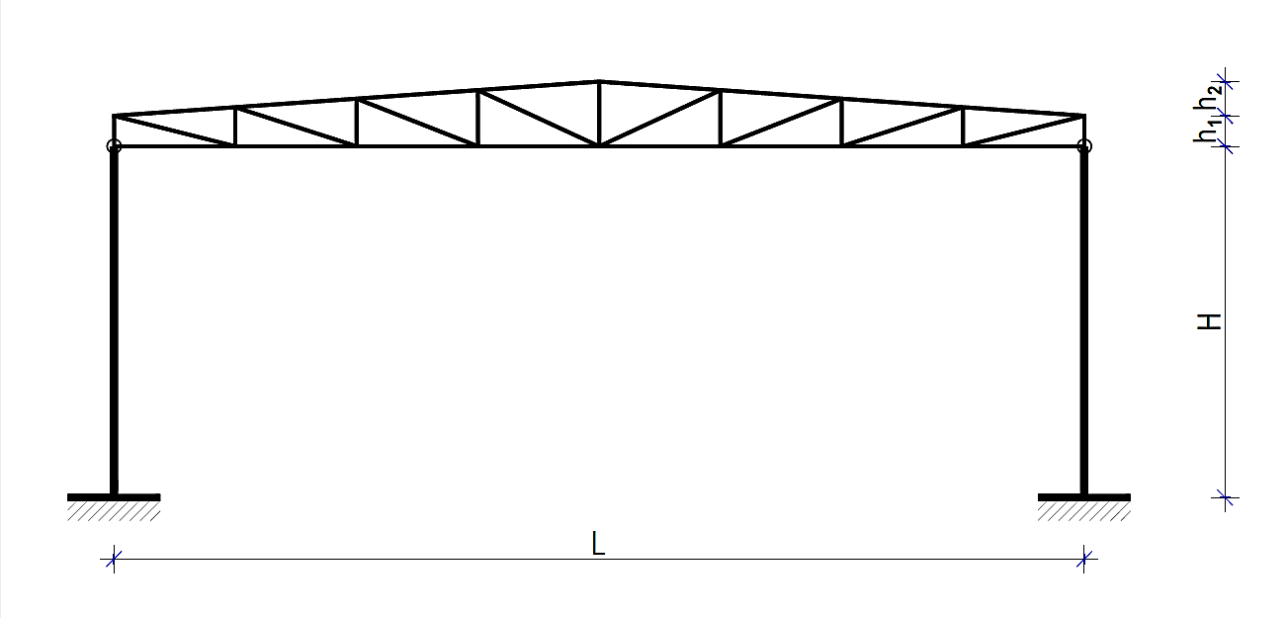
PRIMJER 18

Za dati okvir čelične hale izvršiti statičku analizu primjenom softvera RSAP za GSN i GSU. Zadani su presjeci elemenata čelične konstrukcije kao i karakteristične vrijednosti za stalno opterećenje, snijeg i vjetar.



L = 8 x 2,625 = 21 [m] ; H = 7,60 [m] ; h1 = 0,66 [m] ; h2 = 0,74 [m]

POPREČNI PRESJECI:

***stubovi → HEM 400**

***vertikale i dijagonale rešetke → 100x100x5 mm**

***donji i gornji pojas rešetke → 150x150x6 mm**

***krajnje vertikale rešetke → 130x130x5 mm**

Materijal: S 275

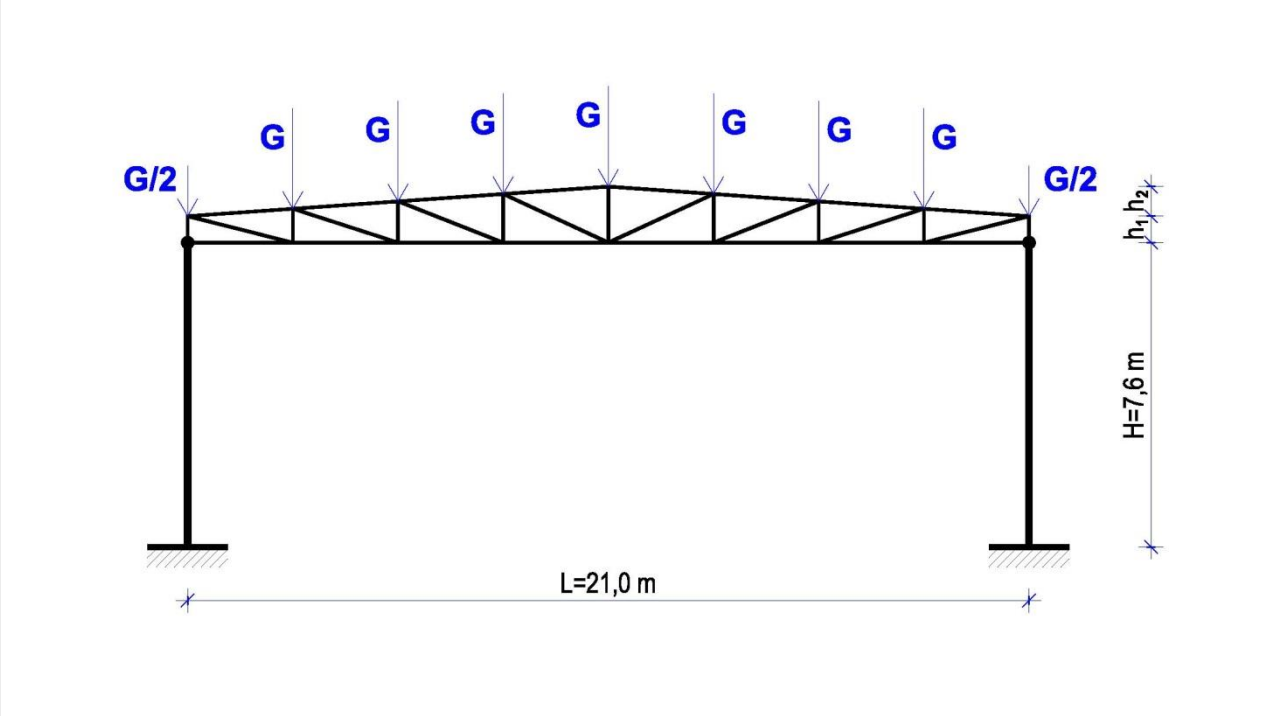
- **razmak između okvira: λ = 6,30 [m]**

Frame 2D Design

SLUČAJEVI OPTEREĆENJA

1. STALNO OPTEREĆENJE

- stalno opterećenje bez sopstvene težine konstrukcije: g = 0,55 [kN/m²]
- nagib krovne plohe: α = 4°



G = 9,12 [kN] ; G/2 = 4,56 [kN]

NAPOMENA: Sopstvenu težinu konstrukcije uzima u obzir računar.

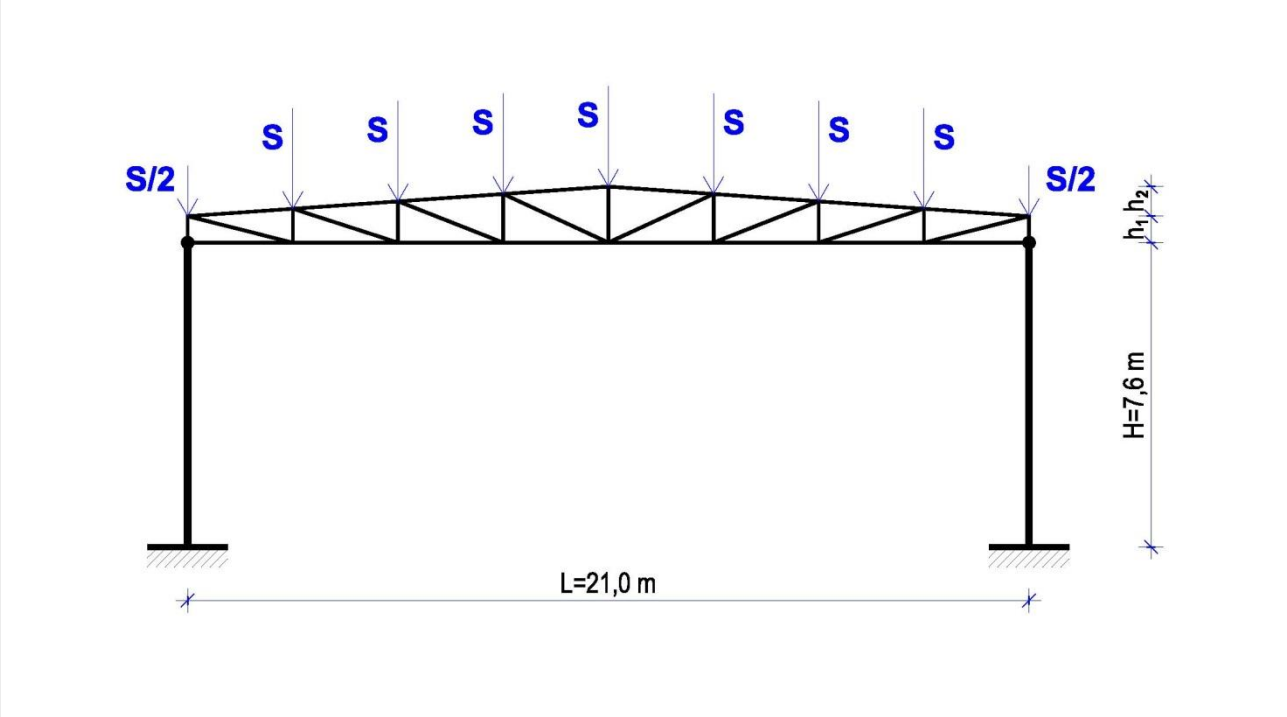
**Frame 2D Design*

2. SNIJEG

Opterećenja snijegom po tlocrtnoj površini krova: s_1 = 0,60 [kN/m²]

s_2 = 0,30 [kN/m²]

