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 Board.
- (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.

1123 **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 10 ft. (3 m) of such hydrant or connection, nor between it and the central line of the street.

Revision Date: 31 Dec 2002

1124 **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 are anticipated.
- (b) Construction materials and equipment shall be secured by guying and shoring, and by tying down loose materials, equipment and construction sheds.

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° 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, earthquake forces and to wind pressure on its surface.
- (f) Pitched roof means a roof having an inclination of more than 10° 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 lb. (1.4 kN) placed on any 1 ft. (300 mm) 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 out 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) Provision shall be made in designing office floors and class 50 garage floors for a load of 2,000 lb. (900 kg) placed upon any area 2'–6" (750 mm) square wherever this load upon an otherwise unloaded floor would produce stresses greater than those caused by a uniformly distributed load of 50 lb./sq.ft (2.5 kPa).
- (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 of not less than 10% of the weight per foot (300 mm) run of the finished partition, but not less than 20 lb./sq.ft (1.0 kPa) if the floor is used for office purposes.

Revision Date: 31 Dec 2002

Where such effective distribution is not provided (eg. 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 of motor vehicles shall be designed for the uniformly distributed live loads shown in Table 12–1 or the following concentrated loads: See Table 12–2 in ANSI A 58.1.
 - (i) Passenger cars accommodating not more than 9 passengers – 2,000 lb. (9 kN) acting on an area of 20 sq.in (125 cm²).
 - (ii) Mechanical parking structures without slab or deck, passenger cars only – 1,500 lb. (6.8 kN) per wheel.
 - (iii) Trucks or buses, maximum axle load on an area of 20 sq.in (125 cm²).
- (h) Parapets and Balustrades. Where it is desired to design against horizontal pressures, the following figures, expressed as horizontal loads acting at handrail or coping level are included as a guide:
 - (i) Light access stairs, gangways and the like: not more than 2'-0" (600 mm) wide – 15 lb./ft run (7 kg per 300 mm or 0.22 kN/m).
 - (ii) Stairways, landings, balconies, private/domestic – 25 lb./ft run (10 kg per 300 mm or 0.365 kN/m).
 - (iii) All other stairways, landings and balconies and all parapets and handrails to roofs – 50 lb./ft run (20 kg per 300 mm or 0.73 kN/m).
 - (iv) Where crowds can panic it may be desirable for all stairways, landings, and balconies and all parapets and handrails in public buildings to be designed for horizontal loads of 200 lb./ft run (90 kg per 300 mm or 2.9 kN/m).

In all cases, the wind load, if greater in effect, must be allowed for.

- (i) Corridors and balconies shall normally be designed for the same class of loading as the floor or other space to which they give access.
- (j) Table 12–3 shall be used to determine design live loads on stairs and landings.

1201.6 **Roof Live Loads**

- (a) Table 12–3 shall be used to determine roof live loads for design purposes.
- (b) The combined effect of dead and live loads on roofs shall be taken into account.
- (c) Roof covering, other than glass, at a slope less than 45' should be capable of carrying load of 200 lb. (90 kg) concentrated on any 8" (200 mm) square at normal stress to provide for loads incidental to maintenance.

Note Live loads do not include wind and earthquake loads.

1201.7 **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 in (b) and (c).
- (b) No reduction should be made for floors of factories and workshops designed for less than 100 lb./sq.ft (4.8 kPa) live loading or for any buildings for storage purposes, warehouses and garages. For factories and workshops designed for 100 lb./sq.ft (4.8 kPa) 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 (4.8 kPa) with no reductions.
- (c) Where a single span of a beam or girder supports not less than 500 sq.ft (50 m²) of floor at one general level the live load taken in the design on the beam or girder may be reduced by 5% for each 500 sq.ft (50 m²) supported, subject to a maximum reduction of 25%. 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.

1201.8 **Posting of Live Load Notices**

In Group A buildings the Board may require the owner 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 and every portion thereof 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, 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 only. In the special case of roofs, in no case shall any roof be designed for live loads less than those specified in Table 12–4 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**

The effect of wind pressure on buildings and structures and parts thereof shall be determined internationally recognised and accepted information on the effects of wind on structures subject to the approval of the Board.

Revision Date: 31 Dec 2002

See BNS CP 28 – Wind Loads for Structural Design

1202.3 **Overturning Moment and Uplift**

- (a) Where the overturning moment on a building or other structure exceeds $\frac{2}{3}$ of the moment of stability computed from dead load only, anchorage to resist the excess over $\frac{2}{3}$ of the dead load moment of stability shall be provided.
- (b) Where the uplift on a building or other structure, or portion thereof, exceed $\frac{2}{3}$ of the dead load only, anchorage to resist the excess uplift over $\frac{2}{3}$ 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 $\frac{1}{3}$ 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. See Section 16 regarding pre-stressed concrete structures.

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 caused significant damage to buildings and other property in some of the islands in the Eastern Caribbean.
- (b) It is necessary therefore that every building and structure and every portion thereof be designed and constructed in accordance with the latest edition of the “Recommended Lateral Force Requirements and Commentary by the Seismology Committee of the Structural Engineer’s Association of California”.
- (c) Unless otherwise approved by the Board, a Z factor of 0.75 shall be used for St. Kitts-Nevis.
- (d) 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 St. Kitts-Nevis, building response data must be obtained from future earthquakes. The installation of at least 3 strong motion accelerographs is recommended in all buildings 6 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 Board 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%.
- (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 12–6 shows the main differences between wind and earthquakes on the design of a building. It will be noted 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, as the main factors affecting building response are the external shape and size of the building.

Table 12–1 Floor Loads

Loading Class Number	Types of Floors	Minimum Imposed	Alternative Imposed Loads	
		Loads Slabs	Beams	
		Uniformly distributed over floor area	Uniformly distributed over span, per ft (300 mm) width	Uniformly distributed over span
30	Dwelling houses of not more than 2 storeys	30 lb./sq.ft 1.4 kPa	240 lb. 109 kg	1,920 lb. 870 kg
40	Residential buildings (other than those of class 30) including dwelling houses of more than one occupation: Residential flats. Rest rooms.	40 lb./sq.ft 1.9 kPa	320 lb. 145 kg	2,560 lb. 1161 kg

Revision Date: 31 Dec 2002

	<p>Hospital wards.</p> <p>Hotel bedrooms and sitting rooms. Institutional establishments of Group B occupancy.</p>			
50	<p>Light work rooms without storage.</p> <p>Garages for passenger cars, gross weight not exceeding 2-1/2 tons (2250 kg).</p>	50 lb./sq.ft 2.4 kPa	See 1201.5 (c)	See 1201.5(c)
60	<p>School class rooms.</p> <p>Offices – ground floor and floors below ground floor.</p> <p>Banking halls. Library reading rooms. Marques, Hospital operating theatres.</p>	60 lb./sq.ft 2.9 kPa	480 lb. 214 kPa	3,840 lb. 1742 kg
70	<p>Offices – other than ground or basement floors</p>	70 lb./sq.ft 3.4 kPa	560 lb. 250 kPa	4,480 lb. 2030 kg
80	<p>Note Fixed seating implies that the removal of the seating and the use of the space for other purposes is impossible.</p> <p>Shops used for the display and sale of light merchandise. Restaurants.</p> <p>Workrooms. Circulation space in machinery halls, power stations, etc., where not occupied by plant or equipment.</p> <p>Garages for vehicles not exceeding 3 tons (2720 kg) gross weight.</p> <p>Places of assembly with fixed seating (Churches, chapels, theatre balconies).</p> <p>City halls, court houses, Art galleries.</p>	80 lb./sq.ft 3.8 kPa	640 lb. 286 kg	5,120 lb. 2322 kg
100	<p>Warehouses, workshops, factories, and other buildings or parts of buildings for lightweight loads.</p> <p>Places of assembly without fixed seating (Public rooms, Dance halls, Theatre balconies,</p>	100 lb./sq.ft 4.8 kPa	800 lb. 358 kg	6,400 lb. 2903 kg

Revision Date: 31 Dec 2002

	Gymnasiums, Platforms; Reviewing stands and bleachers, Auction rooms not used for storage of goods, Drill rooms, Fire escapes). Hospital X-ray rooms and Laboratories. Printing composing and linotype rooms.			
100A	General storage areas and file stores in offices of loading class 50 and 70. Note Special consideration must be given to the average and the localized floor loadings in Class 70 used for heavy filing and storage equipment (such as card cabinets and rolling storage units, and for centralized security and storage.)	100 lb./sq.ft 4.8 kPa	800 lb. 358 kg	6,400 lb.2903 kg
150	Warehouses, Workshops, Factories and other buildings or parts of buildings for light weight loads; Garages for vehicles not exceeding 4 tons (3500 kg) gross weight; Stages: Armouries.	150 lb./sq.ft 7.2 kPa		
200	Warehouses. Workshops, Factories and other buildings or parts of buildings for heavy weight loads (unless actual loading is greater than 200 lb./sq.ft (9.6 kPa) Book stores; Museums.	200 lb./sq.ft 9.6 kPa		

Table 12–2 Minimum Concentrated Loads

Location	Load
Elevator machine room grating on area of 4 sq.in (2580 mm ²)	300 lb. 136 kg
Finish Light floor plate construction on area of 1 sq. in (645 mm ²)	200 lb. 90 kg
Garages	See 1201.5(g)
Office Floors	2,000 lb. 900 kg

Revision Date: 31 Dec 2002

Accessible ceilings	200 lb. 90 kg
Sidewalks	8,000 lb. 3600 kg
Stair treads on area of 4 sq.in (2580 mm ²) at centre of tread.	300 lb. 136 kg

Note Table 12-2 taken from ANSI A58.1 1982

Table 12-3 Design Loads for Stairs and Landings (other than fire escapes)

Class of Floor Served	Live Load	
	30	30 lb./sq.ft
40, 50, 60, 70	60 lb./sq.ft	2.9 kPa
Other classes	100 lb./sq.ft	4.8 kPa

- Note**
- 1 Consideration shall be given to increasing the design loading where there is a possibility of heavy equipment being transported on stairs or landings.
 - 2 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. (180 kg)
Class 40,50 & 60:	600 lb. (270 kg)
Class 70:	600 lb. (270 kg)
Class 80, 100, 150 & 200:	1,000 lb. (450 kg)

Table 12-4 Roof Live Loads

Slope of Roof	With Access	No Access
Up to 10°	30 lb./sq.ft (1.4 kPa)	15 lb./sq.ft (0.7 kPa)
Over 10° up to 30°	15 lb./sq.ft (0.7 kPa)	Nil
Over 75°	Nil	Nil

- Notes**
- 1 For slopes between 30° and 75° the imposed load to be allowed for shall be obtained by linear interpolation.
 - 2 "With access" means access in addition to that necessary for cleaning and repair.
 - 3 "No access" means no access other than that necessary for cleaning and repair.
 - 4 The design loading in this Table does not include wind or earthquake loads.

Table 12-5 Reductions of Total Live Floor Loads on Columns

Number of floors carried by member under consideration	Reduction of live load on all floors above the member under consideration
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Revision Date: 31 Dec 2002

Roof	0
Roof and two floors	0
Roof and three floors	10%
Roof and four floors	30%
Roof and five floors	40%

Table 12–6 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
Predictability 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

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 them 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

Revision Date: 31 Dec 2002

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 Board, an unsafe condition may result or damage may occur as the result of an excavation, it may order the work stopped or may approve the work of excavation subject to such limitations as it 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 capacity of the soil should be substantiated by recognised tests, analyses and procedures. However, where this is not warranted, Table 13–1 may be used as a guide in estimating the allowable bearing capacities of supporting soils.

Table 13–1 Maximum Safe Bearing Capacities for Horizontal Foundations under Vertical Static Loading at Depth 2 ft. (600 mm)

Types of Rocks and Soils		Maximum Safe bearing Capacity	
1	Massively-bedded limestones and hard sandstones	4,000 lb./sq.ft	191.5 kPa
2	Clay shales	2,000 lb./sq.ft	95.7 kPa
3	Thinly-bedded limestones and sandstones	To be determined	
4	Compact sands and gravel-sand mixtures	1,500 lb./sq.ft	72 kPa
5	Firm clays and sandy clays	800 lb./sq.ft	38 kPa
6	Soft clays and silts	500 lb./sq.ft	24 kPa
7	Made ground	To be determined after investigation	

Note: Foundation material not listed in Table 13–1 shall be tested for bearing capacity.

1302.2 Wind and Earthquake

- (a) All allowable soil-bearing values specified in Table 13–1 may be increased by 1/3 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.

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.

The Building Guidelines Section B sets out recommended footings for buildings of conventional construction and not more than 2 storeys in height.

1303.2 **Continuous Footings**

- (a) Footings under walls shall be continuous or continuity must be otherwise provided, and shall not be less than required to keep the soil pressure within that set out in Table 13–1.
- (b) All concrete footings shall be adequately reinforced, the minimum allowable amount of steel reinforcement being 0.15% of the gross cross-sectional area of the concrete in both horizontal directions. Reinforcing bars shall have a minimum 2" (50 mm) concrete cover.
- (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.
- (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 1/3 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 1/3 of any line passing through the centre of gravity of the footing shall be considered eccentric, and provision shall be made to limit

Revision Date: 31 Dec 2002

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.

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 4" (100 mm) 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 4" (100 mm) and shall be reinforced with steel reinforcement not less than 0.15% of the gross cross-sectional area of the concrete in the slab. The reinforcement shall be placed in the upper half of the slab.

1305 **PILED FOUNDATIONS**

1305.1 **General**

- (a) Piled foundations shall be designed and supervised by a suitably qualified and experienced professional engineer approved by the Board.
- (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 out 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 1'-0" (300 mm). 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 5'-0" (1.5 m) below the ground surface unless otherwise prescribed by the design engineer after a foundation investigation by a competent agency approved by the Board.

- (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% 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 3'-6" (1050 mm) 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 2'-6" (750 mm) 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 its safe bearing value.
- (g) Piles should not be driven closer than 4'-0" (1.2 m) to an existing building or structure unless special consideration is given to the properties of the soil and 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 conditions make such load reductions advisable or necessary, the allowable axial load determined for a single pile shall be reduced by 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 Board 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 5 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%.

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.

Revision Date: 31 Dec 2002

- (c) When the allowable axial load of a single pile is determined by a load test, the allowable load shall not exceed:
 - (i) 1/2 the test load at the yield point at which an increase in load produces a disproportionate increase in settlement; or
 - (ii) 1/2 the test load which produces a permanent net settlement not more than 0.01" per ton of test load (0.028 mm per metric ton) during a 48-hour period of continuous load application.

In any case, the maximum settlement shall not exceed 3/4" (19 mm).
- (d) 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.
- (e) Table 13–2 sets out the minimum factor of safety to be used in calculating the allowable axial load on a pile.

Table 13–2 Minimum Factor of Safety for Piles

Type of Ground	Test Load	Dynamic Formula Resistance not Reduced on Driving	Dynamic Formula Resistance Reduced on Redriving	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

1305.3 Timber Piles

- (a) Timber piles shall be of one piece of approved timber showing 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 which are 25'–0" (7.5 m) or less in length shall be not less than 6" (150 mm) at the tip and not less than 10" (250 mm) at 3 ft. (900 mm) from the butt. For piles which exceed 25 ft. (7.5 m) in length, the diameter at the tip shall be not less than 8" (200) and at 3 ft. (900 mm) from the butt, the diameter shall not be less than 12" (300 mm).
- (b) No piles which have a spiral grain exceeding one complete turn in 40'–0" (12 m) shall be used. Squared timber piles less than 8" (200 mm) 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 Board 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% of the basic stress as determined by the US National Forest Products Association or any other Agency approved by the Board, and in no case shall stress exceed 700 lb./sq.in (4.826 MPa).

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 for normal or easy driving and of mix ST5 for hard driving, and for all piles used in marine work. Concrete grades are defined in Section 16.
- (b) All piles shall be reinforced with not less than 4 longitudinal steel bars having an area of not less than 1.25% and not more than 4.0% 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 3/16" (4.5 mm) diameter. In the body of the pile the lateral reinforcement shall be not less than 2% of the gross volume spaced at not more than 1/2 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% 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 at least 1-1/2" (38 mm) of concrete cover except that for piles subjected to the action of open water, waves or other severe exposure 2-1/2" (65 mm) cover shall be provided.
- (e) The compressive stress imposed on driven piles shall not exceed 750 lb./sq.in (5.2 MPa) on the nominal minimum cross-sectional area of the pile.
- (f) Precast concrete piles shall be not less than 10" x 10" (250 x 250 mm) in section.
- (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% of the specified 28-day strength has been attained. Piles shall not be transported nor driven until they have been cured not less than 7 days.

1305.5 **Prestressed Concrete Piles**

Revision Date: 31 Dec 2002

- (a) Prestressed concrete piles shall conform to 1608 of this Code except as specifically detailed in this Section.
- (b) Longitudinal pre-stressing tendons shall have not less than 2" (50 mm) of cover except that for piles subject to open water or wave action, or other severe exposure the cover shall be 3" (75 mm).
- (c) Lateral reinforcement shall be as specified in 1305.4(c) for precast concrete piles.
- (d) Piles shall have a minimum pre-stress of 600 lb./sq.in (4 MPa) 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 1/3 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 relevant BSI or ASTM standards.

See ASTM A706 82a – Standard Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement
- (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% 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 8" (200 mm).
- (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 2" (50 mm) of concrete cover in uncased piles and 1" (25 mm) where piles are completely encased.

- (g) Where the shell has a thickness of 0.12" (3 mm) or more the shell may be considered as carrying part of the load.
- (h) Adequate allowance for corrosion shall be made in the design but not less than the outer 1/16" (1.5 mm) of a steel shell shall be deducted in calculating the area of the shell considered as carrying load. The load carried by the shell shall not exceed 9,000 lb./sq.in (62 MPa) 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 BSI or ASTM standard.
- (b) No section shall have a nominal thickness of metal of less than 3/8" (9.5 mm).
- (c) The allowable stress under working load shall not exceed 25% of the minimum guaranteed yield stress of the steel.
- (d) Where adequate corrosion prevention is not provided 1/16" (1.5 mm) 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" (50 mm) 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 8" (200 mm).
- (c) Foundation beams shall be suitably designed and reinforced around access openings and vents.

1307 **SEA WALLS AND BULKHEADS**

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**

Revision Date: 31 Dec 2002

- (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 Board.
- (c) Structures shall be classed as Gravity Type when the resultant of the acting forces falls within the middle 1/3 of the base. Boulder 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 limestone 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% not including concrete used for copings or decorative purposes.

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" (300 mm) thickness of concrete at its edge and the sides shall slope at an angle of not less than 60° with the horizontal.
- (b) In no case shall such piers or caissons be of less than 2' – 0" (600 mm) minimum horizontal dimension.

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

Timber construction shall be at least equal to the standards in BS 5268 – Structural Use of Timber, AITC 100, or other Standard approved by the Board.

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 Board 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.

Note 1 The standard of the American Wood Pressures Bureau and/or the American Wood Pressure Association is approved in respect of pressure treated wood.

2 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 Board.

- (c) The soil should be treated 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 Board.

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 Board.
- (b) Structural glued laminated timber shall be manufactured in accordance with BS 5268 Part 2 – Structural Use of Timber, or AITC 117 – Standard Specification for Structural Glued Laminated Timbers of Softwood Species, Manufacture and Design.
- (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 Board.
- (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 Board, 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 Board.
- (f) Fibreboard for its various uses shall conform to PS-57 – Voluntary Product Standard, Cellulose Fibre Insulating Material. 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 Board.
- (g) Hardboard shall conform to PS-58 – Basic Hardboard, PS-59 – Pre-finished Hardboard Panelling or, PS-60 – Hardboard Siding, as applicable,

Revision Date: 31 Dec 2002

and shall be identified as to classification. Hardboard siding when used structurally shall be identified by an agency approved by the Board as conforming to the Product Standard.

- (h) Particle board shall conform to ANSI A 208.1 – Mat-Formed Wood Particleboard. Particleboard shall be identified by the Grade Mark or Certificate of Inspection issued by an agency approved by the Board.
- (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 Board, 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.
 - 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.

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% of the minimum net sizes specified in AITC 100 at 19% moisture content. Computations to determine the required sizes of members shall be based on the net sizes contained in the standard.
- (c) Sizes of structural timber framing members must comply with acceptable BSI, Canadian or US Standards and Codes of Practice or be established using an alternative acceptable design method.

See sizes of timber framing members in Building Guidelines Section C – Timber Construction.

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" (750 mm) 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.
- (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 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.

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 (3 mm) 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, or other Standard approved by the Board.

Revision Date: 31 Dec 2002

- (e) Where trusses are to support mechanical or other equipment, the trusses shall be designed for such additional load.

1406 **CONSTRUCTION DETAILS**

1406.1 **Construction Methods**

Sizes of structural timber framing members and construction methods must comply with acceptable BSI, Canadian or US Standards and Codes of Practice or be established using an alternative acceptable design method.

See Building Guidelines Section C – Timber Construction.

1406.2 **Roof Sheathing**

- (a) All rafters and roof joists shall be covered with sheathing such as wood boards of 3/4" (18 mm) minimum thickness, plywood, or fibreboard insulating roof deck not less than 1" (25 mm) 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 2 rafters.

1407 **VENTILATION**

- (a) The space between ceiling joists and roof rafters shall be effectively ventilated.
- (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. The minimum total area of ventilating openings shall be 2 sq.ft (0.18 m²) for each 15'-0" (4.5 m) of exterior wall.
- (c) Where wood-floor joists are used, there shall be not less than 18" (450 mm) distance between the bottom of such floor joists and the ground beneath.
- (d) Openings shall be located to provide effective cross-ventilation, and such openings shall be covered with a corrosion-resistant mesh.

SECTION 15 – CONCRETE BLOCK AND MASONRY CONSTRUCTION

1501 **GENERAL**

- (a) All masonry construction shall conform to the provisions of this Section and other applicable Sections of this Code.
See 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 Board has reason to doubt that the materials meet the applicable specifications it may require tests on the materials.
- (d) Masonry units may be reused when clean, whole and conforming to the other requirements of this Section, except that the allowable working stresses shall be 50% of those permitted for new masonry units.

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.
- (e) 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 1/2" (12 mm).
- (f) Where masonry units are used as veneer, weepholes shall be provided at 4 ft. (1.2 m) centers by omitting mortar in the vertical joints at the bottom course of the veneer or at the lintels in multistorey buildings. A shield or insect barrier shall be provided having openings or louvers 1/16" (1.5 mm) or less which drains and dries the inner cavity but will retain poured insulation.
- (g) 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 1/2" (12 mm).

1502 **QUALITY, TESTS AND APPROVALS**

1502.1 **General**

- (a) The quality of materials assembled into masonry and the method and manner of their assembly shall conform to the requirements of this Section.
- (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 Board.

1502.2 **Bricks**

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" (110 mm) thick, 4–1/4" (110 mm) wide and 8–3/4" (230 mm) long not less than 75% solid.
- (b) **Tests** – Tests shall be made in accordance with BS 1257, or other standard approved by the Board.

Revision Date: 31 Dec 2002

- (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 ASTM C90 – Specifications for Hollow Load-Bearing Concrete Masonry Units, or ASTM C145 – Specifications for Solid Load-Bearing Concrete Masonry Units, when used for bearing walls or piers or when in contact with the ground or exposed to the weather, or equal to ASTM C129 – Specifications for Hollow Non-Loadbearing Concrete Masonry Units, when used for non-loadbearing 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.

1502.4 **Mortar and Grout Materials**

- (a) Mortar and its ingredients shall be of a quality at least equal to that required by ASTM C270 – Standard Specifications for Mortar for Units Masonry, ASTM C476 – Standard Specifications for Mortar and Grout for Reinforced Masonry, or the relevant BSI standard.
- (b) Masonry cement shall be of a quality at least equal to that required by ASTM C91 – Masonry Cement.
- (c) Grout for non-reinforced and reinforced masonry shall conform to ASTM C476 – Standard Specifications for Mortar and Grout for Reinforced Masonry.
- (d) Where mortar type is determined in accordance with Table 15–5 the volume of aggregate in mortar shall be not less than 2–1/4 times but not more than 3 times the volume of cementitious material. When mortar type is determined by proportions, the aggregate ratio shall comply with Table 15–6.

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 Board on the basis of a rational engineering design, the compressive stresses in un-reinforced masonry shall not exceed the values given in Table 15-1.

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 Board, 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 Board 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 25% for compression and 3% for tension in extreme fiber in flexure of the compressive strength of the concrete. When the ratio of height to thickness exceeds 10, the percentages for compression stress shall be reduced proportionately to 18% for a ratio of height to the thickness of 20.

1503.6 **Shear**

The shear in unit masonry shall not exceed 1/10 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 so as to meet the requirements of this Section or in accordance

Revision Date: 31 Dec 2002

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) Walls of hollow concrete block shall be designed for resistance to seismic and lateral forces in accordance with an appropriate Standard or Code of Practice approved by the Board.
- (d) Wall reinforcement shall be as required by Seismic Performance Category C for buildings in seismic zones with peak accelerations of 0.2g to 0.3g. Police stations and buildings housing emergency medical facilities and other buildings as required by the Board shall be designed in accordance with Seismic Performance Category D.
- (e) A check shall be made to establish if the minimum reinforcement in block walls is adequate for walls under wind or earthquake loads.

1504.2 Walls

- (a) Loadbearing walls of unit masonry shall have a minimum thickness of 6" (150 mm) except as otherwise approved by the Board 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" (150 or 200 mm) 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 (24 m²) unless otherwise approved by the Board on the basis of engineering calculations provided by the design engineer.

1504.3 Stiffener columns

- (a) Concrete stiffener columns shall be required in walls of unit masonry as follows:
 - (i) At intervals not exceeding 20'-0" (6 m) between columns.
 - (ii) At corners, unless the walls are properly bonded into one another and no opening occurs within 1'-4" (400 mm) of the nearest wall face at the corner.
 - (iii) 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" (400 mm) 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 and reinforced with No 4 bars.

- (c) Stiffener columns shall not be less than 8" (200 mm) in width unless otherwise approved by the Board. Stiffener columns having an unbraced height exceeding 15'-0" (4.5 m) shall be not less in thickness than 9" (230 mm). 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 with not less than 0.010 times the gross cross-sectional area of the concrete, nor less than four 1/2" (12 mm) diameter bars, tied with 1/4" (6 mm) diameter links spaced not more than 9" (230 mm) apart: 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" (25 mm).
- (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 (24 m²) 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" (400 mm) centres and horizontal bars at 24" (600 mm) centres. Where structural steel members are fire-protected with masonry units the panel walls shall be bonded into such units.

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" (3.6 m). For external walls of 6" (150 mm) concrete block the vertical height shall be no greater than 9'-0" (2.7 m).
- (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" (200 mm).

Revision Date: 31 Dec 2002

- (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 stiffener columns as previously specified and shall be coped with a concrete beam not less than 24 sq.in (150 cm²) in cross-section, reinforced with 2# 3/8" diameter reinforcing bars.

A parapet wall exceeding 5'-0" (1.5 m) 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" (400 mm) wide, such section shall be of steel or reinforced concrete.
- (b) Isolated masonry piers shall be so constructed that the height of any such pier shall not exceed 10 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:

- (a) In all brick walls at least every 6th 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 (450 cm²) 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.
- (b) Rubble stone walls shall be 4" (100 mm) thicker than is required for solid brick or concrete walls of the same respective heights but no part shall be less than 16" (400 mm) thick.

1504.8 Partitions

- (a) The requirements specified herein shall apply to non-loadbearing partitions, other than fire walls, of unit masonry construction.

- (b) The lateral distance between vertical supports of non-loadbearing 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" (100 mm) high and of width at least equal to the width of the partition. The beam shall be reinforced with a single 3/8" (9 mm) 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 over-turning moments.

1505 **CHANGE IN WALL THICKNESS**

Except for permissible 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 4" (100 mm) 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**

- (a) Chases in Masonry walls shall not be deeper than 1/3 the wall thickness, nor longer than 4 ft. (1.2 m) horizontally, except that chases below windows may equal the width of the opening above.
- (b) No chase shall be cut or built in an 8" (200 mm) wall or within the required area of a pier, except that in buildings of residential occupancy not more than 2 storeys in height, chases not more than 4" (100 mm) deep may be built in 8" (200 mm) walls.
- (c) Chases shall not be cut in cavity walls, hollow walls of hollow units but, when permitted, may be built in.

1507 **SUPPORTED STRUCTURAL MEMBERS**

When combustible structural members frame into walls of thickness not greater than 12" (300 mm), they shall project not more than 4" (100 mm) into the wall and shall be so spaced that the distance between embedded ends is not less than 4" (100 mm). 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 4" (100 mm) 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 30 lb./sq.ft properly strapped or reinforced and provided with proper nailing devices for

Revision Date: 31 Dec 2002

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 4" (100 mm). In addition, the bearing area shall be sufficient to prevent a concentration of compressive stresses greater than those allowed in Table 15-1.

1510 **CONSTRUCTION PRECAUTIONS**

- (a) Except when carried independently by girders at each floor, a masonry wall shall not be built up more than 25 ft. (7.5 m) 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 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 of 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) Masonry shall be laid in mortar of the types specified in Tables 15-4 and 15-5.

Revision Date: 31 Dec 2002

- (c) Where the minimum continuous clear opening of a grout space exceeds 6" (150 mm) it may be filled and treated as unreinforced monolithic concrete.

Table 15-1 Allowable Compressive Stresses for Empirical Design of Masonry*

Construction: Compressive Strength of Unit, gross area	Allowable compressive stresses gross cross section area			
	Type M or S Mortar		Type N Mortar	
	psi	MPa	psi	MPa
Solid masonry of brick and other solid units of clay or shale, sand lime or concrete brick				
8,000 psi (55 MPa) or greater	350	2.4	300	2.1
4,500 psi (31 MPa)	225	1.55	200	1.4
2,500 psi (17.2 MPa)	160	1.1	140	0.96
1,500 psi (10.5 MPa)	115	0.8	100	0.7
Grouted solid masonry of clay or shale, sand lime or concrete				
4,500 psi (31 MPa) or greater	225	1.55	200	1.4
2,500 psi (17.2 MPa)	160	1.1	140	0.96
1,500 psi (10.5 MPa)	115	0.8	100	0.7
Masonry of solid concrete masonry units				
3,000 psi (20.7 MPa) or greater	225	1.55	200	1.4
2,000 psi (13.4 MPa)	160	1.1	140	0.96
1,200 psi (8.3 MPa)	115	0.8	100	0.7
Masonry of hollow load bearing units				
2,000 psi (13.4 MPa) or greater	140	0.96	120	0.83
1,500 psi (10.5 MPa)	115	0.8	100	0.7
1,000 psi (6.9 MPa)	75	0.5	70	0.48
700 psi (4.8 MPa)	60	0.41	55	0.38
Piers of hollow units, cellular spaces filled as in Section 15	95	0.66	90	0.62
Hollow walls (non-composite masonry bonded) Solid units				
2,500 psi (17.2 MPa) or greater	160	1.1	140	0.96
1,500 psi (10.5 MPa)	115	0.8	100	0.7
Hollow units	75	0.5	70	0.48

Revision Date: 31 Dec 2002

* See Masonry Structures Building Code (ACI 530–92/ASCE 5–92/TMS 402–92)

Linear interpolation for determining allowable stresses for masonry units having compressive strengths which are intermediate between those given in the Table.

Table 15–2 Specified Compressive Strength of Masonry Based on Specifying the Compressive Strength of Masonry Units*

Compressive Strength of Concrete Masonry Units	Specified Compressive Strength of Masonry			
	Type M or S Mortar		Type N Mortar	
	psi	MPa	psi	MPa
4,800 (33 MPa) or more	3,000	20.7	–2,800	19.3
3,750 (25.9 MPa)	2,500	17.2	2,350	16.2
2,800 (19.3 MPa)	2,000	13.4	1,850	12.8
1,900 (13.1 MPa)	1,500	10.5	1,350	9.3
1,250 (8.6 MPa)	1,000	6.9	950	6.6

* See ACI 530–92 Masonry Structures Building Code

Table 15–3 Properties of In-fill Concrete

Minimum Compressive Strength on 6" (150 mm) cubes at 28 days	Concrete Mix for Cavity In-fill Cement: Sand: Coarse Aggregate	Minimum Compressive Strength of Concrete Block
2,300 psi (15.85 MPa)	1:3:6	1,000 psi (6.9 MPa)
3,300 psi (22.75 MPa)	1:2:4	1,800 psi (12.4 MPa)

Note Aggregate size should not be greater than 3/4" (20 mm).

Table 15–4 Minimum Compressive Strength of Mortar

Type	Minimum Compressive Strength at 28 days	
	psi	MPa
M	2,500	17.2
S	1,800	12.4
N	750	5.2
O	350	2.4

Average of three 2" (50 mm) cubes of laboratory prepared mixed mortar, in accordance with ASTM C270. "Standard Specifications for Mortar for Unit Masonry".

Table 15–5 Types of Mortar Required

Type of Masonry	Type of mortar permitted
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Revision Date: 31 Dec 2002

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 Board.
- (b) The Board may accept concrete mixed by volume provided the use of the concrete so mixed is limited to minor building works.
- (c) The Board 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 Board 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 ASTM standards. 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 Board 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:
 - (i) ASTM C150 – Specification for Portland Cement.
 - (ii) ASTM C595 – Specification for Blended Hydraulic Cements, 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 Board.
- (b) Cement used in the work shall correspond to that on which selection of concrete proportions was based.

1603.3 **Aggregates**

- (a) The use of aggregates for normal structural concrete shall be in accordance with Appendix F of CUBiC Part 2 Section 6 and with
 - (i) ASTM C33 “Specification for Concrete Aggregates”, or
 - (ii) BS 882 Part 1 “Coarse and Fine Aggregates from Natural Sources”.
- (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 authorised by the Board.
- (c) Nominal maximum size of coarse aggregate shall be not larger than:
 - (i) 1/5 the narrowest dimension between sides of forms nor
 - (ii) 1/3 the depth of slabs, nor
 - (iii) 3/4 the minimum clear spacing between individual pre-stressing tendons or ducts.

These limitations may be waived if, in the judgement of the Board, 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 aluminium embedments, 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 shall not be used in concrete unless the following are satisfied:
 - (i) Selection of concrete proportions shall be based on concrete mixes using water from the same source.

Revision Date: 31 Dec 2002

- (ii) Mortar test cubes made with non-potable mixing water shall have 7-day and 28-day strengths equal to at least 90% 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).

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 Board provided that tests carried out by a laboratory approved by the Board 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 Board.

Reinforcement to be welded shall be indicated on the drawings and welding procedures to be used shall be specified. The Board 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. This Code does not prevent the use of steel designated in accordance with BSI standards.

1603.6 Tests on concrete

- (a) The Board 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 or she may consider necessary to ensure compliance with the Code. Not fewer than 3 specimens shall be made for each standard test, nor fewer than one test for each 50 cu.yd of concrete or for each day’s pour of concrete used at any job site, where pours may be less than 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) 3 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% of that average.

- (c) In addition, where there is question as to the quality of the concrete in the structure, the Board 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 4". This may be varied by the Board 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 Board, 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 recognised by this Code shall be concrete having a design strength of 3,000 psi (20 MPa) after 28 days based on 6" x 12" (150 mm x 300 mm) cylinder tests or 3,750 psi (25 MPa) at 28 days based on 6" (150 mm) 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

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.

Revision Date: 31 Dec 2002

- (d) When the structural design is based on a 28-day compressive strength in excess of 3,000 psi (20 MPa) by 6" x 12" (150 mm x 300 mm) cylinder test, proportioning, mixing and placing of concrete shall be under the supervision of a competent engineer, architect or concrete technician, approved by the Board.
- (e) Concrete that will be exposed to sulphate-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) Any rain or ground water should be removed from place of deposit before concrete is placed.

1605.2 **Mixing of Concrete**

- (a) Unless otherwise authorised by the Board, 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 1 cu.yd (1 m²), mixing time shall be increased 15 seconds for each additional cubic yard (cu.m) or fraction thereof.
- (d) Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the Standards referenced in Appendices A and B to this Code.
- (e) Retempering 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 Board has the right to reject all such concrete or order any such mobile equipment off the job site, if in its opinion, mixing has taken place longer than can be allowed to ensure the appropriate concrete strength. The Board 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 rehandling or flowing. The concreting shall be earned 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 ft. (2.4 m). 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 Board 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 ft. (1.2 m) to avoid segregation or separation.

1605.5 **Curing**

In all concrete structures, concrete made with normal portland cement shall be maintained above 10°C. and in a moist condition for at least the first 7 days after placing. High-early-strength concrete shall be so maintained for at least the first 3 days. Other curing periods or methods of curing may be used if the specified strengths are obtained.

1605.6 **Bonding**

Revision Date: 31 Dec 2002

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 (temperature in excess of 85°F.) steps shall be taken to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protection and curing.

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.
 - 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 Board 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 1" (25 mm), nor less than one and 1/3 times the maximum size of the coarse aggregate.

- (b) When reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall not be less than 1" (25 mm) 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 4 bars in any one unit. Bars larger than # 11 can not 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 318-55, 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**

- (a) The reinforcement of footings and other structural members shall have concrete cover not less than as set out in Table 16-3.
- (b) Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion by concrete or other adequate covering.
- (c) 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.
- (d) 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,

Revision Date: 31 Dec 2002

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, including vertical and horizontal reinforcement, etc., shall be carried out in accordance with relevant design standards approved by the Board.
- (b) 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 3 times the wall thickness, nor 500 mm. (20 in.).
- (f) In addition to the minimum reinforcement required by this Section, not less than 2 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 24" (600 mm).

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 relevant Standards set forth in the Appendices.
- (b) All precast structural items shall be designed by an engineer approved by the Board.
- (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 Board may require tests to be made by an approved testing laboratory as it 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 Board 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 3,000 psi (20 MPa) at 28 days based on standard 6" x 12" (150 mm x 300 mm) 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 1/8" (3 mm) 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 Board and in accordance with the engineer's 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

Revision Date: 31 Dec 2002

embedding the top flanges not less than 1/2" (12 mm), 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.

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 Board. Openings not provided for in the structural design shall not be made on the job without the specific approval of the engineer and the Board.
- (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 Board may require tests to be made by an approved testing laboratory as it may consider necessary to ensure compliance with these Standards or uniformity of the product.
- (e) The Board 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 is the span length of the member.
- (b) Calcium chloride shall not be used in concrete for prestressed members.

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 Board.

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 fibreglass materials has led to the construction of structural panels and other primary non-loadbearing 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 1/2" (12 mm) in thickness are possible while with steel reinforced concrete, the thickness of any slab must be at least 1-1/2" (38 mm) to provide cover for the reinforcement. In the Eastern Caribbean, where the cover should be at least 1" (25 mm) for exposed elements, the minimum thickness of a slab will be 2-1/2" (65 mm).

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.

1609.2 Physical Properties

Some of the physical properties of typical spray de-watered GRC with a density of 2.0 tonnes/m² 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

Revision Date: 31 Dec 2002

Tension – elastic limit	9 – 10 N/mm ²
Tension – ultimate strength	14 – 17 N/mm ²

Note 1N = 0.224809 lb
N/mm² = 0.00689476 lb/in² x 10

1609.3 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 for Concrete

(Without Preliminary Tests)

Maximum Permissible Water Cement Ratio – Non Air Entrained Concrete						
Specified Compressive strength at 28 days 6" cube test (150 mm)		Specified Compressive Strength at 28 days 6" x 12" cylinder (150 mm x 300 mm)		US gals per 94 lb bag of cement	Litres per 50 kg cement	Absolute ratio by weight
psi	MPa	psi	MPa			
3,125	21.5	2,500	17.2	7–1/4	32	0.67
3,750	25	3,000	20.6	6–1/2	29	0.58
4,375	30	3,500	24	5–3/4	25.5	0.51
5,000	34.5	4,000	27.5	5	22	0.44

- Notes**
- 1 The minimum cement content shall be not less than 5 x 94 lb. bags per cubic yard (263 kg per cubic metre) unless the mix is designed specifically for the project.
 - 2 Maximum permissible water cement ratio for non-air entrained concrete includes 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	
	psi	MPa
ST1	1,090	7.5
ST2	1,490	10
ST3	2,175	15
ST4	2,900	20

Revision Date: 31 Dec 2002

ST5	3,625	25
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Table 16-3 Minimum Cover to be Provided to Concrete

ACast in Place Concrete (Non-prestressed)		
Description	Minimum Cover	
Concrete cast against and permanently exposed to earth	3"	75 mm
Concrete exposed to earth and weather:	2"	50 mm
Concrete not exposed to weather or in contact with the ground:		
Slabs, Walls, Joists	1-1/2"	38 mm
Beams, Columns	1-1/2"	38 mm
Shells, Folded plate members	3/4"	18 mm
BPrecast Concrete Manufactured under Plant Control Conditions		
Concrete exposed to earth or weather:		
Wall Panels:		
No 14 and No 18 bars*	1-1/2"	38 mm
No 11 bar and smaller	1"	25 mm
Other members:		
No 14 and No 18 bars	2"	50 mm
No 6 through No 35 bars	1-1/2"	38 mm
No 5 bar, W31 or D31 wire and smaller	1-1/2"	38mm
Concrete not exposed to weather or in contact with the ground:		
Slabs, Walls, Joists:		
No 14 and No 18 bars	1-1/4"	30 mm
No 11 bar and smaller	3/4"	18 mm
Beams, Columns:		
Primary Reinforcement:	Bar diameter, but not less than 3/4" (18 mm) and not more than 1-3/4" (44 mm)	
Ties, Stirrups, Spirals	1/2"	12 mm
Shells, Folded Plate members:		
No 6 bar and larger	3/4"	18 mm
No 5 bar, W31 or D31 wire and smaller	1/2"	12 mm

See Table 16-3(A) for equivalent SI bar designations.

