Thornton Tomasetti

Project

TPQ Office China
Steel – Glass Roof Skylight and Glass Cable- Net Facades

- preliminary ideas -

Prepared For

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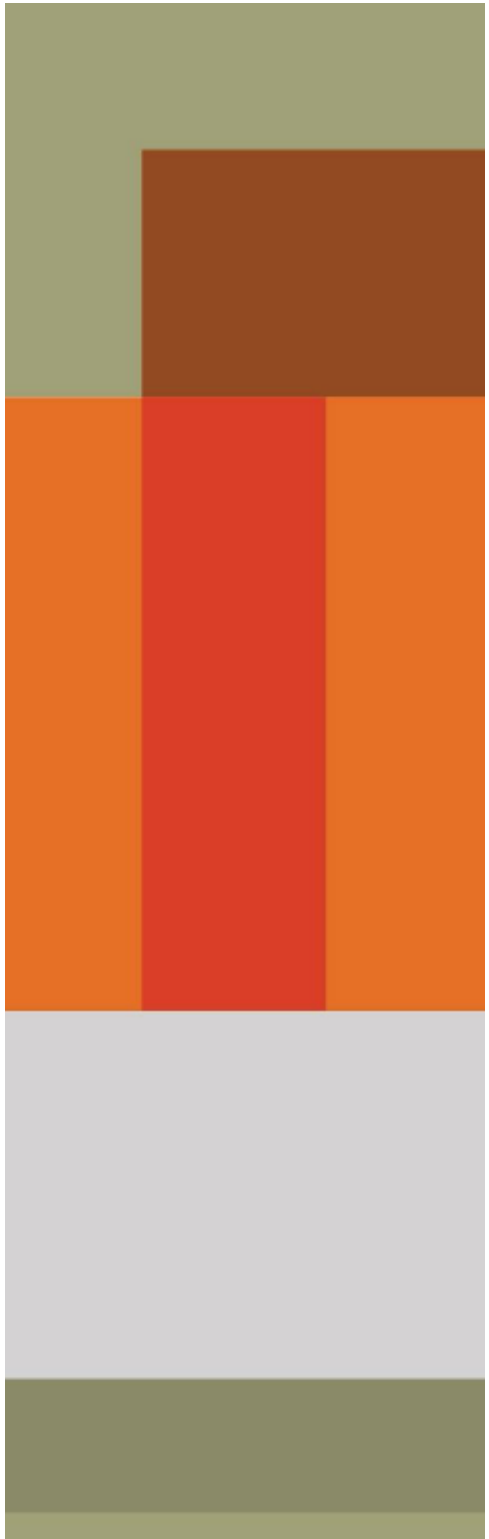

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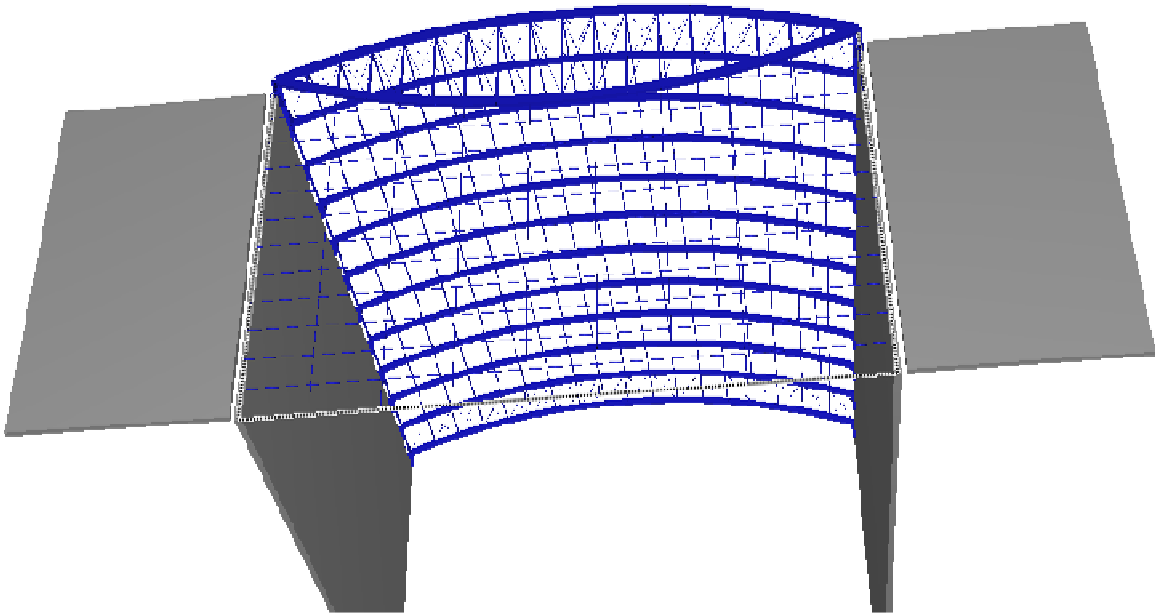
Introduction

Thornton Tomasetti SKIN & SPECIALTY group has been asked by KPF Architects to support their steel-glass design for the transparent roof and cable- net front façade from a structural and façade engineering point of view. This report summarizes one concept option (roof arches) and gives preliminary member sizes.

Steel- Glass Roof

- assumed max span L across = 27m (= 1,063 inches) – preliminary and flexible assumption
- assumed span from one arch to the next = 3m (118 inches) - preliminary and flexible assumption
- assumed glazing sizes 1.54m x 3.00m (61 x 118 inches) - preliminary and flexible assumption
- span L to height (girth) ratio = 10 : 1 - preliminary and flexible assumption



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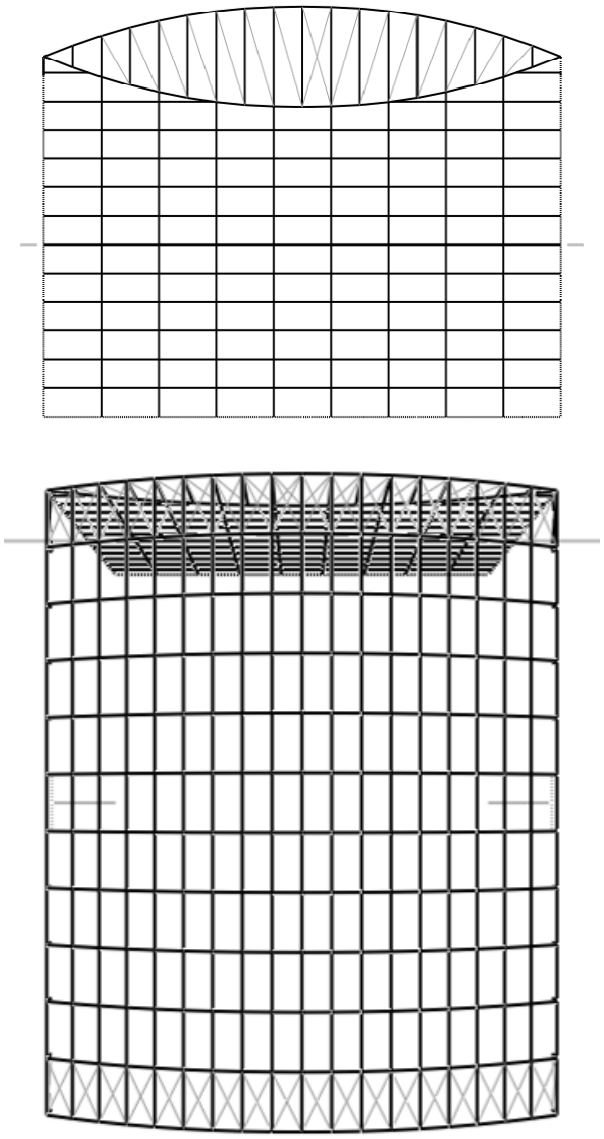

