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Documentationname Detail Design **Part B** CO101 – BEER Experimental cave and control hutch area **Construction part - Concrete structure** **Static analysis and technical report**			Copy number

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Content

1 TECHNICAL REPORT FOR STATIC ASSESSMENT

1.1 INTRODUCTION

The topic of this static assessment is global analysis of new concrete structure experimental cell with place for preparation and check sample and design steel beam for cane crane runway. Calculation of the internal forces of the main components, check concrete cross section and determination reaction on foundation concrete slab. Foundation of concrete cell is not subject of this static assessment. Static calculation is prepared in scope of project for detail design with respect all of allowed norm EN. Due to all of concrete parts are designed like a pre-cast concrete part the calculation of these part will be in pre-production documentation.

In static calculation are documented only necessarily output for design structures and completed static calculation. Completed detailed outputs are compiled and will be printed and added on demand.

1.2 DESCRIPTION OF STRUCTURE

This is one floor concrete cell with concrete platform. Cell is placed on concrete foundation slab and there is not rigid connection. Horizontal connection is considered due to friction between wall of cells and foundation concrete slab. This connection is satisfied due to heavy mass of cell.

Internal dimension of cell is 11,74 x 9,89 m and height is 5,40 m. Upper level platform of cell is -1,50 m. Foundation concrete slab is on level -3The cave will be built from pre-cast parts of concrete. The panels are mechanical switched to each other by internal steel rods and anchoring plates and then filled with grout. This connection creates a co-operating closed unit that will behave as a monolithic structure.
System of connection of the pre-cast parts is described in technical report of civil part – document No. 5043-f-180584 (ESS-0461627), chapter 5.1.4 – connections of pre-cast parts.
The requirement to ensure the rigid connection of the individual pre-cast parts of the experimental cave structure must also be taken into account by contratctor/supplier of the pre-cast structure in its pre-production documentation and its working drawings.

The concrete cave is only laid on the foundation concrete slab without any connection use in horizontal direction. In this case, horizontal forces are captured by friction between the walls and the foundation concrete slab. Due to heavy weight of cave this connection is satisfied and the structure is safety based.

The ceiling structure is made of pre-cast parts that are supported on the ceiling beams. It will be possible to lift the individual ceiling tiles to create a free space. Ceiling panels will not be connected by coupling pins and the joint between them will not be filled with grout.

Mass peripheral concrete wall of thickness 550 and 600 mm supported concrete ceiling with thickness 700mm. Parts of walls under the platform level -1,800 have a different thickness due to load distribution to the foundation slab. For manipulation with samples in the cell is located at the level +3,10 m crane with capacity 4t. The span of crane track is 8,70m and its crane constitutes steel beam with cross section I 400.

Each type of pre-cast parts will be specify in more detail in pre-production documentation by contractor/supplier of the pre-cast structure.

1.3 MATERIALS USE IN BEARING STRUCTURE

- Concrete monoliths structure:
    - C30/37 – XC1 – Ceiling, platform, foundations
    - Heavy concrete γ=3850 kg/m^3 C40/45 – XC1 - Walls

- Steel beam of crane runway S235

All products on site must have valid certificates.

1.4 LOAD USE IN CALCULATION

-	Self-load bearing structures	coefficient	1,35
-	Dead load	coefficient	1,35
-	Active load from crane	coefficient	1,35
-	Active load – according to category of area	coefficient	1,50

1.5 PROCEED CALCULATION AND MODELING

For design and modeling was prepared simple spatial structure of the whole building of experimental cell. Spatial model is composed from plate elements include internal, external walls and ceiling of cell and platform on level -1,500 m. Elements of the crane runway girder and heavy doors are laid in the concrete frame only to determine the total load acting on the foundation.

Connection of concrete pre-cast structure is modeled with joints between each part of pre-cast. In the joints is possible only rotation in the direction of the joint. Whole model is mounting only on vertical support in “Z-axis”. Horizontal supports are only in two corners of model for stabile calculation. In real situation the cell do not supported in horizontal direction (friction from self-weight is enough and there is no risk to horizontal shift).

For ceiling beam was created a separate simple model due to shape of beam.

For design the crane track and heavy doors will prepare separate spatial model. Loads from these models applied to assessment of the anchoring to the concrete walls.

Load in each load condition was set in characteristic value, corresponding coefficient was used during making of load combination.

1.6 USED NORM, SOFTWARE AND BASES

Norm:

- EN 1990 Basis of structural design
- EN 1991-1-1 General actions - Densities, self-weight, imposed loads for buildings
- EN 1992-1-1 Design of concrete structures - Part 1-1: General rules and rules for buildings
- EN 1993-1-1 Design of steel structures - Part 1-1: General rules and rules for buildings

Bases:

- Project documentation of building part

Software:

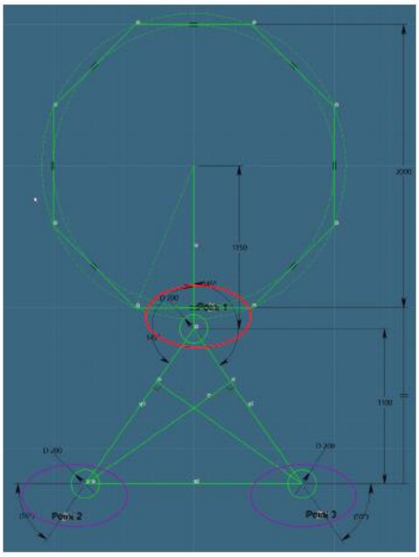
- RFEM5 – Calculations of spatial structures using finite element method, Dlubal Praha
- FIN EC – Concrete
- FIN EC – Steel
- Hilti PROFIS anchor