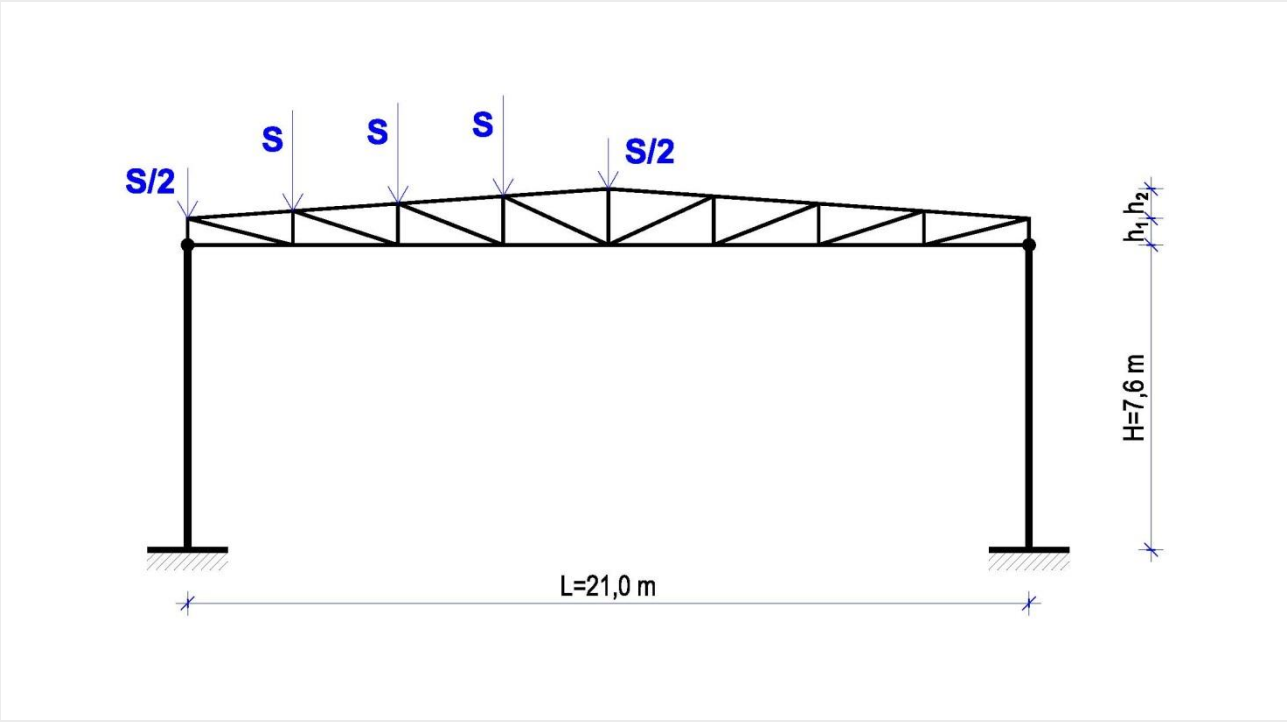
2.1 SNIJEG PREKO CIJELOG KROVA



S = 9,92 [kN] ; S/2 = 4,96 [kN]

