STREETS AND BUILDINGS (CONSOLIDATION) REGULATIONS 1984

This is a consolidated version of this legislation i.e. it incorporates all amendments made since the legislation was enacted as set out in the table below. It has been produced by the SBAA as an aid to transparency and easier access to SBA law. However, it is not the official version of SBA legislation and, although every effort has been made to check the document, its accuracy cannot be guaranteed. The official version of legislation is published in the SBA Gazette.

Legislation incorporated in this Consolidation	**Public Instruments**	**Date in Force**
Streets and Buildings (Consolidation) Regulations 1984	29/84	30/04/1984
Streets and Buildings (Consolidation)(Amendment) Regulations 1985	33/85	20/06/1985
Notice under Section 15(1)	47/85	12/08/1985
Streets and Buildings (Consolidation)(Amendment) Regulations 1987	69/87	24/08/1987
Notice under Section 17	83/90	16/08/1990
Notice under Section 17	28/91	28/03/1991
Streets and Buildings (Consolidation)(Amendment) Regulations 1996	67/96	18/11/1996
Notice under Section 15	39/97	08/07/1997
Streets and Buildings (Consolidation)(Amendment) Regulations 2000	33/00	09/08/2000
Notice under Section 15	22/05	27/04/2005

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PART 1

Preliminary

1. These Regulations may be cited as the Streets and Buildings (Consolidation) Regulations 1984.

2. In these regulations—

"approved" in relation to any material, means approved by the appropriate authority;

"auxiliary building" means any building within a plot on which a main building stands, other than a delimiting wall or fence, which is ancillary or subordinate to the main building and which is used in connection with the main building but does not constitute a separate tenement;

"cubical content" in relation to the measurement of a building, means the space contained within the external surface of its walls and roof and the upper surface of the floor of the lowest storey, and, in the case of a pitched roof, to the underside of the uppermost ceiling;

"disabled person" means a person who, by reason of a physical weakness or deficiency has permanent or temporary difficulty in gaining access to buildings or roads;(**a**)

"domestic building" means a dwelling-house, shop, office building or any other building which is neither a public nor an industrial building;

"drain" means any drain used for the drainage of owe building only, or part of one building only;

"educational institution" includes a nursery school, elementary school, gymnasium, lyceum, college, tutorial school, vocational school and university.(**b**)

"fence" means any structure used or intended to be used for the enclosure or delimitation of any land;

"fire-resisting materia1"—

(a) for the purpose of beams, posts and staircases, means oak, plane, teak, walnut or other hard timber not less than one-and-a-half inches thick;

(b) for the purpose of floors, means any suitable timber, provided that the spaces between the joists are filled in with good concrete pugging at least three inches thick or with other solid and incombustible material at least three inches thick and that the under-side of the joists is covered with a sufficient thickness of good plaster or other incombustible material;

(c) for each of the several purposes aforesaid, means any other material or mode of construction which in the opinion of the appropriate authority is not less fire-resisting;

"ground storey" means that storey of a building to which there is an entrance from the outside on or near the level of the adjoining ground or street and when there are two such storeys then the lower of the two:

(**a**) Definition inserted by Public Instrument 33/2000 – came into force on 09 August 2000
(**b**) Definition inserted by Public Instrument 33/2000 – came into force on 09 August 2000

Provided that no storey of which the floor level is more than four feet below the level of the adjoining ground or street shall be deemed to be a ground storey;

"habitable room" means a room constructed or adapted for use as a living or sleeping room and includes a working room;

"height" in relation to a building, means the vertical distance measured from the crown of the street, or where there is no such street then the natural level of the ground immediately in front of the centre of the face of the building to the level of the top of the external wall or, in the case of a pitch-roofed building, to the level of the eaves;

"industrial building" means a warehouse for the storage of goods, factory, laundry, brewery, distillery, iron foundry and includes any building put, or to be put, to any use permitted in any zone defined by the appropriate authority with the approval of the Administrator under Section 15 of the Ordinance to be a zone within which special trades or industries may be carried on;

"main building" means any building, other than a fence and an auxiliary building, which is the main building on any plot;

"party wall" means—

(d) a wall forming part of a building and used or constructed to be used for separation of adjoining buildings belonging to different owners, or occupied or constructed or adapted to be occupied by different persons; or

(e) a wall so placed that the boundary of the lands of two different owners lies parallel to and within the thickness of the wall measured at ground level;

"plot ratio" means the ratio in relation to the sum of the floor areas of any buildings existing on any plot of land, including any buildings proposed to be erected, and the areas of the plot of land concerned; and in the case of existing or proposed buildings comprising more than one storey the sum total of the floor areas of all such storeys in relation to the area of the plot of land;

"public building" means a building used or constructed or adapted for use, either ordinarily or occasionally, as a church, chapel, mosque or other place of public worship, or as a hospital, public institution, college or school (not being merely a dwelling-house so used), theatre, restaurant or coffee-shop (the main hall of which has a floor area of not less than 1,000 square feet), hotel (having not less than eight bedrooms for guests and being of a cubical content of not less than 50,000 cubic feet), public hall, public concert room, public ballroom, cabaret, public lecture room or public exhibition room, or as a public place of assembly for persons admitted thereto, by tickets or otherwise and whether on payment or not, or used or constructed or adapted to be used, either ordinarily or occasionally, for any other public purpose;

"roadway" in relation to any street or way means the whole space open for traffic whether vehicular traffic and foot traffic or foot traffic only and includes pavements;

"Seismic Code" means the Seismic Code appearing in Appendix I to these Regulations.(**a**)

"street alignment" means the alignment for a street as determined under the provisions of the Ordinance.

PART 2

Permits to construction a street, to divide land for building purposes or to divide buildings

3. Every application for a permit to lay out or construct a street or lay out or divide any land into plots for building purposes or divide any existing building shall be made in duplicate to the appropriate authority; it shall be signed by the owner or his duly authorized agent and shall be

(**a**) Definition inserted by Public Instrument 67/1996 – came into force on18 November 1996

made in such form as may be prescribed from time to time by the appropriate authority. Every such application shall be accompanied by the following documents:—

(a) the certificate of registration of the land affected, or, in the event of the property being mortgaged, a certificate from the appropriate Area Office that the land is registered in the name of the applicant and a statement from the mortgagee that he has no objection thereto;

(b) the relevant Government Survey Plan in duplicate of the area affected on the largest available scale showing in red lines the proposed work together with the dimensions of all plots and the widths of all streets affected thereby; and

(c) if required by the appropriate authority, drawings showing longitudinal sections and cross sections of any new streets, culverts and ditches;

(d) if required by the appropriate authority in the case of the division of a building, any building permit and certificate of approval concerning the building, as well as a description of the proposed use of the parts of the building to be divided.

4. In considering an application for the division of any land, the appropriate authority may require the alteration of the boundaries of any adjoining plot or plots belonging to the same owner and the incorporation in the application of any adjoining plot or plots belonging to the same owner and may also require that plots resulting from the division shall be of such size and shape and with such frontage as the appropriate authority may in each case consider necessary or appropriate. Every such plot shall not be less than 5,600 square feet nor with a frontage less than seventy feet:

Provided that the appropriate authority may, in any case in which it considers that it is equitable so to do and is satisfied that it is not detrimental to the proper development of the area, dispense with the above requirements as to the size and frontage of the plot.

PART 3

Building permits

5.—(1) Every application for a permit to erect, demolish or reconstruct any building or make any alteration, addition or repair to any building (hereinafter referred to as "a building permit") shall be made in duplicate to the appropriate authority; it shall be signed by the owner or his duly authorized agent and shall be in such form as may be prescribed from time to time by the appropriate authority.

Every such application shall be accompanied by the following documents:

(a) the certificate of registration of the property comprising the building site, or, in the event of the property being mortgaged, a certificate from the appropriate Area Office that the property is registered in the name of the applicant and a statement from the mortgagee that he has no objection thereto;

(b) a plan of every floor, such elevations as are necessary to indicate the external appearance of the building and sections of every storey floor and roof of the building, in duplicate, drawn or reproduced in a clear and intelligible manner on suitable and durable materials to a scale of not less than one in one hundred (1:100) and showing—

(i) the position, form, dimensions, method and materials of construction of the foundations, walls, floors, roofs, chimneys and the several parts of the building;

(ii) the form and dimensions of every watercloset, urinal, earthcloset, ashpit, cesspool, septic tank, well and water tank to be constructed in connection with the building;

(iii) the level of the lowest floor of the building in relation to the level of any street adjoining the curtilage of the building, the site of the building, the other floors and roof of the building;

(iv) any such other information as may be required by the appropriate authority:

Provided that when the cubic content of any building or addition does not exceed one thousand cubic feet, or when the estimated cost of any alteration does not exceed one hundred pounds, the appropriate authority may accept an application for a building permit unaccompanied by plans drawn to scale and in such case sketch plans with figured dimensions shall be submitted;

(c) a site plan in duplicate of the largest scale Government Survey Plan available showing—

(i) the boundaries of the building site;

(ii) the position of the proposed building or the alteration or addition to any existing building in relation to those boundaries on the same scale as the Government Survey Plan;

(iii) the access to the plot from a public road as provided in Part 8 of these Regulations;

(iv) the position of all tanks, wells, septic tanks, cesspits and soakaways and the drains connected thereto; and

(v) the area of the plot and the area covered by existing buildings and proposed buildings in square feet.

(2) If with regard to any load-bearing part of the building the appropriate authority is not satisfied as to the stability of the proposed building or any part of it, it may require the following information:—

(a) full detail drawings showing the proposed method of construction and sizes of all structural parts of the building;

(b) the calculations of strength and stability upon which the details referred to in (a) above are based;

(c) a specification of the materials to be used.

(3) During the progress of any building operations the owner shall—

(a) take all necessary steps to secure the free and safe use of the street by the public and to protect the neighbours from any eventual harm or nuisance;

(b) if the appropriate authority so directs, provide and maintain proper sanitary arrangements for the use of the workmen engaged thereon.

(4) After the completion of the digging of the foundation trenches the permit holder shall give notice thereof in writing to the appropriate authority for an inspection and he shall not proceed with the erection of the building until such inspection has been made and the appropriate authority has agreed in writing that he may proceed:

Provided that the inspection shall be made within forty-eight hours from the receipt of the notice.

(5) The owner shall remove any debris which remains on or about the premises or adjacent land or streets after the building operations have been completed or at such stages as the appropriate authority may direct while the building is in the course of construction.

(6) Where an application for a permit to erect, demolish or reconstruct any building or to make any alteration, addition or repair to any building affects two or more plots under separate registration, the appropriate authority may, as a condition of the permit, require that some or all of the plots concerned be amalgamated into one plot.

PART 4

Heights and space about buildings

6.—(1) With regard to building permits, the following requirements shall be observed, that is to say:—

The area of any plot which may be occupied by a new building or by an existing building, together with any new building or addition and extension to an existing building—

(a) if the building consists of one storey, shall not exceed 50% of the total area of land comprised within the boundaries of the plot;

(b) if the building consists of more than one but not more than three storeys, the ground floor shall not exceed 50% and the first and second floor 40% of the total area of land comprised within the boundaries of the plot;

(c) if the building consists of more than three storeys, every floor above the second floor shall not exceed 30% of the total area of the land comprised within the boundaries of the plot:

Provided always that—

(i) out of the permissible percentages for the ground floor hereinbefore mentioned, a percentage of not more than 10% in each case may be occupied by auxiliary buildings not more than 12 feet in height and not less than 5 feet from the main building, for use in connection with the main building;

(ii) the area occupied by covered verandahs shall be included in each one of the areas hereinbefore mentioned but the area occupied by external steps, open garden-tanks and open verandahs shall not be included in such area, except that the area occupied by open verandahs on the ground floor which are higher than 4 feet from the ground level, shall not exceed 3% of the total area of land comprised within the boundaries of the plot;

(iii) out of the percentage occupied by the ground floor of an industrial building, a percentage of not more than twenty five per centum may be occupied by auxiliary buildings erected in connection with the industrial building but in no case such percentage shall exceed ten per centum of the area of the plot.

(2) Notwithstanding anything contained hereinbefore where the building is to be used as an industrial building within the zones approved under Section 14 of the Ordinance in respect of warehouses or industrial buildings or both, the area of any plot which may be occupied by the building to be erected and by existing buildings, if any, may, with the approval of the appropriate authority, be increased to 60% of the extent of the land lying within the boundaries of the plot, and of the 60% aforesaid not more than 20% may be occupied by auxiliary buildings for the same purpose.

(3) No part of the main building or alteration or addition to any existing main building and no open verandah higher than 4 feet from the ground level shall be less than 10 feet from any boundary of the plot on which it stands or less than fifty feet from the boundary of a road, or a section thereof, approved by the Administrator as a trunk road by a notification published in the Gazette, or less than twenty feet from any boundary of the plot on which it stands if the building is an industrial building or a warehouse:

Provided that—

(a) Projections over entrances to hotels may be less than ten feet from any boundary of the plot and the coverage thereof shall be disregarded for the purpose of calculating the plot ratio if the following requirements are satisfied :-

(i) Projections intended to cover spaces used by pedestrians only shall not exceed ten feet in height;

(ii) Projections intended to cover spaces used by vehicles shall not exceed fourteen feet in height;

(b) The distance of any auxiliary building from any street shall not be less than the permissible minimum distance of the main building from that street, but the appropriate authority may increase such distance in the interests of the character, amenities and uniformity of building development in the area;

(c) Balconies, other than those commonly known as oriels between the main building and the street (excluding its pavement) may be erected at a lesser distance from the boundary of such street than that prescribed in this paragraph of this regulation, provided that their width shall not exceed 3 feet and the whole length shall not exceed half of the length of

the frontage of the corresponding storey of the building, unless the appropriate authority considers that this would be detrimental to the character or uniformity of that section of the street on to which the building fronts. The space taken up by such oriels shall be disregarded for the purposes of the total area of the plot which may be built upon or the relation between the size of the plot and the building thereon;

Provided further that a building on a plot which resulted from a partition under the provisions of sub-section (1A) of Section 27 of the Immovable Property (Tenure, Registration and Valuation) Ordinance, shall abut on the boundary of such plot with the other plot which resulted from such partition. (**a**)

(4) Nothing in this regulation shall apply to buildings in any area to which regulation 7 applies.

(5) Notwithstanding the provisions of Regulation 7, the Administrator may, by notification promulgated in the Gazette, prescribe zones within which the height of any new building shall not exceed the height prescribed in the notification.

7.—(1) This regulation shall apply only to buildings erected in such areas, as are defined, for the purpose of this regulation, on survey maps signed by the appropriate authority and the Chief Officer and deposited at his office. Copies of such survey maps shall be deposited in the office of the appropriate authority concerned and shall be open to the inspection of the public during office hours.

(2) The height of a building shall not exceed six-fourths of the horizontal distance measured between the face of the building and the street alignment on the opposite side of the street on which the building abuts, and, where no such alignment exists, then the maximum height shall be determined by the appropriate authority:

Provided that—

(a) the height of a building erected on a corner plot and abutting on more than one street shall be regulated by the wider of such streets and the height of the building on the narrower of such streets may, to a distance not exceeding 45 feet from the wider street, be equal to that on the wider street;

(b) towers, domes and other architectural features and adornments may rise higher than the permitted height of the building subject in each case to the special approval of the appropriate authority who may attach to the approval such conditions as it thinks fit;

(c) a building erected on a corner site and having frontages onto two streets or onto one street and an open space not less than 40 feet in width may, in any special case, be exempted by the appropriate authority from the provisions of this regulation, either unconditionally or upon such conditions as the appropriate authority may prescribe.

(3) In the case of buildings having a depth of more than 25 feet, there shall be provided in the rear an open space as follows:—

(a) when the building does not exceed 14 feet in height, the space shall be not less than 50 square feet;

(b) when the building exceeds 14 feet in height, for every additional 12 feet or part thereof the space shall be increased by 50 square feet:

Provided always that the width of the space shall, in no case, be less than 4 feet and that in cases of doubt the appropriate authority shall determine which part of any building shall be deemed to be the rear for the purposes of this paragraph.

(**a**) Proviso inserted by Public Instrument 69/1987 – came into force on 24 August 1987

PART 5

Ventilation of buildings

8.—(1) A sufficient number of windows or openings shall be constructed in the wall of every storey of a domestic building in such a manner and in such a position that each of the windows or openings affords effectual means of ventilation by direct communication with the external air:

Provided that in the case of a habitable room used as a working room, the appropriate authority may dispense with the above requirement if satisfied that effectual ventilation, mechanical or otherwise, is provided.

(2) Every habitable room shall be provided with a window or french door which shall open directly into the external air and such window or door shall—

(a) have a total area of not less than one-tenth of the floor area of the room; and

(b) be so constructed that no less than the one-half of each window or door may be opened.

(3) Every habitable room shall be not less than 8 and a half feet in height measured from the floor to the lowest part of the ceiling:

Provided that, in the case of a sloping ceiling, the height shall not be less than 6 feet at the lowest part and the average height not less than 8 and a half feet.

(4) The horizontal dimension of the floor area of any room used habitually or occasionally as a sleeping room shall not be less than eight feet.

9. Where a window of a habitable room opens into a courtyard enclosed on three or more sides, the width of the courtyard measured from the face of the window to the opposite wall shall be not less than half the height of the wall, measured from the level of the top of the window to the eaves or top of the parapet of the opposite wall:

Provided that the width of such courtyard shall be not less than 10 feet and further that the superficial area of the courtyard shall be not less than 12 square yards, if enclosed on three sides, or 19 square yards, if enclosed on all sides.

10. Where a courtyard of a building is enclosed on every side and the depth of the courtyard (measured from the eaves or top of the parapet of the lowest of the surrounding walls down to the floor level of the ground storey of the building) exceeds its length or breadth, adequate provision to the satisfaction of the appropriate authority shall be made for the ventilation of the courtyard by passages or other means of communication between the courtyard and the outer air.

11. Every pantry or larder provided in a domestic building for the storage of perishable food shall either be ventilated to the external air by an opening fitted with a fly-proof cover so constructed as to allow an adequate flow of air, or be provided with mechanical means of ventilation.

12. Every room in the lowest storey of a building having a wooden floor, other than a floor constructed of wood bedded directly on to cement concrete, shall have a sufficient space beneath the floor to permit of ventilating the space thereunder by means of air bricks or by such other method as is approved by the appropriate authority.

PART 6

Projections

13.—(1) Save as provided in this regulation, no part of a building may project beyond the street alignment.

(2) No projection shall be permitted which is at a height of less than 12 feet above the street and no oriel (commonly known as kiosk) shall be constructed where the width of the street is less than 20 feet.

(3) Where a projection is at a permitted height—

(a) cornices may project not more than 2 feet;

(b) lamps, clocks and signs, inclusive of any framework or other construction to which or by means of which they are attached to the building, may project not more than 2 feet;

(c) canopies and balconies, where the width of the street—

(i) does not exceed 18 feet, may project not more than 2 feet;

(ii) exceeds 18 feet but does not exceed 20 feet, may project not more than 23 feet;

(iii) exceeds 20 feet, may project not more than 3 feet:

Provided always that no canopy or balcony shall be at a distance smaller than 33 feet from the boundary of any adjoining plot;

(d) oriels (commonly known as kiosks), where the width of the street—

(i) exceeds 20 feet but does not exceed 25 feet, may project not more than 2 feet;

(ii) exceeds 25 feet, may project not more than 2½ feet:

Provided always that—

(iii) the total area occupied by oriels on the elevation of a building shall not exceed one-fifth of the whole of the surface of such elevation; and

(iv) the aggregate length of oriels shall not occupy more than one-third of the total length of the side of the building on which such oriels are constructed;

(v) no oriel shall be at a distance less than 3½ feet from the boundary of any adjoining plot.

