Deliverable Report 7.6

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Table of Contents

1 Introduction

Present report describes the final design of the demonstration unit designed by GXN and supported by Arup for the structural calculation. The demonstration unit collects the final full scale mock-ups for the four of the four case studies in a single assembly. This has been conceived for the EcoBuild exhibition held in London at the beginning of March 2015.

Present report contains the following:

- Project for the demonstration unit as for the design from GXN;
- Structural calculation report performed by Arup;
- Installation phases of the full scale mock ups;
- Final appearance of the demonstration stand at EcoBuild.

All chapters will be structured with a brief explanatory text while the graphic content will be organized in four distinct appendices.

2 Design of the demonstrator unit

The demonstrator has been specifically designed with the aim of exhibiting the full scale mock ups in London at the EcoBuild fair. Main requirement have been:

- Steel structure to support the case studies;
- Wooden furniture & stand basement;
- Match the size constraints for the stand and particularly (6m length, 4 meters in width and 4 meters in height);
- Create an assembly including the four case studies in a homogeneous design;
- Create places for the visitors to discuss with the BioBuild partners about the project;
- Create a visual attraction for the visitors towards the stand;
- Fulfil all the requirements imposed by the EcoBuild organizers.

Figure 1 reports an overview of the stand, while Appendix A reports the full design documentation as developed by GXN.

Figure 1. 3D model of the stand.

3 Structural calculation of the steel structure

The structural calculation has been performed by Arup to account for potential failure of the stand structure. The basic materials is construction steel and the design loads have been considered according to the guidelines of the trade fair and particularly it has been considered the risk of overturning due to:

- Internal wind pressure
- Potential soft body/hard body impact

Figure 2 reports an overview of the 3D model used to perform the structural calculation of the stand, while Appendix B reports the full design documentation as developed by Arup.

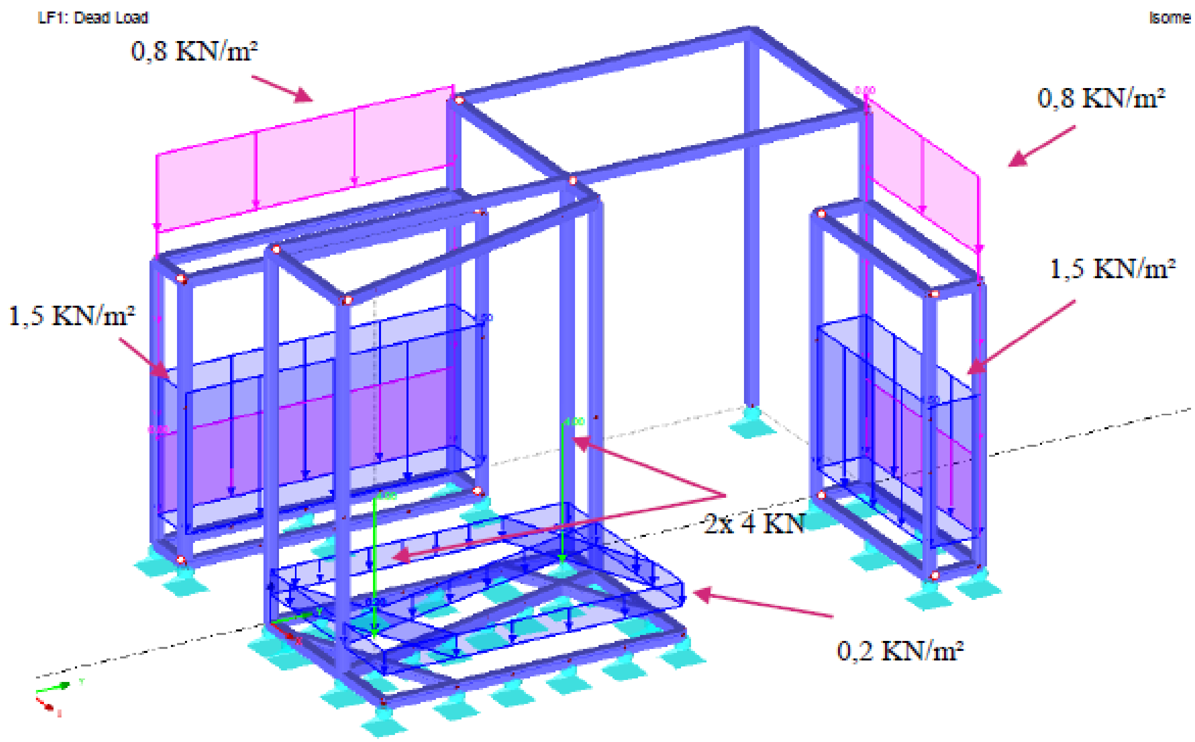


Figure 2. Structural model of the stand.

4 Installation and final appearance

The stand has been installed in three days right before the EcoBuild fair, happening in London from the 3rd to the 5th of March.

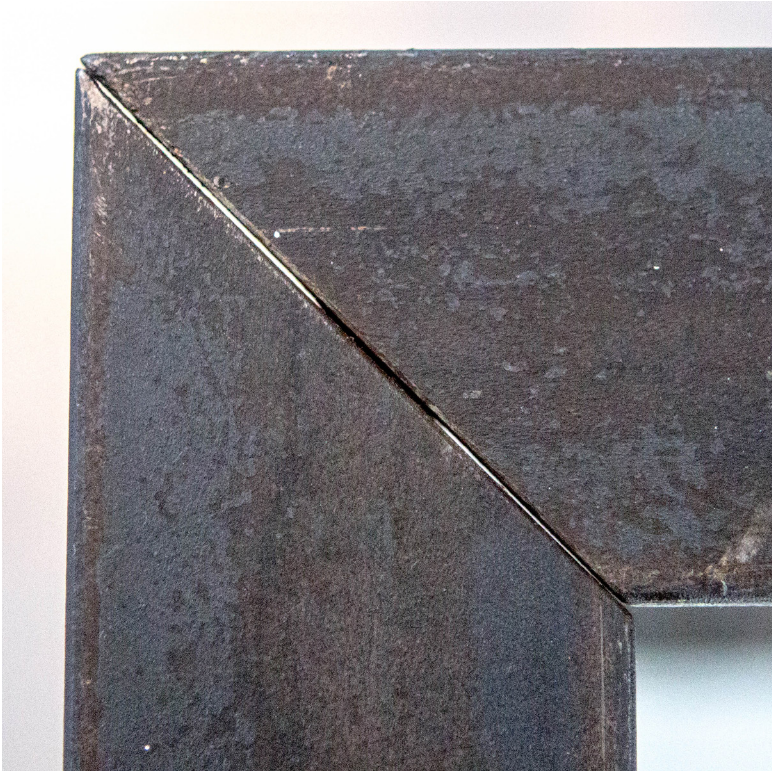
The installation phases as well the final appearance of the stand is reported in Appendix C.

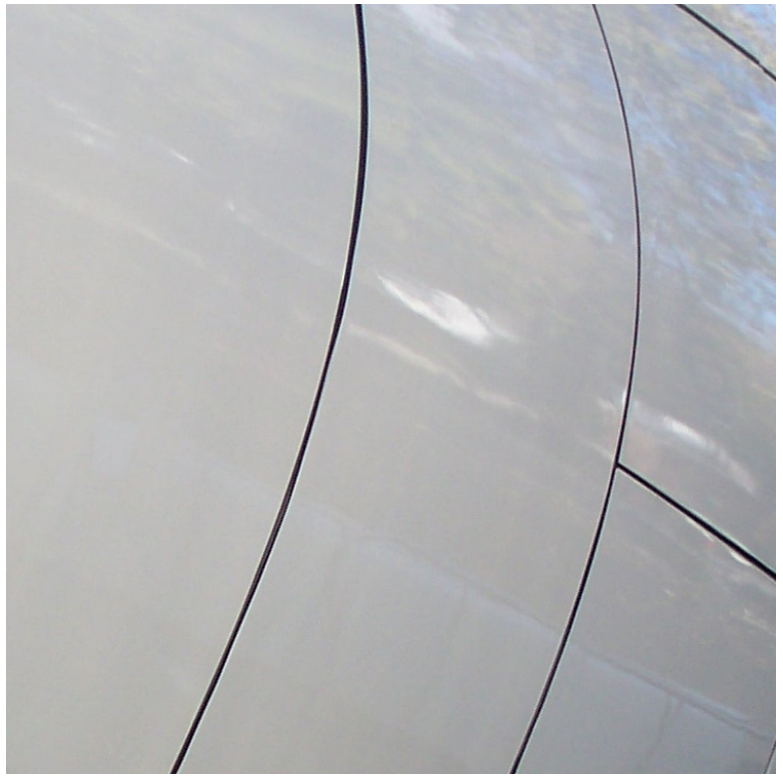
APPENDIX A – Design of the demonstrator units

ECOBUILD exhibition design

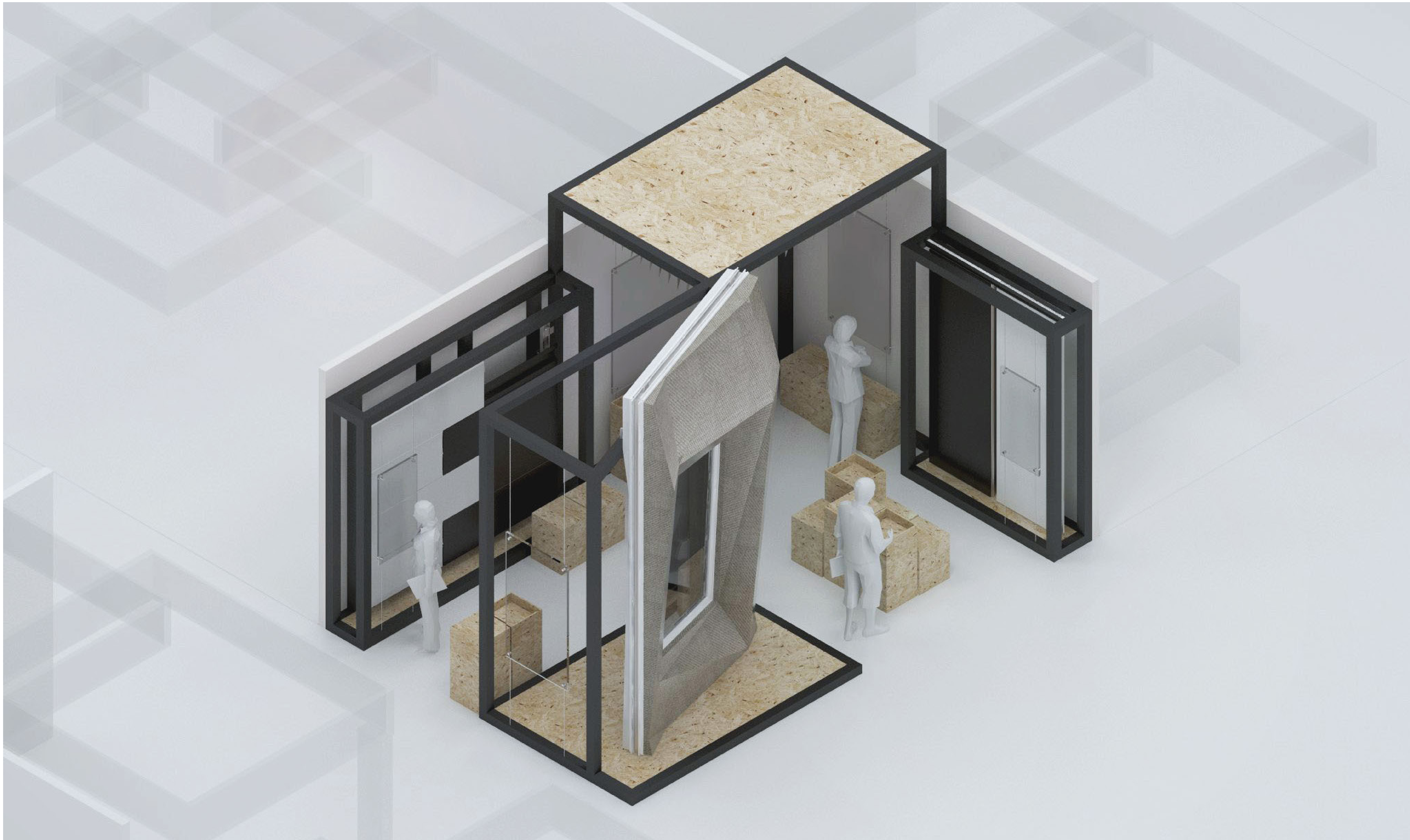
2014-10-13
Additional Material Studies


Orriented Strand Board


Unfinished Steel


Glossy White Finish


Biocomposite with Clearcoat finish

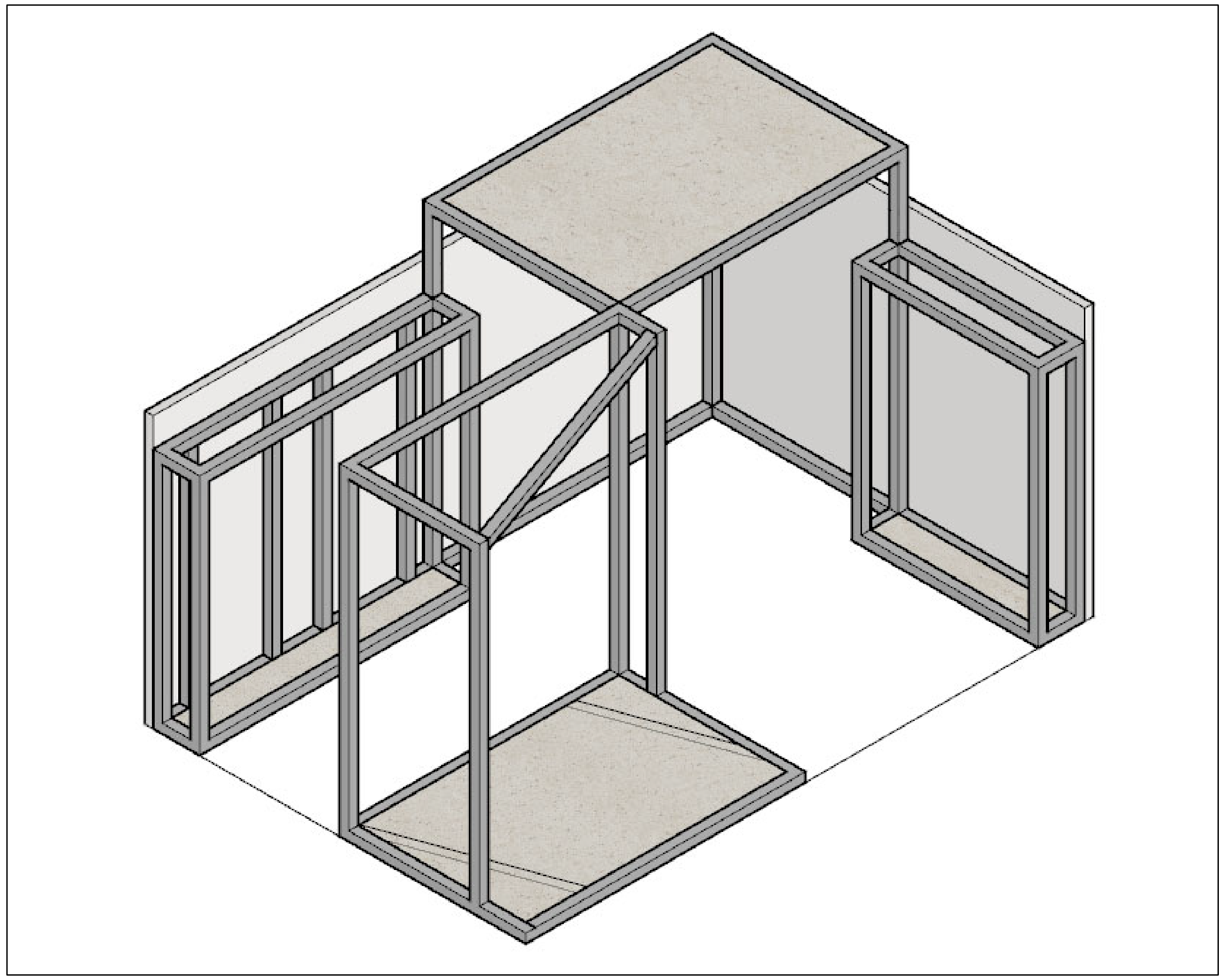



ECK

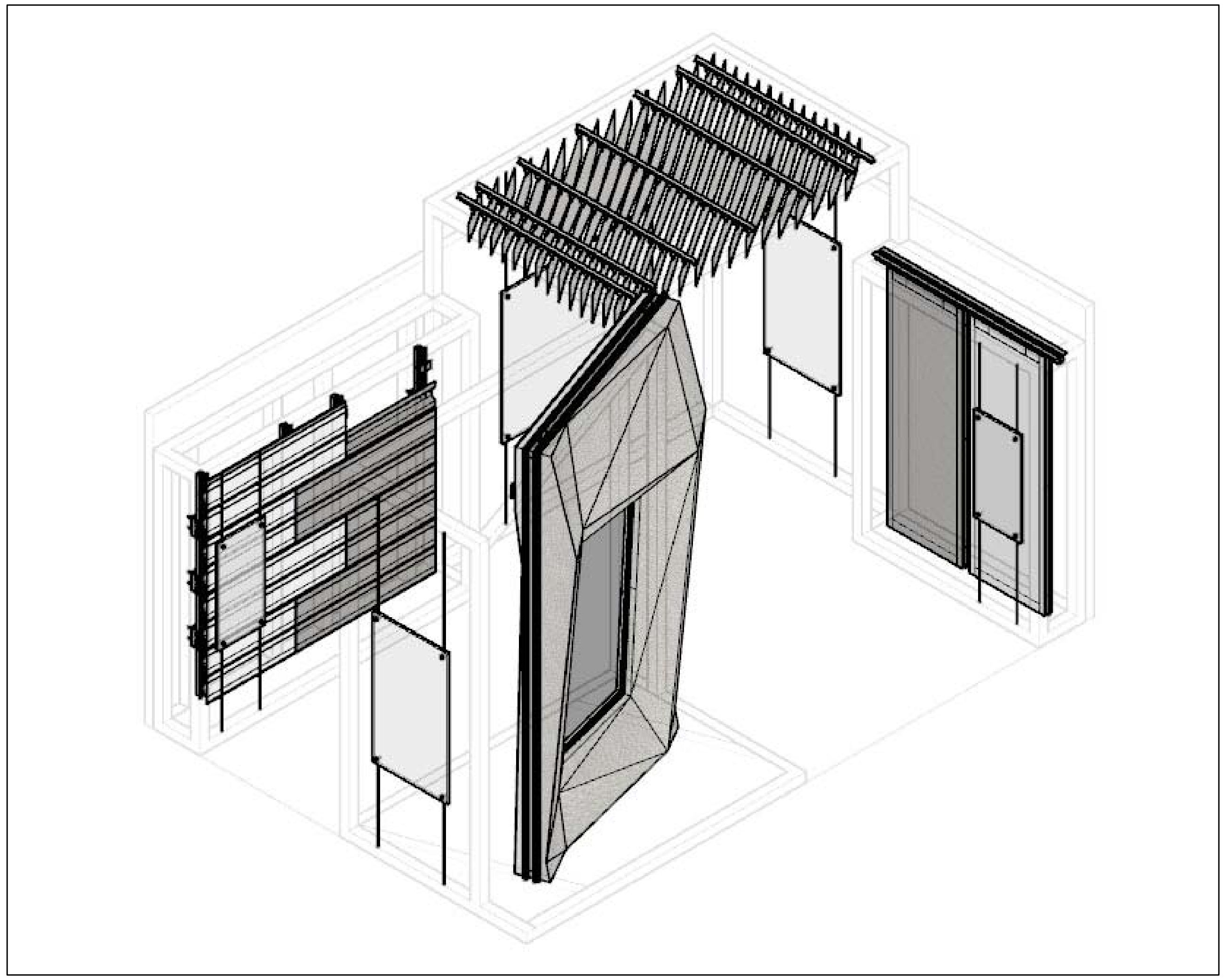

EWP


SCK


IPK
Internal Partition Kit
Biocomposite cladding material.



01 Structural Frame Scope



02 Biobuild Scope

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

DRAWING LIST
A1 - Exhibition Stand
A2 - External Cladding Kit
A3 - External Cladding Kit
A4 - External Wall Panel
A5 - External Wall Panel 2
A6 - Internal Partition Kit
A7 - Suspended Ceiling Kit
A8 - Suspended Ceiling Kit
A9 - Structural Axo
A10 - Structural Axo
A11 - Details

ARCHITECT: GXN - Strandgade 73, 1401 København K, DK

GXN

PHONE: +45 7026 2648

PROJ. ID: 40028

TITLE:

Biobuild Exhibition Scope

SKETCH NO. A0

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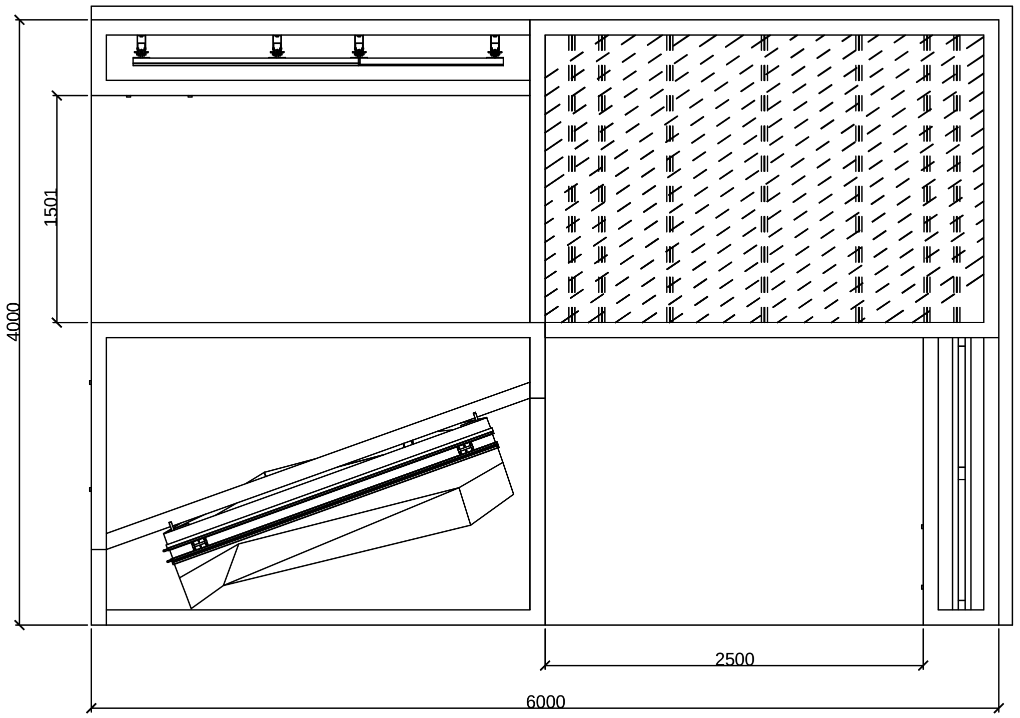
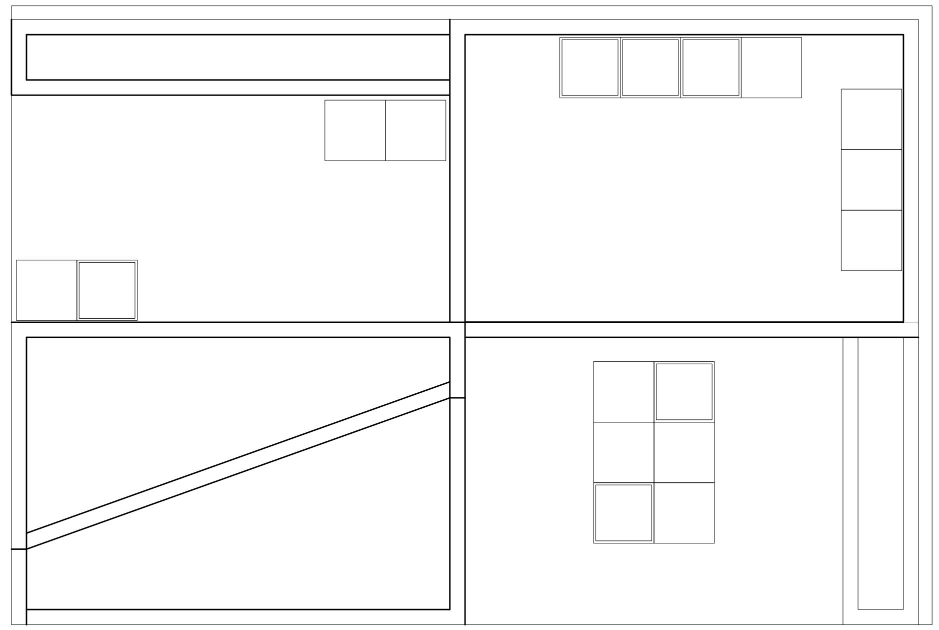
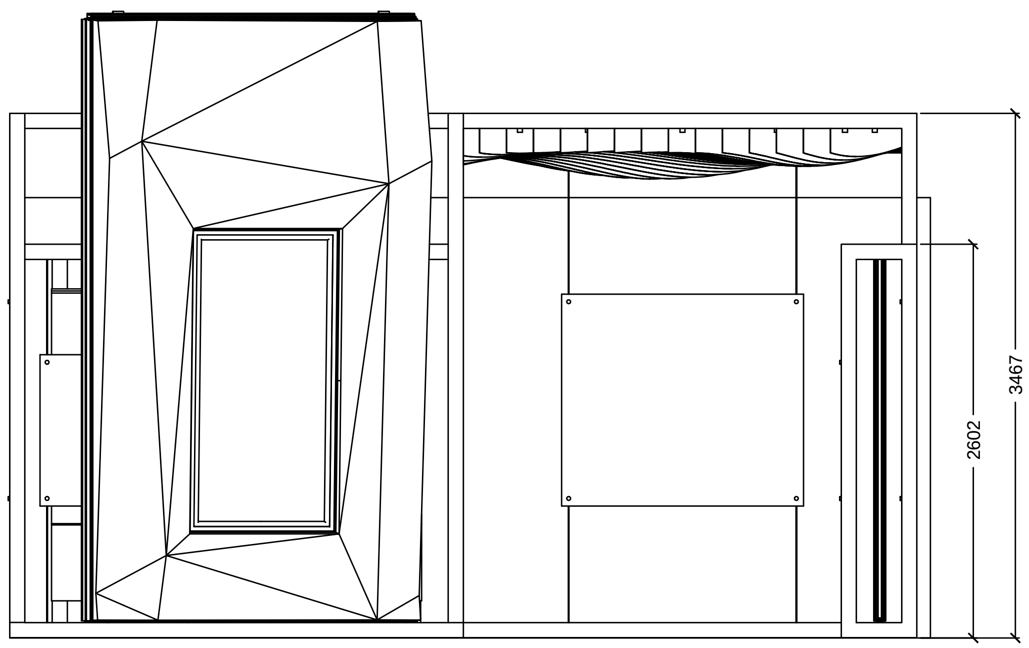


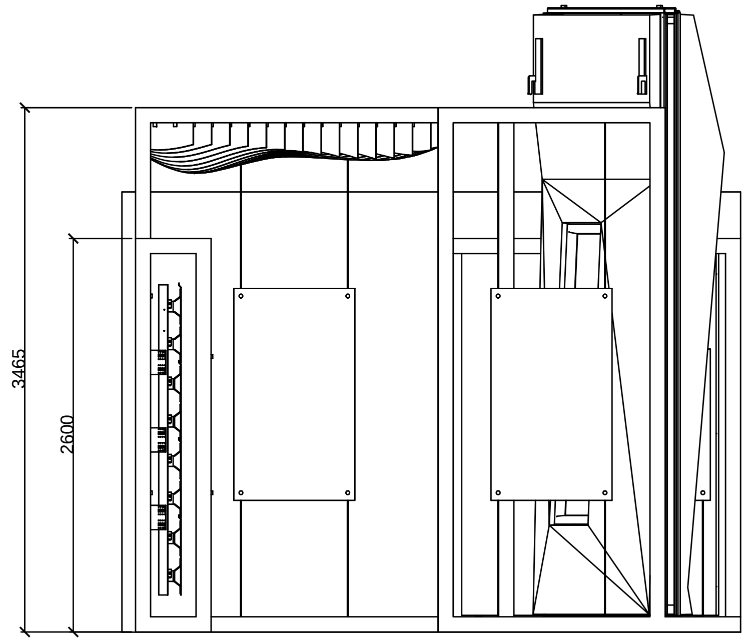
01 BioBuild Exhibition Plan



02 BioBuild Exhibition Display Podiums



03 BioBuild Exhibition Front Elevation



04 BioBuild Exhibition Side Elevation

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK	GXN	PHONE +45 7026 2648	PROJ. ID 40028