2 STATIC ASSESEMENT

2.1 LOAD

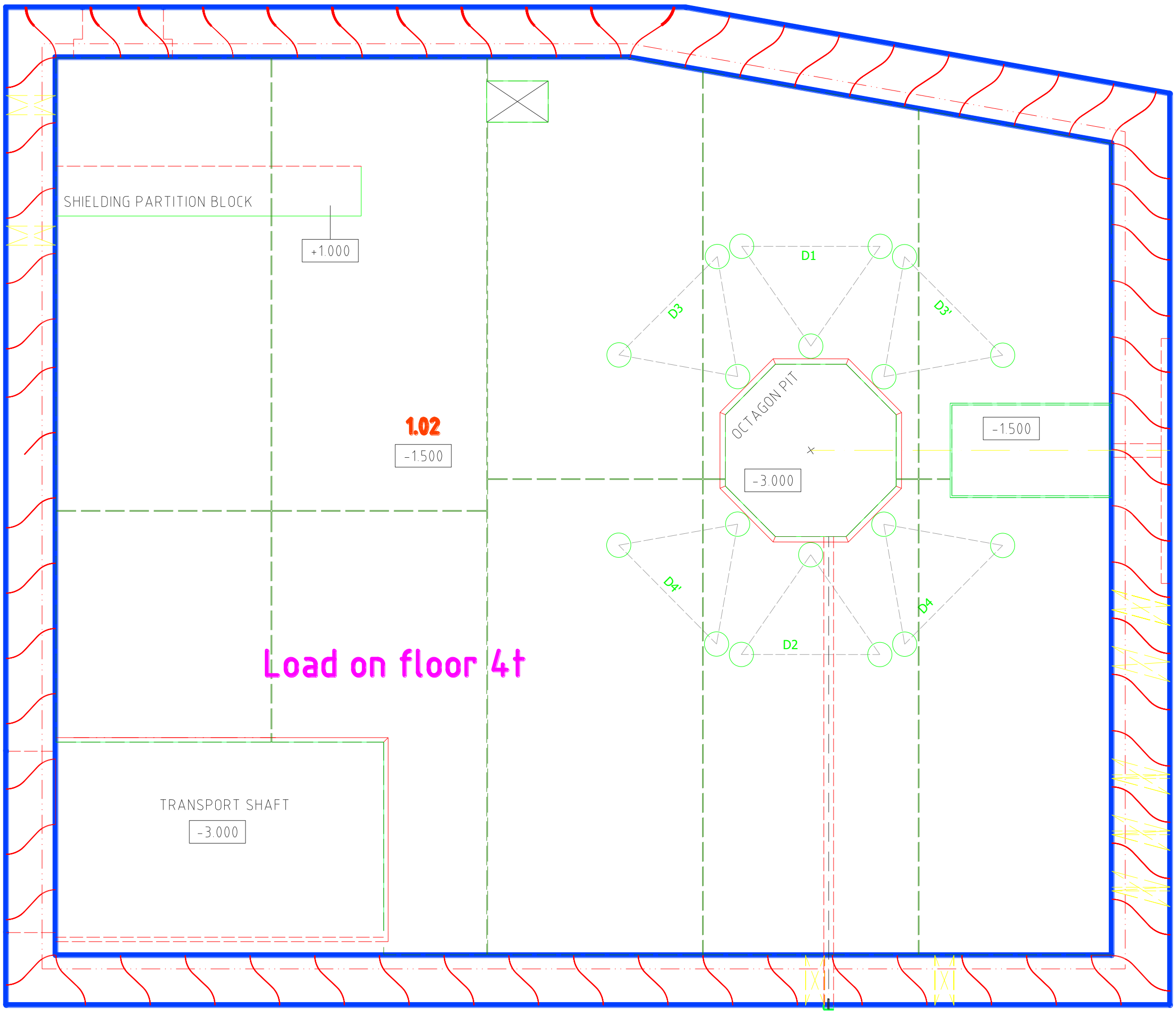
2.1.1 LEVEL -1,500

Assumed Loads on the fixing points



Point 1 : 15 kN (1,5t) estimated

Point 2 and 3 : each 5kN (0,5t) estimated



- Self-weight of structure is calculated in model

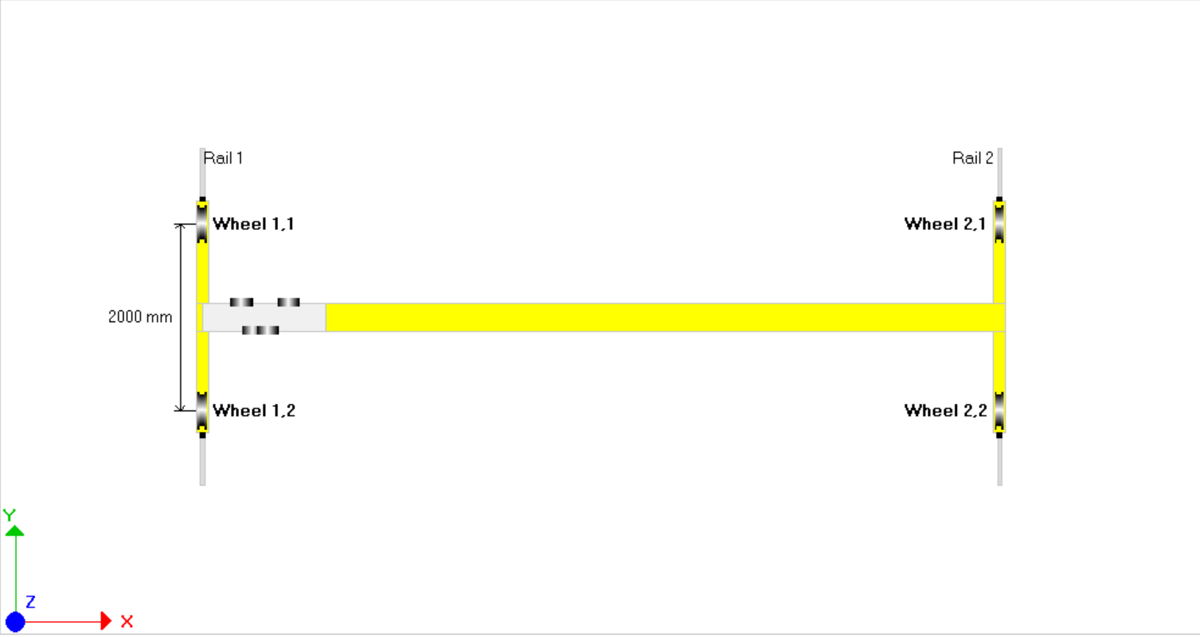
- Active load on level -1,500 see surface in upper picture
  4 t = 40 kN/m^2

2.1.2 LEVEL +4,500 (CEILING)

No additional load is permitted on the roof.