**Frame 2D Design*

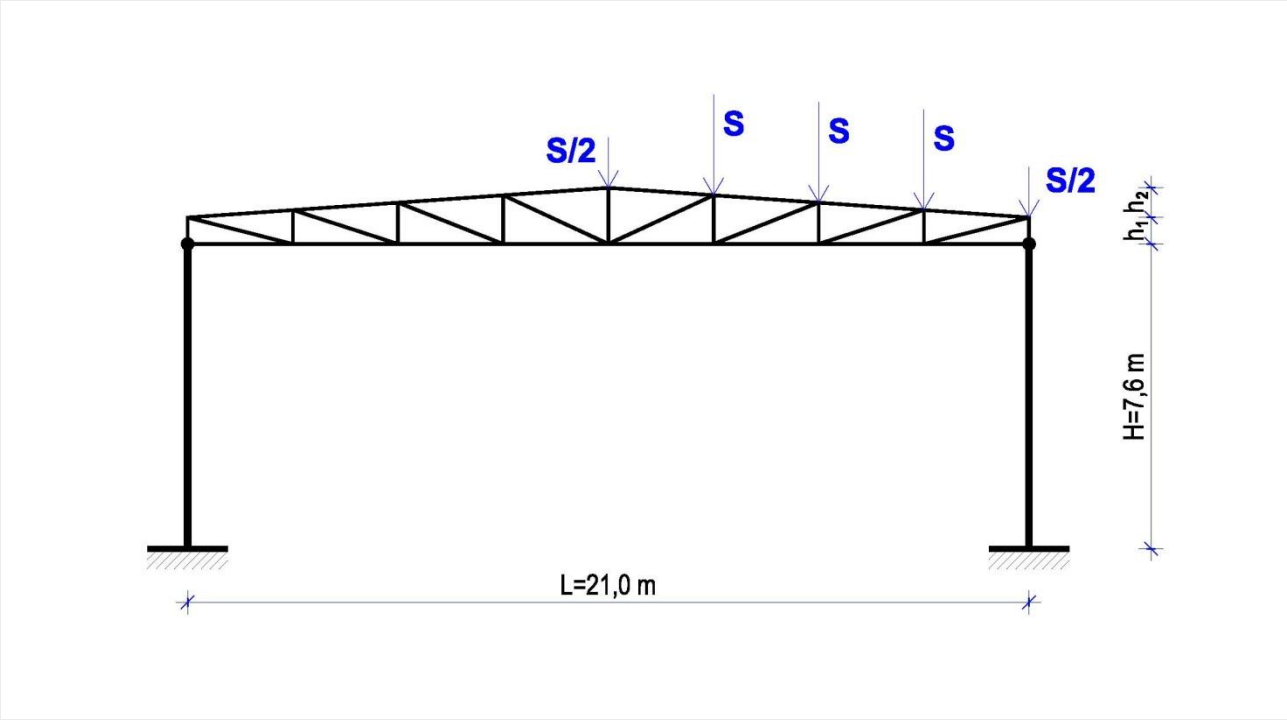
2.2 SNIJEG PREKO POLA KROVNE PLOHE



S = 4,96 [kN] ; S/2 = 2,48 [kN]

**Frame 2D Design*

2.3 SNIJEG PREKO DRUGE POLOVINE KROVNE PLOHE



S = 4,96 [kN] ; S/2 = 2,48 [kN]

**Frame 2D Design*

3. VJETAR

Pritisak vjetra na vanjske površine:

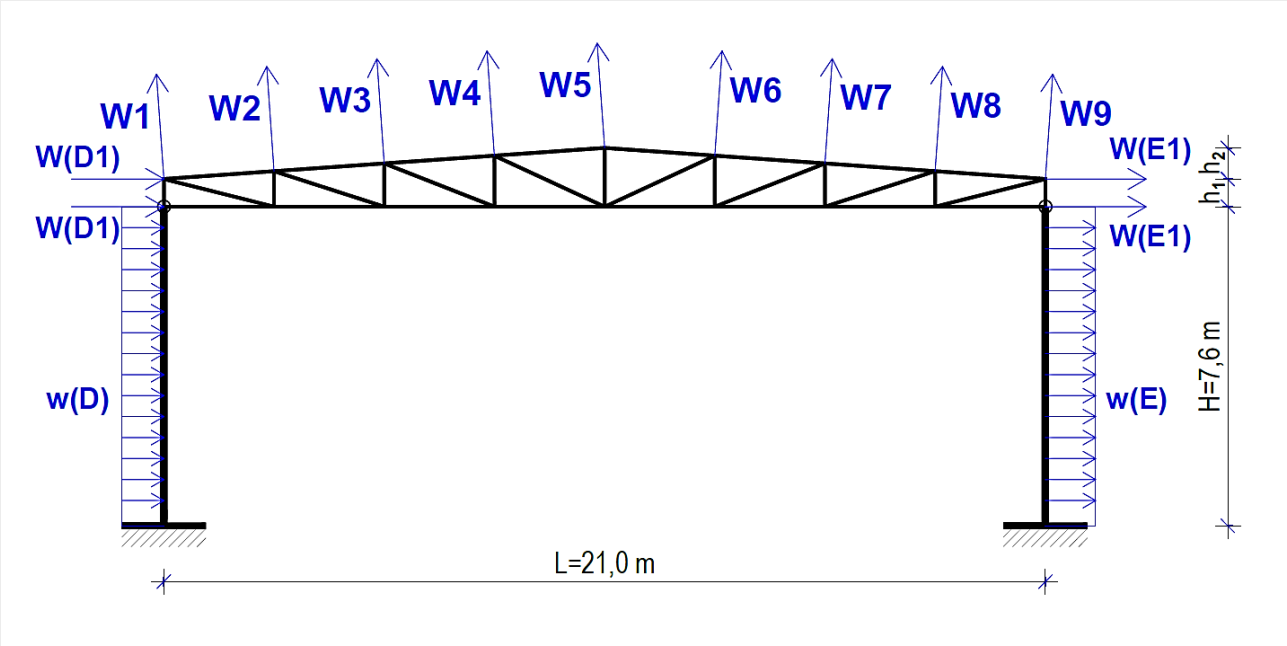
- područje G: $w_e = q_{ref}*c_e(z_e)*c_{pe} = 0,93*2,0*(-1,2) = -2,23$ [kN/m^2]
- područje H: $w_e = q_{ref}*c_e(z_e)*c_{pe} = 0,93*2,0*(-0,6) = -1,12$ [kN/m^2]
- područje I: $w_e = q_{ref}*c_e(z_e)*c_{pe} = 0,93*2,0*(-0,3) = -0,56$ [kN/m^2]
- područje J: $w_e = q_{ref}*c_e(z_e)*c_{pe} = 0,93*2,0*(-0,3) = -0,56$ [kN/m^2]
- područje D: $w_e = q_{ref}*c_e(z)*c_{pe} = 0,93*2,0*0,8 = 1,48$ [kN/m^2]
- područje E: $w_e = q_{ref}*c_e(z)*c_{pe} = 0,93*2,0*(-0,3) = -0,56$ [kN/m^2]

