

KATUSESARIKATE TUGEVARVUTUS

Lähteülesanne: hinnata sarikate tugevust koos päikesepaneelidega. Päikesepaneelide normatiivseks omakaaluks arvestatud 30kg/m²

Katuse omakaalu arvutus:

Materjal	mm	mm	mm		kN/m ²
Kõrgus	Laius	Samm	Mahukaal	Kaal	
Päikesepaneelid					0.300
Plekkkatuse					0.100
Puit	25		6		0.150
Puit	25	50	6	0.013	
Puit	245	45	6	0.110	
Vill	245		0.3	0.074	
Puit	50	50	6	0.038	
Vill	50		0.3	0.015	
OSB	12		8	0.096	
Kips	13		7	0.091	

Kokku **1** kN/m²

EVS-EN 1991-1-1:2002: OMAKAAL

KONSTRUKTSIOONIDE RUUTMEETRI OMAKAAL [kN/m²]:

NIMETUS OMAKAAL
Katus 1.0kN/m²

EVS-EN 1991-1-3:2006+NA: LUMEKOORMUS

$s_k = 1.5 \text{ kN/m}^2$ (NORMATIIVNE LUMEKOORMUS MAAPINNAL, HARJUMAA)

$s_f = 0.8 * 1.5 = 1.2 \text{ kN/m}^2$ (NORMATIIVNE LUMEKOORMUS KATUSEL)