CPre-Stressed Concrete

Revision Date: 31 Dec 2002

Concrete cast against and permanently exposed to earth	3"	75 mm
Concrete exposed to earth or weather:		
Wall Panels, Slabs, Joists	1-1/4"	30 mm
Other Members	1-1/2"	38 mm
Concrete not exposed to weather or in contact with ground:		
Slabs, Walls, Joists	1"	25 mm
Beams, Columns		
Primary Reinforcement	1-1/2"	38 mm
Ties, Stirrups, Spirals	1"	25 mm
Shells, Folded plate members		
No 5 bar, W31 or D31 wire and smaller	1/2"	12 mm
Other Reinforcement	Bar diameter but not less than 1" (25 mm)	

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	
		psi	MPa

Concrete intended to be water-tight:			
a) Concrete exposed to fresh water	0.50	3,625	25
b) Concrete exposed to seawater	0.45	4,350	30
For corrosion protection for reinforced concrete exposed to brackish water, seawater, or spray from these sources	0.40	4,785	33

If the minimum concrete cover required by Table 16–3 is increased by 3/8" (10 mm), water-cement ratio may be increased to 0.45 for normal density concrete, or specified compressive strength reduced to 4,350 psi (30 MPa) for low density concrete.

1.0 MPa (Megapascal) equals 145.038 psi (lb. force per sq.in)

1,000 psi equals 6.89476 MPa

SECTION 17 – STRUCTURAL STEEL

1701 SCOPE

- (a) This Section deals with the design and construction of steel buildings.
- (b) The construction of small steel framed buildings using standard steel sections and general requirements for construction of small houses and other buildings using light steel frame construction are given in the Building Guidelines, Section D – Steel Construction.

1702 BASIS OF DESIGN

- (a) Steel and iron members shall be designed using rational analysis according to established principles of mechanics.
- (b) The quality, design, fabrication and erection of steel in buildings or structures shall conform to the provisions of BS 5950 – Structural Use of Steelwork in Building, AISC – Specification for Structural Steel Buildings, or to any other relevant standard approved by the Authority.

1703 APPLICATION

The requirements set out in 1701 to 1713 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 ANSI/ASTM A6 – Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.

1705 COLD FORMED STAINLESS STEEL CONSTRUCTION

The design, fabrication and erection of cold-formed stainless steel construction shall conform to AISI Design of Cold-Formed Stainless Structural Members.

Revision Date: 31 Dec 2002

1706 COLD FORMED STEEL STRUCTURAL MEMBERS

- (a) The design and construction of cold formed steel structural members shall be in accordance with AISI Specification for the Design of Cold-formed Steel Structural Members. This Code 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 Eastern Caribbean. The materials used and design adopted must be approved by the Board.
- (c) Other references are as follows:
 - ANSI/ASTM A446-76 – Steel Sheet, Zinc Coated (Galvanised) by the Hot-Dip Process, Structural (Physical) Quality (Grades A, B, C, D and F)
 - ANSI/ASTM A525-79 – Steel Sheet, Zinc Coated (Galvanised) by the Hot-Dip Process, General Requirements.
 - ANSI/ASTM A606-75 – Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High Strength, Low Alloy, with Improved Corrosion Resistance.
 - AISI Cold-Formed Steel Design Manual.

1707 OPEN WEB STEEL JOIST CONSTRUCTION

The design, fabrication and erection of open web steel joist construction shall comply with AISC/AJI Standard Specifications for Open Web Steel Joists, H –Series.

1708 WELDING

Details of design, workmanship and technique for welding, inspection of welding, and qualification of welding operators shall conform to AWS Structural Welding Code, and Specifications for Welding Sheet in Buildings.

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 for Riveted and Bolted Structural Joints of the Engineering Foundation.

1710 TESTS

The Board shall consider the need for tests 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 out in Section 12 and the additional stress considerations set out in this Section.

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 out in BS 5950 or equivalent 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" (6 mm) unless the steel used is an atmospheric corrosion-resistant grade approved by the Board. It is recommended that in the corrosive atmosphere of the Eastern Caribbean, all steel members be protected against corrosion by concrete haunching or other approved forms of protection.
- (b) In the main structural framework of buildings primary members shall include any steel member used as a column, beam or to support walls or partitions including trusses, isolated lintels spanning openings of 8 ft. (2.4 m) or more and any member required to brace a column or a truss or to support 200 sq.ft (20 m²) of floor or roof area.
- (c) Secondary members shall to include all other steel members, including filling-in beams of floor systems which individually support less than 200 sq.ft (20 m²) of floor or roof area.
- (d) For primary members of the structural frame all steel used shall be at least 0.20" (5 mm) in thickness for interior work. All steel in exterior walls of structures except lintels spanning an opening of less than 8 ft. (2.4 m) shall be at least 0.20" (5 mm) in thickness when protected as required in 1710 and at least 0.25" thick when not so protected.
- (e) Unless otherwise determined by test, the thickness of fire-resistive members shall be assumed to have the resistance ratings set out in Table 17-1.

Table 17-1 Fire resistance of Steel Members with Concrete Cover

Strength of Concrete Cover	1 Hr	2 Hr	3 Hr	4 Hr
over 2,000 psi	1"	1-1/2"	2"	2"
over 13.8 MPa	25 mm	38 mm	50 mm	50 mm
1,600 – 2,000 psi	1-1/2"	2"	3"	4"
11 – 13.8 MPa	38 mm	50 mm	75 mm	100 mm
with wire fabric				
1,600 – 2,000 psi"	1-1/2"	2"	2"	3
11 – 13.8 MPa	38 mm	50 mm	50 mm	75 mm
Concrete block (nominal dimensions)	–	–	4" 100 mm	4" 100 mm

1713 **CONNECTIONS**

Revision Date: 31 Dec 2002

- (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.
- (b) High strength steel bolts, may be used instead 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 Board, 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.

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" (4.5 mm).
- (b) Where pipe columns support loads in excess of 1,000 lb. (2200 kg) 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" (100 mm) wider than the flange of the beam. The top of the beam shall be at least 2" (50 mm) above the bottom of the slab and at least 1–1/2" (38 mm) 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 Board.

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 Board. 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" (4.5 mm) thick, and used for load bearing purposes.
- (b) The use of light gauge steel construction shall be reserved for single or 2 storey buildings in Group E Occupancy or in Group D(b) Occupancy provided the building is not greater than 3,000 sq.ft (280 m²) in floor area.
- (c) Section D of the Building Guidelines provides outline performance specifications for small steel structures using standard sections and small single storey buildings.

Note US Standard Gauge used throughout this Section.

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 Board 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 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 2 times the live load. Recovery within 24 hours after removal of the full test load, shall be not less than 75% 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.

Revision Date: 31 Dec 2002

- (c) All tests must be carried out in accordance with the applicable BSI or ASTM 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) Structural drawings of the building and written information giving the sizes and thickness of all members, the connections used, and methods of field assembly.
 - (i) Test results required under 1716.2(a).
 - (ii) Test data and specifications of the corrosion method to be used.
 - (iii) Other information required by the Board as per Section 1 of this 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 Board.

These design requirements 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 out 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 Board. Except that the minimum thickness of steel of primary members shall be 16 gauge (1.6 mm), and the spacing of studs shall be no greater than 24" (600 mm) 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 (2.65 mm).
- (c) Light-gauge steel studs for non-bearing partitions shall have a minimum thickness of 18 gauge (1.2 mm).
- (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" (100 mm) of bearing on reinforced concrete nor less than 2" (50 mm) 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 (0.6 mm) for the sheeting. The minimum thickness for secondary members supporting exterior panel construction shall be 18 gauge (1.2 mm).
- (g) Light-gauge steel members resisting lateral stresses in interior partitions of buildings 2 storeys or more in height shall be not less than 16 gauge (1.6 mm).
- (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 out in 1703 or with any other standard approved by the Board and as follows:

- (a) Sheet-metal sections shall have a minimum thickness of 18 gauge (1.2 mm) for floors, or 24 gauge (0.6 mm) 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.
- (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 Board.
- (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

Revision Date: 31 Dec 2002

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" (4.5 mm) in diameter. Lead, neoprene, or other approved washers not less than 1/2" (12 mm) 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 Board.
- (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

1801 BUILDING GUIDELINES

1801.1 Scope

The Building Guidelines provide information on the application of this Code to buildings of conventional construction not more than 2 storeys in height, and in particular, buildings of the following Occupancy Groups:

- Group E(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.
- Group C – Commercial and industrial buildings (small non-hazardous factories and warehouses).
- Group D – Office, administrative and retail service buildings (small offices for government administration, banks, small restaurants and shops).

The Guidelines generally do not apply to buildings over 2 storeys or buildings other than of Occupancy Group E(a) more than 3,000 sq.ft (280 m²) in floor area.

1801.2 Use of Guidelines

The Building Guidelines include recommended specifications and construction details for small concrete, masonry, wood frame and steel frame buildings using traditional methods of design.

It is intended that the Guidelines be completely prescriptive and can be used for the construction of simple buildings, however, where it may be necessary to deviate from the prescriptions given in the Guidelines, reference must be made to the relevant Sections of this Code, in particular:

- Section 14 – Timber Construction
- Section 15 – Concrete Block Masonry
- Section 16 – Plain and Reinforced Concrete
- Section 17 – Structural Steel

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 Board.

Sizes of structural members given in the Guidelines 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 rational calculations.

The design and construction of all buildings must conform with all of the relevant Sections of the Building Code, and the provisions of the Code take precedence over those of the Guidelines. The Guidelines set out recommended practices that in the main will achieve compliance with the Code, but developers and builders need to refer to the Code on matters beyond the scope of the Guidelines in the particular construction project.

APPENDIX A – BRITISH STANDARDS AND CODES APPLICABLE

Code No. or Standard	Description
BS 144	Wood preservation using coal tar creosotes
BS 373	Testing small clear specimens of timber
BS 405	Expanded metal (steel) for general purposes
BS 497	Manhole covers, road gully gratings and frames for drainage purposes
BS 648	Schedule of weights of building materials
BS 690	Asbestos-cement slates and sheets
BS 915	High alumina cement
BS 1187	Wood blocks for floors
BS 1191	Gypsum building plasters

Revision Date: 31 Dec 2002

BS 1200	Sands for mortar for plain and reinforced brickwork, block walling and masonry
BS 1230	Gypsum plasterboard
BS 1282	Guide to the choice, use and application of wood preservatives
BS 1297	Grading and sizing of softwood flooring
BS 1369	Metal lathing (steel) for plastering
BS 1370	Low heat Portland cement
BS 1521	Waterproof building papers
BS 1579	Timber connectors
BS 1876	Automatic flushing for urinals
BS 1881	Methods of testing concrete
BS 2994	Cold rolled steel sections
BS 3260	PVC (vinyl) asbestos floor tiles
BS 3261	Unbacked flexible PVC flooring
BS 3284	Polythene pipe (type 50) for cold water services
BS 3921	Clay brick and blocks
BS 4360	Specification for weldable structural steels
BS 4482	Hard drawn steel wire for the reinforcement of concrete
BS 4483	Steel fabric for the reinforcement of concrete
BS 5135	Arc welding of steels
BS 5268	Structural use of timber
BS 5628	Structural recommendations for load bearing walls
BS 5655	Lifts and service lifts
BS 5911	Precast concrete pipes, fittings and ancillary products
BS 5950	Structural use of steelwork in building
BS 6323	Seamless and welded steel tubes
BS 6399 Part 1	Dead and imposed loads
BS 6925	Mastic asphalt (limestone aggregate)
BS 8000 Part 2	Code of practice for concrete work
BS 8000 Part 3	Code of practice for masonry
BS 8004	Code of practice for foundations
BS 8005 Part 1	Guide to new sewerage construction
BS 8110	The structural use of concrete in buildings
BS 8214	Code of practice for fire door assemblies with non-metallic leaves

APPENDIX B – U.S. AGENCIES STANDARDS AND CODES QUOTED

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

Code No	Description
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Revision Date: 31 Dec 2002

ACI 318	Building code requirements for reinforced concrete
ACI 315	Manual of standard practice for detailing reinforced concrete structures
ACI 530-92	Building code requirements for concrete masonry structures
ASTM C90	Specifications for hollow load-bearing concrete masonry units
ANSI A41.1	Standard requirements for reinforced masonry
AITC 101 to 115	Timber construction standards
NLMA	National design specification for stress grade lumber and its fastenings
NBS R 16	American lumber standards for softwood lumber
NBS-CS	Douglas fir plywood, commercial standard
AISC-SJI	Standard specification for open web long span steel joist construction
AISC	Specifications for design, fabrication and erection of structural steel for buildings
ANSI A59.1	Specifications for reinforced gypsum concrete
SJI AISC	Specifications and load tables for J series and H series joists
AWS D1.1	Structural Welding Code
AWS D1.3 78	Specifications for Welding Sheet Steel in Buildings
AISC	Specifications for Structural Joints using ASTM A325 or ASTM A490 Bolts
ANSI/	Standard Specification for General Requirements for Rolled Steel
ASTM A6	Plates, Shapes, Sheet Piling, and Bars for Structural Use
AISI	Specification for the Design of Cold-Formed Stainless Steel Members
AISI A151	Structural Specifications for the Design of Light Gauge Structural Members
TPI. 1978	Design Specifications for Light Metal Plate Connected Wood Trusses

OTHER CODES

The Codes listed below are not referred to in the Building Code of St.Kitts-Nevis but are listed for information of Code users.

Caribbean Uniform Building Code (CUBiC)

Caricom Secretariat, Georgetown, Guyana

National Building Code of Jamaica

Ministry of Finance and Planning, Kingston, Jamaica

Standard Building Code

Southern Building Code Congress International Birmingham, Alabama, USA.

South Florida Building Code

Board of County Commissioners,
Metropolitan Dade County, Florida, USA.

Bahamas Building Code

Ministry of Works, Nassau, Bahamas

National Building Code of Canada

National Research Council of Canada, Montreal, Ottawa, Ontario, Canada

Barbados National Building Code

Barbados National Standards Institution,
Culloden Road, St. Michael, Barbados

Building Code of Australia

Australian Building Codes Board, Canberra ACT, Australia

Revision Date: 31 Dec 2002

APPENDIX C – STEEL SHEET METAL GAUGES**British Imperial or US Standard Gauge****(Uncoated Steel Sheets)**

Wire Gauge	British Standard Thickness		US Standard Thickness	
	inches	mm	inches	mm
4	0.2242	5.7	0.232	5.9
6	0.1943	4.9	0.192	4.9
8	0.1644	4.2	0.160	4.0
10	0.1345	3.4	0.128	3.3
12	0.1046	2.6	0.104	2.6
14	0.0747	1.9	0.080	2.0
16	0.0598	1.5	0.064	1.6
18	0.0478	1.2	0.048	1.2
20	0.0359	0.9	0.036	0.9
22	0.0299	0.8	0.028	0.7
24	0.0239	0.6	0.022	0.6
26	0.0179	0.5	0.018	0.5
28	0.0149	0.4	0.0148	0.4
30	0.0120	0.3	0.0124	0.3

APPENDIX D – HAZARDOUS MATERIALS**A HIGH HAZARD MATERIALS**

- 1 Acetylene gas and gas under pressure in quantities of greater than 70 m³ 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°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

B 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°C or higher

- 18 Photo engraving
- 19 Soap
- 20 Sugar
- 21 Tobacco, cigars, cigarettes
- 22 Upholstering and mattress manufacturing
- 23 Wax candles

C LOW HAZARD MATERIALS

- 1 Asbestos
- 2 Chalk and Crayons
- 3 Food products
- 4 Glass

Revision Date: 31 Dec 2002

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 lb./sq.ft	Pa
Ceilings		
Plasterboard, unplastered	3	143
Plaster, 3/4" (19 mm) and wood lath	8	383
Plaster on tile or concrete	5	240
Suspended, metal lath and plaster	10	470
Floors		
Hardwood flooring, 7/8" (22 mm) thick	4	192
Sheathing, yellow pine 1" (25 mm) thick	4	192
Spruce	2.5	120
Wood block, creosoted 3" (75 mm) thick	15	718
Cement finish per inch thick	12	575
per mm thick	0.472	22.6
Terrazzo tile per inch thick including base	12	575
per mm thick	0.472	22.6
Gypsum Slab per inch thick	5	240
per mm thick	0.197	9.4
Roofs		
Corrugated metal, galvanised:		
20 gauge (0.9 mm)	1.66	80
24 gauge (0.6 mm)	1.16	56
28 gauge (0.4 mm)	0.78	37
Roofing felt, 3 ply and gravel	5.5	263
Roofing felt, 5 ply and gravel	6.5	311
3 ply ready roofing	1	48
Shingles, wood	3	144
Tile or slate	5 to 20	240 to 958
Partitions		
Channel Studs, metal lath, cement plaster, solid 2" (50 mm) thick	17.5	838
Studs, 2" x 4" (50 x 100 mm) wood or metal lath, 3/4" (19 mm) plaster both sides	18	862
Studs, 2" x 4" (50 mm x 100 mm) plaster board,	18	862

Revision Date: 31 Dec 2002

1/2" (12 mm) plaster both sides		
Plaster, 1/2" (12 mm) on clay tile (one side)	4	192
Mortar Rubble Masonry		
Limestone	150	7.2 kPa
Dry Rubble Masonry		
Limestone	125	6.0
Earth, etc., Excavated		
Sand, gravel, dry, loose	90 to 105	4.3 to 5
Sand, gravel, dry, packed	100 to 120	4.8 to 5.7
Clay, dry	63	3.0
Clay, damp, plastic	110	5.3
Clay, and gravel, dry	100	4.8
Earth, dry, loose	76	3.6
Earth, dry, packed	95	4.5
Earth, moist, packed	96	4.6
Earth, mud packed	115	5.5
Riprap, limestone	80 to 115	3.8
Excavations in Water		
Sand or gravel	60	2.9
Sand or gravel and clay	65	3.1
Clay	80	3.8
River mud	90	4.3
Soil	70	3.4
Stone riprap	65	3.1

Concrete Block	lb.	kg
8" x 8" x 16" (200 mm x 200 mm x 400 mm):		
From USA	35 to 40lb.	16 to 18 kg per block
From the Dominican Republic or other areas	45 to 50 lb.	20 to 23 kg per block
with igneous or extrusive rock		

Concrete	lb./cu.ft	kg/m³
With aggregate (basalt or other extrusive rocks) eg. from Haiti, Dominican Republic	155 to 160	2483 to 2563
With aggregate (sedimentary rock) from Jamaica, Bahamas and other quarries	145 to 150	2323 to 2403
With aggregate from limestone (local sources)	140 to 145	2243 to 2323

APPENDIX F – ACCESSIBILITY GUIDELINES FOR PEOPLE WITH DISABILITIES

F1 SCOPE

Revision Date: 31 Dec 2002

F1.1

The following guidelines are intended to introduce designers and builders to the minimum provisions required for safe access for handicapped persons 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 handicapped persons with the minimum provisions needed for access to all facilities.

F1.2

Designers should also be aware of key legislation in other countries. (such as the United States Americans with Disabilities Act 1990) which determine the minimum provisions for disabled persons in public buildings.

F1.3

Designers of public buildings in Groups A and B(a) would therefore be expected to consult the relevant bodies such as the local chapter of the institutes for the blind for specific information based on the research being carried out by these bodies. In accordance with 501(e), the Board will examine the plans for new public facilities to ensure that adequate provisions have been made for people with disabilities.

F1.4

The following should be considered as minimum provisions for facilities for disabled persons 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 people 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 ease of access by persons in wheel chairs.
- (c) Hotels and other establishments offering accommodation to the public should have at least one bedroom for every 25 bedrooms made accessible for disabled persons.
- (d) In new public housing developments consideration should be given to constructing at least one dwelling unit in every 25 units to be accessible to disabled persons.

F2 RELEVANT GUIDELINES

F2.1

The following Guidelines and Codes provide detailed information on the design of barrier free facilities:

- BS 5588 Means of Escape for disabled persons

- Barrier Free Design – A National Standard for Canada; Canadian Standards Association, June 1990
- Access Needs of Blind and Visually Impaired Travellers in Transportation 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

F2.2

It is suggested that designers also refer to 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.

F3 BUILDING APPROACHES AND ENTRANCES

- (a) In every public building, at least one primary entrance at ground floor level shall be accessible from the street entrance or parking lot by means of a walkway or ramp with a gradient of not more than 1 in 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 ft. x 4 ft. (900 x 1200 mm) to afford the opening and closing of doors by persons in wheel chairs. Such platforms should also be constructed at every change of grade or direction of the ramp and at 30 ft. (9 m) intervals on a long ramp.
- (c) A clear space of 4 ft. x 4 ft. (1.2 x 1.2 m) would allow access for both forward and side approaches to doors. A clear space of 5 ft. x 5 ft. (1.5 x 1.5 m) is required for a wheelchair to pivot 180°.
- (d) Kerbs intended to be crossed by handicapped persons in wheel chairs should be cut to provide a passage of not more than 4" (100 mm) high at the kerb and at least 4 ft. (1.2 m) wide. The lip of the kerb should not be greater than 1" (25 mm) 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" (800 mm) 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" (18 mm) and the bars at least 1/2" (12 mm) 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.

F4 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" (1350 to 1950 mm) wide with shoulders about 4'-0" (1.2 m) wide.

Revision Date: 31 Dec 2002

- (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 be a minimum of 3'-0" (900 mm) wide.
- (f) Sidewalks should be 5'-0" (1.5 m) wide.
- (g) Slopes for sidewalks should be 2-1/2% to 5% maximum

F5 DOORS AND CORRIDORS

- (a) Doors should be openable in a single motion with one hand and with a force of no greater than 5 lb. and should have a clear swing of at least 90°. For sliding doors the force required to operate the door should not be greater than 8.5 lb.
- (b) Doorways should be a minimum of 32" (800 mm) clear.
- (c) Door latches, handles and pull bars should be easy to grasp and between 2'-0" (600 mm) and 4'-0" (1.2 m) high. Knobsets should not be used.
- (d) Corridors should be at least 4'-0" (1.2 m) 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 3'-0" (800 to 900 mm) and be 1-1/2" (38 mm) clear of 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" (1050 x 1200 mm). An area 4 ft. x 4 ft. (1.2 x 1.2 m) 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	Space width	Required space beside latch
Front Approach Side			
hinged Pull	5'-0" (1.5 m)	4'-0" (1.2 m)	2'-0" (600 mm)
Push	4'-0" (1.2 m)	4'-0" (1.2 m)	1'-0" (300 mm)
Latch Side Approach			
Pull Side	4'-0" (1.2 m)	5'-0" (1.5 m)	2'-0" (600 mm)
Push Side	3'-6" (1050 mm)	5'-0" (1.5 m)	2'-0" (600 mm)

Revision Date: 31 Dec 2002

Hinged Side Approach			
Pull Side	5'-0" (1.5 m)	5'-0" (1.5 m)	2'-0" (600 mm)
Push Side	3'-6" (1050 mm)	4'-6" (1350 mm)	1'-5" (425 mm)
Sliding Door			
Front approach	4'-0" (1.2 m)	3'-0" (900 mm)	1'-9" (530 mm)
Side approach	3'-6" (1050 mm)	4'-6" (1350 mm)	1'-10" (555 mm)

F6 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 sq.ft (1.8 m²) with a minimum dimension of 4'-6" (1350 mm).
- (c) The elevator door should be at least 2'-8" (800 mm) in clear width.
- (d) Elevators should be self levelling with a maximum tolerance of 1" (25 mm).
- (e) Control buttons should be located not more than 4'-6" (1350 mm) above the floor.
- (f) Handrails should be provided at a height of between 2'-8" and 3'-0" (800 and 900 mm).

F7 THEATRES, CINEMAS AND AUDITORIA

- (a) There should be accommodation for persons in wheel chairs attending functions at the 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
Over 600	6 plus 1 for each additional increment of 500 seats to a maximum of 12.

Revision Date: 31 Dec 2002

- (b) Wheel chair spaces should be not less than 4'-4" (1300 mm) deep x 2'-6" (750 mm) wide and should preferably be integrated into the regular seating.
- (c) Each space 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 2.

F8 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" (900 mm) 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		Edge Treatment
0 – 1/4"	0 – 6 mm	May be vertical
1/4 – 1/2"	6 – 12 mm	Should be bevelled. Max slope 1:2.
over 1/2"	over 12 mm	Treat as ramp

Table F-4
Slip Resistance of Floor Finishes

Surface	Dry and Unpolished	Wet
Clay tiles	Very good	Very good
Carpet*	Very good	Good
Clay tiles (textured)	Very good	Good (External)
Cork tiles	Very good	
PVC with non-slip granules	Very good	Good
Mastic asphalt	Good	Good
Concrete**	Good	Poor to fair
Terrazao	Good	Poor to fair

Notes The soft weave of the carpet may make travel in a straight line difficult
Textured finish to concrete improves its resistance when wet.

F9 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" (750 mm) and 6'-6" (1950 mm) shall protrude not more than 4" (100 mm) into pedestrian areas such as sidewalks, halls, corridors, etc.

F10 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.

F11 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" (700 mm) from the floor may protrude any amount.
- (b) Objects between 2'-4" (700 mm) and 6'-8" (2 m) from the floor shall not overhang more than 12" (300 mm).
- (c) The maximum height of the bottom edge of an object with a space of more than 12" (300 mm) between supports shall be 2'-3" (675 mm) from the floor.
- (d) Freestanding objects shall not overhang more than 1 ft. (300 mm) between 2'-3" (675 mm) and 6'-5" (1950 mm).

F12 HEADROOM

The minimum headroom – clear height from the floor to ceiling (or any supporting beam or member) – is 7 ft. (2.1 m).

F13 BATHROOM AND TOILET FACILITIES

- (a) All public buildings shall have at least one toilet specially constructed for use by persons with disabilities. 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 disabled persons. The sketches show planning arrangements for the toilet compartments and the international signs used for facilities for the disabled.
- (b) Toilet fixtures should be so placed as to facilitate the turning of a wheelchair.
- (c) Handrails of not less than 1" (25 mm) and not more than 1-1/2" (38 mm) OD shall be provided on both sides of the water closet, and mounted 2'-10" (850 mm) above and parallel to the floor. The handrail should be placed with the front end about 2 ft. (600 mm) in front of the water closet.

Revision Date: 31 Dec 2002

- (d) Toilet seats should be 18" to 24" (450 to 600 mm) 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" (850 mm) high with a clear space of at least 2'-3" high x 3'-0" (675 x 900 mm) under the basin. The wash basin 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 ft. (1.2 m) 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" (900 mm) 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 disabled persons. Such showers should not be less than 5'-0" x 3'-0" (1500 x 900 mm) with a threshold no higher than 1/2" (12 mm) and a curtain hung 3'-0" (900 mm) 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.

F14 PARKING LOTS

- (a) Any parking lot servicing an entrance described in F3 shall have a number of level parking spaces identified by the appropriate international signs as reserved for disabled persons. Each reserved parking space shall not be less than 12'-0" (3.6 m) wide.
- (b) Table F-5 gives the suggested number of reserved parking spaces for disabled persons. 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 People with Disabilities

Total Number of Parking Spaces in Lot for	Required Number of Spaces Reserved for People with Disabilities
1 – 50	1
61 – 75	2
76 – 100	3
101 – 200	4

Revision Date: 31 Dec 2002

201 – 500	5
above 500	1 % of the total number of spaces

F15 ILLUMINATION

All spaces to be used by visually impaired persons should be provided with at least the lighting level of 100 lux.

F16 SIGNS

For adequate recognition of signs by the visually impaired the signs should be constructed and placed in accordance with Table F-6.

Table F-6

Placing of Signs

Minimum Character Height	Maximum Viewing Distance
8" (200 mm)	20'-0" (6 m)
5" (125 mm)	15'-0" (4.5 m)
4" (100 mm)	8'-0" (2.4 m)
3" (75 mm)	7'-10" (2.4 m)
2" (50 mm)	5'-0" (1.5 m)
1" (25 mm)	2'-6" (750 mm)

F17 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" (1.0 m) for travel in a straight line and 5'-0" (1.5 m) to provide for a 180° 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, and for persons in wheel chairs to make a 180° turn. The recommended minimum width for aisles is therefore 5'-0" (1.5 m).

(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" x 4'-0" (750 x 1200 mm). Where a forward approach is possible there should be a clear knee space of at least 2'-6" (750 mm) wide x 1'-8" (500 mm) deep x 2'-4" (700 mm) high.

Revision Date: 31 Dec 2002

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 – Code of practice for shopping complexes.

F18 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" (1350 mm) and a clear floor space of not less than 3'-0" x 4'-0" (900 x 1200 mm) shall be provided in front of the telephone. If a clear height of 2'-6" (750 mm) is available for knee space, then the allowable floor space can extend into the knee area a maximum of 4'-0" (1.2 m).
- (c) The minimum cord length should be 3'-4" (1.0 m).
- (d) The telephone assembly including the enclosures shall not reduce the minimum width required for safe passage in corridors, aisles or walkways.

APPENDIX G – GUIDELINES FOR FIRE RESISTIVE CONSTRUCTION

G1 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 Sections 3 and 4 of this Code and in Section E of the Building Guidelines. Subsection 307 of the Code provides information 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 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 case of buildings without their own water supply, access to the nearest suitable water connection.

G2 OTHER CODES

It is recommended that designers of institutional buildings and buildings of all Occupancy Groups, in particular Groups A, B, C, D, E(b) and (c), and F consult the codes listed below. Where a conflict arises in the interpretation of the Codes, this Code and the directions of the Board take precedence.

The reference codes are:

- **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

- **Barbados National Building Code**
 - Part 3 Fire Safety
 - Section 3.0 Fire Safety Objectives
 - Section 3.1 Compartmentation and Area Limitations
 - Section 3.2 Fire-Resisting Construction
 - Section 3.3 Use and Occupancy Requirements
 - Section 3.4 Fire Protection and Emergency Systems
 - Section 3.5 Means of Egress

G3 FIRE RESISTING CONSTRUCTION FOR IMPORTANT BUILDINGS

Table G-1 gives the fire resistant periods applicable to 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
Fire Resistant Periods

Buildings	Period in Hours
Assembly Halls	1–1/2
Hospitals	1–1/2
Infirmaries	2
Prisons	1
Theatres	1–1/2
Office Buildings	1/2
Banks	1/2
Shops and Shopping Centres	3/4

Revision Date: 31 Dec 2002

The fire resistant periods given are based on the need for the building structure to remain intact while occupants exit the buildings safely. It is important to recognise that while evacuation may be possible in much less time than indicated in the Table, the conditions for safe exit may not be in place, and caution must be used, in particular, in the design of hospitals and infirmaries where the occupants will not be completely mobile and staff may not be immediately available to offer assistance to the immobile or bedridden occupants.

G4 STORAGE OF FLAMMABLE LIQUIDS AND GASES

See NFIPA 30 – Flammable and Combustible Liquids.

NFiPA codes provide 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.

These codes give 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 relevant Codes such as to ensure that the design of the facility conforms to the safety standards approved by the Board.

G5 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" (12 mm) 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" (12 mm) fibreboard. The minimum timber assembly for a 1-hr fire resistive period is given in Table 4–2. This assembly is described as 2" x 4" (50 mm x 100 mm) wood studs 16" (400 mm) on centre with two layers of 3/8" (10 mm) regular gypsum wallboard on each side. This assembly must be 5–1/2" (140 mm) thick.

The Board 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.

APPENDIX H – SPECIAL OCCUPANCY REQUIREMENTS

H1 REQUIREMENTS OF GROUP A OCCUPANCIES

H1.1 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.

H1.2 Construction, Height and Area Allowable

Buildings or parts of buildings, classed in Group A because of use or Occupancy will be of Type 1 construction if more than one storey. 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.

H1.3 Location on Property

The main floor should be located at or near grade.

H1.4 Exit Facilities

Exit facilities for Group A Occupancy shall be as set out in Section 6.

H1.5 Occupancy Content (See Section 3 Table 3–1)

For places of public assembly with fixed seats, a space of 7 sq.ft (0.65 m²) shall be allowed per person. For places of assembly with movable seats, a space of 10 sq.ft (0.9 m²) shall be allowed per person. For night clubs and restaurants with tables, a space of 12 sq.ft (1.1 m²) 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 15 sq.ft (1.4 m²) 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.

H1.6 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 Table 6–1, and Tables 6–3 and 6–4. 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" (550 mm) unit of exit width for each 100 persons or part thereof.
- (b) Areas served by stairs or other type of exit not as set forth in (a) above, one 22" (550 mm) unit of exit width for each 75 persons or the fraction thereof. The minimum exit width shall be 36" (900 mm) in all cases.

However, the number and widths of exit shall not be less than those set out in Tables 6–1 and 6–4.

H1.7 Main Floor Exits

Revision Date: 31 Dec 2002

- (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 shall 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 1 in 10. 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 2 hrs. There shall be not less than 2 remote exits from any Group 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 601.4(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 ft. (45 m) See Table 6-2.

H1.8 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 30 persons may be served by one 44" (1.1 m) stair, and for 30 persons or more at least 2 exits shall be provided.

H1.9 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" (1100 mm) in width and no double door ways shall be less than 3'-9" (1125 mm) in width.

H1.10 Marking of Exit Doors

Above every exit door there shall be a lighted sign marked EXIT in letters at least 4" (100 mm) 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."

H1.11 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; movable or folding seats for the assembly of 500 persons or more shall be fastened together in banks of 6 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 28 ft. (8.5 m) between aisle or gangways nor more than 14 ft. (4.25 m) 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.

H1.12 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 1/8 of the total floor area, 1/2 of which shall be openable, or shall be provided with electric light and mechanically operated ventilating system as set forth in Section 10.

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 10, and emergency lighting shall be provided in all paths of egress to the approval of the Board.

H1.13 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.

H1.14 Enclosure of Vertical Openings

- (a) Vertical openings (shafts) shall be enclosed as set forth in Section 3.
- (b) Elevators which serve dressing rooms, gridiron and fly galleries need not be enclosed above the stage level.

H1.15 Stages

Stages, platforms and accessory features thereof shall be designed and constructed as follows:

- (a) **Stage construction.** All parts of the stage shall be designed to support not less than 125 lb./sq.ft (6 kPa) and shall be of non-combustible construction or fire retardant timber. Any rooms 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.

Revision Date: 31 Dec 2002

Openings through stage floors shall be equipped with tight-fitting trap doors of non-combustible materials or of wood not less than 2" (50 mm) 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 2-hr fire-resistive construction.
- (d) **Proscenium walls.** The proscenium wall separating the stage portion from the auditorium shall be not less than 4-hr fire-resistive construction and shall extend not less than 4 ft. (1.2 m) 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 2 openings at the stage-room level, each of which shall be not more than 25 sq.ft (2.3 m²) 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 10% of weight of cotton or other combustible materials.

Such curtain shall be of 1-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 Board.

Proscenium curtains, 35 ft. (10 m) or less in width, shall have a rigid metal member, not less than the equivalent of a 2" (50 mm) standard steel pipe, at the top and bottom edges, protected by the fabric on both the stage and auditorium sides. Curtains over 35 ft. (10 m) 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 lb./sq.ft.

The proscenium curtain shall extend into non-combustible and smoke-proof guides at the sides, a distance of not less than 12" (300 mm). The curtain shall overlap at the top of the proscenium opening not less than 24" (600 mm) and the bottom edge shall have a yielding pad of non-combustible materials not less than 4" (100 mm) deep to form a seal against the floor.

The proscenium curtain shall be rigged and counter-balanced with not less than six 3/8" (9 mm) flexible steel cables and 6 safety stop chains of 1/4" (6 mm) 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 Board.

- (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 3 fusible links, one of which shall be placed in the ventilator above the mains roof level and the other 2 at approved points, no affected by sprinkler heads. Such links shall fuse and separate at 160°F. 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 2'-6" (750 mm) inches wide shall be provided from each side of the stage opening, directly or by means of a passageway not less than 3'-0" (900 mm) in width, to a street or exit court. An exit stair not less than 2'-6" (750 mm) wide shall be provided for egress from each fly gallery.

Each tier of dressing rooms shall be provided with 2 remote paths of egress, each not less than 2'-6" (750 mm) wide, and where dressing rooms are provided more than one tier above the stage floor, stairways to all tiers shall be enclosed.

- (i) **Other requirements.** There shall be no enclosed structure for human occupancy located above a stage.

H1.16 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 ft. (5.5 m) measured to the 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 ft. (7.5 m).
- (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

Revision Date: 31 Dec 2002

completely separated therefrom by not less than 2-hr 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" (500 mm) wide, shall be provided between the screen or sound equipment and the rear wall.

H1.17 Motion Picture Machine Booths

All booths constructed for the projection or showing of motion picture films shall be as follows:

- (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 sq.ft (4.5 m²) for each motion picture machine in such booth.
- (b) The floors, walls and ceiling of such booth shall be of non-combustible materials of not less than 2-hr 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 sq.ft (18 m²) in area shall have 2 means of exit therefrom, and doors shall be remotely located. Any required exit door from the motion picture booth shall be not less than 2'-6" (750 mm) 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 sq.in. (750 cm²)
- (e) There shall be not more than three combination observation and spotlight ports, and they shall not exceed 30" x 24" (750 x 600 mm).
- (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 10 US gauge sheet metal and enough to overlap at least 1" (25 mm) 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°F 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" (750 mm) square in area, placed near the floor and protected by 2 layers of copper gauze, one of 18 meshes/inch and the other of 10 meshes/inch, in addition to the shutter specified above.
- (i) At the top of every booth, there shall be at least a 10" (250 mm) diameter vent for each motion-picture machine. Such vent shall be constructed of not less than #4 US gauge sheet metal and shall connect into a masonry flue or go directly through the roof and 12" (300 mm) above, and shall be provided with an exhaust fan which will produce a complete change of air in the booth every 2 minutes.
- (i) 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 4" (100 mm) 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 10 such films boxes in each compartment.
- (n) Each compartment shall have a separate tight-fitting, self-closing cover of not less than 10 US gauge sheet metal, arranged to close automatically.

No solder shall be used in the construction of such metal boxes, compartments or cabinets.

H1.18 Fire Protection and Hazards

The installation of fire alarm and fire suppression systems shall be in accordance with Subsection 308.

H1.19 Plumbing and Toilet Facilities

The installation of plumbing and toilet facilities shall be in accordance with Sections 5 and 9.

H1.20 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 Section 6,

Revision Date: 31 Dec 2002

- (c) fire and safety requirements as per Section 3, and
- (d) plumbing and sanitation as per Section 9,

and providing that there is not less than a 2-hr fire separation between such buildings and any other occupancies.

H1.21 Schools and Churches

(a) **Special provisions**

- (i) A fire-resistive ceiling shall not be required in the assembly space of churches and gymnasiums in 1-storey buildings, every part of the roof structure of which is 18 ft. (5.5 m) 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 2-storey Type 3 buildings, basements, including the first floor shall be of Type 1 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 Per Person	
	Sq.ft	m ²
Auditoriums	7	0.6
Dining Rooms	10	0.9
Gymnasium seating areas	6	0.55
Classrooms	16	1.1
School Libraries	40	3.75
Other Group A Uses	40	3.75

(c) **Widths of exits**

Exits shall be provided as per Section 6

(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" (900 mm) 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 2 exit doors, not less than 36"

(900 mm) in width, the combined width of which shall be not less than one 22" (550 mm) 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 6.
- (iv) Classroom exits may be to corridors.
- (v) Rooms in basements shall have not less than 50% 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 6 ft. (1.8 m) nor less than 4" (100 mm) for every 300 sq.ft (28 m²) 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 6 ft. (1.8 m) nor shall drinking fountains or other equipment fixed or moveable, be placed to obstruct the required minimum 6 ft. (1.8 m) width.

(f) **Balconies**

Used as exits shall not be less than 5 ft. (1.5 m) in width at any point.

(g) **Floors**

- (i) There shall be not less than 2 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 the exterior.
- (iii) The upper floors of 2-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 1/2 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 3 storeys shall have smokeproof towers for not less than 1/2 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

Revision Date: 31 Dec 2002

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" (900 mm).
- (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 less than 800 sq.ft (75 m²), to the nearest floor exit shall not exceed 100 ft. (30 m) except that the distance in any room where one exit door is permitted shall not exceed 40 ft. (12 m).

(i) **Fire protection and hazards**

Automatic sprinkler systems, fire extinguishers, fire alarm systems and standpipes shall be as set forth in Section 3.

(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 9.

(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.