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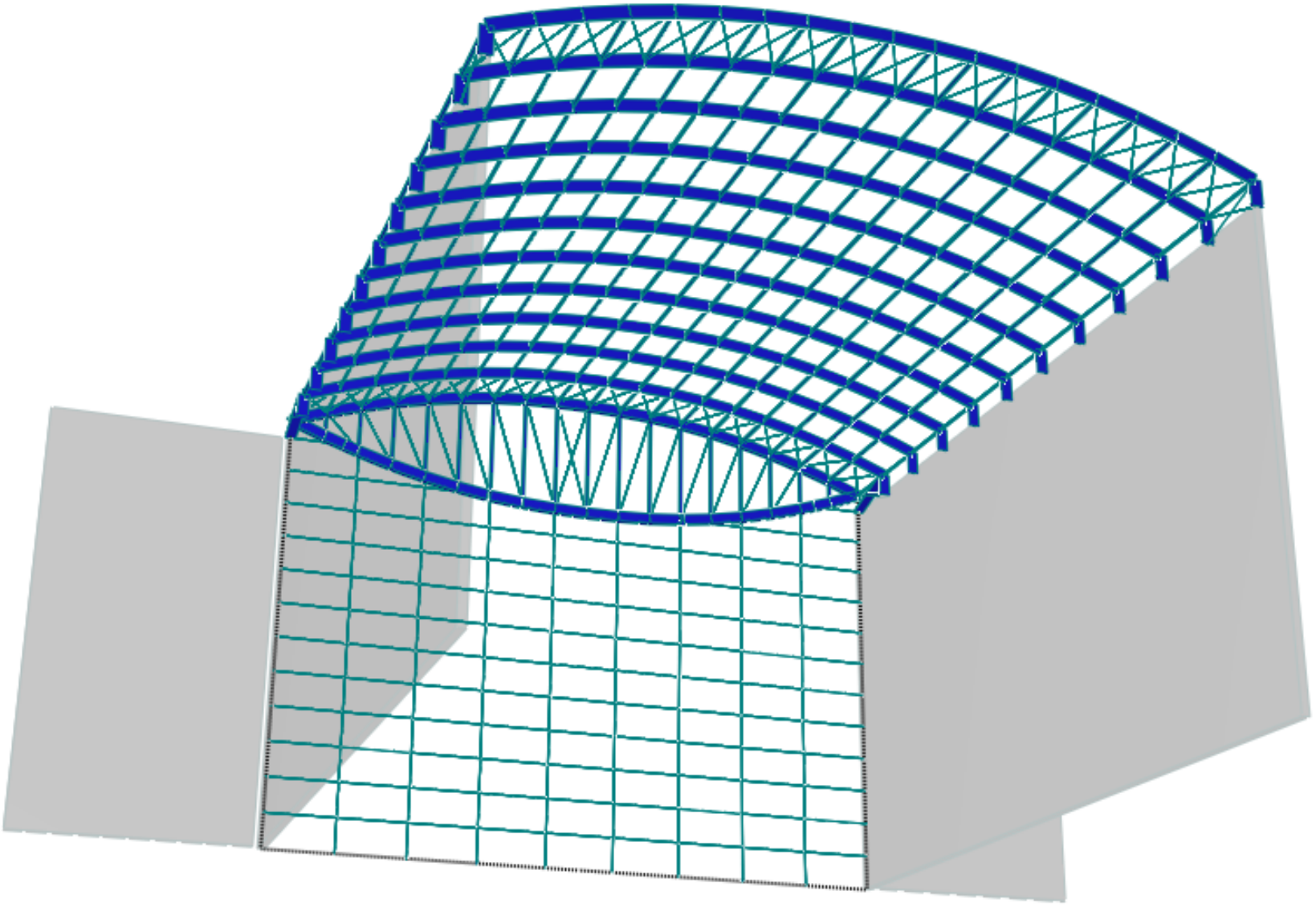

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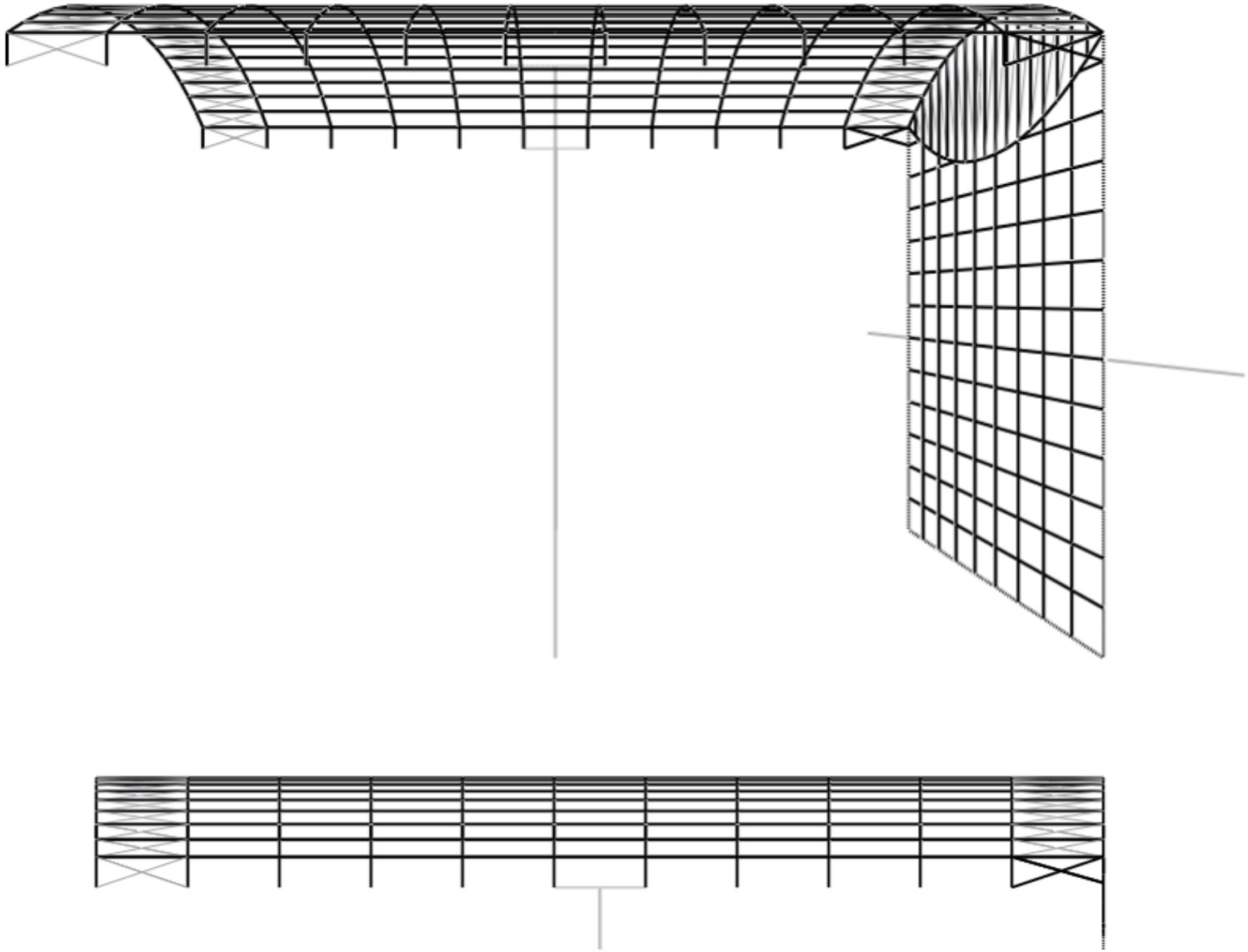