14.—(1) Sunblinds, including any support, frame or other construction attached thereto and which forms part thereof, shall be placed at such height and shall open to such maximum projection as the appropriate authority may approve.

(2) Every such sunblind shall be constructed to fold, roll or otherwise collapse against the wall of the building.

15.—(1) Any window or part of a window which, when opened outwards, projects over the roadway shall be at a height not less than 12 feet above the level of the roadway measured to the lowest part of such window or part thereof.

NOTICE UNDER SECTION 15 (***a***)

In exercise of the powers vested in him by subsections (1)(a) and (d) of the Streets and Buildings Regulation (Consolidation) Ordinance 1984, the Area Officer Akrotiri, as the Appropriate Authority for the Sovereign Base Area of Akrotiri, hereby defines with the approval of the Administrator, the zones in the Sotira village area prescribed in the Schedule hereto, with the purpose of regulating and controlling future development and/or the use of existing buildings and other structures and establishments and generally any activity into, onto, under or over the land in the so defined zones that may cause or generate pollution likely to affect the quality and any of the properties of the water of Symvoulos Dam and its surrounding areas, that is to say the natural environment, the aquifer and the replenishment area of the Dam. Within the defined zones prescribed in the Schedule hereto and indicated on Plan No. 2/97 signed and dated the 4th day of July 1997 and deposited at the Akrotiri Area Office at Phassouri, the types of development, the percentage cover of the plot of land, the building coefficient which is expressed as the ratio of the total extent of the plot of land to the total area of all storeys of the buildings, or other structures and establishments or activities, the maximum height of buildings, the use of buildings or other structures and establishments and generally the use of land, shall be according to the provisions prescribed in the said Schedule.

(**a**) Notice inserted by Public Instrument 39/1997 – came into force on 08 July 1997

Any restrictions and/or requirements imposed by this Notice will be additional to and will not replace any other restrictions or requirements in effect at the time being under the same Ordinance and the Regulations made thereunder.

SCHEDULE

Zone	*First Column*	*Second Column*	*Third Column*	*Fourth Column*	*Fifth Column*
	Description	*Use of buildings, structures, establishments and land*	*Number of storeys and maximum height (metres)*	*Maximum coverage of plot of land %*	*Maximum building coefficient % and maximum area m^2 (total area of all storeys: area of plot)*
A.	*The area shown in blue colour on Plan No. 2/97*	*No development of any type shall be permitted in this are other than traditional agricultural activities. Animal husbandry, whether intensive or extensive, will not be permitted in this zone*			
B.	*The area shown in green colour on Plan No. 2/97*	*Small buildings to be used as stores for agricultural purposes only*	*One storey 4.00m*	*1% (one per centum) of the total area of the plot of land*	*The total area of buildings, structures and establishments should not exceed 1% (one per centum) of the total area of the plot of land..* *Maximum area of buildings 20m^2*
C.	*The area shown in red colour on Plan No. 2/97*	*Small buildings to be used as stores for agricultural purposes only*	*One storey 4.00m*	*1% (one per centum) of the total area of the plot of land*	*The total area of buildings, structures and establishments should not exceed 1% (one per centum) of the total area of the plot of land..* *Maximum area of buildings 20m^2*
		Extensive animal husbandry only. (Sheep and goat pens etc., and small rooms)	*One storey 4.00m*	*20% (one per centum) of the total area of the plot of land*	*The total area of buildings, structures and establishments should not exceed 20% (twenty per centum) of the total area of the plot of land*

NOTICE UNDER SECTION 15 **(*a*)**

In exercise of the powers vested in me by subsections 1(a) and (d) of section 15 of the Streets and Buildings Regulation (Consolidation) Ordinance 1984, being the appropriate authority for the Akrotiri Sovereign Base Area under the said Ordinance, I, with the approval of the Administrator of the Sovereign Base Areas, hereby define the areas described in the Schedule hereto to be zones within which the use and maximum height of buildings or any part thereof, the maximum number of storeys of buildings, the maximum total area of all storeys of buildings taken together and the maximum plot coverage, shall be in accordance with the provisions set out in the said Schedule; all which areas are more particularly shown on three appropriately coloured plans under Identification Nos. SBA/AO(A)/BZ(AK)/1, SBA/AO(A)/BZ(AK)/2 and SBA/AO(A)/BZ(AK)/3, dated 11 April 2005, which have been duly signed and sealed by me and deposited at the Area Office Akrotiri.

SCHEDULE

First Column	*Second Column*	*Third Column*	*Fifth Column*	*Fourth Column*	*Sixth Column*	*Seventh Column*
Zone	*Description*	*Use of Buildings*	*Maximum Height (metres)*	*Maximum Number of Storeys*	*Maximum Total Area of all Storeys of Buildings taken together*	*Maximum Plot Coverage*
A	*The area shown in yellow colour on the maps under Identification Nos. SBA/AO(A)/BZ(AK)/2 and SBA/AO(A)/BZ(AK)/3.*	*Buildings to be used for residential purposes only:* *Provided that other uses which directly serve the needs of residents may be allowed.*	*8,30*	*2*	*120% (per centum) of the area of the plot upon which such buildings are to be erected.*	*70% (per centum) of the area of the plot upon which such buildings are to be erected.*
B	*The area shown in green colour on the maps under Identification Nos. SBA/AO(A)/BZ(AK)/1, SBA/AO(A)/BZ(AK)/2 and SBA/AO(A)/BZ(AK)/3.*	*Buildings to be used for residential purposes only:* *Provided that other uses which directly serve the needs of residents may be allowed.*	*8,30*	*2*	*90% (per centum) of the area of the plot upon which such buildings are to be erected.*	*50% (per centum) of the area of the plot upon which such buildings are to be erected.*

(**a**) Notice and Schedule inserted by Pubic Instrument 22/2005 – came into force on 27 April 2005

C	*The area shown in blue colour on the maps under Identification Nos. SBA/AO(A)/BZ(AK)/2 and SBA/AO(A)/BZ(AK)/3.*	*Buildings to be used for residential purposes only:* *Provided that other uses which directly serve the needs of residents may be allowed.*	*8,30*	*2*	*20% (per centum) of the area of the plot upon which such buildings are to be erected.*	
D	*The areas shown in red colour on the maps under Identification Nos. SBA/AO(A)/BZ(AK)/2 and SBA/AO(A)/BZ(AK)/3.*	*Buildings to be used for residential purposes only: Provided that other uses which directly serve the needs of residents may be allowed.*	*8,30*	*2*	*1% (per centum) of the area of the plot upon which such buildings are to be erected.*	

SCHEDULE (a)

ZONE A

All that area within the Sovereign Base Area of Dhekelia coloured blue on Plan No. D2 of 23rd July, 1985 wherein no structures for the mass breeding of animals and poultry of any kind shall1 be allowed.

ZONE B

All that area within the Sovereign Base Area of Dhekelia coloured green on Plan No. D2 of 23rd July, 1985 wherein no structures for the mass breeding of pigs shall be allowed.

ZONE C

All that area within the Sovereign Base Area of Dhekelia coloured red on Plan No. D2 of 23rd July, 1985 wherein there shall be no restrictions to structures for the mass breeding of animals and poultry.

(2) Every door or gate opening directly on to a street shall be constructed and fixed so as to open inwards, that is to say, away from the street:

Provided that in the case of exits for public buildings where doors must open outwards, the doors shall be so placed that no part of the doors projects beyond the building at any time as the door swings outward.

(**a**) Notice inserted by Public Instrument 47/1985 – came into force on 12 August 1985

PART 7

Fences

16. In all cases the appropriate authority, with a view to preserving the proper character of the locality and safeguarding visibility may, as condition of the permit, specify the type, design and appearance of any fence.

PART 8

Access

17.—(1) No new building shall be erected unless the plot of land on which such new building is to be erected abuts on a registered public road to the satisfaction of the appropriate authority:

~~Provided that the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, allow the erection of such a building on a plot of land which has a right of way of approximately six hundred feet in length in respect of a dwelling house and one thousand feet in respect of livestock installations and a width of not less than twelve feet:~~

~~Provided further that the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, where the acquisition of a right of way of not less than twelve feet is impossible, accept a width of less than twelve feet but not less than ten feet~~. (**a**)

Provided that, subject to the provisions of the Ordinance and the Regulations, the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, allow—

(i) the erection of a building on a plot of land which has a right of way of approximately six hundred feet in length and width of not less than twelve feet in respect of a dwelling house;

(ii) the erection of livestock installations and agricultural buildings which have a right of way of approximately one thousand feet in length and a width of not less than twelve feet; and

(iii) the erection of industrial buildings or warehouses within industrial zones which have a right of way of approximately three hundred feet in length and a width of not less than twenty feet:

Provided further that the appropriate authority may allow the erection of a substation of the Electricity Authority of Cyprus on a plot of land which has a right of way of a width of not less than ten feet:

Provided further that—

(a) the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, issue a building permit of an existing industrial, building or warehouse at the time of coming in force of these Regulations which was erected without a permit on a plot of land within an industrial zone, and which has a right of way of six hundred feet in length and a width of not less than twenty feet;

(b) the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, issue a permit for additions or alterations to an existing industrial building or warehouse erected under a building permit on a plot of land which has a right of way of such length which is registered by or on behalf of the Area Officer on the date of the issue of the permit in respect of the original erection, and of such width as the appropriate authority may determine, not being in excess of twenty feet;

(c) the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, issue a permit for additions or alterations to existing livestock

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(**a**) Provisos repealed and replaced by Public Instrument 33/1985 – came into force on 20 June 1985

installations erected under a building permit on a plot of land which has a right of way of such length and width which is registered by or on behalf of the Area Officer on the date of the issue of the permit in respect of the original erection; and

(d) *the appropriate authority may, with the consent of the Chief Officer, in exceptional circumstances, issue a building permit for additions or alterations to an existing dwelling house erected under a building permit on a plot of land which has a right of way, of such length and width, which is registered by or on behalf of the Area Officer on the date of the issue of the permit in respect of the original erection, and in addition the erection of industrial buildings or warehouses situated within industrial zones on a plot of land having a right of access of approximately one thousand feet in length and a width of not less than twelve feet if the application in respect of such building has been submitted to the appropriate authority before the coming into operation of the Regulations*. (**a**)

(2) The appropriate authority may, as a condition of the permit, require the widening of such right of way but in no case such widening shall be in excess of ten feet of the original width of such right of way.

NOTICE (**b**)

Take Notice that the Area Officer of the Sovereign Base Area of Dhekelia as appropriate authority, having satisfied himself that the wall supporting the terrace of Paradise Restaurant, situated on plot 142/ 1 of sheet /plan 41 /22 W2, alongside the main Dhekelia- Ormedhia road is in such a condition as to be dangerous to passers-by, has decided that steps must be taken to remove such danger by the demolition and re-construction to current design standards of the said wall.

NOTICE (**c**)

Take Notice that the Area Officer of the Sovereign Base Area of Akrotiri as appropriate authority, having satisfied himself that the buildings situated on Plots Nos. 199,97,88,66/1,73,117,111, 110 and 56 of S/Plan 58/47 Vill, Akrotiri village, are in such a condition as to be dangerous to persons residing in the area or passers-by, has decided that steps must be taken to remove such danger either by demolition or repair of the said buildings.

PART 9

Stairways

18.—(1) A building having more than one storey shall be provided with one or more stairways and each such stairway shall be arranged in a continuous succession of flights connecting the several storeys with the ground storey and leading to an exit or passageway into the external air.

(2) Such stairway or stairways shall be so situated that no part of the floor of any storey is more than eighty feet distant from a stairway.

(3) In all buildings other than dwelling houses, stairs and stairways, the floors of all lobbies, landings, corridors and passageways leading to such stairs or stairways together with the structural supports thereof, shall be made of fire-resisting materials.

(**a**) Text inserted by Public Instrument 69/1987 – came into force on 24 August 1987
(**b**) Notice inserted by Public Instrument 83/1990 – came into force on 16 August 1990
(**c**) Notice inserted by Public Instrument 28/1991 – came into force on 28 March 1991

PART 10

Drainage of roofs

19.—(1) The roofs of a building shall be so constructed or formed as to permit of effectual drainage of rainwater therefrom by means of a sufficiency of rainwater pipes of adequate size so arranged, jointed and fixed as—

(a) to ensure that the rainwater is conducted away from the building without causing dampness in any part of the walls or foundations of the building or those of an adjacent building; and

(b) to prevent eaves dripping or the flowing of water from any height on any street.

(2) The appropriate authority may require rainwater pipes to be connected to a drain or sewer or to a covered channel formed beneath any public footpath to connect the rainwater pipe to the street gutter, or in any other manner.

(3) Rainwater pipes shall be affixed to the outside of the external walls of the building or in recesses or chases cut or formed in such external walls or in such other manner as the appropriate authority may approve.

(4) This regulation shall not apply to any building which does not front on a street if proper and sufficient arrangements are made to satisfy the requirements of paragraph (1) (a) of this regulation.

PART 11

Chimneys and Flues

20.—(1) For the purpose of the following regulations relating to chimneys and flues, "flue" means any duct through which smoke or other products of combustion pass, and "chimney" means the material surrounding the flue.

(2) Every chimney shall be constructed of—

(a) stone or brick properly bonded and constructed not less than 44 inches thick unless the appropriate authority otherwise directs:

Provided that—

(i) the thickness of the upper side of the flue when its course makes with the horizon an angle of less than 45 degrees shall be at least 8½ inches; and

(ii) where two or more flues adjoin each other the division between such flues may not be less than 4½ inches; or

(b) piping of iron, steel or other suitable metal, properly jointed and securely fixed; or

(c) such other materials as the appropriate authority may approve.

21. Where the face of any material surrounding a flue or fireplace opening is less than 2 inches from any timber or woodwork and the material is less than 8½ inches thick, the face of the material, if of bricks or stone, shall be properly rendered, and, if of other material, shall be such as to afford adequate protection from fire to the timber or woodwork.

22. The inside of a chimney, if constructed of bricks or stone, shall be properly rendered or pargeted as it is carried up, and, if of other materials, shall be otherwise suitably protected, except that, where any part of the chimney is lined with fireclay or stoneware not less than ¾ of an inch thick or other not less suitable incombustible material of sufficient thickness, such part of the ,chimney as is so lined need not be rendered or pargeted or otherwise protected.

23. Where the back or outside of a chimney does not form part of the outer face of an external wall and the material of which it is constructed is less than 84 inches thick, the back or outside of that part of the chimney which is below the roof, flat or gutter shall be properly rendered or otherwise suitably protected.

24. Where a chimney is constructed in connection with any furnace, kiln, steam boiler or closed fire, used or intended to be used for any purpose of trade, business, or manufacture, or is constructed in connection with any cooking range or cooking apparatus of a building used or intended to be used as a hotel, inn or restaurant, the flue of the chimney shall be surrounded with brickwork or other solid and incombustible material of adequate thickness which, in the opinion of the appropriate authority, gives sufficient degree of heat insulation.

25. Where a flue is in a party wall and is not back-to-back with another flue, the material at the back of that part of the flue which is below the roof, flat or gutter shall be not less than 8½ inches thick.

26. A chimney shall be carried up all round in brickwork or other not less suitable material not less than 4½ inches thick to a height not less than 3 feet above the adjoining roof, flat or gutter, measured from the highest point in the line of junction with the roof, flat or gutter.

27. A chimney, or group of chimneys bonded together, shall not be built higher above the highest point in the line of junction with the roof, flat or gutter of the building than a height equal to six times the least width of the chimney, or six times the overall width of the group of chimneys measured horizontally at right angles to its greatest horizontal dimension, as the case may be, unless the chimney or group of chimneys is otherwise made secure.

28. Timber or woodwork shall not be placed in a wall or chimney breast within 9 inches of a flue or fireplace opening.

PART 12

Water supply and sanitation

29. A well constructed or sunk in connection with a building, intended to supply water for human consumption shall comply with the following requirements:—

(a) it shall be—

(i) not less than 30 feet from any ashpit;

(ii) not less than 40 feet from any earthcloset or privy;

(iii) not less than 60 feet from any cesspool, soakaway or borehole latrine;

(b) the ground adjoining the well shall for a distance of not less than 4 feet in every direction be covered with a watertight paving constructed so as to slope away from the well;

(c) the sides of the well shall be rendered impervious for a depth of not less than 6 feet from the level of the adjoining ground;

(d) a dug well shall be so constructed as to be readily accessible for cleansing;

(e) the top of a dug well shall be surrounded by a curb extending not less than 6 inches above the level of the paving referred to in paragraph (a) of this regulation and so constructed as to prevent any surface water gaining access to the well;

(f) the lining tubes of a bored well shall project not less than 6 inches above the level of the paving referred to in paragraph (a) of this regulation and such projection shall be surrounded on the outer side with concrete not less than 6 inches thick for its full height;

(g) a well from which water is drawn by a bucket shall be provided with—

(i) an efficient hinged wooden or iron cover which will close the well when not in use; and

(ii) a stand for the bucket not less than 6 inches above the level of the paving referred to in paragraph (a) of this regulation;

(h) a well from which water is drawn by a pump shall be provided with a cover so fitted as to prevent surface water or other matter from gaining access to the well.

30. A tank or a cistern constructed or fitted in connection with a building and intended for the storage of water for human consumption or domestic purposes shall comply with the following requirements:—

(a) the tank shall, if so required, be provided with an overflow pipe which shall—

(i) be so placed and fitted as to prevent entry of insects;

(ii) not be connected to a drain or sewer;

(iii) have an open end to permit the overflow pipe serving also as a warning pipe;

(b) the tank shall be provided with a draw-off pipe, tap or other apparatus which shall be not more than 2 inches from the bottom of the tank;

(c) a tank or cistern which is wholly or partly below the level of the adjoining ground shall have its walls, floor and roof constructed of brick, stone or concrete, and if constructed of a material which is not impervious to water shall be properly lined with an impervious material;

(d) all pipes and fittings connected to the tank shall be jointed and connected thereto with proper and water-tight joints;

(e) every tank, whether above or below ground level, shall be so constructed as to prevent the entry of insects and shall be provided with adequate means of ventilation and access for cleaning and all apertures in the casing of the tank shall be made mosquito-proof.

31. Septic tanks constructed in connection with a building shall comply with the following requirements:—

(a) the septic tank shall be situated at least 1½ feet from any building and—

(i) in such a position that the effluent will not contaminate any well, spring or stream of water;

(ii) in such a position as to afford ready means of access, for the purpose of cleaning and emptying it;

(b) the septic tank shall be so constructed as to comply with the requirements of regulation 30 (c) and (d) and be of a design approved by the appropriate authority;

(c) the septic tank shall be of a capacity sufficient for its purpose and approved by the appropriate authority;

(d) the outlet pipe from the septic tank shall discharge the effluent over or into a filter or percolating pit; a dosing syphon shall be provided if the appropriate authority so requires;

(e) the filter or percolating pit shall be of such size, design and construction as may be approved by the appropriate authority;

(f) the effluent issuing from the filter or percolating pit shall be taken to such outfall or be disposed of in such manner as the appropriate authority may require.