H1.22 Mixed Occupancies

Separation of Group A Occupancies or division thereof from all other Occupancies or Divisions of Occupancies shall be as set forth in Section 3.

H2 REQUIREMENTS OF GROUP B OCCUPANCIES

H2.1 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

H2.2 Type of Construction

Buildings in this Group can be of Types 1, 2, 3 or 4 construction. Construction in Type 5 – Wood Frame is not permitted.

The permissible heights and areas under each classification are given in Table 3–3.

H2.3 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.

H2.4 Exit Facilities

(a) **Exit capacity**

The number of persons per 22" (550 mm) unit of exit width from a sprinklered or non-sprinklered building shall be as per Table 6–3.

(b) **Travel Distance**

The maximum permitted travel distance shall be as per Table 6–2, except that for a sprinklered building the maximum travel distance may be increased to 150 ft. (45 m).

H2.5 Fire Protection and Hazards

(a) Buildings in this Group may be either sprinklered or 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 8,000 sq.ft (750 m²) by 1-hr fire rated construction and

(ii) further subdivided into areas not exceeding 4,000 sq.ft (375 m²) 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-hr and doorways to cells and other openings in construction bounding cells must be protected with 1-hr 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.

H2.6 Plumbing and Toilet Facilities

The installation of plumbing and toilet facilities shall be in accordance with Section 9.

H2.7 Electricity and Airconditioning Services

Section 10 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.

Revision Date: 31 Dec 2002

H3 REQUIREMENTS FOR GROUP C OCCUPANCY

H3.1 Definition

Group C Occupancy shall include storage and industrial uses as listed in Section 301.4.

H3.2 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 Board, 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 Board 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 4 storeys may have framework and floors unprotected and exterior walls of not less than 2-hr 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 ft. (7.5 m) from the exit of such building.

H3.3 Location on Property

- (a) The location and site layout of buildings with Group C Occupancy shall comply with the requirements of the Department of Planning.
- (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.

H3.4 Exit Facilities

(a) General

Exit facilities for Group C Occupancies shall be as set forth Section 6, 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 (930 m²) or fraction thereof. See H3.4(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 without deduction for corridors, divided by an area of 100 sq.ft (9 m²) per person.

(c) **Width of exits**

Street floor exits shall be provided based on one 22" (550 mm) unit of exit width for each 100 persons or fraction thereof on the street floor plus 1–1/2 units for each 2 units of stairway or ramp from upper or lower floor where such floors discharge through the street floor.

(d) **Arrangement of exits**

- (i) **Interior spaces** – Rooms or spaces shall have not less than 2 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 ft. (15 m) a single exit may be provided.
 - (ii) **Floors** – There shall be not less than 2 remote paths of egress from each floor except that floors or mezzanines of buildings not exceeding 2 storeys 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, passageways, as specified in Section 6, 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 2 remote exits, shall not exceed 20 ft. (6 m).
 - (v) The upper floor of 2-storey buildings may have interior stairways, enclosed where required under Types of Construction, or open exterior stairways.
 - (vi) The upper floors of 3-storey buildings shall have enclosed interior stairways for not less than 1/2 of the required floor exits. Other upper exits may be open exterior stairways or enclosed interior stairways.
 - (vii) The upper floors of buildings which exceed 3 storeys shall have enclosed interior stairways, except that buildings which exceed 5 storeys shall have not less than 1/2 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 an occupant content of less than 50 persons, to the nearest floor exit shall not exceed 150 ft. (45 m).

Revision Date: 31 Dec 2002

(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 sq.ft (930 m²) 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 ft. (30 m).
- (iv) Stairs shall be not less than 3 ft. (900 mm) wide and shall be enclosed if more than 50% of the periphery of the building is enclosed or if the structure exceed 3 storeys in height.

H3.5 Light and Ventilation

All portions of Group C Occupancies customarily used by human beings shall have light and ventilation as set forth in Section 10. All parts of buildings where flammable liquids are used or stored or where automobiles are stored or handled shall be provided with mechanical ventilation as set forth in Chapter 10, except that the Board may waive this requirement when the building is provided with unobstructed openings and/or cross ventilation.

H3.6 Fire Protection and Hazards

- (a) Automatic-sprinkler systems, fire extinguishers and standpipes shall be as set forth in Section 3.
- (b) The storage of flammable material shall be as recommended in H6 and Appendix G.

H3.7 Plumbing and Toilet Fixtures

Toilet facilities and plumbing shall be installed as set forth in Section 9.

H4 REQUIREMENTS FOR GROUP D OCCUPANCIES

H4.1 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.

H4.2 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 H2 paragraph H3.2(b).

H4.3 Location on Property

The location and site layout of buildings of Group D Occupancy shall comply with the requirements of the Department of Planning, and with Tables 3-4 to 3-7.

H4.4 Exit Facilities

Exit facilities for Group D Occupancies shall be as set forth in this Appendix and in Section 6.

(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 Board.

(b) **Widths of exits**

Street floor exits shall be provided based on 22" (550 mm) of exit width for each 100 persons or fraction thereof on the street floor plus 1-1/2 units for each 2 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 2 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 ft. (15 m) 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 1/2 of the required exits from the first or ground floor of a mercantile occupancy shall be to the main entrance and exit.

Revision Date: 31 Dec 2002

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 2 remote paths of egress from each floor except that floors of buildings not exceeding 2 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 2 remote exits shall not exceed 20 ft. (6 m).

The upper floor of two-storey buildings shall have enclosed interior stairways for not less than 1/2 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 more 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 ft. (45 m) except that if high hazard commodities are displayed or handled without protective wrappings or containers the travel distance shall not exceed 75 ft. (23 m).

(e) **Special restriction**

Smokeproof towers and enclosed interior **stairways** shall not be taken down to basement level. Basement exits shall be separate.

H4.5 Light and Ventilation

All portions of Group D Occupancies customarily used by human beings shall have light and ventilation as provided in Section 10.

H4.6 Fire Protection and Hazards

- (a) Automatic sprinkler systems, fire extinguishers and standpipes shall be as set forth in Section 6.

- (b) Electrical installations shall be as required herein and as specified in Section 10.
- (d) The storage of flammable materials shall be as recommended in H6 and Appendix G.

H4.7 Plumbing and Toilet Facilities

Toilet facilities and plumbing shall be installed as set forth in Section 9.

H5 REQUIREMENTS OF GROUP E OCCUPANCIES

H5.1 Definition

Group E Occupancy shall include multiple-residential uses such as private residences, hotels, motels and other buildings as listed in 301.6.

H5.2 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 3–3.
EXCEPTION Type 3 (Protected) buildings may be 3 storeys in height if the floor level of the 3rd floor is not more than 20 ft. (6 m) above the grade adjacent thereto, but where this exception is used, loadbearing walls shall be of non-combustible materials.
- (b) Basements shall be of Type 1 construction.

H5.3 Location on Property

- (a) The location and site layout of buildings of Group E occupancy shall comply with the requirements of the Department of Planning.
- (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 Tables 3–3 to 3–7.

H5.4 Exit Facilities

- (a) **General**
Exit facilities for Group E Occupancies shall be as set forth in this Appendix and in Section 6.
- (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 sq.ft (11 m²) per person except that the occupant content of a dormitory room shall be computed at 30 sq.ft (3 m²) per person.
- (c) **Widths of exits**

Revision Date: 31 Dec 2002

- (i) Exits from street or ground floors shall be provided on the basis of one 22" (550 mm) unit 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" (550 mm) 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" (1100 mm) in width, except that where serving floors having not more than 4 apartment units or 8 hotel rooms, one such required path of egress may be no less than 36" (900 mm) in width.
 - (iv) The minimum width of exit doors from dwelling units or hotel rooms shall be not less than as given in Table 6-4.
 - (v) Residential apartment units in multiple apartment buildings, having a 2nd floor or balcony contained wholly within the unit not exceeding 1,000 sq.ft (93 m²) and an additional exit not less than 30" (750 mm) in width from upper areas exceeding 1,000 sq.ft (93 m²). 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 the Department of Planning but not less than 44" (1100 mm) and inner courts shall have a clear width of not less than 10 ft. (3 m).
- (d) **Arrangement of exits**
- (i) **Unit exits**

Dwelling units and hotel rooms, 800 sq.ft (75 m²) or more in area, shall have not less than 2 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 sq.ft (93 m²), not less than 2 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 2 remote paths of egress from each floor except for 2 floor building containing only 3 apartments.

Floor exits shall be by means of stairways, ramps, horizontal exits and passageways as specified in Section 6 or by doors at or near grade, directly to the exterior.

Dead ends in exit corridors beyond a floor exit or other corridor having 2 remote exits shall not exceed 20 ft. (6 m).

The upper floor of 2-storey buildings may have enclosed interior stairways for not less than 1/2 of the required floor exits. Other upper floor exits may be open exterior stairways or enclosed interior stairways.

The upper floors of 3-storey buildings shall have enclosed interior stairways for not less than 1/2 the required floor exits. Other upper floor exits may be open exterior stairways or enclosed interior stairways.

EXCEPTION

Where the floor level of the 3rd floor does not exceed 22 ft. above grade, all floor exits may be open exterior stairways.

The upper floors of buildings which exceed 3 storeys shall have enclosed interior stairways, except that buildings which exceed 5 storeys shall have not less than 1/2 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 more 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 sq.ft (93 m²) to the nearest floor exit shall not exceed 100 ft. (30 m) except that the travel distance in any room where one exit is permitted shall not exceed 50 ft. (15 m).
- (ii) **Apartments** – Exits and means of access thereto shall be located so that it will not be necessary to travel more than 50 ft. (15 m) 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** – Every sleeping room below the eighth floor in Group E Occupancies shall have at least one openable window or exterior door to permit emergency exit or rescue. Where such windows are provided, such windows shall have a sill height of not more than 48" (1.2 m) above the floor and shall provide not less than 5 sq.ft (0.45 m²) of openable area with no dimension less than 22" (550 mm).
- (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.

Revision Date: 31 Dec 2002

(f) **Special provisions**

Where Group E Occupancy buildings exceed 3 storeys in height and where the distance between floor exits exceeds 100 ft. (30 m) smoke doors shall be provided in the corridors, centrally located between the exits.

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 impede 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'-8" (2 m) in height and shall be of a width deemed necessary to meet the exit requirements and shall be of 1-3/8" (34 mm) solid construction with a 10" x 10" (250 x 250 mm) wired glass panel. These doors shall be tested at 6 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.

H5.5 Light and Ventilation

(a) **General**

- (i) Rooms used for sleeping or living purposes shall be provided with light and ventilation by means of windows in exterior walls with an area not less than 1/8 of the floor area of such rooms and not less than 1/2 of the required windows 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 10.
- (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**

Rooms used for sleeping, living and dining rooms, kitchens, corridors and toilet rooms shall have floor areas and ceiling heights as specified in Section 5.

Rooms, the floor of which is more than 3 ft. (900 mm) below grade and which depend on natural ventilation, shall not be used for sleeping purposes.

H5.6 Fire Protection and Hazards

- (a) Automatic sprinkler systems, fire extinguishers and standpipes shall be as set forth in Section 3.
- (b) The storage of flammable materials shall be as recommended in H6 and Appendix G.

H5.7 Plumbing and Toilet Facilities

- (a) Plumbing and toilet facilities shall be as required in Section 9.
- (b) Toilet rooms serving a one-family unit shall have outside openings screened with 18-mesh wire screening. The minimum openable area shall be 2 sq.ft. (900 cm²)
- (c) For establishments with an occupant content of 10 or more persons, separate facilities shall be provided for employees.
- (d) Separate facilities consisting of water closet, handbasin, and a bath or shower, shall be contiguous thereto and directly accessible from each hotel room.
- (e) Sanitary facilities may be located in rooms provided there is no conflict with minimum requirements otherwise set forth in Section 5.

H6 REQUIREMENTS OF GROUP F OCCUPANCIES

H6.1 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.

H6.2 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 should refer to other laws, codes and standards which apply to 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.

H6.3 Location on Property

The location and layout on site of buildings of Group F Occupancy shall comply with the requirements of Department of Planning and be in accordance with Tables 3-4 to 3-7.

Revision Date: 31 Dec 2002

H6.4 Exit Facilities

Exit facilities for Group F Occupancies shall be as set forth Section 6 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:
 - (i) Street floor exits shall be provided based on one 22" (550 mm) unit of exit width for each 100 persons or fraction thereof on the street floor plus 1–1/2 units for each 2 units of stairway or ramp from upper or lower floors where such floors discharge through the street floor.
 - (ii) Upper or lower floors other than street shall have one 22" (550 mm) unit of exit width for each 60 persons or fraction thereof except that horizontal exits and smoke towers may serve 100 persons for each 22" (550 mm) unit 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 sq.ft (37 m²) or more in area, shall have not less than 2 remote exits.
 - (ii) **Floors** – There shall be not less than 2 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 2-storey buildings may have enclosed interior stairways or exterior open stairways.

The upper floors of 3-storey buildings shall have enclosed interior stairways for net less than 1/2 the required floor exits.

Other upper floor exits may be open exterior stairways or enclosed interior stairways.

The upper floors of buildings which exceed 3 storeys shall have smokeproof towers for not less than 1/2 the required floor exits. Other upper floor exits shall be 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 more 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 more than 75 ft. (22 m).

EXCEPTION: The travel distance in any room, including mezzanines, where one exit door is permitted, shall not exceed 25 ft. (7.5 m).

H6.5 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 5. 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.

H6.6 Enclosure of Vertical Openings

Vertical openings shall be enclosed and shall be of non-combustible materials of not less than 1-hr fire resistive materials. Walls adjacent to open interior stairways and the soffits thereof shall be constructed of not less than 1-hr fire resistive materials as specified in Section 4.

H6.7 Fire Protection and Hazards

- (a) Automatic sprinkler systems, fire extinguishers, and standpipes shall be as set forth in Section 3.
- (b) Electrical installations shall be as required herein and as specified in Section 10.
- (c) The storage or use of flammable materials shall be as recommended in H6 and Appendix G.
- (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 of the Board under Subsection 506.

H6.8 Plumbing and Toilet Facilities

Plumbing and toilet facilities shall be installed as set forth in Section 9 and Subsection 505.

Revision Date: 31 Dec 2002

APPENDIX I – CLASSIFICATION BY TYPES OF CONSTRUCTION

II TYPE 1 – FIRE RESISTIVE CONSTRUCTION

II.1 Definition

The structural frame of Type 1 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.

II.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.

II.3 Structural Framework

- (a) The primary structural framework shall be of not less than the following fire-resistive construction, as per Table 3–4, Section 3:
 - Exterior frame 4 hours
 - Interior frame 3 hours
- (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" (200 mm) masonry block walls shall be limited to 20 ft. (6 m) in height and 12" (300 mm) masonry block walls shall be limited to 30 ft. (7.5 m) in height. Bearing walls shall be of fire-resistive construction as set forth in Tables 3–4 to 3–7.

II.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 5 ft. (1.5 m) from and parallel to the common lot line.
- (b) Main exterior walls shall be of noncombustible 4-hr 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 5 ft. (1.5 m) or walls, except on street fronts, which are less than 5 ft. (1.5 m) from the building line of continuous lot, shall have no openings.
 - (ii) Openings in walls of buildings having a distance separation of from 5 ft. to 10 ft. (1.5 to 3 m) shall be protected by fire-resistive doors or windows. The total area of openings in any storey shall be limited to 30% with no single opening more than 10% of such wall area. Walls having a distance separation of more than 10 ft. (3 m) but less than 30 ft. (9 m) shall be

- protected by ordinary doors or windows not exceeding 50% 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) Access openings shall be suitably marked and spaced not more than 50 ft. (15 m) apart on each floor in each accessible side of the building.
 - (ii) Each access opening shall be not less than 2'-8" (800 mm) wide and 4'-0" (1.2 m) high with sill not higher than 2'-8" (800 mm) above the floor.
 - (iii) Access openings shall not be required if the building has smokeproof towers spaced not over 100 ft. (30 m) apart serving as a required exit ways.
 - (e) Fire walls shall be of the fire-resistive rating as required in Section 4.
 - (f) Interior bearing walls shall be of 3-hr fire-resistive construction as per Tables 3-4 to 3-7, except that:
 - (i) Corridor partitions shall also comply with Section 6 – Means of Egress.
 - (ii) Full-height 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 non-combustible or fire-retarded treated wood material.
 - (g)
 - (i) Underground structures exceeding 2,500 sq.ft (230 m²) in area shall be provided with at least 2 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 more occupants use the underground structure and the required exits involve upward travel, a smoke proof exit shall be provided.

II.5 Floors

- (a) **Material**
 - (i) Floor systems shall be of non-combustible materials. Poured-in-place concrete slabs shall be not less than 2-1/2" (65 mm) thick where removable forms are used nor less than 2" (50 mm) 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 non-combustible materials.
- (b) **Fireproofing** – Floors for buildings more than 6 storeys or 80 ft. (25 m) in height shall be of not less than 2-hr fire-resistive construction. The use of bar joists shall be limited to buildings for 4 storeys.

Revision Date: 31 Dec 2002

I1.6 Roofs

(a) Materials

Roof systems shall be of non-combustible materials.

(b) Fireproofing

Roofs for buildings more than 6 storeys or 80 ft. (25 m) in height shall be of not less than 2-hr fire-resistive construction.

(c) Roof Coverings

Roof coverings shall be fire-retardant in accordance with the test procedure of the BSI or ASTM.

(d) Spaces above a Ceiling

Access trap doors, not less than 16" x 30" (400 x 750 mm) shall be provided to all spaces above a furred ceiling having a vertical distance of 36" (900 mm) or more. Such access trap doors shall be from common spaces such as corridors and no part of such furred space shall be more than 100 ft. (30 m) from an access trap door. Walkways shall be provided in such furred spaces above the ceiling.

I1.7 Enclosure of Vertical Openings

Enclosure of vertical openings shall be of non-combustible materials and not less than 1-hr fire-resistive construction, and where such openings exceed 8 sq.ft (0.7 m²) in area shall be of not less than 2-hr fire-resistive construction, with fire-resistive doors and/or windows.

I1.8 Stairways

(a) Stairways shall be as required in Section 6.

(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.

I1.9 Doors and Windows

(a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected or entirely prohibited. Subsection 405 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.

I1.10 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 1-hr 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.

11.11 Roof Structures and Skylights

- (a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of non-combustible materials.
- (b) Roof structures, for plant or equipment, shall be limited in total combined area to 30% of the area of the roof, otherwise they shall be constructed with fire separation from the main portion of the building, in accordance with Tables 3-4 to 3-7.
- (c) Minor roof structures having an area of less than 30% of the roof area 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 the public has access to roof areas, a guard rail not less than 36" (900 mm) above the roof shall be provided around all open wells or shafts and at all exterior walls.
- (g) 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.

11.12 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 movable 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 11.4, and floor finishes may be of combustible materials. Wood doors or windows or frames may be used except where fire-resistive protection is required by other provisions of this Code.
- (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 breach the fire-resistance integrity of the exterior walls.
- (d) In places of public assembly, all draperies, hanging and other decorative materials suspended from walls or ceilings shall be non-combustible or flame-resistant provided the permissible amount of

Revision Date: 31 Dec 2002

flame-resistant decorative hangings shall not exceed 10% of the total wall and ceiling area.

I2 TYPE 2 – SEMI-FIRE RESISTANT CONSTRUCTION

I2.1 Definition

- (a) The structural frame of buildings or structures of Type 2 Construction shall be of steel, 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 1-hr fire resistive construction may use fire-retardant treated wood within the assembly.

I2.2 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.

I2.3 Structural Framework

- (a) The primary structural framework shall be of not less than as specified in 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" (200 mm) masonry block walls shall be limited to 20 ft. (6 m) in height and 12" (300 mm) masonry block walls shall be limited to 30 ft. (9 m) in height. Bearing walls shall be of fire-resistive construction as set forth in Table 3-2.

I2.4 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 1-hr fire-resistive construction as per Tables 3-4 to 3-7.
- (d) Partitions shall be of not less than 1-hr fire resistive construction except as provided in Tables 3-4 to 3-7.

I2.5 Floors

- (a) Material
 - (i) Floor systems shall be of non-combustible material or fire-retardant treated wood.
Exception: Fire retardant treated wood may not be used in buildings exceeding 2 storeys 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 similar spaces less than 100 sq.ft (9 m²) in area.
 - (iii) Spaces under a timber 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 2-hr 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 3 ft. (900 mm) such fire protection for the ground floor may be omitted.

I2.6 Roofs

- (a) **Materials** – Roof systems shall be of non-combustible materials or of fire-retardant treated wood.
- (b) **Fireproofing** – Roofs and all parts thereof shall be of not less than 1-hr fire-resistive construction as per Tables 3–4 to 3–7, except as follows:
 - (i) Roofs, where the structural framework is 20 ft. (6 m) 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% enclosed by walls, in which the travel distance to the nearest exit does not exceed 40 ft. (12 m) may be of unprotected non-combustible materials.
- (c) **Roof Coverings** – Roof coverings shall be fire-retardant and as specified in Section 3.
- (d) **Roof Drainage** – Roof drainage and the disposal of rainwater shall be as specified in the Section 5. In general, roof systems not designed to support accumulated water shall be sloped for drainage.
- (e) **Attic/roof Spaces** – Any attic spaces shall have a minimum vertical dimension of 18" (450 mm) clear distance and where unprotected combustible material is exposed, shall be divided, by fire-stops, into areas not exceeding 2,500 sq.ft (230 m²). Access shall be provided to ceiling spaces as for Type 1 Construction in I1.6(d).

I2.7 Enclosure of Vertical Openings

Enclosure of vertical openings shall be of non-combustible materials and where such openings exceed 8 sq.ft (0.7 m²) in area shall be not less than 1-hr fire-resistive, non-combustible or fire-retardant treated wood construction, with fire-resistive doors and/or windows.

I2.8 Stairways

- (a) Stairways shall be as required in the Section 6.

Revision Date: 31 Dec 2002

- (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.

I2.9 Doors and Windows

Doors and windows shall not project over public property.

I2.10 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 1-hr 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.

I2.11 Roof Structures and Skylights

- (a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of non-combustible materials. Roof structures extending more than 25 ft. (7.5 m) above the roof or signs more than 100 sq.ft (9 m²) in area shall be supported to the ground by a non-combustible frame, unless already incorporated into the building frame design.
- (b) Roof structures, for plant or equipment, shall be limited in total combined area to 30% of the area of the roof, otherwise they shall be constructed with fire separation from the main portion of the building, in accordance with Tables 3-4 to 3-7.
- (c) Minor roof structures having an area of less than 30% of the roof area 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 where the roof is of non-combustible, fire-resistive construction.

Parapets shall be not less than 20" (500 mm) above the roof immediately adjacent thereto where located 20 ft. (6 m) 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.

- (g) Where the public has access to roof areas, a guard rail not less than 36" (900 mm) above the roof shall be provided around all open wells or shafts and at all exterior walls.

I2.12 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 1-5/8" (40 mm) thick. Such wood construction shall not breach the fire-resistance integrity of the exterior walls.

I3 TYPE 3 – ORDINARY MASONRY CONSTRUCTION

I3.1 Definition

- (a) 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.

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.

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 1-hr fire resistive construction may use fire-retardant treated wood within the assembly.

I3.2 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.

I3.3 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" (200 mm) masonry walls shall be limited to 20 ft. (6 m) in height and 12" (300 mm) masonry block walls shall be limited to 30 ft. (9 m) 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 non-combustible 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

Revision Date: 31 Dec 2002

less than 1-hr 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 1 storey in height shall be fire-proofed with not less than 1-hr fire-resistive construction.
 - (iii) Heavy timber structures, designed and constructed in accordance with this Appendix and Section 14, shall be considered the equivalent of 1-hr fire-resistive protection.
- (c) **Heavy Timber Construction**

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.

I3.4 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 non-combustible materials or of wood studs, and where supporting upper floors or where adjacent to common corridors shall be of 1-hr fire-resistive construction.

I3.5 Floors

- (a) **Material**
 - (i) Floors shall be of non-combustible material or wood.
 - (ii) Wood joists shall not be used to support concrete and cement-base tile or terrazzo floor surfaces other than for bathrooms or areas less than 100 sq.ft (9 m²) 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 3 ft. (900 mm) such fire protection may be omitted.

I3.6 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 1-hr fire-resistive construction, except as follows:

- (i) Roofs, where every part of the structural framework is 18 ft. (5.5 m) or more above any part of any floor, may be of unprotected non-combustible materials or protected combustible materials.
 - (ii) Roofs of 1-storey open sheds not more than 75% enclosed by walls, in which the travel distance to the nearest exit does not exceed 40 ft. (12 m) may be of unprotected non-combustible materials or protected combustible materials.
- (c) **Roof Coverings** – Roof coverings shall be fire-retardant.
- (d) **Roof Drainage** – Roof drainage and the disposal of rainwater shall be as specified in the Section 5. In general, roof systems not designed to support accumulated water shall be sloped for drainage.
- (e) **Attic Spaces** – Any attic spaces shall have a minimum vertical dimension of 18" (450 mm) clear distance and where unprotected combustible material is exposed, shall be divided, by fire-stops, into areas not exceeding 2,500 sq.ft (230 m²). Access shall be provided to ceiling spaces as for Type 1 Construction in I1.6(d).

I3.7 Enclosure of Vertical Openings

Enclosure of vertical openings shall be of non-combustible materials and where such openings exceed 8 sq.ft (0.75 m²) in area shall be not less than 1-hr fire-resistive construction. Walls adjacent to open interior stairways and the soffits thereof shall be of not less than 1-hr fire-resistive construction.

I3.8 Stairways

Stairways shall be as required in Section 6.

I3.9 Doors and Windows

- (a) Doors, windows and similar openings in exterior walls, fire walls and enclosure walls shall be protected as per Section 4.
- (b) Doors and windows shall not project over public property or restricted areas.

I3.10 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.

I3.11 Roof Structures and Skylights

- (a) Towers, pylons, masts, signs and similar structures above a roof, when not enclosed, shall be of non-combustible materials. Roof structures extending more than 25 ft. (7.5 m) above the roof or signs more than 100 sq.ft (9 m²)

Revision Date: 31 Dec 2002

- in area shall be supported to the ground by a non-combustible frame, unless already incorporated into the building frame design.
- (b) Roof structures, for plant or equipment, shall be limited in total combined area to 30% of the area of the roof, otherwise they shall be constructed with fire separation from the main portion of the building, in accordance with Tables 3-4 to 3-7.
 - (c) Minor roof structures having an area of less than 30% of the roof area 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 ft. (6 m) 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" (500 mm) above the roof immediately adjacent thereto and shall be constructed as set forth in Sections 15 or 16.

I3.12 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" (44 mm) thick. Such wood construction shall not breach the fire-resistance integrity of the exterior walls.

I4 TYPE 4 – NON-COMBUSTIBLE CONSTRUCTION

I4.1 Definition

All structural and other elements of Type 4 buildings shall be of non-combustible materials.

I4.2 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.

I4.3 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.

I4.4 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 5 ft. (1.5 m) 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 5 to 10 ft. (1.5 to 3 m) shall be of not less than 1-hr fire resistive construction and openings therein shall be protected by fire-resistive doors and windows and shall be limited in area to 30% of the wall area with no single openings or more than 10% 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.

I4.5 Floors

Floors shall be of non-combustible material, provided, however that a wood surface or finish may be applied over such non-combustible materials.

I4.6 Roofs

Roof systems shall be of non-combustible materials and fire-proofing shall not be required.

I4.7 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.

I4.8 Projections from the Building

Projections from the building shall be of non-combustible materials.

I4.9 Roof Structures and Skylights

Revision Date: 31 Dec 2002

- (a) Roof structures extending above the building 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" (900 mm) above the roof shall be provided around all open wells or shafts and at all exterior walls.

I4.10 Combustible Materials

A loading platform may be constructed of heavy timber with wood floors not less than 1–3/4" (44 mm) thick. A Type 4 building or structure erected over such platform shall be supported by non-combustible materials to the foundation.

I5 TYPE 5 CONSTRUCTION – WOOD FRAME

I5.1 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.

I5.2 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.

I5.3 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 5 ft. (1.5 m) 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 5 ft. (1.5 m) or walls except of street fronts which are less than 5 ft. (1.5 m) from the building of a contiguous lot, shall be of not less than 2-hr fire-resistive construction and have no openings therein.
 - (ii) Main exterior walls having a distance separation of from 5 to 10 ft. (1.5 to 3 m) shall be of not less than 1-hr fire resistive construction and openings therein shall be protected by fire-resistive doors and windows and shall be limited in area to 30%

of the wall area with no single openings or more than 10% 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.

I5.4 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.

I5.5 Roofs

- (a) Roof systems shall be of non-combustible materials or wood.
- (b) Roof drainage and the disposal of rainwater shall be as specified in Section 5. In general, roof systems not designed to support accumulated water shall be sloped for drainage.
- (c) Any attic spaces shall have a minimum vertical dimension of 18" (450 mm) clear distance and where unprotected combustible material is exposed, shall be divided, by fire-stops, into areas not exceeding 2,500 sq.ft (230 m²). Access shall be provided to ceiling spaces as for Type 1 Construction in 11.6(d). Minimum vertical dimension shall not be required for hip or gable roof construction.

I5.6 Fireproofing

Bearing walls supporting floors shall not be less than 1-hr fire-resistive protection except that where a ground floor has clearance of less than 3 ft. (900 mm) such protection may be omitted.

I5.7 Stairways

- (a) Stairways shall be as required in Section 3 and in Section 4.
- (b) Stairways may be of non-combustible or combustible materials.

I5.8 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.

I5.9 Projections from the Building

Projections from the building may be of wood.

Revision Date: 31 Dec 2002

15.10 Combustible Materials

No materials more combustible than wood shall be permitted in the construction of permanent portions of Type 5 buildings.

APPENDIX J – SELECTION OF FIRE SUPPRESSION SYSTEM

J1 CLASSIFICATION OF FIRE HAZARDS

As a guide to the proper type of fixed fire protection system and the extinguishing agent for each type of hazard, fires may be classified as follows:

CLASS A Fires involving organic solids producing glowing embers and ordinary combustible materials (such as wood, cloth, paper, rubber and many plastics), requiring the heat-absorbing or cooling effects of water, water solutions, or the coating effects of dry chemicals which retard combustion.

CLASS B Fires involving flammable or combustible liquids, flammable gases, greases and similar materials where extinguishment is most readily secured by excluding air or oxygen, inhibiting the release of combustible vapors or interrupting the combustion chain reaction.

CLASS C Fires involving energized electrical equipment where safety to the operator requires the use of electricity non-conductive extinguishing agents.

Note Electrical fires should not be fought with portable class A or B extinguishers or with hand-held solid stream nozzle(s). However, fixed water spray systems may be used to fight fires in energized electrical systems.

CLASS D Metals (eg. aluminium or magnesium).

J2 SPECIAL HAZARDS

In rooms of buildings containing combustibles, such as aluminium powder, calcium carbide, calcium phosphide, metallic sodium or potassium, quicklime, magnesium powder, or sodium peroxide, which are incompatible with the use of water as an extinguishing agent, other extinguishing agents shall be used.

J3 SELECTION OF FIRE SUPPRESSION SYSTEM

Where a fire suppression system is required, the type of system suitable for the hazard involved, if not otherwise specified in this Code, shall be as follows:

Table J3
GUIDE FOR SELECTION OF FIRE SUPPRESSION SYSTEM

Hazard	Water Sprinklers or Spray	Foam	Carbon Dioxide or Halogenated	Dry Chemical
Class A fire potential	X	X	X	X

Revision Date: 31 Dec 2002

Class B fire potential	X	X	X	X
Class C fire potential	X		X	
Special Fire Hazard Areas				
Aircraft hangers	X	X	X	X
Alcohol storage	X	X	X	X
Ammunition loading	X			
Ammunition magazines	X			
Asphalt impregnating	X	X		
Battery rooms			X	
Carburettor overhaul shops	X	X	X	X
Cleaning plant equipment	X	X	X	X
Computer rooms	X		X	
Drying ovens	X		X	X
Engine test cells	X	X	X	
Escalator, stair wells	X			
Explosives: manufacturing, storage	X			
Flammable liquid storage	X	X	X	
Flammable solids storage	X			
Fuel oil storage	X	X		
Hanger floors	X	X		
Hydraulic oil, lubrication oil	X		X	
Hydro-turbine generators	X		X	
Jet engine test cells	X	X	X	
Library stacks	X		X	
Lignite storage or handling	X			
LP gas storage	X			
Oil quenching bath	X	X	X	X
Paints manufacturing or storage	X	X	X	X
Paint spray booths	X		X	X
Petrochemical storage	X	X	X	
Petroleum testing laboratories	X	X	X	
Printing presses	X		X	
Range hoods	X		X	X
Record vaults	X		X	
Rubber mixing and heat treating	X			
Service station (inside buildings)	X		X	
Shipboard storage	X		X	
Solvent cleaning tanks		X	X	X
Solvent thinned coatings		X	X	X

Revision Date: 31 Dec 2002

Switchgear rooms			X	
Transformers:				
circuit breakers (outdoors)	X			
circuit breakers (indoors)	X		X	
Turbine lubricating oil	X	X	X	X
Vegetable oil, solvent extraction	X	X		

SCHEDULE 3

(Regulation 27)

GENERAL CONSTRUCTION PRINCIPLES (BUILDING GUIDELINES)

INTRODUCTION

These Guidelines have been prepared for the general assistance of builders in the Eastern Caribbean. The provisions in the various Sections explain and describe how the requirements of the Building Code may be achieved, particularly in the case of small buildings. See Building Code Section 18 – Small Buildings.

The recommendations set out in the Guidelines are not mandatory, but if followed are generally deemed to satisfy the intentions of the Building Code.

In the case of any discrepancy between the Building Code and the Guidelines, the Building Code takes precedence.

September 1995 Edition

The draft St.Kitts-Nevis Building Code and Building Guidelines were circulated for comment in late 1994. UNCHS consultant, Mr Gil Williams ARAIA, MAIBS, visited St.Kitts-Nevis in March 1995 to review the comments received and discuss proposed amendments with Government and industry representatives. A further visit took place in May 1995 to discuss the amendments to be included in the revised edition.

In June 1995, the Code was reviewed by UNCHS-Nairobi and in August, further amendments, mainly editorial in nature were made to the Code and Guidelines.

Comments

Any comments or suggestions on the content or application of the St.Kitts-Nevis Building Code or Building Guidelines should be addressed to the Building Boards of St.Kitts or Nevis as appropriate, or to UNCHS c/- UNDP Barbados.

SECTION A – GENERAL CONSTRUCTION PRINCIPLES

A1 APPROVAL PROCEDURES

A1.1 Planning Permission

The first step in obtaining approval to build is to check whether Planning Permission is required.

Generally, if a change in the use or purpose of the land or building is involved, or if the proposed work includes the demolition, construction, alteration or extension of a building other than a single-family detached dwelling, an approval from the Planning Department is required.

Also, special planning permission may be required if the proposed work affects a conservation or foreshore area, or is otherwise environmentally sensitive, or if it involves a building or place of historic significance.

It is always wise to consult the Planning Department in the first instance to determine if planning permission is required.

A1.2 Planning Requirements

The relevant Zoning Plan, statutory Planning Scheme, or Planning Regulations will contain requirements concerning land use, vehicular access, parking, setbacks from boundaries, site coverage, floor area limitations, height limitations, external appearance (in some cases including preferred colours), tree planting. There may also be special planning controls on alterations to buildings of historic interest. Usually, signs and advertising devices are subject to planning controls.

A1.3 Building Approval

The Building Code and the enabling legislation sets out the requirements and procedures for obtaining Building Permits.

Consult the Building Board for advice on whether a particular proposal requires approval and the nature of the rules and regulations that apply.

It is also necessary to meet the requirements of the Electricity Supply Authority, Solid Waste Management Corporation (garbage and solid waste disposal), Water Authority (water supply, storage and treatment), Health Department (septic tanks, sewerage disposal). Other Authorities may be involved in the case of commercial or industrial premises.

See the Building Code, Section 1 – Administration of the Code.

Revision Date: 31 Dec 2002

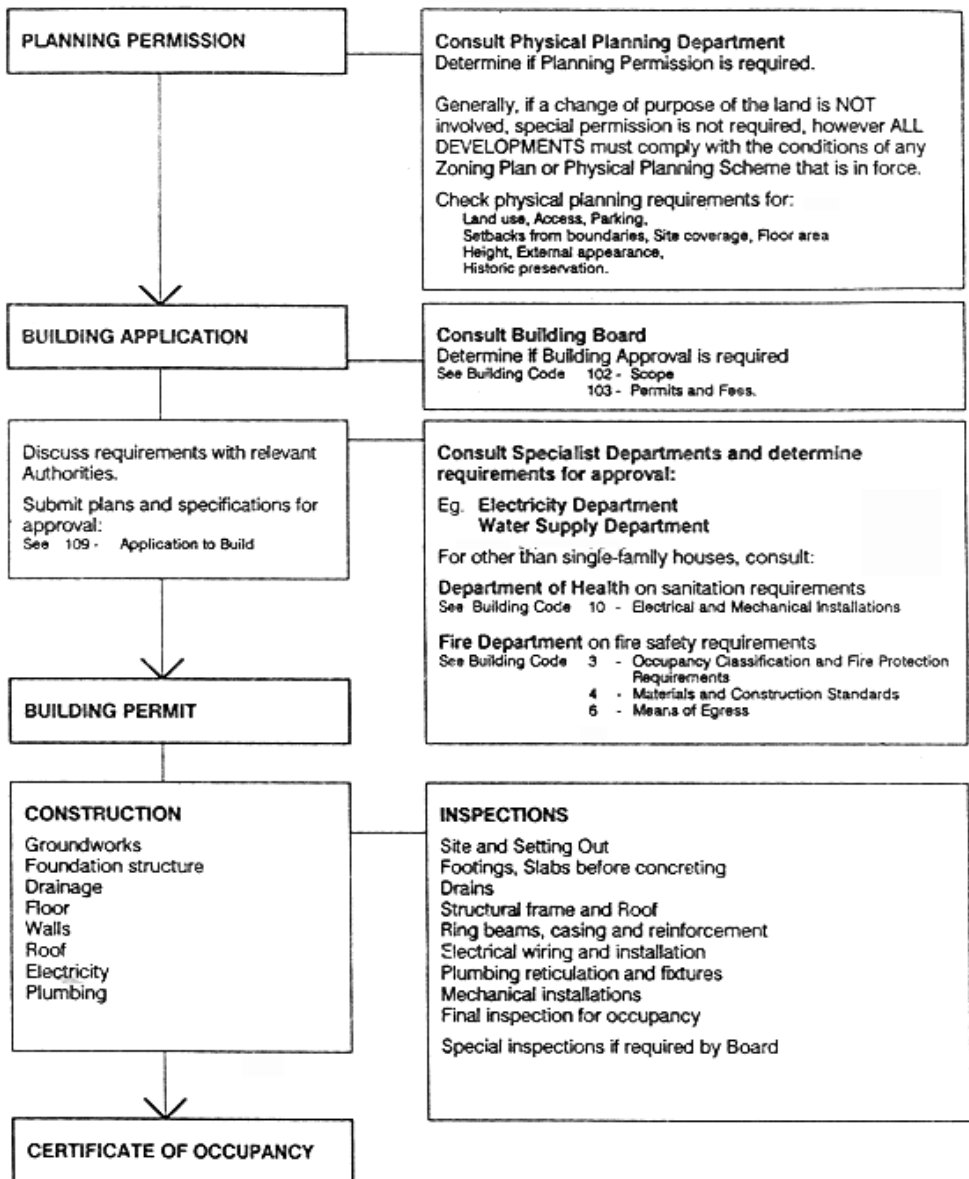


Fig. A1-1 BUILDING APPROVAL PROCEDURES

A2 SITE PREPARATION

A2.1 Preliminary Investigation

Before any construction work commences, a preliminary inspection of the site should be undertaken so that preparation may be made for any problems or difficulties that

may arise. This time should also be used to plan how the site will be organised so that a logical layout may emerge. Completion of the following checklist will provide enough information about the site and its conditions to permit construction to begin.

A2.2 **Checklist for Site Conditions**

- 1 Take note of general topography of site and other physical conditions likely to cause hazards or affect design or construction:

Check for—

- prevailing breeze, views, orientation and sun angles,
- adequate natural provision for removal of storm water,
- any likelihood that the area is subject to land slippage,
- a need for the removal of large trees (requiring approval or special engineering measures),
- the possibility that construction endanger public utility services,
- availability of water, sewage disposal facilities, and electricity on site,
- availability and adequacy of easy access to site,
- evidence of termite infestation in soil or trees,
- indication of the depth of suitable foundation stratum,
- indication of the height of the water table if appropriate,
- suitability of foundation soil for the construction of a soak-away pit,
- availability of suitable area on-site or adjacent for stockpiling aggregate and other materials, concrete mixer or other plant or equipment.

- 2 Check whether planning permission is required and has been obtained
- 3 Determine whether a surveyor's drawing of the site is available. Find location of boundary markers (if any) and decide if a surveyor needs to identify boundaries and set out the proposed building.

By completing the above checklist, possible construction problems may be highlighted and requirements of plant and materials ascertained. It is recommended that an engineer or other appropriate professional be consulted when foundation problems are evident.