TITLE:			SKETCH NO.		VER.
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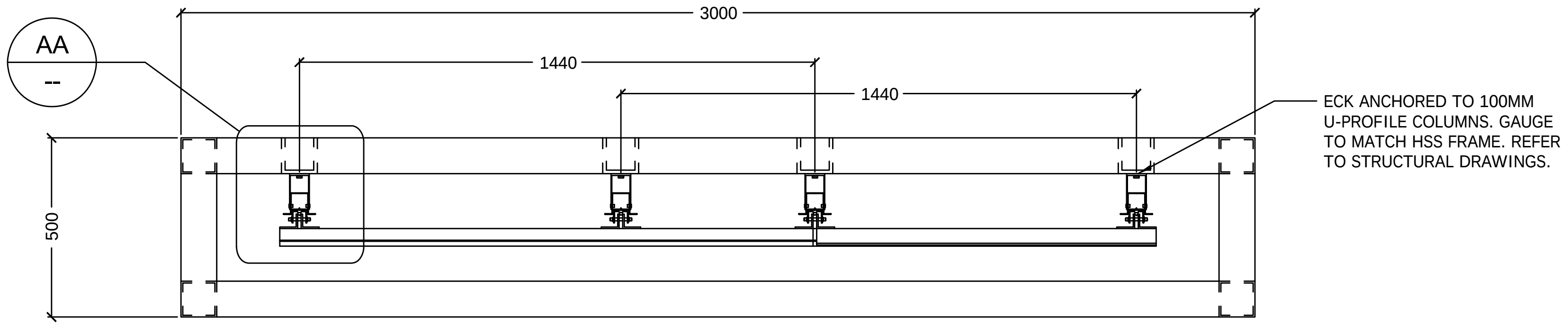
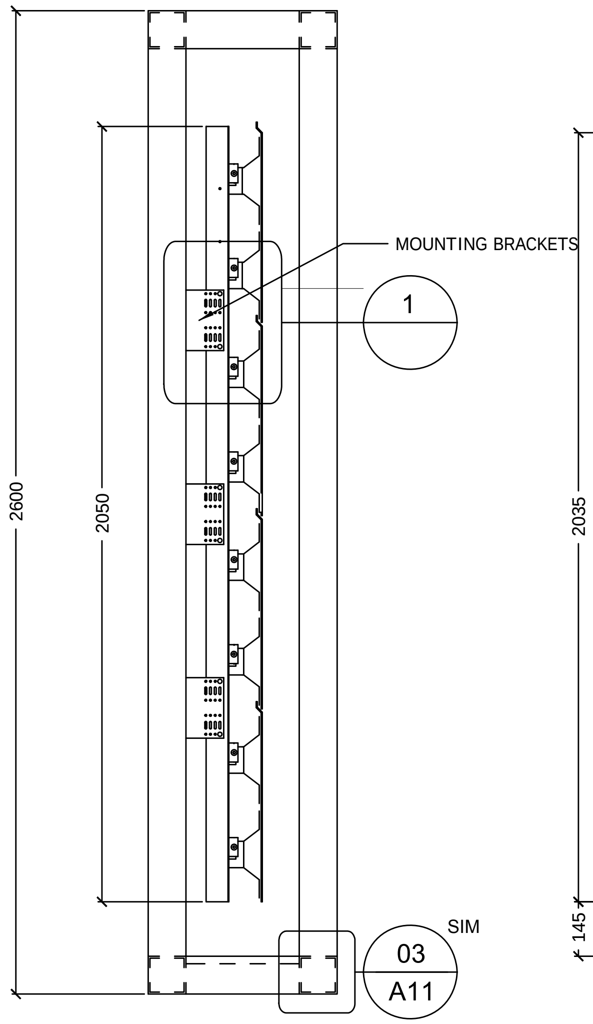
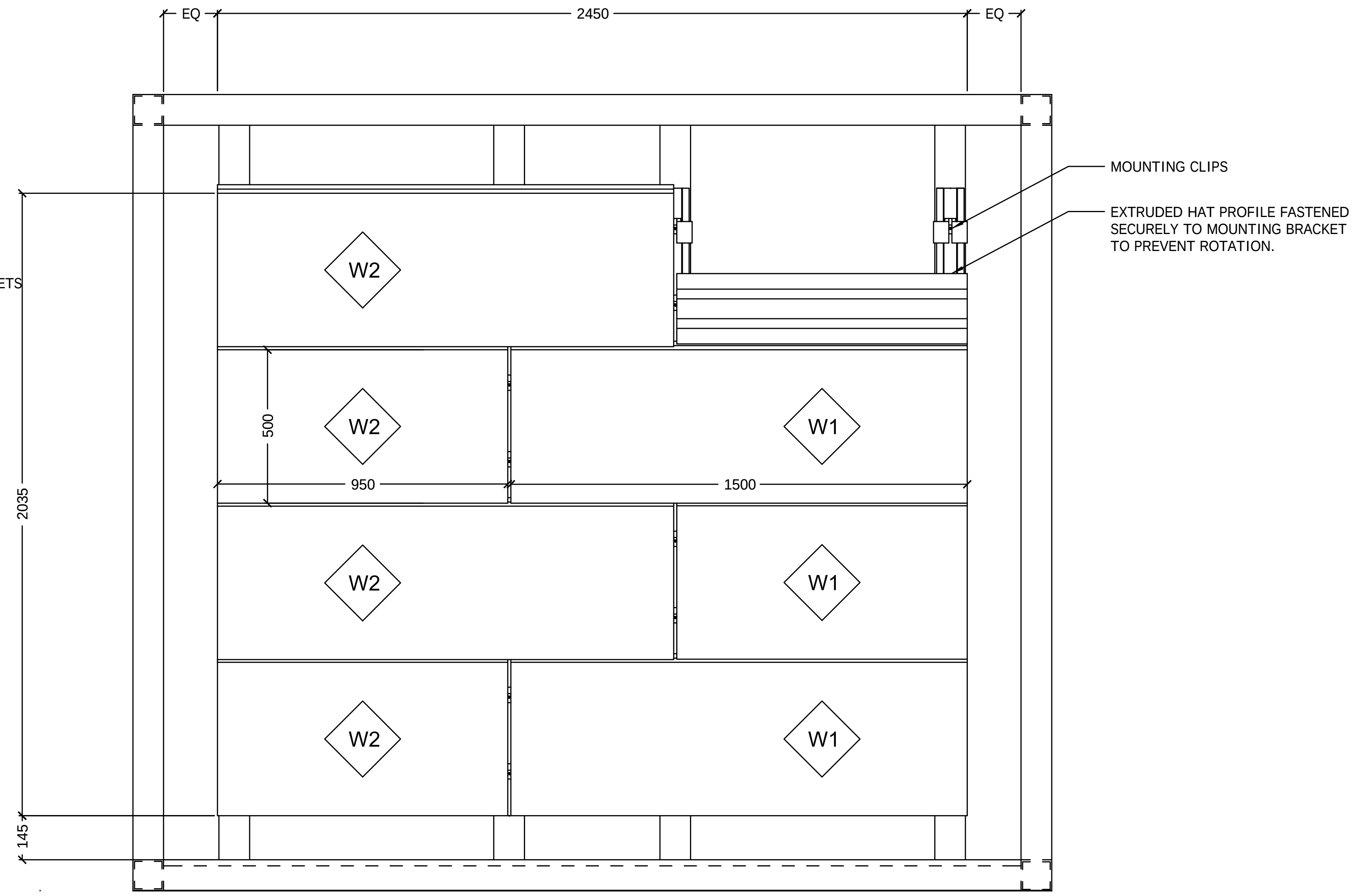


01 EPK - Plan





02 EPK - Side Elevation

03 EPK - Front Elevation

FINISHES

W1 - Clear-coat finish
W2 - White finish

COMPONENTS	QUANTITY
1500 x 500 mm Panel	4
950 x 500 mm Panel	3
Brackets	12
Clips	32

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT: GXN - Strandgade 73, 1401 København K, DK

GXN

PHONE	PROJ. ID
+45 7026 2648	40028

TITLE:

Exterior Cladding Kit

SKETCH NO. A2

VER.

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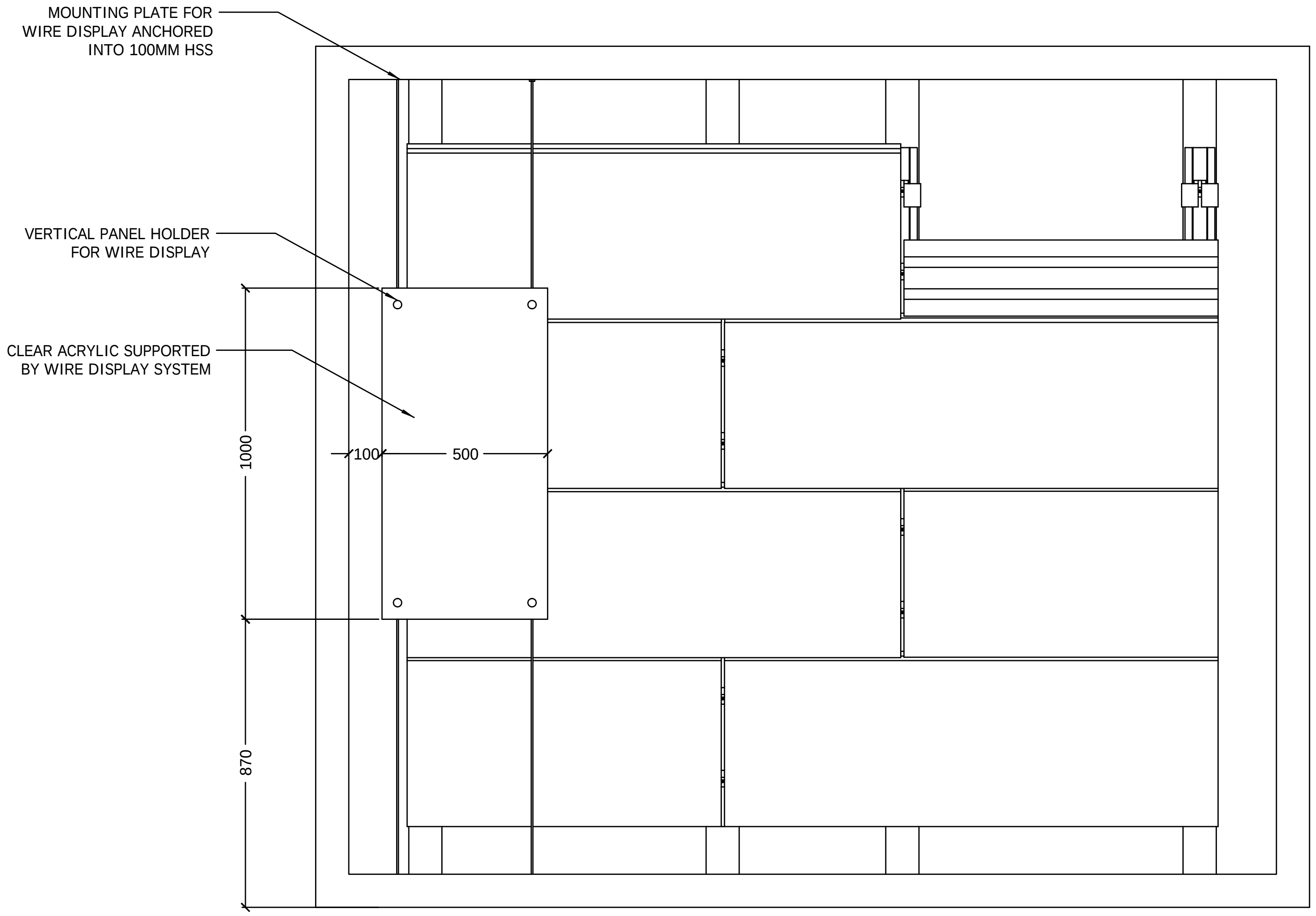

01 EPK - Front Elevation Acrylic Display

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK	GXN	PHONE +45 7026 2648	PROJ. ID 40028

TITLE:

Exterior Cladding Kit - Acrylic Display

SKETCH NO. A3 VER.

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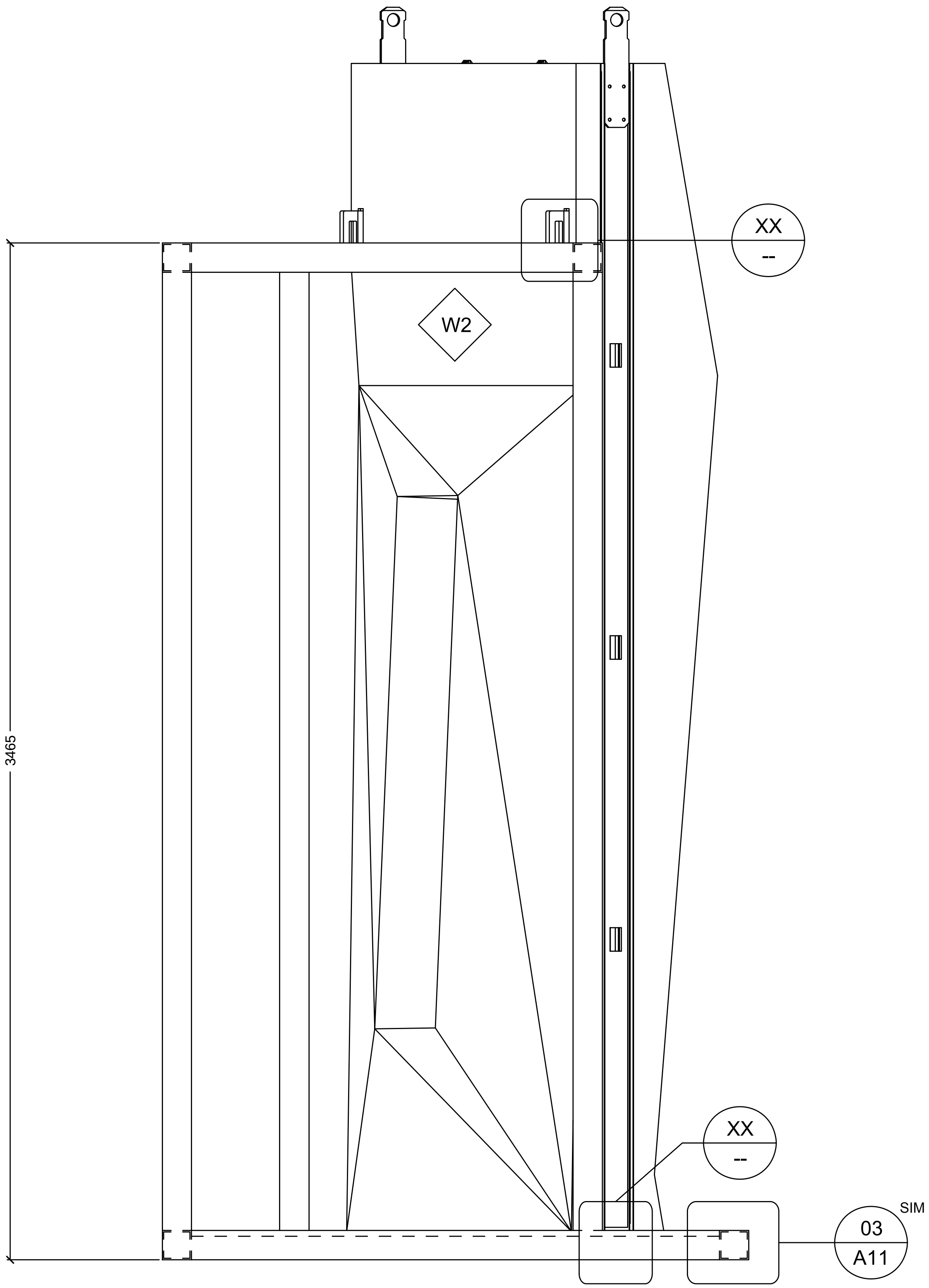
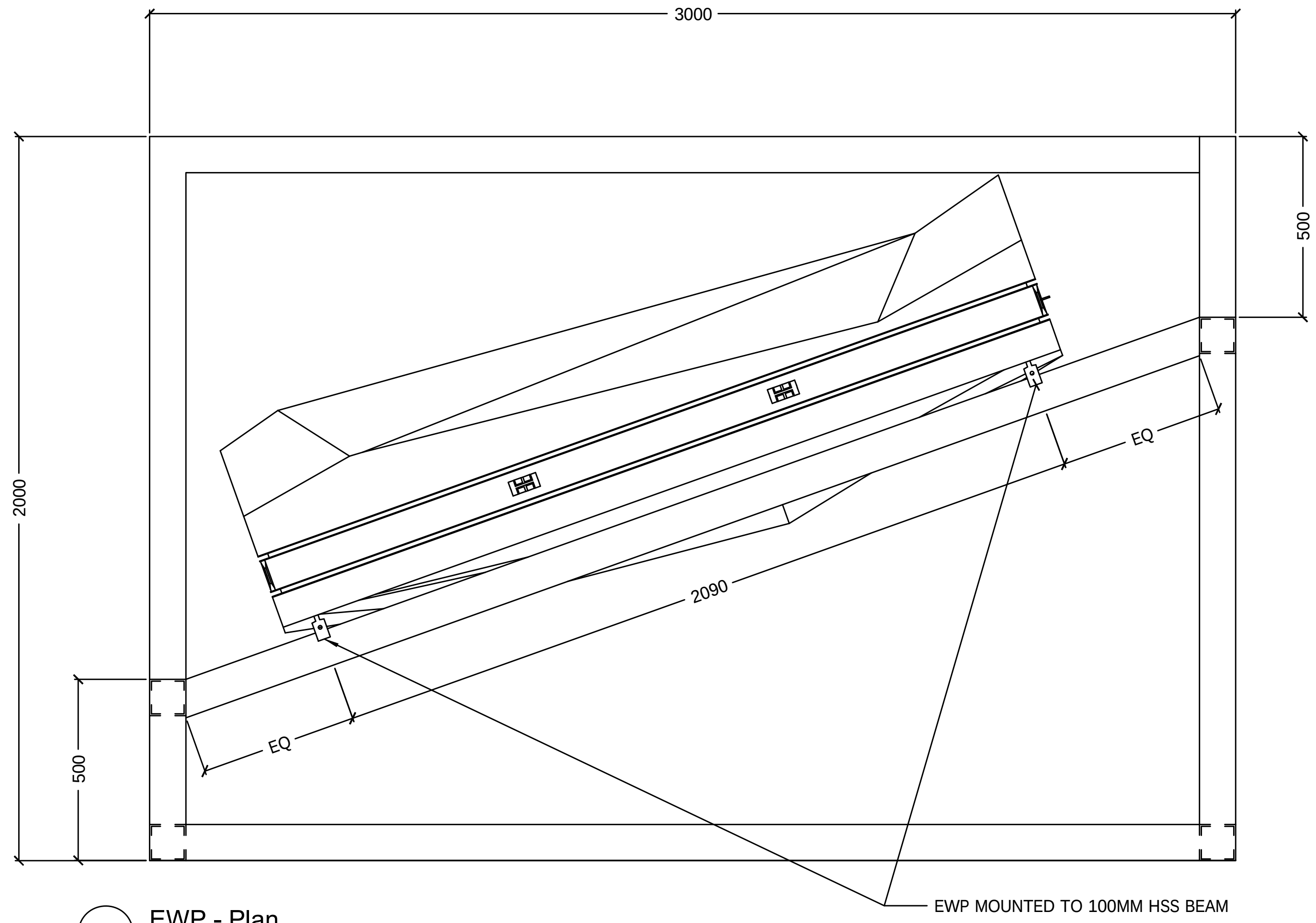


01 EWP - Side Elevation



02 EWP - Plan

FINISHES
W1 - Clear-coat finish
W2 - White finish

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK	GXN	PHONE +45 7026 2648	PROJ. ID 40028

TITLE:

Exterior Wall Panel

SKETCH NO. A4

VER.

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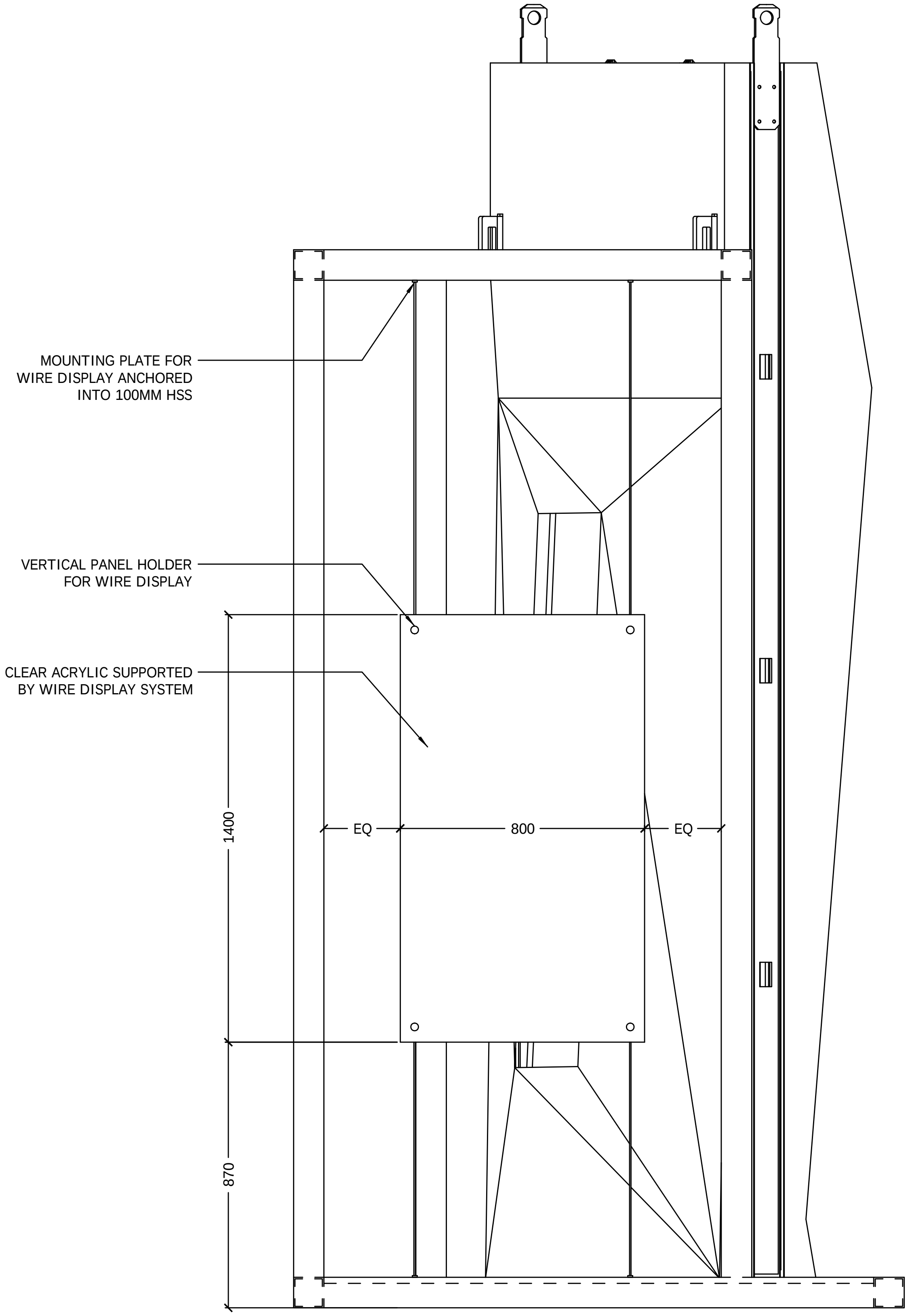
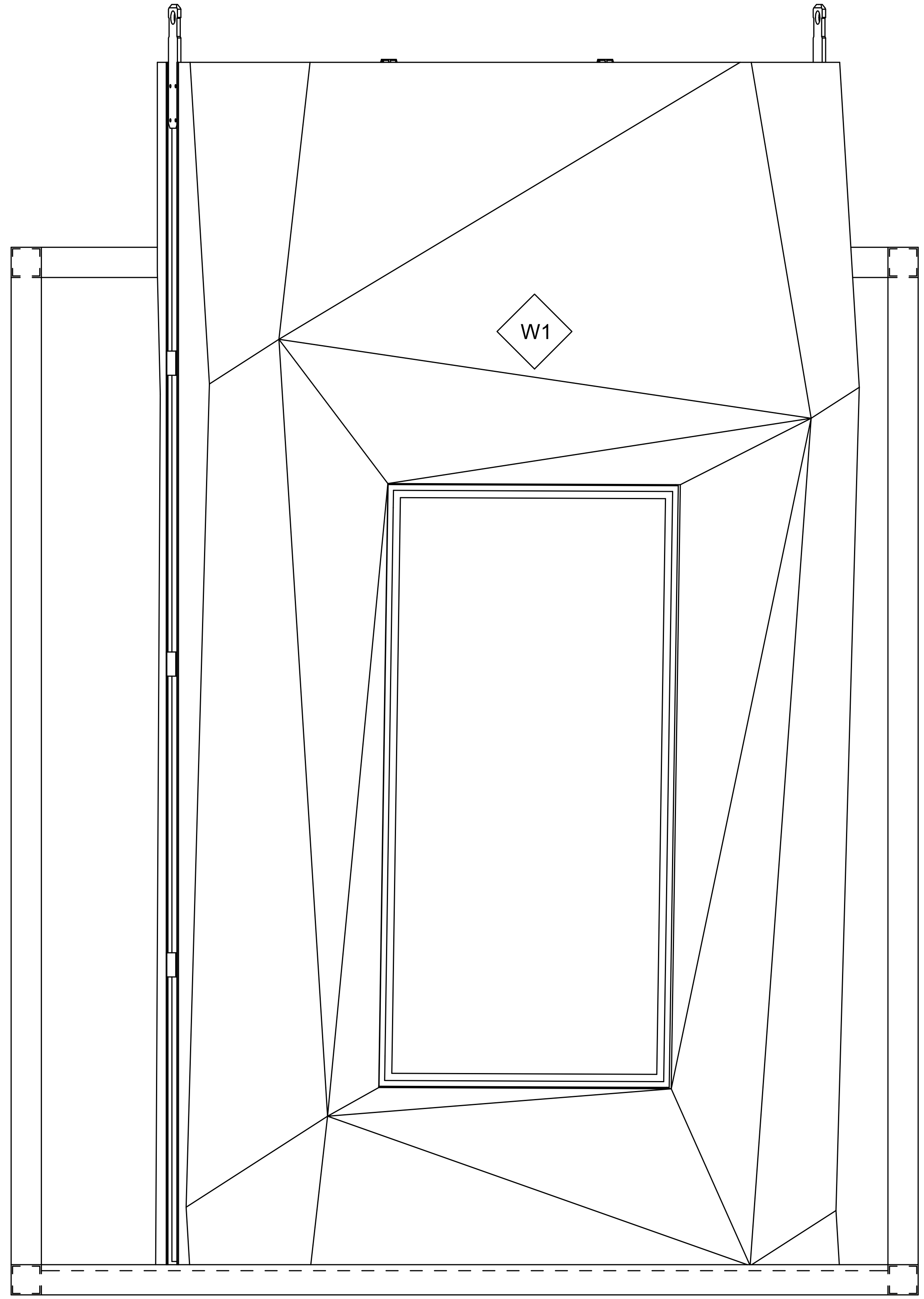


01 EWP - Side Elevation Acrylic Display



02 EWP - Front Elevation

REV.	DATO	EMNE	UDARB.	GODK.

FINISHES
W1 - Clear-coat finish
W2 - White finish

Biobuild Exhibition

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK		GXN	PHONE +45 7026 2648		PROJ. ID 40028
TITLE: Exterior Wall Panel				SKETCH NO. A5		VER.
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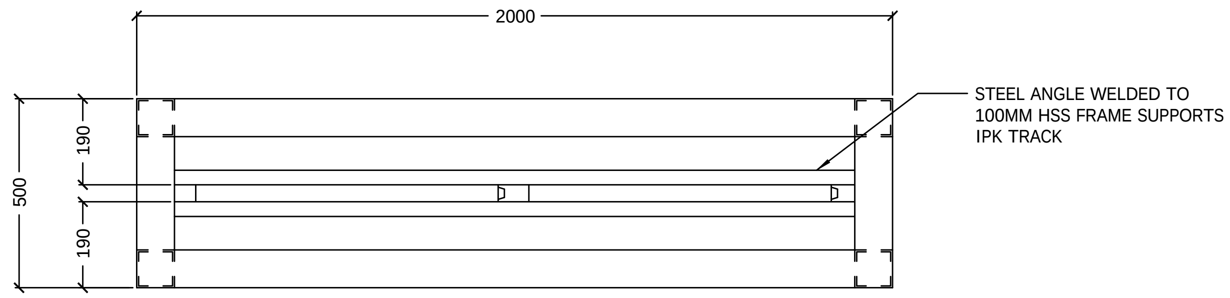
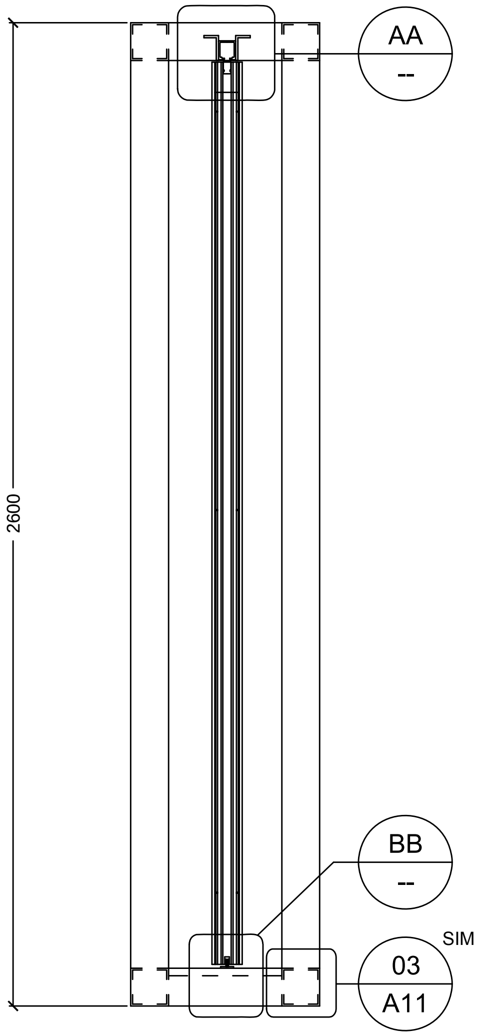
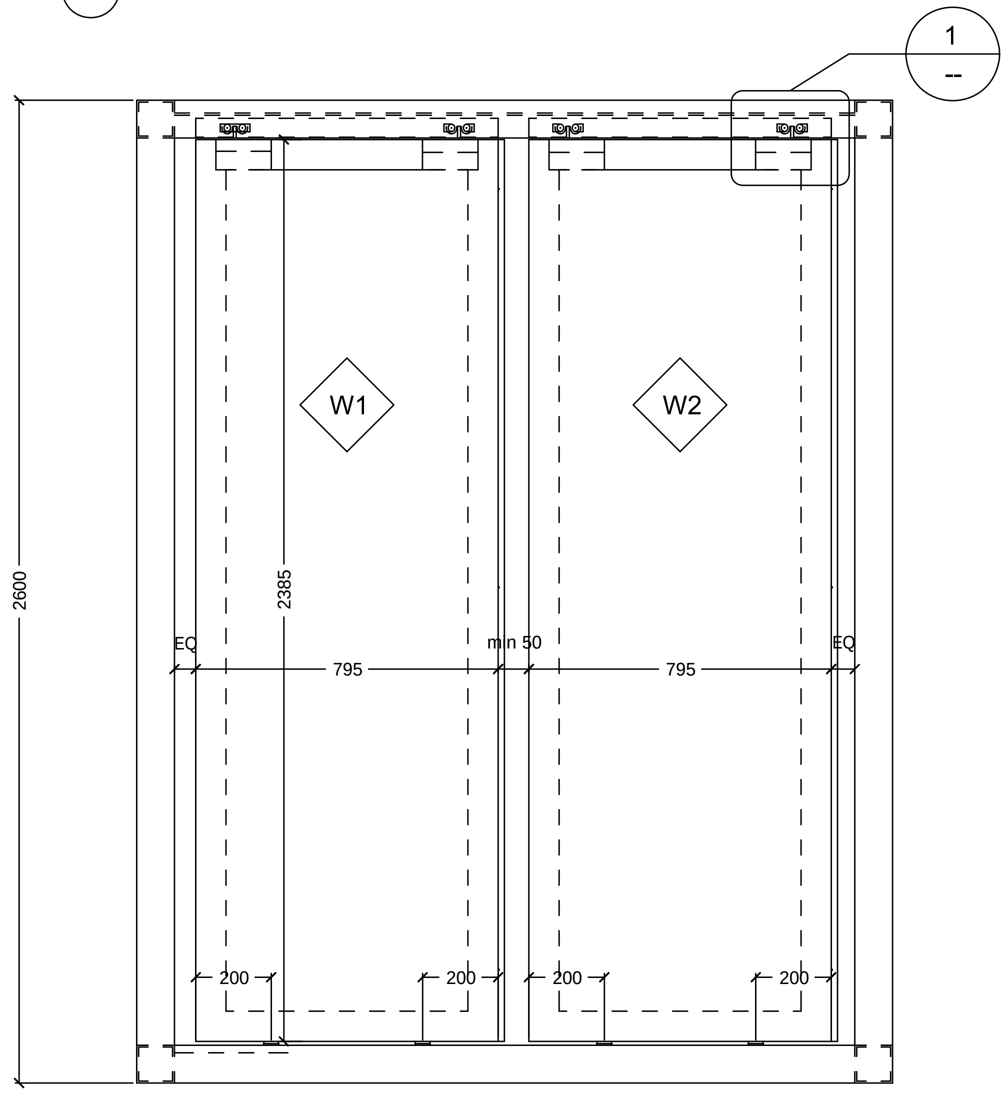


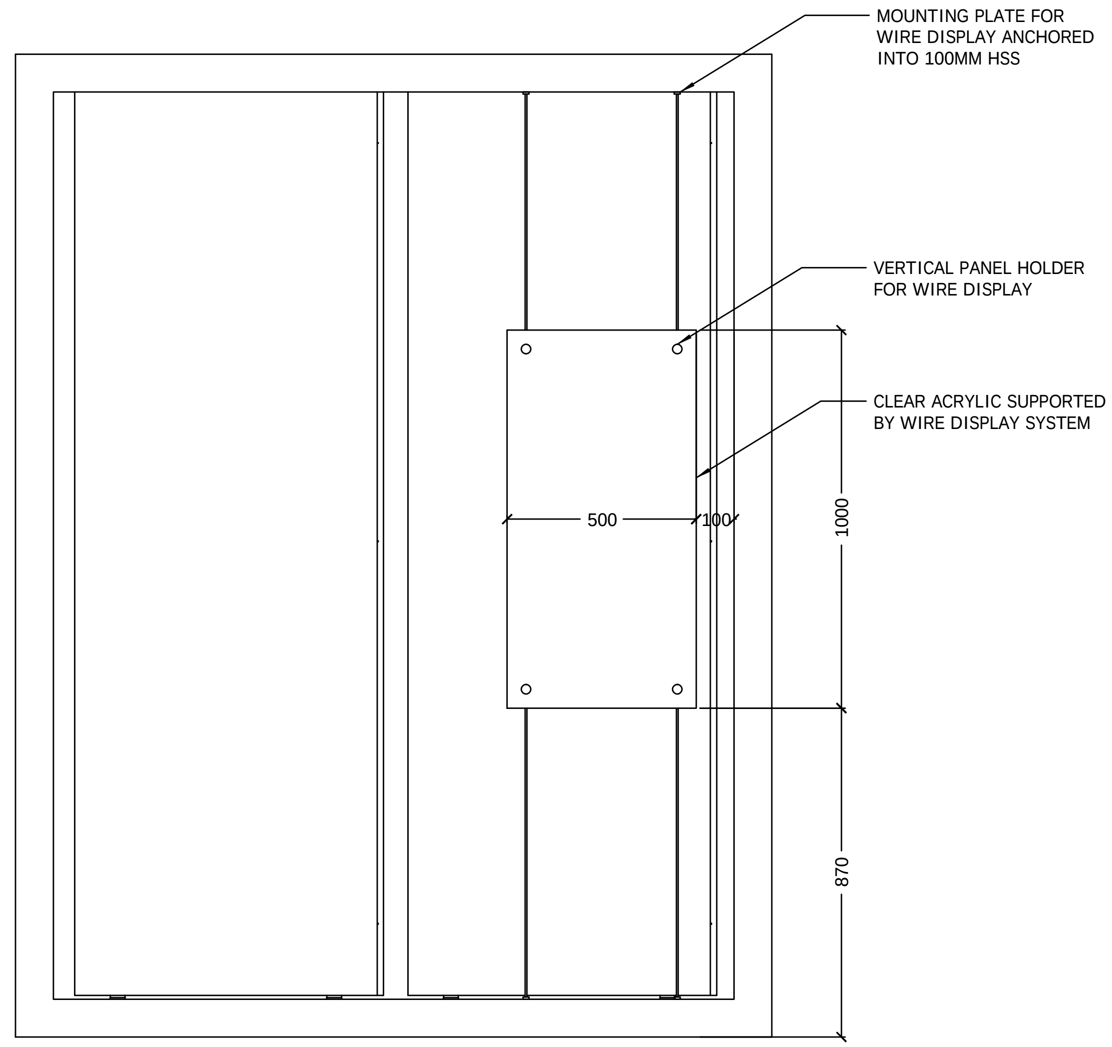
01 IPK - Plan



02 IPK - Side Elevation



03 IPK - Front Elevation



04 IPK - Front Elevation Acrylic Display

FINISHES
W1 - Clear-coat finish
W2 - White finish

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT: GXN - Strandgade 73, 1401 København K, DK

PHONE	PROJ. ID
+45 7026 2648	40028

TITLE:

Interior Partition Kit

SKETCH NO. A6

VER.