32. Cesspits, percolating pits and soakaway pits in connection with a building shall—

(a) be so situated that they do not in the opinion of the appropriate authority endanger the foundations or wall of any building;

(b) be at least 60 feet from a well, spring or stream of water;

(c) have no communication with the external air except as allowed by the appropriate authority;

(d) be provided with a sufficient ventilator the open end of which shall be fitted with a cover of copper wire gauze and in such a position that the escape of foul air into any building is effectually prevented.

33. A water closet constructed or fitted in connection with a building shall—

(a) have at least one of its sides abutting on an open space of not less than 50 square feet in superficial area and an opening of not less than two square feet, exclusive of frame, opening directly into the external air:

Provided that, in the case of a water closet constructed or fitted in connection with any building, the appropriate authority may dispense with the above requirement if satisfied that effectual ventilation, mechanical or otherwise is provided:

Provided further that where a room contains more than one water closet, such room shall be divided into cubicles each containing a pan and the partitions or divisions shall be so constructed as to allow the free circulation of air throughout the room;

(b) be furnished with a soil pan which shall be—

(i) of non-absorbent material so constructed and fitted as to receive and contain sufficient water and to allow any filth to fall free of the sides directly into the water;

(ii) be provided with a suitable and efficient trap;

(c) be paved with hard, smooth impervious material;

(d) be provided with suitable cistern and apparatus or valve for effectively flushing and cleansing the pan; and

(e) be provided with adequate hand washing facilities to the satisfaction of the appropriate authority.

34.—(1) A urinal compartment shall comply in all respects with the requirements of regulation 33.

(2) The urinal shall consist of a stall made of glazed stoneware, glazed earthware or enamelled fireclay or such other impervious material as is approved by the appropriate authority.

35. A pit latrine shall comply with the following requirements:—

(a) its only direct entrance shall be from the external air;

(b) it shall be not less than 60 feet from any well, spring or stream of water;

(c) it shall be provided with a sufficient opening for lighting and ventilation as near the top as practicable and communicating directly with the external air;

(d) the floor shall be of non-absorbent material;

(e) it shall be at least 20 feet from any dwelling house or any building in which persons are or may be employed in any manufacture, trade or business:

Provided that in exceptional cases the distances mentioned in paragraphs (b) and (e) may be modified as the appropriate authority may, in each case, decide.

36. With regard to earthclosets—

(a) the receptacle for faecal matter (hereinafter in this regulation called "the receptacle") shall be of non-absorbent material so constructed and placed that its contents shall not escape by leakage or otherwise or be exposed to rainfall or to the drainage of any waste water or liquid refuse;

(b) the receptacle shall be of a capacity not exceeding two cubic feet;

(c) it shall be provided with—

(i) a suitable vessel of adequate capacity for dry earth or other suitable deodorising material so constructed and placed as to admit of ready access for depositing therein the necessary supply of the earth or other material; and

(ii) sufficient means for applying the earth or other material to the faecal matter in the receptacle;

(d) it shall comply with the requirements of paragraphs (c) and (d) of regulation 35.

37.—(1) For the purpose of this regulation, the term "sanitary convenience" includes a water closet, earthcloset and pit latrine.

(2) Buildings shall be provided with sanitary conveniences as follows:—

(a) every dwelling house shall have at least one sanitary convenience;

(b) a building designed or used for human habitation otherwise than in separate apartments, such as hotels, khans, hostels, hospices, and lodging houses, shall be provided with at least one sanitary convenience for every 900 sq. feet of floor area;

(c) industrial buildings shall be provided with at least one water closet in respect of each manufacture, trade or business carried on therein, and where more than 25 persons are employed or likely to be employed in each such manufacture, trade or business, an additional water closet shall be provided for every additional twenty-five persons; for the purpose of this provision, any fraction of twenty-five shall be reckoned as twenty-five;

(d) where persons of both sexes are employed, the sanitary conveniences for each sex shall be so arranged that the interior shall not be visible, even when the door of any such convenience is open, from any place where persons of the other sex have access. If the conveniences for one sex adjoin those for the other sex, the approaches shall be adequately separated.

PART 12A (**a**)

Safety of Buildings

37A. *In relation to any building requiring the use of reinforced concrete an anti-seismic study shall be submitted to the appropriate authority in accordance with the Seismic Code:*

Provided that no anti-seismic study shall be required under this regulation in relation to the following:—

(a) Buildings with a cubic content of less than 200 cubic metres;

(b) Auxiliary buildings;

(c) Farm and livestock installations; and

(d) Additions and alterations, whether horizontal or vertical, to existing buildings, except public buildings.

PART 12B (**b**)

Use of buildings by disabled persons

37B.*—(1) This Regulation shall apply to the following buildings—*

(a) public buildings and buildings which the public are permitted to enter;

(b) shopping centres;

(c) buildings which contain shops or offices or both;

(d) blocks of flats with five or more housing units or buildings with more than five parking spaces;

(e) educational institutions including halls of residence for students, sports grounds and swimming pools attached to or forming part thereof;

(f) clinics, surgeries and therapeutic or diagnostic centres;

(g) industrial buildings exceeding 600 m^2 in area or with employed persons exceeding ten in number and to complexes of workshops the total area of which exceeds 600 m^2;

(h) any other buildings where the appropriate authority deems that the application of this Regulation is required:

(**a**) 12A inserted by Public Instrument 67/1996 – came into force on 11 November 1996
(**b**) 12B inserted by Public Instrument 33/2000 – came into force on 09 August 2000

Provided that in exceptional cases, where the ground floor of an existing building is covered by a building permit, and the full application of the provisions of this Regulation is not possible, the appropriate authority shall relax the full application of this Regulation to the extent that it is impossible to apply.

(2) No building to which this Regulation applies shall be erected, unless—

(a) all levels of the building are accessible to disabled persons;

(b) the main entrance and doors meet the following specifications:—

(i) the entrance has a clear width of at least 0.90 metres measured between the door frames;

(ii) doors have handles and automatic closing devices and are fitted with reinforced transparent glass positioned to afford good visibility to all users;

(iii) there is a width of at least 0.30 metres between the edge of the fitted glass and the edge of that side of the door nearest to the handle;

(iv) all internal doors are at least 0.90 metres in width.

(c) where there are staircases or over two stairs there are double handrails with a distance of one metre between them, at a height of 0.70 metres and 0.90 metres respectively, with a diameter of the handrail of 0.05 metres and on one side such handrail protrudes by 0.40 metres from the first and last stair;

(d) the common corridors are at least 1.25 metres in width;

(e) the dimensions of lobbies of the stairwells and elevator wells are at least 1.50 metres x 1.50 metres:

Provided that in the cases of clinics and surgeries the minimum dimensions are 2.10 metres x 2.10 metres;

(f) there is a suitably constructed ramp securely connecting the main entrance of the building to a public road or pavement, constructed of non-slip material and which has the following characteristics:

(i) a minimum unobstructed width of 1.20 metres;

(ii) a gradient of 1 : 15 for a ramp up to 5 metres in length and of 1:20 for a ramp exceeding 5 metres in length;

(iii) a raised edge on either side of the ramp with a minimum height of 0.15 metres, and a handrail at a height of between 0.80 metres and 0.90 metres on each side and with a diameter of 0.05 metres;

(iv) at the beginning and end of each ramp, a landing of a minimum unobstructed length of 1.20 metres and a width equal to the width of the ramp:

Provided that, where the total length of such ramp exceeds 10 metres, an intermediate landing of a minimum length of 1.50 metres shall be provided:

Provided further that where there is a change in the direction of the ramp there is an intermediate landing with a minimum width of 1.40 metres and length of 1.60 metres;

(g) where there are pavements they are shaped and connected to the road surface for easy access, have a non-slip surface and marked as being for disabled persons, all in a manner to the satisfaction of the appropriate authority;

(h) where there are elevators—

(i) entry to and exit from the elevator is accessible to disabled persons;

(ii) the entrance door of the elevator has a clear width of at least 0.80 metres;

(iii) the elevator has clear internal dimensions of at least 1.40 metres in length and 1.10 metres in width:

Provided that where the building is used as a clinic, the clear internal dimensions of the elevator are at least 2.20 metres in length and 1.10 metres in width;

(iv) the control buttons have embossed markings and are placed at a height of between 0.90 metres and 1.30 metres and at a distance of 0.40 metres from the door and provide sound and visual indications;

(v) there is a telephone apparatus fixed at a height of between 1.05 metres and 1.30 metres and at a distance of 0.40 metres from the door which is connected to the telecommunications network and programmed to communicate with the person responsible for the maintenance of such elevator, the police or the fire service;

(i) there is a common lavatory and wash basin for use by both sexes, suitably constructed, with the following characteristics:

*(i) the dimensions are 2 metres **x** 2 metres and the centre of the lavatory bowl is situated at a distance of at least 0.50 metres from the nearest side wall and the lavatory bowl is of such a design, size and shape as to permit its proper use by any disabled person;*

(ii) the door of the lavatory opens outwards:

Provided that the additional space required by these Regulations for disabled persons for the purpose of hygiene shall not be taken into account in the calculation of the building coefficient;

(j) in the case of buildings to which the public are to be admitted as spectators such as swimming pools, theatres, cinemas, indoor sports arenas and the like, seats are arranged so as to provide easy access by disabled persons and provision is made so that 1% of the total number of seats, with a minimum of four seats, are suitably arranged for use by disabled persons and have easy access to emergency exits.

(k) where the number of parking places required for a building does not exceed 100, 10% of such places are reserved and marked for use exclusively by disabled persons, with an additional 5% of such parking places where the total number of parking places is in excess of 100. Each such reserved parking place shall have a minimum dimension of 5 metres x 3.30 metres with access to the main or other entrance of the building.

***37C.** In all industrial buildings and complexes of workshops, whether or not they come within Regulation 37B above, lavatories shall be so arranged as to be capable of being used by disabled persons.*

PART 13

Drains

38. The lowest storey of a building shall be at such level and so constructed as to allow of its effectual drainage by gravity.

39. Drains in connection with a building shall comply with the following requirements:—

(a) the pipes shall be sound, salt-glazed earthenware, cast iron or asbestos-cement pipes or of any other material specifically approved by the appropriate authority;

(b) the pipes shall be laid at a gradient not less than 1 in 40, and be provided with suitable watertight joints;

(c) drains shall not, without the written consent of the appropriate authority, be so laid as to pass beneath a building, and where such consent is given, the drain shall be constructed of cast iron or of other not less suitable material surrounded with cement concrete not less than 4 inches thick and shall be laid in a direct line between the point at which it enters the building and the point at which it leaves the building, and shall be provided with means of access at each of such points;

(d) every branch drain shall join the main drain obliquely in the direction of the flow of the main drain;

(e) the pipes shall be provided with adequate means of access and shall be of such materials, size and construction as may be required by the appropriate authority;

(f) where the drain is laid beneath or passes through a wall it shall be protected from, and relieved of the weight of the wall by means of a relieving arch or lintel formed in the wall immediately over the drain;

(g) every inlet to the drain to be trapped, other than a soil pipe or ventilating pipe, shall be trapped by a suitable and efficient trap of a design to be approved by the appropriate authority;

(h) an intercepting trap shall be fixed to every drain where it discharges into a cesspool or septic tank, as near as practicable to such cesspool or septic tank;

(i) the drains intended for conveying foul water from a building shall be provided with at least one ventilating pipe, situated as near as practicable to the building and as far as practicable from the point of discharge:

Provided that a soil pipe from a water-closet, or a waste pipe from a slop sink, constructed in accordance with these regulations may serve €or the ventilating pipe of the drain, if its situation is in accordance with this regulation;

(j) the ventilating pipe shall be carried upwards to such a height and in such a manner as effectually to prevent the escape of foul air from the drains into any building and shall be covered as its open end with wire cage of copper or galvanized iron.

40. Soil pipes, soil ventilating pipes and ventilating pipes fitted in or on a building shall—

(a) be constructed of drawn lead pipe or heavy grade cast iron pipe or of such other materials and construction as the appropriate authority may approve;

(b) be easily accessible and provided with an adequate number of cleaning eyes in suitable positions;

(c) be situated on an external wall of a building, or be placed in ducts or chases in the walls of a building, and when so placed they shall be grouped and arranged, and the ducts or chases shall be designed and treated to the satisfaction of the appropriate authority;

(d) throughout their entire length be circular in cross section and have an internal diameter of not less than 3 inches, or such larger diameter as the appropriate authority may require, if, in its opinion, the circumstances so warrant, and, where the internal diameter of the outlet of the trap of any water closet, slop sink, bidet or urinal connected to any such pipe exceeds 3 inches, the pipe shall have a diameter not less than the diameter of such outlet.

41.—(1) For the purposes of this regulation, the term "sanitary fitting" includes any water closet, slop sink, urinal or bidet.

(2) Where two or more sanitary fittings drain into a single soil pipe or waste pipe, the trap of every such fitting shall be ventilated into the open air by means of a branch ventilating pipe connecting the said trap to a main ventilating pipe, and such main ventilating pipe shall be continued vertically to a height not less than that of the soil pipe or waste pipe with which the said traps are in connection, or it may be connected to the said soil or waste pipe at a point above the level of the uppermost of the said traps.

(3) Branch and main ventilating pipes shall have a diameter of not less than 2 inches throughout and shall comply with the requirements of regulation 40.

(4) The connection of a ventilating pipe to a trap, branch, soil or waste pipe shall be—

(a) at a point not less than 3 inches nor more than 12 inches from the highest point of the trap;

(b) on that side of the water seal nearest to the soil pipe or waste pipe;

(c) in the direction of the flow.

42.—(1) For the purposes of this regulation, the term "sanitary fitting" includes a bath, lavatory basin and sink (not being a slop sink).

(2) A waste pipe connected to a sanitary fitting and a waste ventilating pipe shall be made of drawn lead, copper or iron, or such other material as is approved by the appropriate authority, and shall be securely fixed and laid to an adequate gradient.

(3) The internal diameter of a waste pipe shall be not less than 14 inches or, where two or more sanitary fittings connect thereto, such larger diameter, if any, as the appropriate authority may require.

(4) Every waste pipe shall be trapped immediately after its connection to the sanitary fitting by a trap providing a depth of water seal of at least 14 inches.

(5) Where two or more sanitary fittings are fixed in a range, the waste pipe from each fitting may discharge without the interposition of a trap into an open channel made of glazed stoneware or other suitable material formed or fixed in or above the floor immediately below the sanitary fittings, and discharging into a suitable and efficient trap of a design approved by the appropriate authority.

(6) Whenever the appropriate authority so requires, the trap of a sanitary fitting shall be ventilated by means of a ventilating pipe carried up vertically in such a position and to such a height as the appropriate authority may prescribe, and when two or more sanitary fittings fixed on different storeys are connected to such a pipe, such pipe shall be continued vertically to a height not less than that of the waste pipe with which the said sanitary fittings are in connection, or it may be connected to the said waste pipe at a point above the level of the uppermost of the said fittings.

(7) Branch and main ventilating pipes shall have an internal diameter throughout not less than two-thirds of the internal diameter of the branch and main waste pipe.

PART 14

Public buildings

43. A public building provided with a proscenium opening and a stage on which scenery may be used or a building constructed or adapted to be used for the exhibition of cinematograph films (whether occasionally or ordinarily) shall—

(a) where forming part of another building or where it adjoins another building, comply with such requirements as the appropriate authority may prescribe;

(b) not contain habitable rooms except a room for the guard;

(c) not be erected unless at least one-sixth of the total length of the perimeter of the building abuts or fronts on one or more streets and at least another two-sixths of the same on some open space connected with the street as may be approved by the appropriate authority.

44. In every public building, all floors, staircases, balconies, tiers, roofs and all other parts used by the public shall be constructed of fire-resisting materials and shall comply with the following requirements:—

(a) there shall not be more than two tiers or horizontal divisions above the lowest floors used by the public as an auditorium;

(b) the height measured from such lowest floor to the soffit of the tier next above shall be not less than 10 feet;

(c) the height measured from the floor of the first tier to the soffit of the second tier, if any, shall be not less than 8½ feet;

(d) the height between any part of the floor of the highest tier and the ceiling immediately over it shall be not less than 10 feet.

45. In every public building two separate exits leading directly to a street or open space shall be provided from any tier or floor, and where a tier or floor accommodates more than four hundred

persons an additional exit leading directly to a street or open space shall be provided for every two hundred, or part of two hundred, persons in excess of the said four hundred, and such exits shall comply with the following requirements:—

(a) every such exit shall have a clear width of not less than 56 inches measured between the walls at any point and also between the jambs of the frames of any doors therein;

(b) the line of travel from any part of any gangway to the nearest exit from the auditorium shall not exceed 50 feet.

46. All doors in a public building, except a building constructed or adapted to be used as a place of public worship, used by the public as a means of exit shall be indicated by the word "EXIT" in clear lettering in English, Greek and Turkish, and such doors shall be further indicated by a red light at all times during which the building is being used by the public, and every such light shall be placed over the doors at a height of not less than 7 feet above the level of the floor.

47. Where vestibules are provided in a public building, the aggregate width of all the doorways and passages communicating from each vestibule and leading therefrom to the street or open space shall be at least one-third greater than the aggregate width of all doorways and passages leading into such vestibule.

48. Where cloakrooms are provided they shall be so situated that their use shall not interfere with the free use of any exit way.

49. In a public building every staircase for the use of the public—

(a) shall be of the width laid down for corridors and passages in regulation 50, measured between handrails;

(b) shall be enclosed by solid walls of fire-resisting material not less than 8½ inches in thickness and, except where continued upwards above the roof as an open staircase, shall be sealed with reinforced concrete or other materials to the satisfaction of the appropriate authority;

(c) shall have treads not less than 11 inches wide and risers not more than 7 inches high and both treads and risers shall be of uniform width and height in each flight of steps;

(d) shall be arranged in straight flights without winders, and no flight shall have more than fifteen or less than three steps:

Provided that a staircase not arranged in straight flights may be approved by the appropriate authority either unconditionally or upon such conditions as the appropriate authority may prescribe;

(e) shall have not more than two flights of fifteen steps each without a return, and the depth of the landing between flights shall be not less than the width of the staircase;

(f) shall have a continuous uninterrupted handrail fixed securely to both sides of all steps and landings, and shall project not more than 3 inches;

(g) shall have no recesses or projections, other than the handrail for staircases prescribed in this regulation, or projecting light fitting brackets, in the walls of such staircase at a height less than 7 feet above the tread of any stair or above the floor of any landing;

(h) shall be adequately ventilated and lighted by means of windows or sky-lights opening directly into the external air.

50.—(1) Every corridor or passage leading from an exit shall be not less than the clear minimum width laid down for that exit.

(2) Where two or more exits open into a corridor or passage at successive points in its length, proceeding in the direction of exit the width of such corridor or passage shall be increased at each such successive point by the width of the exit opening into it at that point:

Provided that no additional width is required in respect of doorways leading into a corridor or passage from cloakrooms, boxes, small bars or lavatories.

51. Inclines may be used instead of steps, and where used shall not have a gradient exceeding one in ten.

52.—(1) Doors in a public building intended to be used by the public as a means of exit shall—

(a) when measured between the door frames or posts be of a width not less than 56 inches;

(b) be hung in two leaves and be made to open outwards towards the street;

(c) be so hung that when open, they will not obstruct any gangway, staircase, passage or landing nor open immediately upon a flight of steps;

(d) be so arranged as to open within a recess or on to a landing not less than 40 inches in depth between such flight and door;

(e) shall have no fastening other than automatic "panic" bolts of a pattern and in a position approved by the appropriate authority.

