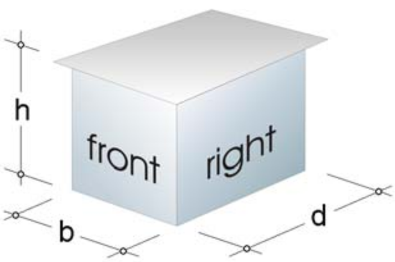
1. Basic data

BUILDING PROJECT:	**Hochhaus in Hannover EC**		
STANDARD:	Eurocode:	wind:	DIN EN 1991-1-4:2010-12 in conjunction with National Annex "Deutschland" here: DIN EN 1991-1-4:2010-12/NA (protected) subsequently named EC1-1-4
		snow:	DIN EN 1991-1-3:2010-12 in conjunction with National Annex "Deutschland" here: DIN EN 1991-1-3:2010-12/NA (protected) subsequently named EC1-1-3

LOCATION:	Hannover, Landeshauptstadt	
AMTL. GEMEINDESCHLÜSSEL:	03241001	
TYPE:	Stadt	
DISTRICT:	Region Hannover	
FEDERAL STATE:	Niedersachsen	
ALT. ABOVE SEA LEVEL:	55 m	
WIND ZONE:	2	⇒ $v_{b,0}$ = 28.00 m/s
SNOW LOAD ZONE:	2	⇒ s_k = 0.85 kN/m²

2. Wind actions

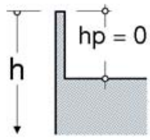
2.1 Input data



building model:
type: flat roof
h = 48.00 m
b = 14.00 m
d = 16.00 m

loc.: inland
orography: general rule

roof edge: with parapet



protr. roofs	front	right	back	left
in m	0.00	0.00	0.00	0.00

2.2 Height-dependent peak velocity pressure

peak velocity pressures

z = height above ground, $v_{mf}(z)$ and $I_{vf}(z)$ acc. to EC1-1-4/NA Tab NA.B.2 resp. NA.B.4, $v_m(z)$ acc. to (NA.B.9), $I_v(z)$ acc. to (NA.B.10)
peak velocity pressures $q_p(z)$ acc. to (NA.B.11) mit ρ = 1.25 kg/m³, orography factor: $c_o(z)$ = 1.0 (general rule)

z m	$v_{mf}(z)$ m/s	$I_{vf}(z)$ -	$v_m(z)$ m/s	$I_v(z)$ -	$q_p(z)$ kN/m2
14.00	26.19	0.202	26.19	0.202	0.95
16.00	27.08	0.196	27.08	0.196	1.00
48.00	35.64	0.149	35.64	0.149	1.50