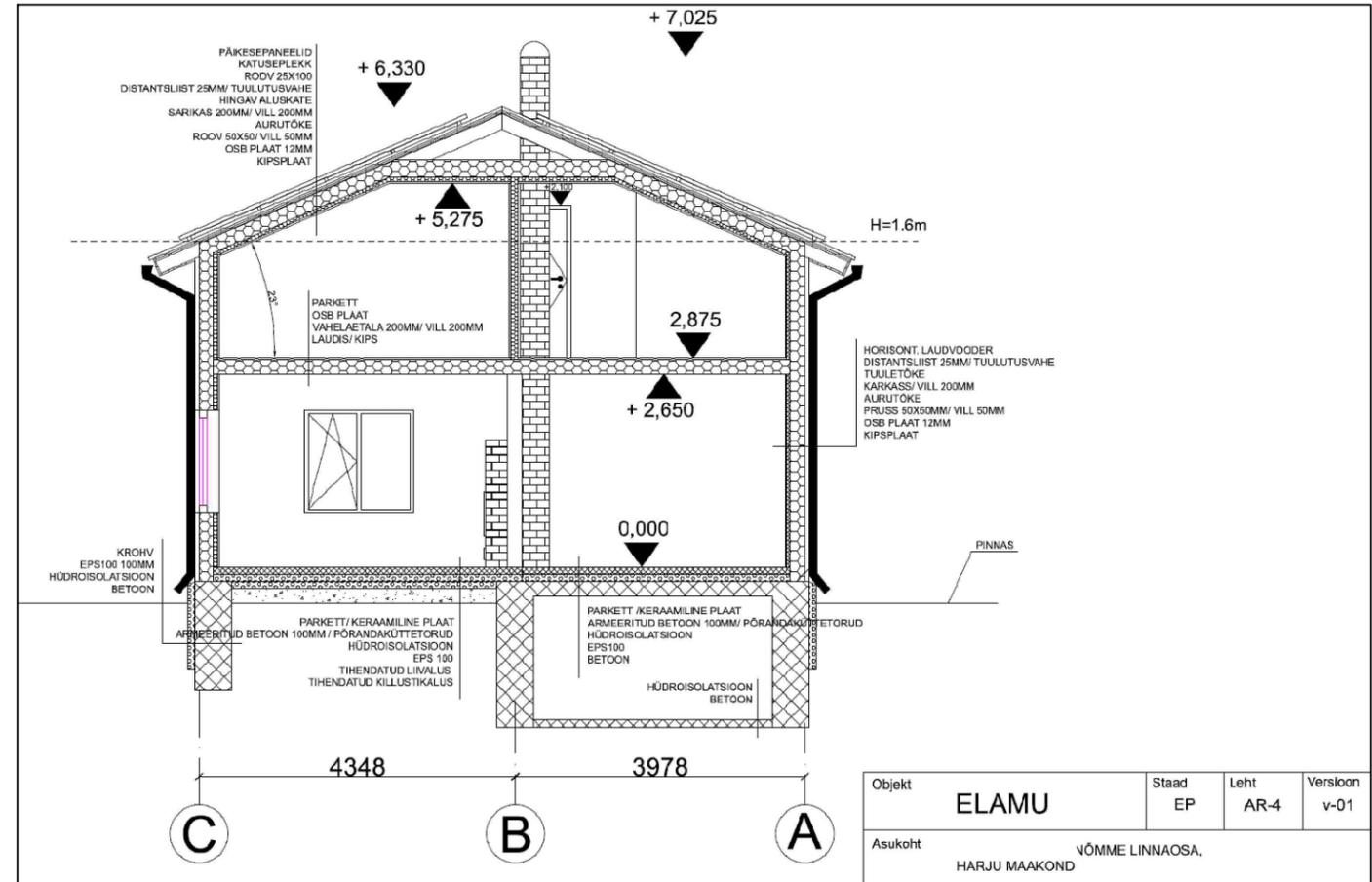
EVS-EN 1991-1-4:2005+NA: TUULEKOORMUS

$w_k = 0.4 \text{ kN/m}^2$ (Maastikutüüp 3; h=6.5m)

Kontrollitava C24 puitmaterjali tugevusparameetrid:

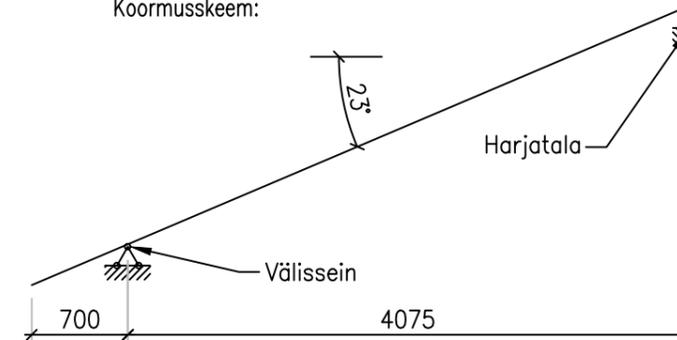
Paine	$f_{m,k}$	24
Tõmme pikikiudu	$f_{t,0,k}$	14
Tõmme ristikiudu	$f_{t,90,k}$	0.4
Surve pikikiudu	$f_{c,0,k}$	21
Surve ristikiudu	$f_{c,90,k}$	2.5
Nihe/Lõige	$f_{v,k}$	4
JÄIKUSOMADUSED (N/mm ²)		
Keskmine elastusmoodul pikikiudu	$E_{0,mean}$	11000
5% elastusmoodul pikikiudu	$E_{0,05}$	7400
Keskmine elastusmoodul ristikiudu	$E_{90,mean}$	370
Keskmine nihkemoodul	G_{mean}	690
TIHEDUS		
Tihedus	ρ_k	350
Keskmine tihedus	ρ_{mean}	420
Osavarutegur	γ_m	1.3

Hoone arhitektuurne lõige:

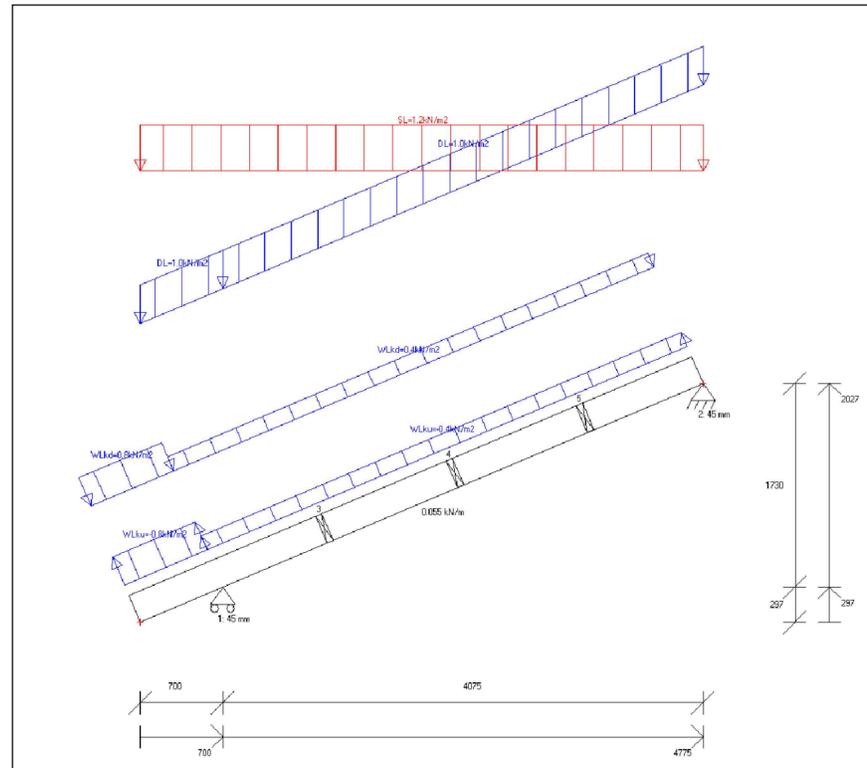


Objekt	ELAMU	Staad	EP	Leht	AR-4	Versioon	v-01
Asukoht	NÕMME LINNAOSA, HARJU MAAKOND						

