

1. Basic data

BUILDING PROJECT: **hipped roof im Schwarzw. 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

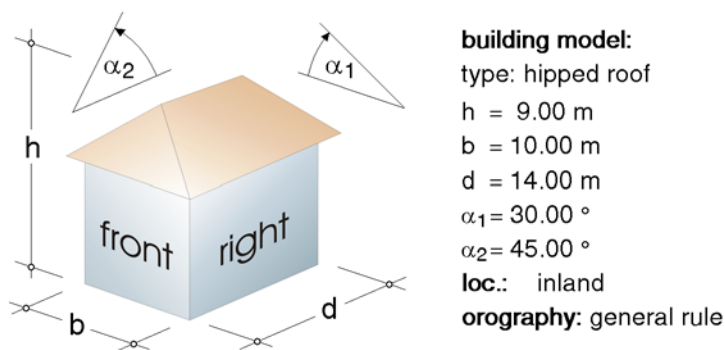
LOCATION: Hornberg, Stadt
AMTL. GEMEINDESCHLÜSSEL: 08317051
TYPE: Stadt
DISTRICT: Ortenaukreis
FEDERAL STATE: Baden-Württemberg

ALT. ABOVE SEA LEVEL: 953 m
WIND ZONE: 1 $\Rightarrow v_{b,0} = 28.00 \text{ m/s}$
SNOW LOAD ZONE: 2 $\Rightarrow s_k = 4.20 \text{ kN/m}^2$

increasing factor: 1.1530 to increase dynamic wind pressure for heights > 800m + NN acc. to EN 1991-1-4 / NAA.2

2. Wind actions

2.1 Input data



protr. roofs	front	right	back	left
in m	0.90	1.56	0.90	1.56

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 $\rho = 1.25 \text{ kg/m}^3$, 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/m ²
9.00	23.45	0.226	23.45	0.226	0.93

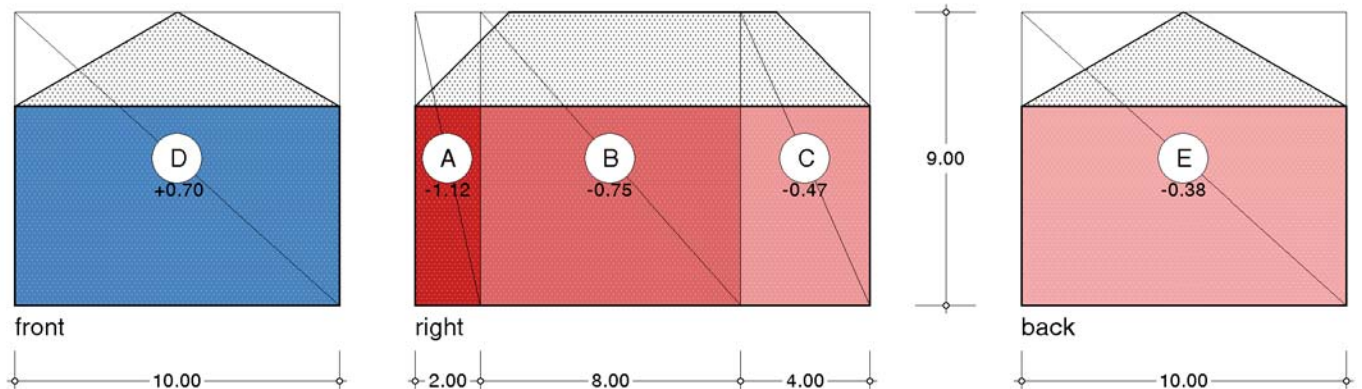
2.3 Wind from front side

characteristic values: $e = \min(b, 2h) = 10.00 \text{ m}$ type: $e < d$ $h/d = 0.64$

