PROGETTO:

La Pensilina - LUMIA

Contenuto:

01 Definizione resistenze del sistema tramite calcolo statico

REV.:00

DATA:16/04/2021

COMMITTENTE:

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Modifiche

REV.	Data	Tecnico	Commenti
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Indice

1 Introduzione

1.1 Descrizione

Sulle seguenti pagine sono riportati i calcoli statici della pensilina in vetro chiamata **"La** Pensilina - LUMIA **"**della ditta Logli.

La pensilina è incastrata a un lato su sottostruttura sufficientemente portante per mezzo di un profilo in alluminio, all'interno del quale sarà fissata opportunamente una lastra in vetro stratificata.

I calcoli statici sono stati eseguiti sia per una configurazione lineare che per una configurazione nell'angolo considerando una lunghezza totale della pensilina L_{tot} variabile partendo da 800 mm fino ad 1500 mm. Le lunghezze Ltot sono considerate a partire dalla base portante sul quale il profilo è fissato - vedi figura. La larghezza minima Bmin è prescritta con 1000 mm sia per la configurazione dritta che per quella nell´angolo.

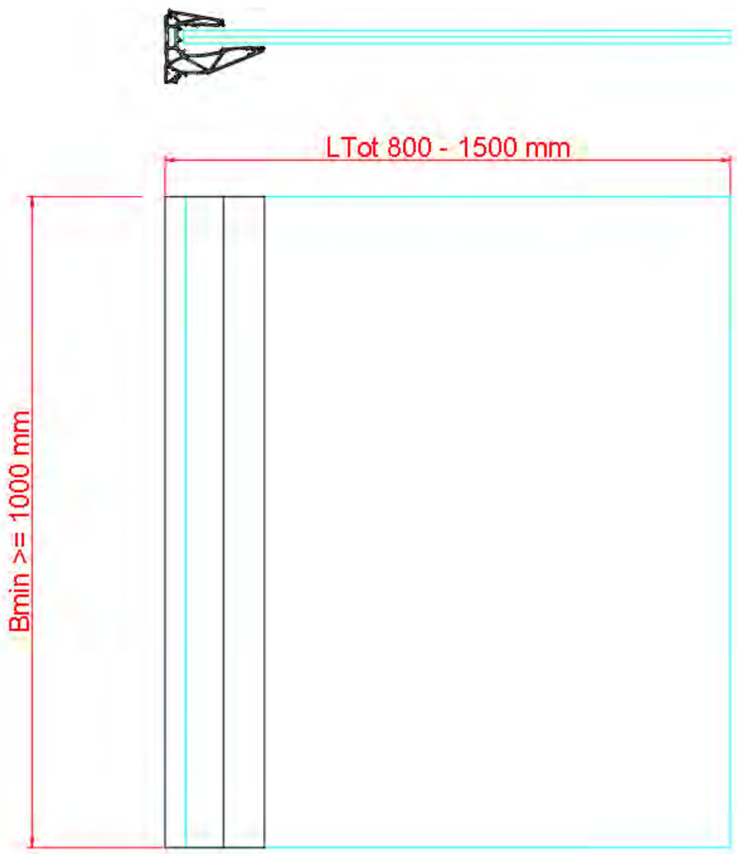


Fig: Configurazione lineare

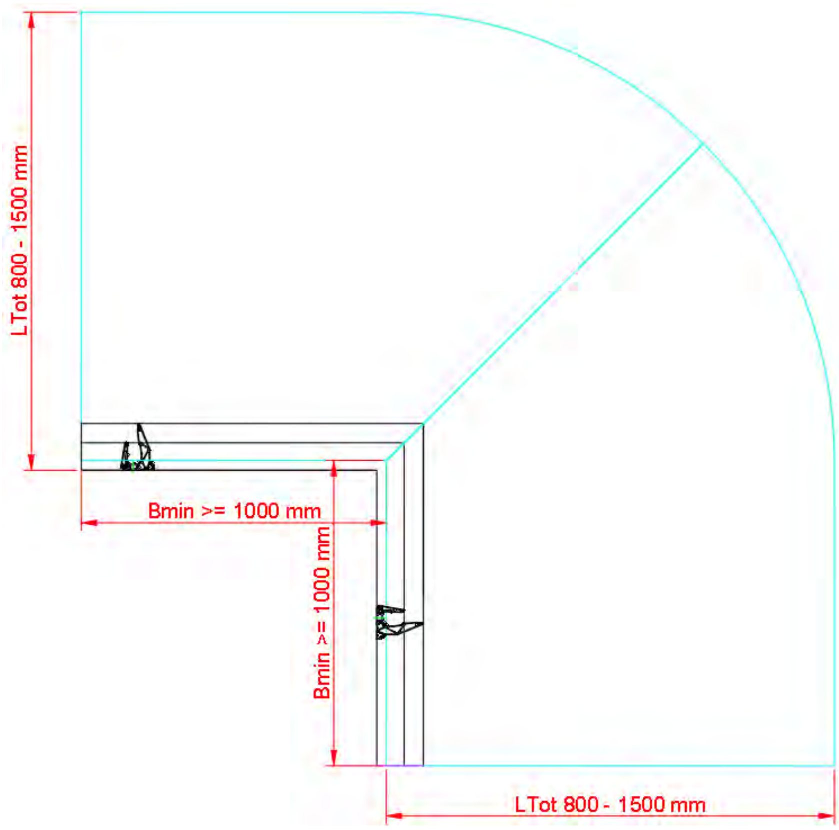


Fig: Configurazione ad angolo

Il profilo estruso è prodotto con la lega EN AW6063-T6 ed è fissato alla base tramite ancoranti posti ad un interasse di 200 mm. I fissaggi dovranno essere verificati da un tecnico competente per ogni progetto in funzione alle condizioni ambientali.

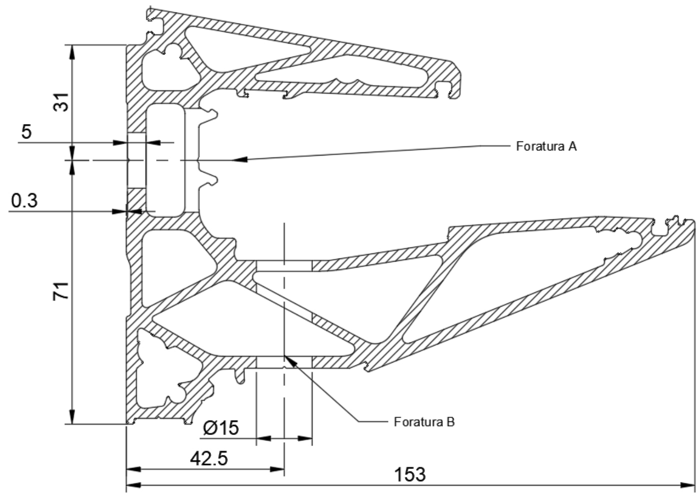


Fig: Sezione profilo

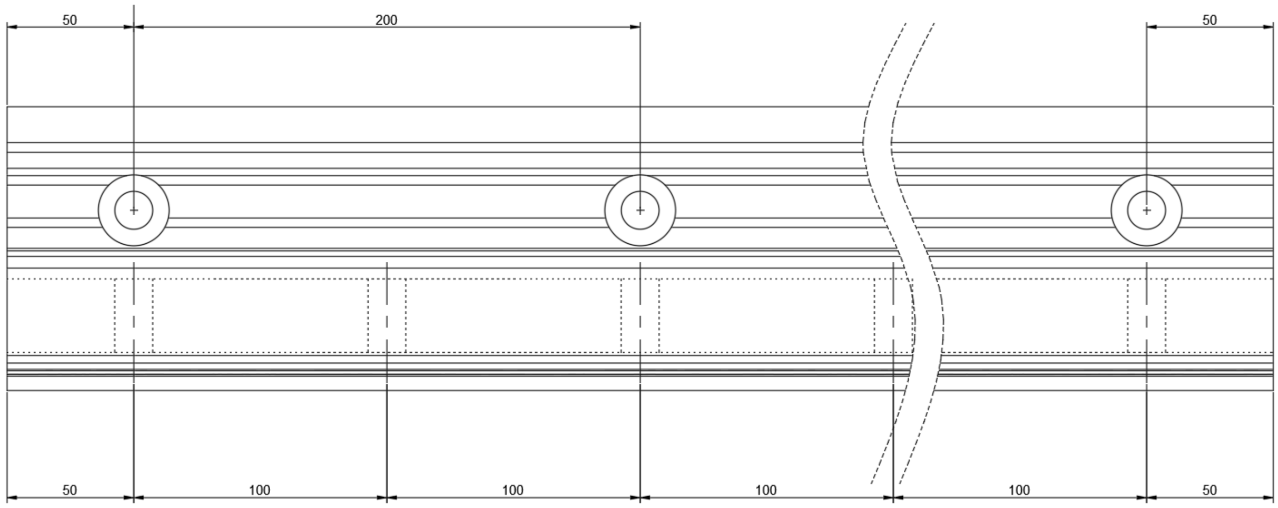


Fig: Distanza fissaggi

Per installare e fissare la lastra in vetro dentro nel profilo sono previste delle pinze ad una distanza di 100 mm oppure 200 mm (vedi configurazione 1 e 2 nei grafici) - vedi anche capitolo 7 per la resistenza delle pinze. Per carichi di compressione verso il basso la lastra in vetro si appoggia sia sulla guarnizione inferiore che su quella superiore, per carichi di depressione (vento) la lastra si incastra tra la guarnizione superiore e le pinze - vedi anche capitoli 5 e 6.

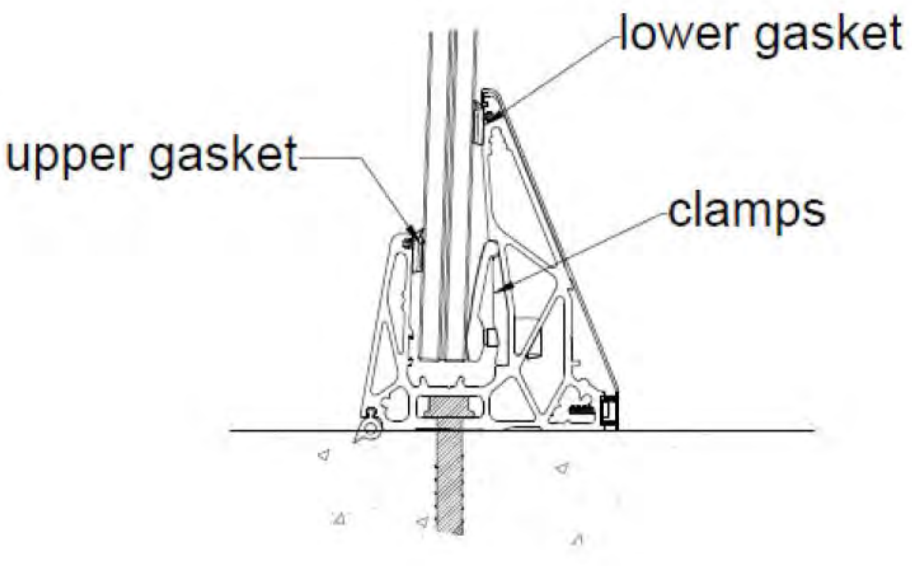


Fig: Fissaggio vetro nel profilo

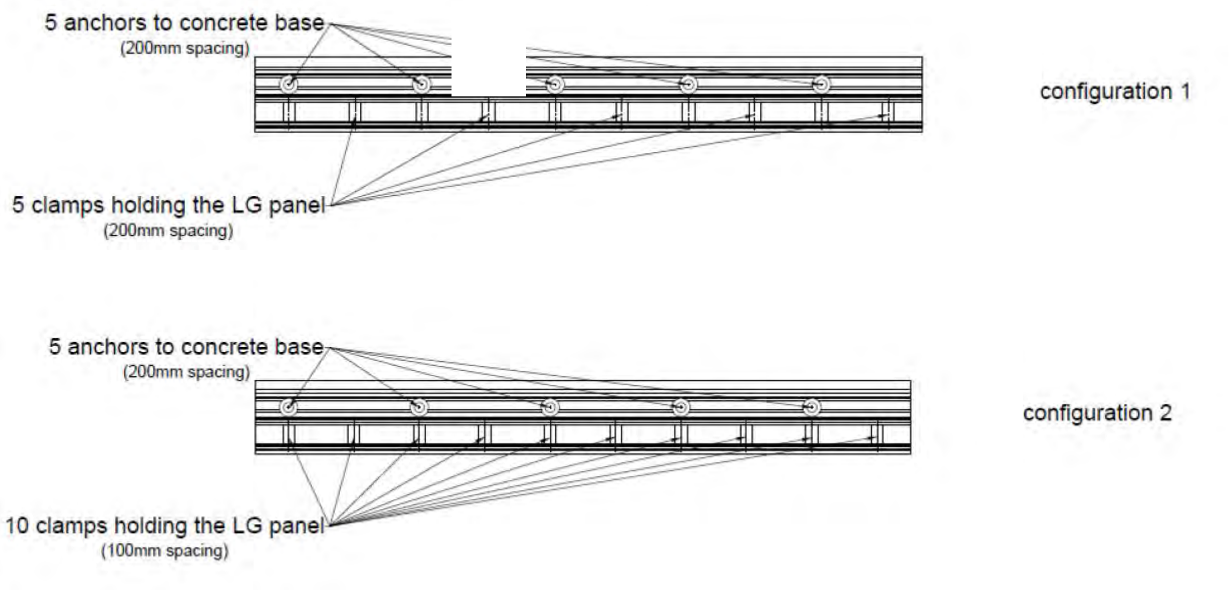


Fig: Configurazioni delle pinze

La verifica della pensilina (vetro e profilo) è stata eseguita sulla base delle normative vigenti in Italia, Europa (Eurodici) e sulla base dello stato dell'arte.

Le stratigrafie del vetro previste per "La Pensilina – LUMIA" – configurazione lineare - sono le seguenti:

	Glass composition "LA Pensilina – LUMIA" – straight configuration – FULLY TEMPERED GLASS - FTG		
Interlayer	8+8 FTG	10+10 FTG	8+8+4 FTG
PVB 0.76mm	YES	YES	YES
SGP 5000	YES	YES	YES

	Glass composition "LA Pensilina – LUMIA" – straight configuration – HEAT STRENGTHENED GLASS - HSG		
Interlayer	8+8 HSG	10+10 HSG	8+8+4 HSG
PVB 0.76mm	YES	YES	YES
SGP 5000	YES	YES	YES

FTG…fully tempered glass = vetro temprato

HSG…heat strengthened glass = vetro indurito

Per “La Pensilina - LUMIA” nella configurazione ad angolo, solo la seguente stratigrafia è prevista:

	Glass composition “LA Pensilina – LUMIA” – edge configuration **–** FULLY TEMPERED GLASS - FTG
Interlayer	10+10 FTG
SGP 5000	YES

Utilizzando l’intercalare SGP 5000 si considera un trasferimento di taglio come previsto dall’AbZ Nr. Z-70.3-170 per carichi variabili (neve + vento) mentre per il PVB e per l´SGP e carichi permanenti secondo la DIN 18008-1 nessun trasferimento di taglio deve essere considerato.

La valutazione, determinazione e la combinazione dei carichi di neve, vento, carichi permanenti o eventuali altri carichi deve essere fatta a base della situazione reale di progetto da un tecnico abilitato seconde le normative europee e italiane attualmente in vigore.

Tabelle di predimensionamento per una valutazione approssimativa della scelta del vetro e del profilo si trovano nel capitolo 8.

1.2 Paese di installazione

Italia

1.3 Vita nominale

Vita nominale = 50 anni come per edifici ed altre strutture portanti ordinari

1.4 Concetto statico

Lo schema statico usato per il calcolo della pensilina è di una trave orrizontale incastrata alla base con carico distribuito.

1.5 Stati limiti rispettati

Nel calcolo sono stati rispettati i seguenti stati limiti:

- Stato limite ultimo - carichi statici

1.6 Geometria

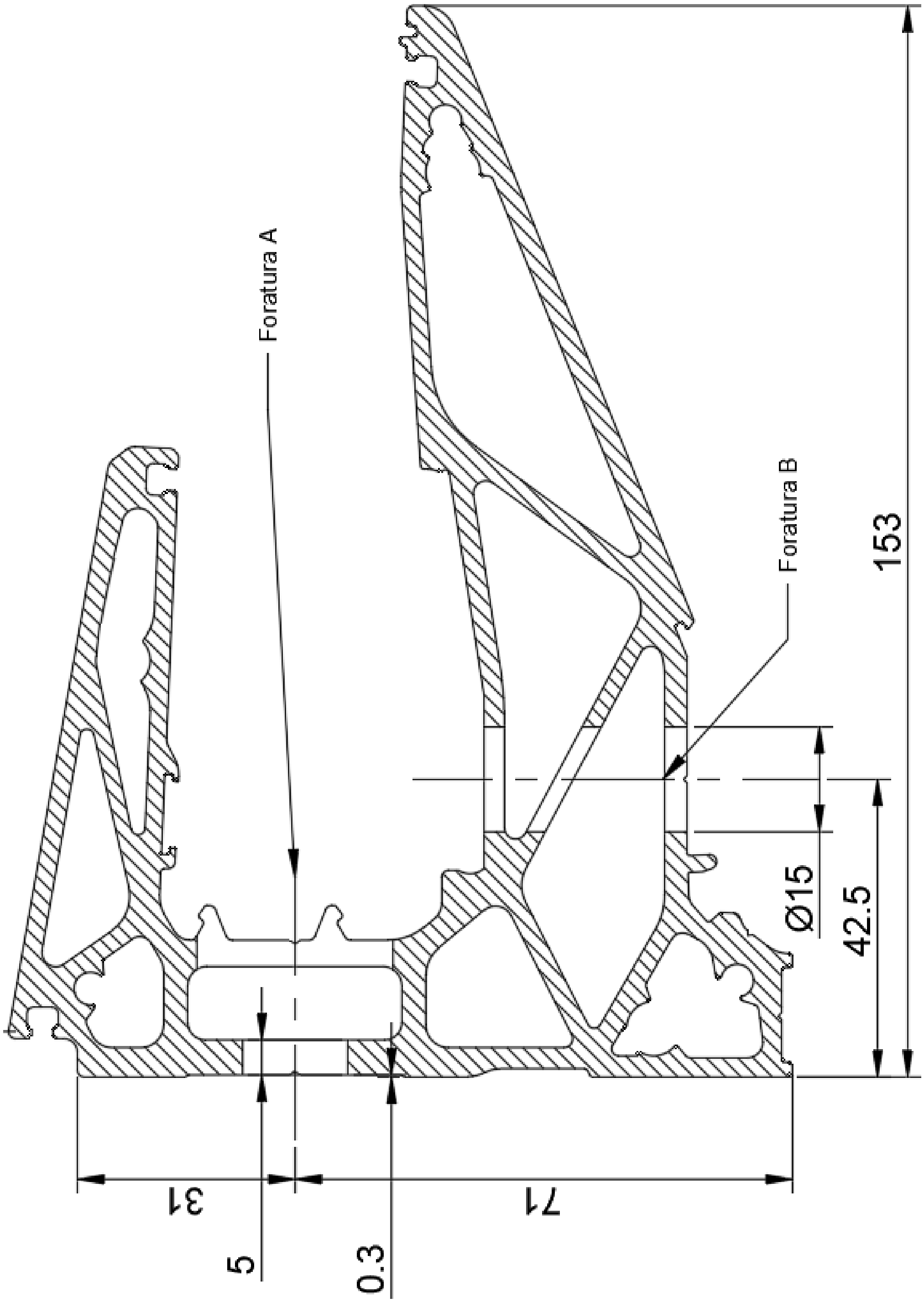


Fig: Sezione trasversale profilo in alluminio

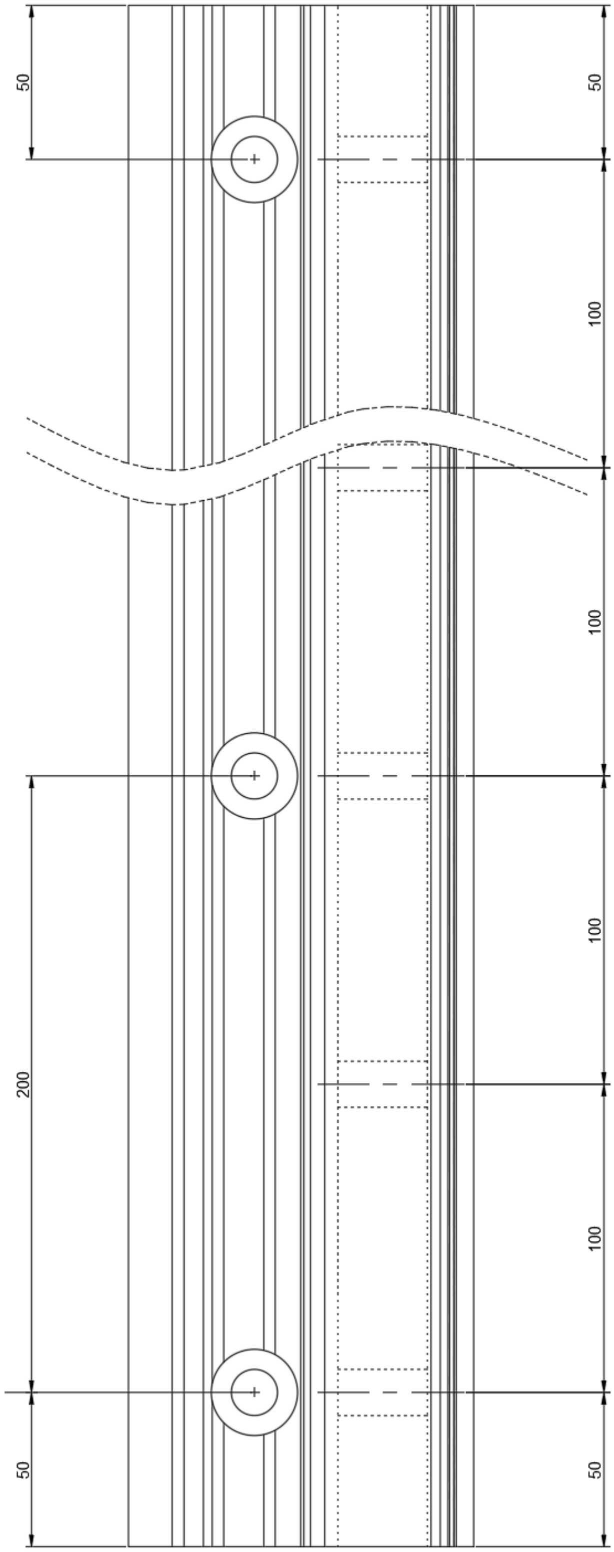


Fig: Sezione longitudinale profilo on alluminio

1.7 Normative

1.7.1 Generale

NTC	DECRETO MINISTERIALE 17 gennaio 2018 (G.U. 20-02-2018, N. 42) Norme tecniche per le costruzioni	2018
Circolare	Istruzioni per l'applicazione delle "Nuove norme tecniche per le costruzioni" di cui al D.M. 17 gennaio 2018	2018

EN 1090 Esecuzione di strutture di acciaio e alluminio

EN 1090-1	Parte 1: Requisiti per la valutazione di conformità dei componenti strutturali	03.2012
EN 1090-3	Parte 3: Requisiti tecnici per le strutture di alluminio	12.2008

1.7.2 Azioni

UNI EN 1991-1-1	Parte 1-1: Azioni in generale - Pesi per unità di volume, pesi propri e sovraccarichi per gli edifici	09.2011
UNI EN 1991-1-1	Appendice nazionale	
UNI EN 1991-1-3	Parte 1-3: Azioni in generale - Carichi da neve	03.2012
UNI EN 1991-1-3	Appendice nazionale	
UNI EN 1991-1-4	Parte 1-4: Azioni in generale - Azioni del vento	05.2011
UNI EN 1991-1-4	Appendice nazionale	

1.7.3 Alluminio

UNI EN 1999-1-1	Eurocodice 9 - Progettazione delle strutture di alluminio - Parte 1-1: Regole strutturali generali	02.2014

1.7.4 Vetro

DIN 18008-1	Teil 1: Begriffe und allgemeine Grundlagen	12.2010
DIN 18008-2	Teil 2: Linienförmig gelagerte Verglasungen	12.2010
DIN 18008-2 Berichtigung 1	Teil 2: Linienförmig gelagerte Verglasungen	04.2011
DIN 18008-4	Teil 4: Zusatzanforderungen an absturzsichernde Verglasungen	07.2013

1.8 Software

Sofistik 2020

SJ Mepla 5.0.7

Microsoft Excel

SMath Studio

1.9 Coefficienti parziali

I coefficienti parziali devono essere applicati in modo sfavorevole.

Coefficienti parziali:

- Carichi permanenti 1.35/1.00
- Carichi variabili 1.50/0.00

1.10 Stabilità a lungo termine secondo EN 1990

La vita utile e l'utilizzo degli elementi sono da rispettare nella progettazione e nella scelta della protezione anticorrosione.
Ispezione e manutenzione dei singoli elementi devono essere garantite, oppure applicata una protezione della superficie o protezione anticorrosione adatta.

2 Materiali

2.1 Alluminio secondo EN 1999-1-1

Per lega EN AW 6063-T6 e EP (profili estrusi) con $t \leq 25mm$

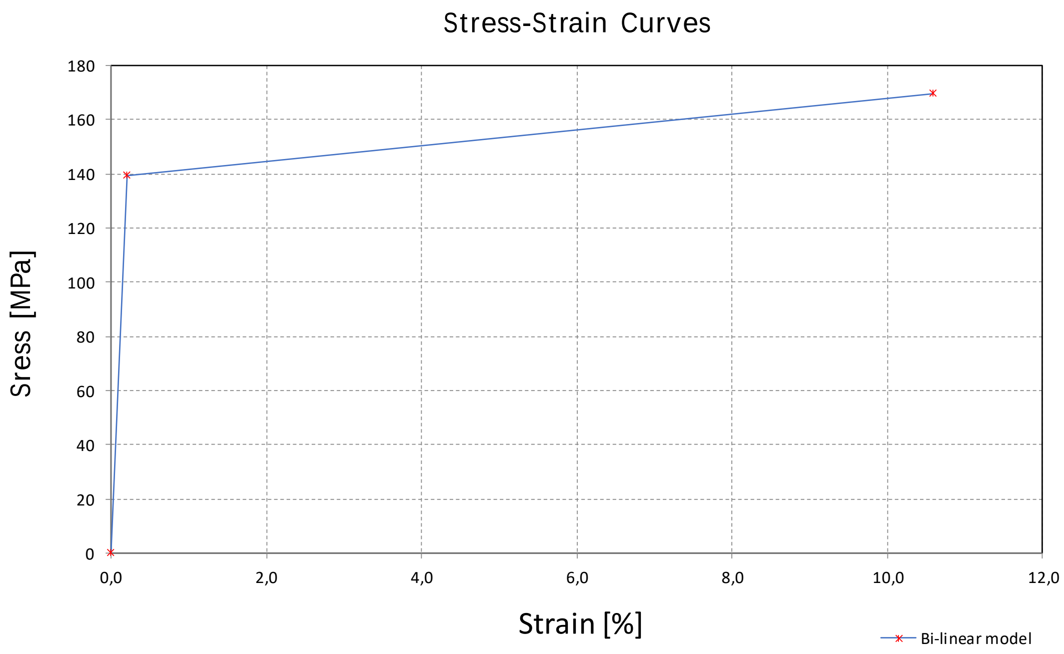
Modulo elastico:	$E=70000\ N/mm^2$
Coefficiente di Poisson	$\nu=0.30$
Coefficiente di dilatazione termica	$\alpha=23*10^{-6}\ 1/K$
Densità	$\rho=2700\ kg/m^3$
Resistenza a snervamento:	$f_{ok}=160\ N/mm^2$
Resistenza ultima a trazione:	$f_{uk}=195\ N/mm^2$
Allungamento a rottura:	A=8%
Coefficiente di sicurezza materiale	$\gamma_m=1.15$ (valido per l'Italia)

Per il calcolo numerico agli elementi finiti del profilo verrà usato un legame bilineare secondo EN 1999-1-1 Annex E - vedi grafico pagina successiva:

Stress - Strain curves According to EN 1999-1-1 Annex E

Standard	Material	γ_M	E	$f_o = f_y$	$f_{Max} = f_u$	f_{od}	f_{ud}
		[-]	[N/mm²]	[N/mm²]	[N/mm²]	[N/mm²]	[N/mm²]
UNI-EN 1999-1-1	EN AW 6063 T6 t ≤ 25	1,15	70000	160	195	139,130	169,5652

Bi-linear model



Formulas

$\sigma = E \; x \; \varepsilon \qquad for \; 0 \leq \varepsilon \leq \varepsilon p$ (E.1)

$\sigma = fp + E1 \; x \; (\varepsilon \; x \; \varepsilon p) \qquad for \; \varepsilon p \leq \varepsilon \leq \varepsilon max$ (E.2)

$\varepsilon u = 0.3 - 0.22 \; x \; \frac{fo}{400}$ = 21,2 [%] (E.2.1.1)

$\varepsilon p = \frac{fo}{E}$ = 0,1988 [%]

$\varepsilon max = 0.5 \; x \; \varepsilon u$ = 10,600 [%]

$E1 = \frac{(fu - f_o)}{(\varepsilon_u - \varepsilon_p)}$ = 1 [N/mm²]

Bi-linear model	
σ (MPa)	ε
0	0,0
139,1	0,19876
169,6	10,60000

2.2 Vetro secondo DIN 18008

Modulo elastico:	E=70000 N/mm²
Coefficiente di Poisson	ν=0.23
Coefficiente di dilatazione termica	$\alpha=9*10^{-6}$ 1/K
Densità	ρ=2500 kg/m³

Resistenze caratteristiche vetro fk:

Vetro temprato (FTG…fully tempered glass) secondo EN 12150-1 (2000):	fk=120 N/mm²
Vetro indurito (HST…heat strengthened glass) secondo EN 1863-1 (2011):	fk=70 N/mm²
Vetro float (FL…float glass) secondo EN 572-1 (2012):	fk=45 N/mm²

Resistenza ultima vetro per verifiche di resistenza a tensione fRd:

Vetro temprato (FTG) secondo DIN 18008-1 e DIN 18008-2	fRd=80 N/mm²
Vetro indurito (HST) secondo DIN 18008-1 e DIN 18008-2	fRd=46.66 N/mm²
Vetro float (FL) secondo DIN 18008-1 e DIN 18008-2	fRd=24.0 N/mm² *

* per vetro Float con k_{mod}=0.7 per durata corta dei carichi come spinta e vento e con una riduzione a 80% della resistenza a flessione caratteristica per i bordi della lastra regolarmente soggetti a tensioni a trazione.

2.3 Intercalare

2.3.1 PVB

Polyvinyl-Butyral-Interlayer (PVB)

Proprietà meccaniche a 23°C:

Carico di rottura	> 20 N/mm²
Allungamento alla rottura	> 250 %

Queste proprietà devono essere confermate dal produttore dell'intercalare con il certificato di conformità 2.1 secondo EN 10204:1995-08. La normativa DIN 18008 per intercalari di tipo PVB non consente nessun trasferimento di taglio se agita in modo favorevole.

2.3.2 SGP (SentryGlas SG5000)

secondo DIN 18008 ed AbP Nr.Z-70.3-170

Tabelle 3: Kennwerte für Einfachverglasungen

Lastfall		Schubmodul G [N/mm²]	k_{VSG} [12]	k_{mod}
Fassadenbereich	**Verglasungen ohne absturzsichernde Funktion**			
	Lastfall Wind	100	1	0,7
	Verglasungen mit absturzsichernder Funktion			
	Lastfall horizontale Nutzlast infolge von Personen[13]	4	1	0,7
	Lastfall Holm und Wind	65	1	0,7
Innenbereich	**Verglasungen ohne absturzsichernde Funktion**			
	Lastfall Wind	100	1	0,7
	Verglasungen mit absturzsichernder Funktion			
	Lastfall Holm	65	1	0,7
	Lastfall Holm und Wind	65	1	0,7
Überkopf-bereich	Lastfall Schnee	60	1	0,4
	Lastfall Wind und Schnee	60	1	0,7
	Lastfall Eigengewicht	0	1,1	0,25

Per elementi strutturali in vetro orizzontali sopraelevati ("Überkopfbereich"), per carichi di neve ("Schnee") e carichi di vento ("Wind") un modulo di taglio G di 60 N/mm² può essere considerato nelle verifiche statiche.
Per il peso proprio ("Eigengewicht) è da considerare nessun trasferimento di taglio.
Il fattore k_{VSG} viene scelto con il valore di 1.0 sia per carichi permanenti che variabili. Questo è leggermente sul lato sicuro.

Per la verifica numerica del vetro con Mepla, il modulo elastico di Young è richiesto:

$$\nu_{SGP} := 0.50$$

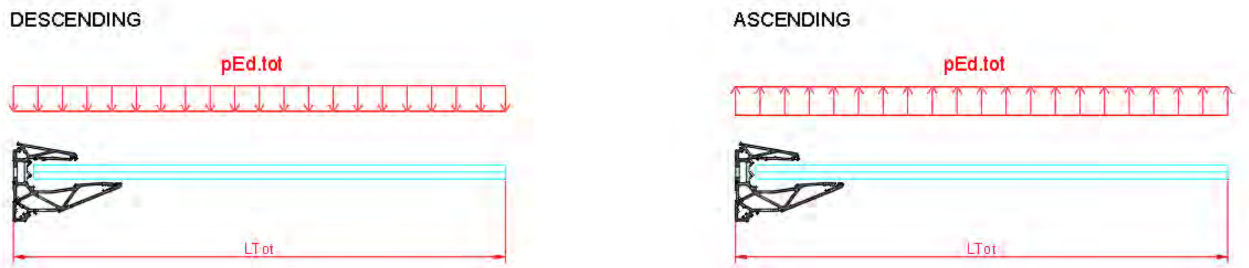
$$G_{SGP.neve.vento} := 60\ \mathrm{MPa}$$

$$E_{SGP.neve.vento} := G_{SGP.neve.vento} \cdot \left(2 \cdot \left(1 + \nu_{SGP}\right)\right) = 180\ \mathrm{MPa}$$

3 Carichi

3.1 Carichi verticali distribuiti

Il calcolo della pensilina è stato eseguito considerando dei carichi uniformemente distribuiti su tutta la superfice della pensilina. I carichi agiscono sia verso il basso (descending), per esempio neve e peso proprio, che verso l'alto (ascending), p.e. il vento.



La valutazione, determinazione e la combinazione dei carichi di neve, vento, carichi permanenti o eventuali altri carichi deve essere fatta a base della situazione reale di progetto da un tecnico abilitato seconde le normative europee e italiane attualmente in vigore.

4 Dimensionamento statico del vetro

4.1 Informazioni generali

Il calcolo statico del vetro è stato eseguito tramite il programma SJ Mepla, considerando per le lastre della configurazione lineare un incastro rigido all'altezza del primo appoggio del vetro sul profilo in alluminio.

La lunghezza libera di flessione (L3 oppure "span glass" nelle tabelle successive) considerata nel calcolo numerico si determina quindi detraendo dalla lunghezza totale L_{tot} della pensilina la distanza tra la base e il primo appoggio vetro/profilo - vedi grafici:

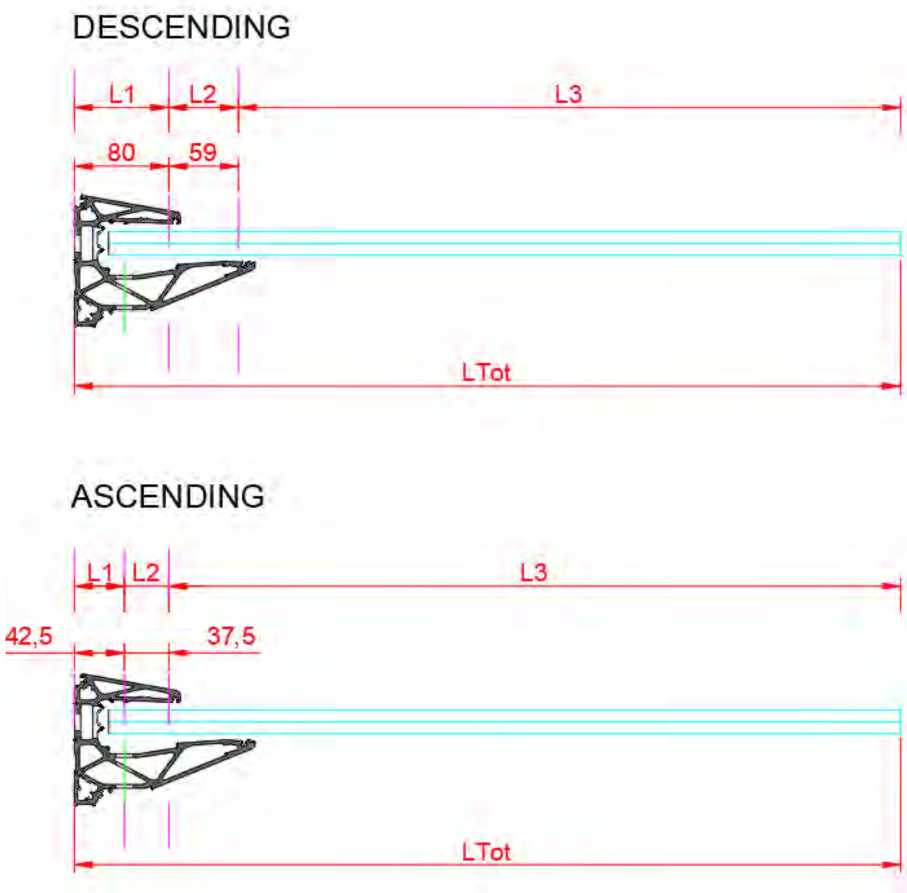


Fig: Sistema statico per il calcolo del vetro

I seguenti valori di rigidezza degli intercalari sono stati usati nei calcoli:

Interlayer	t	G	ν	E
-	mm	N/mm²	-	N/mm²
PVB	0,76	0	0,50	**0**
SGP 5000	0,76	60	0,50	**180**

a) Procedura di calcolo per intercalare PVB e carico verso il basso:

Il calcolo della resistenza del vetro per carichi verso il basso è stato eseguito in due passi: Nel primo passo è stata calcolata per una certa stratigrafia e lunghezza la tensione massima nel vetro σ_{Ed1} dovuto ad un carico unitario di p_u=1.0 kN/m².

Dividendo la resistenza massima del vetro σ_{Rd} per la massima tensione unitaria σ_{Ed1} si ottiene il massimo carico di progetto totale verso il basso, che include anche il peso proprio.

$p_{Ed.tot.max} = \sigma_{Rd} / \sigma_{Ed1}$

E quindi il massimo carico di progetto variabile verso il basso (la neve) si calcola detraendo dal carico di progetto totale il carico del peso proprio di progetto:

$p_{Ed.var.max} = p_{Ed.tot.max} - p_{Ed.perm}$ (con γ_{sup}=1.35)

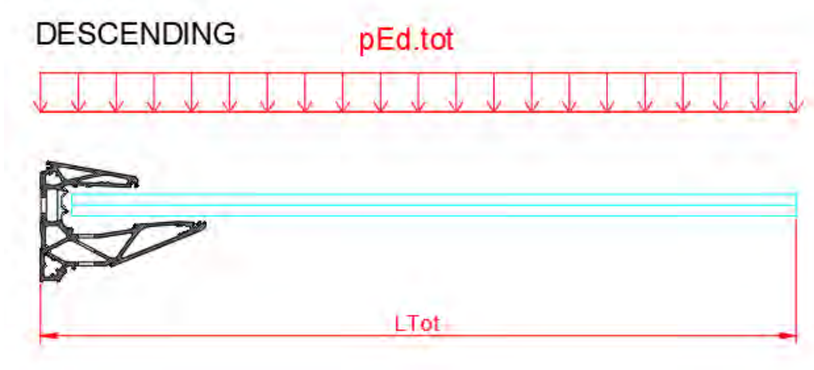


Fig: Direzione carico verso il basso

Nell'allegato si vede in modo esemplare per ogni tipo vetro ed intercalare il calcolo Mepla per una certa lunghezza e carico unitario pu=1 kN/m². Per tutte le altre lunghezze il calcolo è stato fatto nello stesso modo modificando soltanto il valore L3.

b) Procedura di calcolo per intercalare SGP e carico verso il basso:

Il calcolo della resistenza del vetro con intercalare SGP per carichi verso il basso è stato eseguito in tre passi: Nel primo passo è stata calcolata per una certa stratigrafia e lunghezza la tensione massima nel vetro $\sigma_{Ed1.VAR}$ dovuto ad un carico unitario di p_u=1.0 kN/m² usando il modulo di taglio per carichi variabili specificato nel AbP del SGP.
Nel secondo passo si ottiene la tensione massima nel vetro $\sigma_{Ed1.PERM}$ dovuto ad un carico unitario di p_u=1.0 kN/m² considerando nessun trasferimento di taglio prescritto per carichi permanenti.

Quindi il massimo carico di progetto variabile verso il basso (la neve) si calcola nel seguente modo:

$p_{Ed.var.max} = (\sigma_{Rd} - \sigma_{Ed1.PERM} * p_{Ed.perm}) / \sigma_{Ed1.VAR}$ (con $\gamma_{sup.perm}$=1.35)

Il massimo carico di progetto totale verso il basso, che include anche il peso proprio, si ottiene nel seguente modo:

$p_{Ed.tot.max} = p_{Ed.var.max} + p_{Ed.perm}$

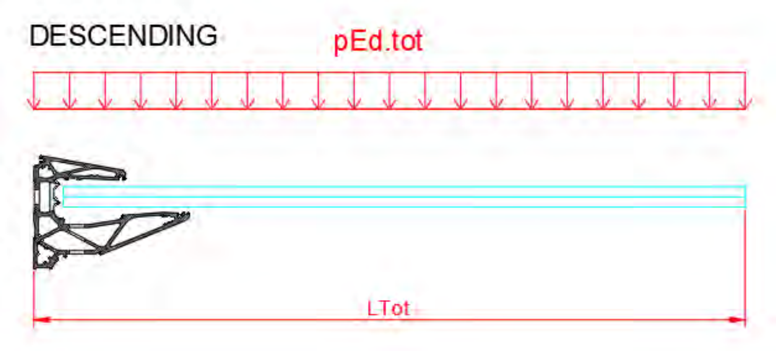


Fig: Direzione carico verso il basso

Nell'allegato si vede in modo esemplare per ogni tipo vetro ed intercalare il calcolo Mepla per una certa lunghezza e carico unitario pu=1 kN/m². Per tutte le altre lunghezze il calcolo è stato fatto nello stesso modo modificando soltanto il valore L3.

c) Procedura di calcolo per intercalare PVB e carico verso **l'alto** (vento):

Il calcolo della resistenza del vetro per carichi verso l'alto è stato eseguito in due passi: Nel primo passo è stata calcolata per una certa stratigrafia e lunghezza la tensione massima nel vetro σ_{Ed1} dovuto ad un carico unitario di p_u=1.0 kN/m².

Dividendo la resistenza massima del vetro σ_{Rd} per la massima tensione unitaria σ_{Ed1} si ottiene il massimo carico di progetto totale verso l'alto, che include anche il peso proprio.

$p_{Ed.tot.max} = \sigma_{Rd} / \sigma_{Ed1}$

E quindi il massimo carico di progetto variabile verso l'alto (il vento) si calcola sommando al carico di progetto totale il carico del peso proprio caratteristico, perché agisce nella direzione opposta al vento:

$p_{Ed.var.max} = p_{Ed.tot.max} + p_{Ed.perm}$ (con γinf=1.0)

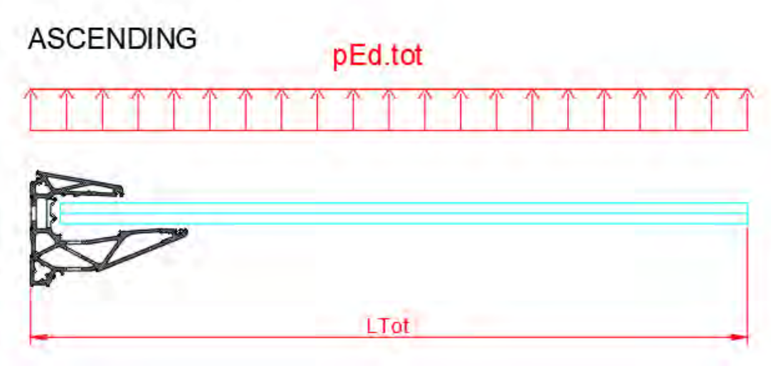


Fig: Direzione carico verso l'alto

Nell'allegato si vede in modo esemplare per ogni tipo vetro ed intercalare il calcolo Mepla per una certa lunghezza e carico unitario pu=1 kN/m². Per tutte le altre lunghezze il calcolo è stato fatto nello stesso modo modificando soltanto il valore L3.

d) Procedura di calcolo per intercalare SGP **e carico verso l'alto (vento):**

Il calcolo della resistenza del vetro per carichi verso l'alto è stato eseguito in due passi: Nel primo passo è stata calcolata per una certa stratigrafia e lunghezza la tensione massima nel vetro σ_{Ed1} dovuto ad un carico unitario di p_u=1.0 kN/m² usando il modulo di taglio del SGP per carichi variabili indicato nel ApP del SGP.

Siccome il carico massimo finale rimane agente nella direzione di depressione, sia per i carichi variabili che per i carichi permanenti lo stesso modulo di taglio dei carichi variabili può essere considerato.

Quindi dividendo la resistenza massima del vetro σ_{Rd} per la massima tensione unitaria $\sigma_{Ed1} = \sigma_{Ed1.VAR} = \sigma_{Ed1.PERM}$ si ottiene il massimo carico di progetto totale verso l'alto, che include anche il peso proprio.

$p_{Ed.tot.max}=\sigma_{Rd} / \sigma_{Ed1}$

Finalmente il massimo carico di progetto variabile verso l'alto (il vento) si calcola sommando al carico di progetto totale il carico del peso proprio caratteristico, perché agisce nella direzione opposta al vento:

$p_{Ed.var.max}= p_{Ed.tot.max} + p_{Ed.perm}$ (con γ_{inf}=1.0)

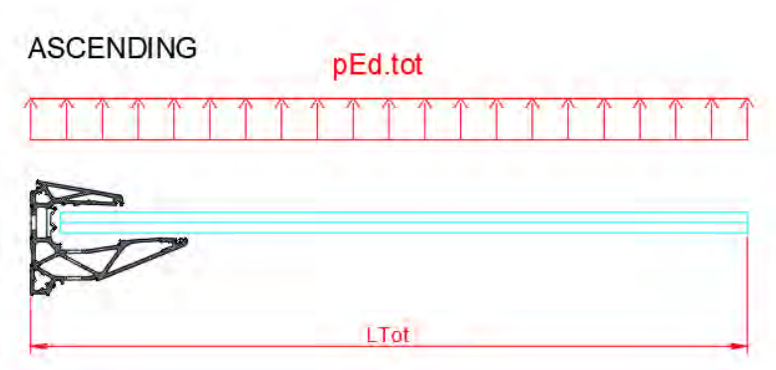


Fig: Direzione carico verso l'alto

Nell'allegato si vede in modo esemplare per ogni tipo vetro ed intercalare il calcolo Mepla per una certa lunghezza e carico unitario pu=1 kN/m². Per tutte le altre lunghezze il calcolo è stato fatto nello stesso modo modificando soltanto il valore L3.

4.2 Dimensionamento vetri temprati

4.2.1 Dimensionamento vetri temprati - configurazione lineare - carichi verso il basso (neve)

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load	E glass	ρ glass	σ_{rd}	$\gamma_{per\ m}$	γ_{var}
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]	[N/mm²]	[-]	[-]
80	59	1	70000	25	80,00	1,35	1,5

Glass	total span	span glass	tot. glass length	unitary load MEPLA			max loads and deformation					
composition				σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot\ max}$	$p_{ed\ per\ m}$	$p_{ed\ var}$	$p_{ek\ per\ m}$	$p_{ek\ var}$	w_{SLS}
	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	10,43	10,43	3,58	7,670	0,540	7,130	0,400	4,753	18,4
8	850	711	818	12,10	12,10	5,15	6,612	0,540	6,072	0,400	4,048	22,9
+	900	761	868	13,90	13,90	6,77	5,755	0,540	5,215	0,400	3,477	26,2
8	950	811	918	15,83	15,83	8,73	5,054	0,540	4,514	0,400	3,009	29,8
0,76	1000	861	968	17,88	17,88	11,09	4,474	0,540	3,934	0,400	2,623	33,5
PVB	1050	911	1018	20,07	20,07	13,91	3,986	0,540	3,446	0,400	2,297	37,5
	1100	961	1068	22,39	22,39	17,23	3,573	0,540	3,033	0,400	2,022	41,7
	1150	1011	1118	24,84	24,84	21,11	3,221	0,540	2,681	0,400	1,787	46,2
	1200	1061	1168	27,35	27,35	25,61	2,925	0,540	2,385	0,400	1,590	51,0

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

				unitary load MEPLA			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	6,68	6,68	1,97	11,976	0,675	11,301	0,500	7,534	15,8
10	850	711	818	7,75	7,75	2,64	10,323	0,675	9,648	0,500	6,432	18,3
+	900	761	868	8,90	8,90	3,46	8,989	0,675	8,314	0,500	5,543	20,9
10	950	811	918	10,13	10,13	4,47	7,897	0,675	7,222	0,500	4,815	23,8
0,76	1000	861	968	11,45	11,45	5,68	6,987	0,675	6,312	0,500	4,208	26,7
PVB	1050	911	1018	12,85	12,85	7,12	6,226	0,675	5,551	0,500	3,700	29,9
	1100	961	1068	14,33	14,33	8,82	5,583	0,675	4,908	0,500	3,272	33,3
	1150	1011	1118	15,90	15,90	10,81	5,031	0,675	4,356	0,500	2,904	36,8
	1200	1061	1168	17,51	17,51	13,12	4,569	0,675	3,894	0,500	2,596	40,6
	1250	1111	1218	19,24	19,24	15,77	4,158	0,675	3,483	0,500	2,322	44,5
	1300	1161	1268	21,11	21,11	18,81	3,790	0,675	3,115	0,500	2,076	48,5
	1350	1211	1318	23,02	23,02	22,28	3,475	0,675	2,800	0,500	1,867	52,7
	1400	1261	1368	24,96	24,96	26,21	3,205	0,675	2,530	0,500	1,687	57,3
	1450	1311	1418	27,03	27,03	30,63	2,960	0,675	2,285	0,500	1,523	62,0
	1500	1361	1468	29,29	29,29	35,59	2,731	0,675	2,056	0,500	1,371	66,6

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

				unitary load MEPLA				max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	9,82	9,82	4,93	3,62	8,147	0,675	7,472	0,500	4,981	19,8
8	850	711	818	11,38	11,38	5,72	4,85	7,030	0,675	6,355	0,500	4,237	23,0
+	900	761	868	13,08	13,08	6,57	6,37	6,116	0,675	5,441	0,500	3,627	26,3
8	950	811	918	14,89	14,89	7,48	8,21	5,373	0,675	4,698	0,500	3,132	29,8
+	1000	861	968	16,83	16,83	8,45	10,44	4,753	0,675	4,078	0,500	2,719	33,6
4	1050	911	1018	18,89	18,89	9,48	13,09	4,235	0,675	3,560	0,500	2,373	37,6
0,76	1100	961	1068	21,07	21,07	10,57	16,21	3,797	0,675	3,122	0,500	2,081	41,8
PVB	1150	1011	1118	23,37	23,37	11,72	19,87	3,423	0,675	2,748	0,500	1,832	46,3
	1200	1061	1168	25,74	25,74	12,90	24,10	3,108	0,675	2,433	0,500	1,622	51,1
	1250	1111	1218	28,29	28,29	14,18	28,99	2,828	0,675	2,153	0,500	1,435	56,1
	1300	1161	1268	31,04	31,04	15,56	34,59	2,577	0,675	1,902	0,500	1,268	61,2
	1350	1211	1318	33,84	33,84	16,97	40,96	2,364	0,675	1,689	0,500	1,126	66,6
	1400	1261	1368	36,69	36,69	18,39	48,17	2,180	0,675	1,505	0,500	1,004	72,4
	1450	1311	1418	39,73	39,73	19,91	56,28	2,014	0,675	1,339	0,500	0,892	78,4
	1500	1361	1468	43,01	43,01	21,56	65,41	1,860	0,675	1,185	0,500	0,790	84,4

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

				unitary load - VAR			unitary load - PERM		
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	661	768	5,19	0,66	0,86	6,68	6,68	1,97
8	850	711	818	5,99	0,71	1,15	7,75	7,8	2,6
+	900	761	868	6,85	0,76	1,50	8,90	8,9	3,5
8	950	811	918	7,78	0,81	1,94	10,13	10,1	4,5
0,76	1000	861	968	8,76	0,86	2,46	11,45	11,5	5,7
SGP	1050	911	1018	9,81	0,91	3,08	12,85	12,9	7,1
	1100	961	1068	10,91	0,97	3,80	14,33	14,3	8,8
	1150	1011	1118	12,08	1,01	4,66	15,90	15,9	10,8
	1200	1061	1168	13,23	1,32	5,64	17,51	17,5	13,1

max loads and deformation						
$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
76,393	0,540	14,719	15,259	0,400	9,813	9,2
75,815	0,540	12,657	13,197	0,400	8,438	10,8
75,194	0,540	10,977	11,517	0,400	7,318	12,4
74,530	0,540	9,580	10,120	0,400	6,386	14,2
73,817	0,540	8,427	8,967	0,400	5,618	16,1
73,061	0,540	7,448	7,988	0,400	4,965	18,1
72,262	0,540	6,623	7,163	0,400	4,416	20,3
71,414	0,540	5,912	6,452	0,400	3,941	22,7
70,545	0,540	5,332	5,872	0,400	3,555	25,3

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

				unitary load - VAR			unitary load - PERM		
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	661	768	3,41	0,52	0,46	6,68	6,68	1,97
10	850	711	818	3,94	0,55	0,61	7,75	7,8	2,6
+	900	761	868	4,50	0,60	0,80	8,90	8,9	3,5
10	950	811	918	5,11	0,64	1,02	10,13	10,1	4,5
0,76	1000	861	968	5,76	0,68	1,30	11,45	11,5	5,7
SGP	1050	911	1018	6,43	0,73	1,62	12,85	12,9	7,1
	1100	961	1068	7,16	0,77	2,01	14,33	14,3	8,8
	1150	1011	1118	7,92	0,82	2,46	15,90	15,9	10,8
	1200	1061	1168	8,68	0,82	2,98	17,51	17,5	13,1
	1250	1111	1218	9,52	0,90	3,58	19,24	19,2	15,8
	1300	1161	1268	10,45	0,95	4,26	21,11	21,1	18,8
	1350	1211	1318	11,38	1,00	5,04	23,02	23,0	22,3
	1400	1261	1368	12,28	1,13	5,93	24,96	25,0	26,2
	1450	1311	1418	13,28	1,23	6,92	27,03	27,0	30,6
	1500	1361	1468	14,39	1,15	8,04	29,29	29,3	35,6

max loads and deformation						
$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
75,491	0,675	22,138	22,813	0,500	14,759	7,8
74,769	0,675	18,977	19,652	0,500	12,651	9,0
73,993	0,675	16,443	17,118	0,500	10,962	10,5
73,162	0,675	14,317	14,992	0,500	9,545	12,0
72,271	0,675	12,547	13,222	0,500	8,365	13,7
71,326	0,675	11,093	11,768	0,500	7,395	15,5
70,327	0,675	9,822	10,497	0,500	6,548	17,6
69,268	0,675	8,746	9,421	0,500	5,831	19,7
68,181	0,675	7,855	8,530	0,500	5,237	22,2
67,013	0,675	7,039	7,714	0,500	4,693	24,7
65,751	0,675	6,292	6,967	0,500	4,195	27,3
64,462	0,675	5,664	6,339	0,500	3,776	30,2
63,152	0,675	5,143	5,818	0,500	3,428	33,4
61,755	0,675	4,650	5,325	0,500	3,100	36,8
60,229	0,675	4,185	4,860	0,500	2,790	40,2

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Fully tempered glass - descending loads

l1	l2	unitary load	E glass	ρ glass
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]
80	59	1	70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

Glass	total span	span glass	tot. glass length	unitary load MEPLA VAR				unitary load - PERM			
				σ_{ed1}	σ_{ed2}	σ_{ed3}	w	σ_{ed1}	σ_{ed2}	σ_{ed3}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[N/mm²]	[N/mm²]
	800	661	768	3,22	2,22	0,11	0,43	9,82	9,82	4,93	3,62
8	850	711	818	3,73	2,54	0,12	0,58	11,38	11,38	5,72	4,85
+	900	761	868	4,27	2,88	0,14	0,75	13,08	13,08	6,57	6,37
8	950	811	918	4,86	3,25	0,16	0,97	14,89	14,89	7,48	8,21
+	1000	861	968	5,47	3,64	0,18	1,23	16,83	16,83	8,45	10,44
4	1050	911	1018	6,14	4,05	0,20	1,53	18,89	18,89	9,48	13,09
0,76	1100	961	1068	6,88	4,49	0,22	1,89	21,07	21,07	10,57	16,21
SGP	1150	1011	1118	7,57	4,94	0,25	2,32	23,37	23,37	11,72	19,87
	1200	1061	1168	8,31	5,35	0,32	2,81	25,74	25,74	12,90	24,10
	1250	1111	1218	9,12	5,85	0,36	3,37	28,29	28,29	14,18	28,99
	1300	1161	1268	10,02	6,45	0,33	4,02	31,04	31,04	15,56	34,59
	1350	1211	1318	10,91	7,00	0,36	4,75	33,84	33,84	16,97	40,96
	1400	1261	1368	11,79	7,49	0,47	5,58	36,69	36,69	18,39	48,17
	1450	1311	1418	12,76	8,08	0,51	6,52	39,73	39,73	19,91	56,28
	1500	1361	1468	13,83	8,80	0,45	7,57	43,01	43,01	21,56	65,41

max loads and deformation						
$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
73,372	0,675	22,786	23,461	0,500	15,191	8,3
72,319	0,675	19,388	20,063	0,500	12,926	9,9
71,171	0,675	16,668	17,343	0,500	11,112	11,5
69,949	0,675	14,393	15,068	0,500	9,595	13,4
68,640	0,675	12,548	13,223	0,500	8,366	15,5
67,249	0,675	10,953	11,628	0,500	7,302	17,7
65,778	0,675	9,561	10,236	0,500	6,374	20,2
64,225	0,675	8,484	9,159	0,500	5,656	23,1
62,626	0,675	7,536	8,211	0,500	5,024	26,2
60,904	0,675	6,678	7,353	0,500	4,452	29,5
59,048	0,675	5,893	6,568	0,500	3,929	33,1
57,158	0,675	5,239	5,914	0,500	3,493	37,1
55,234	0,675	4,685	5,360	0,500	3,123	41,5
53,182	0,675	4,168	4,843	0,500	2,779	46,3
50,968	0,675	3,685	4,360	0,500	2,457	51,3

4.2.1 Dimensionamento vetri temprati - configurazione lineare - carichi verso **l'alto** (vento)

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

Glass	total span	span glass	tot. glass length	unitary load drilled holes			max loads and deformation					
				σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	17,48	17,48	5,83	4,577	0,400	4,977	0,400	3,318	17,011
8	850	770	817	19,79	19,79	7,59	4,042	0,400	4,442	0,400	2,962	19,443
+	900	820	867	22,20	22,20	9,73	3,604	0,400	4,004	0,400	2,669	22,078
8	950	870	917	24,76	24,76	12,29	3,231	0,400	3,631	0,400	2,421	24,834
0,76	1000	920	967	27,41	27,41	15,33	2,919	0,400	3,319	0,400	2,212	27,785
PVB	1050	970	1017	30,22	30,22	18,89	2,647	0,400	3,047	0,400	2,032	30,819
	1100	1020	1067	33,11	33,11	23,04	2,416	0,400	2,816	0,400	1,877	34,041
	1150	1070	1117	36,15	36,15	27,85	2,213	0,400	2,613	0,400	1,742	37,375
	1200	1120	1167	39,27	39,27	33,37	2,037	0,400	2,437	0,400	1,625	40,871

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

				unitary load drilled holes			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	12,86	12,86	3,00	6,221	0,500	6,721	0,500	4,481	11,942
10	850	770	817	14,55	14,55	3,91	5,498	0,500	5,998	0,500	3,999	13,681
+	900	820	867	16,32	16,32	5,01	4,902	0,500	5,402	0,500	3,601	15,538
10	950	870	917	18,19	18,19	6,32	4,398	0,500	4,898	0,500	3,265	17,477
0,76	1000	920	967	20,14	20,14	7,88	3,972	0,500	4,472	0,500	2,981	19,554
PVB	1050	970	1017	22,19	22,19	9,71	3,605	0,500	4,105	0,500	2,737	21,720
	1100	1020	1067	24,32	24,32	11,85	3,289	0,500	3,789	0,500	2,526	24,012
	1150	1070	1117	26,53	26,53	14,32	3,015	0,500	3,515	0,500	2,344	26,401
	1200	1120	1167	28,83	28,83	17,15	2,775	0,500	3,275	0,500	2,183	28,868
	1250	1170	1217	31,22	31,22	20,39	2,562	0,500	3,062	0,500	2,042	31,434
	1300	1220	1267	33,68	33,68	24,06	2,375	0,500	2,875	0,500	1,917	34,090
	1350	1270	1317	36,32	36,32	28,21	2,203	0,500	2,703	0,500	1,802	36,723
	1400	1320	1367	38,87	38,87	32,88	2,058	0,500	2,558	0,500	1,705	39,634
	1450	1370	1417	41,58	41,58	38,11	1,924	0,500	2,424	0,500	1,616	42,531
	1500	1420	1467	44,37	44,37	43,93	1,803	0,500	2,303	0,500	1,535	45,483

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

Glass	total span	span glass	tot. glass length	unitary load drilled holes				max loads and deformation					
				σ_{ed1}	σ_{ed2}	σ_{ed3}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	18,79	18,79	9,49	5,49	4,258	0,500	4,758	0,500	3,172	14,668
8	850	770	817	21,32	21,32	10,77	7,15	3,752	0,500	4,252	0,500	2,835	16,695
+	900	820	867	23,84	23,84	12,05	9,16	3,356	0,500	3,856	0,500	2,570	18,966
8	950	870	917	26,59	26,59	13,45	11,57	3,009	0,500	3,509	0,500	2,339	21,278
+	1000	920	967	29,49	29,49	14,91	14,42	2,713	0,500	3,213	0,500	2,142	23,676
4	1050	970	1017	32,51	32,51	16,44	17,78	2,461	0,500	2,961	0,500	1,974	26,205
0,76	1100	1020	1067	35,67	35,67	18,04	21,69	2,243	0,500	2,743	0,500	1,829	28,816
PVB	1150	1070	1117	38,96	38,96	19,70	26,21	2,053	0,500	2,553	0,500	1,702	31,511
	1200	1120	1167	42,28	42,28	21,39	31,40	1,892	0,500	2,392	0,500	1,595	34,376
	1250	1170	1217	45,82	45,82	23,18	37,34	1,746	0,500	2,246	0,500	1,497	37,239
	1300	1220	1267	49,48	49,48	25,04	44,07	1,617	0,500	2,117	0,500	1,411	40,157
	1350	1270	1317	53,27	53,27	26,96	51,68	1,502	0,500	2,002	0,500	1,335	43,128
	1400	1320	1367	57,18	57,18	28,94	60,24	1,399	0,500	1,899	0,500	1,266	46,147
	1450	1370	1417	61,21	61,21	30,98	69,83	1,307	0,500	1,807	0,500	1,205	49,206
	1500	1420	1467	65,27	65,27	33,05	80,51	1,226	0,500	1,726	0,500	1,150	52,368

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

Glass	total span	span glass	tot. glass length	unitary load drilled holes- VAR			unitary load drilled holes - PERM		
				σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	720	767	13,28	4,51	1,59	13,28	4,51	1,59
8	850	770	817	15,09	5,07	2,04	15,09	5,07	2,04
+	900	820	867	16,99	5,69	2,59	16,99	5,69	2,59
8	950	870	917	19,02	6,31	3,24	19,02	6,31	3,24
0,76	1000	920	967	21,12	7,00	4,00	21,12	7,00	4,00
SGP	1050	970	1017	23,37	7,68	4,89	23,37	7,68	4,89
	1100	1020	1067	25,68	8,43	5,92	25,68	8,43	5,92
	1150	1070	1117	28,13	9,17	7,10	28,13	9,17	7,10
	1200	1120	1167	30,65	9,98	8,46	30,65	9,98	8,46

max loads and deformation					
$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
0,500	6,524	6,024	0,500	4,349	7,711
0,400	5,702	5,302	0,400	3,801	8,570
0,400	5,109	4,709	0,400	3,406	9,857
0,400	4,606	4,206	0,400	3,071	11,245
0,400	4,188	3,788	0,400	2,792	12,768
0,400	3,823	3,423	0,400	2,549	14,420
0,400	3,515	3,115	0,400	2,344	16,242
0,400	3,244	2,844	0,400	2,163	18,195
0,400	3,010	2,610	0,400	2,007	20,361

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

Glass	total span	span glass	tot. glass length	unitary load drilled holes- VAR			unitary load drilled holes - PERM		
				σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	720	767	9,74	3,25	0,88	9,74	3,25	0,88
10	850	770	817	11,06	3,68	1,12	11,06	3,68	1,12
+	900	820	867	12,45	4,14	1,42	12,45	4,14	1,42
10	950	870	917	13,91	4,62	1,77	13,91	4,62	1,77
0,76	1000	920	967	15,46	5,12	2,19	15,46	5,12	2,19
SGP	1050	970	1017	17,08	5,65	2,67	17,08	5,65	2,67
	1100	1020	1067	18,77	6,24	3,23	18,77	6,24	3,23
	1150	1070	1117	20,54	6,79	3,87	20,54	6,79	3,87
	1200	1120	1167	22,39	7,49	4,60	22,39	7,49	4,60
	1250	1170	1217	24,30	8,03	5,44	24,30	8,03	5,44
	1300	1220	1267	26,29	8,69	6,38	26,29	8,69	6,38
	1350	1270	1317	28,36	9,37	7,43	28,36	9,37	7,43
	1400	1320	1367	30,49	10,11	8,62	30,49	10,11	8,62
	1450	1370	1417	32,71	10,82	9,93	32,71	10,82	9,93
	1500	1420	1467	34,99	11,66	11,40	34,99	11,66	11,40

max loads and deformation					
$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
0,500	8,714	8,214	0,500	5,809	5,552
0,500	7,733	7,233	0,500	5,156	6,334
0,500	6,926	6,426	0,500	4,617	7,266
0,500	6,251	5,751	0,500	4,168	8,261
0,500	5,675	5,175	0,500	3,783	9,380
0,500	5,184	4,684	0,500	3,456	10,562
0,500	4,762	4,262	0,500	3,175	11,869
0,500	4,395	3,895	0,500	2,930	13,274
0,500	4,073	3,573	0,500	2,715	14,791
0,500	3,792	3,292	0,500	2,528	16,473
0,500	3,543	3,043	0,500	2,362	18,259
0,500	3,321	2,821	0,500	2,214	20,164
0,500	3,124	2,624	0,500	2,083	22,262
0,500	2,946	2,446	0,500	1,964	24,466
0,500	2,786	2,286	0,500	1,858	26,876

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Fully tempered glass - ascending loads

l1	l2	unitary load	E glass	ρ glass
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]
33	47	1	70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
80,00	1	1,5

Glass	total span	span glass	tot. glass length	unitary load drilled holes - VAR				unitary load drilled holes - PERM		
				σ_{ed1}	σ_{ed2}	σ_{ed3}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	720	767	10,57	5,16	2,33	0,90	10,57	5,16	0,90
8	850	770	817	12,03	5,84	2,73	1,15	12,03	5,84	1,15
+	900	820	867	13,50	6,52	2,96	1,45	13,50	6,52	1,45
8	950	870	917	15,12	7,26	3,33	1,81	15,12	7,26	1,81
+	1000	920	967	16,81	8,04	3,73	2,22	16,81	8,04	2,22
4	1050	970	1017	18,60	8,85	4,14	2,70	18,60	8,85	2,70
0,76	1100	1020	1067	20,47	9,70	4,58	3,26	20,47	9,70	3,26
SGP	1150	1070	1117	22,42	10,59	5,07	3,90	22,42	10,59	3,90
	1200	1120	1167	24,42	11,49	5,44	4,62	24,42	11,49	4,62
	1250	1170	1217	26,54	12,45	5,93	5,45	26,54	12,45	5,45
	1300	1220	1267	28,74	13,44	6,45	6,37	28,74	13,44	6,37
	1350	1270	1317	31,03	14,47	6,99	7,41	31,03	14,47	7,41
	1400	1320	1367	33,40	15,53	7,55	8,58	33,40	15,53	8,58
	1450	1370	1417	35,84	16,62	8,15	9,87	35,84	16,62	9,87
	1500	1420	1467	38,34	17,73	8,63	11,31	38,34	17,73	11,31

max loads and deformation					
$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
0,500	8,069	7,569	0,500	5,379	5,291
0,500	7,150	6,650	0,500	4,767	6,057
0,500	6,426	5,926	0,500	4,284	6,937
0,500	5,791	5,291	0,500	3,861	7,893
0,500	5,259	4,759	0,500	3,506	8,893
0,500	4,801	4,301	0,500	3,201	9,992
0,500	4,408	3,908	0,500	2,939	11,210
0,500	4,068	3,568	0,500	2,712	12,527
0,500	3,776	3,276	0,500	2,517	13,940
0,500	3,514	3,014	0,500	2,343	15,494
0,500	3,284	2,784	0,500	2,189	17,129
0,500	3,078	2,578	0,500	2,052	18,911
0,500	2,895	2,395	0,500	1,930	20,851
0,500	2,732	2,232	0,500	1,821	22,913
0,500	2,587	2,087	0,500	1,724	25,158

4.2.2 Dimensionamento vetri temprati - configurazione angolo - carichi verso il basso (neve)

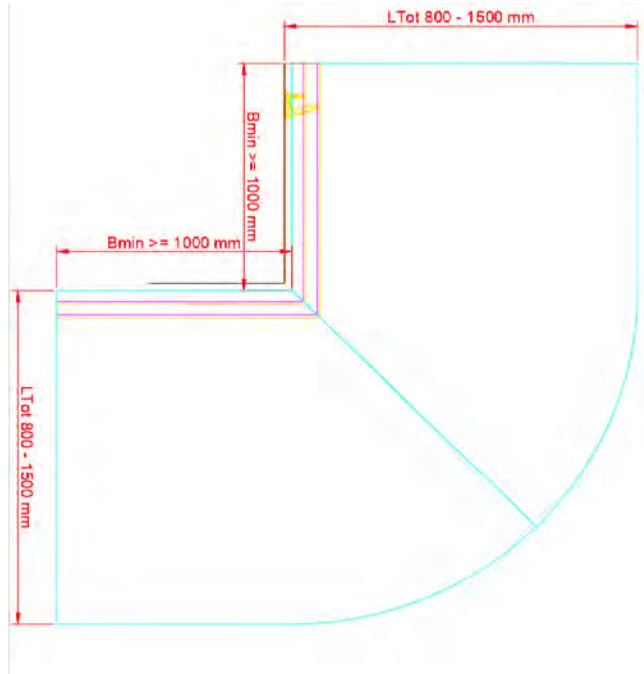
21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - EDGE ZONE VAR 2A - Fully tempered glass - Descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
80,00	1,35	1,5

				unitary load - VAR			unitary load - PERM			max loads and deformation						
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w	$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]	[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	7,82	3,73	0,90	14,69	14,69	3,21	70,084	0,675	8,962	9,637	0,500	5,975	7,0
10	850	711	818	9,33	4,45	1,19	17,55	17,55	4,30	68,154	0,675	7,305	7,980	0,500	4,870	7,9
+	900	761	868	11,00	5,22	1,55	20,72	20,72	5,65	66,014	0,675	6,001	6,676	0,500	4,001	9,0
10	950	811	918	12,65	5,96	1,98	24,00	24,00	7,30	63,800	0,675	5,043	5,718	0,500	3,362	10,3
0,76	1000	861	968	14,60	6,88	2,50	27,79	27,79	9,29	61,242	0,675	4,195	4,870	0,500	2,796	11,6
SGP	1050	911	1018	16,84	7,93	3,12	31,96	31,96	11,67	58,427	0,675	3,470	4,145	0,500	2,313	13,1
	1100	961	1068	19,23	9,10	3,84	36,23	36,23	14,49	55,545	0,675	2,888	3,563	0,500	1,926	14,6
	1150	1011	1118	21,40	9,98	4,70	40,98	40,98	17,81	52,339	0,675	2,446	3,121	0,500	1,630	16,6
	1200	1061	1168	24,43	11,57	5,69	45,95	45,95	21,68	48,984	0,675	2,005	2,680	0,500	1,337	18,4
	1250	1111	1218	26,87	12,45	6,83	51,55	51,55	26,18	45,204	0,675	1,682	2,357	0,500	1,122	20,8
	1300	1161	1268	29,91	13,85	8,14	57,43	57,43	31,35	41,235	0,675	1,379	2,054	0,500	0,919	23,2
	1350	1211	1318	33,17	15,36	9,64	63,59	63,59	37,28	37,077	0,675	1,118	1,793	0,500	0,745	25,8
	1400	1261	1368	37,08	17,46	11,35	70,13	70,13	44,04	32,662	0,675	0,881	1,556	0,500	0,587	28,7
	1450	1311	1418	40,24	18,57	13,27	77,30	77,30	51,71	27,823	0,675	0,691	1,366	0,500	0,461	32,0
	1500	1361	1468	44,12	20,40	15,44	85,02	85,02	60,36	22,612	0,675	0,513	1,188	0,500	0,342	35,5



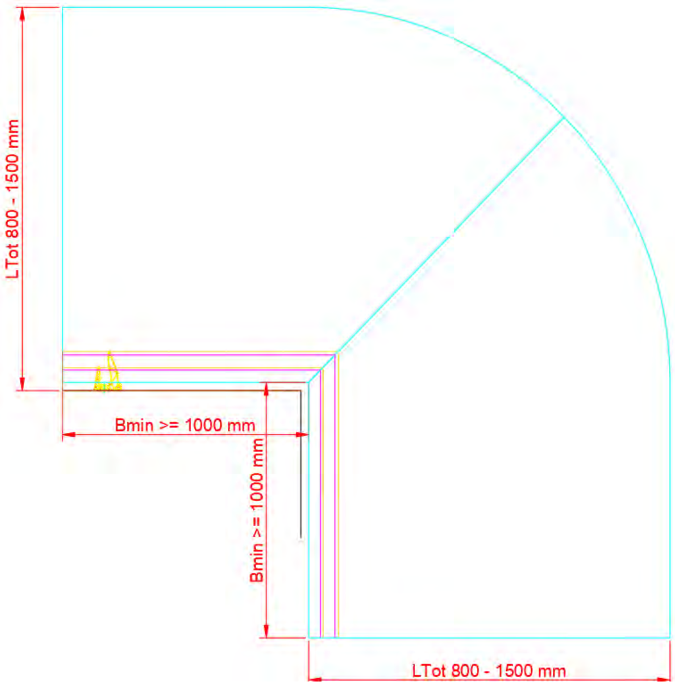
4.2.3 Dimensionamento vetri temprati - configurazione angolo - carichi verso **l’alto** (vento)

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - EDGE ZONE VAR 2A - Fully tempered glass -Ascending loads

l1	l2	unitary load	E glass	ρ glass	σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]	[N/mm²]	[-]	[-]
32	48	1	70000	25	80,00	1	1,5

Glass composition	total span [mm]	span glass [mm]	tot. glass length [mm]	unitary load no holes VAR σ_{ed1} [N/mm²]	σ_{ed2} [N/mm²]	w [mm]	unitary load no holes PERM σ_{ed1} [kNm/m]	σ_{ed2} [N/mm²]	w [mm]
	800	720	768	11,28	6,79	1,38	11,28	6,79	1,38
10	850	770	818	13,13	7,90	1,79	13,13	7,90	1,79
+	900	820	868	15,23	8,99	2,27	15,23	8,99	2,27
10	950	870	918	17,49	10,44	2,85	17,49	10,44	2,85
0,76	1000	920	968	19,89	11,88	3,54	19,89	11,88	3,54
SGP	1050	970	1018	22,55	13,20	4,35	22,55	13,20	4,35
	1100	1020	1068	25,61	15,09	5,30	25,61	15,09	5,30
	1150	1070	1118	28,43	16,88	6,39	28,43	16,88	6,39
	1200	1120	1168	31,45	18,20	7,65	31,45	18,20	7,65
	1250	1170	1218	35,10	19,40	9,10	35,10	19,40	9,10
	1300	1220	1268	38,92	23,03	10,74	38,92	23,03	10,74
	1350	1270	1318	42,98	25,34	12,61	42,98	25,34	12,61
	1400	1320	1368	47,57	28,08	14,71	47,57	28,08	14,71
	1450	1370	1418	51,54	30,36	17,09	51,54	30,36	17,09
	1500	1420	1468	56,11	33,17	19,74	56,11	33,17	19,74

max loads and deformation					
$p_{ed\ perm}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot.max}$ [kN/m²]	$p_{ek\ perm}$ [kN/m²]	$p_{ek\ var}$ [kN/m²]	w_{SLS} [mm]
0,500	7,592	7,092	0,500	5,061	7,675
0,500	6,593	6,093	0,500	4,395	8,763
0,500	5,753	5,253	0,500	3,835	9,841
0,500	5,074	4,574	0,500	3,383	11,066
0,500	4,522	4,022	0,500	3,015	12,442
0,500	4,048	3,548	0,500	2,698	13,913
0,500	3,624	3,124	0,500	2,416	15,454
0,500	3,314	2,814	0,500	2,209	17,312
0,500	3,044	2,544	0,500	2,029	19,348
0,500	2,779	2,279	0,500	1,853	21,410
0,500	2,555	2,055	0,500	1,704	23,667
0,500	2,361	1,861	0,500	1,574	26,156
0,500	2,182	1,682	0,500	1,454	28,751
0,500	2,052	1,552	0,500	1,368	31,926
0,500	1,926	1,426	0,500	1,284	35,213



4.3 Dimensionamento vetri induriti

4.3.1 Dimensionamento vetri induriti - configurazione lineare - carichi verso il basso (neve)

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

				unitary load MEPLA			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	10,43	10,43	3,58	4,474	0,540	3,934	0,400	2,623	10,8
8	850	711	818	12,10	12,10	5,15	3,857	0,540	3,317	0,400	2,211	13,4
+	900	761	868	13,90	13,90	6,77	3,357	0,540	2,817	0,400	1,878	15,4
8	950	811	918	15,83	15,83	8,73	2,948	0,540	2,408	0,400	1,605	17,5
0,76	1000	861	968	17,88	17,88	11,09	2,610	0,540	2,070	0,400	1,380	19,7
PVB	1050	911	1018	20,07	20,07	13,91	2,325	0,540	1,785	0,400	1,190	22,1
	1100	961	1068	22,39	22,39	17,23	2,084	0,540	1,544	0,400	1,030	24,6
	1150	1011	1118	24,84	24,84	21,11	1,879	0,540	1,339	0,400	0,892	27,3
	1200	1061	1168	27,35	27,35	25,61	1,706	0,540	1,166	0,400	0,778	30,2

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

				unitary load MEPLA			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	6,68	6,68	1,97	6,986	0,675	6,311	0,500	4,207	9,3
10	850	711	818	7,75	7,75	2,64	6,022	0,675	5,347	0,500	3,564	10,7
+	900	761	868	8,90	8,90	3,46	5,243	0,675	4,568	0,500	3,046	12,3
10	950	811	918	10,13	10,13	4,47	4,607	0,675	3,932	0,500	2,621	14,0
0,76	1000	861	968	11,45	11,45	5,68	4,076	0,675	3,401	0,500	2,267	15,7
PVB	1050	911	1018	12,85	12,85	7,12	3,632	0,675	2,957	0,500	1,971	17,6
	1100	961	1068	14,33	14,33	8,82	3,257	0,675	2,582	0,500	1,721	19,6
	1150	1011	1118	15,90	15,90	10,81	2,935	0,675	2,260	0,500	1,507	21,7
	1200	1061	1168	17,51	17,51	13,12	2,665	0,675	1,990	0,500	1,327	24,0
	1250	1111	1218	19,24	19,24	15,77	2,426	0,675	1,751	0,500	1,167	26,3
	1300	1161	1268	21,11	21,11	18,81	2,211	0,675	1,536	0,500	1,024	28,7
	1350	1211	1318	23,02	23,02	22,28	2,027	0,675	1,352	0,500	0,901	31,2
	1400	1261	1368	24,96	24,96	26,21	1,870	0,675	1,195	0,500	0,796	34,0
	1450	1311	1418	27,03	27,03	30,63	1,726	0,675	1,051	0,500	0,701	36,8
	1500	1361	1468	29,29	29,25	35,59	1,593	0,675	0,918	0,500	0,612	39,6