2.1.3 LEVEL +3,100 (CRANE)

Calculation number / work number	Nivia I /
Rated capacity of crane, [kg]	4 000
Span, [m]	8,500
Rail type	40*30



Dynamic factors according to EN 13001-2

Phi1	1,10	For hoisting and gravity effects acting on the mass of the crane
Phi2	1,17	For inertial and gravity effects acting on the hoist load
Phi3	1,00	For sudden release of a part of the hoist load
Phi4	1,00	Loads caused by travelling on uneven surface
Phi5 Hoist	1,00	For loads caused by acceleration of hoisting machinery
Phi5 Trolley	1,20	For loads caused by acceleration of traversing machinery
Phi5 Bridge	1,20	For loads caused by acceleration of the travelling machinery
Phi6	1,09	For dynamic test loads
Phi7	1,25	For buffer forces
eta	0,00934	Remaining hoist load

(Note! Given wheel loads don’t include any dynamic factors)

Basic load action: Self weight of the crane
Includes weight of bridge and trolley(s)

Trolley(s) at Rail 1

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-4,80**	0	0	**-3,35**
Wheel i,2	0	0	**-4,68**	0	0	**-3,34**

Trolley(s) at Rail 2

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-3,34**	0	0	**-4,82**
Wheel i,2	0	0	**-3,33**	0	0	**-4,69**

Basic load action: Weight of the hoist load

Trolley(s) at Rail 1

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-18,0**	0	0	**-1,63**
Wheel i,2	0	0	**-18,3**	0	0	**-1,68**

Trolley(s) at Rail 2

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-1,36**	0	0	**-18,3**
Wheel i,2	0	0	**-1,44**	0	0	**-18,5**

Basic load action: Acceleration of the crane bridge

Trolley(s) at Rail 1, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**-0,263**	**-0,589**	-22,8	**-0,263**	**-0,129**	-4,99
Wheel i,2	**0**	**0,589**	-22,9	**0**	**0,129**	-5,02

Trolley(s) at Rail 2, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**-0,263**	**0,125**	-4,70	**-0,263**	**0,614**	-23,1
Wheel i,2	**0**	**-0,125**	-4,77	**0**	**-0,614**	-23,2

Trolley(s) at Rail 1, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0,263**	**0,589**	-22,8	**0,263**	**0,129**	-4,99
Wheel i,2	**0**	**-0,589**	-22,9	**0**	**-0,129**	-5,02

Trolley(s) at Rail 2, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0,263**	**-0,125**	-4,70	**0,263**	**-0,614**	-23,1
Wheel i,2	**0**	**0,125**	-4,77	**0**	**0,614**	-23,2

Basic load action: Skewing of the bridge crane

Trolley(s) at Rail 1, Rail 1 is guiding, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**-3,95+4,81**	-22,8	**0**	**-0,863**	-4,99
Wheel i,2	**0**	**0**	-22,9	**0**	**0**	-5,02

Trolley(s) at Rail 2, Rail 1 is guiding, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**-0,812+4,81**	-4,70	**0**	**-4,00**	-23,1
Wheel i,2	**0**	**0**	-4,77	**0**	**0**	-23,2

Trolley(s) at Rail 1, Rail 2 is guiding, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**-3,95**	-22,8	**0**	**-0,863+4,81**	-4,99
Wheel i,2	**0**	**0**	-22,9	**0**	**0**	-5,02

Trolley(s) at Rail 2, Rail 2 is guiding, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**-0,812**	-4,70	**0**	**-4,00+4,81**	-23,1
Wheel i,2	**0**	**0**	-4,77	**0**	**0**	-23,2

Trolley(s) at Rail 1, Rail 1 is guiding, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**0**	-22,8	**0**	**0**	-4,99
Wheel i,2	**0**	**-3,97+4,84**	-22,9	**0**	**-0,868**	-5,02

Trolley(s) at Rail 2, Rail 1 is guiding, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**0**	-4,70	**0**	**0**	-23,1
Wheel i,2	**0**	**-0,824+4,84**	-4,77	**0**	**-4,01**	-23,2

Trolley(s) at Rail 1, Rail 2 is guiding, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	**0**	-22,8	**0**	**0**	-4,99
Wheel i,2	**0**	**-3,97**	-22,9	**0**	**-0,868+4,84**	-5,02

Trolley(s) at Rail 2, Rail 2 is guiding, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]

Wheel i,1	**0**	**0**	-4,70	**0**	**0**	-23,1
Wheel i,2	**0**	**-0,824**	-4,77	**0**	**-4,01+4,84**	-23,2

Basic load action: Acceleration of the trolley(s)

Trolley(s) at middle, accelerating to positive direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	**-0,101**	-13,8	0	**-0,102**	-14,0
Wheel i,2	0	**-0,101**	-13,9	0	**-0,102**	-14,0

Trolley(s) at middle, accelerating to negative direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	**0,101**	-13,8	0	**0,102**	-14,0
Wheel i,2	0	**0,101**	-13,9	0	**0,102**	-14,0

Basic load action: Weight of the test load

Trolley(s) at Rail 1

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transvere	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-19,8**	0	0	**-1,80**
Wheel i,2	0	0	**-20,1**	0	0	**-1,84**

Trolley(s) at Rail 2

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	0	0	**-1,49**	0	0	**-20,1**
Wheel i,2	0	0	**-1,58**	0	0	**-20,3**

Basic load action: Crane collision to the buffers

Trolley(s) at Rail 1, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Buffer i,1	**3,01**	0	0	**2,13**	0	0

Wheel i,1	**0**	0	-22,8	**0**	0	-4,99
Wheel i,2	**0**	0	-22,9	**0**	0	-5,02

Trolley(s) at Rail 2, positive driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Buffer i,1	**2,12**	0	0	**3,02**	0	0
Wheel i,1	**0**	0	-4,70	**0**	0	-23,1
Wheel i,2	**0**	0	-4,77	**0**	0	-23,2

