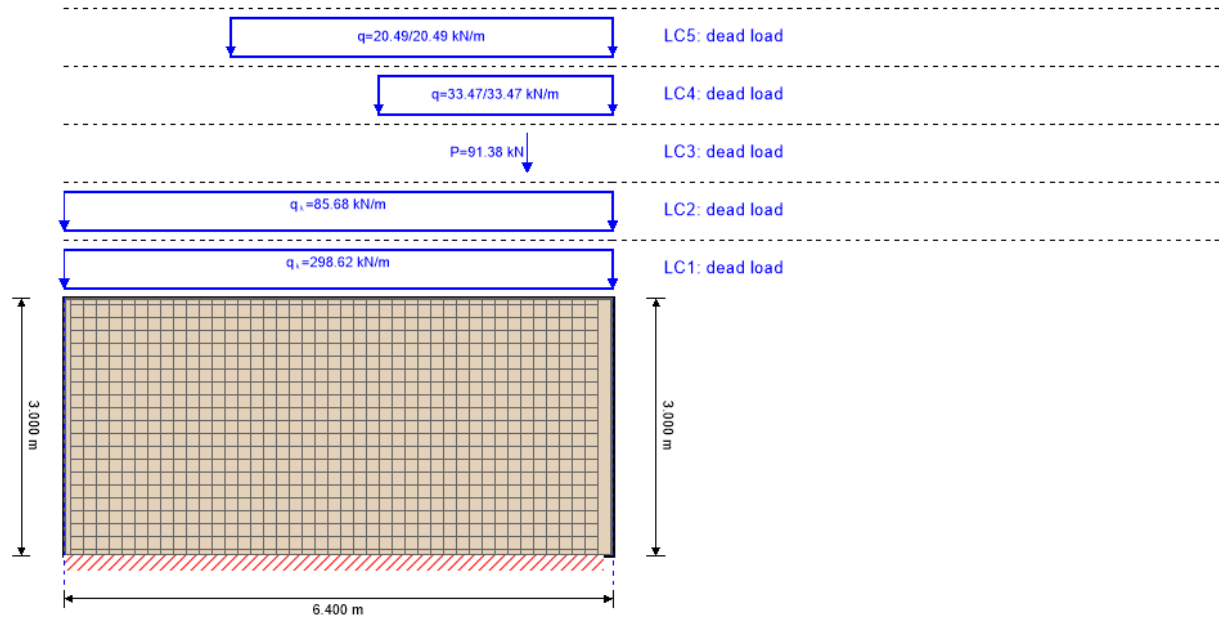


# Vedlegg 15

Dimensjonering av vegg i Calculatis

## system

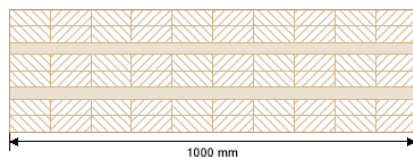


## global utilization ratio

45 %

ULS	45 %	ULS fire	!	SLS	0 %
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## section: CLT 300 L8s - 2



layer	thickness	orientation	material
1	40.0 mm	0°	C24 spruce
2	40.0 mm	0°	C24 spruce
3	30.0 mm	90°	C24 spruce
4	40.0 mm	0°	C24 spruce
5	40.0 mm	0°	C24 spruce
6	30.0 mm	90°	C24 spruce
7	40.0 mm	0°	C24 spruce
8	40.0 mm	0°	C24 spruce
t <sub>CLT</sub>	<b>300.0 mm</b>		

## material values

material	f <sub>m,k</sub>	f <sub>t,0,k</sub>	f <sub>t,90,k</sub>	f <sub>c,0,k</sub>	f <sub>c,90,k</sub>	f <sub>v,k</sub>	f <sub>r,k min</sub>	E <sub>0,mean</sub>	G <sub>mean</sub>	G <sub>r,mean</sub>
	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]
C24 spruce	24.00	14.00	0.12	21.00	2.50	4.00	1.25	12,500.00	690.00	50.00

## load

## load case groups

	load case category	Typ	duration	Kmod	γ <sub>inf</sub>	γ <sub>sup</sub>	Ψ <sub>0</sub>	Ψ <sub>1</sub>	Ψ <sub>2</sub>
LC1	dead load	G	permanet	0.6	1	1.35	1	1	1
LC2	dead load	G	permanet	0.6	1	1.35	1	1	1
LC3	dead load	G	permanet	0.6	1	1.35	1	1	1
LC4	dead load	G	permanet	0.6	1	1.35	1	1	1
LC5	dead load	G	permanet	0.6	1	1.35	1	1	1