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

				unitary load MEPLA				max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	9,82	9,82	4,93	3,62	4,752	0,675	4,077	0,500	2,718	11,6
8	850	711	818	11,38	11,38	5,72	4,85	4,101	0,675	3,426	0,500	2,284	13,5
+	900	761	868	13,08	13,08	6,57	6,37	3,568	0,675	2,893	0,500	1,929	15,5
8	950	811	918	14,89	14,89	7,48	8,21	3,134	0,675	2,459	0,500	1,639	17,6
+	1000	861	968	16,83	16,83	8,45	10,44	2,773	0,675	2,098	0,500	1,399	19,8
4	1050	911	1018	18,89	18,89	9,48	13,09	2,470	0,675	1,795	0,500	1,197	22,2
0,76	1100	961	1068	21,07	21,07	10,57	16,21	2,215	0,675	1,540	0,500	1,027	24,7
PVB	1150	1011	1118	23,37	23,37	11,72	19,87	1,997	0,675	1,322	0,500	0,881	27,4
	1200	1061	1168	25,74	25,74	12,90	24,10	1,813	0,675	1,138	0,500	0,759	30,3
	1250	1111	1218	28,29	28,29	14,18	28,99	1,650	0,675	0,975	0,500	0,650	33,3
	1300	1161	1268	31,04	31,04	15,56	34,59	1,503	0,675	0,828	0,500	0,552	36,4
	1350	1211	1318	33,84	33,84	16,97	40,96	1,379	0,675	0,704	0,500	0,469	39,7
	1400	1261	1368	36,69	36,69	18,39	48,17	1,272	0,675	0,597	0,500	0,398	43,3
	1450	1311	1418	39,73	39,73	19,91	56,28	1,175	0,675	0,500	0,500	0,333	46,9
	1500	1361	1468	43,01	43,01	21,56	65,41	1,085	0,675	0,410	0,500	0,273	50,6

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

Glass	total span	span glass	tot. glass length	unitary load - VAR			unitary load - PERM		
				σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	661	768	5,19	0,66	0,86	6,68	6,68	1,97
8	850	711	818	5,99	0,71	1,15	7,75	7,8	2,6
+	900	761	868	6,85	0,76	1,50	8,90	8,9	3,5
8	950	811	918	7,78	0,81	1,94	10,13	10,1	4,5
0,76	1000	861	968	8,76	0,86	2,46	11,45	11,5	5,7
SGP	1050	911	1018	9,81	0,91	3,08	12,85	12,9	7,1
	1100	961	1068	10,91	0,97	3,80	14,33	14,3	8,8
	1150	1011	1118	12,08	1,01	4,66	15,90	15,9	10,8
	1200	1061	1168	13,23	1,32	5,64	17,51	17,5	13,1

max loads and deformation						
$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
43,059	0,540	8,297	8,837	0,400	5,531	5,5
42,482	0,540	7,092	7,632	0,400	4,728	6,5
41,861	0,540	6,111	6,651	0,400	4,074	7,5
41,196	0,540	5,295	5,835	0,400	3,530	8,6
40,484	0,540	4,621	5,161	0,400	3,081	9,9
39,728	0,540	4,050	4,590	0,400	2,700	11,2
38,928	0,540	3,568	4,108	0,400	2,379	12,6
38,081	0,540	3,152	3,692	0,400	2,102	14,1
37,211	0,540	2,813	3,353	0,400	1,875	15,8

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

Glass	total span	span glass	tot. glass length	unitary load - VAR			unitary load - PERM		
composition				σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w
	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]
	800	661	768	3,41	0,52	0,46	6,68	6,68	1,97
10	850	711	818	3,94	0,55	0,61	7,75	7,8	2,6
+	900	761	868	4,50	0,60	0,80	8,90	8,9	3,5
10	950	811	918	5,11	0,64	1,02	10,13	10,1	4,5
0,76	1000	861	968	5,76	0,68	1,30	11,45	11,5	5,7
SGP	1050	911	1018	6,43	0,73	1,62	12,85	12,9	7,1
	1100	961	1068	7,16	0,77	2,01	14,33	14,3	8,8
	1150	1011	1118	7,92	0,82	2,46	15,90	15,9	10,8
	1200	1061	1168	8,68	0,82	2,98	17,51	17,5	13,1
	1250	1111	1218	9,52	0,90	3,58	19,24	19,2	15,8
	1300	1161	1268	10,45	0,95	4,26	21,11	21,1	18,8
	1350	1211	1318	11,38	1,00	5,04	23,02	23,0	22,3
	1400	1261	1368	12,28	1,13	5,93	24,96	25,0	26,2
	1450	1311	1418	13,28	1,23	6,92	27,03	27,0	30,6
	1500	1361	1468	14,39	1,15	8,04	29,29	29,3	35,6

max loads and deformation						
$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
42,158	0,675	12,363	13,038	0,500	8,242	4,8
41,435	0,675	10,517	11,192	0,500	7,011	5,6
40,659	0,675	9,035	9,710	0,500	6,024	6,5
39,829	0,675	7,794	8,469	0,500	5,196	7,5
38,938	0,675	6,760	7,435	0,500	4,507	8,7
37,993	0,675	5,909	6,584	0,500	3,939	9,9
36,994	0,675	5,167	5,842	0,500	3,444	11,3
35,934	0,675	4,537	5,212	0,500	3,025	12,8
34,847	0,675	4,015	4,690	0,500	2,676	14,5
33,680	0,675	3,538	4,213	0,500	2,359	16,3
32,417	0,675	3,102	3,777	0,500	2,068	18,2
31,128	0,675	2,735	3,410	0,500	1,824	20,3
29,819	0,675	2,428	3,103	0,500	1,619	22,7
28,421	0,675	2,140	2,815	0,500	1,427	25,2
26,896	0,675	1,869	2,544	0,500	1,246	27,8

21015 Pensilina a sbalzo - IT, Logli : Overview of glass pane dimensioning - Heat strengthened glass - descending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
80	59	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	γ_{perm}	γ_{var}
[N/mm²]	[-]	[-]
46,67	1,35	1,5

				unitary load MEPLA VAR				unitary load - PERM				max loads and deformation						
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	$\Delta\sigma_{edvar}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[N/mm²]	[N/mm²]	[N/mm²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	661	768	3,22	2,22	0,11	0,43	9,82	9,82	4,93	3,62	40,038	0,675	12,434	13,109	0,500	8,289	5,4
8	850	711	818	3,73	2,54	0,12	0,58	11,38	11,38	5,72	4,85	38,985	0,675	10,452	11,127	0,500	6,968	6,5
+	900	761	868	4,27	2,88	0,14	0,75	13,08	13,08	6,57	6,37	37,838	0,675	8,861	9,536	0,500	5,908	7,6
8	950	811	918	4,86	3,25	0,16	0,97	14,89	14,89	7,48	8,21	36,616	0,675	7,534	8,209	0,500	5,023	9,0
+	1000	861	968	5,47	3,64	0,18	1,23	16,83	16,83	8,45	10,44	35,306	0,675	6,455	7,130	0,500	4,303	10,5
4	1050	911	1018	6,14	4,05	0,20	1,53	18,89	18,89	9,48	13,09	33,916	0,675	5,524	6,199	0,500	3,683	12,2
0,76	1100	961	1068	6,88	4,49	0,22	1,89	21,07	21,07	10,57	16,21	32,444	0,675	4,716	5,391	0,500	3,144	14,0
SGP	1150	1011	1118	7,57	4,94	0,25	2,32	23,37	23,37	11,72	19,87	30,892	0,675	4,081	4,756	0,500	2,721	16,2
	1200	1061	1168	8,31	5,35	0,32	2,81	25,74	25,74	12,90	24,10	29,292	0,675	3,525	4,200	0,500	2,350	18,7
	1250	1111	1218	9,12	5,85	0,36	3,37	28,29	28,29	14,18	28,99	27,571	0,675	3,023	3,698	0,500	2,015	21,3
	1300	1161	1268	10,02	6,45	0,33	4,02	31,04	31,04	15,56	34,59	25,715	0,675	2,566	3,241	0,500	1,711	24,2
	1350	1211	1318	10,91	7,00	0,36	4,75	33,84	33,84	16,97	40,96	23,825	0,675	2,184	2,859	0,500	1,456	27,4
	1400	1261	1368	11,79	7,49	0,47	5,58	36,69	36,69	18,39	48,17	21,901	0,675	1,858	2,533	0,500	1,238	31,0
	1450	1311	1418	12,76	8,08	0,51	6,52	39,73	39,73	19,91	56,28	19,849	0,675	1,556	2,231	0,500	1,037	34,9
	1500	1361	1468	13,83	8,80	0,45	7,57	43,01	43,01	21,56	65,41	17,635	0,675	1,275	1,950	0,500	0,850	39,1

4.3.1 Dimensionamento vetri induriti - configurazione lineare - carichi verso **l'alto (vento)**

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load	E glass	ρ glass	σ_{rd}	$\gamma_{perm,inf}$	γ_{var}
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]	[N/mm²]	[-]	[-]
33	47	1	70000	25	46,67	1	1,5

				unitary load drilled holes			max loads and deformation					
Glass composition	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot,max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	17,48	17,48	5,83	2,670	0,400	3,070	0,400	2,046	9,599
8	850	770	817	19,79	19,79	7,59	2,358	0,400	2,758	0,400	1,839	10,920
+	900	820	867	22,20	22,20	9,73	2,102	0,400	2,502	0,400	1,668	12,338
8	950	870	917	24,76	24,76	12,29	1,885	0,400	2,285	0,400	1,523	13,804
0,76	1000	920	967	27,41	27,41	15,33	1,703	0,400	2,103	0,400	1,402	15,356
PVB	1050	970	1017	30,22	30,22	18,89	1,544	0,400	1,944	0,400	1,296	16,928
	1100	1020	1067	33,11	33,11	23,04	1,409	0,400	1,809	0,400	1,206	18,577
	1150	1070	1117	36,15	36,15	27,85	1,291	0,400	1,691	0,400	1,127	20,255
	1200	1120	1167	39,27	39,27	33,37	1,188	0,400	1,588	0,400	1,059	21,988

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
46,67	1	1,5

				unitary load drilled holes			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	12,86	12,86	3,00	3,629	0,500	4,129	0,500	2,753	6,758
10	850	770	817	14,55	14,55	3,91	3,207	0,500	3,707	0,500	2,472	7,709
+	900	820	867	16,32	16,32	5,01	2,859	0,500	3,359	0,500	2,240	8,716
10	950	870	917	18,19	18,19	6,32	2,566	0,500	3,066	0,500	2,044	9,756
0,76	1000	920	967	20,14	20,14	7,88	2,317	0,500	2,817	0,500	1,878	10,859
PVB	1050	970	1017	22,19	22,19	9,71	2,103	0,500	2,603	0,500	1,735	11,995
	1100	1020	1067	24,32	24,32	11,85	1,919	0,500	2,419	0,500	1,613	13,184
	1150	1070	1117	26,53	26,53	14,32	1,759	0,500	2,259	0,500	1,506	14,406
	1200	1120	1167	28,83	28,83	17,15	1,619	0,500	2,119	0,500	1,412	15,649
	1250	1170	1217	31,22	31,22	20,39	1,495	0,500	1,995	0,500	1,330	16,921
	1300	1220	1267	33,68	33,68	24,06	1,386	0,500	1,886	0,500	1,257	18,215
	1350	1270	1317	36,32	36,32	28,21	1,285	0,500	1,785	0,500	1,190	19,463
	1400	1320	1367	38,87	38,87	32,88	1,201	0,500	1,701	0,500	1,134	20,837
	1450	1370	1417	41,58	41,58	38,11	1,122	0,500	1,622	0,500	1,082	22,163
	1500	1420	1467	44,37	44,37	43,93	1,052	0,500	1,552	0,500	1,035	23,481

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
46,67	1	1,5

				unitary load drilled holes				max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	$p_{ed\ tot.max}$	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	18,79	18,79	9,49	5,49	2,484	0,500	2,984	0,500	1,989	8,175
8	850	770	817	21,32	21,32	10,77	7,15	2,189	0,500	2,689	0,500	1,793	9,242
+	900	820	867	23,84	23,84	12,05	9,16	1,957	0,500	2,457	0,500	1,638	10,427
8	950	870	917	26,59	26,59	13,45	11,57	1,755	0,500	2,255	0,500	1,503	11,609
+	1000	920	967	29,49	29,49	14,91	14,42	1,582	0,500	2,082	0,500	1,388	12,809
4	1050	970	1017	32,51	32,51	16,44	17,78	1,435	0,500	1,935	0,500	1,290	14,052
0,76	1100	1020	1067	35,67	35,67	18,04	21,69	1,308	0,500	1,808	0,500	1,206	15,303
PVB	1150	1070	1117	38,96	38,96	19,70	26,21	1,198	0,500	1,698	0,500	1,132	16,561
	1200	1120	1167	42,28	42,28	21,39	31,40	1,104	0,500	1,604	0,500	1,069	17,872
	1250	1170	1217	45,82	45,82	23,18	37,34	1,018	0,500	1,518	0,500	1,012	19,130
	1300	1220	1267	49,48	49,48	25,04	44,07	0,943	0,500	1,443	0,500	0,962	20,365
	1350	1270	1317	53,27	53,27	26,96	51,68	0,876	0,500	1,376	0,500	0,917	21,569
	1400	1320	1367	57,18	57,18	28,94	60,24	0,816	0,500	1,316	0,500	0,877	22,736
	1450	1370	1417	61,21	61,21	30,98	69,83	0,762	0,500	1,262	0,500	0,842	23,854
	1500	1420	1467	65,27	65,27	33,05	80,51	0,715	0,500	1,215	0,500	0,810	24,957

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load	E glass	ρ glass	σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[mm]	[mm]	[kN/m²]	[N/mm²]	[kN/m³]	[N/mm²]	[-]	[-]
33	47	1	70000	25	46,67	1	1,5

				unitary load drilled holes - VAR			unitary load drilled holes - PERM			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	13,28	4,51	1,59	13,28	4,51	1,59	0,400	3,914	3,514	0,400	2,609	4,785
8	850	770	817	15,09	5,07	2,04	15,09	5,07	2,04	0,400	3,493	3,093	0,400	2,328	5,566
+	900	820	867	16,99	5,69	2,59	16,99	5,69	2,59	0,400	3,147	2,747	0,400	2,098	6,469
8	950	870	917	19,02	6,31	3,24	19,02	6,31	3,24	0,400	2,854	2,454	0,400	1,902	7,460
0,76	1000	920	967	21,12	7,00	4,00	21,12	7,00	4,00	0,400	2,610	2,210	0,400	1,740	8,559
SGP	1050	970	1017	23,37	7,68	4,89	23,37	7,68	4,89	0,400	2,397	1,997	0,400	1,598	9,770
	1100	1020	1067	25,68	8,43	5,92	25,68	8,43	5,92	0,400	2,217	1,817	0,400	1,478	11,119
	1150	1070	1117	28,13	9,17	7,10	28,13	9,17	7,10	0,400	2,059	1,659	0,400	1,373	12,586
	1200	1120	1167	30,65	9,98	8,46	30,65	9,98	8,46	0,400	1,923	1,523	0,400	1,282	14,227

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
46,67	1	1,5

				unitary load drilled holes - VAR			unitary load drilled holes - PERM			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	w	σ_{ed1}	σ_{ed2}	w	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	9,74	3,25	0,88	9,74	3,25	0,88	0,500	5,291	4,791	0,500	3,527	3,544
10	850	770	817	11,06	3,68	1,12	11,06	3,68	1,12	0,500	4,719	4,219	0,500	3,146	4,084
+	900	820	867	12,45	4,14	1,42	12,45	4,14	1,42	0,500	4,248	3,748	0,500	2,832	4,732
10	950	870	917	13,91	4,62	1,77	13,91	4,62	1,77	0,500	3,855	3,355	0,500	2,570	5,434
0,76	1000	920	967	15,46	5,12	2,19	15,46	5,12	2,19	0,500	3,519	3,019	0,500	2,346	6,232
SGP	1050	970	1017	17,08	5,65	2,67	17,08	5,65	2,67	0,500	3,232	2,732	0,500	2,155	7,088
	1100	1020	1067	18,77	6,24	3,23	18,77	6,24	3,23	0,500	2,986	2,486	0,500	1,991	8,045
	1150	1070	1117	20,54	6,79	3,87	20,54	6,79	3,87	0,500	2,772	2,272	0,500	1,848	9,087
	1200	1120	1167	22,39	7,49	4,60	22,39	7,49	4,60	0,500	2,584	2,084	0,500	1,723	10,225
	1250	1170	1217	24,30	8,03	5,44	24,30	8,03	5,44	0,500	2,420	1,920	0,500	1,614	11,498
	1300	1220	1267	26,29	8,69	6,38	26,29	8,69	6,38	0,500	2,275	1,775	0,500	1,517	12,867
	1350	1270	1317	28,36	9,37	7,43	28,36	9,37	7,43	0,500	2,146	1,646	0,500	1,430	14,342
	1400	1320	1367	30,49	10,11	8,62	30,49	10,11	8,62	0,500	2,031	1,531	0,500	1,354	15,979
	1450	1370	1417	32,71	10,82	9,93	32,71	10,82	9,93	0,500	1,927	1,427	0,500	1,284	17,720
	1500	1420	1467	34,99	11,66	11,40	34,99	11,66	11,40	0,500	1,834	1,334	0,500	1,222	19,636

21015 Pensilina a sbalzo - IT, Logli : Glass pane dimensioning - Heat strengthened glass - ascending loads

l1	l2	unitary load
[mm]	[mm]	[kN/m²]
33	47	1

E glass	ρ glass
[N/mm²]	[kN/m³]
70000	25

σ_{rd}	$\gamma_{perm.inf}$	γ_{var}
[N/mm²]	[-]	[-]
46,67	1	1,5

				unitary load drilled holes - VAR				unitary load drilled holes - PERM			max loads and deformation					
Glass	total span	span glass	tot. glass length	σ_{ed1}	σ_{ed2}	σ_{ed3}	w	σ_{ed1}	σ_{ed2}	w	$p_{ed\ perm}$	$p_{ed\ var}$	$p_{ed\ tot.max}$	$p_{ek\ perm}$	$p_{ek\ var}$	w_{SLS}
composition	[mm]	[mm]	[mm]	[N/mm²]	[N/mm²]	[N/mm²]	[mm]	[kNm/m]	[N/mm²]	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[mm]
	800	720	767	10,57	5,16	2,33	0,90	10,57	5,16	0,90	0,500	4,915	4,415	0,500	3,277	3,399
8	850	770	817	12,03	5,84	2,73	1,15	12,03	5,84	1,15	0,500	4,379	3,879	0,500	2,919	3,932
+	900	820	867	13,50	6,52	2,96	1,45	13,50	6,52	1,45	0,500	3,957	3,457	0,500	2,638	4,550
8	950	870	917	15,12	7,26	3,33	1,81	15,12	7,26	1,81	0,500	3,586	3,086	0,500	2,391	5,233
+	1000	920	967	16,81	8,04	3,73	2,22	16,81	8,04	2,22	0,500	3,276	2,776	0,500	2,184	5,959
4	1050	970	1017	18,60	8,85	4,14	2,70	18,60	8,85	2,70	0,500	3,009	2,509	0,500	2,006	6,766
0,76	1100	1020	1067	20,47	9,70	4,58	3,26	20,47	9,70	3,26	0,500	2,780	2,280	0,500	1,853	7,671
SGP	1150	1070	1117	22,42	10,59	5,07	3,90	22,42	10,59	3,90	0,500	2,581	2,081	0,500	1,721	8,662
	1200	1120	1167	24,42	11,49	5,44	4,62	24,42	11,49	4,62	0,500	2,411	1,911	0,500	1,607	9,736
	1250	1170	1217	26,54	12,45	5,93	5,45	26,54	12,45	5,45	0,500	2,258	1,758	0,500	1,506	10,930
	1300	1220	1267	28,74	13,44	6,45	6,37	28,74	13,44	6,37	0,500	2,124	1,624	0,500	1,416	12,204
	1350	1270	1317	31,03	14,47	6,99	7,41	31,03	14,47	7,41	0,500	2,004	1,504	0,500	1,336	13,604
	1400	1320	1367	33,40	15,53	7,55	8,58	33,40	15,53	8,58	0,500	1,897	1,397	0,500	1,265	15,142
	1450	1370	1417	35,84	16,62	8,15	9,87	35,84	16,62	9,87	0,500	1,802	1,302	0,500	1,201	16,793
	1500	1420	1467	38,34	17,73	8,63	11,31	38,34	17,73	11,31	0,500	1,717	1,217	0,500	1,145	18,603

5 Dimensionamento del profilo in alluminio - configurazione lineare

5.1.1 Informazioni generali

Per installare e fissare la lastra in vetro dentro nel profilo sono previste sia delle guarnizioni sopra e sotto che delle pinze ad una distanza di 100 mm oppure 200. Per carichi di compressione verso il basso la lastra in vetro si appoggia sia sulla guarnizione inferiore che superiore, per carichi di depressione (vento) la lastra si incastra tra la guarnizione superiore e le pinze.

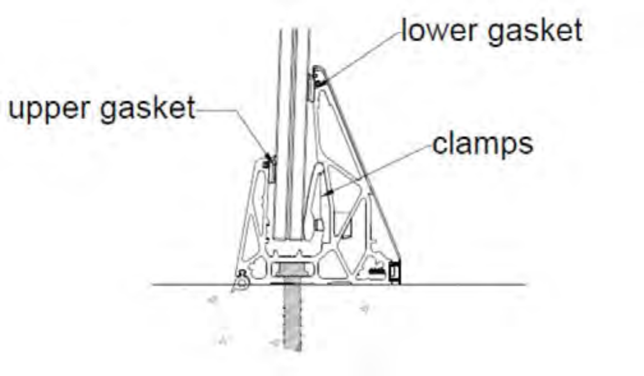


Fig: Fissaggio vetro nel profilo

Nelle figure seguente sono indicati le posizioni degli appoggi vetro/profilo con le relative distanze e i nomi dei variabili usati nel calcolo seguente del profilo:

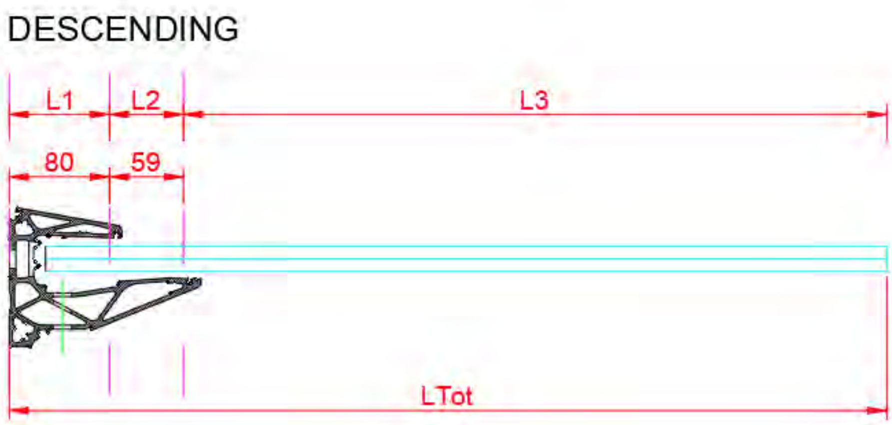


Fig: Sistema statico per il determinare le forze agenti tra profilo e vetro

Fig: Sistema statico per il determinare le forze agenti tra profilo e vetro

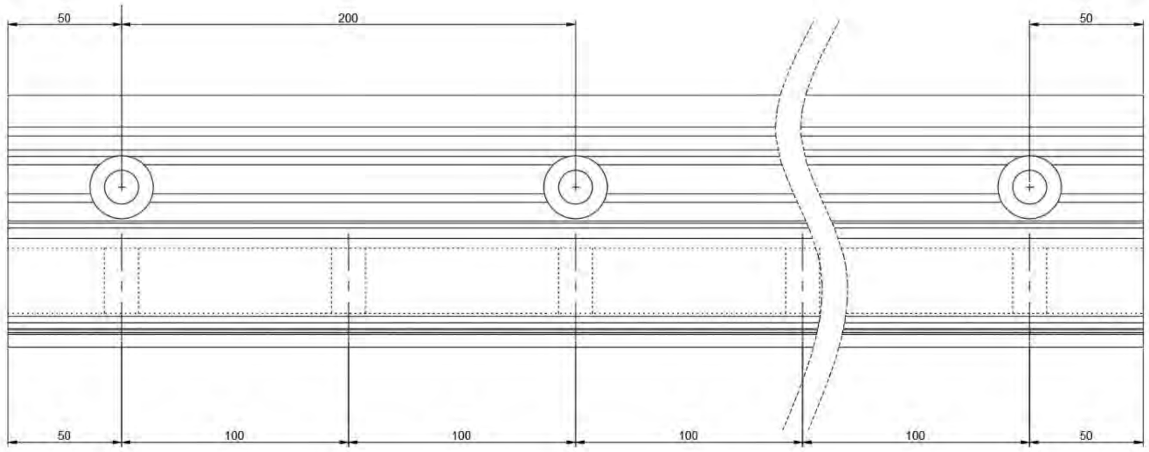
Il calcolo del profilo in alluminio è condotto tramite il programma di calcolo Sofistik in modo iterativo.

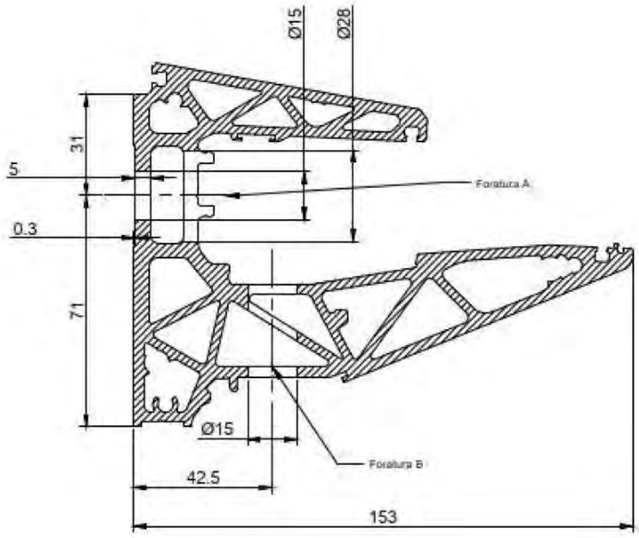
In un primo step è stato calcolato il carico lineare agente sugli appoggi tra vetro e profilo per un carico unitario di 1.0 kN/m². Questo carico è stato applicato al modello numerico in Sofistik variandolo finché il limite basato alla resistenza ultima del materiale è stato trovato.

A base di queste massime forze di contatto profilo/vetro ammissibili allo SLU, il massimo carico distribuito pEd.tot allo SLU è stato ricavato.

Per i risultati delle verifiche numeriche si riferisce **all'allegato**.

DIMENSIONAMENTO PROFILO





Massimo e minimo sbalzo pensilina dalla parete:

$l_{span.max} := 1500\ \mathrm{mm}$

$l_{span.min} := 800\ \mathrm{mm}$

$p_u := 1\ \frac{\mathrm{kN}}{\mathrm{m}^2}$ forza unitaria di carico distribuito

Per forze di compressione in direzione forze di gravitá (DESCENDING):

$l_{1.d} := 80\ \text{mm}$

$l_{2.d} := 59\ \text{mm}$

$l_{3.d.max} := l_{span.max} - l_{1.d} - l_{2.d} = 1361\ \text{mm}$

$l_{3.d.min} := l_{span.min} - l_{1.d} - l_{2.d} = 661\ \text{mm}$

a) Per massimo sbalzo:

$$F_{A.glas.prof.d.max} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.max} + l_{2.d}\right)^2 = 17.0881 \cdot \frac{1}{\text{m}}\ \text{kN}$$

$$F_{B.glas.prof.d.max} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left({l_{2.d}}^2 - {l_{3.d.max}}^2\right) = -15.6681 \cdot \frac{1}{\text{m}}\ \text{kN}$$

Controllo:

$$F_{A.glas.prof.d.max} - \left|F_{B.glas.prof.d.max}\right| = 1.42\ \frac{\text{kN}}{\text{m}}$$

$$\left(l_{3.d.max} + l_{2.d}\right) \cdot p_u = 1.42\ \frac{\text{kN}}{\text{m}}$$

$f_{ped.max} := 3.50$ fattore di massimo aumento carico tra carico unitario pu e carico massimo allo stato limite ultimo pEd dovuto alla restenza del profilo- vedi verifiche agli elementi finiti

Controlle forze di reazione sui tasselli:

$e_{v.1} := 71\ \text{mm}$

$l_{c.1} := 6\ \text{mm}$

$$e_{v.1.ct} := e_{v.1} - \frac{l_{c.1}}{2} = 68\ \text{mm}$$

$$F_{t.Ed.fix.1fm} := \frac{f_{ped.max} \cdot p_u \cdot \frac{{l_{span.max}}^2}{2}}{e_{v.1.ct}} = 57.9044 \cdot \frac{1}{\text{m}}\ \text{kN}$$

$e_{fix} := 200\ \text{mm}$

$$F_{t.Ed.fix} := e_{fix} \cdot F_{t.Ed.fix.1fm} = 11.5809\ \text{kN}$$

$$F_{v.Ed.fix} := f_{ped.max} \cdot p_u \cdot l_{span.max} \cdot e_{fix} = 1.05\ \text{kN}$$

Controllo compressione cemento armato - qualitá cemento armato >= C25/30:

$h_c := l_{c.1} = 6\ \mathrm{mm}$

$b_c := e_{fix} = 200\ \mathrm{mm}$

$A_c := h_c \cdot b_c = 1200\ \mathrm{mm}^2$

$f_{ck} := 25\ \mathrm{MPa}$

$f_{cd} := 0.85 \cdot \dfrac{f_{ck}}{1.5} = 14.1667\ \mathrm{MPa}$

$F_{c.Rd} := f_{cd} \cdot A_c = 17\ \mathrm{kN}$

$F_{c.Ed} := F_{t.Ed.fix} = 11.5809\ \mathrm{kN}$

$\boxed{\dfrac{F_{c.Ed}}{F_{c.Rd}} = 0.6812}$

b) Per minimo sbalzo:

$F_{A.glas.prof.d.min.u} := \dfrac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.min} + l_{2.d}\right)^2 = 4.3932 \cdot \dfrac{1}{\mathrm{m}}\ \mathrm{kN}$

$F_{B.glas.prof.d.min.u} := \dfrac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{2.d}^{\ 2} - l_{3.d.min}^{\ 2}\right) = -3.6732 \cdot \dfrac{1}{\mathrm{m}}\ \mathrm{kN}$

$F_{A.glas.prof.d.min.u} - \left|F_{B.glas.prof.d.min.u}\right| = 0.72\ \dfrac{\mathrm{kN}}{\mathrm{m}}$

$\left(l_{3.d.min} + l_{2.d}\right) \cdot p_u = 0.72\ \dfrac{\mathrm{kN}}{\mathrm{m}}$

$\boxed{f_{ped.min} := \dfrac{f_{ped.max} \cdot F_{A.glas.prof.d.max}}{F_{A.glas.prof.d.min.u}} = 13.6138}$

$F_{A.glas.prof.d.min} := \dfrac{p_u \cdot f_{ped.min}}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.min} + l_{2.d}\right)^2 = 59.8085 \cdot \dfrac{1}{\mathrm{m}}\ \mathrm{kN}$

$F_{B.glas.prof.d.min} := \dfrac{p_u \cdot f_{ped.min}}{2 \cdot l_{2.d}} \cdot \left(l_{2.d}^{\ 2} - l_{3.d.min}^{\ 2}\right) = -50.0065 \cdot \dfrac{1}{\mathrm{m}}\ \mathrm{kN}$

$F_{A.glas.prof.d.min} - \left|F_{B.glas.prof.d.min}\right| = 9.8019\ \dfrac{\mathrm{kN}}{\mathrm{m}}$

$\left(l_{3.d.min} + l_{2.d}\right) \cdot p_u \cdot f_{ped.min} = 9.8019\ \dfrac{\mathrm{kN}}{\mathrm{m}}$

Controlle forze di reazione sui tasselli:

$e_{v.1} := 71\ \mathrm{mm}$

$l_{c.1} := 6\ \mathrm{mm}$

$e_{v.1.ct} := e_{v.1} - \frac{l_{c.1}}{2} = 68\ \mathrm{mm}$

$F_{t.Ed.fix.1fm} := \frac{f_{ped.min} \cdot p_u \cdot \frac{l_{span.min}^{2}}{2}}{e_{v.1.ct}} = 64.065 \cdot \frac{1}{\mathrm{m}}\ \mathrm{kN}$

$e_{fix} := 200\ \mathrm{mm}$

$F_{t.Ed.fix} := e_{fix} \cdot F_{t.Ed.fix.1fm} = 12.813\ \mathrm{kN}$

$F_{v.Ed.fix} := f_{ped.min} \cdot p_u \cdot l_{span.min} \cdot e_{fix} = 2.1782\ \mathrm{kN}$

Controllo compressione cemento armato - qualitá cemento armato >= C25/30:

$h_c := l_{c.1} = 6\ \mathrm{mm}$

$b_c := e_{fix} = 200\ \mathrm{mm}$

$A_c := h_c \cdot b_c = 1200\ \mathrm{mm}^2$

$f_{ck} := 25\ \mathrm{MPa}$

$f_{cd} := 0.85 \cdot \frac{f_{ck}}{1.5} = 14.1667\ \mathrm{MPa}$

$F_{c.Rd} := f_{cd} \cdot A_c = 17\ \mathrm{kN}$

$F_{c.Ed} := F_{t.Ed.fix} = 12.813\ \mathrm{kN}$

$\boxed{\frac{F_{c.Ed}}{F_{c.Rd}} = 0.7537}$

Per forze di depressione (ASCENDING):

$l_{1.d} := 42.5\ mm$

$l_{2.d} := 80\ mm - l_{1.d} = 37.5\ mm$

$l_{3.d.max} := l_{span.max} - l_{1.d} - l_{2.d} = 1420\ mm$

$l_{3.d.min} := l_{span.min} - l_{1.d} - l_{2.d} = 720\ mm$

a) Per massimo sbalzo:

$$F_{A.glas.prof.d.max} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.max} + l_{2.d}\right)^2 = 28.3241 \cdot \frac{1}{m}\ kN$$

$$F_{B.glas.prof.d.max} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{2.d}{}^2 - l_{3.d.max}{}^2\right) = -26.8666 \cdot \frac{1}{m}\ kN$$

Controllo:

$$F_{A.glas.prof.d.max} - \left|F_{B.glas.prof.d.max}\right| = 1.4575\ \frac{kN}{m}$$

$$\left(l_{3.d.max} + l_{2.d}\right) \cdot p_u = 1.4575\ \frac{kN}{m}$$

$f_{ped.max.up} := 2.3$ fattore di massimo aumento carico tra carico unitario pu e carico massimo allo stato limite ultimo pEd dovuto alla restenza del profilo- vedi verifiche agli elementi finiti

Controlle forze di reazione sui tasselli:

$e_{v.2} := 30\ mm$

$l_{c.2} := 6\ mm$

$$e_{v.2.ct} := e_{v.2} - \frac{l_{c.2}}{2} = 27\ mm$$

$$F_{t.Ed.fix.1fm} := \frac{f_{ped.max.up} \cdot p_u \cdot \frac{l_{span.max}{}^2}{2}}{e_{v.2.ct}} = 95.8333 \cdot \frac{1}{m}\ kN$$

$e_{fix} := 200\ mm$

$F_{t.Ed.fix} := e_{fix} \cdot F_{t.Ed.fix.1fm} = 19.1667\ kN$

$F_{v.Ed.fix} := f_{ped.max.up} \cdot p_u \cdot l_{span.max} \cdot e_{fix} = 0.69\ kN$

Controllo compressione cemento armato - qualitá cemento armato >= C25/30:

$h_c := l_{c.2} = 6\ mm$

$b_c := e_{fix} = 200\ mm$

$A_c := h_c \cdot b_c = 1200\ mm^2$

$f_{ck} := 25\ MPa$

$f_{cd} := 1 \cdot \frac{f_{ck}}{1.5} = 16.6667\ MPa$ con αcc=1.0 perchè sono carichi di durata corta (vento)

$F_{c.Rd} := f_{cd} \cdot A_c = 20\ kN$

$F_{c.Ed} := F_{t.Ed.fix} = 19.1667\ kN$

$\frac{F_{c.Ed}}{F_{c.Rd}} = 0.9583$

b) Per minimo sbalzo:

$$F_{A.glas.prof.d.min.u} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.min} + l_{2.d}\right)^2 = 7.6508 \cdot \frac{1}{m}\ kN$$

$$F_{B.glas.prof.d.min.u} := \frac{p_u}{2 \cdot l_{2.d}} \cdot \left(l_{2.d}{}^2 - l_{3.d.min}{}^2\right) = -6.8932 \cdot \frac{1}{m}\ kN$$

$$F_{A.glas.prof.d.min.u} - \left|F_{B.glas.prof.d.min.u}\right| = 0.7575\ \frac{kN}{m}$$

$$\left(l_{3.d.min} + l_{2.d}\right) \cdot p_u = 0.7575\ \frac{kN}{m}$$

$$f_{ped.min.up} := \frac{f_{ped.max.up} \cdot F_{A.glas.prof.d.max}}{F_{A.glas.prof.d.min.u}} = 8.5149$$

$$F_{A.glas.prof.d.min} := \frac{p_u \cdot f_{ped.min.up}}{2 \cdot l_{2.d}} \cdot \left(l_{3.d.min} + l_{2.d}\right)^2 = 65.1454 \cdot \frac{1}{m}\ kN$$

$$F_{B.glas.prof.d.min} := \frac{p_u \cdot f_{ped.min.up}}{2 \cdot l_{2.d}} \cdot \left(l_{2.d}{}^2 - l_{3.d.min}{}^2\right) = -58.6954 \cdot \frac{1}{m}\ kN$$

$$F_{A.glas.prof.d.min} - \left|F_{B.glas.prof.d.min}\right| = 6.45\ \frac{kN}{m}$$

$$\left(l_{3.d.min} + l_{2.d}\right) \cdot p_u \cdot f_{ped.min.up} = 6.45\ \frac{kN}{m}$$

Controlle forze di reazione sui tasselli:

$$e_{v.2} := 30\ mm$$

$$l_{c.2} := 6\ mm$$

$$e_{v.2.ct} := e_{v.2} - \frac{l_{c.2}}{2} = 27\ mm$$

$$F_{t.Ed.fix.1fm} := \frac{f_{ped.min.up} \cdot p_u \cdot \frac{l_{span.min}{}^2}{2}}{e_{v.2.ct}} = 100.9174 \cdot \frac{1}{m}\ kN$$

$$e_{fix} := 200\ mm$$

$$F_{t.Ed.fix} := e_{fix} \cdot F_{t.Ed.fix.1fm} = 20.1835\ kN$$

$$F_{v.Ed.fix} := f_{ped.min.up} \cdot p_u \cdot l_{span.min} \cdot e_{fix} = 1.3624\ kN$$

Controllo compressione cemento armato - qualitá cemento armato >= C25/30:

$h_c := l_{c.2} = 6\ mm$

$b_c := e_{fix} = 200\ mm$

$A_c := h_c \cdot b_c = 1200\ mm^2$

$f_{ck} := 25\ MPa$

$f_{cd} := 1 \cdot \frac{f_{ck}}{1.5} = 16.6667\ MPa$ con αcc=1.0 perchè sono carichi di durata corta (vento)

$F_{c.Rd} := f_{cd} \cdot A_c = 20\ kN$

$F_{c.Ed} := F_{t.Ed.fix} = 20.1835\ kN$

$\frac{F_{c.Ed}}{F_{c.Rd}} = 1.0092$

5.1.2 Risultati profilo in alluminio per carichi verso il basso- configurazione lineare

tglas.max	20	mm
gk.glas	0,5	kN/m²
γperm.sup	1,35	-
γvar	1,5	-

Lenght of glass roof				Reactions glass/profile - uniform load				DESCENDING Max. design. total load	Reactions - ultimate load		
Ltotal	l1	l2	l3=Lspan-glas	pu	FA.Ed.gp	FB.Ed.gp	Fv.Ed.tot	pEd.Tot	FA.Ed.gp	FB.Ed.gp	Fv.Ed.tot
[mm]	[mm]	[mm]	[mm]	[kN/m²]	[kN/m]	[kN/m]	[kN/m]	[kN/m²]	[kN/m]	[kN/m]	[kN/m]
800	80	59	661	1,00	4,393	-3,673	0,720	13,614	59,808	-50,007	9,802
850	80	59	711	1,00	5,025	-4,255	0,770	11,903	59,808	-50,643	9,165
900	80	59	761	1,00	5,698	-4,878	0,820	10,496	59,808	-51,202	8,607
950	80	59	811	1,00	6,414	-5,544	0,870	9,324	59,808	-51,697	8,112
1000	80	59	861	1,00	7,173	-6,253	0,920	8,338	59,808	-52,137	7,671
1050	80	59	911	1,00	7,974	-7,004	0,970	7,501	59,808	-52,533	7,276
1100	80	59	961	1,00	8,817	-7,797	1,020	6,783	59,808	-52,889	6,919
1150	80	59	1011	1,00	9,703	-8,633	1,070	6,164	59,808	-53,213	6,596
1200	80	59	1061	1,00	10,631	-9,511	1,120	5,626	59,808	-53,507	6,301
1250	80	59	1111	1,00	11,601	-10,431	1,170	5,156	59,808	-53,777	6,032
1300	80	59	1161	1,00	12,614	-11,394	1,220	4,742	59,808	-54,024	5,785
1350	80	59	1211	1,00	13,669	-12,399	1,270	4,376	59,808	-54,251	5,557
1400	80	59	1261	1,00	14,766	-13,446	1,320	4,050	59,808	-54,462	5,347
1450	80	59	1311	1,00	15,906	-14,536	1,370	3,760	59,808	-54,657	5,151
1500	80	59	1361	1,00	17,088	-15,668	1,420	3,500	59,808	-54,838	4,970

Lenght of glass roof				Reactions on fixations based on Ltotal					DESCENDING Max. char. variable load	DESCENDING Max. design. variable load
Ltotal	l1	l2	l3=Lspan-glas	e.t.c	Ft.Ed.fix.m	efix	Ft.Ed.fix	Fv.Ed.fix	qEk*	qEd*
[mm]	[mm]	[mm]	[mm]	[mm]	[KN/m]	[mm]	[kN]	[kN]	[kN/m²]	[kN/m²]
800	80	59	661	68	64,065	200	12,813	2,178	8,626	12,939
850	80	59	711	68	63,236	200	12,647	2,024	7,485	11,228
900	80	59	761	68	62,512	200	12,502	1,889	6,547	9,821
950	80	59	811	68	61,875	200	12,375	1,772	5,766	8,649
1000	80	59	861	68	61,310	200	12,262	1,668	5,109	7,663
1050	80	59	911	68	60,805	200	12,161	1,575	4,550	6,826
1100	80	59	961	68	60,352	200	12,070	1,492	4,072	6,108
1150	80	59	1011	68	59,942	200	11,988	1,418	3,659	5,489
1200	80	59	1061	68	59,571	200	11,914	1,350	3,301	4,951
1250	80	59	1111	68	59,232	200	11,846	1,289	2,987	4,481
1300	80	59	1161	68	58,921	200	11,784	1,233	2,711	4,067
1350	80	59	1211	68	58,636	200	11,727	1,181	2,467	3,701
1400	80	59	1261	68	58,373	200	11,675	1,134	2,250	3,375
1450	80	59	1311	68	58,130	200	11,626	1,090	2,057	3,085
1500	80	59	1361	68	57,904	200	11,581	1,050	1,883	2,825

* for 20 mm glass thickness,
for other glass thickness to calculate appropriately

5.1.3 Risultati profilo in alluminio per carichi verso **l'alto** - configurazione lineare

Material EN AW6063-T6, γm=1.15

tglas.min	20	mm	γm.clamp	1,25
gk.glas	0,5	kN/m²		
γperm.inf	1			
γvar	1,5			

Lenght of glass roof				Reactions glass/profile - uniform load				ASCENDING Max. design. total load	Reactions - ultimate load		
Ltotal	l1	l2	l3=Lspan-glas	pu	FA.Ed.gp	FB.Ed.gp	Fv.Ed.tot	pEd.p	FA.Ed.gp	FB.Ed.gp	Fv.Ed.tot
[mm]	[mm]	[mm]	[mm]	[kN/m²]	[kN/m]	[kN/m]	[kN/m]	[kN/m²]	[kN/m]	[kN/m]	[kN/m]
800	42,5	37,5	720	1,00	7,651	-6,893	0,758	8,515	65,145	-58,695	6,450
850	42,5	37,5	770	1,00	8,694	-7,887	0,807	7,493	65,145	-59,095	6,051
900	42,5	37,5	820	1,00	9,804	-8,947	0,858	6,645	65,145	-59,448	5,698
950	42,5	37,5	870	1,00	10,981	-10,073	0,908	5,933	65,145	-59,761	5,384
1000	42,5	37,5	920	1,00	12,224	-11,267	0,958	5,329	65,145	-60,043	5,103
1050	42,5	37,5	970	1,00	13,534	-12,527	1,008	4,813	65,145	-60,296	4,850
1100	42,5	37,5	1020	1,00	14,911	-13,853	1,058	4,369	65,145	-60,525	4,620
1150	42,5	37,5	1070	1,00	16,354	-15,247	1,108	3,983	65,145	-60,734	4,412
1200	42,5	37,5	1120	1,00	17,864	-16,707	1,158	3,647	65,145	-60,924	4,221
1250	42,5	37,5	1170	1,00	19,441	-18,233	1,208	3,351	65,145	-61,099	4,046
1300	42,5	37,5	1220	1,00	21,084	-19,827	1,258	3,090	65,145	-61,260	3,885
1350	42,5	37,5	1270	1,00	22,794	-21,487	1,308	2,858	65,145	-61,409	3,737
1400	42,5	37,5	1320	1,00	24,571	-23,213	1,358	2,651	65,145	-61,546	3,599
1450	42,5	37,5	1370	1,00	26,414	-25,007	1,408	2,466	65,145	-61,674	3,471
1500	42,5	37,5	1420	1,00	28,324	-26,867	1,458	2,300	65,145	-61,793	3,352

Lenght of glass roof				Reactions on fixations based on Ltotal					ASCENDING Max. char. variable load	ASCENDING Max. design variable load
Ltotal	l1	l2	l3=Lspan-glas	e.t.c	Ft.Ed.fix.m	efix	Ft.Ed.fix	Fv.Ed.fix	qEk*	qEd*
[mm]	[mm]	[mm]	[mm]	[mm]	[KN/m]	[mm]	[kN]	[kN]	[kN/m²]	[kN/m²]
800	42,5	37,5	720	27	100,917	200	20,183	1,362	6,010	9,015
850	42,5	37,5	770	27	100,255	200	20,051	1,274	5,329	7,993
900	42,5	37,5	820	27	99,671	200	19,934	1,196	4,763	7,145
950	42,5	37,5	870	27	99,153	200	19,831	1,127	4,288	6,433
1000	42,5	37,5	920	27	98,690	200	19,738	1,066	3,886	5,829
1050	42,5	37,5	970	27	98,274	200	19,655	1,011	3,542	5,313
1100	42,5	37,5	1020	27	97,898	200	19,580	0,961	3,246	4,869
1150	42,5	37,5	1070	27	97,557	200	19,511	0,916	2,989	4,483
1200	42,5	37,5	1120	27	97,246	200	19,449	0,875	2,764	4,147
1250	42,5	37,5	1170	27	96,961	200	19,392	0,838	2,567	3,851
1300	42,5	37,5	1220	27	96,699	200	19,340	0,803	2,393	3,590
1350	42,5	37,5	1270	27	96,457	200	19,291	0,772	2,239	3,358
1400	42,5	37,5	1320	27	96,234	200	19,247	0,742	2,101	3,151
1450	42,5	37,5	1370	27	96,026	200	19,205	0,715	1,978	2,966
1500	42,5	37,5	1420	27	95,833	200	19,167	0,690	1,867	2,800

* for 20 mm glass thickness,
for other glass thickness to calculate appropriately

Lenght of glass roof						Clamp resistances - distance= 200mm			Clamp resistances - distance= 100mm		
Ltotal	l1	l2	l3=Lspan-glas	Fck.5%.clamp	FcEd.clamp.sing	e.clamp	FcEd.lfm	pEd.clamp.E200	e.clamp	FcEd.lfm	pEd.clamp.E100
[mm]	[mm]	[mm]	[mm]	[kN[	[kN[	[mm]	[kN/m]	[kN/m²]	[mm]	[kN/m]	[kN/m²]
800	42,5	37,5	720	8,094	6,48	200	32,376	4,697	100	64,752	9,394
850	42,5	37,5	770	8,094	6,48	200	32,376	4,105	100	64,752	8,210
900	42,5	37,5	820	8,094	6,48	200	32,376	3,619	100	64,752	7,238
950	42,5	37,5	870	8,094	6,48	200	32,376	3,214	100	64,752	6,428
1000	42,5	37,5	920	8,094	6,48	200	32,376	2,874	100	64,752	5,747
1050	42,5	37,5	970	8,094	6,48	200	32,376	2,585	100	64,752	5,169
1100	42,5	37,5	1020	8,094	6,48	200	32,376	2,337	100	64,752	4,674
1150	42,5	37,5	1070	8,094	6,48	200	32,376	2,123	100	64,752	4,247
1200	42,5	37,5	1120	8,094	6,48	200	32,376	1,938	100	64,752	3,876
1250	42,5	37,5	1170	8,094	6,48	200	32,376	1,776	100	64,752	3,551
1300	42,5	37,5	1220	8,094	6,48	200	32,376	1,633	100	64,752	3,266
1350	42,5	37,5	1270	8,094	6,48	200	32,376	1,507	100	64,752	3,014
1400	42,5	37,5	1320	8,094	6,48	200	32,376	1,395	100	64,752	2,789
1450	42,5	37,5	1370	8,094	6,48	200	32,376	1,295	100	64,752	2,589
1500	42,5	37,5	1420	8,094	6,48	200	32,376	1,205	100	64,752	2,410

6 Dimensionamento del profilo in alluminio - configurazione zona angolo

6.1.1 Informazioni generali

Per installare e fissare la lastra in vetro dentro nel profilo sono previste sia delle guarnizioni sopra e sotto che delle pinze.
Per la zona **d'angolo** è permessa solo la configurazione con le pinze ogni 100 mm.
Per carichi di compressione verso il basso la lastra in vetro si appoggia sia sulla guarnizione inferiore che superiore, per carichi di depressione (vento) la lastra si incastra tra la guarnizione superiore e le pinze.

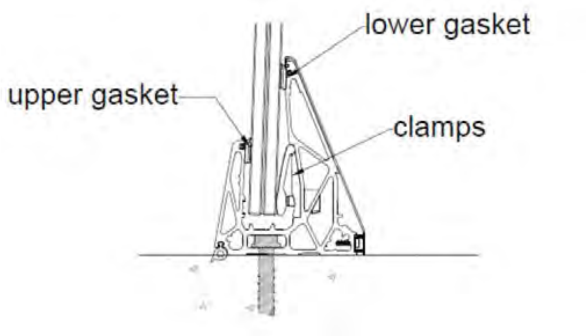
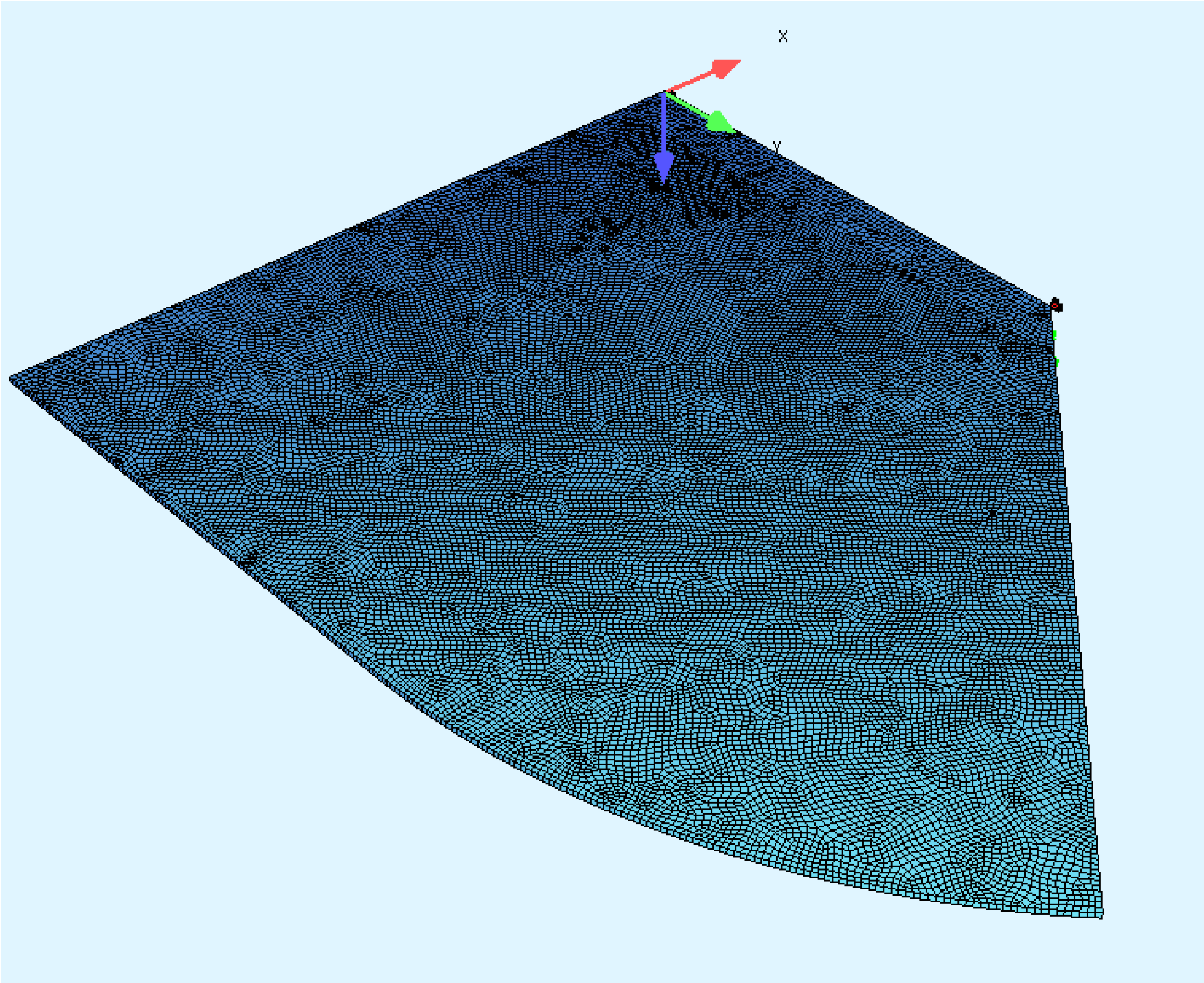
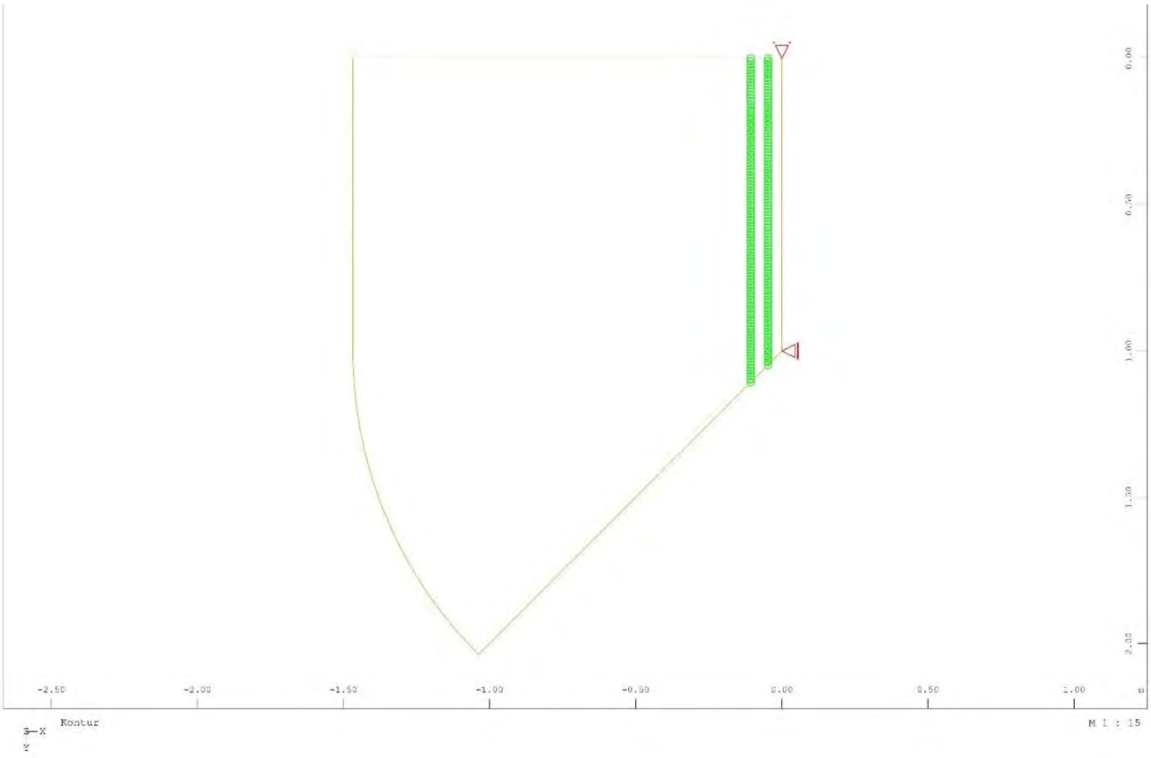


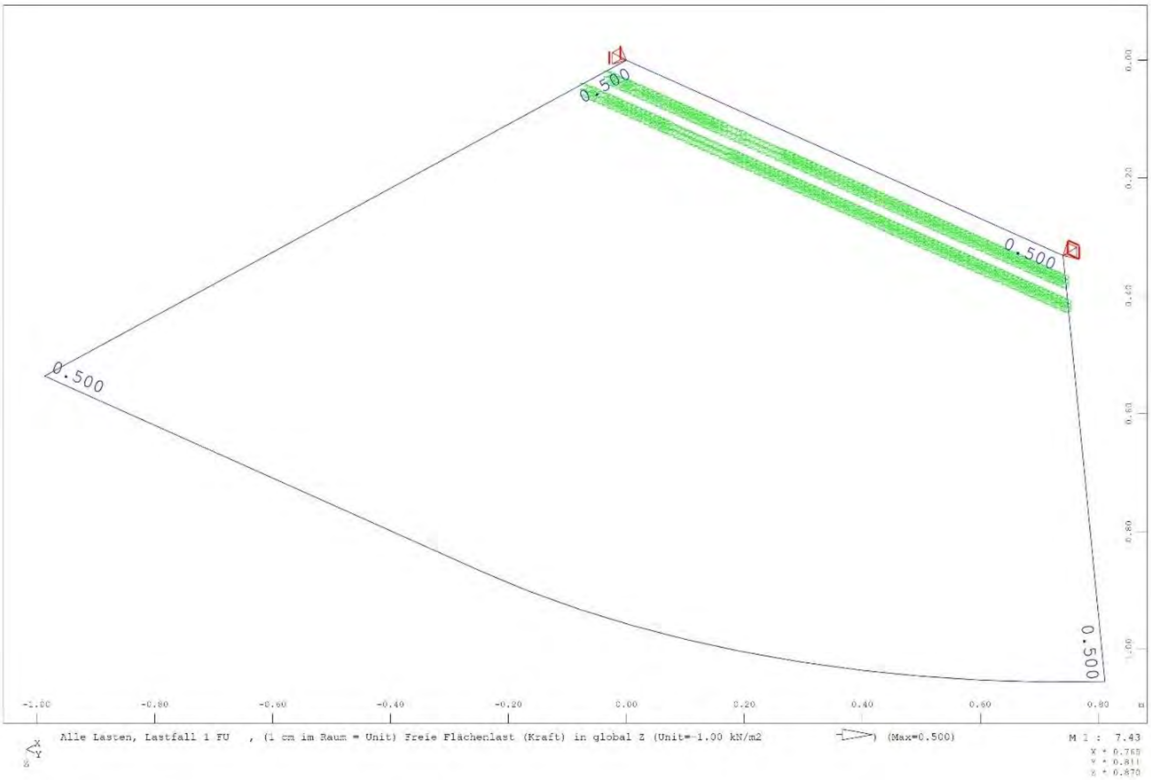
Fig: Fissaggio vetro nel profilo

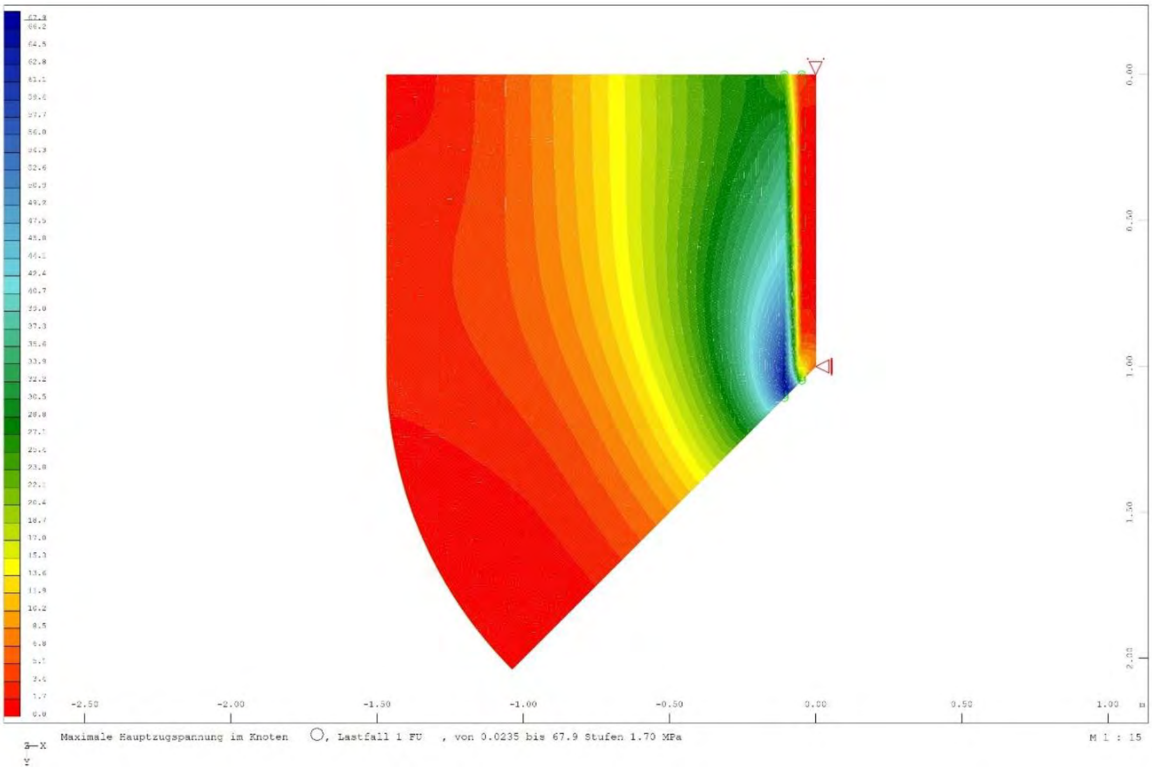
Il calcolo del profilo in alluminio è condotto tramite il programma di calcolo Sofistik in modo iterativo. In un primo step è stato calcolato il carico lineare agente sugli appoggi tra vetro e profilo per un carico unitario. Per la zona d'angolo questo step non è stato fatto analiticamente ma numericamente con Sofistik, modellando una lastra in vetro e applicando in questo caso metà del carico unitario su una lastra, cioè 0.5 kN/m²
Le forze d'appoggio in zona d'angolo ottenute con il calcolo numerico non sono costanti sulla larghezza d'appoggio ma variano, avendo nello spigolo una massima concentrazione delle forze. Allora questo carico nonlineare è stato applicato al modello numerico in Sofistik variandolo finché il limite basato alla resistenza ultima del materiale è stato trovato.
A base di queste massime forze di contatto profilo/vetro ammissibili allo SLU, il massimo carico distribuito pEd.tot allo SLU è stato ricavato.
Nelle pagine precedenti questo procedimento è documentato sia per le forze di depressione che di compressione:

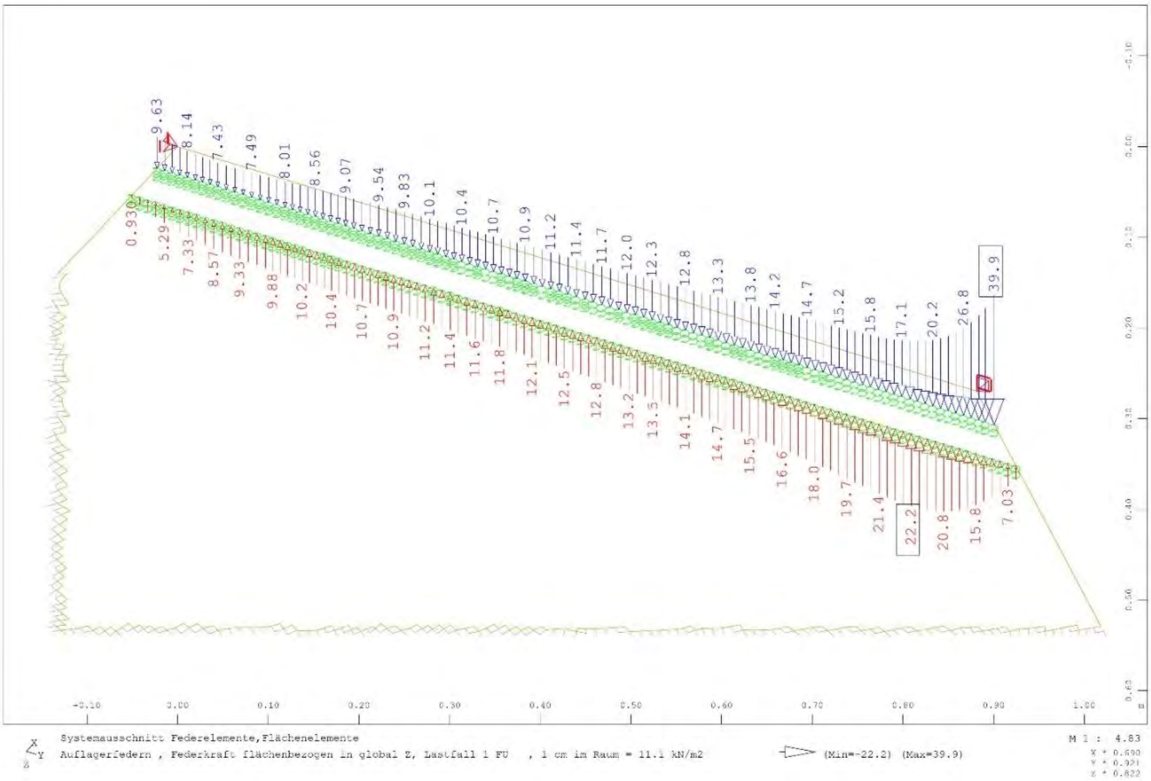
a) Per forze di compressione verso il basso

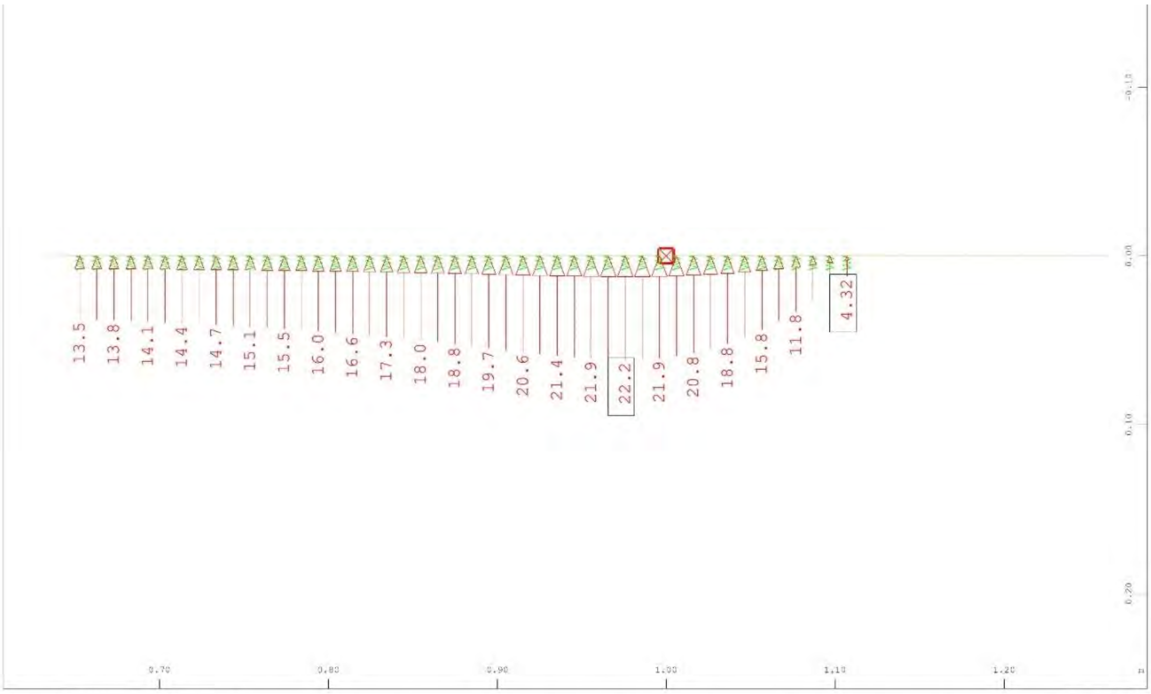



Kontur
M 1 : 15

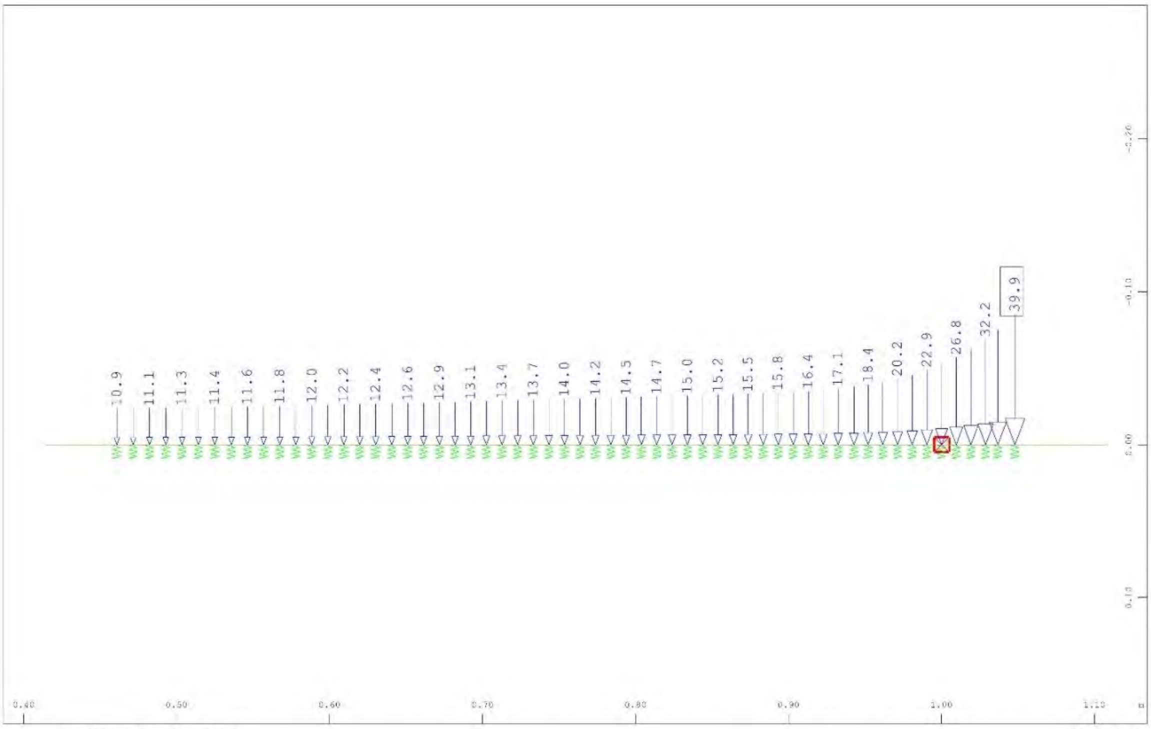

0.500
0.500
0.500
0.500
Alle Lasten, Lastfall 1 FU , (1 cm im Raum = Unit) Freie Flächenlast (Kraft) in global Z (Unit=-1.00 kN/m2
(Max=0.500)
M 1 : 7.43


Maximale Hauptzugspannung im Knoten, Lastfall 1 FU, von 0.0235 bis 67.9 Stufen 1.70 MPa
M 1 : 15


Systemausschnitt Federelemente,Flächenelemente
Auflagerfedern , Federkraft flächenbezogen in global Z, Lastfall 1 FU , 1 cm im Raum = 11.1 kN/m2
(Min=-22.2) (Max=39.9)
M 1 : 4.83

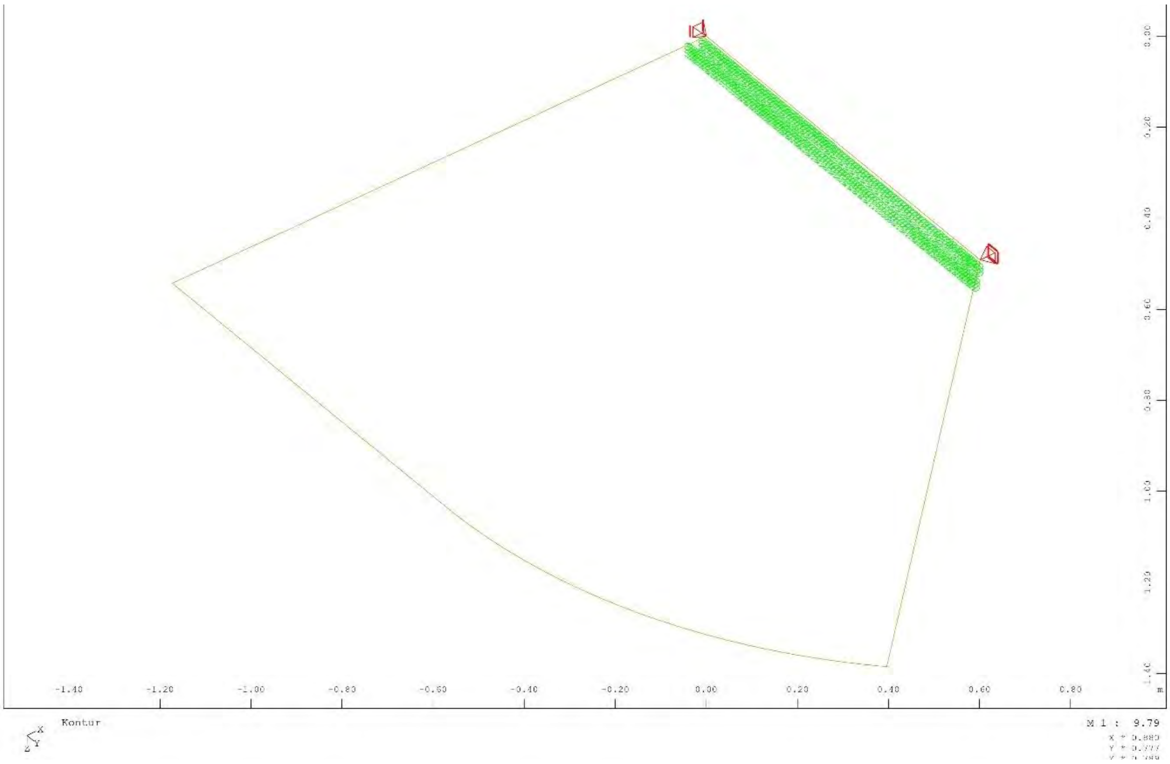


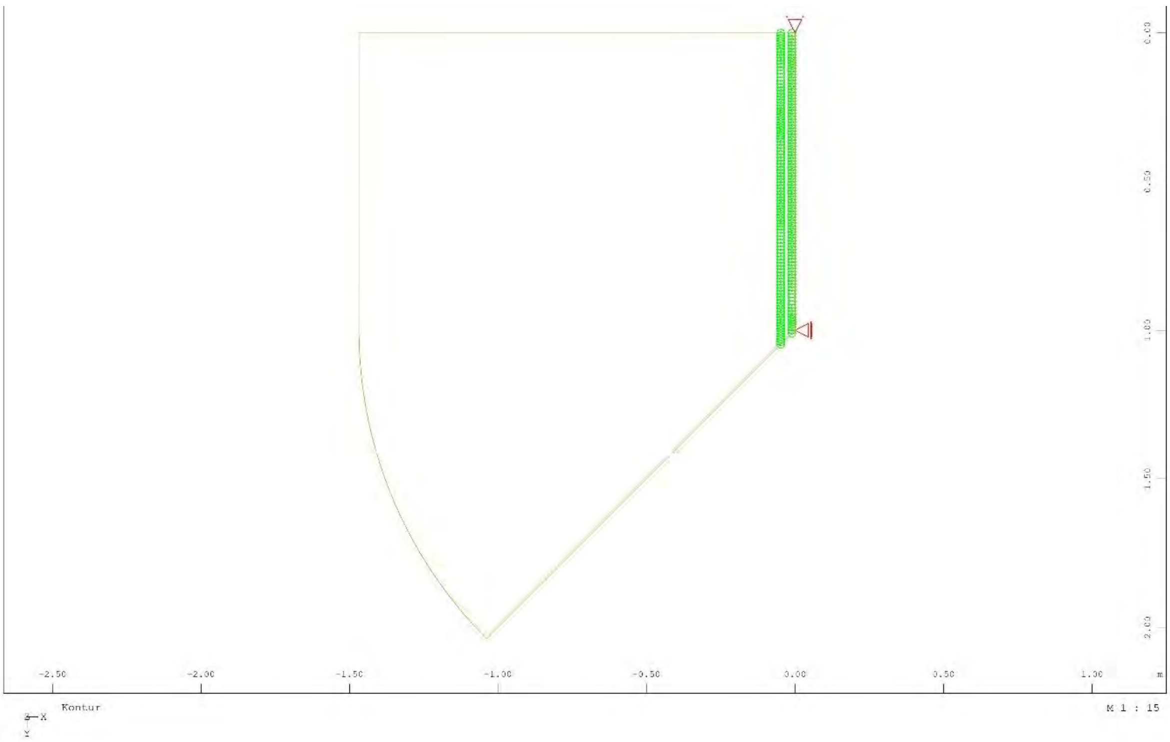
Systemausschnitt Gruppe 1 10
Auflagerfedern , Federkraft flächenbezogen in global Z, Lastfall 1 FU , 1 cm im Raum = 9.38 kN/m2 (Min=-22.2) (Max=-4.32) M 1 : 2.60

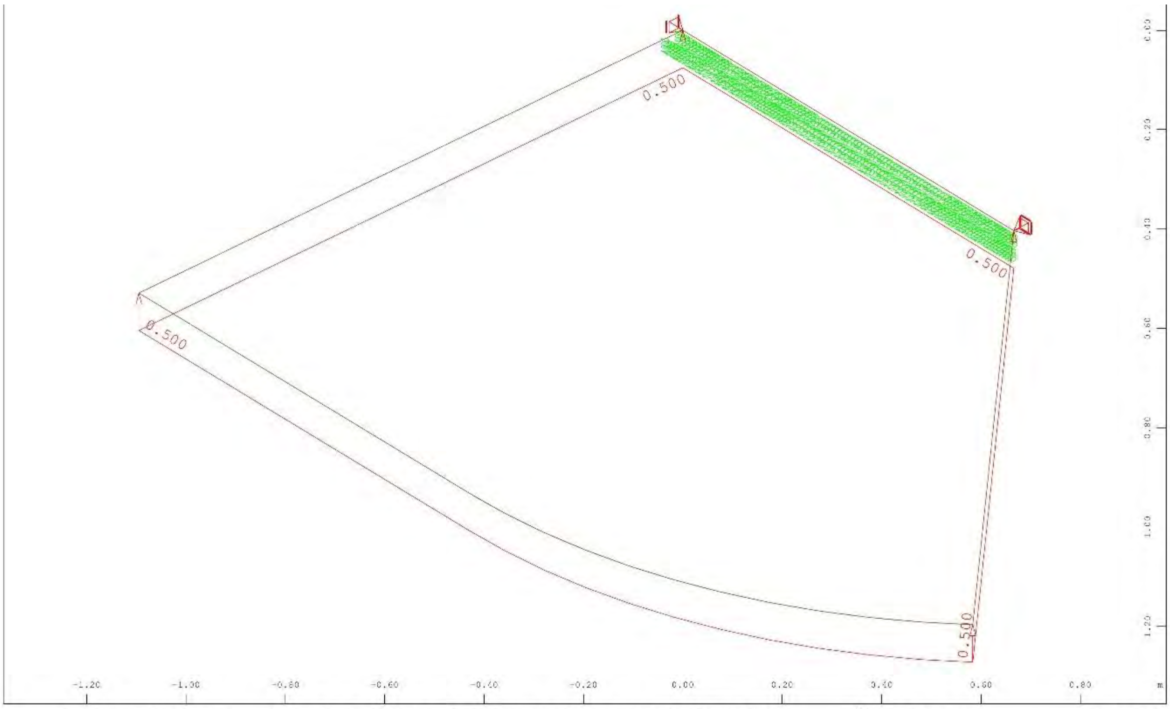


Systemausschnitt Gruppe 1 11
Auflagerfedern , Federkraft flächenbezogen in global Z, Lastfall 1 FU , 1 cm im Raum = 13.4 kN/m2 (Max=39.9) M 1 : 2.86