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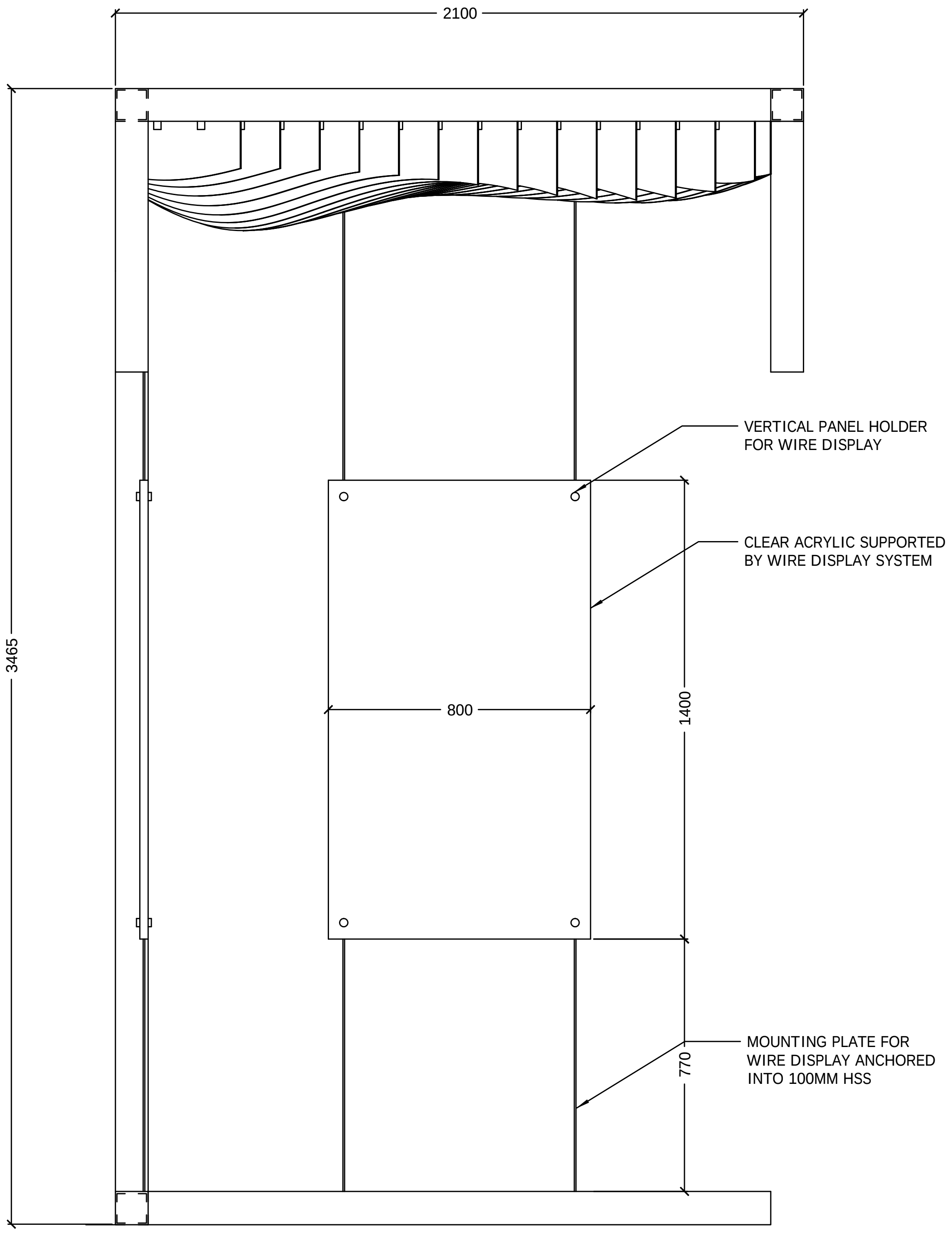
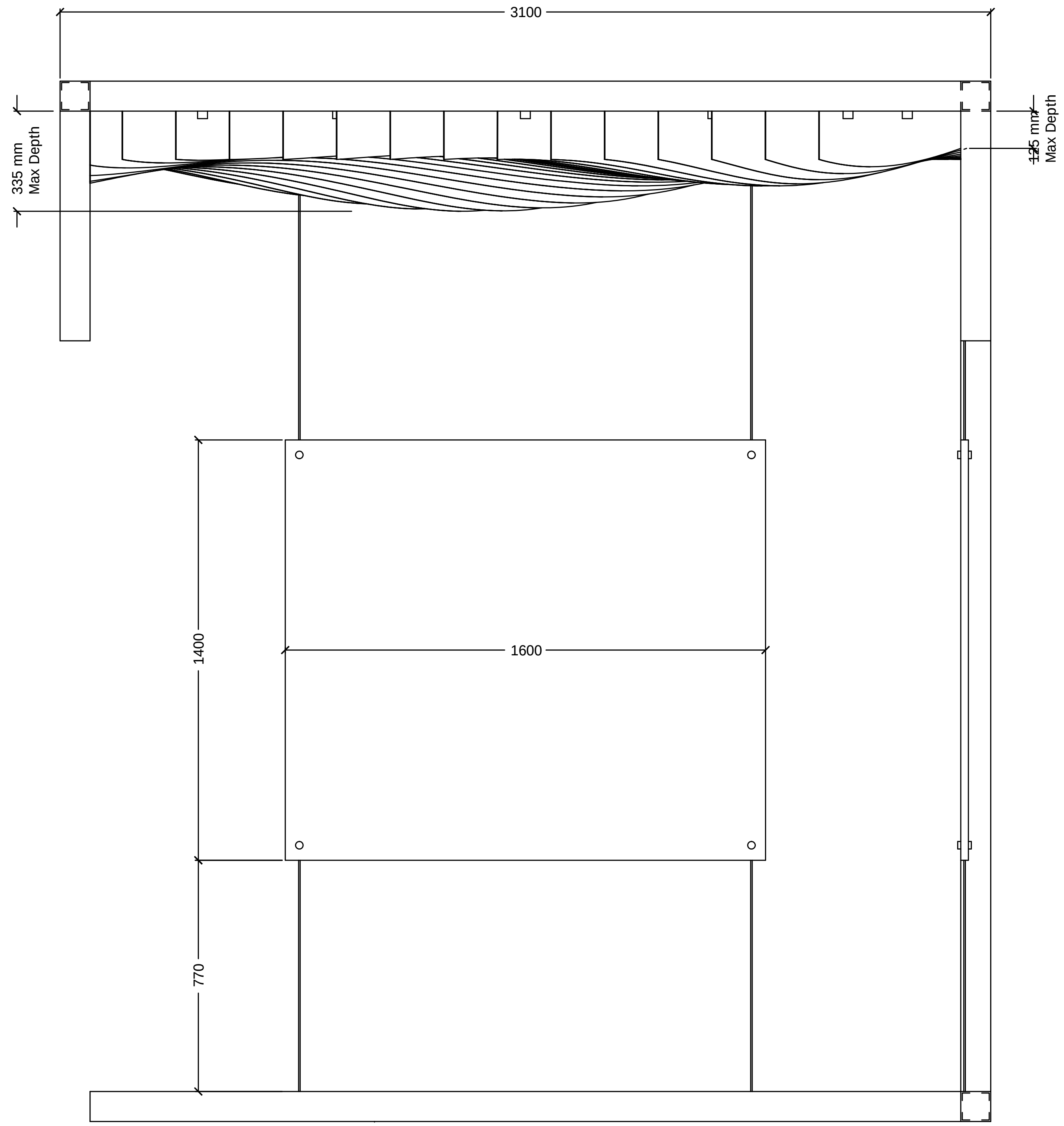


01 SCK - Side Elevation Acrylic Display



02 SCK - Front Elevation Acrylic Display

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

FINISHES
W1 - Clear-coat finish
W2 - White finish

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK	PHONE	PROJ. ID
		+45 7026 2648	40028

TITLE:

Suspended Ceiling Kit

SKETCH NO. A7

VER.

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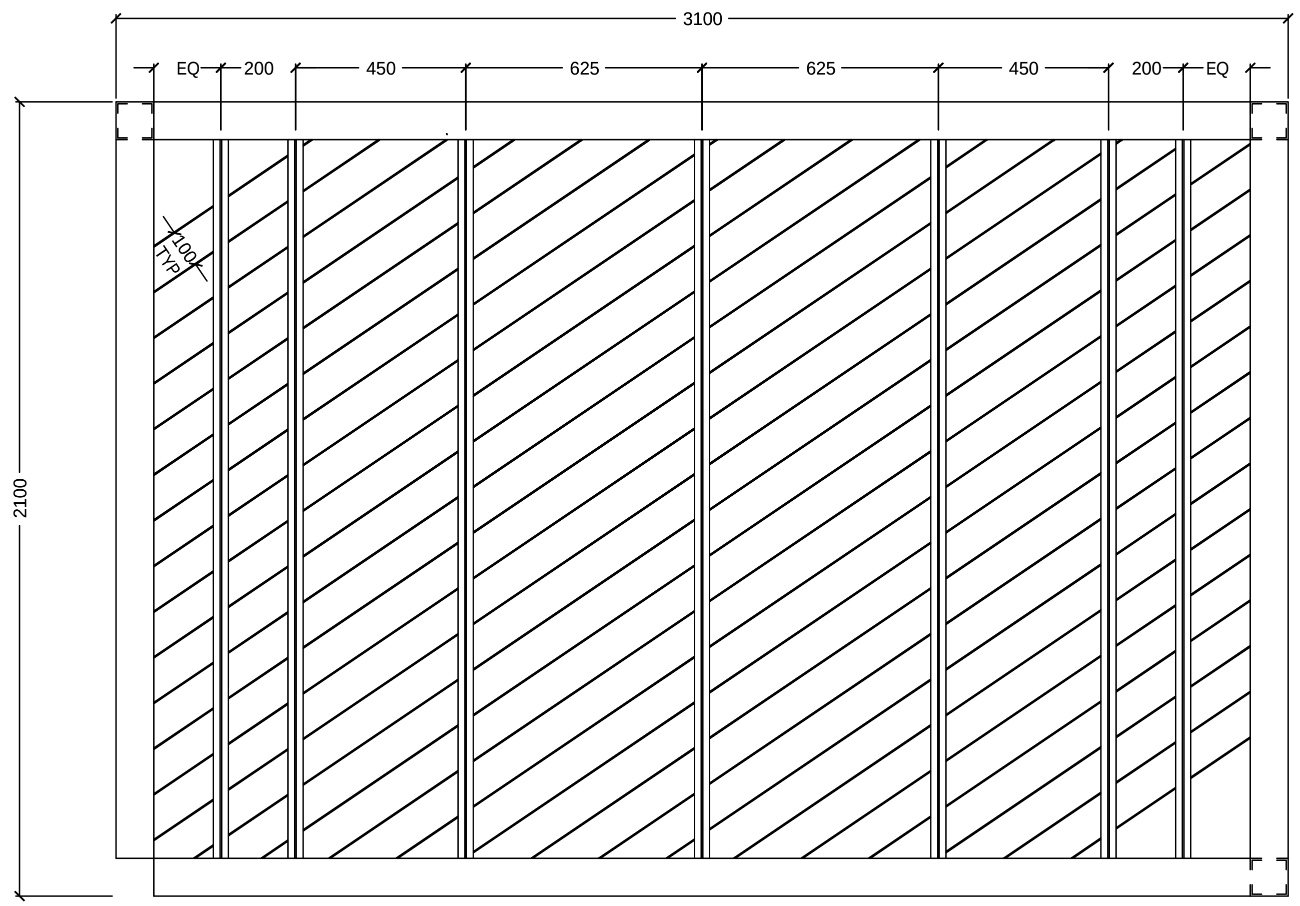

01 IPK - Front Elevation Acrylic Display

FINISHES
W1 - Clear-coat finish
W2 - White finish

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT: GXN - Strandgade 73, 1401 København K, DK

PHONE	PROJ. ID
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TITLE:

Suspended Ceiling Kit

SKETCH NO. A8

VER.

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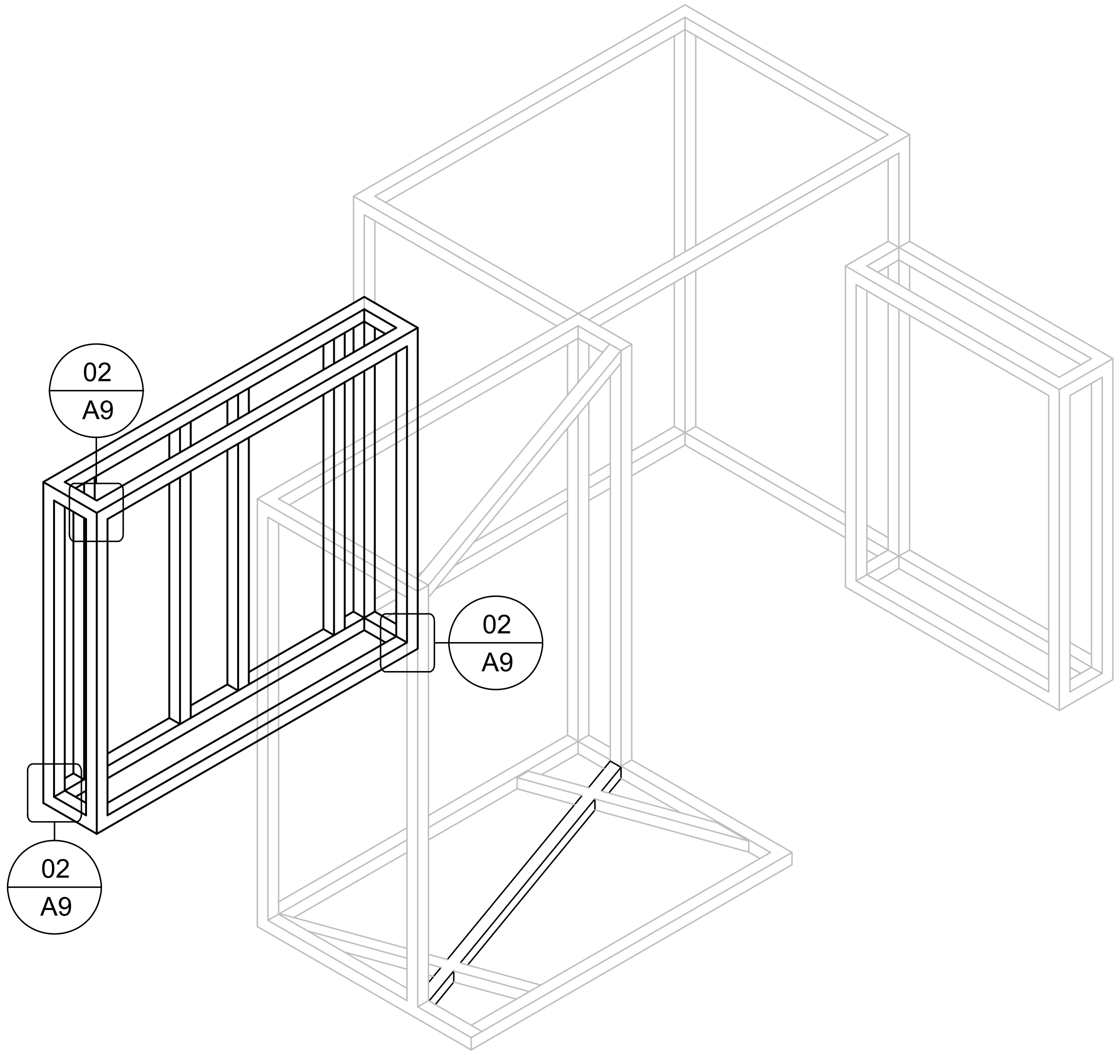
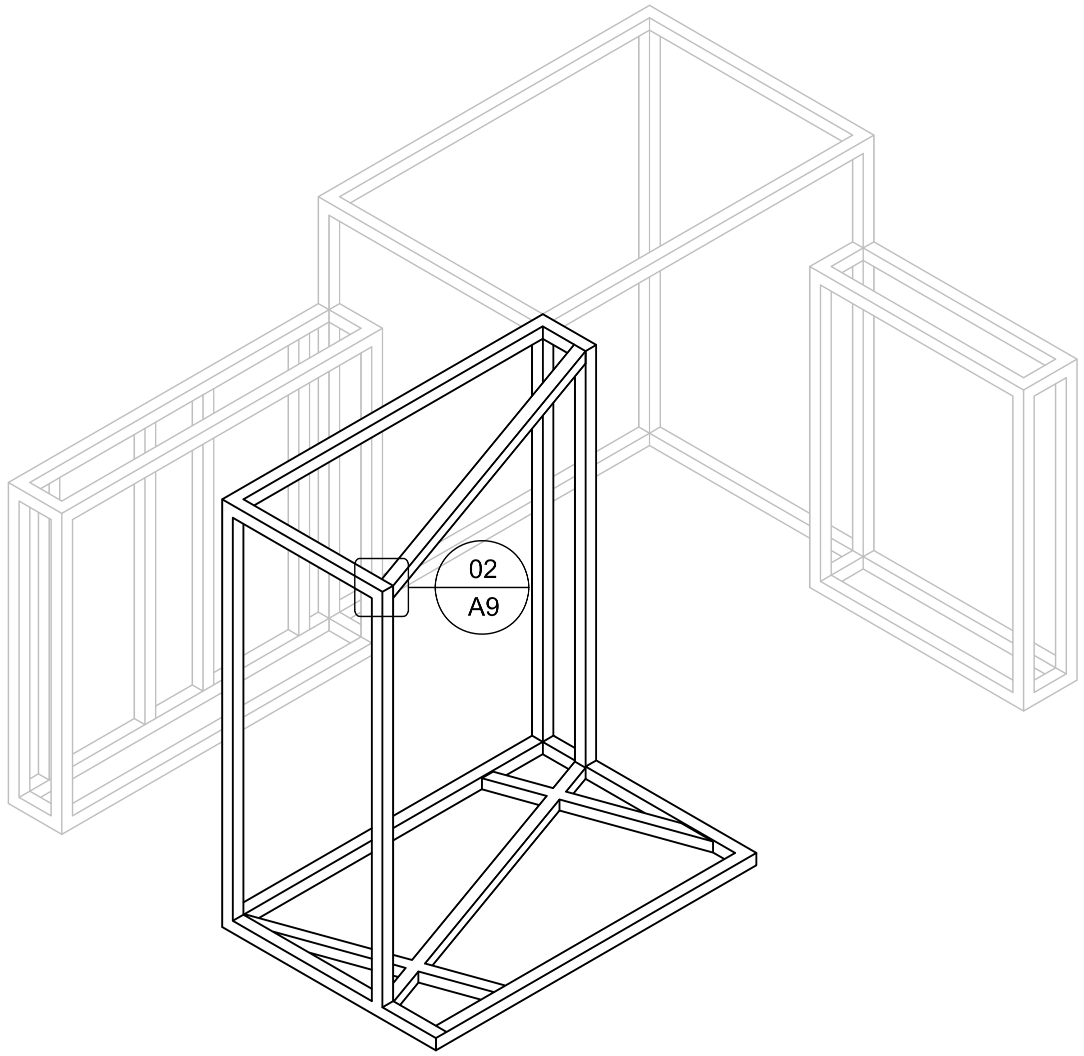


01 ECK - Steel Frame



02 EWP - Steel Frame

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

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			+45 7026 2648	40028

TITLE:	SKETCH NO.	VER.
Structural Axo	A9	

FILE	PHASE	DATE	SCALE	DRAWN	CONTROL	APPR.
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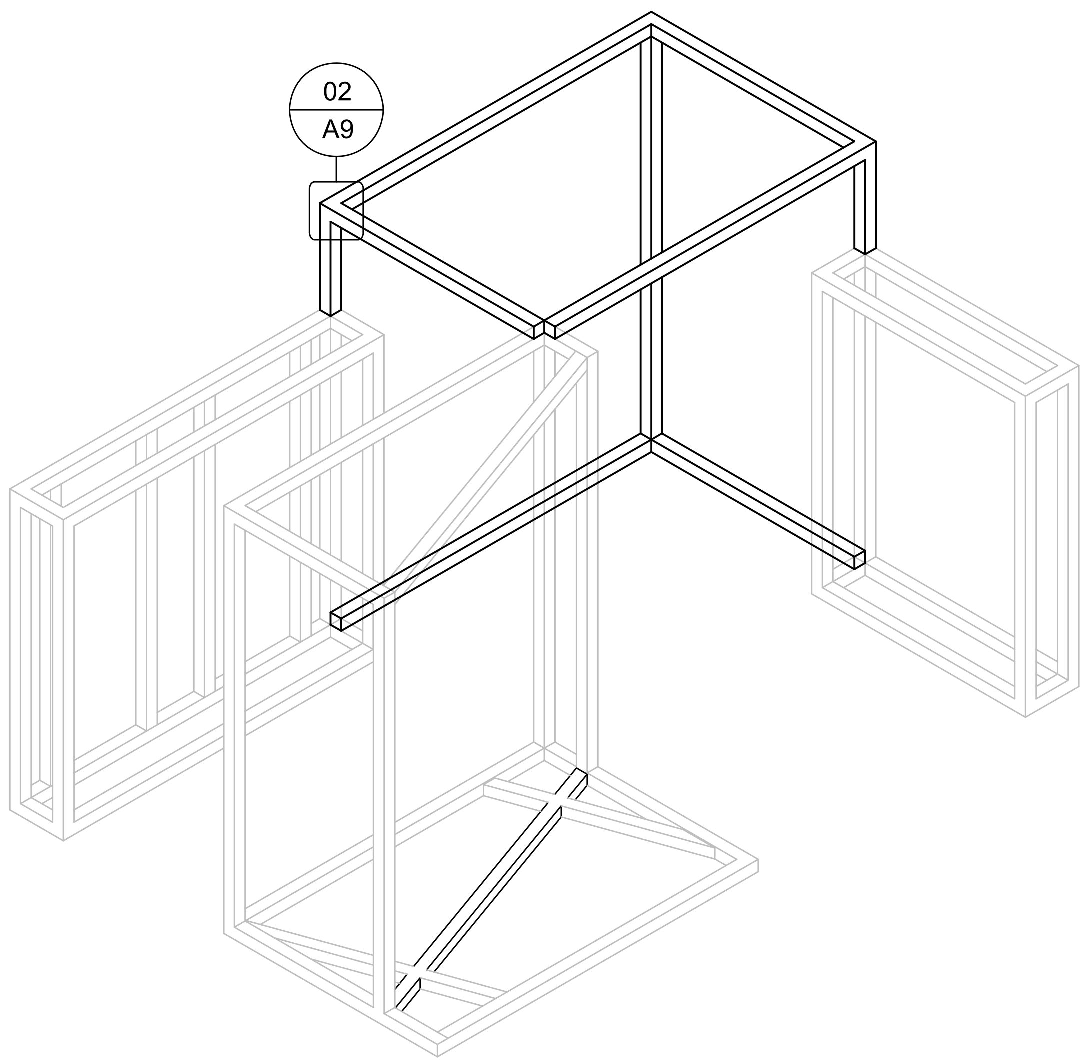
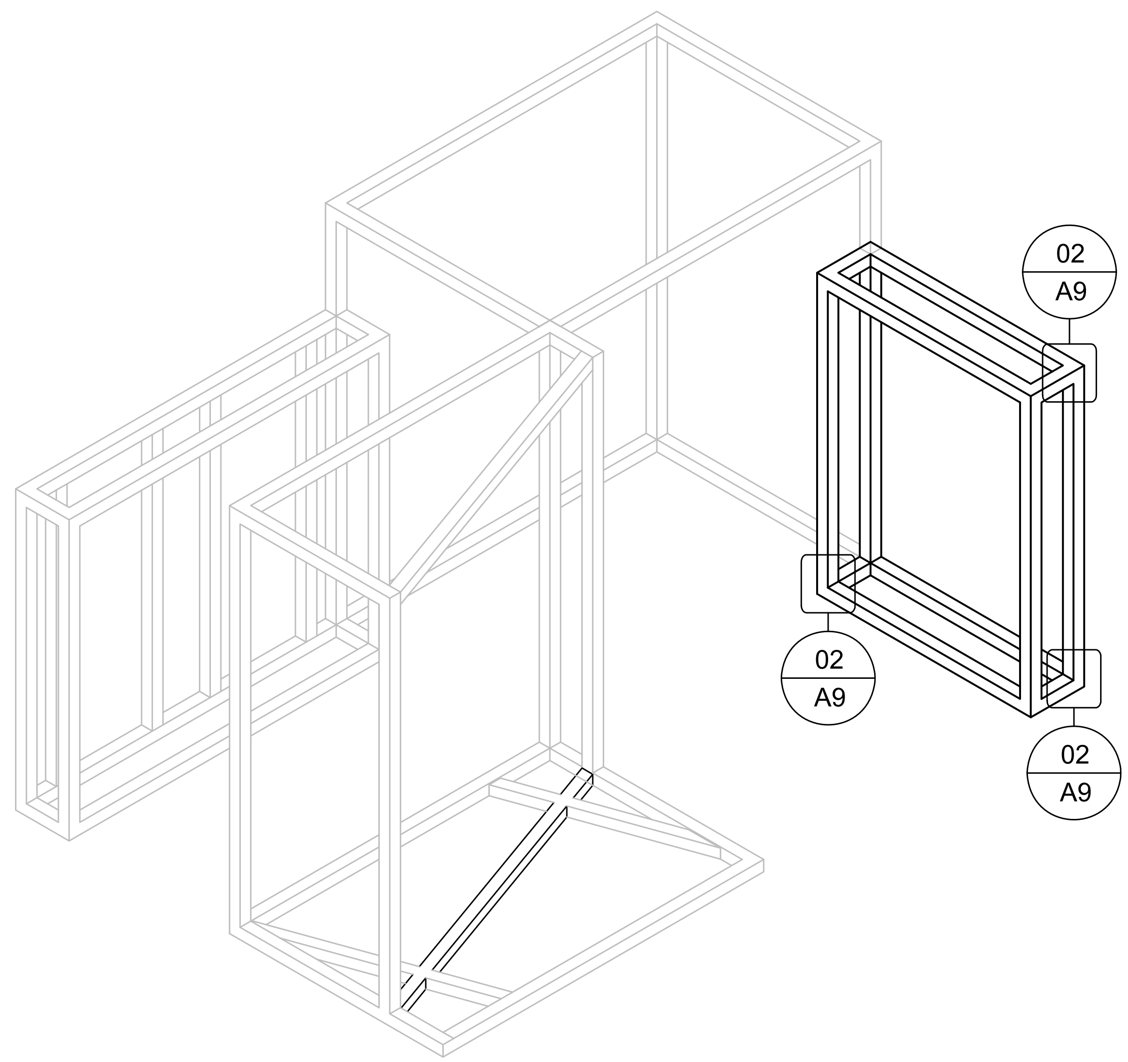


02 SCK - Steel Frame



02 IPK - Steel Frame

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT:	GXN - Strandgade 73, 1401 København K, DK	PHONE: +45 7026 2648	PROJ. ID: 40028

TITLE:

Steel Frame Axo

SKETCH NO. A10

VER.