(2) All doors leading from exit passages, staircases or corridors intended to be used by the public to the other parts of the building shall be hung so as to be closed by the stream of persons passing from the auditorium to the street and shall be fitted with spring hinges.

(3) All doors and gates intended to be used by the public as entrances shall be made to open both ways, and shall, when opened inwards, be so fitted that they may be locked back against the wall in such a manner as to require a key to release them.

53. Every public building, not being a place of public worship, shall be provided with water closets, wash basins and urinals, constructed and arranged for separate use by males and females to the satisfaction of the appropriate authority, and in numbers proportionate to the total seating and standing accommodation for the public, as follows:—

water closets, one for 200 persons or less;

urinal stalls, one for 200 persons or less;

wash basins, one for 200 persons or less.

54.—(1) Where a public building is constructed, or adapted to be used, for the exhibition of cinematograph films, separate operating and winding room shall be provided and shall be constructed throughout of fire-resisting materials and efficiently ventilated by means of apertures communicating directly with the external air. The operating rooms shall communicate directly with the winding room by means of a door.

(2) The operating and winding rooms shall comply with the following requirements:—

(a) the floor area of the operating room shall be not less than 65 square feet;

(b) there shall be no direct access from either room to the auditorium;

(c) the total area of apertures opening into the auditorium shall not exceed 120 square inches;

(d) each of such rooms shall be provided with a separate exit door leading either directly into the external air or into a lobby, corridor or passageway opening directly into the external air but not being a means of exit for the public;

(e) the said exit doors shall be made of fire-resisting material, and shall be close-fitting and be fitted with a self-closing device.

55. Every part of a public building shall be adequately ventilated in a manner approved by the appropriate authority.

56. In every public building where a proscenium and stage are provided such proscenium and stage shall comply with the following requirements:—

(a) the stage shall be separated from the auditorium by a wall of fire-resisting materials not less than 13 inches in thickness, and such wall shall be carried up to a height not less than 40 inches above the roof (such height being measured at right angles to the slope of the roof) and shall be carried down below the stage to a solid foundation;

(b) a separate exit shall be provided from the stage direct to a street;

(c) where the sitting capacity of the building exceeds 600 persons, the proscenium opening shall be provided with a drop curtain in the form of a fire-resisting screen;

(d) the roof over the stage shall not be of fire-resisting materials or heavy construction. It shall be provided with a roof vent equal in area to one-tenth the area of the stage;

(e) openings in the proscenium wall (exclusive of the proscenium opening) shall be fitted with iron or steel doors overlapping the wall opening by 3 inches and hung in such a manner as to be self-closing without a spring.

57.—(1) Dressing rooms shall comply with the following requirements:—

(a) they shall be adequately lighted and ventilated by windows in the external walls, and shall be divided from the stage and all other parts of the building by solid walls of brick, stone or concrete not less in thickness than 8½ inches;

(b) they shall have only such means of communication with the stage and the other parts of the building as the appropriate authority may approve;

(c) they shall have a separate exit way leading directly to a road and the exit doors thereof shall be fitted with automatic panic bolts only;

(d) they shall not be situated at a line lower than one storey below the ground storey.

(2) Separate water closets, wash basins and urinals shall be provided for the use of the artists and orchestra, in such numbers and so constructed and arranged as the appropriate authority shall require.

58.—(1) All workshops, store-rooms, wardrobes, painting rooms and other rooms used in connection with a stage and forming part of such a building shall be divided from the stage, from each other and from other parts of the building by solid walls of brick, stone or concrete not less in thickness than 8½ inches and shall be arranged in positions to the satisfaction of the appropriate authority.

(2) All openings in such walls shall be fitted with fire-resisting doors complying with the requirements of regulation 56 (e) and of such sizes as the appropriate authority may approve.

(3) All such rooms shall be adequately ventilated to the satisfaction of the appropriate authority.

(4) Water closet and lavatory accommodation shall be provided for the work-people in such numbers and positions as may be required by the appropriate authority.

59. All boilers, dynamos and lime light tanks in connection with such buildings shall be situated in ventilated chambers of fire-proof construction separated from each other and other parts of the building by solid walls of brick, stone or concrete not less in thickness than 8½ inches. At least one wall of each such chamber shall be an external wall and all openings between such chambers and other parts of the building shall be fitted with fire-resisting doors complying with the requirements of regulation 56(e).

60. Fireplaces and stoves shall not be permitted in any part of an auditorium or stage in a public building, and any open fireplace or stove in any other part of such building shall be adequately protected by strong fixed metal guards to the satisfaction of the appropriate authority.

61.—(1) Gangways or passages not less than 3½ feet wide shall be provided in the auditorium leading direct to the exit doors, and no seat shall be more than lo+ feet from such gangway or passage measured in the line of the seating.

(2) The seating area assigned to each person in the auditorium shall not be less than 28 inches deep, and 18 inches wide, where there are no arms, and 20 inches wide, where there are arms to the seats.

(3) There shall be a space of not less than 12 inches in depth between the back of every seat and the front of the next seat behind when measured between perpendiculars.

(4) Where separate chairs are used in an auditorium they shall be battened together in groups of not less than four nor more than twelve chairs so that the centres of the chairs are not less than 20 inches apart in the case of chairs with arms and 18 inches apart in other cases.

62.—(1) When application is made for a building permit for the erection of a building or the conversion of an existing building to be used as a public building the appropriate authority shall, as a condition of the permit, require the owner to provide and maintain in the immediate vicinity of such building an adequate vehicle parking space to the satisfaction of the appropriate authority and such vehicle parking space shall not be less in size than—

(a) in the case of hotels, hospitals or clinics, 200 sq. ft. or, where the parking space is within an enclosed area, adequate space for parking one car, for every five bedrooms;

(b) in the case of cinemas, theatres, concert halls or similar uses, 200 sq. ft. or, where the parking space is within an enclosed area, adequate space for parking one car, for every 30 seats of public seating accommodation;

(c) in the case of cabarets, clubs or similar uses, 200 sq. ft. or, where the parking space is within an enclosed area, adequate space for parking one car, for every 800 sq. ft. of floor space to which the public or patrons have access, irrespective of whether such floor space be roofed or open to the sky;

(d) in the case of sports stadiums, 200 sq. ft. or, where the parking space is within an enclosed area, adequate space for parking one car, for every 100 sq. ft. of ground covered by grand stands.

(2) Where a building is to be used as an industrial building, or as a block of flats or offices or as a taxi office, or as an office or depot for public transport vehicles, the appropriate authority shall, as a condition of the permit, require the owner to provide and maintain such means of ingress and egress and such accommodation for the loading or unloading of vehicles, or the picking up or setting down of passengers in connection with the building and such parking space for vehicles in the immediate vicinity of the building as shall be necessary to keep the public highway clear of stationary vehicles connected with the building.

(3) Where a building is to be used for any other purpose and the appropriate authority is satisfied that the character and use will be such as to cause or be likely to cause increased vehicular traffic or interference with the traffic along any road in front of, or adjacent to, such building, the appropriate authority, as a condition of the permit, shall require the owner to provide and maintain such means of ingress and egress and such accommodation for the loading or unloading of vehicles, or the picking up and setting down of passengers and persons in connection with the building and such parking space for vehicles in the immediate vicinity of the building as it shall specify.

63. The appropriate authority may dispense with all or any of the requirements of the regulations in this Part in cases of open air theatres and cinematographs.

PART 15

Fees and miscellaneous

64.—(1) The fees set out in the Appendix hereto shall be payable to the appropriate authorities for permits granted by such authorities under the provisions of the Ordinance in respect of the several matters set out in such Appendix as follows:—

(a) where the appropriate authority is the Area Officer, the fees set out in Part 1 of the Appendix shall be payable;

(b) where the appropriate authority is an Improvement Board in the Republic whose jurisdiction overlaps into the Areas by reason of the fact that the land concerned lies in the Areas, the fees set out in Part 2 of the Appendix shall be payable.

(2) No fees shall be payable, in respect of a permit to erect any place of public worship or a school operating under any Ordinance in force for the time being relating to elementary or secondary education or to demolish or reconstruct or make any alteration, addition or repair to any existing place of public worship or such school.

65. The appropriate authority or its authorized representative may, at all times during which operations are being carried out in virtue of a permit issued under the provisions of the Ordinance, inspect the work and the permit holder or person in charge of the operations shall afford to such authority or representative all facilities for the purpose, free from all obstructions.

66. Notwithstanding anything contained in these regulations, the appropriate authority may dispense with all or any of the requirements of these regulations or apply them with such modifications, not being more onerous, as may seem fit to such authority having regard to the particular circumstances of any case of the general conditions obtaining in the area.

67. The Streets and Buildings Regulations in S. L. I. p. 307, Gaz. Sup. No. 3 of 20.1.55 and 23.6.55 (Cyprus) and Public Instruments Nos. 16 of 1965, 45 of 1970, 54 of 1970 and 74 of 1980 are hereby revoked without prejudice to anything done or left undone thereunder.

Appendix 1(**a**) *(Regulation 37A)*

Seismic code for reinforced concrete structures

Table of Contents:

(**a**) Appendix 1 inserted by Public Instrument 67/1996 – came into force on 18 November 1996

1. SCOPE AND FIELD OF APPLICATION

This code sets down minimum design requirements to be met when dealing with seismic situations, that is, situations in which the earthquake action is considered as a critical action in conjunction with other permanent or variable actions.

The aim of seismic design is:

- To save human lives
- To ensure the continuation of vital services
- To minimise property loss

The code applies to reinforced concrete buildings for ordinary uses, having structural resisting systems belonging to one of the three types as defined below:

Frame System: A system in which both vertical loads and lateral forces are resisted by space frames.

Wall System: A system in which both vertical loads and lateral forces are resisted by vertical structural walls, either simple or coupled. A coupled wall is composed by two or more simple walls, connected in a regular pattern by adequately reinforced ductile beams ("coupling beams")

Dual System: A system in which support for the vertical loads is essentially provided by a space frame. Resistance to lateral action is contributed in part by the frame system and in part by structural walls, isolated or coupled.

Other structural systems, not included in the above classification (eg. inverted pendulum structures, flat slab systems, etc.) can be designed subject to a documented proof that they satisfy all the requirements of this code.

Buildings having special characteristics or buildings involving high induced risk (eg. chemical or nuclear facilities) are outside the scope of this code.

2 REQUIREMENTS

2.1 Structural Safety

The entire structure and all its elements, including the main structural system designed to resist the total seismic action, as well as any secondary connected system not possessing a seismic resistance of its own, must retain their integrity and a residual capacity after the seismic action has ceased.

2.2 Serviceability

It is required that the building as a whole, including structural and non structural elements, be protected with adequate reliability against the occurrence of damages and limitations of use as a consequence of the seismic action.

3 DESIGN CRITERIA

3.1 Definitions

Design criteria comprise the set of operations to be performed in order to satisfy the general requirements set forth in ch. 2. These operations include:

- Consideration of the relevant limit-states of structural behaviour, and checking of these limit-states by means of analytical procedures based on appropriate models and values of actions and resistances.

- Detailing of structural elements according to the provisions contained in this code.

  Adopting quality assurance procedures both in the design and construction processes.

3.1.1 Stability

Stability verifications include rigid body equilibrium (sliding and overturning) and foundation stability. Foundation systems have to be dimensioned so that the soil strains will remain essentially elastic, that is without appreciable residual deformations.

3.1.2 Collapse Mechanism

The provisions of this code have been developed on the assumption that structures should resist earthquake actions by means of a stable, non linear energy dissipating response mechanism. This aim will be achieved by following the dimensioning rules of the various elements in ch. 4.

3.1.3 Strength and Ductility

Critical regions (i.e. where most of the energy dissipation is expected) must be provided by an appropriate balance of these properties, both of them contributing to safety and serviceability. Specific analytical provisions, which take into account the influence of cumulative damage and degrading of mechanical properties are given in chs 4 & 5.

3.1.4 Limiting of Deformations

The amplitude of the structure's deformation under the design forces shall be limited in accordance with cl. 4.5.4.

3.1.5 Global Ductility

Use of appropriate materials (cl. 4.1) as well as of experimentally validated detailing arrangements (ch. 5) contribute to ductile behaviour at least as significantly as the available analytical procedures.

3.1.6 Quality Assurance

Attention should be paid to the correspondence between the structural model adopted for the analysis and the actual structure, considering all the elements, either structural or not, which could alter the predicted behaviour

Checks of good workmanship in the detailing should be carried out, especially in those areas indicated as critical by the designer (extremities of columns and beams, bases of walls, lintels, etc.)

3.2 Reliability Differentiation

Target reliabilities shall be established on the basis of the consequences of failure, in which monetary and non monetary losses are included, depending principally on their use and the importance of their functions.

Structures are divided into five different reliability levels. According to the required protection, the structures will be classified as follows:

Class I Buildings whose destruction could have disastrous consequences - like nuclear power stations, toxic flammable chemicals storage buildings, dams - or buildings over 15 floors or very important buildings.

Class II Buildings or places of mass meetings - cinemas, theatres, big recreation halls etc. - or buildings of great importance to the community - schools, hospitals, airports, fire stations etc. or industrial buildings with exceptionally expensive equipment.

Class III Houses, flats, restaurants, hotels, industrial establishments and other permanent buildings that do not belong to classes I and II.

Class IV Auxiliary buildings and agricultural establishments.

Class V Temporary constructions whose possible destruction does not endanger human lives.

The different reliability levels apropriate for each class shall be obtained by multiplying the design action with a factor I, called "importance factor", given in Table 3.2.

Class	I	Comments
I	-	not covered by the code
II	1.5	
III	1.0	
IV	0.5	
V	-	no need for seismic analysis

Table 3.2

In addition or as an alternative to the use of the factor I, checking of specific limit-states relevant to damage or loss of function can be required for certain types of buildings.

3.3 Ductility Levels

Structural systems covered by this code can be designed for different "ductility levels", according to the following classification.

Ductility level I (DL I) - This level includes structures designed to the ordinary concrete code with the few additional requirements on detailing contained in ch. 5.

Ductility level II (DL II) - For this level specific seismic provisions are to be adopted, enabling the structure to enter the inelastic range of response under repeated reversed loading while avoiding premature brittle-type failures.

Ductility level III (DL III) - For this level special procedures for the evaluation of the design actions and for the proportioning and detailing of the elements are to be adopted to ensure the development of selected stable mechanisms associated with large energy - dissipation capacities.

The greater the ductility level conferred to a structure, the lower is the seismic action to be considered for the design, as quantified by the value of the "behaviour factor" K. (cl. 4.1.3)

4 METHODS OF ASSESSMENT

4.1 Basic Data

4.1.1 Material Characteristics

4.1.1.1 Concrete

Normal aggregate concrete shall satisfy the following minimum requirements:

Ductility level	DL I	DL II	DL III
Minimum Grades	C10/20	C20/25	C25/30

Table 4.1.1

4.1.1.2 Steel

DL I and DL II Structures

Steel properties shall be in accordance with the requirements contained in the Code for Reinforced Concrete

DL II) Structures .

The following additional requirements shall be satisfied:

a) It must be proven that the steel used possesses adequate ductility under repeated reversed deformations.

b) Steel grades higher than S400 shall not be used unless it is demonstrated that the use of higher grades in special sectional arrangements does not affect unfavourably the ductility.

c) The actual yield stress shall not exceed its nominal value by more than 15%.

d) The ratio of the mean value of the ultimate strength to the actual yield stress shall not be less than 1.25 for S220 and 1.15 for S400.

e) Only high bond steel shall be used for flexural reinforcement, unless adequate provisions are taken to ensure bond and anchorage.

4.1.2 Material Safety Factors

Design values of strength for concrete and steel shall be obtained from their respective values by using the factors:

Concrete: $\gamma_c = 1.5$ Steel: $\gamma_s = 1.15$

4.1.3 Structure Behaviour Factors

The values of the behaviour factor K, defining the intensity of the design action (cf. 6.4.4) as a function of the structural type and of the selected ductility level, are given in Table 4.1.3.

	DUCTILITY LEVEL		
STRUCTURAL SYSTEM	DL I	DL II	DL III
Frame	2	3.5	5
Wall & Dual	2	3	4

Table 4.1.3
Structure Behaviour Factors

The values of K in Table 4.1.3 for wall & dual structures apply if at least 50% of the lateral force in both directions is resisted by coupled walls. If this condition is not satisfied, the K values shall be reduced by a factor of 0.7.

Ductility level I is permitted only for Class III, IV, and V structures.

Class II structures to be built in high seismicity areas shall be preferably designed for DL III. If appropriate, for greater safety, K values for DL II could also be used in this case.

4.1.4 Design Load Combination

The fundamental combination of load effects to be used for all the limit-states verifications is:

$$S_d = S(G+E+\psi Q) \qquad (4.1.4)$$

where:

G: includes all the permanent loads at their nominal value.

E: is the design seismic action as defined in cl. 5.4.4.

Q: are all the variable loads at their nominal values, whose duration of application is long enough for the probability of their joint occurrence with earthquake action being not negligible.

ψ: factor determining the percentage of variable loads to be considered in seismic analysis. Values for ψ are given below.

Type of Construction	ψ
Roofs and Ceiling,	0
Houses, Apartments, Offices, Hotels etc.	0.25
Public halls, Hospitals, Schools, Mass meeting areas etc.	0.50
Storage rooms, Refrigerators, Factories	0.75
Tanks, Water towers etc.	1.00

Table 4.1.4 Fraction of Variable Loads to be Considered in Seismic Analysis

The estimate of the seismic action will be based on all loads of gravity appearing in equation 4.1.4.

4.2 Structural Analysis

4.2.1 Building Configuration

Allowable methods of structural analysis shall be different for buildings which according to the definition given in this chapter are classified as "regular" or "irregular".

Regular buildings can be designed according to the simplified methods of analysis (indicated as equivalent static analysis), described in cl. 4.2.4 provided that their height does not exceed 50m and the fundamental period is shorter than 2 seconds.

If these conditions are not satisfied or if the building is of the irregular type, the dynamic method in cl. 4.2.5 shall be applied.

In irregular buildings the application of the equivalent static method in the following cases is allowed as an exception:

a) In buildings of Class III and IV up to three storeys.

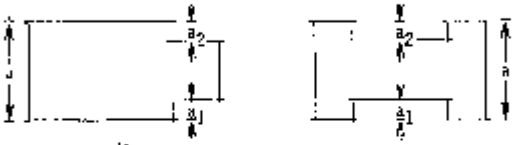
b) In Class III buildings, including those of more than three storeys, provided factor K from Table 4.1.3 is decreased by 25%

In irregular buildings of Class II analysis by the dynamic method should be applied.

A building shall be classified as regular when the following conditions, in both plan and vertical configuration are satisfied.

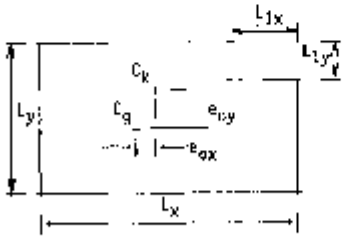
4.2.1.1 Plan Configuration

The building has an approximately symmetrical plan configuration with respect to at least two orthogonal directions along which the earthquake resisting elements are oriented. When re-entrant corners are present, they do not exceed 25% of the building's external dimensions.