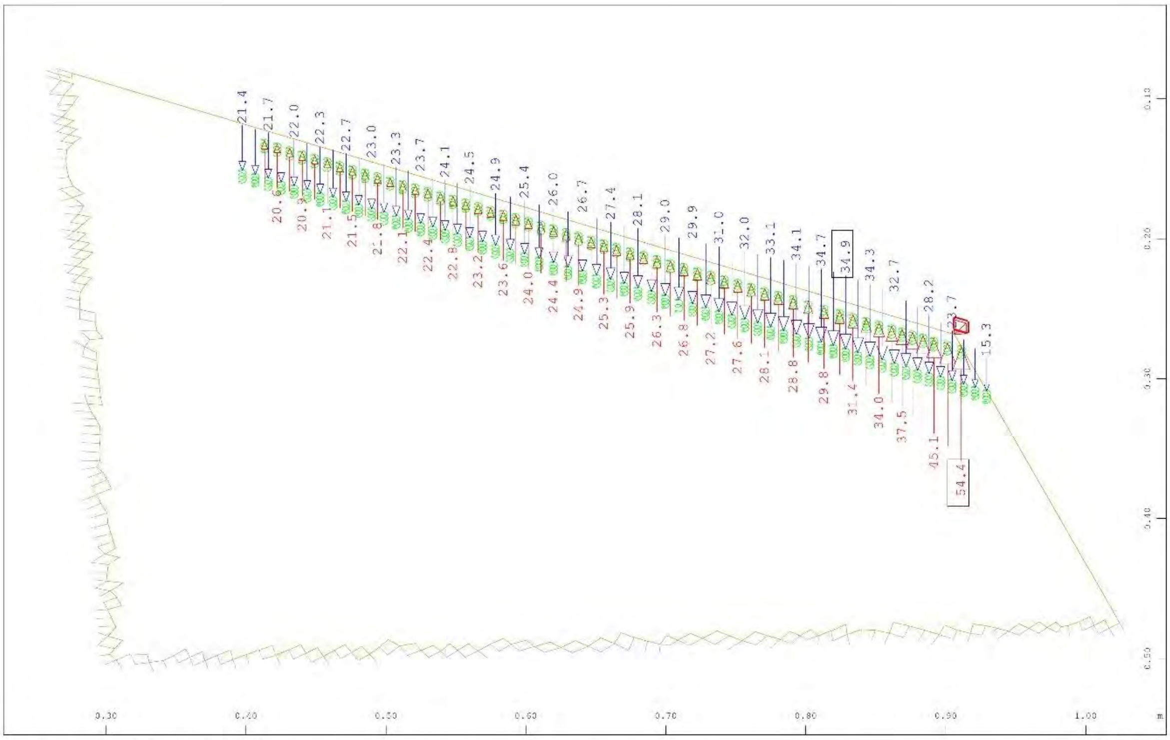
b) Per forze di depressione



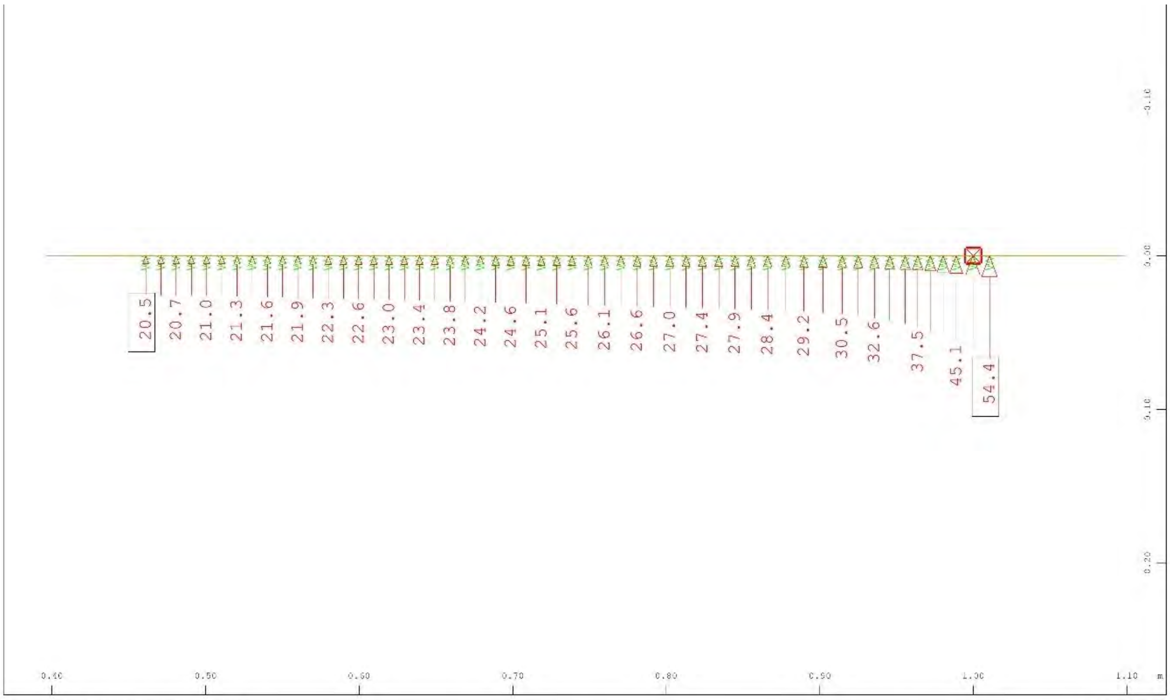




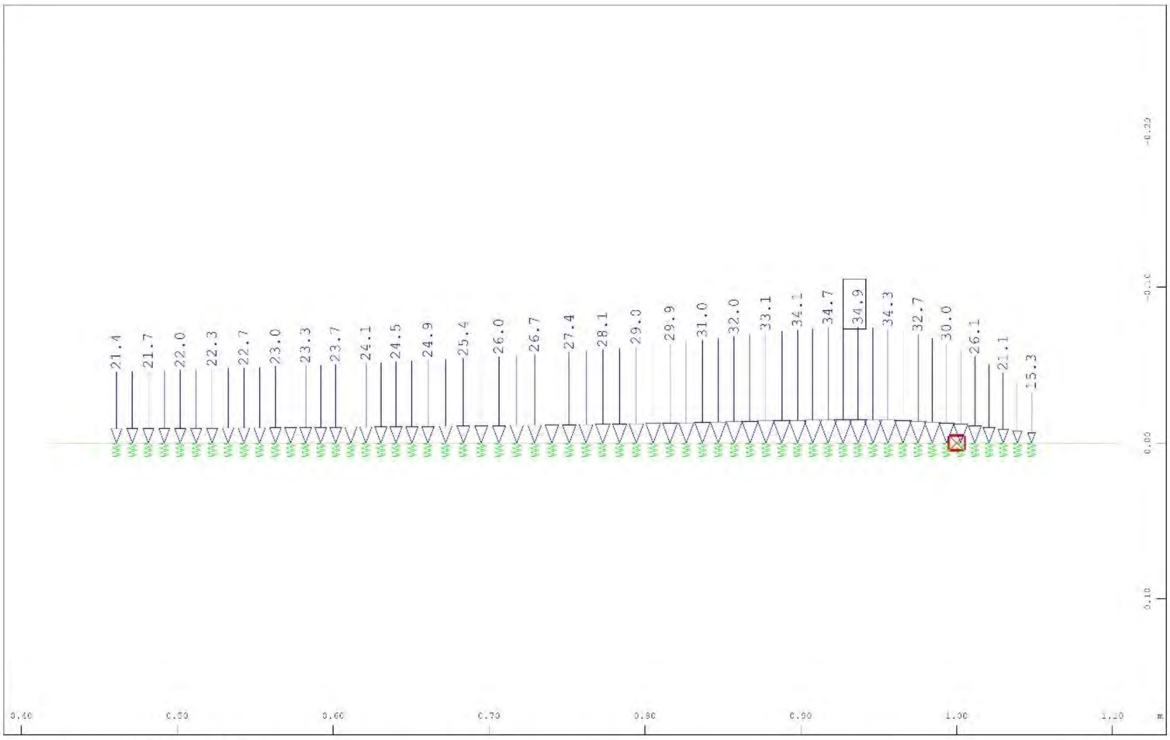
Alle Lasten, Lastfall 1 FU , (1 cm im Raum = Unit) Freie Flächenlast (Kraft) in global Z (Unit=0.500 kN/m2 (Min=-0.500) (Max=-0.500) M 1 : 8.97



Systemausschnitt Gruppe 1 10 11
Auflagerfedern , Federkraft flächenbezogen in global Z, Lastfall 1 FU , 1 cm im Raum = 16.4 kN/m2 (Min=-54.4) (Max=34.9) M 1 : 3.18



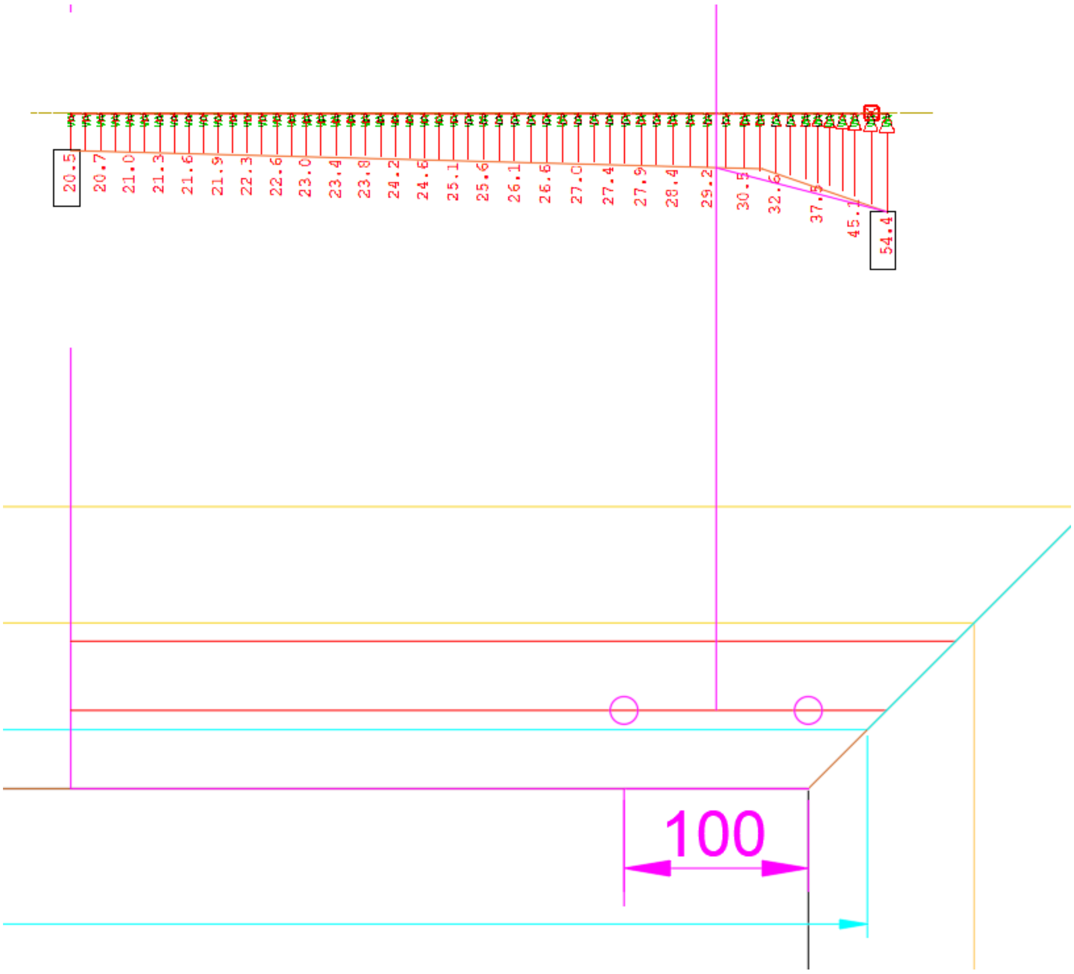
Systemausschnitt Gruppe 1 10 M 1 : 2.90
Auflagerfedern , Federkraft flächenbezogen in globa_ Z, Lastfall 1 FU , 1 cm im Raum = 23.4 kN/m2 (Min=-54.4) (Max=-20.5)



Systemausschnitt Gruppe 1 11 M 1 : 2.86
Auflagerfedern , Federkraft flächenbezogen in globa_ Z, Lastfall 1 FU , 1 cm im Raum = 13.4 kN/m2 (Max=34.9)

Calcolo delle forze sulle pinze per la zona d´angolo:

Per la prima pinza il valore medio tra il picco sul bordo esterno e il valore tra la prima pinza e la seconda è considerata - vedi figura:



Valore medio per carico unitario di 0.5 kN/m²:

p.u.pinza.mean=(54.4 + 29.2)/2=41.8 kN/m

6.1.2 Risultati profilo in alluminio per carichi verso il basso- configurazione zona **d'angolo**

Lenght of glass roof				Reactions glass/profile - uniform load			DOWNWARD Max. design. total load	Reactions- ultimate load		DOWNWARD Max. char. variable load	DOWNWARD Max. design. variable oad
Ltotal	l1	l2	l3=Lspan-glas	pu	FA.Ed.gp	FB.Ed.gp	pEd.Tot	FA.Ed.gp*	FB.Ed.gp	qEk*	qEd*
[mm]	[mm]	[mm]	[mm]	[kN/m²]	[kN/m]	[kN/m]	[kN/m²]	[kN/m]	[kN/m]	[kN/m²]	[kN/m²]
800	80	59	661	0,50	3,990	6,819	6,677	53,280	-91,064	4,001	6,002
850	80	59	711	0,50	4,718	8,126	5,646	53,280	-91,767	3,314	4,971
900	80	59	761	0,50	5,520	9,572	4,826	53,280	-92,385	2,767	4,151
950	80	59	811	0,50	6,400	11,161	4,163	53,280	-92,919	2,325	3,488
1000	80	59	861	0,50	7,360	12,898	3,620	53,280	-93,376	1,963	2,945
1050	80	59	911	0,50	8,405	14,790	3,170	53,280	-93,761	1,663	2,495
1100	80	59	961	0,50	9,537	16,841	2,793	53,280	-94,081	1,412	2,118
1150	80	59	1011	0,50	10,762	19,056	2,475	53,280	-94,344	1,200	1,800
1200	80	59	1061	0,50	12,082	21,441	2,205	53,280	-94,555	1,020	1,530
1250	80	59	1111	0,50	13,500	24,000	1,973	53,280	-94,721	0,866	1,298
1300	80	59	1161	0,50	15,021	26,740	1,774	53,280	-94,847	0,732	1,099
1350	80	59	1211	0,50	16,648	29,664	1,600	53,280	-94,938	0,617	0,925
1400	80	59	1261	0,50	18,384	32,779	1,449	53,280	-94,998	0,516	0,774
1450	80	59	1311	0,50	20,234	36,089	1,317	53,280	-95,030	0,428	0,642
1500	80	59	1361	0,50	22,200	39,600	1,200	53,280	-95,040	0,350	0,525

* for 20 mm glass thickness

6.1.3 Risultati profilo in alluminio per carichi verso **l'alto** - configurazione **d'angolo**

Material EN AW6063-T6, γm=1.15

tglas.min	20	mm	γm.clamp	1,25
gk.glas	0,5	kN/m²		
γperm.inf	1			
γvar	1,5			

Lenght of glass roof				Reactions glass/profile - uniform load				UPWARD Max. design. total load	Reactions - ultimate load		UPWARD Max. char. variable Load	UPWARD Max. design variable Load
Ltotal	l1	l2	l3=Lspan-glas	pu	FA.Ed.gp	FB.Ed.gp	FB.Ed.mean.clamp	pEd.p	FA.Ed.gp*	FB.Ed.gp	qEk	qEd
[mm]	[mm]	[mm]	[mm]	[kN/m²]	[kN/m]	[kN/m]	[kN/m]	[kN/m²]	[kN/m]	[kN/m]	[kN/m²]	[kN/m²]
800	42,5	37,5	720	0,50	6,950	10,300	7,914	4,017	55,840	82,756	3,012	4,517
850	42,5	37,5	770	0,50	8,101	12,046	9,256	3,446	55,840	83,028	2,631	3,946
900	42,5	37,5	820	0,50	9,369	13,996	10,754	2,980	55,840	83,421	2,320	3,480
950	42,5	37,5	870	0,50	10,755	16,153	12,412	2,596	55,840	83,866	2,064	3,096
1000	42,5	37,5	920	0,50	12,264	18,520	14,230	2,277	55,840	84,323	1,851	2,777
1050	42,5	37,5	970	0,50	13,900	21,100	16,213	2,009	55,840	84,764	1,672	2,509
1100	42,5	37,5	1020	0,50	15,666	23,896	18,361	1,782	55,840	85,177	1,521	2,282
1150	42,5	37,5	1070	0,50	17,565	26,911	20,678	1,590	55,840	85,551	1,393	2,090
1200	42,5	37,5	1120	0,50	19,601	30,148	23,165	1,424	55,840	85,885	1,283	1,924
1250	42,5	37,5	1170	0,50	21,779	33,610	25,825	1,282	55,840	86,176	1,188	1,782
1300	42,5	37,5	1220	0,50	24,100	37,300	28,661	1,159	55,840	86,425	1,106	1,659
1350	42,5	37,5	1270	0,50	26,569	41,221	31,673	1,051	55,840	86,633	1,034	1,551
1400	42,5	37,5	1320	0,50	29,190	45,376	34,866	0,956	55,840	86,804	0,971	1,456
1450	42,5	37,5	1370	0,50	31,966	49,768	38,241	0,873	55,840	86,938	0,916	1,373
1500	42,5	37,5	1420	0,50	34,900	54,400	41,800	0,800	55,840	87,040	0,867	1,300

Lenght of glass roof				Clamp resistances - distance=100mm				
Ltotal	l1	l2	l3=Lspan-glas	Fck.5%	FcEd	e.clamp	FcEd.lfm	pEd.clamp
[mm]	[mm]	[mm]	[mm]	[kN[	[kN[	[mm]	[kN/m]	[kN/m²]
800	42,5	37,5	720	8,094	6,48	100	64,752	4,091
850	42,5	37,5	770	8,094	6,48	100	64,752	3,498
900	42,5	37,5	820	8,094	6,48	100	64,752	3,011
950	42,5	37,5	870	8,094	6,48	100	64,752	2,609
1000	42,5	37,5	920	8,094	6,48	100	64,752	2,275
1050	42,5	37,5	970	8,094	6,48	100	64,752	1,997
1100	42,5	37,5	1020	8,094	6,48	100	64,752	1,763
1150	42,5	37,5	1070	8,094	6,48	100	64,752	1,566
1200	42,5	37,5	1120	8,094	6,48	100	64,752	1,398
1250	42,5	37,5	1170	8,094	6,48	100	64,752	1,254
1300	42,5	37,5	1220	8,094	6,48	100	64,752	1,130
1350	42,5	37,5	1270	8,094	6,48	100	64,752	1,022
1400	42,5	37,5	1320	8,094	6,48	100	64,752	0,929
1450	42,5	37,5	1370	8,094	6,48	100	64,752	0,847
1500	42,5	37,5	1420	8,094	6,48	100	64,752	0,775

7 Resistenza pinze

La resistenza di progetto allo stato limite ultimo delle pinze viene calcolata a base del Test report N. 2021/0988 del 09.04.2021 eseguito dal laboratorio prove materiali del Politecnico di Milano. Per tutto il report si riferisce agli allegati.

Client code LOGLI01 – Test report n° 2021/0988 – Pag. 1 di 12

POLITECNICO
MILANO 1863
LABORATORIO PROVE MATERIALI

Spett.le
LOGLI MASSIMO S.P.A.
VIA CHEMNITZ 49/51
59100 PRATO (PO) - ITA

Test report N. 2021/0988 issued in Milan 09/04/2021

Client: LOGLI MASSIMO S.P.A.- PRATO (PO) – ITALIA

Specimen entry: 22/03/2021

TEST REPORT

Tests on cantilevered canopy La Pensilina "LUMIA" for equivalent snow and wind uplift loads

In the following pages are reported:
- Specimen description and test procedure;
- Test results.

The results are related only to the tested specimens.
The test report consists of 12 pages.
The test report can be only completely reproduced in full and shall be subjected to stamp duty for use according to Italian law D.P.R. 642/72.

THE SERVICE HEAD
Roberto Minerva

Digitally signed in accordance with current legislation.

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Official Laboratory (art. 20 Law n. 1086 del 5 November 1971) – NB 1777 Reg. (UE) 305/2011

Sono stati testati due configurazioni di pinze: la configurazione 1 con 5 pinze al metro lineare e configurazione 2 con 10 pinze al metro lineare.

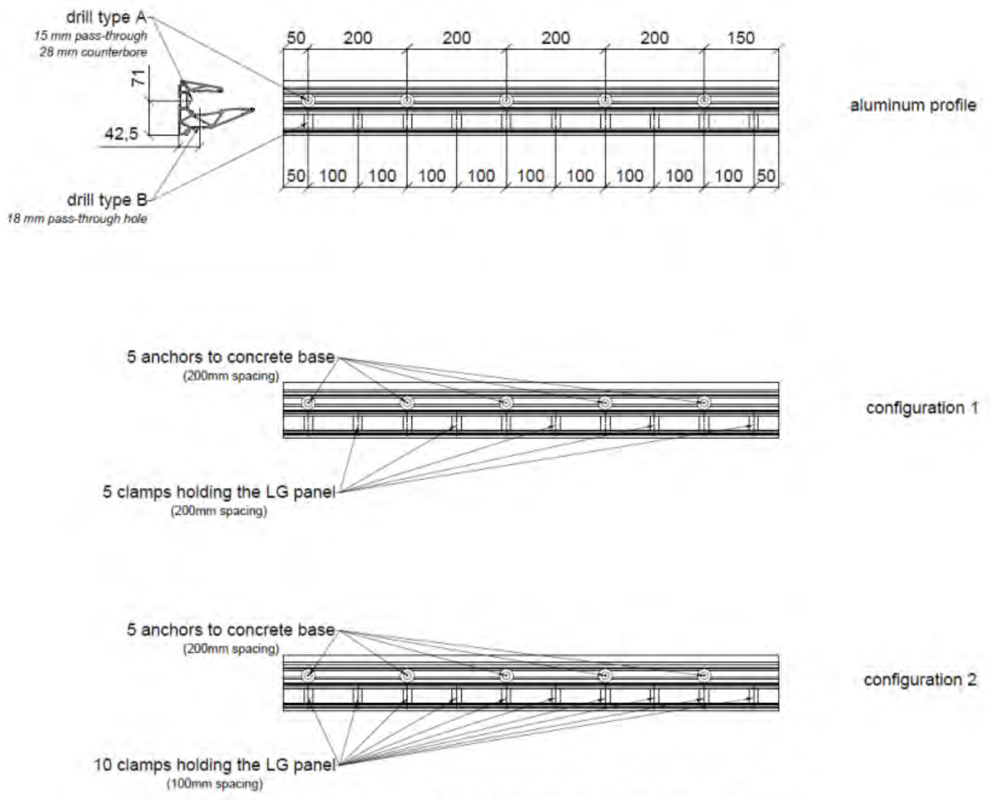
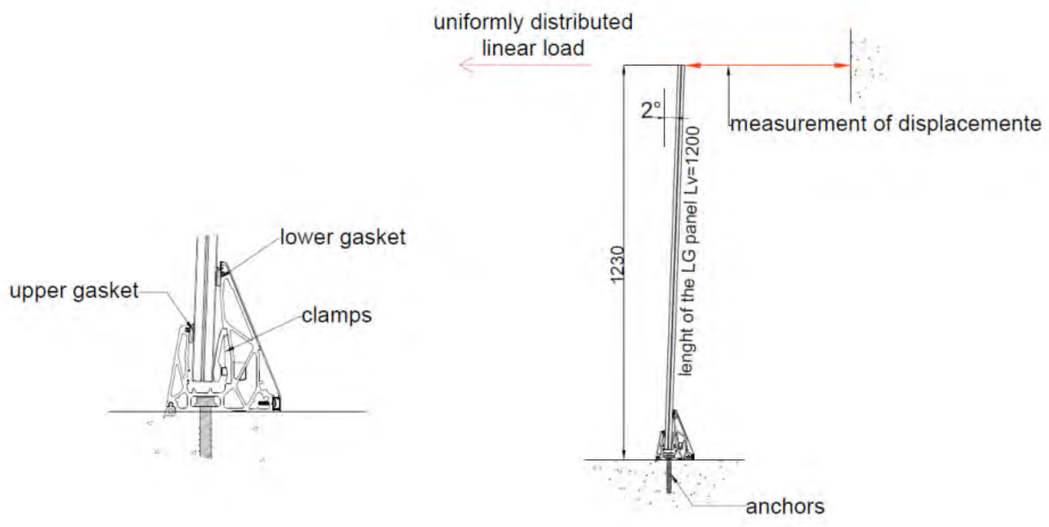


Figure 2.2 – aluminium rail and testing configuration details

I test sono stati eseguiti montando la pensilina in direzione verticale e tirando con un carico lineare orrizontale [kN/m] sulla punta della trave a sbalzo.



CALCOLO RESISTENZE PINZE BASATO AI TEST

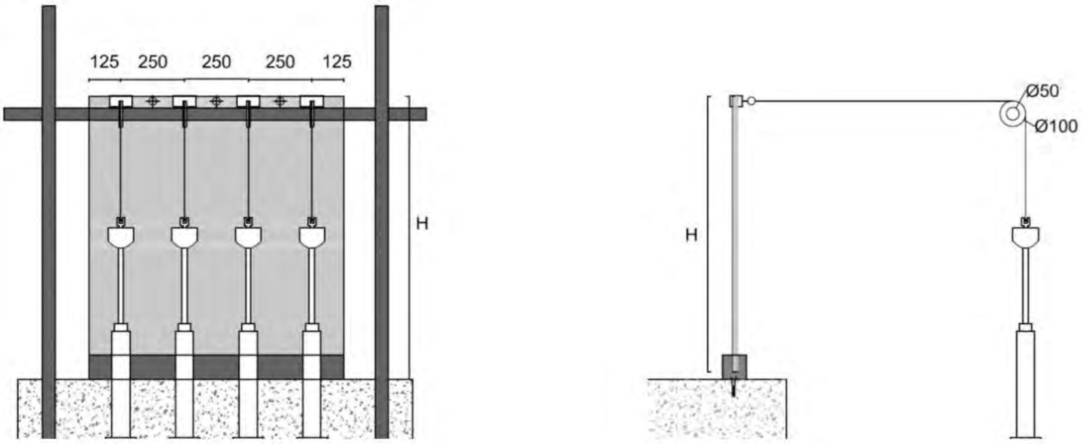


Table 4.1 – Maximum load and average displacement at failure

test reference	configuration	number of clamps	maximum load [kN/m]	displacement measured at max load [mm]
PENL-WIND-EQ-1	1	5 (5/m)	2.03	80.06
PENL-WIND-EQ-2			2.15	86.25
PENL-WIND-EQ-3			1.65	60.73
PENL-WIND-EQ-4	2	10 (10/m)	4.26	153.35
PENL-WIND-EQ-5			4.41	148.28
PENL-WIND-EQ-6			4.03	132.93

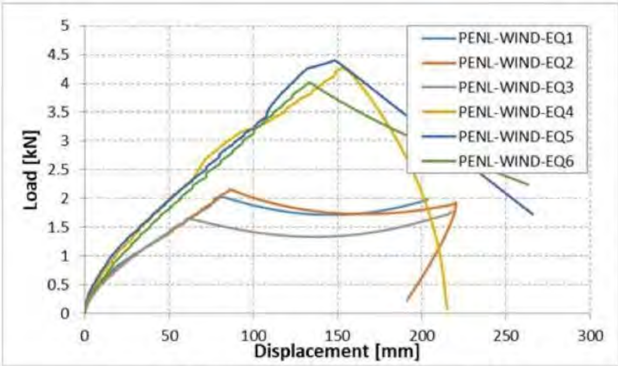
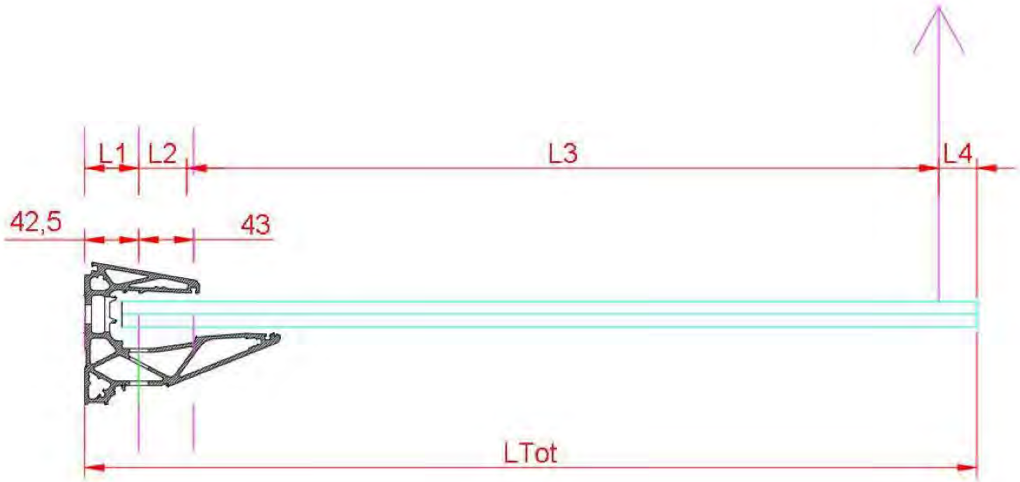


Figure 4.1 –WIND tests - Load- Displacement curves

Facendo un´evaluazione statistica dei 6 valori del valore di rottura della pinza, mettendo insieme i risultati dei test con 5 e 10 spinze, si ottiene il valore charatteristico 5 % frattile:

$$F_{max.load.5\%.frattile} := 1.59\ \frac{kN}{m}$$

Per il sistema statico di una trave a sbalzo con forza singola:



$l_{tot.test} := 1230\ mm$

$l_1 := 42.5\ mm$

$l_2 := 43\ mm$

$l_4 := 50\ mm$ per considerare il fatto che non viene direttamente tirato sul bordo superiore - vedi test setup e per considerare delle tolerante di installazione

$l_3 := l_{tot.test} - l_1 - l_2 - l_4 = 1094.5\ mm$

$e_{clamp} := 200\ mm$

$$F_{B.clamp.char.1fm} := F_{max.load.5\%.frattile} \cdot \frac{-l_3}{l_2} = -40.471 \cdot \frac{1}{m}\ kN$$

$$F_{B.clamp.char} := F_{max.load.5\%.frattile} \cdot \frac{-l_3}{l_2} \cdot e_{clamp} = -8.0942\ kN$$

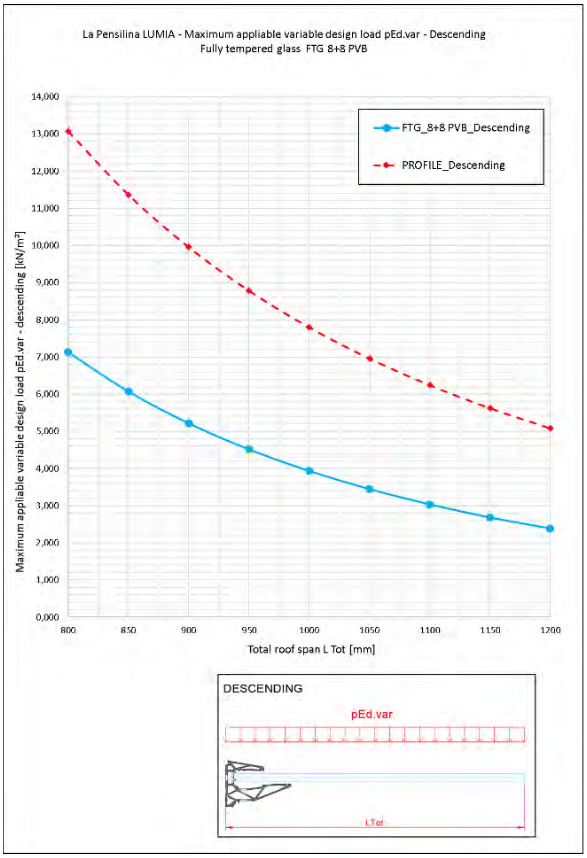
Il valore Fb.clam.char è la base per il calcolo del carico massimo ammissibile di depressione vento basato alla resistenza delle pinze - vedi capitolo 5.

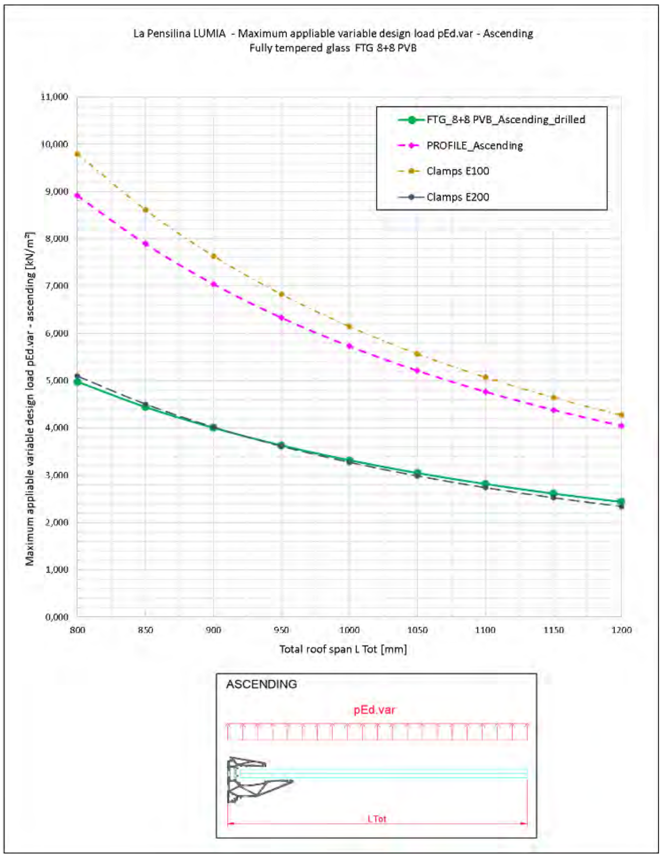
8 Riepilogo risultati vetro e profilo

8.1 Comparazione resistenze vetro, profilo e pinze - vetri temprati

8.1.1 FTG 8+8 PVB

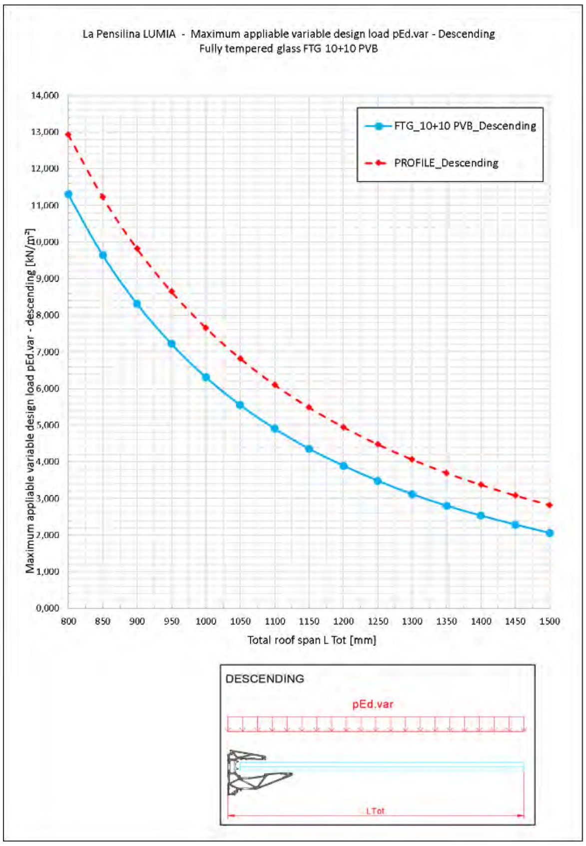
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 8+8 PVB	800	0,540	7,670	7,130	13,614	13,074	0,400	4,577	4,977	8,515	8,915	9,394	9,794	4,697	5,097
	850	0,540	6,612	6,072	11,903	11,363	0,400	4,042	4,442	7,493	7,893	8,210	8,610	4,105	4,505
	900	0,540	5,755	5,215	10,496	9,956	0,400	3,604	4,004	6,645	7,045	7,238	7,638	3,619	4,019
	950	0,540	5,054	4,514	9,324	8,784	0,400	3,231	3,631	5,933	6,333	6,428	6,828	3,214	3,614
	1000	0,540	4,474	3,934	8,338	7,798	0,400	2,919	3,319	5,329	5,729	5,747	6,147	2,874	3,274
	1050	0,540	3,986	3,446	7,501	6,961	0,400	2,647	3,047	4,813	5,213	5,169	5,569	2,585	2,985
	1100	0,540	3,573	3,033	6,783	6,243	0,400	2,416	2,816	4,369	4,769	4,674	5,074	2,337	2,737
	1150	0,540	3,221	2,681	6,164	5,624	0,400	2,213	2,613	3,983	4,383	4,247	4,647	2,123	2,523
	1200	0,540	2,925	2,385	5,626	5,086	0,400	2,037	2,437	3,647	4,047	3,876	4,276	1,938	2,338

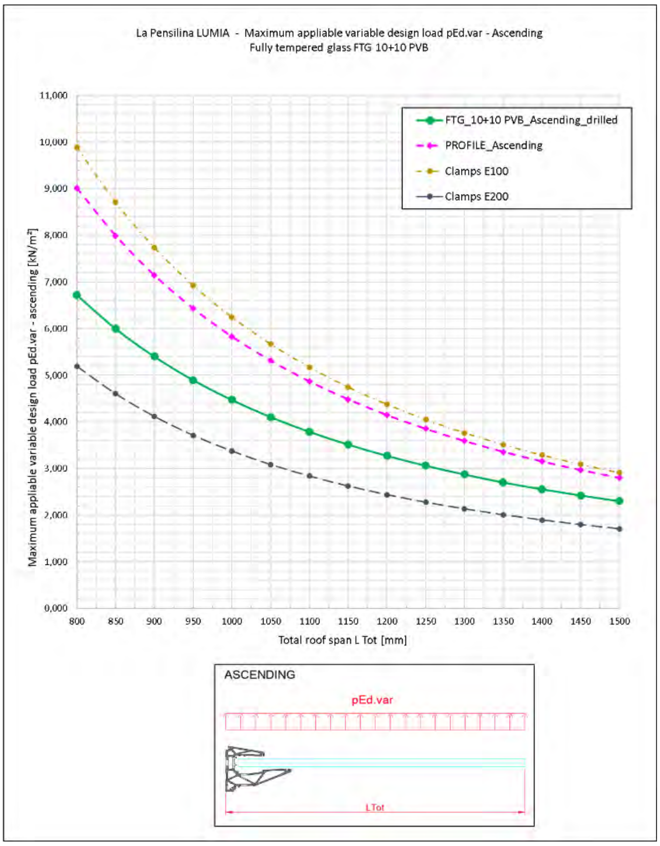




8.1.2 FTG 10+10 PVB

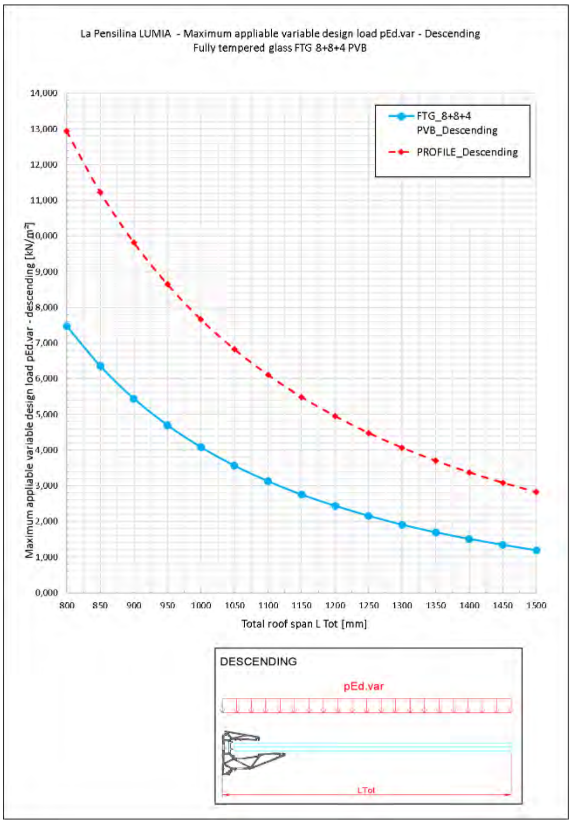
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 10+10 PVB	800	0,675	11,976	11,301	13,614	12,939	0,500	6,221	6,721	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	10,323	9,648	11,903	11,228	0,500	5,498	5,998	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	8,989	8,314	10,496	9,821	0,500	4,902	5,402	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	7,897	7,222	9,324	8,649	0,500	4,398	4,898	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	6,987	6,312	8,338	7,663	0,500	3,972	4,472	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	6,226	5,551	7,501	6,826	0,500	3,605	4,105	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	5,583	4,908	6,783	6,108	0,500	3,289	3,789	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	5,031	4,356	6,164	5,489	0,500	3,015	3,515	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	4,569	3,894	5,626	4,951	0,500	2,775	3,275	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	4,158	3,483	5,156	4,481	0,500	2,562	3,062	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	3,790	3,115	4,742	4,067	0,500	2,375	2,875	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	3,475	2,800	4,376	3,701	0,500	2,203	2,703	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	3,205	2,530	4,050	3,375	0,500	2,058	2,558	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	2,960	2,285	3,760	3,085	0,500	1,924	2,424	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	2,731	2,056	3,500	2,825	0,500	1,803	2,303	2,300	2,800	2,410	2,910	1,205	1,705

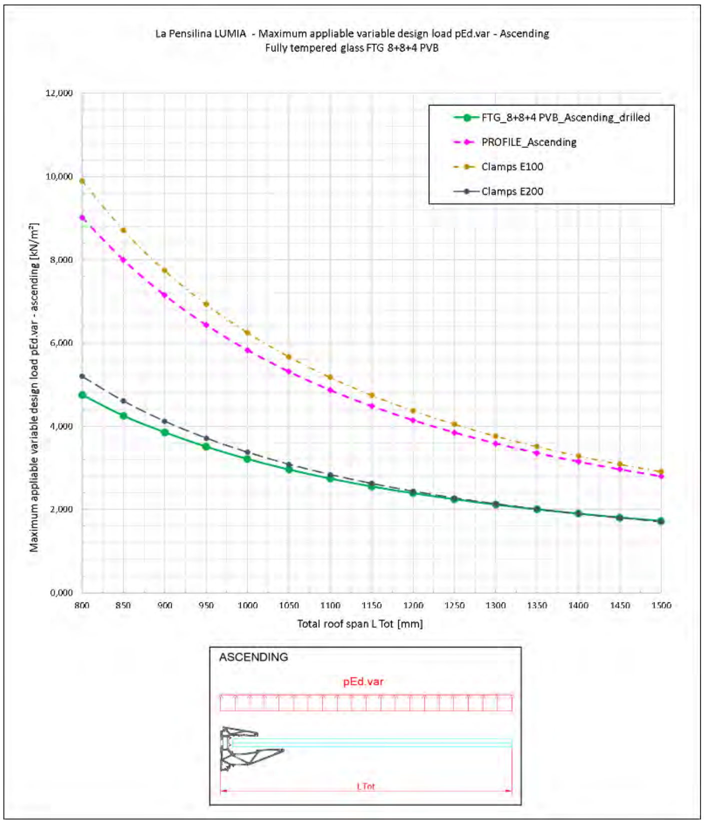




8.1.3 FTG 8+8+4 PVB

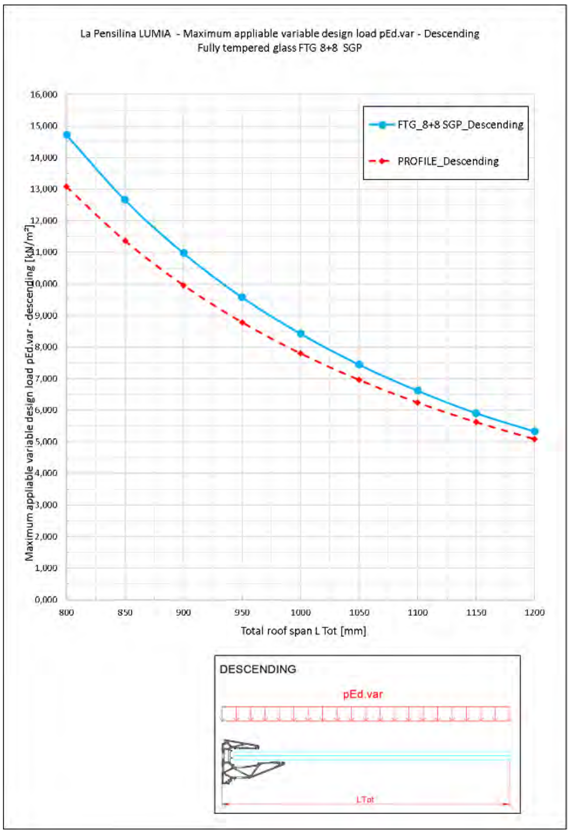
		DESCENDING					ASCENDING								
		Descending glass			Descending profile			Ascending - drilled glass		Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ per\ m.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ per\ m.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 8+8+4 PVB	800	0,675	8,147	7,472	13,614	12,939	0,500	4,258	4,758	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	7,030	6,355	11,903	11,228	0,500	3,752	4,252	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	6,116	5,441	10,496	9,821	0,500	3,356	3,856	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	5,373	4,698	9,324	8,649	0,500	3,009	3,509	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	4,753	4,078	8,338	7,663	0,500	2,713	3,213	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	4,235	3,560	7,501	6,826	0,500	2,461	2,961	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	3,797	3,122	6,783	6,108	0,500	2,243	2,743	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	3,423	2,748	6,164	5,489	0,500	2,053	2,553	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	3,108	2,433	5,626	4,951	0,500	1,892	2,392	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	2,828	2,153	5,156	4,481	0,500	1,746	2,246	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	2,577	1,902	4,742	4,067	0,500	1,617	2,117	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	2,364	1,689	4,376	3,701	0,500	1,502	2,002	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	2,180	1,505	4,050	3,375	0,500	1,399	1,899	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	2,014	1,339	3,760	3,085	0,500	1,307	1,807	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	1,860	1,185	3,500	2,825	0,500	1,226	1,726	2,300	2,800	2,410	2,910	1,205	1,705

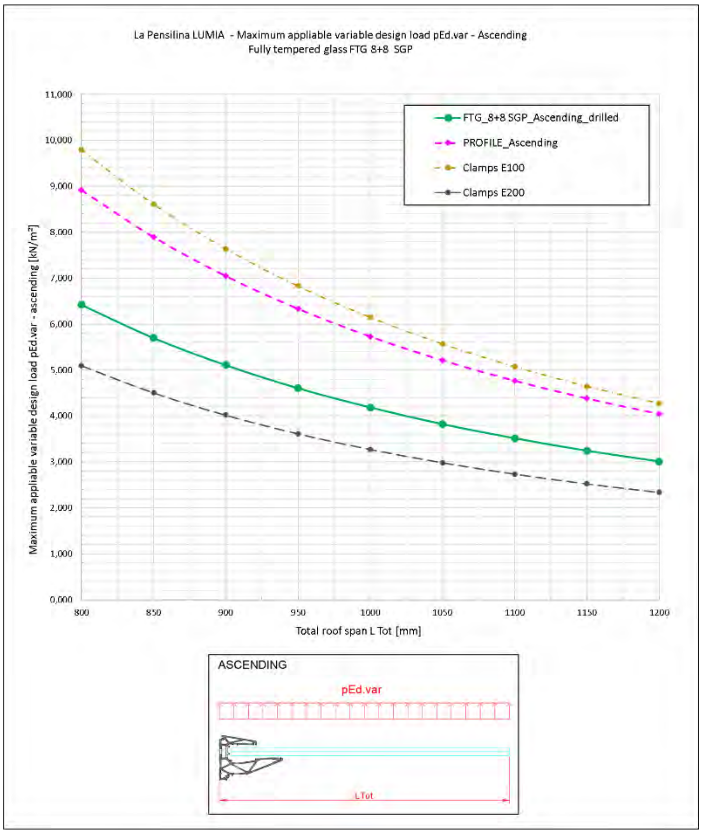




8.1.4 FTG 8+8 SGP

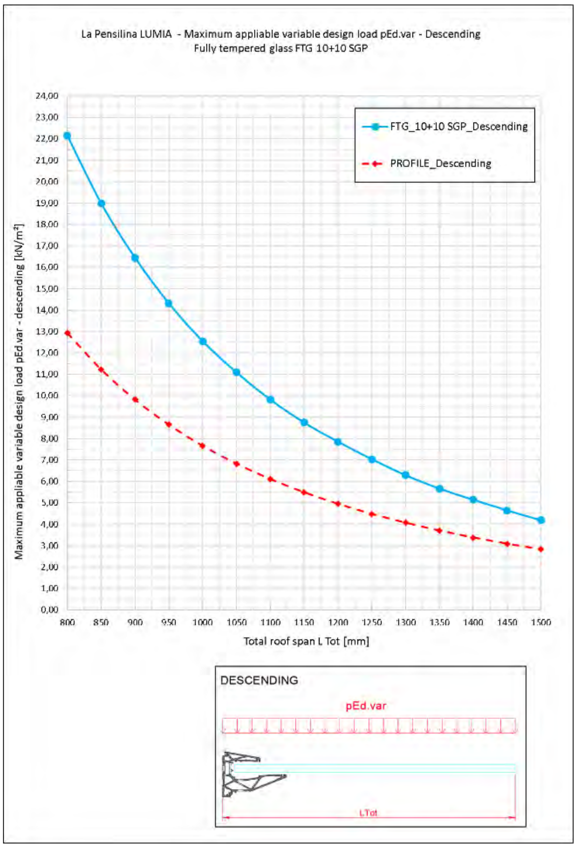
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 8+8 SGP	800	0,540	15,259	14,719	13,614	13,074	0,400	6,024	6,424	8,515	8,915	9,394	9,794	4,697	5,097
	850	0,540	13,197	12,657	11,903	11,363	0,400	5,302	5,702	7,493	7,893	8,210	8,610	4,105	4,505
	900	0,540	11,517	10,977	10,496	9,956	0,400	4,709	5,109	6,645	7,045	7,238	7,638	3,619	4,019
	950	0,540	10,120	9,580	9,324	8,784	0,400	4,206	4,606	5,933	6,333	6,428	6,828	3,214	3,614
	1000	0,540	8,967	8,427	8,338	7,798	0,400	3,788	4,188	5,329	5,729	5,747	6,147	2,874	3,274
	1050	0,540	7,988	7,448	7,501	6,961	0,400	3,423	3,823	4,813	5,213	5,169	5,569	2,585	2,985
	1100	0,540	7,163	6,623	6,783	6,243	0,400	3,115	3,515	4,369	4,769	4,674	5,074	2,337	2,737
	1150	0,540	6,452	5,912	6,164	5,624	0,400	2,844	3,244	3,983	4,383	4,247	4,647	2,123	2,523
	1200	0,540	5,872	5,332	5,626	5,086	0,400	2,610	3,010	3,647	4,047	3,876	4,276	1,938	2,338

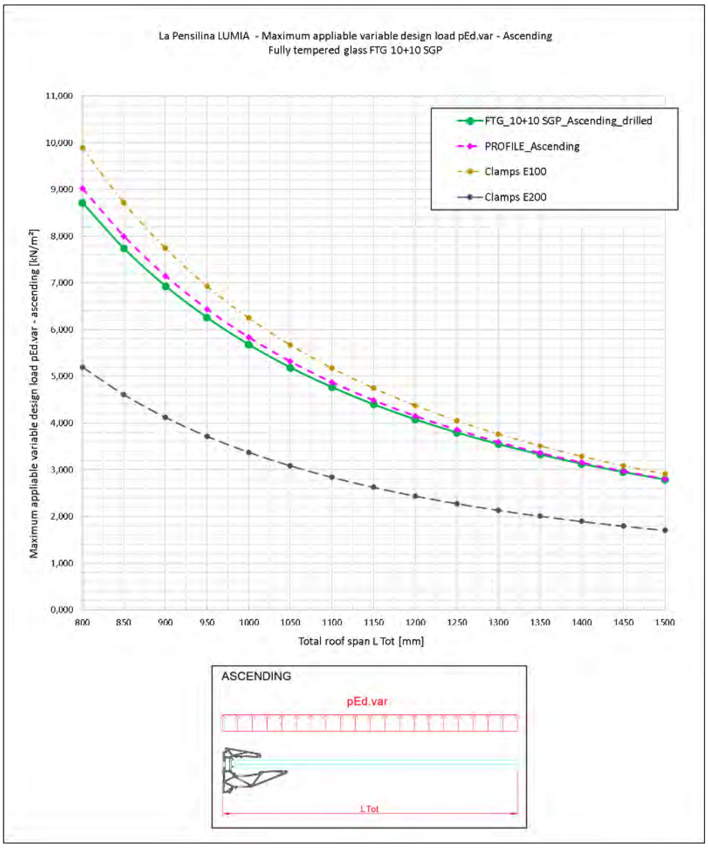




8.1.5 FTG 10+10 SGP

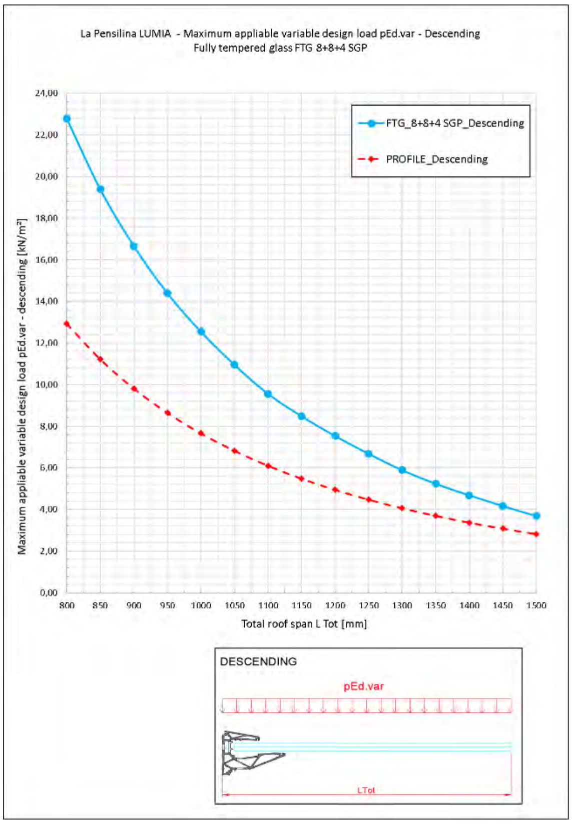
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 10+10 SGP	800	0,675	22,813	22,138	13,614	12,939	0,500	8,214	8,714	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	19,652	18,977	11,903	11,228	0,500	7,233	7,733	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	17,118	16,443	10,496	9,821	0,500	6,426	6,926	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	14,992	14,317	9,324	8,649	0,500	5,751	6,251	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	13,222	12,547	8,338	7,663	0,500	5,175	5,675	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	11,768	11,093	7,501	6,826	0,500	4,684	5,184	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	10,497	9,822	6,783	6,108	0,500	4,262	4,762	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	9,421	8,746	6,164	5,489	0,500	3,895	4,395	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	8,530	7,855	5,626	4,951	0,500	3,573	4,073	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	7,714	7,039	5,156	4,481	0,500	3,292	3,792	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	6,967	6,292	4,742	4,067	0,500	3,043	3,543	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	6,339	5,664	4,376	3,701	0,500	2,821	3,321	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	5,818	5,143	4,050	3,375	0,500	2,624	3,124	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	5,325	4,650	3,760	3,085	0,500	2,446	2,946	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	4,860	4,185	3,500	2,825	0,500	2,286	2,786	2,300	2,800	2,410	2,910	1,205	1,705

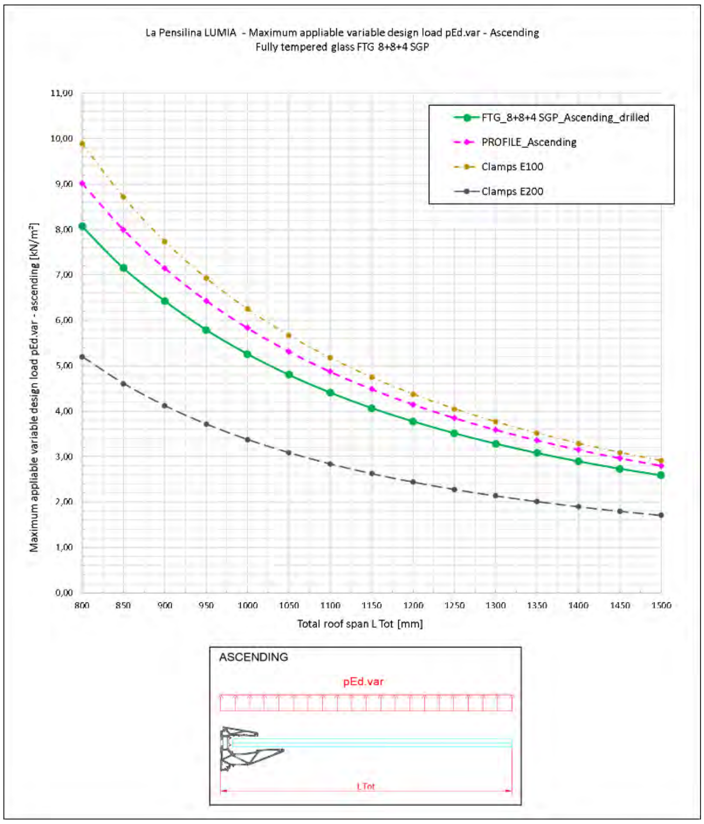




8.1.6 FTG 8+8+4 SGP

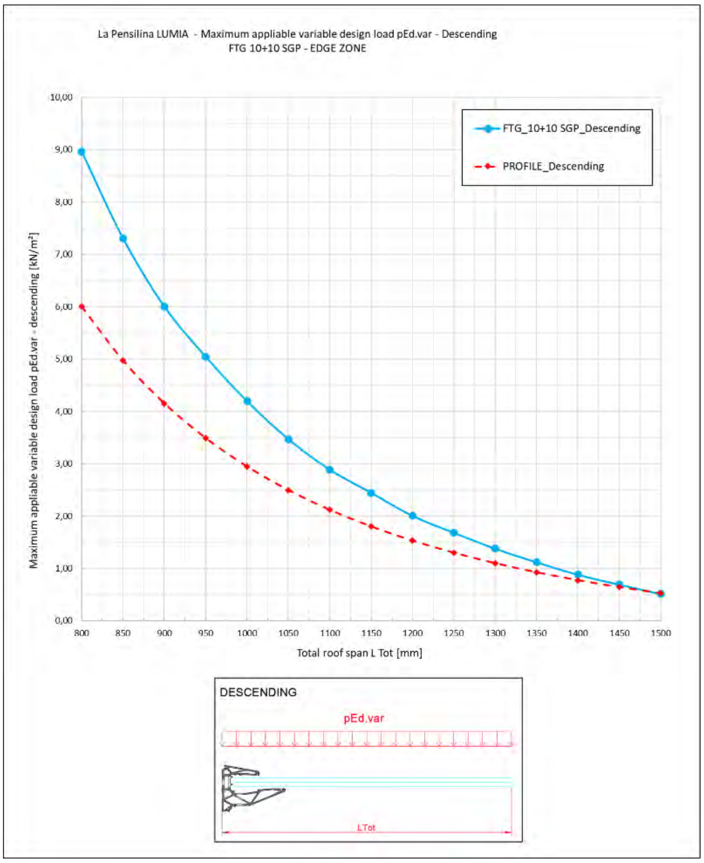
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ per\ m.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ per\ m.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 8+8+4 SGP	800	0,675	23,461	22,786	13,614	12,939	0,500	7,569	8,069	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	20,063	19,388	11,903	11,228	0,500	6,650	7,150	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	17,343	16,668	10,496	9,821	0,500	5,926	6,426	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	15,068	14,393	9,324	8,649	0,500	5,291	5,791	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	13,223	12,548	8,338	7,663	0,500	4,759	5,259	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	11,628	10,953	7,501	6,826	0,500	4,301	4,801	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	10,236	9,561	6,783	6,108	0,500	3,908	4,408	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	9,159	8,484	6,164	5,489	0,500	3,568	4,068	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	8,211	7,536	5,626	4,951	0,500	3,276	3,776	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	7,353	6,678	5,156	4,481	0,500	3,014	3,514	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	6,568	5,893	4,742	4,067	0,500	2,784	3,284	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	5,914	5,239	4,376	3,701	0,500	2,578	3,078	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	5,360	4,685	4,050	3,375	0,500	2,395	2,895	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	4,843	4,168	3,760	3,085	0,500	2,232	2,732	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	4,360	3,685	3,500	2,825	0,500	2,087	2,587	2,300	2,800	2,410	2,910	1,205	1,705

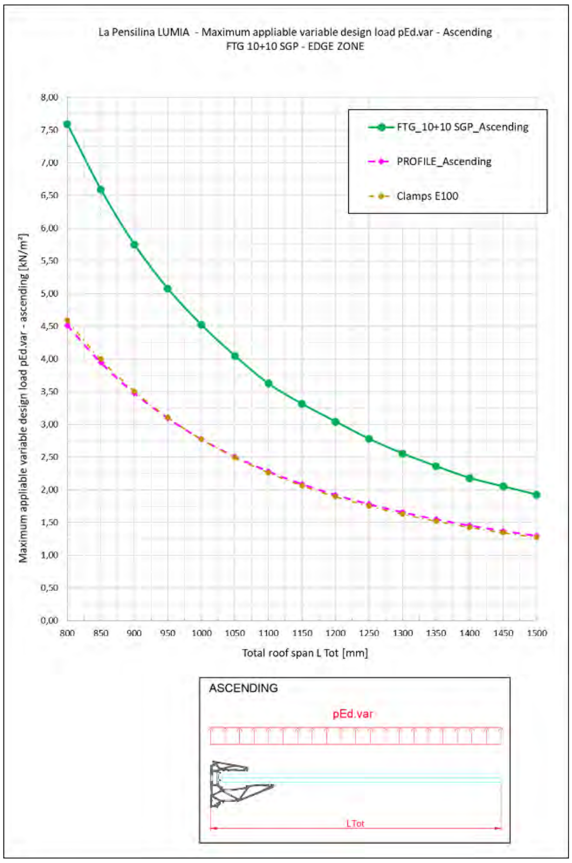




8.1.7 FTG 10+10 SGP - Zona **d'angolo**

		DESCENDING					ASCENDING						
		Descending glass			Descending profile		Ascending - undrilled glass			Ascending profile		Ascending clamps E100	
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
FTG 10+10 SGP EDGE ZONE	800	0,675	9,637	8,962	6,677	6,002	0,500	7,092	7,592	4,017	4,517	4,091	4,591
	850	0,675	7,980	7,305	5,646	4,971	0,500	6,093	6,593	3,446	3,946	3,498	3,998
	900	0,675	6,676	6,001	4,826	4,151	0,500	5,253	5,753	2,980	3,480	3,011	3,511
	950	0,675	5,718	5,043	4,163	3,488	0,500	4,574	5,074	2,596	3,096	2,609	3,109
	1000	0,675	4,870	4,195	3,620	2,945	0,500	4,022	4,522	2,277	2,777	2,275	2,775
	1050	0,675	4,145	3,470	3,170	2,495	0,500	3,548	4,048	2,009	2,509	1,997	2,497
	1100	0,675	3,563	2,888	2,793	2,118	0,500	3,124	3,624	1,782	2,282	1,763	2,263
	1150	0,675	3,121	2,446	2,475	1,800	0,500	2,814	3,314	1,590	2,090	1,566	2,066
	1200	0,675	2,680	2,005	2,205	1,530	0,500	2,544	3,044	1,424	1,924	1,398	1,898
	1250	0,675	2,357	1,682	1,973	1,298	0,500	2,279	2,779	1,282	1,782	1,254	1,754
	1300	0,675	2,054	1,379	1,774	1,099	0,500	2,055	2,555	1,159	1,659	1,130	1,630
	1350	0,675	1,793	1,118	1,600	0,925	0,500	1,861	2,361	1,051	1,551	1,022	1,522
	1400	0,675	1,556	0,881	1,449	0,774	0,500	1,682	2,182	0,956	1,456	0,929	1,429
	1450	0,675	1,366	0,691	1,317	0,642	0,500	1,552	2,052	0,873	1,373	0,847	1,347
	1500	0,675	1,188	0,513	1,200	0,525	0,500	1,426	1,926	0,800	1,300	0,775	1,275

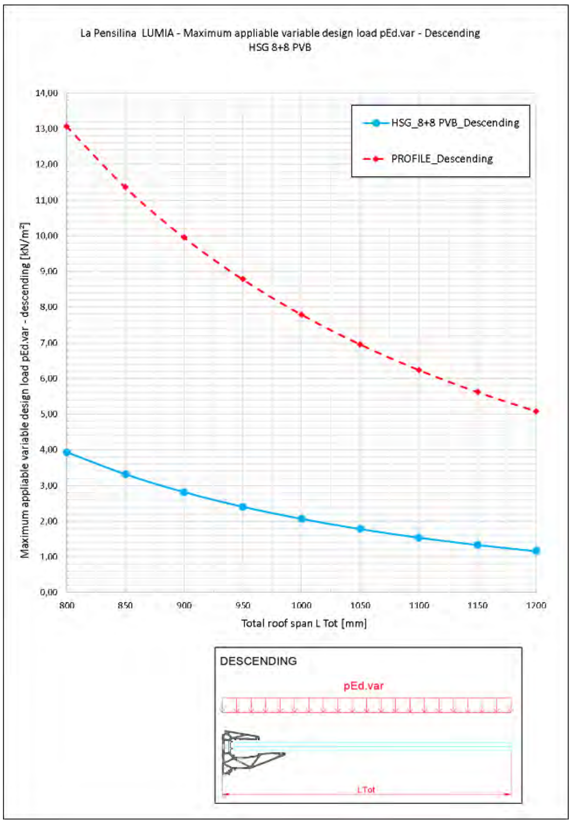


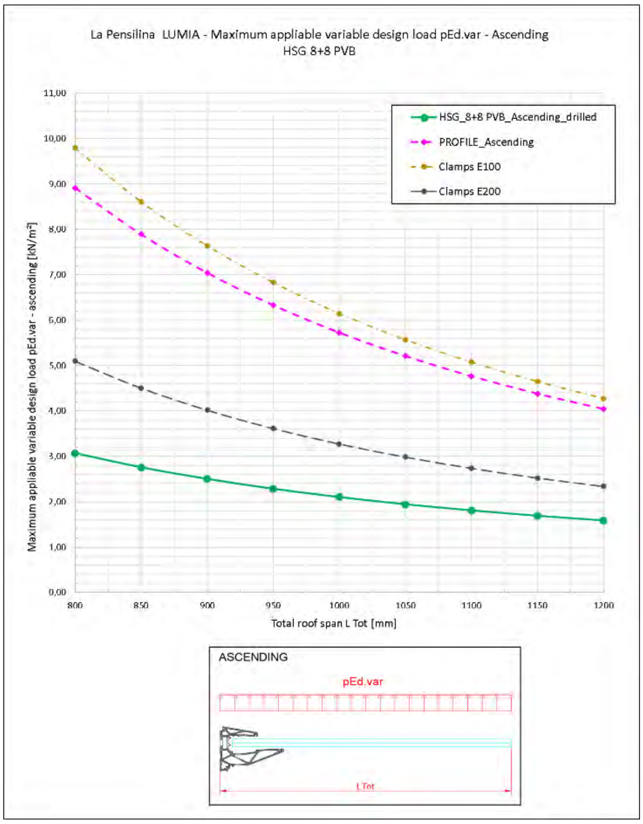


8.2 Comparazione resistenze vetro, profilo e pinze - vetri induriti

8.2.1 HSG 8+8 PVB

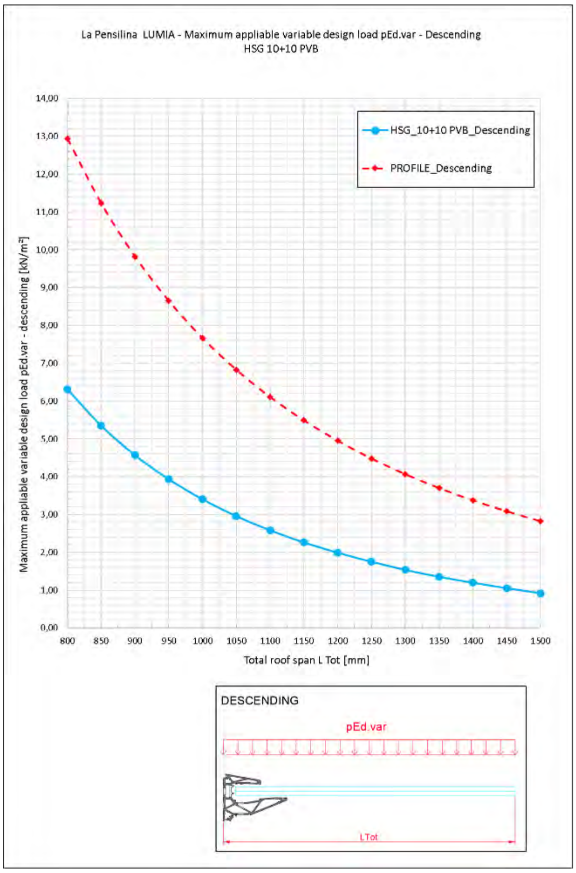
		DESCENDING					ASCENDING									
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass composition	total span L_{tot} [mm]	$p_{ed\ per\ m.desc}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ per\ m.asc}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]
HSG 8+8 PVB	800	0,540	4,474	3,934	13,614	13,074	0,400	2,670	3,070	8,515	8,915	9,394	9,794	4,697	5,097
	850	0,540	3,857	3,317	11,903	11,363	0,400	2,358	2,758	7,493	7,893	8,210	8,610	4,105	4,505
	900	0,540	3,357	2,817	10,496	9,956	0,400	2,102	2,502	6,645	7,045	7,238	7,638	3,619	4,019
	950	0,540	2,948	2,408	9,324	8,784	0,400	1,885	2,285	5,933	6,333	6,428	6,828	3,214	3,614
	1000	0,540	2,610	2,070	8,338	7,798	0,400	1,703	2,103	5,329	5,729	5,747	6,147	2,874	3,274
	1050	0,540	2,325	1,785	7,501	6,961	0,400	1,544	1,944	4,813	5,213	5,169	5,569	2,585	2,985
	1100	0,540	2,084	1,544	6,783	6,243	0,400	1,409	1,809	4,369	4,769	4,674	5,074	2,337	2,737
	1150	0,540	1,879	1,339	6,164	5,624	0,400	1,291	1,691	3,983	4,383	4,247	4,647	2,123	2,523
	1200	0,540	1,706	1,166	5,626	5,086	0,400	1,188	1,588	3,647	4,047	3,876	4,276	1,938	2,338

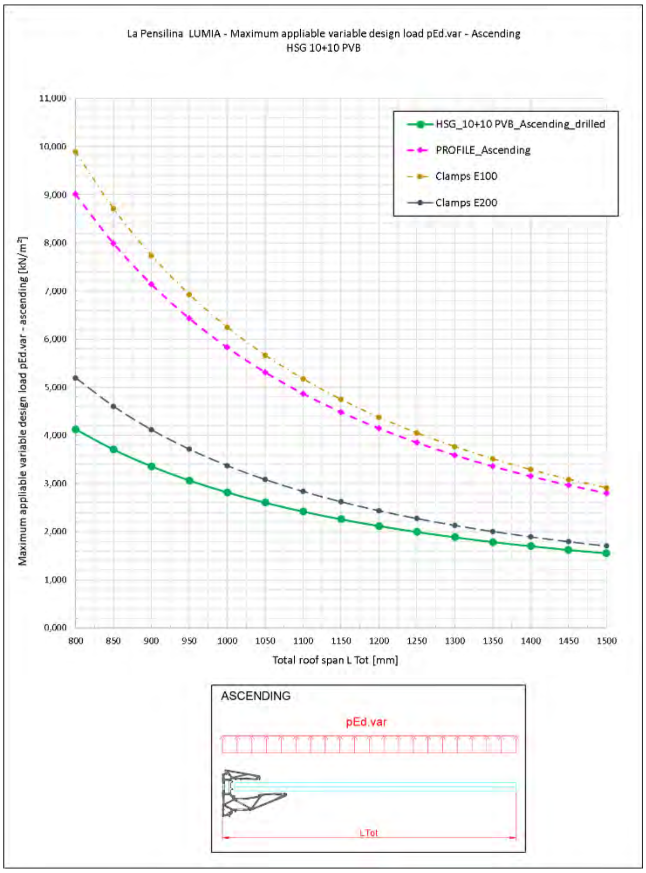




8.2.2 HSG 10+10 PVB

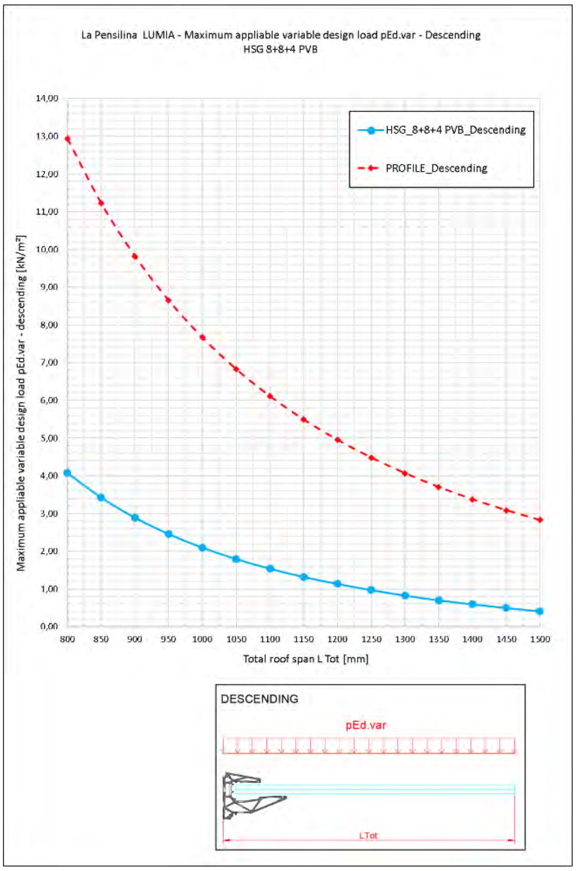
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass composition	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
HSG 10+10 PVB	800	0,675	6,986	6,311	13,614	12,939	0,500	3,629	4,129	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	6,022	5,347	11,903	11,228	0,500	3,207	3,707	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	5,243	4,568	10,496	9,821	0,500	2,859	3,359	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	4,607	3,932	9,324	8,649	0,500	2,566	3,066	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	4,076	3,401	8,338	7,663	0,500	2,317	2,817	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	3,632	2,957	7,501	6,826	0,500	2,103	2,603	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	3,257	2,582	6,783	6,108	0,500	1,919	2,419	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	2,935	2,260	6,164	5,489	0,500	1,759	2,259	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	2,665	1,990	5,626	4,951	0,500	1,619	2,119	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	2,426	1,751	5,156	4,481	0,500	1,495	1,995	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	2,211	1,536	4,742	4,067	0,500	1,386	1,886	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	2,027	1,352	4,376	3,701	0,500	1,285	1,785	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	1,870	1,195	4,050	3,375	0,500	1,201	1,701	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	1,726	1,051	3,760	3,085	0,500	1,122	1,622	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	1,593	0,918	3,500	2,825	0,500	1,052	1,552	2,300	2,800	2,410	2,910	1,205	1,705

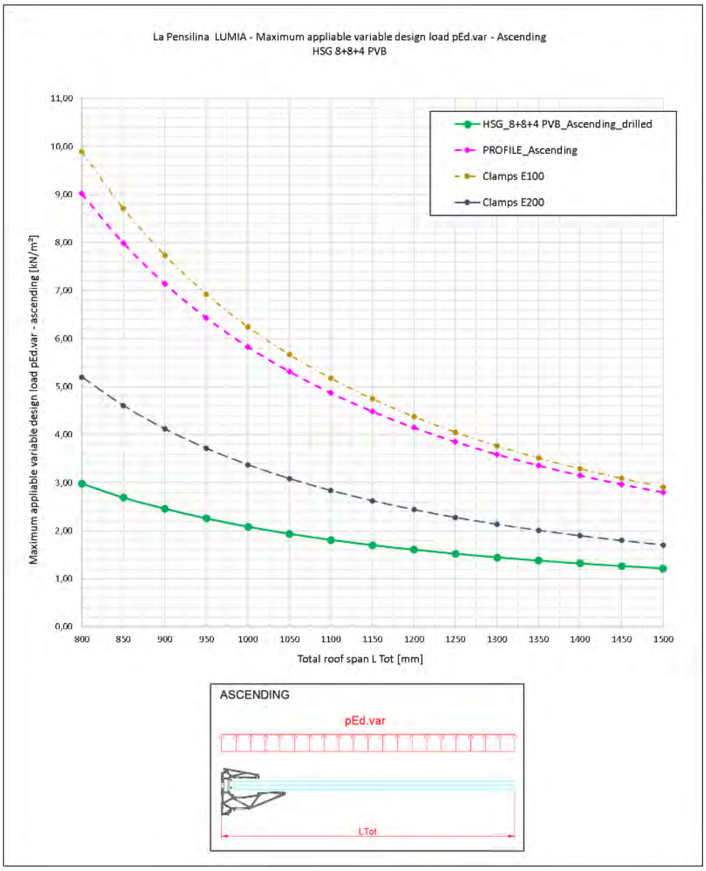




8.2.3 HSG 8+8+4 PVB

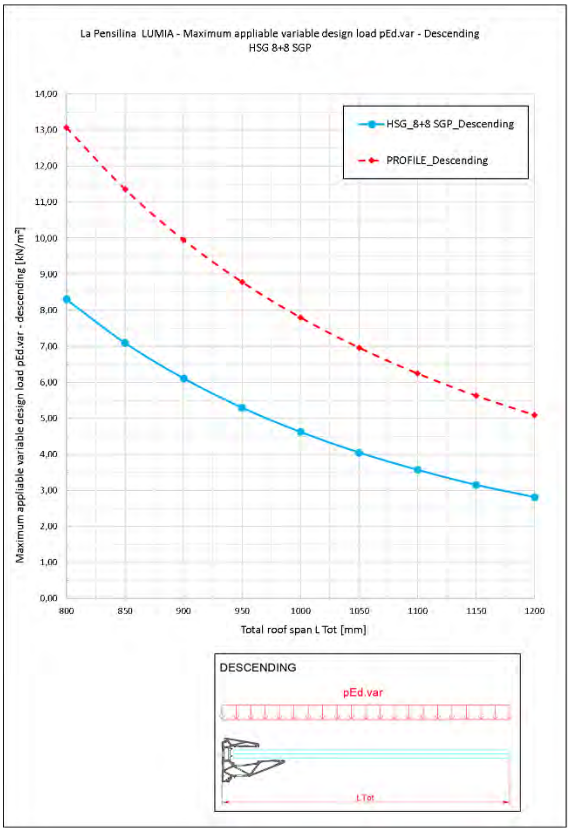
		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ per\ m.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ per\ m.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
HSG 8+8+4 PVB	800	0,675	4,752	4,077	13,614	12,939	0,500	2,484	2,984	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	4,101	3,426	11,903	11,228	0,500	2,189	2,689	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	3,568	2,893	10,496	9,821	0,500	1,957	2,457	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	3,134	2,459	9,324	8,649	0,500	1,755	2,255	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	2,773	2,098	8,338	7,663	0,500	1,582	2,082	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	2,470	1,795	7,501	6,826	0,500	1,435	1,935	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	2,215	1,540	6,783	6,108	0,500	1,308	1,808	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	1,997	1,322	6,164	5,489	0,500	1,198	1,698	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	1,813	1,138	5,626	4,951	0,500	1,104	1,604	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	1,650	0,975	5,156	4,481	0,500	1,018	1,518	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	1,503	0,828	4,742	4,067	0,500	0,943	1,443	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	1,379	0,704	4,376	3,701	0,500	0,876	1,376	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	1,272	0,597	4,050	3,375	0,500	0,816	1,316	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	1,175	0,500	3,760	3,085	0,500	0,762	1,262	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	1,085	0,410	3,500	2,825	0,500	0,715	1,215	2,300	2,800	2,410	2,910	1,205	1,705