A2.3 **Site Clearance**

- (a) Care should be taken to preserve any trees on the site. If trees have to be removed, special care shall be taken to remove totally, all roots and stumps of felled trees. This vegetable matter shall be removed from the site.

Note The Board may require an inspection of the site before the site is cleared of trees and other growth.

- (b) The area where the building will be situated should then be stripped of top soil and this material stock piled in a suitable area for later reinstatement and use during landscaping.

A2.4 **Material Storage**

- (a) Areas should be allocated on the cleared site for the storage of materials. Coarse and fine aggregate for the mixing of concrete and mortar should be

Revision Date: 31 Dec 2002

placed in separate heaps in a location near to the concrete mixer and/or concrete mixing area.

- (b) Cement, nails and finished materials requiring protected storage should be stored in a shed which is weather tight and has a wooden floor raised not less than 4" (100 mm) off the ground.
- (c) Reinforcement should be stacked off the ground to reduce corrosion.

A2.5 Batter Boards

- (a) The building should be properly set out. Batter boards, which are horizontal boards parallel to the sides of the building and supported by vertical boards driven into the ground may be erected in convenient locations near the four corners of the building, and to these boards should be transferred the building lines and levels for the project.
- (b) The floor level is usually marked on the batter boards and used as a permanent reference. All wall lines and levels shall be referred to these boards. Periodic checks shall be made to see that these boards have not been shifted from their intended positions.

A2.6 Roads and Pavings

- (a) The roads and pavings dealt with in this Section are those suitable for use as driveways and parking areas for private cars and light goods vehicles only. Roadways should not be less than 8 ft. (2.4 m) wide and must conform to the relevant Planning Regulation.
- (b) The choice of flexible (asphalt) or rigid (concrete) paving is largely influenced by the soil conditions at the site and the cost of driveway. Gravel roads and pavings are acceptable if adequate drainage is available and if the gravel or crushed rock is reasonably hard, free from clay, and would not be easily crushed by the light traffic. Adequate provision for drainage should be made.
- (c) Where firm soils or rock are present, any paving type may be used. Where soft soils are present a flexible paving or gravel is recommended.
- (d) For all kinds of paving the top soil should be removed and replaced by a minimum of 6" (150 mm) of compacted, granular material.
- (e) For rigid pavings, a concrete slab with a minimum thickness of 4" (100 mm) is added, reinforced by A142 welded wire mesh or equivalent, placed 1" (25 mm) below the slab surface. For flexible pavings a minimum thickness of 2" (50 mm) of asphalt cold mix or hot mix is applied and compacted by roller.
- (f) Single surface dressing is acceptable for light use driveways, or alternatively a sand seal applied on crushed limestone. The Chief Engineer/Director of the Public Works Department or the Ministry of Works should be consulted when any questions arise.

A2.7 Excavations

- (a) Excavations for foundations shall be carried out along the building lines to the depth of the foundation stratum identified as suitable. It may be desirable to seek the assistance of an experienced engineer in determining the appropriate level for the foundation.
- (b) Excavations not exceeding 5 ft. (1.5 m) in depth may generally be without planking and strutting, which is a system of braced timber walls erected against the faces of the excavation to prevent collapse. For excavations exceeding 5 ft. (1.5 m) the extent of planking and strutting necessary shall be determined by the nature of the soil and the location of the water table.
- (c) Where collapse of the side of excavation is anticipated, all excavation in excess of 5 ft. (1.5 m) depth should be planked and strutted.
- (d) Where the foundation is in rock, it is necessary to excavate at least 2" to 4" (50 to 100 mm) so as to provide a key for the footings.
- (e) The bottom of all excavations shall be level and firm. Where loose materials are encountered, footing trench bottoms shall be compacted by ramming.
- (f) Where excavations have been carried beyond their generally required depth, either by accident or design, the deep areas shall be backfilled with compacted, approved material or with concrete of proportions 1:3:6 by volume (10 MPa).

A2.8 Backfilling

- (a) Backfilling around foundation walls and under floor slabs shall be carried out using only suitable, selected materials. Unless the floor slab is reinforced to act as a suspended slab, the depth of fill should not exceed 3 ft. (900 mm).
- (b) Suitable fill material may be brought to the site or obtained from excavated material, provided always that such material is free of substantial amounts of clay or organic matter.
- (c) All backfill shall be well compacted in layers not exceeding 6" (150 mm) in thickness where compacted is by hand or small mechanical compactors. Where vibratory rollers are used, the thickness of layers may be increased to 9" (230 mm).
- (d) Where backfilling under floor slabs has been effected using hard core, a 2" (50 mm) layer of sand shall be applied to the top of the compacted hard core to protect damp proof membranes from puncture.
- (e) A damp proof course of polythene sheeting is sometimes applied between the top of the fill and the bottom of the floor slab to prevent damp from travelling upwards from the foundation to the wall, especially in areas of high water table. However polythene sheeting may be punctured during construction and cannot therefore act as a damp proof course.
- (f) Other preferred methods of providing a damp proof course may be used, such as a dense concrete layer or bitumen on the foundation courses. Any

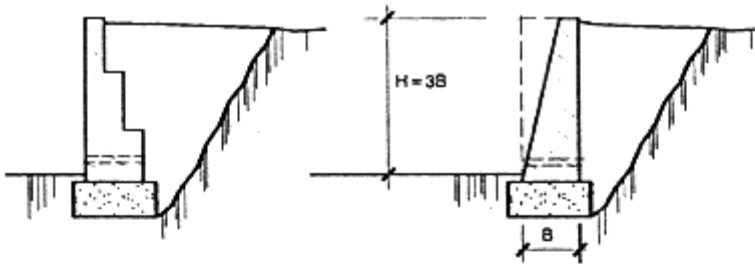
Revision Date: 31 Dec 2002

such measure should be discussed with the Building Inspector, and should be a proven method of preventing the upward movement of moisture.

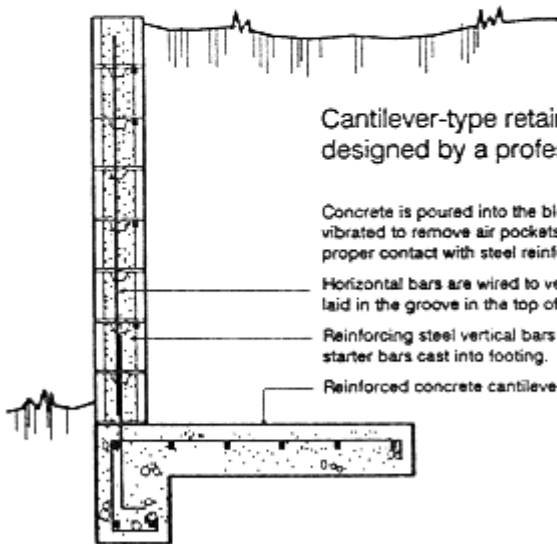
A2.9 Compaction

Compaction of some soils is necessary to increase the bearing value of the soil. However the characteristics of the soils may best be known through local experience of the behaviour of the soils. For example, the compaction of organic clays is poor to very poor, while the compaction of sandy soils or sand clay mixtures by a rubber tired roller should provide good results.

It is recommended that where clay is encountered, professional advice be sought before planning the foundation.



GRAVITY TYPE



Cantilever-type retaining walls must be designed by a professional engineer.

Concrete is poured into the block cavities and vibrated to remove air pockets and ensure proper contact with steel reinforcing.

Horizontal bars are wired to vertical bars and laid in the groove in the top of the webs.

Reinforcing steel vertical bars are spliced to starter bars cast into footing.

Reinforced concrete cantilever footing.

CANTILEVER TYPE

Fig. A2-1 BLOCK MASONRY RETAINING WALLS

Revision Date: 31 Dec 2002

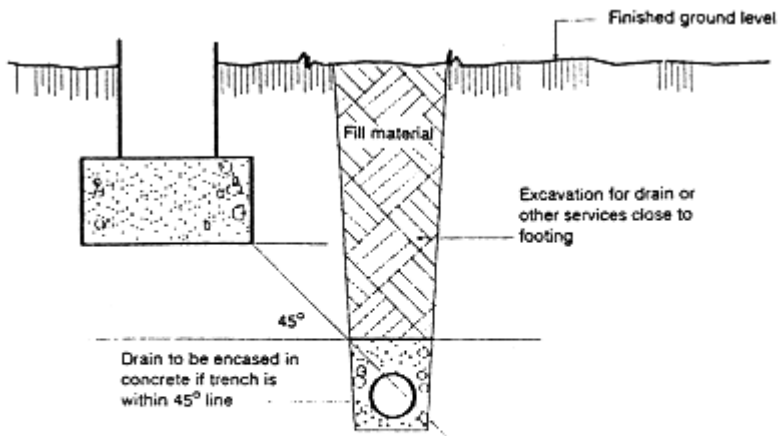


Fig. A2-2 EXCAVATIONS ADJACENT TO STRIP FOOTINGS

A3 EARTHQUAKE RESISTANT CONSTRUCTION

A3.1 General

- (a) It is widely recognised in the building industry, that many of the Caribbean Islands are in an earthquake zone and have suffered varying degrees of damage due to earthquakes.
- (b) Because of this situation, buildings must be designed and constructed so that they have some resistance to the shaking or lateral forces produced by earthquakes.

A3.2 Effect of Soil Type

- (a) The type of soil at the site may have a significant effect upon the resistance of the building to an earthquake. However for buildings within the scope of these Guidelines the effect of the soil type is not so significant provided that the building is not constructed on loose saturated sands, which may liquefy during an earthquake and cause collapse of the building.
- (b) The earthquake may also, due to shaking of the ground, compact loose sands or fill material, and if a building is constructed on such material, the building will be damaged.

A3.3 Effect of High Seas

Buildings on coastal areas may suffer due to high waves produced by earthquakes, and therefore the siting of the building in relation to the sea level is very important.

A3.4 **Building Shape**

- (a) The success with which a building survives an earthquake is greatly affected by its shape in plan, the way the building is tied together and the quality of construction.
- (b) Most buildings with a simple rectangular shape with no projections (or only short projections) perform well under earthquake conditions provided the construction is adequate.
- (c) Long narrow buildings should be avoided by limiting the length to three times the width. If the building must be longer, then it should be divided into separate blocks with adequate separation. Fig. A3-1 illustrates desirable and undesirable plan shapes.
- (d) Rectangular buildings with well inter-connected cross walls are inherently strong and therefore desirable.

A3.5 **Appendages**

Where buildings have decorative or functional additions or appendages such as window hoods, parapets and wall panels, etc., extreme care must be taken to ensure that they are securely fixed, since many of such items tend to fall easily and may cause damage during an earthquake.

A3.6 **Location of Openings**

The location and size of openings in walls have a significant effect upon the strength of a wall and its ability to resist earthquake forces.

See Fig. A3-2

- (a) Openings are to be located away from a corner by a clear distance to at least 1/4 of the height of the opening. It is recommended that the minimum distance be 15" (375 mm).
- (c) The total length of the openings should not exceed 1/2 the length of the wall between consecutive cross walls.
- (d) The horizontal distance between two openings should not be less than 1/2 the height of the shorter opening.

For 2-storey buildings, the vertical distance from an opening to one directly above it should not be less than 2'-0" (600 mm), nor less than 1/2 the width of the smaller opening.

A3.7 **Masonry Buildings**

An important factor contributing to the earthquake resistance of concrete masonry buildings is the detailing and placing of steel reinforcement. The design of a reinforced concrete frame building should be undertaken by experienced engineers. The reinforcing guide given in this section therefore must only be used for simple single storey buildings constructed of good quality concrete blocks.

The minimum quantities of reinforcing to be used have been described in Section B3.4. The following is a checklist which should be used to ensure that all necessary steps have been taken:

Revision Date: 31 Dec 2002

- 1 Vertical reinforced columns should be placed in all masonry walls with a maximum dimension between columns of 16 ft. (4.8 m).
- 2 All exterior walls should be reinforced as shown in B3.4. Interior walls also require reinforcement for earthquakes.
- 3 All vertical wall reinforcement must be securely fixed to the foundation and belt course.
- 4 Where vertical reinforcement is not a continuous bar, adequate lap lengths are to be provided and securely tied. (See Table B-1). Minimum lap length for a 3/8" (9 mm) bar should be 1'-6" (450 mm).
- 5 Reinforced block work cores are to be filled after the laying of every three courses with well compacted concrete, or poured grout.
- 6 In addition to the minimum vertical wall reinforcement, all wall, corners and junctions are to be reinforced. Figs B3-1 and B3-2
- 7 All vertical reinforcement is to be securely fixed to the ring beam. Horizontal reinforcement must be placed every 3 courses.
- 8 Window and door jambs should be reinforced and tied into the lintels.
- 9 Gable walls are to be reinforced by bars fixed to the concrete beam at eaves height and to the sloping ring beam at the top of the gable. Fig. B3-6

A3.8 Timber Buildings

Although the foregoing principles apply to concrete block buildings, there are two additional areas of concern with respect to timber buildings:

- (a) All corners and intersections must be adequately braced.
- (b) Earthquake forces tend to remove timber buildings from their supports by shaking. Because of this it is important to securely fasten sills to foundations.

A3.9 Steel Buildings

- (a) While steel buildings are generally beyond the scope of these Guidelines, it should be noted that the natural ductility of steel protects the frame itself from severe damage.
- (b) However, in many cases concrete block walls are used and the precautions already listed for these walls will apply. The wall reinforcement must now be anchored by welding to the steel columns and beams, or the steel frame encased in concrete in which case the wall reinforcement can be tied into the concrete cage encasing the steel frame.

A4 HURRICANE RESISTANT CONSTRUCTION

A4.1 **General**

- (a) It is very important in the Caribbean to be ever conscious of the fact that the region lies in the hurricane belt.
- (b) Because of this, hurricane resistant construction principles must be adhered to if safe buildings are to be erected. This section gives general principles for safe hurricane resistant design.
- (c) For buildings within the scope of this document the areas most vulnerable to hurricane forces are the roofs, windows and walls.
- (d) The underlying objective of hurricane resistant construction is to produce a building that will not collapse during a hurricane. The building must be standing and its occupants should be safe.

A4.2 **Building Site**

- (a) Buildings sited in exposed areas (eg. on the brow of a hill) are most vulnerable, while those sheltered by natural topography are less vulnerable. Buildings sited in gullies or in river beds are very vulnerable as they are subject to severe damage by floods caused by the heavy rains which often accompany a hurricane.
- (b) In siting the building, therefore, steep slopes and edge of cliffs should be avoided, as well as other conditions such as steep sided valleys where exceptionally high wind speeds are found.
- (c) Where building on a steep site is unavoidable, reinforced concrete tie beams should be constructed to reduce the untied height of the columns to a maximum of 10 ft. (3 m). [Fig. A4-1]

It is advisable to seek professional assistance for such construction.

A4.3 **Roofs**

- (a) Experience and research have shown that flat roofs are vulnerable to high winds. In an effort to reduce the uplifting wind forces on the roof, the roof pitch should be not less than 25° to 30°. Hip roofs should be used, since this shape of roof has been found to be more hurricane resistant than the gable roof. [Fig. A4-2]
Where gable roofs are used they should be strongly constructed. [Fig. B3-6]
- (b) Attention should be given to the location of fixings used for the roof cladding. It is necessary to provide additional fixings at the roof edges and ridge, since high localised pressures are produced in these locations.
- (c) The high suction along the eaves can be reduced by the use of a parapet, but then this has to be adequately strengthened, so that it does not become a hazard during a hurricane or in the event of an earthquake. Parapets were very popular in some Caribbean Islands because of the protection offered to roof eaves.
- (d) Roof overhangs also experience high local pressures and, where possible, these should be kept to a minimum or removed completely.

Revision Date: 31 Dec 2002

- (e) Where buildings have roofed patios or verandas, their roofs should be separate structures rather than extensions of the main building roof. A patio or verandah roof may be lost without endangering the safety of the main roof.
- (f) The main roof must be securely fixed to the ring beam and ridge beams. [Fig. B3–3]

A4.4 Windows and Doors

Special attention must be paid to the installation of doors and windows, since the loss of a door or window during a hurricane will greatly alter the internal pressure of the building, thus adversely affecting its safety. For this reason, glazed windows and doors should be fitted with wooden shutters.

A4.5 Walls

Although it may not be common for the walls of concrete block buildings to be destroyed during a hurricane, many concrete block buildings were completely destroyed during the passage of hurricanes David in 1979 and Hugo in 1989. For this reason, it is important that the wall reinforcement be properly anchored at the foundation and the ring beam levels. [Fig. B3–3]

A4.6 Timber Buildings

- (a) Because of the relatively light nature of a timber building, extra precautions must be taken concerning uplift. The building must not be lifted off of its foundations. Care must therefore be taken to ensure that the entire structure is securely fastened to the foundations.
- (b) The spaces between the supporting columns or piers should be filled in to prevent increasing the uplift forces. [Fig. A4–2]
- (c) As far as timber walls are concerned, in addition to bracing corners in both directions, diagonal braces or steel straps must be installed at the level of the top plate to provide rigidity of the corners at that level. [Fig. C4–1]
- (d) In summary, timber buildings must be securely anchored to the ground and the building structure itself must be tied together with timber braces or metal straps.

A4.7 Steel Buildings

Extensive damage to steel frames has occurred as a result to recent hurricanes in the Caribbean. The damage resulted from, in some cases, underdesigned sections and in most cases poor maintenance which led to significant reduction in the sizes of critical members and thence to failure.

The principles for the design and construction of hurricane resistant steel buildings are:

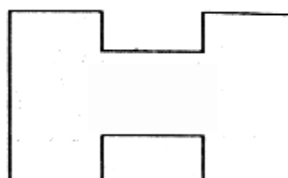
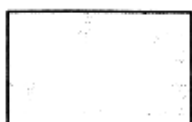
- (a) Ensure that the manufacturer has been provided with the proper information regarding the design wind speeds so that the building frame design can be in accordance with the Code.

- (b) Ensure that there are adequate numbers and sizes of foundation holding down bolts, and that they are all in place and properly fixed.
- (c) Ensure that there is adequate lateral support provided by cross bracing or horizontal ties or by cast in place concrete or masonry walls.
- (d) Where concrete walls or concrete masonry are used, the connections between the steel frames and the walls must be carefully designed and constructed as per Section D3.
- (e) Ensure that the manufacturer’s recommendations with regards to the construction of the roof and roof covering are followed.

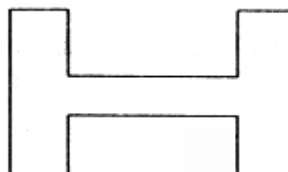
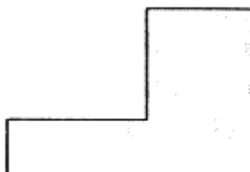
Table A4-1 MAIN DIFFERENCES BETWEEN WIND AND EARTHQUAKES

ITEM CONSIDERED	WIND	EARTHQUAKES EFFECTS
Source of loading	External forces due to wind pressures	Applied movements from ground vibration
Type and duration of loading	Wind storm of several hours’ duration; loads fluctuate, but predominantly in one direction	Transient cyclic loads of at most a few minutes’ duration; loads change direction repeatedly
Influence of local soil conditions on response	Unimportant	Can be important
Predictability of loads	Usually good.	Poor
Main factors affecting building response	External shape and size of building; dynamic properties unimportant except for very slender buildings	Response governed by building dynamic properties: fundamental period, damping and mass
Normal design basis for maximum event	Elastic response require	Inelastic response permitted, but ductility must be provided; design is for a 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

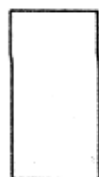
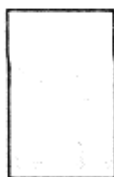
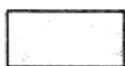
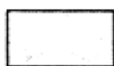
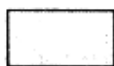
Revision Date: 31 Dec 2002



DESIRABLE PLAN SHAPES



UNDESIRABLE PLAN SHAPES



USE OF SEPARATION TO IMPROVE RESISTANCE

Fig. A3-1 PLAN SHAPES OF BUILDINGS

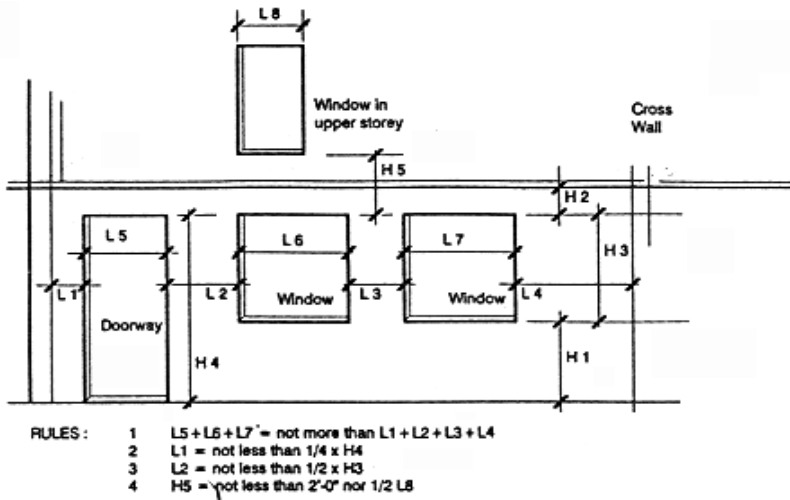
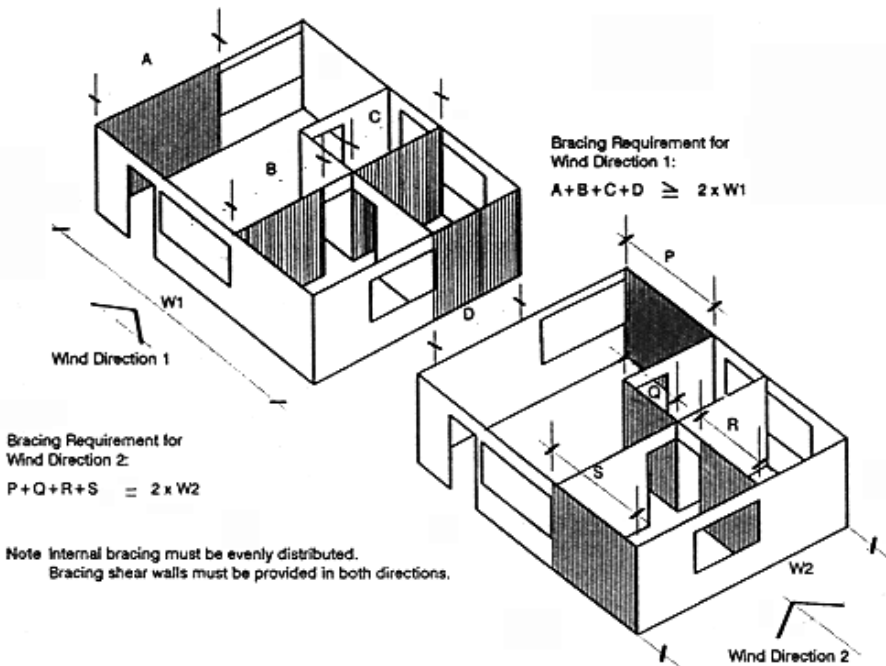


Fig. A3-2 RECOMMENDATIONS FOR EARTHQUAKE RESISTANT BUILDINGS SIZE AND LOCATION OF WALL OPENINGS



Revision Date: 31 Dec 2002

Fig. A3-3 BRACING AND SHEAR WALLS RESISTANCE AGAINST HIGH WINDS

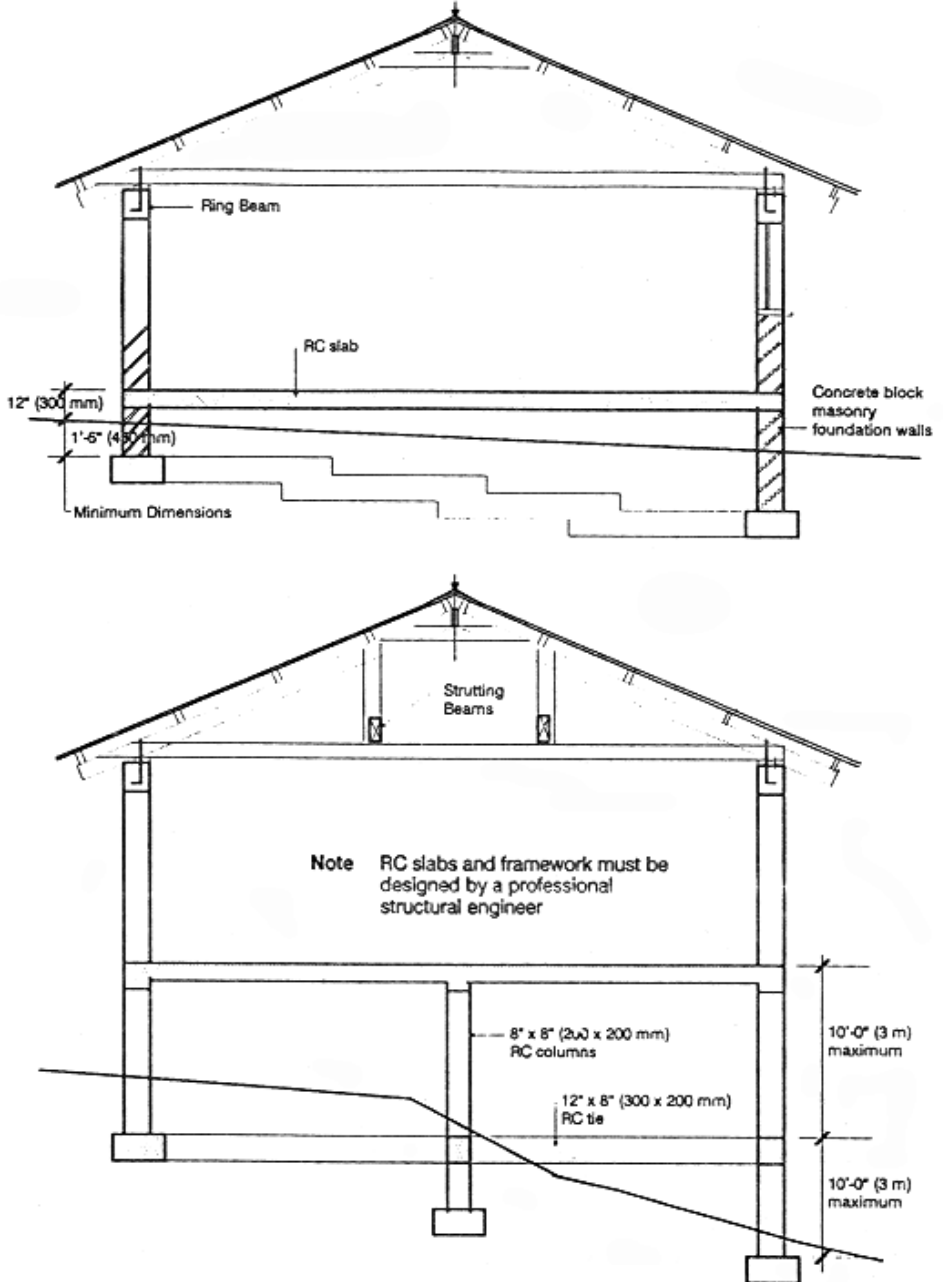


Fig. A4-1 RECOMMENDED METHOD FOR CONSTRUCTION ON SLOPING SITE

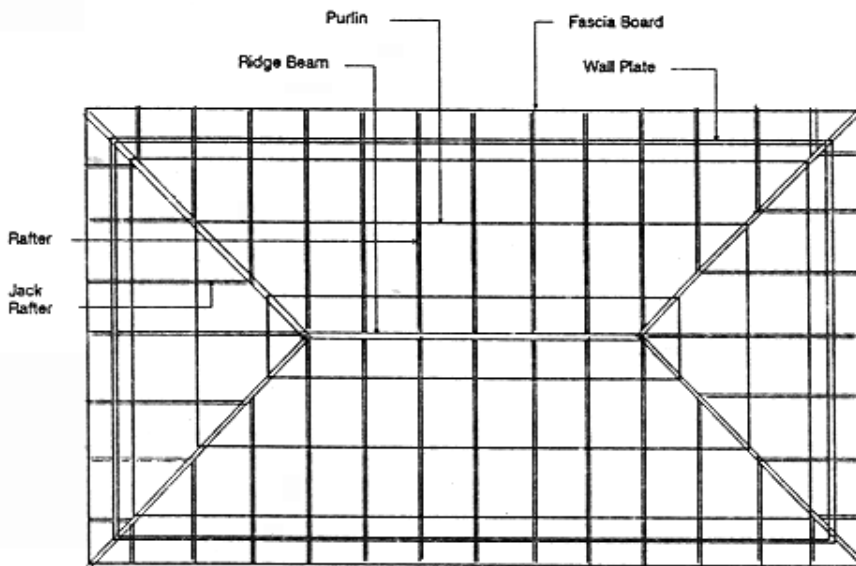
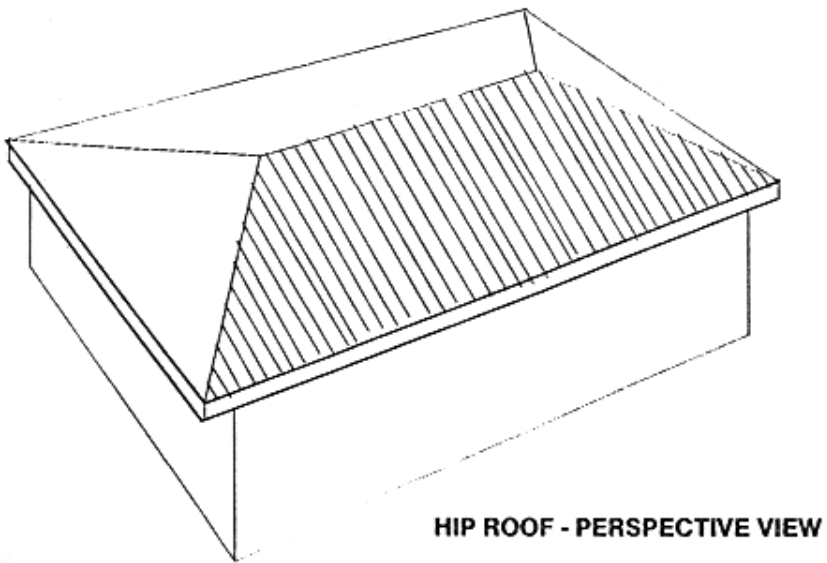


Fig. A4-2 **HIP ROOF FRAMING**

SECTION B – CONCRETE CONSTRUCTION

B1 FOUNDATIONS AND FOOTINGS

B1.1 General

- (a) All exterior walls and interior load bearing walls should be supported on reinforced concrete strip footings. Interior walls may be supported by thickening the slab under the wall and suitably reinforcing it. The foundations should generally be located on a layer of soil or rock with good bearing characteristics. Such soils would include dense sands, marl, other granular materials and stiff clays. Special precautions are necessary if the foundation material is expansive clay subject to extreme seasonal movement.
- (b) Footings in soil or soft clay foundation should be cast not less than 1'-6" to 2'-0" (450 to 600 mm) below ground surface, with a thickness not less than 9" (230 mm) and width not less than 24" (600 mm) or a minimum of 3 times the width of the wall immediately supported by it. Footings on rock or marl should be 4" to 12" (100 to 300 mm) below the ground surface. [Fig. B1-1]
- (c) Where soft clays must be used as the foundation bearing material, the width of the footing should be increased to a minimum of 2'-6". Footings on expansive clays should be designed as a beam so as to resist differential movement.
- (d) The use of reinforced concrete wall stiffeners will require no widening of the foundation beyond the width being used under the walls.
- (e) When isolated reinforced concrete or concrete block columns are used they should be supported by square pad footings not less than 2'-0" (600 mm) square and 12" (300 mm) thick. [Fig. B1-2]

B1.2 Reinforcement

- (a) Reinforcement in the footing is needed to ensure the continuity of the structure and it is especially useful in cases of bad ground or where the building may be subjected to earthquake forces.
- (b) This Section, therefore describes the reinforcement needs for normal conditions. For compact dwelling houses of up to 600 sq.ft, constructed on firm soils or rock, footings need not be reinforced.
- (c) The reinforcement used in this section is assumed to be deformed high yield steel bars which are commonly supplied in the Eastern Caribbean.
- (d) For strip footings, the minimum reinforcement should consist of 2 No.4 1/2" (12 mm) bars placed longitudinally and 1/4" (6 mm) diameter bars placed transversely at 2 ft. (600 mm) centres. [Fig. B1-1]

- (e) For column footings, the minimum reinforcement should be 1/2" (12 mm) diameter bars at 6" (150 mm) centres in both directions forming a 6" (150 mm) mesh. [Fig. B1–2].
- (f) Where plain, round, mild steel bars are used, areas of steel should be increased by 60%.
- (g) All bars may be suitably cranked at the ends. Lap lengths should be a minimum of 30 times the diameter of the bars being joined.

Table 13–2
Minimum Dimensions for Continuous Footings

Allowable bearing capacity	Number of storeys	Depth and width
Up to 0.5 ton/sq.ft (47.8 kPa)	1	12" x 30" 300 x 750 mm
	2	12" x 36" 300 x 900 mm
Over 0.5 but less than 1.0 ton/sq.ft (95.8 kPa)	1	9" x 24" 230 x 600 mm
	2	12" x 24" 300 x 600 mm
1.0 ton/sq.ft (95.8 kPa) or more	1	9" x 16" 230 x 400 mm
	2	9" x 24" 230 x 600 mm

- Note**
- 1** The sizes given in the Table are to be used with caution as the characteristics of soils vary considerably and all soils should be analyzed before designing the footing system.
 - 2** 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 16" (400 mm) nor less than 4" (100 mm) more than the width of the foundation wall whichever is greater.
 - 3** Concrete used in footings should be 2,175 psi (15 MPa) pre-mixed. On-site mixed concrete should be 1 cement: 2–1/2 sand: 4 aggregate by volume. Aggregate should be 1/2" (20 mm).

B1.3 Alternative Footing for a Small Timber Buildings

- (a) An acceptable arrangement for a foundation of a small timber building with a concrete or wood floor is shown in Fig. B1–4.

This construction is suitable in reasonably stiff soils or marl. Where the building will be on rock, the thickness of the footing may be reduced, but timber buildings are very light and can easily be blown off of their foundations. Therefore the building must be securely bolted to the concrete footing, and the footings must be heavy enough to prevent uplift.

Revision Date: 31 Dec 2002

B2 REINFORCED CONCRETE

B2.1 Materials

- (a) Concrete should be manufactured from ordinary Portland cement, sand, stone aggregate and water.
- (b) The cement must be fresh and contained in unopened sacks which have been well protected from moisture.
- (c) The sands must be clean, natural sand, preferably taken from an inland source as the use of beach sand will not be allowed.
- (d) The sand shall be free of clay lumps, organic material, and broken shells.
- (e) The coarse aggregate should be of crushed stone or gravel with a maximum size of 3/4" (20 mm). The aggregate shall be washed free of dust. However, in certain areas only broken stone may be available. In these circumstances care must be taken to use stone as near to 3/4" (20 mm) as practicable.
- (f) Only clean, potable water shall be used for the mixing of concrete. Galvanised reinforcing bars are recommended.

B2.2 Mixing

- (a) A concrete mix producing concrete with a compressive cube strength of 3,000 psi at 28 days or 2,400 psi at 7 days should be used (Footings should be 15 MPa, elsewhere 20 MPa).
- (b) The approximate proportions normally required to produce such a mix are:

Use	Cement	Sand	Aggregate
Footings	1	2-1/2	4
Elsewhere	1	2	3

Note The maximum amount of water required is affected by any moisture which may be present in the aggregate. The quantity should, therefore, be reduced when the aggregate is wet.

- (c) The ingredients shall be mixed by machine or by hand until no areas of unmixed materials are visible and a uniform colour is obtained. Machine mixing, however, is to be preferred.

B2.3 Formwork

- (a) The formwork into which the concrete is to be placed shall be strongly constructed of straight timber so braced that no movement or deformation is caused by the wet concrete and normal construction loads.
- (b) The formwork shall have close fitting joints so that no fine aggregate, cement or water are lost through leakage.

B2.4 **Steel Fixing**

- (a) Reinforcement steel, which is to be reasonably free of rust, is to be properly tied together by mild steel tying wire and the whole assembly so positioned within the formwork by spacer blocks, that the correct concrete cover to the steel is maintained.
- (b) Concrete should not be vibrated by direct contact between the vibrating instrument and reinforcing rod. The practice of vibrating the formwork is not the preferred way of vibrating concrete as it may displace the steel fixings and should be used with caution.
- (c) Minimum recommended concrete covers are as follows:

Slabs (on internal surfaces):	3/4"	18 mm
Beams:	1-1/2"	38 mm
Columns:	1/1-2"	38 mm
Surfaces in contact with earth:	3"	75 mm

See Table 16-3 of the Building Code
- (d) For the harsh environmental conditions in the Eastern Caribbean it is advisable to use galvanised reinforcing steel to avoid corrosion.

B2.5 **Placing Concrete**

- (a) Concrete should be placed in forms that have been thoroughly cleaned to remove sawdust, bits of wood, wire and other debris.
- (b) Transporting the concrete over long distances (unless special equipment is used) should be avoided as segregation of the components may occur.
- (c) All runways and routes between the mixer and the area where the concreting is to be carried out should be set up beforehand and kept clear, so that the placing of the concrete can proceed smoothly without interruptions.
- (d) The poured concrete is to be compacted in the formwork by vibration or rodding, so that a dense concrete is obtained. Where necessary chutes should be used to place concrete in tight areas such as column forms.
- (e) Where floor slabs or roof slabs cannot be poured in one operation, construction joints should be used. Professional help should be sought on the proper placing of the construction joints in suspended slabs.

B2.6 **Curing**

- (a) The optimum concrete strength is obtained by proper curing. To achieve this, the poured concrete must be kept moist by wetting over the first 3 days after pouring. Slabs may be covered with a layer of sand which is kept wet, and beams and columns may be wrapped in hessian (or similar material) which is kept wet.
- (b) Proprietary curing compounds may also be used in accordance with the manufacturer's instructions.

Revision Date: 31 Dec 2002

B2.7 Stripping of Formwork

The side formwork may be removed from the fresh concrete after 24 hours. The bottom forms and props for suspended beams and slabs shall remain in place for not less than 14 days.

B3 CONCRETE BLOCK WALLS

B3.1 Hollow Concrete Blocks

- (a) Concrete blocks used in walls should be sound and free from cracks and their edges should be straight and true.
- (b) The nominal width of blocks for exterior walls and load bearing interior walls should be a minimum of 6" (150 mm) and the face shell a minimum thickness of 1" (25 mm). It is better to construct exterior walls of 8" (200 mm) thick concrete block.
- (c) Non-load bearing partitions may be constructed using blocks with a nominal thickness of 4" or 6" (100 or 150 mm).
- (d) Where testing equipment is available, the contractor should ensure that individual blocks shall have a compressive strength of not less than 500 psi (on gross area).

B3.2 Block Laying

- (a) Blocks should be laid in half bond in courses which have been aligned using lines and levels.
- (b) Walls at junctions and corners should be bonded to each other by reinforcement as well as interlocked in half bond. However interlocking at Tee junctions is discouraged. All walls should be tied to columns or to reinforced corners every 3 courses. [Fig. B3.2]
- (c) Horizontal and vertical mortar joints should be an average thickness of 1/2" (12 mm) and must be properly filled with mortar.

B3.3 Mortar

- (a) Mortar should be made from one part by volume of ordinary portland cement to a maximum of 4 parts of clean sifted sand. In some areas, mortar composed of cement, lime and sand is used. A proportion of 1 cement, 1 lime and 4 sand produces mortar of acceptable strength. See Building Code Table 15-3
- (b) Mortar should be mixed by mixer or by hand until the ingredients are thoroughly mixed (not less than 3 minutes by mixer). A minimum amount of water should be added to the dry mixture to allow for workability. There should be no re-mixing of mortar.
- (c) Mixing of mortar should be done in a manner to allow all mortar mixed to be completely used up within one hour.

B3.4 Reinforcement

- (a) Blockwork walls should be reinforced both vertically and horizontally; this is to resist hurricane and earthquake loads. It is normal practice in most of the Eastern Caribbean to use concrete columns at all corners and intersections. Door and window jambs must be reinforced with a minimum of 2# 1/2" (12 mm) bars vertically, with an anchorage length of 2 ft. (600 mm) beyond the edges.

All openings of 2 ft. (600 mm) square or greater should be reinforced both horizontally and vertically with the anchorage lengths as stated above.