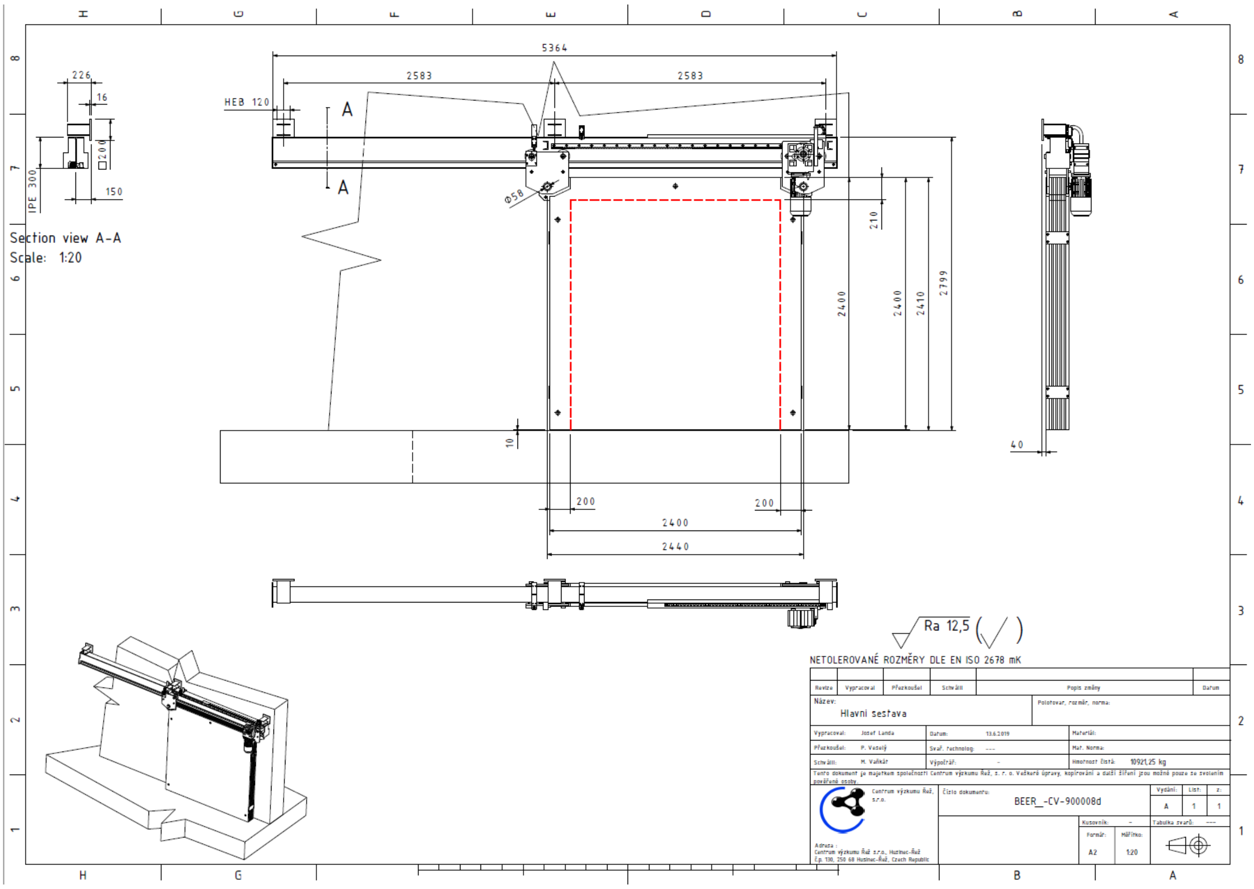
Trolley(s) at Rail 1, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	0	-22,8	**0**	0	-4,99
Wheel i,2	**0**	0	-22,9	**0**	0	-5,02
Buffer i,2	**-3,01**	0	0	**-2,13**	0	0

Trolley(s) at Rail 2, negative driving direction

Component	Crane rail 1 (i=1)			Crane rail 2 (i=2)		
	Longitudinal	Transverse	Vertical	Longitudinal	Transverse	Vertical
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Wheel i,1	**0**	0	-4,70	**0**	0	-23,1
Wheel i,2	**0**	0	-4,77	**0**	0	-23,2
Buffer i,2	**-2,12**	0	0	**-3,02**	0	0

2.1.4 HEAVY DOOR



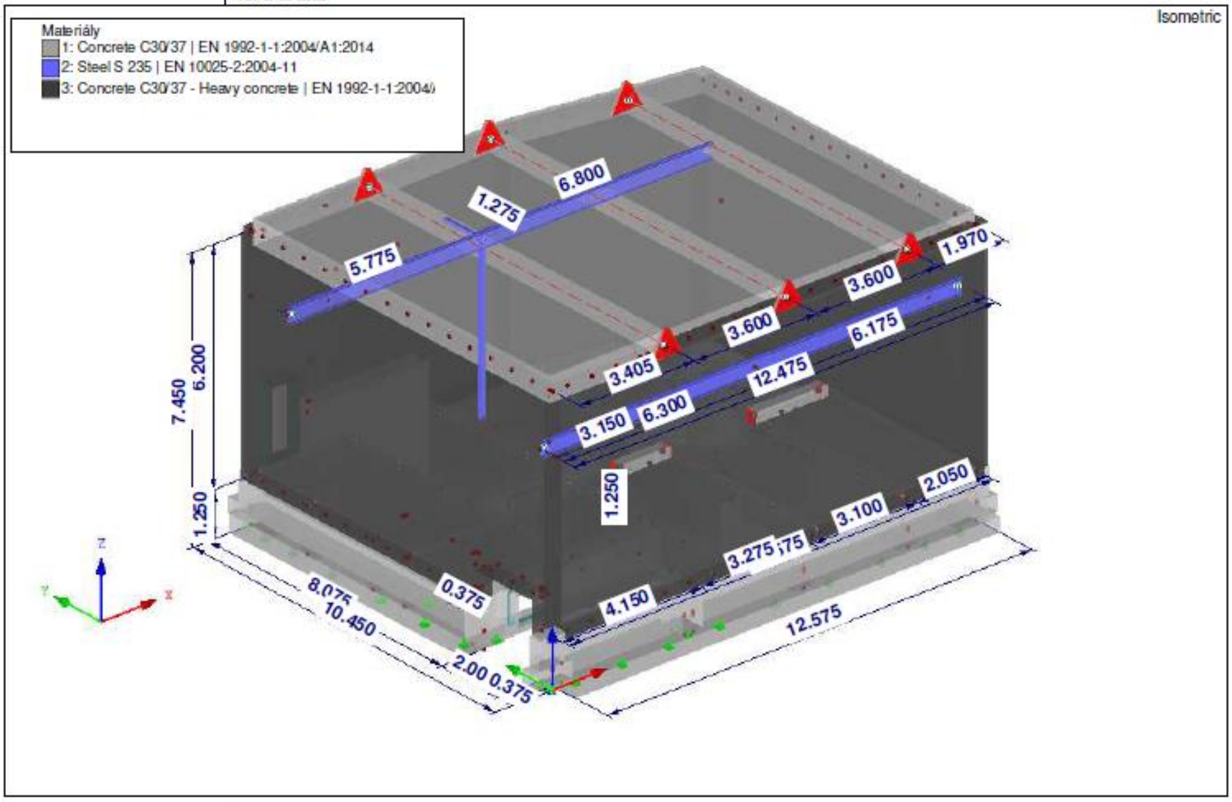
Weight of heavy door ….   10,921 kg -> **107,135** kN

In this static calculation is assessment only anchoring to the wall of concrete walls.