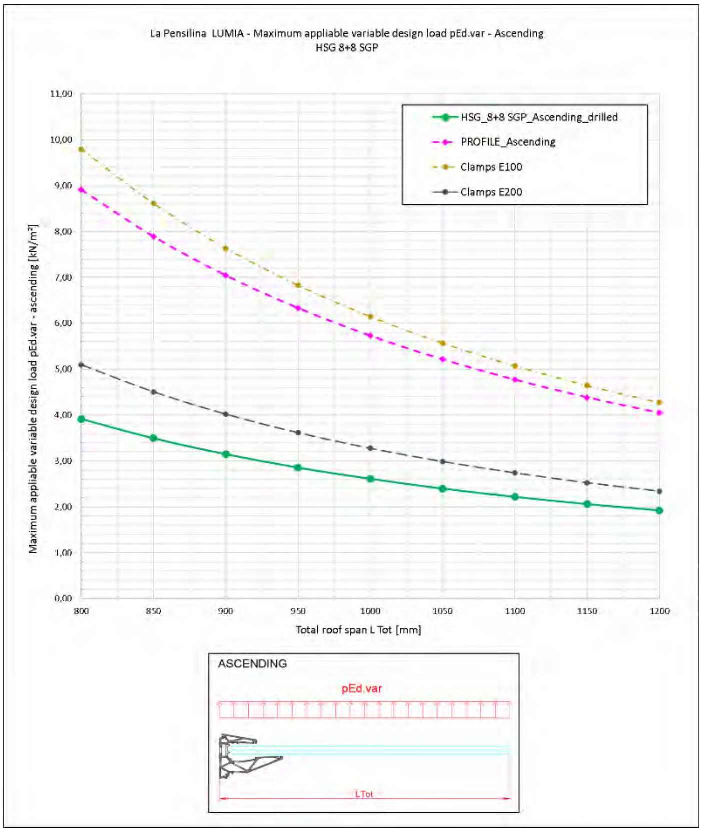




8.2.4 HSG 8+8 SGP

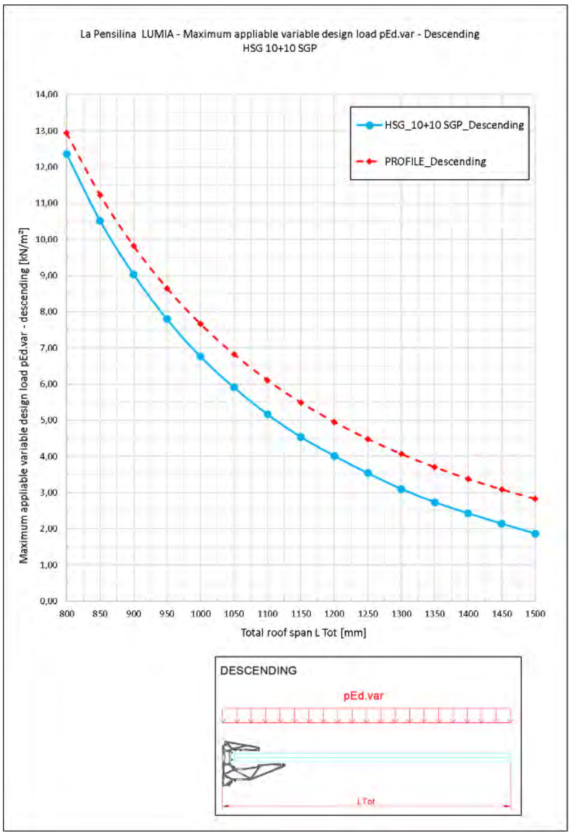
		DESCENDING					ASCENDING									
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200		
Glass	total span L_{tot}	$p_{ed\ perm.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ perm.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	
HSG 8+8 SGP	800	0,540	8,837	8,297	13,614	13,074	0,400	3,514	3,914	8,515	8,915	9,394	9,794	4,697	5,097	
	850	0,540	7,632	7,092	11,903	11,363	0,400	3,093	3,493	7,493	7,893	8,210	8,610	4,105	4,505	
	900	0,540	6,651	6,111	10,496	9,956	0,400	2,747	3,147	6,645	7,045	7,238	7,638	3,619	4,019	
	950	0,540	5,835	5,295	9,324	8,784	0,400	2,454	2,854	5,933	6,333	6,428	6,828	3,214	3,614	
	1000	0,540	5,161	4,621	8,338	7,798	0,400	2,210	2,610	5,329	5,729	5,747	6,147	2,874	3,274	
	1050	0,540	4,590	4,050	7,501	6,961	0,400	1,997	2,397	4,813	5,213	5,169	5,569	2,585	2,985	
	1100	0,540	4,108	3,568	6,783	6,243	0,400	1,817	2,217	4,369	4,769	4,674	5,074	2,337	2,737	
	1150	0,540	3,692	3,152	6,164	5,624	0,400	1,659	2,059	3,983	4,383	4,247	4,647	2,123	2,523	
	1200	0,540	3,353	2,813	5,626	5,086	0,400	1,523	1,923	3,647	4,047	3,876	4,276	1,938	2,338	

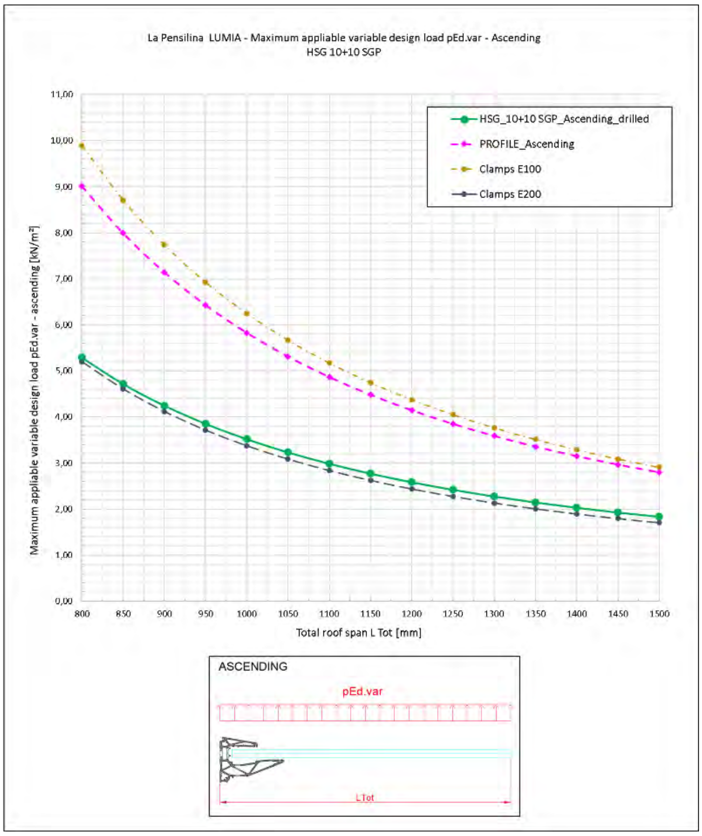




8.2.5 HSG 10+10 SGP

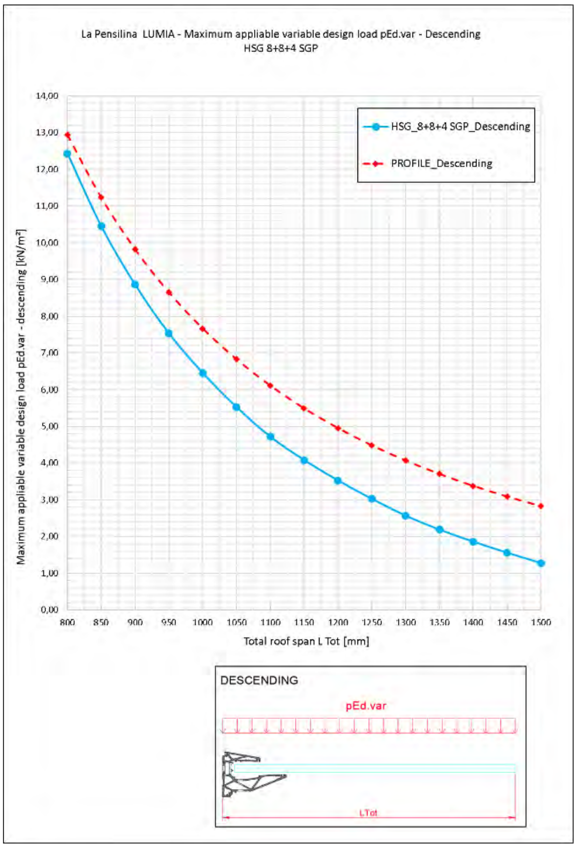
		DESCENDING					ASCENDING									
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200		
Glass composition	total span L_{tot} [mm]	$p_{ed\ perm.desc}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ perm.asc}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	$p_{ed\ tot}$ [kN/m²]	$p_{ed\ var}$ [kN/m²]	
HSG 10+10 SGP	800	0,675	13,038	12,363	13,614	12,939	0,500	4,791	5,291	8,515	9,015	9,394	9,894	4,697	5,197	
	850	0,675	11,192	10,517	11,903	11,228	0,500	4,219	4,719	7,493	7,993	8,210	8,710	4,105	4,605	
	900	0,675	9,710	9,035	10,496	9,821	0,500	3,748	4,248	6,645	7,145	7,238	7,738	3,619	4,119	
	950	0,675	8,469	7,794	9,324	8,649	0,500	3,355	3,855	5,933	6,433	6,428	6,928	3,214	3,714	
	1000	0,675	7,435	6,760	8,338	7,663	0,500	3,019	3,519	5,329	5,829	5,747	6,247	2,874	3,374	
	1050	0,675	6,584	5,909	7,501	6,826	0,500	2,732	3,232	4,813	5,313	5,169	5,669	2,585	3,085	
	1100	0,675	5,842	5,167	6,783	6,108	0,500	2,486	2,986	4,369	4,869	4,674	5,174	2,337	2,837	
	1150	0,675	5,212	4,537	6,164	5,489	0,500	2,272	2,772	3,983	4,483	4,247	4,747	2,123	2,623	
	1200	0,675	4,690	4,015	5,626	4,951	0,500	2,084	2,584	3,647	4,147	3,876	4,376	1,938	2,438	
	1250	0,675	4,213	3,538	5,156	4,481	0,500	1,920	2,420	3,351	3,851	3,551	4,051	1,776	2,276	
	1300	0,675	3,777	3,102	4,742	4,067	0,500	1,775	2,275	3,090	3,590	3,266	3,766	1,633	2,133	
	1350	0,675	3,410	2,735	4,376	3,701	0,500	1,646	2,146	2,858	3,358	3,014	3,514	1,507	2,007	
	1400	0,675	3,103	2,428	4,050	3,375	0,500	1,531	2,031	2,651	3,151	2,789	3,289	1,395	1,895	
	1450	0,675	2,815	2,140	3,760	3,085	0,500	1,427	1,927	2,466	2,966	2,589	3,089	1,295	1,795	
	1500	0,675	2,544	1,869	3,500	2,825	0,500	1,334	1,834	2,300	2,800	2,410	2,910	1,205	1,705	

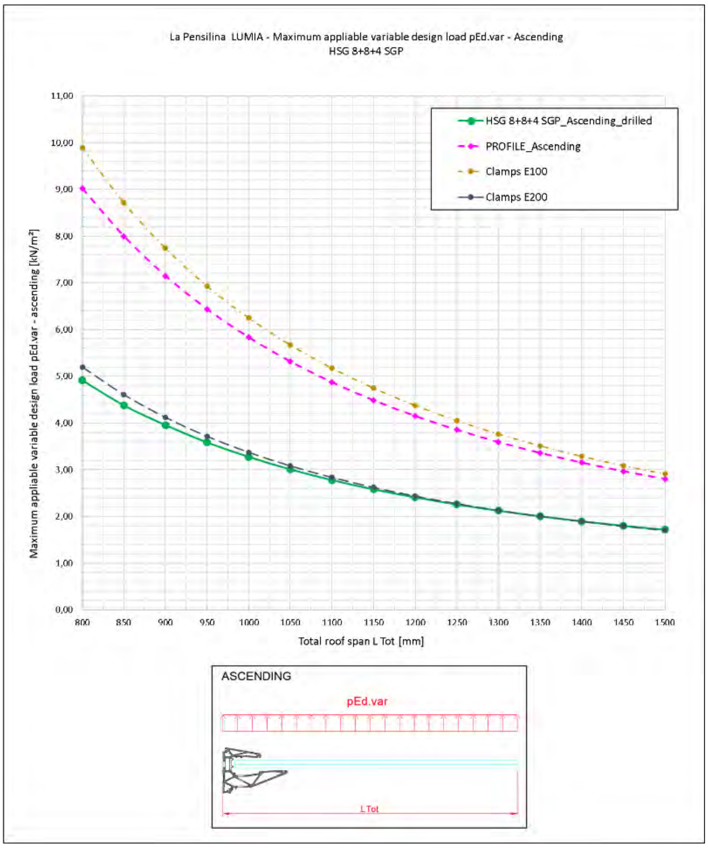




8.2.6 HSG 8+8+4 SGP

		DESCENDING					ASCENDING								
		Descending glass			Descending profile		Ascending - drilled glass			Ascending profile		Ascending clamps E100		Ascending clamps E200	
Glass	total span L_{tot}	$p_{ed\ per\ m.desc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ per\ m.asc}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$	$p_{ed\ tot}$	$p_{ed\ var}$
composition	[mm]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]	[kN/m²]
HSG 8+8+4 SGP	800	0,675	13,109	12,434	13,614	12,939	0,500	4,415	4,915	8,515	9,015	9,394	9,894	4,697	5,197
	850	0,675	11,127	10,452	11,903	11,228	0,500	3,879	4,379	7,493	7,993	8,210	8,710	4,105	4,605
	900	0,675	9,536	8,861	10,496	9,821	0,500	3,457	3,957	6,645	7,145	7,238	7,738	3,619	4,119
	950	0,675	8,209	7,534	9,324	8,649	0,500	3,086	3,586	5,933	6,433	6,428	6,928	3,214	3,714
	1000	0,675	7,130	6,455	8,338	7,663	0,500	2,776	3,276	5,329	5,829	5,747	6,247	2,874	3,374
	1050	0,675	6,199	5,524	7,501	6,826	0,500	2,509	3,009	4,813	5,313	5,169	5,669	2,585	3,085
	1100	0,675	5,391	4,716	6,783	6,108	0,500	2,280	2,780	4,369	4,869	4,674	5,174	2,337	2,837
	1150	0,675	4,756	4,081	6,164	5,489	0,500	2,081	2,581	3,983	4,483	4,247	4,747	2,123	2,623
	1200	0,675	4,200	3,525	5,626	4,951	0,500	1,911	2,411	3,647	4,147	3,876	4,376	1,938	2,438
	1250	0,675	3,698	3,023	5,156	4,481	0,500	1,758	2,258	3,351	3,851	3,551	4,051	1,776	2,276
	1300	0,675	3,241	2,566	4,742	4,067	0,500	1,624	2,124	3,090	3,590	3,266	3,766	1,633	2,133
	1350	0,675	2,859	2,184	4,376	3,701	0,500	1,504	2,004	2,858	3,358	3,014	3,514	1,507	2,007
	1400	0,675	2,533	1,858	4,050	3,375	0,500	1,397	1,897	2,651	3,151	2,789	3,289	1,395	1,895
	1450	0,675	2,231	1,556	3,760	3,085	0,500	1,302	1,802	2,466	2,966	2,589	3,089	1,295	1,795
	1500	0,675	1,950	1,275	3,500	2,825	0,500	1,217	1,717	2,300	2,800	2,410	2,910	1,205	1,705





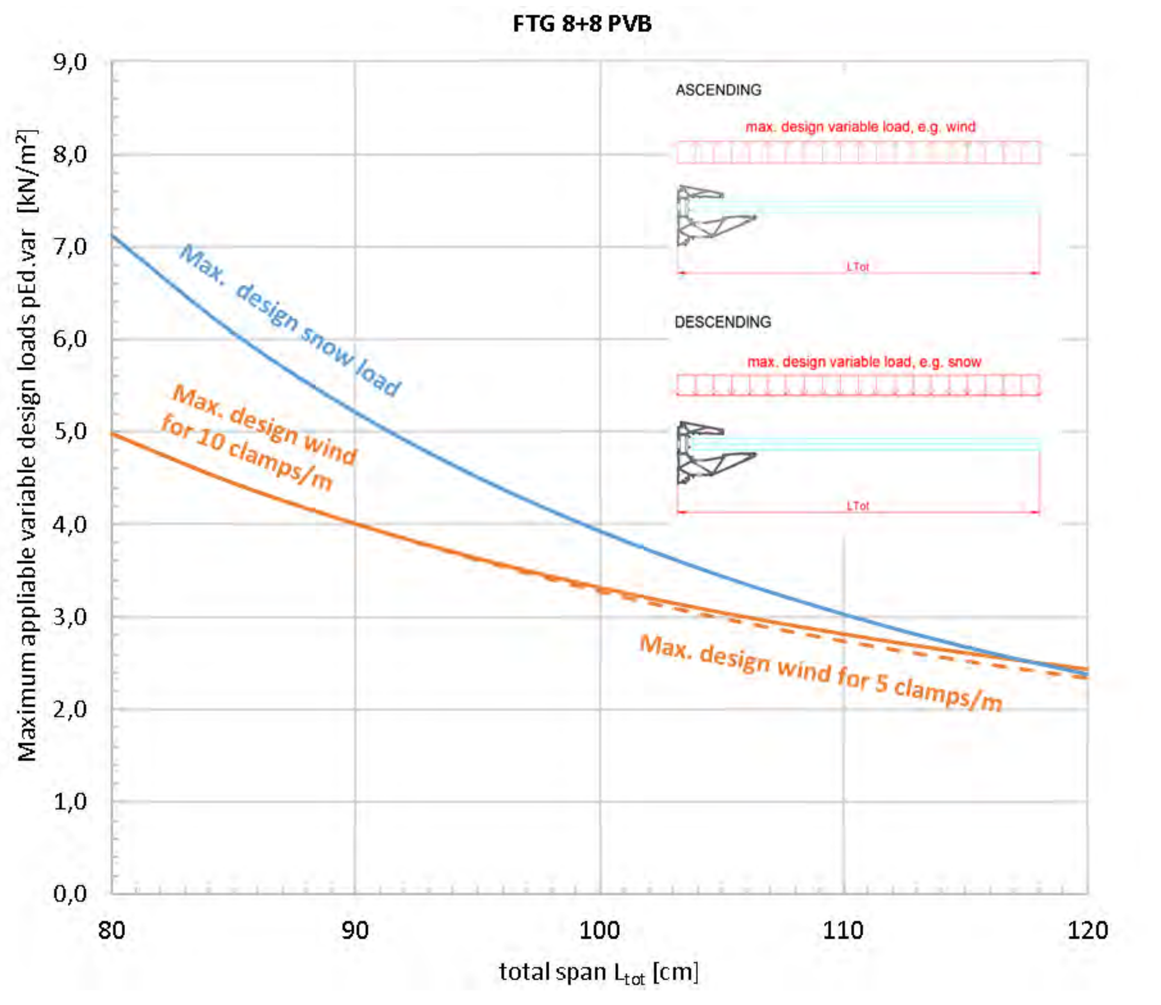
8.3 Conclusioni - vetri temprati

Si riporta in forma di tabelle e grafici una sintesi di possibili soluzioni di applicazione per il sistema **“La pensilina** - LUMIA**“** per diverse tipologie di lastre di vetro e situazioni di installazione.

Summary of results for Fully tempered glass FTG 8+8 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

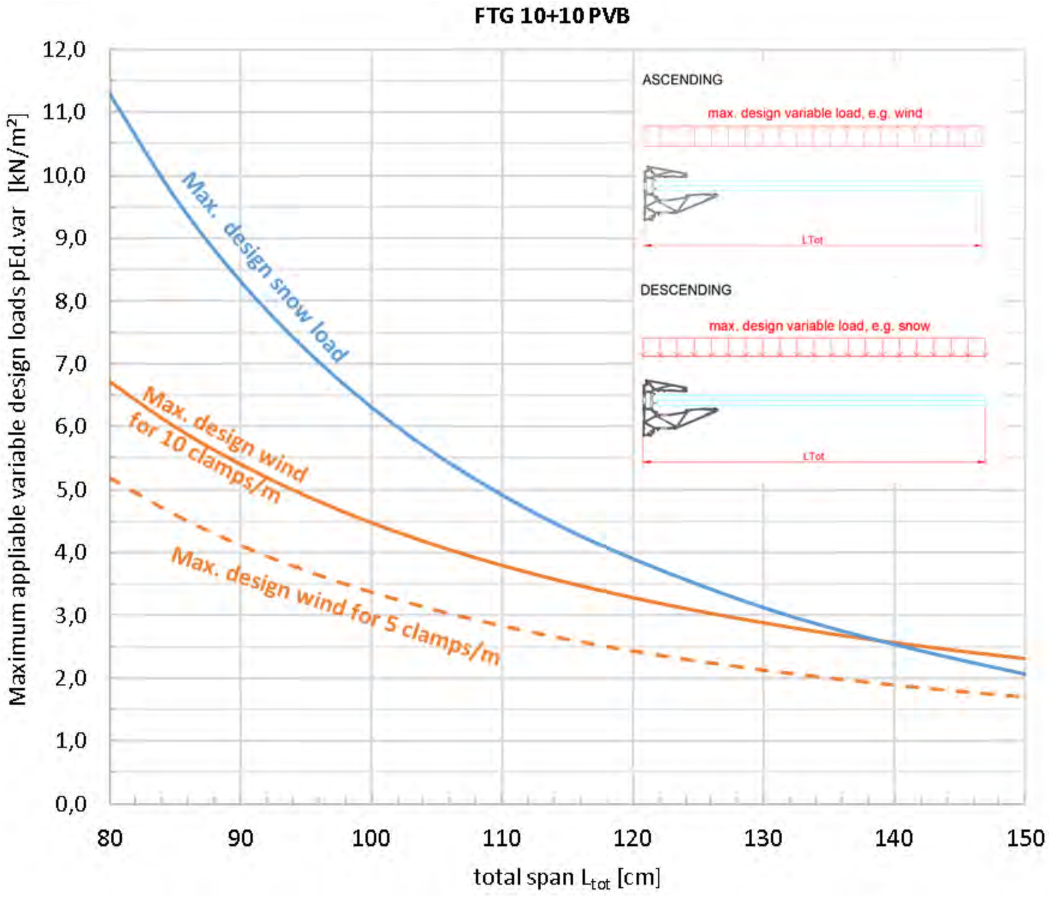
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	7,130	4,977	4,977
85	6,072	4,442	4,442
90	5,215	4,004	4,004
95	4,514	3,631	3,614
100	3,934	3,319	3,274
105	3,446	3,047	2,985
110	3,033	2,816	2,737
115	2,681	2,613	2,523
120	2,385	2,437	2,338



Summary of results for Fully tempered glass FTG 10+10 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

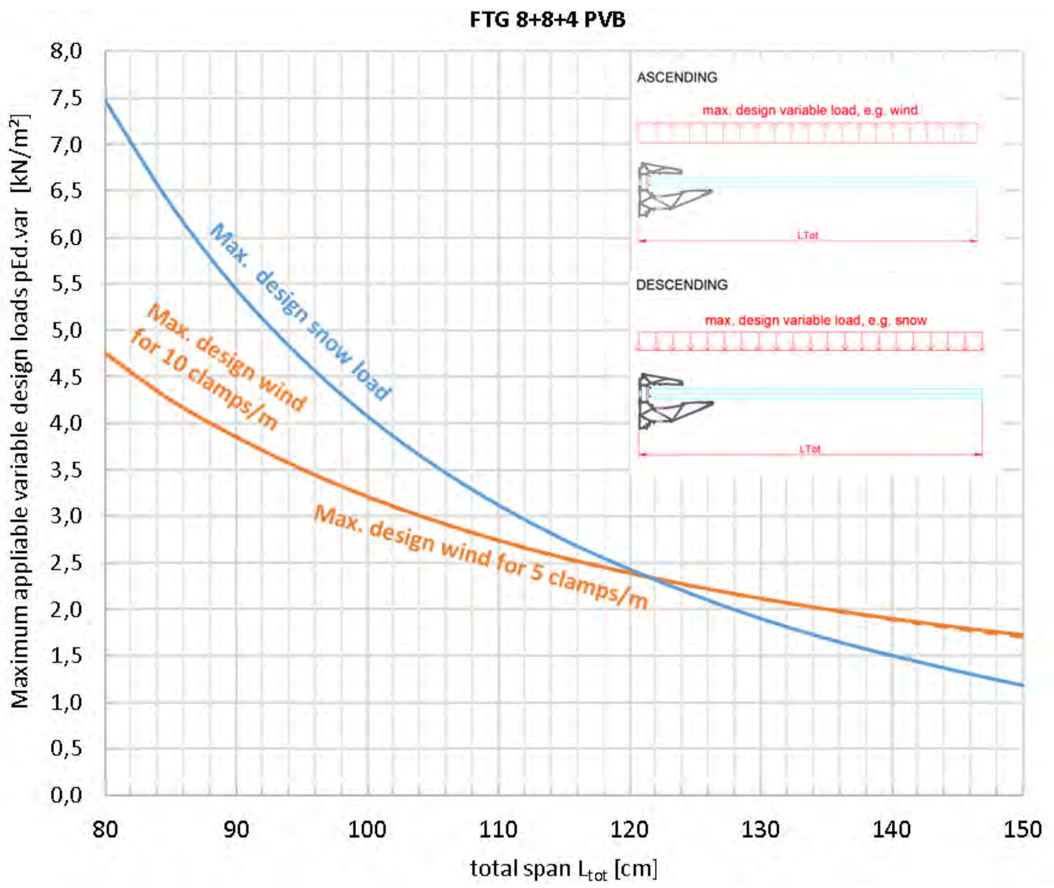
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	11,301	6,721	5,197
85	9,648	5,998	4,605
90	8,314	5,402	4,119
95	7,222	4,898	3,714
100	6,312	4,472	3,374
105	5,551	4,105	3,085
110	4,908	3,789	2,837
115	4,356	3,515	2,623
120	3,894	3,275	2,438
125	3,483	3,062	2,276
130	3,115	2,875	2,133
135	2,800	2,703	2,007
140	2,530	2,558	1,895
145	2,285	2,424	1,795
150	2,056	2,303	1,705



Summary of results for Fully tempered glass FTG 8+8+4 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
4mm glass is intended placed on top of the assembly (upper side)
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

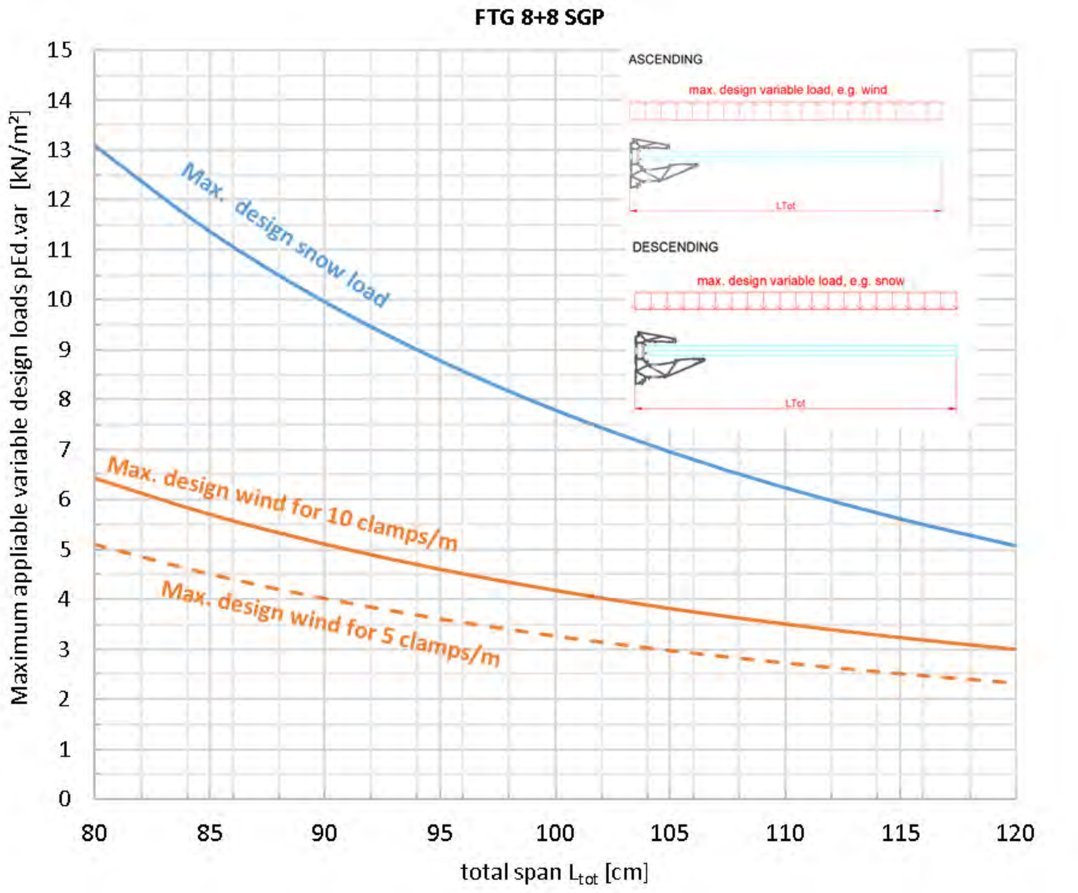
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	7,472	4,758	4,758
85	6,355	4,252	4,252
90	5,441	3,856	3,856
95	4,698	3,509	3,509
100	4,078	3,213	3,213
105	3,560	2,961	2,961
110	3,122	2,743	2,743
115	2,748	2,553	2,553
120	2,433	2,392	2,392
125	2,153	2,246	2,246
130	1,902	2,117	2,117
135	1,689	2,002	2,002
140	1,505	1,899	1,895
145	1,339	1,807	1,795
150	1,185	1,726	1,705



Summary of results for Fully tempered glass FTG 8+8 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	13,074	6,424	5,097
85	11,363	5,702	4,505
90	9,956	5,109	4,019
95	8,784	4,606	3,614
100	7,798	4,188	3,274
105	6,961	3,823	2,985
110	6,243	3,515	2,737
115	5,624	3,244	2,523
120	5,086	3,010	2,338

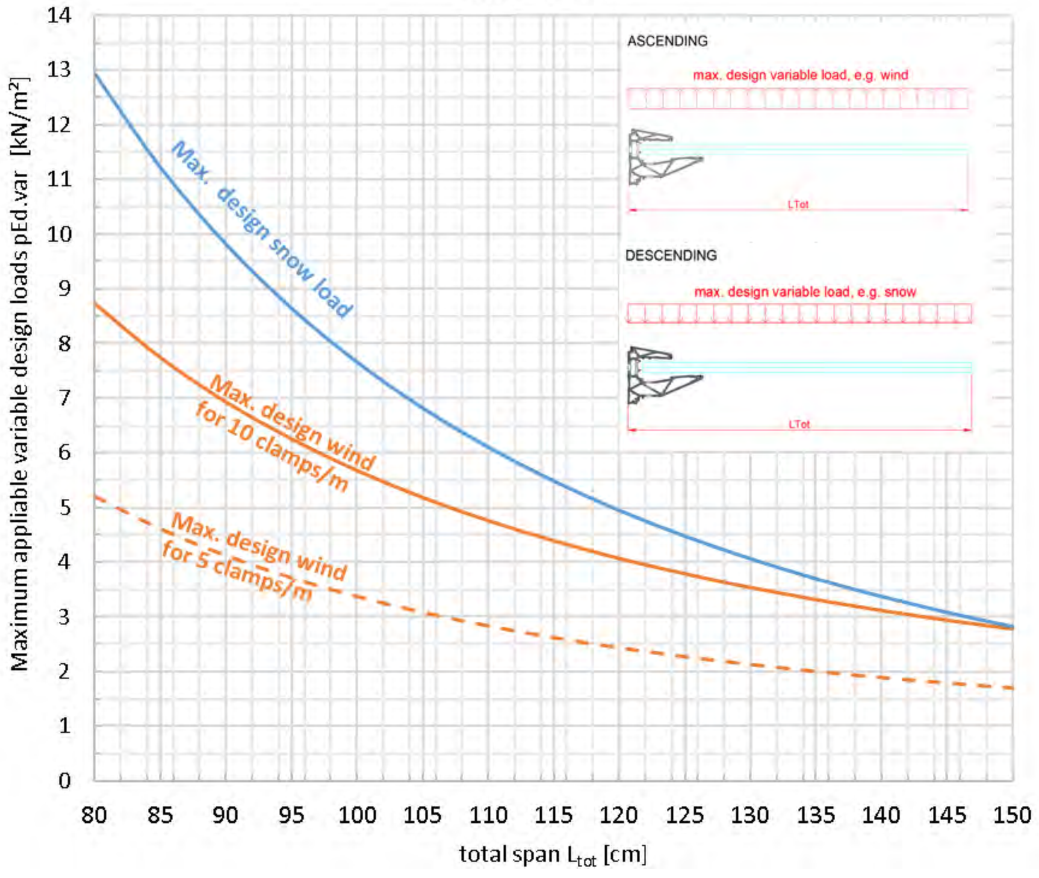


Summary of results for Fully tempered glass FTG 10+10 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	12,939	8,714	5,197
85	11,228	7,733	4,605
90	9,821	6,926	4,119
95	8,649	6,251	3,714
100	7,663	5,675	3,374
105	6,826	5,184	3,085
110	6,108	4,762	2,837
115	5,489	4,395	2,623
120	4,951	4,073	2,438
125	4,481	3,792	2,276
130	4,067	3,543	2,133
135	3,701	3,321	2,007
140	3,375	3,124	1,895
145	3,085	2,946	1,795
150	2,825	2,786	1,705

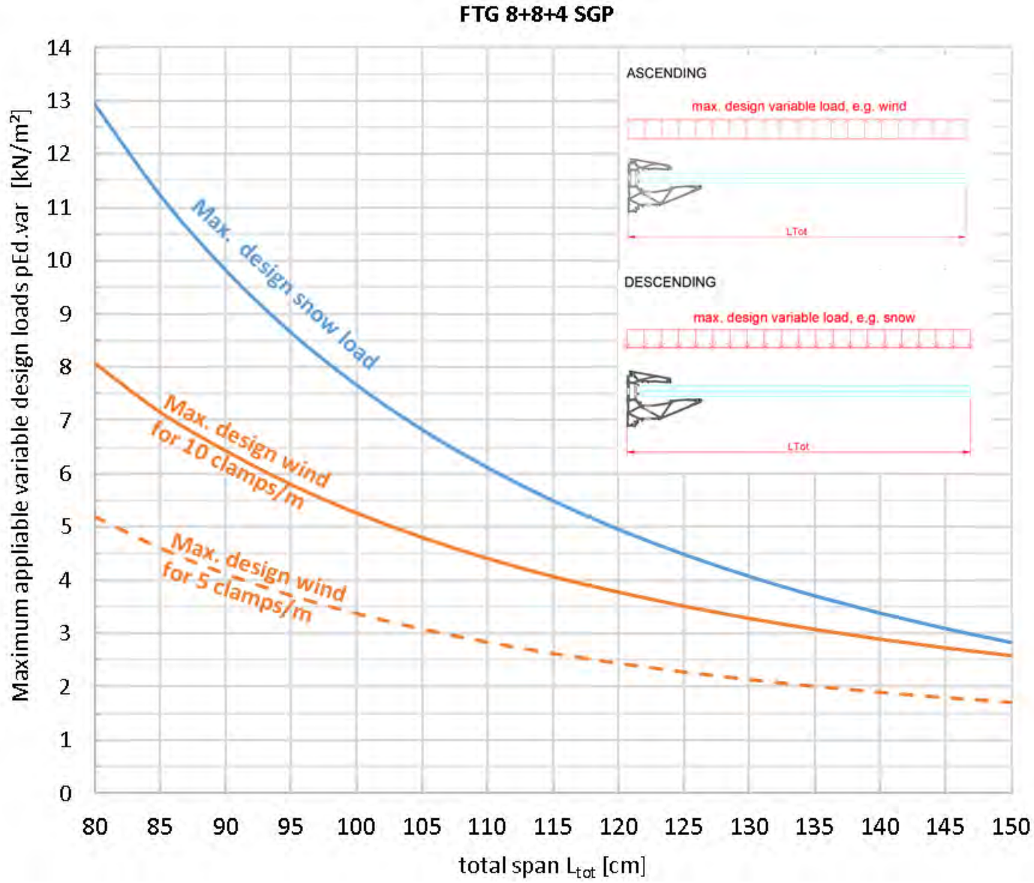
FTG 10+10 SGP



Summary of results for Fully tempered glass FTG 8+8+4 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
4mm glass is intended placed on top of the assembly (upper side)
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

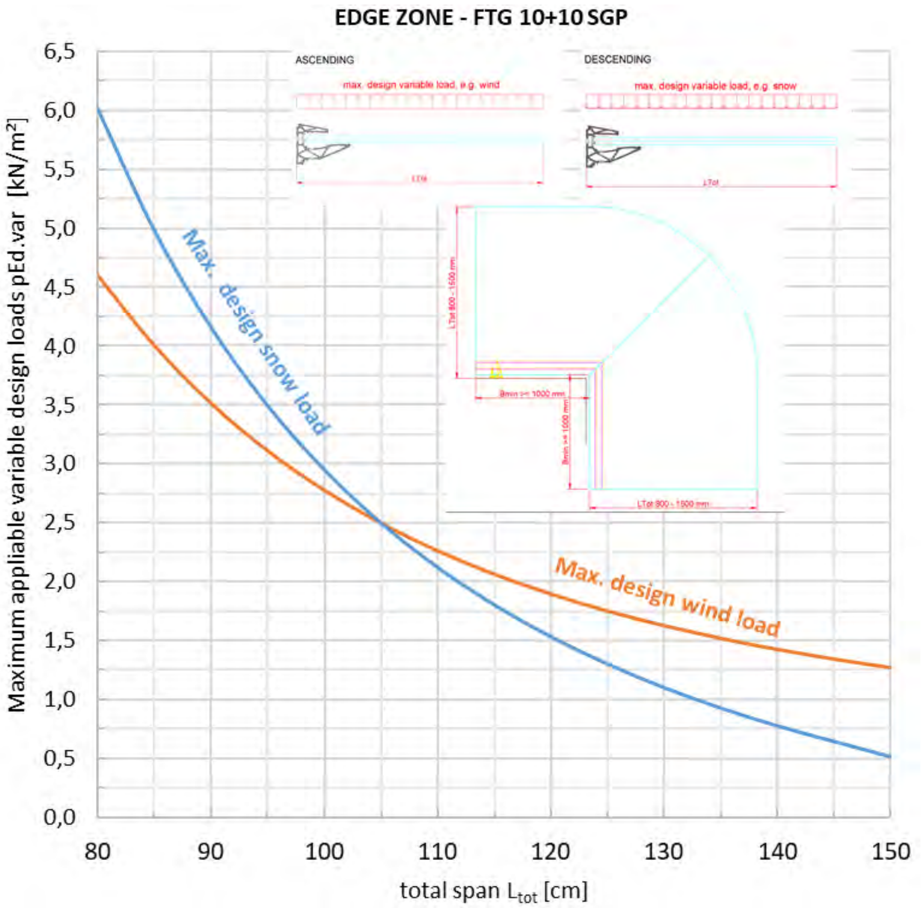
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	12,939	8,069	5,197
85	11,228	7,150	4,605
90	9,821	6,426	4,119
95	8,649	5,791	3,714
100	7,663	5,259	3,374
105	6,826	4,801	3,085
110	6,108	4,408	2,837
115	5,489	4,068	2,623
120	4,951	3,776	2,438
125	4,481	3,514	2,276
130	4,067	3,284	2,133
135	3,701	3,078	2,007
140	3,375	2,895	1,895
145	3,085	2,732	1,795
150	2,825	2,587	1,705



Summary of results for Fully tempered glass FTG 10+10 SGP - EDGE ZONE

Notes: Only non-drilled glass plates allowed ; Only usage with 10 clamps/m allowed
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]
		10 clamps/m
80	6,002	4,517
85	4,971	3,946
90	4,151	3,480
95	3,488	3,096
100	2,945	2,775
105	2,495	2,497
110	2,118	2,263
115	1,800	2,066
120	1,530	1,898
125	1,298	1,754
130	1,099	1,630
135	0,925	1,522
140	0,774	1,429
145	0,642	1,347
150	0,513	1,275



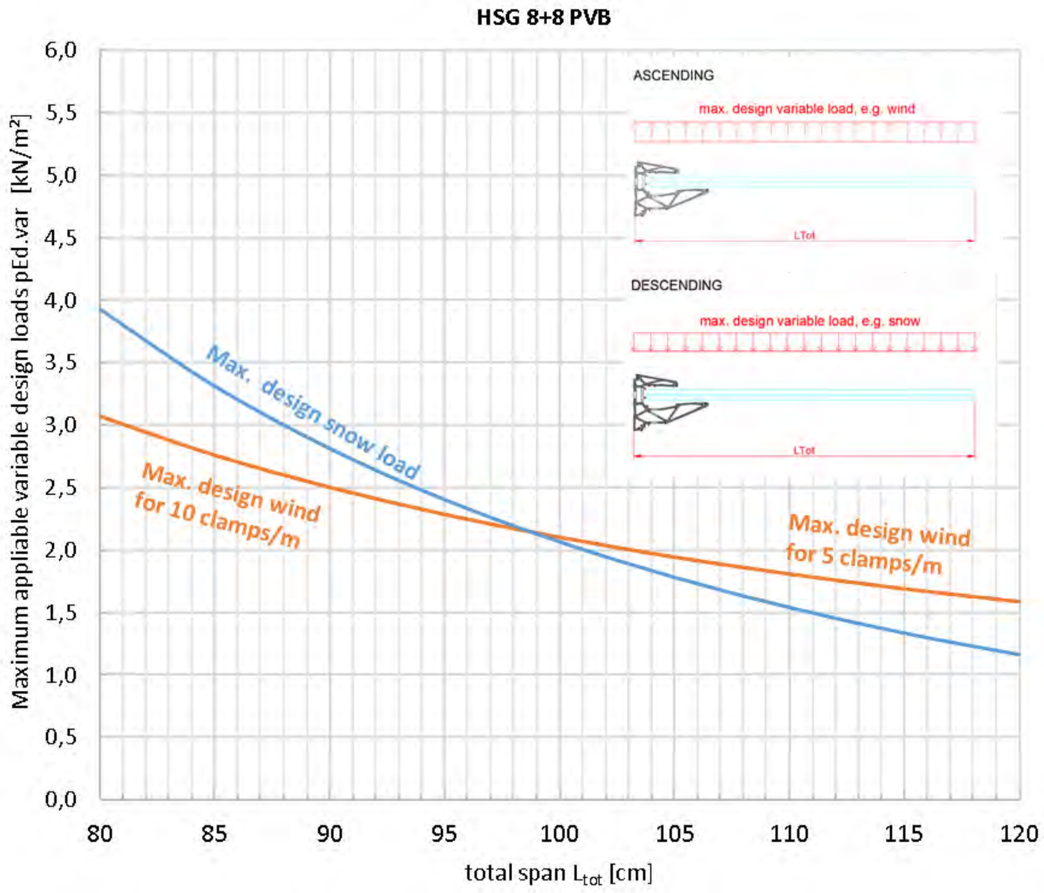
8.4 Conclusioni - vetri induriti

Si riporta in forma di tabelle e grafici una sintesi di possibili soluzioni di applicazione per il sistema "La pensilina - LUMIA" per diverse tipologie di lastre di vetro e situazioni di installazione.

Summary of results for Heat strengthened glass HSG 8+8 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

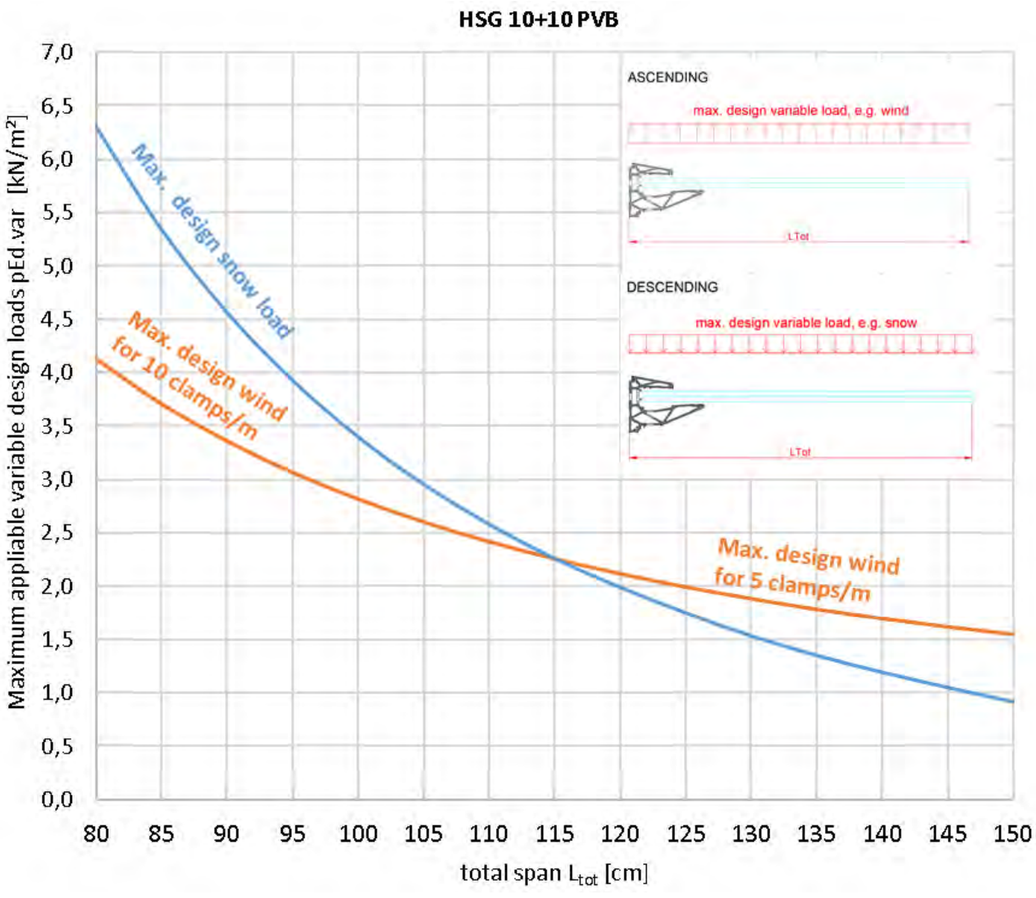
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	3,934	3,070	3,070
85	3,317	2,758	2,758
90	2,817	2,502	2,502
95	2,408	2,285	2,285
100	2,070	2,103	2,103
105	1,785	1,944	1,944
110	1,544	1,809	1,809
115	1,339	1,691	1,691
120	1,166	1,588	1,588



Summary of results for Heat strengthened glass HSG 10+10 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

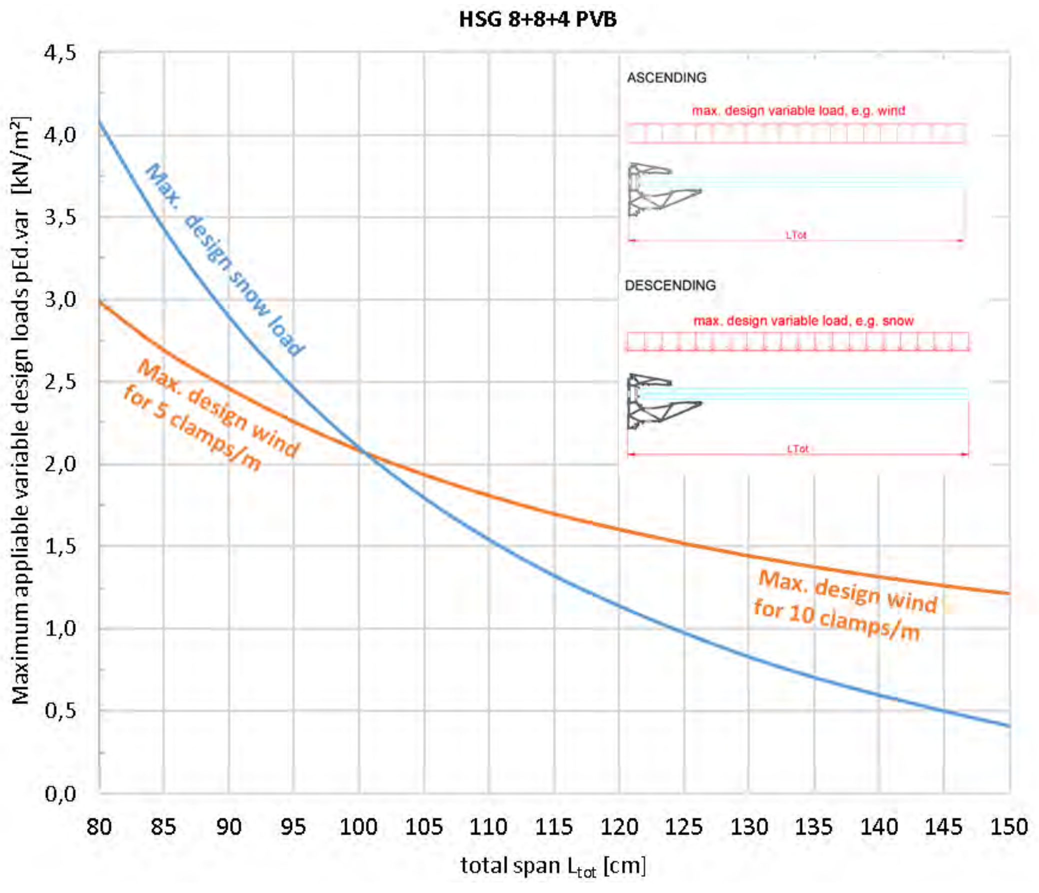
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	6,311	4,129	4,129
85	5,347	3,707	3,707
90	4,568	3,359	3,359
95	3,932	3,066	3,066
100	3,401	2,817	2,817
105	2,957	2,603	2,603
110	2,582	2,419	2,419
115	2,260	2,259	2,259
120	1,990	2,119	2,119
125	1,751	1,995	1,995
130	1,536	1,886	1,886
135	1,352	1,785	1,785
140	1,195	1,701	1,701
145	1,051	1,622	1,622
150	0,918	1,552	1,552



Summary of results for Heat strengthened glass HSG 8+8+4 PVB

Notes: Bottom glass plate may be drilled laterally for use with security pins
4mm glass is intended placed on top of the assembly (upper side)
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

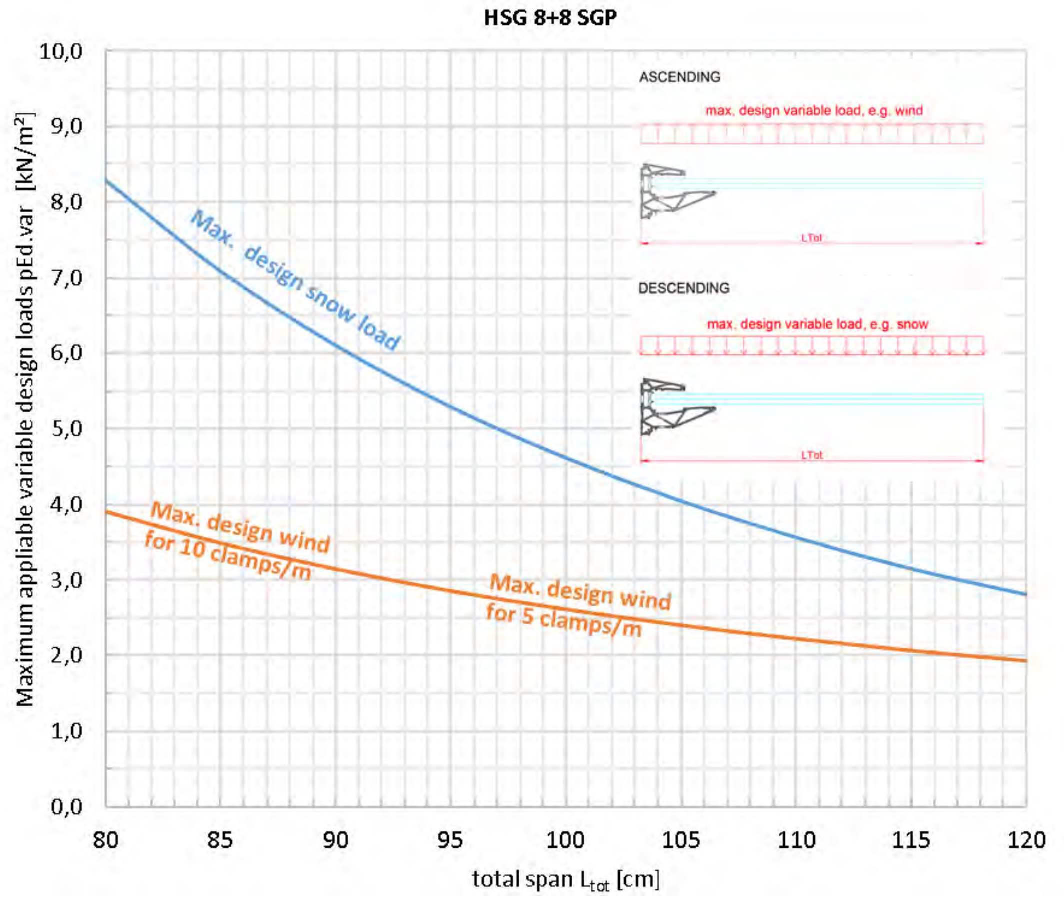
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	4,077	2,984	2,984
85	3,426	2,689	2,689
90	2,893	2,457	2,457
95	2,459	2,255	2,255
100	2,098	2,082	2,082
105	1,795	1,935	1,935
110	1,540	1,808	1,808
115	1,322	1,698	1,698
120	1,138	1,604	1,604
125	0,975	1,518	1,518
130	0,828	1,443	1,443
135	0,704	1,376	1,376
140	0,597	1,316	1,316
145	0,500	1,262	1,262
150	0,410	1,215	1,215



Summary of results for Heat strengthened glass HSG 8+8 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

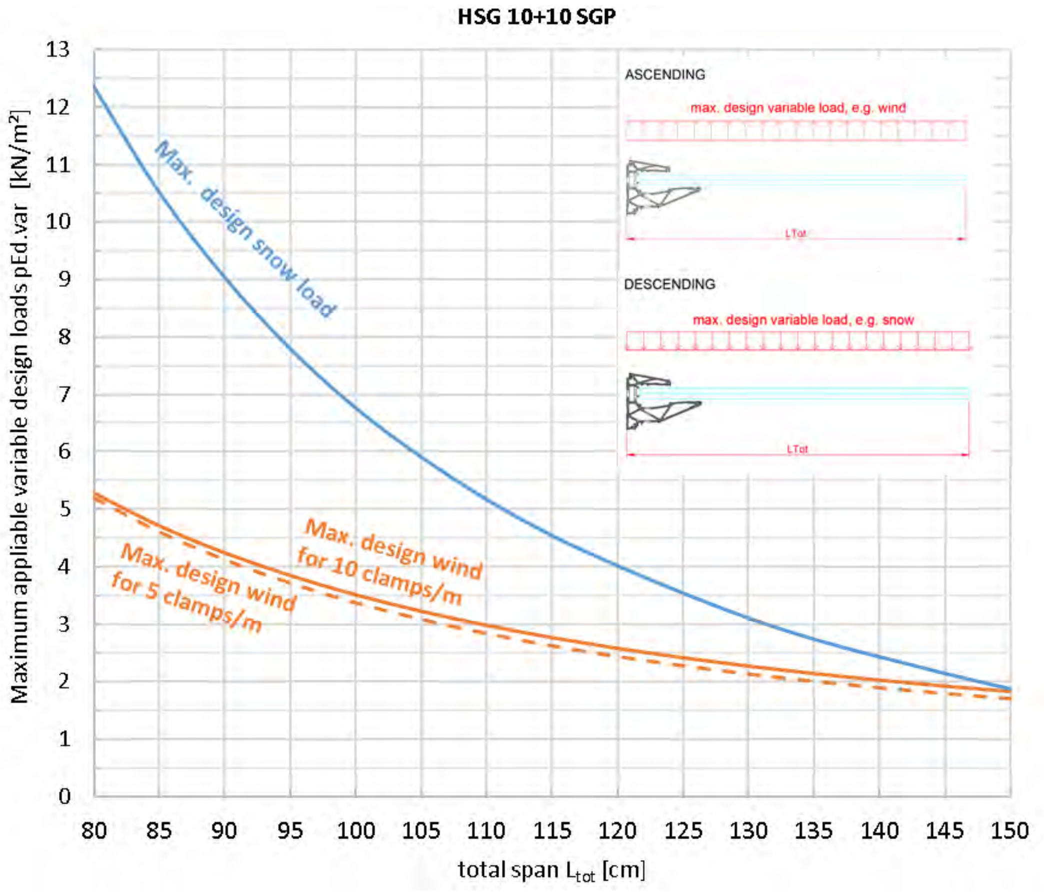
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	8,297	3,914	3,914
85	7,092	3,493	3,493
90	6,111	3,147	3,147
95	5,295	2,854	2,854
100	4,621	2,610	2,610
105	4,050	2,397	2,397
110	3,568	2,217	2,217
115	3,152	2,059	2,059
120	2,813	1,923	1,923



Summary of results for Heat strengthened glass HSG 10+10 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

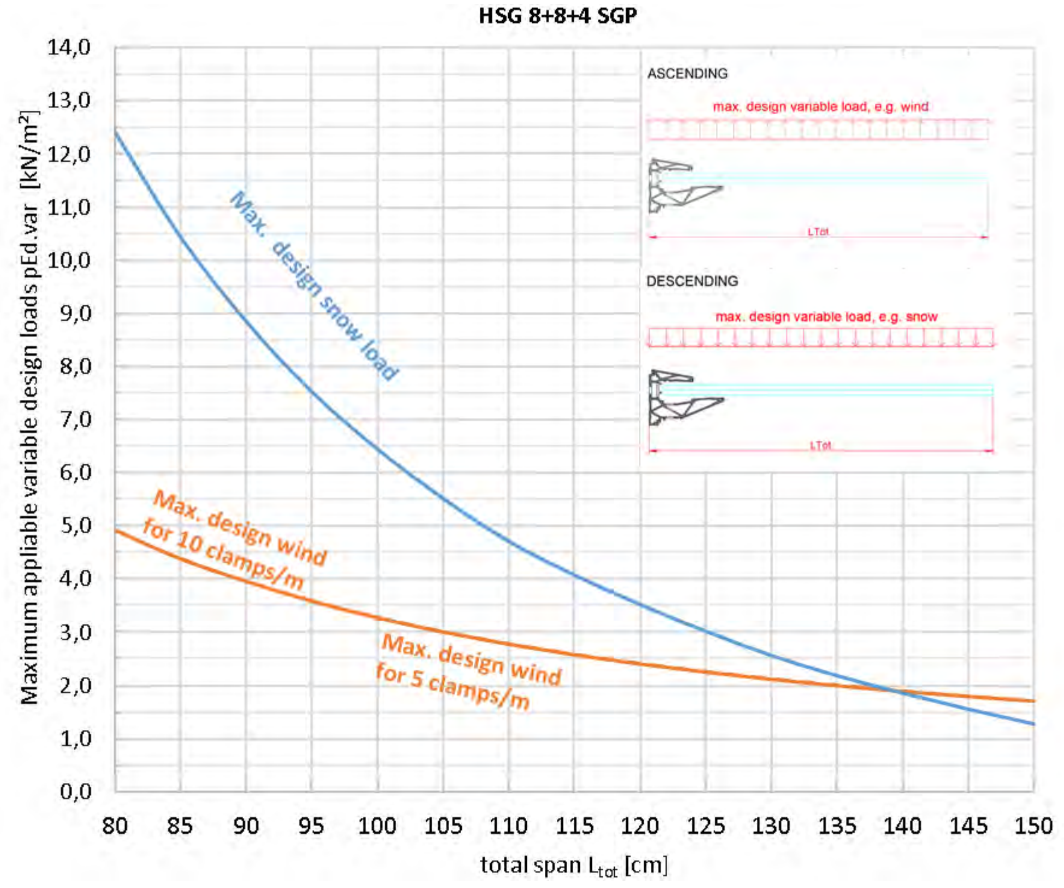
Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	12,363	5,291	5,197
85	10,517	4,719	4,605
90	9,035	4,248	4,119
95	7,794	3,855	3,714
100	6,760	3,519	3,374
105	5,909	3,232	3,085
110	5,167	2,986	2,837
115	4,537	2,772	2,623
120	4,015	2,584	2,438
125	3,538	2,420	2,276
130	3,102	2,275	2,133
135	2,735	2,146	2,007
140	2,428	2,031	1,895
145	2,140	1,927	1,795
150	1,869	1,834	1,705



Summary of results for Heat strengthened glass HSG 8+8+4 SGP

Notes: Bottom glass plate may be drilled laterally for use with security pins
4mm glass is intended placed on top of the assembly (upper side)
The resistances are the minimum of the resistance of the profile, the glass plates and the clamps

Total span L_{tot} [cm]	Max. design snow load [kN/m²]	Max. design wind load [kN/m²]	
		10 clamps/m	5 clamps/m
80	12,434	4,915	4,915
85	10,452	4,379	4,379
90	8,861	3,957	3,957
95	7,534	3,586	3,586
100	6,455	3,276	3,276
105	5,524	3,009	3,009
110	4,716	2,780	2,780
115	4,081	2,581	2,581
120	3,525	2,411	2,411
125	3,023	2,258	2,258
130	2,566	2,124	2,124
135	2,184	2,004	2,004
140	1,858	1,897	1,895
145	1,556	1,802	1,795
150	1,275	1,717	1,705



9 Allegati

9.1 Risultati calcolo del vetro con SJ Mepla

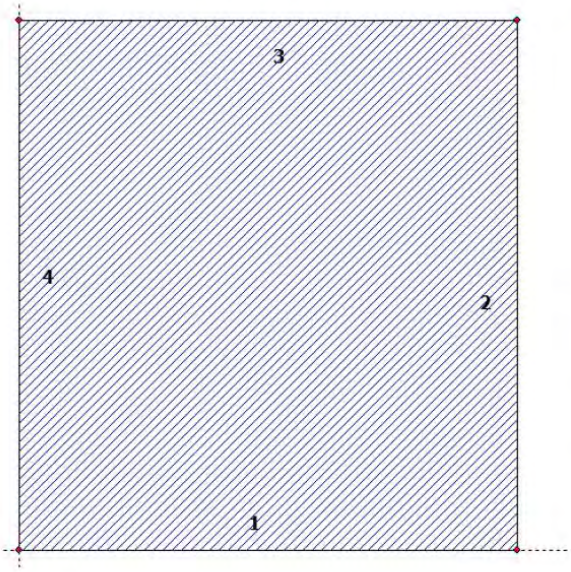
9.1.1 Calcolo numerico vetro - carico verso il basso (neve) - 8+8 PVB

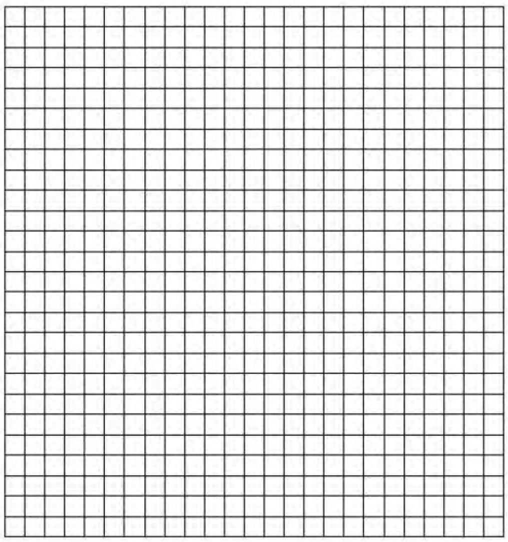
Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 temprato + 0,76 mm PVB con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Progetto: 21015 Pensilina a sbalzo - IT, Logli 8+8 PVB - 1200mm

14.04.2021
Pagina: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint		Arccenter		Direction of rotation
	mm	mm	mm	mm	+/-
1	0.00	0.00			
2	1000.00	0.00			

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3	1000.00	1061.00
4	0.00	1061.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 40.0 mm
Number of elements : 650

Number of nodes : 2703 (per package)
Number of unknown : 23868

Calculation results:

Minimum and maximum displacements w:

Package	- Position- x mm	y mm	Displacement w mm	
1	0.00	0.00	0.00	(min)
	500.00	1061.00	25.61	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	515.49	1056.40	0.63	27.35
		(bottom)	500.00	4.60	27.35	
1	1	(top)	484.51	1056.40	0.63	27.35
		(bottom)	500.00	4.60	27.35	

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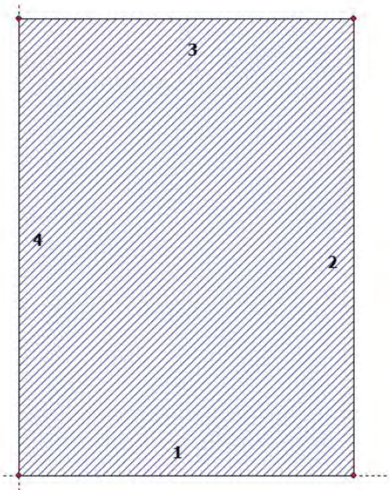
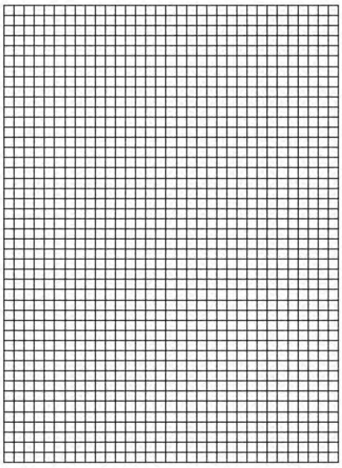
9.1.2 Calcolo numerico vetro - carico verso il basso (neve) - 10+10 PVB

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm PVB con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Project: 21015 Pensilina a sbalzo - IT, Logli - 10+10 PVB 1500mm | 08.02.2021 | Page: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	0.00	0.00			
2	1000.00	0.00			

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3	1000.00	1361.00
4	0.00	1361.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 30.0 mm
Number of elements : 1485

Number of nodes : 6097 (per package)
Number of unknown : 54270

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm	
1	0.00	0.00	0.00	(min)
	500.00	1361.00	35.59	(max)

Maximum principal stress:

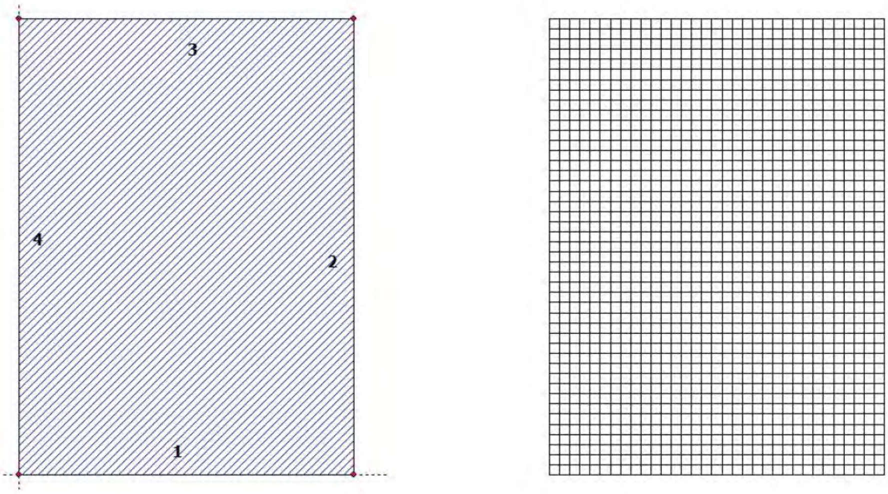
Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	488.26	1327.35	0.66	29.25
		(bottom)	500.00	3.41	29.25	
1	1	(top)	511.74	1327.35	0.66	29.25
		(bottom)	500.00	3.41	29.25	

9.1.3 Calcolo numerico vetro - carico verso il basso (neve) - 8+8+4 PVB

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 +4 temprato + 0,76 mm PVB con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Project: 21015 Pensilina a sbalzo - IT, Logli 8+8+4 PVB - 1500mm | 09.02.2021 Page: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	0.00	0.00			
2	1000.00	0.00			

3	1000.00	1361.00
4	0.00	1361.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	5	Glass, fully toughened
1	4	PVB long time loading
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod.	ν	Thickness	Density	αt	ΔT
		N/mm²		mm	kg/m³	1/K	K
1	5	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	4	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	4.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure
	N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 30.0 mm
Number of elements : 1485
Number of nodes : 6097 (per package)
Number of unknown : 78390

Calculation results:

Minimum and maximum displacements w:

Package	x	y	w	
	- Position-		Displacement	
	mm	mm	mm	
1	0.00	0.00	0.00	(min)
	500.00	1361.00	65.41	(max)

Maximum principal stress:

Package	Layer		x	y	σ	σ (max)
			mm	mm	N/mm²	N/mm²
1	5	(top)	488.26	1327.35	0.98	43.01
		(bottom)	500.00	3.41	43.01	
1	3	(top)	511.74	1327.35	0.98	43.01
		(bottom)	500.00	3.41	43.01	
1	1	(top)	3.42	15.12	0.78	21.56
		(bottom)	500.00	3.41	21.56	

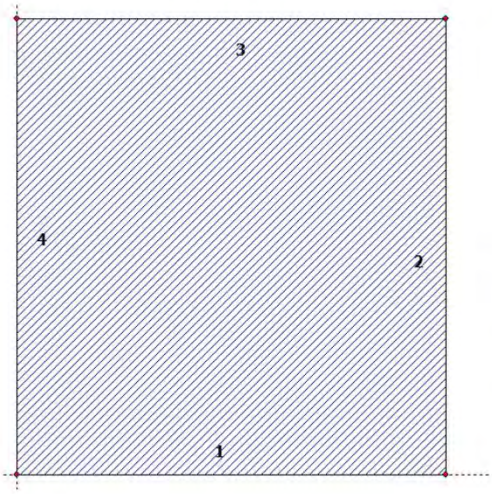
9.1.4 Calcolo numerico vetro - carico verso il basso (neve) - 8+8 SGP

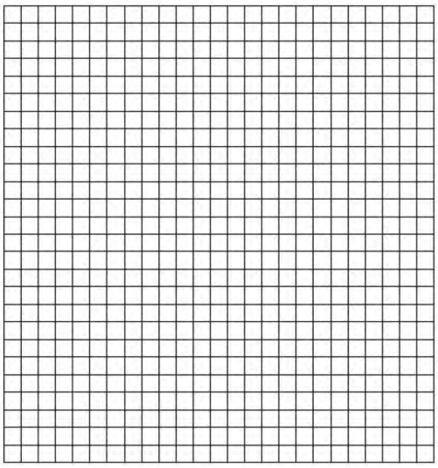
Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 temprato + 0,76 mm SGP con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Progetto: 21015 Pensilina a sbalzo - IT, Logli 8+8 SGP - 1200mm

14.04.2021
Pagina: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	0.00	0.00			
2	1000.00	0.00			

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3	1000.00	1061.00
4	0.00	1061.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 40.0 mm
Number of elements : 650

Number of nodes : 2703 (per package)
Number of unknown : 23868

Calculation results:

Minimum and maximum displacements w:

Package	x (Position) mm	y (Position) mm	w (Displacement) mm
1	0.00	0.00	0.00 (min)
	500.00	1061.00	5.64 (max)

Maximum principal stress:

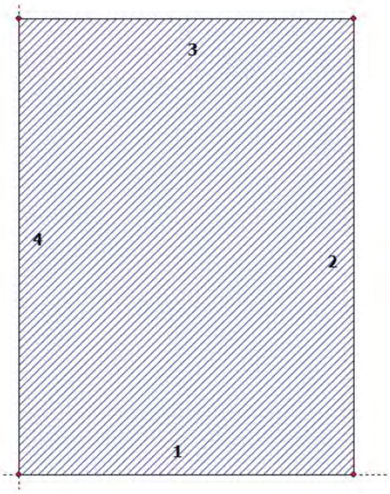
Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	484.51	1024.79	0.30	1.32
		(bottom)	4.51	36.21	1.32	
1	1	(top)	4.51	4.60	3.58	13.23
		(bottom)	500.00	4.60	13.23	

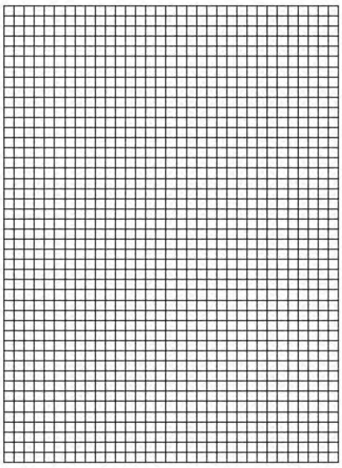
9.1.5 Calcolo numerico vetro - carico verso il basso (neve) - 10+10 SGP

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm SGP con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina a sbalzo - IT, Logli 10+10 SGP - 1500mm | 09.02.2021 | Seite: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	Borderpoint mm	Arccenter mm	Arccenter mm	Direction of rotation +/-
1	0.00	0.00			
2	1000.00	0.00			

3	1000.00	1361.00
4	0.00	1361.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 30.0 mm
Number of elements : 1485

Number of nodes : 6097 (per package)
Number of unknown : 54270

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm	
1	0.00	0.00	0.00	(min)
	500.00	1361.00	8.04	(max)

Maximum principal stress:

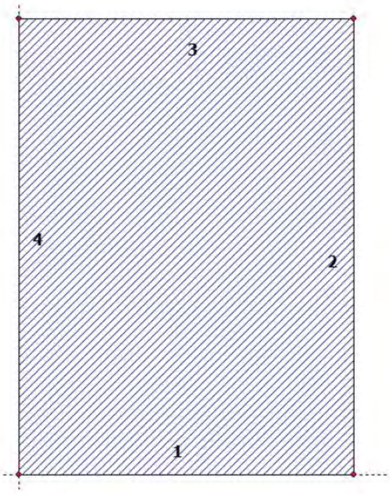
Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	488.26	1327.35	0.31	1.15
		(bottom)	166.67	3.41	1.15	
1	1	(top)	3.42	3.41	5.11	14.39
		(bottom)	500.00	3.41	14.39	

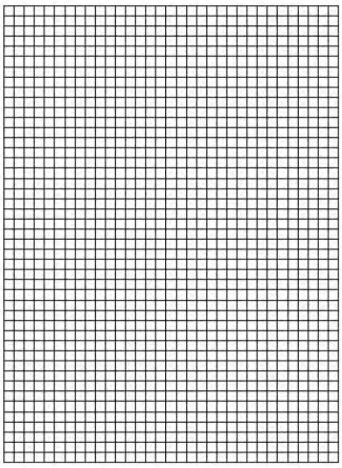
9.1.6 Calcolo numerico vetro - carico verso il basso (neve) - 8+8+4 SGP

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 +4 temprato + 0,76 mm SGP con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina a sbalzo - IT, Logli 8+8+4 SGP - 1500mm — 09.02.2021, Seite: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	Borderpoint mm	Arccenter mm	Arccenter mm	Direction of rotation +/-
1	0.00	0.00			
2	1000.00	0.00			

3	1000.00	1361.00
4	0.00	1361.00

Supports:

Edge supports:

Edge	Type of supports
1	w,u,v,φ,θ: fixed (all d.o.f supported and clamped)

Layers:

Layer order:

Package	Layer	Description
1	5	ESG
1	4	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	5	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	4	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	4.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 30.0 mm
Number of elements	: 1485
Number of nodes	: 6097 (per package)
Number of unknown	: 78390

Calculation results:

Minimum and maximum displacements w:

Package	- Position- x mm	y mm	Displacement w mm	
1	0.00	15.12	-0.00	(min)
	500.00	1361.00	7.57	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	5	(top)	511.74	1334.16	0.29	0.45
		(bottom)	3.42	26.84	0.45	
1	3	(top)	3.42	3.41	1.85	8.80
		(bottom)	500.00	3.41	8.80	
1	1	(top)	3.42	3.41	11.22	13.83
		(bottom)	500.00	3.41	13.83	

9.1.7 Calcolo numerico vetro - carico verso il basso (neve) - 10+10 SGP -EDGE

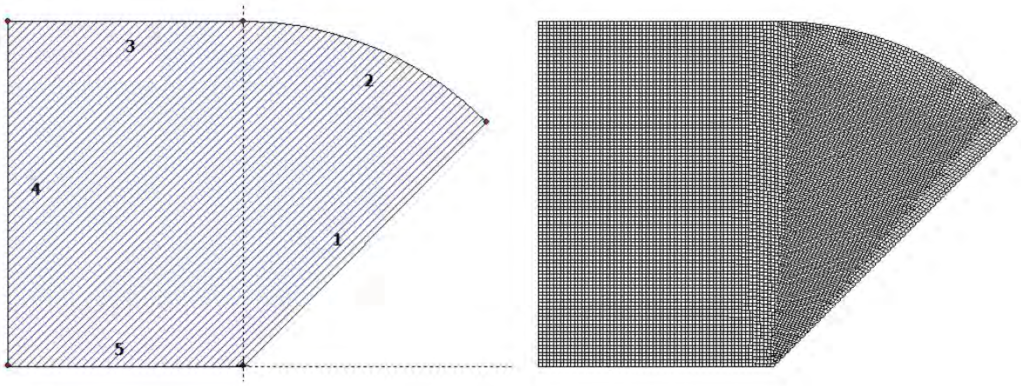
Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm SGP con un carico distribuito unitario verso il basso di pu = 1.0 kN/m² sull'intera area della lastra.

Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili (Q) di vento e neve secondo AbP Nr.Z-70.3-170 è considerato, per i carichi permanenti (G) nessun trasferimento di taglio è considerato.

La lastra è situata nell'angolo – tipologia 2A.