- (b) The recommended minimum reinforcement for concrete block construction is as follows:
 - (i) 4# – 1/2" (12 mm) diameter bars at corners vertically.
 - (ii) 2# – 1/2" (12 mm) diameter bars at junctions vertically.
 - (iii) 2# – 1/2" (12 mm) diameter bars at jambs of doors and windows.
 - (iv) For horizontal wall reinforcement use "Dur a Wal" (or similar) or 1/4" (6 mm) bars every 3rd course as follows:

4" (100 mm) blocks:	1 bar
6" (150 mm) blocks:	2 bars
8" (200 mm) blocks:	2 bars

- (v) For vertical wall reinforcement use 1/2" (12 mm) bars spaced as follows:

4" (100 mm) blocks:	48" (1.2 m)
6" (150 mm) blocks:	32" (800 mm)
8" (200 mm) blocks:	24" (600 mm)

- (d) Reinforced block cores for 6" (150 mm) and 8" (200 mm) blocks shall be filled with 1:2:4 nominal mix concrete properly rodded, with concrete being added after the erection of three courses of blocks. Reinforced block cores for 4" (100 mm) blocks should be filled with grout or fine aggregate concrete as the work proceeds.
- (e) Concreting to block cores is to be stopped 1–1/2" (30 mm) below the top of the block to form a key at joints.
- (f) The wall reinforcement must be securely anchored in the wall footing below and the ring beam above. Horizontal reinforcement must be bedded in mortar and must be continuous through intersections and corners. [Fig. B3–3)

B3.5 Ring Beams

- (a) All walls should be finished at the top by a reinforced concrete ring beam no less than 8" (200 mm) preferably 9" (230 mm) in depth.
- (b) The minimum ring beam reinforcement for an 8" (200 mm) thick wall should be 4# 1/2" (12 mm) diameter bars and 1/4" (6 mm) diameter

Revision Date: 31 Dec 2002

stirrups at 9" (230 mm) centres. For a 6" (150 mm) thick wall the ring beam should be 9" (230 mm) deep with reinforcement of 2 – 1/2" (12 mm) dia. bars and 1/3" (8 mm) dia. links at 9" (230 mm) centres.

B3.6 Columns

- (a) Columns should have minimum dimensions of 8" x 6" (200 x 150 mm) and may be formed by formwork on four sides or formwork on two sides with blockwork on the other two.
- (b) The minimum column reinforcement should be 4# 1/2" (12 mm) diameter bars with 1/4" (6 mm) stirrups at 6" (150 mm) centres. Fig. B-7
- (c) A filled core column or poured concrete column should be placed full height to the belt course (ring beam) at each door jamb.

B3.7 Lintels

- (a) Reinforced concrete lintels must span all door and window opening and must be extended beyond the jambs not less than 8" (200 mm).
- (b) The lintel should be 8" (200 mm) deep for openings no greater than 8 ft. (2.4 m).
- (c) The reinforcement of such a lintel shall be 4# 5/8" (16 mm) diameter bars and 1/4" (6 mm) diameter stirrups at 6" (150 mm) centres. (Two bars at the bottom and two at the top).
- (d) Professional guidance should be sought where spans more than 8 ft. (2.4 m) are involved.

Table B-1 Minimum Lap lengths for Steel Reinforcement

Bar Diameter	Minimum Lap Length
1/4" 6 mm	1' – 0" 300 mm
3/8" 9 mm	1' – 6" 450 mm
1/2" 12 mm	2' – 0" 600 mm
5/8" 16 mm	2' – 6" 750 mm
3/4" 18 mm	3' – 0" 900 mm
Mesh	1 – 1/2 mesh widths

B3.8 Chasing

The chasing of walls for the installation of services should be carefully controlled. Horizontal chases at any one level shall be restricted to 4'-0" (1.2 m) in length and only one side of the wall may be chased. Chasing should be done before the walls are plastered.

B4 **CONCRETE FLOORS**

B4.1 **Materials**

The concrete for floors shall be mixed, placed, compacted and cured in the same manner as described in Section B2.

B4.2 **Layout**

- (a) The concrete floor must be a minimum of 4" (100 mm) thick and be supported on not less than 8" (200 mm) of compacted marl, gravel or approved granular material. It is recommended that the fill material needed be not more than 3'-0" (900 mm) deep and be of well compacted selected material.
- (b) Where fills greater than 3 ft. (900 mm) are required, the floor should be constructed as a suspended reinforced concrete slab. This procedure will prevent cracking of the concrete floor slab due to imperfectly compacted fill.
- (c) As a protection against flooding, the finished surface of the floor should be located not less than 12" (300 mm) above finished ground level. On a sloping site, the floor should be at least 12" (300 mm) above the ground at any point.

B4.3 **Damp Proof Course**

- (a) A damp proof course of 500 gauge polythene (visqueen) may be laid over the compacted floor foundation where moisture is present in the ground. This material must be used with caution as it is easily broken. This course will halt rising moisture and retain moisture in the wet concrete during the setting period so that proper curing is effected.
- (b) Laps in the damp proof membrane should not be less than 6" (150 mm).
- (c) Damp proofing of walls must be carried out with care and attention to all details, as minor breaks in the damp proofing membrane will encourage the passage of moisture and damage the walls.

B4.4 **Reinforcement**

- (a) In order to inhibit cracking, the floor slab on grade should be reinforced with welded wire mesh No. A142 or similar 6" (150 mm) mesh. The mesh should be located 1" (25 mm) from the top of the slab and care must be taken during pouring that this location is maintained.
- (b) The mesh must be tied to the ground beams where such beams are used. Minimum laps in the mesh should be 6" (150 mm).

B4.5 **Finishes**

The slab should be floated immediately after pouring as this produces a durable surface. Alternatively, a sand-cement screed, not less than 3/4" (20 mm) thick may be applied to roughened surface of the concrete. The surface must be cleaned and washed

Revision Date: 31 Dec 2002

before applying the screed. A screed of proportions 1 cement to 4 sand (by volume) would be suitable.

B4.6 Services

All pipes and conduits for services must be laid before the floor reinforcement is placed and must be so arranged that the required concrete cover to the reinforcement is maintained.

Table B-2 Typical Reinforcement for Simply Supported Slabs Spanning in One Direction

Slab Location	Span	Slab Thickness	Main Reinforcement	Distribution Steel
Domestic Floor	10' – 12' 3 – 3.6 m	5" 125 mm	1/2" at 9" c/c 12 mm @ 230 mm c/c	3/8" at 15" c/c 9 mm @ 375 mm c/c
Domestic floor	12' – 15' 3.6 – 4.5 m	6-1/2" 165 mm	1/2" at 7" c/c 12 mm – 175 mm c/c	3/8" at 12" c/c 9 mm @ 300 mm c/c
Office Floor	10' – 12' 3 – 3.6 m	5-1/2" 140 mm	1/2" at 6" 12 mm – 150 mm c/c	3/8" at 12" c/c 9 mm – 300 mm c/c
Office Floor	12' – 15' 3.6 – 4.5 m	7" 175 mm	5/8" at 8" c/c 16 mm – 200 mm c/c	3/8" at 10" c/c 9 mm – 250 mm c/c
Light Industrial Floor	10' – 12' 3 – 3.6 m	5-1/2" 140 mm	1/2" at 8" c/c 12 mm – 200 mm c/c	3/8" at 12" c/c 9 mm – 300 mm c/c
Light Industrial Floor	12' – 15' 3.6 – 4.5 m	7" 175 mm	5/8" at 8" c/c 16 mm – 200 mm c/c	3/8" at 10" c/c 9 mm – 250 mm c/c
Roof	10' – 12' 3 – 3.6 m	4" 100 mm	1/2" at 9" c/c 12 mm – 230 mm c/c	3/8" at 12" c/c 9 mm – 300 mm c/c
Roof	12' – 15' 3.6 – 4.5 m	6" 150 mm	1/2" at 8" c/c 12 mm – 200 mm c/c	3/8" at 12" c/c 9 mm – 300 mm c/c

Note Most structures within the scope of these Guidelines would have floor slabs on compacted granular material, but on sloping sites, floor slabs may have to be suspended. The reinforcement set out above will provide a safe suspended floor or roof. An experienced Engineer should be asked to advise on the size and placement of reinforcement for situations other than those described.

B5 ROOFS

B5.1 Materials

- (a) In general, and for the types of buildings within the scope of these Guidelines, roofs are constructed with a structural frame of timber, a timber slab or a secondary frame and one of a variety of roof cladding materials.

- (b) Reinforced concrete roofs may also be used. Where reinforced concrete roofs are used it is advisable that professional assistance be sought for spans greater than those shown tabulated in Table B-2 or spans supported differently.
- (c) The timber in roofs shall be well seasoned, sound and straight. Pressure treated timber to resist termite attack should always be used. Where pressure treated timber is not available and untreated timber is used, a proprietary wood preservative applied in accordance with the manufacturer's instructions must be applied. Under such circumstances permission for the use of untreated timber must be obtained from the Board.

B5.2 **Layout**

- (a) Timber roofs are generally constructed as one of 3 common types. These are gable roofs, hip roofs or mono-pitched roofs.
- (b) The gable roof consists of a structural frame made up with a ridge beam and rafters.
- (c) The minimum sizes of roof members should be:
 - Ridge beam 2" x 6" (50 x 150 mm)
 - Rafters 2" x 4" (50 x 100 mm) at 2'-0" (600 mm) centres.The same size rafters may be used for mono-pitch (shed) roofs.
- (d) In the case of the hip roof, hip rafters are introduced into the structural frame as shown. The minimum size of the hip rafters should be 2" x 6". Table B-3 gives rafter sizes of main members constructed of standard yellow pine or pitch pine. [Fig. B5-1]
- (e) The designer or builder may vary these sizes in accordance with the type of timbers used but care must be taken to avoid sagging of the roof members or of the roof sheathing.
- (f) The timber roof sheathing is generally constructed using 1" x 6" (25 x 150 mm) tongue-and-groove boarding, 5/8" (16 mm) plywood or other patented boarding.
- (g) Sheathing may be replaced by a secondary frame of bracing using 1" x 6" or 2" x 2" (25 x 150 mm or 50 x 50 mm) battens fixed to the rafters.
- (h) There are a variety of roof coverings available and in common use.
- (i) Where the cladding is corrugated galvanised sheeting its thickness should not be less than 24 gauge and timber battens or purlins must be used as supporting members.
- (j) Where asphalt shingles and built up roofing are used, a solid timber sheathing is normally employed.
- (k) Aluminum sheeting is not recommended unless 22 gauge sheeting is available and unless the fixings supplied have been tested to withstand hurricane force winds.

Revision Date: 31 Dec 2002

Table B-3 Maximum Span for Pitch Pine Rafters spaced not more than 2'-0" (600 mm) c/c

Rafter Size		Maximum Span	
2" x 4"	50 x 100 mm	6'-0"	1.8 m
2" x 5"	50 x 125 mm	9'-4"	2.8 m
2" x 6"	50 x 150 mm	12'-0"	3.6 m
2" x 7"	50 x 175 mm	15'-0"	4.5 m
2" x 8"	50 x 200 mm	16'-6"	5.0 m

B5.3 Fixings

- (a) One of the most important aspects of roof construction is the fixings.
- (b) The rafters must be securely fixed to the ring beam at the top of the walls and to the ridge beam at the crown of the roof.
- (c) It is common practice in the Eastern Caribbean for rafters to be built into the concrete ring beams and anchored with a 1/2" (12 mm) bar placed horizontally. This detail could lead to problems if the rafters have to be removed. An alternative detail is to fix the rafters to a wall plate which is bolted to the ring beam. Fig. B3.3
- (d) The use of patented hurricane clips or metal straps for fixing rafters to plates, purlins and ridge beams is necessary.
- (e) Corrugated sheeting should be fixed (with drive screws) to battens or purlins. The drive screws should be driven through each crown of the corrugation at the eaves and at the ridge and through every other corrugation elsewhere. A more hurricane resistant detail would be to use valley fixings where such patented fixings are available.
- (f) Drive screws should have large heads or 3/4" (20 mm) diameter washers. They should be twisted and galvanised.
- (g) Where asphalt shingles are used, they should be fixed using the proper adhesives in accordance with the manufacturer's instructions. Plywood sheeting underlay should be screwed to the purlins or rafters and at spacing of not less than 2'-0" (600 mm).
- (h) Where pitch pine boards are used as sheeting underlay, the timber should be secured at each purlin by at least two galvanised nails at least 1-1/2" (38 mm) long for a 1/2" (12 mm) thick board.
- (i) In larger buildings such as halls or shops with large spans, it is recommended that roof ventilators be installed to reduce the pressure that may build up under the roof. The ventilators will make the roof more resistant to hurricane forces.

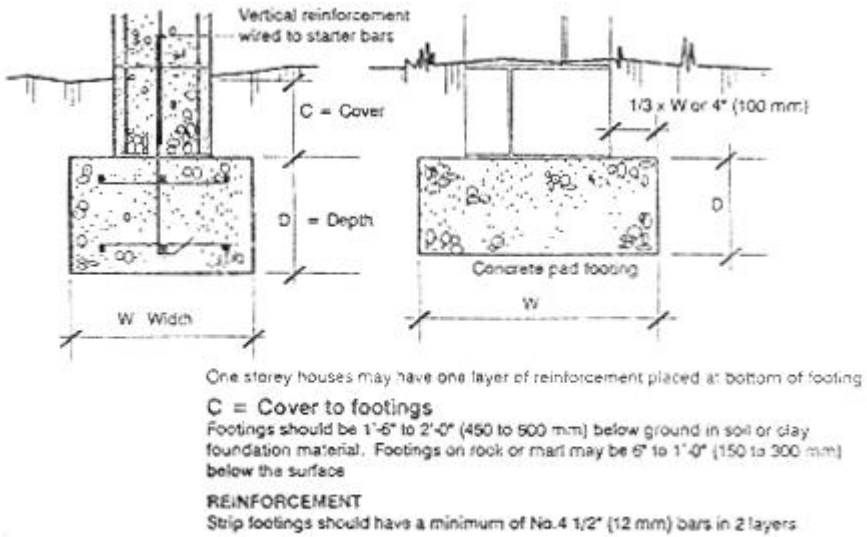


Fig. B1-1 DIMENSIONS OF FOOTINGS

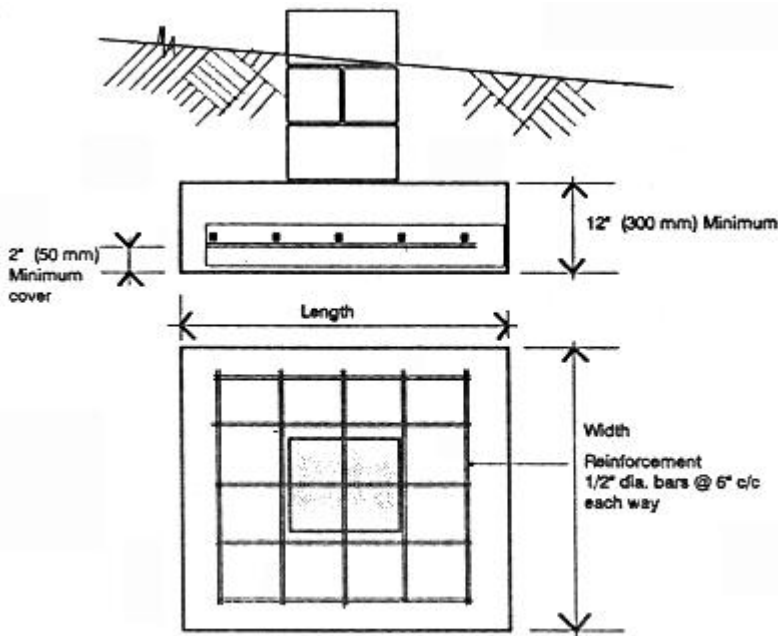


Fig. B1-2 TYPICAL SPREAD FOOTING DETAIL

Revision Date: 31 Dec 2002

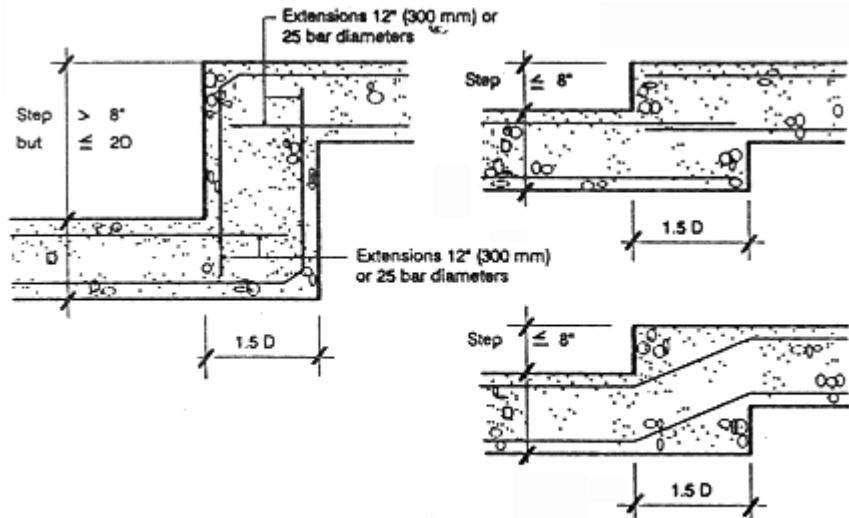


Fig. B1-3 STEPPING OF STRIP FOOTINGS

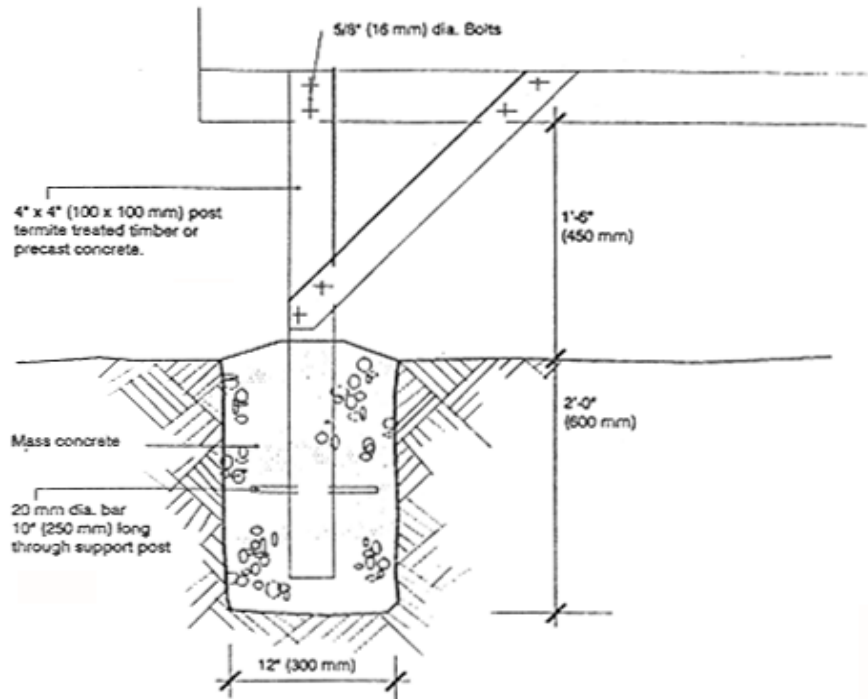


Fig. B1-4 FOUNDATIONS FOR SMALL TIMBER BUILDINGS

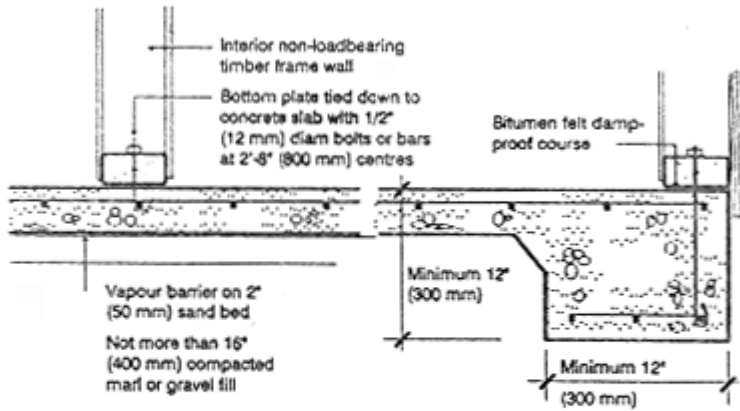


Fig. B1-5 CONCRETE SLAB-ON-GROUND CONSTRUCTION TIMBER FRAME WALLS

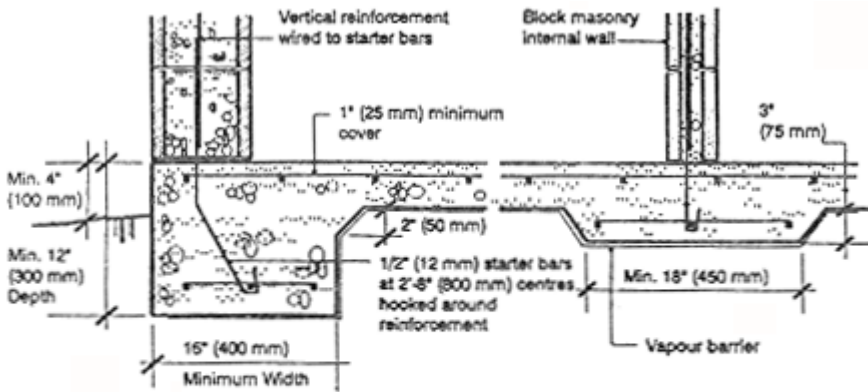


Fig. B1-6 CONCRETE SLAB-ON-GROUND CONSTRUCTION CONCRETE BLOCK MASONRY WALLS

Revision Date: 31 Dec 2002

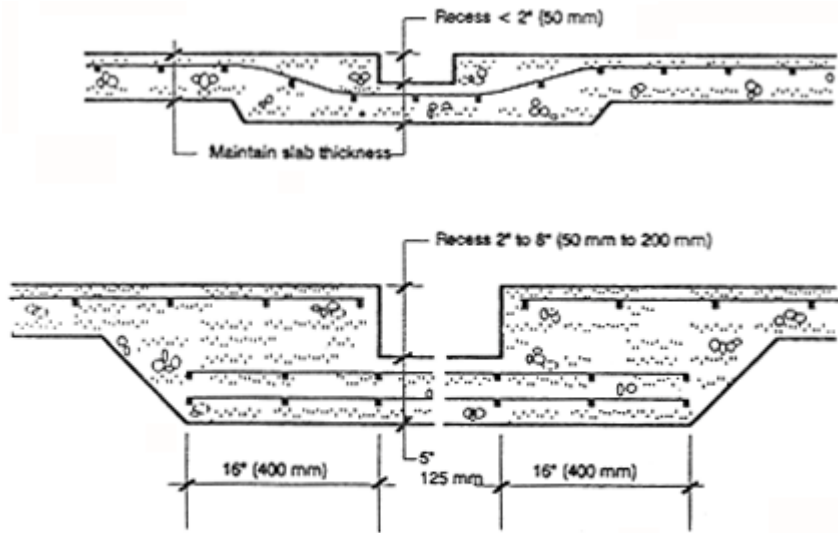


Fig. B1-7 SLAB-ON-GROUND – THICKENING AT RECESSES

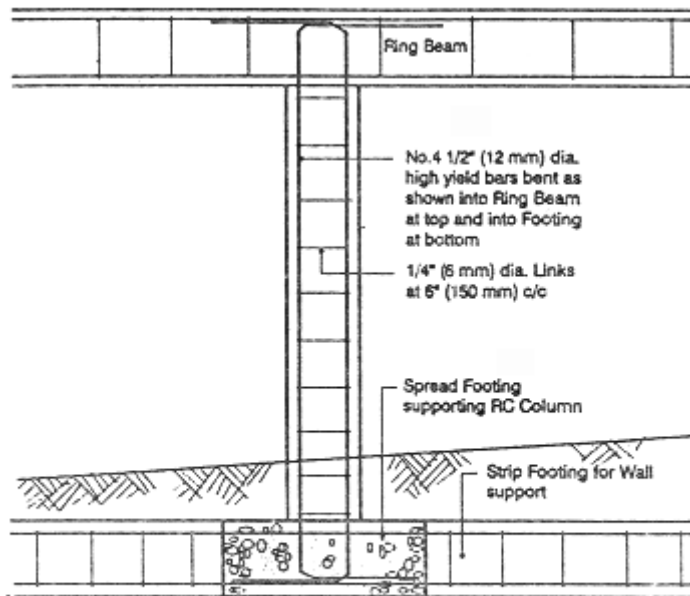


Fig. B2-1 COLUMN DETAIL

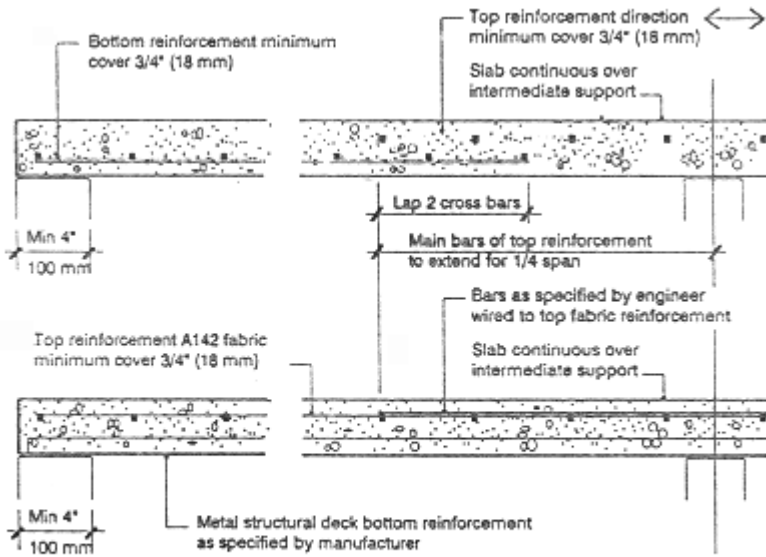


Fig. B2-2 **SUSPENDED CONCRETE SLABS**

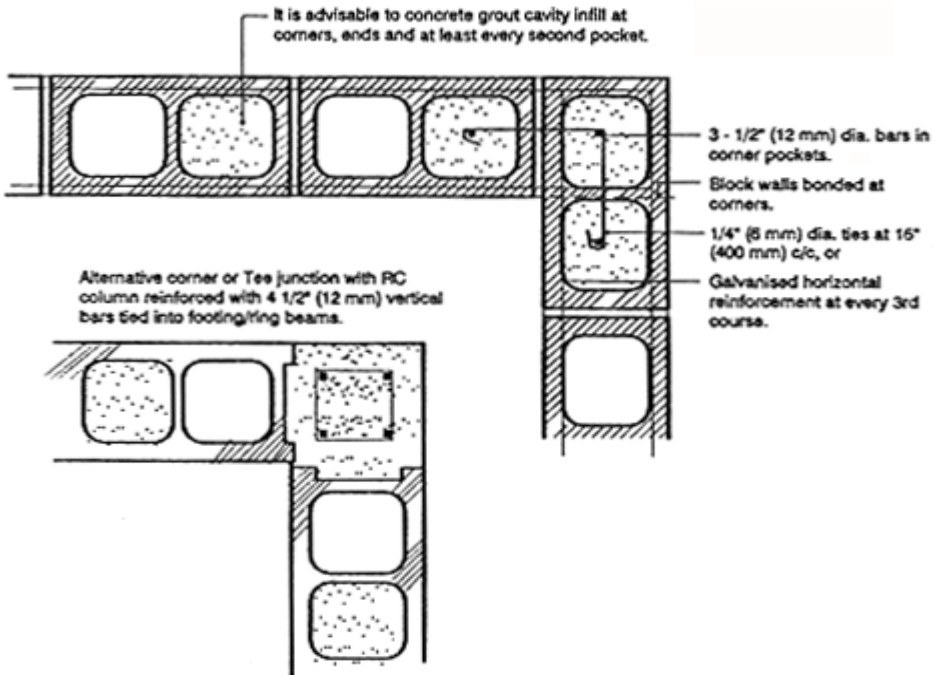


Fig. B3-1 **WALL CORNER DETAIL**

Revision Date: 31 Dec 2002

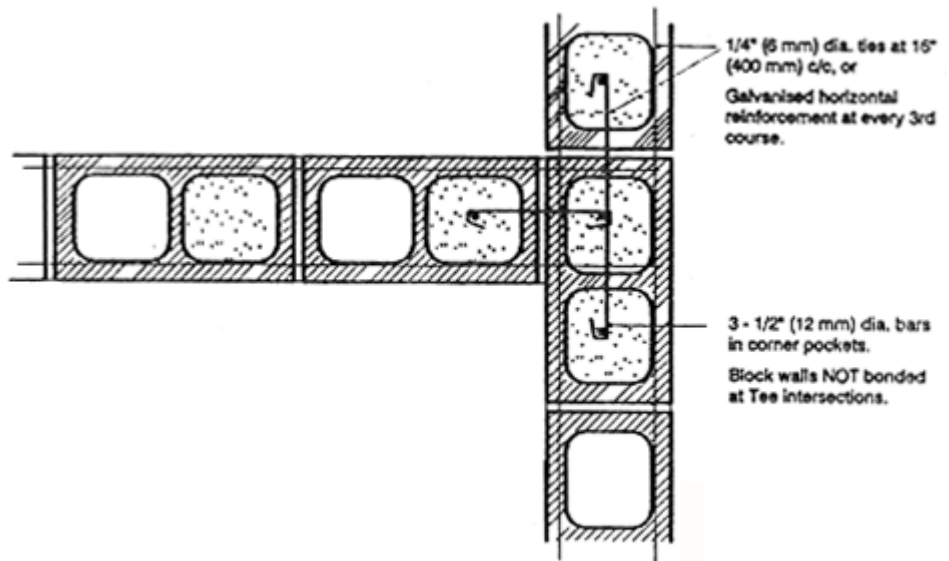


Fig. B3.2 WALL Tee JUNCTION DETAIL

Revision Date: 31 Dec 2002

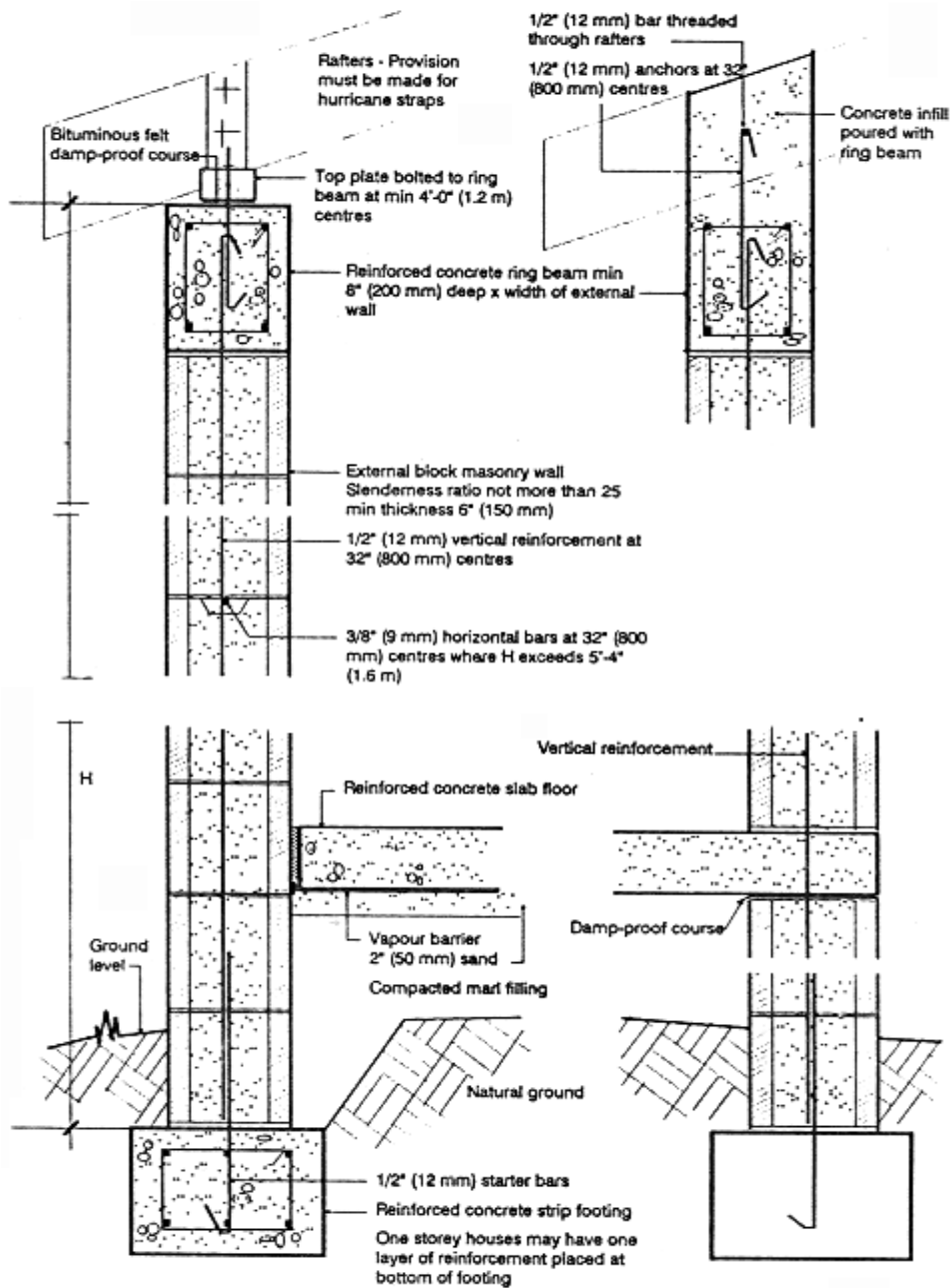


Fig. B3-3 TYPICAL BLOCK MASONRY CONSTRUCTION

Revision Date: 31 Dec 2002

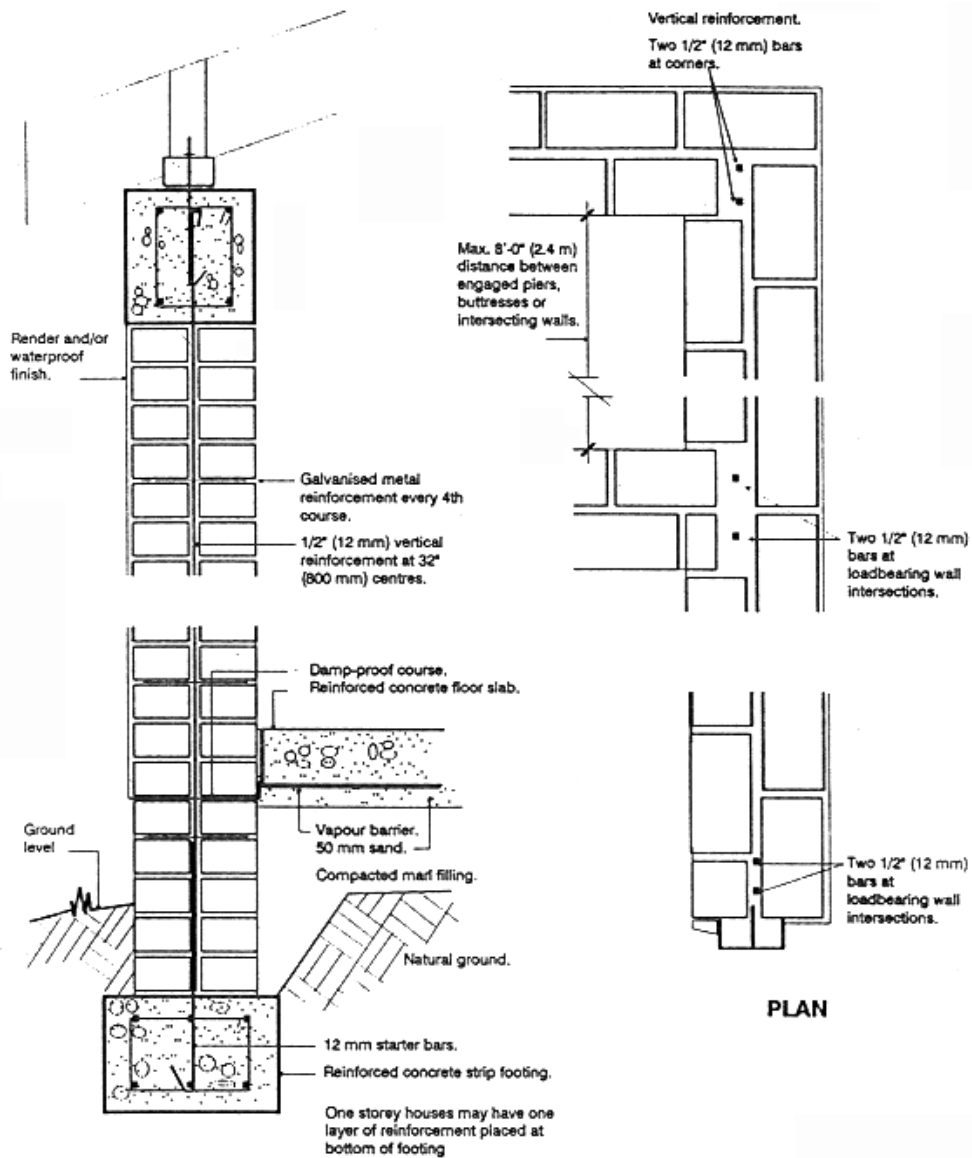


Fig. B3-4

TYPICAL BRICKWORK DETAILS

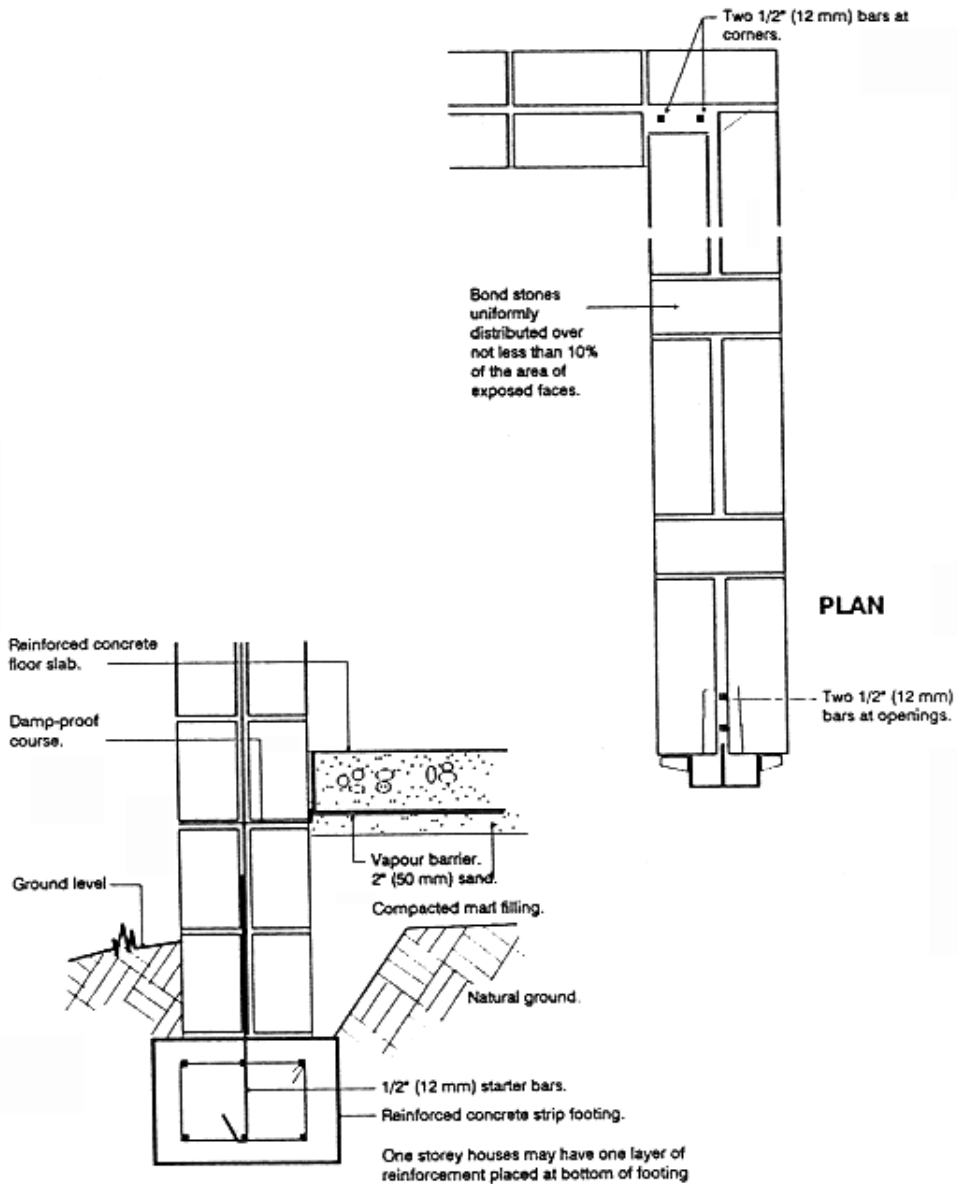


Fig. B3-5 TYPICAL CORAL LIMESTONE CONSTRUCTION

Revision Date: 31 Dec 2002

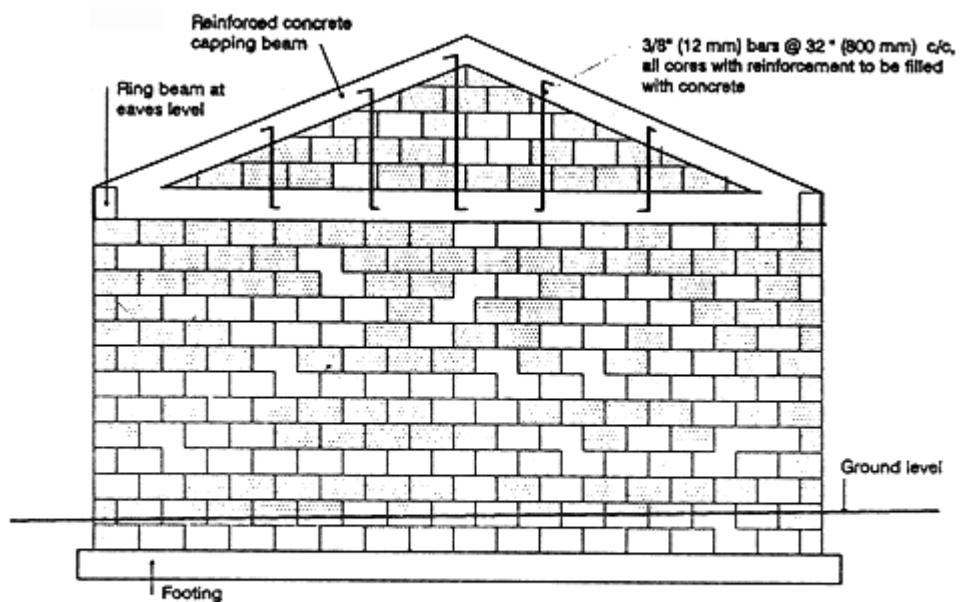


Fig. B3-6 REINFORCED CONCRETE MASONRY

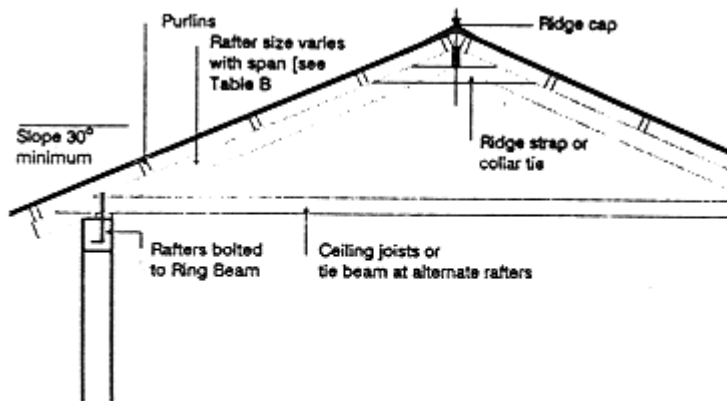


Fig. B5-1 ROOF ANCHORAGE

SECTION C – TIMBER CONSTRUCTION

C1 FOUNDATIONS

C1.1 General

- (a) With timber construction, the functions of the foundation are to ensure that the building is adequately supported by the underlying soil, that it is raised off the ground thus inhibiting rotting of the timber, and that it is securely held in position so that it cannot be blown or shaken off of its foundation.
- (b) For most timber buildings within the scope of these guidelines the foundations must be firmly pinned to the ground to prevent the building from being moved by high winds.