$a_1 + a_2 < a/4$

At any storey the distance (measured in the direction orthogonal to that of the seismic action) between the centre of mass and that of stiffness does not exceed 15% of the "resilience radius", defined as the square root of the ratio of the storey torsional and translational stiffness.



$$\frac{l_{1x}}{L_x} \leq 0.25 \text{ or } \frac{L_{1y}}{l_y} \leq 0.25$$

$$\frac{e_{oy}}{r_x} < 0.15 \quad r_x^2 = \frac{K_t}{K_x}$$

$$\frac{e_{ox}}{r_y} < 0.15 \quad r_y^2 = \frac{K_t}{K_y}$$

$$K_x = \Sigma K_{xi} \quad K_y = \Sigma K_{yi} \quad K_t = \Sigma (K_{xi} y_i^2 + K_{yi} x_i^2 + T_i)$$

where:

K_{xi}: stiffness of element ir direction x
K_{yi}: stiffness of element ir direction y
x_i: distance of element in direction x fron the elastic centre
y_i: distance of element in direction y fron the elastic centre
T_i: torsional stiffness of element around its axis

4.2.1.2 Vertical Configuration

The stiffness and mass distributions are approximately uniform along the building height. Change of stiffness of 50% in two consecutive floors is considered an irregular arrangement.

In frame structures, the ratio between actual shear capacity (sum of the shear forces contributed by all vertical elements at their design strengths) and the design shear does not differ more than 20% for any two storeys of the building.

In the case of gradual setback along its height, the setback at any floor is not greater than 15% of the plan dimension in the direction of the setback. This clause need not be complied with if the setback occurs within the lower 20% of the total height or within the first 6m from the ground or in the last storey.

4.2.1.3 Importance of Regularity

Regularity (generally meaning a strong, symmetrical plan shape and uniform mass and stiffness distribution) is by itself a very desirable property, because it naturally leads to an effective, economical and more predictable seismic behaviour.

Also, because there are many uncertainties, the actual behaviour of irregular buildings is difficult to predict even with the use of complicated mathematical models. Thus, non-symmetrical arrangements lead to major torsional effects resulting in concentrations of ductility demand in some elements that can therefore change into critical points for the global stability of the building.

Equally dangerous ductility demand concentrations can occur due to discontinuities in stiffness and/or strength of the structural system along the height, as produced by a softer intermediate storey or by a sudden variation of the building plan dimensions.

4.2.2 Application of Seismic Action

Horizontal Action

The seismic actions shall be applied to the building in the directions producing in each element the most unfavourable effect.

In buildings having one axis of structural symmetry the seismic action can be assumed as acting separately along this axis and its orthogonal direction.

Vertical Action

The vertical component of the seismic action shall be considered in the design of non vertical cantilevers and in cases of large concentrated loads.

4.2.3 Analytical Model

The determination of the seismic effects on the structure shall be based on an idealised mathematical model which is adequate for representing the actual behaviour: the model shall also account for all the non-structural elements that can influence the response of the main resisting system.

The interaction between structural and non-structural elements is generally considered undesirable and should, wherever possible, be reduced or avoided.

For the purpose of the present code, the determination of the load effects due to design forces may be based on a linear elastic model of the structural system.

4.2.4 Equivalent Static Analysis

The equivalent static analysis can be adopted for buildings classified as regular according to 4.2.1 provided their height does not exceed 50m and the fundamental period is not greater than 2 seconds. These limits are given because in buildings with greater fundamental period (generally higher buildings) the effect of higher modes of vibration increases.

4.2.4.1 Horizontal Design Forces

The design lateral force to be applied at each floor level, in the direction being analysed, shall be given by:

$$F_i = C_d \cdot v_s \cdot W_i \qquad (4.2.4.1.1)$$

where:

C_d=Design seismic coefficient, equal in value to the design response spectrum as given in cl. 6.4.4.

v_s=Distribution factor depending on the height of floor i, measured from the building base.

W_i=Total gravity load at floor i.

The fundamental period of the building, which is required for the evaluation of C_d, shall be calculated using the elastic properties of the structure by ordinary methods of mechanics, taking into account all the elements which contribute to the building stiffness.

For frame structures an approximate expression of the fundamental period, based on analytical and experimental results is:

$$T = N/12$$

where N is the number of storeys.

In various cases, a sufficiently accurate estimate of the period can be obtained with reference to an "equivalent" uniform cantilever, whose period is given by the expression:

$$T = 1.8\pi\left(\frac{mh^4}{EJ}\right)^{\frac{1}{2}}$$

where:

m is the building mass per unit height
-h is the height of the the building from the foundation level
-EJ is the flexural stiffness of the "equivalent" cantilever

In case the period is not calculated, C_d shall be taken as:

$$C_d = I.\ Amax.\alpha\ \frac{1}{K}$$

where:

-I = Importance factor cl. 3.2.
Amax= Maximum ground acceleration cl. 5.2.
α = Spectrum factor cl. 6.4.1.
-K = Factor of behaviour cl. 4.1.3.

The distribution factor Y_i is given by the following expression:

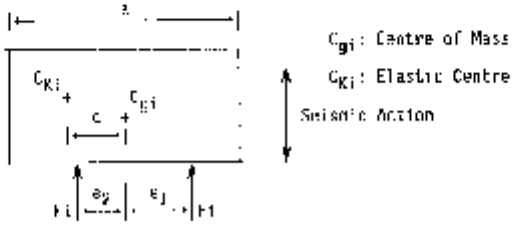
$$Y_i = h_i\ \frac{\Sigma N_i}{\Sigma W_i h_i}$$

where h_i is the height of floor i from the foundation level.

4.2.4.2 Torsional Effects

At each floor of the building the lateral design force shall be assumed to be displaced from its nominal location at the distances e_1 and e_2 as illustrated in the figure below, whichever is most unfavourable for every member to be checked. The expressions for e_1 and e_2 are:

e_1=0.5d+0.05a e_2=0.05a



The total shear force and torsional moment at the generic floor shall be distributed to the various resisting elements below that floor with due consideration of their relative stiffness as well as of the stiffness of the diaphragm.

Symmetrical Cases

Where complete symmetry of stiffness and mass about one axis parallel to the direction of seismic action exists, torsional effects can be accounted for by means of the following simplified procedure:

- The lateral design force shall be applied at the floor centre of gravity to be distributed to various elements as above.

- The actions in each of the elements shall be further multiplied by a factor ξ defined as:

$$\xi = 1+0.6\,\frac{x}{a}$$

where x is the distance of the element from the floor centre of gravity, measured perpendicularly to the direction of the seismic action.

4.2.4.3 Second-Order Effects

Second order effects on storey shears and moments need not to be considered when the following condition is satisfied at every floor.

$$\theta = \frac{W.\Delta el.K}{V.h} \leq 0.10$$

where:

θ= Deformability index ie. the ratio of the second order moment to the moment due to the shear force on the storey.
V= Seismic design shear force acting across the storey considered.
Δel=Elastic interstorey drift due to the design actions.
K= Behaviour factor. (cl.4.1.3)
h= Floor height.
W= Total gravity load above the considered storey.

It is to be recalled that under the action of a critical earthquake the structures are expected to undergo large inelastic dynamic displacements and a state of collapse can be reached if the deformations are excessively increased due to the effects of the 2nd order terms.

Since the prevailing contribution to these terms is given by the inelastic part of the deformation, the best remedy against collapse due to instability is to strengthen the structure so as to reduce the amount of the inelastic demand for displacement.

The deformability index θ shall not in any case exceed 0.15.

For $0.10 < \theta \leq 0.15$ second-order effects shall be accounted for by means of one of the statical methods indicated in ch. 14 of the code for concrete. In these limits it has been considered that an elastic static approach, although conceptually inappropriate, could all the same serve the purpose of providing extra strength.

4.2.5 Modal Analysis Procedure

4.2.5.1 Modelling

If the building can vibrate in two orthogonal directions without significant coupling, it can be analysed by means of two separate planar models, one for each orthogonal direction. This condition is assumed to occur when cl. 4.2.1.1, paragraph 2, is satisfied. When the above requirement is not complied with the model shall account for the non-planar motion of the structure.

For the purpose of determining the global inertia forces acting at each floor the building can be modelled as a system of masses lumped at floor levels, each mass having two translational and one rotational degrees of freedom in the case of spatial model.

The number of lumped masses should be consistent with the desired number of vibration modes to be used. In general, the number of degrees of freedom should be at least double the number of vibration modes that can be determined with accuracy.

Once the global forces are obtained, they shall be distributed to the various vertical resisting elements (frames, walls, etc.) with due consideration of the relative stiffness of the vertical components and the diaphragm.

4.2.5.2 Modes

In the case of planar models, the analysis shall include for each of the two orthogonal axes at least the lowest three modes of vibration or all modes of vibration with periods greater than 0.4 seconds, whichever is greater

For non-planar models the analysis shall include for each direction of application of the seismic action at least four modes, two of them predominantly translational and two of them predominantly rotational, or all modes of vibration with periods greater than 0.4 seconds whichever is greater.

The modes considered shall be those with the greatest participation coefficients for the direction under consideration.

4.2.5.3 Combination of Modal Responses

The response quantities (force, displacements etc.) separately obtained for each mode shall be combined to obtain their corresponding design values by taking the square root of the sum of the squares of modal values.

4.2.5.4 Torsional Effects

At each floor of the building the mass contributing to inertia forces shall be assumed to be displaced from its nominal location by the amount $\pm 0.05a$, whichever is more unfavourable for the element to be checked, a being the dimension of the building in the direction orthogonal to that of the considered seismic action.

When the building is analysed by means of planar models (cl. 4.2.5.1) torsional effects can be accounted for by increasing the action effects due to the translational oscillations of the building by the factor defined as:

$$\xi = 1 + 0.6 \frac{x}{a}$$

where x is the distance of the planar element considered from the floor centre of gravity, measured perpendicularly to the direction of the seismic action.

4.2.5.5 Second-Order Effects

Clause 4.2.4.3 applies.

4.3 Design Actions

Structural elements shall be dimensioned and verified (see cl. 4.4) for the design actions as defined in the present chapter.

Design actions derive from the actions obtained from the structural analysis in cl. 4.2 above, appropriately modified for the selected design ductility level.

DL I structures shall be dimensioned directly on the basis of the results of structural analysis, with a possible redistribution of action effects as permitted in the code for concrete.

The difference between DL II and DL III design procedures lies essentially in the use, for the latter, of partial factors γ_{rd}. These factors are meant to ensure, as implied in the definition of DL III (cl. 3.3), the development of stable mechanisms associated with large energy dissipation capacities.

Factors γ_{rd} are used to amplify action effects, namely bending moments, when those latter become, through the laws of static equilibrium, actions by which other actions are to be calculated.

These derived action effects include:

- Shear forces in beams
- Shear forces in columns
- Shear forces in walls
- Column bending moment at sections adjacent to beam-column joints
- Shear forces and bond stresses in joint cores.

4.3.1 Ductility Levels II and III:

4.3.1.1 Elements Subject to Bending ($N_d \leq 0.1 A_g \cdot f_{cd}$)

Bending Moments

The design bending moments shall be those obtained from the linear analysis of the structure for the load combination given by equation 4.1.4. Redistribution according to the code for concrete cl. 8.3 is permitted.

Columns not carrying significant vertical loads behave similarly to beams. Thus, for axial loads below the commonly accepted limit of $N_d = 0.1 A_g . f_{cd}$, the provisions for beams apply to columns also.

N_d is the element axial force in the most unfavourable load combination including the seismic action.

Shear Forces

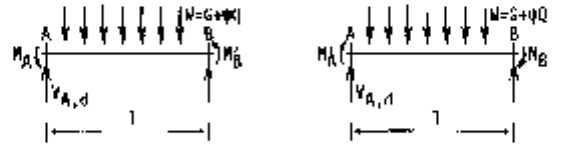
The design shear forces shall be determined from the condition of static equilibrium of the element subjected to the relevant transverse load, if any, and to a rational combination of the end moments. The latter shall correspond to the design flexural strength of the end sections based on the actual reinforcement provided. For DL III structures these values will be multiplied by a factor γ_n=1.25.

At each end section, two values of shear force shall be calculated, ie. the maximum and minimum value, corresponding to positive and negative moment yielding at hinges.

The algebraic ratio between the maximum and minimum values of shear force at a section shall be denoted by ζ.

For the purposes to follow, the value of ζ should not be taken smaller than minus one.

With the notations and signs shown in the following figure, the maximum and minimum shear forces at A will be:



$$V_{A,c} = V_A + \frac{M_A + M'_B}{l} \qquad \zeta . V_{A,d} = V_A - \frac{M'_A + M_B}{l}$$

With the end moments at their design ultimate values.

For DL III structures these values will be multiplied by a factor γ_n = 1.25.

4.3.1.2 Elements subject to Bending and Axial Force

Axial forces and bending moments

The axial forces and bending moments to be used for column design shall be determined by considering all the possible unfavourable combinations as obtained from a linear analysis of the structure for the load combination given by equation 4.1.4 eventually redistributed according to the code for concrete, cl. 8.3.

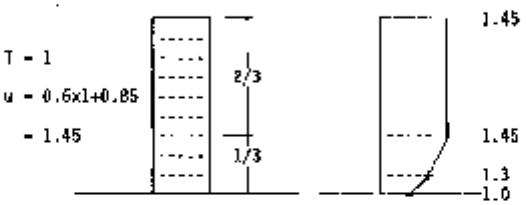
The bending moments thus obtained shall be further modified as required by the following clause.

For regular structures, three storeys or higher, to which the equivalent static analysis has been applied, the column moment due to the lateral forces alone shall be multiplied by the dynamic magnification factors ω as given by the following expressions.

Planar Frames: $\omega = 0.6T + 0.85$ $\quad (1.3 \leq \omega \leq 1.8)$
Spatial Frames: $\omega = 0.5T + 1.10$ $\quad (1.5 \leq \omega \leq 1.9)$

where T is the fundamental period of structure.

The values of the dynamic factor ω as given by formulae above are applicable to storeys within the upper two thirds of the building height. Below this level a linear variation of ω should be assumed. The value at first floor level should be taken as 1.3 and 1.5 as appropriate to planar and spatial frames.



In addition to the above, column moments shall satisfy the condition on the relative strength between columns and beams framing into a joint, see cl. 4.4.1.3.

Shear forces

In evaluating the design shear forces from the condition of static equilibrium, the design end moments shall be the most adverse ones (ie, those producing the maximum shear force) obtained from the analysis of the structure under code load combination (equation 4.1.4) modified, if appropriate, by the dynamic magnification factors. For DL III structures they will be multiplied by a factor γ_n=1.10 as well.

4.3.1.3 Beam-Column Joints

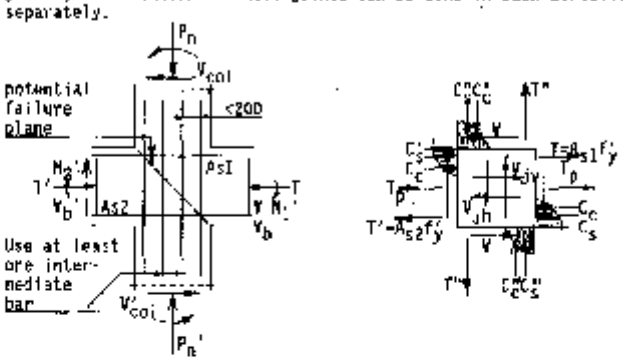
No explicit evaluation of the internal forces in the joint is required for DL II structures.

DL III Structures

The design bending moments shall be obtained by multiplying the design flexural strength of the end sections by a factor γ_n = 1.25, except where plastic hinges in columns are allowed (cl. 4.4.1.3). The axial force on the beam shall be the minimum corresponding to the seismic design forces.

Results of actions, - column moment and shear force, horizontal and vertical shear forces in the core of the joint - shall be calculated by a rational analysis taking into account the effect of all the forces acting on the joint's equilibrium.

When two frames which are not on the same plane have common joints, verification of these joints can be done in each direction separately.



The simplified formula

$$V_{jh} = \gamma_n (A_{s1} + A_{s2}) f_{yd} \left(1 - \frac{2h_b}{l_c + l_c'}\right) \qquad (4.2.1.3)$$

where l_c, l_c' are the heights above and below the column, gives a conservative value of the horizontal shear force on the joint when

$$\frac{h_c}{l_1} \geq 0.08, \qquad \frac{l_2}{l_1} \geq 0.7$$

where l_1, l_2 are the spans of the beams. The vertical shear force is given approximately by the formula

$$V_{jv} = V_{jh} \frac{b_b}{h_c}$$

4.3.1.4 Structural Walls

The design actions shall be obtained from a linear analysis of the building under the code load combination (equation 4...4) modified as appropriate in accordance with cl. 4.3.1.4 1/2/3/4/5 below.

4.3.1.4.1 Redistribution

The distribution of the total force to the various walls as obtained from the elastic analysis, may be subsequently modified, provided the global equilibrium is maintained and the maximum value of the action in any wall is not reduced by more than 30%.

In a coupled wall, the elastic shear forces in the coupling beams can also be modified, with a maximum reduction of 20% provided that corresponding increases in the shear capacities of beams at other floors are made.

4.3.1.4.2 Bending Moment Design Envelope

The design moments along the height of the wall shall be those given by a linear envelope of the calculated moment diagram, vertically displaced by a distance equal to the horizontal length of the wall.

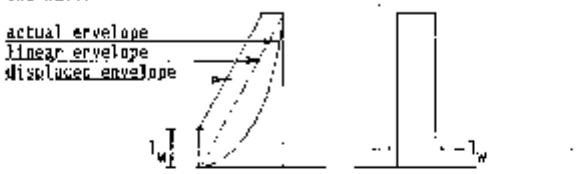


fig. 4.3.1.2 Bending moment design envelope

4.3.1.4.3 Earthquake Induced Axial Load in Coupled Walls

The design axial load in the walls due to the lateral action shall be computed using the shear strengths of the coupling beams above the section considered, calculated by using characteristic values of concrete and steel strength.

The shear strength of the beams thus calculated shall be further amplified by a factor of 1.25 to account for possible unfavourable increase of the beam strength with respect to the design values.

4.3.1.4.4 Dynamic Magnification Factors

In case the equivalent static analysis is adopted, the shear forces in the walls shall be magnified by the dynamic amplification factor ω as given by the expression below for buildings up to 5 storeys high:

$$\omega = 0.1N+0.9$$

where N is the number of storeys.

For walls taller than five storeys, ω shall be linearly increased up to the value of ω=1.8, for N=15

4.3.1.4.5 Shear Forces (DI III Structures Only)

a) The design shear forces in walls shall be compatible with the actual flexural strength that can be possibly developed at the wall base. This shall be obtained by multiplying the shear forces due to code loading by the following γ_n factor:

$$\gamma_n = M^+_{u,c}/M_d$$

Where M_d is the design moment obtained from the analysis, and $M^+_{u,d}$ is the flexural strength of the section on the basis of actual reinforcement provided, calculated by using the characteristic values of concrete and steel strengths.

In evaluating the flexural strength of the base section the appropriate axial load shall also be considered.

b) The factor γ_n need not to be taken greater than 4.