Projekt: 21015 Pensilina Logli - DOWNWARD_EDGE_VAR2A - E_10+10_SGP_G_1500 — 14.04.2021, Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint		Arccenter		Direction of rotation
	mm	mm	mm	mm	+/-
1	0.00	0.00			
2	1038.00	1038.00	0.00	0.00	(+)
3	0.00	1467.95			
4	-1000.00	1468.00			
5	-1000.00	0.00			

Supports:

Elastic line supports:

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Projekt: 21015 Pensilina Logli - DOWNWARD_EDGE_VAR2A - E_10+10_SGP_G_1500 14.04.2021
Seite: 3

Element size	: 15.0 mm
Number of elements	: 11623
Number of nodes	: 46895 (per package)
Number of unknown	: 422055

Calculation results:

Minimum and maximum displacements w:

Package	x (mm)	y (mm)	w (mm)
	- Position-		Displacement
1	80.26	80.26	-0.16 (min)
	469.46	1390.86	60.36 (max)

Maximum principal stress:

Package	Layer		x (mm)	y (mm)	σ (N/mm²)	σ (max) (N/mm²)
1	3	(top)	35.49	49.43	38.97	85.02
		(bottom)	50.07	106.61	85.02	
1	1	(top)	35.49	49.43	38.97	85.02
		(bottom)	50.07	106.61	85.02	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ (N/mm²)	Reactionforce (Fz) N
1	7.989 (max)	29016.74
	-4.412 (min)	
2	-0.890 (max)	-26702.54
	-16.987 (min)	

Extreme values:

x (mm)	y (mm)	σ (N/mm²)
29.51	107.00	7.989 (max)
37.52	48.00	-16.987 (min)

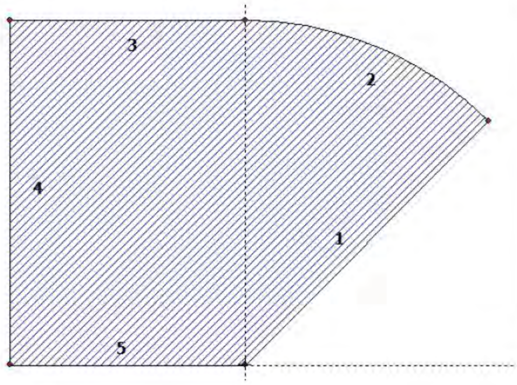
Springs:

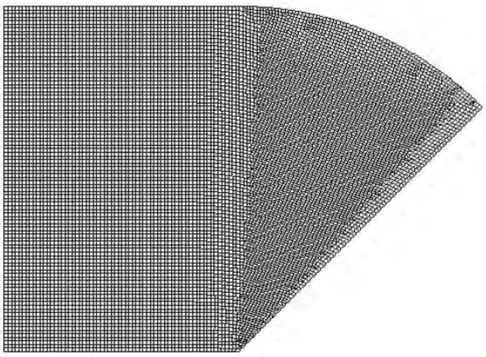
Package (x / y)	Layer	u (mm)	v (mm)	w (mm)	φ (rad)	θ (rad)	Fx (N)	Fy (N)	Fz (N)	M_φ (Nmm)	M_θ (Nmm)

Projekt: 21015 Pensilina Logli - DOWNWARD_EDGE_VAR2A - E_10+10_SGP_G_1500 14.04.2021
Seite: 4

Package (x / y)	Layer	u (mm)	v (mm)	w (mm)	φ (rad)	θ (rad)	Fx (N)	Fy (N)	Fz (N)	M_φ (Nmm)	M_θ (Nmm)
(0.00 / 0.00)											
1	1	-0.00	0.00	0.08	-0.0001	0.0018	-0.00	0.00	0.00	-0.00	0.00
(-1000.00 / 0.00)											
1	1	-0.00	0.00	0.02	-0.0000	0.0005	-0.00	0.00	0.00	-0.00	0.00

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint x (mm)	Borderpoint y (mm)	Arccenter x (mm)	Arccenter y (mm)	Direction of rotation +/-
1	0.00	0.00			
2	1038.00	1038.00	0.00	0.00	(+)
3	0.00	1467.95			
4	-1000.00	1468.00			
5	-1000.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	-1000.00	107.00	107.00	107.00	3000.00	10.00	4.00	0
2	-1000.00	48.00	48.00	48.00	3000.00	10.00	4.00	0

Spring supports:

Package	Layer	x mm	y mm	z mm	C_x N/mm	C_y N/mm	C_z N/mm	C_φ Nmm	C_θ Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	-1000.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

```
Element size          : 15.0 mm
Number of elements    : 11623
Number of nodes       : 46895 (per package)
Number of unknown     : 422055
```

Calculation results:

Minimum and maximum displacements w:

```
              - Position-   Displacement
Package          x        y         w
_____________mm_______mm_______mm______
1             74.91    74.91    -0.06 (min)
             455.07  1395.64    15.44 (max)
```

Maximum principal stress:

```
Package Layer                x         y          σ          σ (max)
___________________________mm________mm_________N/mm²______N/mm²_
1        3  (top)          35.49     49.43      16.52      20.40
            (bottom)       30.04    104.47      20.40
1        1  (top)          39.21     47.06      24.89      44.12
            (bottom)       10.42    107.59      44.12
```

Extreme stresses and reaction force in the elastic line supports:

```
 Nr.             σ          Reactionforce
____________N/mm²_______________(Fz) N_
 1            5.361 (max)       29016.74
             -1.205 (min)
 2           -1.375 (max)      -26702.54
             -9.832 (min)

 Extreme values:
       x        y             σ
______mm_______mm_________N/mm²______
   29.51   107.00         5.361 (max)
   37.52    48.00        -9.832 (min)
```

Springs:

```
Package Layer  u        v        w       φ       θ        Fx         Fy         Fz          M_φ          M_θ
(x / y)_______mm_______mm_______mm_____rad_____rad_________N__________N__________N__________Nmm__________Nmm_
```



```
(     0.00 /     0.00 )
1      1    -0.00    -0.00    -0.02 -0.0001 -0.0006    -0.00      -0.00      -0.00       -0.00        -0.00
(-1000.00 /     0.00 )
1      1    -0.00     0.00    -0.01 -0.0000 -0.0003    -0.00       0.00      -0.00       -0.00        -0.00
```

Projekt: 21015 Pensilina Logli - DOWNWARD_EDGE_VAR2A - E_10+10_SGP_G_1500 14.04.2021
Seite: 2

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	-1000.00	107.00	107.00	107.00	3000.00	10.00	4.00	0
2	-1000.00	48.00	48.00	48.00	3000.00	10.00	4.00	0

Spring supports:

Package	Layer	x mm	y mm	z mm	C_x N/mm	C_y N/mm	C_z N/mm	C_φ Nmm	C_θ Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	-1000.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf EG, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

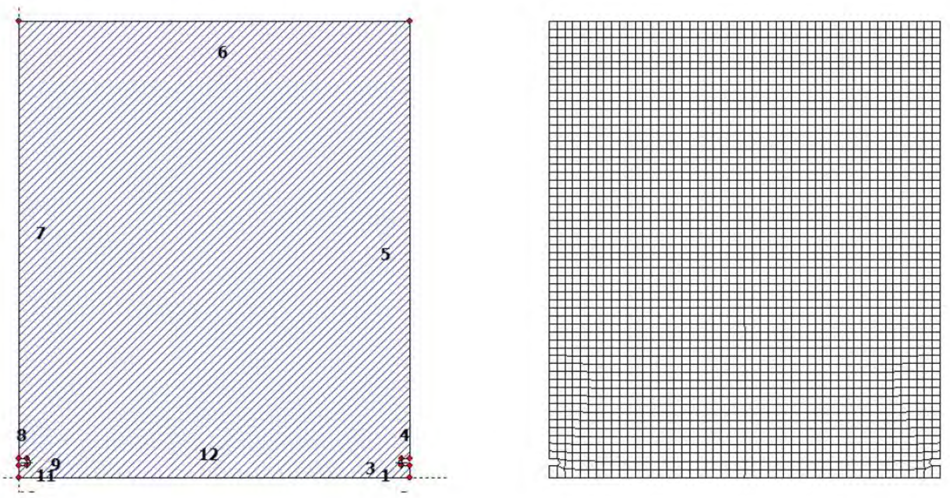
Characteristics of the finite element mesh:

9.1.9 Calcolo numerico vetro - carico verso alto (vento) - 8+8 PVB

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 temprato + 0,76 mm PVB con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica.
Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Progetto: 21015 Pensilina a sbalzo - IT, Logli 8+8 PVB Upward loads - 1200mm — 14.04.2021, Pagina: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

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3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1167.00			
7	0.00	1167.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	4000.00	10.00	4.00	0
2	0.00	10.00	1000.00	10.00	4000.00	10.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 20.0 mm
Number of elements : 2848
Number of nodes : 11611 (per package)
Number of unknown : 104499

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm	
1	10.00	30.00	-0.01	(min)
	500.00	1167.00	33.37	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	2.25	50.29	3.01	39.27
		(bottom)	969.78	38.49	39.27	
1	1	(top)	2.25	50.29	3.01	39.27
		(bottom)	969.78	38.49	39.27	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²		Reactionforce (Fz) N
1	2.586	(max)	17611.77
	-2.042	(min)	
2	-0.260	(max)	-16445.71
	-1.736	(min)	

Extreme values:

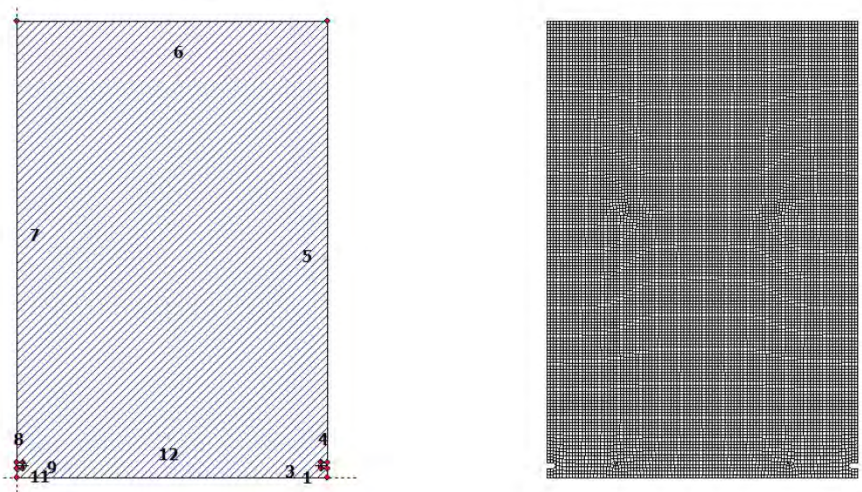
9.1.10 Calcolo numerico vetro - carico verso alto (vento) - 10+10 PVB

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm PVB con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina Logli - UPWARD - 10+10 PVB 1500mm

14.04.2021
Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	Borderpoint mm	Arccenter mm	Arccenter mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

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3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1467.00			
7	0.00	1467.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	10000.00	5.00	4.00	0
2	0.00	10.00	1000.00	10.00	10000.00	5.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 10.0 mm
Number of elements : 14356
Number of nodes : 57925 (per package)
Number of unknown : 521325

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm	
1	26.36	32.64	-0.01	(min)
	500.00	1467.00	43.93	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	11.13	49.04	5.53	44.37
		(bottom)	28.71	42.03	44.37	
1	1	(top)	11.13	49.04	5.53	44.37
		(bottom)	28.71	42.03	44.37	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²		Reactionforce (Fz) N
1	7.347	(max)	27930.17
	-5.973	(min)	
2	-0.952	(max)	-26464.14
	-5.628	(min)	

Extreme values:

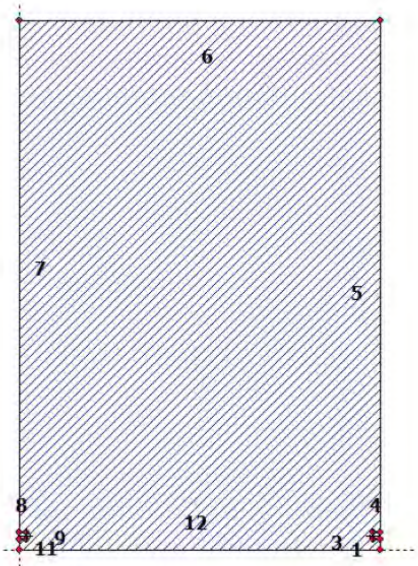
x mm	y mm	σ N/mm²	
50.00	48.00	7.347	(max)
10.00	48.00	-5.973	(min)

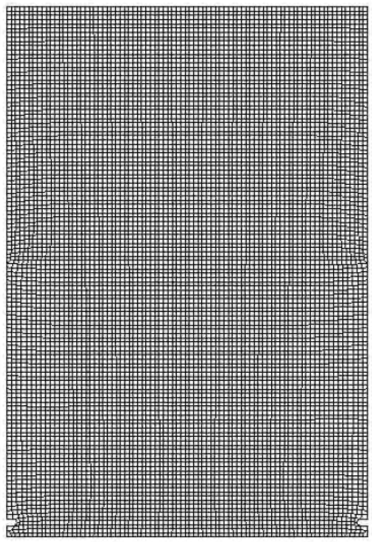
9.1.11 Calcolo numerico vetro - carico verso alto (vento) - 8+8+4 PVB

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 +4 temprato + 0,76 mm PVB con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare PVB nessun trasferimento di taglio è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina Logli - UPWARD - 8+8+4 PVB 1500mm 14.04.2021
Seite: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

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3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1467.00			
7	0.00	1467.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	10000.00	5.00	4.00	0
2	0.00	10.00	1000.00	10.00	10000.00	5.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	5	Glass, fully toughened
1	4	PVB long time loading
1	3	Glass, fully toughened
1	2	PVB long time loading
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	5	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	4	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	0.00	0.50	0.76	1070.00	8.0000e-05	0.00
1	1	70000.00	0.23	4.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 12.0 mm
Number of elements : 10160
Number of nodes : 41055 (per package)
Number of unknown : 533715

Calculation results:

Minimum and maximum displacements w:

Package	Position- x mm	y mm	Displacement w mm	
1	973.64	32.64	-0.02	(min)
	500.00	1467.00	80.51	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	5	(top)	976.91	30.42	15.73	65.27
		(bottom)	970.50	40.89	65.27	
1	3	(top)	976.91	30.42	15.73	65.27
		(bottom)	970.50	40.89	65.27	
1	1	(top)	976.91	30.42	6.31	33.05
		(bottom)	970.50	40.89	33.05	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²	Reactionforce (Fz) N

1	7.679 (max)	27918.72
	-7.196 (min)	
2	-0.818 (max)	-26452.69
	-5.698 (min)	

Extreme values:

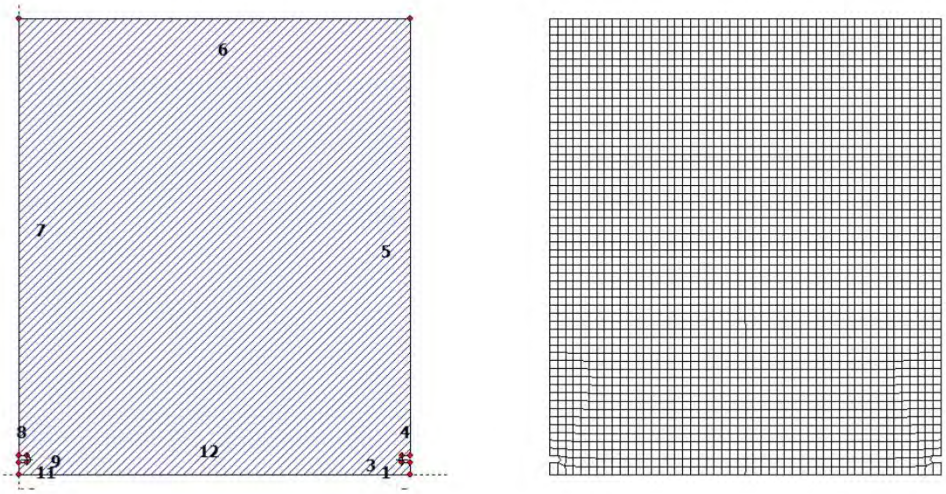
x mm	y mm	σ N/mm²
950.00	48.00	7.679 (max)
990.00	48.00	-7.196 (min)

9.1.12 Calcolo numerico vetro - carico verso alto (vento) - 8+8 SGP

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 temprato + 0,76 mm SGP con un carico distribuito unitario verso l’alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica.
Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l’intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina a sbalzo - IT, Logli 8+8 SGP Upward loads - 1200mm | 14.04.2021 Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

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3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1167.00			
7	0.00	1167.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	4000.00	10.00	4.00	0
2	0.00	10.00	1000.00	10.00	4000.00	10.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 20.0 mm
Number of elements : 2848
Number of nodes : 11611 (per package)
Number of unknown : 104499

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm
1	400.02	31.57	-0.00 (min)
	500.00	1167.00	8.46 (max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	962.27	2.75	1.95	9.98
		(bottom)	974.56	45.61	9.98	
1	1	(top)	17.75	26.62	4.67	30.65
		(bottom)	30.22	38.49	30.65	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²	Reactionforce (Fz) N
1	2.109 (max)	17611.77
	-1.063 (min)	
2	-0.409 (max)	-16445.71
	-1.733 (min)	

Extreme values:

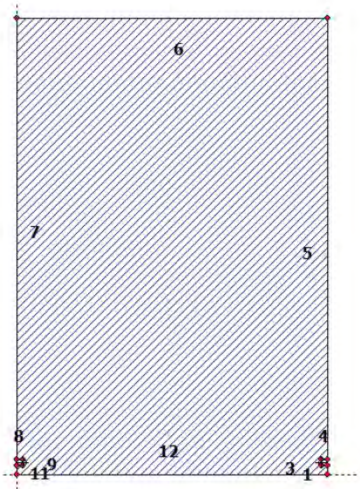
x mm	y mm	σ N/mm²	
50.00	48.00	2.109	(max)
510.00	10.00	-1.733	(min)

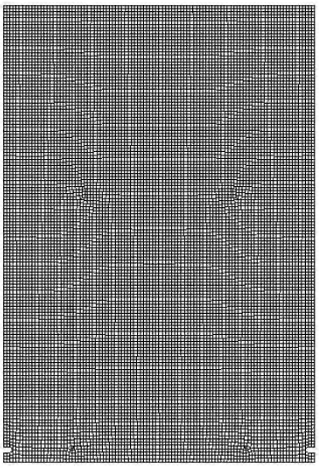
9.1.13 Calcolo numerico vetro - carico verso alto (vento) - 10+10 SGP

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm SGP con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina Logli - UPWARD - 10+10 SGP 1500mm | 14.04.2021
Seite: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1467.00			
7	0.00	1467.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	10000.00	5.00	4.00	0
2	0.00	10.00	1000.00	10.00	10000.00	5.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:

- constant distributed:

Package pressure

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 10.0 mm
Number of elements : 14356
Number of nodes : 57925 (per package)
Number of unknown : 521325

Calculation results:

Minimum and maximum displacements w:

Package	Position x mm	Position y mm	Displacement w mm
1	0.00	48.00	-0.00 (min)
	500.00	1467.00	11.40 (max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	11.13	49.04	2.80	11.66
		(bottom)	211.11	48.03	11.66	
1	1	(top)	528.94	9.55	4.63	34.99
		(bottom)	28.71	42.03	34.99	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²	Reactionforce (Fz) N
1	6.224 (max)	27930.17
	-3.057 (min)	
2	-1.357 (max)	-26464.14
	-5.614 (min)	

Extreme values:

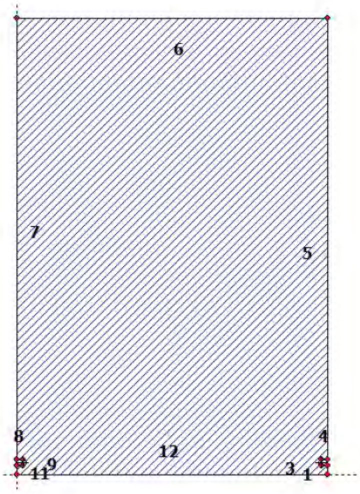
x mm	y mm	σ N/mm²	
50.00	48.00	6.224	(max)
590.00	10.00	-5.614	(min)

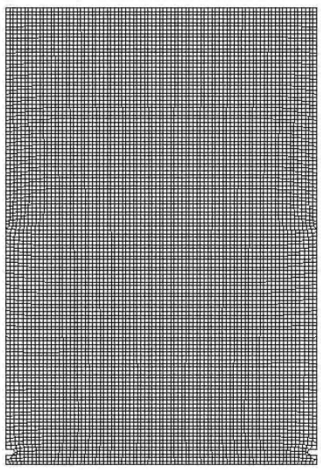
9.1.14 Calcolo numerico vetro - carico verso alto (vento) - 8+8+4 SGP

Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 8 + 8 + 4 temprato + 0,76 mm SGP con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra, considerando i fori laterali per la ritenuta meccanica. Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato. La larghezza della lastra è sempre di 1.0 m per le verifiche del vetro.

Projekt: 21015 Pensilina Logli - UPWARD - 8+8+4 SGP 1500mm | 14.04.2021 Seite: 1

SJ MEPLA Calculation protocol:





Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	1000.00	0.00			
2	1000.00	30.00			

Projekt: 21015 Pensilina Logli - UPWARD - 8+8+4 SGP 1500mm 14.04.2021 Seite: 2

3	980.00	30.00	980.00	39.00	(-)
4	980.00	48.00			
5	1000.00	48.00			
6	1000.00	1467.00			
7	0.00	1467.00			
8	0.00	48.00			
9	20.00	48.00	20.00	39.00	(-)
10	20.00	30.00			
11	0.00	30.00			
12	0.00	0.00			

Supports:

Elastic line supports:

Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	0.00	48.00	1000.00	48.00	10000.00	5.00	4.00	0
2	0.00	10.00	1000.00	10.00	10000.00	5.00	4.00	0

Layers:

Layer order:

Package	Layer	Description
1	5	ESG
1	4	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	5	70000.00	0.23	4.00	2550.00	1.0000e-05	0.00
1	4	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	3	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	8.00	2550.00	1.0000e-05	0.00

Loads:

Projekt: 21015 Pensilina Logli - UPWARD - 8+8+4 SGP 1500mm 14.04.2021 Seite: 3

Face loads:

- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:

small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size	: 12.0 mm
Number of elements	: 10160
Number of nodes	: 41055 (per package)
Number of unknown	: 533715

Calculation results:

Minimum and maximum displacements w:

Package	- Position- x mm	y mm	Displacement w mm
1	963.86	0.00	-0.00 (min)
	500.00	1467.00	11.31 (max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	5	(top)	976.91	30.42	8.63	8.63
		(bottom)	23.01	47.97	7.75	
1	3	(top)	976.91	30.42	6.05	17.73
		(bottom)	970.50	40.89	17.73	
1	1	(top)	972.36	30.95	8.80	38.34
		(bottom)	970.50	40.89	38.34	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²	Reactionforce (Fz) N

Projekt: 21015 Pensilina Logli - UPWARD - 8+8+4 SGP 1500mm

14.04.2021
Seite: 4

1	6.257 (max)	27920.16
	-2.965 (min)	
2	-1.364 (max)	-26454.13
	-5.691 (min)	

Extreme values:

x mm	y mm	σ N/mm²
950.00	48.00	6.257 (max)
490.00	10.00	-5.691 (min)

9.1.15 Calcolo numerico vetro - carico verso alto (vento) - 10+10 SGP -EDGE

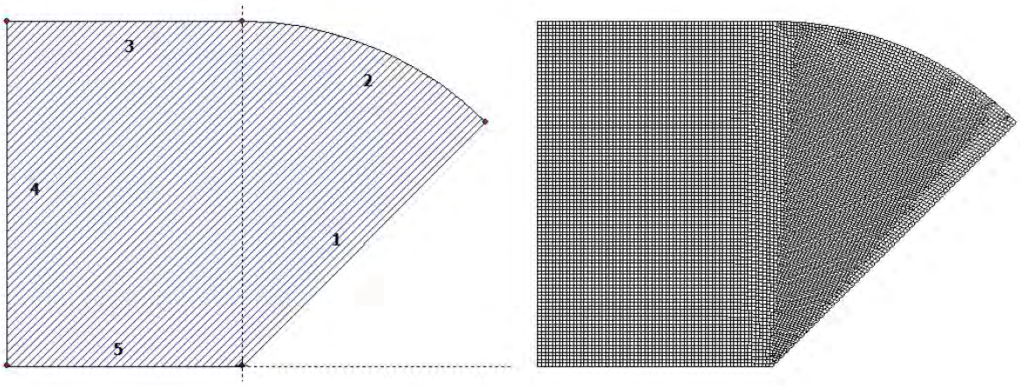
Di seguito è riportato un esempio del calcolo del vetro con il software SJ Mepla per una lastra in vetro 10 + 10 temprato + 0,76 mm SGP con un carico distribuito unitario verso l'alto di pu = 1.0 kN/m² sull'intera area della lastra senza fori per la ritenuta meccanica.

Per tutte le altre lunghezze delle lastre i calcoli vengono eseguiti in modo simile solo con una variazione della lunghezza del vetro. Per l'intercalare SGP un trasferimento di taglio per i carichi variabili di vento e neve secondo AbP Nr.Z-70.3-170 è considerato.

La lastra è situata nell'angolo - tipologia 2A.

Projekt: 21015 Pensilina Logli - UPWARD_EDGE_VAR2A - E_10+10_SGP_Q_1500 | 14.04.2021 | Seite: 1

SJ MEPLA Calculation protocol:



Geometry:

Edge	Borderpoint mm	Borderpoint mm	Arccenter mm	Arccenter mm	Direction of rotation +/-
1	0.00	0.00			
2	1038.00	1038.00	0.00	0.00	(+)
3	0.00	1467.95			
4	-1000.00	1468.00			
5	-1000.00	0.00			

Supports:

Elastic line supports:

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Nr	from x	from y	to x	to y	E-modul N/mm²	Width mm	Height mm	Contact
1	-1000.00	10.50	10.50	10.50	3000.00	10.00	4.00	0
2	-1000.00	48.00	48.00	48.00	3000.00	10.00	4.00	0

Spring supports:

Package	Layer	x mm	y mm	z mm	C_x N/mm	C_y N/mm	C_z N/mm	C_φ Nmm	C_θ Nmm
1	1	0.0	0.0	0.0	1.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00
1	1	-1000.0	0.0	0.0	0.000e+00	1.000e+00	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	ESG
1	2	SG5000, 30°C, Überkopf Schnee, AbZ Z-70.3-170
1	1	ESG

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00
1	2	180.00	0.49	0.76	950.00	1.5000e-04	0.00
1	1	70000.00	0.23	10.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	1.00000e-03

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:

Element size : 15.0 mm
Number of elements : 11623
Number of nodes : 46895 (per package)
Number of unknown : 422055

Calculation results:

Minimum and maximum displacements w:

Package	Position- x mm	y mm	Displacement w mm
1	26.75	26.75	-0.05 (min)
	455.07	1395.64	19.74 (max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	-0.14	10.98	13.22	33.17
		(bottom)	-6.69	47.11	33.17	
1	1	(top)	-0.14	10.98	19.12	56.11
		(bottom)	-2.86	49.09	56.11	

Extreme stresses and reaction force in the elastic line supports:

Nr.	σ N/mm²	Reactionforce (Fz) N
1	-2.286 (max)	-45653.00
	-14.157 (min)	
2	9.255 (max)	47967.20
	-0.211 (min)	

Extreme values:

x mm	y mm	σ N/mm²
-25.36	48.00	9.255 (max)
0.40	10.50	-14.157 (min)

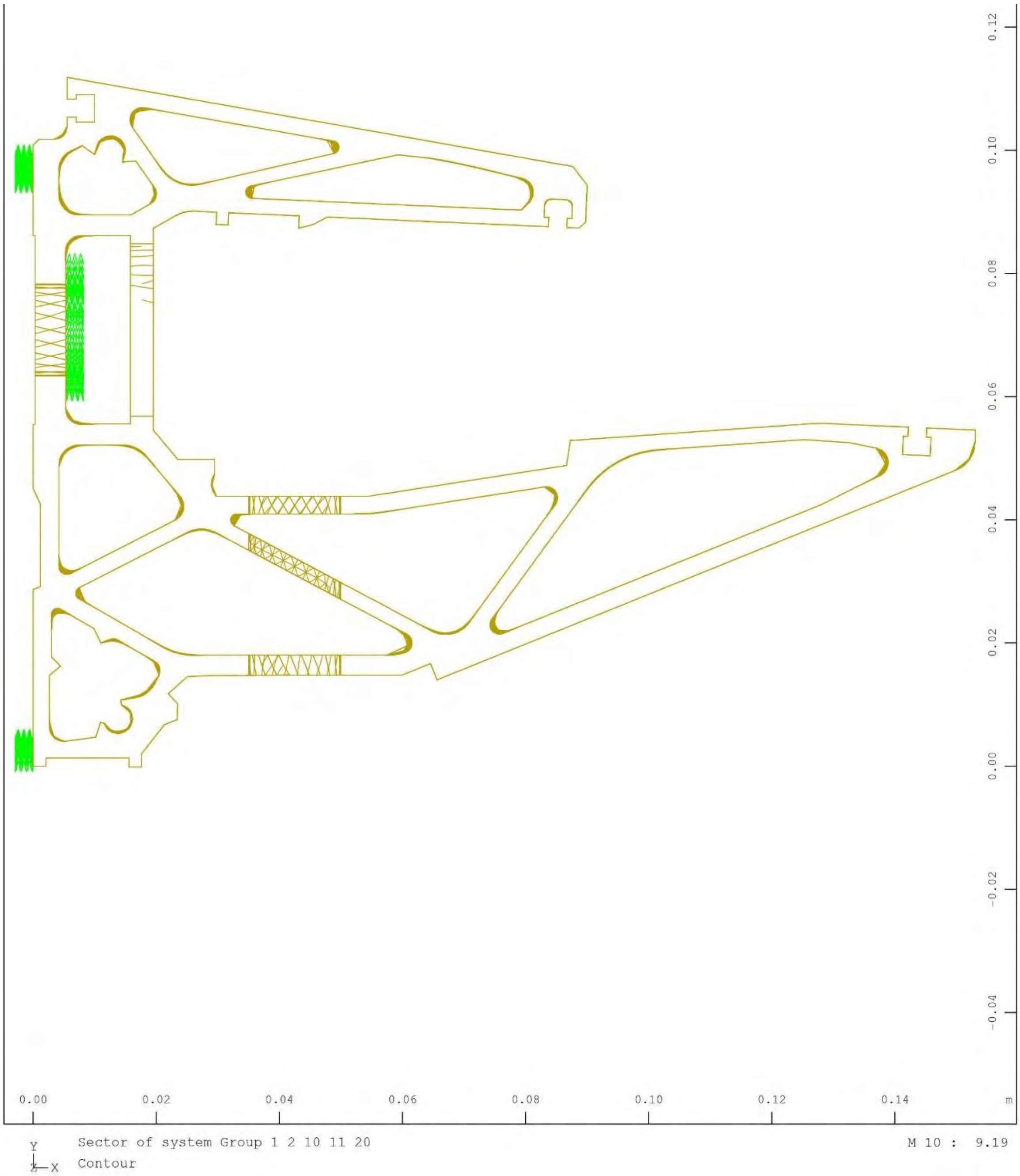
Springs:

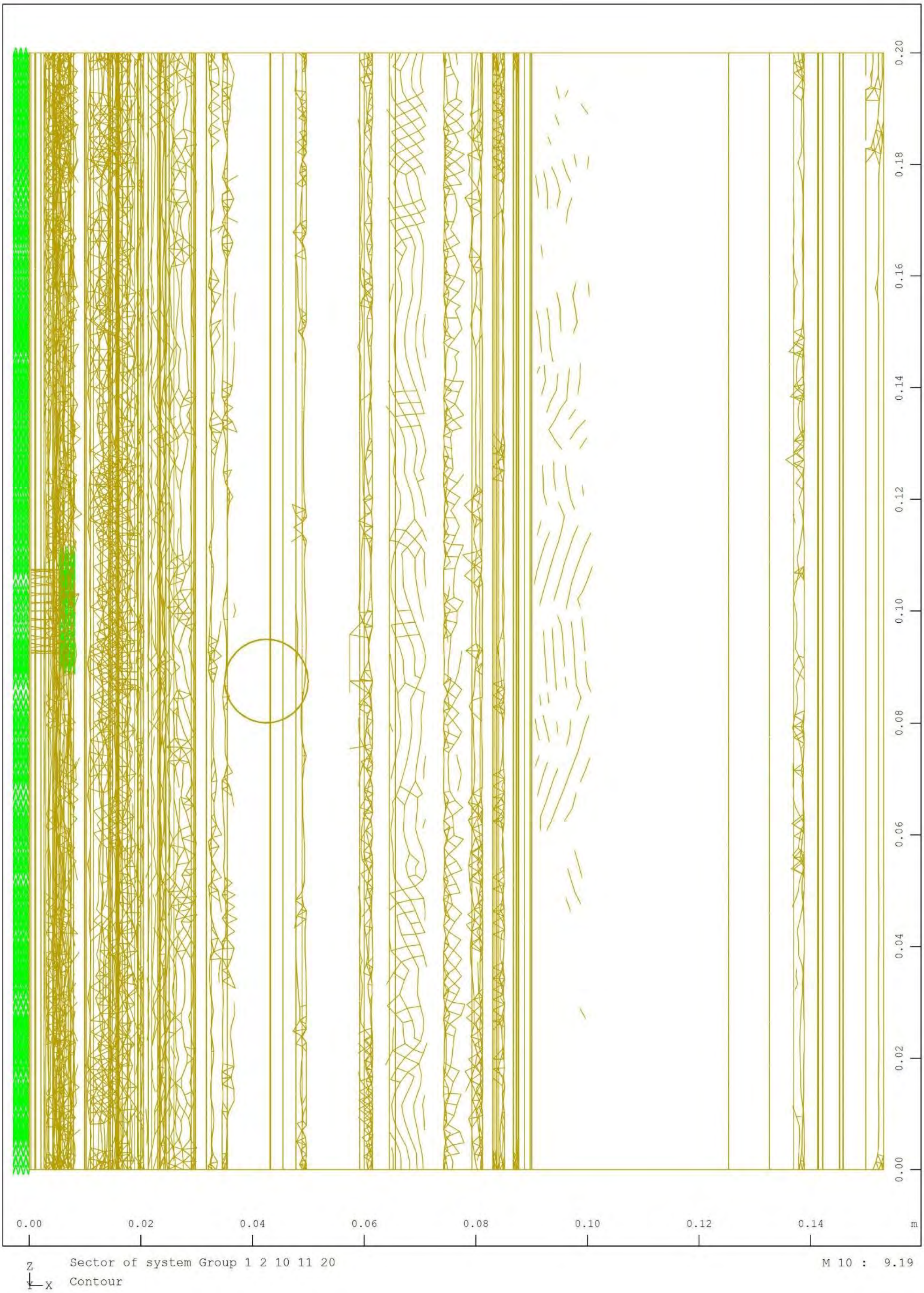
Package Layer (x / y)	u mm	v mm	w mm	φ rad	θ rad	Fx N	Fy N	Fz N	M_φ Nmm	M_θ Nmm

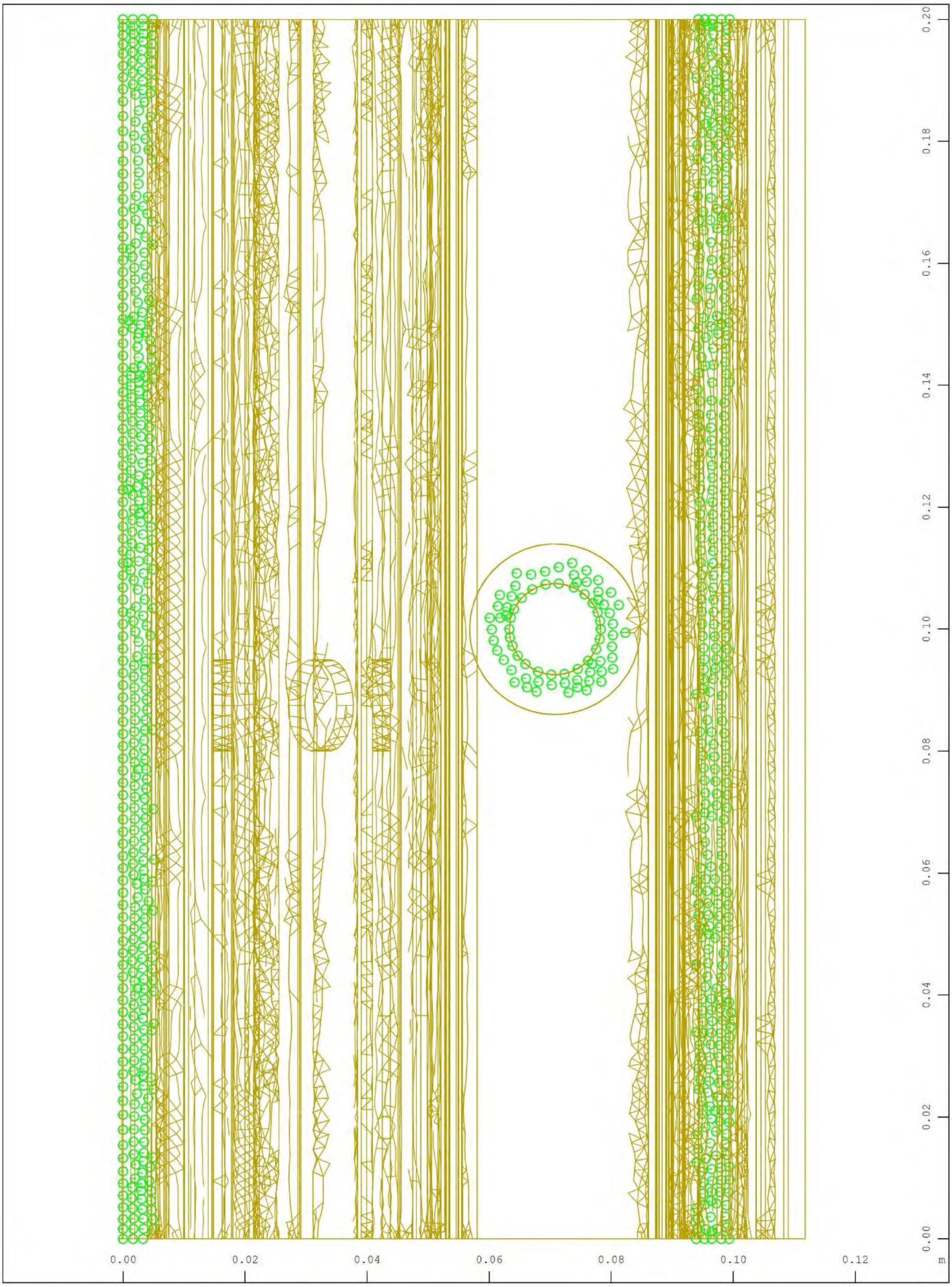
```
 (    0.00 /    0.00 )
 1    1   -0.00   -0.00   -0.02  0.0006 -0.0002   -0.00   -0.00   -0.00     0.00    -0.00
 (-1000.00 /    0.00 )
 1    1   -0.00    0.00   -0.01 -0.0001 -0.0001   -0.00    0.00   -0.00    -0.00    -0.00
```

9.2 Risultati calcolo numerico profili in alluminio

9.2.1 Calcolo numerico profilo - configurazione lineare - carichi verso il basso (neve)

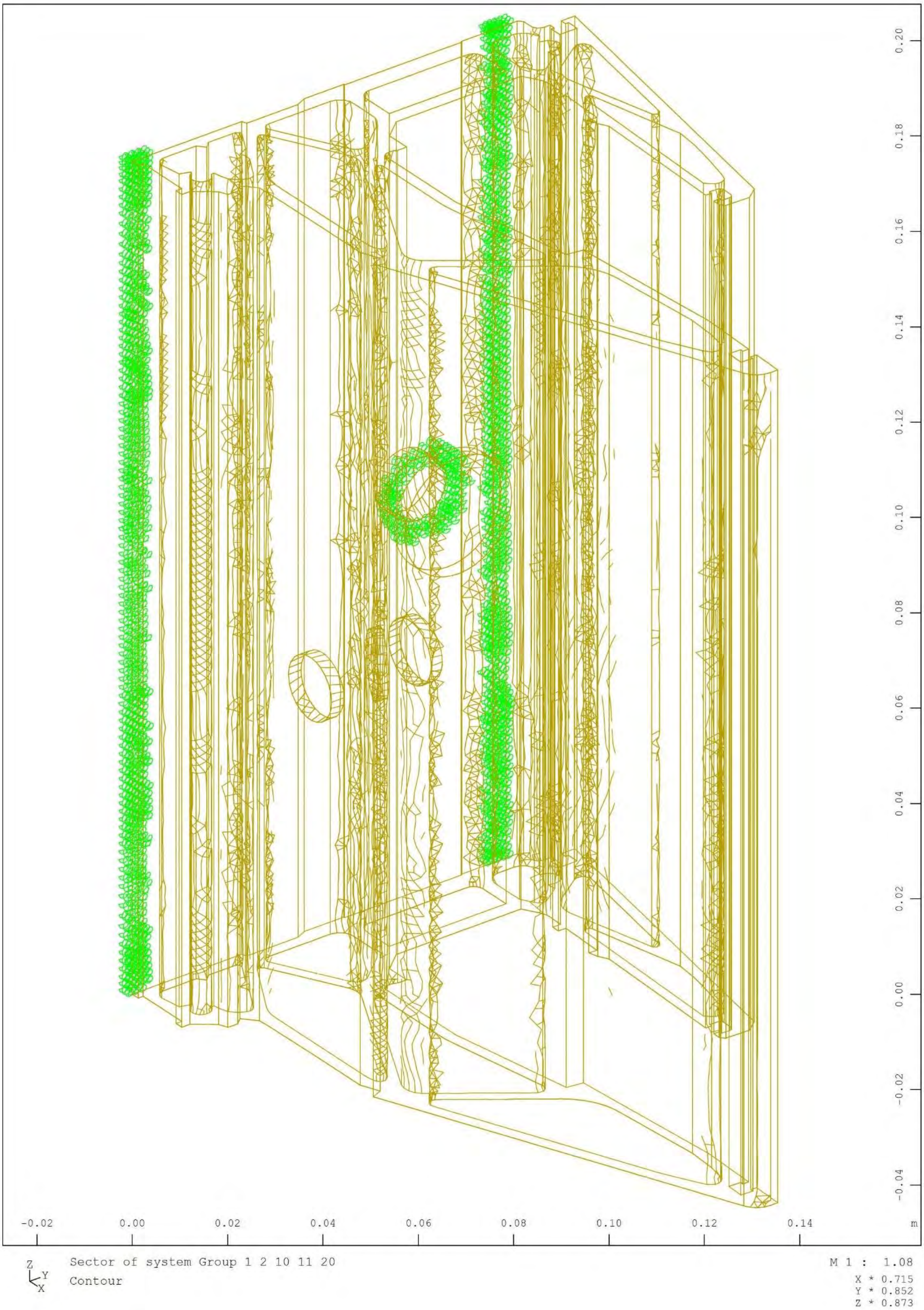


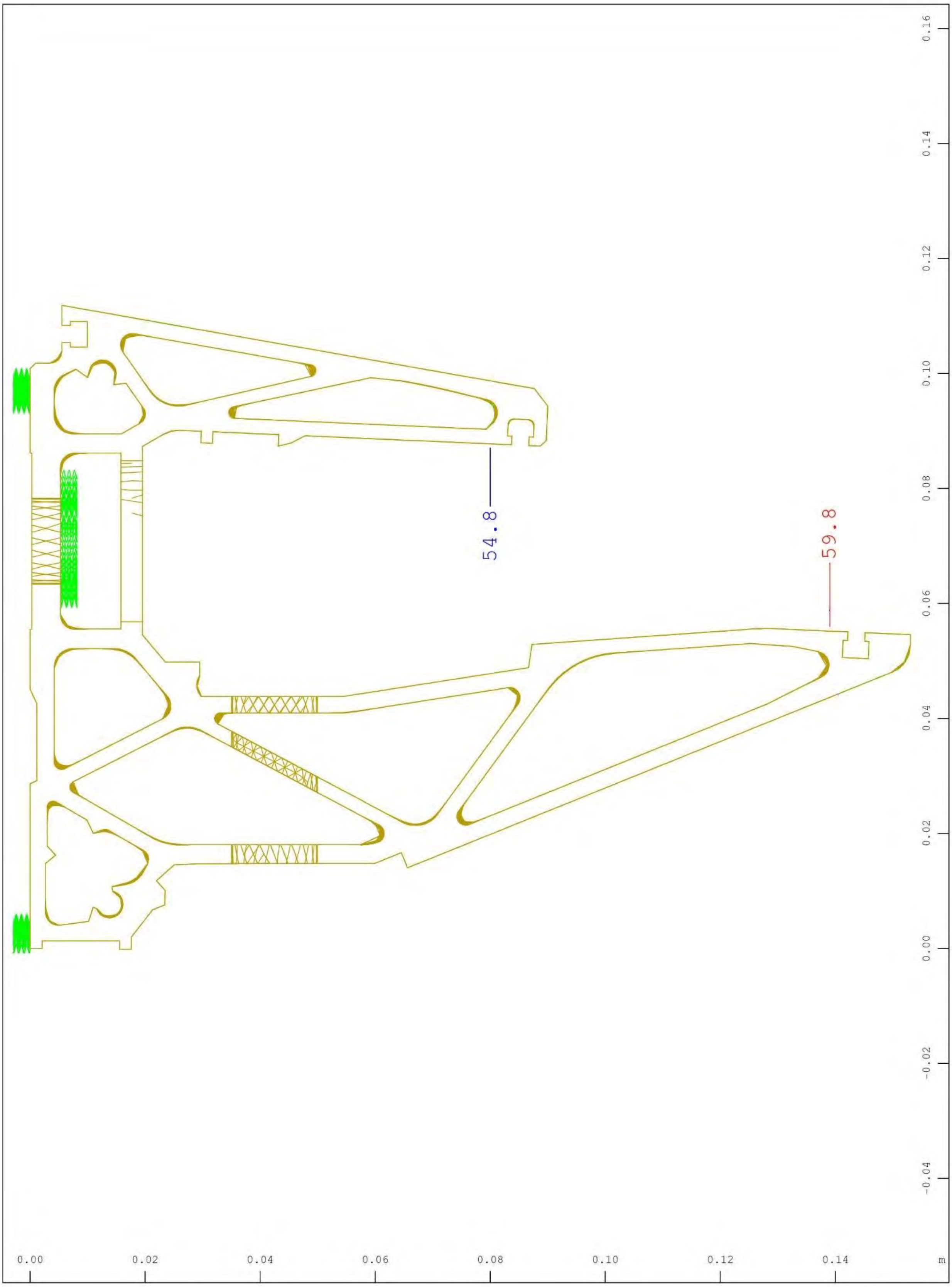

0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
m
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Z
X
Sector of system Group 1 2 10 11 20
Contour
M 10 : 9.19



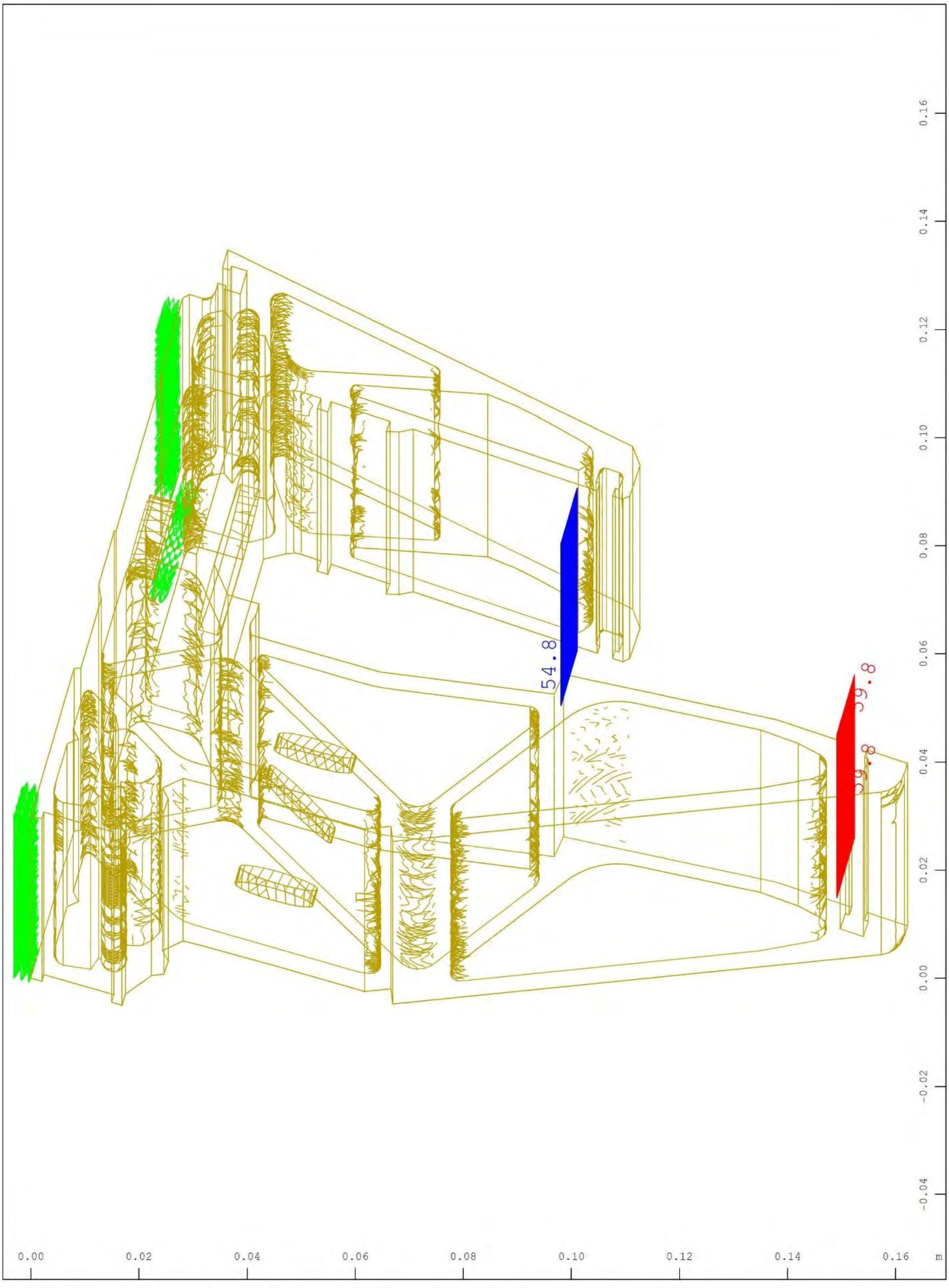
Z
X—Y
Sector of system Group 1 2 10 11 20
Contour

M 10 : 8.66


0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
m
Z
Y
X
Sector of system Group 1 2 10 11 20
Contour
M 1 : 1.08
X * 0.715
Y * 0.852
Z * 0.873

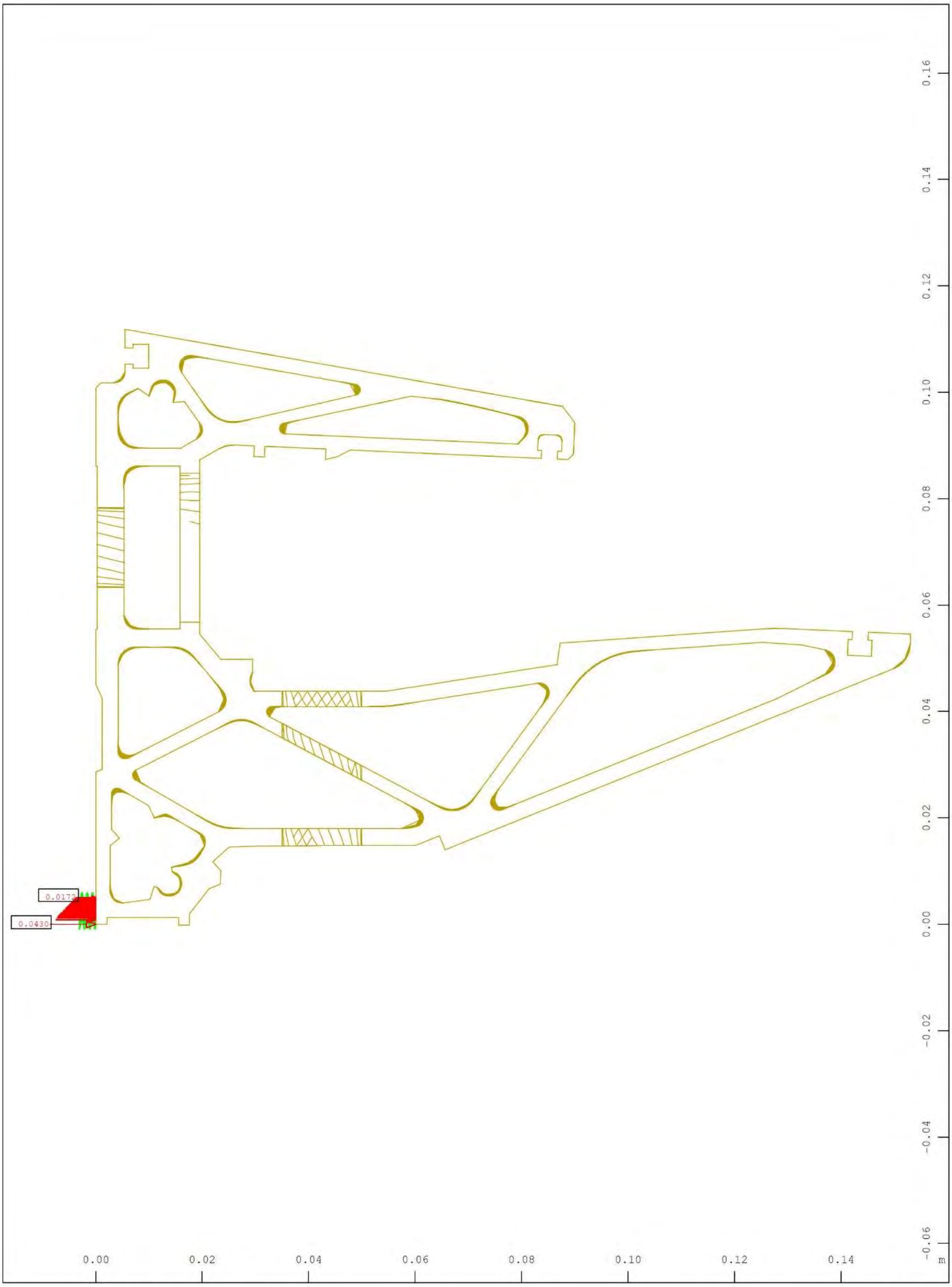


Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-59.8) (Max=54.8)

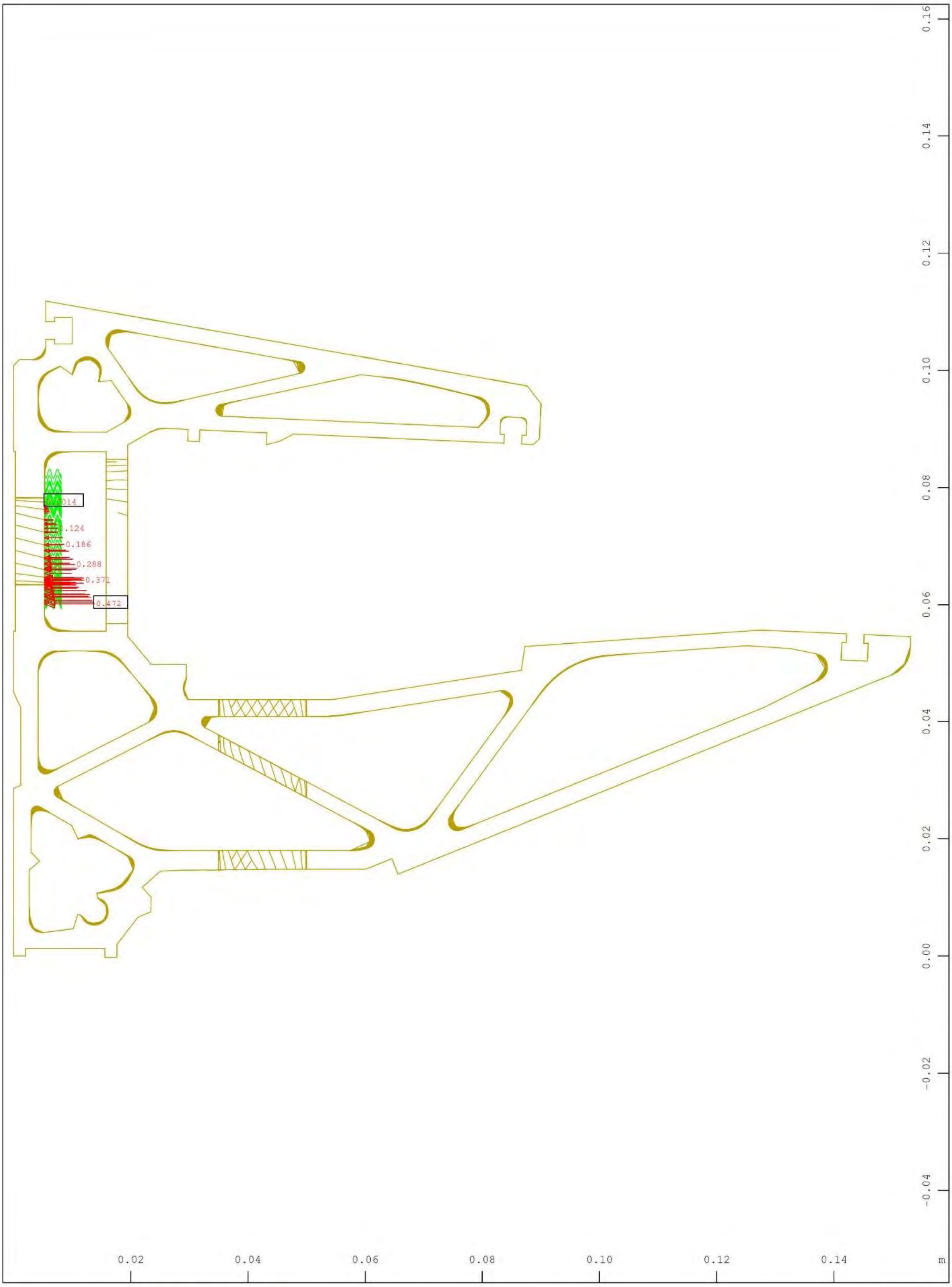


Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-59.8) (Max=54.8)

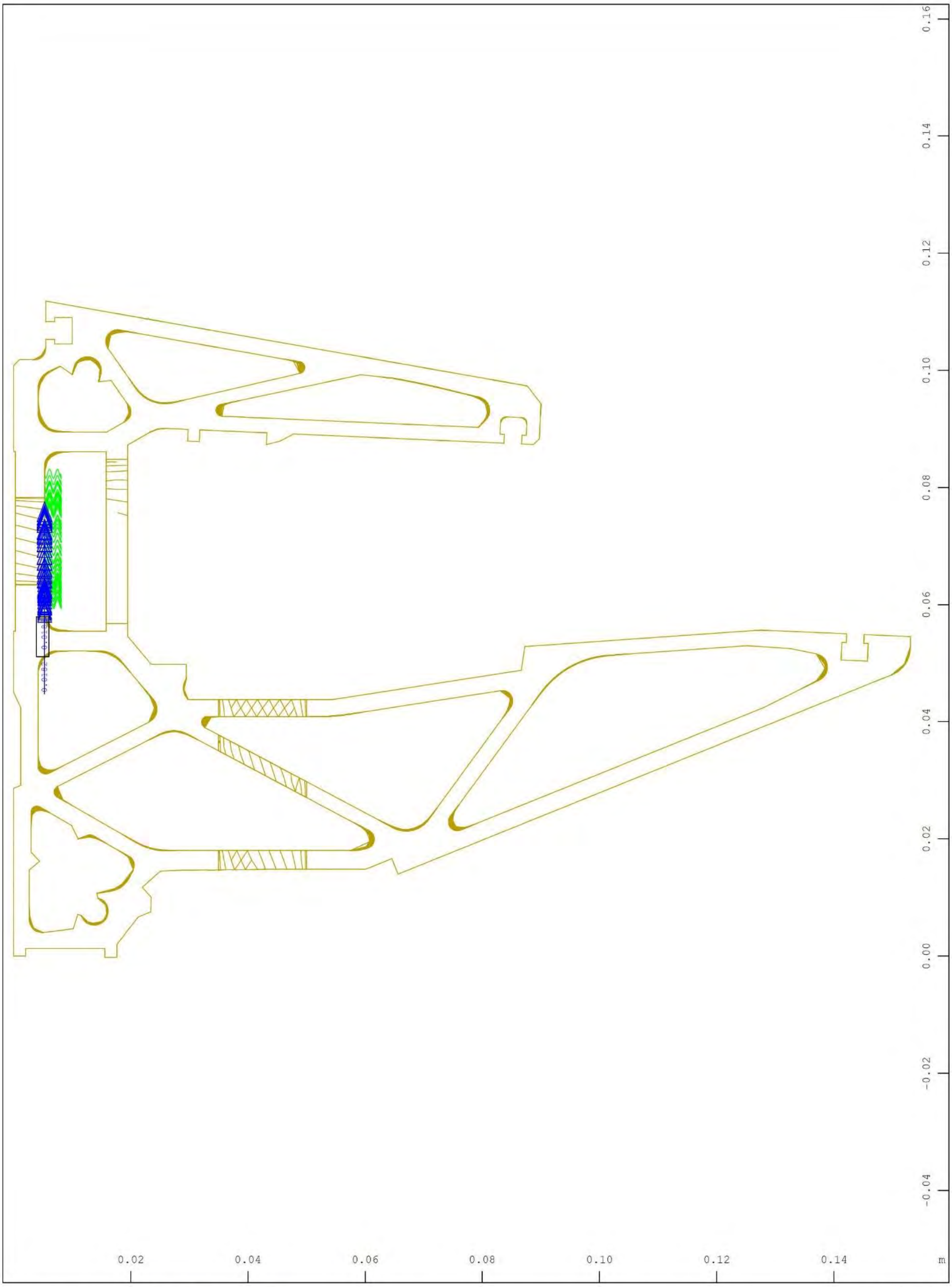
M 10 : 9.75
X * 0.999
Y * 0.990
Z * 0.150



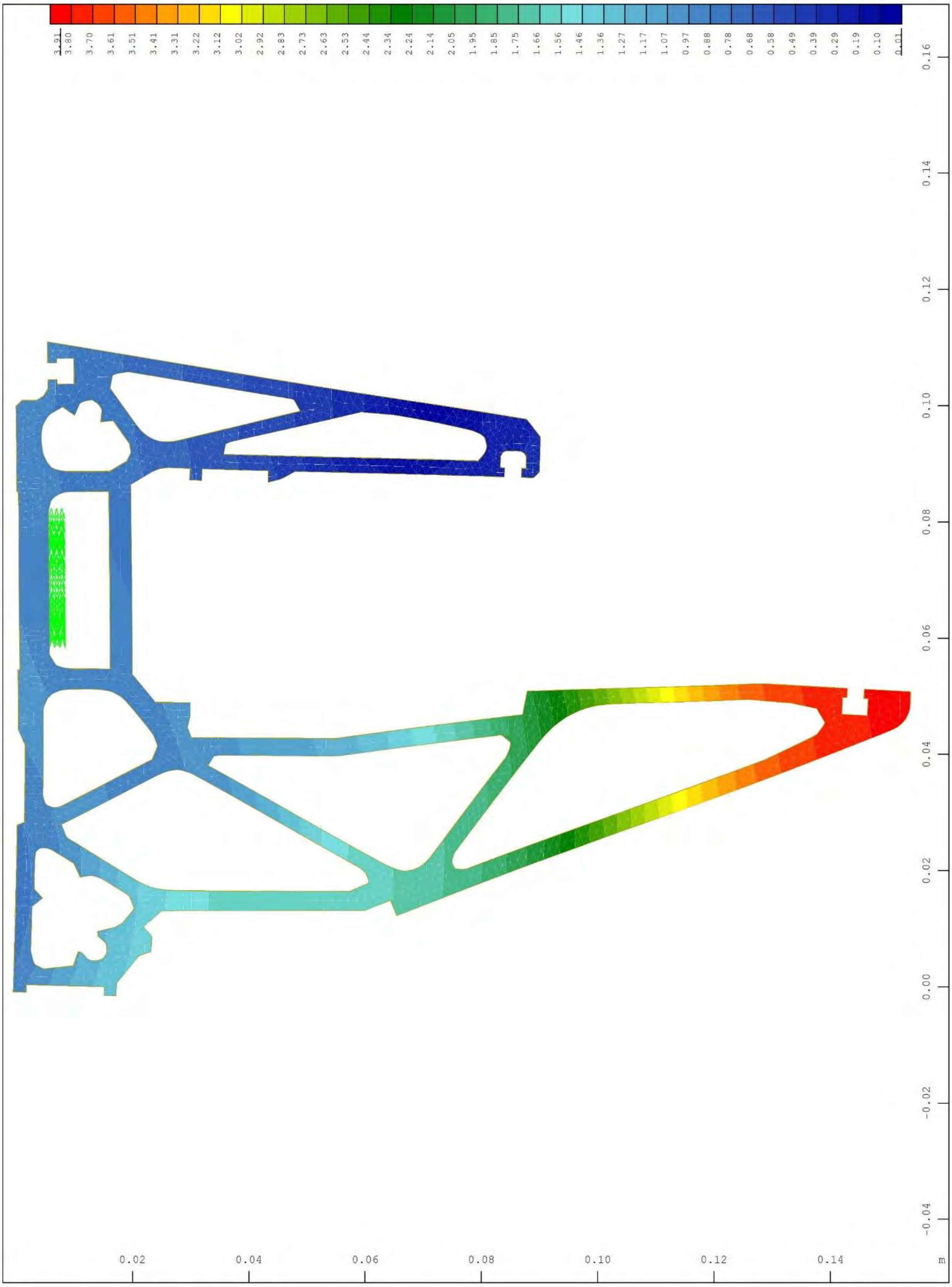
Sector of system Group 2 10 M 1 : 1
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.0500 kN
(Min=-0.0430) (Max=-0.0172) (total: -12.3)



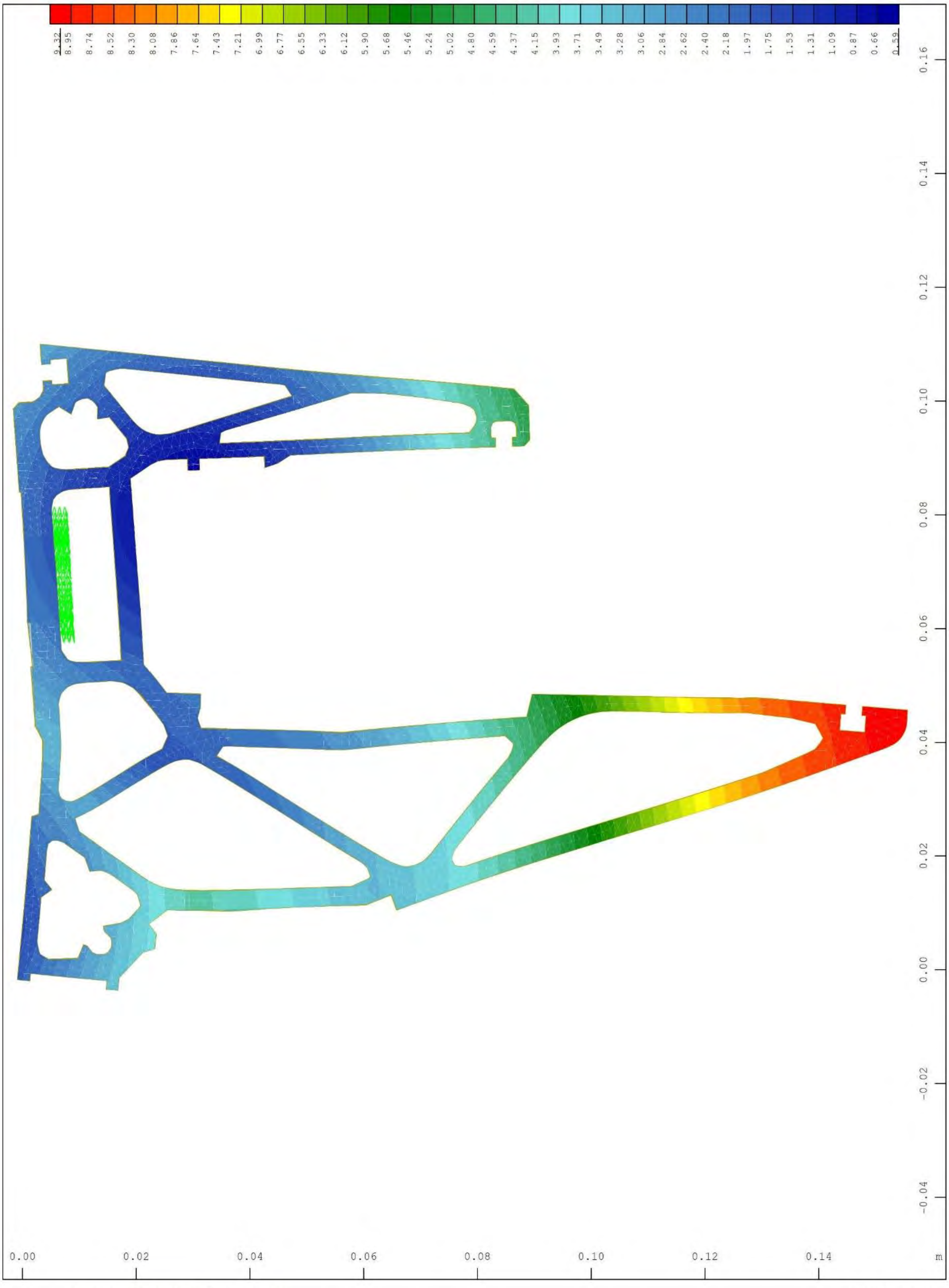
Y
Z—X Sector of system Group 2 20 M 10 : 9
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.500 kN
(Min=-0.472) (Max=0) (total: -12.3)



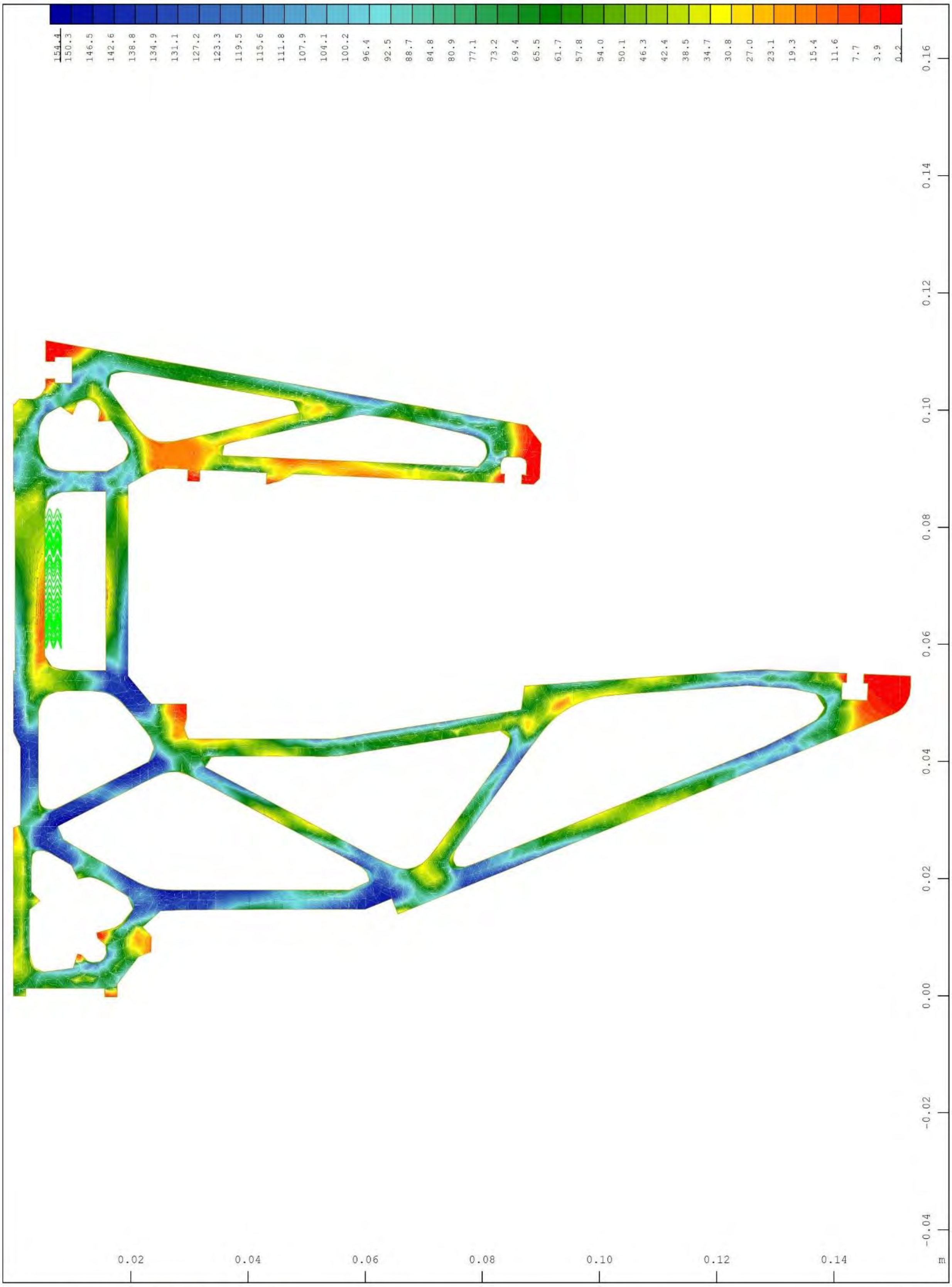
Y
Z—X
Sector of system Group 2 20
Supporting springs , Spring force in global Y, nonlinear Loadcase 10 ULS , 1 cm 3D =
0.0100 kN (Max=0.0185) (total: 0.999)
M 10 : 9



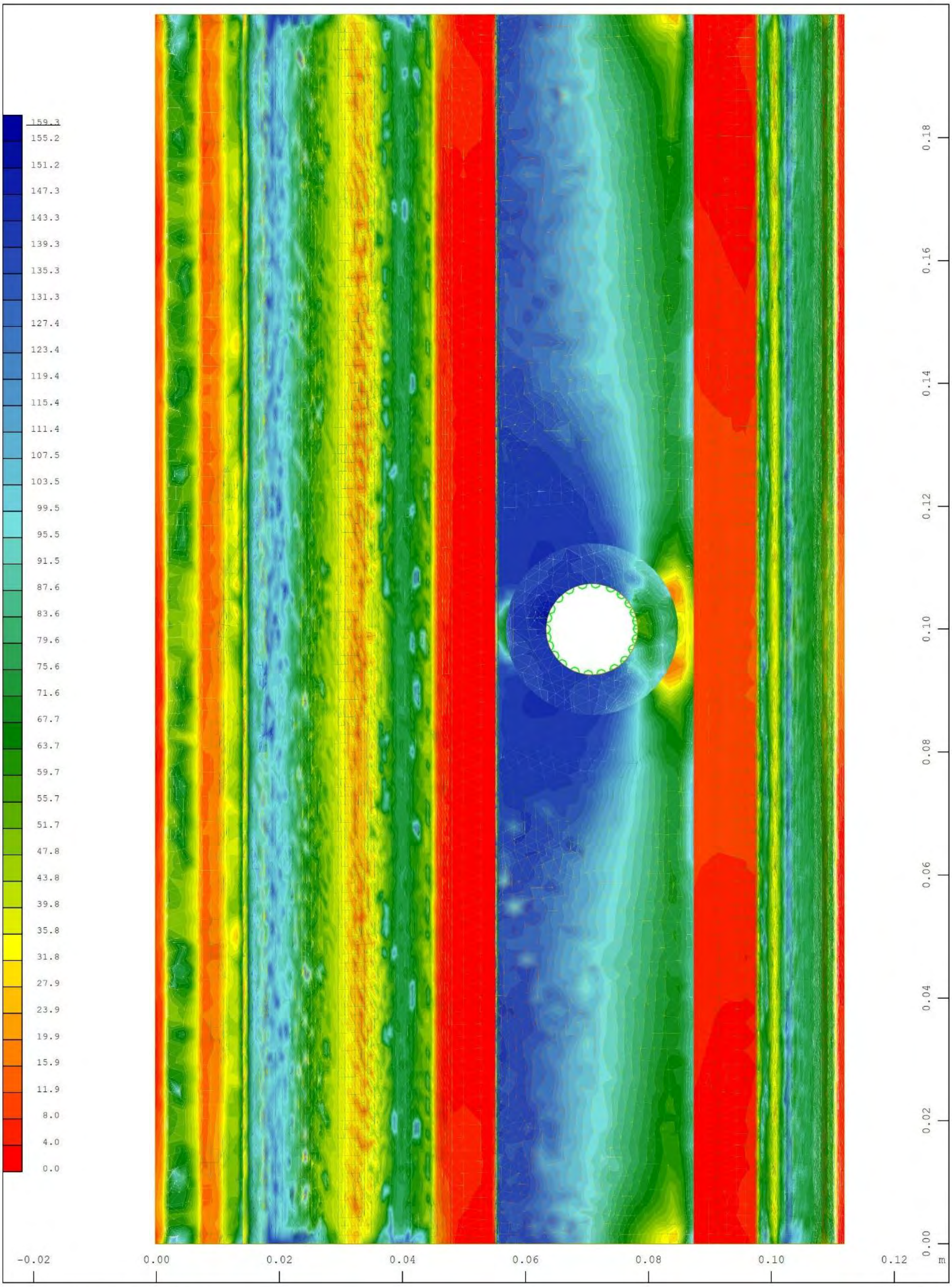
Sector of system Group 2 20 M 10 : 9.09
Deformed Structure from LC 20 SLS
Nodal displacement vector in Node, nonlinear Loadcase 20 SLS , from 0.0081 to 3.91



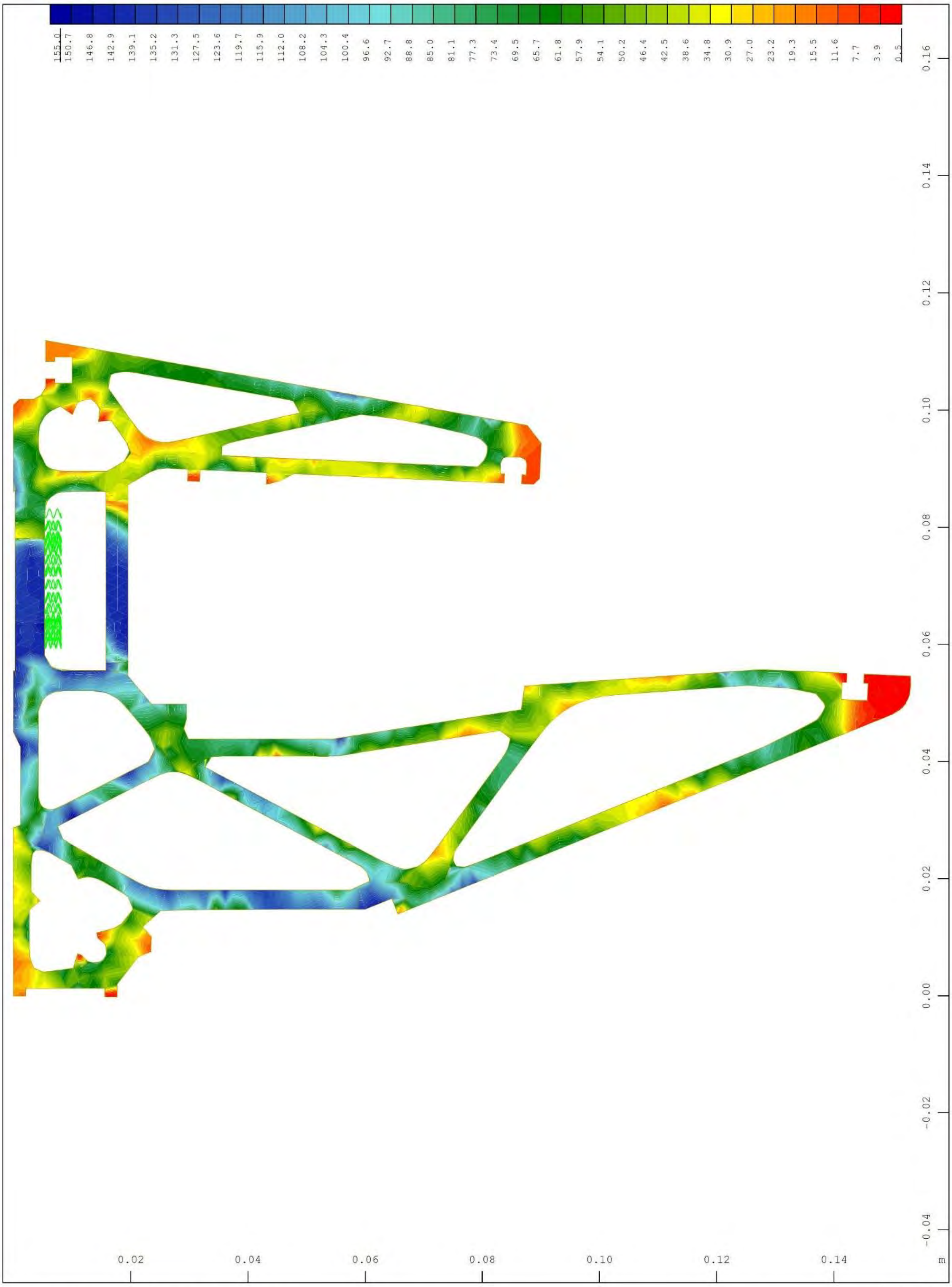
Sector of system Group 2 20 M 10 : 9.26
Deformed Structure from LC 10 ULS
Nodal displacement vector in Node, nonlinear Loadcase 10 ULS , from 0.587 to 9.32



