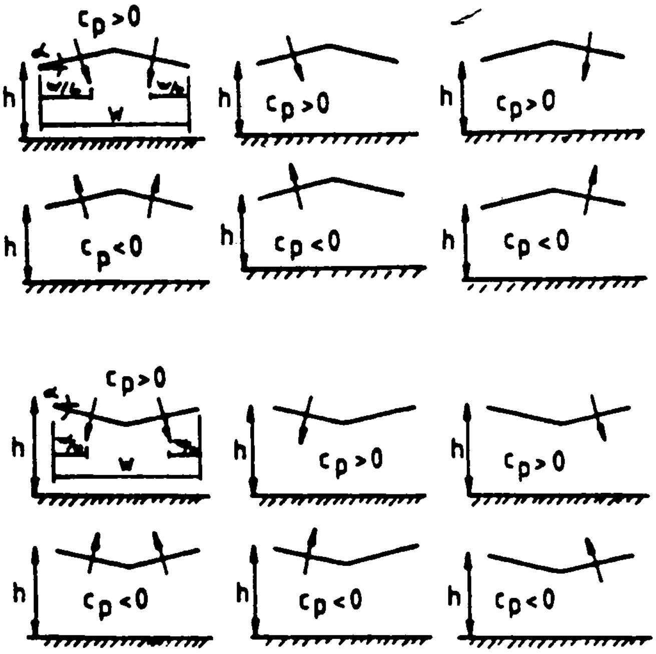


Figure A.14 Load Arrangement for Doupitch Canopies

Table A.9 $c_{p,net}$ Values for Multibay Canopies

Bay	Location	Factors for all φ	
		on maximum (downward) overall coefficient	on minimum (upward) overall coefficient
1	end bay	1.00	0.81
2	second bay	0.87	0.64
3	third and subsequent bays	0.68	0.63

A.4 Free-Standing Boundary Walls, Fences and Signboards

A.4.1 Solid Boundary Walls

(1) The wall should be divided into zones as shown in Fig. A.16

(2) Values of net pressure coefficients $c_{p,net}$ for free-standing walls and parapets, with or without return corners, are given in Table A.10 for two values of solidity. Solidity $\varphi = 1$ refers to solid walls, while
$\varphi = 0.8$, refers to walls which are 80% solid and 20% open. The reference area in both cases is the gross area.

(3) Linear interpolation for solidity ratio may be used in the range $0.8 < \varphi < 1$. For porous walls with solidity less than 0.8, coefficients should be derived as for plane lattice frames (see Section A.10).

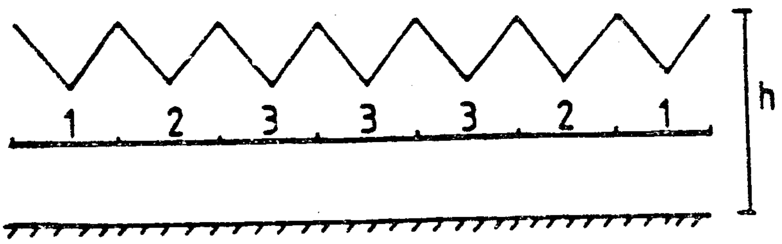


Figure A.15 Multibay Canopies

(4) The slenderness factor ψ_s (see Section A.12) may be applied.

(5) The reference height z_e should be taken as h.