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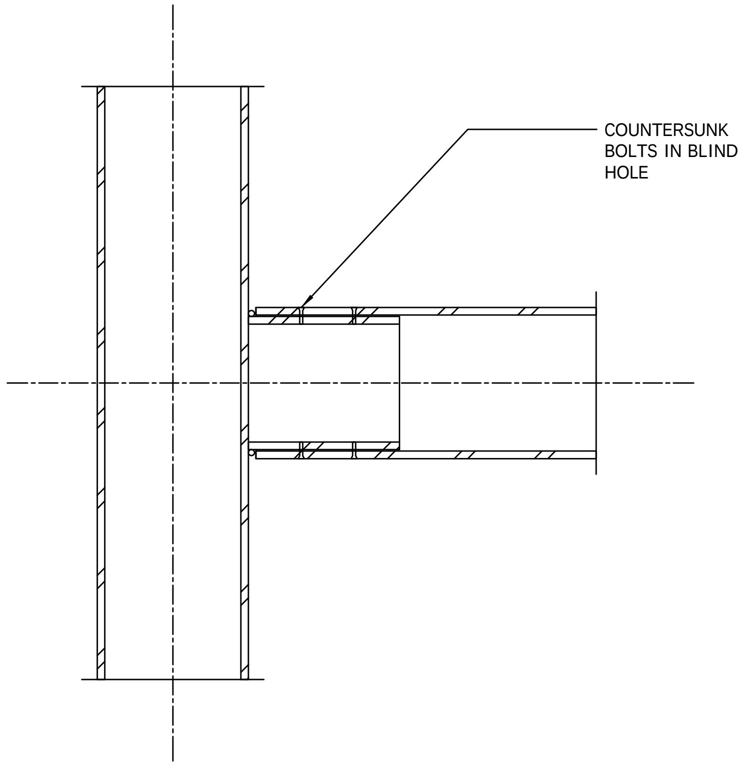
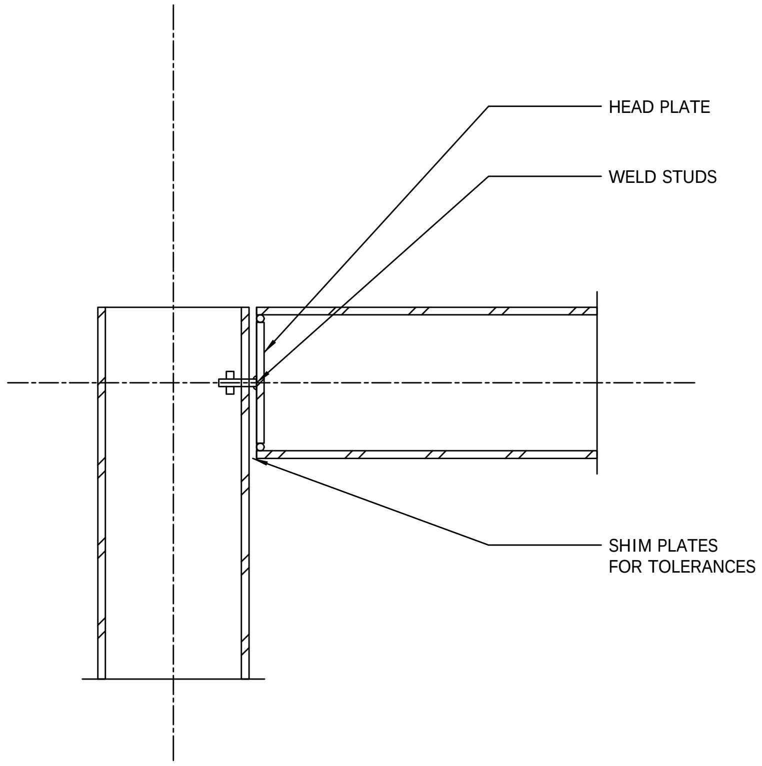
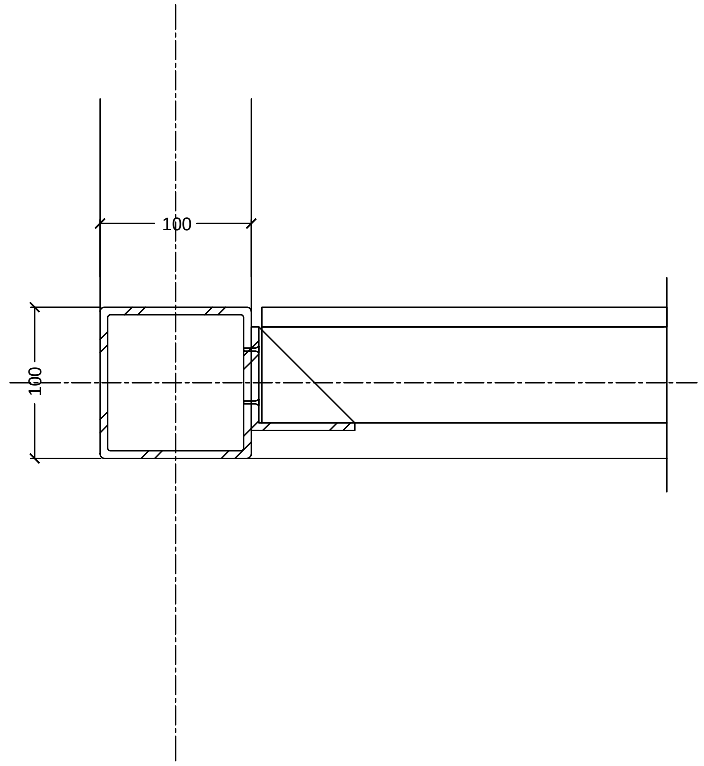


01 Stiff Connection



02 Hinge Connection



03 Floor Connection at HSS Frame TYP

REV.	DATO	EMNE	UDARB.	GODK.

Biobuild Exhibition

ARCHITECT: GXN - Strandgade 73, 1401 København K, DK
GXN
PHONE: +45 7026 2648

PROJ. ID: 40028

TITLE:

Details

SKETCH NO.: A11

VER.:

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APPENDIX B - Structural calculation of the steel structure

BioBuild project

EcoBuild 2015 - stand design

Structural calculation report

Issue | November 12, 2014

Job number 219314-00

Arup Deutschland Gmbh
Joachimstaler Straße 41
10623 Berlin Germany
www.arup.com

ARUP

Document Verification

ARUP

Job title	EcoBuild 2015 - stand design			**Job number** 219314-00
Document title	Structural calculation report			**File reference**
Document ref				
Revision	**Date**	**Filename**	141104-structural report-sh.docx	
Draft 1	Nov 4, 2014	**Description**	First draft	
			Prepared by	Checked by	Approved by
		Name	Sarah Hübner	Guglielmo Carra	Joachim Guesgen
		Signature			
	Nov 10, 2014	**Filename**	Review Guglielmo Carra		
		Description	Second Draft		
			Prepared by	Checked by	Approved by
		Name	Sarah Hübner	Guglielmo Carra	Joachim Guesgen
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
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		Signature			

Issue Document Verification with Document ✓

Contents

1 Introduction

The BioBuild consortium is willing to present the full scale prototypes of the four bio-composite case studies, developed through the project, during the EcoBuild event, which is going to take place in March 2015 in London.

The participation of the BioBiuld consortium at the EcoBuild 2015 fair has been identified as strategic from the project partners and it is part of the dissemination activities planned in WP9.

Arup has being appointed by the BioBuild consortium to conduce the structural calculation of the stand, this needed to dimension and assess the performance of the structural elements and therefore inform the design.

Present report shows the structural calculation for the stand, being designed by the architects GXN.

2 The design of the stand

The design of the stand has been developed by GXN and reviewed by Net Composite and Arup during the design process.

The main design idea is to create the stand, as the combination of modules that are temporarily assembled. Each of the modules support one of the case study systems, Figure 1. The overall dimensions of the stand are 6m x 4m x 4m.

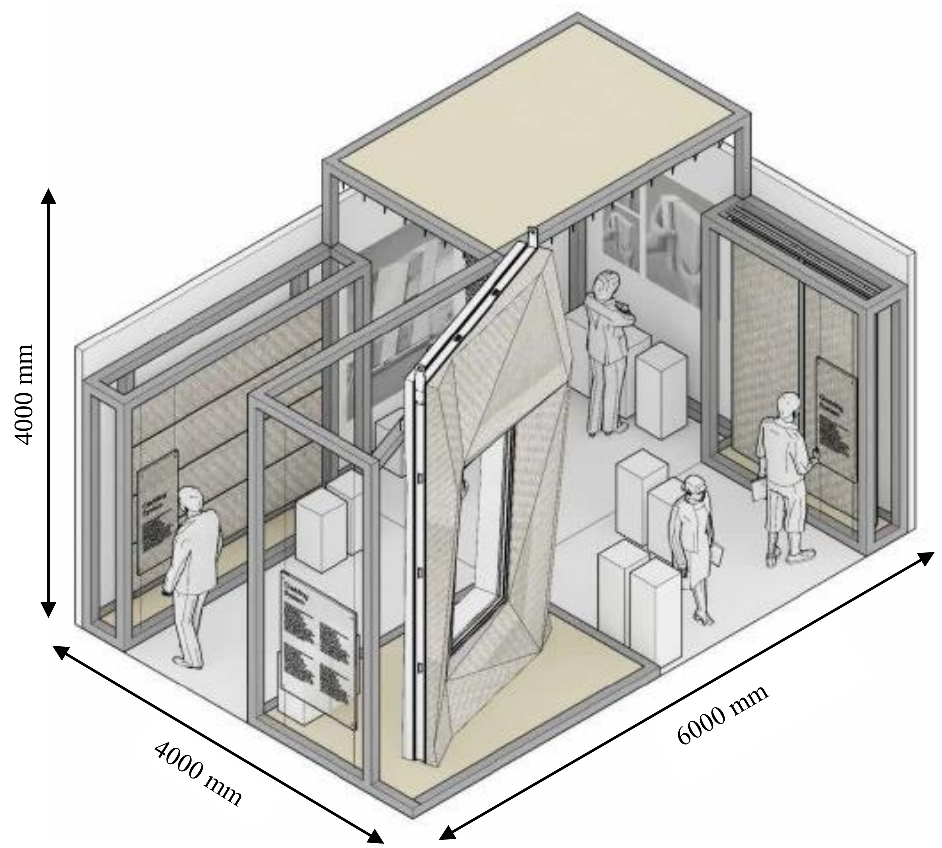


Figure 1. Overall design of the stand showing the position of the cage for the four case studies.

The single modules are open cages made with construction steel square tubes, having a hollow section of 100 x 100 mm and a thickness of 5mm. The structure of the cages is partially welded in the factory and partially bonded on site. To ease the transportation of the elements these are split in parts having reduced dimensions.

The connections in between the elements are of the type male-female, with the inner tube being a hollow square section with dimensions 89mm x 89mm x 8mm. The connections can be made either as encastre or as hinge, depending on the number of bolts used to tighten the connection.

The cages have different dimensions as well as different geometry, according to the size of the case study they support and contain.

Particularly the cages that host the Internal Partition Kit (IPK) and the External Cladding Kit (ECK) have a parallelepiped shape with dimensions 2000mm x 500mm x 2600mm (length-depth-height) and 3000mm x 500mm x 2600mm respectively.

The Suspended Ceiling Kit (SCK) is supported by a “Table” structure, made without the bottom perimeter profile and having dimensions 3100mm x 2100mm x 3465mm.

The External Wall Panel (EWP) is supported with a more complicated support structure to allow bringing its weight which is expected to be about 800 kg. The external panel is supported at the bottom level with two pins while, at a height of about 3400 mm, it is supported by the brackets.

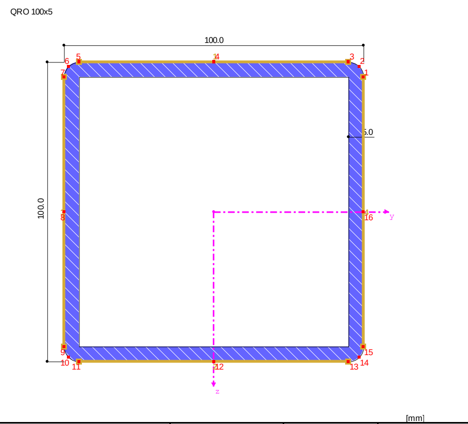
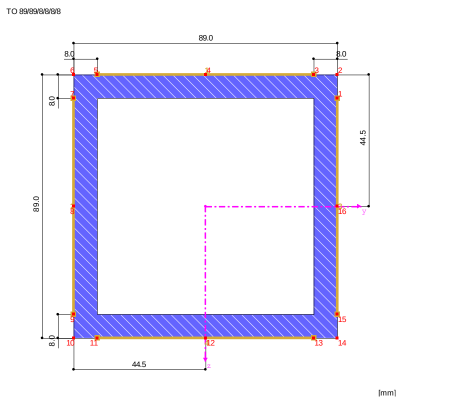
3 Material

The cages have been checked under the assumption that the base material they are composed of is steel, S235. The mechanical performance of the steel are reported within the following Table 1, while Table 2 is reporting the relevant properties for the two sections used in the calculation, these being the 100mm x 100mm x 5mm outer tube and the 89mm x 89mm x 8mm inner tube.

Table 1. Mechanical performance of the steel S235, assumed as material for the cages.

Material	Mechanical performance
S235	Yield strength f_y = 235 N/mm² Tensile strength f_u = 360 N/mm²

Table 2. Properties for the steel sections used in the construction of the cages.

Cross sections							
							
Cross-Section Property	Symbol	Value	Unit	Cross-Section Property	Symbol	Value	Unit
Outer edge length, nominal length	b	100,00	mm	Depth	a	89,00	mm
Wall thickness	t	5,00	mm	Width	b	89,00	mm
Outer edge rounding	r	5,00	mm	Left wall thickness	t_{al}	8,00	mm
Cross-sectional area	A	18,80	cm²	Right wall thickness	tar s/ub>	8,00	mm
Shear area	A_y	7,96	cm²	Upper wall thickness	t_{bt}	8,00	mm

Shear area according to EC 3	Av,y	9,40	cm2	Lower wall thickness	tbb	8,00	mm
Core area	Ac	90,20	cm2	Cross-sectional area	A	25,92	cm2
Plastic shear area	Apl,y	9,50	cm2	Shear area	Ay	10,94	cm2
Moment of inertia	Iy	281,00	cm4	Core area	Ac	65,61	cm2
Governing radius of gyration	ry	38,70	mm	Moment of inertia	Iy	286,20	cm4
Polar radius of gyration	ro	54,70	mm	Governing radius of gyration	ry	33,20	mm
Volume	V	1880,00	cm3/m	Polar radius of gyration	ro	47,00	mm
Weight	wt	14,80	kg/m	Weight	wt	20,30	kg/m
Surface	Asurf	0,39	m2/m	Surface	Asurf	0,36	m2/m
Section factor	Am/V	207,98	1/m	Torsional constant	J	430,68	cm4
Torsional constant	J	433,00	cm4	Warping constant referring to M	Cw	0,00	cm6
Warping constant	Cw	0,35	cm6	Elastic section modulus	Sy	64,31	cm3
Elastic section modulus	Sy	56,30	cm3				

4 Load cases

Present chapter describes the load cases assumed for the calculation. These have been distinguished in:

- Dead loads according to the weight of the materials and the systems;
- Live loads, according to the EcoBuild guidelines;
- Wind loads according to the EcoBuild guidelines.

4.1 Dead loads

Dead loads have been identified according to the weight of the materials and the systems. Particularly it has been assumed that the dead load of the EWP is equal to about 800 kg, while the dead load of both the IPK and ECK has been considered of about 80 kg/m^2. The dead load of the SCK has been instead assumed negligible.

Both Table 3 and Figure 2 describe the dead loads for the stand.

Table 3. Dead loads according to the weight of the materials and the systems.

Dead Load	Value
Steel	dl= 78,5 kN/m³
Door element	8 kN
Frame interior	0,8 kN/m²
Bottom panel for extra load	dl=1,5 kN/m²

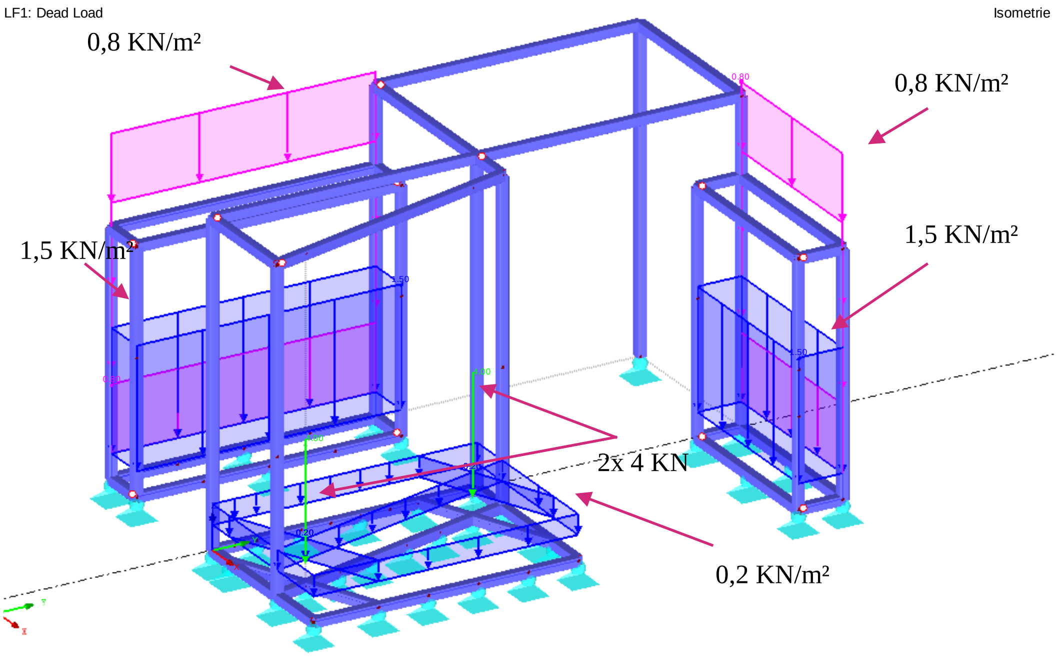


Figure 2. Schematic indication of the dead loads considered in the analysis.

4.2 Live loads

Live loads have been considered those related to both the potential impact of a soft body on the case study systems and the uniform distributed load applied on the base of the cages and generated by the visitors walking on it (or the load applied on the basement during cleaning operations/service). Particularly the impact load is considered applied at a height of 1500 mm from the bottom fixing point of the system. These loads have been derived from the EcoBuild guidelines (Appendix A) for the design of the stands.

Table 4 reports the values for the live loads. Figure 3 indicates the application point of the impact load in case of the EWP, Figure 4 indicates the application point of the impact load in case of the ECK, Figure 5 indicates the application point of the impact load in case of the IPK and Figure 6 indicates the live load in case of the EWP.

Table 4. Live loads according to the EcoBuild guidelines.

Live load	Value
Impact load at h=1,5m	Ip=0,75 kN
Uniform distributed area load	ll=5 kN/m²

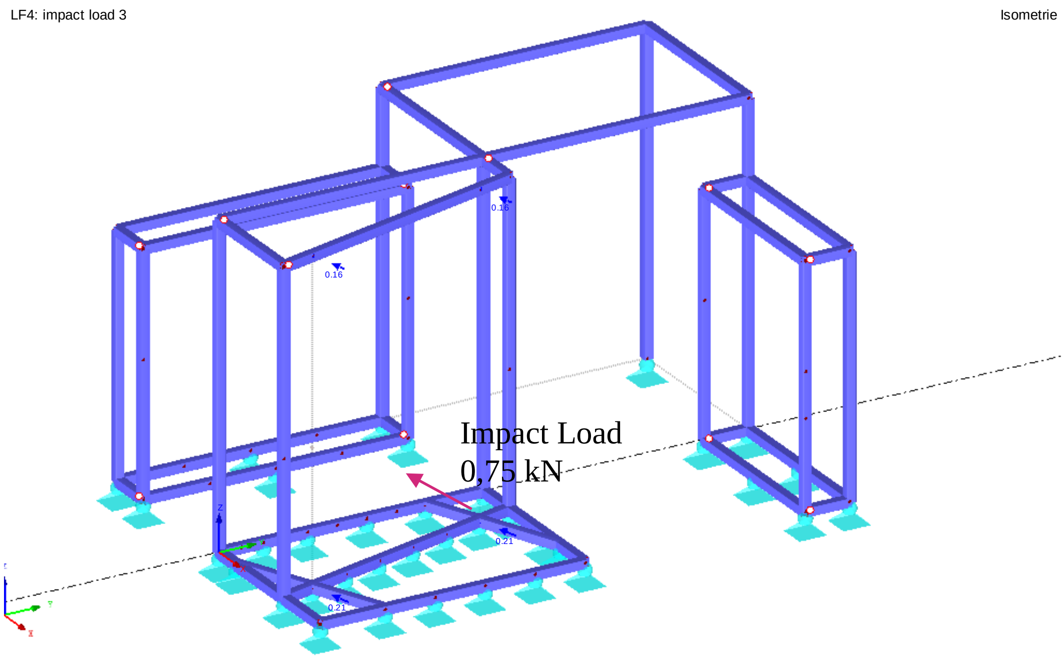


Figure 3. Indication of the impact load applied in the middle region of the EWP at 1500 height.

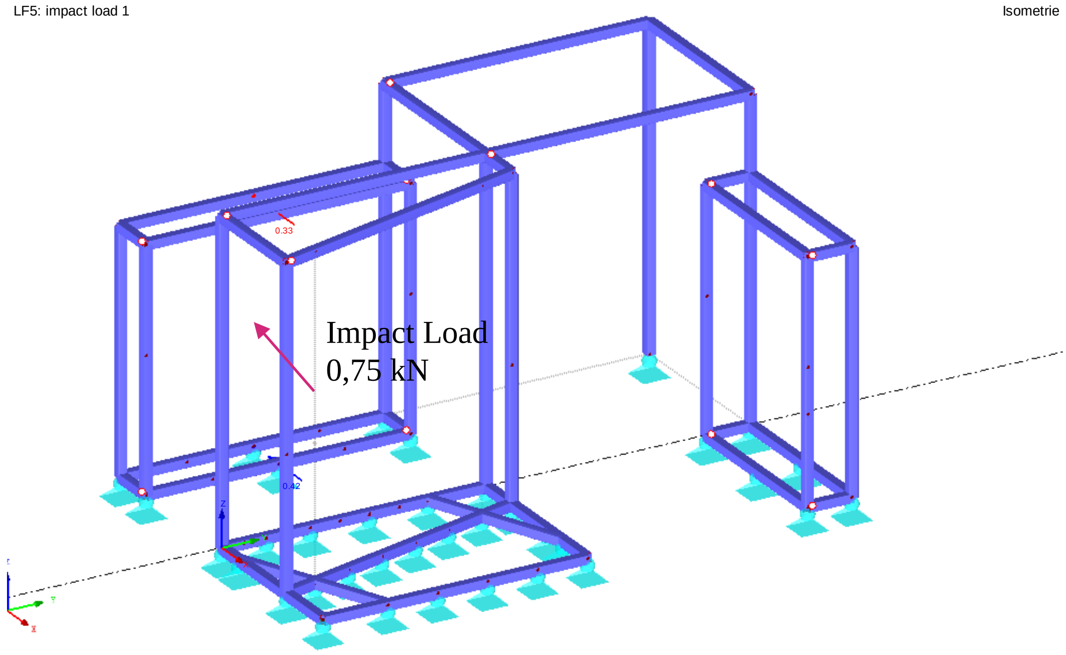


Figure 4. Indication of the impact load applied in the middle region of the ECK at 1500 height.

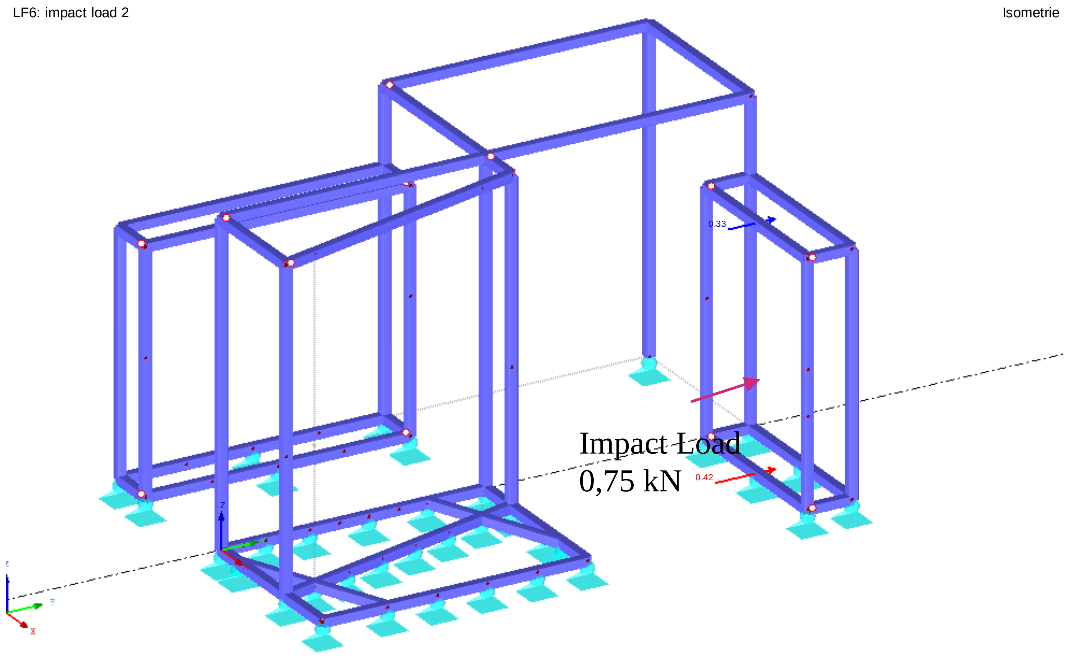


Figure 5. Indication of the impact load applied in the middle region of the IPK at 1500 height.

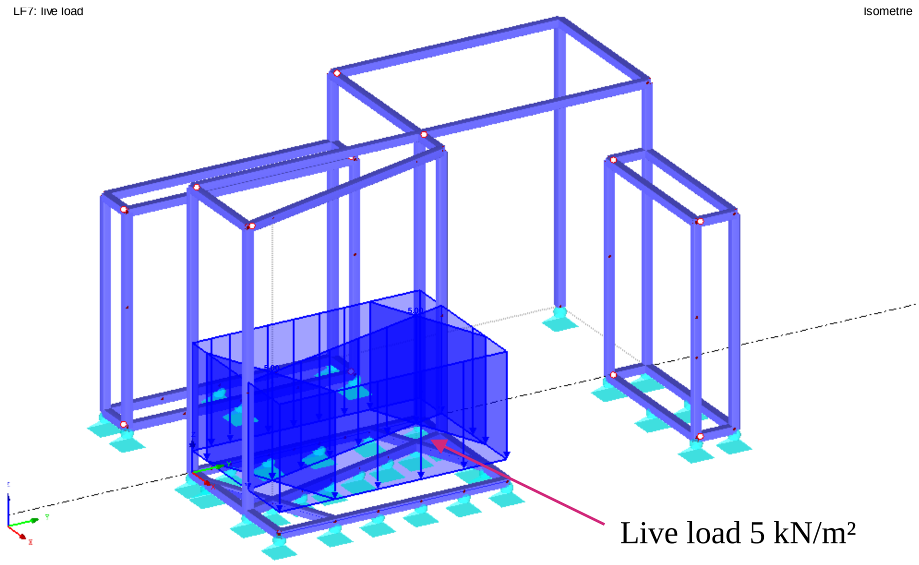


Figure 6. Indication of the live load applied on the bottom plate of the EWP cage.

4.3 Wind loads

The Wind loads have been considered applied to the side surfaces of the stand. The value for the wind load has been obtained from the guidelines for the EcoBuild.

Table 5 reports the values for the wind load, while Figures 7 is showing the wind load acting on the 6 m long walls of the stand and Figure 8 is showing the wind load applied to the 4 m long walls of the stand.

Table 5. Wind load according to the EcoBuild guidelines.

Wind load	Value
Inner wind	W = 0,15 kN/m²

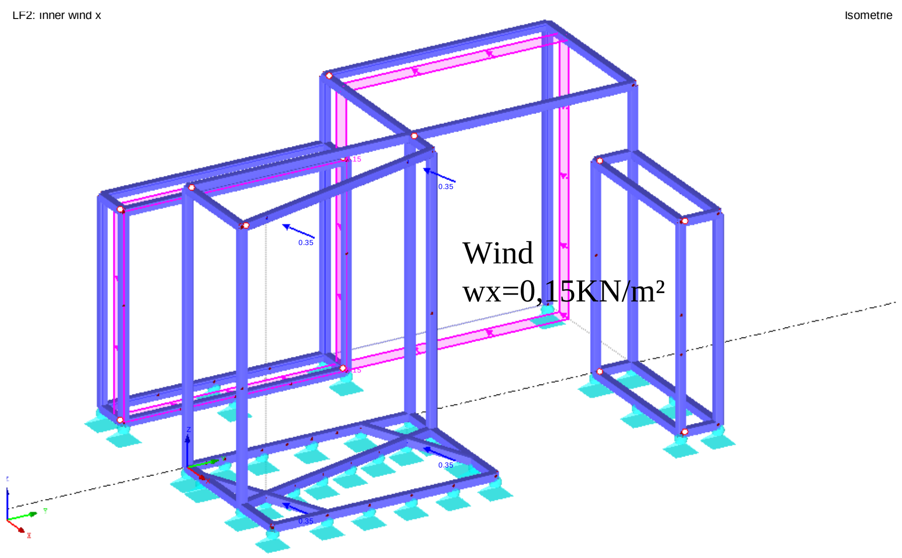


Figure 7. Indication of the wind load on the side walls of the stand in “x” direction.

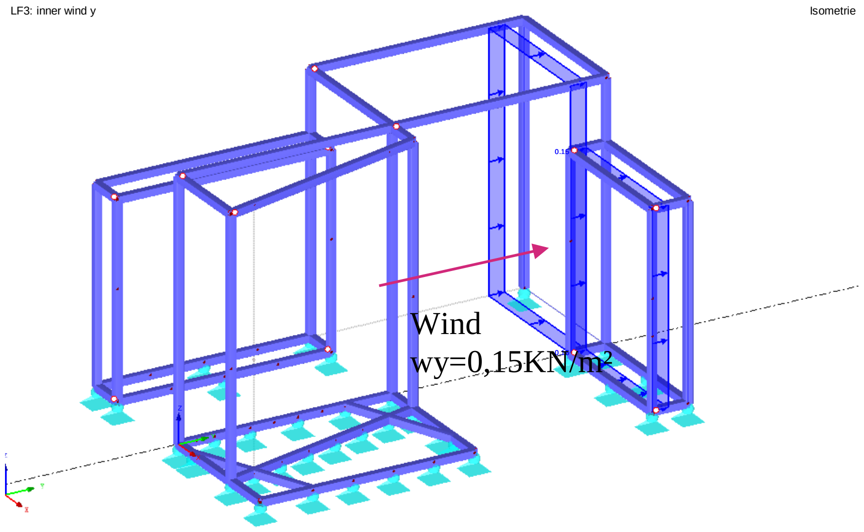


Figure 8. Indication of the wind load on the side walls of the stand in “y” direction.