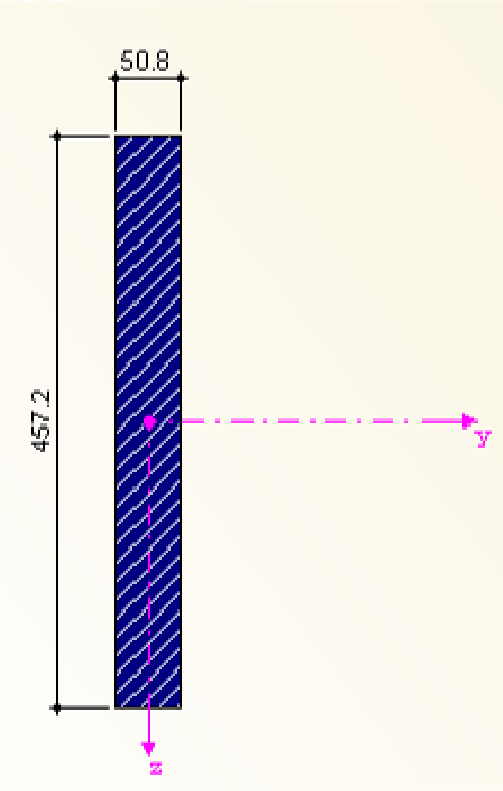

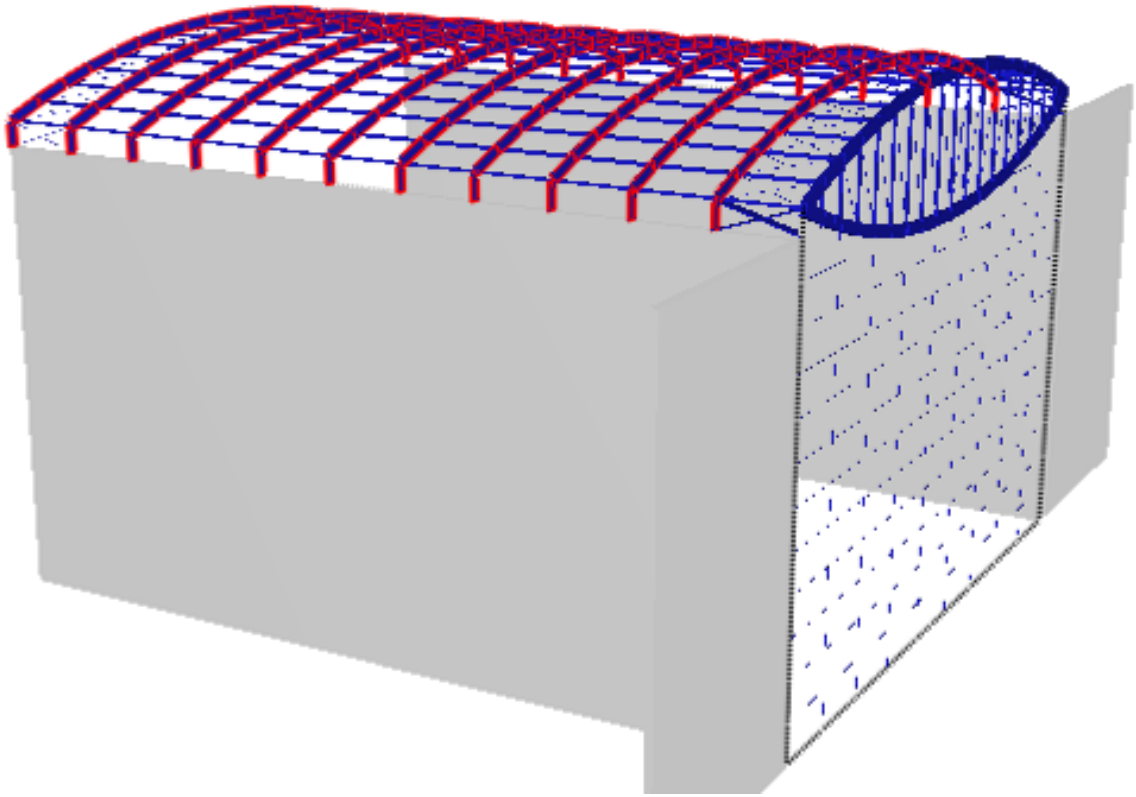

[mm] – main typical arches

Please notice that local cut- outs are possible for this section (laser- cut patterns according to KPF)

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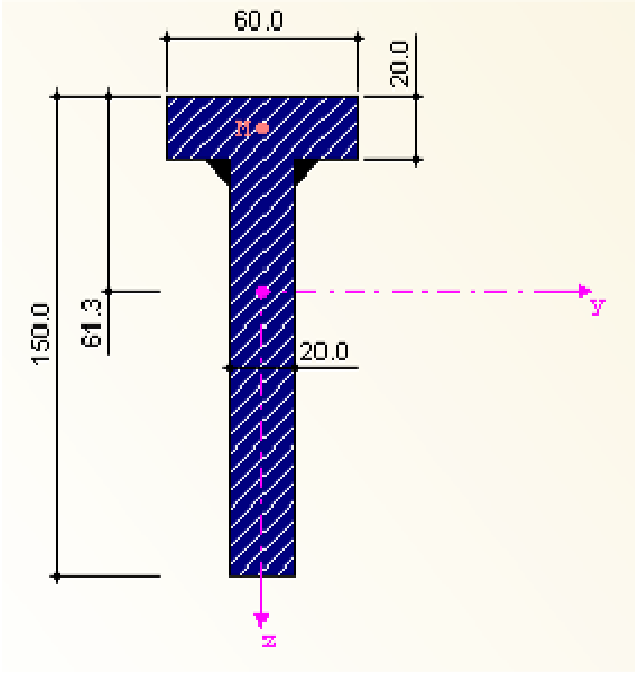
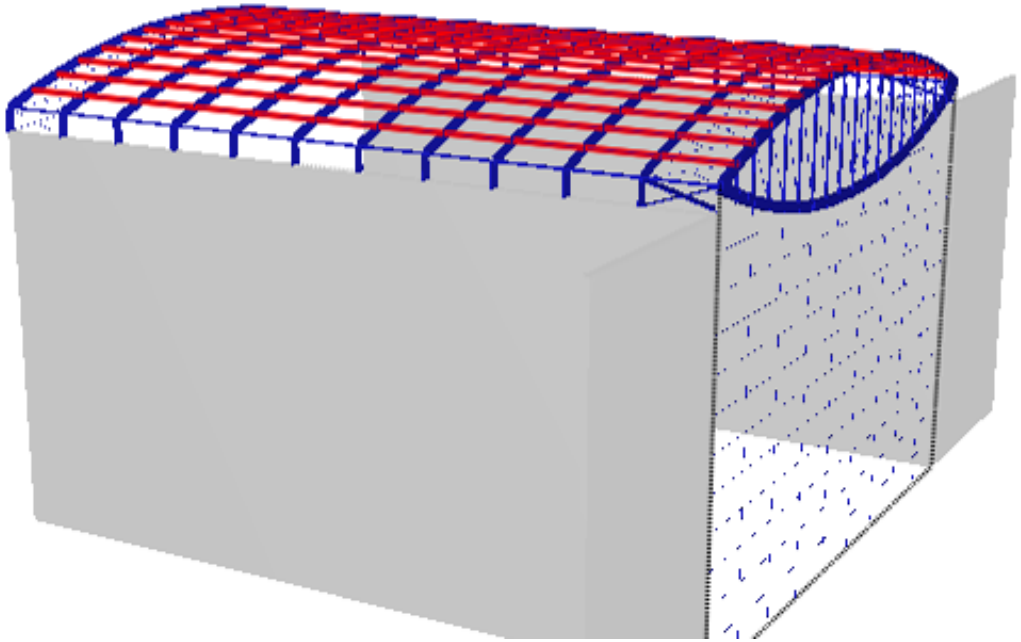
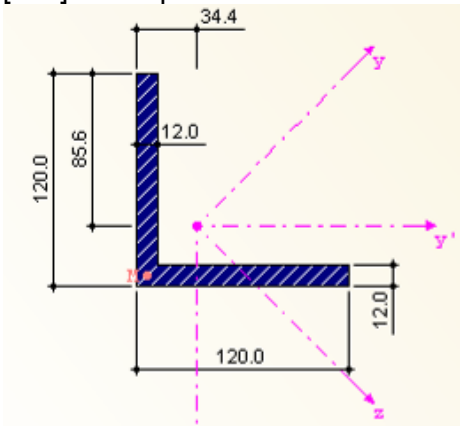
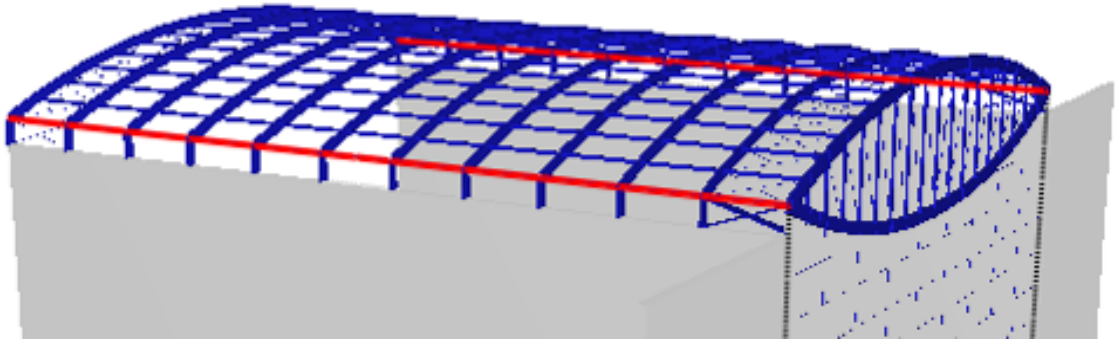
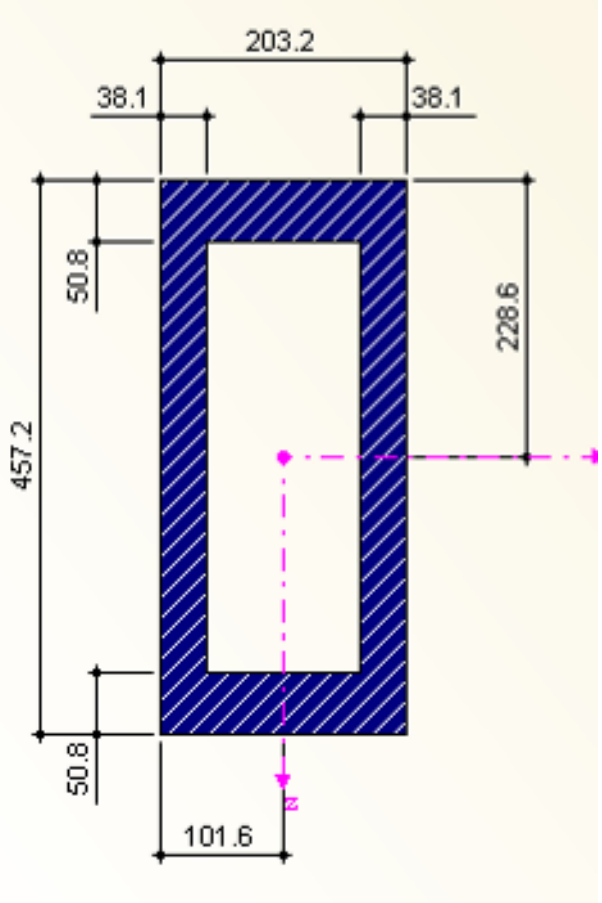