Table A.10 Net Pressure Coefficients for Free-Standing Walls

Solidity	Zone	A	B	C	D
$\varphi = 1$	without return corners	3.4	2.1	1.7	1.2
	With return corners	2.1	1.8	1.4	1.2
$\varphi = 0.8$		1.2	1.2	1.2	1.2

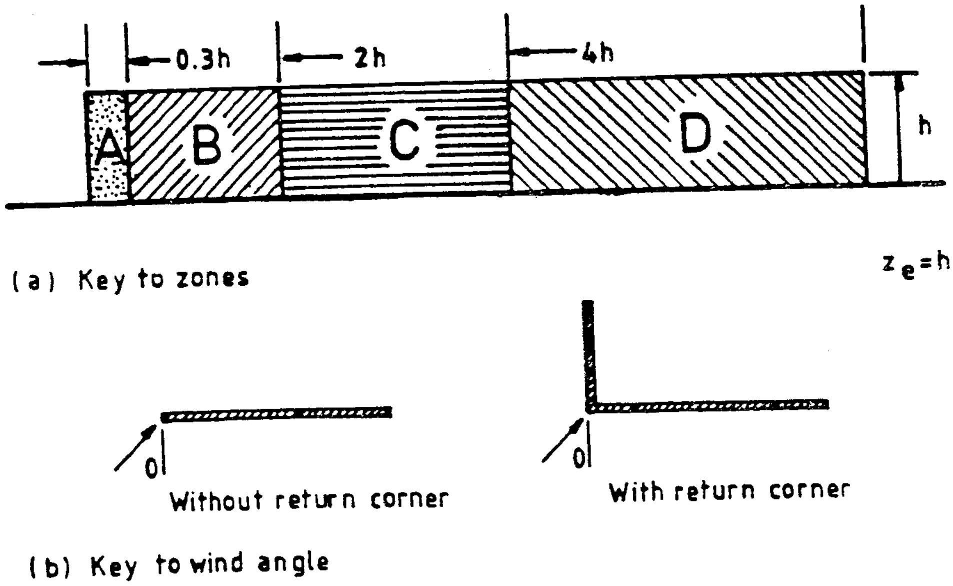


Figure A.16 Key to Boundary Walls

A.4.2 Pressure Coefficients for Porous Fences

(1) Porous fences with solidity ratio $\psi \leq 0.8$ should be treated as a plane lattice using the provisions of Section A.10.

A.4.3 Signboards

(1) The force coefficients for signboards, separated from the ground by at least $d/4$ height (see Fig. A.17), is given by:

$$c_f = 2.5\ \psi\lambda \tag{A.5}$$

where ψ_λ slenderness reduction factor (see Section 10.12)

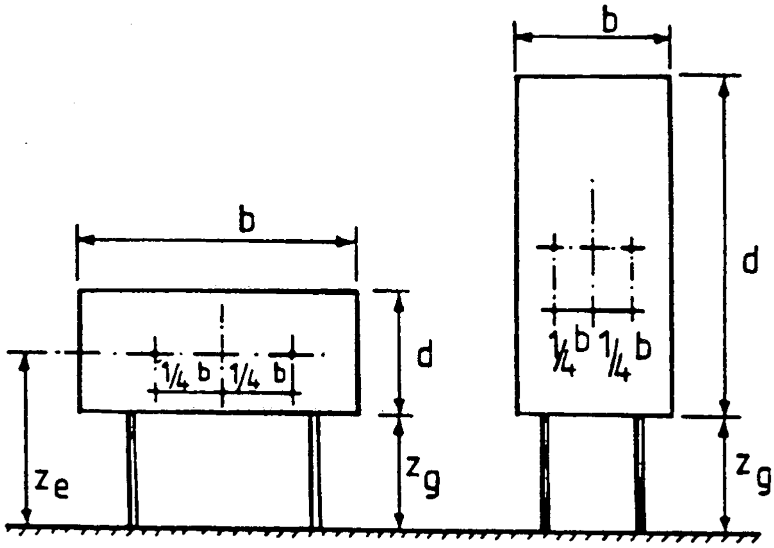


Figure A.17 Key for Signboards

Note: (i) reference : $z_e = z_g + d/2$
(ii) reference area: $A_{ref} = b\ d$
(iii) $z_g \geq d/4$ if not assumed as boundary wall

(2) The resultant force normal to the signboard should be taken to act at the height of the center of the board, with an horizontal eccentricity of:

$$e = \pm 0.25\, b \tag{A.6}$$

A.5 Structural Elements with Rectangular Sections

(1) The force coefficient c_f of structural elements of rectangular section and with wind blowing normally to a face is given by:

$$c_f = c_{f.o}\, \psi_r\, \psi_\lambda \tag{A.7}$$

where $c_{f.o}$ force coefficient of rectangular sections with sharp corners and infinite slenderness ratio λ ($\lambda = l/b$, l = length, b = width of element) as given in Fig. A.18.