2.2 SPATIAL MODEL OF EXPERIMENTAL CAVE

Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	1/24
						Sheet:	1

MODEL



MODEL - GENERAL DATA

General	Model name	:	Beer_Neuvia - prefa - úprava rozdělení na segmenty
	Type of model	:	3D
	Positive direction of global axis Z	:	Upward
	Classification of load cases and combinations	:	According to Standard: EN 1990 + EN 1991-3; Jeøáby National Annex: CEN - EU
	☒ Automatically create combinations	:	☒ Load Combinations
Options	☐ RF-FORM-FINDING - Find initial equilibrium shapes of membrane and cable structures		
	☐ RF-CUTTING-PATTERN		
	☐ Piping analysis		
	☐ Use CQC Rule		
	☐ Enable CAD/BIM model		
	Standard Gravity		
	g	:	10.00 m/s²

FE MESH SETTINGS

General	Target length of finite elements	l_{FE}	:	0.3 m
	Maximum distance between a node and a line to integrate it into the line	ε	:	0.0 m
	Maximum number of mesh nodes (in thousands)		:	500
Members	Number of divisions of members with cable, elastic foundation, taper, or plastic characteristic		:	10
	☒ Activate member divisions for large deformation or post-critical analysis			
	☒ Use division for members with node lying on them			
Surfaces	Maximum ratio of FE rectangle diagonals	Δ_D	:	1.800
	Maximum out-of-plane inclination of two finite elements	α	:	0.50 °
	Shape direction of finite elements		:	Triangles and quadrangles ☒ Same squares where possible

1.3 MATERIALS

Matl. No.	Modulus E [N/mm²]	Modulus G [N/mm²]	Poisson's Ratio ν [-]	Spec. Weight γ [kN/m³]	Coeff. of Th. Exp. α [1/°C]	Partial Factor γ_M [-]	Material Model
1	Concrete C30/37 | EN 1992-1-1:2004/A1:2014						
	33000.00	13750.00	0.200	25.00	1.00E-05	1.00	Isotropic Linear Elastic
2	Steel S 235 | EN 10025-2:2004-11						
	210000.00	80769.20	0.300	78.50	1.20E-05	1.00	Isotropic Linear Elastic
3	Concrete C20/25 | EN 1992-1-1:2004/A1:2014						
	30000.00	12500.00	0.200	38.50	1.00E-05	1.00	Isotropic Linear Elastic

1.4 SURFACES

Surface No.	Surface Type Geometry	Surface Type Stiffness	Boundary Lines No.	Matl. No.	Thickness Type	Thickness d [mm]	Area A [m²]	Weight W [kg]
1	Plane	Standard	1,107,407,404,401, 409,413,416,419,422, 425,428,431,434,437, 440,960,4,117,132, 439,436,433,200,430, 427,424,138,421,139, 418,415,412,410,20, 21,24,400,403,406,25, 53	3	Constant	550.0	63.090	133593.0
2	Plane	Standard	1,443,446,449,452, 454,457,22,128,461, 185,975,464,467,470, 97,472,43,40,475,479, 482,60,94,74,487,490, 277,145,120,8,489, 486,100,484,481,478, 476,473,83,469,466, 463,460,458,86,455,9, 451,448,445,442	3	Constant	550.0	77.965	165091.0
3	Plane	Standard	12,84,563,566,570, 573,576,89,579,16, 581,584,588,591,117, 114,184,587,153,585, 582,311,231,578,52, 575,572,310,298,569, 137,567,564,131,123	3	Constant	550.0	44.471	94166.5
4	Plane	Standard	13,560,557,554,551, 548,103,545,542,539, 14,130,290,540,543, 546,192,190,549,552, 555,558,109,116,561, 123	3	Constant	650.0	32.182	80535.1
5	Plane	Standard	14,19,972,537,534, 531,528,525,522,519, 516,513,510,507,504, 501,498,495,112,120, 129,492,494,497,500, 503,506,509,512,135, 515,151,518,521,136, 524,527,530,533,536	3	Constant	650.0	59.210	148173.0
7	Plane	Standard	33,172,167,186,133, 34,915,917,918,42, 169,176	1	Constant	600.0	5.616	8424.2
9	Plane	Standard	44,182,895,896,189, 191,46,47,304,317, 313,315,122	1	Constant	300.0	6.933	5200.1
10	Plane	Standard	48,118,175,173,168, 205,125,49,897,913, 914,152,76,51	1	Constant	300.0	6.933	5200.1
13	Plane	Standard	61,157,62-64	1	Constant	600.0	2.219	3328.1
31	Plane	Standard	140,148,51,142,46	1	Constant	300.0	1.375	1031.3
37	Plane	Standard	93,177,906,73,911,179	1	Constant	600.0	3.125	4687.5
38	Plane	Standard	98,181,907,75,912,183	1	Constant	600.0	3.125	4687.5
41	Plane	Standard	95,38,905,70,909,204	1	Constant	600.0	0.938	1406.3
42	Plane	Standard	207-210	1	Constant	600.0	1.294	1940.6
43	Plane	Standard	211-214	1	Constant	600.0	1.294	1940.6
44	Plane	Standard	215-217,207	1	Constant	600.0	1.295	1943.1
45	Plane	Standard	218,379,149,219,220, 216	1	Constant	600.0	1.294	1940.6
46	Plane	Standard	221,211,223,219	1	Constant	600.0	1.295	1942.3
47	Plane	Standard	224-226,209	1	Constant	600.0	1.295	1942.3
48	Plane	Standard	227,160,228,229,225	1	Constant	600.0	1.294	1940.6
49	Plane	Standard	230,165,274,213,232, 228	1	Constant	600.0	1.294	1941.6
52	Plane	Standard	241-244,144,146	1	Constant	600.0	2.330	3494.9
53	Plane	Standard	281,246,247,243	1	Constant	600.0	2.325	3487.5
56	Plane	Standard	254-256,307	1	Constant	600.0	2.330	3494.9
57	Plane	Standard	272,271,258-260,256	1	Constant	600.0	2.325	3487.5
63	Plane	Standard	2,17,101,206,37,36	1	Constant	600.0	1.125	1687.3
65	Plane	Standard	141,55,71,939,916,56, 39,90	1	Constant	550.0	13.065	17964.4
66	Plane	Standard	56,68,942,96	1	Constant	600.0	2.481	3721.9
68	Plane	Standard	828,263,264,846,851, 254	1	Constant	600.0	2.324	3486.6
70	Plane	Standard	852,869,246,280,278, 871	1	Constant	600.0	2.330	3494.9
71	Plane	Standard	943,944,77,910,946,78	1	Constant	1250.0	4.298	13429.7
72	Plane	Standard	536,533,530,527,524, 136,521,518,151,515, 135,512,509,506,503, 500,497,494,492,129, 904,59,943,126	1	Constant	750.0	7.640	14325.0
73	Plane	Standard	7,6,41,91,92,77, 902-899	1	Constant	1600.0	5.030	20120.0
74	Plane	Standard	22,457,454,452,449,4	1	Constant	750.0	10.689	20041.4