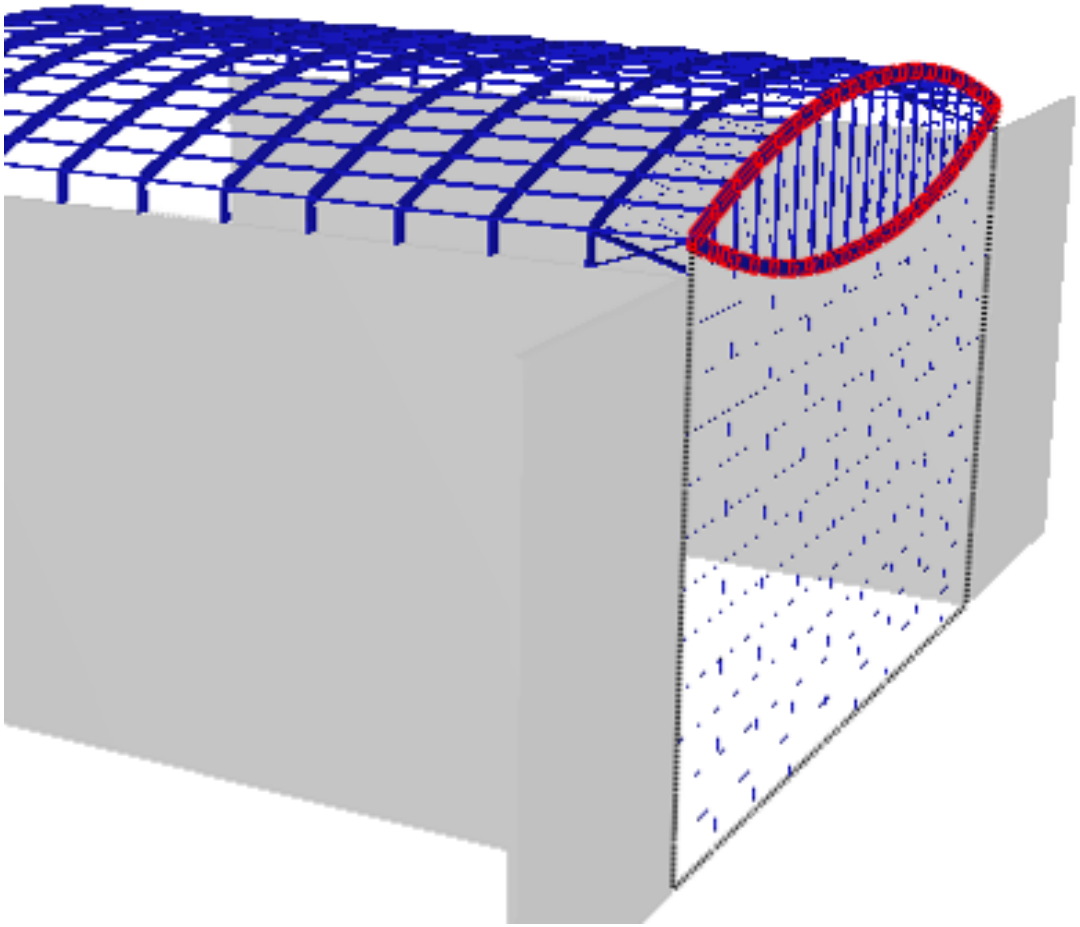


[mm] – roof purlins



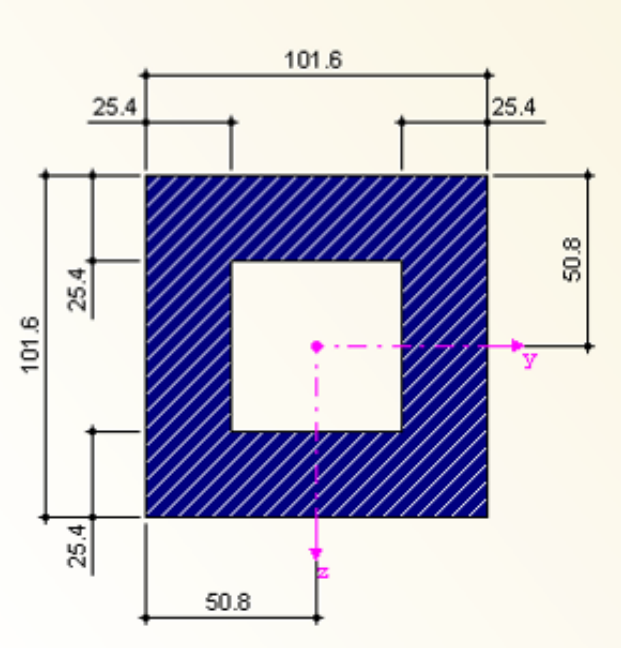


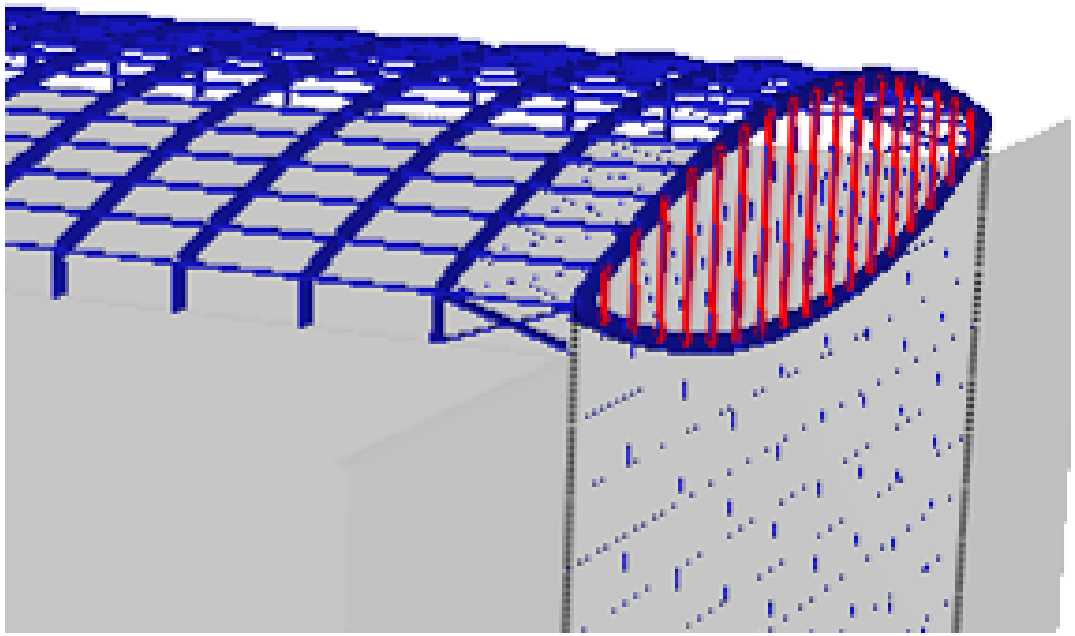




[mm]

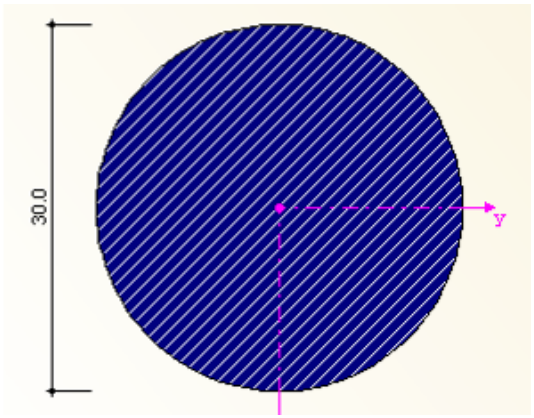
Main front truss, top and bottom chord - note that the wall thicknesses are preliminary at this stage

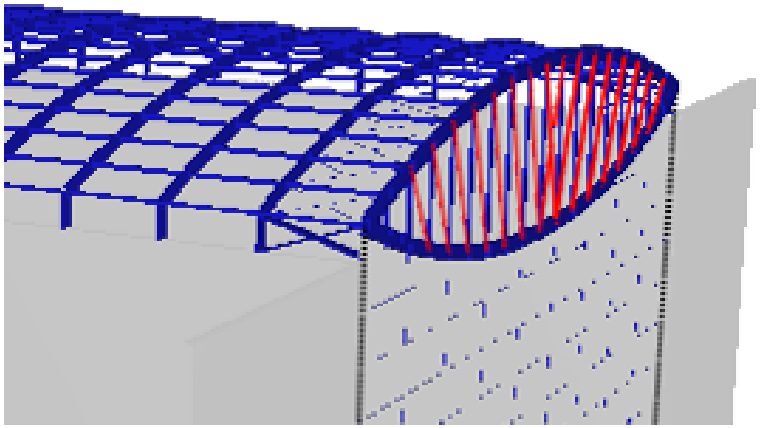




[mm]