ψ_r reduction factor for square sections with rounded corners, ψ_r are given in Fig. A.19.

ψ_λ reduction factor for elements with finite slenderness ratio as defined in Section 10.12.

(2) The reference area A_{ref} is:

$$A_{ref} = l\, b \tag{A.8}$$

The reference height z_e is equal to the height above ground of the section being considered.

(3) For plate-like sections ($d/b < 0.2$) lift forces at certain wind angles of attack may give rise to higher values of c_f up to an increase of 25% (for example, see Section A.4 signboards).

A.6 Structural Elements with Sharp Edged Section

(1) The force coefficient c_f of structural elements with sharp edged section (e.g. elements with cross sections such as those shown in Fig. A.20) is given by:

$$c_f = c_{f.o}\, \psi_P \tag{A.9}$$

where $c_{f.o}$ force coefficient of structural elements with infinite slenderness ratio λ ($\lambda = l/b$, l = length, b = width), as defined in Fig. A.18. It is given for all sections and for both wind directions as: $c_{f.o} = 2.0$

ψ_λ slenderness reduction factor (see Section A.12)

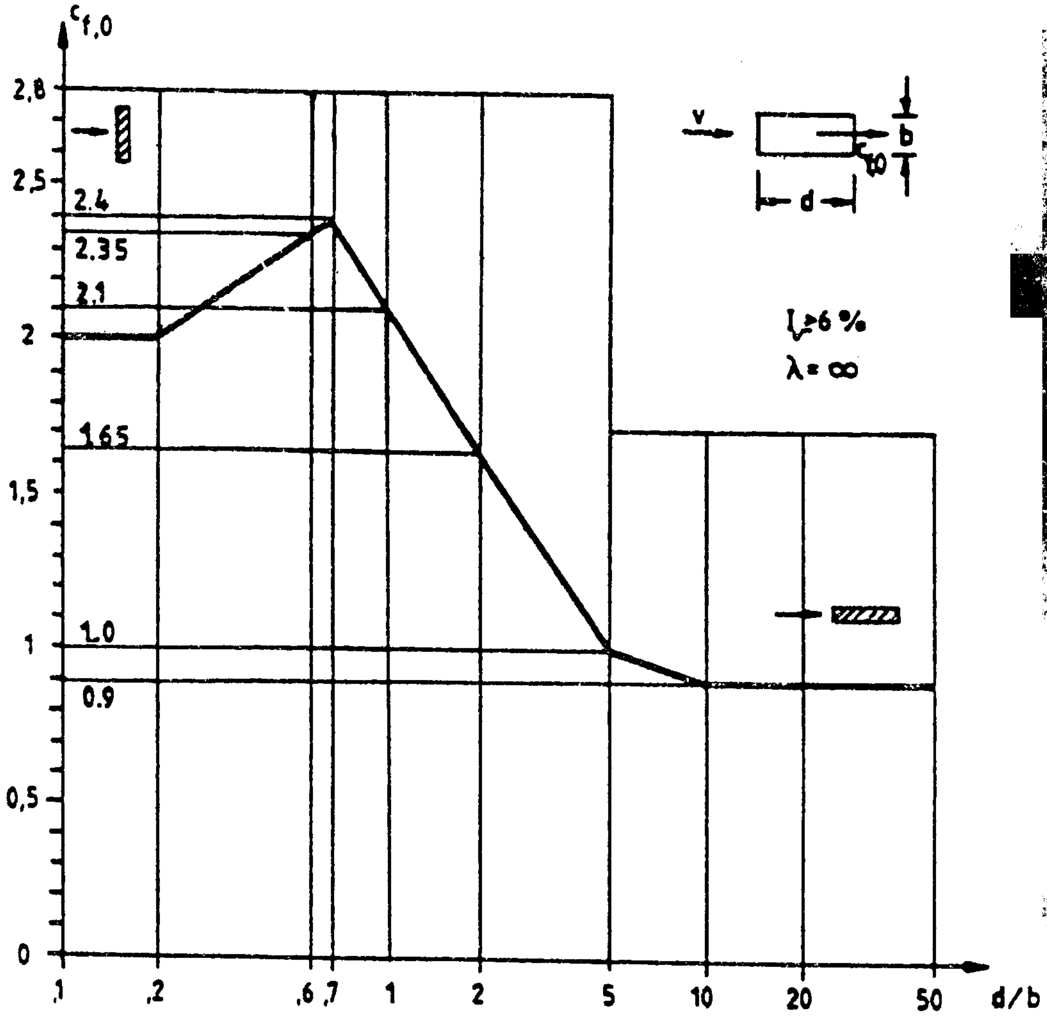


Figure A.18 Force Coefficients $C_{f,o}$ of Rectangular Section with Sharp Corners and Slenderness $\lambda = l/b = \infty$ and Trubulence Intensity of $l_v \geq 6\%$

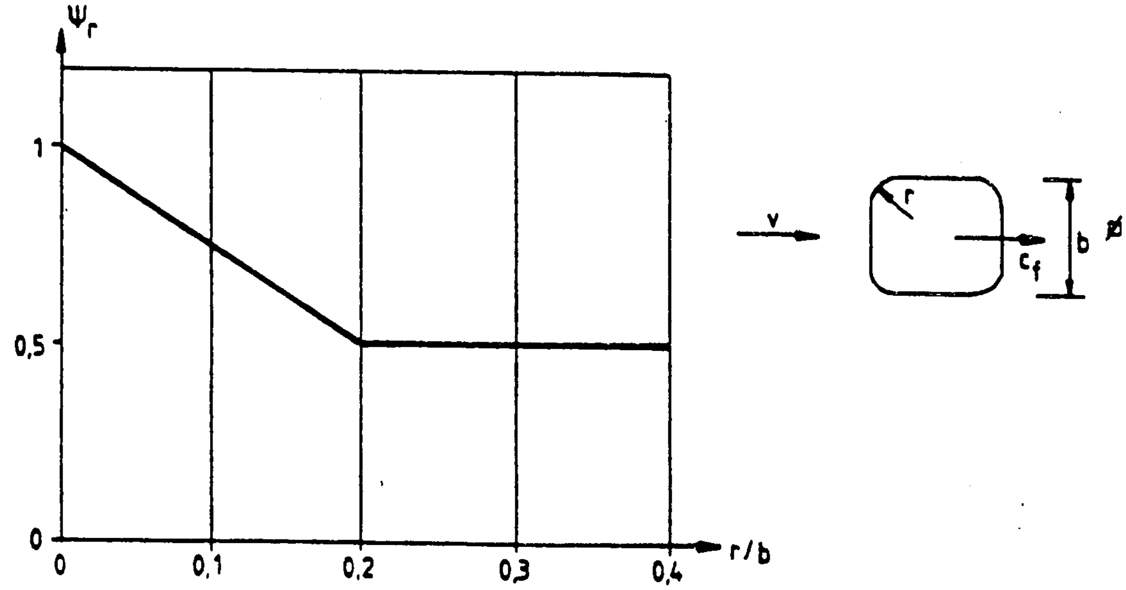
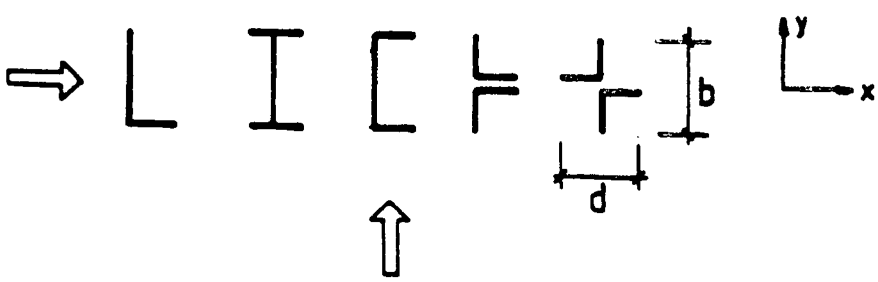