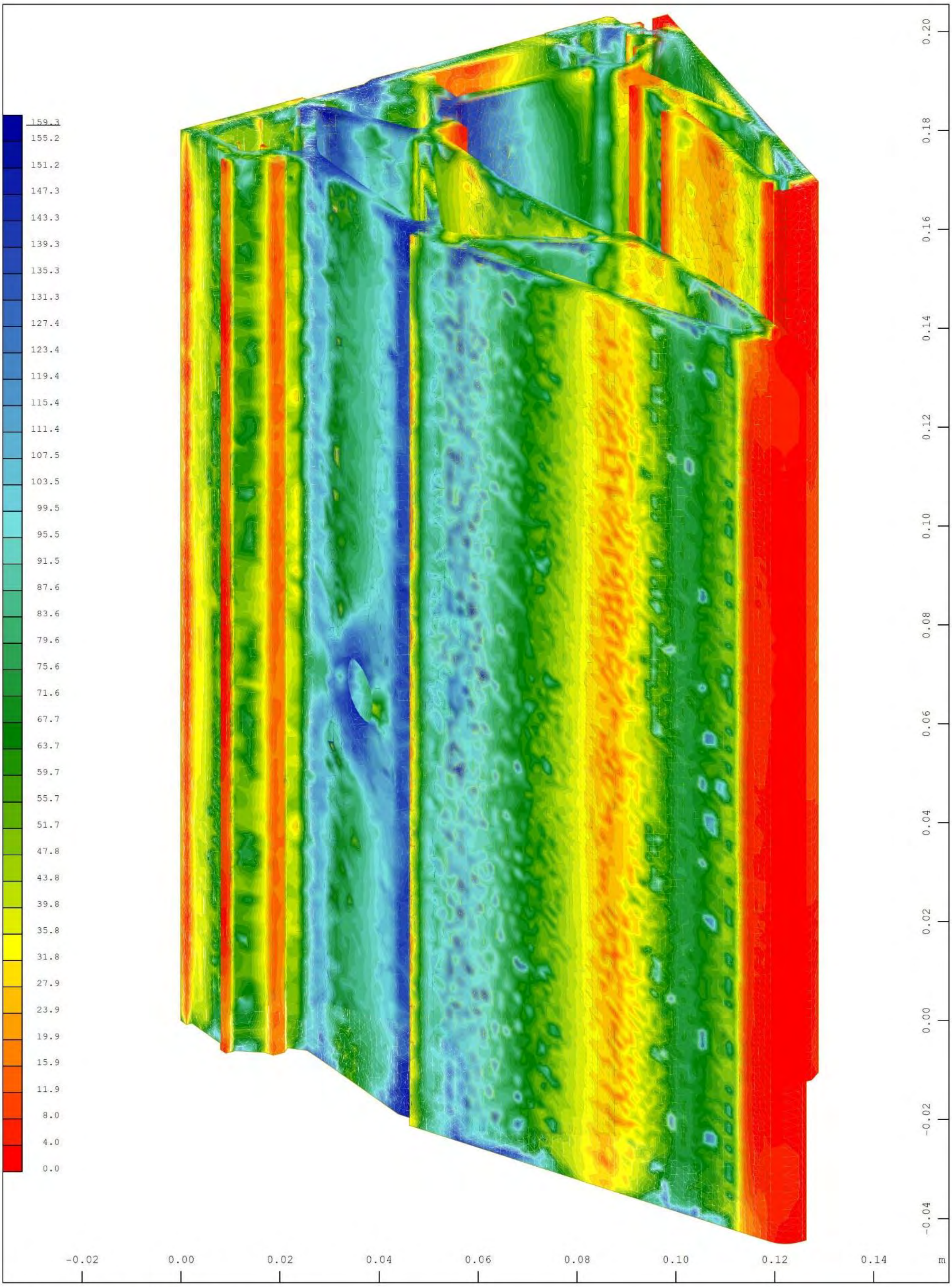
Sector of system Group 2 20 M 10 : 9
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.200 to 154.4
step 3.85 MPa



Z
X—Y
Sector of system Group 2 20 M 10 : 8.60
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.146 to 159.3 step 3.98 MPa

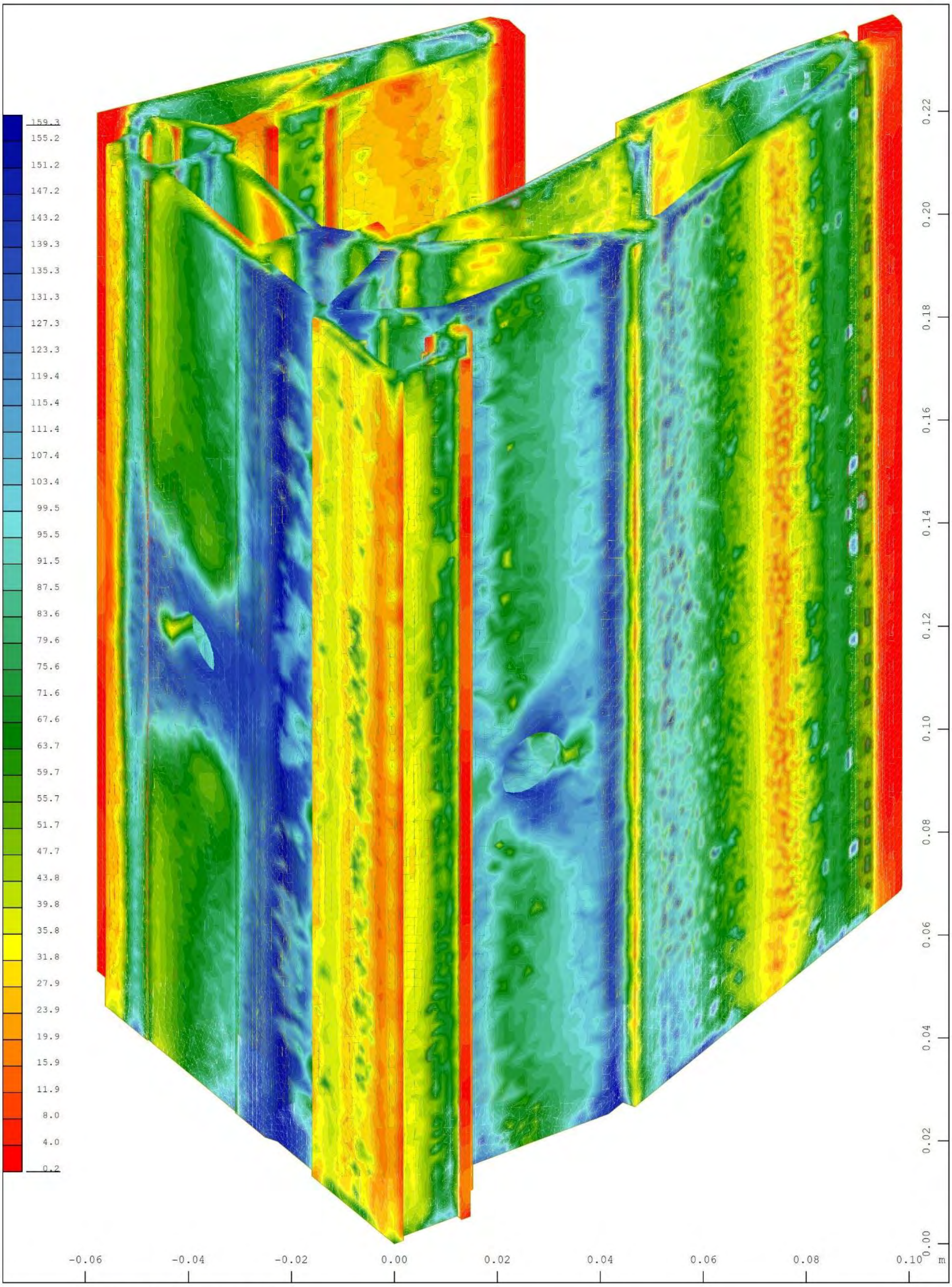


Sector of system Group 2 20 M 10 : 9
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.483 to 155.0
step 3.86 MPa



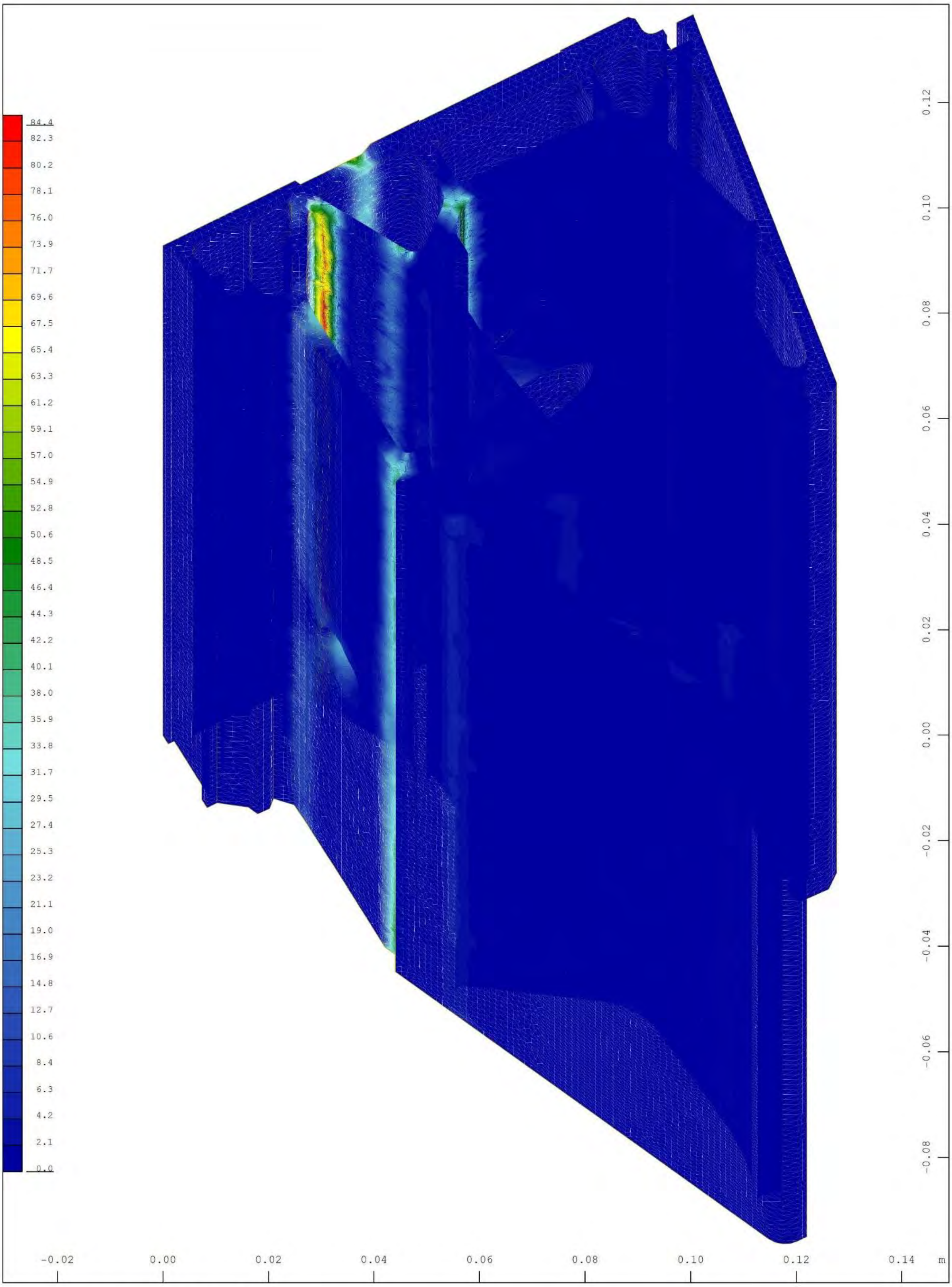
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.146 to 159.3 step 3.98 MPa

M 1 : 1.07
X * 0.640
Y * 0.883
Z * 0.901



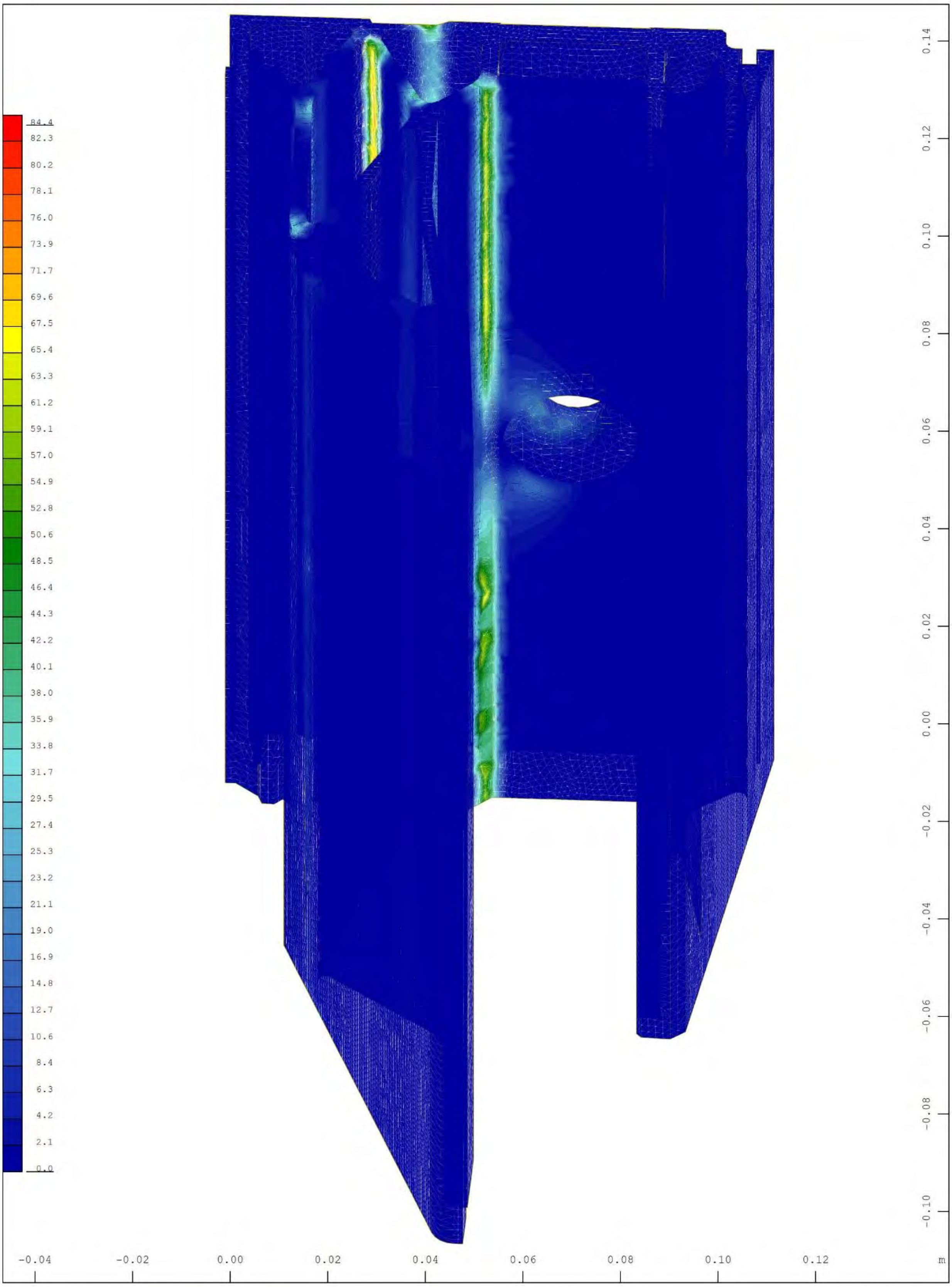
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.200 to 159.3
step 3.98 MPa

M 1 : 1
X * 0.886
Y * 0.722
Z * 0.833



Sector of system Group 2 20
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 , BRIC
Gauss points in Node o/oo, from 0 to 84.4 step 2.11

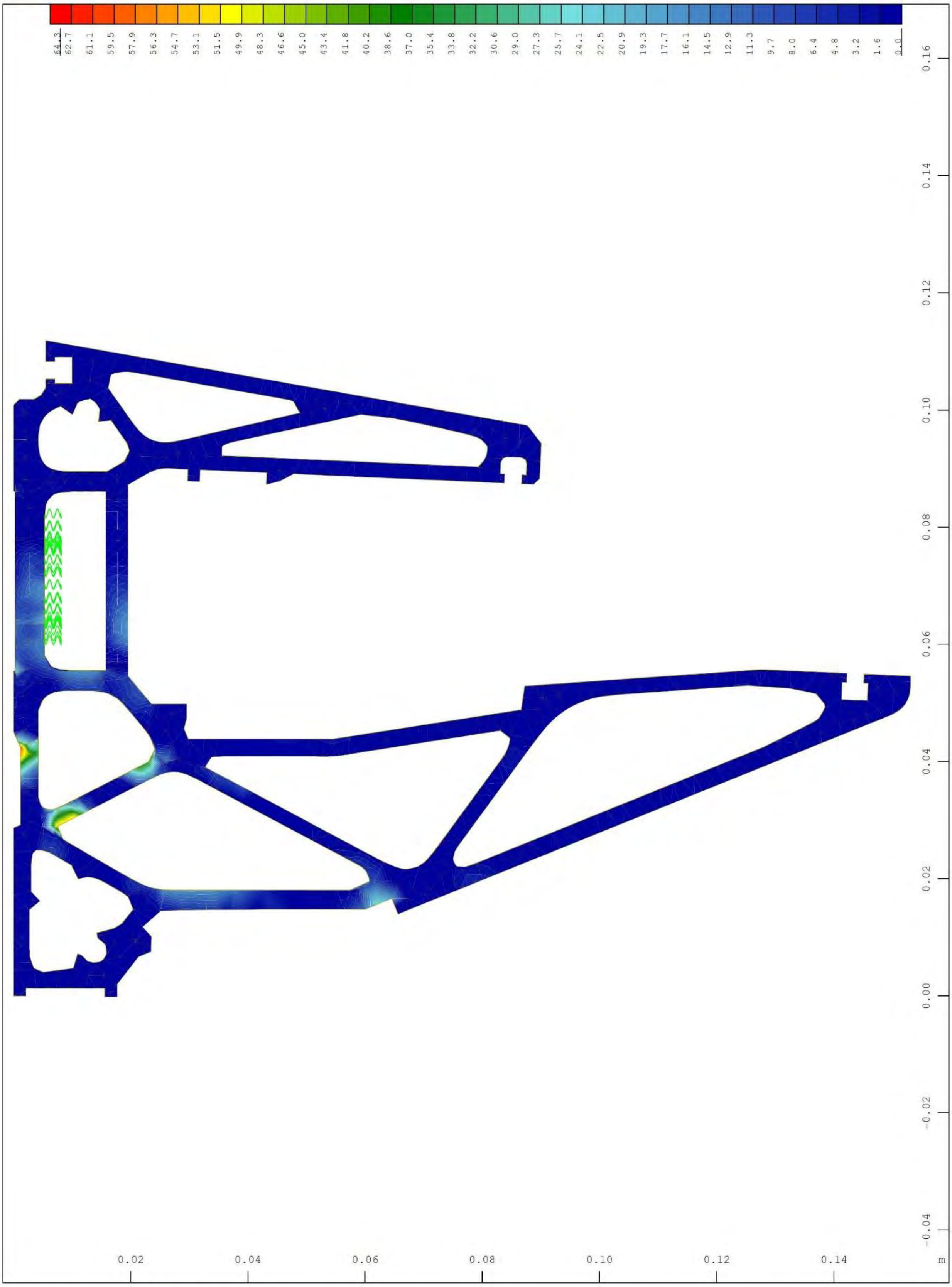
M 1 : 1
X * 0.914
Y * 0.974
Z * 0.464



Z Y X

Sector of system Group 2 20
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 84.4 step 2.11

M 1 : 1.08
X * 0.687
Y * 0.999
Z * 0.727

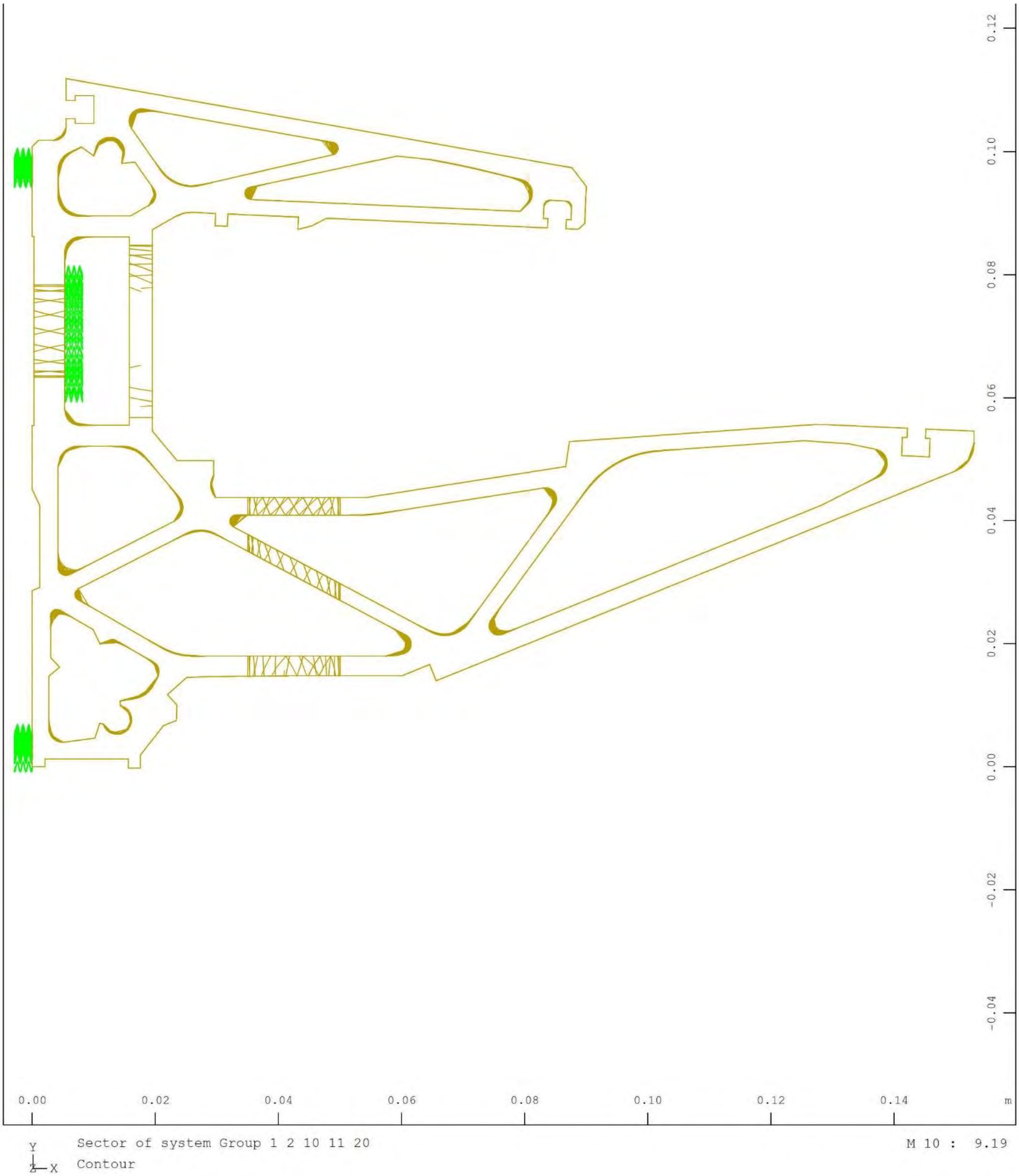


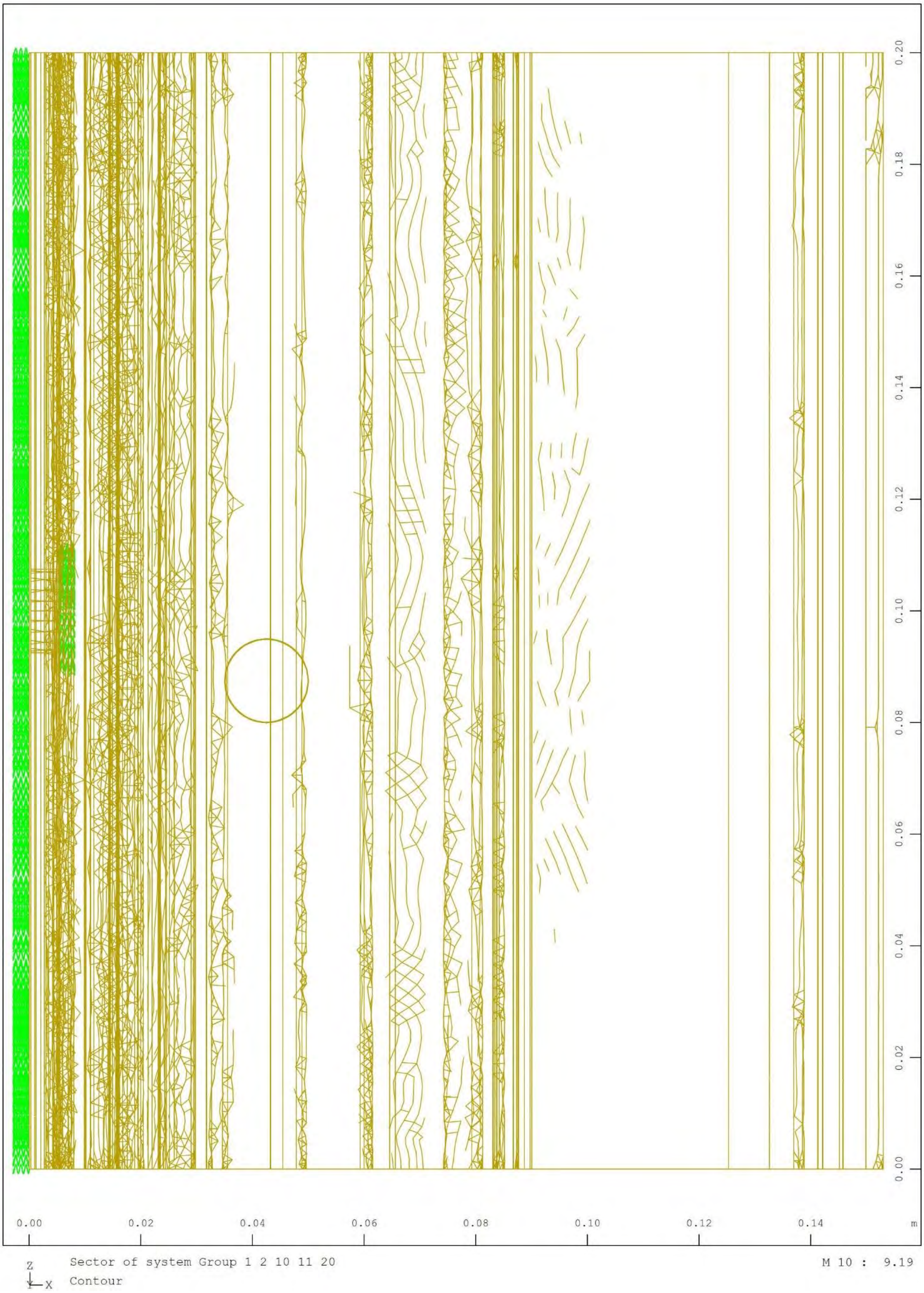
Y Z X Sector of system Group 2 20 M 10 : 9

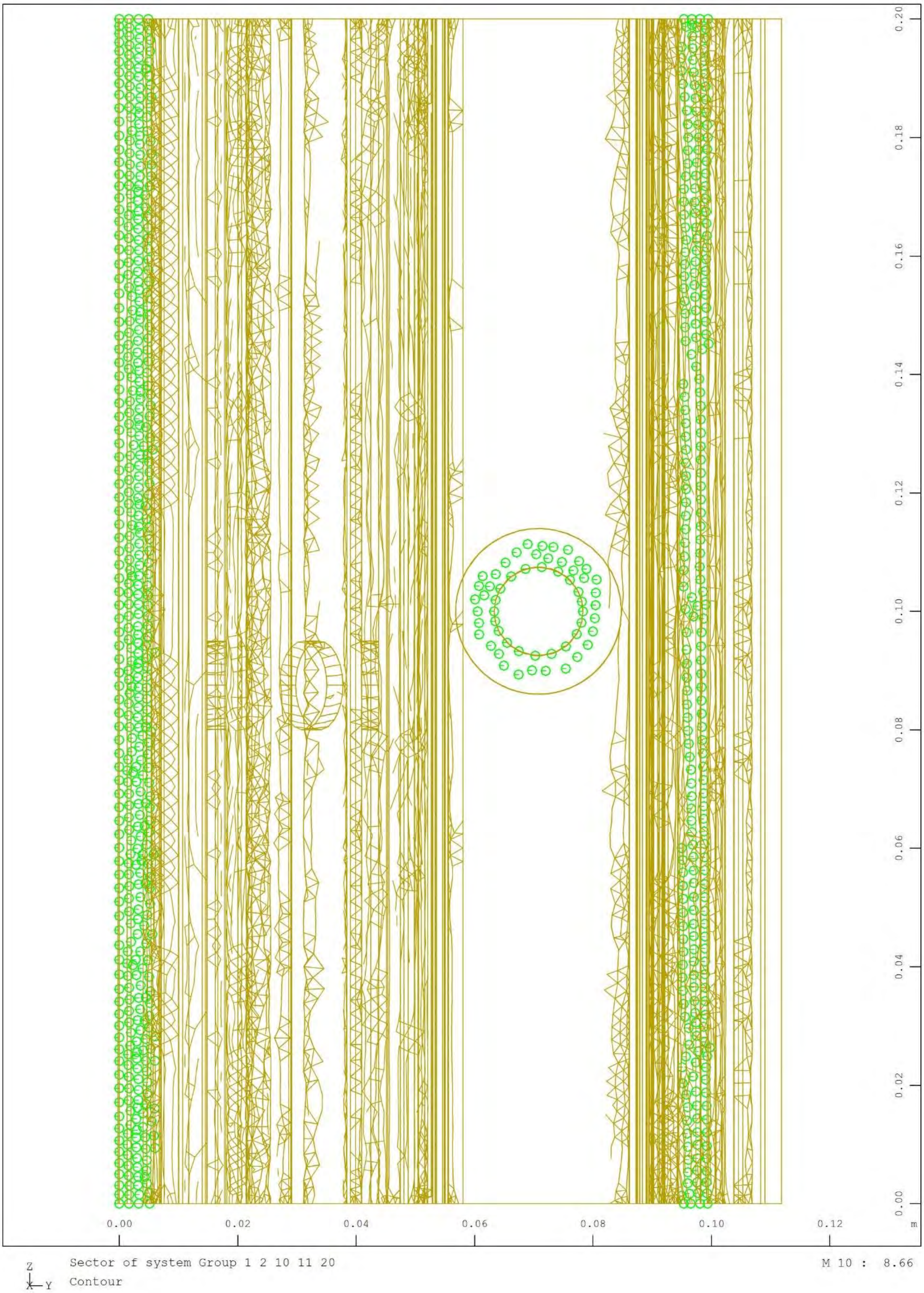
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 , BRIC

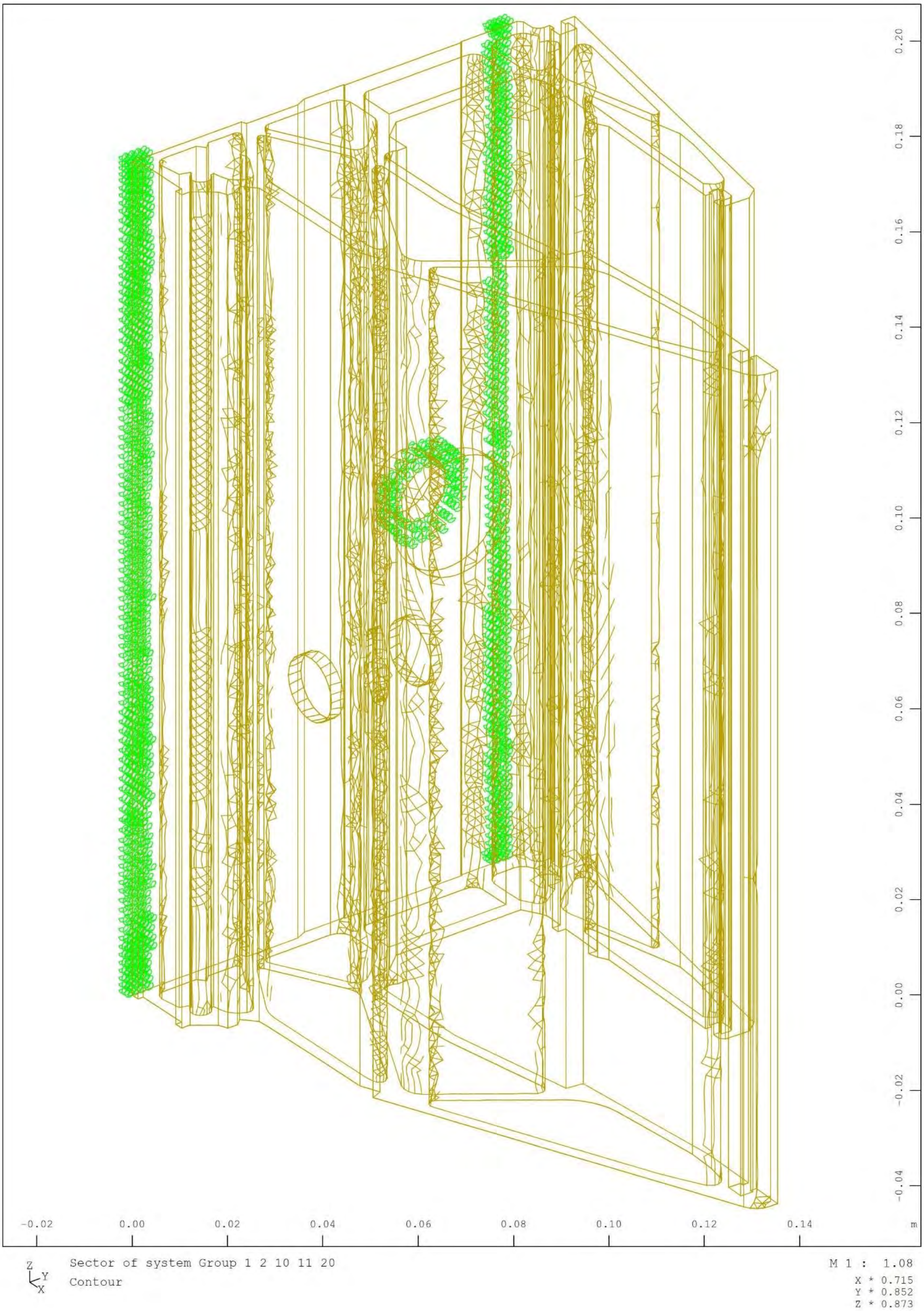
Gauss points in Node o/oo, from 0 to 64.3 step 1.61

9.2.2 Calcolo numerico profilo - configurazione lineare - carichi di depressione (vento)

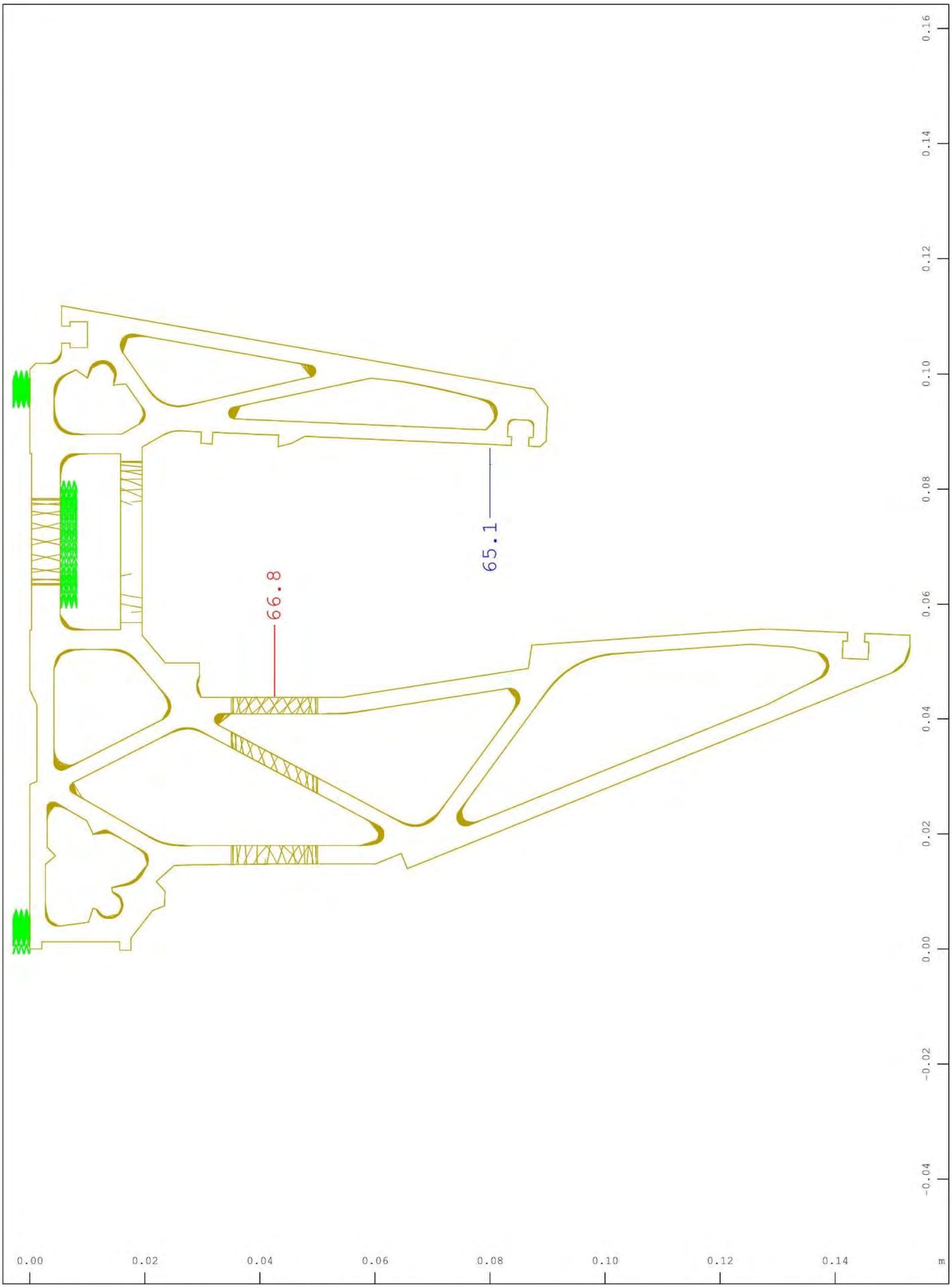



0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 m
Z
X
Sector of system Group 1 2 10 11 20
Contour
M 10 : 9.19


0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.00
0.02
0.04
0.06
0.08
0.10
0.12
m
Z
X Y
Sector of system Group 1 2 10 11 20
Contour
M 10 : 8.66

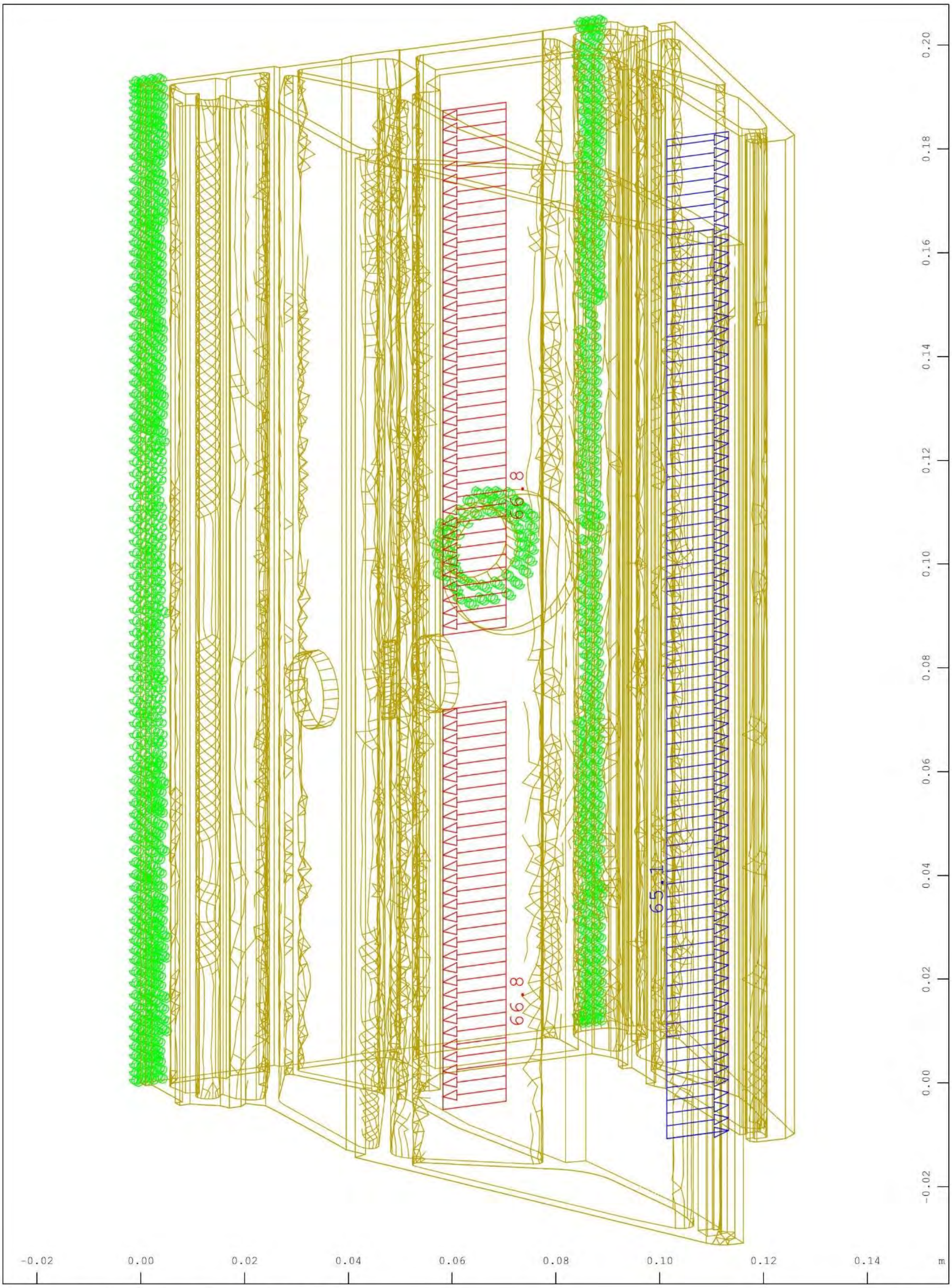


0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
m
Z
Y
X
Sector of system Group 1 2 10 11 20
Contour
M 1 : 1.08
X * 0.715
Y * 0.852
Z * 0.873



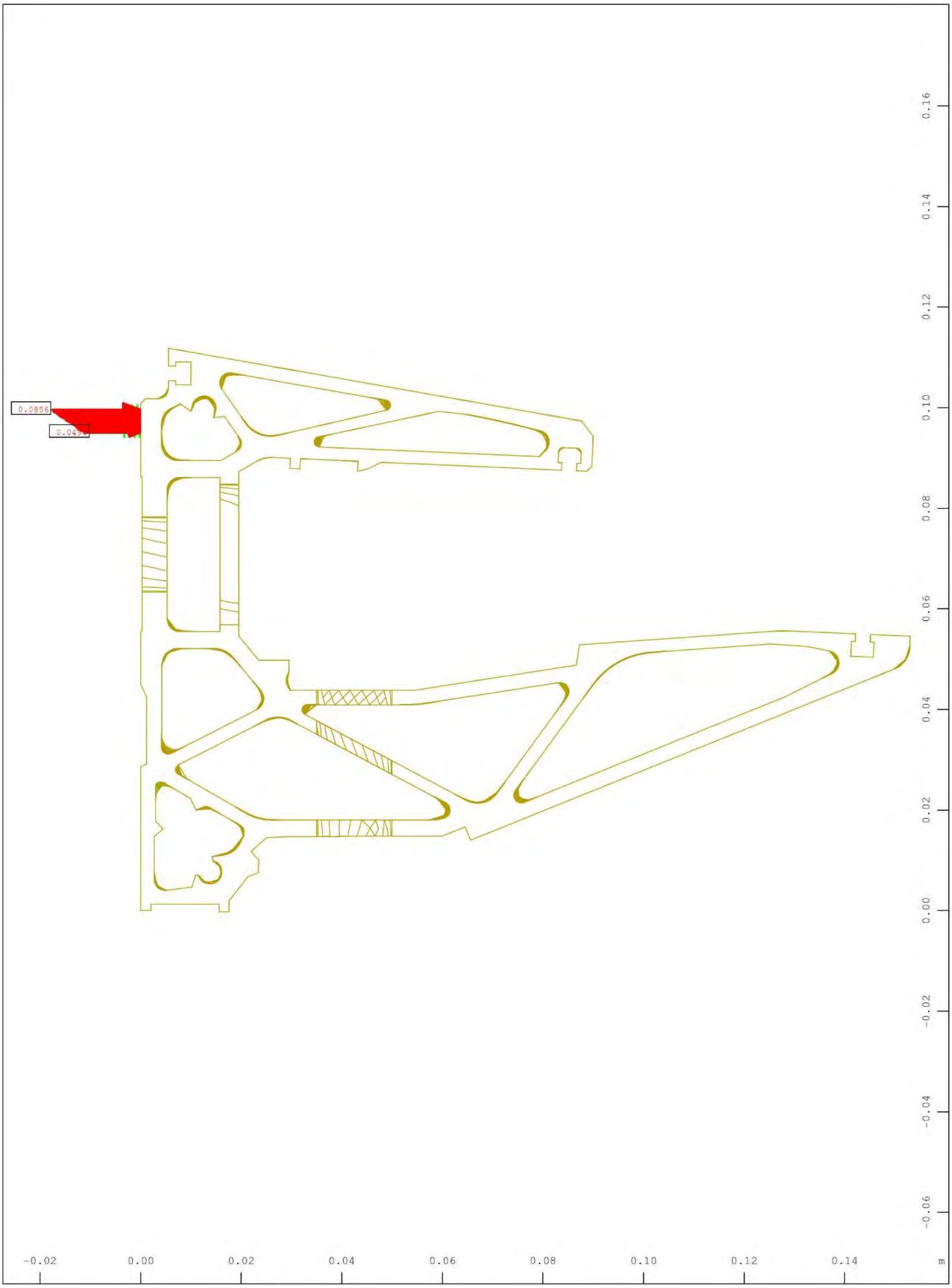
Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-66.8) (Max=65.1)

M 10 : 9.19



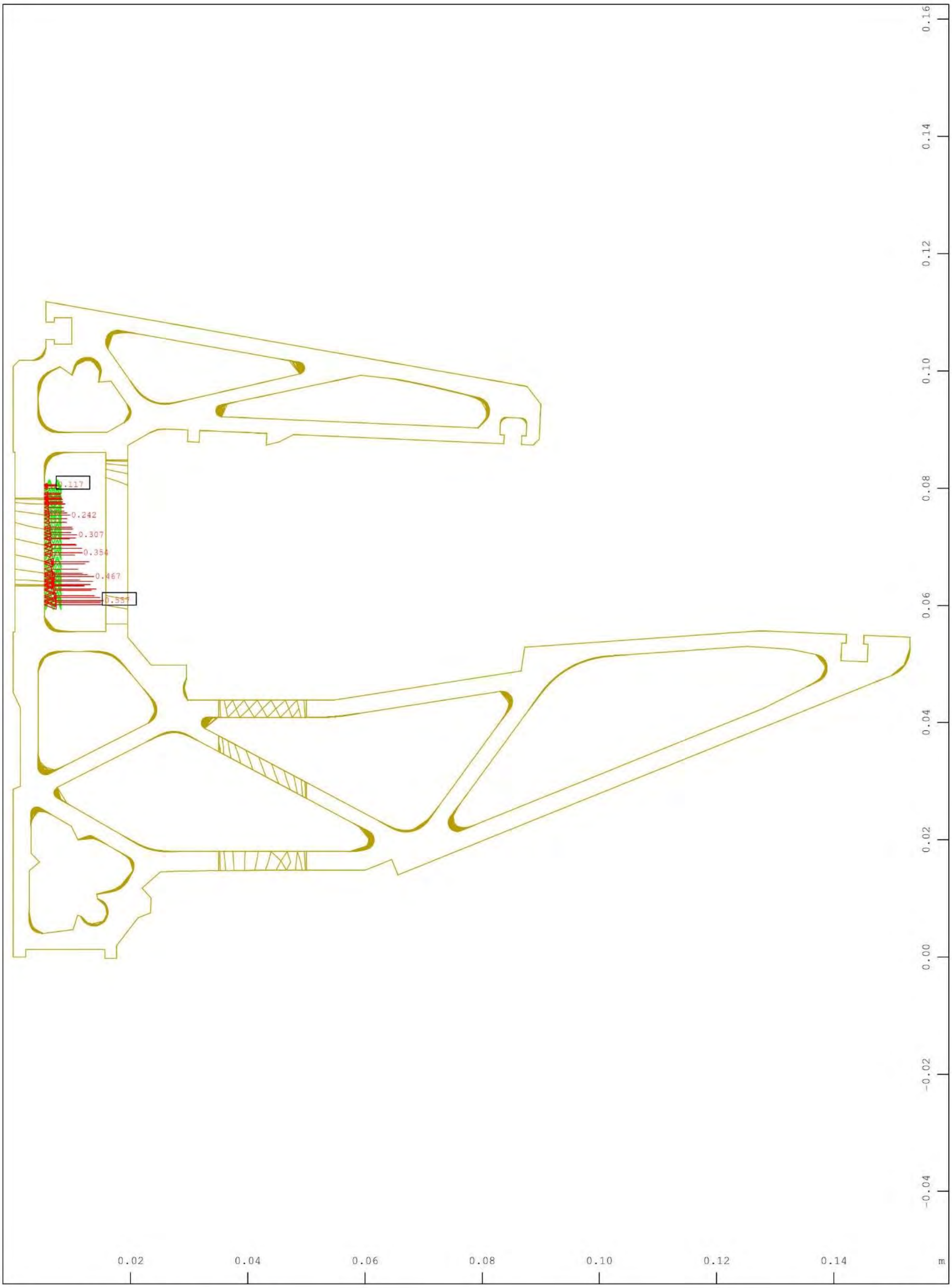
Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y
(Unit=50.0 kN/m) (Min=-66.8) (Max=65.1)

M 1 : 1
X * 0.502
Y * 0.906
Z * 0.962

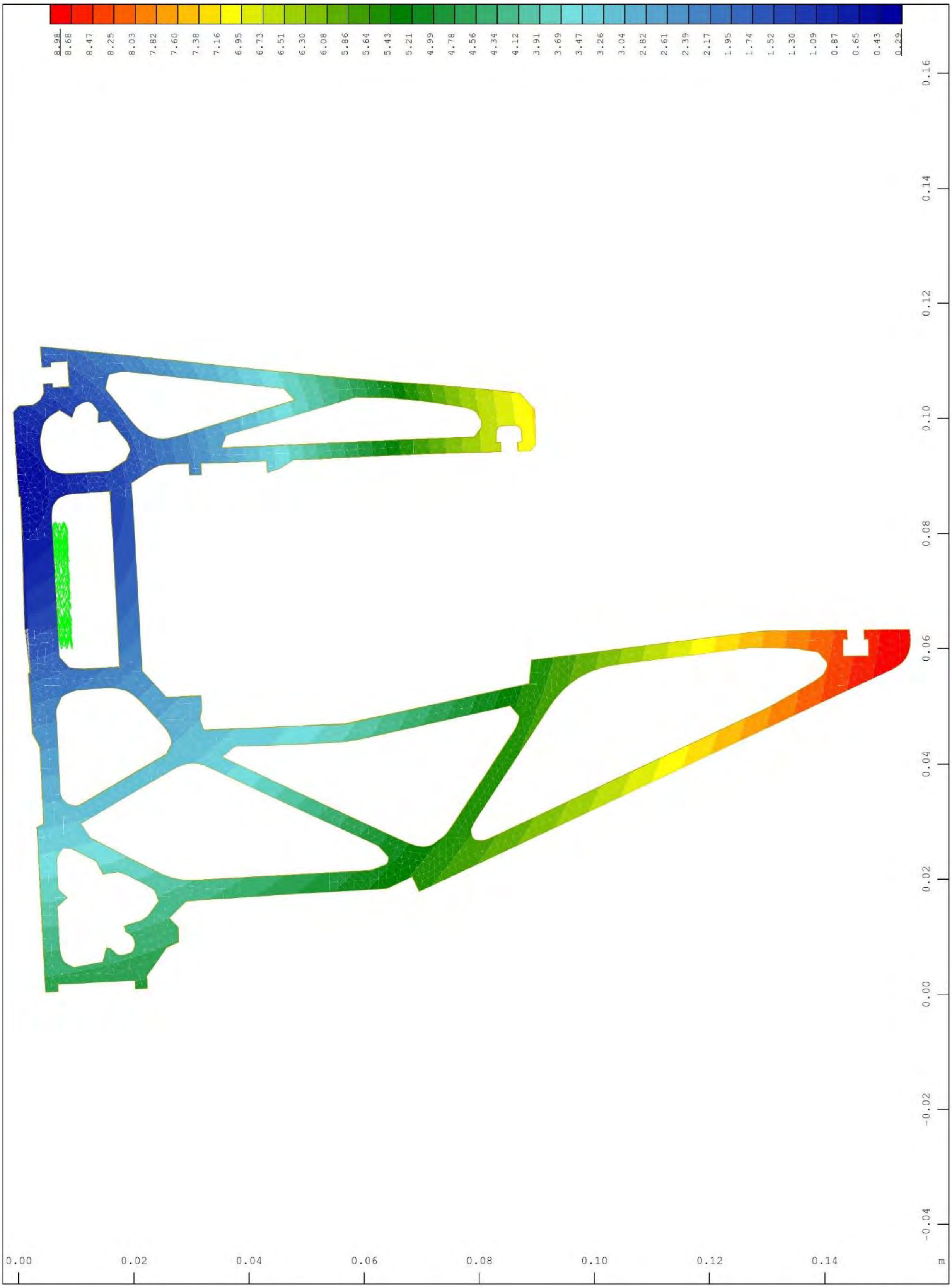


Y
Z X

Sector of system Group 2 11 M 1 : 1.05
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.0500 kN
(Min=-0.0856) (Max=-0.0494) (total: -17.0)

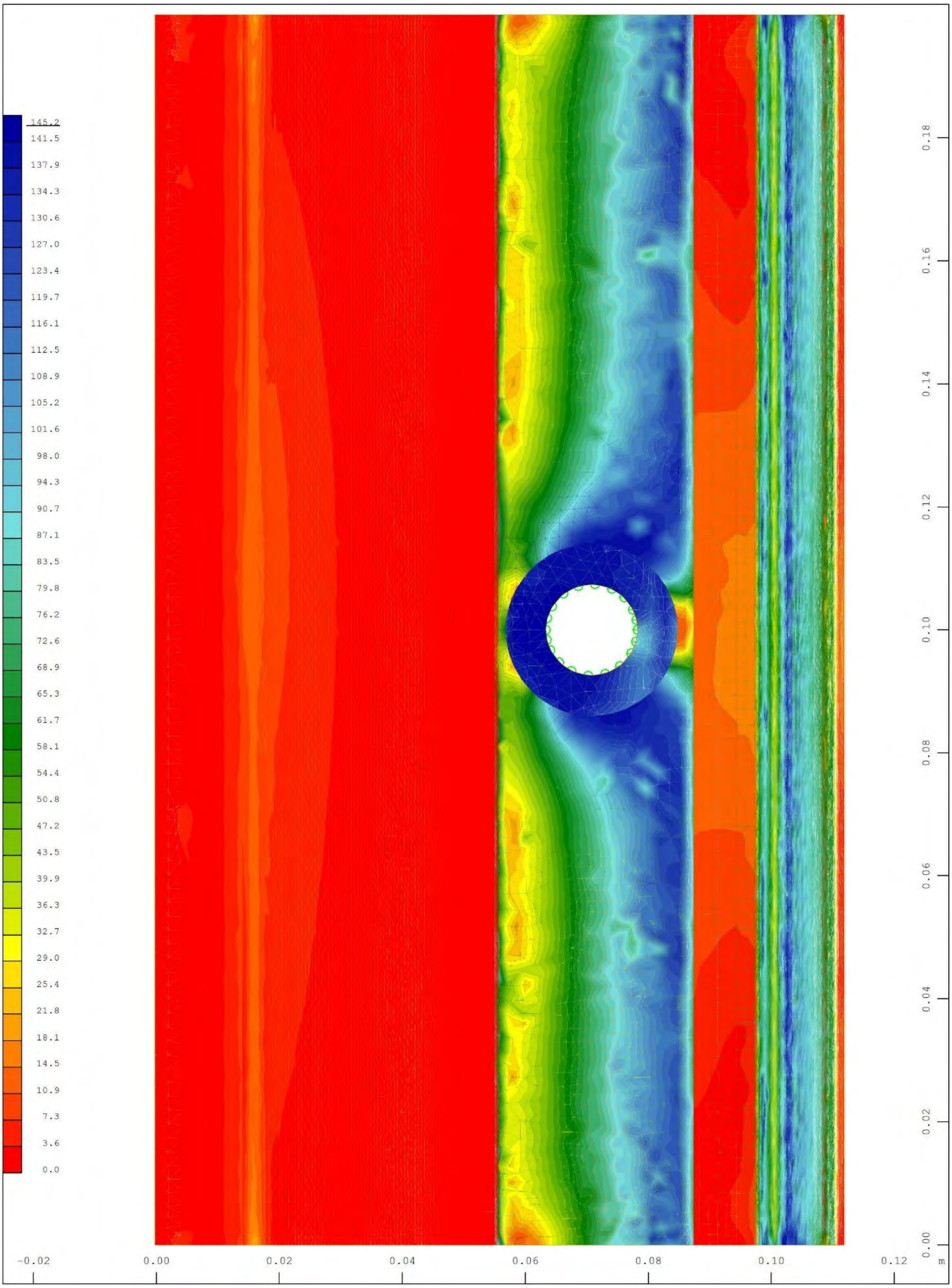


Sector of system Group 2 20
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.500 kN
(Min=-0.557) (Max=-0.117) (total: -17.0)
M 10 : 9

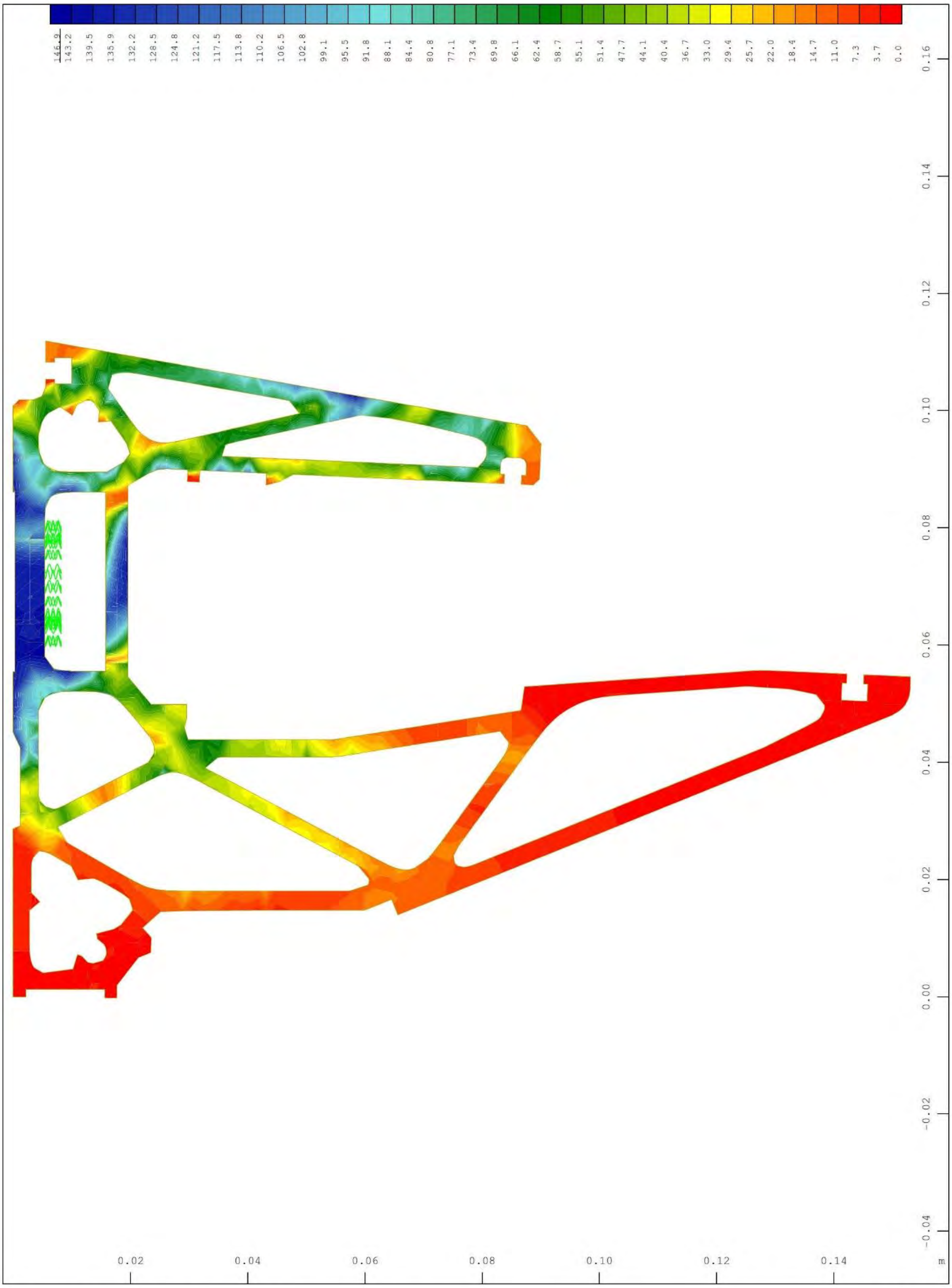


Sector of system Group 2 20
Deformed Structure from LC 10 ULS
Nodal displacement vector in Node, nonlinear Loadcase 10 ULS , from 0.295 to 8.98

M 10 : 9.18

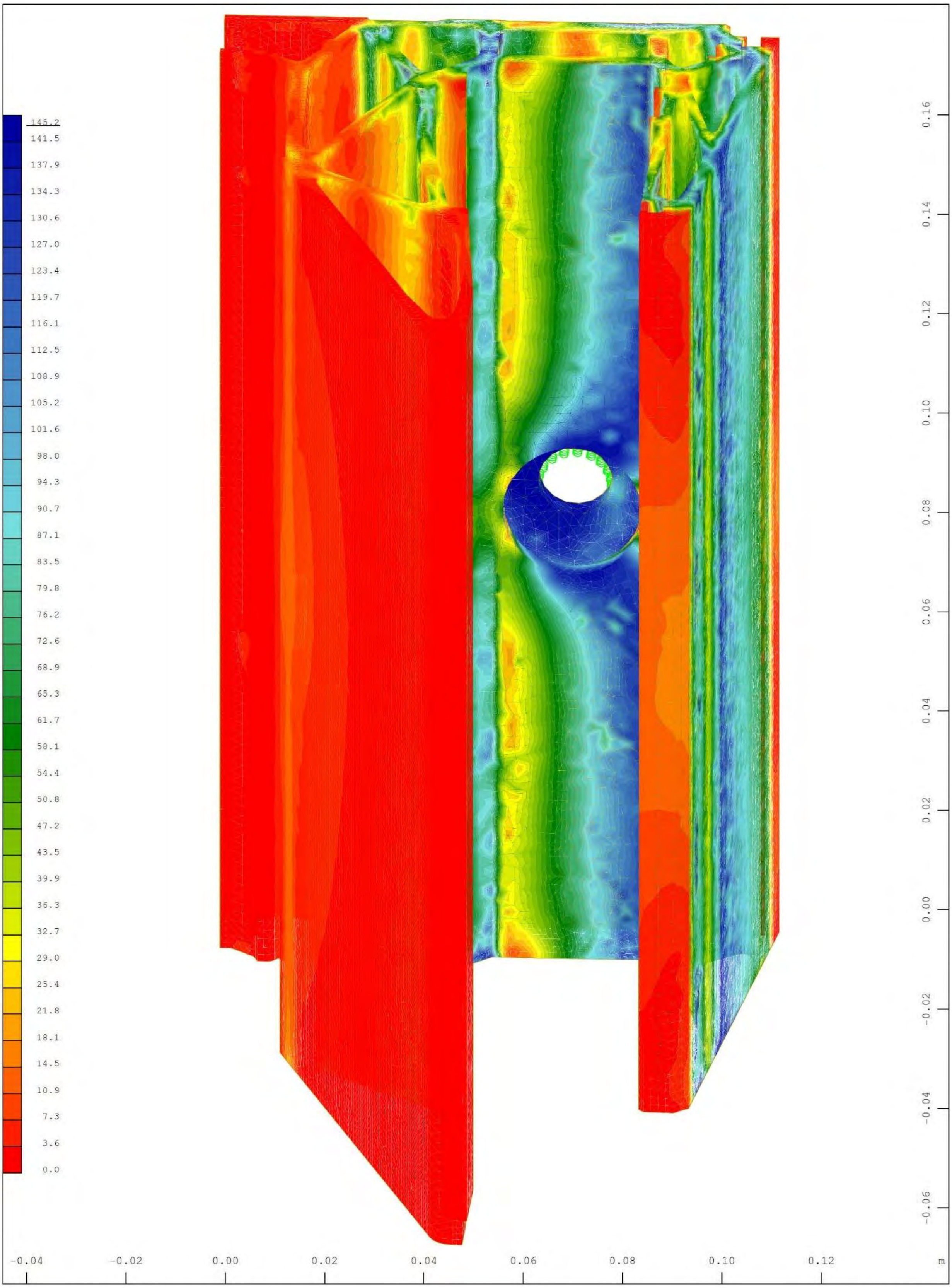


Sector of system Group 2 20 M 10 : 8.60
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0233 to 145.2 step 3.63 MPa



Y
Z X

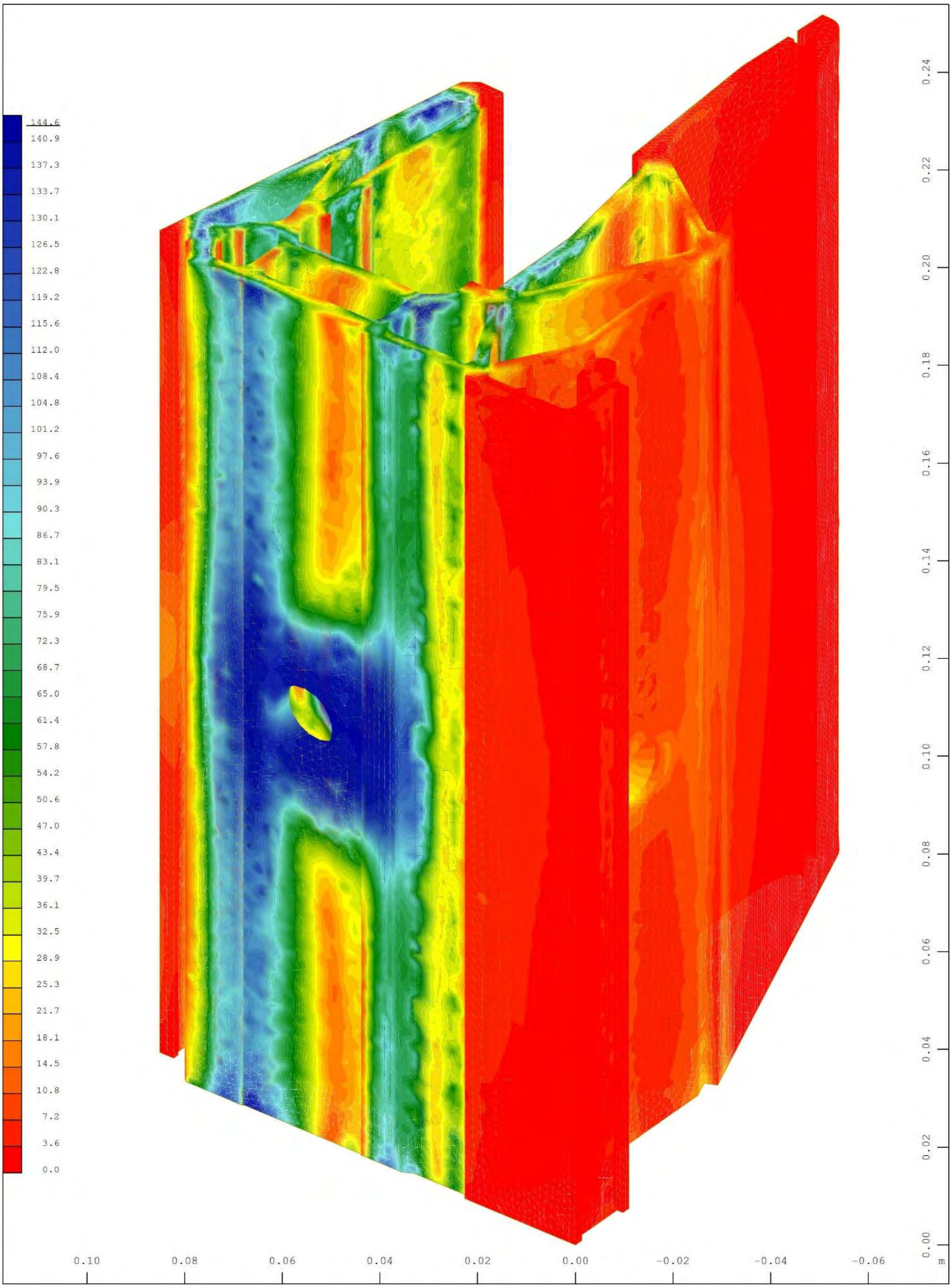
Sector of system Group 2 20 M 10 : 9
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0719 to 146.9
step 3.67 MPa



Z
Y
X

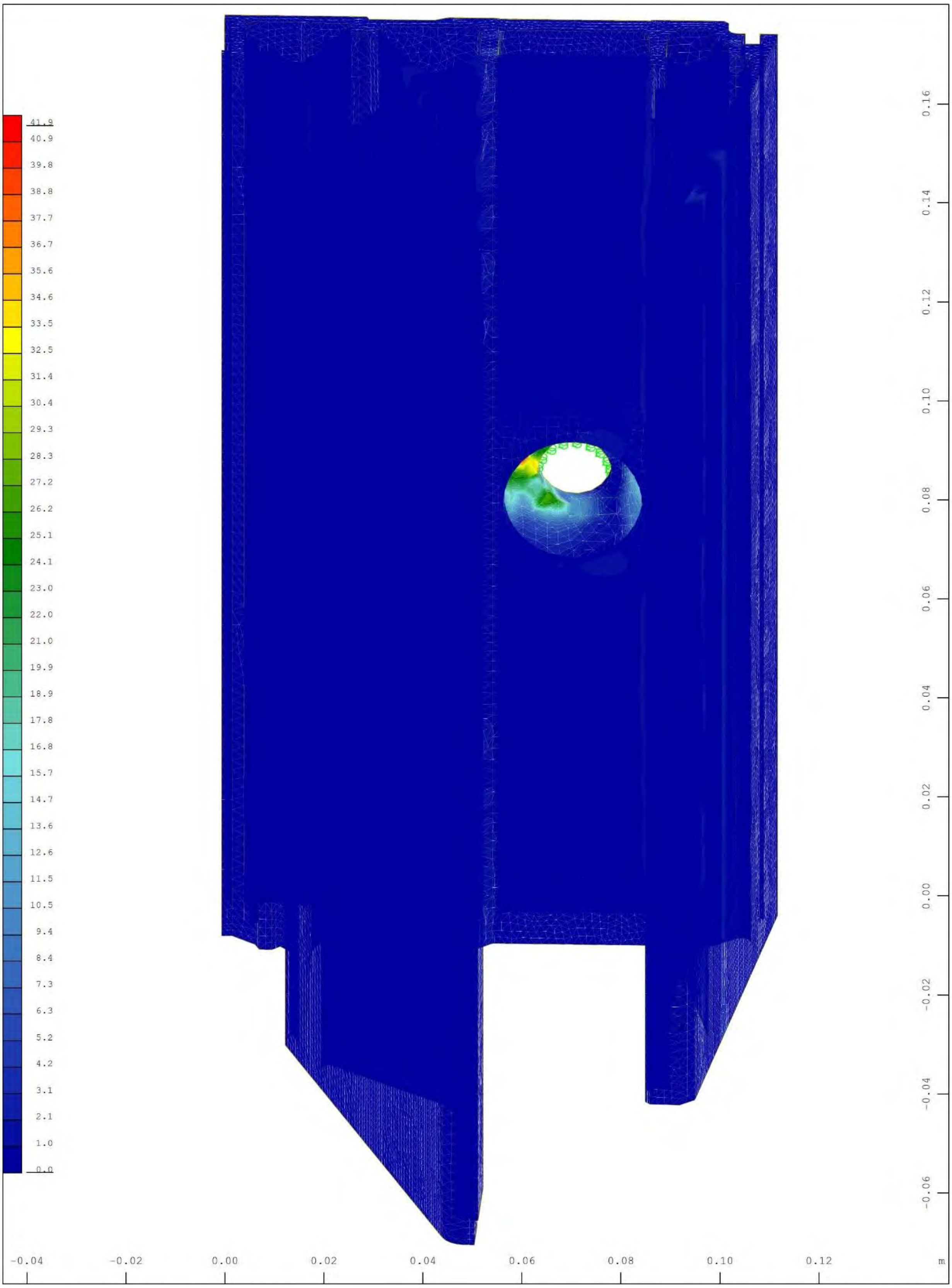
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0233 to 145.2 step 3.63 MPa

M 1 : 1.06
X * 0.436
Y * 0.999
Z * 0.901



Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0233 to
144.6 step 3.61 MPa

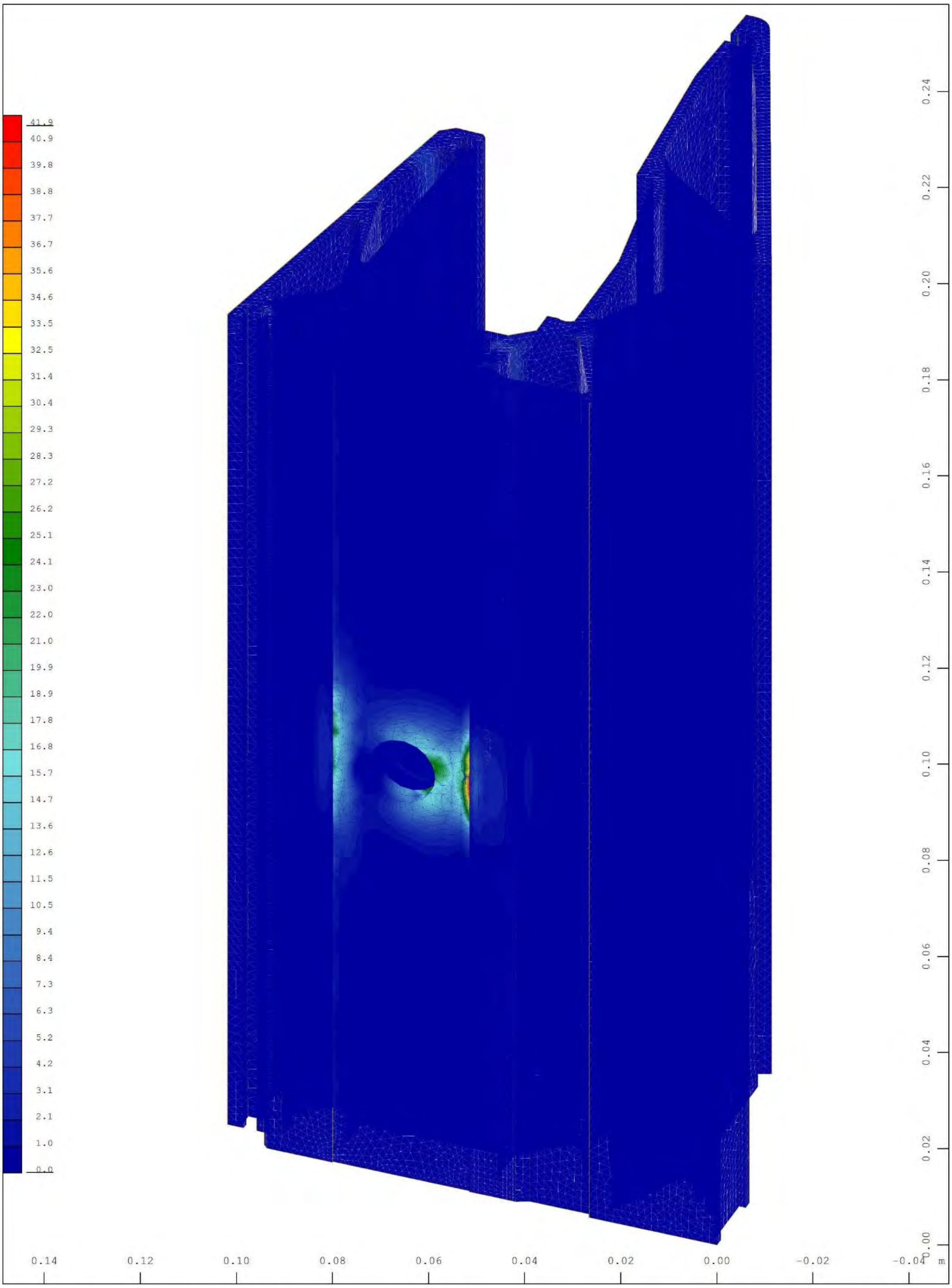
M 1 : 1.08
X * 0.747
Y * 0.857
Z * 0.841



Z
Y
X

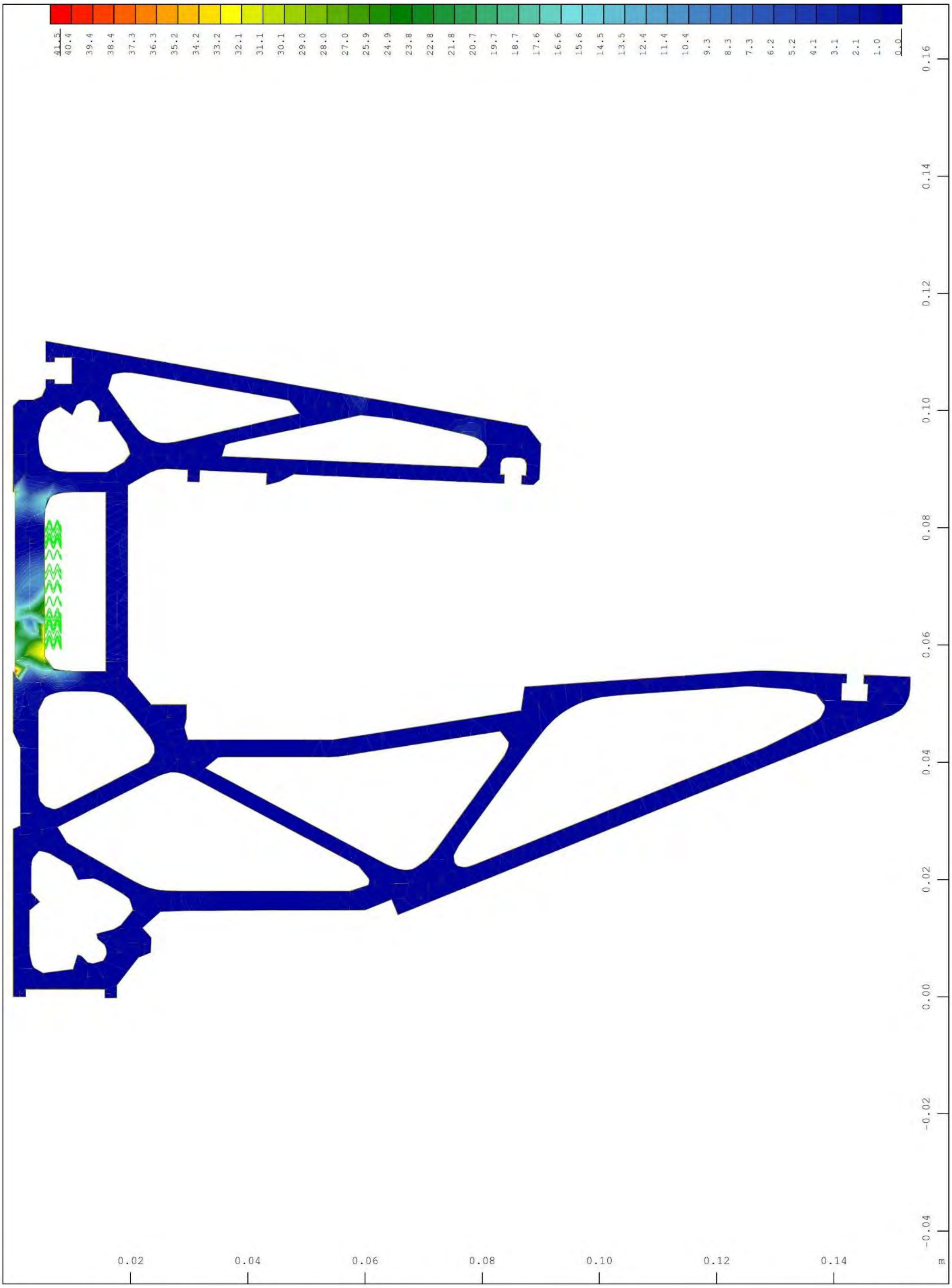
Sector of system Group 2 20
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 41.9 step 1.05