4.4 Dimensioning and Verification

4.4.1 Linear Elements

4.4.1.1 General

The design strengths of the structural elements in bending, bending with axial force, shear and torsion shall be evaluated in accordance with the code for concrete except as modified by provisions in the present cl. 4.4.1.

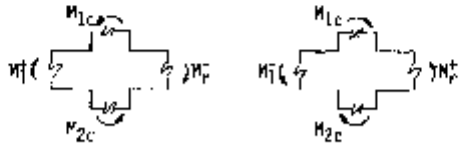
4.4.1.2 Limiting Axial Load

For ductility reasons the design axial compression load under the most severe load combination including the seismic action shall not exceed the following limit:

$$0.5 A_g \cdot f_{ck}$$

4.4.1.3 Beam-Column Strength Ratio

Except for cases where hinge formation in columns is permitted (see below) at any beam-column joint the sum of the absolute values of the design ultimate moments of the columns (under the most unfavourable value of the axial force) shall not be less than the sum of the absolute values of the design ultimate moments of the beams framing into that joint.



$\Sigma|M_{1c}| > |M^-_l| + |M^-_r|$ $\quad \Sigma M_{1ci} > |M^-_l| + |M^+_r|$

4.4.1.3 Beam-column Strength Ratio

Development of plastic hinges in columns should be avoided because sources of energy dissipation should be located in beams rather than in columns. Attention is called to the potentially dangerous, yet rather commonly adopted, 'soft first storey' concept. The be-

haviour of this type of building is difficult to control, because of its marked sensitivity to both the structural and ground motion characteristics.

For the above reasons this solution, which is not included in the structural types covered by this code, can be designed if design forces are increased by 50% and special detailing provisions for soft first storey columns satisfying DL III demands are adopted.

DL III Structures

For columns of DL III structures, the design bending moments shall account for the possible increase in strength of the beams connecting at the joint. Unless otherwise justified, the global strength increase can be assumed as $\gamma_n = 1.5$ and is applicable to all storeys, including the column bases in the ground floor.

Development of plastic hinges in columns and of columns hinge mechanisms (ie. exception from the prescription on beam-column strength ratio) is permitted in the following cases:

- For frames having four or more columns, hinging is permitted to occur in one column for every three others remaining elastic.

  Column hinge mechanisms are permitted in single and two-storey buildings and in the top storey of a multi-storey building.

4.4.1.4 Resistance to shear

4.4.1.4.1 Contribution of Concrete

The magnitude of the term: V_{cd} expressing the design resistance contributed by concrete (Code for Concrete Cl. 11.2.2, equation 11.8) shall be taken as follows:

a) When $N_d \leq 0.1 A_g . f_{cd}$ shall be assumed to be zero where stirrups are required in accordance with cl. 4.6.1.3 (except case c).

b) When $N_d > 0.1 A_g . f_{cd}$ shall be computed by the expression:

$$V_{cd} = 2\tau_{Rd} . b_w . d . \beta_1 \qquad (4.4.1.4.1.1)$$

where the values of τ_{Rd} and β_1 are given in the code for concrete as functions of the concrete grades (Table 11.1 equation 11.3).

4.4.1.4.2 Transverse Reinforcement

1. $N_d \leq 0.1 A_g . f_{cd}$: Two cases shall be considered, depending on the value of the ratio ζ.

a) $\zeta > 0$: The resistance to shear provided by the reinforcement V_{wd} shall be assessed on the basis of the truss model, in accordance with the procedure given in the code for concrete cl. 11.2.

b) $\zeta < 0$: Here reversal of shear takes place.

- The same requirements as in a) exist when V_{sd} does not exceed the limit value V_{Rd1} where:

$$V_{Rd1} = 3\ (2+\zeta)\ \tau_{Rd} \cdot b_w \cdot d$$

- For V_{sd} exceeding the limit value V_{Rd2} where:

$$V_{Rd2} = 6\ (2+\zeta)\ \tau_{Rd} \cdot b_w \cdot d$$

the entire shear shall be resisted by diagonal reinforcement across the web. Steel bars inclined in two directions shall balance with their compression and tension components the shear forces of opposite sign V_{sd} and $\zeta . V_{sd}$ occurring at the section.

For $V_{Rd1} < V_{sd} < V_{Rd2}$

one half of the maximum shear force shall be carried by doubly diagonal bars, the other half by transverse reinforcement.

II. $N_d > 0.1 A_g f_{cd}$ - The resistance to shear shall be checked as for the case I. a).

4.4.2 Beam-Column Joints (DL 13f Structures Only)

4.4.2.1 Horizontal Joint Shear

4.4.2.1.1 Nominal Horizontal Shear Stress

The nominal horizontal shear stress in the joint as given by the following expression

$$\tau_{jh} = \frac{V_{jh}}{b_j h_j} \qquad (4.4.2.1.1)$$

shall not exceed the value $20\tau_{Rd}$.

The effective joint width b_j shall be taken as:

a) When $b_c > b_w$ either $b_j = b_c$
or $b_j = b_w + 0.5h$ whichever is smaller.

b) When $b_c < b_w$ either $b_j = b_w$
or $b_j = b_c + 0.5h_c$ whichever is smaller.

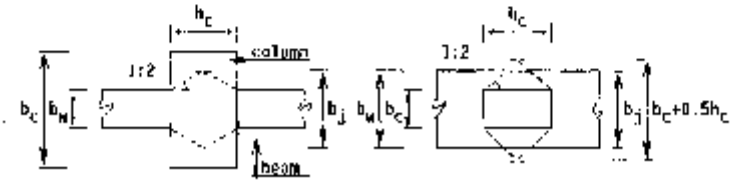


fig.4.4.2.1.1 Effective Joint Width

4.4.2.1.2 Mechanisms of Joint Core Shear Resistance

Two mechanisms for transmission of the horizontal shear force V_{jh} through the joint core are in general possible:

a) A diagonal concrete strut across the compressed joint corners carrying a shear force V_{ch}.

b) A truss mechanism consisting of horizontal stirrups and diagonal concrete struts carrying a shear force V_{sh} where:

$$V_{sh} + V_{ch} = V_{jh} \qquad (4.4.2.1.2.1)$$

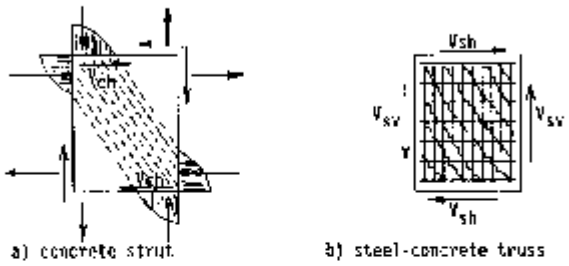


fig. 4.4.2.1.2 Mechanisms of shear resistance

4.4.2.1.3 Shear Force Carried by Concrete

The value of shear force carried by the concrete strut, V_{ch}, shall be assumed zero except for the following:

a) When the minimum average compression stress on the gross concrete area of the column above the joint, exceeds $0.1f_{ck}$:

$$V_{ch} = 2\eta_{Rd}\sqrt{\sigma_{cm}\cdot 0.1f_{ck}}\cdot b_j\cdot h_c \qquad (4.4.2.1.3.1)$$

b) When the design precludes the formation of any beam plastic hinge at the joint, or when all beams of the joint are detailed so that the critical section of the plastic hinge is located at a distance from the column face not less that h_b or for external joints where the flexural steel is anchored outside the column core in a beam stub

$$V_{ch} = \frac{A'_s}{A_s}\frac{V_{jh}}{2}\left(1 - \frac{N_d}{0.4A_g\cdot f_{ck}}\right) \qquad (4.4.2.1.3.3)$$

where the ratio A'_s/A_s of the compression to the tension longitudinal beam reinforcement shall be taken larger than 1.0.

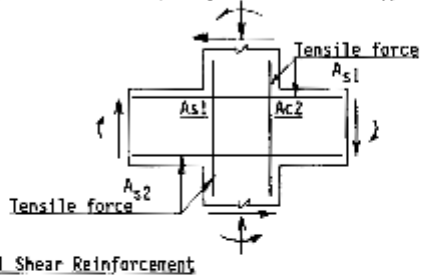
When the axial column load results in tensile stresses over the gross concrete area exceeding $0.2f_{ck}$ the entire joint shear shall be resisted by reinforcement.

For axial tension smaller than this limit the value of V_{ch} may be linearly interpolated between zero and the values given by equation 4.4.2.1.3.3 with N_d taken as zero.

c) When parts A_{a1} and A_{a2} of the tensile reinforcement A_{s1} and A_{s2} of the adjacent beams are bent vertically and anchored in the tensile face of the column:

$$V_{ch} = A_a \frac{f_{yk}}{\gamma_s} \qquad (4.4.2.1.3.4)$$

where A_a is the smaller of A_{a1} and A_{a2}. The values obtained from equations 4.4.2.1.1/4 may be added where applicable.



4.4.2.1.4 Horizontal Shear Reinforcement

The horizontal shear reinforcement shall be capable of carrying the design joint shear force:

$$V_{sh} = V_{jh} - V_{ch}$$

across a corner-to-corner potential failure plane. The effective total area of horizontal reinforcement that crosses the critical diagonal plane and is situated within the effective joint width b_j, shall not be less than

$$A_{jh} = \frac{V_{sh}}{f_{yk}/\gamma_s} \qquad (4.4.2.1.4.1)$$

Horizontal sets of stirrups shall be placed as uniformly as practicable between the top and bottom beam reinforcement.

4.4.2.2 Vertical Joint Shear

4.4.2.2.1 Vertical Joint Reinforcement

The vertical joint shear reinforcement shall be able to resist a vertical shear force

$$V_{jv} = V_{cv}$$

where the value V_{cv} shall be determined from:

$$V_{cv} = \frac{A'_{sc}}{A_{sc}} V_{jv} \left(0.6 + \frac{N_d}{A_g \cdot f_{ck}}\right) \qquad (4.4.2.2.1.1)$$

where A'_{sc} and A_{sc} are the areas of longitudinal compression and tension reinforcement in columns, with the following exceptions:

a) Where axial load results in tensile stresses over the column section, the value given by eq. 4.4.2.2.1.1 with N_d taken as zero; and zero when the axial tension over the gross concrete area is $0.2f_{ck}$.

b) Where plastic hinges are expected to form in the column above or below a joint, as part of the primary seismic energy dissipating mechanism, V_{cv} shall be assumed to be zero for any value of the axial load on the column.

The required area of vertical joint shear reinforcement within the effective joint width j shall be determined from:

$$A_{jv} = \frac{V_{sv}}{f_{yk}/\gamma_s}$$

The vertical joint shear reinforcement shall consist of intermediate column bars, placed in the plane of bending between corner bars, or of vertical stirrup ties or special bars, placed in the column and adequately anchored to transmit the required tensile forces within the joint.

The spacing of vertical joint reinforcement in each plane of any beam framing into a joint shall not exceed 200mm, and in no case shall there be less than one intermediate bar in each side of the column in that plane.

4.4.2.3 Eccentric Beam-Column Joints

All design provisions of this section apply, except that in case of an eccentricity of a beam relative to the column into which it frames, as measured by the distance between the geometric centrelines of the two members, the effective joint width shall not be taken larger than

$$0.5(b_w - b_c + 0.5h_c) - e$$

4.4.3 Structural Walls

The purpose of the provisions in this chapter, as well as those in cl. 5.5 relative to detailing, is to provide walls with adequate ductility and energy-dissipation capacity through flexural yielding in clearly defined hinge zones.

In addition, the likelihood of failure due to shear or inadequate anchorage, or even the occurrence of significant shear inelastic deformations (which progressively impair the energy-dissipation capacity of the structure), is reduced to a minimum.

$$V_{cv} = \frac{A'_{sc}}{A_{sc}} V_{jv} \left(0.6 + \frac{N_d}{A_g \cdot f_{ck}}\right) \qquad (4.4.2.2.1.1)$$

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b) Where plastic hinges are expected to form in the column above or below a joint, as part of the primary seismic energy dissipating mechanism, V_{cv} shall be assumed to be zero for any value of the axial load on the column.

The required area of vertical joint shear reinforcement within the effective joint width j shall be determined from:

$$A_{jv} = \frac{V_{sv}}{f_{yk}/\gamma_s}$$

The vertical joint shear reinforcement shall consist of intermediate column bars, placed in the plane of bending between corner bars, or of vertical stirrup ties or special bars, placed in the column and adequately anchored to transmit the required tensile forces within the joint.

The spacing of vertical joint reinforcement in each plane of any beam framing into a joint shall not exceed 200mm, and in no case shall there be less than one intermediate bar in each side of the column in that plane.

4.4.2.3 Eccentric Beam-Column Joints

All design provisions of this section apply, except that in case of an eccentricity of a beam relative to the column into which it frames, as measured by the distance between the geometric centrelines of the two members, the effective joint width shall not be taken larger than

$$0.5(b_w - b_c + 0.5h_c) - e$$

4.4.3 Structural Walls

The purpose of the provisions in this chapter, as well as those in cl. 5.5 relative to detailing, is to provide walls with adequate ductility and energy-dissipation capacity through flexural yielding in clearly defined hinge zones.

In addition, the likelihood of failure due to shear or inadequate anchorage, or even the occurrence of significant shear inelastic deformations (which progressively impair the energy-dissipation capacity of the structure), is reduced to a minimum.

$$p_v = \frac{A_v}{b.s_h} = \frac{\tau_d - \tau_{cd} - N_d/A_g}{f_{yd}}$$

The vertical shear reinforcement can be assumed to fully contribute to the required flexural strength.

4.4.3.3 Coupling Beams

Coupling beams are ductile, energy-dissipating elements connecting in a regular pattern two or more walls. Symmetrical flexural reinforcement (p=p') shall be adopted in case of the usual arrangement. Design for flexure and shear shall be carried out as for ordinary beams unless the following limits are exceeded:

$\tau_d > 6\tau_{Rd}$

$$\rho = \frac{1}{4} \cdot \frac{\sqrt{f_{ck}}}{f_{yk}} \qquad (f_{ck}, f_{yk} \text{ in MPa})$$

(ρ = longitudinal reinforcement ratio, top or bottom)

in which case all flexural and shear actions shall be resisted by diagonal reinforcement in both directions.

4.4.4 Diaphragms and Stair Slabs

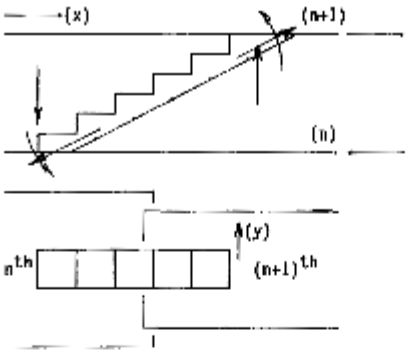
Floor systems connecting vertical seismic elements (frames, walls, cores) shall be checked for the forces to be transmitted to the seismic elements to enable them to develop their maximum capacity.

When it is shown that the forces to be transmitted do not produce yielding in a diaphragm, provisions indicated in the code for concrete apply. If yielding in a diaphragm cannot be avoided provisions for ductile structural walls and in particular, Cl. 5.5.3.1 for confining reinforcement in boundary zones, shall be applied.

Openings in diaphragms shall be so arranged that unintentional failures across weak lines do not reduce the strength of the diaphragm. Boundary elements around openings shall be provided whenever needed, with a rational assessment of their required strength.

Adequate connection must be provided between the diaphragm and the vertical seismic resistant elements. This aspect is particularly important when staircases and elevator shafts act as seismic elements since this usually involves interruption of the diaphragm.

Stair slabs (inclined) shall be appropriately designed so that relative interstorey displacements are compatible with axial and flexural rigidity of stair slabs. Axial forces, bending moments and shear forces may be developed due to relative displacements along the x-axis. Bending and shear may also be developed due to relative displacements along the y axis.



4.5 Verifications

4.5.1 Collapse Verification

For the purpose of the present code a structure shall be deemed to satisfy the safety requirements against collapse if the following conditions are met:

- The strength and stability verifications are satisfied.
- The elements are dimensioned and detailed in accordance with the rules given in chs. 4 and 5 relative to the appropriate structural type and intended ductility level.

4.5.2 Strength Verification

The following condition must be satisfied for every element:

$$S_d \leq R_d \qquad (4.5.2.1)$$

where: S_d is the design load effect on the element evaluated according to cl. 4.3.

R_d is the design strength of the element evaluated according to cl. 4.4.

4.5.3 Stability Verification

The stability verification shall be considered satisfied if:

- The deformability index θ is less than 0.1.
- For $0.1 \leq \theta \leq 0.15$ the 2nd order effects are calculated by means of one of the statical methods in ch. 14 of the Code for Concrete and added to the design forces.
- The stability verification cannot be satisfiec if $\theta > 0.15$.

4.5.4 Serviceability Verification

The elastic interstorey drift, Δ_{el}, resulting from the application of the horizontal forces specified in cl.4.2.4 or from the dynamic procedure as in cl.4.2.5, shall at any storey satisfy the condition:

$$\Delta_{el} \leq \frac{0.03D}{K} \cdot h$$

where h is the clear height of the floor.

For class III or IV buildings, the indicated limits may be increased of 50% if it can be demonstrated that the finishes adopted are not brittle-type and can accommodate without significant damage those limits.

When the limits above are exceeded separation of the non-structural elements is required, of an amount adequate for permitting an interstorey drift equal at least to

$$\bar{\Delta} = 0.35\Delta_{el}.K$$

to take place without restraint.

In no case shall the interstorey drift, Δ_{el} exceed the limit:

$$\Delta_{max} = \frac{0.025}{K}.h$$

4.5.5 Maximum Expected Displacements

The maximum expected displacements of the building shall be obtained by multiplying the displacements produced by the system of horizontal forces specified in cl. 4.2.4 or those obtained from the dynamic analysis as in cl. 4.2.5 by the appropriate values of the behaviour factor K.

5. DETAILING, CONSTRUCTION AND USE OF STRUCTURE

When there is no distinction, the requirements of this chapter apply in common for structures of DL II and DL III. Requirements for structures of DL I are always referred to explicitly.

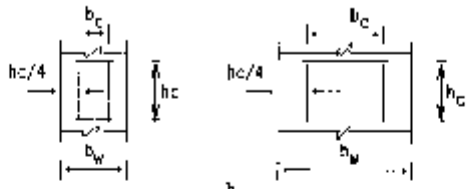
5.1 Elements Subject to Bending ($M_d \leq 0.1\ A_g.f_{cd}$)

5.1.1 Geometrical constraints

DL II and DL III Structures

The following restrictions must be satisfied, unless it is specifically proved that they are not required.

a) In order to ensure that there is effective transfer of moment from the beam to the column, the width of the beam shall not be less than 200mm or greater than the width of the column plus 1/4 of the depth of the column on each side. In no case shall the width of the beam exceed two times the width of the column.



$$b_{wmax} \leq b_c \quad \frac{h_c}{2} \leq 2b_c$$

b) In order that there is no risk of lateral buckling under non-linear response, the ratio of the width to the depth of the beam shall not be less than 0.25.

c) The behaviour of members in portal frames whose l/h ratio is less than 4, is significantly different from that of slender members. For this reason, the ratio l/h shall not be less than 4. (This requirement is not valid for coupling beams in structures with walls, cl. 4.4.3.3).

d) The eccentricity of a beam with respect to the column on which it is connected, as measured by the distance between the geometrical axes of the two elements, shall not be greater than 1/4 of the width of the column.