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 = $c_{pe,10} \cdot q(h)$, (+) = pressure

area	A	B	C	D	E	note
$c_{pe,10}$	-1.20	-0.80	-0.50	+0.75	-0.40	interpolated
ordinates	-1.12	-0.75	-0.47	+0.70	-0.38	kN/m ²



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 Increased wind actions on vertical walls (wind from front side) for reckoning of connections and verification of details

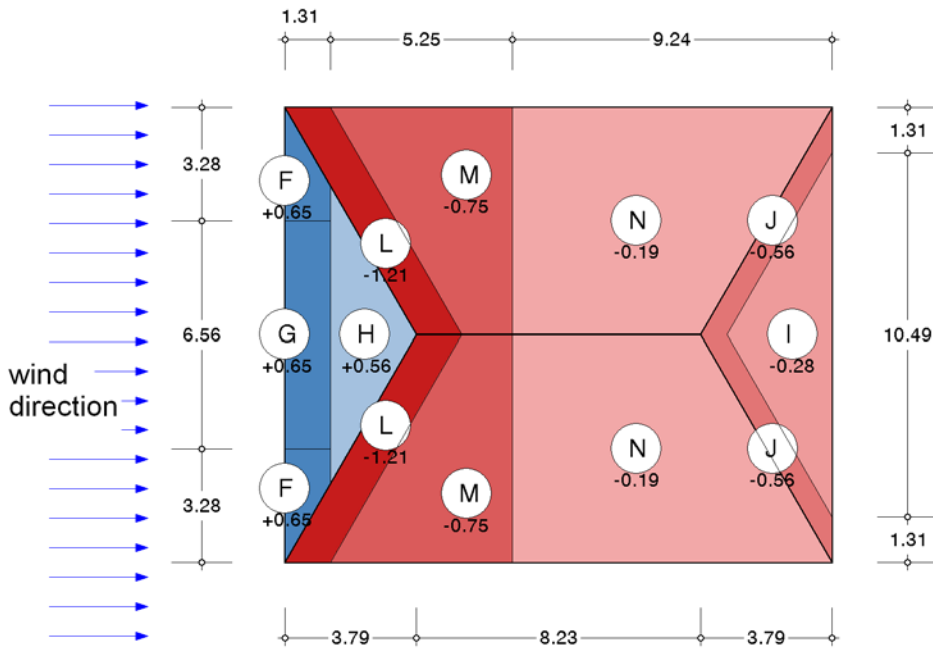
logarithmically interpolated external pressure coefficients depending on predefined loaded areas A_i acc. to EC1-1-4 / 7.2.1
 ordinate = $c_{pe,A_i} \cdot q(h)$, (+) = pressure

area	A	B	C	D	E	note
loaded area $A_1 = 1.00 \text{ m}^2$						
c_{pe,A_1}	-1.40	-1.10	-0.50	+1.00	-0.50	interpolated
ordinates	-1.31	-1.03	-0.47	+0.93	-0.47	kN/m ²

2.3.3 Loading of roof area (wind from front side)

external pressure coefficients and load ordinates for dupitch roofs acc. to EC1-1-4 / Tab. 7.5 ($\vartheta=90^\circ$)
 ordinate = $c_{pe,10} \cdot q(h)$, (+) = pressure

area	F	G	H	I	J	K	L	M	N	note
$c_{pe,10}$	+0.70	+0.70	+0.60	-0.30	-0.60	-	-1.30	-0.80	-0.20	interpolated
ordinates	+0.65	+0.65	+0.56	-0.28	-0.56	-	-1.21	-0.75	-0.19	kN/m ²



2.3.4 Increased suction loads on roof area (wind from front side) for reckoning of connections and verification of details

logarithmically interpolated external pressure coefficients depending on predefined loaded areas A_i acc. to EC1-1-4 / 7.2.1
ordinate = $c_{pe,A_i} \cdot q(h)$. Here only the suction loads(-) are shown. If the preceding table additionally contains pressure loads (+)
these are effective also for reckoning of connections and verification of details.