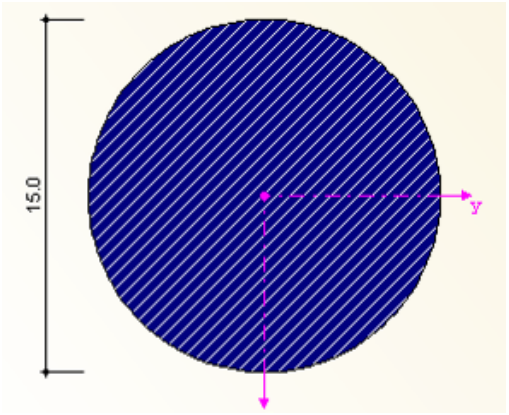
Main front truss, vertical chords (in line with vertical cables) - note that the profile wall thicknesses are preliminary at this stage

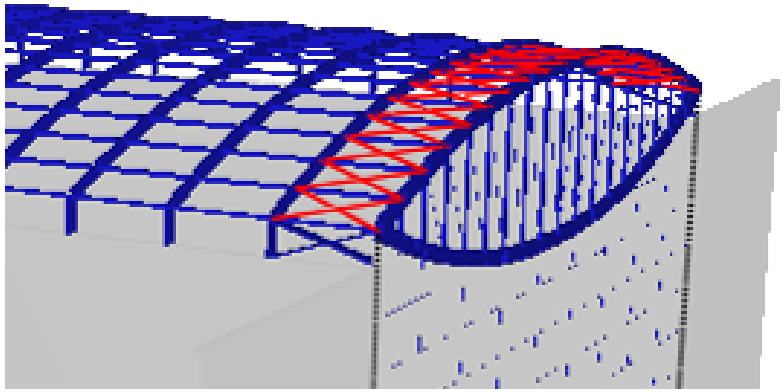




[mm]

Main front truss, diagonal cables - note that the cable thicknesses are preliminary at this stage





Roof bracing diagonals

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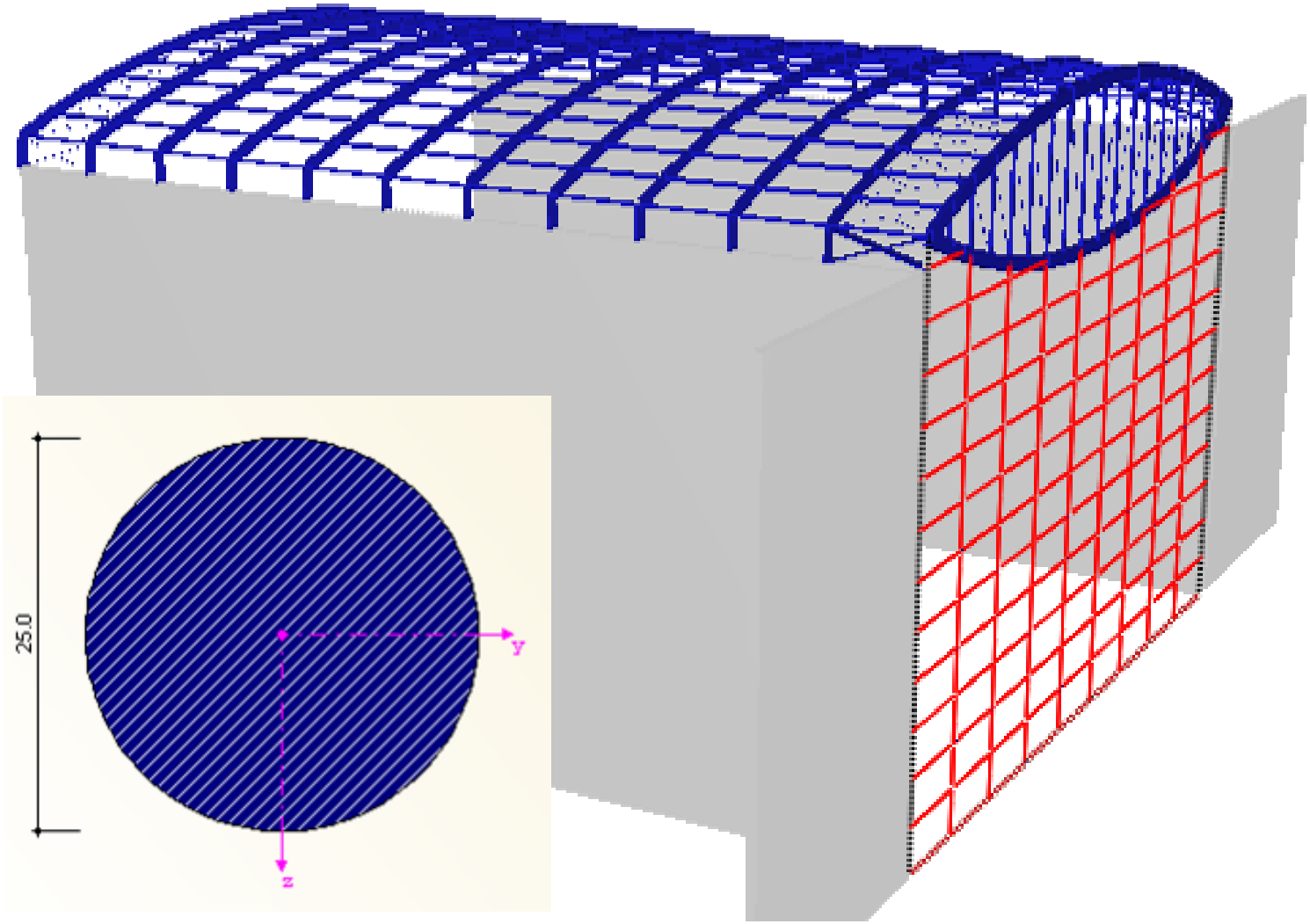

[mm]

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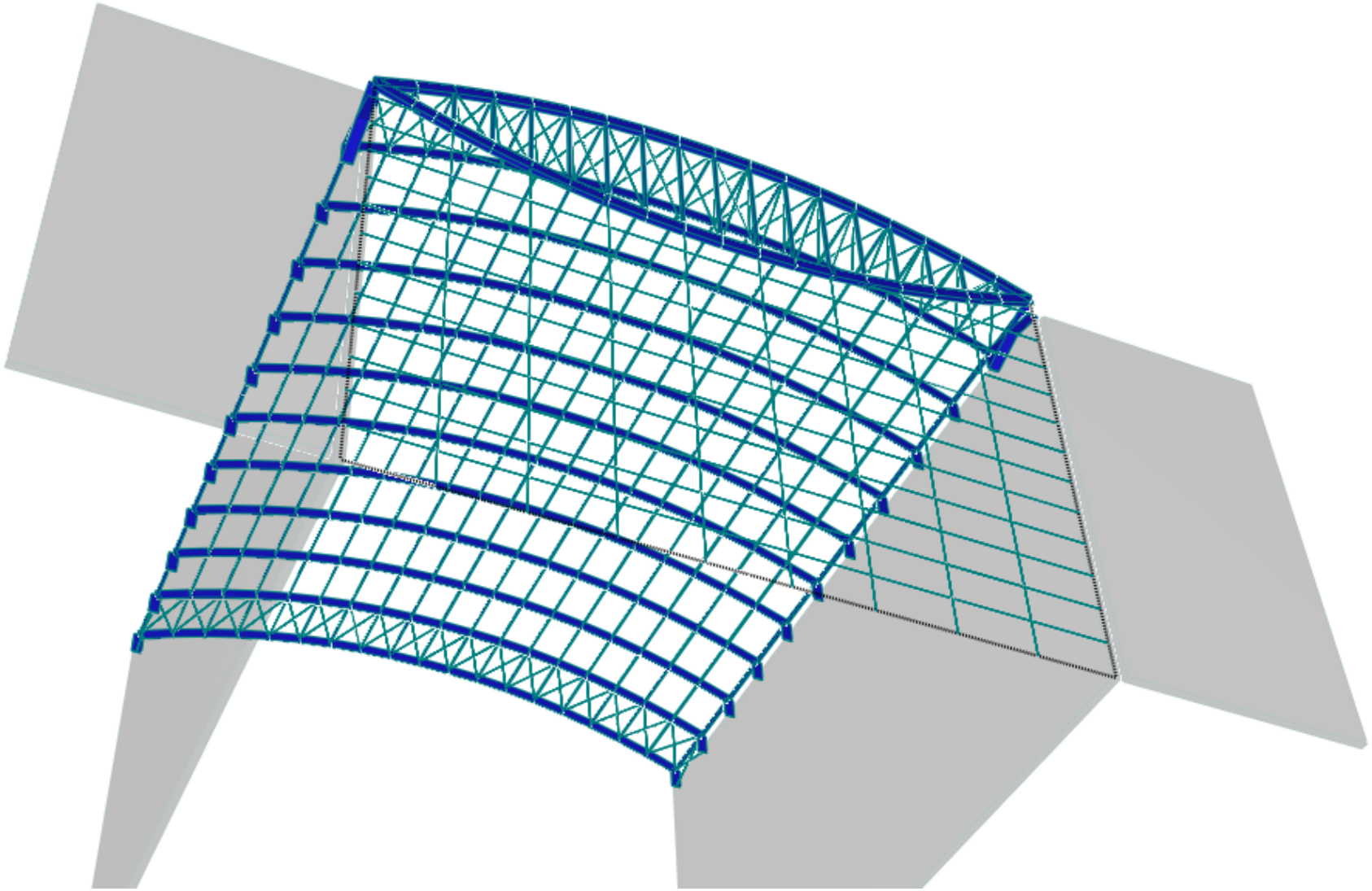