5 Structural model

The structural model works as a set of elements connected according to stiff (bending resistant BR) and hinge connections.

Figure 9 shows the position assumed in the model for the hinges, represented as white points. All the other connections are assumed as being BR and shall be manufactured accordingly. A detail for BR connections is reported in Chapter 6 of present report.

The support connections at the base of the cages are assumed to work in compression only. The displacement at the level of the floor is checked in the structural analysis to be small in order to avoid any potential risk of overturning of the cages.

Regarding the issue of the floor connections it is in here anticipated that these can be continuous along the base perimeter.

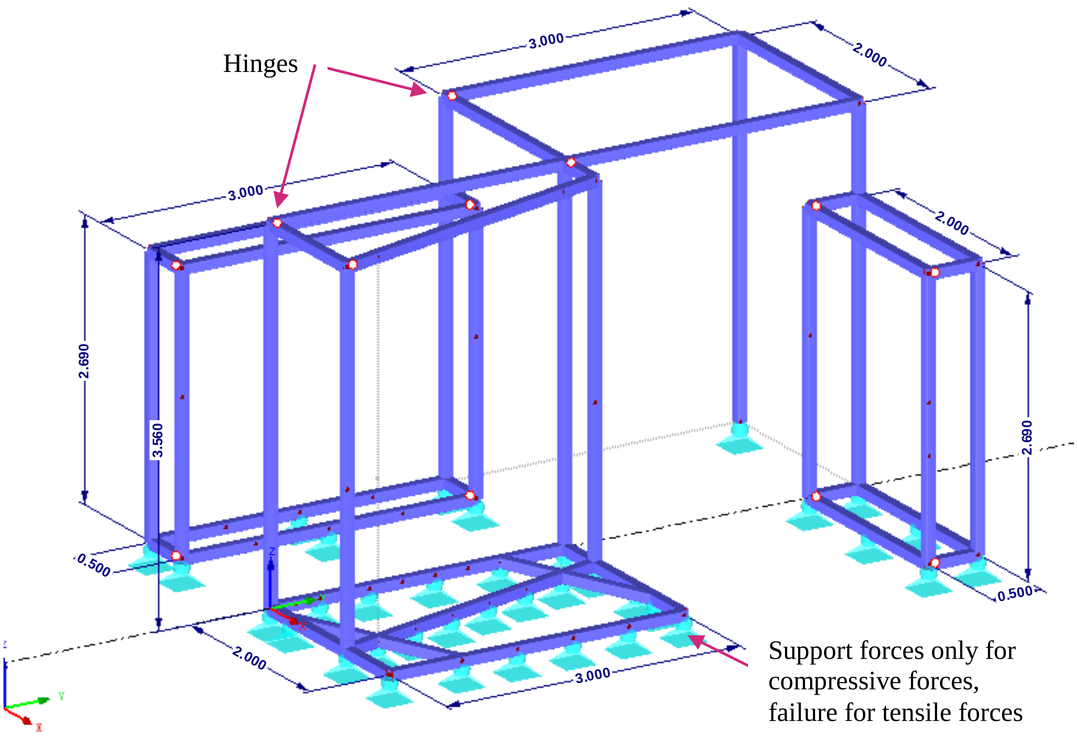


Figure 9. Position of the hinges in the model and position of the floor connections.

6 Ultimate Limit Design

6.1 Summary of inner forces

In present chapter it has been reported the results of the structural assessment in terms of internal stresses for both the structural members and the connections. These are generated by the combination of the load cases applied to the cages and introduced in Chapter 5.

Table 6 reports the values for the maximum inner forces within the sections. Figure 10 shows the diagrams for the axial forces in the structure, Figure 11 shows the shear forces in y direction, Figure 12 shows the shear forces in z direction, Figure 13 shows the bending moment in y direction and Figure 14 shows the bending moment in z direction.

In this section are presented only the more relevant results in terms of internal stresses. For the definition of the load cases please refer to Appendix B – Printout report.

Table 6. Maximum inner forces generated by the combination of the load cases.

Inner forces	
Axial force in section longitudinal direction	N_d=4,6 kN
Shear force in y direction	$V_{y,d}$=1,8 kN
Shear force in z direction	$V_{z,d}$=4,3 kN
Bending Moment in y direction	$M_{y,d}$=1,5 kNm
Bending Moment in z direction	$M_{z,d}$=1,5 kNm
Section properties and stress calculation	
Cross-sectional area	A=18,80cm²
Elastic section modulus	S=56,3cm³
σel,d=Nd/A+Myd/S+Mzd/S	$\sigma_{el,d}$=5,6 kN/cm²<<σ_{rd}=21,8 kNcm²

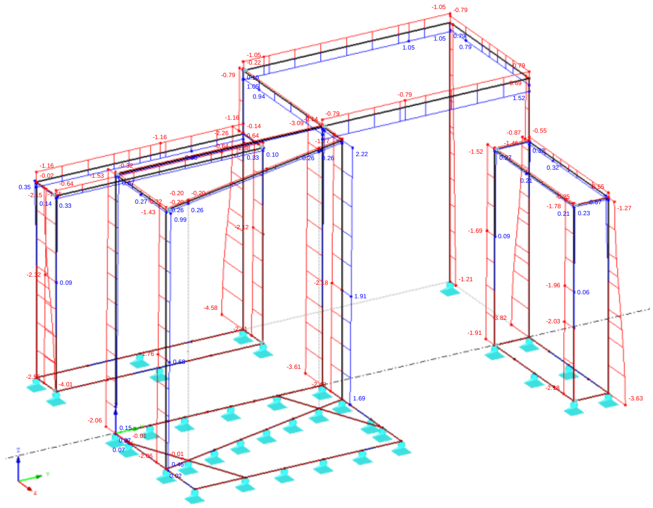


Figure 10. Axial forces generated by the combination of the load cases.

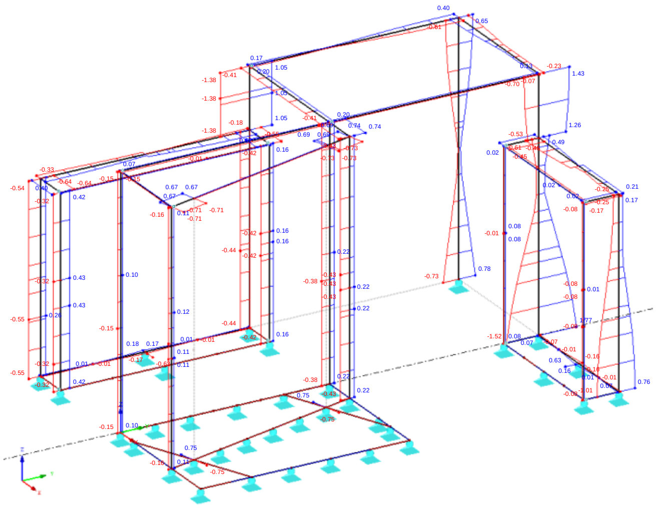


Figure 11. Shear force in y-direction generated by the combination of the load cases.

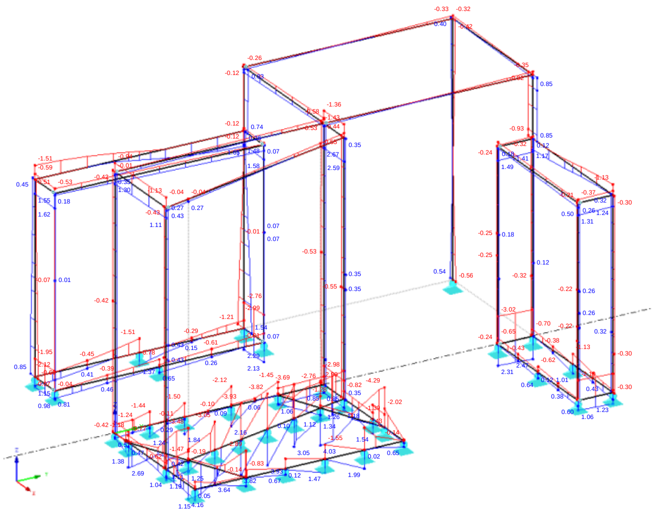


Figure 12. Shear stresses in z-direction generated by the combination of the load cases.

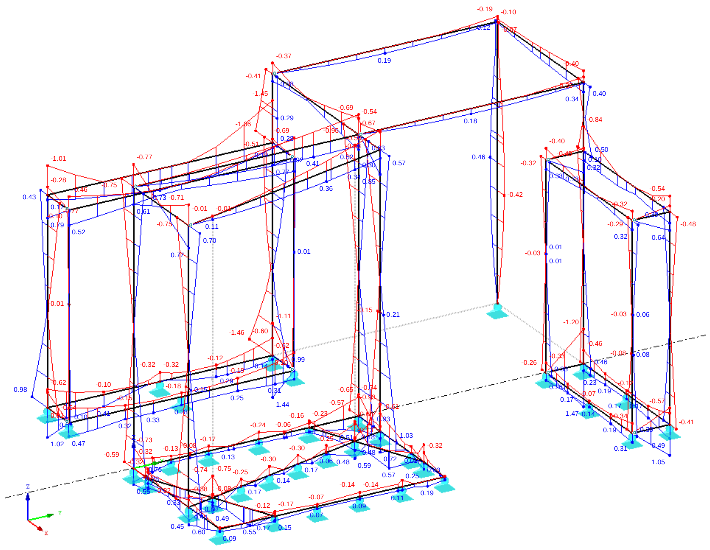


Figure 13. Bending moment in y-direction generated by the combination of the load cases.

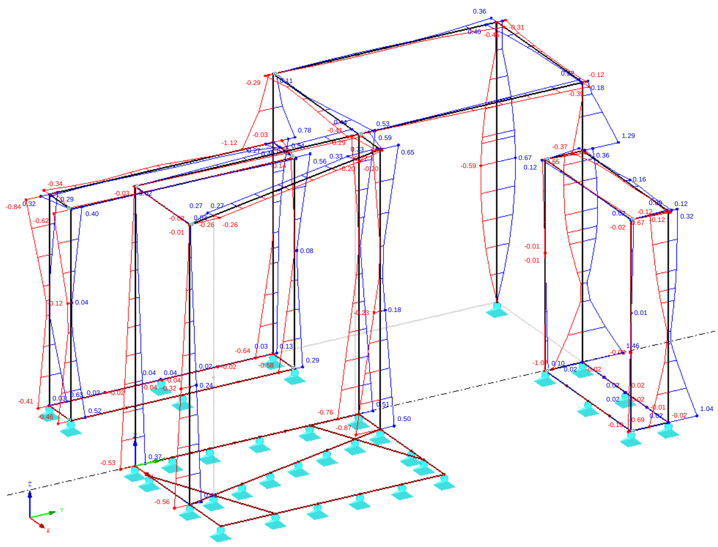


Figure 14. Bending moment in z-direction generated by the combination of the load cases.

6.2 Design of the connection detail

As anticipated the structure of the cages works relying on both stiff connections and hinge connections. Figure 15 shows the typical design of a bending resistant connection. The bending moment is transferred by contact of the inner section to the outer section. The bolts can be designed for only shear forces.

The same type of connection can be potentially used in case of hinges.

Table 7 and the calculation reported in the following of present paragraph are referred to the calculation of the structural performance for the bolts used within the connection to prove that the system is working at an appropriate level of performance according to the loads applied to the structure.

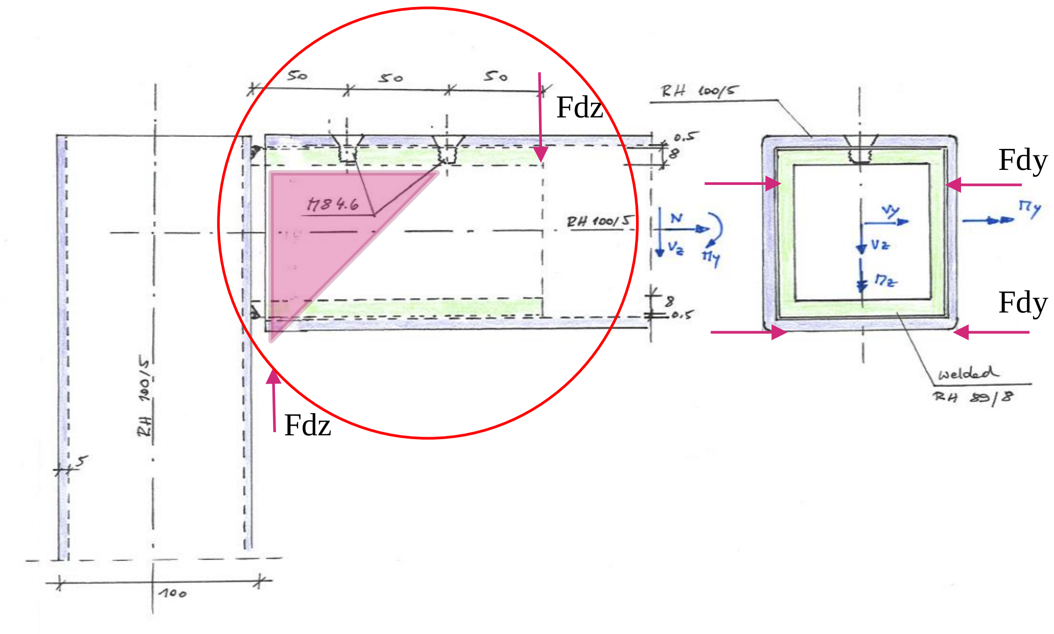


Figure 15. Bending resistant connection for the system.

Table 7. Structural calculation for the bolts used in the connection.

Bolt	
Counter sunk bolt M8 4.6	FvRd=7,99KN > N_d/2=2,3kN FbRd=28,8KN > N_d/2=2,3kN

Shear forces $V_{y,d}$ and $V_{z,d}$ will be transferred by contact, without further prove. Local stress according to bending moment $M_{y,d}$ and $M_{z,d}$ can be proved as followed:

The moments will be transferred by contact, hence the moments can be divided into a force pair:

$F_{d,z} = M_y/15\ cm = 150\ kNcm/15cm = 10\ kN$

$F_{d,y} = M_z/15cm = 150\ kNcm/15cm = 10\ kN$

Area of flange of RH 100/5:

$A = 10cm*0,5cm*2 = 10cm^2$

$\underline{\sigma_{e,l} = 10\ kN/10cm^2 = 1\ kN/cm^2 << \sigma_{r,d} = 21,8\ kN/cm^2}$<u>, for both directions</u>

The inner section must be designed for the same bending moment, as follows:

$\sigma=N/A+My/Sy+Mz/Sz=4,6KN/25,92cm^2+150KNcm/64cm^3$

$150KNcm/64cm^3=4,9KN/cm^2<< \sigma rd=21,8KN/cm^2$

6.3 Support forces

According to the EcoBuild guidelines the maximum load applied at the floor level for the stand connections is 6 kN per point load.

The structural assessment showed that for most of the load combinations the limit of 6 kN is exceeded in some connection point, in case the connection with the floor is made with discontinuous point loads. A solution to avoid exceeding the allowed point load would be to create a continuous connection at the bottom edge of the cages. In this case it shall be proven that the interface between the frame and the floor is even and really works as a continuous contact surface without generating concentrated load transfer.

Figure 16 shows the position of the stand feets that would exceed the allowable point load according to the EcoBuild guidelines in case of non-continuous connections.

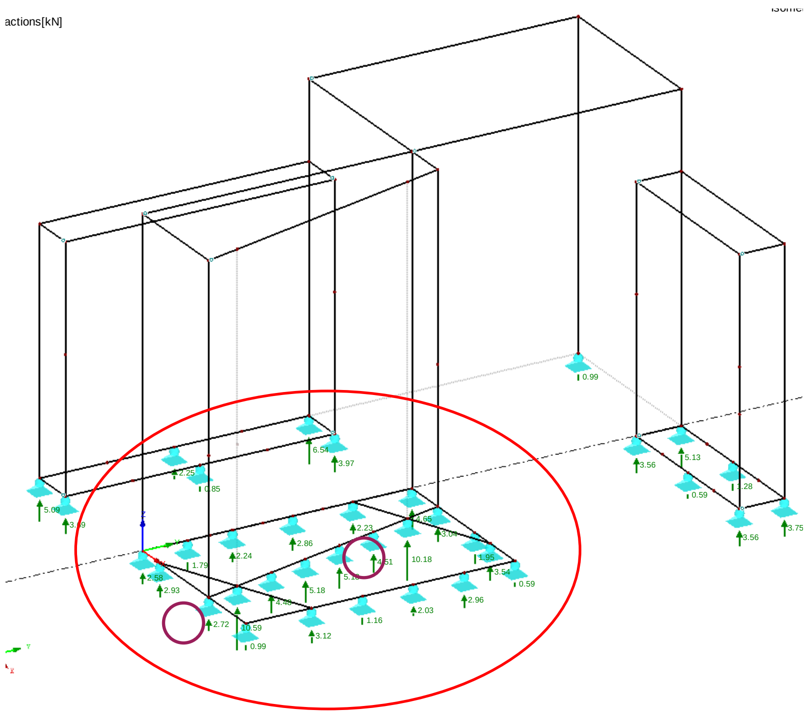


Figure 16. Point connections exceeding the allowable point load of 6kN.

7 Service Limit Design

The maximum horizontal deflection obtained from the calculation is 4,5mm, which leads to a ratio of L/600 believed to be more than acceptable for the structure.

According to overturning the maximum vertical uplifting deflection is 0,5mm, which can be considered negligible.

Following Figure 17 shows the deflection of combining all relevant load cases.

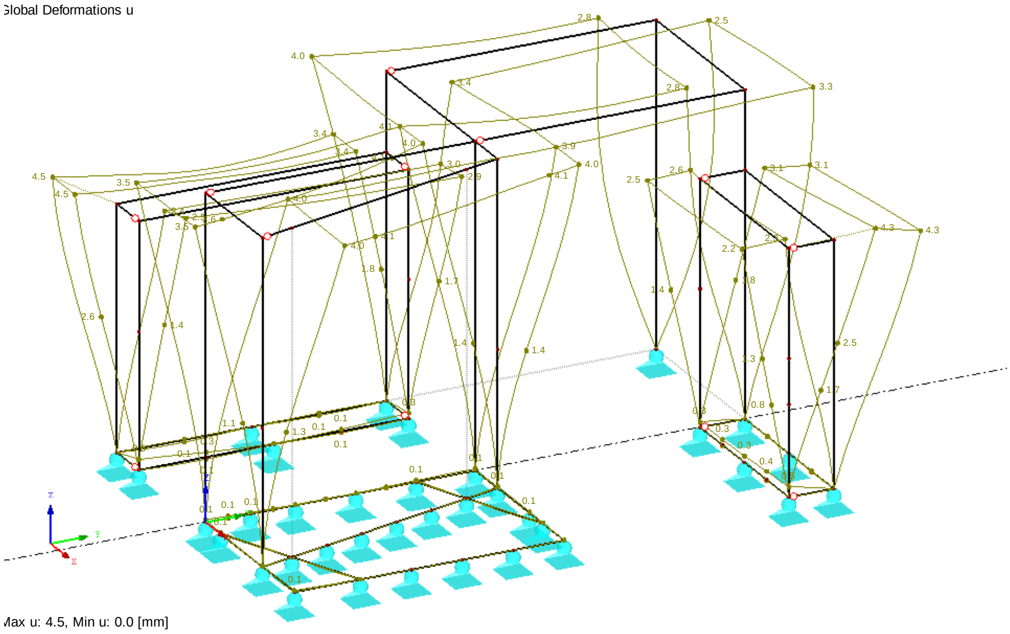


Figure 17. Displacement for the panel after the structural assessment.

EcoBuild guidelines

COMPLEX STANDS - NOT DOUBLE DECK STRUCTURES

STRUCTURE INFORMATION REQUIREMENTS AT EXCEL SHOWS

1. It is a requirement of all venues that complex stands are audited by independent Engineers prior to the stands being constructed on site. The following information will be inspected and a certificate to build will be issued.

2. Submission of information should be in the form of drawings and calculations, not photographs or rough sketches, as it is not possible to assess the structure without details of the stand.

3. Drawings should contain enough detail to show exactly how the stand will be constructed including baseplates, joint construction support details etc.

4. Calculations are to prove that the stand is stable and capable of supporting the loads of anything which will be supported i.e.: lights, speaker's plasma screens etc.

5. A nominal load should be applied for wind (0.15 kN/m^2) although this appears not to apply in the halls, stands have been affected by doors being open. A calculation should also be carried out for overturning this assumed to be the impact of a person (0.75 kN) at a height of 1.5m above the ground.

6. No fixing is allowed into the hall floor at these venues, other means of securing the stands need to be considered.

7. All structure information should be submitted to CR at least two weeks (10 working days) prior to the show build-up date.

Contact: tonythorpe@campbellreith.com

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COMPLEX STANDS - DOUBLE DECK STRUCTURES

STRUCTURE INFORMATION REQUIRED AT EXCEL SHOWS

1. Submission of information should be in the form of drawings and calculations, not photographs or rough sketches, as it is not possible to assess the structure without details of the stand.

2. Drawings should contain enough details to show exactly how the stand will be constructed including baseplates, joint construction support details etc.

3. Baseplates should be a minimum of 300 x 300 x 12 and tied together using straps to prevent spreading of the baseplates, if not then a calculation should be provided to justify there omission.

4. No Fixing is allowed into the hall floor.

5. Calculations are to prove that the stand is stable and capable of supporting the dead load of the structure and a live load of 5 kN/m^2 (refer to EXCEL & ECO Regulations). A nominal load should be applied for wind (0.15 kN/m^2) although this appears not to apply in the halls, stands have been affected by doors being open. A calculation should also be carried out for stability and sway moments, these should be counteracted using either bracing or moment connections.

6. Stair calculations should assume a live load of 5 kN/m^2. Stair dimensions vary depending on the number of risers, details can be found in the EXCEL & ECO regulations.

7. Handrails should be designed to resist a horizontal load of 1.5 kN/m run at a height of 1.1m. Infill panels should be constructed using solid material or vertical bars, horizontal bars or wires are not acceptable.

8. All structural information should be submitted to CR at least two weeks (10 working days) prior to the show build-up date.

Contact: tonythorpe@campbellreith.com

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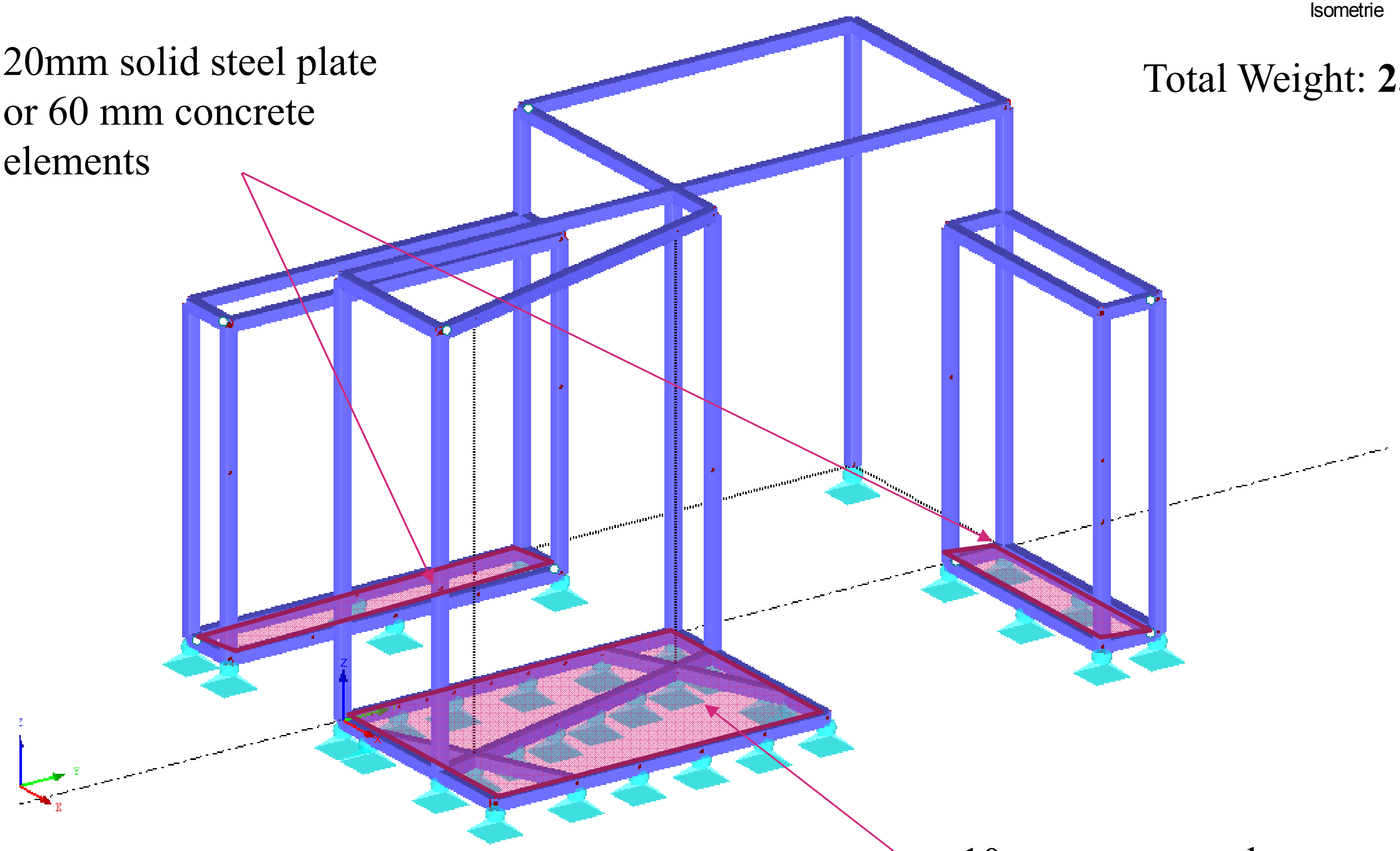
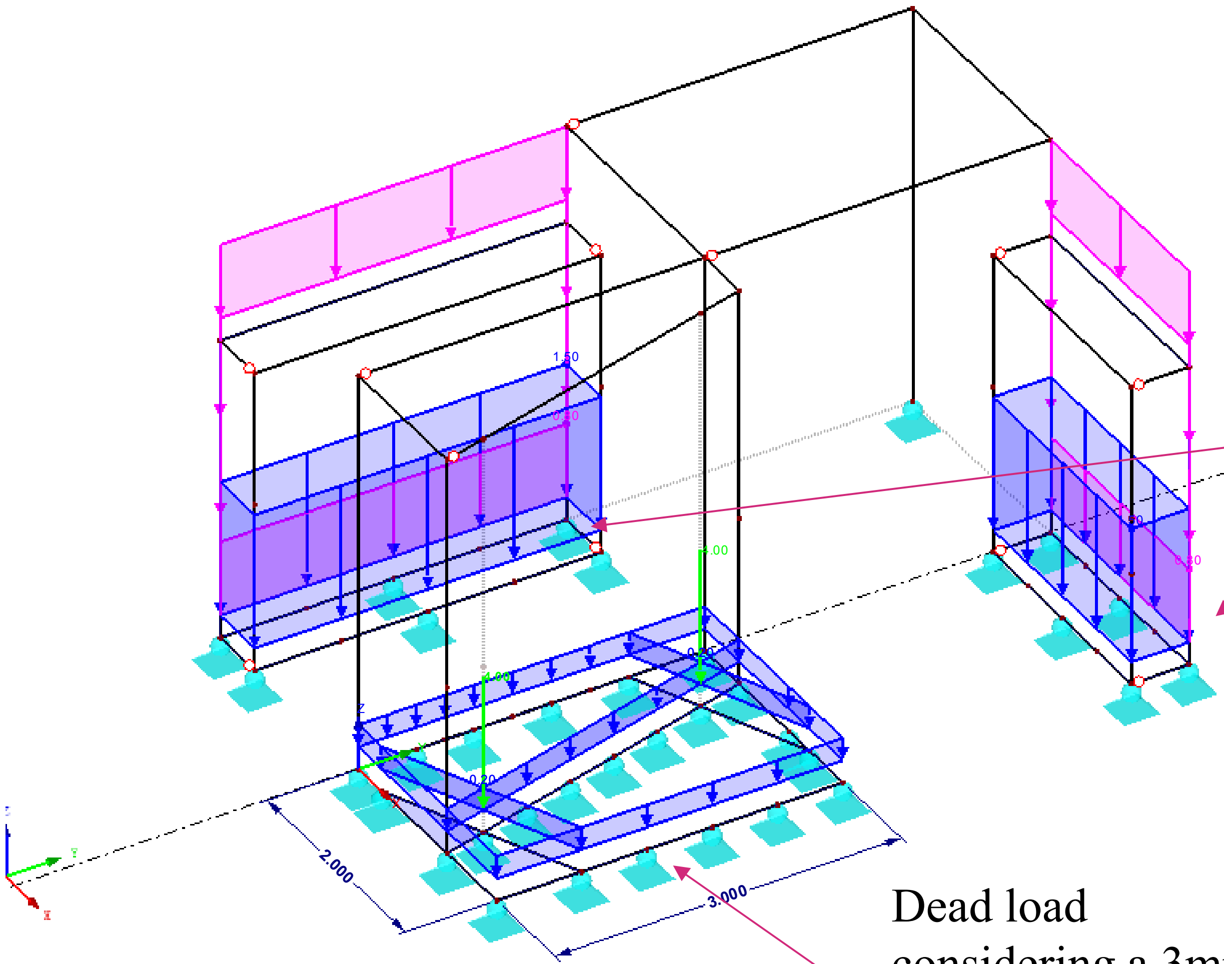
Printout report