Pritisak vjetra na unutrašnje površine: $w_i = q_{ref}*c_e(z_i)*c_{pi} = 0,93*2,0*(\pm0,3) = \pm0,56$ [kN/m^2]

Rezultujuće djelovanje vjetrom na okvir: $w_k = w_e - w_i$

3.1 VJETAR 1 (VJETAR IZVANA + PRITISAK IZNUTRA)

- područje G: $w_k = -2,23-0,56 = -2,79$ [kN/m^2]
- područje H: $w_k = -1,12-0,56 = -1,68$ [kN/m^2]
- područje I: $w_k = -0,56-0,56 = -1,12$ [kN/m^2]
- područje J: $w_k = -0,56-0,56 = -1,12$ [kN/m^2]
- područje D: $w_k = 1,48-0,56 = 0,92$ [kN/m^2]
- područje E: $w_k = -0,56-0,56 = -1,12$ [kN/m^2]



W_1 = -31,64 [kN] ; $W_2 = W_3 = W_4$ = -27,85 [kN] ; W_{5L} = -13,92 [kN] ; W_{5D} = -12,70 [kN]

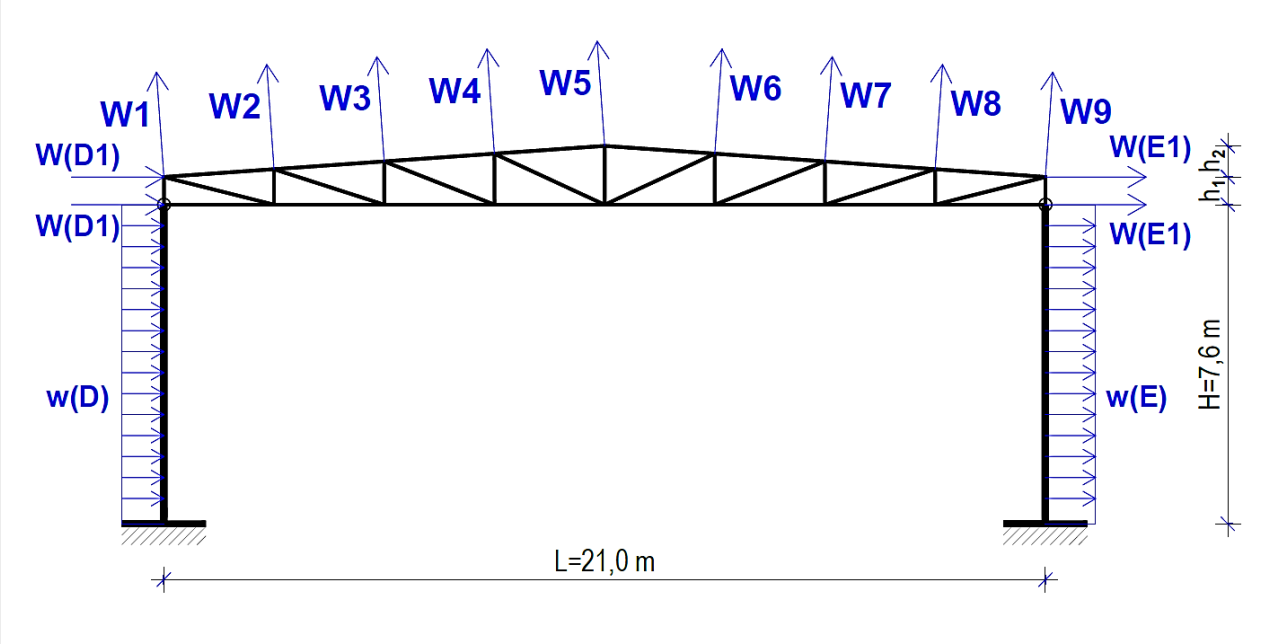
$W_6 = W_7 = W_8$ = -18,56 [kN] ; W_9 = -9,27 [kN]

w(D) = 5,79 [kN/m] ; w(E) = -7,06 [kN/m] ; W(D1) = 1,91 [kN] ; W(E1) = -2,33 [kN]