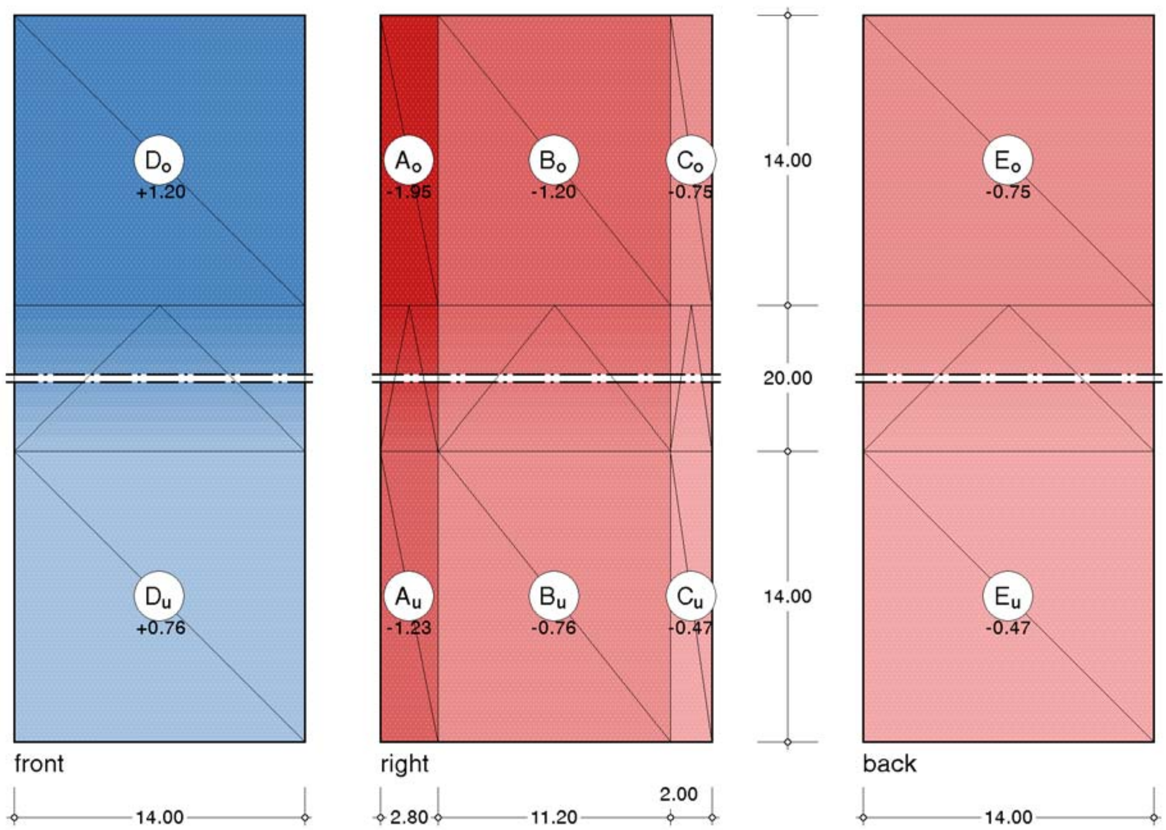
2.3 Wind from front side

characteristic values: e = min(b, 2h) = 14.00 m type: e < d h/d = 3.00

2.3.1 Loading of vertical walls (wind from front side)

external pressure coefficients and load ordinates acc. to EC1-1-4 / Tab. 7.1
ordinate (o) = $c_{pe,10}$ * q(h), ordinate (u) = $c_{pe,10}$ * q(b), (+) = pressure

area	A	B	C	D	E	note
$c_{pe,10}$	-1.30	-0.80	-0.50	+0.80	-0.50	interpolated
ordinates (o)	**-1.95**	**-1.20**	**-0.75**	**+1.20**	**-0.75**	kN/m²
ordinates (u)	**-1.23**	**-0.76**	**-0.47**	**+0.76**	**-0.47**	kN/m²

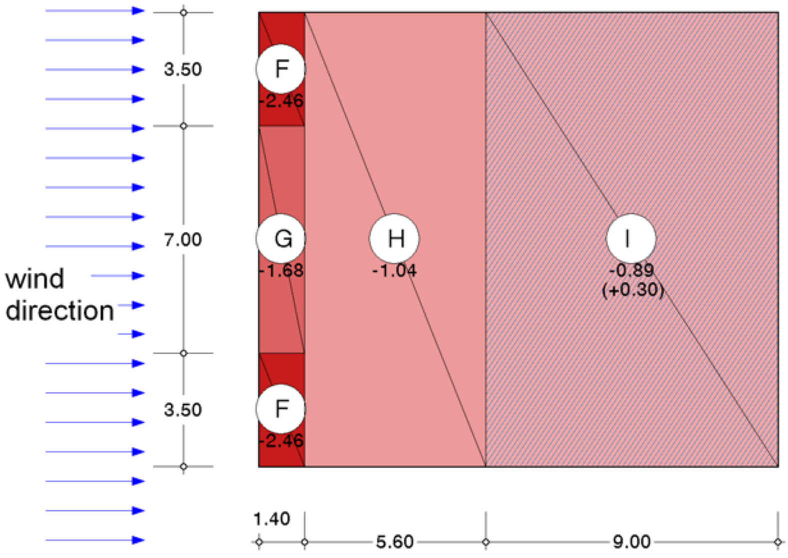


the values described here in level of the roof edge are also effective for the lower surface of the roof area in the region of protruding roofs

2.3.2 Loading of roof area (wind from front side)

external pressure coefficients and load ordinates for flat roofs acc. to EC1-1-4 / Tab. 7.2
ordinate = $c_{pe,10}$ * q(h), (+) = pressure (calculation is done with h=h-hp ⇒ e = 14.00 m; q(h) = 1.49 kN/m²)

area	F	G	H	I	note
$c_{pe,10}$	-1.65	-1.13	-0.70	-0.60	interpolated
alternative	-	-	-	+0.20	interpolated
ordinates	**-2.46**	**-1.68**	**-1.04**	**-0.89**	kN/m²
alternative	-	-	-	**+0.30**	kN/m²