M 1 : 1.07
X * 0.457
Y * 1.000
Z * 0.890



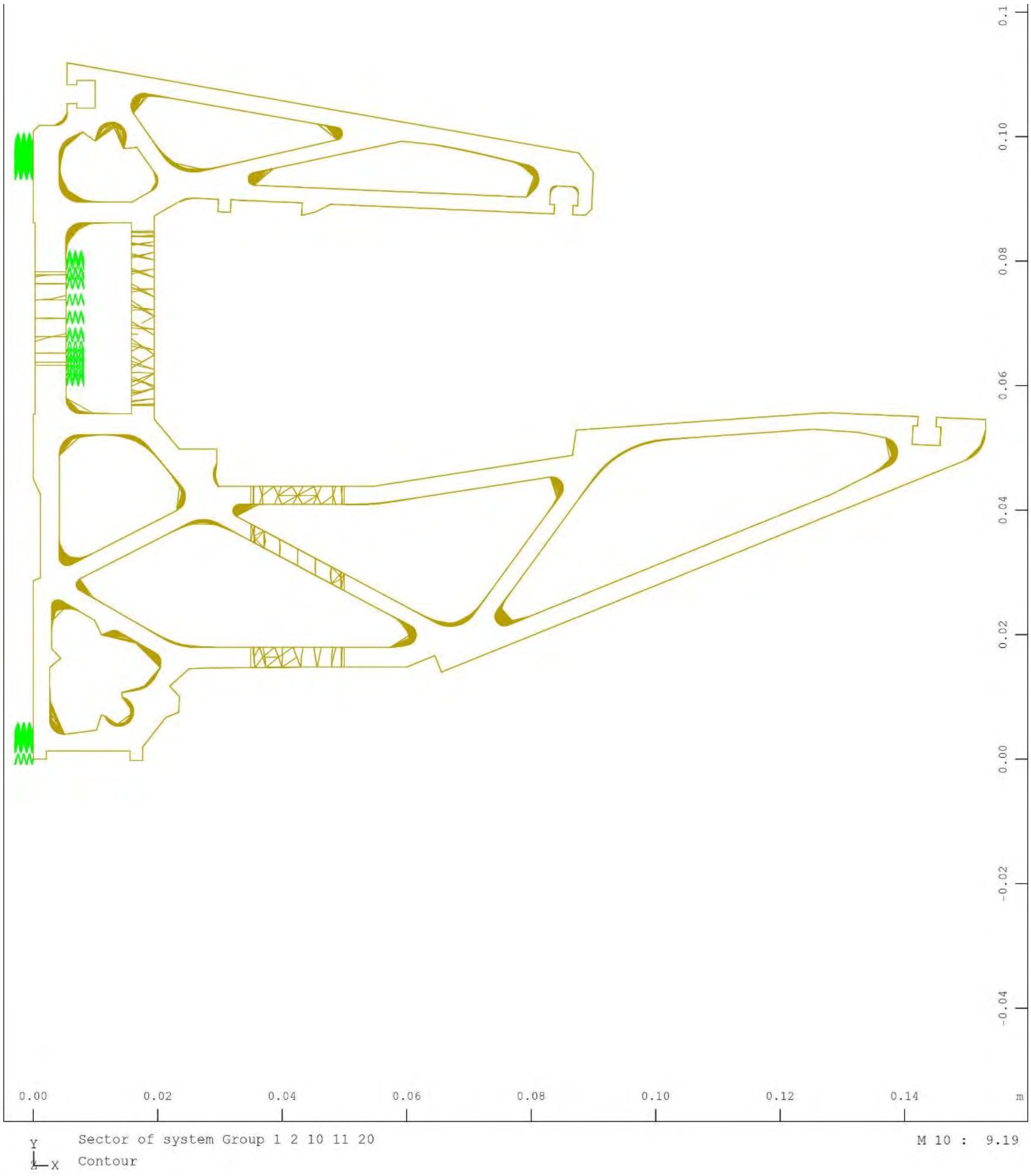
Sector of system Group 2 20
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 41.9 step 1.05

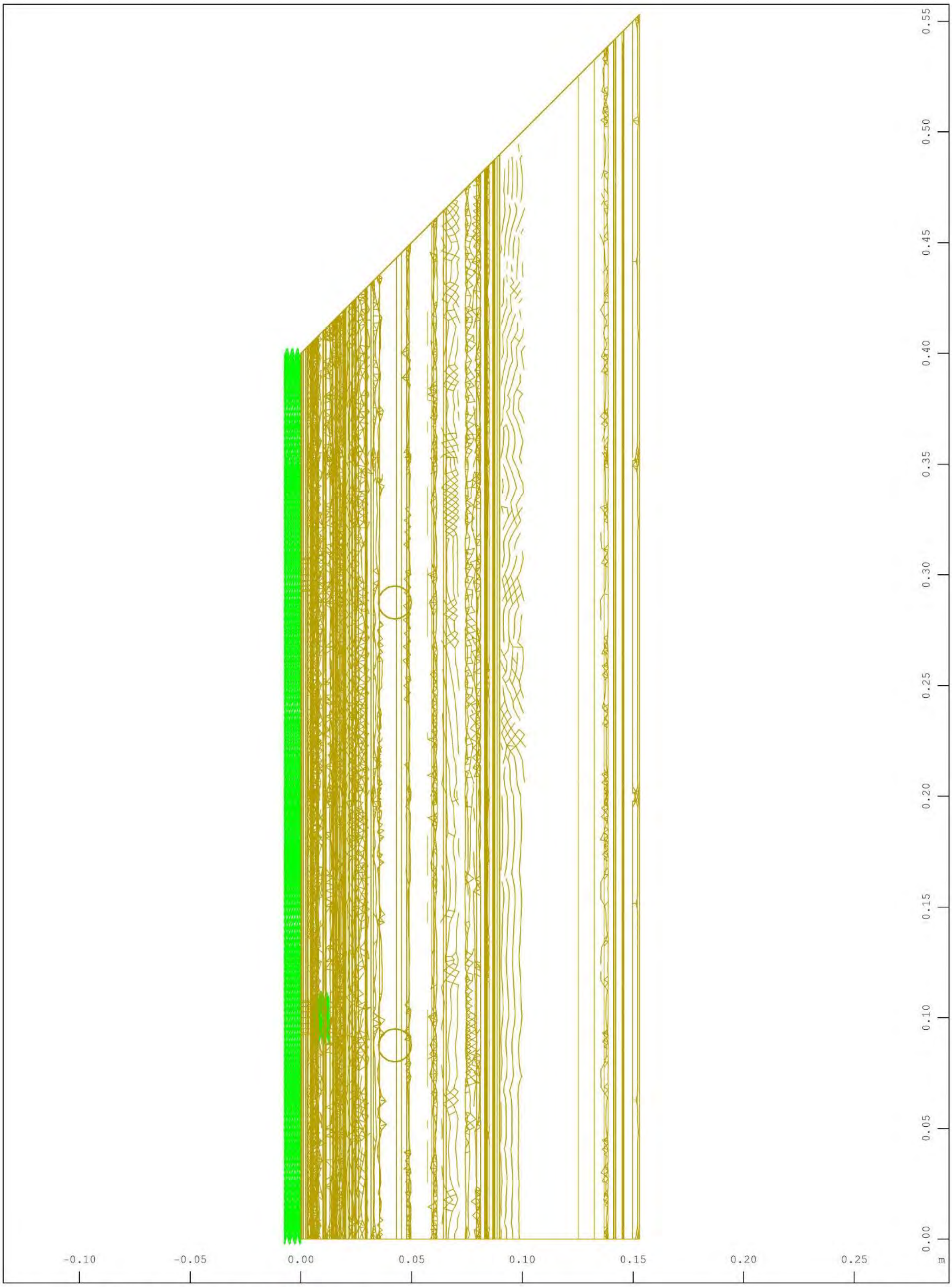
M 1 : 1.10
X * 0.622
Y * 0.950
Z * 0.843



Sector of system Group 2 20 M 10 : 9
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 , BRIC
Gauss points in Node o/oo, from 0 to 41.5 step 1.04

9.2.3 Calcolo numerico profilo - configurazione ad angolo - carichi verso il basso (neve)



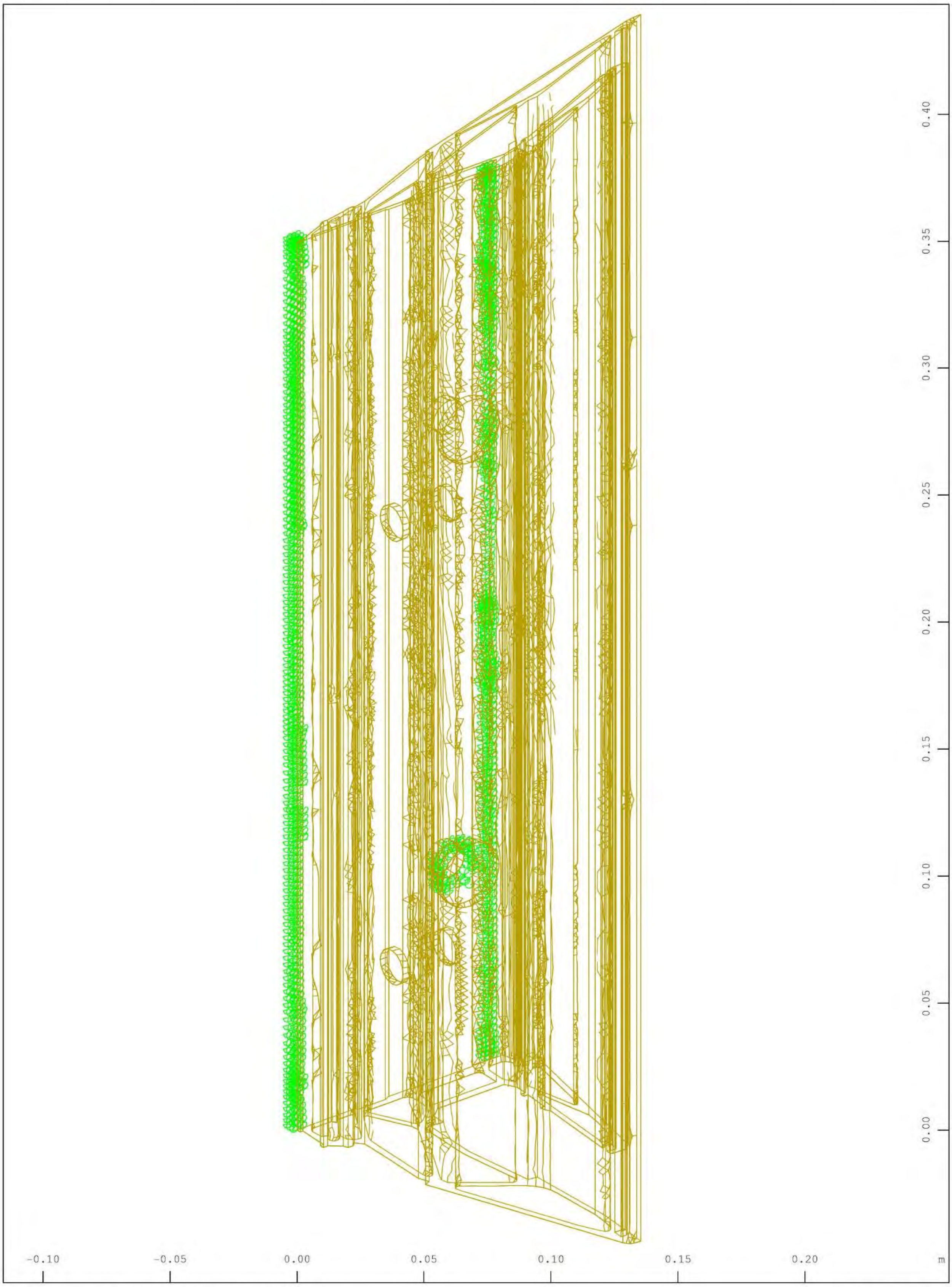


Z
X
Sector of system Group 1 2 10 11 20
Contour

M 1 : 2.39

Z
Y
Sector of system Group 1 2 10 11 20
Contour

M 1 : 2.39



Z Y X

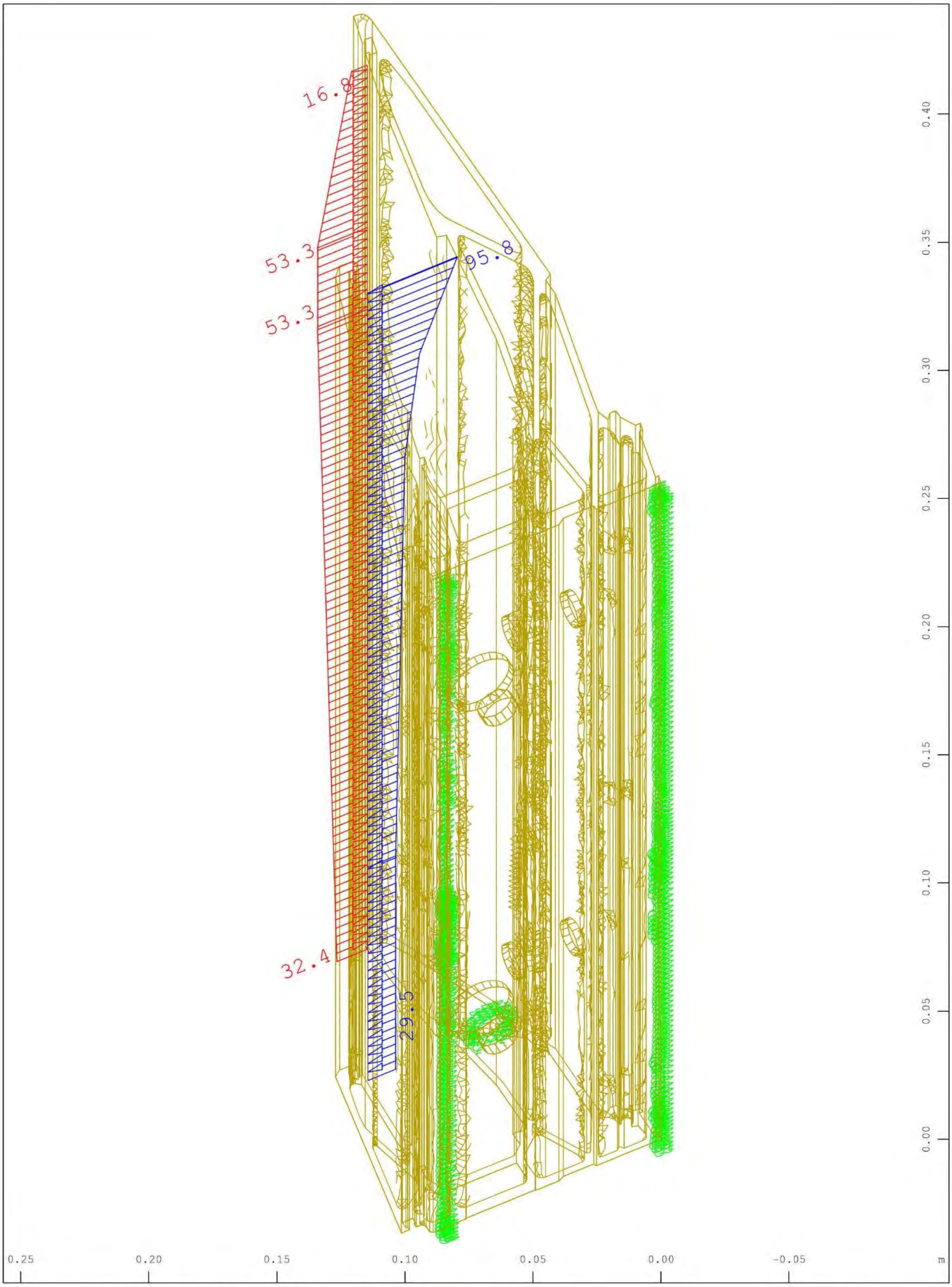
Sector of system Group 1 2 10 11 20

Contour

M 1 : 2.08

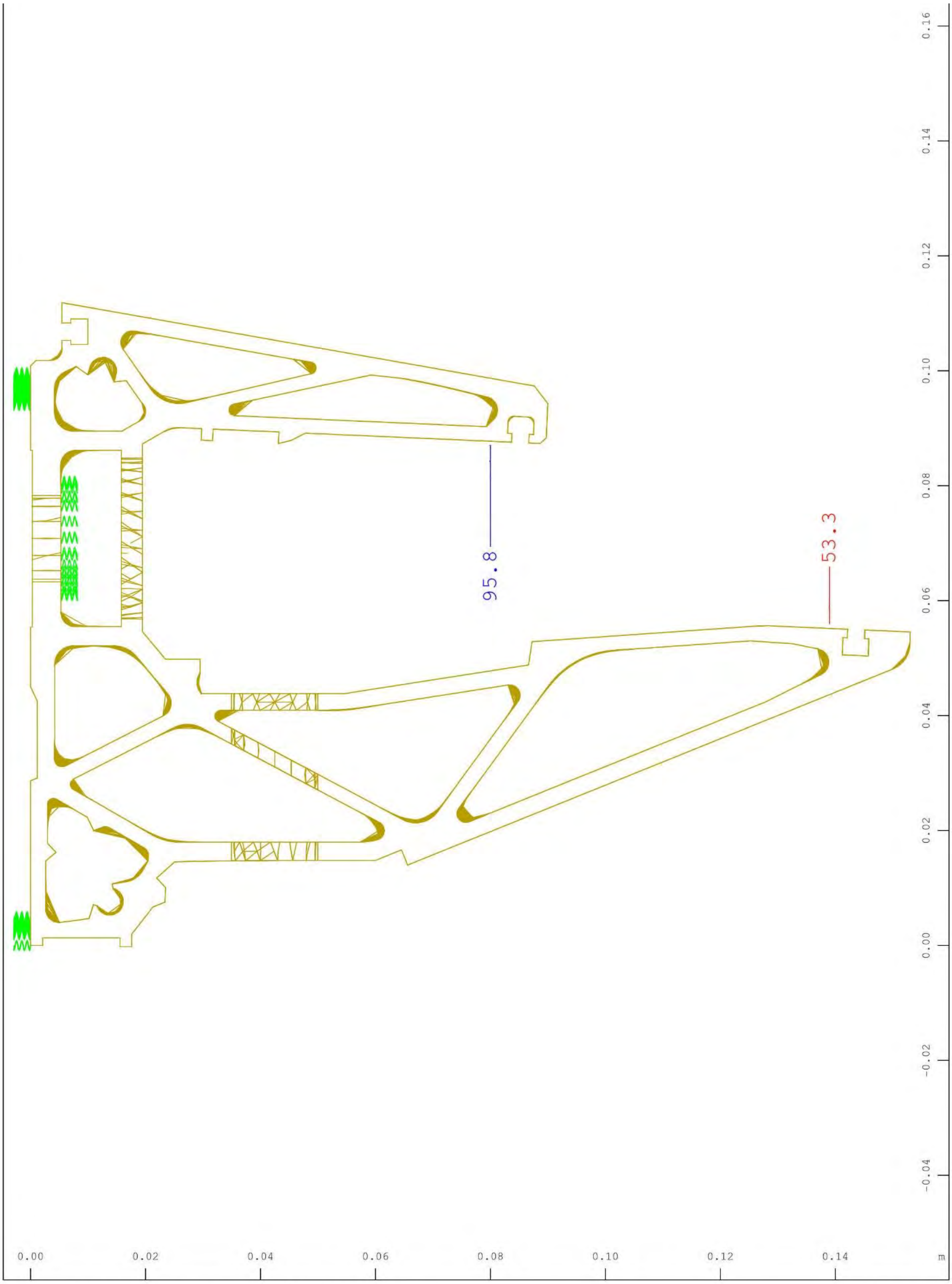
X * 0.715

Y * 0.852

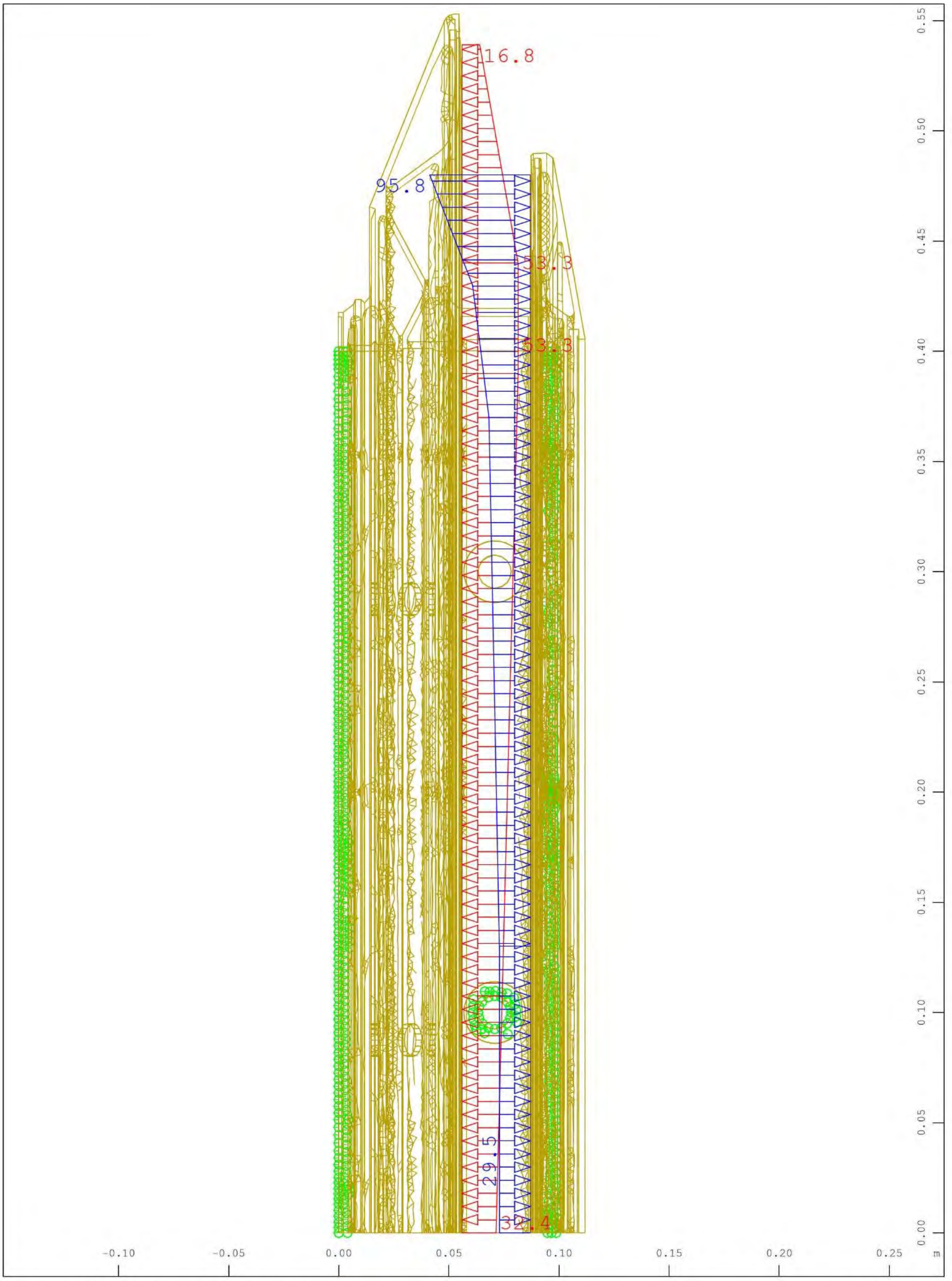


Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in
global Y (Unit=50.0 kN/m) (Min=-53.3) (Max=95.8)

M 1 : 2.06
X * 0.825
Y * 0.954
Z * 0.640

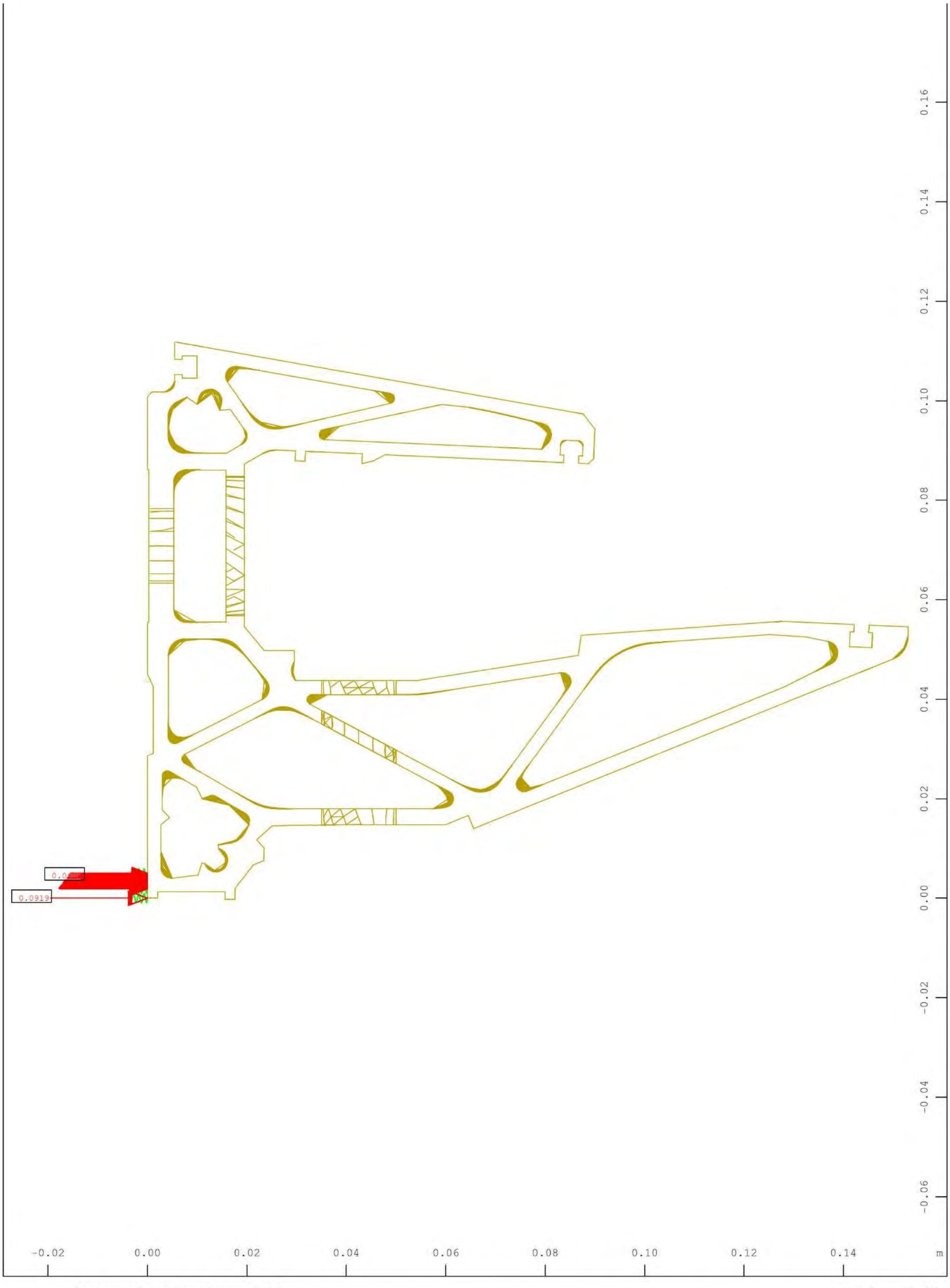


Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-53.3) (Max=95.8)



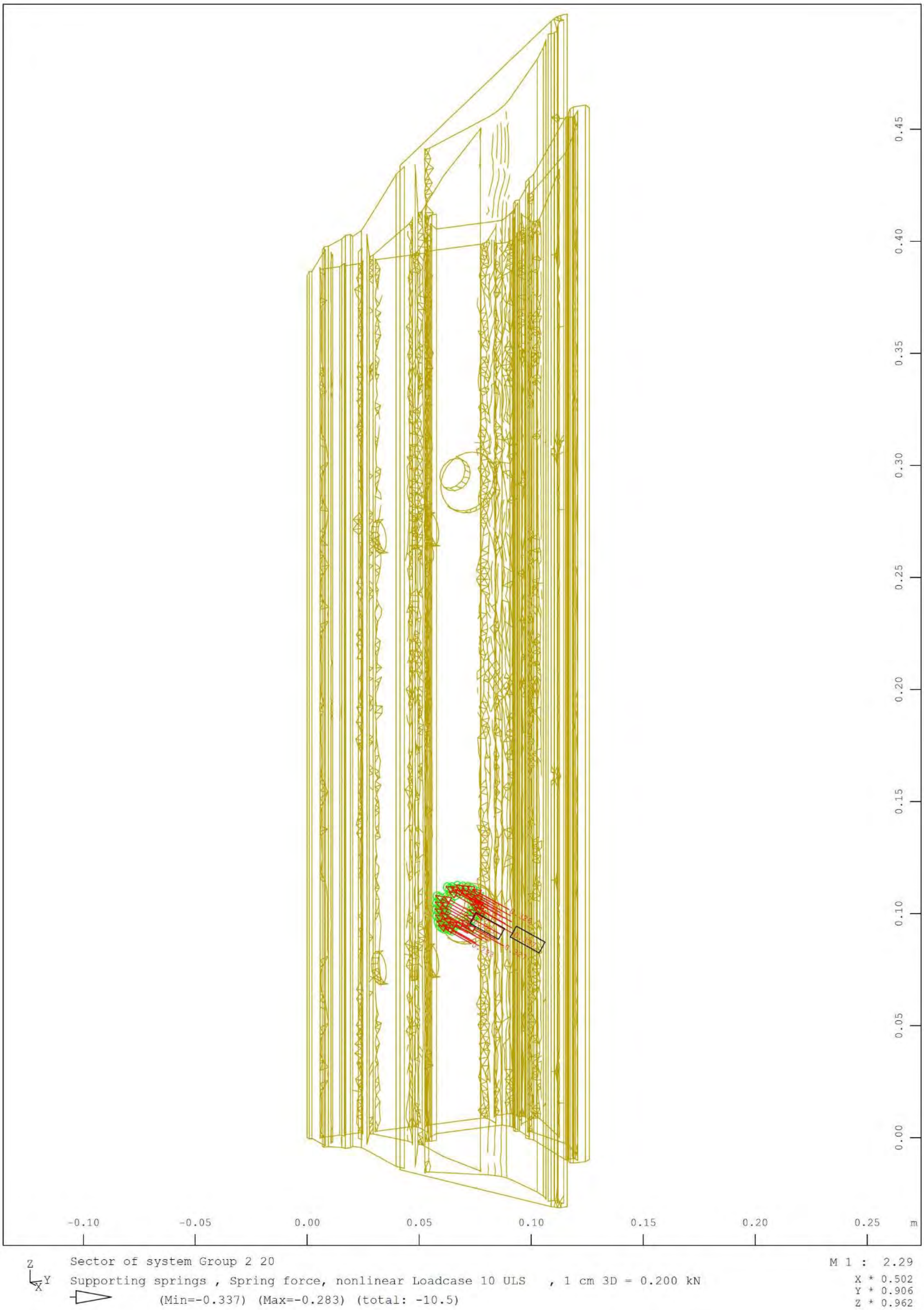
Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-53.3) (Max=95.8)

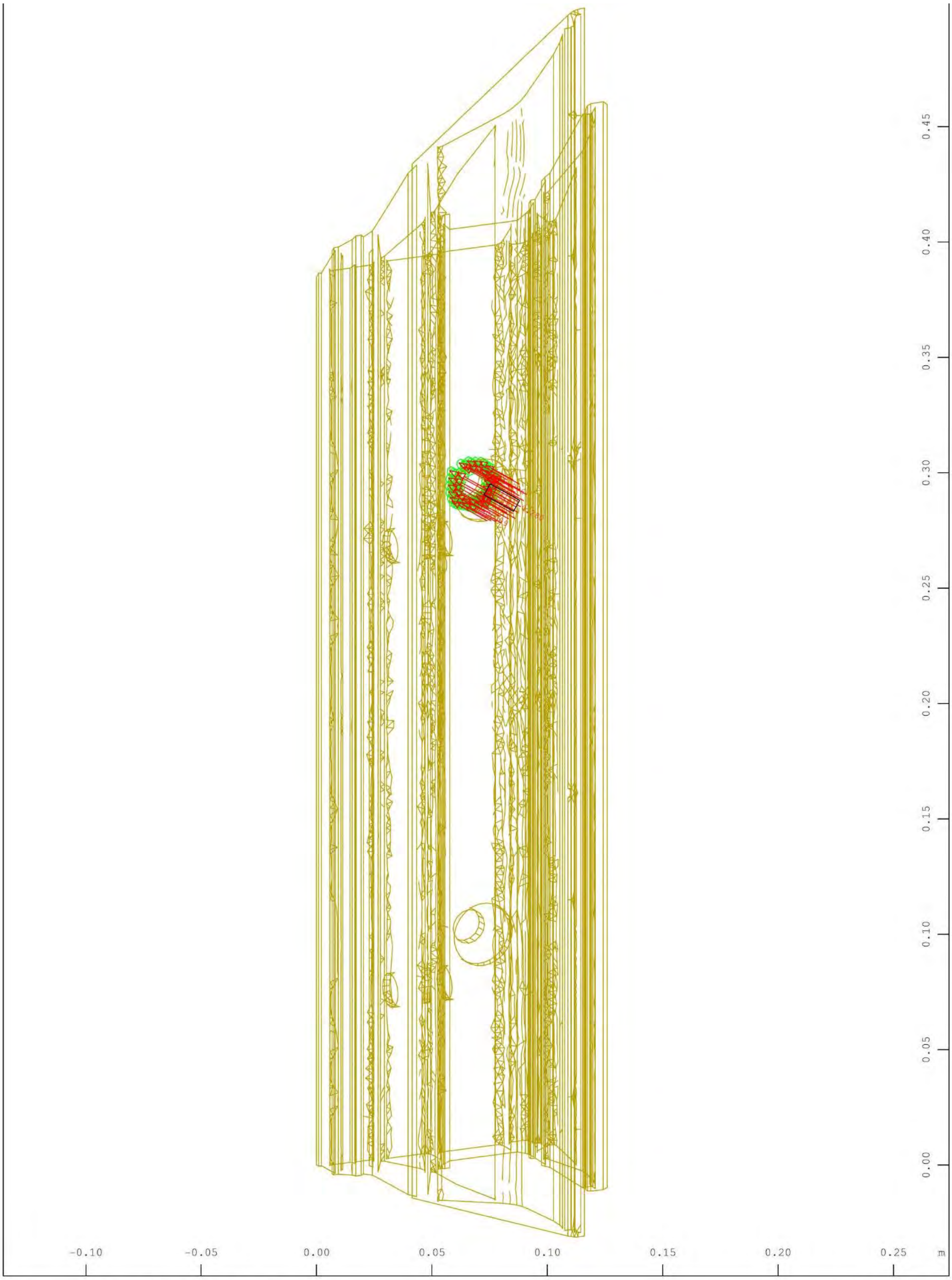
M 1 : 2.39



Sector of system Group 2 10
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.0500 kN
(Min=-0.0919) (Max=-0.0605) (total: -23.1)

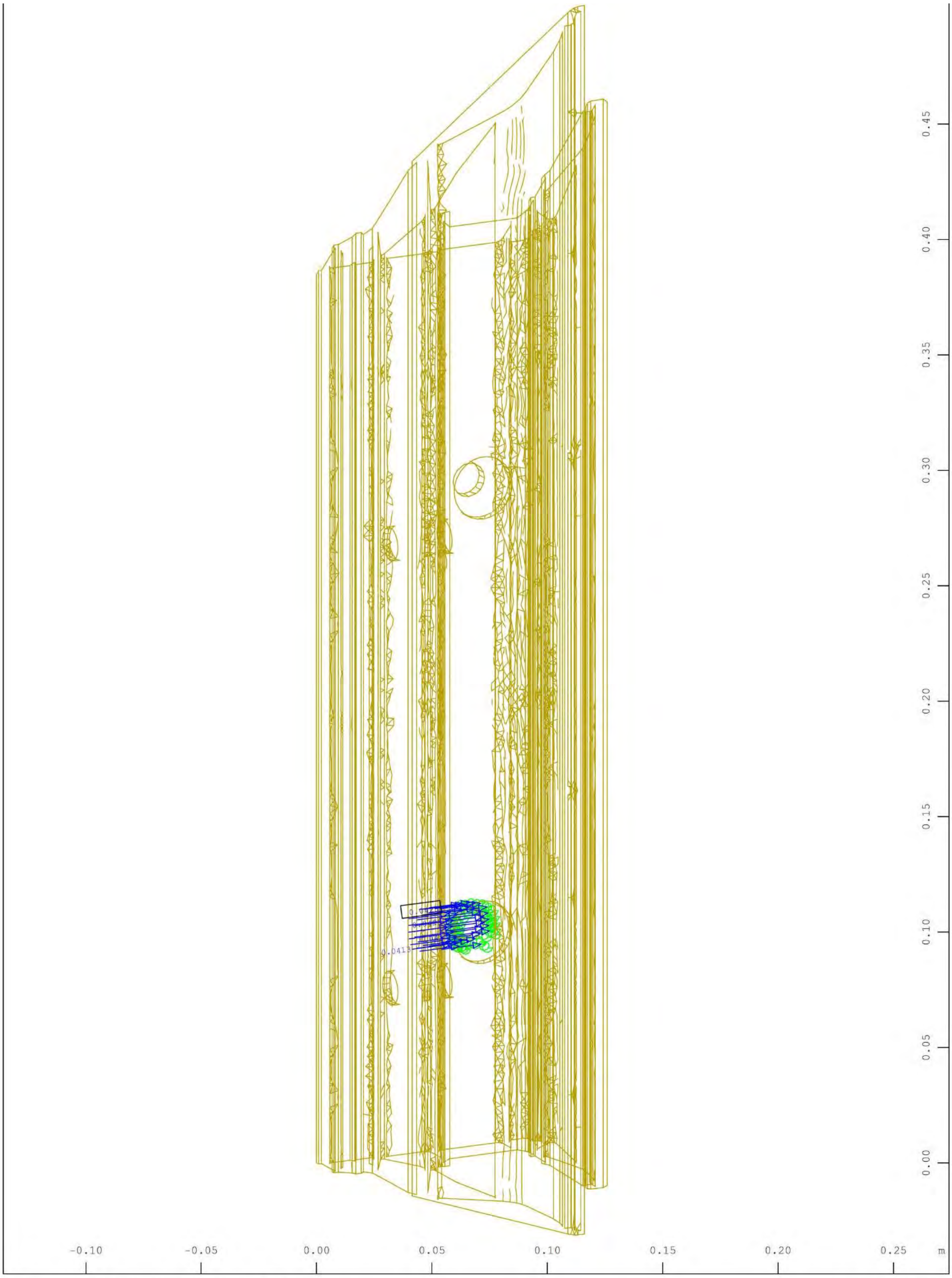
M 1 : 1.06


0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
m
Z
Y
X
Sector of system Group 2 20
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.200 kN
(Min=-0.337) (Max=-0.283) (total: -10.5)
M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



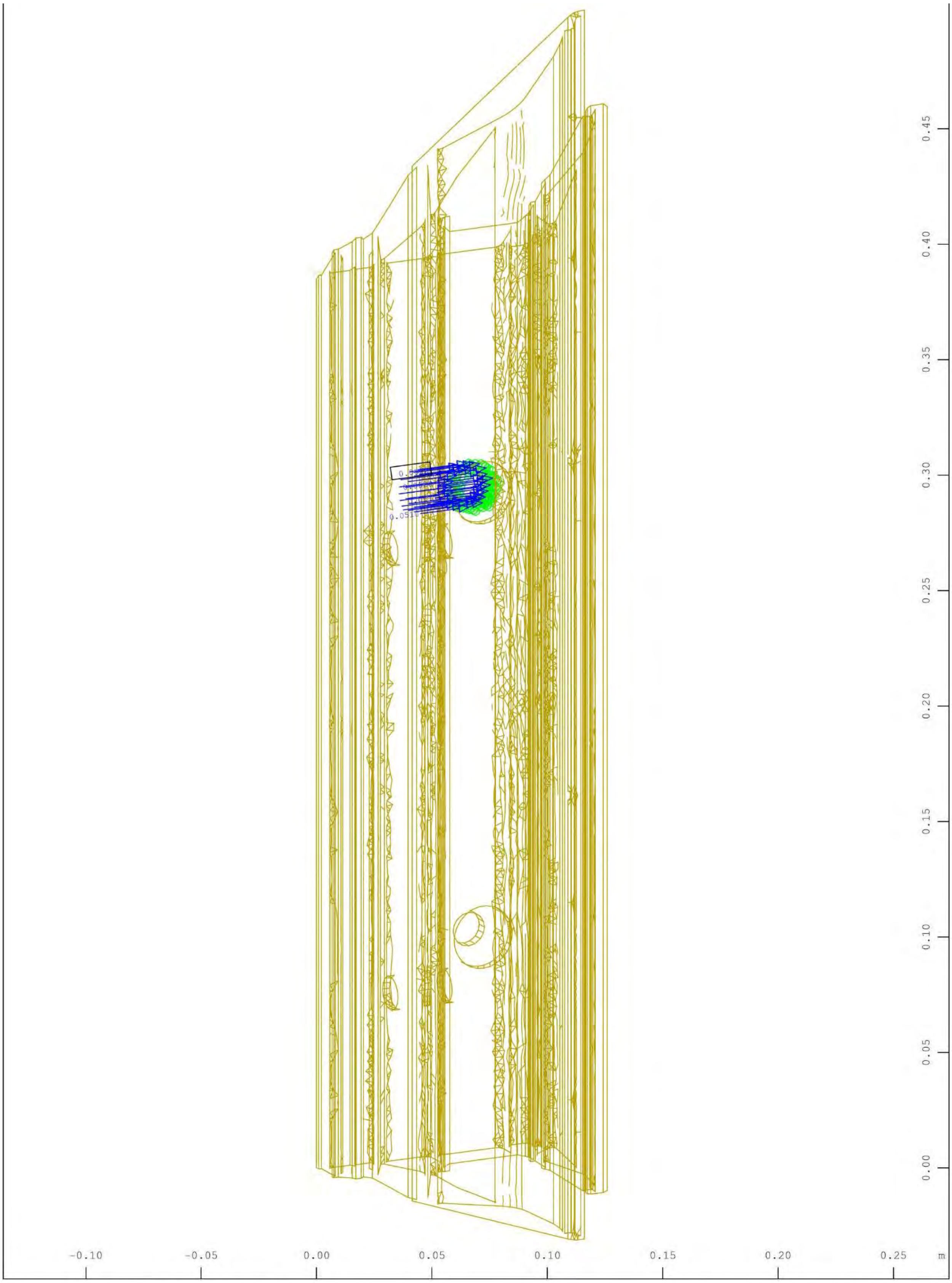
Sector of system Group 2 30
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.200 kN
(Min=-0.319) (Max=-0.261) (total: -12.6)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



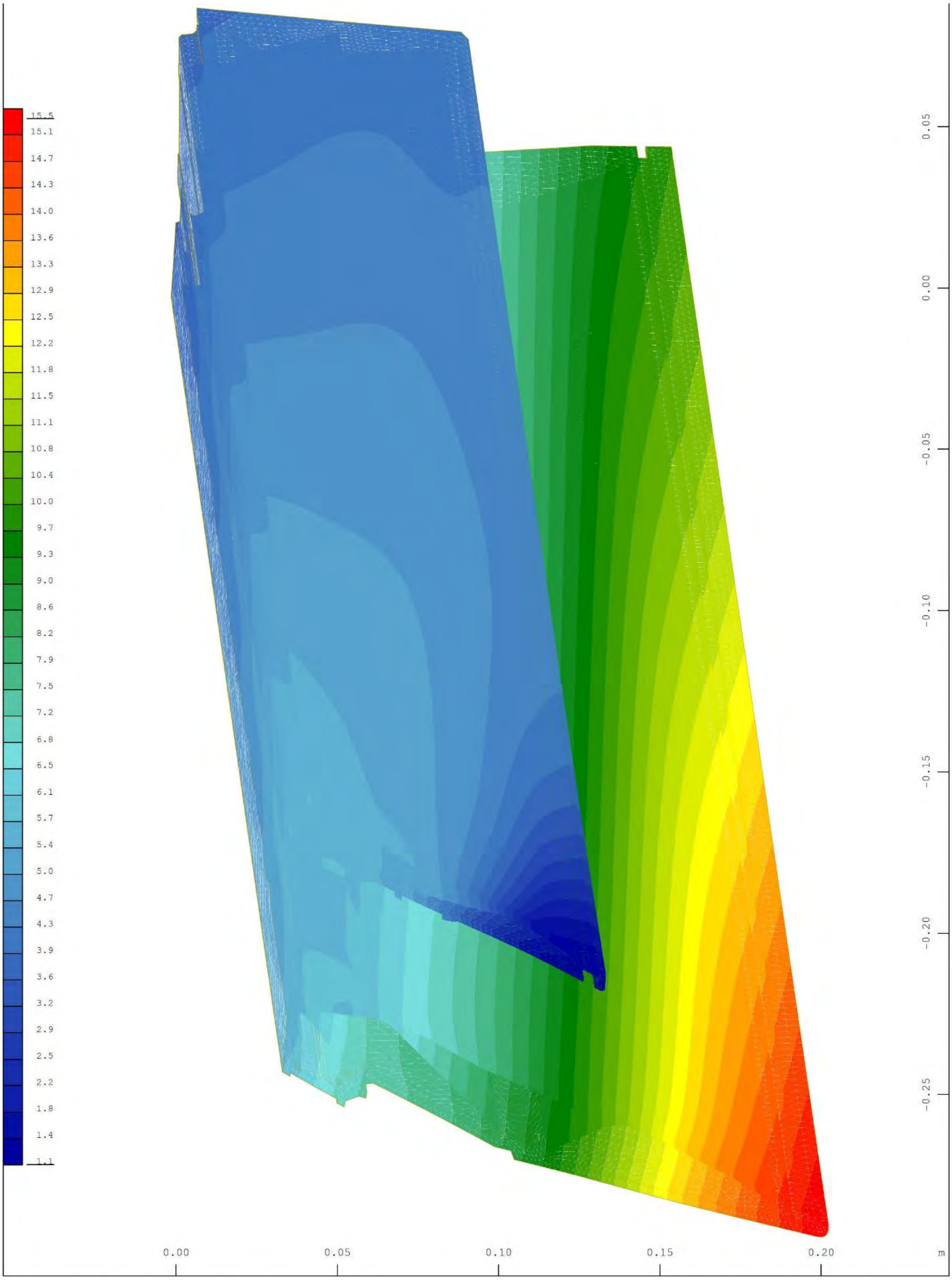
Sector of system Group 2 20
Supporting springs , Spring force in global Y, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.0500 kN (Max=0.0425) (total: 1.47)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



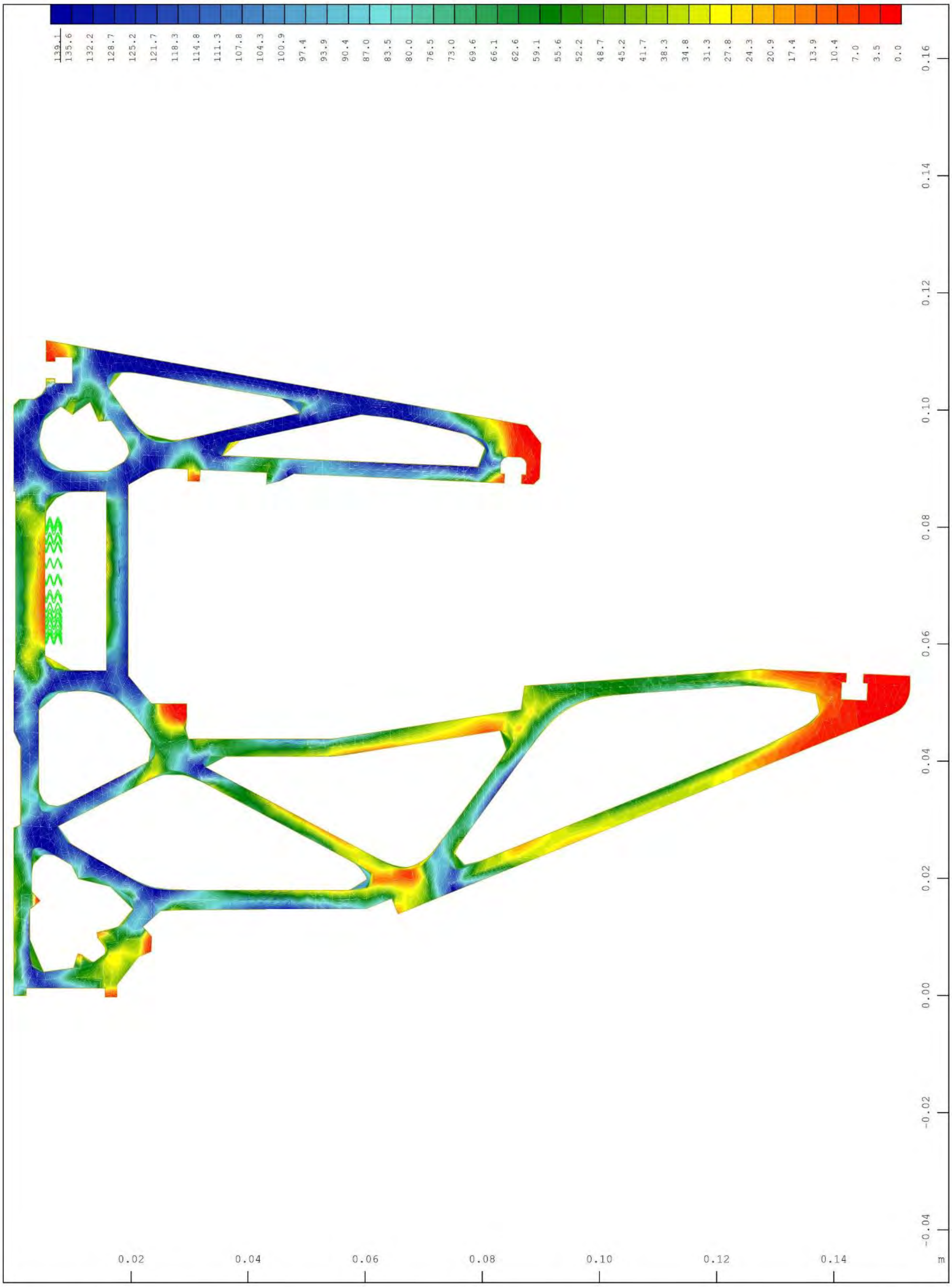
Sector of system Group 2 30
Supporting springs , Spring force in global Y, nonlinear Loadcase 10 ULS , 1 cm 3D =
0.0500 kN (Max=0.0522) (total: 2.27)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



Sector of system Group 2 20
Deformed Structure from LC 10 ULS
Nodal displacement vector in Node, nonlinear Loadcase 10 ULS , from 1.15 to 15.5 step

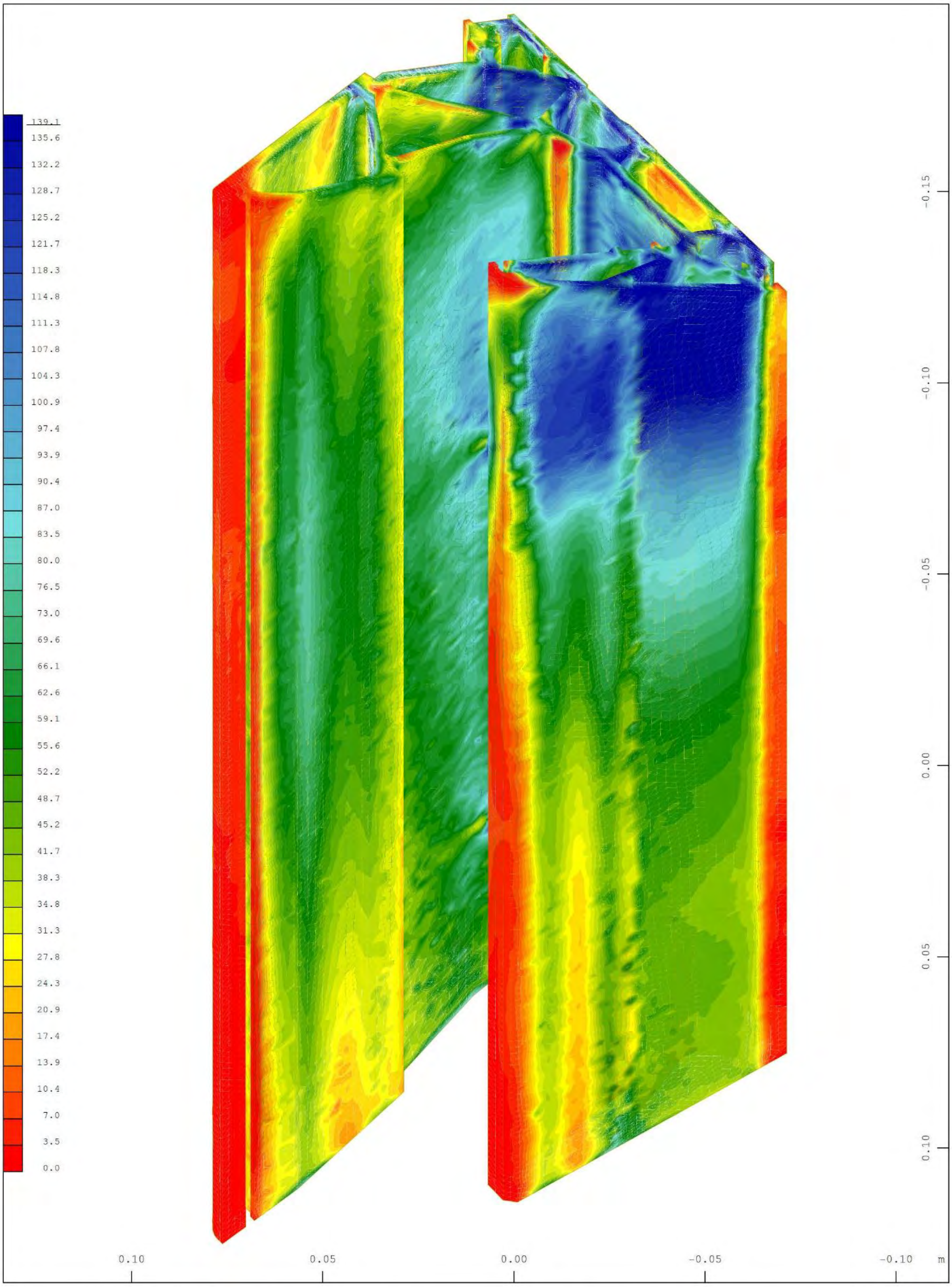
M 1 : 1.64
X * 0.998
Y * 0.801
Z * 0.603



Sector of system Group 2 20 — M 10 : 9

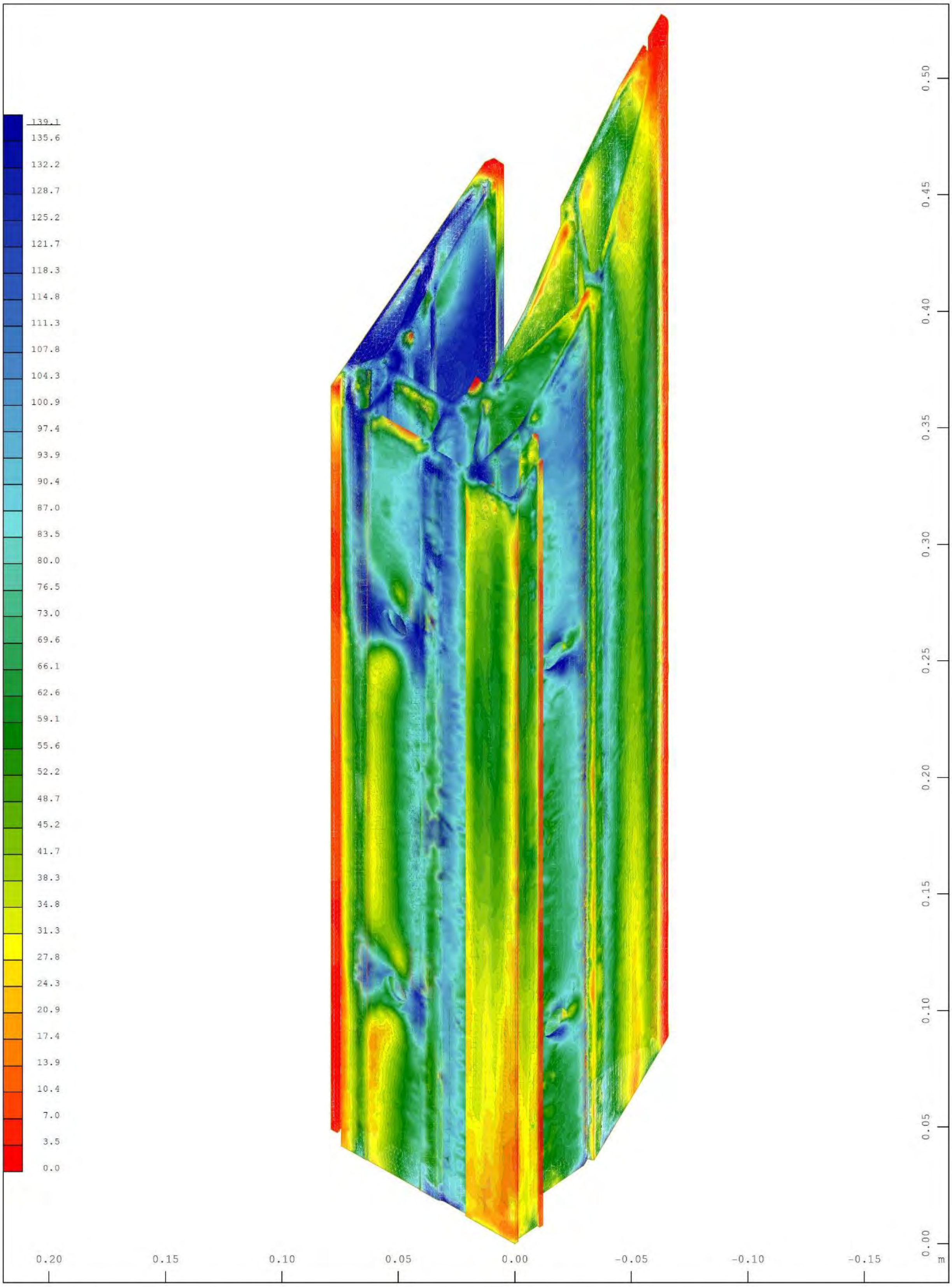
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0034 to 139.1

step 3.48 MPa



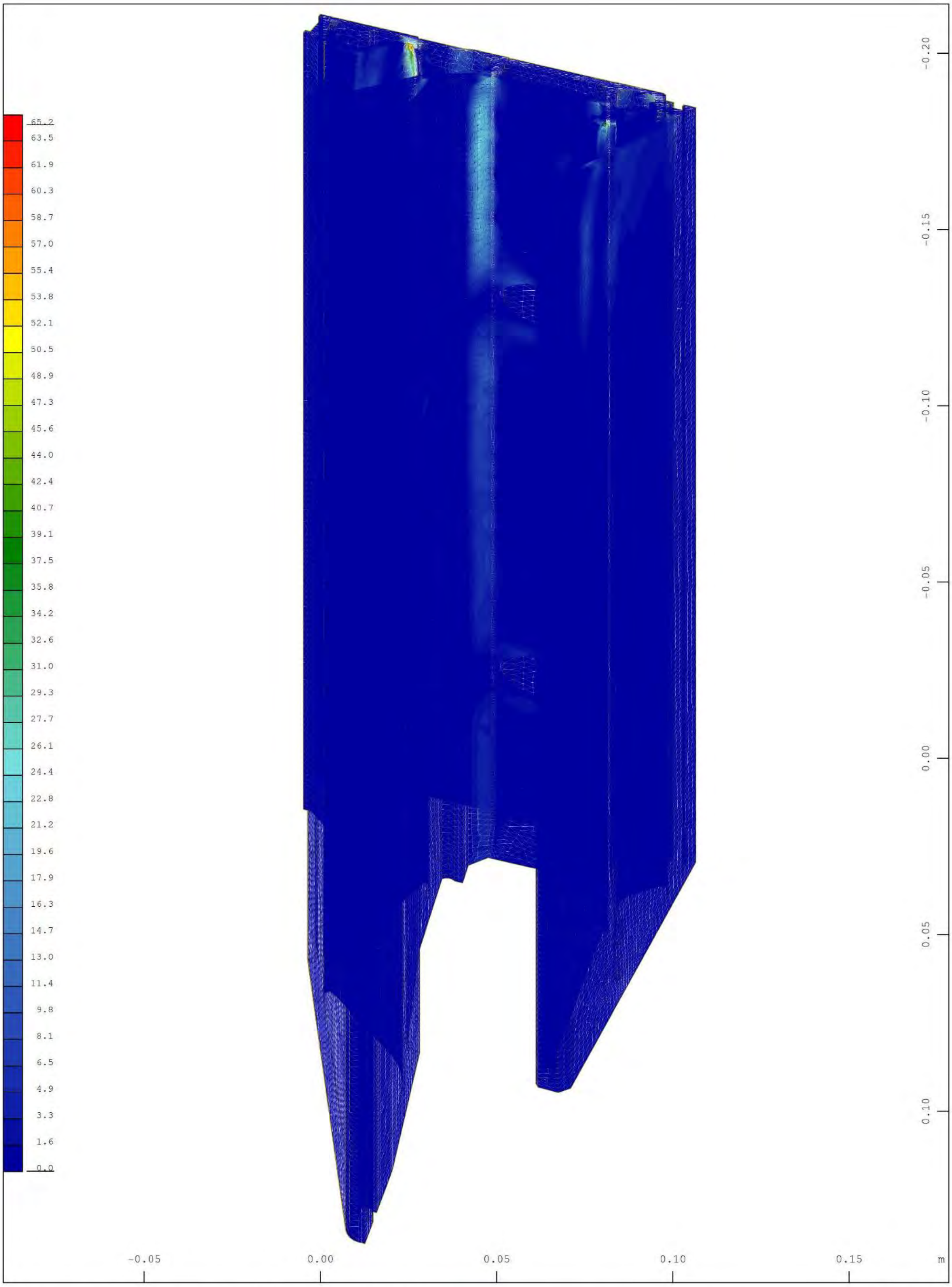
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0034 to 139.1 step 3.48 MPa

M 1 : 1.38
X * 0.944
Y * 0.932
Z * 0.491



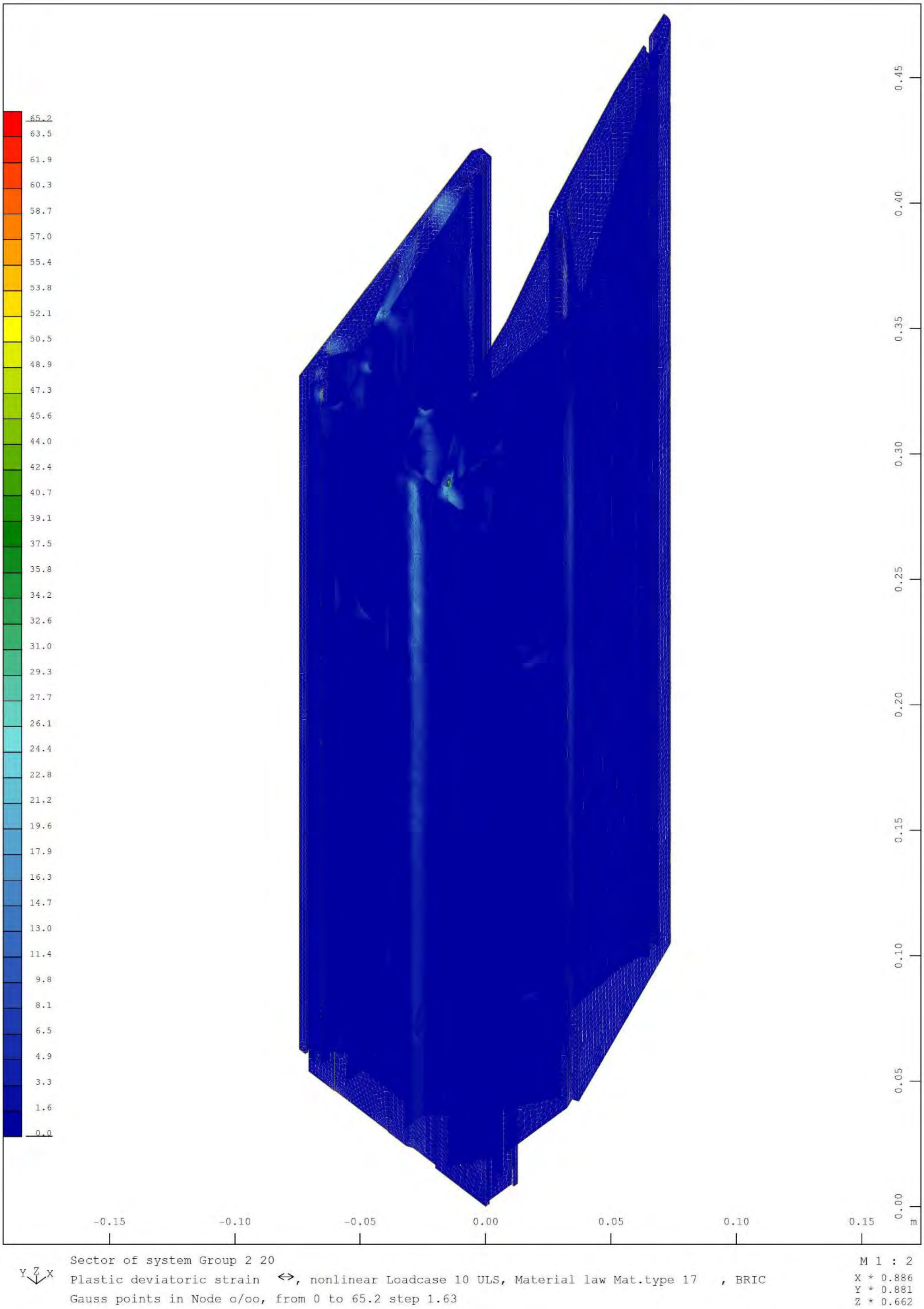
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 0.0034 to
139.1 step 3.48 MPa

M 1 : 2.27
X * 0.814
Y * 0.848
Z * 0.786

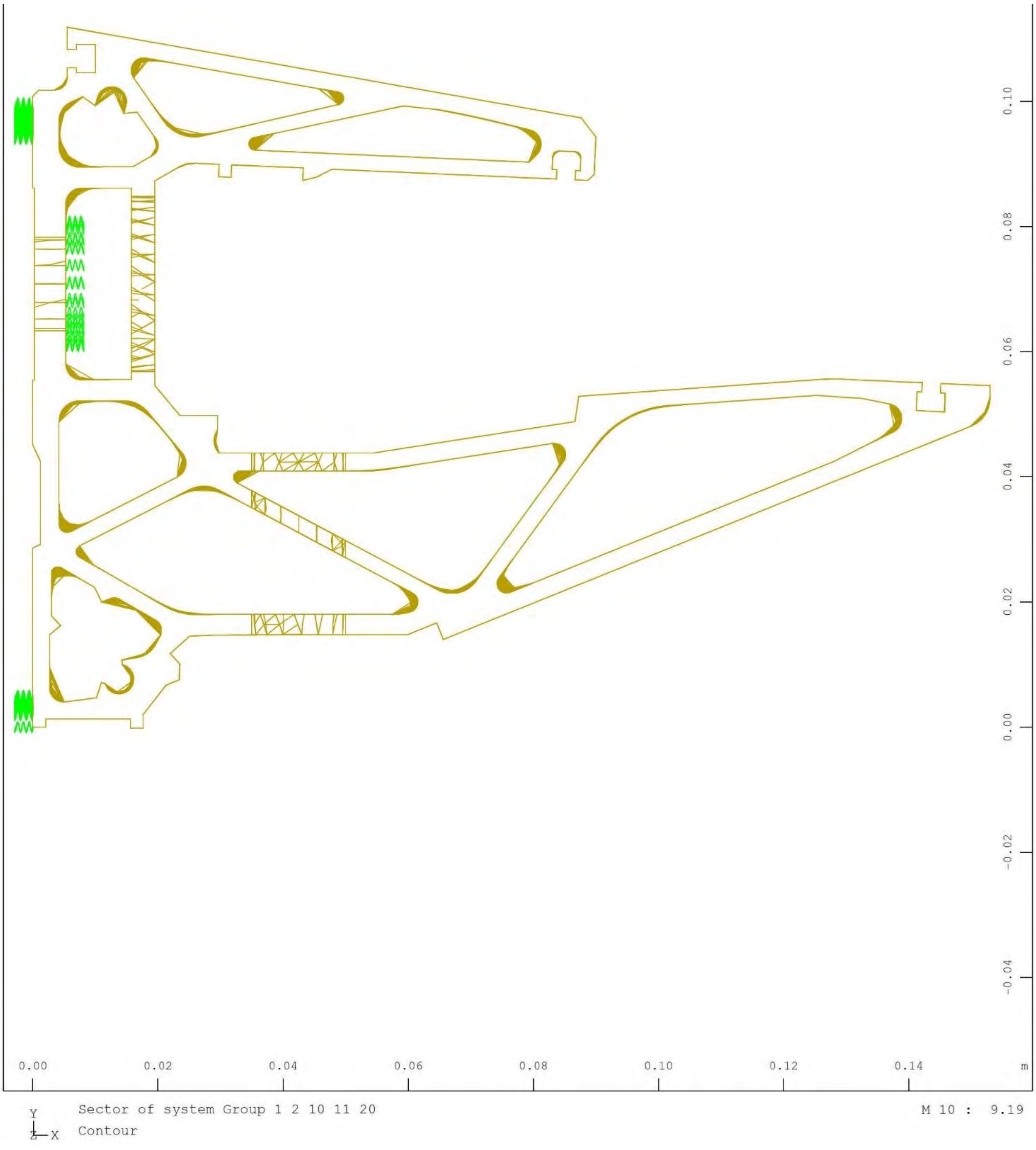


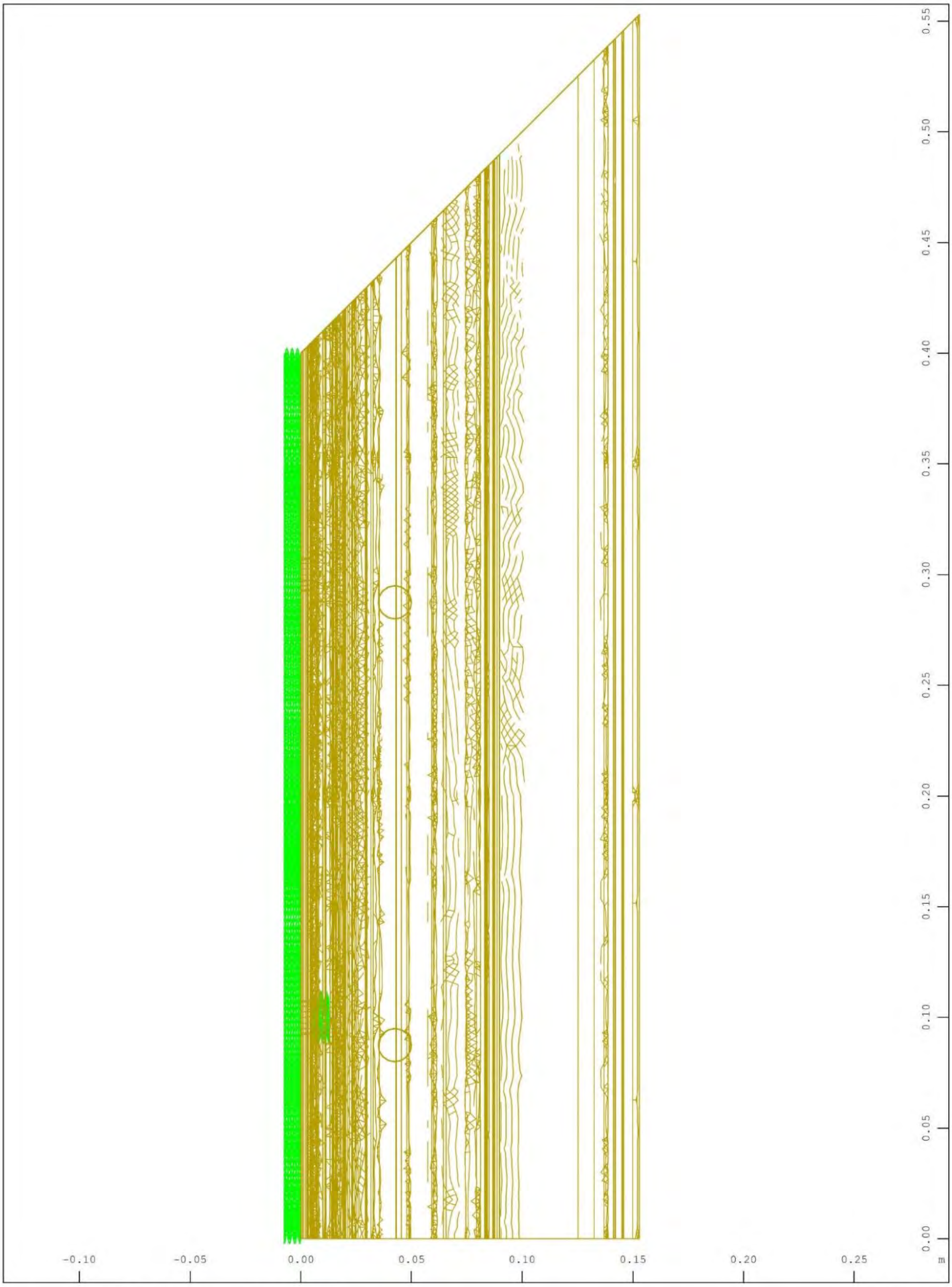
Sector of system Quadrilateral Elements,Volume Elements
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 65.2 step 1.63

M 1 : 1.50
X * 0.861
Y * 0.990
Z * 0.528


65.2
63.5
61.9
60.3
58.7
57.0
55.4
53.8
52.1
50.5
48.9
47.3
45.6
44.0
42.4
40.7
39.1
37.5
35.8
34.2
32.6
31.0
29.3
27.7
26.1
24.4
22.8
21.2
19.6
17.9
16.3
14.7
13.0
11.4
9.8
8.1
6.5
4.9
3.3
1.6
0.0
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
m
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Y Z X
Sector of system Group 2 20
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 , BRIC
Gauss points in Node o/oo, from 0 to 65.2 step 1.63
M 1 : 2
X * 0.886
Y * 0.881
Z * 0.662

9.2.4 Calcolo numerico profilo - configurazione ad angolo - carichi di depressione (vento)



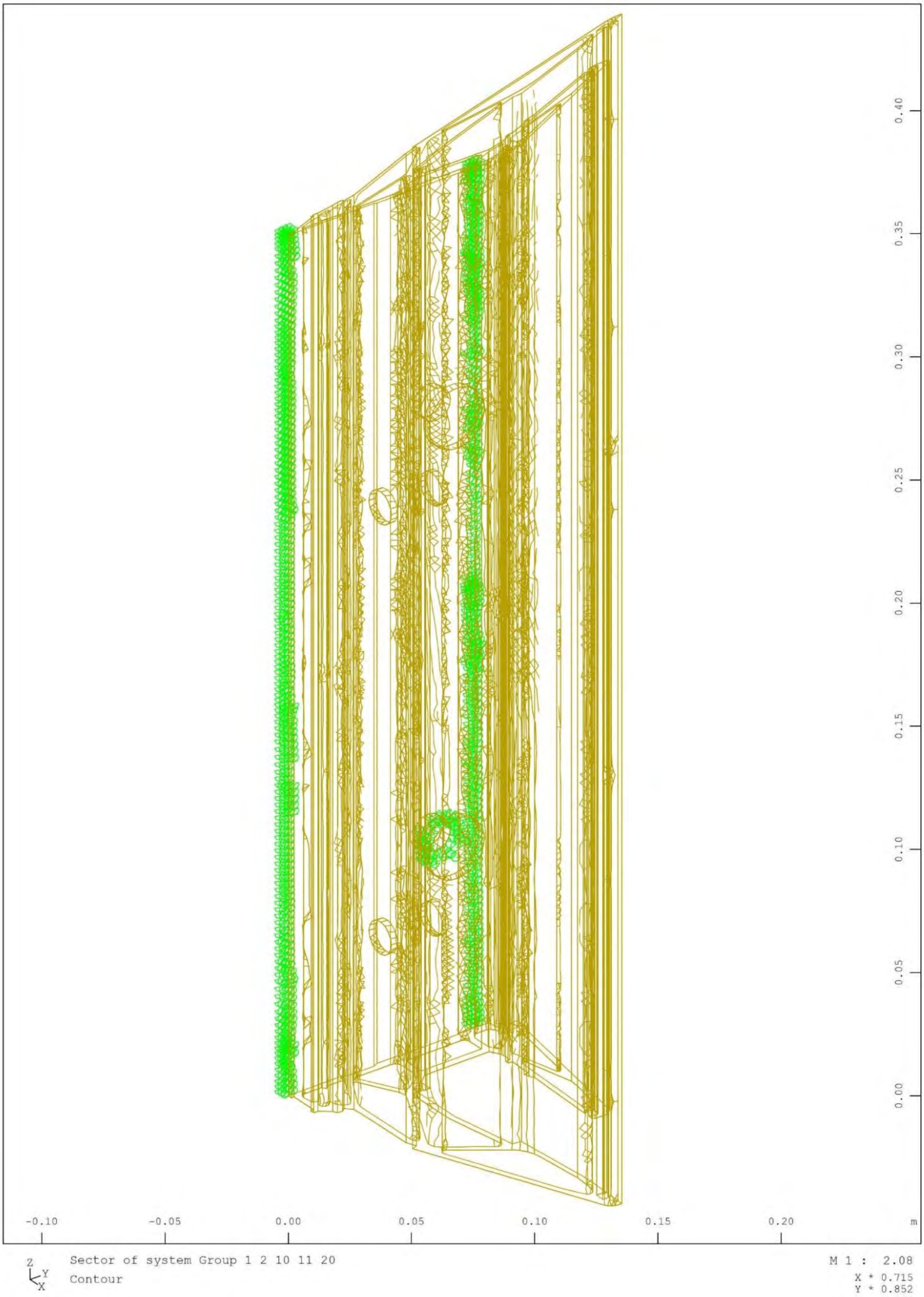


Z X
Sector of system Group 1 2 10 11 20
Contour

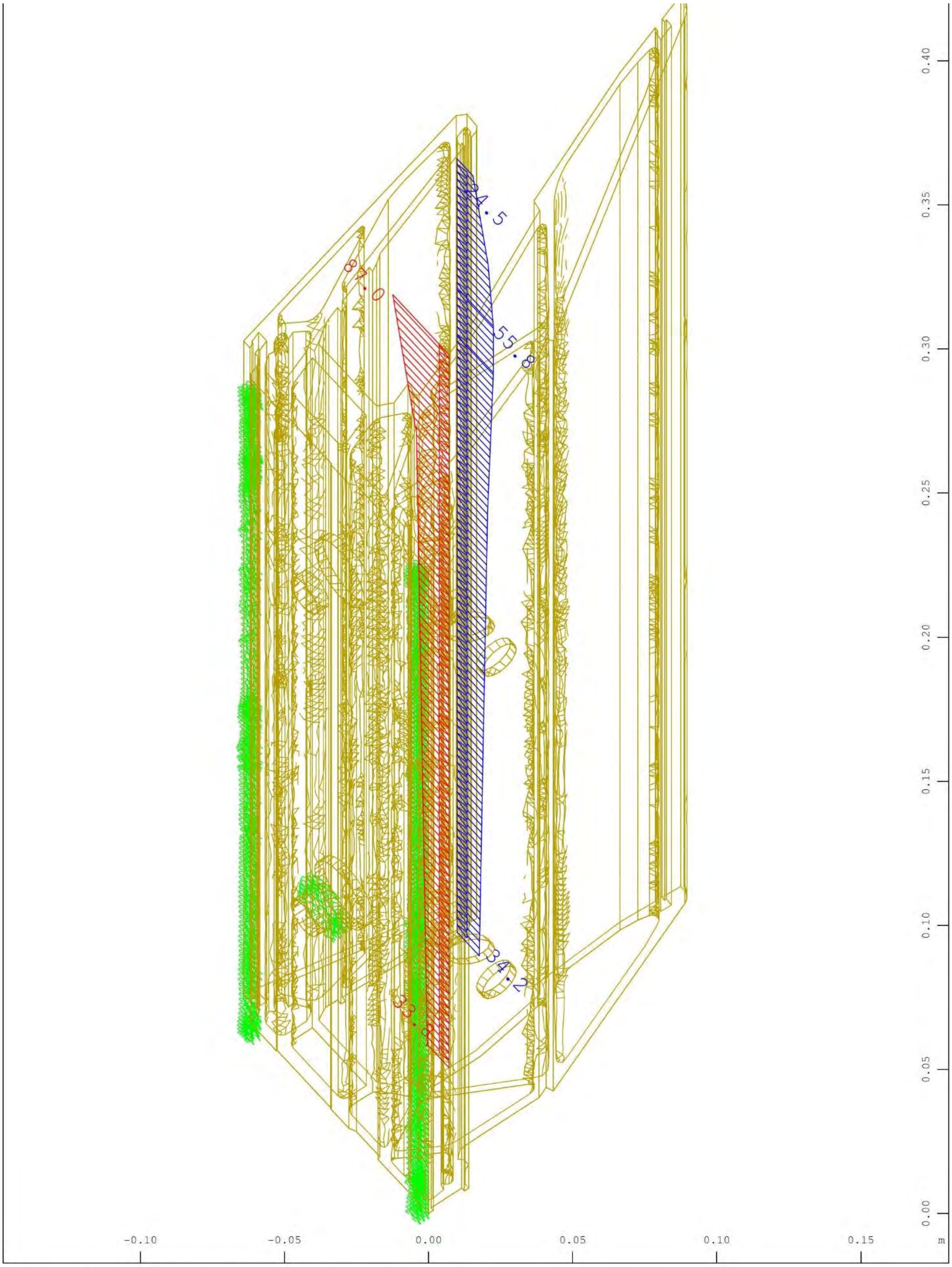
M 1 : 2.39

Z
X Y
Sector of system Group 1 2 10 11 20
Contour

M 1 : 2.39

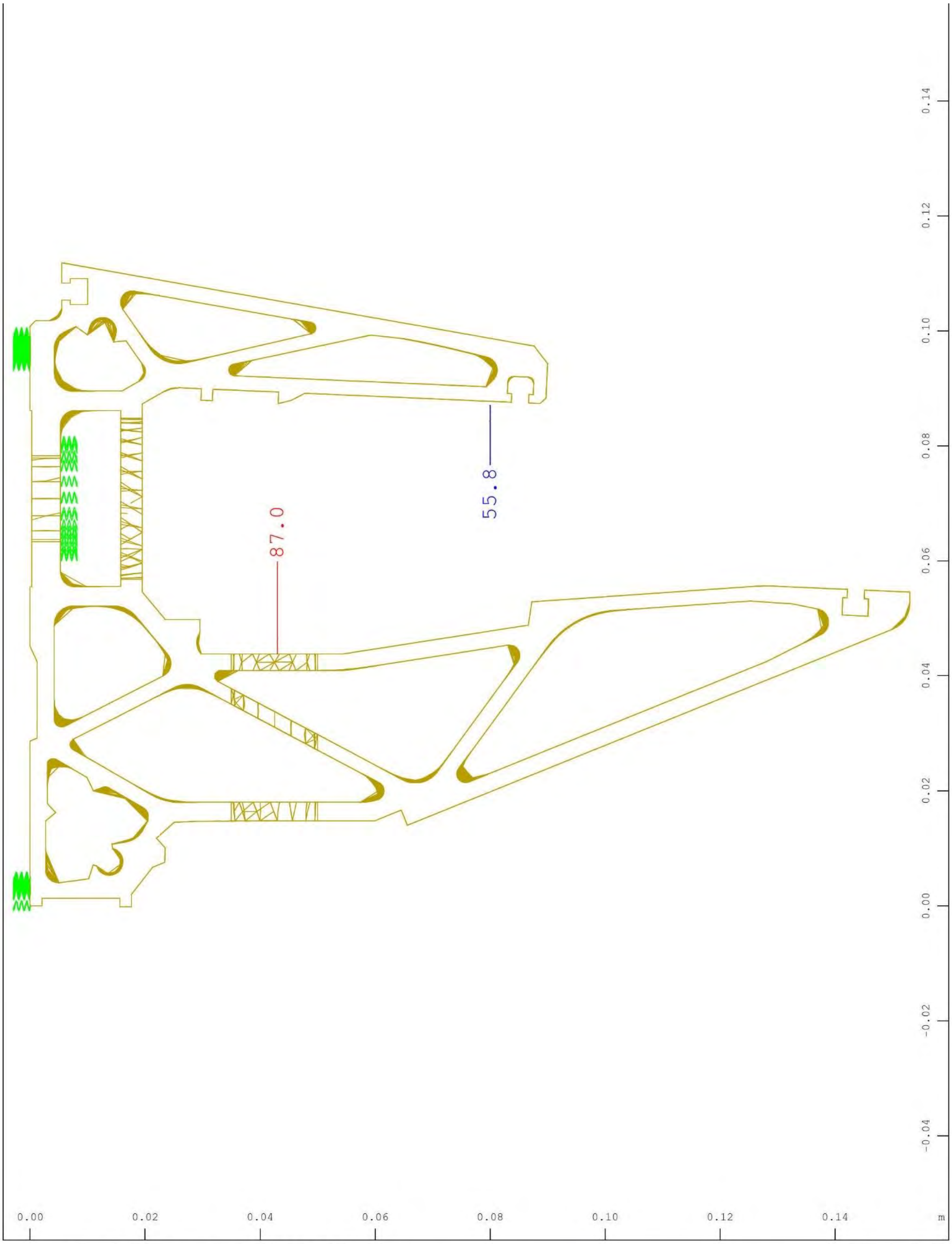


0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
m
Z
Y
X
Sector of system Group 1 2 10 11 20
Contour
M 1 : 2.08
X * 0.715
Y * 0.852