#### LC1:dead load

##### continous load

$q_k$
[kN/m]
298.62

#### LC2:dead load

##### continous load

$q_k$
[kN/m]
85.68

#### LC3:dead load

##### point load

distance from start	$P_k$
[m]	[kN]
5.400	91.38

#### LC4:dead load

##### trapezoidal load

distance from start	$q_{k,a}$	load at end	load length
[m]	[kN/m]		[m]
3.670	33.47	33.47	2.730

#### LC5:dead load

##### trapezoidal load

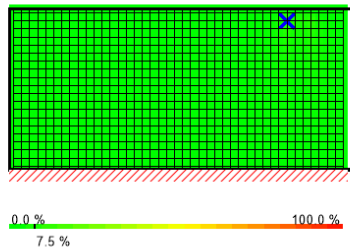
distance from start	$q_{k,a}$	load at end	load length
[m]	[kN/m]		[m]
1.940	20.49	20.49	4.460

#### ULS combinations

	combination rule
LC01	$1.35/1.00 * LC1 + 1.35/1.00 * LC2 + 1.35/1.00 * LC3 + 1.35/1.00 * LC4 + 1.35/1.00 * LC5$

#### Ultimate limit state (ULS) - design results

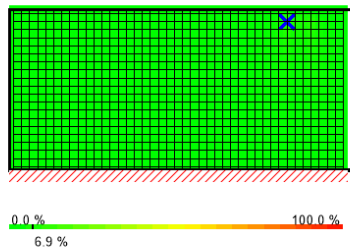
### utilization rate of shear stress in plane on net section



#### LCO1

Id	X	Z	$k_{mod}$	$f_{IP,Netto,k}$	Q	$T_{IP,Net,d}$	ratio
[-]	[m]	[m]	[-]	[N/mm <sup>2</sup> ]	[kN]	[N/mm <sup>2</sup> ]	[%]
833	5.175	2.775	0.6	8.0	5.01	0.28	8 %

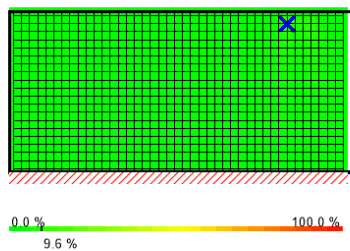
### utilization rate of shear stress in plaen of gross section



#### LCO1

Id	X	Z	$k_{mod}$	$f_{v,IP,Brutto,k}$	Q	$\tau_{IP,Gross,d}$	ratio
[-]	[m]	[m]	[-]	[N/mm <sup>2</sup> ]	[kN]	[N/mm <sup>2</sup> ]	[%]
833	5.175	2.775	0.6	3.5	5.01	0.11	7 %

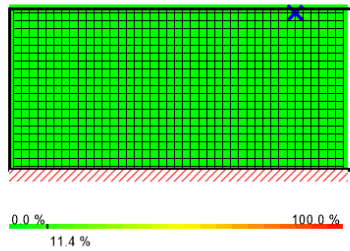
### utilization rate of torsional shear stress in face glued surfaces



#### LCO1

Id	X	Z	$k_{mod}$	$f_{v,IP,T,k}$	Q	$T_{T,Node,d}$	ratio
[-]	[m]	[m]	[-]	[N/mm <sup>2</sup> ]	[kN]	[N/mm <sup>2</sup> ]	[%]
833	5.175	2.775	0.6	2.5	5.01	0.11	10 %

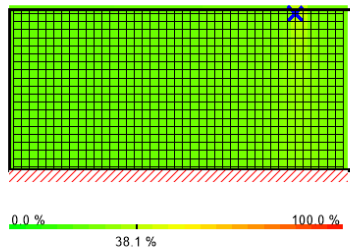
### utilization rate of axail force horizontal



#### LCO1

Id	X	Z	$k_{mod}$	$f_{m,k}$	$N_{h,max}$	$M_y$	$\sigma_{h,max}$	ratio
[-]	[m]	[m]	[-]	[N/mm <sup>2</sup> ]	[kN]	[kNm]	[N/mm <sup>2</sup> ]	[%]
876	5.325	2.925	0.6	24.0	1.3393	0.0000	1.26	11 %

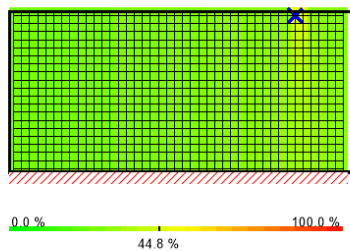
### utilization rate of axail force vertical