Total Weight: **2,0 to**

LF1: Dead Load

Isometrie

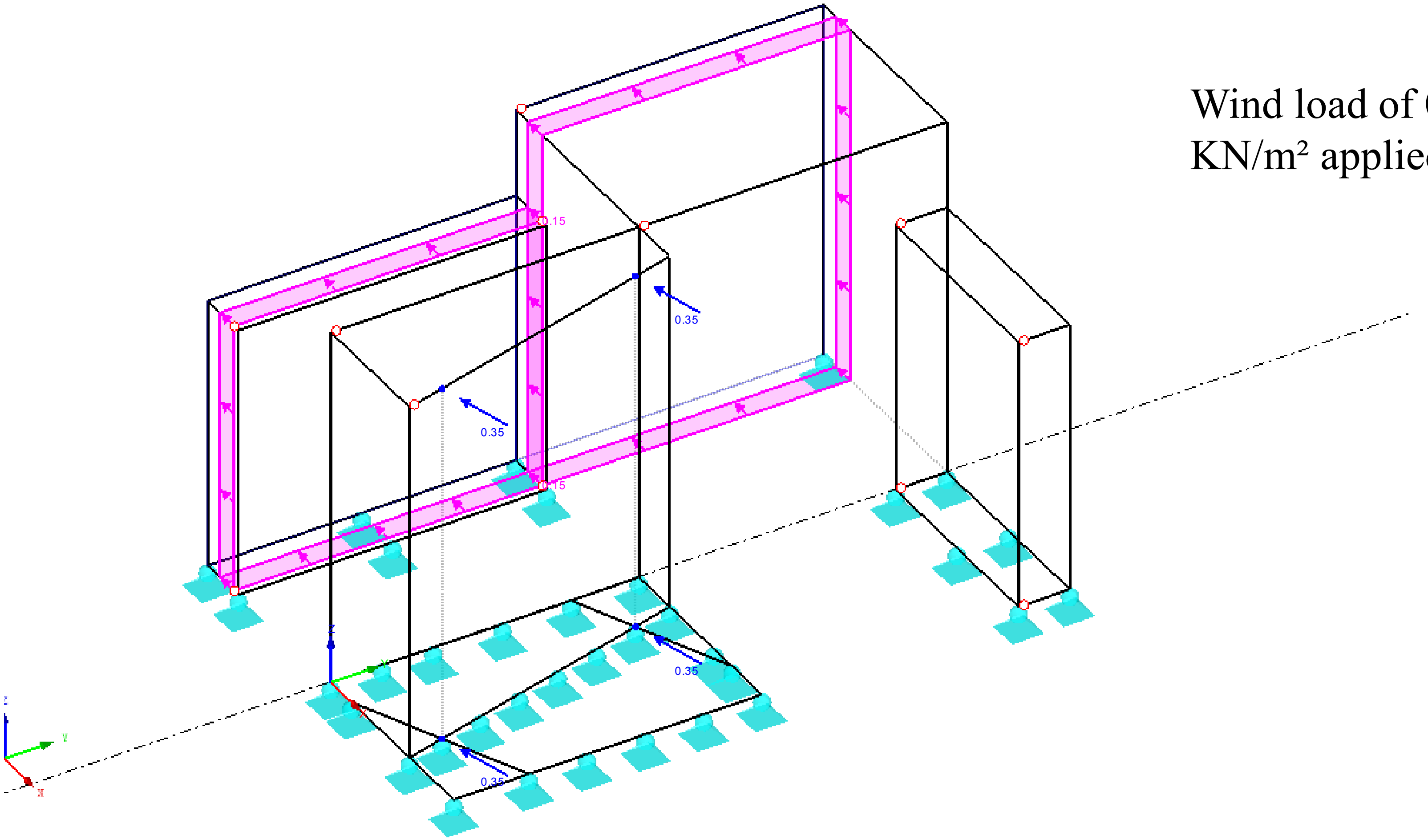


Dead load considering a 20mm thick steel plate on the bottom

Dead load considering a 3mm thick steel plate on the bottom

LF2: inner wind x

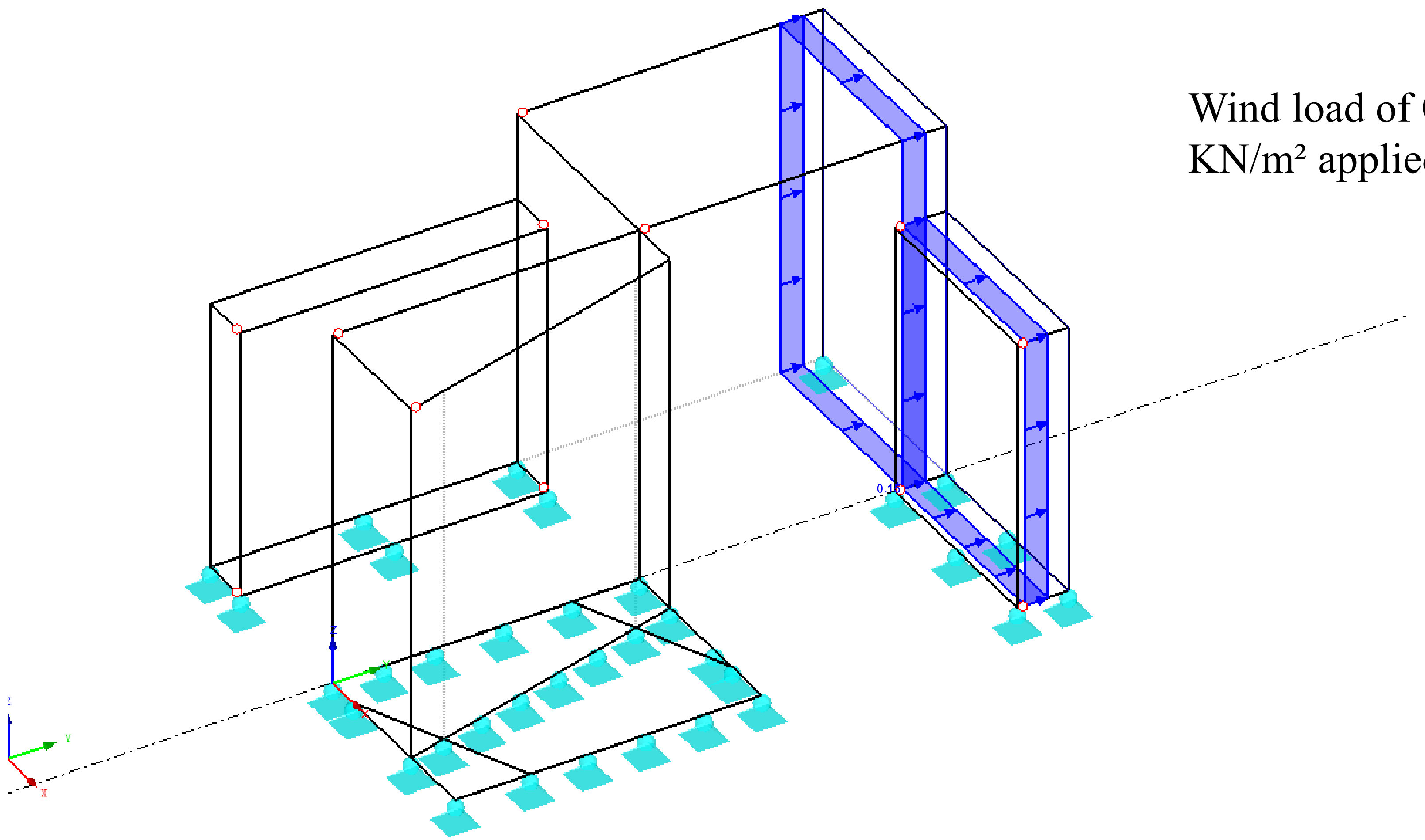
Isometrie



Wind load of 0,15 KN/m² applied

LF3: inner wind y

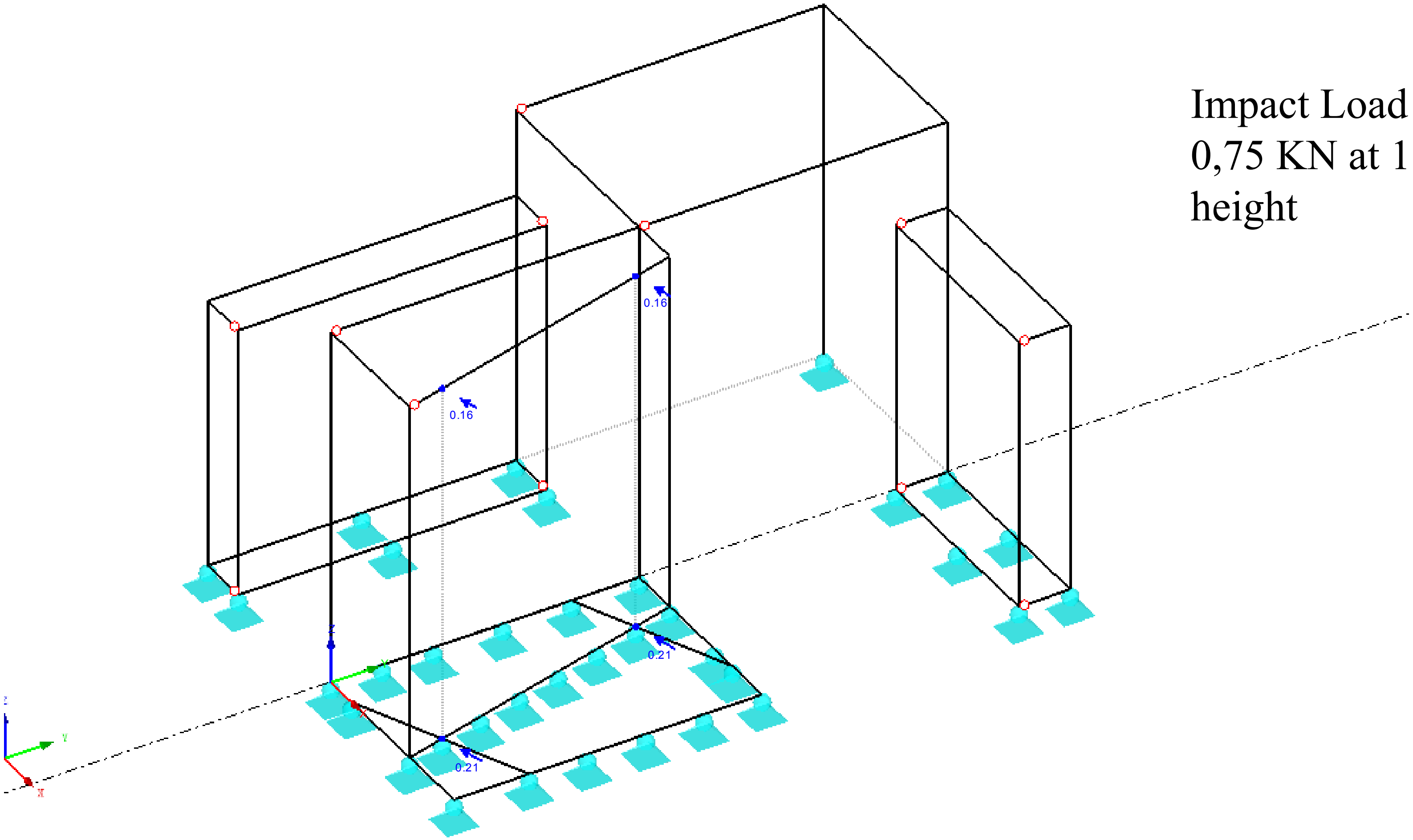
Isometrie



Wind load of 0,15 KN/m² applied

LF4: impact load 3

Isometrie

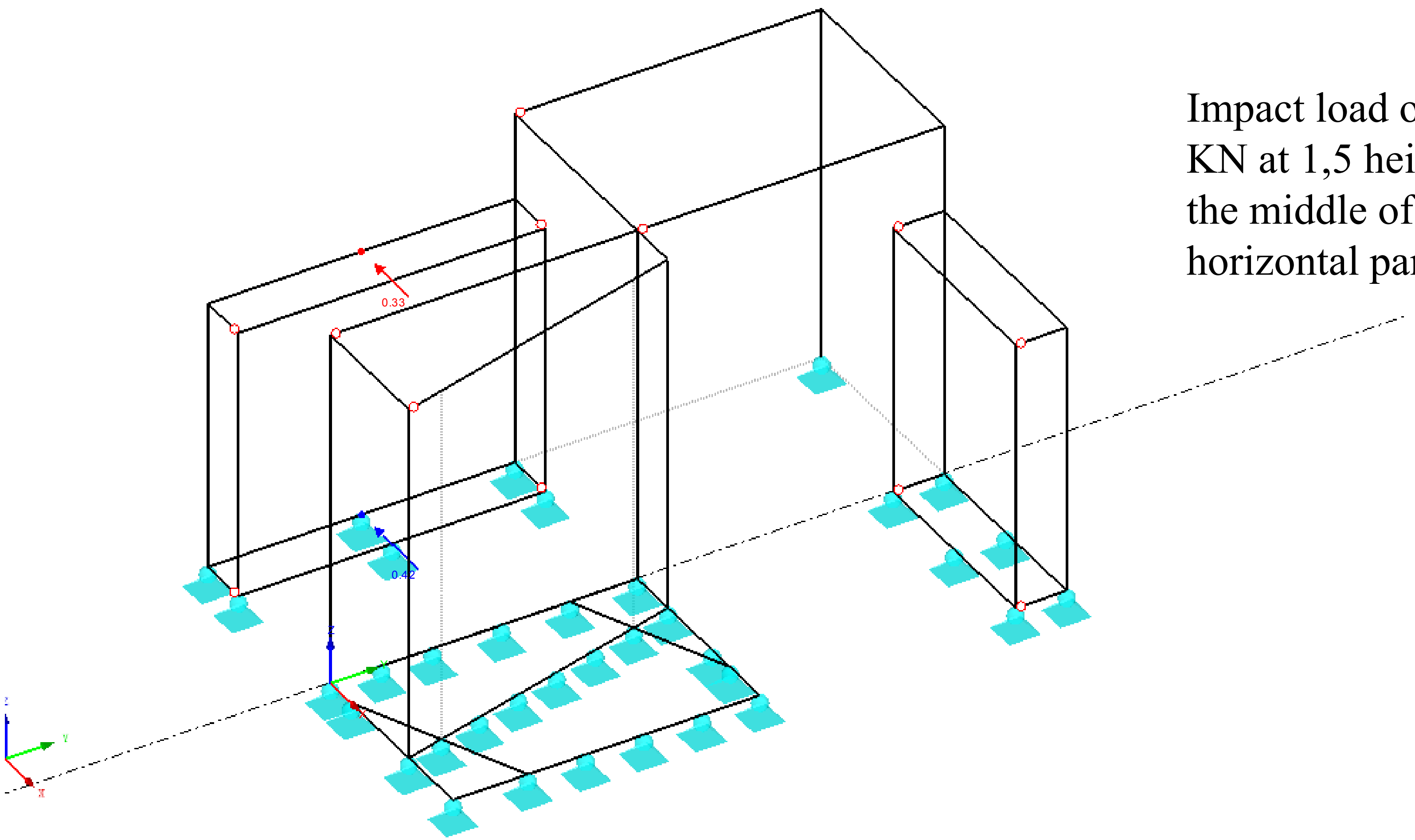


Impact Load of 0,75 KN at 1,5m height

ARUP

LF5: impact load 1

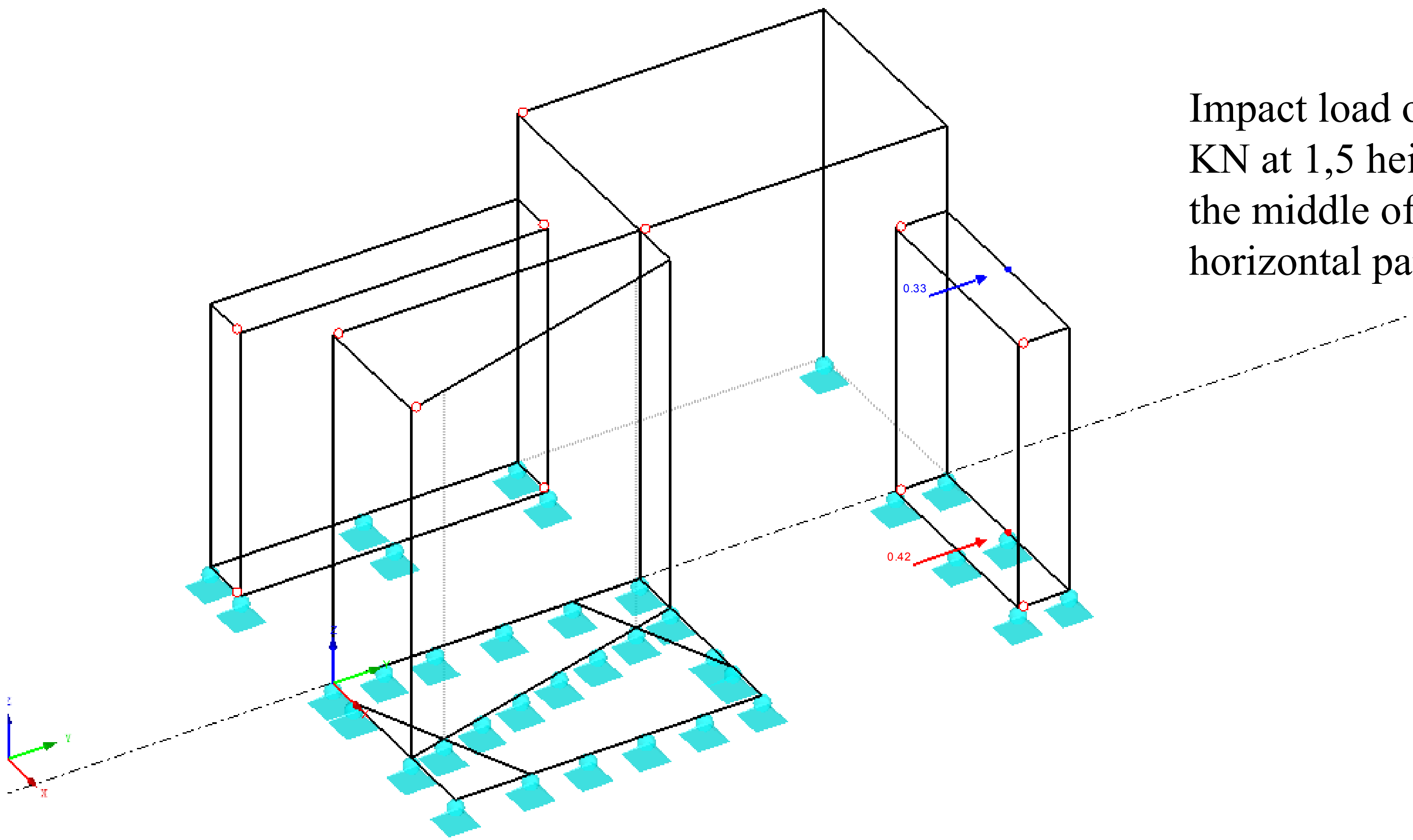
Isometrie



Impact load of 0,75 KN at 1,5 height in the middle of a horizontal panel

LF6: impact load 2

Isometrie

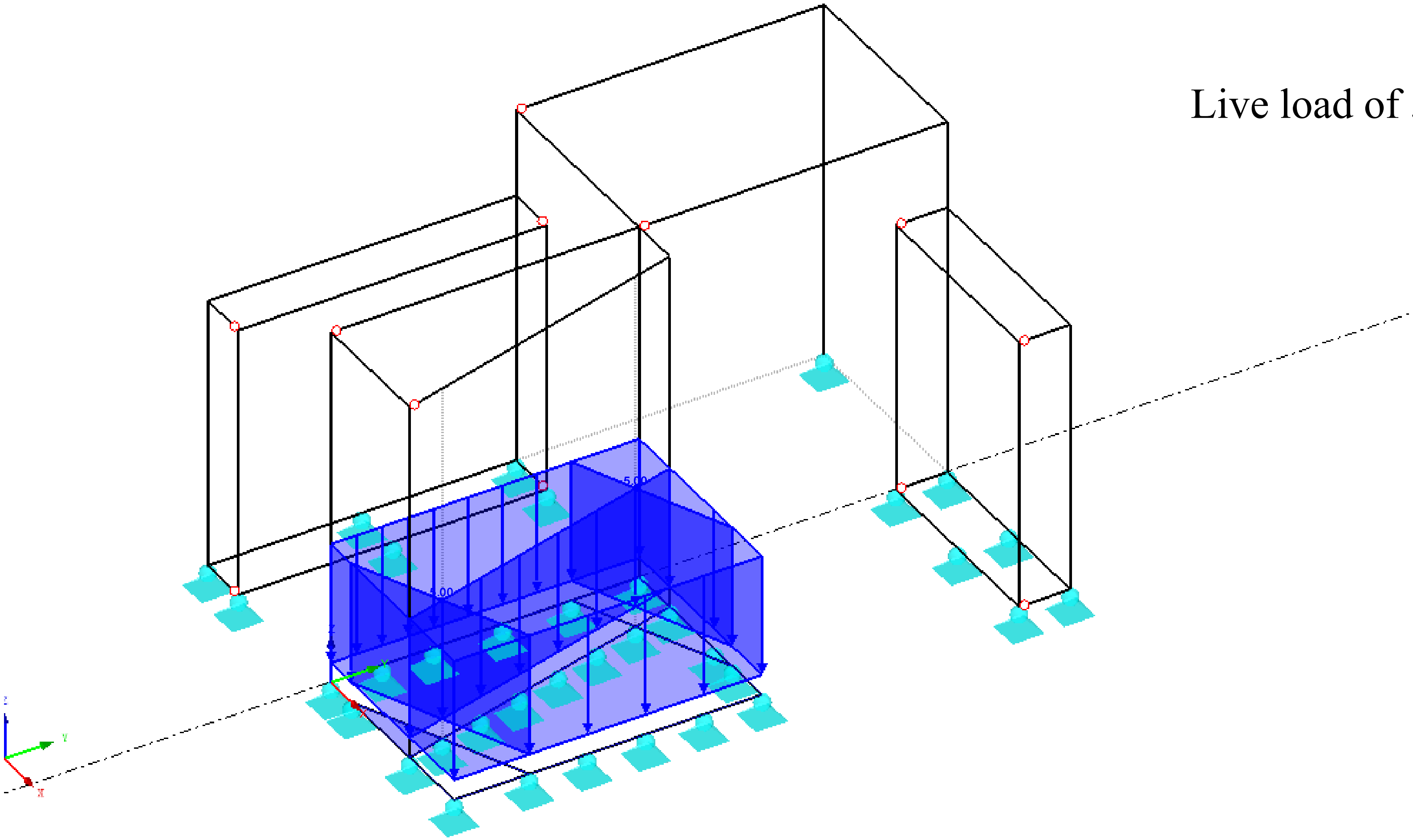


Impact load of 0,75 KN at 1,5 height in the middle of a horizontal panel

LF7: live load

Isometrie

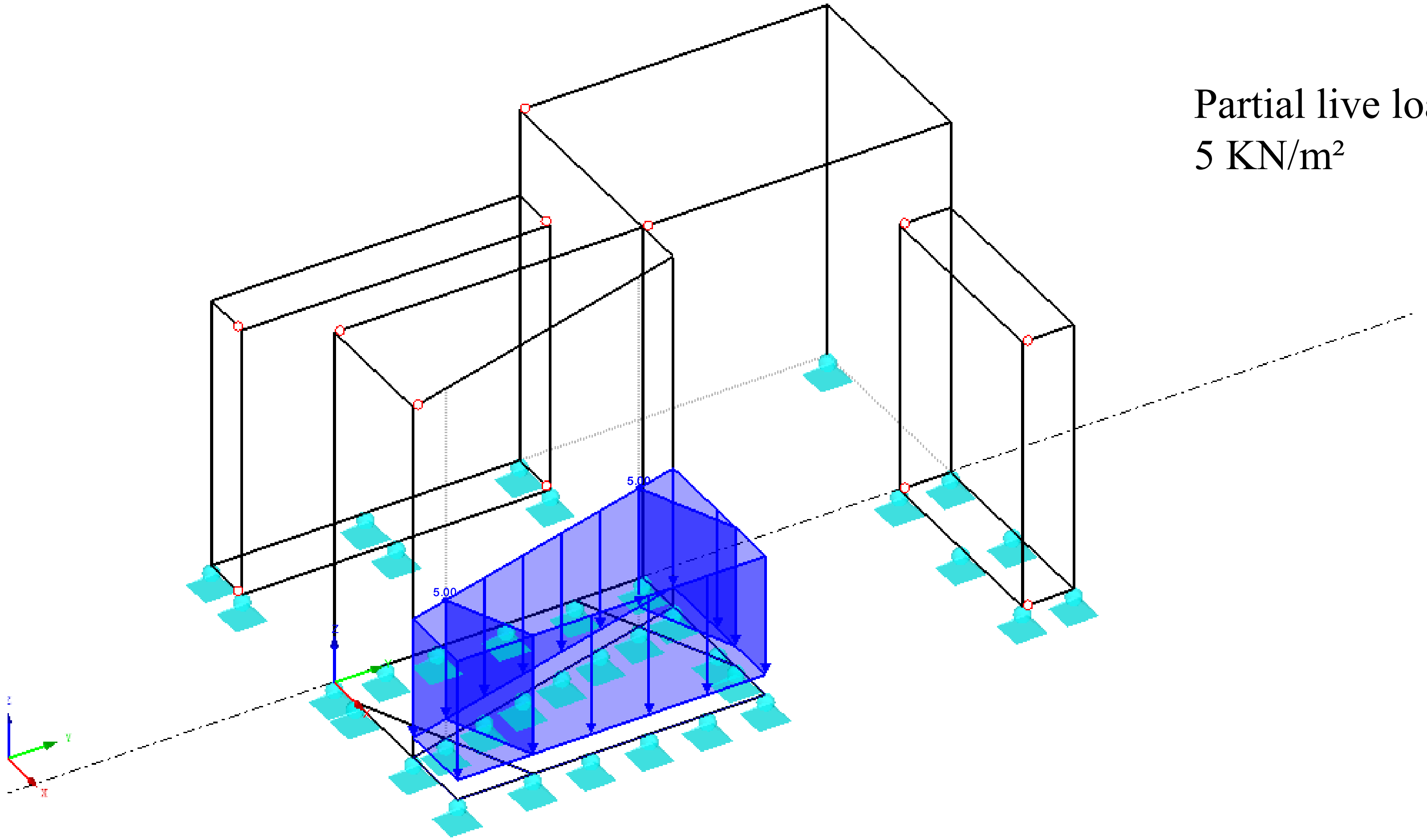
Live load of 5 KN/m²



ARUP

LF8: live load partial