1.4 SURFACES

Surface No.	Surface Type Geometry	Stiffness	Boundary Lines No.	Matl. No.	Thickness Type	d [mm]	Area A [m²]	Weight W [kg]
			446,443,23,82,81, 899-902,944,59,904, 145,277,490,487,74, 94,60,482,479,475,40, 43,472,97,470,467, 464,975,185,461,128					
75	Plane	Standard	131,564,567,137,569, 298,310,572,575,52, 578,231,311,582,585, 153,587,184,114,948, 80,949,950	1	Constant	750.0	6.344	11894.2
76	Plane	Standard	130,290,540,543,546, 192,190,549,552,555, 558,109,116,561,950, 953,78,126	1	Constant	750.0	4.412	8272.6
77	Plane	Standard	946,15,11,953	1	Constant	1600.0	2.076	8305.0
78	Plane	Standard	949,3,10,50,65,11	1	Constant	1600.0	2.985	11940.8
79	Plane	Standard	3,80,955,956,18,45,69	1	Constant	1250.0	3.876	12112.5
80	Plane	Standard	132,439,436,433,200, 430,427,424,138,421, 139,418,415,412,410, 20,79,955,948	1	Constant	750.0	6.218	11658.3
81	Plane	Standard	23,82,958,959,53	1	Constant	750.0	0.289	541.4
82	Plane	Standard	958,81,7,908,27	1	Constant	1150.0	0.180	517.5
83	Plane	Standard	960,440,437,434,431, 428,425,422,419,416, 413,409,401,404,407, 961-963	1	Constant	700.0	34.901	61077.2
84	Plane	Standard	964-966,962	1	Constant	700.0	36.900	64575.0
85	Plane	Standard	967-970,965	1	Constant	700.0	36.031	63054.2
86	Plane	Standard	971,972,537,534,531, 528,525,522,519,516, 513,510,507,504,501, 498,495,973,969	1	Constant	700.0	18.761	32832.0
90	Plane	Standard	175,174,329,330,178, 342,345,461,128,95, 203,37,33,288,292,171	1	Constant	250.0	8.989	5618.0
91	Plane	Standard	127,167,287,291,166, 168	1	Constant	250.0	6.227	3892.2
95	Plane	Standard	310,572,575,52,578, 984,306,300,320,295, 312,283,175,986,340, 318,337-339	1	Constant	250.0	13.108	8192.2
96	Plane	Standard	104,587,153,585,582, 311,303,299,321,294, 316,285,987,168,124, 121	1	Constant	250.0	14.177	8860.9
97	Plane	Standard	490,487,74,94,324, 368-370,202,364,105, 279,515,135,512,509, 506,503,500,497,494, 492,129,145,277	1	Constant	250.0	11.239	7024.4
98	Plane	Standard	322,353-355,276,352, 221,214,274,165,230, 363,198,367-365,314, 482,479,475,40	1	Constant	250.0	11.786	7366.5
99	Plane	Standard	215,210,224,385,390, 267,399,393,396,194, 190,549,552,555,558, 161,377,378,270,382	1	Constant	250.0	8.367	5229.5
100	Plane	Standard	105,279,151,518,521, 136,524,527,530,533, 536,130,290,540,543, 546,193,395,392,398, 266,389,384,387	1	Constant	250.0	9.334	5833.7
101	Plane	Standard	567,564,131,561,116, 106,375,376,268,380, 381,265,269,297,333, 305,334-336,569,137	1	Constant	250.0	13.120	8200.2
102	Plane	Standard	97,472,323,356-358, 273,351,265,269,974, 261,331,332,262,343, 346,975,464,467,470	1	Constant	250.0	13.689	8555.7

1.4.2 SURFACES - INTEGRATED OBJECTS

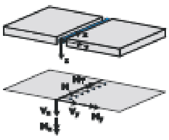
Surface No.	Integrated Objects No. Nodes	Lines	Openings	Comment
1	50,99,100,920, 923,924,1134, 1135,1138, 1140,1142, 1144,1145, 1181	102,141,402,405,408,411,414,417,420, 423,426,429,432,435,438		
2	103,107,444	441,444,447,450,453,456,459,462,465, 468,471,474,477,480,483,485,488		
3	99,184	143,562,565,568,571,574,577,580,583, 586,590	2	
4		538,541,544,547,550,553,556,559		
5	102	491,493,496,499,502,505,508,511,514, 517,520,523,526,529,532,535		
7		36	7	
9			10,11	
10	136,138		8,9	
13	65			
65	50	54,87,113,134,180,319		
72	16,29			
73	82,84	70,73,75		
74	13,29,1161,1	38,177,181,905-907		

1.4.2 SURFACES - INTEGRATED OBJECTS

Surface No.	Integrated Objects No. Nodes	Lines	Openings	Comment
	1162			
75	14,15,65			
76	15,16			
78	65			
79	1168,1170, 1171	71		
80	14,32			
81	13			
83	112-115			
85	71			
86	72			
90	136,138	176		
95	136,138	87,96,317		
96		315,319		
97	154	93,146		
98	61	233,244,280,281		
99	64,925	253,272,307,828		
100	921	264		
101	178,242	47,61,140,157,258		
102	1108	48,98,148,871		