*Frame 2D Design

3.2 VJETAR 2 (VJETAR IZVANA + SIŠUĆE DEJSTVO VJETRA IZNUTRA)

- područje G: w_k = -2,23+0,56 = -1,67 [kN/m^2]
- područje H: w_k = -1,12+0,56 = -0,56 [kN/m^2]
- područje I: w_k = -0,56+0,56 = 0,00 [kN/m^2]
- područje J: w_k = -0,56+0,56 = 0,00 [kN/m^2]
- područje D: w_k = 1,48+0,56 = 2,04 [kN/m^2]
- područje E: w_k = -0,56+0,56 = 0,00 [kN/m^2]



W_1 = -18,94 [kN] ; $W_2 = W_3 = W_4$ = -9,28 [kN] ; W_{5L} = -4,64 [kN] ; W_{5D} = 0,00 [kN]

$W_6 = W_7 = W_8$ = 0,00 [kN] ; W_9 = 0,00 [kN]

w(D) = 12,85 [kN/m] ; w(E) = 0,00 [kN/m] ; W(D1) = 4,24 [kN] ; W(E1) = 0,00 [kN]

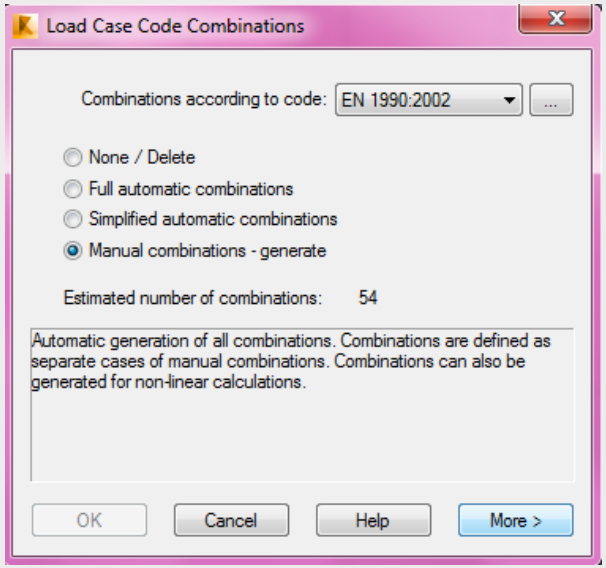
**Frame 2D Design*

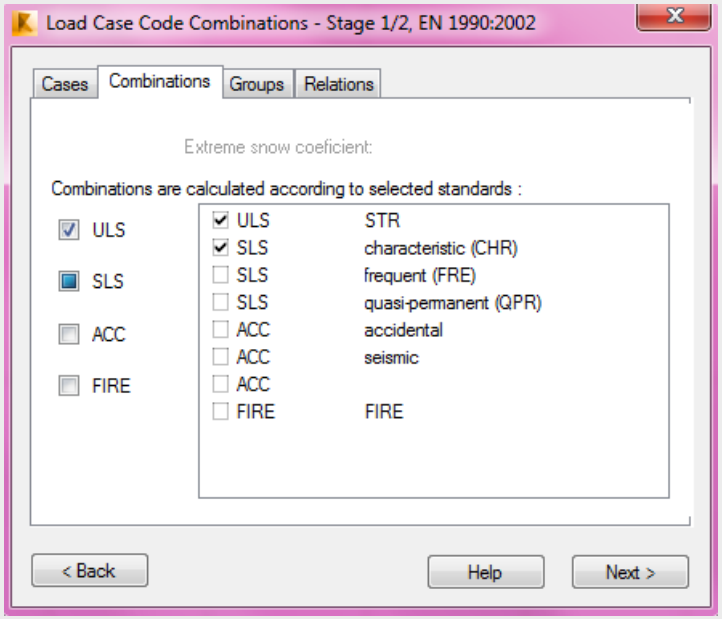
SLUČAJEVI OPTEREĆENJA:

I. stalno (uključena i sopstvena težina konstrukcije)
II. snijeg preko cijelog krova
III. snijeg preko pola krovne plohe
IV. snijeg preko druge polovine krovne plohe
V. vjetar 1 (vjetar izvana+pritisak iznutra)
VI. vjetar 2 (vjetar izvana+sišuće dejstvo vjetra iznutra)