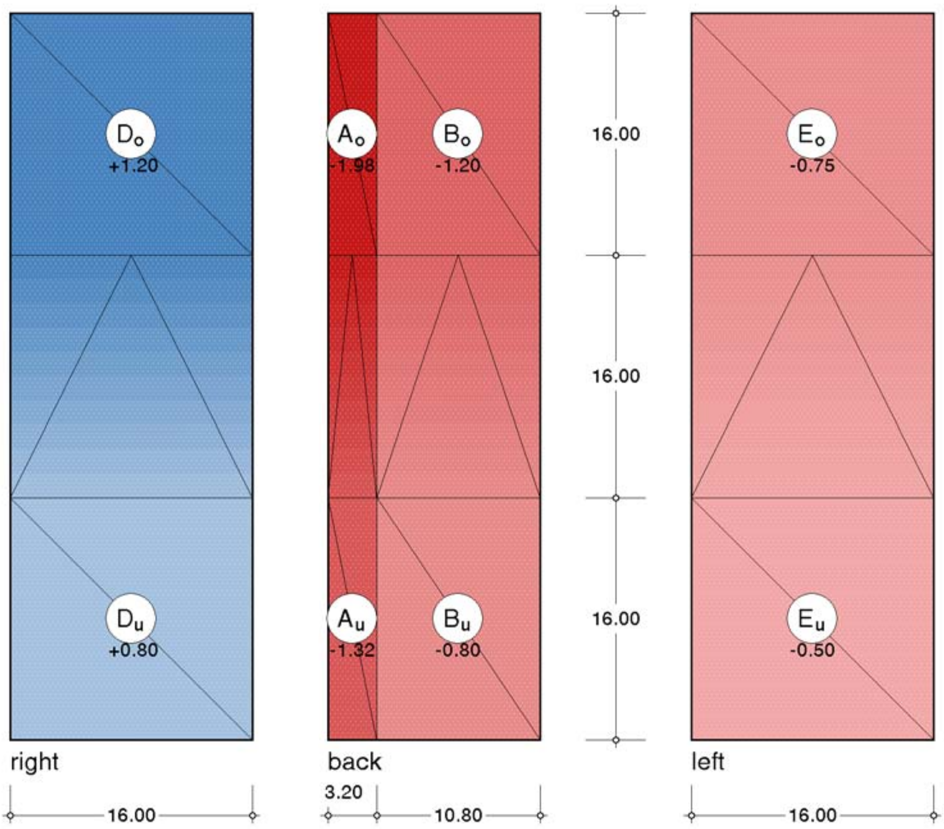
2.4 Wind from righthand

characteristic values: e = min(d, 2h) = 16.00 m type: b ≤ e ≤ 5b h/b = 3.43

2.4.1 Loading of vertical walls (wind from righthand)

external pressure coefficients and load ordinates acc. to EC1-1-4 / Tab. 7.1
ordinate (o) = $c_{pe,10}$ * q(h), ordinate (u) = $c_{pe,10}$ * q(d), (+) = pressure

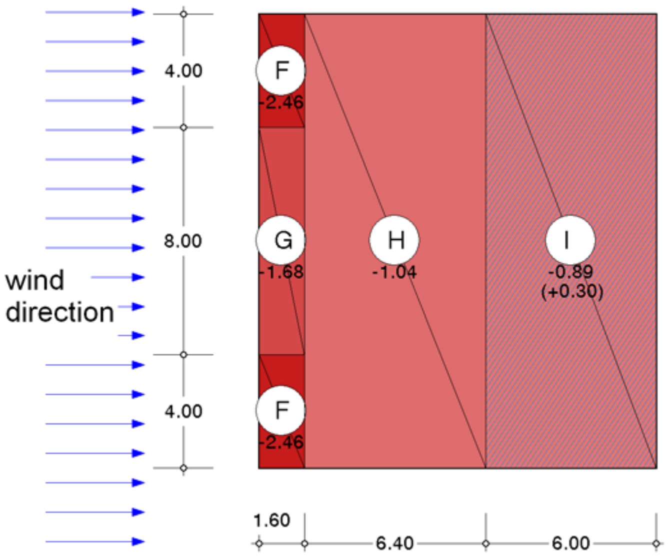
area	A	B	C	D	E	note
$c_{pe,10}$	-1.32	-0.80	-0.50	+0.80	-0.50	interpolated
ordinates (o)	**-1.98**	**-1.20**	**-0.75**	**+1.20**	**-0.75**	kN/m²
ordinates (u)	**-1.32**	**-0.80**	**-0.50**	**+0.80**	**-0.50**	kN/m²



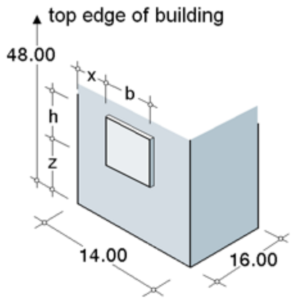
the values described here in level of the roof edge are also effective for the lower surface of the roof area in the region of protruding roofs

2.4.2 Loading of roof area (wind from righthand)

ordinates: see table(s) under paragraph "wind from front side"



2.6 min/max resultant on cladding units



The determination of the resultant is done by integration (acc. to EC1-1-4 par. 7.2.2) of the range dependant calculated pressure/suction ordinates over the area of the cladding units. In so doing the respectively most unfavourable wind directions are considered.