1.6 OPENINGS

Opening No.	Boundary Lines No.	In Surface No.	Area A [m²]	Comment
2	28,589,592,29-31	3	1.800	
7	195,201,199,222	7	1.040	
8	119,152,57,196	10	0.855	
9	988-991	10	0.274	
10	992-995	9	0.274	
11	188,189,187,197	9	0.855	



1.10 LINE HINGES

Hinge No.	Line No.	Surface No.	Side	Axial/Shear Release [kN/m²] u_x	u_y	u_z	Moment Release [kNm/rad/m] φ_x	φ_y	φ_z
1	965	85	-	☐	☐	☐	☒	☐	☐
2	969	85	-	☐	☐	☐	☒	☐	☐
3	962	84	-	☐	☐	☐	☒	☐	☐
4	965	84	-	☐	☐	☐	☒	☐	☐
5	960	83	-	☐	☐	☐	☒	☐	☐
6	962	83	-	☐	☐	☐	☒	☐	☐
7	969	86	-	☐	☐	☐	☒	☐	☐
8	972	86	-	☐	☐	☐	☒	☐	☐
9	167	91	-	☐	☐	☐	☒	☐	☐
10	168	91	-	☐	☐	☐	☒	☐	☐
11	33	90	-	☐	☐	☐	☒	☐	☐
12	128	90	-	☐	☐	☐	☒	☐	☐
13	175	90	-	☐	☐	☐	☒	☐	☐
14	401	83	-	☐	☐	☐	☒	☐	☐
15	404	83	-	☐	☐	☐	☒	☐	☐
16	407	83	-	☐	☐	☐	☒	☐	☐
17	409	83	-	☐	☐	☐	☒	☐	☐
18	413	83	-	☐	☐	☐	☒	☐	☐
19	416	83	-	☐	☐	☐	☒	☐	☐
20	419	83	-	☐	☐	☐	☒	☐	☐
21	422	83	-	☐	☐	☐	☒	☐	☐
22	425	83	-	☐	☐	☐	☒	☐	☐
23	428	83	-	☐	☐	☐	☒	☐	☐
24	431	83	-	☐	☐	☐	☒	☐	☐
25	434	83	-	☐	☐	☐	☒	☐	☐
26	437	83	-	☐	☐	☐	☒	☐	☐
27	440	83	-	☐	☐	☐	☒	☐	☐
28	461	90	-	☐	☐	☐	☒	☐	☐
29	495	86	-	☐	☐	☐	☒	☐	☐
30	498	86	-	☐	☐	☐	☒	☐	☐
31	501	86	-	☐	☐	☐	☒	☐	☐
32	504	86	-	☐	☐	☐	☒	☐	☐
33	507	86	-	☐	☐	☐	☒	☐	☐
34	510	86	-	☐	☐	☐	☒	☐	☐
35	513	86	-	☐	☐	☐	☒	☐	☐
36	516	86	-	☐	☐	☐	☒	☐	☐
37	519	86	-	☐	☐	☐	☒	☐	☐
38	522	86	-	☐	☐	☐	☒	☐	☐
39	525	86	-	☐	☐	☐	☒	☐	☐
40	528	86	-	☐	☐	☐	☒	☐	☐
41	531	86	-	☐	☐	☐	☒	☐	☐
42	534	86	-	☐	☐	☐	☒	☐	☐
43	537	86	-	☐	☐	☐	☒	☐	☐
57	52	95	-	☐	☐	☐	☒	☐	☐
58	578	95	-	☐	☐	☐	☒	☐	☐
59	175	95	-	☐	☐	☐	☒	☐	☐
60	310	95	-	☐	☐	☐	☒	☐	☐
61	572	95	-	☐	☐	☐	☒	☐	☐
62	153	96	-	☐	☐	☐	☒	☐	☐
63	168	96	-	☐	☐	☐	☒	☐	☐
64	311	96	-	☐	☐	☐	☒	☐	☐
65	575	95	-	☐	☐	☐	☒	☐	☐
66	582	96	-	☐	☐	☐	☒	☐	☐
67	585	96	-	☐	☐	☐	☒	☐	☐
68	47	9	-	☐	☐	☐	☒	☐	☐
69	315	9	-	☐	☐	☐	☒	☐	☐
70	317	9	-	☐	☐	☐	☒	☐	☐
71	48	10	-	☐	☐	☐	☒	☐	☐
72	96	66	-	☐	☐	☐	☒	☐	☐
73	61	13	-	☐	☐	☐	☒	☐	☐