area	F	G	H	I	J	K	L	M	N	note
loaded area $A_1 = 1.00 \text{ m}^2$										
c_{pe,A_1}	-	-	-	-0.30	-0.60	-	-2.00	-1.20	-0.20	interpolated
ordinates	-	-	-	-0.28	-0.56	-	-1.87	-1.12	-0.19	kN/m^2

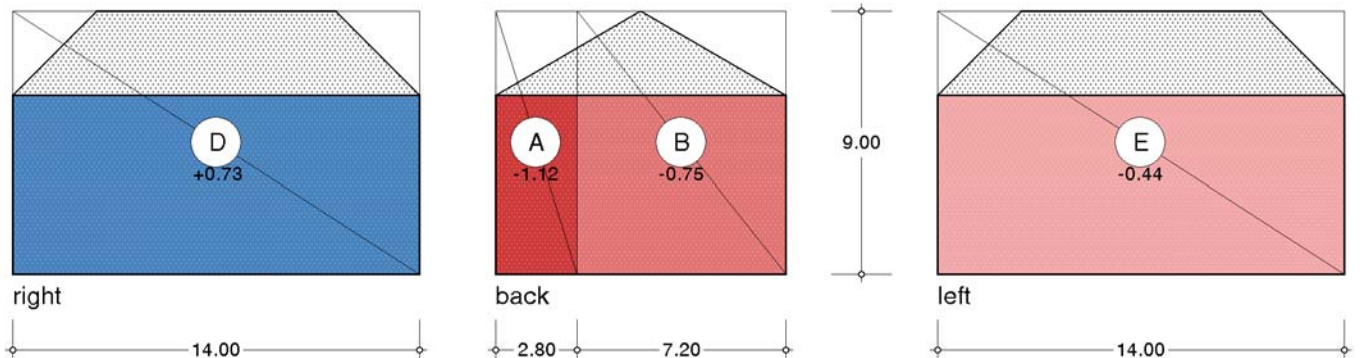
2.4 Wind from righthand

characteristic values: $e = \min(d, 2h) = 14.00 \text{ m}$ type: $b \leq e \leq 5b$ $h/b = 0.90$

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 = $c_{pe,10} \cdot q$, (+) = pressure

area	A	B	C	D	E	note
$c_{pe,10}$	-1.20	-0.80	-0.50	+0.79	-0.47	interpolated
ordinates	-1.12	-0.75	-0.47	+0.73	-0.44	kN/m^2



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 Increased wind actions on vertical walls (wind from righthand) for reckoning of connections and verification of details

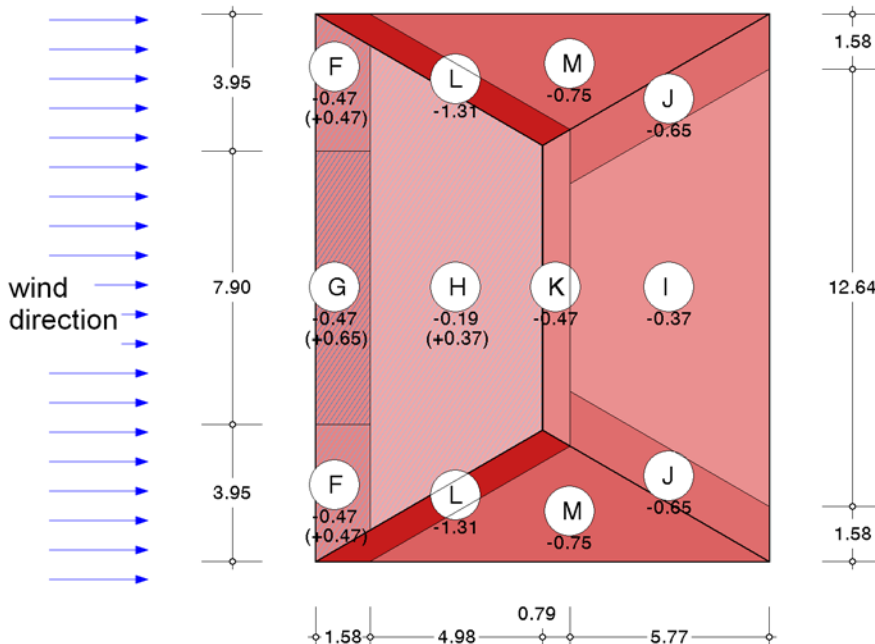
logarithmically interpolated external pressure coefficients depending on predefined loaded areas A_i acc. to EC1-1-4 / 7.2.1
ordinate = $c_{pe,A_i} * q(h)$, (+) = pressure