$c_{pe,A}$ (A = frontage area with 1 < A < 10) is used as pressure coefficient.

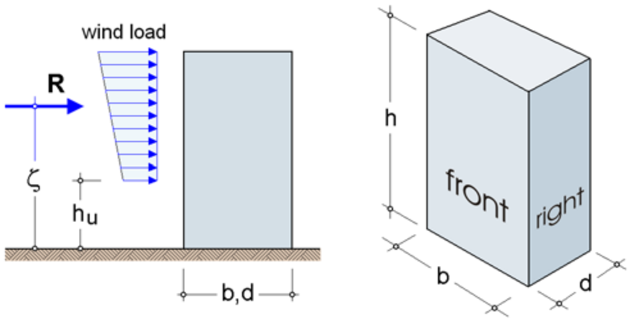
If the cladding unit is located in several areas with different load ordinates, the resultant is no longer acting in the centroid of the cladding unit. The depending eccentricities are recorded as Δx resp. Δz (horizontal resp. vertical distance from frontage centroid.

results

If in column T an X is recorded, the width and depth of the building were exchanged for the depending cladding unit. Then the result is effective for a cladding unit on the long side of the building.

Nr.	x	b	z	h	T	press.	Δx_D	Δz_D	suc.	Δx_S	Δz_S
-	m	m	m	m	-	kN	cm	cm	kN	cm	cm
1	0.00	2.00	0.00	1.50	-	**2.576**	0	0	**-4.358**	0	0
2	2.00	2.00	0.00	1.50	-	**2.576**	0	0	**-3.759**	-10	0
3	0.00	2.00	40.00	1.50	X	**4.076**	0	0	**-6.447**	0	0
4	2.00	2.00	40.00	1.50	X	**4.076**	0	0	**-5.166**	-10	0
5	6.00	2.00	46.50	1.50	-	**4.076**	0	0	**-4.312**	0	0
6	0.00	2.00	46.50	1.50	-	**4.076**	0	0	**-6.569**	0	0

2.7 Resultant wind force



h = 48.000 m
b = 14.000 m
d = 16.000 m

h_u = 0.000 m

results

The determination of the resultant wind force is done acc. to EC1-1-4 par. 5.3 and 7.6. The roof shape is not considered. The structural factor $c_s c_d$ is taken as 1.0.

wind from front side	wind from righthand	acc. to EC1-1-4
h/d = 3.00	h/b = 3.43	
d/b = 1.14	b/d = 0.88	
$c_{f,0}$ = 2.05	$c_{f,0}$ = 2.24	7.6 (fig. 7.23)
λ = 4.84	λ = 4.23	7.13 (Tab 7.16)
Ψ_λ = 0.67	Ψ_λ = 0.66	7.13 (fig. 7.36)
ζ = 28.80 m	ζ = 28.80 m	irrelevant
$q(h)$ = 1.50 kN/m²	$q(h)$ = 1.50 kN/m²	7.6 (2) and 4.5
A_{ref} = 672.00 m²	A_{ref} = 768.00 m²	7.6 (2)
R = 1383.81 kN	**R = 1713.15 kN**	$c_{f,0}\ \Psi_\lambda\ q(h)\ A_{ref}$

3. Snow loads

3.1 Basic loading

roof shape: flat roof

$\mu_1 = 0.80$ (acc. to EC 1-1-3 / Tab. 5.2) $q = \mu_1 s_k =$ **0.68** kN/m²

(constant on total roof area)

3.2 Drift

$h = 0.90$ m

$\mu_1 = 0.8$

$q_1 = \mu_1 s_k = 0.68$ kN/m²

$\mu_2 = 0.8 \le \gamma h / s_k \le 2.0 = 2.00$

$q_2 = (\mu_2 - \mu_1)\, s_k = 1.02$ kN/m²

$l_s = 5 \le 2h \le 15 = 5.00$ m