C1.2 Basic Types

- (a) For timber buildings there are many forms of foundations which can provide the functions stated above.
- (b) Several of these involve a timber post or pile driven into the soil or placed in a hole and concreted.
- (c) While this kind of foundation is satisfactory, it has the disadvantage of lack of durability unless special rot resistant timbers, such as Greenheart or specially pressure treated timber are used.
- (d) Where this type of material is not readily available, then such foundation types should be avoided and a concrete post used.
- (e) The posts should be capped by a termite shield which inhibits termites from invading the building. It is recommended also that the ground should be treated against termites. This treatment should be repeated periodically.
- (f) A more common foundation type consists of a mass concrete pad 1'-6" x 1'-6" x 8" thick (450 x 450 x 200 mm) located at least 1'-6" (450 mm) below ground level (if on marl or firm material) supporting a column of 8" (200 mm) concrete masonry blocks. These blocks should be filled and reinforced with 1# ½" (12 mm) diameter threaded steel bar which is anchored in the concrete pad and bolted to the sill plate. Fig. C-1
Alternatively, a ½" (12 mm) diameter bolt 12" (300 mm) long may be cast into the column where the threaded ½" (12 mm) diameter steel bar is not readily available.
- (g) This type of foundation, which combines functional adequacy and durability, is the preferred one.
- (h) It should be stressed that stacked, unbonded, concrete blocks or stones have very little resistance to uplift or shaking and are not acceptable as proper forms of foundation.
- (i) Where a timber building has a reinforced concrete floor slab, then the slab can be constructed so as to become the foundation. See Fig. B1-5

Revision Date: 31 Dec 2002

- (j) In such cases, the sill plate should be bolted to the slab by ½" (12 mm) diameter bolts spaced not more than 3'-0" (900 mm) apart. All bolts shall be fitted with 1½" (38 mm) diameter washers.

C2 FLOORS

C2.1 Concrete Floors

- (a) Floors may be constructed using a reinforced concrete slab not less than 4" (100 mm) thick with a 9" (230 mm) wide perimeter band thickened to 8" (200 mm) to permit adequate wall fixing and to function as a wall footing.
- (b) The floor slab shall be supported on firm, compacted material and generally produced in accordance with Subection B4.
- (c) A vapour barrier (damp proof course) should be installed as per Section A paragraph A2.2(e).

C2.2 Beams to Support Floors

- (a) The floor structure for timber floors should consist of 4" x 3" (100 x 75 mm) or 6" x 2" (150 x 50 mm) bearers bolted to foundation walls and piers. Beams must have even and level bearing and the length of bearing at end supports shall be at least 4" (100 mm). Steel beams shall be shop primed.
- (b) Where a beam is made up of individual pieces of lumber that are nailed or otherwise permanently fixed together, the beam shall be as follows:
 - Individual members shall be 1–½" (38 mm) or greater in thickness and installed on edge.
 - Where the individual members of a beam 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" (150 mm) of the end quarter points of the clear span of the beam provided they do not occur in adjacent members at the same quarter point and do not reduce the effective beam width by more than half. Members joined at quarter points shall be continuous over the adjacent supports.
 - Individual members shall be nailed together with a double row of nails at least 2–½" (65 mm) in length at maximum 18" (450 mm) centres in each row with the end nails located 4" to 6" (100 to 150 mm) from the end of each piece, or where not nailed, they shall be bolted together with at least ½" (12 mm) diameter bolts fitted with washers at not more than 4 ft. (1.2 m) centres, with the end bolts located not more than 2 ft. (600 mm) from the ends of the members.
- (c) Where sill plates provide bearing for the floor system they shall be not less than 2" x 4" (50 x 100 mm) material on flat and levelled by setting them on a full bed of mortar.

C2.3 **Support for Floor Joists**

Floor joists may be supported on the top of beams or may be framed into the sides of beams, as follows:

- (a) Except where supported on a ribbon strip, floor joists shall have not less than 1-1/2" (35 mm) of bearing on wood or metal nor less than 3" (75 mm) on masonry.
- (b) Floor joists may be supported by a ribbon strip of 1" x 4" (25 x 100 mm) timber let into the studs, and nailed to the adjoining stud.
- (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" x 3" (38 x 75 mm) nailed to the side of the supporting beam, or by other approved methods.
- (d) When framed into the side of steel beams, the joists may be supported on the bottom flange of the beam or on a ledger strip not less than 1-1/2" x 2" (38 x 50 mm) bolted to the web with not less than 1/4" (6 mm) diameter bolts spaced not more than 2 ft. (600 mm) apart.
- (e) Joists framing from opposite sides of a beam, girder or partition shall be lapped at least 4" (100 mm) and fastened, or the opposing joists shall be tied together in an approved manner.
- (f) Joists shall be supported laterally at the ends by solid blocks or diagonal struts (bridging) except where the ends of joists are end-nailed to a beam, header or fixed to an adjoining stud. Where joists have a depth to thickness ratio exceeding 6, unless ceiling furring or plywood lining is fixed to the underside, floor joists shall be restrained from twisting by 1-1/2" x 2" (38 x 50 mm) cross bridging or solid blocking at intervals between supports not exceeding 8 ft. (2.4 m). Blocking should fit tightly between joists and be securely nailed in place so as to restrain joist twisting.

C2.4 **Header and Trimmer Joists**

- (a) Header joists around floor openings shall be doubled when they exceed 4 ft. (1.2 m) in length. The size of header joists exceeding 10 ft. (3 m) in length shall be determined by calculations.
- (b) Trimmer joists around floor openings shall be doubled when the length of the header joist exceeds 32" (800 mm). When the header joist exceeds 6'-6" (1950 mm) in length the size of the trimmer joists shall be determined by calculations.
- (c) When tail joists and header joists are supported by the floor framing, they shall be supported by suitable joist hangers or nailing.

C2.5 **Beams and Joists Supporting Partitions**

- (a) Non-loadbearing partitions parallel to floor joists shall be supported on beams, loadbearing walls or doubled joists where the partition is over 6 ft.

Revision Date: 31 Dec 2002

(1.8 m) 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. (1.8 m) in length need not be supported on framing but may be supported by the subfloor.

- (b) Doubled joists may be separated not more than 8" (200 mm) by blocking consisting of timber not less than 1-1/2" x 4" (38 x 100 mm) spaced not more than 4 ft. (1.2 m) apart.
- (c) Non-loadbearing partitions at right angles to the floor joists are not restricted as to location.
- (d) 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.
- (e) Loadbearing interior walls at right angles to floor joists shall be located not more than 3 ft. (900 mm) from the joist support when the wall does not support a floor, and not more than 2 ft. (600 mm) from the joist support when the wall supports one or more floors, unless the joist size is designed to support such loads.

C2.6 Cantilevered Joists

Floor joists supporting roof loads shall not be cantilevered more than 10" (250 mm) beyond their supports where 2" x 8" (50 x 200 mm) joists are used, and not more than 2'-6" (750 mm) beyond their supports where 2" x 10" (50 x 250 mm) 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. 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.

C2.7 Maximum Span of 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.

See Table C-1 for recommended joist sizes for various spans of domestic loading using standard pitch pine lumber available in the Eastern Caribbean.

- (b) Spans for field-glued plywood lumber floor systems using adhesives shall comply with APA Glued System, as published by the America Plywood Association. Adhesives for such systems shall be those meeting the requirements of AFG-01 – Adhesives for Field Gluing Plywood to Wood Framing, as published by the American Plywood Association.

Table C-1 Recommended Minimum Pitch Pine Joists, Spans & Sizes

at 2 ft. (600 mm) centres

Span Range		Joist Size (Nominal)	
6 – 8 ft.	1.8 – 2.4 m	2" x 6"	50 x 150 mm
8 – 10 ft.	2.4 – 3.0 m	2" x 8"	50 x 200 mm
10 – 12 ft.	3.0 – 3.6 m	2" x 8"	50 x 200 mm
12 – 15ft.	3.6 – 4.5 m	3" x 8"	75 x 200 mm
15 – 20 ft.	4.5 – 6.0 m	3" x 12"	75 x 300 mm

Note The recommended sizes in Table C-1 is for domestic floors not more than 40 psi loading and with other loads such as a ceiling of not more than 7 psi. using timber joists with a fibre stress of 1200 psi.

C2.8 Notching and Cutting

- (a) Notches on the ends of joists shall not exceed 1/4 the depth. Notches for pipes in the top or bottom of joists shall not exceed 1/6 the depth and shall not be located in the middle 1/3 of the span.
- (b) Holes bored for pipes or cables shall not be within 2" (50 mm) of the top or bottom of the joist and the diameter of any such hole shall not exceed 1/3 the depth of the joist.

C2.9 Flooring

- (a) Floor decking may consist of 1" x 6" (25 x 150 mm) tongue-and-groove boarding or other similar boarding nailed to each joist.
- (b) Where timber floors are to be tiled, the T&G boarding may be replaced by plywood or covered by compressed fibreboard sheets. Both of these systems provide a smooth surface with few joints for the fixing of the tiles.

C2.10 Ventilation

- (a) 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 3 sides. The minimum total area of ventilating openings shall be 2 sq.ft. (0.185 m²) for each 15'-0" (4.5 m) of exterior wall. Such openings need not be placed in the front of the building.
- (b) Where timber floor joists are used, there shall be not less than 18" (450 mm) distance between the bottom of such floor joists and the ground beneath.

Revision Date: 31 Dec 2002

C2.11 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.
- (b) The minimum thickness of lumber used as sub-flooring shall be in accordance with Table C-2.

Table C-2 Minimum Thickness of Lumber Sub-flooring

Joist spacing*		Minimum net thickness for lumber placed			
		Perpendicular to joists		Diagonally to joists	
24"	600 mm	1-1/16"	27 mm	3/4"	18 mm
16"	500 mm	5/8"	16 mm	5/8"	16 mm
12"	300 mm	5/8"	16 mm	5/8"	16 mm

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 2 joists.

- (c) Plywood shall be applied in accordance with the provisions of Table C-3 and C-4.

Table C-3 Spans of Plywood Sub-floor Continuous over Two or More Supports

Panel Identification Index	Maximum Span
32/16,36/16	16" 400 mm
42/20	20" 500 mm
48/24	24" 600 mm

Table C-4 Allowable Spans for Plywood Combination Subfloor-Underlayment

Plywood Continuous over Two or More Spans and Face Grain Perpendicular to Supports						
Species Groups	Maximum Spacing of Joists					
	16"	400 mm	20"	500 mm	24"	600 mm
1	1/2"	12 mm	5/8"	16 mm	3/4"	18mm
2,3	5/8"	16 mm	3/4"	18 mm	7/8"	22mm
4	3/4"	18 mm	7/8"	22 mm	1"	25mm

- 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".
 - 3 Underlayment Grade and C-C (plugged) panels may be of nominal thickness 1/32" less than the nominal thickness shown when marked with the reduced thickness.
- (d) Sub-flooring may be omitted when joist spacing does not exceed 16" (400 mm) and nominal 1" (25 mm) 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 C-4 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 C-5 and fastened in accordance with a standard fastening system.

Table C-5 Allowable Spans for Particleboard Subfloor and Combined Subfloor-underlayment (1), (4)

Grade	Thickness	Maximum spacing of supports (2), (3)	
		Subfloor	Combined subfloor underlayment
2-M-W	5/8" 16 mm	16" 400 mm	16" 400 mm
2-M-W	3/4" 18 mm	19" 475 mm	19" 475 mm
2-M-F	3/4" 18 mm	19" 475 mm	19" 475 mm

- Notes**
- 1 All panels continuous over 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.

 Revision Date: 31 Dec 2002

C3 WALLS

C3.1 Materials

- (a) Walls can be constructed of Douglas Fir, Pitch Pine or other approved structural timber.
- (b) Where possible, only treated timber should be used. The timber should be sound, straight and well seasoned timber with a moisture content between 15% and 20%.

C3.2 Base Plates

- (a) Plates or sills resting on masonry or concrete walls must comply with C3.2(c), and be bolted to the masonry or concrete at the corners and at not more than 4 ft. (1.2 m) intervals with 18" (450 mm) long 1/2" (12 mm) bolts. Base plates on concrete or masonry must have a suitable damp proof course under the plate.
- (b) Base plates must be treated with a suitable preservative and must not be less than 2" x 4" (50 x 100 mm).

C3.3 Exterior Wall Framing

- (a) Stud size and spacing of studs in 1 and 2 storey buildings shall be not less than 2" x 4" (50 x 100 mm) with the wide face perpendicular to wall. In 3 storey buildings, studs in the first storey shall be not less than 3" x 4" (75 x 100 mm) or 2" x 6" (50 x 150 mm). Studs shall be spaced not more than as shown in Table C-6.

Table C-6 Maximum Spacing of Studs

Stud size	Supporting roof and ceiling only	Supporting 1 floor, roof and ceiling	Supporting 2 floors, roof and ceiling
2" x 4" 50 x 100 mm	24" 600 mm	16" 400 mm	16" 400 mm
3" x 4" 75 x 100 mm	24" 600 mm	24" 600 mm	16" 400 mm
4" x 4" 100 x 100 mm	24" 600 mm	24" 600 mm	16" 400 mm
2" x 6" 50 x 150 mm	24" 600 mm	24" 600 mm	16" 400 mm

Note Walls shall be designed to resist the dead and live loads as per Section 12.

- (b) Maximum allowable height of 2" x 4" (50 x 100 mm) and 3" x 4" (75 x 100 mm) stud framing shall be 14 ft. (4.2 m) and of 2" x 6" (50 x 150 mm) stud framing shall be 20 ft. (6 m) unless the wall is otherwise laterally

supported. Solid wood bridging shall be placed at intervals of not over 8 ft. (2.4 m).

- (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.

C3.4 Framing over Openings

- (a) Openings in non-loadbearing walls shall be framed with not less than 2" (50 mm) 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" (50 mm) 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" (50 mm) nominal thickness placed on edge. Such headers or lintels shall have not less than 2" (50 mm) solid bearing at each end.

C3.5 Bracing of Exterior Stud Walls

- (a) Not less than 3 studs shall be installed at every corner of an exterior wall, except that a 3rd stud may be omitted through the use of continuous wood spacer or backup cleat 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 1" x 4" (25 x 100 mm) continuous diagonal strips set into the face of the studs and top and bottom plates at each corner of building.

Revision Date: 31 Dec 2002

- (2) Wood boards of 5/8" (12 mm), (net) minimum thickness, applied diagonally.
 - (3) Wood sheathing panels 2'-0" x 8'-0" (600 x 2400 mm) of 5/8" 15 mm) minimum thickness applied horizontally.
 - (4) Plywood sheathing panels not less than 48" (1.2 m) wide and 96" (2.4 m) long applied vertically or horizontally.
- (c) Sheathing shall be applied on the exterior walls of all Type 5 buildings (Table 3-2), more than 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 Board.

Table C-7 Allowable Spans for Plywood Wall Sheathing

Panel identification	Maximum stud spacing and construction	
	Exterior covering nailed to:	
	Stud	Sheathing
5/16	16" (400 mm)	16" (400 mm)
3/8 and 1/2	24" (600 mm)	16" (400 mm)
3 ply	24" (600 mm)	24" (600 mm)
1/2 (4 and 5 ply)	24" (600 mm)	24" (600 mm)

- Notes**
- 1 When plywood sheathing is used, building paper and diagonal wall bracing can be omitted.
 - 2 When siding such as shingles is nailed only to the plywood sheathing, apply plywood with face grain across studs.

C4 POST, BEAM AND PLANK CONSTRUCTION

C4.1 General

- (a) The size and spacing of posts and beams and the span and thickness of floor and roof decking shall be calculated by a professional structural engineer in accordance with this Section.
- (b) Requirements for nails, lumber, notching and drilling, anchorage and sill plates shall conform to this Section.

C4.2 Decking

- (a) Floor and roof decking shall consist of not less than 1" (25 mm) lumber laid on the flat or on edge.

- (b) Plank floor decking laid on the flat shall be not more than 8" (200 mm) 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.

C4.3 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" (100 mm).
- (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 by a professional structural engineer.
- (f) Opposing loadbearing beams shall be tied together at the joints by means of splices or suitable mechanical connectors.

C4.4 Posts

- (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.

C4.5 Plank Frame Wall Construction

- (a) Thickness of plank framing in plank frame walls shall conform to this Section. The unsupported height of 1-1/2" (38 mm) vertical plank non-loadbearing partitions shall not exceed 12 ft. (3.6 m).
- (b) Vertical framing in plank frame walls shall consist of not less than 10" (250 mm) wide planks spaced not more than 8 ft. (2.4 m) 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 C-8 Nominal Thickness of Plank Framing

Revision Date: 31 Dec 2002

Supported Load (Including dead load and ceiling)	Minimum Plank Thickness
Roof with or without attic storage	1-1/2" (38 mm)
Roof with or without attic storage plus 1 floor	1-3/4" (44 mm)
Roof with or without attic storage plus 2 floors	2-1/2" (65 mm)

- (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 2'- 6" (750 mm) 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" (50 mm) 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. (4.8 m) and the spans of trusses do not exceed 32 ft. (9.6 m) the spans for wood lintels shown in Table C-9 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" (25 mm).
- (j) Non-loadbearing horizontal members (fillers) in plank frame walls shall be securely fastened to the vertical framing.

Table C-9 Lintel Spans

Lintel Size (nominal)	Maximum Span
2" x 6" 50 x 150 mm	5'-0" 1.5 m
2" x 8" 50 x 200 mm	6'-0" 1.8 m
2" x 10" 50 x 250 mm	7'-0" 2.1 m
3" x 8" 75 x 200 mm	7'-0" 2.1 m
3" x 10" 75 x 250 mm	9'-0" 2.7 m

C4.6 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.

C5 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, 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 3-1/2" (38 mm).

C6 CLADDING

C6.1 General

The cladding of all external walls must be of approved weather proof material. All cladding must be nailed securely to each framing member.

C6.2 Plaster on Metal Lath

- (a) Where plaster is used as the cladding, it should consist of not less than two coats applied to metal laths which shall be securely fastened to the weather proof backing.
- (b) The metal laths may consist of expanded metal sheets, "hy-rib" or other standard materials. Such material must be used in accordance with the manufacturer's instructions.
- (c) The first or scratch coat of plaster shall be not less than 1/2" (12 mm) thick and shall be kept moist by wetting for not less than 24 hours before applying the second coat which shall also be a minimum of 1/2" (12 mm) thick.
- (d) Interior walls may be covered by any approved kind of interior partition boards or with plaster as described above.

C6.3 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.

Revision Date: 31 Dec 2002

- (a) **Weather-boarding.** Wood siding patterns known as rustic drop siding or shiplap shall have an average thickness in place of not less than 19/32" and shall have a minimum thickness of not less than 3/8". Bevel siding shall have a minimum thickness measured at the butt section of not less than 7/16" and a tip thickness of not less than 3/16". Siding of lesser dimensions may be used provided such wall covering is placed over sheathing which conforms to the provisions of this Section.
- (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 3/8".
- (c) **Plywood.** Plywood shall be of the exterior type and shall have a minimum thickness of 3/8". All plywood joints shall be backed solidly with nailing pieces not less than 2" 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 be 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 Board to be impractical.

C7 **ROOFS**

C7.1 **Construction**

Although Section B5 will generally apply here, most local timber houses being constructed tend to be smaller than concrete houses. Accordingly, the recommended sizes of roof rafters for roof spans no greater than 20 ft. (6 m) are as follows:

- (a) The ridge beam shall be 1-1/2" x 6" (38 x 150 mm) or 1-1/2" x 8" (38 x 200 mm) or 2" x 6" (50 x 150 mm) depending on the size of the rafter.

- (b) Rafters and tie beam should be 2" x 4" (50 x 100 mm) at 2'-0" (600 mm) centres, but 2" x 6" (50 x 150 mm) rafters are often used.
- (c) Hip rafters shall be 2" x 6" (50 x 150 mm).

For roof spans exceeding 30 ft. (9 m) rafters shall be replaced by trusses. Professional advice should be sought for the design of such trusses.

C7.2 Roof Joists and Rafters

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

- (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 1/4 the depth. Holes bored for pipes or cable shall be on the neutral axis and at least 2" from the top or bottom of the joist. The diameter of any such hole shall not exceed 1/3 the depth of the joist. Holes shall not be less than 3 diameters apart. Notches for pipes in the top or bottom of joists shall not exceed 1/6 the depth and shall not be located in the middle 1/3 of the span.

C7.3 Roof and Ceiling Framing

- (a) Figure C-3 show typical roof framing for small buildings. Such rafters are generally placed at intervals of 2 ft. (600 mm) 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" (18 mm) 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 Board.
- (d) Hip and valley rafters shall be not less than 2" (50 m) greater in depth than the common rafters and not less than 2" (50 mm) 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" x 4" (50 x 100 mm) material extending from each rafter to a loadbearing wall at an angle of not less than 45° 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

Revision Date: 31 Dec 2002

shall be installed between floor joists beneath dwarf walls that enclose finished rooms.

- (g) Except as provided in (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" x 6" (38 x 150 mm) material. Such ridge beam shall be supported at intervals not exceeding 4ft. (1.2 m) by not less than 1-1/2" x 4" (38 x 100 mm) 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, nailed and securely fixed with hurricane straps or bolts.
- (i) Roof trusses shall be designed by an experienced engineer or architect in accordance with the appropriate engineering requirements.
- (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.
- (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" (400 mm) on centres. They shall be not less than 2" x 2" (50 x 50 mm) lumber spanning not more than 24" (600 mm) for ceilings of 1/2" (12 mm) 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 C-10 Spans and Sizes of Ceiling Joists

Maximum Span		Maximum Spacing		Width x Depth	
7'-0"	2.1 m	16'	400 mm	2" x 4"	50 x 100 mm
6'-0"	1.8 m	24"	600 mm	2" x 4"	50 x 100 mm
10'-0"	3.0 m	16"	400 mm	2" x 5"	50 x 125 mm
9'-3"	2.8 m	24"	600 mm	2" x 5"	50 x 125 mm
13'-3"	4.0 m	16"	400 mm	2" x 6"	50 x 150 mm
12'-8"	3.8 m	24"	600 mm	2" x 6"	50 x 150 mm
15'-9"	4.8 m	16"	400 mm	2" x 7"	50 x 175 mm
15'-2"	4.6 m	24"	600 mm	2" x 7"	50 x 175 mm
17'-6"	5.3 m	16"	400 mm	2" x 8"	50 x 200 mm
18'-2"	5.5 m	24"	600 mm	2" x 8"	50 x 200 mm

C7.4 Bearing

Joists and rafters shall bear on wood plates and shall have not less than 4" (100 mm) of bearing.

C7.5 Anchorage

Anchorage for joists and rafters 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. The anchorage for the base plates consist of bolts fixed into the concrete or masonry. 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.

C7.6 Fixing

- (a) All roofs should be so framed and tied into the framework of the supporting walls so as to form an integral part of the whole building.
- (b) All rafters should be fixed with metal plates or straps to the wall plates. Bird mousing is occasionally used but metal straps and bolts provide a firmer connection.
- (c) The ends of all trusses are to be directly supported by studs or columns not less than 4" x 4" (100 x 100 mm).
- (d) All roof fixings must be improved by the use of the appropriate hurricane clips or straps.

Table C-11 Allowable Spans for Plywood Roof Sheathing Continuous over Two or More Supports

Panel Identification Index	Maximum span if block or other edge support	Maximum span without edge support
24/0 (1/2" only)	24" 600 mm	20" 500 mm
30/12	30" 750 mm	26" 650 mm
32/16	30" 750 mm	28" 700 mm
36/16	32" 800 mm	30" 750 mm
42/20	36" 900 mm	32" 800 mm
48/24	42" 1050 mm	36" 900 mm

- Note**
- 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).

Revision Date: 31 Dec 2002

- 3 For roof live load of 40 psf (1.9 kPa) decrease span by 13% 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 1/4" (6 mm) minimum thickness underlayment is installed, or finished floor is 25/32" (20 mm) wood strip. Allowable uniform load based on deflection of 1/360 of span is 165 psf (7.9 kPa).
- 5 For joists spaced 24" (600 mm) on plywood sheathing with Identification Index numbers 42/20 or greater can be used for subfloors when supporting 1-1/2" (38 mm) lightweight concrete.

C7.7 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 Board for the specific application desired.
- (e) It is recommended that where rainwater is collected from a shingled roof a filter be installed at the inlet pipe to the storage tank.

C8 VENTILATION

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.

C9 NAILING AND WORKMANSHIP

C9.1 General

- (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 good workmanship practices to achieve the degree of structural strength required by the particular joint or connection of timber members.

C9.2 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"

- (50 mm) 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" (38 mm) 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" (50 mm) 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.

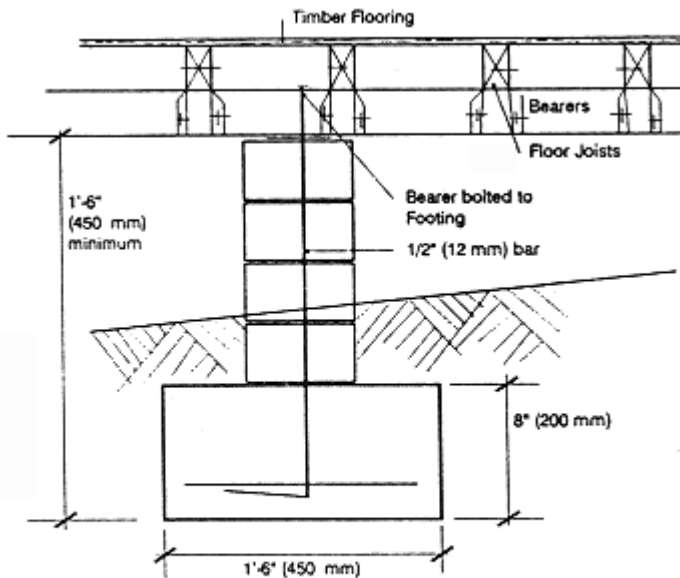


Fig. C-1 **TIMBER CONSTRUCTION ANCHORING OF BEARERS TO FOOTING**

Revision Date: 31 Dec 2002

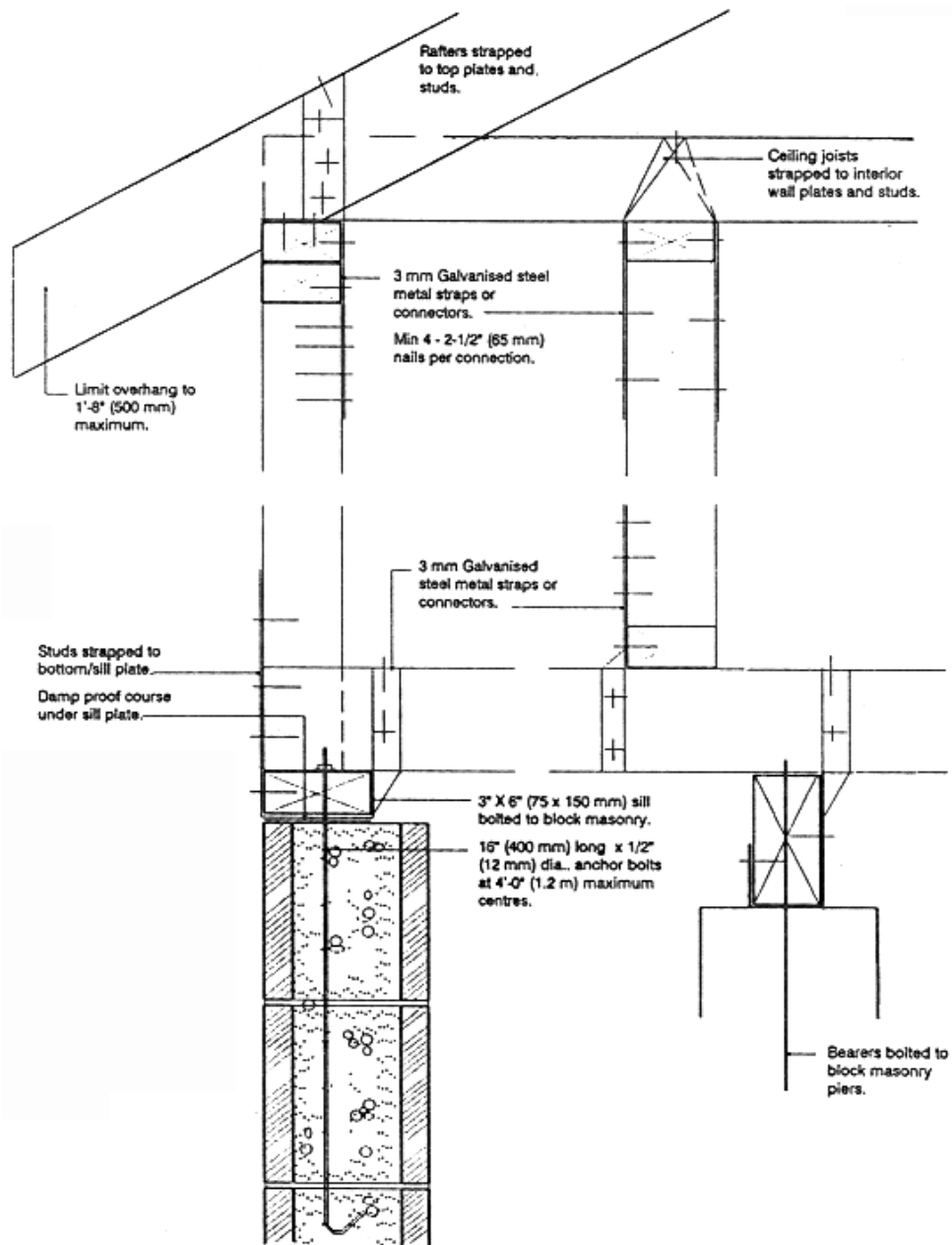


Fig. C-2

TIMBER FRAMING

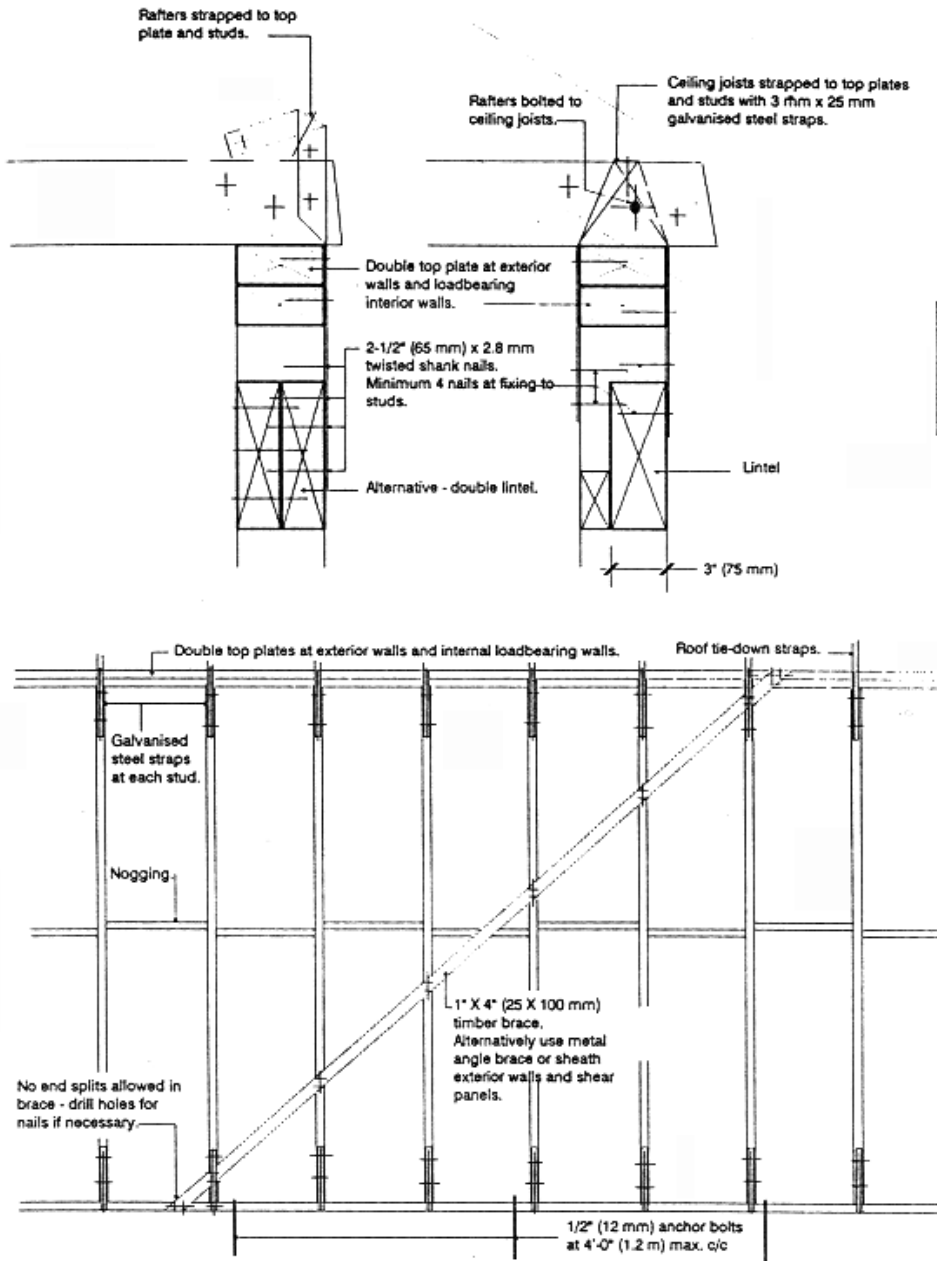


Fig. C-4 BRACING REQUIREMENTS

Revision Date: 31 Dec 2002

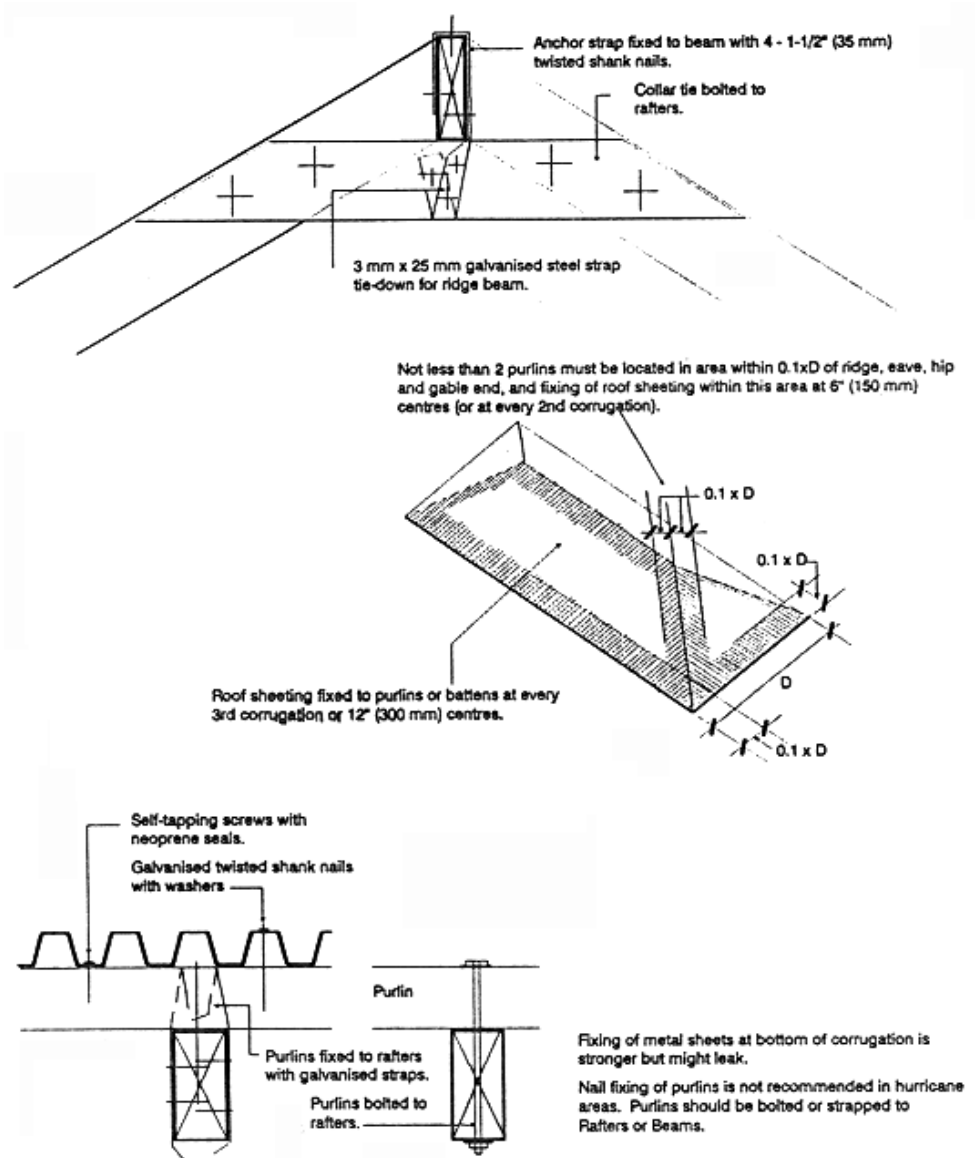


Fig. C-5 ROOF CONSTRUCTION

SECTION D – STEEL CONSTRUCTION

D1 MANAGEMENT

D1.1 **Ordering and Purchasing**

- (a) In many parts of the Eastern Caribbean, there is no local company undertaking the design and fabrication of structural steelwork components.
- (b) For this reason, all steel structures to be erected are imported in dismantled form and erected on site.
- (c) Most suppliers of steel buildings require information setting out the plan dimensions of the proposed building, its height, type of framing and design parameters such as basic wind speed, and gravity loading.
- (d) Using this information the supplier will design the structures and provide a quotation.
- (e) On receipt of approval, the fabrication of components is put in hand and arrangements for payments finalised.
- (f) Payment is usually by letter of credit but other methods of payment may be agreed.
- (g) The design and construction of steel structures are generally outside the scope of these Guidelines. However, there is an increasing number of steel shells being imported and used for factories and small manufacturing enterprises. The information contained in these Guidelines is intended to assist the builder in understanding the basic considerations for ordering, storing, and erecting the structure.
- (h) It is further recommended that, in all cases when contemplating the use of steel structures, experienced professional advice be sought.