area	A	B	C	D	E	note
loaded area $A1 = 1.00 \text{ m}^2$						
$c_{pe,A1}$	-1.40	-1.10	-0.50	+1.00	-0.50	interpolated
ordinates	-1.31	-1.03	-0.47	+0.93	-0.47	kN/m^2

2.4.3 Loading of roof area (wind from righthand)

external pressure coefficients and load ordinates for duopitch roofs acc. to EC1-1-4 / Tab. 7.5 ($\Theta=0^\circ$)
ordinate = $c_{pe,10} * q(h)$, (+) = pressure

area	F	G	H	I	J	K	L	M	N	note
$c_{pe,10}$	-0.50	-0.50	-0.20	-0.40	-0.70	-0.50	-1.40	-0.80	-	interpolated
alternative	+0.50	+0.70	+0.40	-	-	-	-	-	-	interpolated
ordinates	-0.47	-0.47	-0.19	-0.37	-0.65	-0.47	-1.31	-0.75	-	kN/m^2
alternative	+0.47	+0.65	+0.37	-	-	-	-	-	-	kN/m^2



2.4.4 Increased suction loads on roof area (wind from front side) for reckoning of connections and verification of details

logarithmically interpolated external pressure coefficients depending on predefined loaded areas A_i acc. to EC1-1-4 / 7.2.1
ordinate = $c_{pe,A_i} * q(h)$. Here only the suction loads(-) are shown. If the preceding table additionally contains pressure loads (+) these are effective also for reckoning of connections and verification of details.

area	F	G	H	I	J	K	L	M	N	note
loaded area $A1 = 1.00 \text{ m}^2$										
$c_{pe,A1}$	-1.50	-1.50	-0.20	-0.40	-1.20	-0.50	-2.00	-1.20	-	interpolated
ordinates	-1.40	-1.40	-0.19	-0.37	-1.12	-0.47	-1.87	-1.12	-	kN/m^2