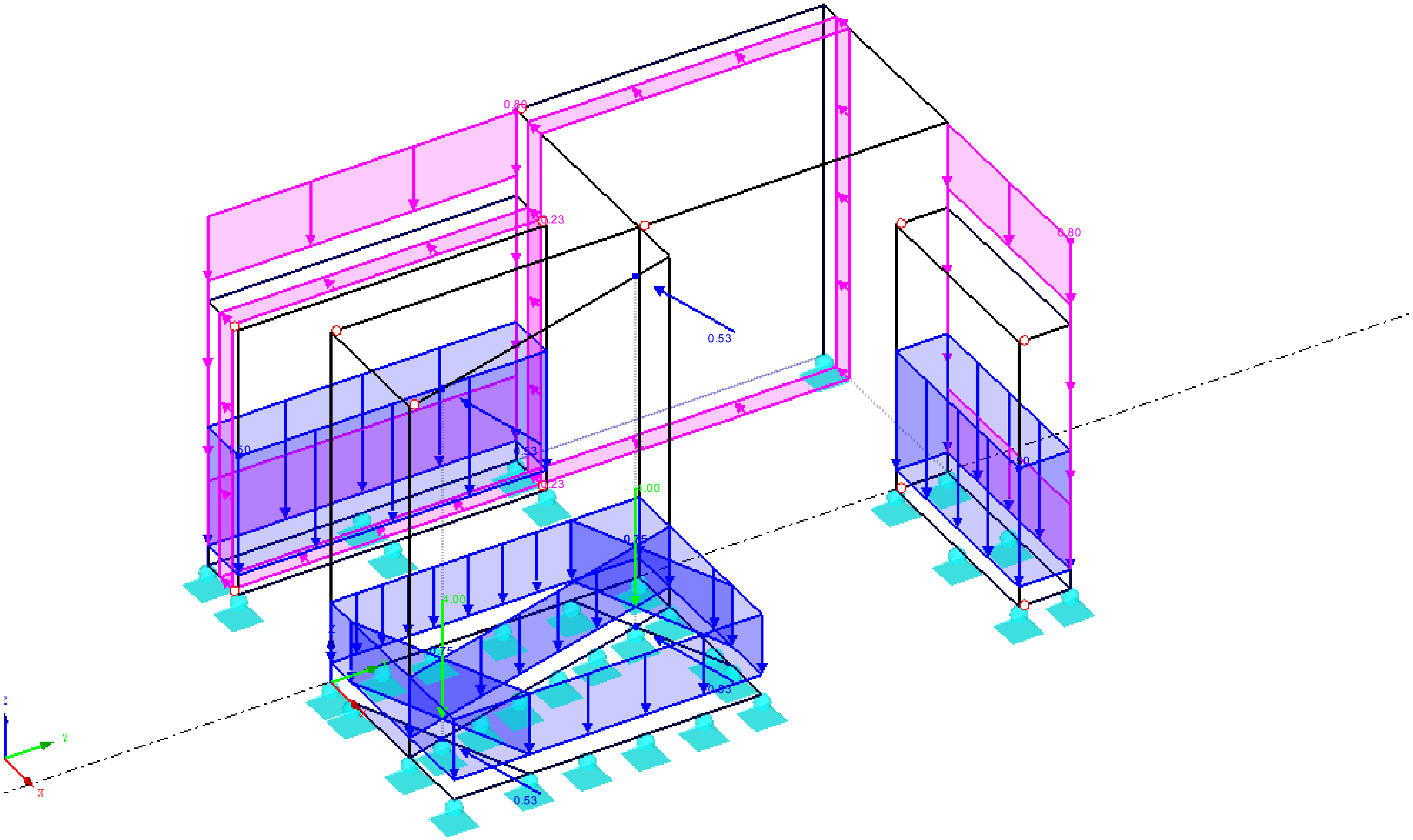
Isometrie



Partial live load of 5 KN/m²

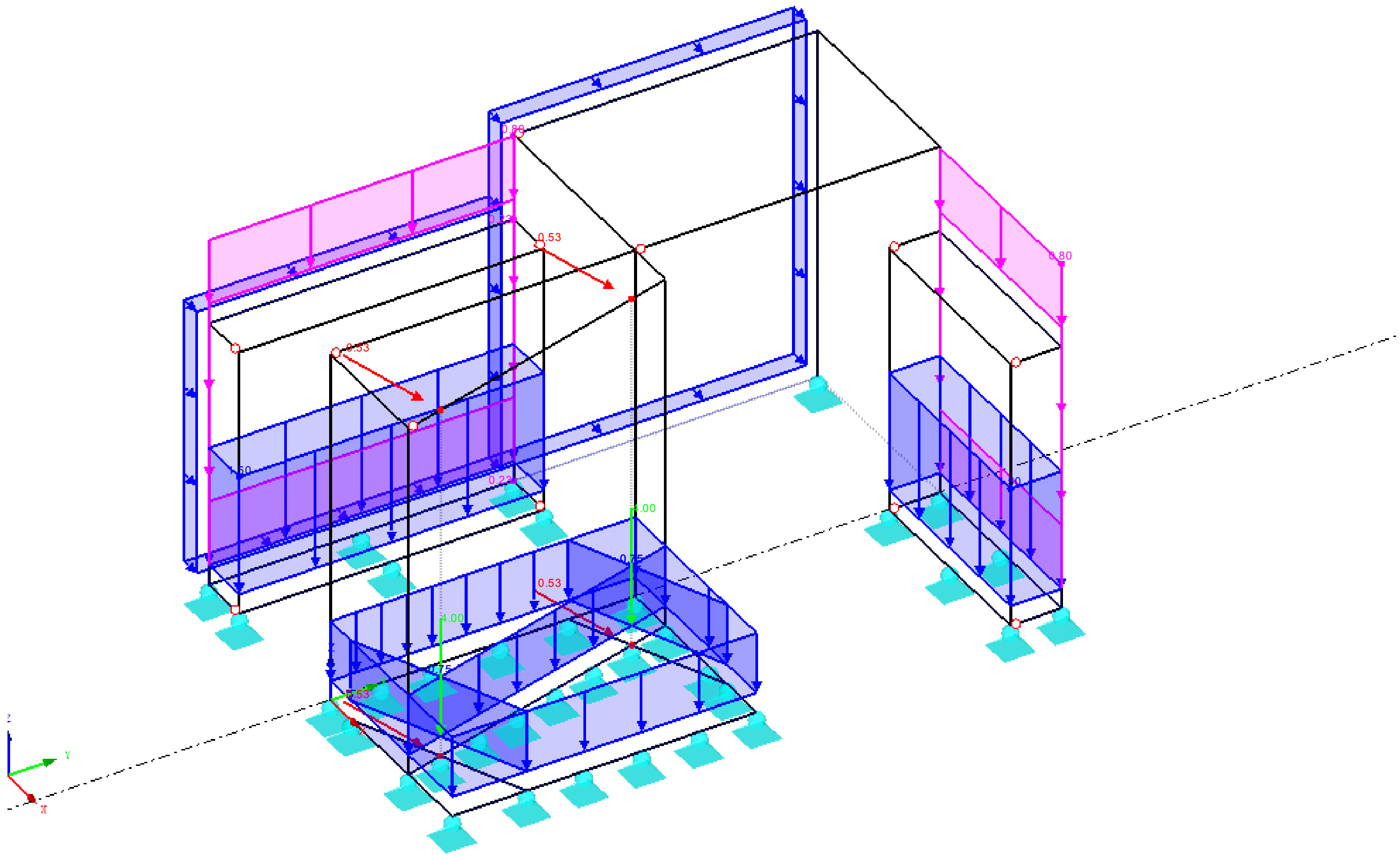
LK1: 1,0dl+1,5wx

Isometrie



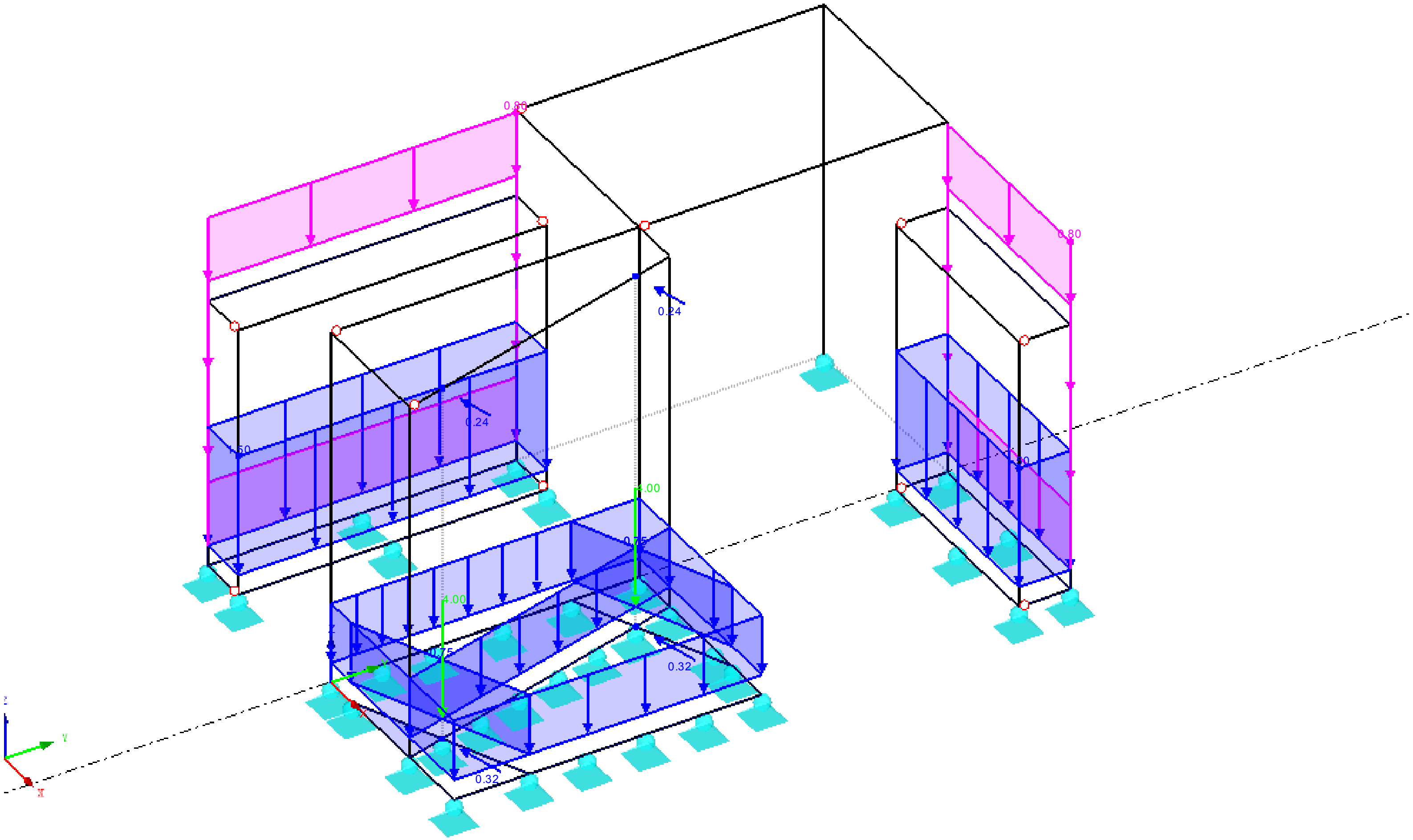
LK2: 1,0dl+1,5w-x

Isometrie



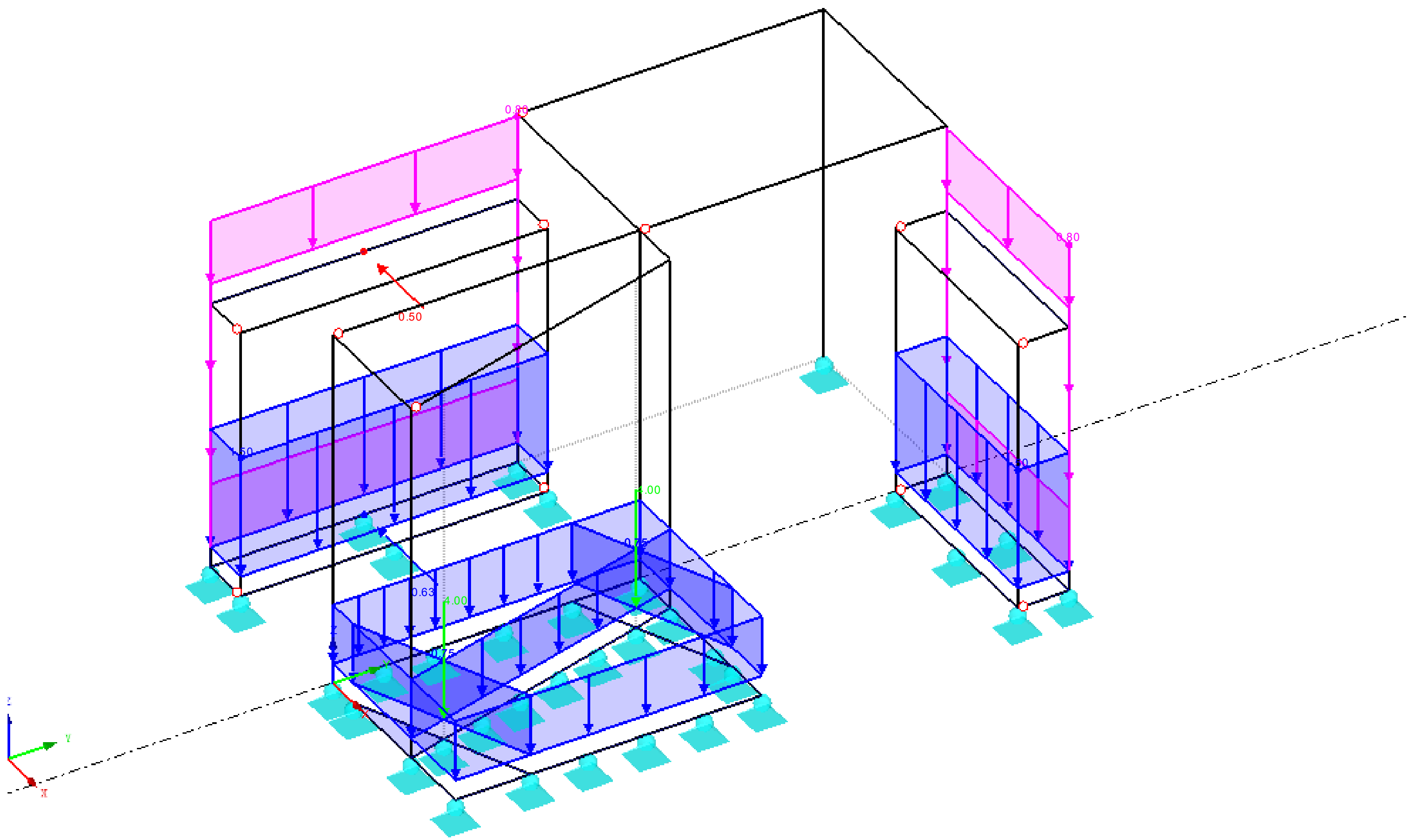
LK3: 1,0dl+1,5hr

Isometrie



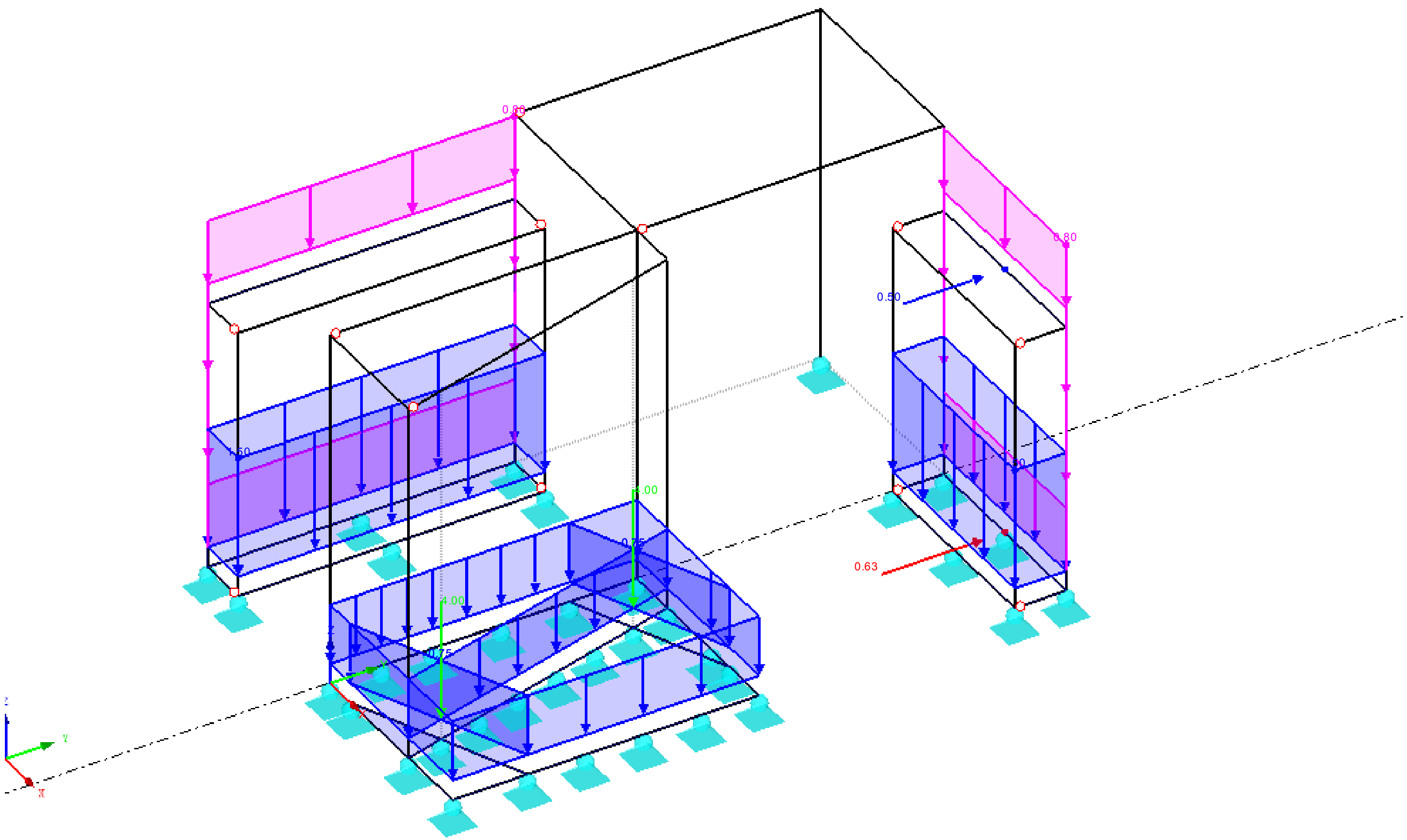
LK4: 1,0dl+1,5ip1

Isometrie



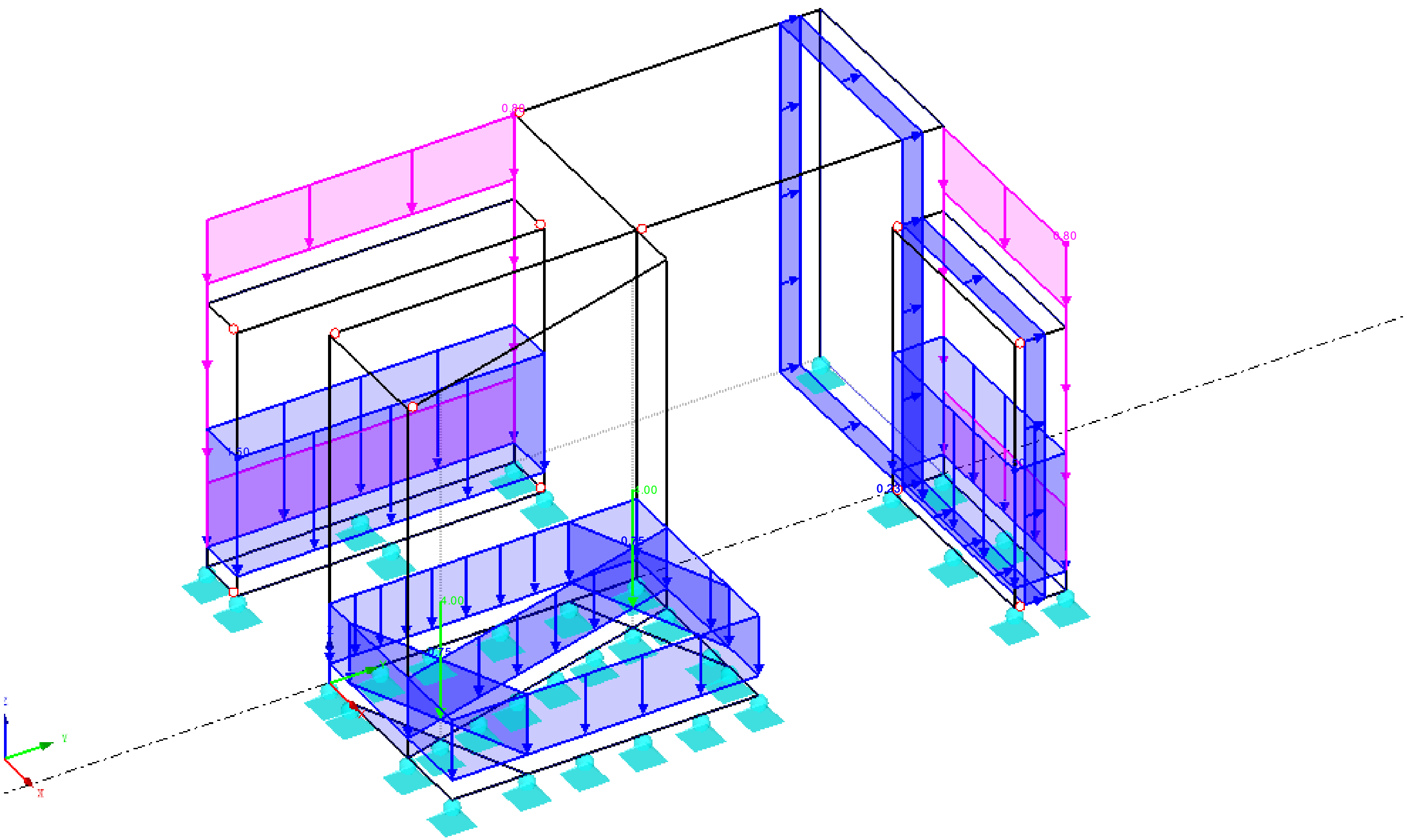
LK5: 1,0dl+1,5ip2

Isometrie



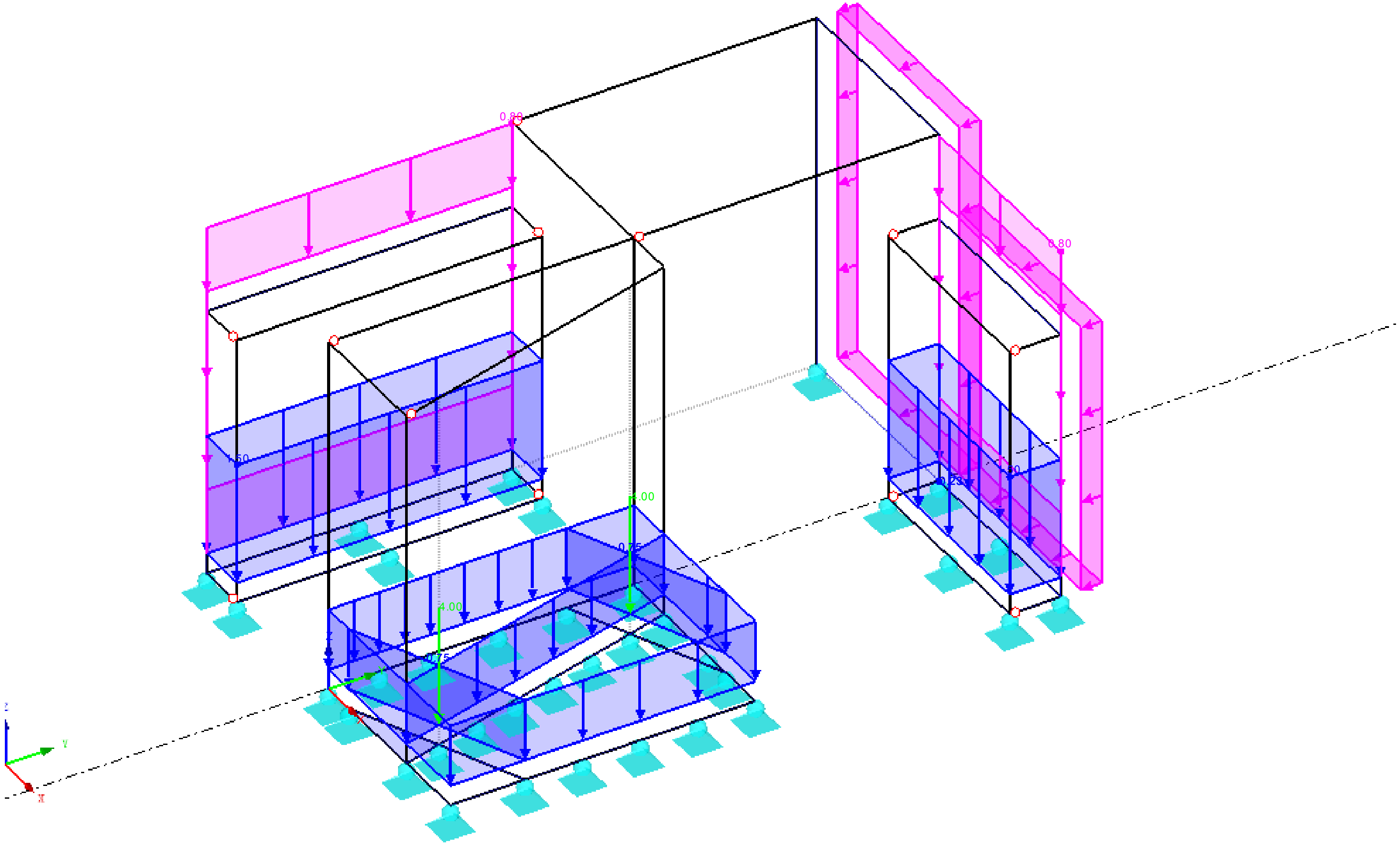
LK6: 1,0dl+1,5wy

Isometrie



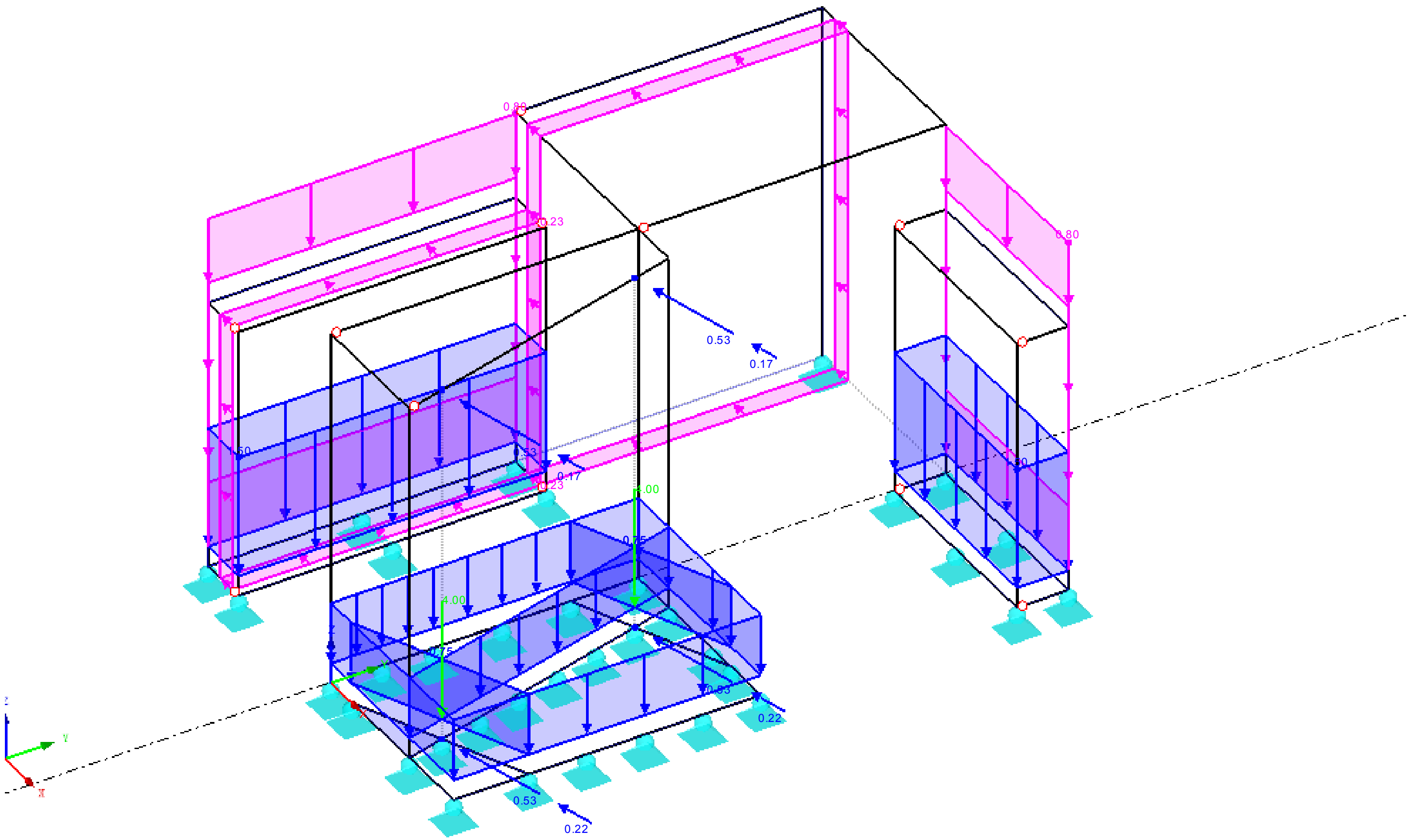
LK7: 1,0dl+1,5w-y

Isometrie



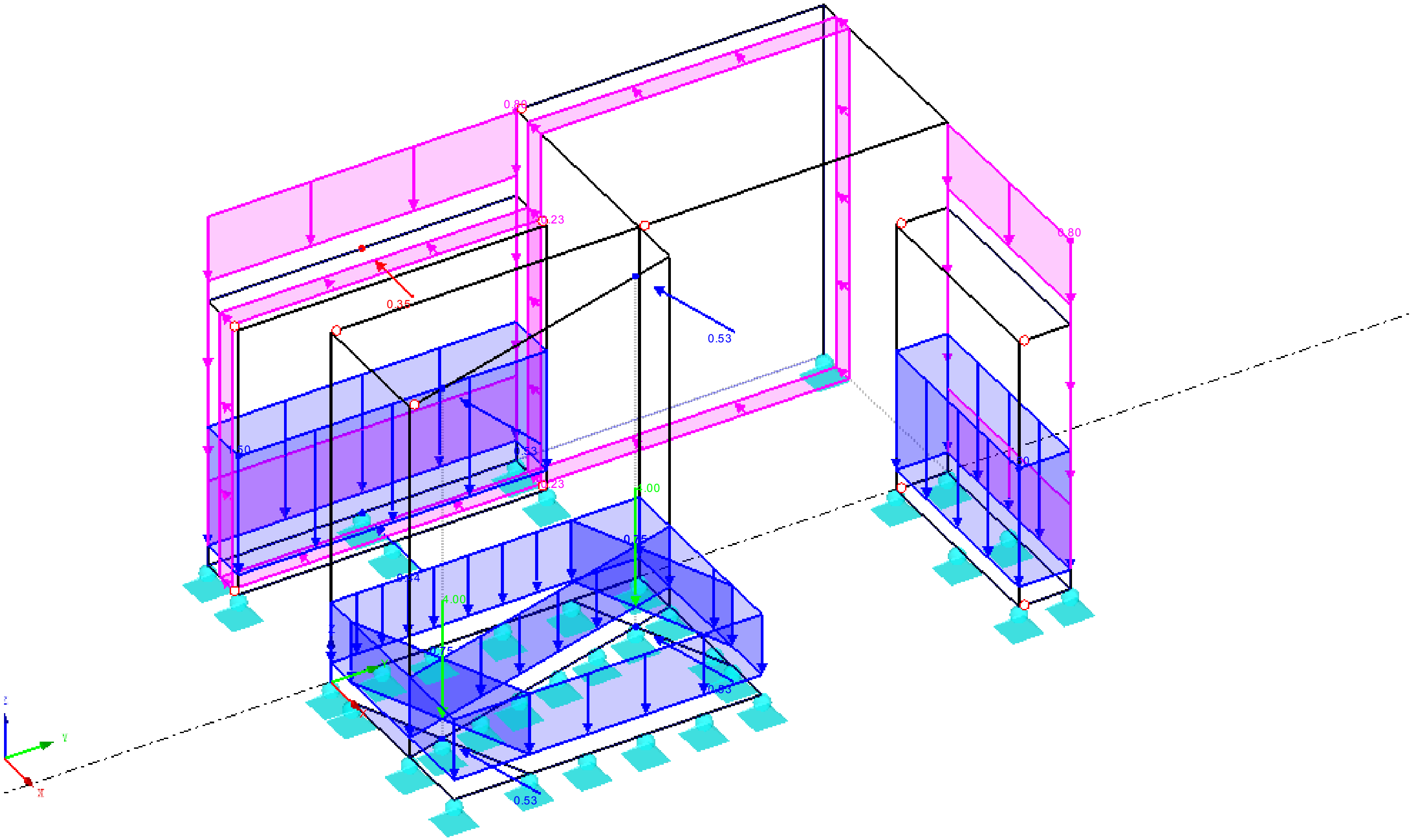
LK8: 1,0dl+1,5wx+1,05ip3

Isometrie



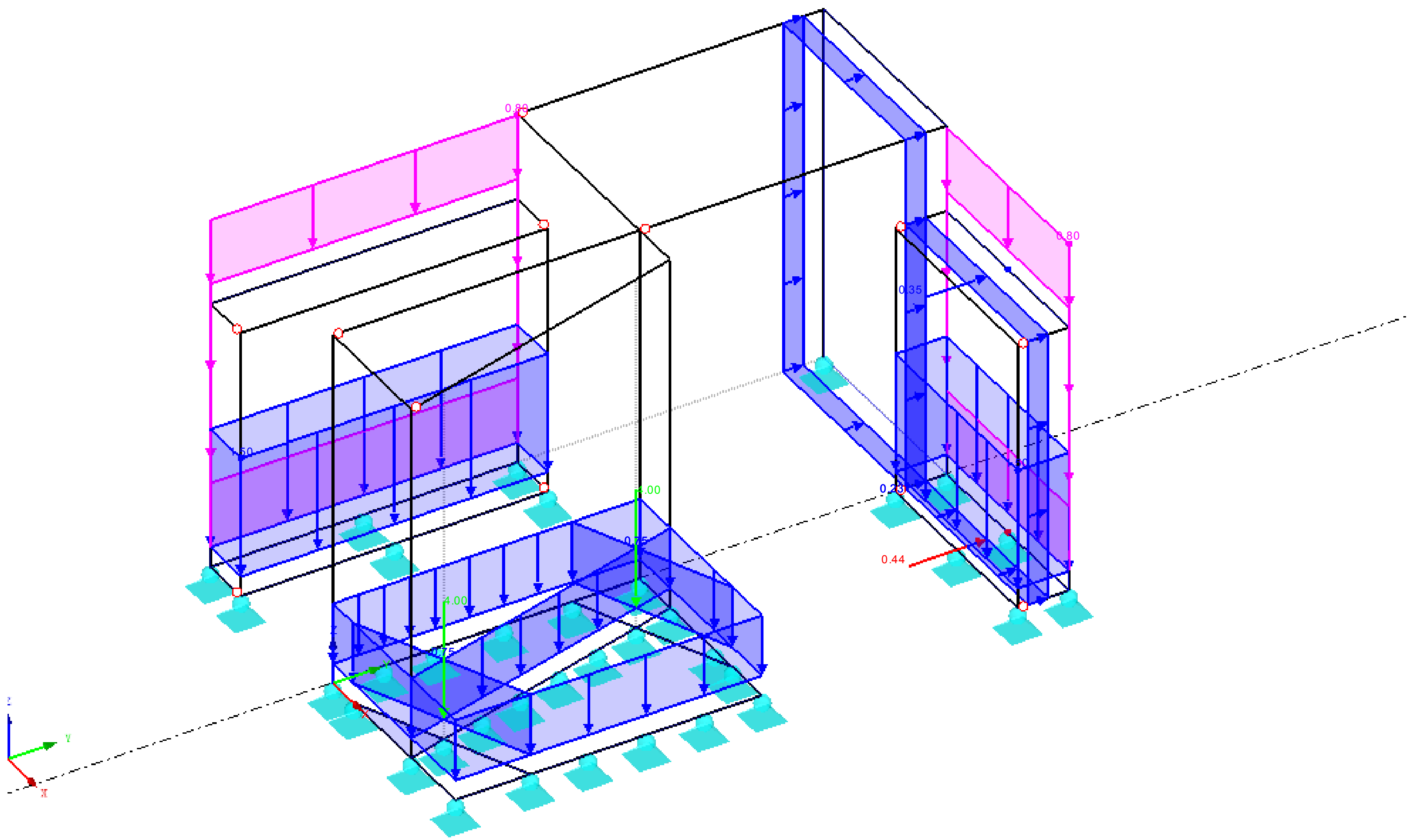
LK9: 1,0dl+1,5wx+1,05ip1

Isometrie



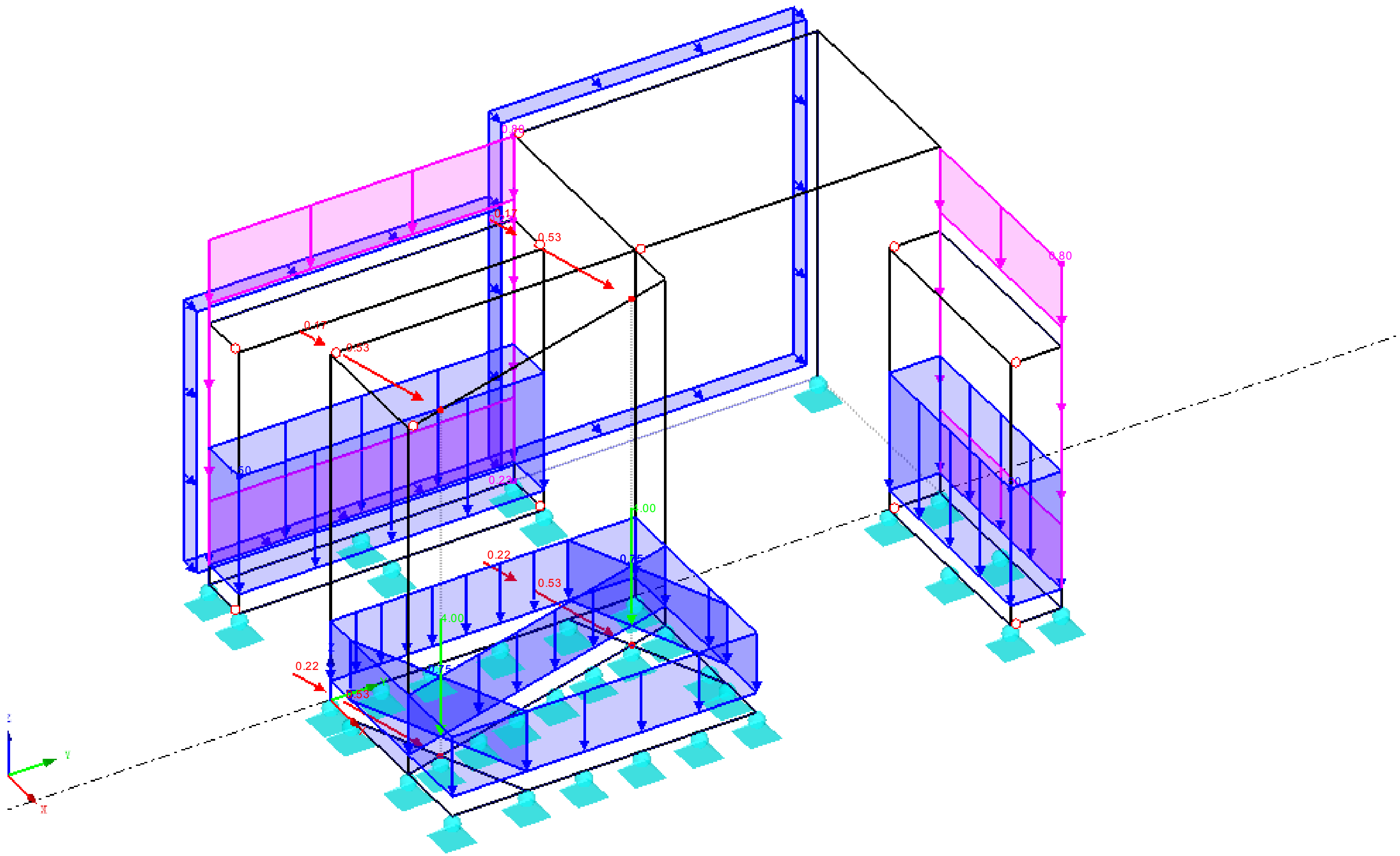
LK10: 1,0dl+1,5wy+1,05ip2

Isometrie



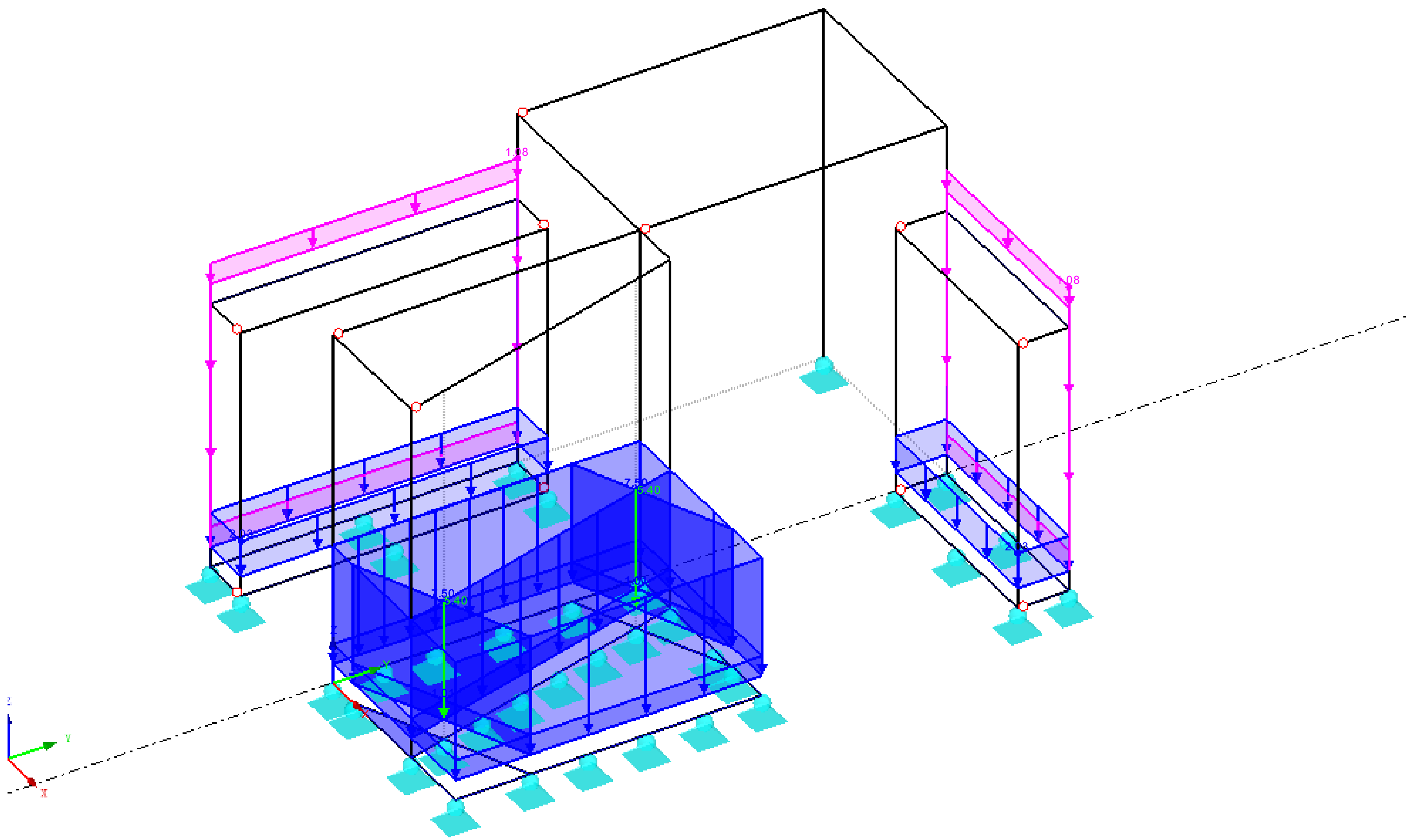
LK11: 1,0dl+1,5w-x+1,05-ip3

Isometrie



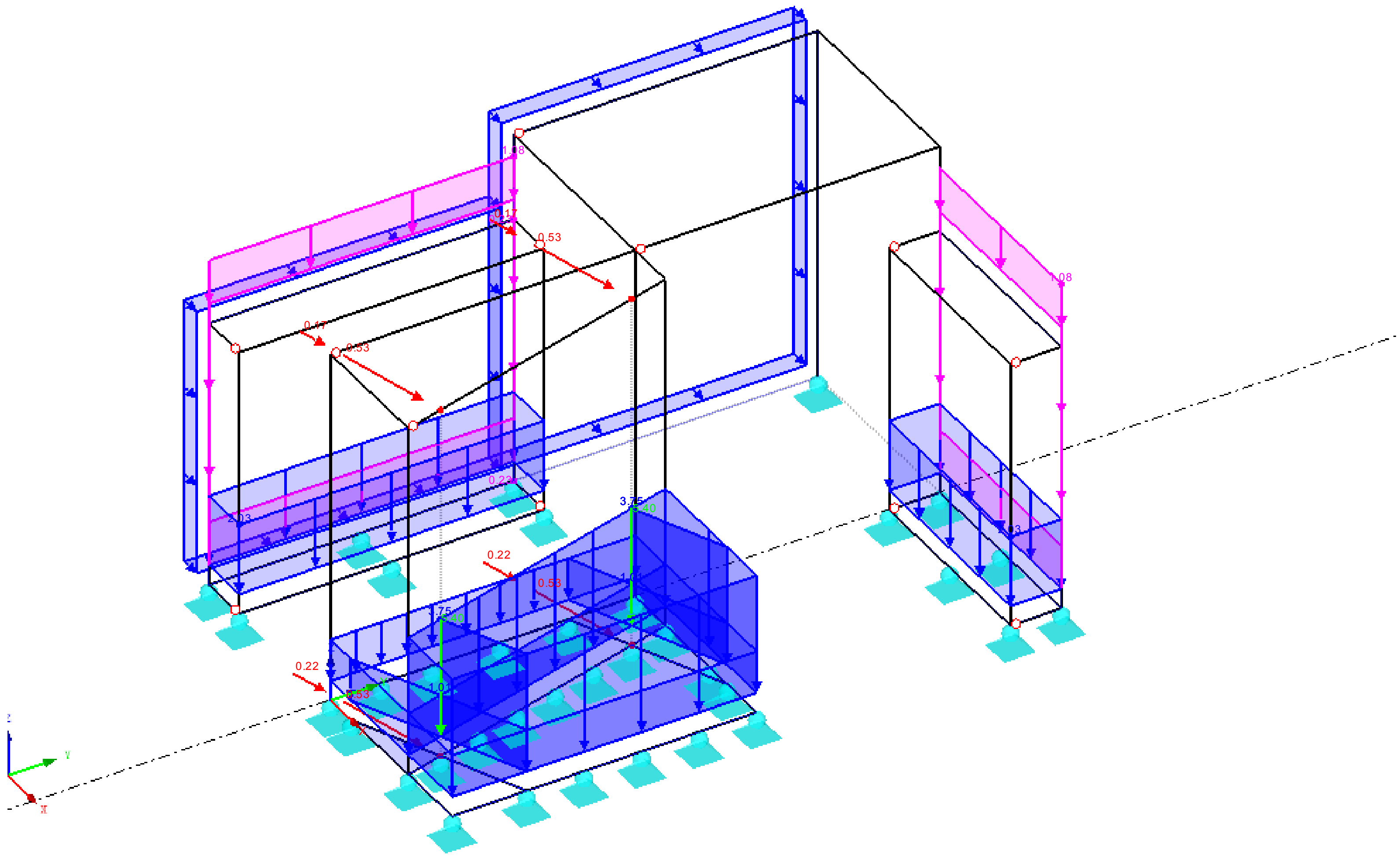
LK14: 1,35dl+1,5ll

Isometrie