D1.2 **Handling**

- (a) The performance of a steel framed building will depend to a large extent upon the way it is handled in the early stages.
- (b) Preferably, steel work should be cleaned of rust by shot or sand blasting and then painted with 2 coats of red lead oxide metal primer.
- (c) This treatment will ensure that it reaches site in very good condition.
- (d) Before erection, the steel work should be primed with red lead oxide primer to ensure that all surfaces are primed before the final decoration is applied.

Note The basic wind speed and other factors to be used in the design must be in accordance with the factors described in the Building Code.

D2 **FOUNDATIONS**

D2.1 **General**

- (a) Foundations for steel framed buildings generally consist of a reinforced concrete pad located at a suitable depth on a bearing stratum.
- (b) The pad supports a stub column which has the column holding down bolts cast into it.

Revision Date: 31 Dec 2002

- (c) The height of the stub column is such that the column base is located at the desired elevation.
- (d) Since steel framed buildings are comparatively light weight structures, the footing size is usually arrived at by determining the size of the adequate anchor to prevent uplift due to wind. The size of footing should therefore be provided by the designer or supplier, and the horizontal restraint needed at the column bases must also be shown on the designer.
- (e) Because of this, it is not possible to provide specific design guidelines, since the size of the footing is dependant upon the forces which would be generated by the wind. Experienced engineers would be required to carry out a wind analysis, the result of which would permit design of the footing to be undertaken.
- (f) When hollow concrete blocks are used to construct the walls, strip footings between the column footings are used for their support. These strip footings are as described in Section B1.
- (g) Fig. D-1 shows the typical arrangement for the installation of a steel frame. The design of the stub columns (where necessary), the design of the footings and the connections of the exterior walls to the steel columns must be carried out by an experienced engineer.

D3 WALLS

D3.1 General

For steel framed buildings, two systems are generally used for walls. These are hollow concrete block walls or metal cladding.

D3.2 Concrete Walls

- (a) When concrete walls are used, the information given in Section B. is applicable. There are some minor differences concerning the anchoring of the wall reinforcement. The vertical steel is anchored to the footing in the normal manner and anchored at the top by welding to the longitudinal beam, or fixed to a concrete beam constructed on top of the walls.
- (b) The horizontal reinforcement is welded to the web of the columns. If the columns are encased in concrete the reinforcement can be carried to the face of the steel column.
- (c) Care must be taken to fix these walls to the steel frames so as to provide lateral continuity to the walls and to prevent the wall from collapsing either under the shaking from an earthquake or from the pressures due to hurricane winds.
- (d) It is however, sometimes necessary to install a flexible joint between the block wall and the steel column where the walls have not been used to provide lateral stability. In this event the steel frame must be adequately braced to accommodate the lateral loads without collapse.

D3.3 **Metal Cladding**

- (a) Where metal cladding is used, Z-purlins are attached to the columns with suitable fixings.
- (b) The vertical siding, as the sheeting is then called, is attached to the Z-purlins in the normal manner employed for roofs. Fixings made in the valleys rather than on the crowns would provide greater hurricane resistance. Care must be taken to prevent leaks.

D4 **SHEET STEEL STUD WALL FRAMING**

D4.1 **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 published by the American Iron and Steel Institute.

D4.2 **Design Criteria**

- (a) Where loadbearing steel studs are used they shall be designed in conformance with the Building Code.
- (b) Steel studs and runners shall conform to ASTM C 645 – 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" (9 mm) through the metal.
- (e) Except as required in (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" (25 mm) flanges. Note that except otherwise approved by the Board, 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. (1.2 m) in width, the width of steel studs shall be at least 2–1/2" (65 mm). Where openings exceed 4 ft. (1.2 m) in width, the stud width shall be at least 3–1/2" (88 mm). The metal thickness of the studs must be adequate for the size of stud being used.

Revision Date: 31 Dec 2002

- (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" (400 mm). Where the distance between the framing over the opening at the top runner exceeds 16" (400 mm) in such walls, intermediate support shall be installed at intervals of not more than 16" (400 mm) above the opening.
- (i) The size of spacing of non-loadbearing steel studs for exterior walls shall be in conformance with Table D-2.

Table D-1 Steel Studs for Non-Loadbearing Partitions

Minimum Stud Size	Maximum Stud Spacing	Maximum Wall Height
1-1/4" x 1-1/2" 30 x 38 mm	16" 400 mm	9'-6" 2.85 m
	24" 600 mm	8'-6" 2.55 m
1-1/4" x 2-1/2" 30 x 65 mm	16" 400 mm	13'-0" 4.0 m
	24" 600 mm	11'-6" 3.5 m
1-1/2" x 3-1/2" 38 x 88 mm	16" 400 mm	17'-0" 5.0 m
	24" 600 mm	16'-0" 4.8 m

D4.3 Size of Framing

Except as required in D4.2(f) and (h) the size and spacing of steel studs for non-loadbearing partitions shall conform to Table D-1.

D4.4 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" (50 mm) from the end of the runners, and at intervals of not more than 2 ft. (600 mm) on centres for interior studs and 12" (300 mm) for exterior studs. Such fasteners shall consist of the equivalent of 2-1/2" (65 mm) nails or 1" (25 mm) 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" (12 mm) 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 D4.2, 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 7'-9" (2350 mm) 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 D-2 Steel Studs for Non-loadbearing Exterior Walls

Minimum Stud Dimensions (Nominal)	Minimum Metal Thickness (excluding coatings)	Minimum Stud Length		
		Spacing of Studs – centre to centre		
		12" 300 mm	16" 400 mm	24" 600 mm
1-1/4" x 4" 30 x 100 mm	0.021" 0.6 mm	9'-6" 2.85 m	8'-0" 2.4 m	—
1-1/4" x 4" 30 x 100 mm	0.027" 0.7 mm	11'-0" 3.3 m	8'-10" 2.65 m	7'-10" 2.4 m
1-1/4" x 4" 30 x 100 mm	0.033" 0.9 mm	11'-6" 3.5 m	10'-0" 3.0 m	8'-10" 2.65 m
1-1/4" x 4" 30 x 100 mm	0.039" 1.0 mm	13'-0"	10'-10"	10'-0"

D5 PORTAL FRAMES

D5.1 Frame Types

- (a) The type of frame most commonly used in the region is the portal frame with pinned bases. This kind of frame is commonly used in factory shells, warehouses and some commercial buildings.
- (b) The frame consists of two columns and two rafters and all connections are usually bolted, although welded connections are sometimes used.
- (c) The portal frames are linked by longitudinal beams at the top of the columns and purlins between the rafters.
- (d) The first and last bays are usually fitted with diagonal bracing in the plane of the columns and in the plane of the roof. This diagonal bracing is very

Revision Date: 31 Dec 2002

important to the stability of the frame and must not be left out unless other arrangements are made to provide resistance to lateral loads.

- (e) Where the end bays must be left clear for doors, the diagonal bracing is replaced by a longitudinal frame sometimes referred to as “goal-post bracing”, or diagonal bracing placed in other bays.
- (f) The roof bracing is usually of tubular steel while the column bracing is similar or is made of adjustable steel rods acting in tension, in which case it must be cross bracing.
- (g) The roof is usually clad with corrugated galvanised or plastic coated steel sheets or corrugated aluminium sheets. These sheets are fixed to the purlins by self-tapping screws fitted with flexible washers driven through the crowns of the corrugation. The spacing of these fixings is as described in Section A3.3. If special aligning guns are used, valley fixings would provide much greater hurricane resistance than crown fixings.

D5.2 **Erection**

- (a) The steel frames are erected on the prepared foundation which will have the holding down bolts projecting above the level of the stub columns. These bolts are usually cast in PVC sleeves so that some adjustment is possible.
- (b) Firstly, the columns are lifted and slipped over the bolts. Nuts and washers are put on and partially tightened.
- (c) This assembly is then lifted and the connections to the two columns made.
- (d) This process is repeated with the second frame and the two are then joined by one purlin on each side of the crown.
- (e) After all the frames have been erected, the columns are plumbed and the holding down bolts are grouted, the longitudinal beams added and all connections completed.
- (f) The remaining purlins, the roof bracing and the diagonal column bracing are then installed.
- (g) The roof sheeting and walls are then added to the completed frames.

D6 **PERFORMANCE SPECIFICATIONS FOR SMALL STEEL FRAMED BUILDINGS**

D6.1 **Introduction**

- (a) It is recognised that there may be significant savings in labour in the construction of pre-engineered buildings, especially in view of the technology affecting the design of such buildings. The criteria to be considered in the appraisal of pre-engineered buildings are:
 - (i) Resistance to wind and earthquake forces.
 - (ii) Resistance to corrosion.
 - (iii) Compatibility with environmental and aesthetic standards.

- (b) Other economic and social criteria may also be considered by the Planning Authorities, but the structural characteristics must be in accordance with the minimum requirements of the Building Code.
- (c) The following specifications are for the construction of small single storey buildings of less than 3,000 sq.ft. (300 m²) The design of larger buildings must be carried out by a rational method in accordance with a Code or Standard approved by the Board.

D6.2 **Outline Specifications**

- (a) Single storey building. Room sizes no greater than 160 sq.ft (15 m²) with concrete floor and standard foundations.
- (b) Eave height a maximum of 10 ft. (3 m).
- (c) Roof pitch 25° minimum. Hipped roofs preferable. If roof is composed of light steel joists, the design and fixing of those joists must be in accordance with Section 17 of the Building Code.
- (d) Roof sheets to be a minimum of 22 gauge if of aluminum, or 24 gauge if of steel. Purlins to be spaced a maximum of 2 ft. (600 mm) on centre and fastened with drive screws at every crown; provided that the crowns are not further than 12" (300 mm) apart.
- (e) Roof and cladding material if of metal to be protected with approved non-corrosive covering or galvanising.
- (f) Roof overhang a maximum of 12" (300 mm).
- (g) Joints and connections to be capable of withstanding the horizontal and vertical forces.
- (h) Wall panels or cladding of steel plate shall be a minimum of 16 gauge. Steel plate panels should be no greater than 4 ft. x 10 ft. (1.2 x 3 m) and be supported firmly at sill and plate levels. If panels are built up to form a sandwich board, the panels should be tested for resistance to hurricane force loads at the unrestrained spacing recommended by the manufacturer. The connections between the panels and the steel frame must be shown on the drawings. If the panels are of corrugated sheeting, the gauge of the sheetings must be at least the same gauge as specified for the roof sheets.
- (i) Intermediate studs are not to exceed 2 ft. (600 mm) centres and horizontal connector pieces to form unrestrained panels of no more than 2 ft. x 2 ft. (600 x 600 mm) should be installed. The use and spacing of horizontal connector or bridging members is dependent on the strength of the infill panel.
- (j) Sill beam and plate members to be American Standard Channel Sections (or equivalent) at least 3" (75 mm) wide. If other steel sections are being used, the developer must show that such sections are capable of withstanding the vertical uplift loads imposed without tearing of the metal.
- (k) The sill member should be bolted to the concrete floor slab or concrete beam at least every 2 ft. (600 mm) on centre. The bolts should penetrate the concrete at least 4" (100 mm).

Revision Date: 31 Dec 2002

- (l) Where cladding is of concrete block, the developer must show in the drawings the connection between the cladding and the steel frames.
- (m) All end frames should be cross braced, except where the developer can demonstrate on the drawings that the concrete block cladding is suitably connected to the frames and can act as lateral support to the frames.

D6.3 Other Requirements

- (a) Each building to be provided with WC and bath or shower of at least 35 sq.ft (3 m²) in area.
- (b) There should be 2 exit doors, one of which should be capable of accommodating a wheel chair.

D6.4 General Review by the Board

- (a) Developers should show that their proposed building has been subjected to, or can resist hurricane forces, either by laboratory tests or by actual previous exposure to hurricanes.
- (b) All proposed technology will be seriously considered and examined by experienced engineers appointed by the Board, to determine whether the building is acceptable and responsive to the conditions in the region.
- (c) The engineer may recommend minor changes which are, in his or her/her opinion, needed to make the building resistant to the environmental hazards. Such changes may be the placing of extra holding bolts, installation of cross bracing in end frames or extra fastenings for roof sheets.
- (d) However, it is the responsibility of the developer to show by supporting documentation that the building proposed is structurally adequate.

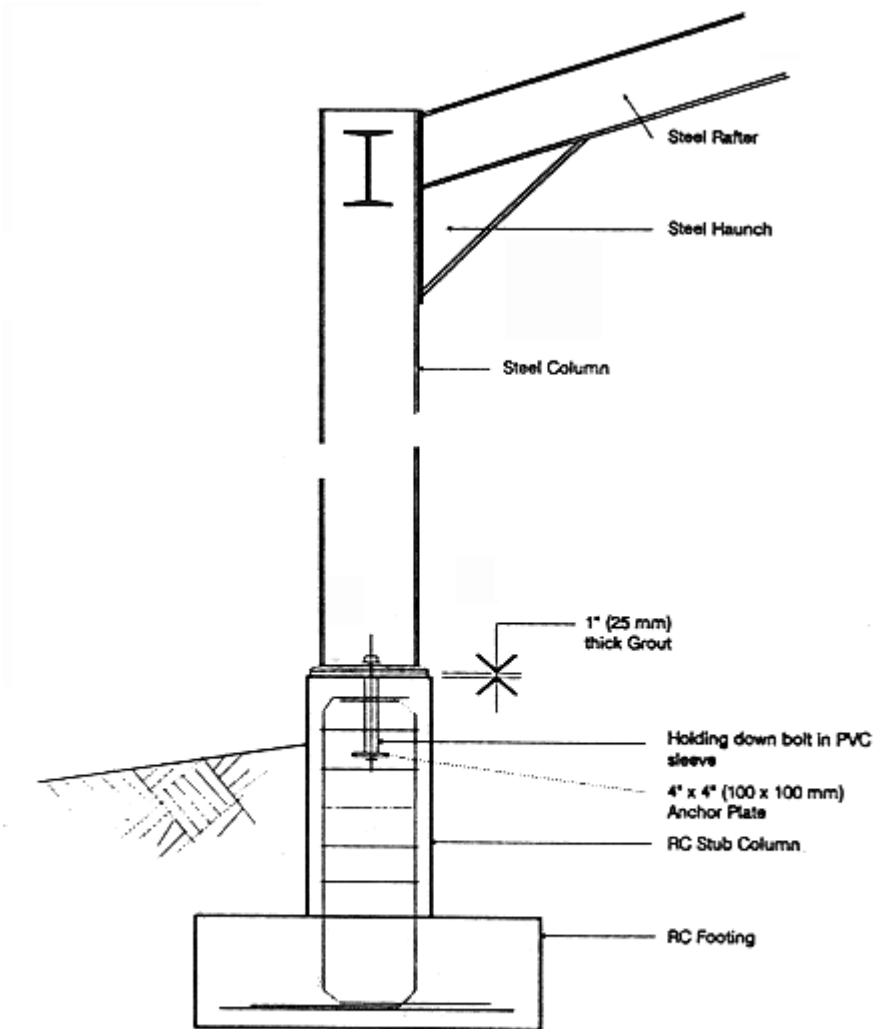


Fig. D-1 TYPICAL STEEL FRAME DETAIL

SECTION E – FIRE PREVENTION AND FIRE SAFETY

E1 SCOPE

This Section provides general guidelines for fire resistance construction of small buildings used generally for domestic purposes and for small retail and storage facilities not exceeding 3,000 sq.ft (300 m²) in area. This Section however, does not cover construction requirements for storage or retail facilities of flammable or hazardous material as defined in the Building Code.

Section 4 of the Building Code gives more detailed information of the fire resistance requirements of materials used in construction. Developers are advised to consult the Code for the design and construction of any building which may be outside of the scope of these Guidelines.

E2 FIRE RESISTING CONSTRUCTION

E2.1 General Requirements

- (a) Fire safety within the scope of these guidelines would require the following:
 - (i) Direct access of occupants to the outside from the kitchen and at least one other room.
 - (ii) Use of a non-flammable material in the construction of exposed components. For example, some types of synthetic material used for ceilings and light partitions are flammable, and some drapery material is considered to be very vulnerable and dangerous.
- (b) Domestic fires would generally start in the kitchen areas from malfunctioning stoves, or from burning firewood or coals dropping on timber floors. Electrical fires are not common, but must be considered seriously as more houses are now supplied with electricity and bad wiring and overloaded circuits can produce dangerous situations in timber houses.
- (c) Fire safety depends not only on the use of appropriate materials but on safe construction practices, and on safe use of household appliances. The structural sizes used for masonry buildings within the scope of these Guidelines are adequate for ½ hr fire resistance, but lightweight partitions and ceilings of fibreboard or plaster board will provide only 10 to 30 minutes of resistance to fire.
- (d) Timber buildings are, as expected, very vulnerable. The fire resistance of 1/2" fibreboard is 5 minutes, and that of 5/8" (16 mm) Douglas fir plywood which is preferred sheathing, is 15 minutes. Timber studs and joists in a properly constructed building have resistances of 10 to 20 minutes.

E3 RECOMMENDATIONS

E3.1

It is recommended therefore that the following steps be taken to prevent and to limit the spread of fires in a small building:

- (a) Interior partitions constructed of either timber or concrete block should be carried to the underside of the roof.
- (b) Ceilings should not be made of flammable material.
- (c) Drapes, curtains, cushion coverings, etc., made of synthetic materials should not be used in kitchen areas.
- (d) Kitchens should have an exterior door which opens outwards.
- (e) All exterior doors of the house should open outwards, but interior doors may open inwards.
- (f) All windows should be capable of being opened from inside the house. Hurricane shutters should be removed as soon as possible after an emergency is over.
- (g) Stairways should be at least 3 ft. (900 mm) wide to make it possible for injured persons to be carried down the stairs to safety.
- (h) Kitchen floors should be concrete and if of timber, should be covered with a fire resistant material. Stoves should not be placed near material which is not fire resistant. If this is necessary, protecting the timber with zinc or aluminium sheeting is recommended, as this would inhibit the start of fires.
- (i) Inspection of all electrical installations should be rigorously pursued in accordance with relevant Electricity Regulations.
- (j) Steel frames should be encased in concrete at least 1–½" (38 mm) thick, as steel structures fail suddenly under extreme heat.

E3.2

It is recommended that designers and builders of large buildings outside the scope of these Guidelines seek guidance from the Building Code or from other relevant Codes as listed in Appendices A and B of the Building Code.

E4 **FIRE RESISTANCE RATING**

- (a) The Tables which follow give the fire rating of various materials of construction commonly used in small buildings. The designer and builder must recognise that the fire resistances quoted are for sound materials used properly. It is the responsibility of the designer to ensure that the building is constructed in a manner that would limit the spread of a fire and that the occupants would be able to escape through the doors or ground floor windows. (For more information on fire prevention see Appendix H of the Building Code).
- (b) Table E-6 gives the fire resistance of partitions and walls constructed of solid concrete (limestone aggregate) with horizontal reinforcement not less than 0.25% and vertical reinforcement of not less than 0.15%.

Revision Date: 31 Dec 2002

Table E-1 Minimum thickness of concrete walls

Concrete type	Minimum slab thickness for fire rating				
	1 hr	1 ½hr	2 hr	3 hr	4 hr
Portland Cement with limestone aggregate	3.2" 80 mm	4.0" 100 mm	4.6" 115 mm	5.7" 143 mm	6.6" 165 mm
Lightweight aggregate	2.5" 62 mm	3.1" 77 mm	3.6" 90 mm	4.4" 110 mm	5.1" 128 mm

Table E-2 Minimum cover to main reinforcement of reinforced concrete beams (unrestrained)

Beam width	Cover thickness for fire resistance rating			
	1 hr	2 hr	3 hr	4 hr
5" (125 mm)	3/4" (18 mm)	1/4" (32 mm)	–	–
7" (175 mm)	3/4" (18 mm)	3/4" (18 mm)	1–3/4" (44 mm)	3" (75 mm)
10" (250 mm)	3/4" (18 mm)	3/4" (18 mm)	1" (25 mm)	1–3/4" (44 mm)

Note The covers recommended in Section B2.4 would provide a fire resistance of about 4 hr for lintel and beams if constructed as recommended.

Table E-3 Minimum sizes of concrete columns
(least dimension required for structural stability)

Type of construction	Minimum column dimension for fire resistance rating			
	1 hr	2 hr	3 hr	4 hr
Reinforced concrete (limestone aggregate)	4" 100 mm	8" 200 mm	12" 300 mm	16" 400 mm
Concrete block (cavities filled)	8" 200 mm	8" 200 mm	12" 300 mm	16" 400 mm

Note Column sizes recommended for single storey concrete block building will provide a 1–½ hr fire rating.

Table E-4 Fire resistance time assigned to wall board members

Description of finish	Time in minutes
½" (12 mm) fibreboard	5
3/8" (10 mm) Douglas fir	5
5/8" (16 mm) Douglas fir	15
3/8" (10 mm) Gypsum wallboard	10

Revision Date: 31 Dec 2002

5/8" (16 mm) Gypsum wallboard	30
Double 3/8" (10 mm) gypsum wallboard	25

Note Partitions made of fibreboard or plywood must be well constructed to provide the fire resistance quoted. However it is recommended that fibreboard not be used for exterior siding.

Table E-5 Rated fire resistive period for concrete block walls and partitions made of limestone aggregate and plastered both faces

Construction	Min. finished thickness face to face			
	1 hr	2 hr	3 hr	4 hr
Cavities filled	3" (75 mm)	4" (100 mm)	6" (150 mm)	6" (150 mm)
Cavities hollow	8" (200 mm)	–	–	–

Note The fire resistance of hollow concrete block depends on the quality of the block and the quality and thickness of the plaster covering. Hollow concrete blocks unplastered would not achieve a 1 hr rating.

Table E-6 Minimum finished thickness of walls and partitions for various fire ratings
(solid reinforced concrete walls)

Ratings	1 hr	2 hr	3 hr	4 hr
Wall thickness	3½" (88 mm)	5" (125 mm)	6" (150 mm)	6½" (163 mm)

SECTION F – PLUMBING, SANITATION AND WATER SUPPLY

F1 GENERAL REQUIREMENTS

F1.2 Prohibited fittings and connections

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

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

Fig. F-1 illustrates the acceptable connections of lavatory fixtures for a single storey dwelling.

F1.3 Dead ends

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.

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

Revision Date: 31 Dec 2002

F1.4 **Changes in direction**

All horizontal changes in direction of soil or waste pipes shall be provided with an accessible inspection chamber or cleanout.

22½° bends and sanitary tees may be used for changes in direction of flow from horizontal to vertical.

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

F1.5 **Supports and hangers**

All vertical piping shall be supported, anchored and adequately fixed with spacings not exceeding 5 ft. (1.5 m) and not exceeding 3 ft. (900 mm) at offsets or branch connections.

All horizontal piping shall be supported, anchored and adequately fixed to prevent sagging at each hub, for cast iron and copper, at 6 ft. (1.8 m) intervals, and throughout its length for pitch fibre and PVC.

Pipe hangers shall be fixed to stone, brickwork, blockwork or concrete by means of expansion-type plugs.

Hangers of copper shall be of the same material as the pipe or if of different material be insulated to prevent electrolysis.

Drains laid in unstable ground shall be supported on a layer of 1:3:6 concrete not less than 4" (100 mm) thick and 6" (150 mm) on either side wider than the pipe diameter.

F2 **SOIL AND WASTE SYSTEMS**

F2.1 **Pipe materials**

Generally these shall be of suitable material, hard, smooth, impervious and non-corrosive, such as copper, PVC, or cast iron.

Black iron, galvanized iron or concrete pipes are not recommended for use as soil pipes.

F2.2 **Pipe sizes**

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

Waste water pipes shall not be less than 1¼" (32 mm) in diameter.

F2.3 **Workmanship**

All plumbing shall be installed in a workmanlike manner.

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.

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

F2.4 Gradients and self-cleansing velocities

Soil pipes shall be laid at a minimum gradient of 1:40 for 4" (100 mm) pipes and 1:60 for 6" (150 mm) pipes.

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

Self cleansing velocities would be achieved if velocities are approximately 2.5 ft. (750 mm) per second with the pipe flowing $\frac{1}{4}$ full.

F2.5 Joints and Connections

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

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

Joints to soil pipes shall be as follows:

- (a) Lead – wiped or burned
- (b) Cast Iron – sockets made with hemp or yarn and metallic lead properly caulked
- (c) Pitch Fibre – tapered couplings
- (d) PVC – a suitable fitting, sealed and welded with solvent cement.
- (e) Vitrified clay/salt-glazed ware sockets made with tarred hemp or gasket and the remaining space filled with 1:3 cement: sand mixture. Neat cement should not be used as the cement will shrink on setting, resulting in a leaky joint.
- (f) No coating or painting shall be applied before testing.
- (g) Where waste pipes are connected to soil pipes all pipes are to be constructed in the same way as specified for soil pipes.

F2.6 Plumbing Fixtures

F2.6.1 General

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

F2.6.2 Water closets

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

Water closet bowls shall be attached to the floor and/or wall with a normal height of 16" (400 mm) above floor level and be fitted with a seat of smooth non-absorbent material.

Revision Date: 31 Dec 2002

“Low water use” water closets are available from various manufactures and should be used wherever water consumption is a consideration, such as from a cistern supply.

The use of a separate saltwater well flushing system will greatly reduce the use of fresh water from the cistern and the salt water will not interfere with septic tank operation. All components of the salt water system shall be plastic.

F2.6.3 Flushing cisterns

Water closet flushing cisterns should have a capacity not less than 2 imperial or 2.4 US gallons (9 litres), flush valves which are easily accessible for repairs, and flush pipes of not less than 1¼" (32 mm) diameter.

When low level cisterns are used, larger flush pipes are necessary. Flushing cisterns are normally used only in commercial settings.

F2.6.4 Lavatory basins/sinks

The top front edge of a lavatory basin or sink should be fixed at a nominal height of 36" (900 mm) above finished floor level with waste pipes not less than 1½" (38 mm) for sinks and 1¼" (32 mm) diameter for basins.

Fixtures for special uses, such as in lavatories to be used by handicapped persons or by children, shall be mounted at the appropriate heights for the applications.

Every lavatory basin or sink shall be provided with an overflow, connected on the building or inlet side of the trap.

F2.6.5 Shower baths

Shower and tub outlets shall not be less than 1½" (38 mm) in diameter and be fitted with removable strainers. The use of “water saver” shower heads is encouraged.

F2.6.6 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 or her lips on the orifice.

F2.6.7 Traps

Traps forming an integral part of plumbing fixtures shall be supplied with the fittings to which they are to be attached. Those intended to disconnect from the drain or wastes are placed at the foot of wastes from lavatory basins, sinks, baths and drinking fountains. They are generally S or P traps.

All fixtures connected to foul drainage shall be trapped as close to the fixture as possible.

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.

F2.6.8 Water seals

All traps shall have a minimum water seal of 3" (75 mm) for soil and 2" (50 mm) for wastes and be not less than 4" (100 mm) diameter for soil fixtures and 1¼" (32 mm) for waste water.

F2.6.9 Clean-outs

Every clean-out shall be equal thickness to the wall thickness 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.

F2.6.10 Venting systems

All water closets shall have a vent pipe of not less than 2" (50 mm) in diameter.

Vent pipes shall also be used when two or more waste fittings are connected into a soil or waste pipe. See Figure F-1. They shall be connected above floor level rim of the highest fixture served and so graded to drip back to the soil or waste pipe.

Vent pipes shall be extended to a minimum distance of 1 ft. (300 mm) above the roof of any habitable room or to a greater distance as may be prescribed by the authority for unusual situations such as roof gardens.

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

It is essential that a drain be ventilated to prevent the accumulation of foul air and to maintain equal pressure inside and outside the system. It is better to have a vertical vent pipe at the head of the drainage system, carried up to a height at which it is unlikely to cause a nuisance, and to omit an intercepting trap at the sewer near to the property boundary. This enables the sewer as well as the individual drainage system to be ventilated.

Soil and soil ventilating pipes may be used to provide this ventilation if they occur in suitable positions.

F2.6.11 Manholes/Inspection Chambers

Manholes/inspection chambers shall be installed at every change of direction and gradient and on straight runs be spaced a maximum distance of 40 ft. (12 m) apart.

Manholes shall be constructed of reinforced concrete or concrete blockwork, and the drain, where it passes through the manhole, shall be carried in an open channel.

Channels shall be adequately benched, glazed, and be constructed of impervious material.

Branches are connected to the drain at manholes and their invert levels shall be above the main invert to prevent fouling at the mouth of an unused branch.

The widths and lengths of excavation for manholes will depend on requirements; the length being determined by the number of branches or by the depth. Manholes below ground surface to a depth of 2 ft. (600 mm) shall be a minimum size of 2'-0" (600 mm) long x 1'-6" (450 mm) wide. Those between 2 ft. and 4 ft. (600 and 1200 mm) deep shall be a minimum of 3 ft. (900 mm) long x 2 ft. (600 mm) wide.

Revision Date: 31 Dec 2002

Manhole covers shall be of reinforced concrete steel or similar durable material and shall be airtight and fitted with lifting handles to facilitate removal.

F2.6.12 Trenches

Trenches for laying of building sewers shall not be less than 18" (450 mm) wide.

Care shall be taken to back fill and ram them carefully in layers not exceeding 6" (150 mm) deep in order that the drain may not be injured or broken. It is good practice to water the trench during the back-filling process to assist in consolidating the returned material. It is desirable to arrange for the best material to be returned to the trench when back filling, leaving the rubbish to be carted away.

F2.6.13 Pipes under floors and walls

No part of a drain shall be laid under a building unless absolutely necessary.

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).

Where drains are laid on piers, they shall be placed on sound foundations and shall be a minimum size of 10" x 10" (250 " 250 mm) and be spaced not more than 8 ft. (2.4 m) apart.

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

F2.6.14 Toilet flushing ball-valves

Where a ball-valve is used, a relief pipe shall be provided in the silencing pipe immediately below the valve outlet to avoid siphonage.

The rating of ball valves shall be checked with the manufacturer's data. If a low pressure valve is installed on a high pressure system, dribbling will occur thereby wasting water and increasing the consumer's bill in a metered water supply.

F2.6.15 Electrolytic action

Dissimilar metals shall not be connected because of the danger of electrolytic (galvanic) action with resulting corrosion.

F3 SANITATION

F3.1 Sanitary Drainage

The type of drainage to be adopted will depend upon the facilities for disposal of waste matter.

F3.2 Single pipe system

In sewered areas, all waste shall be discharged through the soil pipe or building sewer to the sewerage system.

In areas where there is no sewerage system and where sub-surface drainage is adequate, all waste shall preferably be discharged into septic tanks or other approved installations employing the water carriage system.

F3.3 Dual pipe system

In areas where sub-surface disposal is inadequate, soil and waste shall preferably discharge separately; soil pipe to the septic tank and waste pipe to a soakaway, surface drain, or garden. In either system, branch drains shall be as short as possible.

F3.4 Setting out drainage work

The lines of drains can be set out by driving stakes along one side of the proposed trench and stretching a line tightly between them.

The trenches can then be excavated to the required depth and gradient. The most accurate and labour-saving method of excavating to required gradients is by means of "sight rails" and "boning rods". A sight rail is a horizontal rail secured to two uprights braced one on either side of the trench and a boning rod is a long T square.

Timbering the side of trenches shall be effected for deep trenches in treacherous ground in order to prevent accidents.

F4 SEPTIC TANKS

F4.1 General

- (a) The Health Department (Ministry of Health) provides information on size, location, construction, operation, and maintenance of septic tank systems. However, the following information and the sketch of a typical septic tank shown at Figure F-3 may be used to construct small systems for single family residential use. Septic tanks must be designed, located, constructed, used and maintained to the approval of the Health Department.
- (b) The basic function of a septic tank is to receive domestic sewage, partially treat it, segregate the solids, and discharge the liquid to a tile field or soakaway. Anaerobic bacterial action breaks down much of the solid matter into liquids and gases. While in an efficiently operating tank the liquid discharge is comparatively clear, tanks do not accomplish a high degree of bacteria removal and infectious agents including pathogenic organisms may be widespread in the effluent which is "septic."
- (c) The primary purpose of the tank is to condition sewage and the following functions take place:
 - (i) Removal of solids in the following approximate quantities: 100% settleable solids and 70% suspended. The heavier solids settle to the bottom forming a blanket of sludge and the lighter ones rise to the surface to form a scum layer.
 - (ii) Decomposition by anaerobic bacterial and natural processes – the organic strength being reduced by approximately 30%.

Revision Date: 31 Dec 2002

- (iii) Storage of sludge and scum so that the sludge and other material accumulated between cleanings will not be scoured into the disposal field and clog the system.

F4.2 Sizing

- (a) In order to provide for maximum solids removal, adequate tank capacity is necessary. Liberal tank capacity is not only important from a functional standpoint, but is also good economy.
- (b) The capacity of the tank depends on the amount of liquid being discharged in the tank daily, and this in turn depends on the number of persons living in the building and using the toilet facilities.
- (c) See Clause 815 of the Building Code for recommendations on the capacity and size of septic tanks.
- (d) Septic tanks shall not be undersized or be constructed in series, as the velocity of flow through two identical tanks is the same as the velocity of flow through one of them. This type of arrangement virtually doubles the velocity and results in the carry over of 70% suspended material. The heavier solids settle to the bottom forming a blanket of sludge and the lighter ones rises to the surface to form a scum layer.
- (e) The recommended dimensions of a tank for a single family dwelling shall be (see Fig. F-3):
Length = 2 x width
Liquid depth = 4 ft (1.2 m)
- (f) It is recommended that designers of septic tanks consult the Health Department to ensure that the system design and capacity are acceptable.

F4.3 Location

- (a) Tanks shall be located not less than 10 ft. (3 m) from any dwelling and 100 ft. (30 m) from any well or drinking water source.
- (b) Tanks shall be located where the largest possible area is available for the disposal arrangements.

F4.4 Construction

- (a) Two compartment tanks achieve better clarity of effluent than single compartment tanks.
- (b) Tanks shall preferably be constructed of reinforced concrete block work rendered on the inside and base, or of 1:2:4 reinforced concrete. Provide removable cover slabs or manholes over inlets and outlets and an air space of 12" (300 m).
- (c) Inlets and outlets shall be so located as to avoid disturbance of surface scum.
- (d) The approximate dimensions and construction of a septic tank for a single family home should be as follows:

(i) **Walls**

6" (150 mm) reinforced concrete with 1/2" (12 mm) dia. bars at 8" (200 mm) vertically and 1/2" (12 mm) dia. bars at 16" (400 mm) horizontally, or

8" (200 mm) concrete block filled with 1:3:6 concrete and with ladder type reinforcement every other course. The inside face to be plastered with two layers of 3/8" (10 mm) cement mortar.

(ii) **Top and Bottom Slabs**

6" (150 mm) reinforced concrete with 1/2" (12 mm) dia. bars at 12" (300 mm) centres longitudinally. Slope bottom slab to 1 in 50.

(iii) **Access Hatches**

Access Hatches to be patented cast iron or steel covers 18" (450 mm) or 2'-0" (600 mm) square, or of 4" (100 mm) thick concrete with 4" (100 mm) mesh reinforcement.

F4.5 Operation

- (a) Tanks should be cleaned when the level of the bottom of the scum is within 3" (75 mm) or the surface of the sludge is within 18" (450 mm) of the bottom of the outlet fitting (tie or bend).
- (b) Only small quantities of soap and detergents normally used in the homes should be discharged to the tank. Large doses of chemicals such as bleach will kill or inhibit bacteria.
- (c) Water from roofs, weeping tiles, or foundation drains and surface run-off shall be excluded as large volumes of clear water will stir up the contents, reduce the retention time and carry solids to the disposal field.
- (d) Bacterial action can be started off by seeding with animal manure.
- (e) Paper towels, newspapers, wrapping paper and rags should not be used as they will not decompose in the tank.

F4.6 Maintenance

- (a) Tanks should be inspected every year with a view to cleaning probably in 3 years.
- (b) A chart shall be prepared for each building showing the location of tank and disposal system. It shall contain brief instructions for inspection and maintenance, thus forestalling failures.
- (b) Tanks shall not be entered until they are thoroughly ventilated and gases removed in order to prevent accidents from explosions or asphyxiation.

F5 GREASE TRAPS

Approved septic tanks are of sufficient capacity to allow for greases normally discharged from houses.

Revision Date: 31 Dec 2002

Where, in the opinion of the Ministry of Health, there is to be an excessive discharge of grease/oil, such as a restaurant kitchen, a grease/oil trap shall be installed.

Traps shall be designed for 2.5 US gallons (9.5 litres) capacity per person with a minimum capacity of 125 gallons (473 litres).

F6 SUBSURFACE DISPOSAL

- (a) Suitability of a soil for a subsurface disposal system is dependant on its percolation rate and this is generally determined by the Health Department or by a percolation test.
- (b) Soil texture can be used, with certain limitations, as a means of determining absorption capabilities and preliminary indications shall be obtained by examination of roads cuts, stream embankments and excavations for foundations. The larger the particles, the larger the fines and the faster will be the percolation rate. If the soil appears to be suitable, percolation tests shall be made. This method is an acceptable and reliable means of obtaining soil absorption capabilities.

F6.1 Percolation tests

The procedure is summarized as follows:

- (a) Dig three holes 1 ft. x 1 ft. (300 x 300 mm) to a depth of approximately 2½ ft. (750 mm) in the area of the proposed drain field or soakaway.
- (b) Remove all loose material.
- (c) Add 6" (150 mm) of fine gravel to protect the bottom from scouring or sediment.
- (d) Fill with clean water and saturate overnight.
- (e) Fill the holes with clean water again the next day and time how long it takes in minutes for the water level to drop 1" (25 mm).
- (f) Consult the table below to find required size of tile drainage field.

Table F-2 Percolation Tests

Time to fall 1" (25 mm) Minutes	Area of trench per bedroom	
	Sq.ft	m²
2 or less min.	75	7
3	85	8
4	95	9
5	105	10
6-10	135	12
11-15	160	15
16-30	205	19
31-45	245	23

46-60

275

25

-
- (g) Use the average of the times for the 3 holes. If it takes longer than 60 minutes for the water to fall, the area is not suitable for a drain field, and another area or method of disposal must be used.
 - (h) If the house includes a garbage disposal unit, add 25% to the above trench figures.

F6.2 **Tile fields**

A tile field removes pollution by means of percolation through the soil in which there is bacterial action.

F6.3 **Location and Setbacks of Tile Fields**

- (a) Tile fields shall not be less than 100 ft. (30 m) from an underground water supply, 50 ft. (15 m) from a creek, canal, lake, or coastline and 10 ft. (3 m) from a dwelling house or property line.
- (b) Tile fields shall not be less than 4 ft. (1.2 m) above the ground water table and when located in rocky areas require a 50 ft. (15 m) apron of earth sufficient in depth to promote bacterial growth. They may be raised or partly raised to achieve those conditions.
- (c) Tile fields shall be located away from tree roots. Heavy machinery shall be excluded from the disposal area and whenever possible sufficient space for an additional field shall be allowed should the original field fail or become clogged. Tile fields shall be tested and inspected before back filling.
- (d) Tile fields are constructed by digging trenches, placing gravel at the bottom the trenches, laying the perforated pipe or open joint tile in a gentle gradient from the distribution box, covering with tar paper, and backfilling. The trenches are generally 18" (450 mm) wide by 24" (600 mm) deep with 6" (150 mm) of gravel on the bottom. Bends and other fittings should be kept to a minimum in the drain field.

F6.4 **Soakaways**

Soakaways shall be used as alternatives to shallow absorption fields where sub-surface conditions are feasible. They shall never be used where there is likelihood of contaminating underground water supplies, such as areas with fresh water wells.

Note The most suitable disposal system is dependant on the percolation rate and this is generally determined by the Health Department.

F6.5 **Disposal Wells**

Disposal wells must not be used in any fresh water lens area without the express permission of the Health Department.

F6.6 **Percolation criteria**

Revision Date: 31 Dec 2002

- (a) Soils with absorption rates of less than 1" (25 mm) in 30 minutes are unsuitable for soakaways.
- (b) Capacity of soakaways shall be computed on the basis of percolation tests (as above) made in each stratum penetrated.
- (c) Absorption area required shall be based on the effective vertical wall area. No allowance shall be made for the bottom or area above the inlet.

F6.7 Size Requirements for Soakaways

Table F-3 shows the size of soakaway required for various soil conditions. Add 25% to the areas for houses with garbage disposals.

Note For a 3 bedroom house on a site with a percolation rate of 10 minutes for a drop of 1" (25 mm), the soakaway pit would have to be about 8 ft. x 6 ft. x 8 ft. deep (2.4 m x 1.8 m x 2.4 m). For a percolation rate of 2 minutes or less the pit can be 6 ft. x 4 ft. x 6 ft. deep (1.8 m x 1.2 m x 1.8 m). For a rate of 30 minutes it is suggested that two pits be constructed, each 8ft. x 6ft. x 8ft. deep (2.4 m x 1.8 m x 2.4 m).