2.5 Wind actions on canopy

geometry

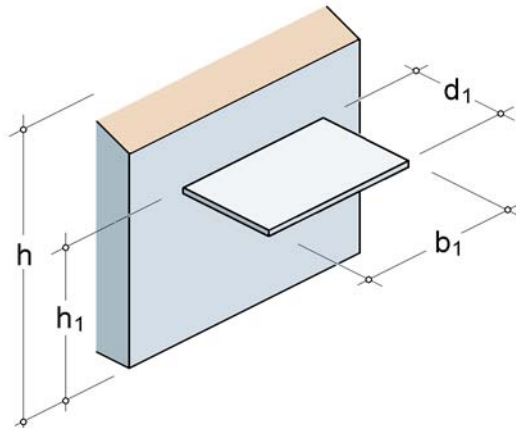
$$b_1 = 3.50 \text{ m}$$

$$d_1 = 2.50 \text{ m}$$

$$h_1 = 3.00 \text{ m}$$

$$h = 8.00 \text{ m}$$

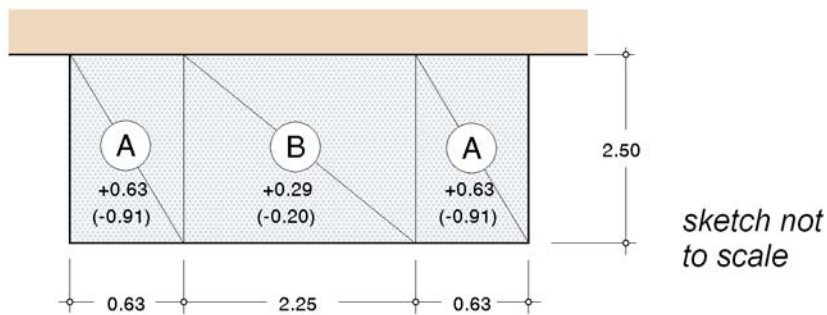
h is the mean height of the main building



Load determination acc. to Muster-Liste der Technischen Baubestimmungen vom Februar 2007 - Anlage 1.1/1 - Absatz 4. This is substantially corresponding to annex NA.V of the German National Annex of DIN EN 1991-1-4/NA:2010-12 to Eurocode - and therefore is Eurocode in Germany.

$$e = \min (d_1/4, b_1/2) = 0.63 \text{ m}$$

$$q(h) = 0.90 \text{ kN/m}^2$$



pressure values and load ordinates for canopy roofs				
load direct.	↓ downw. (+)		↑ upward (-)	
area	A	B	A	B
$C_{p,net}$	+0.70	+0.33	-1.01	-0.22
ordinates	+0.63	+0.29	-0.91	-0.20

interpolated
kN/m²

$$\text{ordinate} = c_{p,net} q(h)$$

3. Snow loads

3.1 Basic loading

hipped roof

$$\alpha_1 = 30.00^\circ \Rightarrow \mu_1(\alpha_1) = 0.80$$

$$\alpha_2 = 45.00^\circ \Rightarrow \mu_1(\alpha_2) = 0.80$$

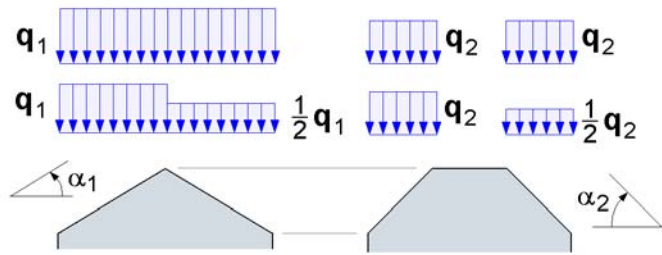
$$q_1 = \mu_1(\alpha_1) s_k = 3.36 \text{ kN/m}^2$$

$$q_2 = \mu_1(\alpha_2) s_k = 3.36 \text{ kN/m}^2$$

$$\frac{1}{2} q_1 = 1.68 \text{ kN/m}^2$$

$$\frac{1}{2} q_2 = 1.68 \text{ kN/m}^2$$

note: in case of layout of snowguards μ is 0.8.



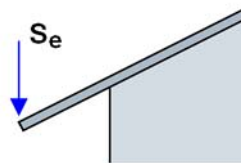
if the structure is sensitive to unevenly distributed loads, the design should also consider one-sided half load

3.2 Protruding roof

The design of those parts of a roof cantilevered out beyond the walls should take account of snow overhanging the edge of the roof, in addition to the load on that part of the roof.

$$S_e = 0.4 (\mu_1 s_k)^2 / \gamma = \underline{\underline{1.51 \text{ kN/m}}}$$

($\gamma = 3.0 \text{ kN/m}^3$)



acc. to EC 1-1-3 / par. 6.3 in conjunction with NA-DE (NDP to 6.3)

3.3 Snowguard

In case of placing of snowguards or other obstacles a force F_s should be taken as

$$F_s = \bar{\mu}_1 s_k b \sin \alpha = \underline{\underline{8.40 \text{ kN/m}}}$$

($\bar{\mu}_1 = 0.8$)

with $b = 5.00 \text{ m}$