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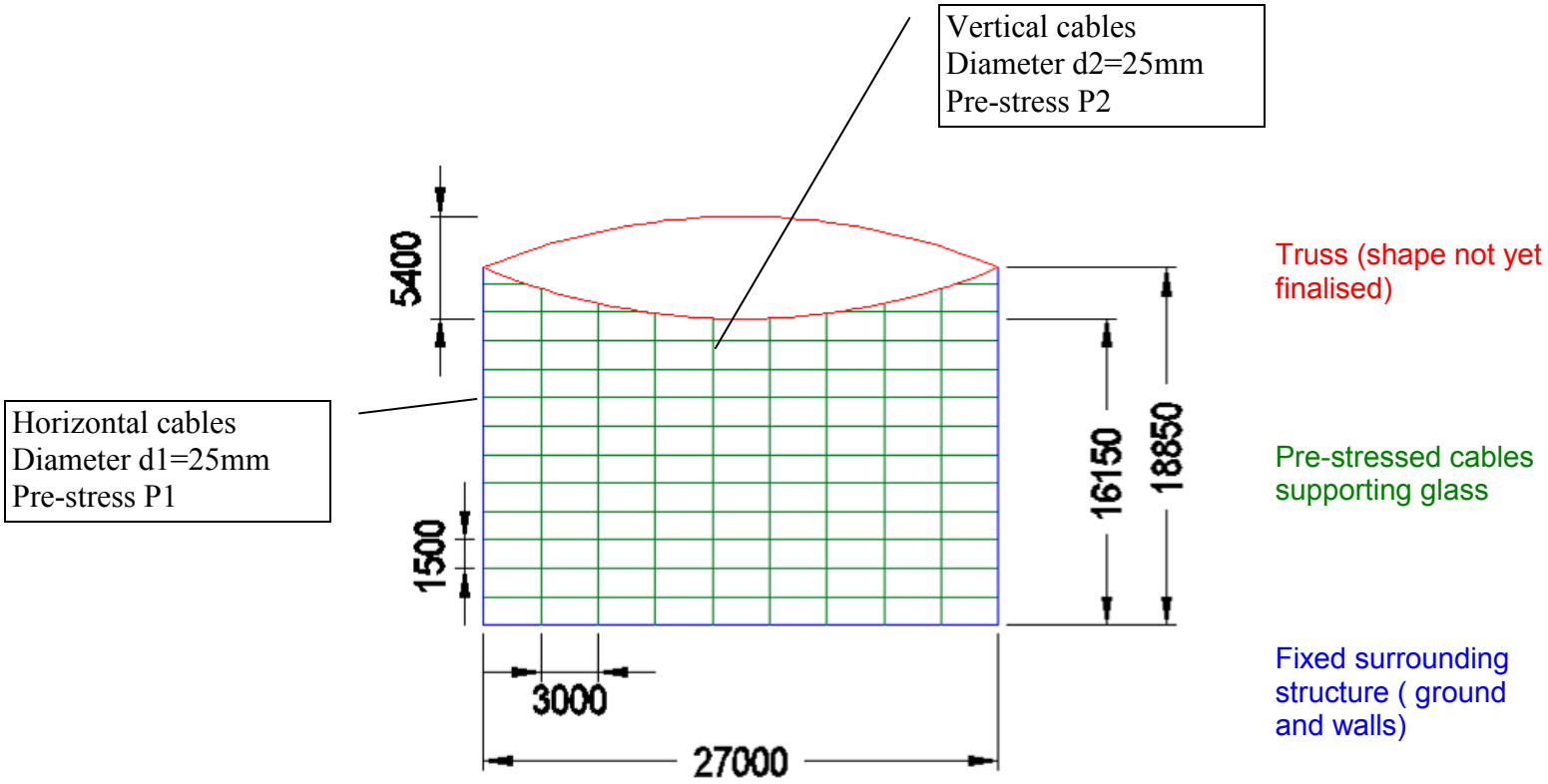
Cable- Net Facade

The 2-ways cable net façade is spanning in between two buildings (assumed max width = 9 x 3m = 27m wide). Roof is made of arches and vertical cables are tied to the ground at the bottom and to a truss beam at the top. Current pre- stress levels are placeholders only and will be finalized later as the design progresses. Currently a rigid top truss is assumed, this can be refined.



Cable facade sketch (unit = mm)

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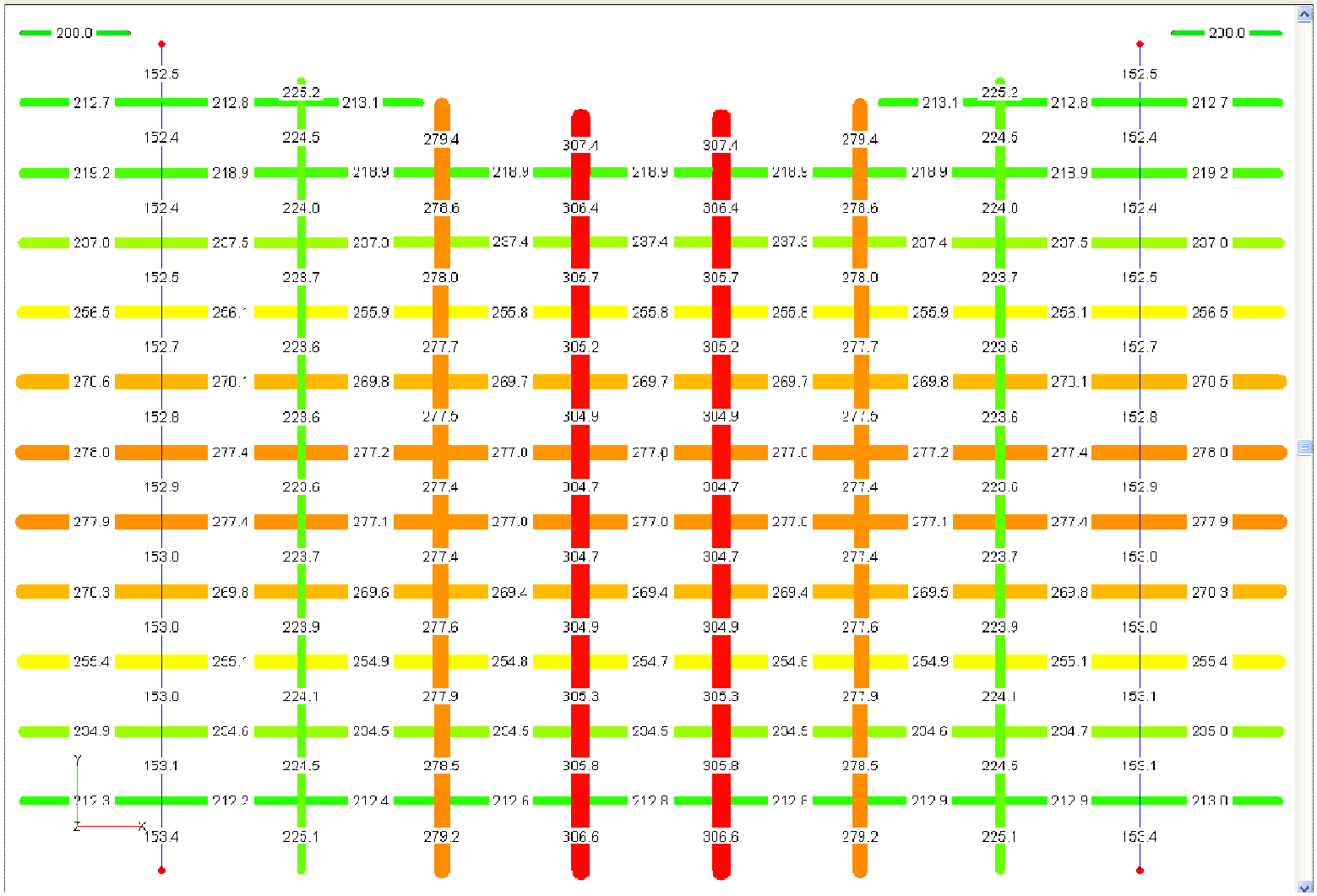


Forces under pre-stress and max. wind load

Maximum deflection is f max=0.47m=h/34 – careful local glazing fitting and edge support detailed design is required.