Table F-3 Size Requirements for Soakaways

Time for water to drop 1" (25 mm)	Area of pit walls per bedroom		Time for water to drop 1" (25 mm)	Area of pit walls per bedroom	
	Sq.ft	m ²		Sq.ft	m ²
2 min. (or less)	40	3.75	10	75	7
3	50	4.65	15	90	8.5
4	55	5	30	150	14
5	60	5.5			

- (c) It is important however that a test be carried out at each building site, as soil types vary widely and the size of the pit depends on the type of soil.

F6.8 Construction

- (a) Proper precautions shall be taken in the construction of soakaways to prevent the side walls from collapsing while workmen are in the hole.
- (b) The soakaway pit should be lined with stones, bricks, or concrete blocks laid up dry with open joints backed up with at least 3" (75 mm) of gravel. The bottom of the pit is to be filled with coarse gravel (pea rock), to depth of at least 1 ft. (300 mm). The cover is to be made of reinforced concrete.

F6.9 Location

- (a) The criteria for location of soakaways is similar to that for tile fields. Where 2 soakaways are to be constructed they shall be located not less than 3 times the largest of the surface dimensions apart.

- (b) The area selected for construction shall be large enough to allow for additional pits should there be failure.
- (c) Soakaways may be used in all areas for the disposal of excess rainwater or runoff from buildings that is not of a septic nature.

F7 **PACKAGE PLANTS**

Proprietary aerobic sewage treatment plants are available for small dwellings and/or buildings. They shall be considered either for larger buildings or groups of buildings where it is not possible to build a proper septic tank/leach field system.

There must be an adequate provision of skilled personnel for their operation and maintenance.

- (c) The water recovered from these systems is often suitable for irrigation use after proper post treatment.
- (d) Sewage treatment plants shall not be purchased or installed without the prior approval of the Board.

F8 **COMPOST PRIVIES**

Compost privies have been successful only where there has been a high degree of user care and attention. They are still in the evaluation phase and should be carefully investigated before steps are taken to construct them.

F9 **PIT PRIVIES**

F9.1 **Location**

- (a) Pit privies shall be sited at the same distances indicated in the section on seepage pits and drain fields.
- (b) They shall preferably be located on the leeward side of a building or as otherwise approved by the Health Department. In densely populated areas, pit privies may not be feasible. Privies shall be ventilated.
- (c) Privies shall not be used in areas where the water table is within 2 ft. (600 mm) of the surface since they will not function well. They will be odorous and the contents will not compact. Raised pit latrines could be used in areas of high water table.
- (d) Where a pit privy is impracticable, consideration should be given to alternative means of disposal.

F9.2 **Construction**

- (a) The precast concrete slab pit privy has been adopted by many health authorities.
- (b) There shall be openings at the top of the walls to dissipate odours and, in case of the Ventilated Improved Pit Latrine (VIP) to provide the through draft required for functioning of the vent pipe.

Revision Date: 31 Dec 2002

- (c) The door should open outwards in order to minimize the internal floor area.
- (d) The toilet shall be sufficiently screened to discourage flies.
- (e) The walls and roof shall be weatherproof, shall provide privacy, exclude vermin and be architecturally compatible in external appearance with the main house.
- (f) Seat height shall be 16" (400 mm) above the slab level and the size of the seat opening 10" (250 mm) in diameter. To encourage proper use by children and to prevent their falling into the pit, a second smaller 6" (150 mm) diameter seat should be provided. This may be a separate seat on the seat cover.
- (g) For maximum odour control in the VIP, the vent pipe shall be at least 6" (150 mm) dia. painted black, screened with a wire gauze and located on the sunny side of the latrine so that air inside the pipe will heat up and create an updraft.
- (h) The size of the pit should not be greater than 4'-0" x 4'-0" (1.2 x 1.2 m) and at a depth of about 6 ft. (1.8 m).
- (i) Figure F-4 shows a typical arrangement of a pit privy with a precast concrete box on a concrete slab.

F9.3 Maintenance

If water enters the pit, a cupful of kerosene can be poured into it at weekly intervals to control mosquito breeding. If the seat cover is replaced in the horizontal position after use, this will also help in mosquito control.

F10 CESSPOOLS

F10.1 General

Cesspools are watertight underground sewage storage chambers sometimes used in rural districts and are usually emptied at regular intervals by a special vehicle which transports the sewage to a disposal point. Cesspools are ordinarily not permitted.

Where cesspools are allowed by the Health Department they must be:

- (a) Watertight.
- (b) Properly covered.
- (c) So sited as to permit easy access for emptying under all weather conditions.
- (d) Of a depth not exceeding 14 ft. (4.3 m) below the cover in order to allow the suction hose of the emptying truck to be used.

If odours occur they can be controlled by the use of lime. No disinfectants shall be used in the pit.

F11 WATER SUPPLY

F11.1 Workmanship

All water supply pipes shall be installed in a workmanlike manner and be provided with a properly protected and easily accessible stop cock or gate valve near to the boundary of the plot or at the water pump location.

F11.2 Capacities of pipes

Table F-1 gives the numbers and sizes of smaller diameter branch or distribution pipes that may be taken off a supply pipe (or rising main), which are to be all in service at the same time.

Table F-1 Size and Number of Branches

Size of pipe or riser main	1¼" 32 mm	1" 25 mm	¾" 19 mm	5/8" 16 mm	¼" 6 mm
1-1/4" 32mm	1	2	4	6	10
3/4" 19 mm	–	–	1	2	3
1/2" 12 mm	–	–	–	–	1

Many more branches are generally taken off based on the assumption that water will be drawn intermittently and only a percentage of the branches are used at any one time.

The minimum size of a branch or distribution line shall be ½" (12 mm).

F11.3 Cross connections

The building sewer and potable water pipes shall not be laid in the same trench.

Sewer lines shall be laid at a lower elevation and in any case with inverts not less than 12" (300 mm) below the invert of the water service pipe and horizontally as far apart as practicable. Vertical separating distances shall be increased at crossover points.

There shall be a break or gap between the inlet levels and the top water levels in receptacles where the inlet level is below the surface e.g. in swimming pools, bidets and some flushing cisterns and washing machines.

Direct connections of pipes and valves between public and private water supplies are not allowed, even on a stand-by basis. Irrigation lines and soaker hoses can be a source of cross connections. They must be designed to avoid siphonage of dirty water back into the supply line through the use of vacuum breakers and anti-syphon valves. Professional advice shall be sought for these situations.

Close attention shall be given to avoiding possible back siphonage of dirty water from toilets, lavatory basins, etc., into the water supply pipes or by direct connection between waste and water pipes.

F11.4 Water Supply Equipment

F11.4.1 Reverse osmosis water makers

Revision Date: 31 Dec 2002

Reverse osmosis water makers are complex machines that can be used to remove salt and other minerals from sea or brackish water. They can be used to provide a source of potable water in a location that has no other water resources. Because of the operational and maintenance requirements of these units, they should be installed and operated by skilled professional personnel.

F11.4.2 Water heaters

Water heaters may be obtained for gas, electric, solar, or oil fuel. Solar heaters are recommended for economy of operation and energy conservation.

Solar heaters are of two types, gravity convection feed and pumped. The gravity operated units need less maintenance, but require the solar-panels to be mounted below the tank.

Solar water heaters can be supplied with booster elements to maintain water temperature on cloudy days or at night.

F11.4.3 Domestic water pumps

Where a water pump is provided as part of a private domestic water supply, it shall be sized to maintain a minimum of 15 psi (100 kPa) pressure under all conditions of water use. The pump is usually set for 30 psi (200 kPa) cut-in and 50 psi (350 kPa) cut out. A pressure tank of adequate capacity shall be installed.

It is recommended that the plumbing within 3 ft. (900 mm) of the water pump be of galvanized steel to prevent melting of plastic pipe fittings if the pump should run dry. Special pressure switches are available to shut off the pump if the supply runs dry.

Paper and charcoal filters placed in the domestic water supply line will help in reducing colour and odour in the water supply. However, no passive filter will remove disease organisms from contaminated water.

F11.5 Safety devices

A pressure-relief valve must be installed for all equipment used for heating or storing hot water. It opens automatically against the adjustable setting of the spring.

The size of hot-water piping installations can be one size smaller than cold-water ones. Hot water must be run in copper or CPVC pipe. Do not use regular (white) PVC. A check valve placed in the cold water supply line to the conventional (not solar) water heater will save energy by stopping convection circulation.

Water hammer is caused by loosely fixed pipes, use of sharp bends, or taps such as self-closing or spring types which shut off the supply quickly. It is more likely to occur in long branches than when the tap is fixed close to the supply pipe. An air vessel or dead end riser pipe shall be fixed as close to the tap as possible in order to absorb the shock and thus minimize water hammer.

F12 WATER STORAGE CISTERNS

F12.1 General

In areas without a public water supply, a water storage cistern should be constructed for each house or dwelling, along with a rainwater collection system from the roof or other suitable catchment.

F12.2 Location

The water storage cistern can be located under one or more buildings of a dwelling group or consist of a separate tank remotely located. The cistern shall be located uphill and as far as practical from any septic tank, privy, soakaway, or leaching tile field.

F12.3 Construction

- (a) The water storage cistern shall be of reinforced concrete, concrete block, treated timber with a suitable liner, treated metal, or reinforced plastic construction. It shall be sized and constructed to comply with the Building Code but should have no less than 10 gallons (380 litres) capacity for each sq.ft (sq.m) of roof or catchment area.
- (b) The coating or liner in the water storage cistern shall be of a material that is approved for contact with potable water if the cistern is to be used for domestic drinking or cooking water.
- (c) The cistern shall be provided with an access hatch to allow cleaning out and repairs.
- (d) The cover of the water storage cistern shall be of a durable, non-rotting material. Wood or plywood is generally not satisfactory. The cover must be tightly fitting to prevent mosquito breeding. Light should be excluded from the cistern water to prevent the growth of algae.
- (e) Sufficient overflows must be provided to prevent flooding of dwellings. The overflows must be screened to prevent the entrance of mosquitoes, frogs, or other vermin.
- (f) The catchment can consist of the dwelling roof area or a specially constructed concreted or lined area to capture rainwater. PVC guttering and downspouts is recommended for roof catchments.
- (g) If the water is to be used for domestic drinking and cooking purposes, the catchment area must be protected from contamination by animal and human activity. Hillside catchments should be fenced off and accessible deck areas or roofs separately drained to soakaways to prevent dirt, manure, etc., from being washed into the storage tank. Catchments must not be coated with any paint that contains harmful substances.
- (h) The use of asbestos roofing tiles for catchments is no longer acceptable.
- (i) Do not coat catchment roofs with any paint containing lead compounds.

F12.4 Operation

It is a good practice to sanitize the water in the cistern by the addition of two teaspoons of bleach per 100 gallons (380 litres) of water if contamination is suspected. If no bleach is available, the water should be boiled before drinking.

Revision Date: 31 Dec 2002

The cistern and its catchment should be cleaned on a regular basis and scrubbed with a sanitizing bleach solution if it is to be used for drinking water.

F13 ARRANGEMENTS FOR DISABLED PERSONS

Appendix F of the Building Code – Accessibility Guidelines for People with Disabilities, provides information on the layout of access to sanitary facilities and to other public areas. Designers of small public buildings such as shops, which may fall within the scope of the Guidelines, must consult Appendix F and the other references noted to ensure that appropriate access arrangements are made for disabled persons.

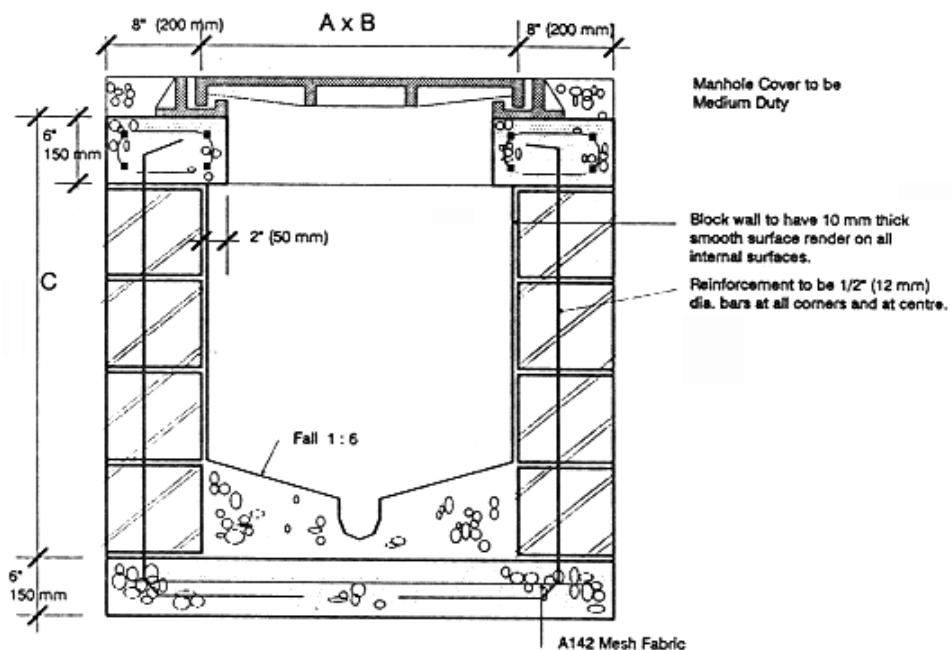


Fig. F-2 DETAIL OF MANHOLE CONSTRUCTION

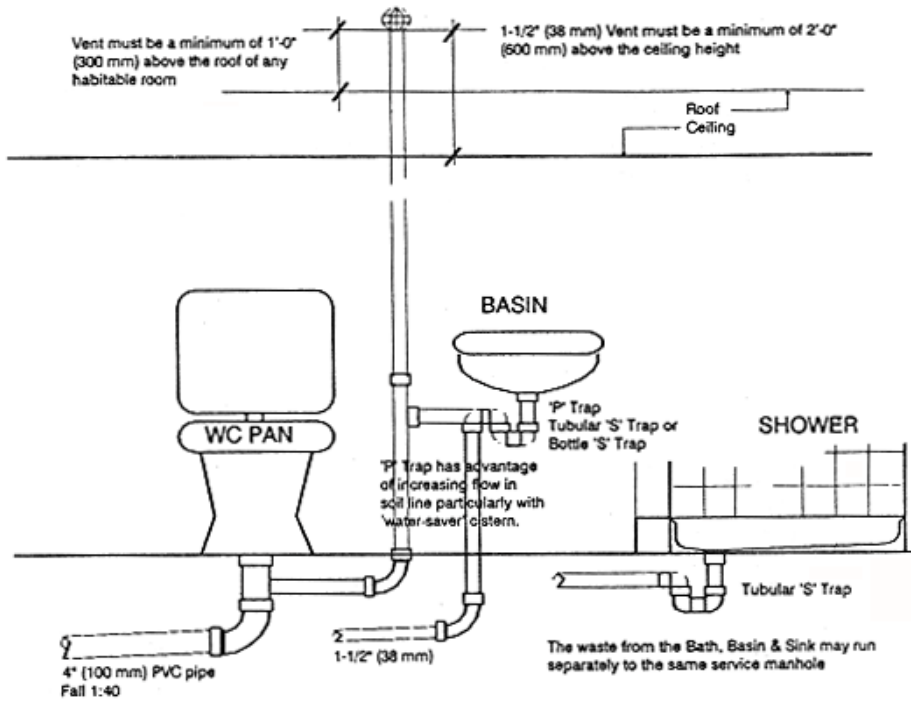


Fig. F-1 SCHEMATIC CONNECTION OF FIXTURES FOR A SINGLE STOREY DWELLING

- Notes**
- 1 The waste from the shower and Sink may be connected separately to the Service Manhole.
 - 2 All traps under 4" (100 mm) dia. should have a seal of 2" (50 mm). Traps 4" (100 mm) and above should have a 3" (75 mm) seal.
 - 3 The waste from the Shower, Basin and Sink must have a fall of between 1-1/4" (32 mm) and 1-1/2" (38 mm). The 4" (100 mm) waste from WCs must have a fall of 1:40.
 - 4 The distance from the centre of the lowest connection and the invert of the branch to the service manhole should not be less than 1'-6" (450 mm).
 - 5 The bend at the base of the WC or Branch must be a sweep bend.

Revision Date: 31 Dec 2002

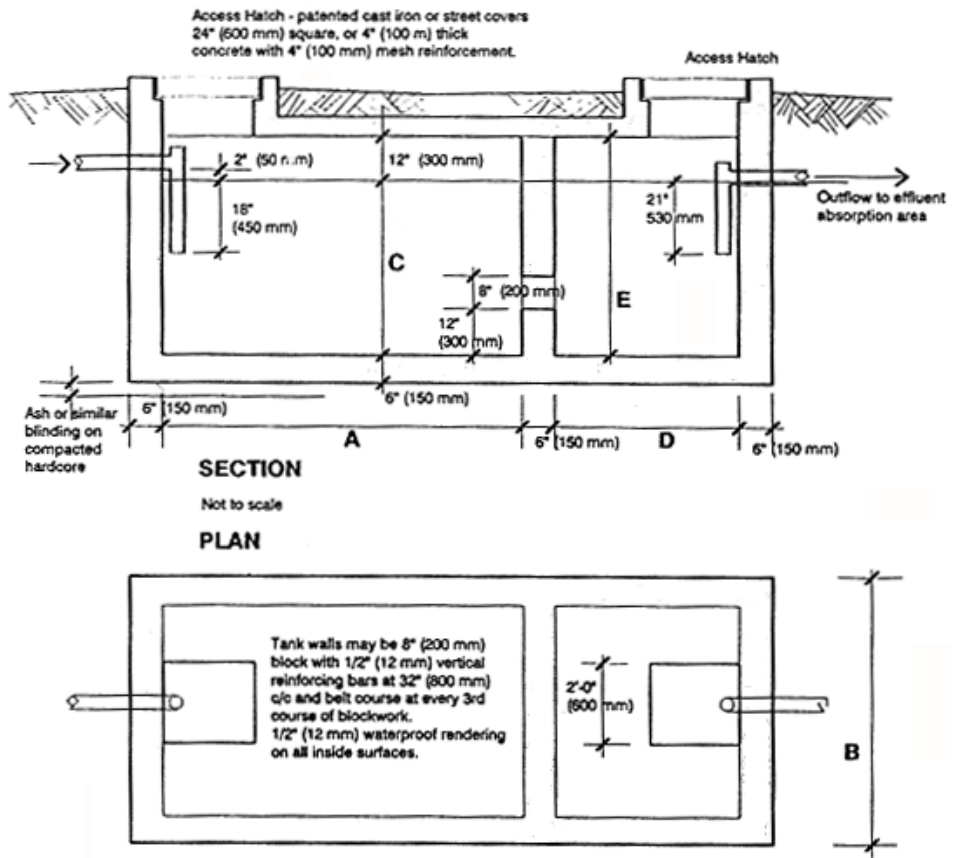


Fig. F-3 STANDARD SEPTIC TANK DETAILS

Note Septic Tanks are to be constructed in accordance with the designs approved/provided by the Health Department. Main specifications are:

Walls – 6" (150 mm) reinforced concrete (1:2:4) with 1/2" (12 mm) dia. bars at 8" (200 mm) c/c vertically and 1/2" (12 mm) dia. bars at 16" (400 mm) c/c horizontally

Top and Bottom Slabs – 6" (150 mm) RC with 1/2" (12 mm) dia. bars at 9" (230 mm) c/c transversely and 3/8" (10 mm) dia. bars at 12" (300 mm) c/c longitudinally. Slope of bottom slab to be 1 in 50.

CAPACITY Gallons	NOMINAL DIMENSIONS ft.in mm										
			A	B		C		D		E	
750	2840 litres	5'-0"	1500	3'-6"	1050	4'-0"	1200	2'-6"	750	6'-0"	1800
1,000	3785	5'-6"	1650	3'-6"	1050	4'-6"	1350	3'-0"	900	5'-6"	1650
1,500	5600	7'-0"	2100	4'-6"	1350	4'-6"	1350	3'-6"	1350	5'-6"	1650
2,000	7570	8'-0"	2400	5'-0"	1500	4'-6"	1350	4'-0"	1200	5'-6"	1650
2,500	9500	9'-0"	2700	6'-0"	1800	5'-0"	1500	4'-6"	1350	6'-0"	1800

Septic tanks more than 2,500 gallons (9500 litres) may not be allowed without special approval.

Tanks between 1,500 (5600) and 2,500 gallons (9500 litres) contingent on subsurface testing.

SECTION **G**
ELECTRICAL GUIDELINES

CONTENTS

SECTION G – ELECTRICAL GUIDELINES FOR RESIDENTIAL & LIGHT COMMERCIAL CONSTRUCTION 538

G1 SCOPE 538

G1.1 General 538

G1.2 Additions to Installations 539

G1.3 Precautions in Wet and Damp Conditions 539

G1.4 Flexible Wires 539

G1.5 Inspection and Testing 540

G2 TEMPORARY SERVICES 541

G2.1 General 541

G2.2 Location 541

G2.3 Operation 541

G3 SERVICE ENTRANCE WIRING 542

G3.1 General 542

G3.2 Mechanical Support and Overhead Clearances 542

G3.3 Underground Service Entrances – to a Utility Pole 543

G3.4 Meter Sockets 543

G3.5 Main Disconnect Switch 544

G3.6 Service Ground (Earth) 545

G4 CONDUITS 546

G4.1 General Requirements 546

G4.2 Installation of Conduits 546

G4.3 Installation of Wiring 547

G5 MOTORS AND MISCELLANEOUS APPARATUS 547

G5.1 General Requirements 547

G5.2 Protection of Electronic Equipment 548

G6 SWITCHES 548

G6.1 Toggle Switches 548

G6.2 Socket Outlets 548

Table G6–2 Number of Socket Outlets Recommended for a 3 Bedroom House 548

G7 LIGHT FIXTURES & LIGHTING OUTLETS 548

G7.1 Location of Fixtures 548

G7.2 Fixture Boxes 549

G7.3 Outdoor Fixtures 549

G8 SPECIAL WIRING 549

G9 SMOKE DETECTORS 549

Revision Date: 31 Dec 2002

SECTION G – ELECTRICAL GUIDELINES FOR RESIDENTIAL & LIGHT COMMERCIAL CONSTRUCTION

G1 SCOPE

G1.1 General

- (a) Electrical contractors and all persons arranging for the installation of electrical wiring or electrical equipment should be aware that all electrical installations must be approved by the Government Electrical Inspector. The electricity service will not be connected unless an Inspection Certificate signed by the Government Electrical Inspector is available.
- (b) Developers, builders and electricians should consult the Electricity Department on the requirements for consumer's installations and equipment. Guidance from the Department should be sought where the installations may be for heavy equipment or large buildings.
- (c) The safe and adequate installation of electrical wiring is of the utmost importance. The leading cause of fires in many developed countries is defective or overloaded electrical wiring. In addition many persons are killed and injured each year from contact with faulty or incorrectly wired electrical systems.

Note Improper wiring is potentially fatal. Only experienced and/or licensed electricians should install electrical systems.

- (d) All new or additional electricity supplies require an application for supply obtained from the Electricity Department.
- (e) Electricity is supplied at 60 Hz (cycles/sec) AC as follows:
 - 230 volts 2 wire single phase.
 - 400 volts 4 wire three phase.

Consumers are advised to consult the Electricity Department as to the type of supply to be provided, before purchasing material or equipment for new or existing installations.

- (f) Persons considering building or acquiring homes on land where electricity supply lines are not presently available should contact the Electricity Department for guidance in planning and obtaining the cost for an electricity supply. Plans should be provided by developers well in advance in order for the Electricity Department to design and cost the supply.
- (g) It will be the responsibility of the consumer to remove any trees which would interfere with proposed overhead power lines. It should be noted that in some areas overhead power lines are not permitted.

G1.2 Additions to Installations

No addition, temporary or permanent, should be made to the authorised load of an existing installation, unless it has been ascertained that the current rating and the condition of any existing wires and apparatus (including the incoming mains wire) which will have

to carry the additional load are adequate for the increased loading, and the earthing arrangements are also adequate.

G1.3 Precautions in Wet and Damp Conditions

- (a) In damp situations every item of apparatus should be of dust proof and damp proof type. No apparatus unless suitably protected should be installed in a position where it is exposed to water.
- (b) Every lampholder in any damp situation or on any situation where it can readily be touched by a person in contact with or standing on earthed metal should be earthed or constructed of insulating material and fitted with a protecting shield.
- (c) In a situation which may normally be wet or damp, electrical installations should be effectively connected to metal materials such as sinks, water pipes, etc., to ensure continuity of earthing.

G1.4 Flexible Wires

- (a) Flexible cords if not properly installed and maintained can become a common cause of fire and shock.
- (b) Flexible wires should not be used for fixed wiring except for the short lengths used to connect fixed apparatus to the mains. Flexible cords should not be fixed where exposed to dampness or immediately below water pipes. They should be open to view throughout their entire length. Flexible cords should never be fixed by clips.
- (c) Connections between flexible cords and cables should be made with an insulating connector, and this connector should be enclosed in a box or within part of a luminaire.

G1.5 Inspection and Testing

(a) General

Every installation and alteration to an existing installation should be inspected and tested on completion of the installation in accordance with the Electricity Regulations. It is recommended that testing be carried out at least every 5 years to ensure that the system has not deteriorated due to effects of the environment on the wiring or to other causes.

(b) Inspection

Special attention should be paid to flexible cords which are connected to portable appliances.

In old installations, the insulation of cables where they enter the main switch should be carefully examined as very often the insulation becomes damaged due to heat.

All fuses should be checked to ensure that they are the correct rating to protect the circuit wires which they control.

Revision Date: 31 Dec 2002

(c) **Testing**

The tests are normally carried out by special inspectors employed by the Government to test and certify all installations. The tests are normally carried out in the following sequence:

- 1 Continuity of circuit wires
- 2 Continuity of protective wires
- 3 Earth electrode resistance
- 4 Insulation resistance
- 5 Verification of polarity
- 6 Earth fault loop impedance
- 7 Operation of protective devices

(d) **Insulation Resistance**

The insulation resistance to earth should not be less than 1 megohm at 500 volts when measured with all fuse links in place, all switches closed, and the live and neutral wires connected together.

(e) **Verification of Polarity**

Verification of polarity is carried out to ensure that all single pole switches, including switches on socket outlets, are connected to the live wire of supply.

G2 TEMPORARY SERVICES

G2.1 General

Building sites usually need temporary power of some sort to allow use of power tools, lights, etc., Careful planning of the temporary service can save time and money in the finished work. The temporary service must be installed with the same care as a permanent installation, since many electrical accidents can occur on the job site.

G2.2 Location

- (a) The best location for the temporary service is on the utility service pole that eventually will feed the permanent installation. If it is possible to get the utility to install the needed poles without obstructing the access to the building site with overhead wires, etc., a more satisfactory arrangement will result.
- (b) Any temporary mast or pole must be well braced and placed in an area where it will not be damaged by job site activities. The maximum distance from the utility pole to the temporary mast is 100 ft. (30 m). Make sure the overhead service cable will have clearance of at least 12 ft. (3.6 m) over driveways and service roads. If it must cross a public road, a minimum of 16'-6" (5.0 m) clearance is required.

- (c) The temporary service unit must be protected from the rain by using all rain-tight electrical equipment or by placing the unit in a small weatherproof building with a pad-locked door.
- (d) The receptacles used on any electrical service must be of the 3-wire type with a ground pin. A bonding wire must be connected to the panel neutral bar, panel box enclosure, all metal switch boxes, and the outlet (green) grounding screw on the receptacles. A ground rod is absolutely essential. The power company will not connect a service if it is improperly grounded.

G2.3 Operation

- (a) Use only 3-wire outdoor (orange) extension cords on the job site, and check to see that all power tools are properly grounded or are of the plastic “double insulated” type. If the “U” shaped grounding pin on a tool cord is damaged or missing, replace the plug at once, connecting the green wire in the tool cord to the “U” ground pin. Inspect all cords and tools daily for signs of damage and repair or replace them at once.
- (b) Never use any power tool in the rain or in a wet area. If tools are used in a damp location, the operator should stand on at least 2" (50 mm) of dry wood and wear rubber soled boots or shoes. Bare feet, wet ground, and a power tool are a guaranteed deadly combination.
- (c) The ground fault receptacles of the temporary service will instantly disconnect a defective power tool or extension cord that shows any leakage to ground. If this occurs, do not use the tool or cord until it has been repaired. The ground fault receptacles can be used in the bathrooms and outdoor sockets in the finished house.

G3 SERVICE ENTRANCE WIRING

G3.1 General

- (a) For any electricity supply, the “supply point” is the connection to the ends of the load lines belonging to the consumer, at which point the supply is delivered by the supply line or cable, unless otherwise agreed by the Electricity Department. Generally, only one supply point is given to serve a building.
- (b) The location where the electric lines from the power company enter the building is called the “service entrance.” The Electricity Department should be consulted for the requirements for service entrances.

G3.2 Mechanical Support and Overhead Clearances

- (a) For an overhead supply, conductors are installed from the Electricity Department’s distribution system to the nearest point on the fascia board of the building, or above the fascia to a service mast or pipe securely fastened to the building by straps with bolts into structural members of the building frame.

Revision Date: 31 Dec 2002

- (b) Do not use PVC pipe for service masts since the mast takes all the strain of the entrance cables and the extra loading caused by wind. If the service mast penetrates the roof or soffit of the building, it should be flashed with a flexible rubber collar to prevent leaks.
- (c) The service mast or fascia connection must be high enough to allow for the following clearances (above grade) of cables:

Over roofs and other buildings:	8'-0"	(2.4 m)
At the service entrance location:	10'-0"	(3.0 m)
Over sidewalks, paths and driveways:	12'-0"	(3.6 m)
Over public streets and parking lots:	16'-6"	(5.0 m)
- (d) The service cables must also be not less than 3 ft. (900 mm) horizontally from windows, doors, porches, and fire escapes.
- (e) The mast must be higher than the required clearance because the cable will droop in the middle of its run and the power company will attach the cable somewhat below the top of the mast.

G3.3 Underground Service Entrances – to a Utility Pole

The Electricity Department does not normally provide underground service lines. Consumers can however supply underground cables as part of their installation to locations specified by the Department. It is recommended the Electricity Department be consulted as early as possible if underground service is required.

The following basic rules should be followed:

- (a) PVC insulated multicore armoured cable must be used for all underground supplies. Underground service entrances are to be run in schedule 40 PVC conduit of the sizes and for distances approved by the Electricity Department.
- (b) The conduit must be buried at least 18" (450 mm) deep along the run. The pole end must run at least 10 ft. (3 m) up the pole and be equipped with a weather-head. The meter is generally to be located on the building end of the run unless special permission is obtained from the power company to place the meter on the pole. Run the pvc conduit up the pole on the side away from any traffic to avoid damage. The PVC must be firmly strapped to the pole every 2 ft. (600 mm).

G3.4 Meter Sockets

- (a) One meter is generally provided to serve a building. If there are out buildings it is required that the consumer provides the wiring between the buildings. Just as in multi-occupied premises, the consumer may decide to be supplied by 2 or more meters but these will be treated as separate supplies (and result in higher electricity charges). The Electricity Department supplies, installs and maintains all electricity meters. Check meters are not provided by the Electricity Department in addition to the supply meter.

- (b) The wiring in a multiple dwelling or commercial building should be located in one group in a public or common area, on the ground floor as near to the point of entrance as possible. A Main Switch should be provided for each supply required. Each Main Switch must positively identify what it controls.
- (c) The meter position should be at eye level in a readily accessible sheltered location on an outside wall of the building which is close to the Electricity Department’s low voltage supply pole, safe from damage and easily accessible to the meter reader. If this position does not provide shelter for the meter, a box should be made to provide shelter. Locations subject to vibration, excessive heat or mechanical damage, or a position above a doorway, in a stairway, or under a water or drain pipe, should be avoided.
- (d) A meter should be installed at a maximum height of 6’-8” (2 m) and a minimum height of 4’-0” (1.2 m). There should be a clear space of at least 3 ft. (900 mm) in front of the meter to allow easy access and reading. Meters must not be in locked rooms without the permission of the Department.
- (e) The connection to the meter and all other electrical connections must be very tight and protected from water. Use glued or threaded joints in all electrical service pipe and treat it just as if it was a plumbing connection.

G3.5 Main Disconnect Switch

Next in line after the meter socket is the Main Disconnect or Main Switch. The Main Switch is a very important safety device for the home, as it allows the power to be quickly shut off in case of fire or emergency. The following rules apply to the Main Switch:

- (a) There must be only one Main Switch for each dwelling or apartment.
- (b) The Main Switch must be mounted within 10 ft. (3 m) of where the service entrance wires come through the wall of the building.
- (c) The switch handle must be mounted at least 3 ft. (900 mm) and not more than 6’-6” (1950 mm) from the ground.
- (d) The Main Switch must be easily accessible (not in a locked room) and clearly labelled “MAIN DISCONNECT” or “MAIN SWITCH”
- (e) Select the right size of load lines and Main Switch or Distribution Centre:

Main Switch or Distribution Centre	Size of Cable
supply up to 30 amp.	4 mm ² cable
supply above 30 amp. up to a maximum of 60 amp.	16 mm ² cable
supply above 60 amp.	25 mm ² cable

Note The load lines must be of sufficient length to be connected to the Electricity Department supply point.

- (f) The Main Switch or Distribution Centre should be located inside or outside of the building within 6’-8” (2 m) of the meter position.

Revision Date: 31 Dec 2002

Where this is impractical, an addition Main Switch should be installed within 6'-8" (2 m) of the meter.

- (g) To minimise voltage fluctuation and improve efficiency, circuits supplying major appliances and power points should be separated from the lighting circuits.

G3.6 Service Ground (Earth)

- (a) All service entrances must be properly grounded. The power company will not connect to any service that does not have a ground. The usual ground for a dwelling is an 8 ft. (2.4 m) plated rod driven in the ground near the meter location. This rod is connected to the neutral bar of both the meter socket and the Main Disconnect or Distribution Centre by a copper wire of #6 minimum size.
- (b) A special ground rod clamp is used to connect the wire to the ground rod. The wire may be bare or have green plastic insulation, and must be placed so it cannot be damaged by traffic, etc. It is best to run the wire inside a 1/2" (12 mm) pipe for protection. Keep the wire as short as possible.
- (c) It is good practice to connect to the ground rod to a reinforcing bar in the foundation. This will help in giving a better ground.
- (d) In some locations, it is not possible to place a ground rod because of rock or hard soil. In this case, a ring of #6 bare copper wire must be placed completely around the dwelling and be connected to the slab reinforcing bar at all corners of the building. This loop of wire must be buried as deep around the foundation as possible. Tie the two ends of the loop together and connect these to the neutral bars of both the meter socket and disconnect/panel.
- (e) Any metal plumbing (except gas) must be bonded to the electrical ground rod. This includes the water heater and major water appliances such as pumps, water heaters, and washing machines. Use #10 copper wire for this purpose.
- (f) All metal electrical cabinets must be bonded to the ground system. Circuit breaker panels include a special screw that is to be put through the neutral bar and driven into the metal box. Make sure this screw is in place.

G4 CONDUITS

G4.1 General Requirements

- (a) Conduit must be used in all cast concrete slabs or concrete block walls. It must be used in timber construction in places of public assembly, such as restaurants, churches, schools, stores, offices. Conduit may be used in timber dwellings if desired.
- (b) Conduit must be used for underground wiring unless special underground cable is used.

- (c) Wiring Rules determined by the Electricity Department will specify the sizes of pipe used and the maximum number of wires that can be used in each size. It is always permissible to use a larger size pipe if extra room is needed to get around a difficult wire pull.

G4.2 Installation of Conduits

- (a) A run of PVC conduit should have no more than 3 90° bends between boxes, to allow the wire to be more easily removed by pulling if it is ever damaged in the future.
- (b) PVC conduit joints should be glued as watertight as if they were plumbing fittings.
- (c) Use only electrical bends, fittings, and elbows with PVC conduit. Plumbing fittings do not have the necessary room to allow wire to be pulled in or out of the conduit. Each run of pipe should end in a male adaptor and a lock nut where it joins a thin metal box. Plastic boxes can have a glued joint.
- (d) Tape up conduit ends and boxes or stuff them with paper to prevent concrete from plugging them up during a pour. Leave the conduit empty until all the rough-in work is finished.
- (e) PVC conduit can be bent by gentle heating with a gas torch or heat lamp. Rotate the pipe and move the heat source from side to side while bending. Use a wet sponge to cool the pipe quickly after bending. Make all bends on a gentle curve and do not bend more than 90°.
- (f) Conduit must be firmly strapped to walls and ceilings every 4 ft. (1.2 m) with plumbing pipe straps, or plastic ones made especially for conduit.
- (g) Conduit should be continuous, sealed and glued, from box to box. Do not leave gaps near the ends or try to fish wires through voids in blocks, etc. Special fittings are available to help out in almost any situation.

G4.3 Installation of Wiring

- (a) Pulling wire requires 2 persons, one to pull and one to feed the wire in the pipe carefully. Pull all wires at the same time to prevent tangles in the pipe. Pull wire out from the centre of the box it comes in to prevent kinks. Wire on reels should be set up on an axle so it rolls off with no kinks. Use care in pulling wire into conduit so that the insulation is not “skinned” by the edge of the pipe, box or fitting.
- (b) Liquid soap can be used to help ease the friction in pulling wire into empty conduit. Do not use grease or oil for this purpose, as it will damage the wire insulation over time. Placing pull boxes in a long run of conduit will make the job of pulling wire easier.
- (c) Do not pull a wire splice into a pipe. Splices must be made in an accessible box with a securely fastened cover.

Revision Date: 31 Dec 2002

G5 MOTORS AND MISCELLANEOUS APPARATUS

G5.1 General Requirements

- (a) It is important that motors, motor starting equipment and other apparatus such as welders and X-ray machines, particularly with respect to in-rush current, do not impair the quality of supply rendered by the Electricity Department to its consumers.
- (b) Motors over 5 hp must be 3 phase with reduced voltage starting.
- (c) To maintain balance between phases, single phase appliances supplied from a 4 wire supply must be so connected that the operating current imbalance between phases will be less than 20%.

G5.2 Protection of Electronic Equipment

Although the Electricity Department strives to furnish a reliable supply, it cannot guarantee supply continuity. Some consumers may have equipment which could be affected by a supply interruption. The consumer should therefore install a suitable standby generator or uninterruptable power supply (UPS) equipment. Other forms of protection for computer systems, etc., include surge suppressors and constant voltage stabilisers.

G6 SWITCHES

G6.1 Toggle Switches

Toggle switches are normally mounted 4'-6" (1350 mm) from the floor and on the latch side of doorways. Special switches are made for switching a light from 2 or 3 different places.

G6.2 Socket Outlets

Table G6-2 gives the recommended number of socket outlets for a standard 3 bedroom house.

Table G6-2 Number of Socket Outlets Recommended for a 3 Bedroom House

Area	Minimum Number	Recommended Number
Kitchen	4	4
Dining Room	1	2
Living Room	3	5
Master Bedroom	2	2
Other Bedrooms	2	2
Corridor	1	1
Garage, Workshop or Store room	–	1*

*Must be water proof

G7 LIGHT FIXTURES & LIGHTING OUTLETS

G7.1 Location of Fixtures

- (a) Lighting fixtures are usually mounted on an electrical box set flush in the ceiling or wall. The only exception to this is in hung ceiling construction, where the wiring may be run directly to the box on the fixture. Do not use a light fixture as a splice box unless it is designed for this use.
- (b) Light fixtures generate heat and can cause fires. Do not put a surface type light fixture in any location, such as a closet shelf, where combustible goods can come in contact with the fixture.
- (c) Fluorescent light fixtures produce more light for less power and are recommended for lighting large areas. A fluorescent fixture must be securely grounded or it will not light reliably.

G7.2 Fixture Boxes

- (a) Fixture boxes are usually round types and must be securely mounted to take the weight of the fixture. A box with a 1/4" (6 mm) stud on the back is available to hold heavy, large fixtures. There are also fixture bars made to hold a box securely between rafters.
- (b) Fixtures usually have a black and white wire or bronze and silver screw terminal that should be matched up with the correct circuit wire colour. The bare ground wire must be connected to the metal body of the fixture or the box the fixture mounts on.

G7.3 Outdoor Fixtures

Fixtures for outdoor use must be marked as being suitable for the location. "Damp" location fixtures can be mounted outdoors in protected locations such as under overhangs, on porches, etc., "Wet" location fixtures can be mounted in exposed areas. Make sure all fixtures are securely grounded with the bare or green wire attached to the metal parts.

G8 SPECIAL WIRING

When wiring a dwelling, give some thought to the telephone and other needs such as cable TV which is now available in many areas, and may be a requirement of the house owner.

The utility companies should be contacted as they would usually provide the required wire and advice in installing it. Special wall plates are available for telephone and other outlets to make a neat installation of these services.

G9 SMOKE DETECTORS

Smoke detectors are inexpensive battery operated devices that can provide a valuable warning in case of fire. For a large dwelling or business premises it is recommended that a smoke detector be mounted in each sleeping area, hall way and other areas in the building.

The Fire Department should be consulted as early as possible during the design of the building for advice on the placing of smoke detectors.