KOMBINACIJE OPTEREĆENJA (EN 1990:2002):

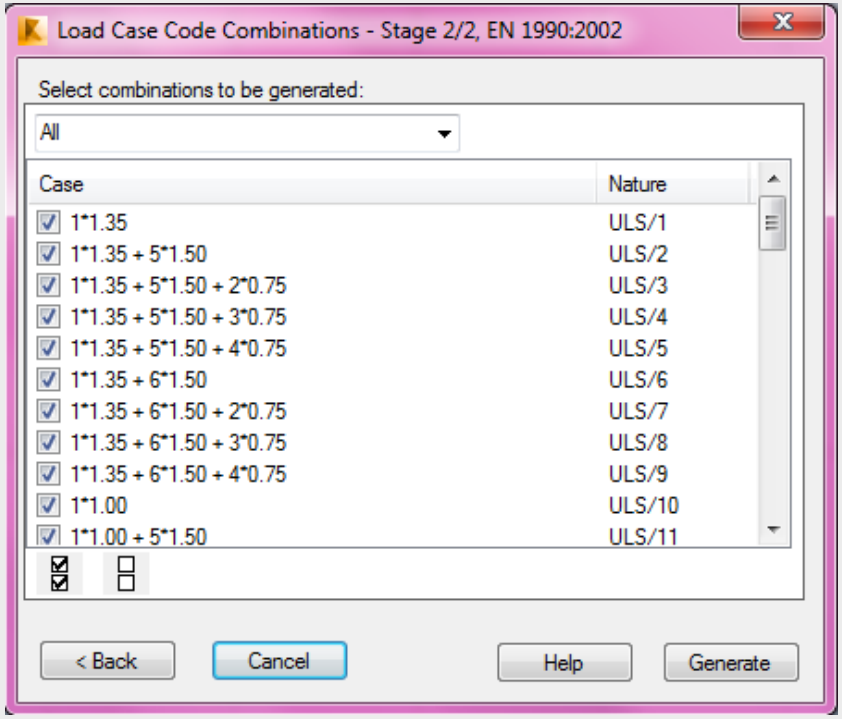
*** Loads → Automatic Combinations → Manual Combinations – generate → More**





Frame 2D Design

- Prva grupa – kombinacije za ULS (granično stanje nosivosti)
- Druga grupa - karakteristične kombinacije za SLS (granično stanje upotrebljivosti)