5.1.2 Longitudinal Reinforcement

DL II and DL III Structures

a) In every section, in order to ensure that the ultimate moment is greater than the moment of the cracked section, the compression reinforcement, top or bottom shall not be less than

$$\rho_{min} = 1.4/f_{yk} \quad (f_{yk} \text{ in MPa}) \qquad (5.1.2.1)$$

and to ensure adequate ductility it shall not be more than

$$\rho_{max} = 7.0/f_{yk} \quad (f_{yk} \text{ in MPa}) \qquad (5.1.2.2)$$

where ρ_{min} and ρ_{max} refer to the total concrete area A_g.

b) At least two bars of 12mm diameter shall be placed both at the top and bottom, along the whole length of the element.

c) In order to ensure that there is adequate ductility and strength for stress reversal, the compression reinforcement shall not be less than half the tension reinforcement, in areas where plastic joints might develop. ($\rho' \geq 0.5\rho$)

d) At least one quarter of the top reinforcement at the end of the element shall extend to the whole of its length.

e) In flanged beams with a T or L shape which are monolithic with the slab, the reinforcement that is taken into consideration near the columns, in addition to the reinforcement within the links, shall be as follows:

I. For interior columns, if there is a transverse beam which is monolithic with the column, all the reinforcement in the slab within a distance of 4 times the slab thickness on each side of the column.

II. For interior columns, in the absence of a transverse beam, all the reinforcement within a distance of 2.5 times the slab thickness on each side of the column.

III. For exterior columns, if there is a transverse beam of similar dimensions and which is monolithic with the column on which the beam reinforcement is anchored, all the reinforcement of the slab within a distance of 2 times the slab thickness on each side of the column.

IV. For exterior columns, in the absence of a transverse beam, all the reinforcement within the width of the column.

In any event, at least 75% of the required reinforcement on each side shall pass through the column or be anchored in the core of the column.

DL.I Structures

Only cl. 5.1.2 a. is required.

5.1.3 Minimum Transverse Reinforcement.

Transverse reinforcement shall be placed in accordance with the requirements of this part, unless more reinforcement is required in order to resist the shear force (cl. 4.4.2.4). The aim of the transverse reinforcement is:

- to confine the concrete in order to increase the ultimate deformation and the bending strength of the reinforcement.

- to tie the reinforcement and prevent its buckling.

- to provide shear resistance.

Regions of beams which are considered as "Critical" regions are:

a) Twice the depth of the beam, starting from the column face, towards the middle of the span, on both sides of the beam.

b) Twice the depth of the beam on both sides of a possible plastic hinge.

c) Where compression reinforcement is required.

DL II Structures

In critical regions, as defined above, the links shall be at least 8mm diameter with spacing not exceeding the minimum of the following:

a) h/4
b) 8Φl (Φl is the diameter of the longitudinal reinforcement)
c) 24Φh (Φh is the diameter of the link)
d) 200mm

The first link shall be placed not more than 50mm from the side of the column. At least one in every two separate longitudinal bars in the beam shall be restrained by a 90° bend of a link.

DL III Structures

In the critical regions, as defined above, the links shall be at least 8mm diameter with spacing not exceeding the minimum of the following:

a) h/4
b) 6Φl
c) 150mm

The minimum area of one leg of the link shall be:

$$A_{s,\,min} = \frac{\Sigma A_l . f_{yk}}{16 f_{ykt}} \cdot \frac{s}{100} \qquad 5.1.3.1$$

so as to prevent the deflection of the longitudinal bars in the event of large reverse plastic deformations.

ΣA_l - the sum of the area of the longitudinal bars restrained by the leg of the link.
f_{yk} = The ultimate strength of the longitudinal bars
f_{ykt} = The ultimate strength of the links
s = the link spacing

The first link shall be placed not more than 50mm from the side of the column.

At least one in every two separate longitudinal bars in the beam must be restrained by a 90° bend of a link.

Elements Subject to Bending and Axial force ($N_d > 0.1 A_g . f_{cd}$)

The aim of this clause is to provide the columns with adequate ductility which might prove necessary if there is a deviation from the expected static behaviour of the structure.

Observations on damage caused by earthquakes frequently indicate that corner columns are more vulnerable than interior ones, due to unforeseen torsional phenomena. It is therefore suggested that particular care in detailing shall be given to corner columns or even to make them stronger than what is required from the analysis.

5.2.1 Geometrical Constraints

Structures of D. [I

The minimum section dimension shall not be less than 250mm.

The l/b ratio shall not be greater than 25.

Structures of DL III

The minimum section dimension shall not be less than 300mm.

The l/b ratio shall not be less than:

16 for columns with moments of opposite sign at the two ends.
- 10 for cantilever columns.

5.2.2 Longitudinal Reinforcement

The reinforcement ratio shall not be less than 1% or greater than 6% even at sections where there are reinforcement connections ($1.0\% \leq \rho \leq 6.0\%$).

For steel S400 the reinforcement outside the connections shall not be greater than 4%.

When the dimensions are determined by architectural requirements, the minimum reinforcement can be reduced. When the calculated required reinforcement is less than 0.5% then the reinforcement that may be used is twice the required reinforcement. In no event shall the reinforcement be less than 0.5%.

The spacing between bars shall not be more than 250mm for structures of DL II or 200mm for structures of D. [I].

DL I Structures

The above requirements shall also be satisfied for DL I structures.

5.2.3 Transverse Reinforcement

Nominal reinforcement shall be placed throughout the height of the column, whilst special reinforcement shall be placed in critical regions, as defined in paragraph 5.2.3.1.

The reinforcement ratio which shall be used shall be as defined in this article, unless more reinforcement is required for shear resistance in accordance with cl. 4.4.1.4.

5.2.3.1 Critical Regions in columns

a) For ordinary cases, critical regions are considered to be the two ends of the column, above and below the joints and over a length from the face of the joint which shall not be less than the maximum of the following:

- the longest dimension of the section
- 1/6 of the clear height of the column
- 450mm

b) Where there is an infill wall in contact with one or both sides of a column, in part of the height of the column, then the whole length of the column shall be considered as critical.

c) In the case where part of the column is tied to a concrete wall, the untied part of the column shall be considered as critical region.

Critical regions of columns require links more closely spaced and well anchored than the rest of the column to ensure better confinement of the concrete (and hence adequate ductility), lateral support of the longitudinal bars and shear strength.

5.2.3.2 D. U Structures

Critical Regions

Special transverse reinforcement shall be placed having 8mm minimum diameter in link or spiral form.

Additional links which tie the bars which are not directly tied to the links, shall be placed in accordance with the concrete code.

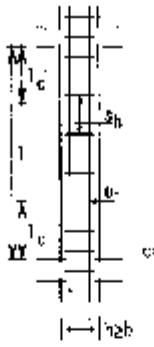
The spacing between the spirals or links shall not exceed the minimum of the following:

a) 8 times the diameter of the smaller bar of the main reinforcement.
b) 1/2 the minimum section dimension
c) 200mm.

The above transverse reinforcement shall extend throughout the height of the beam joint.

Non-Critical Regions

The minimum transverse reinforcement in the non critical regions shall be in accordance with the concrete code.



DUCTILITY LEVEL H

CRITICAL REGION l_c = max(h, l/6, 450mm)		
SPACING	CRITICAL REGION:	s=min($8\Phi_l$, b/2, 200mm)
	ELSEWHERE:	s=min($12\Phi_l$, b, 300mm)

Special transverse reinforcement: critical regions and spacing

5.2.3.3 DL [1] Structures

Critical regions

The volumetric ratio of the transverse reinforcement (spiral or links) shall not be less than the maximum of the following:

$$\rho_s = \lambda_1 \frac{f_{ck}}{f_{yk}} \qquad (5.2.3.3.1)$$

or

$$\rho_s = \lambda_2 \left(\frac{A_g}{A_c} - 1\right) \frac{f_{ck}}{f_{yk}} \qquad (5.2.3.3.2)$$

where A_g = total cross sectional area
A_c = area of confined concrete

and the values of λ1 and λ2 are given by the following table as functions of the axial loading.

$N_d/A_g \cdot f_{ck}$	0.10	0.20	0.30	0.40	0.50
λ_1	0.05	0.06	0.07	0.08	0.09
λ_2	0.18	0.22	0.26	0.30	0.34

Values of λ_1 and λ_2 in equations 5.2.3.3.1 and 5.2.3.3.2

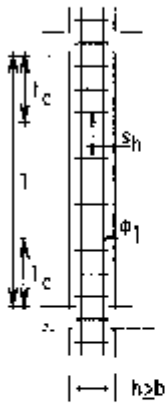
The volumetric ratio is the ratio of the volume of the spiral reinforcement or the links over the total area of the core of the concrete (measured from the exterior side of the bars) within the distance between the spirals or the links s_h. The volumetric ratio for rectangular sections is defined as:

$$\rho_s = A_{sh}/s_h \cdot h' \qquad (5.2.3.3.3)$$

where A_{sh} is the total area of the links in each of the main directions of the section, s_h is the spacing between the links and h' is the distance between the centres of the exterior bars.

The minimum diameter of the links or spiral shall be 8mm. The maximum distance between the spirals or the links shall not exceed the minimum of the following:

a) 6 times the minimum diameter of the longitudinal reinforcement.
b) 1/4 of the minimum section dimension
c) 150mm.



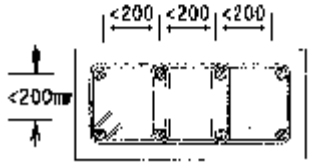
DUCTILITY LEVEL III		
CRITICAL REGION l_c= max(h, l/6, 450mm)		
SPACING	CRITICAL REGION:	s=min($6\Phi_l$, b/4, 150mm)
	ELSEWHERE:	s=min($6\Phi_l$, b/2, 200mm)

Special transverse reinforcement: critical regions and spacing

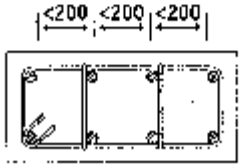
3. Every longitudinal bar or bundle of bars shall be restrained by a bend of a link of at least 135° or by additional links, except:

a) bars or bundles of bars between two bars which are restrained by the same link and their spacing is not greater than 200mm.

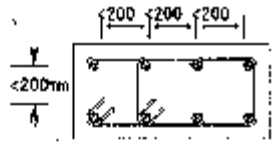
b) interior layers of bars in the core of the concrete whose center is 75mm or more from the interior side of the links.



a) Complementary ties around main reinforcement

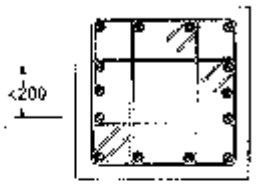


b) Complementary ties around the link

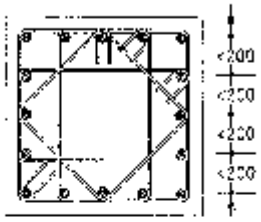


c) Two links
-preferred detail

d) Two links
-detail c preferred



e) Three links



f) Four links

4. The tensile strength of the leg of a link or additional link shall be at least 1/6 the tensile strength of the bar or bars which it restrains, including bars that are exempted by cl. 3.a.

5. The end of every additional link shall be tied to a longitudinal bar, or the peripheral link at a point next to a bar, with a bend of at least 135° and the straight part shall extend beyond the bend at least 10 times the diameter of the additional link. Additional links and legs of links shall not have in between spacing of more than 200mm or 1/4 of the dimension of the column perpendicular to the direction of the transverse reinforcement.

Non-critical regions

The requirements for critical regions of DL II columns shall apply

5.3 Beam-Column Joints

5.3.1 Confinement

DL I and DL II Structures

The horizontal transverse reinforcement in the joints shall not be less than what is required in the columns.

DL III Structures

The horizontal transverse reinforcement in the beam-column joints shall not be less than what is required in the columns apart from the case where there are beams on the four sides of the column designed in accordance with cl. 4.4.7.1.3/b or c, in which case

the transverse reinforcement of the joint can be reduced to one half of what is required in the columns, but the spacing between the links shall in no case be greater than 10 times the diameter of the bars of the column or 200mm, whichever is less.

When the width of the column is greater than the width of the joint, as defined in Cl. 4.4.2.1.1, all the bending reinforcement in the column which is required to be tied to the narrow beam shall pass within the width of the joint $b_j h_c$. Additional column longitudinal reinforcement shall be placed outside the width of the joint.

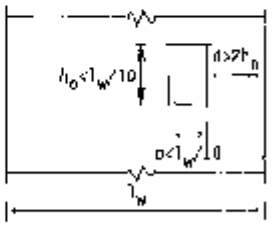
5.4 Structural Walls

5.4.1 Geometrical Constraints

The thickness of structural walls shall not be less than 150mm.

Openings in the walls which are not in a regular arrangement so as to form coupled walls shall be avoided, except if the influence on the seismic performance of the wall is negligible or specific analysis of the performance of the wall locally is made.

Openings that can be considered as negligible are those whose largest dimension does not exceed 1/10 the width of the wall and their distance from the edge of the wall or from another opening is not less than twice their height. Special reinforcement shall be placed around every opening in order to compensate for the strength of the part which is removed.

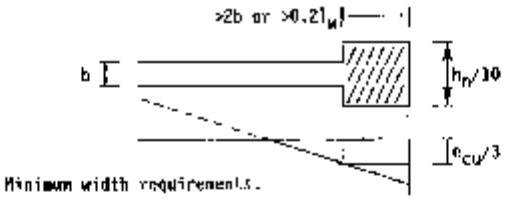


Dimensions of wall openings that can be considered negligible.

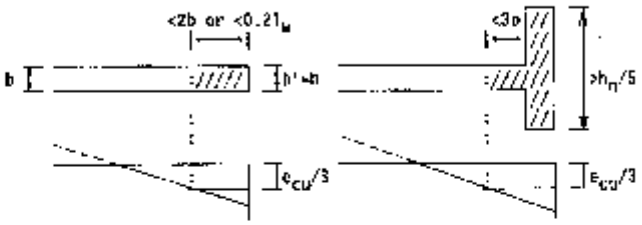
DL III Structures: In addition to the above requirements, the following shall be implemented for structures of DL III:

a) The ratio of the total height (h_w) to the length (l_w) of the wall shall not be less than 2.

b) The local thickness of a wall shall not be less than $h_o/10$, (where h_o the height of the floor) in cases where the largest compressive deformation exceeds the value $\varepsilon_{cu}/3$. The value of ε_{cu} is given in the Concrete Code, Cl. 7.1.2.



Minimum width requirements.



Exemptions from the requirements of clause 5.4.1 b.

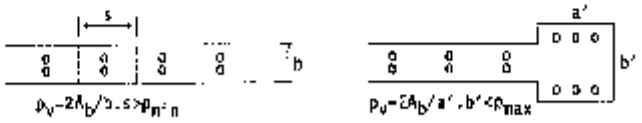
The following cases are exempted:

1) When the distance from the critical fibre, i.e. wher. $\varepsilon_c=\varepsilon_{cu}/3$, from the edge of the wall is less than 2b or $0.2l_w$, and

2) when the distance between the critical fibre and the vertical wall at which the wall ends, or from an end wall with width not less than $h_n/5$, is less than 3b.

5.4.7 Vertical reinforcement

The total vertical reinforcement shall not be less than 0.25% of the cross sectional area, or greater than 4%.



Definition of vertical reinforcement ratio

At least two layers of reinforcement shall be placed, one on each side of the wall. The reinforcement bar diameter in any part of the wall shall not exceed b/10.

The spacing between the reinforcement bars shall not exceed 300mm. When the section is required to be confined, the bar spacing shall not be greater than 200mm.

Curtailement of Bars

The vertical reinforcement shall be curtailed according to the bending moment diagram, adding the anchorage lengths of the curtailed bars.

Splicing of Bars

Vertical bar connection shall be avoided in regions where the formation of plastic hinges is expected. In no case shall connections be made in more than 1/3 of the reinforcement in these regions. Particular attention shall be placed in the connection of the main (bencing) vertical reinforcement. The connections shall be staggered and the in-between spacing in the vertical direction, shall be at least twice the overlap length.

Construction Joints

The ratio of the vertical reinforcement passing through a construction joint, shall be such that it can withstand all the shear resistance of the concrete and given by the expression:

$$\rho_v = (1.3 f_{ctm} - 0.7 \frac{N_d}{A_g}) / f_{yk} > 0.0025 \qquad (5.4.2.1)$$

where

$\rho_v = A_{st}/b_w$ with A_{st} the total vertical reinforcement including the reinforcement of the end elements which resist bending.

A_g is the total wall cross sectional area, including the end elements.

N_d is the minimum bending force in the wall. If the wall is to be subjected to tension, then N_d shall be taken as negative.

5.4.3 Horizontal Reinforcement

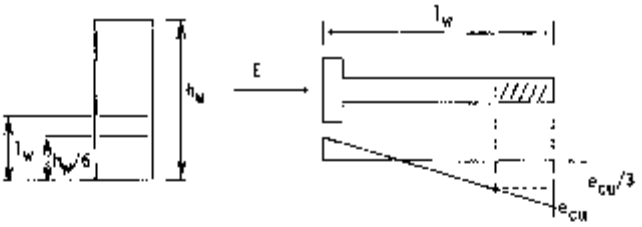
The requirements for minimum reinforcement, largest bar diameter and maximum bar spacing, shall be the same as those for the vertical reinforcement cl. 5.4.2.

5.4.3.1 Regions with Special Horizontal Reinforcement

a) Regions of walls in which special horizontal reinforcement is required, as defined in paragraph b, are defined as follows:

In the vertical direction they shall extend from the base above the point of the likely plastic hinge, which in this case shall be considered the largest of the length l_w or 1/6 of the height h_w of the wall.

In plan, in cases where the calculated concrete deformation exceeds the value of $\varepsilon_{cu}/3$.



b) The amount of special transverse reinforcement required is a function of the calculated depth of the neutral axis, at the base of the wall and the ductility level, as follows:

DL II Structures: The depth of the neutral axis is calculated for the worst moment M_d and is given from the formula:

$$\bar{x} = 0.20 \left(\frac{M_{u,d}}{M_d}\right) l_w \qquad 5.4.3.1.1$$

when:

$x \leq \bar{x}$: The horizontal reinforcement shall satisfy the requirements of cl. 5.4.3. Links that tie the vertical reinforcement shall be used in accordance with the concrete code.

$x > \bar{x}$: The horizontal reinforcement shall satisfy the requirements of cl. 5.2.3.2 (columns of DL II in critical regions).

DL III Structures: The depth of the neutral axis is calculated for the worst moment M_d and is given by the equation:

$$\bar{x} = 0.10 \left[\frac{M_{u,d}}{M_d}\right] l_w \qquad (5.4.3.1.2)$$

when:

$x \leq \bar{x}$: The horizontal reinforcement must satisfy the requirements of cl. 5.2.3.3 (columns of DL III in non critical regions).

$x > \bar{x}$: The horizontal reinforcement must satisfy the requirements of cl. 5.2.3.3 (columns of DL II in critical regions) with the values of $\lambda 1$ and $\lambda 2$ as given in the following table as a function of the depth of the neutral axis.

x/lw	0.10	0.20	0.30	0.40	0.50	0.60	0.70
λ1	0.07	0.08	0.09	0.105	0.115	0.125	0.135
λ2	0.18	0.205	0.23	0.26	0.285	0.31	0.34

Table 5.4.3.1. - Values of λ1 and λ2 which shall be used in equations 5.2.3.3.1 and 5.2.3.3.2

5.4.4 Coupling Beams

The diagonal reinforcement in each direction shall be tied with closed links in accordance with the requirements of cl. 5.2.3.3 and the spacing between the links shall not exceed 100mm.