Figure A.19 Reduction Factor ψ_r for a Square Cross-Section with Rounded Corners



Note: L = length

Figure A.20 Sharp Edged Structural Section

(2) The reference areas:

In x-direction: $A_{ref.x} = lb$
In y-direction: $A_{ref.y} = lb$

(3) In all cases the reference height z_e is equal to the height above ground of the section being considered.

A.7 Structural Elements with Regular Polygonal Section

(1) The force coefficient c_f of structural elements with regular polygonal section with 5 or more sides is given by:

$$c_f = c_{f.o}\,\psi_\lambda \qquad \text{(A.10)}$$

where $c_{f.o}$ force coefficient of structural elements with infinite slenderness ratio λ ($\lambda = \ell/b$, l = length, b = diameter of circumscribed circumference, see Fig. A.21)as defined in Table A.11.

ψ_λ slenderness reduction factor as defined in A.14

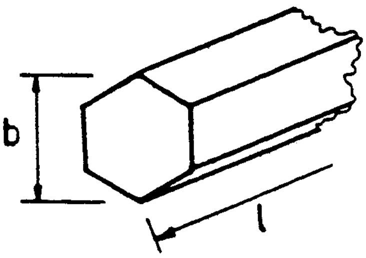


Figure A.21 Regular Polygonal Section

(2) The reference area A_{ref} is:

$$A_{ref} = lb \qquad \text{(A.11)}$$

(3) The reference height z_e is equal to the height above ground of the section being considered.

Table A.11 Force Coefficient $c_{f,o1}$ for Regular Polygonal Sections

Number of sides	Sections	Finish of Surface and of Corners	Reynolds Number Re	$C_{f,o}$
5	pentagon	all	all	1.8
6	hexagon	all	all	1.6
8	octagon	surface smooth $r/b < 0.75(2)$	$Re \leq 2.4 \,.\, 10^5$ $Re \geq 3 \,.\, 10^5$	1.45 1.3
		surface smooth $r/b < 0.75(2)$	$Re \leq 2 \,.\, 10^5$ $Re \geq 7 \,.\, 10^5$	1.3 1.1
10	decagon	all	all	1.3
12	dodecagon	surface smooth (3) corners rounded	$2 \,.\, 10^5 < Re < 1.2 \,.10^6$	0.9
		all other	$Re < 2 \,.\, 10^5$ $Re \leq 4 \,.\, 10^5$	1.3 1.1
16		surface smooth (3) corners rounded	$Re < 2 \,.\, 10^5$	like circular cylinders
			$2 \,.\, 10^5 \leq Re < 1.2 \,.10^6$	0.7
18		surface smooth (3) corners rounded	$Re < 2 \,.\, 10^5$	like circular cylinders
			$2 \,.\, 10^5 \leq Re < 1.2 \,.10^5$	0.7

Note: (1) Reynold number, Re, is defined in Section A.8
(2) r = corner radius, b = diameter
(3) from tests in wind tunnel with galvanised steel surface and a section with b = 0.3m and corner radius of 0.06 b