<< GENERATE >>

* Loads → Combinations Table

**Frame 2D Design*

Combinations	Name	Analysis type	Combination type	Definition
7 (C)	ULS/1=1*1.35	Linear Combination		1*1.35
8 (C)	ULS/2=1*1.35 + 5*1.50	Linear Combination		1*1.35+5*1.50
9 (C)	ULS/3=1*1.35 + 5*1.50 + 2*0.75	Linear Combination		1*1.35+5*1.50+2*0.75
10 (C)	ULS/4=1*1.35 + 5*1.50 + 3*0.75	Linear Combination		1*1.35+5*1.50+3*0.75
11 (C)	ULS/5=1*1.35 + 5*1.50 + 4*0.75	Linear Combination		1*1.35+5*1.50+4*0.75
12 (C)	ULS/6=1*1.35 + 6*1.50	Linear Combination		1*1.35+6*1.50
13 (C)	ULS/7=1*1.35 + 6*1.50 + 2*0.75	Linear Combination		1*1.35+6*1.50+2*0.75
14 (C)	ULS/8=1*1.35 + 6*1.50 + 3*0.75	Linear Combination		1*1.35+6*1.50+3*0.75
15 (C)	ULS/9=1*1.35 + 6*1.50 + 4*0.75	Linear Combination		1*1.35+6*1.50+4*0.75
16 (C)	ULS/10=1*1.00	Linear Combination		1*1.00
17 (C)	ULS/11=1*1.00 + 5*1.50	Linear Combination		1*1.00+5*1.50
18 (C)	ULS/12=1*1.00 + 5*1.50 + 2*0.75	Linear Combination		1*1.00+5*1.50+2*0.75
19 (C)	ULS/13=1*1.00 + 5*1.50 + 3*0.75	Linear Combination		1*1.00+5*1.50+3*0.75
20 (C)	ULS/14=1*1.00 + 5*1.50 + 4*0.75	Linear Combination		1*1.00+5*1.50+4*0.75
21 (C)	ULS/15=1*1.00 + 6*1.50	Linear Combination		1*1.00+6*1.50
22 (C)	ULS/16=1*1.00 + 6*1.50 + 2*0.75	Linear Combination		1*1.00+6*1.50+2*0.75
23 (C)	ULS/17=1*1.00 + 6*1.50 + 3*0.75	Linear Combination		1*1.00+6*1.50+3*0.75
24 (C)	ULS/18=1*1.00 + 6*1.50 + 4*0.75	Linear Combination		1*1.00+6*1.50+4*0.75
25 (C)	ULS/19=1*1.35 + 2*1.50	Linear Combination		1*1.35+2*1.50
26 (C)	ULS/20=1*1.35 + 3*1.50	Linear Combination		1*1.35+3*1.50
27 (C)	ULS/21=1*1.35 + 4*1.50	Linear Combination		1*1.35+4*1.50
28 (C)	ULS/22=1*1.35 + 5*0.90 + 2*1.50	Linear Combination		1*1.35+5*0.90+2*1.50
29 (C)	ULS/23=1*1.35 + 5*0.90 + 3*1.50	Linear Combination		1*1.35+5*0.90+3*1.50
30 (C)	ULS/24=1*1.35 + 5*0.90 + 4*1.50	Linear Combination		1*1.35+5*0.90+4*1.50
31 (C)	ULS/25=1*1.35 + 6*0.90 + 2*1.50	Linear Combination		1*1.35+6*0.90+2*1.50
32 (C)	ULS/26=1*1.35 + 6*0.90 + 3*1.50	Linear Combination		1*1.35+6*0.90+3*1.50
33 (C)	ULS/27=1*1.35 + 6*0.90 + 4*1.50	Linear Combination		1*1.35+6*0.90+4*1.50
34 (C)	ULS/28=1*1.00 + 2*1.50	Linear Combination		1*1.00+2*1.50
35 (C)	ULS/29=1*1.00 + 3*1.50	Linear Combination		1*1.00+3*1.50
36 (C)	ULS/30=1*1.00 + 4*1.50	Linear Combination		1*1.00+4*1.50
37 (C)	ULS/31=1*1.00 + 5*0.90 + 2*1.50	Linear Combination		1*1.00+5*0.90+2*1.50
38 (C)	ULS/32=1*1.00 + 5*0.90 + 3*1.50	Linear Combination		1*1.00+5*0.90+3*1.50
39 (C)	ULS/33=1*1.00 + 5*0.90 + 4*1.50	Linear Combination		1*1.00+5*0.90+4*1.50
40 (C)	ULS/34=1*1.00 + 6*0.90 + 2*1.50	Linear Combination		1*1.00+6*0.90+2*1.50
41 (C)	ULS/35=1*1.00 + 6*0.90 + 3*1.50	Linear Combination		1*1.00+6*0.90+3*1.50
42 (C)	ULS/36=1*1.00 + 6*0.90 + 4*1.50	Linear Combination		1*1.00+6*0.90+4*1.50
43 (C)	SLS:CHR/1=1*1.00	Linear Combination	SLS:CHR	1*1.00
44 (C)	SLS:CHR/2=1*1.00 + 5*1.00	Linear Combination	SLS:CHR	(1+5)*1.00
45 (C)	SLS:CHR/3=1*1.00 + 5*1.00 + 2*0.50	Linear Combination	SLS:CHR	(1+5)*1.00+2*0.50
46 (C)	SLS:CHR/4=1*1.00 + 5*1.00 + 3*0.50	Linear Combination	SLS:CHR	(1+5)*1.00+3*0.50
47 (C)	SLS:CHR/5=1*1.00 + 5*1.00 + 4*0.50	Linear Combination	SLS:CHR	(1+5)*1.00+4*0.50
48 (C)	SLS:CHR/6=1*1.00 + 6*1.00	Linear Combination	SLS:CHR	(1+6)*1.00
49 (C)	SLS:CHR/7=1*1.00 + 6*1.00 + 2*0.50	Linear Combination	SLS:CHR	(1+6)*1.00+2*0.50
50 (C)	SLS:CHR/8=1*1.00 + 6*1.00 + 3*0.50	Linear Combination	SLS:CHR	(1+6)*1.00+3*0.50
51 (C)	SLS:CHR/9=1*1.00 + 6*1.00 + 4*0.50	Linear Combination	SLS:CHR	(1+6)*1.00+4*0.50
52 (C)	SLS:CHR/10=1*1.00 + 2*1.00	Linear Combination	SLS:CHR	(1+2)*1.00
53 (C)	SLS:CHR/11=1*1.00 + 3*1.00	Linear Combination	SLS:CHR	(1+3)*1.00
54 (C)	SLS:CHR/12=1*1.00 + 4*1.00	Linear Combination	SLS:CHR	(1+4)*1.00
55 (C)	SLS:CHR/13=1*1.00 + 5*0.60 + 2*1.00	Linear Combination	SLS:CHR	(1+2)*1.00+5*0.60

*Frame 2D Design