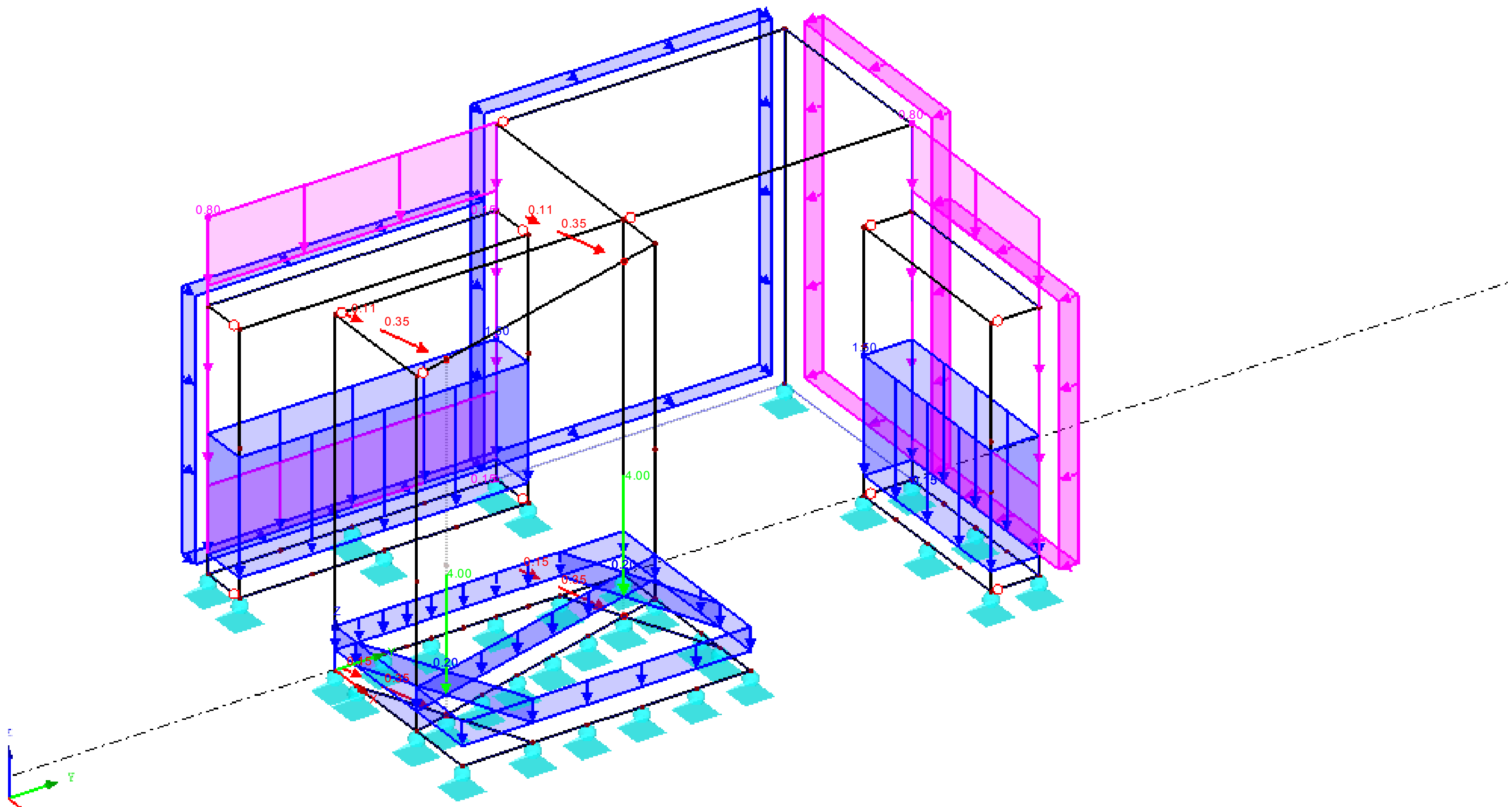
LK15: 1,35dl+1,5w-x+1,05-ip3+0,75ll

Isometrie

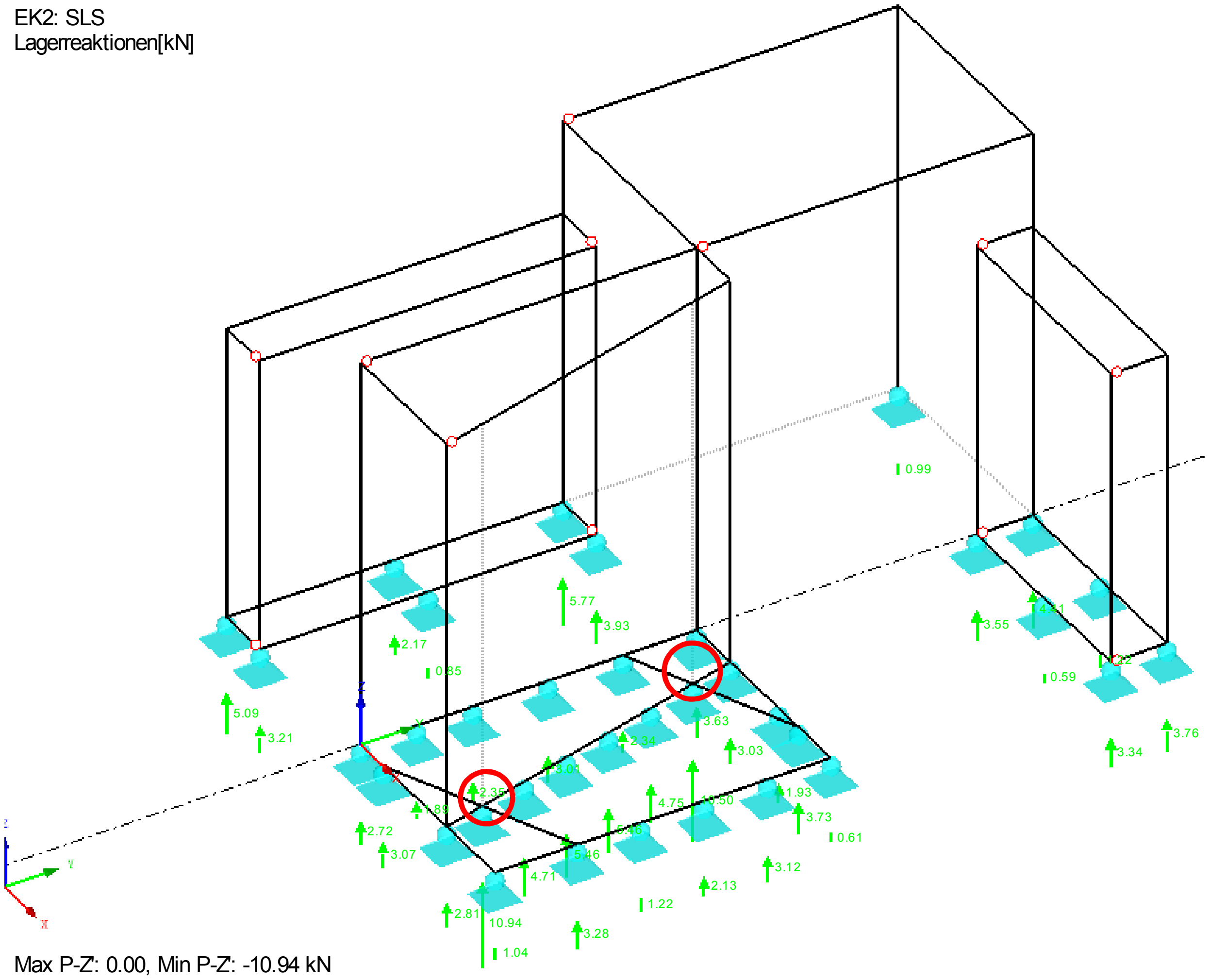


LK31: dl+w-y+1w-x+0,7-ip3

Isometrie

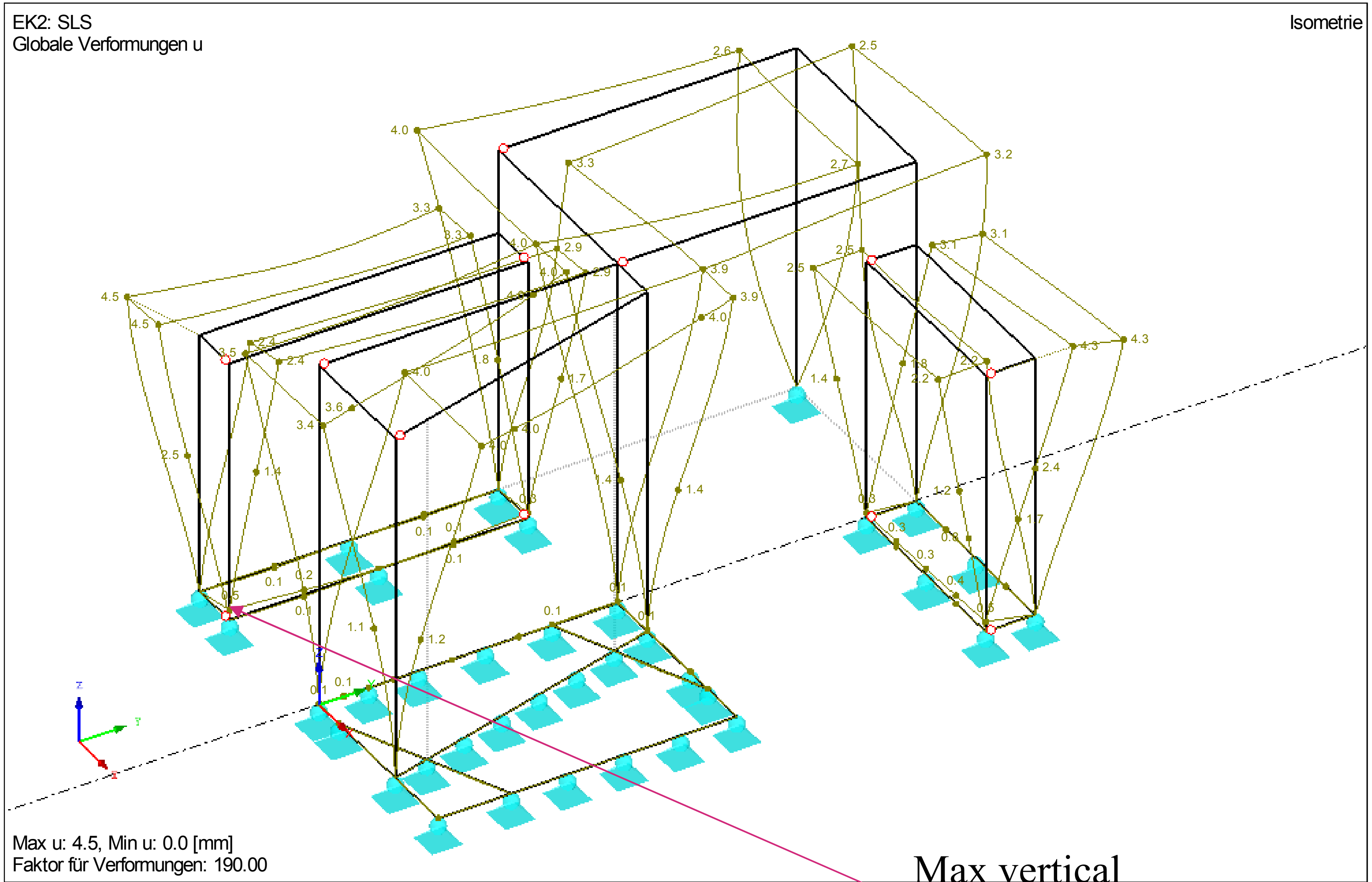


Isometrie



Max. of Load Cases <u>without</u> safety factor, considering wind and 70% of person impact

Red circles mark the exceeding of allowable point load to be induced in floor



Max vertical deflection acc. uplifting 0,5mm

APPENDIX C - Installation and final appearance

Figure 3. Erection of the EWP.

Figure 4. Installation of the EWP on the construction steel structures.

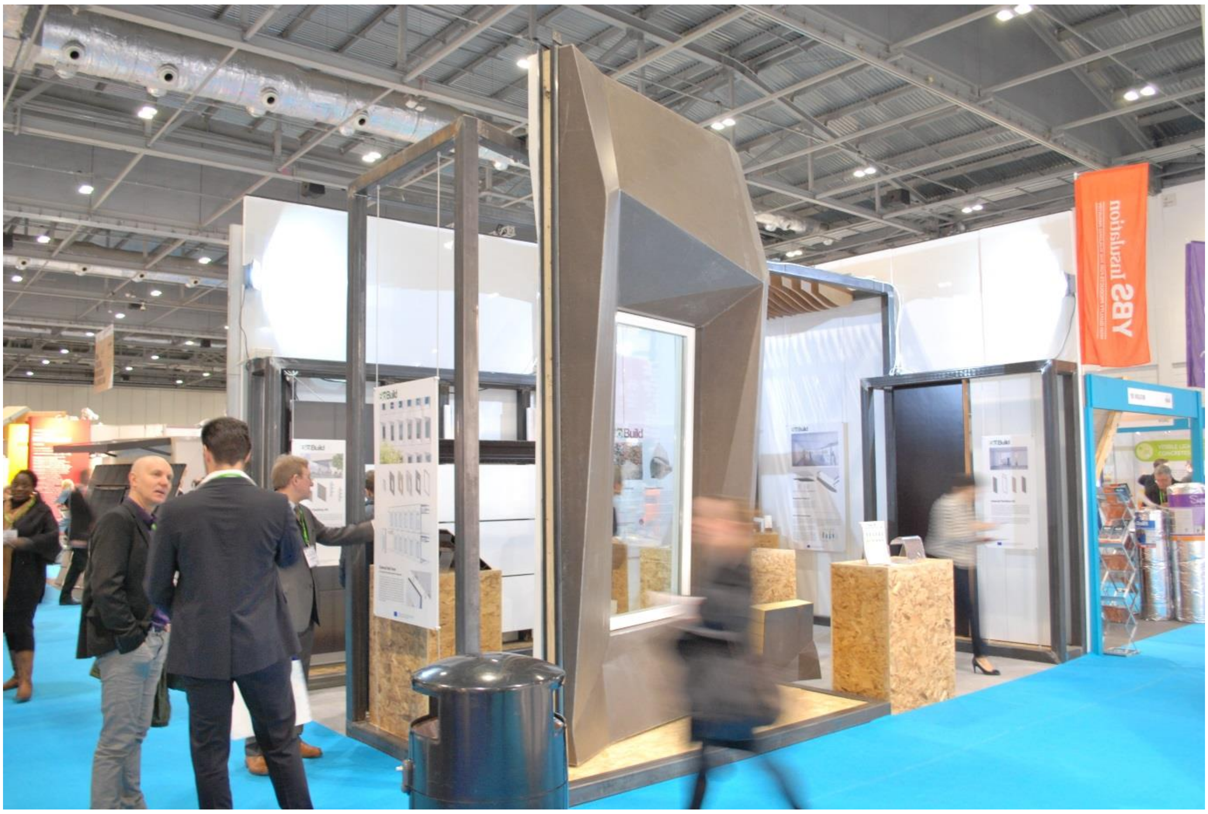


Figure 5. Overall views of the stand during the event at EcoBuild.

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Figure 6. External Wall Panel at EcoBuild.

Figure 7. External Cladding Kit at EcoBuild.

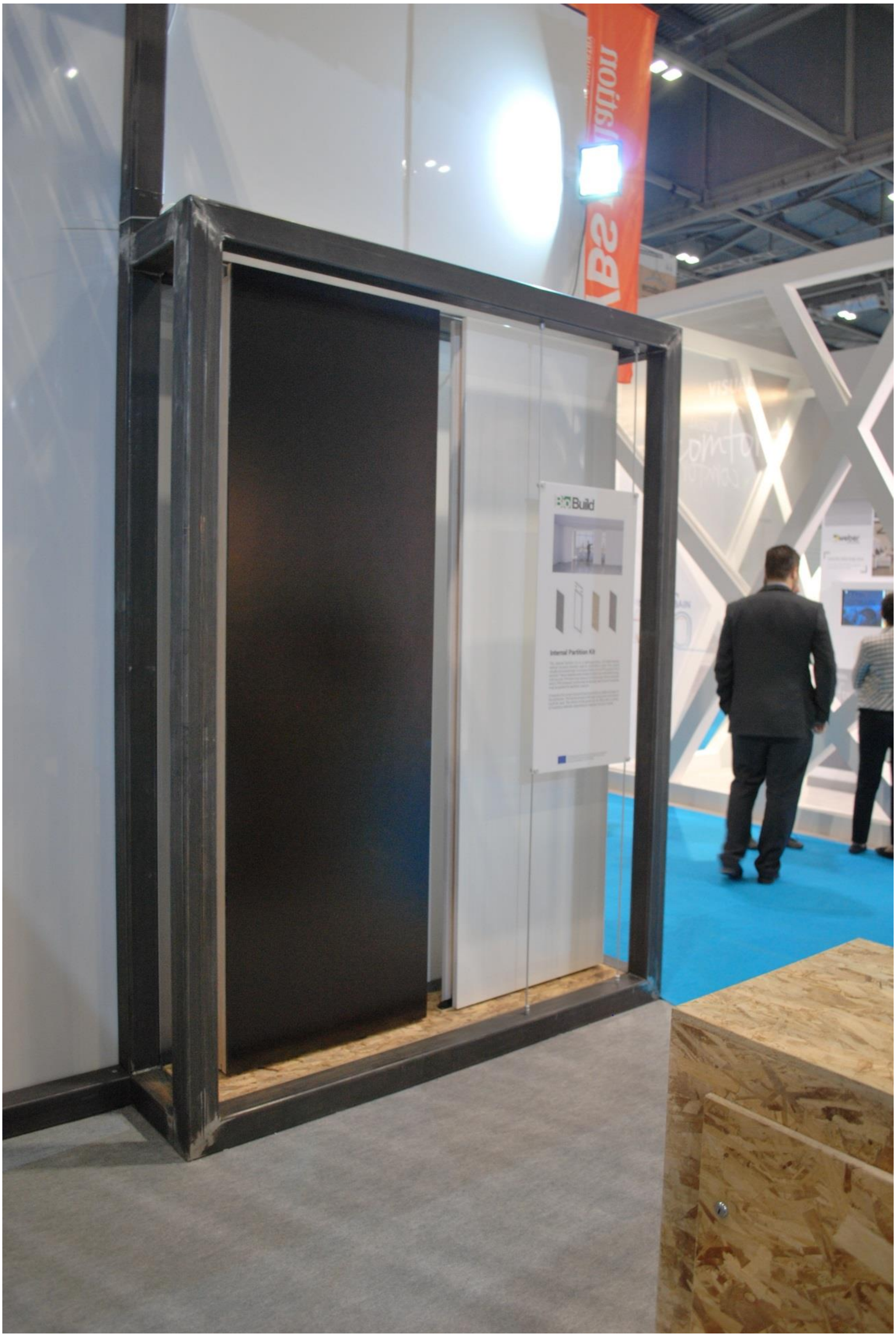

Figure 8. Internal Partition Kit at EcoBuild.

Figure 9. Suspended Ceiling Kit at EcoBuild.