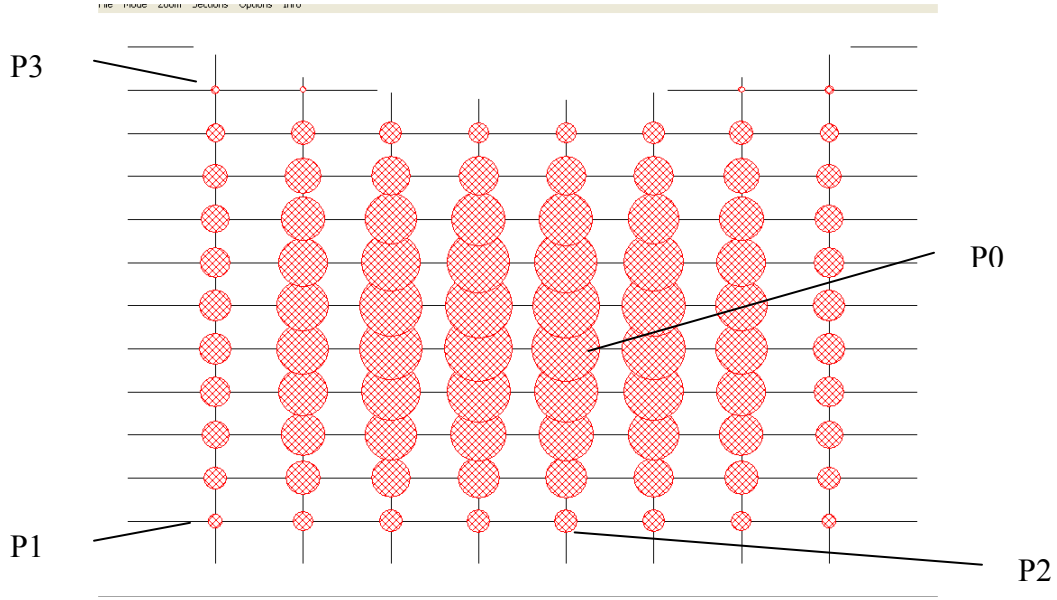
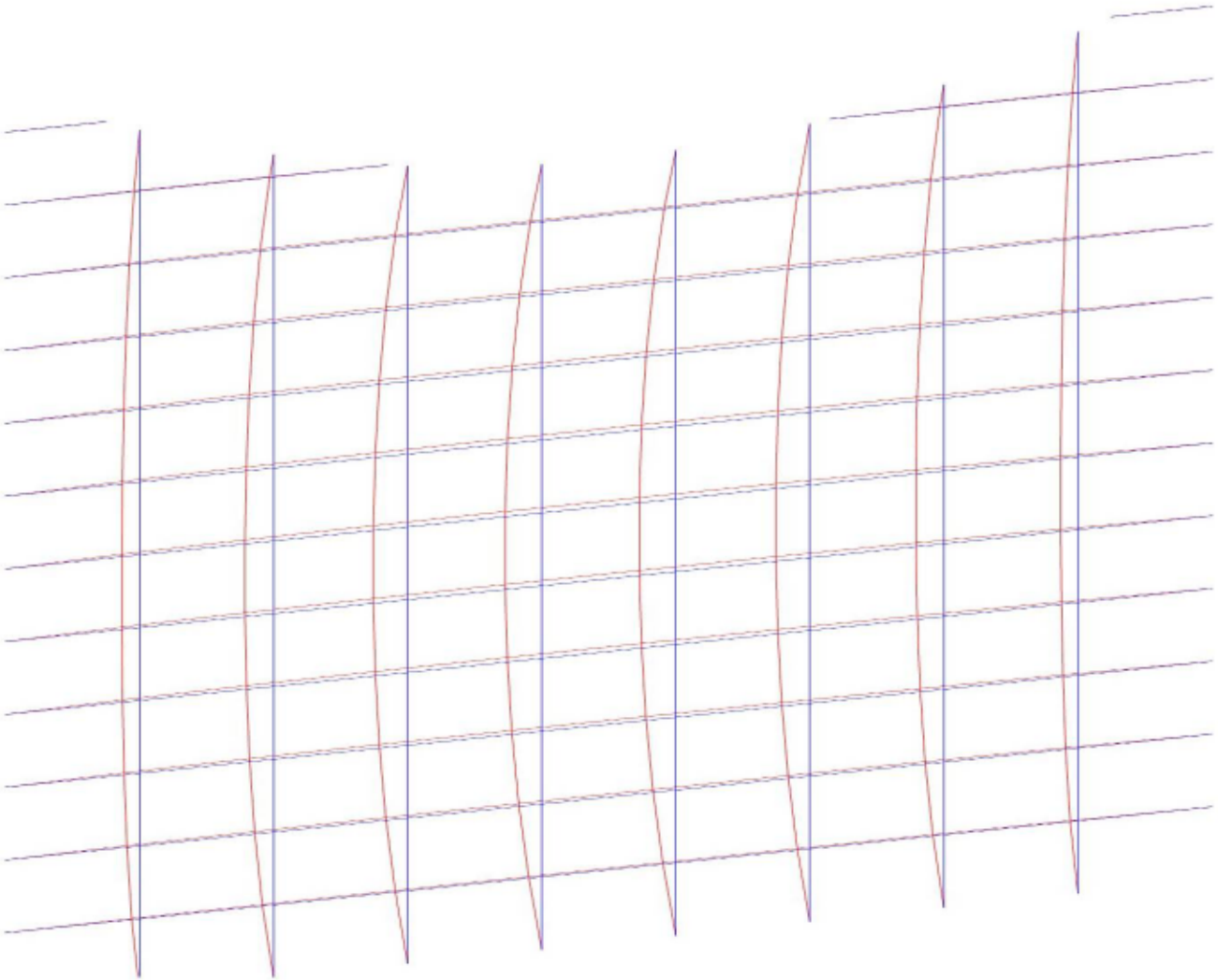
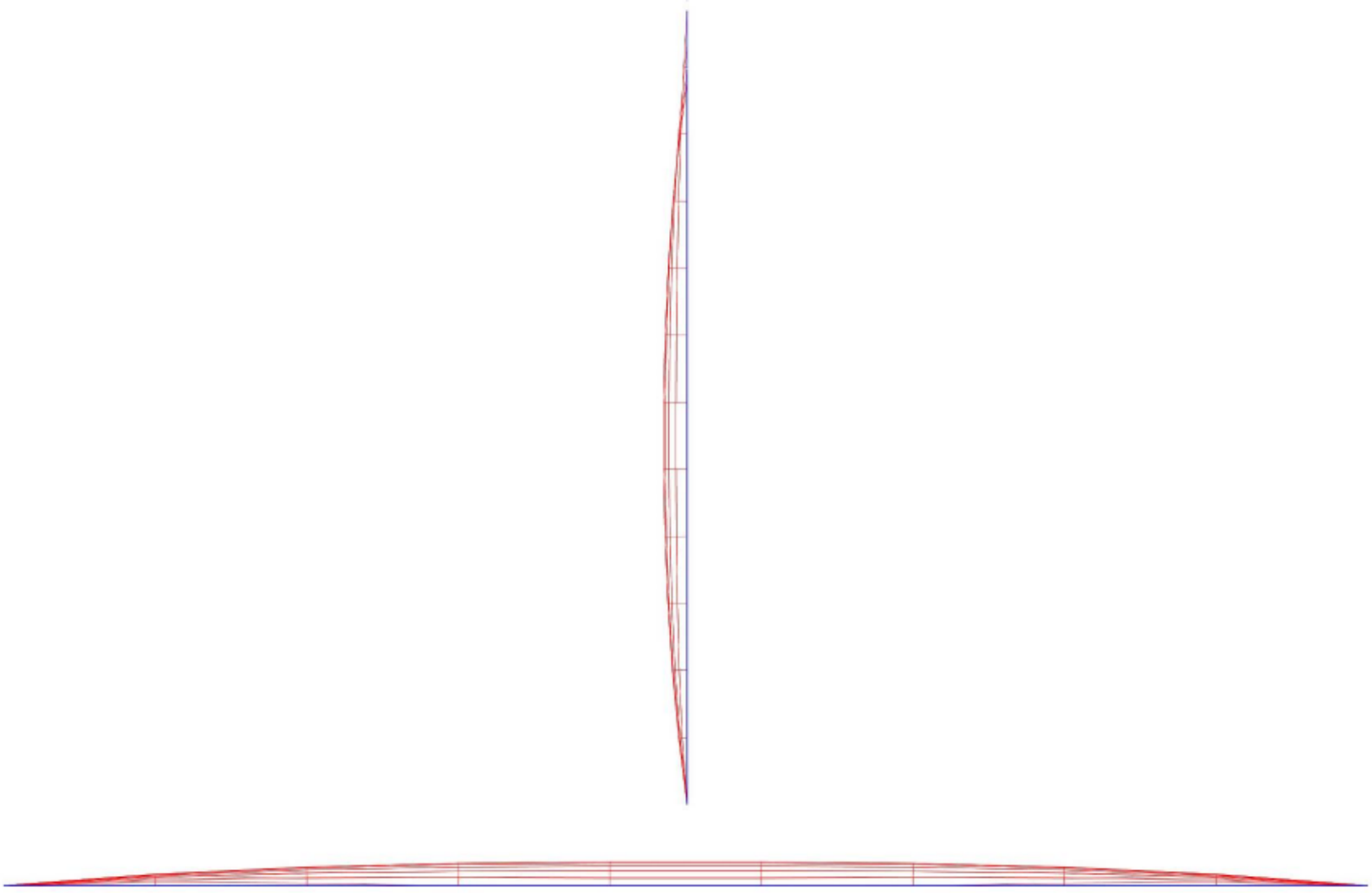