Koormuskeem:



Sarika dimensioneerimine:



Määravaks saavad koormuskombinatsioonid:

Kandepiiriseisund ULS: 1.2DL+1.5SL (koormuse kestvusklass keskketev; kmod=0.8)

Kasutuspiiriseisund SLS: 1.0DL+1.0SL (Kontrollitav tingimus: w.net.fin=L/300)

EXTREME DESIGN RESULTS:

Checking:	Design value:	Resistance:	% of utilization *):	Location x:	
Shear (z):	3.34 kN	12.12 kN	27.5 %	1003 mm	Comb. 2/1, Medium-term
Tension:	1.49 kN	98.38 kN	1.5 %	5187 mm	Comb. 2/1, Medium-term
Compression:	1.59 kN	142.48 kN	1.1 %	760 mm	Comb. 2/1, Medium-term
Bending (My):	3.78 kNm	5.77 kNm	65.4 %	2983 mm	Comb. 2/1, Medium-term
(without kcrit):	3.78 kNm	6.65 kNm	56.8 %	2983 mm	Comb. 2/1, Medium-term
Bending+tension:	0.57	1.00	56.9 %	3112 mm	Comb. 2/1, Medium-term
(My=3.78 kNm, Mz=0.00 kNm, Nx=0.05 kN)					
Bending+compression:	0.57	1.00	56.8 %	2983 mm	Comb. 2/1, Medium-term
(My=3.78 kNm, Mz=0.00 kNm, Nx=0.04 kN)					
Bearing, support 1:	4.98 kN	10.90 kN	45.7 %	760 mm	Comb. 2/1, Medium-term
Bearing load factor = 3.50					
Bearing, support 2:	3.52 kN	7.79 kN	45.2 %	5187 mm	Comb. 2/1, Medium-term
Bearing load factor = 2.50					
Left cant., Wz,fin:	-6.4 mm	-- mm	-- %	0 mm	Comb. 16/1
Left cant., Wz,net,fin:	-6.4 mm	-- mm	-- %	0 mm	Comb. 16/1
Span 1, Wz,fin:	13.6 mm	-- mm	-- %	2983 mm	Comb. 16/1
Span 1, Wz,net,fin:	13.6 mm	14.8 mm	92.1 %	2983 mm	Comb. 16/1

SUPPORT REACTIONS:

FX:	ULSmax:	ULSmin:	SLSmax:	SLSmin:
Support:				
1:	0.00 kN	0.00 kN	0.00 kN	0.00 kN
2:	0.84 kN	-0.84 kN	0.56 kN	-0.56 kN
3:	0.00 kN	0.00 kN	0.00 kN	0.00 kN
4:	0.00 kN	0.00 kN	0.00 kN	0.00 kN
5:	0.00 kN	0.00 kN	0.00 kN	0.00 kN

FZ:	ULSmax:	ULSmin:	SLSmax:	SLSmin:
Support:				
1:	6.22 kN	0.28 kN	4.41 kN	0.98 kN
2:	4.03 kN	0.81 kN	2.83 kN	1.10 kN

SUPPORT REACTIONS OF LOAD GROUPS (CHARACTERISTIC VALUES)

Load group:	Self-weight	
Support:	FZ [kN]:	
1:	1.99	
2:	1.41	
3:	0.00	
4:	0.00	
5:	0.00	

Load group:	Snow load	
Support:	FZ [kN]:	
1:	2.01	
2:	1.42	
3:	0.00	
4:	0.00	
5:	0.00	

Load group:	Wind load (down)	
Support:	FX [kN]:	FZ [kN]:
1:	0.00	1.01
2:	-0.56	0.31
3:	0.00	0.00
4:	0.00	0.00
5:	0.00	0.00

Load group:	Wind load (up)	
Support:	FX [kN]:	FZ [kN]:
1:	0.00	-1.01
2:	0.56	-0.31
3:	0.00	0.00
4:	0.00	0.00
5:	0.00	0.00

PROFILE SELECTION

Shape of cross-section: Rectangle
Material: C24
List of cross-section sizes: 45x245
MATERIAL: C24
SHAPE: Rectangle
WIDTH B: 45 mm
HEIGHT H: 245 mm
A: 11025 mm²
Iy: 55147969 mm⁴
Wy: 450188 mm³
SPACING C/C: 600 mm
WEIGHT: 5.5 kg/m
LENGTH L: 5187 mm

DESIGN PARAMETERS

Service class: 1
Reliability class: CC2 (KFI=1.0)

STRUCTURAL DESIGN

ULTIMATE LIMIT STATE (ULS)

Buckling checking

Lateral torsional buckling checking

SERVICEABILITY LIMIT STATE (SLS)

Deflection checking

Vibration checking

FIRE/ACCIDENTAL DESIGN

Strength checking (ULS)

Buckling checking

Torsional buckling checking

Serviceability Limit State (SLS)

Deflection checking

NOTE! Please check all design settings (ULS and SLS) before running the design.