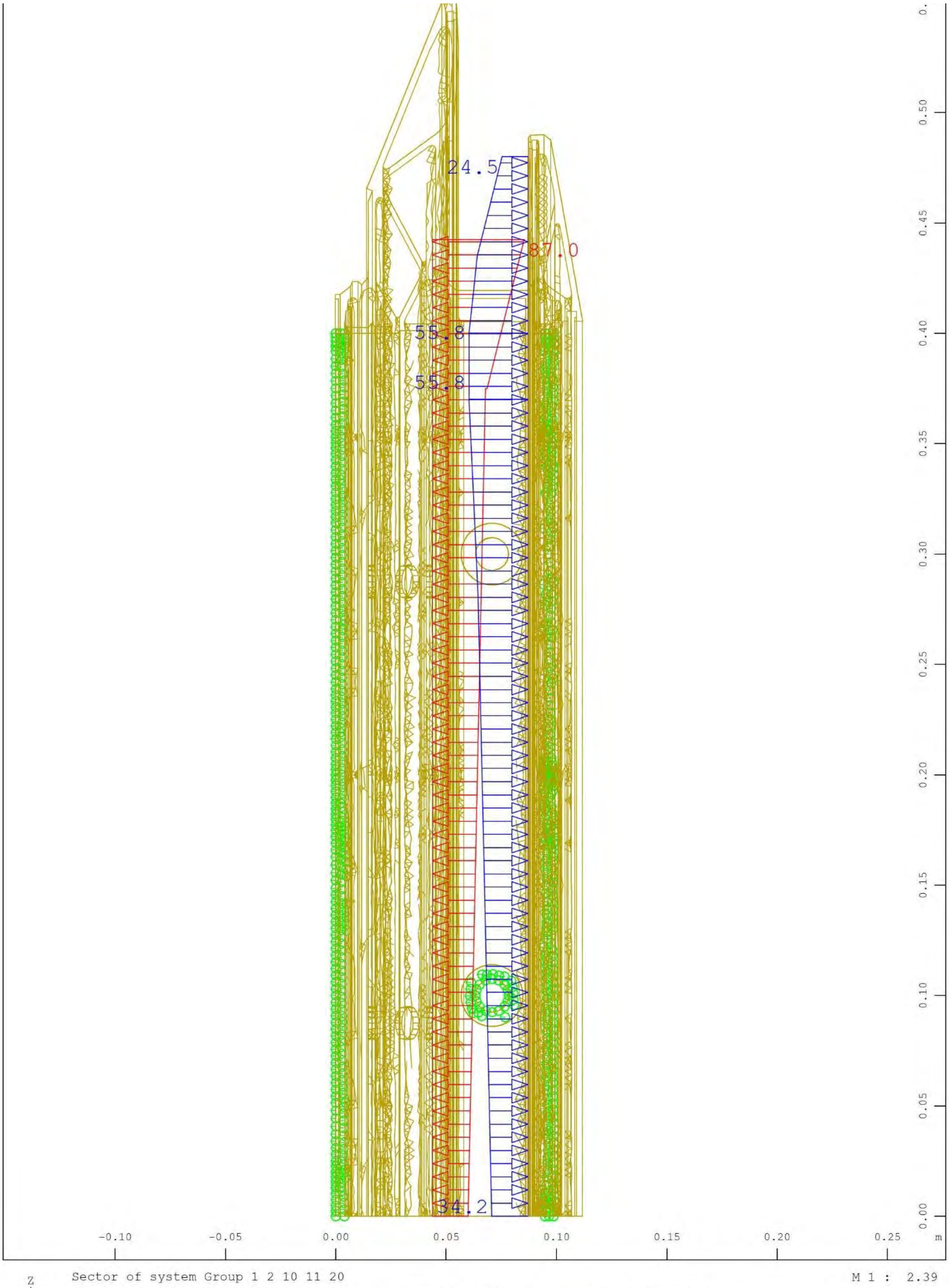


Sector of system Group 1 2 10 11 20
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-87.0) (Max=55.8)

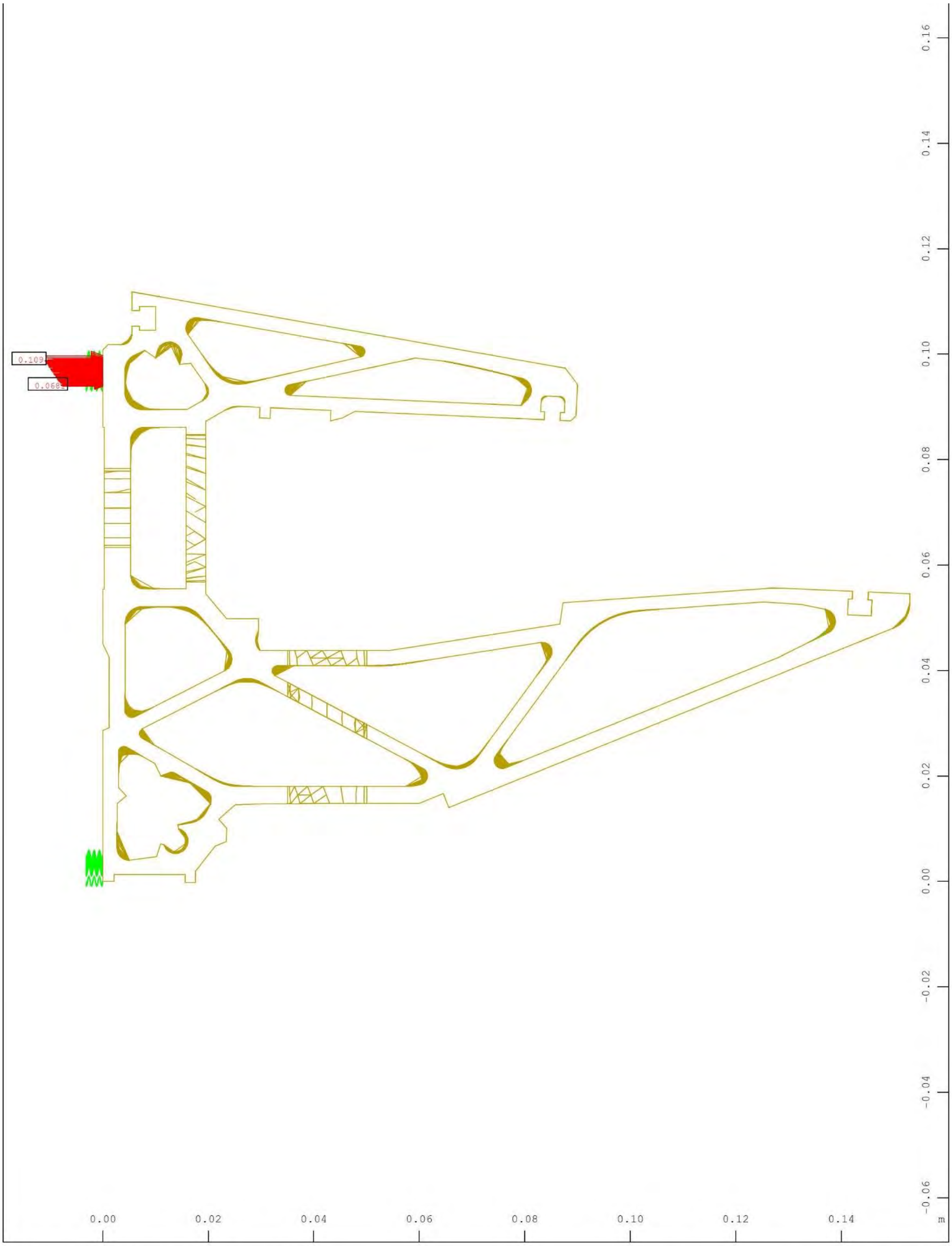
M 1 : 1.83
X * 0.939
Y * 0.897
Z * 0.559



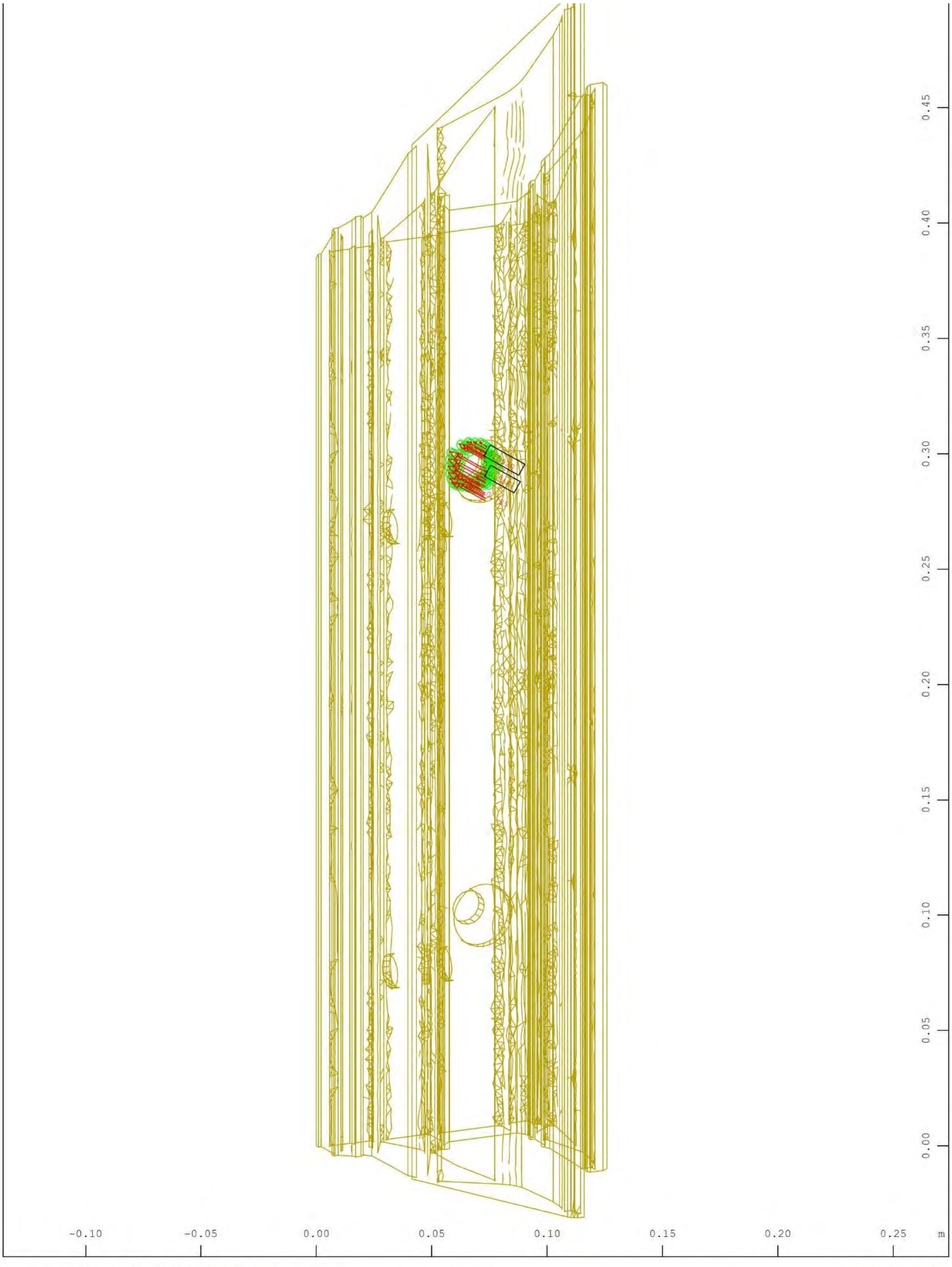
Sector of system Group 1 2 10 11 20 M 10 : 9.19
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-87.0) (Max=55.8)



Sector of system Group 1 2 10 11 20 M 1 : 2.39
All loads, nonlinear Loadcase 10 ULS , (1 cm 3D = unit) Free line load (force) in global Y (Unit=50.0 kN/m) (Min=-87.0) (Max=55.8)

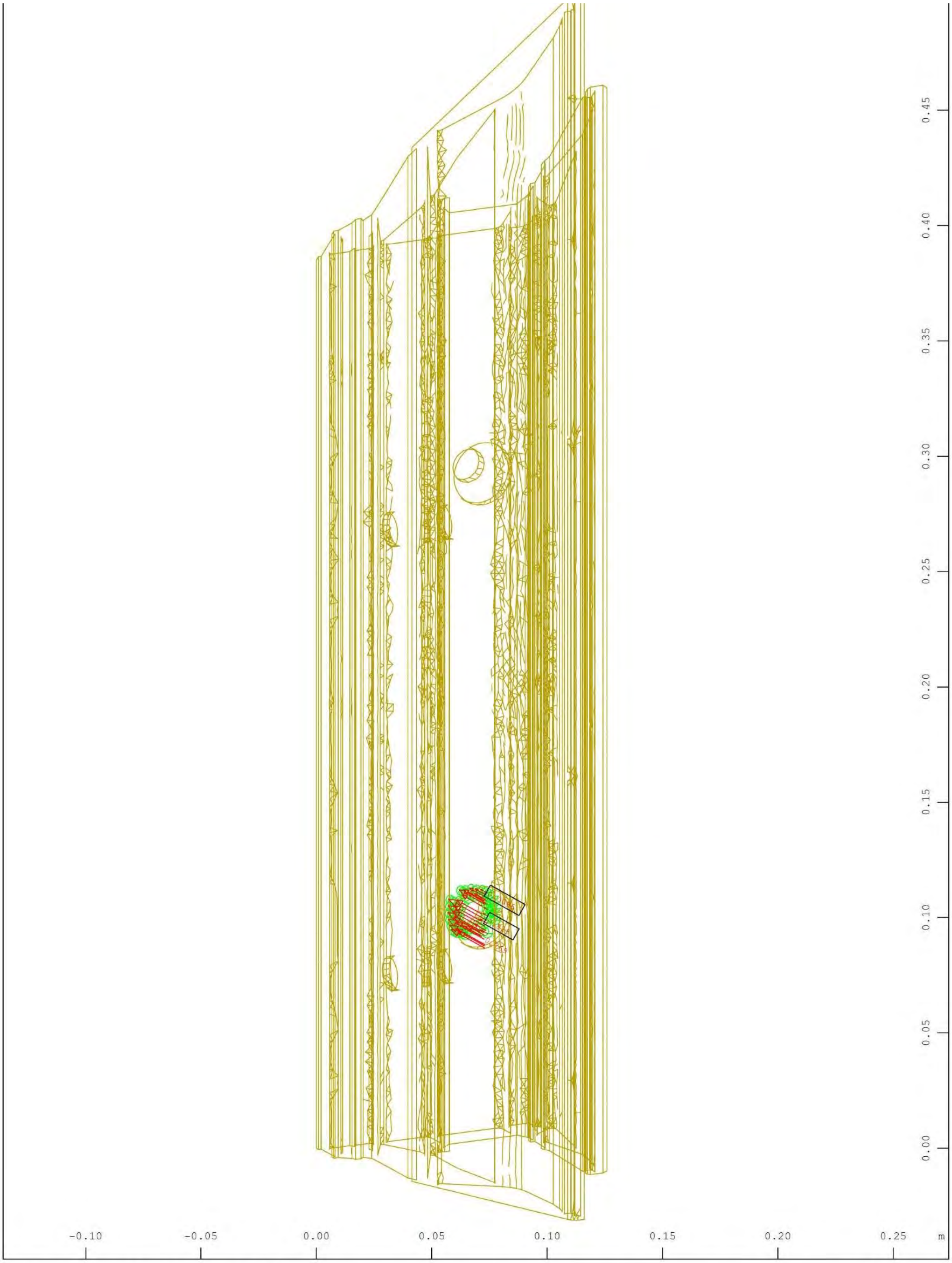


Sector of system Group 2 10 11 M 1 : 1
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.100 kN
(Min=-0.109) (Max=0) (total: -26.7)



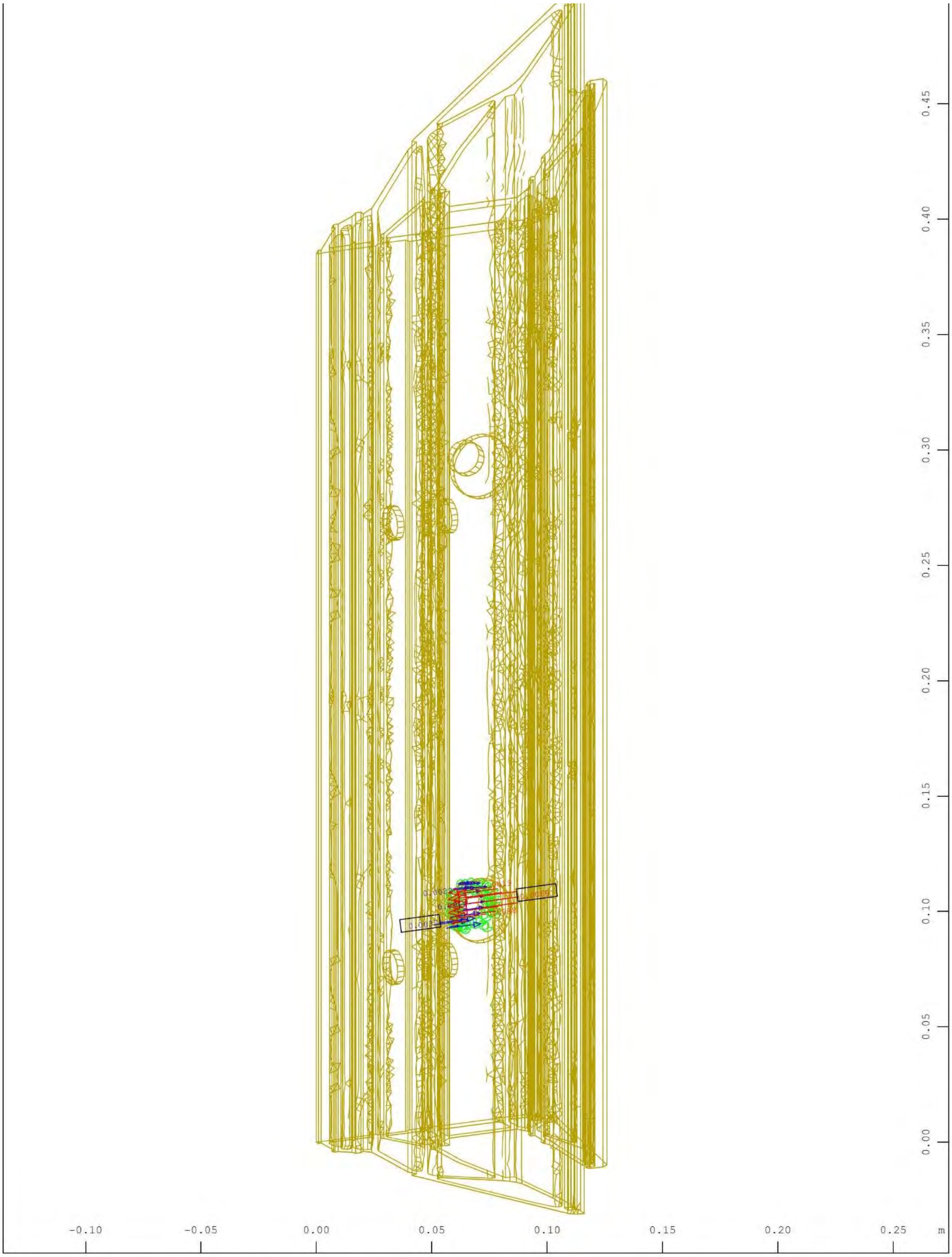
Sector of system Group 2 30
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.500 kN
(Min=-0.816) (Max=0) (total: -13.8)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



Sector of system Group 2 20
Supporting springs , Spring force, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.500 kN
(Min=-0.813) (Max=0) (total: -12.9)

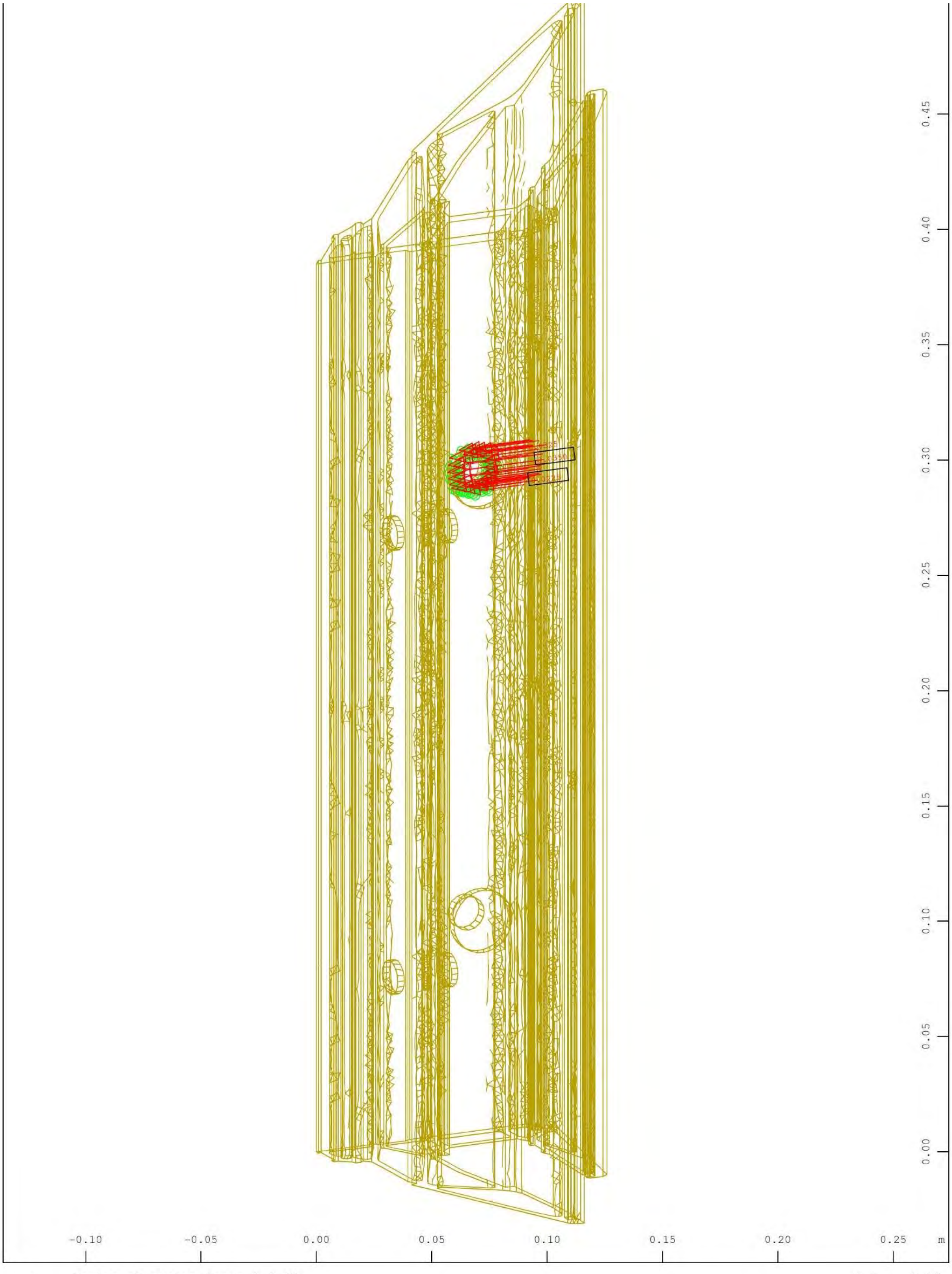
M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962



Z
Y
X

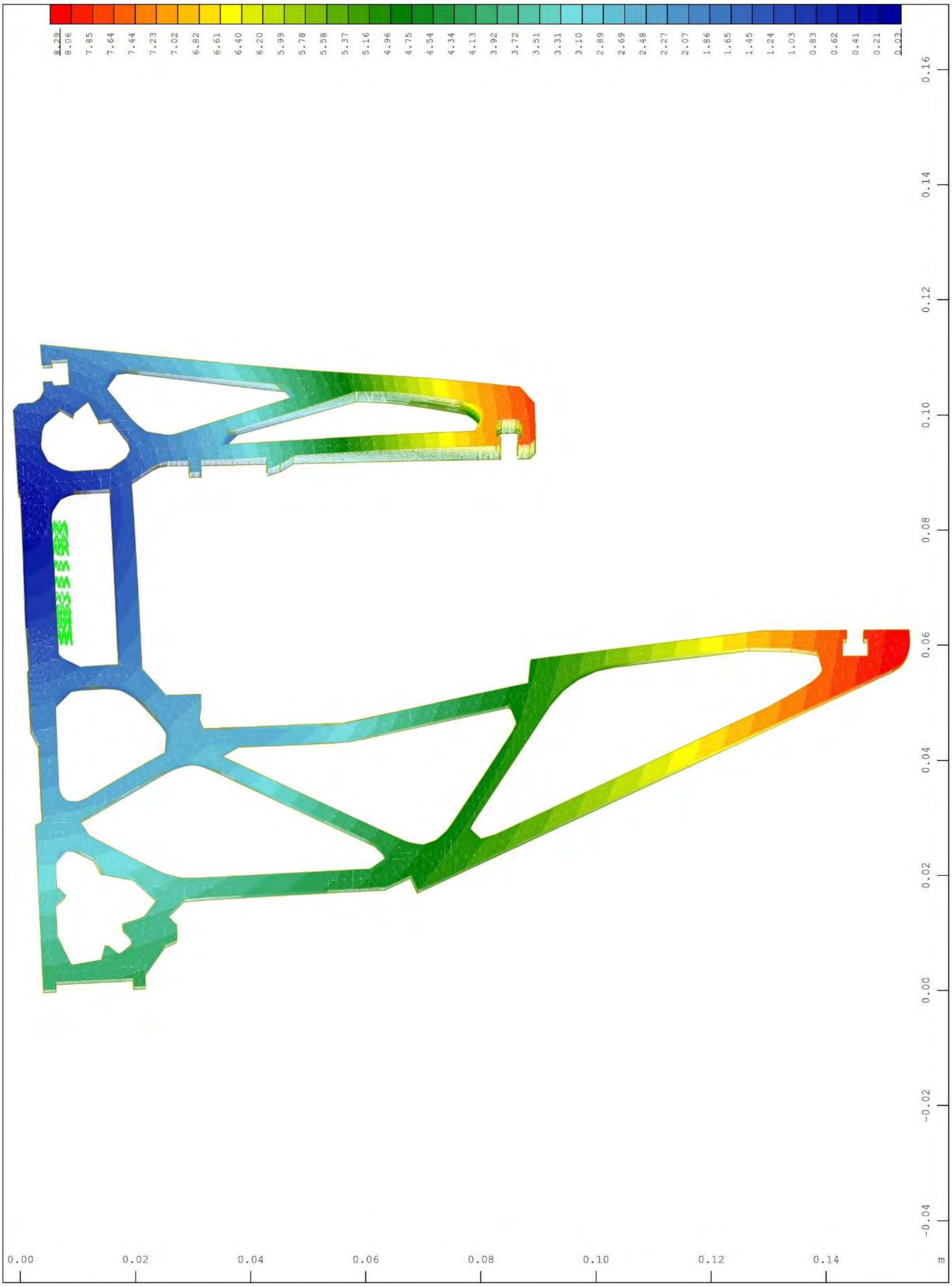
Sector of system Group 1 2 20
Supporting springs , Spring force in global Y, nonlinear Loadcase 10 ULS , 1 cm 3D =
0.0050 kN (Min=-0.0069) (Max=0.0037) (total: -0.0275)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962

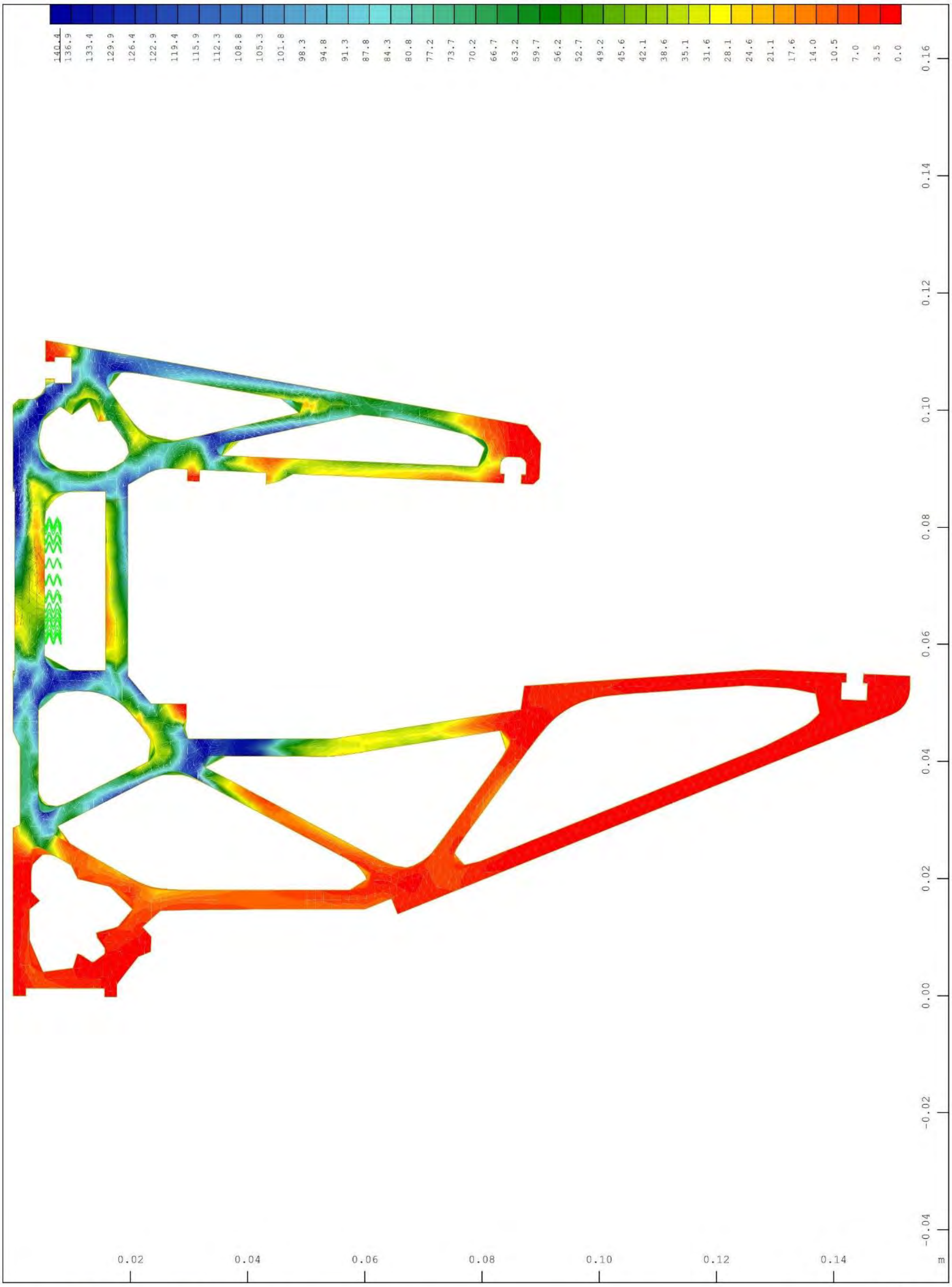


Sector of system Group 1 2 30
Supporting springs , Spring force in global Y, nonlinear Loadcase 10 ULS , 1 cm 3D = 0.0200 kN (Min=-0.0350) (Max=0) (total: -1.09)

M 1 : 2.29
X * 0.502
Y * 0.906
Z * 0.962

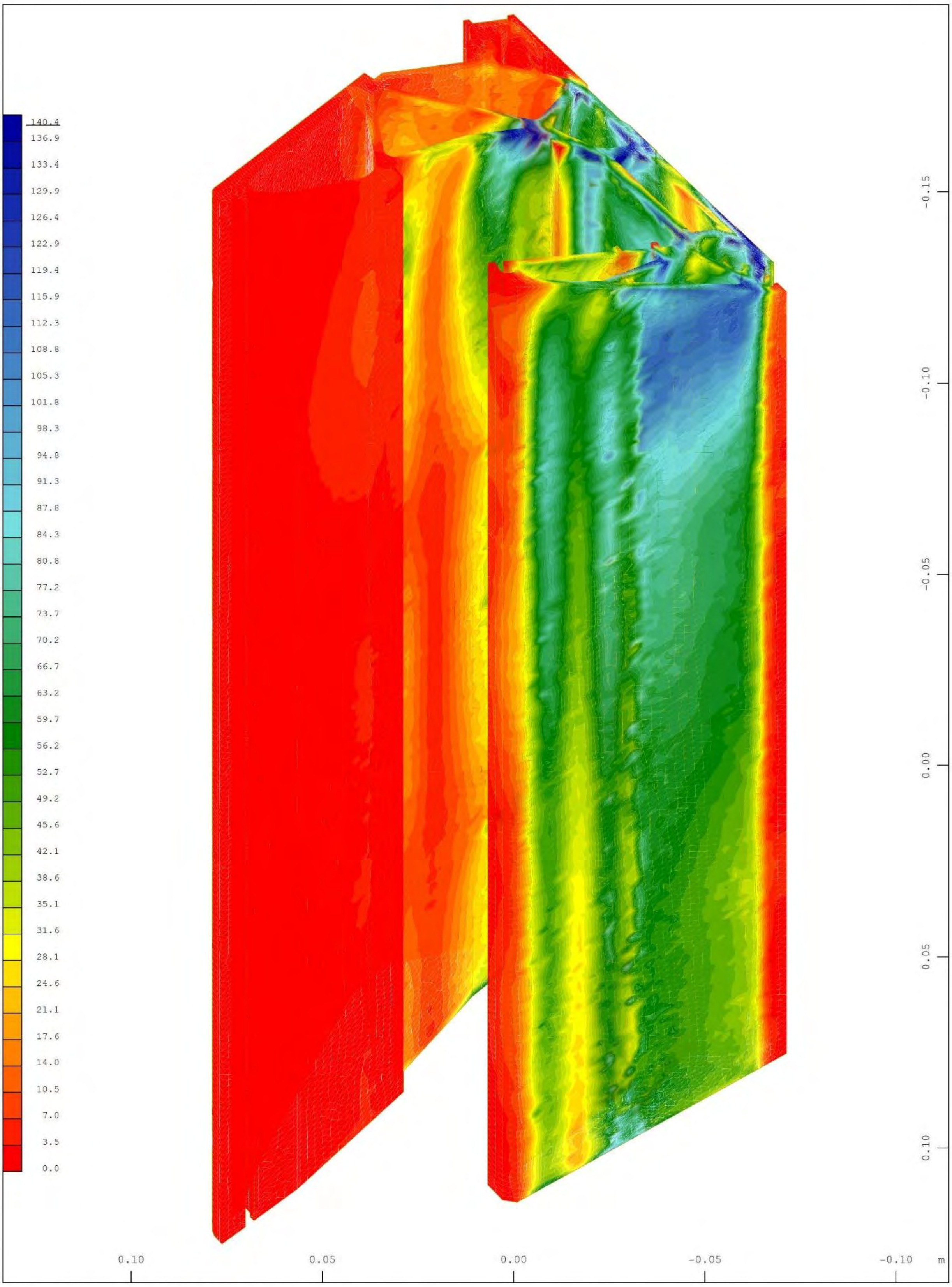


Sector of system Group 2 20 M 10 : 9.18
Deformed Structure from LC 10 ULS
Nodal displacement vector in Node, nonlinear Loadcase 10 ULS , from 0.0296 to 8.29



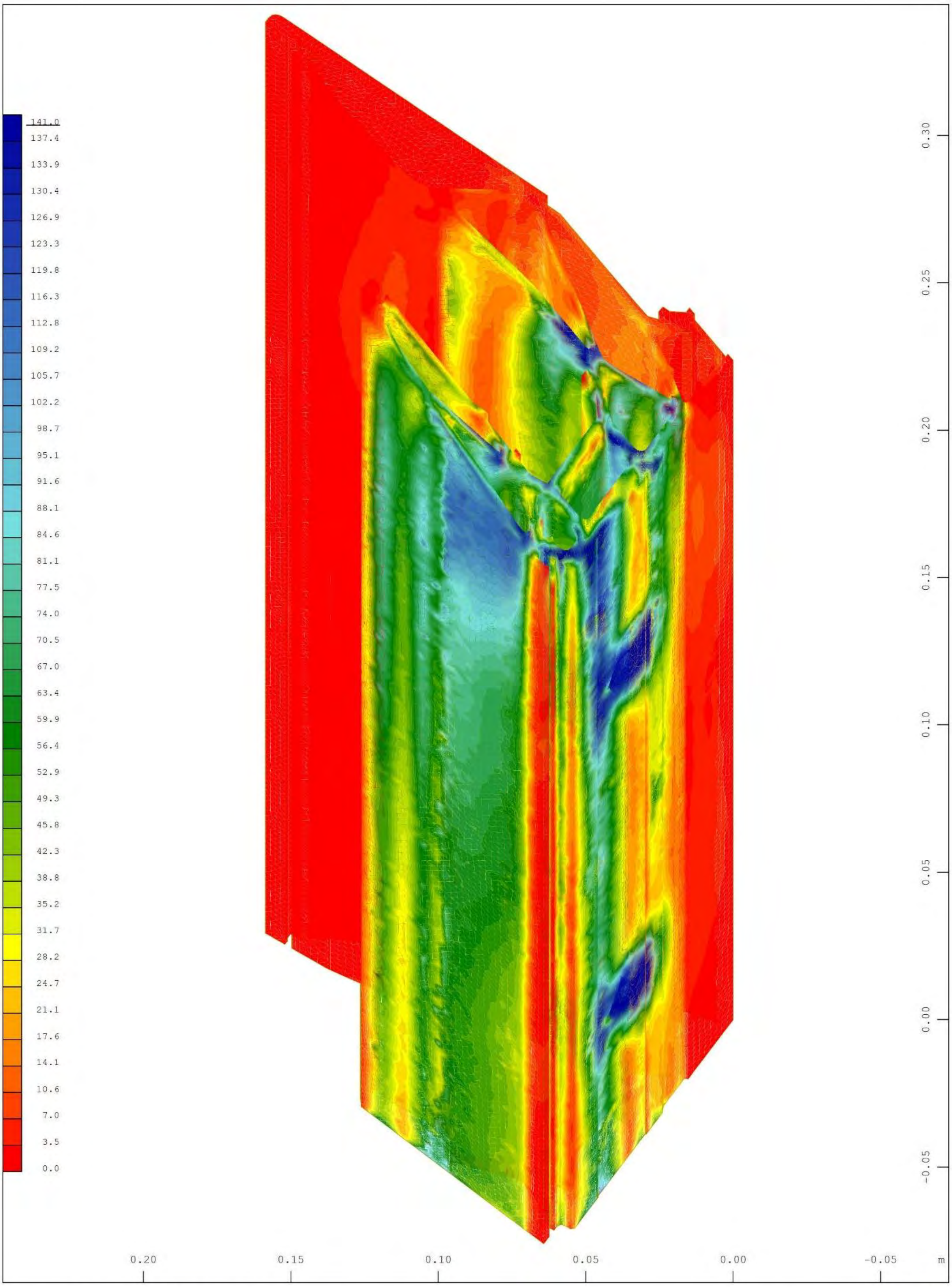
Y
Z X

Sector of system Group 2 20 M 10 : 9
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 3.0084e-05 to 140.4 step 3.51 MPa



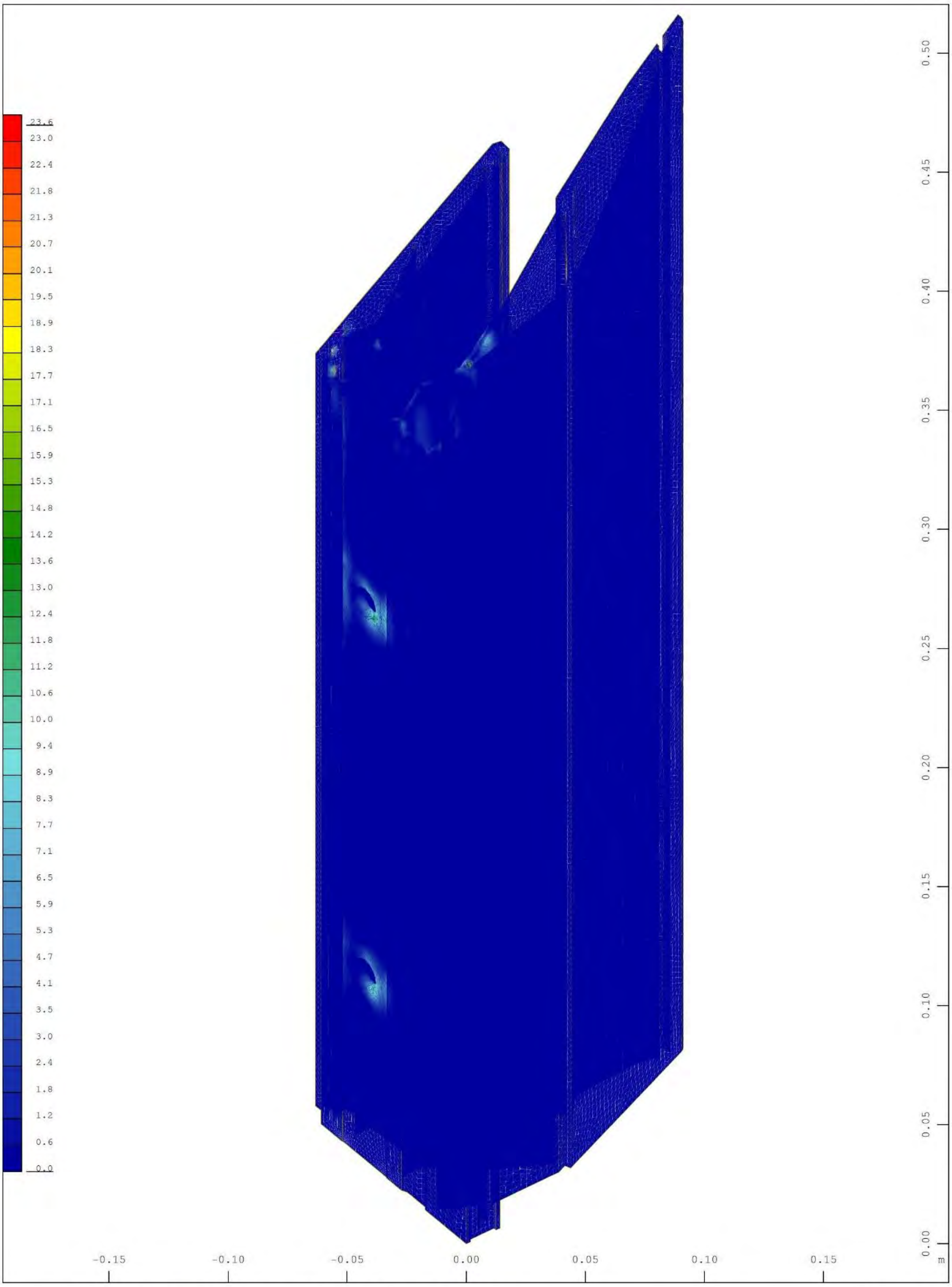
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 3.0084e-05
to 140.4 step 3.51 MPa

M 1 : 1.38
X * 0.944
Y * 0.932
Z * 0.491



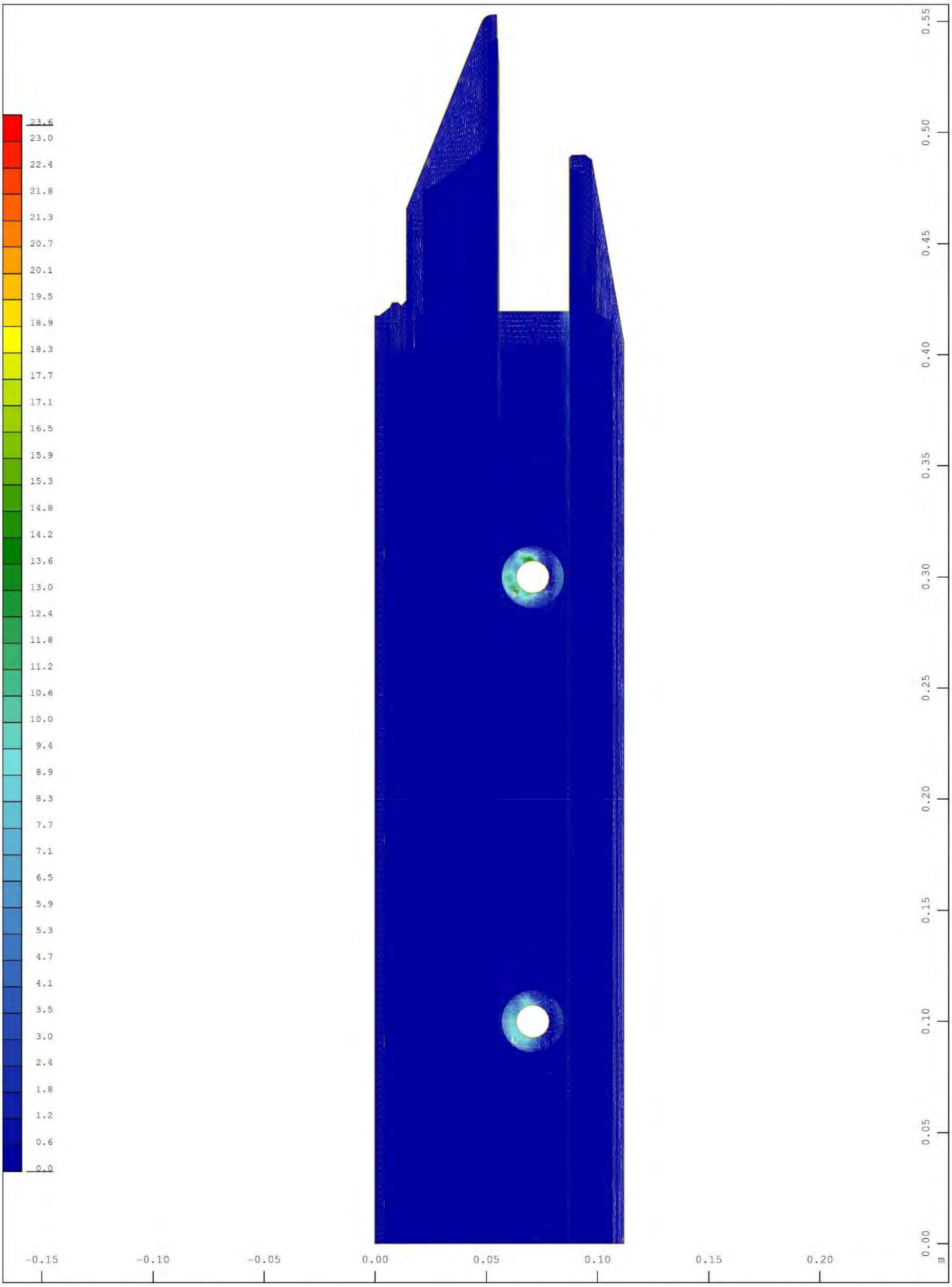
Sector of system Group 2 20
v.Mises stress from middle of element ↔, nonlinear Loadcase 10 ULS , from 3.0084e-05
to 141.0 step 3.52 MPa

M 1 : 1.79
X * 0.955
Y * 0.881
Z * 0.559



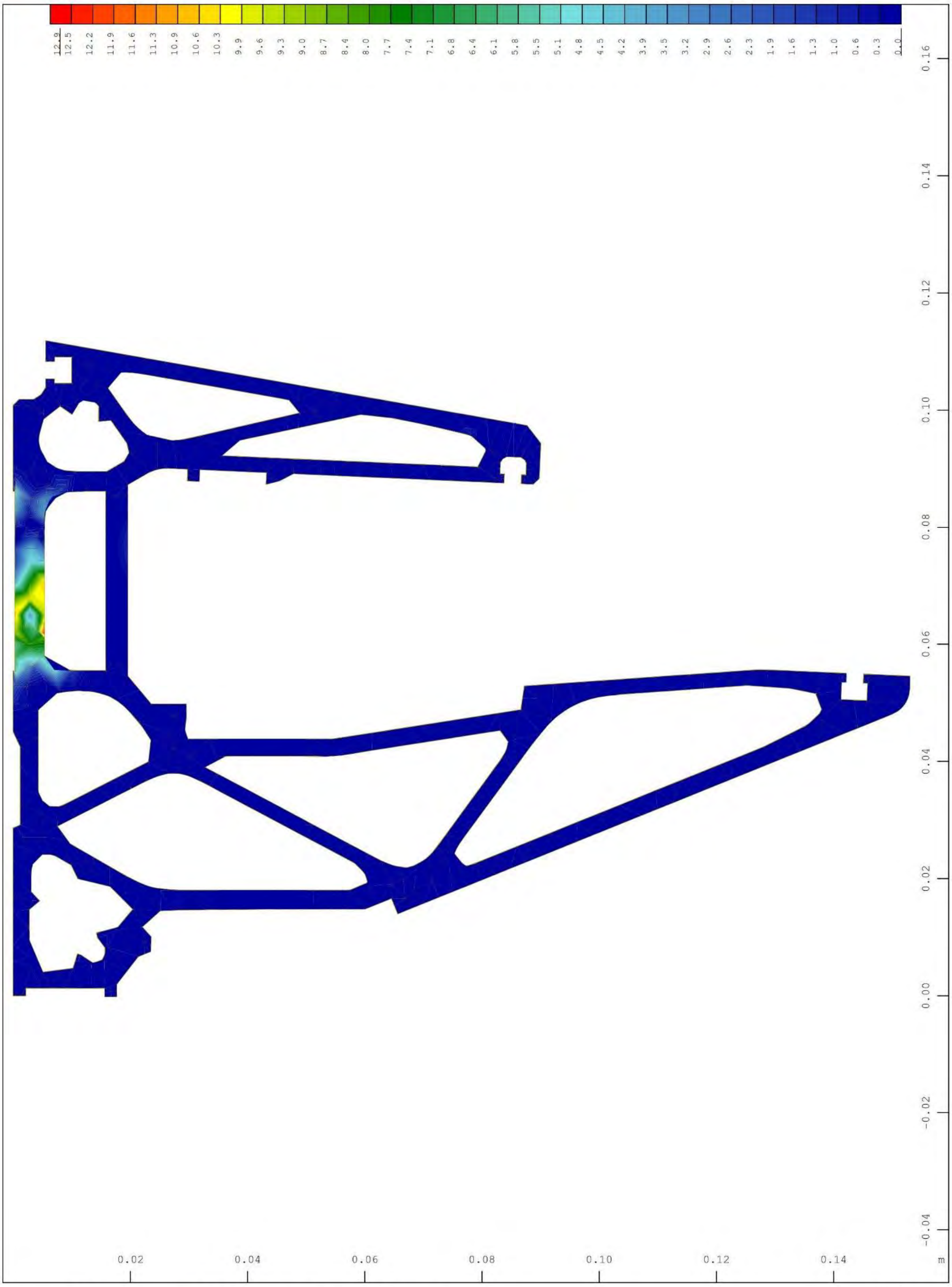
Sector of system Quadrilateral Elements,Volume Elements
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 23.6 step 0.590

M 1 : 2.22
X * 0.882
Y * 0.784
Z * 0.779



Z X Y

Sector of system Quadrilateral Elements,Volume Elements M 1 : 2.38
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 ,
BRIC Gauss points in Node o/oo, from 0 to 23.6 step 0.590



Y
Z X

Sector of system Quadrilateral Elements,Volume Elements M 10 : 9
Plastic deviatoric strain ↔, nonlinear Loadcase 10 ULS, Material law Mat.type 17 , BRIC
Gauss points in Node o/oo, from 0 to 12.9 step 0.321

9.3 Test report

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Spett.le
LOGLI MASSIMO S.P.A.
VIA CHEMNITZ 49/51
59100 PRATO (PO) - ITA

Test report N. 2021/0988 issued in Milan 09/04/2021

Client: LOGLI MASSIMO S.P.A.- PRATO (PO) – ITALIA

Specimen entry: 22/03/2021

TEST REPORT

Tests on cantilevered canopy La Pensilina "LUMIA" for equivalent snow and wind uplift loads

In the following pages are reported:

- Specimen description and test procedure;
- Test results.

The results are related only to the tested specimens.
The test report consists of 12 pages.
The test report can be only completely reproduced in full and shall be subjected to stamp duty for use according to Italian law D.P.R. 642/72.

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Roberto Minerva

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INDEX

1. INTRODUCTION

This test report presents the results of static tests on cantilevered structural glazing.
Tests were performed at LPMSC (Materials, Structures and Constructions Laboratory) of Politecnico di Milano on the 23/03/2021 at the presence of the following persons:
Mr Daniele Spinelli (Politecnico di Milano)
Prof. Eng. Ph.D. Sara Cattaneo (Politecnico di Milano)
Eng. Ph.D. Lorenzo Piscitelli (Logli Massimo S.p.A.)

2. SPECIMEN IDENTIFICATION

La Pensilina "LUMIA" is a system by Logli Massimo Saint-Gobain, made with an EN AW 6063 T6 aluminum rail, clamps in Grivory GV-5H (polyamide) and gaskets in TPE. The system is intended for fixing of cantilevered canopies using laminated glass (LG) panels.
One LG specimen measuring 1000x1200mm was used to perform tests on the system. This specimen was made of two glass plies of 10 mm (both tempered), joined through 1.52 mm Sentryglas® interlayer (Fig.2.1). The length of 1000mm was inserted in the system La Pensilina "LUMIA", also having a length of 1000mm, in such a way that the length of 1200 mm of the LG was put in a cantilevered position with respect of the base structure (Fig.2.2).
The glass specimen was provided by the company Quidam s.r.l. commissioned by the client.

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The code of each specimen is given by the type of test: WIND or SNOW depending on the load direction.
Six tests were performed for evaluating the performance with respect to equivalent WIND loads, in two different configurations:

- WIND tests 1 to 3 were performed in configuration 1, using 5 clamps (5 clamps/m),
- WIND tests 4 to 6 were performed in configuration 2, using 10 clamps (10 clamps/m),

One cyclical test was performed for evaluating the performance with respect to equivalent SNOW loads:

- SNOW test consisting of 3 consecutive load ramps in configuration 1, using 5 clamps (5 clamps/m),

Figure 2.1 Glass label

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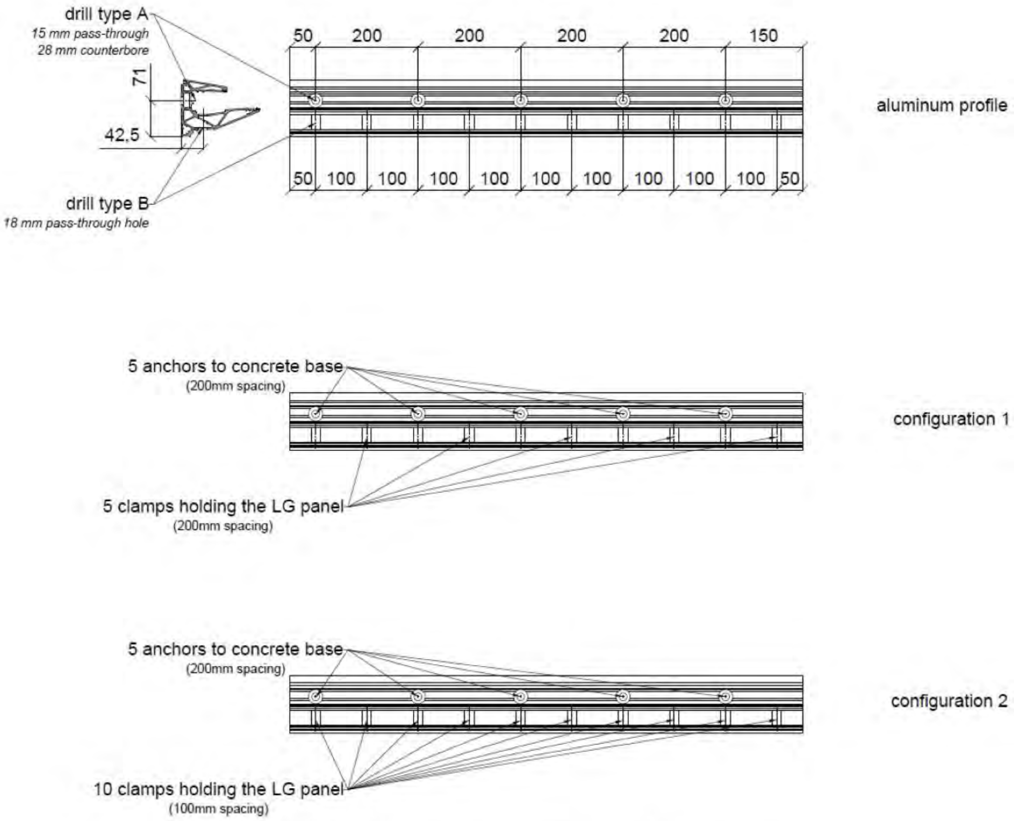

Figure 2.2 – aluminium rail and testing configuration details

3. TEST PROCEDURE

Tests were performed on specimens installed according to the following procedure:

1. Marking of the position of for the holes on the concrete slab (this was done using the rail as template and checking for the correct position with a level),
2. Drilling of the slab at an embedment depth of 120 mm in the anchoring points,

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3. cleaning of the dust within the holes,
4. installation of the rail La Pensilina "LUMIA" profile with 5 anchors (Fischer FBS10x100/15 US/A4 ETA-11/0095) with 200mm spacing,
5. tightening of the anchors up to a measured torque of 40 Nm,
6. assembly of the clamps and installation inside the profile with the spacing of 200 mm in configuration 1 (tests WIND 1-2-3 and in test SNOW), with the spacing of 100mm in configuration 2 (tests WIND 4-5-6),
7. inserting of the gaskets,
8. inserting of the glass aluminum profile (due to the vertical insertion of the glass, a thin plastic spacer about 3 cm long was used on both side of the aluminium rail, to avoid direct contact of the glass with the metal, this red spacer is visible both in Fig. 4.2c and Fig. 4.2d)
9. tightening of the clamps wedge with a torque moment of 3 Nm,

The installation was done according to instructions and with the supervision of the company Logli Massimo. Once the glass was placed, test were performed.
The system was installed on a concrete element C20/25, casted according to TR048 – EOTA -2016. The average concrete compressive strength (cubic) was equal to 30 MPa.
During all tests the temperature and the relative humidity were monitored with Extech Instrument RH520 Temperature and Humidity Recorder.
The test was performed with a loading system made of four pneumatic jacks attached to the strong floor and that apply the load via four ties attached to the upper edge of the balustrade with spacing 30 cm. The sketch of the testing system is shown in Fig. 3.1. Depending on the test the load was applied in two opposite directions (WIND or SNOW) according to Fig.3.2 and Fig.3.3.
The applied load of each jack was monitored via load cell (AEPTC4 S.N. 430971-400896–715249- 440041, class 1).
By rotating the specimen 180°, it was possible to apply the load in two opposite directions when testing for equivalent WIND or equivalent SNOW loads, according to schemes described in Fig. 3.2 and Fig. 3.3.
The load was progressively increased to failure of the system or maximum capability of the testing setup (whichever came first):

- in testing for WIND loads, end test was always defined by ultimate resistance of the system: one load ramp was performed for each installation of the specimen, both for configuration 1 or configuration 2 (cf. Fig. 2.2). Six tests were performed in total.
- in testing for SNOW loads, end test was defined by the maximum capability of the setup:

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three consecutive cycles of loading/unloading were carried out up to the maximum capacity of the setup; during the last loading cycle, the load was held constant at the value of 9.0 kN (9.0 kN/m) for 15 minutes.

For all tests, the load simultaneously measured by the 4 load cells was acquired by control system PLC Siemens S7 running a dedicated software, designed to maintain a uniform load in the four points in all phases of the tests (loading, constant load, unloading).
The displacements were measured with three wire transducers WAYCON SX50-750-1R-KA02, placed at the same height of the load application, at midspan (S.N. 17555215) and with spacing of 30 cm (S.N. 18561245 (left), 17555213 (right)) (Fig.3.1).
All data (4 load cells and 3 displacement transducers) were acquired by Spider 8 HBM data acquisition system with specimen frequency of 2 Hz.

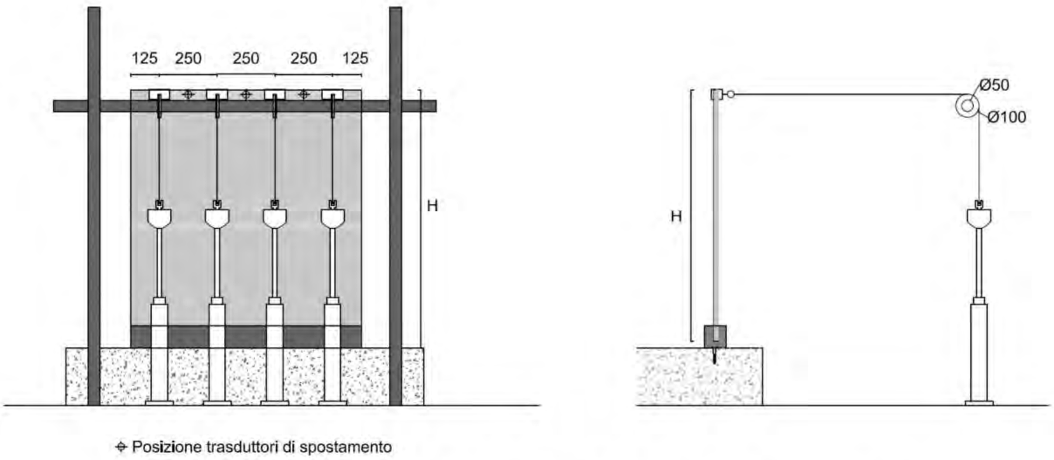

Figure 3.1 –Sketch of the testing setup – Front and lateral view (measure in mm)

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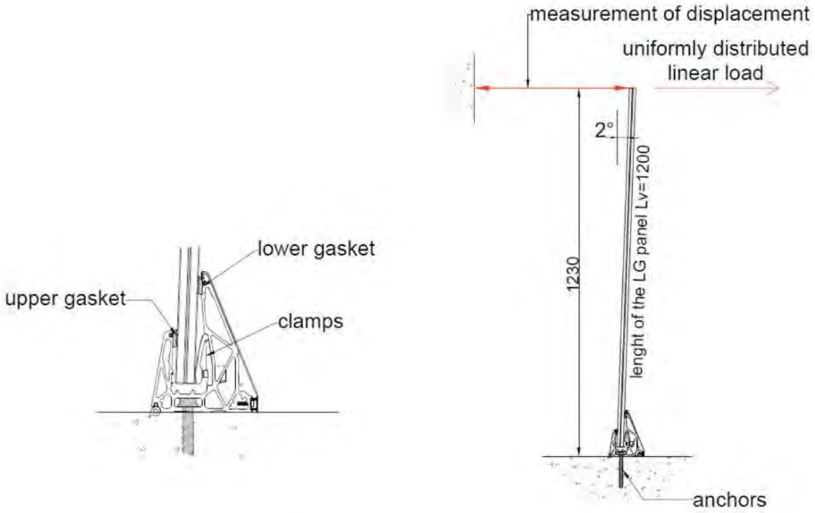

Figure 3.2 – equivalent SNOW tests

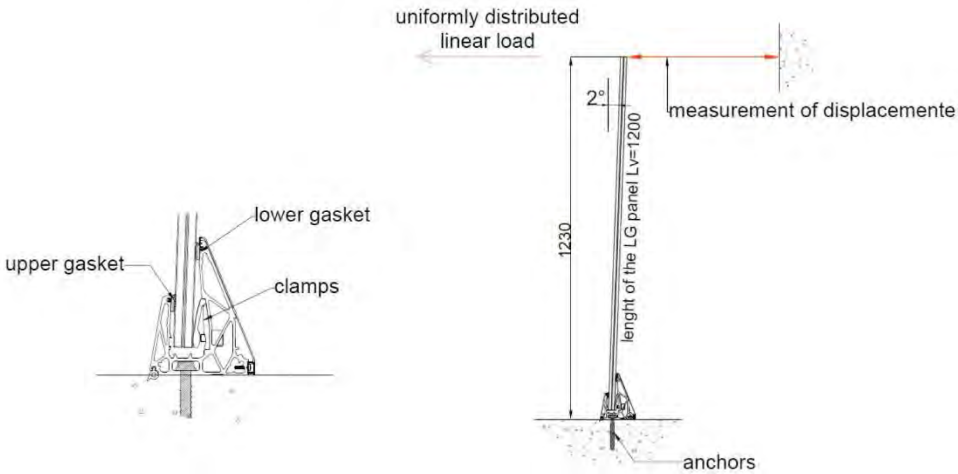

Figure 3.3 – equivalent WIND tests

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4. TEST RESULTS

The average temperature and the relative humidity of the laboratory during the tests were equal to 20°C and 49% respectively.

4.1 Equivalent WIND load tests

All of the six tests resulted in a localized punching failure within the body of the polyamide clamps (Fig. 4.2b).

Table 4.1 reports the maximum load associated to the failure of the clamps and the average displacement for each test under the "Wind configuration".

Figure 4.1 shows the load - average displacements curves.

Figure 4.2 shows the test configuration and the failure of the clamps.

Table 4.1 – Maximum load and average displacement at failure

test reference	configuration	number of clamps	maximum load [kN/m]	displacement measured at max load [mm]
PENL-WIND-EQ-1	1	5 (5/m)	2.03	80.06
PENL-WIND-EQ-2			2.15	86.25
PENL-WIND-EQ-3			1.65	60.73
PENL-WIND-EQ-4	2	10 (10/m)	4.26	153.35
PENL-WIND-EQ-5			4.41	148.28
PENL-WIND-EQ-6			4.03	132.93

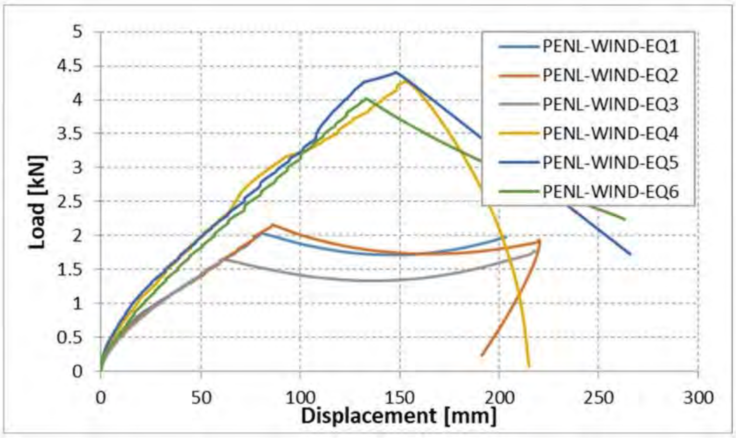

Figure 4.1 –WIND tests - Load- Displacement curves

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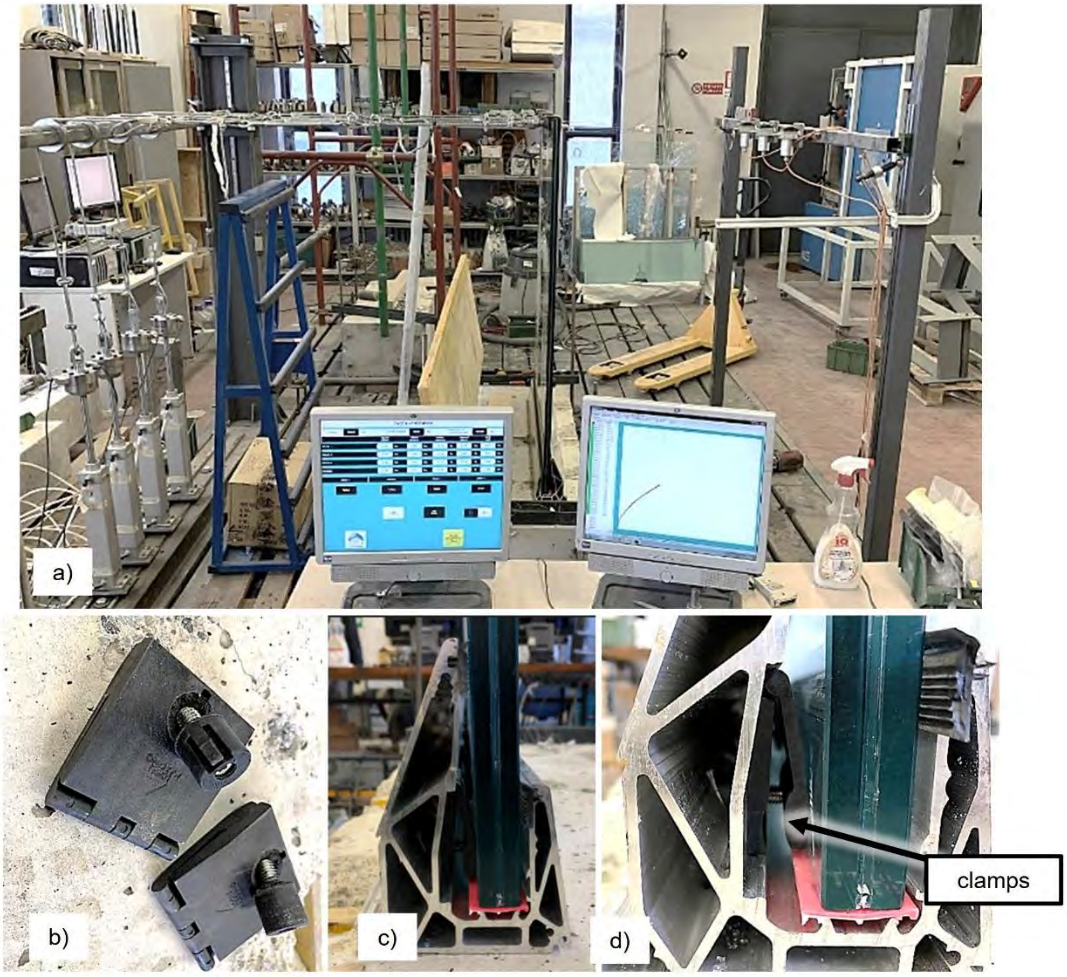

Figure 4.2 – Specimen WIND: load application and detail of failure

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4.2 Snow test

Table 4.2 reports the maximum load, the average displacement at the peak load and the residual displacement after each load cycle.

Figure 4.3 shows the load - average displacement curve.

Figure 4.4 shows the specimen subjected to load.

The specimen did not fail (Fig.4.5).

Table 4.2 – Maximum load, displacement and residual load

test reference	Load cycle	Maximum load applied (kN/m)	Maximum displacement measured (mm)	Residual dislacement [1](mm)
PENL-SNOW-EQ-1	1st	9.31	104.5	7.4
	2nd	9.22	104.4	7.5
	3rd[2]	9.00	105.9	10.3

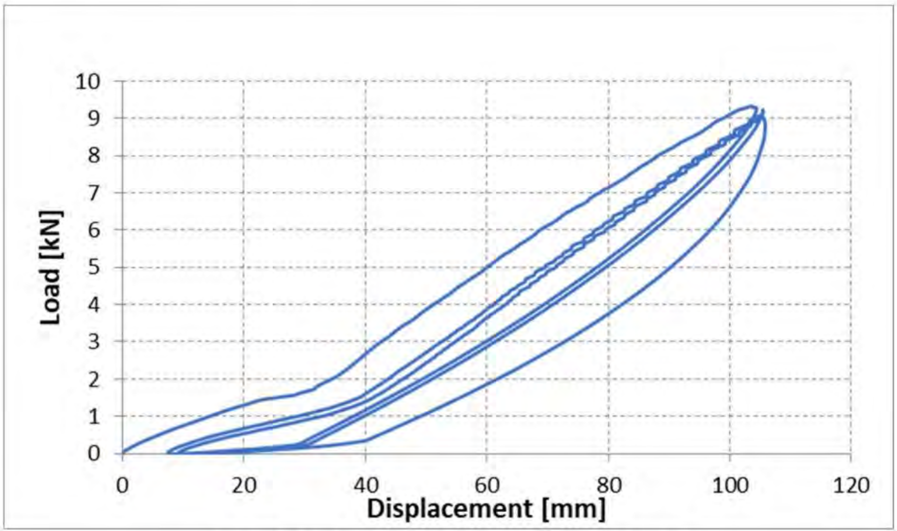

Figure 4.3 – SNOW test- Load- Displacement curve

[1] Residual displacement is total, not cumulative after each ramp
[2] Maximum load is held for 15 minutes during the 3rd load cycle

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Figure 4.4 – Specimen snow: load application

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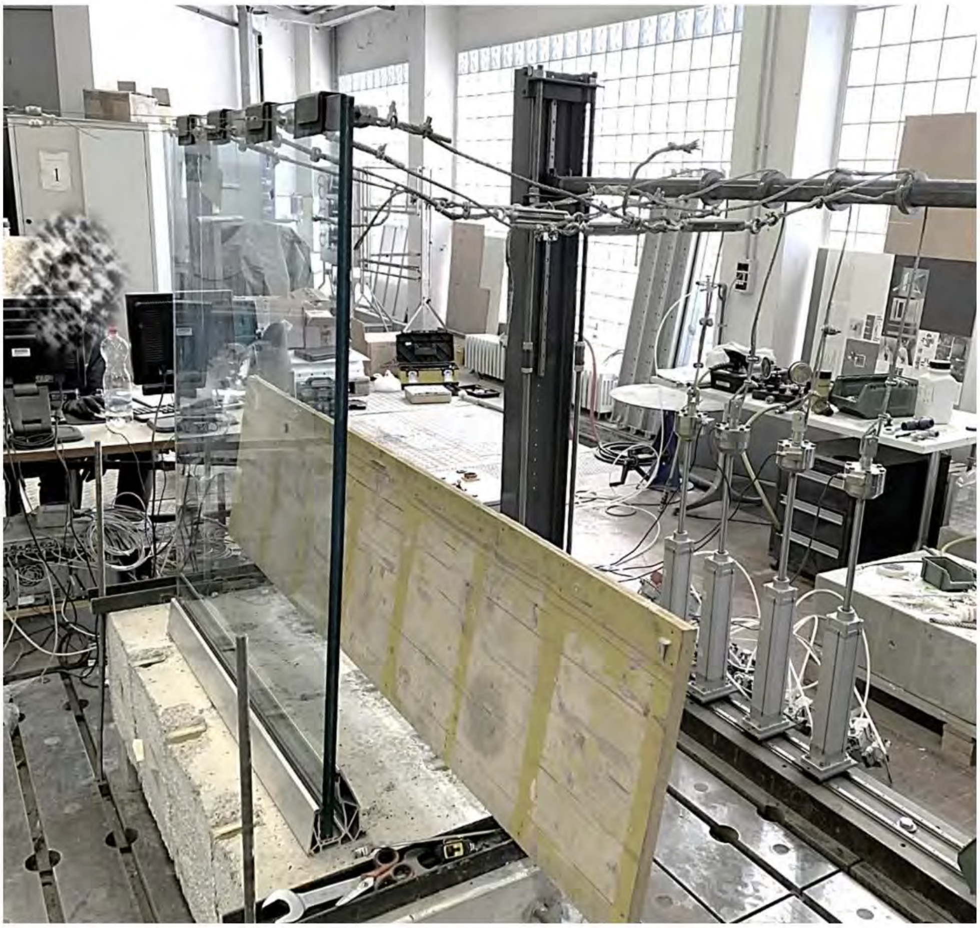

Figure 4.5 – Specimen snow: load removed

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