Figure 1 Deflections under pre-stress and wind load (40psf)

	P0	P1	P2	P3
Deflection f (mm)	470	100	165	69
Angle alpha (/vertical)		3.8°	6.3°	3.1°
Angle beta (/horizontal)		1.9°		1.3°



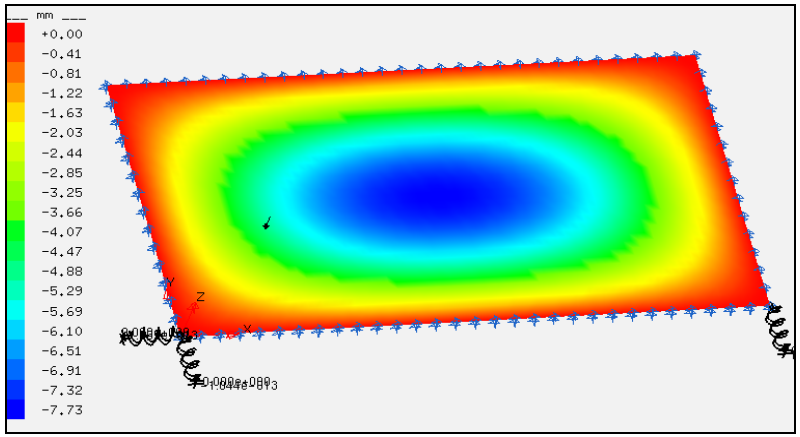
Deflected shape of cable- net structure under full wind load 40 psf



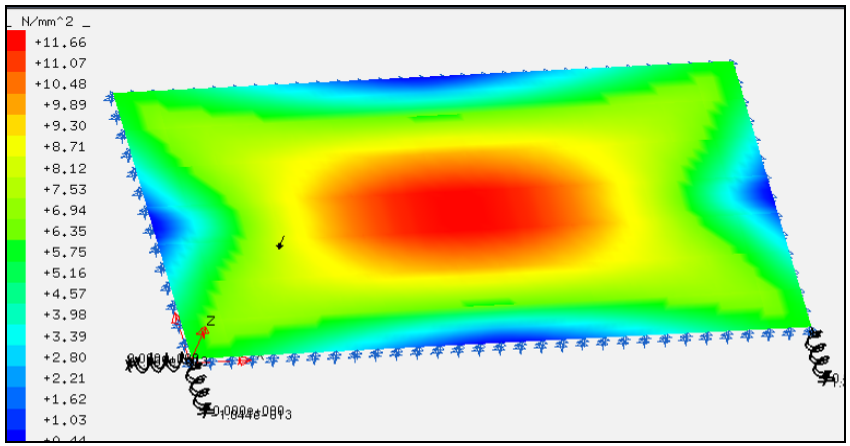
Deflected shape of cable- net structure under full wind load 40 psf

Roof Glazing

- Ceramic frit pattern according to kpf
- walk- on glass (with integrated latch-way support points)
- IGU with soft solar coating
- top lite fully tempered HST / air cavity / bottom lites laminated safety glass composed of heat- strengthened glass



max deflections – ok

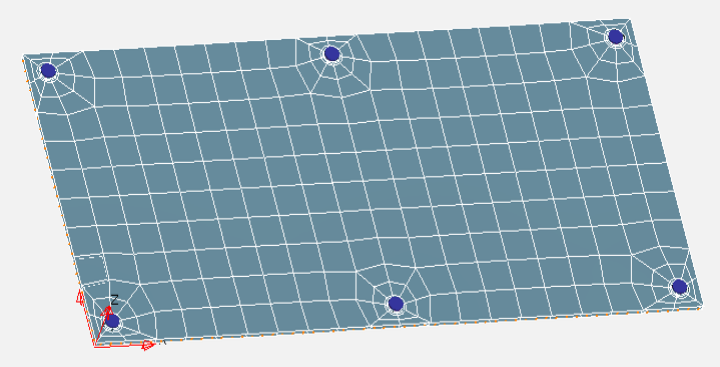


max stresses - ok

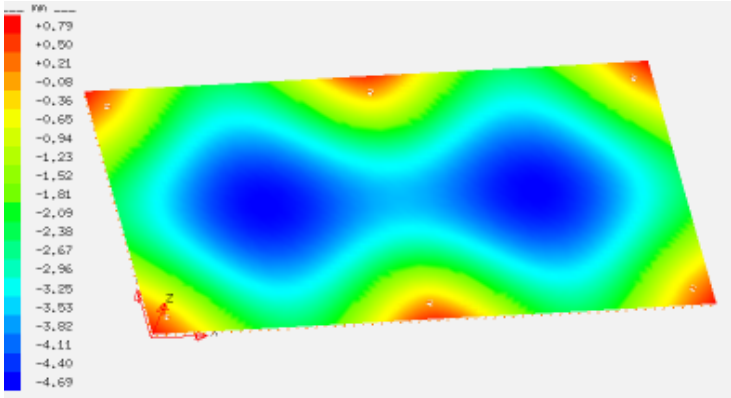
Layer	Material	E	ν	t	ρ	α_T	ΔT
	Glass, heat str	70000.	0.23	8	2.55e-9	1.e-5	0
3	Glass, heat st...	70000.	0.23	8	2.55e-9	1.e-5	0
2	PVB long time...	0.03	0.5	.76	1.07e-9	8.e-5	0
1	Glass, heat st...	70000.	0.23	8	2.55e-9	1.e-5	0

Front Cable- net Façade Glazing

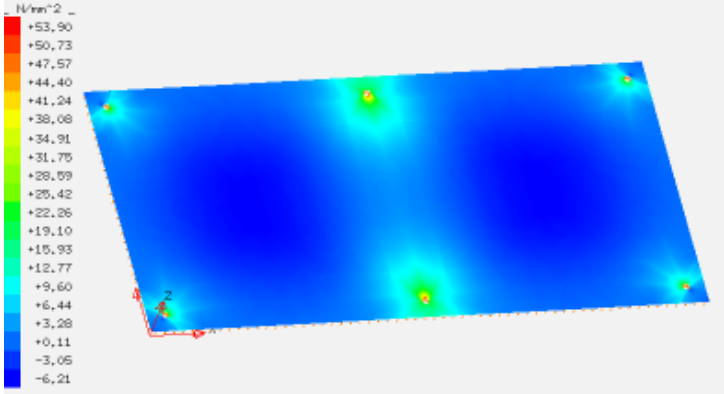
- Ceramic frit pattern according to kpf
- IGU with soft solar coating
- 6 point supports or 6 local edge clamps, fixed to horizontal and vertical cables (spiders or arms)
- inner lite fully tempered HST / air cavity / outer lites laminated safety glass composed of tempered glass HST



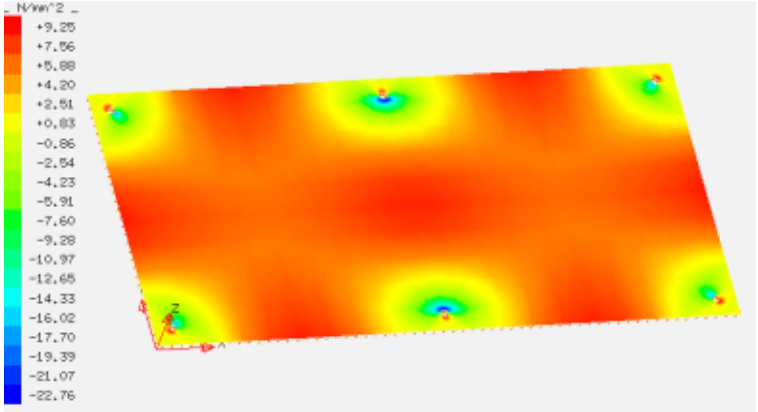
6 local point supports or edge clamps



max deflections - ok



Max stresses – ok



max stresses - ok