A.8 CIRCULAR CYLINDERS

A.8.1 External Pressure Coefficients

(1) Pressure coefficients of circular sections depends upon the Reynolds numbers Re defined as:

$$Re = \frac{b v_m(z_e)}{v} \tag{A.12}$$

where
- b — diameter
- v — kinematic viscocity of the air ($v = 15.10^{-6}$ m²/S)
- $v_m(z_e)$ — mean wind velocity as defined in Section 3.8.1

(2) The external pressure coefficients c_{pe} of circular cylinders is given by:

$$c_{pe} = c_{p,o}\, \psi\lambda\alpha \tag{A.13}$$

where $c_{p,o}$ external pressure coefficient for infinite slenderness ratio λ (see (3) below)

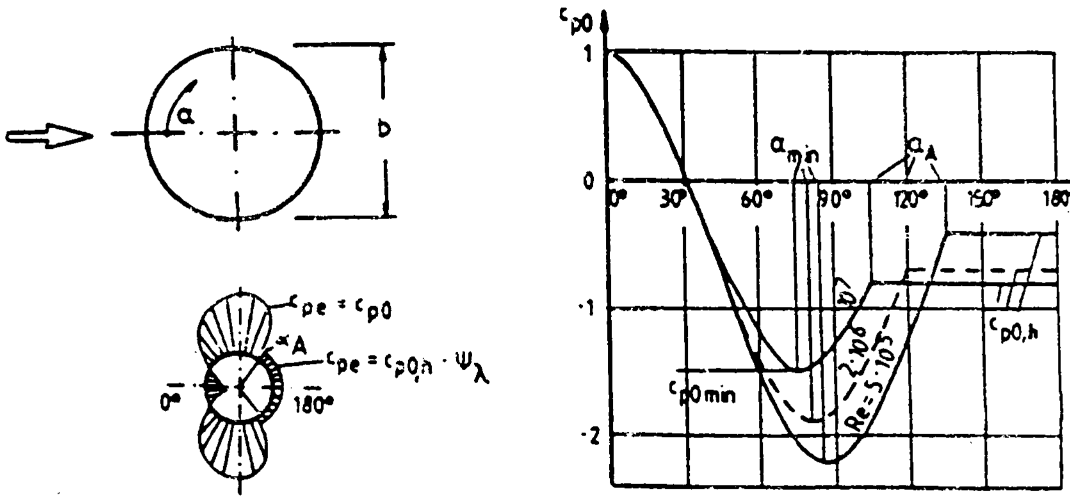
$\psi_{\lambda a}$ slenderness reduction factor (see (4) below)

(3) The external pressure coefficient $C_{p,o}$ is given in Fig.A.22 for various Reynolds numbers as a function of angle α.

(4) The slenderness reduction factor $\psi_{\lambda\alpha}$ is given by:

$$\psi_{\lambda\alpha} = 1 \quad \text{for} \quad 0° \leq \alpha \leq \alpha_A$$
$$360° - \alpha_A \leq \alpha \leq 360°$$
$$\psi_{\lambda\alpha} = \psi_{\lambda} \quad \text{for} \quad \alpha_A \leq \alpha \leq 360° \ \alpha_A \qquad \text{(A.14)}$$

where α_A position of the flow separation (see Fig. A.23)
ψ_{λ} slenderness reduction factor (see Section A.2)



Note: (i) Intermediate values may be interpolated linearly
(ii) typical values in the above Fig. are shown in the Table below

Re	α_{min}	$c_{po,min}$	α_A	$c_{po,h}$
5 x 10^5	85	-2.2	135	-0.4
2 x 10^6	80	-1.9	120	-0.7
107	75	-1.5	105	-0.8

where α_{min} position of the minimum pressure
$c_{po,min}$ value of the minimum pressure coefficient
α_A position of the flow separation
$c_{po,h}$ base pressure coefficient

(iii) The above Fig.is based on an equivalent roughness *K/B* less than 5.10^{-4}. Typical values of roughness height *k* are given in Table A.12.

Figure A.22 Pressure Distribution for Circular Cylinders for Different Reynolds Number Ranges and Infinite Slenderness Ratio