#### LCO1

Id	X	Z	$k_{mod}$	$f_{m,k}$	$N_{v,max}$	$M_y$	$\sigma_{v,max}$	ratio
[-]	[m]	[m]	[-]	[N/mm <sup>2</sup> ]	[kN]	[kNm]	[N/mm <sup>2</sup> ]	[%]
876	5.325	2.925	0.6	24.0	1.8446	0.0000	4.22	38 %

### utilization rate for buckling

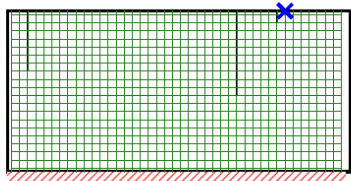


#### LCO1

Id	X	Z	$l_k$	$\lambda_y$	$\beta_c$	$k_{c,y}$	$f_{c,d}$	$\sigma_{c,0,d}$	$\sigma_{m,y,d}$	ratio
[-]	[m]	[m]	[m]	[-]	[-]	[-]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[%]
876	5.325	2.925	3.0	32	0.1	0.972	9.69	4.22	0.00	45 %

### Service limit state design (SLS) - design results

### horizontal deformation

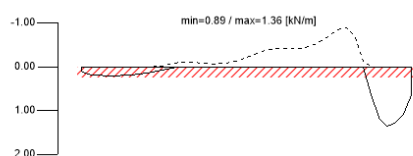


#### LCO1

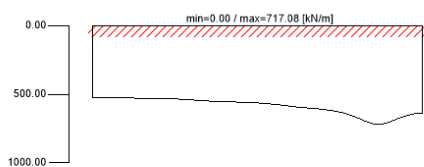
Id	X	Z	W <sub>limit</sub>	limit	V <sub>h,max</sub>	ratio
[-]	[m]	[m]	[mm]	[mm]	[mm]	[%]
917	5.175	3	10.0	L/300 = 10.0	0.0390	0.4 %

### support reaction

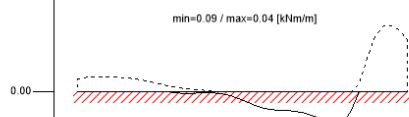
#### support reaction horizontal min/max



#### support reaction vertical min/max



#### support reaction moment min/max



### reference documents for this analysis

English title	description
EN 338	EN 338 - Structural timber — Strength classes
EN 1995-1-1	EN 1995-1-1 - Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings
ETA-14/0349	European Technical Assessment ETA-14/0349 of 02.10.2014

reference documents for this analysis	
English title	description
Expertise Rolling shear - no edge gluing, H.J. Blass EN 1995-1-2	Expertise on Rolling shear for CLT EN 1995-1-2 - Eurocode 5 — Design of timber structures — Part 1-2: General — Structural fire design
EN 14080	EN 14080 - Timber Structures - Glued laminated timber and glued solid timber - Requirements
DIN EN 1995-1-1	EN 1995-1-1 - Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings
DIN EN 1995-1-1 NA	EN 1995-1-1 - National Annex – Nationally determined parameters – Eurocode 5: Design of timber structures – Part 1-1: General — Common rules and rules for buildings
Technical expertise 122/2011/02: analysis of load bearing capacity and separation performance of CLT elements	Verification of the load bearing capacity and the insulation criterion of CLT structures with Stora Enso CLT
Technical expertise 2434/2012 - BB: failure time $t_f$ of gypsum fire boards (GKF) according to ON B 3410 EN 1990	Expertise on failure time $t_f$ of gypsum wall fire boards according to ON B3410 and gypsum wall boards type DF according to EN 520 EN 1990 - Eurocode — Basis of structural design
Fire safety in timber buildings - technical guideline for Europe	Fire safety in timber buildings - technical guideline for Europe; publishes by SP Technical Research Institute of Sweden
National specifications concerning ÖNORM EN 1995-1-2, national comments and national supplements, chapter 12	ÖNORM EN 1995-1-2 - National specifications concerning ÖNORM EN 1995-1-2, national comments and national supplements, chapter 12
Analysis of CLT wall elements, using a beam grid model - TU-Graz - focus_sts 113_1_SF_12	Analysis of CLT shear walls with beam grid models - TU-Graz - focus_sts 113_1_SF_12
DIN EN 1995-1-2_NA	DIN EN 1995-1-2 - Germany - National Annex - Eurocode 5: Design of timber structures — Part 1-2: General — Structural fire design — National specifications concerning DIN EN 1995-1-2, national comments and national supplements
Expertise Rolling shear, H.J. Blass	Expertise on rolling shear strength and rolling shear modulus of CLT panels
Expertise shear in plane of CLT, H.J. Blass	Expertise - revision of DIBt technical approval Z-9.1/599 - shear in the plane of CLT

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