The minimum width of the diagonally reinforced beams shall not be less than 230mm. The anchorage length of the diagonal reinforcement in the adjacent walls shall be increased by 50% above the normal length.

5.5 Anchorage and Connection of Reinforcing Bars

5.5.1 General

In addition to the rules of the concrete code, chapter 17, the following requirements must be satisfied so that reliable performance is ensured under cyclic loading conditions caused by the seismic actions.

All the reinforcing bars shall be in a position to develop their maximum strength $\gamma_n . f_{ck}$ when a plastic hinge is formed.

All the bars shall be considered to be in a non-effective anchorage bond condition, except when the anchorage is done in areas confined with transverse reinforcement where effective anchorage bond can be achieved.

When the equation (concrete code, cl. 17.4.1.2, equation 17.5) is applied in a region where plastic hinges are likely to be formed, the ratio $A_{s,cal}/A_{s,eff}$ shall be taken equal to 1.

5.5.2 Beams: Anchorage of Longitudinal Reinforcement

Beams connected to opposite sides of a column shall have both top and bottom reinforcement continuous through the column, where this is possible. When the reinforcement cannot be continuous through the column, due to a change in the beam cross section or in exterior columns, the reinforcement shall be anchored in the joint in accordance with the following:

a) The reinforcement shall extend to the opposite face of the confined area and shall be anchored satisfactorily so that it can develop its ultimate strength.

b) Every bar shall end in a 90° angle or equivalent anchorage method as close to the opposite face of the column as possible.

c) The anchorage length shall be calculated starting from a distance of 10Φ from the face of the column.

DL III Structures: When the beams are connected on opposite sides of the column, the maximum diameter of the longitudinal bars which continue through the column, shall not exceed 1/30 the depth of the column (parallel to the bar).

5.5.3 Columns: Anchorage of Longitudinal Reinforcement

The maximum diameter of the longitudinal bars of columns passing through a joint shall not exceed 1/25 of the depth of the beam. When plastic hinges are allowed in columns that value can be 1/30.

The anchorage of the bars of the column in the beam shall be made with a 90° hook or in a similar way, as close to the top face of the beam as possible. The direction of the horizontal part of the hook shall be towards the core of the joint.

When columns end at the top of the frame or at a joint with a foundation, the anchorage of the column bars shall be considered that it starts at a distance of 1/2 the depth of the beam or 10Φ, whichever is less, from the entrance of the bar into the joint.

5.5.4 Splicing of Longitudinal Reinforcement

Splices are not allowed within beam-column joints or in regions where plastic hinges are likely to form.

If it can be shown that a plastic hinge cannot be formed, then splices at the edge of the columns are allowed, if links are placed with spacing not greater than 6 diameters.

Links shall be placed along the length of the splice in beams and columns. The link spacing shall not exceed 10 diameters of the bar which is spliced.

DL[I]] Structures: In addition, the spacing shall not exceed 150mm.

Welding or mechanical connections in accordance with the concrete code, cl. 12.4, can be used, if alternating bars are spliced in each layer of longitudinal reinforcement and the spacing between splices of adjacent bars is 600mm or more, along the length of the frame member.

5.5.5 Anchorage and Connection of Transverse Reinforcement

The transverse reinforcement (links) shall be anchored at an angle of at least 135° around a longitudinal bar with minimum extension of the free end of 10 diameters. Alternatively, the ends of the links can be welded in such a way that they can develop the complete strength of the bar.

Transverse reinforcement shall not be connected by overlaps in concrete cover, in joints or in regions in which plastic region might develop. Connection by overlapping is allowed only for deformed (high bond) bars.

When the anchorage of spiral reinforcement ends at an angle of 135° around a longitudinal bar, the extension beyond the bend shall be at least 10 diameters of the spiral bar.

5.6 Foundations

5.6.1 Foundation Level

The foundations of a structure must be at the same horizontal level. When this is not practical, for example in particularly adverse topographical or geotechnical conditions or building arrangements, special measures shall be taken to ensure uniform performance of the structure during an earthquake.

5.6.2 Connection of Footings

In cases of foundations with isolated footings or strip footings in one direction the foundations shall be connected between them with tie-bars in two directions in order to avoid horizontal displacements.

The tie-bars shall connect the footings and not the columns, that is, they shall be at the level of the footings or they shall touch the top surface of the footings.

The tie bars shall be at least 250mm wide and 500mm high. In single and two-story structures the height is allowed to be 400mm.

Every tie bar shall be in a position to withstand a tensile or compressive axial force of least equal to 1/10 of the largest vertical load of the footings it connects.

The minimum longitudinal reinforcement shall be 0.4% top and 0.4% bottom. The transverse reinforcement shall be links of 8 mm minimum diameter placed every 200mm. The anchorage requirements for beam reinforcement shall also apply for tie-bars.

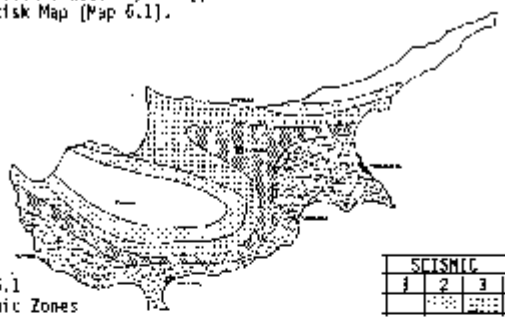
5.6.3 Increase in Allowable Stress

During the checks of the foundations, an increase of the allowable soil stress of 30% is allowed, when the seismic actions are taken in combination with the vertical loads. Reduction in the foundation dimensions derived from calculations for vertical loads only is not allowed under any circumstances.

6 SEISMIC ACTION

6.1 Regional Seismicity

The seismic activity in Cyprus is described in the following Seismic Risk Map (Map 6.1).



Map 6.1
Seismic Zones

For the purpose of structural design the most suitable parameter is the maximum value of ground acceleration Amax.

6.2 Seismic Zones

For code application, Cyprus is divided into 5 zones based on the expected seismic stresses. For every zone, calculation values for the maximum ground acceleration Amax, are given in table 6.2 as a fraction of g.

Zone	Amax
1,2,3	0.075
4	0.100
5	0.150

Table 6.2: Seismic Zones

6.3 Characteristics of Seismic Actions

Seismic actions result from the vibrations of the soil transmitted to the structures during the earthquakes.

For the purpose of this code the ground motion shall be adequately described by means of:

- the peak ground acceleration Amax, treated as a random variable of known distribution,

  the response spectrum for horizontal motion for firm soil conditions, normalised to Amax=1,

- the response spectrum for vertical motion, scaled to 2/3 of the corresponding horizontal motion response spectrum.

In sites where geological evidence indicates the possibility of "near field" type of shocks (for which the response spectrum concept is inadequate), or where there is extensive and deep soil layering (for which selective amplification can occur) the expected characteristics of ground motion shall be determined by special studies.

More simple geotechnical and morphological site conditions shall be accounted for by suitable modification of the basic spectrum relative to the area.

6.4 Design Seismic Action

The design seismic action is, by definition, the action that, when used in conjunction with other permanent and variable loads in design structures in accordance with the present provisions and with those of the Concrete Structures Code, satisfies the general requirements set forth in ch. 2 with the established level of reliability.

6.4.1 Normalised Elastic Response Spectrum

For the purpose of these recommendations, the shape of the "standard" (rocky or firm soil conditions) elastic response spectrum normalised to a unit peak ground acceleration shall be idealised as shown in fig. 6.4.1.

The spectrum is intended for a damping ratio of 5%. Spectral amplification shapes different from the proposed one can be adopted, conditioned to site specific historical and/or geophysical evidence.

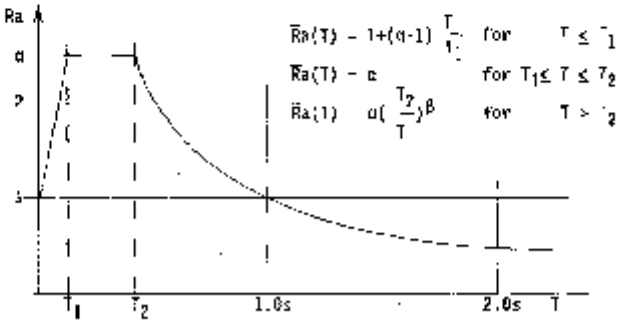


fig. 6.4.1 Normalised elastic response spectrum.

For a probability of non-exceedance 70-80%: $\alpha = 2.5$, $\beta = 1.0$
When no more specific information is given: $T_1 = 0.1s$, $T_2 = 0.4s$

6.4.2 Site Effects

When more detailed knowledge on the effects of local soil conditions on the characteristics of ground motion arriving at the site from possibly different sources is not available, the procedure in cl. 6.4.2.1/2/3 shall be applied.

6.4.2.1 Soil Profile Types

The effects of site conditions on building response shall be established based on the soil profile types defined as follows:

SOIL PROFILE S1: Rock of any characteristic, either shale-like or crystalline (such material may be characterised by a shear wave velocity greater than 800 m/sec.); or stiff soil conditions where the soil depth is less than 60m and the soil types overlying rock are stable deposits of sands, gravels or stiffer clays.

SOIL PROFILE S2: Deep cohesionless or stiff clay, including sites where the soil depth exceeds 60m and the soil types overlying rock are stable deposits of sands, gravels or stiff clays.

SOIL PROFILE S3: Soft-to-medium stiff clays and sands, characterised by 10m or more of soft-to-medium stiff clay with or without intervening layers of sand and other cohesionless soils.

In locations where soil properties are not known in sufficient detail to determine the soil profile, or where the profile does not fit any of the three types, soil profile S2 shall be used.

Special in-situ and laboratory studies shall be carried out to investigate the possibilities and the conditions for the erection of buildings in cases where there is evidence of:

a) Dynamic instability by liquefaction of sand or other soils
b) Excessive settlement
c) Landslides or Falling rocks and
d) Faulting

If not absolutely necessary, buildings on these kinds of soils should not be built.

6.4.2.2 Site Coefficient

The site coefficient S is used to modify the standard elastic response spectrum to account for the site conditions. Its values are given in Table 6.4.2.2.

Soil Profile Type	S1	S2	S3
Site Coefficient S	1.00	1.25	1.50

Table 6.4.2.2

6.4.3 Site-dependent Normalised Elastic Response Spectra

The site-dependent normalised elastic spectra for the 2 soil profiles are shown in fig. 6.4.3, their ordinates being defined as the smallest from the following expressions:

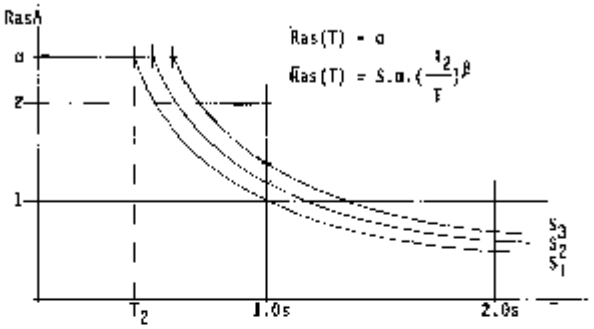


Fig. 6.4.3 Site-dependent Normalised Elastic Response Spectrum

In lack of specific site-related information T2, α and β can be assigned values as proposed in cl. 6.4.1.

Spectra for vertical motions may be determined with sufficient accuracy by multiplying the ordinates of the spectra for horizontal motions by a factor of 2/3.

6.4.4 Design Response Spectrum

The ordinates of design response spectrum are given by multiplying the ordinates of the site-dependent normalised response spectrum with the factors:

$$Rd = \overline{Ras} \cdot I \cdot \frac{2}{K} \cdot Amax$$

where:

I = the importance factor defined in cl. 3.2.
K = the behaviour factor as given in Table 4.1.3.
Amax = the peak ground acceleration as given in Table 6.2.

SYMBOLS

CAPITAL LATIN

Amax	Peak ground acceleration (6.2)
A_c	Confines area measured to outside peripheral transverse reinforcement
A_g	Gross sectional area of concrete
A^t_s	ension bar reinforcement
A^c_s	Compression bar reinforcement
A_{s1}	Cross-sectional area of top joint reinforcement (4.3.1.3)
A_{s2}	Cross-sectional area of bottom joint reinforcement (4.3.1.3)
C_d	Design seismic coefficient (4.2.4.1)
C_g	Centre of mass (4.2.1.1)
C_k	Centre of stiffness (4.2.1.1)
E	Seismic Action (4.1.4.1)
F_{id}	Design lateral force on floor i (4.2.4..)
G	Permanent loads (4.1.4)
I	Structure importance factor (3.2)
K	Structure behaviour factor (4.1.3)
M_d	Design moment (4.3.1.4.5)
$M_{u,d}$	Ultimate moment of a concrete section evaluated with factored values of concrete and steel strengths (4.3.1.4.5)
$M^+_{u,d}$	Ultimate moment of a concrete section evaluated with characteristic values of concrete and steel strengths
N_d	Design axial force under the most unfavourable load combination including the seismic action
Q	Variable loads (4.1.4)
R_d	Design strength (4.5.2)
S	Site coefficient (6.4.2.2)
S_d	Fundamental combination of load effects (4.1.4)
S_i	Site type index (6.4.2.1)
T	Fundamental period of building (4.2.4.1)
V_{cd}	Shear force carried by concrete in beam or column or sections (4.4.1.4, 4.3.1.3)
V_d	Design shear force
V_{jh}	Horizontal shear joint (4.3.1.3)
V_{jv}	Vertical shear joint (4.3.1.4)
V_{Rd}	Design shear force (4.4.1.4)
V_{Sd}	Design shear of action (4.4.1.4)
W_i	Total gravity load on floor i (4.2.4.1)

SMALL LATIN

a	plan dimension of the building in a direction orthogonal to that of the seismic action
b_w	web width of concrete section
h,b	height and width of beams, major and minor sides in columns
h',b'	distance between bars located at the ends of sides h and b respectively
d	effective depth of cross-section
e	eccentricity
s_h	spacing of transverse reinforcement in beams, columns and walls
f_{ck}	characteristic concrete cylinder strength
f_{ctm}	mean tensile concrete strength
f_{yd}	design steel strength
f_{yk}	characteristic steel strength
h	height of floor
l_w	horizontal wall height
h_w	total height of wall
h_0	vertical distance between floors in walls

GREEK

α	spectral amplification factor
β	parameter of the elastic response spectrum
β	shear multiplication factor
γ_c	partial safety factor for concrete
γ_s	partial safety factor for steel
γ_i	load distribution factor
γ_n	additional partial safety factor for DL III structures
δ	inter-storey drift under service load
δ_{el}	elastic inter-storey drift under design seismic actions
Δ_{max}	maximum inter-storey drift under seismic actions
ζ	ratio between maximum and minimum shear force at the end of a beam
θ	deformability index
ξ	amplification factor for torsional effects
ρ	tensile reinforcement ratio
ρ'	compressive reinforcement ratio
ρ_s	volumetric ratio of transverse reinforcement
σ_{cm}	minimum mean compression stress on the column above the joint
τ_{cd}	shear stress contributed by the concrete
τ_d	maximum nominal design shear stress
τ_{jh}	nominal horizontal shear stress in joint
τ_{Rd}	design shear stress
ω	dynamic magnification factor

Other symbols are defined in the appropriate chapters.

Dated this 14th day of November, 1996.

By the Administrator's Command,
P.A. ROTHERAM,
Chief Officer,
Sovereign Base Areas.

(112/A)

Appendix 2(**a**) *(Regulation 64)*

Part 1 - Fees

1. *In respect of streets—*

For the layout or construction of a street, for every 100 feet of length or fraction thereof, a fee of £2.00

2. *In respect of buildings—*

(a) for the erection or reconstruction of a domestic or public building—

(i) where the cubical content of the building does not exceed 25,000 cubic feet, a fee of £0.75 for every 1,000 cubic feet or fraction thereof, of the cubical content of the building;

(ii) where the cubical content of the building exceeds 25,000 cubic feet but not 50 000 cubic feet, a fee of £1.50 for every 1,000 cubic feet or fraction thereof, of the cubical content of the building;

(iii) where the cubical content of the building exceeds 50,000 cubic feet, a fee of £1.50 for every 1,000 cubic feet, or fraction thereof of the cubical content of the building;

(b) for additions to a domestic or public building—

(i) a fee of £0.75 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building does not exceed 25,000 cubic feet;

(ii) a fee of £1.00 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building exceeds 25,000 cubic feet but does not exceed 50,000 cubic feet;

(iii) a fee of £1.50 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building exceeds 50,000 cubic feet ;

(c) For the erection or reconstruction of an industrial building or additions thereto or for the alteration or repair to any domestic, industrial or public building or for the construction of a wall, earth bank, fence, paling or other construction enclosing or delimiting land, a fee at the rate of 1% on the estimated cost of the building (including fixtures affixed on the building).

3. *In respect of divisions—*

For the division of any land into plots for building purposes or for the division of any existing buildings, for every 1,000 square feet or fraction thereof of land, including the land which may be occupied by an existing building, a fee of £2.00.

Provided that in cases of division of land into plots for building purposes or division of any existing buildings not exceeding two in either case, a fee of £1.00 shall be payable for every 1,000 square feet of land (including the land which may be occupied by an existing building) or fraction thereof.

Part 2 – Fees

1. *In respect of streets—*

(**a**) Appendix 2 inserted by Public Instrument 67/1996 – came into force on 18 November 1996

For the layout or construction of a street, for every 100 feet of length or fraction thereof, a fee of £2.00.

2. *In respect of buildings—*

(a) for the erection or reconstruction of a domestic or public building—

(i) where the cubical content of the building does not exceed 25,000 cubic feet, a fee of £1.25 for every 1,000 cubic feet or fraction thereof, of the cubical content of the building;

(ii) where the cubical content of the building exceeds 25,000 cubic feet but not 50,000 cubic feet, a fee of £1.75 for every 1,000 cubic feet or fraction thereof, of the cubical content of the building;

(iii) where the cubical content of the building exceeds 50,000 cubic feet, a fee of £2.25 for every 1,000 cubic feet, or fraction thereof of the cubical content of the building;

(b) for additions to a domestic or public building—

(i) a fee of £1.25 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building does not exceed 25,000 cubic feet;

(ii) a fee of £1.75 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building exceeds 25,000 cubic feet but does not exceed 50,000 cubic feet;

(iii) a fee of £2.25 for every 1,000 cubic feet or fraction thereof, where the cubical content of the additions together with the cubical content of the existing building exceeds 50,000 cubic feet;

(c) For the erection or reconstruction of an industrial building or additions thereto or for the alteration or repair to any domestic, industrial or public building or for the construction of a wall, earth bank, fence, paling or other construction enclosing or delimiting land, a fee at the rate of 1% on the estimated cost of the building (including fixtures affixed on the building).

3. *In respect of divisions—*

For the division of any land into more than five plots for building purposes or for the division of any existing buildings, for every 1,000 square feet or fraction thereof of land, including the land which may be occupied by an existing building, a fee of £3.50.

Provided that in cases of division of land into plots not exceeding five for building purposes a fee of £l.50 shall be payable for every 1,000 square feet of land or fraction thereof.