DESIGN RESULTS

Total utilization rate = 92.1 %

STRUCTURAL DESIGN (92 %)

ULTIMATE LIMIT STATE: (65 %)

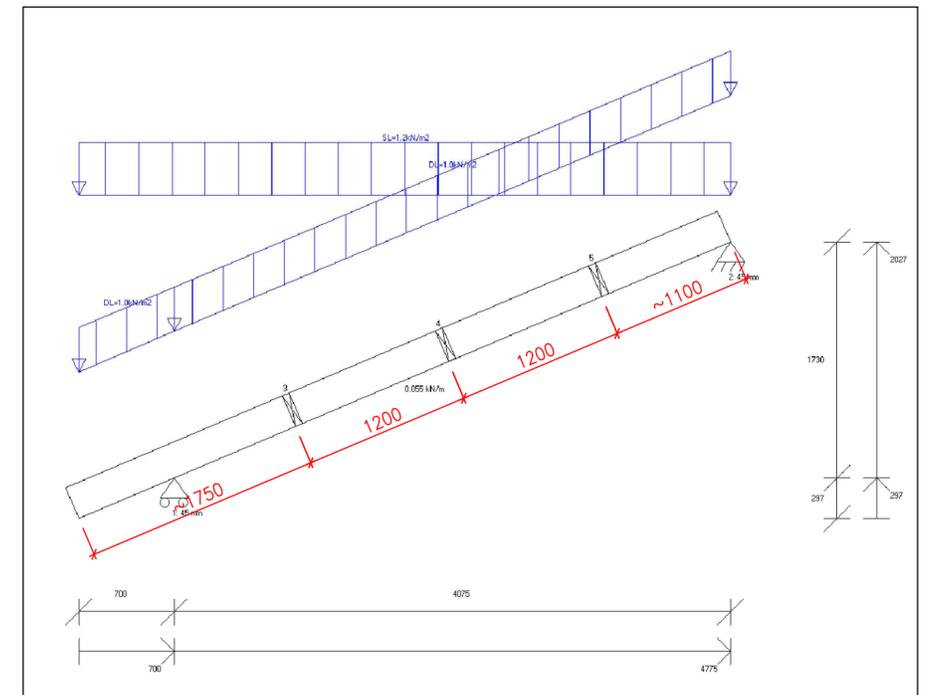
- Shear (Vz): 3.34 kN, (28 %), x = 1003 mm
- Tension: 1.49 kN, (2 %), x = 5187 mm
- Compression: 1.59 kN, (1 %), x = 760 mm
- Bending (My): 3.78 kNm, (65 %), x = 2983 mm
 - Lef = 1690 mm
 - kcrit-factor = 0.868
 - lambda,rel = 0.922
 - sigma,crit = 28.229 N/mm²
 - (without kcrit): 3.78 kNm, (57 %), x = 2983 mm
- Bending+tension: 0.57, (57 %), x = 3112 mm
 - My = 3.78 kNm
 - Nx = 0.05 kN
- Bending+compression: 0.57, (57 %), x = 2983 mm
 - My = 3.78 kNm
 - Nx = 0.04 kN
 - Lef = 1690 mm

SERVICEABILITY LIMIT STATE: (92 %)

- Deflection checking: (92%)
 - Left cantilever (0%)
 - Wz,fin = -6.4 mm (0%), x = 0 mm
 - Wz,net,fin = -6.4 mm (0%), x = 0 mm
 - Span 1 (92%)
 - Wz,fin = 13.6 mm (0%), x = 2983 mm
 - Wz,net,fin = 13.6 mm (92%), x = 2983 mm

Kokkuvõte:

Sarikad C24 45x245 sammuga 600mm on sobilikud lähteülesandes mainitud koormuste kandmiseks (sh päikesepaneelide kandmiseks) Vaja paigaldada kolm kiivetuge vastavalt alloleval joonisel näidatule. Paigaldustolerants ± 100mm. Kandepiiriseisundi ärakasutus 65%. Kasutuspiiriseisundi ärakasutus 92%.



TÖÖ TELLIJAJ:
TÖÖ TEOSTAS:
KUUPÄEV: 01.06.2023
VERSION 1

DIPLOMEERITUD EHTUSINSENER TASE 7, KUTSETUNNISTUSE NUMBER