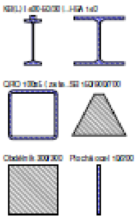
1.10 LINE HINGES

Hinge	Line	Surface		Axial/Shear Release [kN/m²]			Moment Release [kNm/rad/m]		
No.	No.	No.	Side	u_x	u_y	u_z	φ_x	φ_y	φ_z
74	157	13	-	☐	☐	☐	☒	☐	☐
75	258	57	-	☐	☐	☐	☒	☐	☐
76	307	56	-	☐	☐	☐	☒	☐	☐
77	828	68	-	☐	☐	☐	☒	☐	☐
78	244	52	-	☐	☐	☐	☒	☐	☐
79	281	53	-	☐	☐	☐	☒	☐	☐
80	871	70	-	☐	☐	☐	☒	☐	☐
81	93	37	-	☐	☐	☐	☒	☐	☐
82	98	38	-	☐	☐	☐	☒	☐	☐
83	176	7	-	☐	☐	☐	☒	☐	☐
84	37	63	-	☐	☐	☐	☒	☐	☐
85	95	41	-	☐	☐	☐	☒	☐	☐
86	87	65	Left	☐	☐	☐	☒	☐	☐
87	319	65	Left	☐	☐	☐	☒	☐	☐
88	116	101	-	☐	☐	☐	☒	☐	☐
89	131	101	-	☐	☐	☐	☒	☐	☐
90	137	101	-	☐	☐	☐	☒	☐	☐
91	265	101	-	☐	☐	☐	☒	☐	☐
92	97	102	-	☐	☐	☐	☒	☐	☐
93	265	102	-	☐	☐	☐	☒	☐	☐
94	975	102	-	☐	☐	☐	☒	☐	☐
95	40	98	-	☐	☐	☐	☒	☐	☐
96	165	98	-	☐	☐	☐	☒	☐	☐
97	214	98	-	☐	☐	☐	☒	☐	☐
98	221	98	-	☐	☐	☐	☒	☐	☐
99	230	98	-	☐	☐	☐	☒	☐	☐
100	274	98	-	☐	☐	☐	☒	☐	☐
101	74	97	-	☐	☐	☐	☒	☐	☐
102	94	97	-	☐	☐	☐	☒	☐	☐
103	105	97	-	☐	☐	☐	☒	☐	☐
104	105	100	-	☐	☐	☐	☒	☐	☐
105	290	100	-	☐	☐	☐	☒	☐	☐
106	130	100	-	☐	☐	☐	☒	☐	☐
107	136	100	-	☐	☐	☐	☒	☐	☐
108	151	100	-	☐	☐	☐	☒	☐	☐
109	279	100	-	☐	☐	☐	☒	☐	☐
110	129	97	-	☐	☐	☐	☒	☐	☐
111	135	97	-	☐	☐	☐	☒	☐	☐
112	145	97	-	☐	☐	☐	☒	☐	☐
113	277	97	-	☐	☐	☐	☒	☐	☐
114	279	97	-	☐	☐	☐	☒	☐	☐
115	190	99	-	☐	☐	☐	☒	☐	☐
116	210	99	-	☐	☐	☐	☒	☐	☐
117	215	99	-	☐	☐	☐	☒	☐	☐
118	224	99	-	☐	☐	☐	☒	☐	☐
119	144	52	-	☐	☐	☐	☒	☐	☐
120	146	52	-	☐	☐	☐	☒	☐	☐
121	263	68	-	☐	☐	☐	☒	☐	☐
122	264	68	-	☐	☐	☐	☒	☐	☐
123	271	57	-	☐	☐	☐	☒	☐	☐
124	272	57	-	☐	☐	☐	☒	☐	☐
125	278	70	-	☐	☐	☐	☒	☐	☐
126	280	70	-	☐	☐	☐	☒	☐	☐
127	972	5	-	☐	☐	☐	☒	☐	☐
128	960	1	-	☐	☐	☐	☒	☐	☐
129	401	1	-	☐	☐	☐	☒	☐	☐
130	404	1	-	☐	☐	☐	☒	☐	☐
131	407	1	-	☐	☐	☐	☒	☐	☐
132	102	1	Left	☐	☐	☐	☒	☐	☐
133	402	1	Left	☐	☐	☐	☒	☐	☐
134	405	1	Left	☐	☐	☐	☒	☐	☐
135	409	1	-	☐	☐	☐	☒	☐	☐
136	413	1	-	☐	☐	☐	☒	☐	☐
137	416	1	-	☐	☐	☐	☒	☐	☐
138	419	1	-	☐	☐	☐	☒	☐	☐
139	422	1	-	☐	☐	☐	☒	☐	☐
140	425	1	-	☐	☐	☐	☒	☐	☐
141	428	1	-	☐	☐	☐	☒	☐	☐
142	431	1	-	☐	☐	☐	☒	☐	☐
143	434	1	-	☐	☐	☐	☒	☐	☐
144	437	1	-	☐	☐	☐	☒	☐	☐
145	440	1	-	☐	☐	☐	☒	☐	☐
146	408	1	Left	☐	☐	☐	☒	☐	☐
147	411	1	Left	☐	☐	☐	☒	☐	☐
148	414	1	Left	☐	☐	☐	☒	☐	☐
149	417	1	Left	☐	☐	☐	☒	☐	☐
150	420	1	Left	☐	☐	☐	☒	☐	☐
151	423	1	Left	☐	☐	☐	☒	☐	☐
152	426	1	Left	☐	☐	☐	☒	☐	☐
153	429	1	Left	☐	☐	☐	☒	☐	☐
154	432	1	Left	☐	☐	☐	☒	☐	☐
155	435	1	Left	☐	☐	☐	☒	☐	☐
156	438	1	Left	☐	☐	☐	☒	☐	☐
157	1	2	-	☐	☐	☐	☒	☐	☐
158	120	2	-	☐	☐	☐	☒	☐	☐
159	464	102	-	☐	☐	☐	☒	☐	☐
160	467	102	-	☐	☐	☐	☒	☐	☐
161	470	102	-	☐	☐	☐	☒	☐	☐
162	472	102	-	☐	☐	☐	☒	☐	☐
163	475	98	-	☐	☐	☐	☒	☐	☐
164	479	98	-	☐	☐	☐	☒	☐	☐
165	482	98	-	☐	☐	☐	☒	☐	☐
166	487	97	-	☐	☐	☐	☒	☐	☐
167	490	97	-	☐	☐	☐	☒	☐	☐
168	441	2	Left	☐	☐	☐	☒	☐	☐
169	444	2	Left	☐	☐	☐	☒	☐	☐
170	447	2	Left	☐	☐	☐	☒	☐	☐
171	450	2	Left	☐	☐	☐	☒	☐	☐
172	453	2	Left	☐	☐	☐	☒	☐	☐
173	456	2	Left	☐	☐	☐	☒	☐	☐

1.10 LINE HINGES

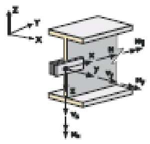
Hinge	Line	Surface		Axial/Shear Release [kN/m²]			Moment Release [kNm/rad/m]		
No.	No.	No.	Side	u_x	u_y	u_z	φ_x	φ_y	φ_z
174	459	2	Left	☐	☐	☐	☒	☐	☐
175	462	2	Left	☐	☐	☐	☒	☐	☐
176	465	2	Left	☐	☐	☐	☒	☐	☐
177	468	2	Left	☐	☐	☐	☒	☐	☐
178	471	2	Left	☐	☐	☐	☒	☐	☐
179	474	2	Left	☐	☐	☐	☒	☐	☐
180	477	2	Left	☐	☐	☐	☒	☐	☐
181	480	2	Left	☐	☐	☐	☒	☐	☐
182	483	2	Left	☐	☐	☐	☒	☐	☐
183	485	2	Left	☐	☐	☐	☒	☐	☐
184	488	2	Left	☐	☐	☐	☒	☐	☐
185	492	97	-	☐	☐	☐	☒	☐	☐
186	495	5	-	☐	☐	☐	☒	☐	☐
187	494	97	-	☐	☐	☐	☒	☐	☐
188	498	5	-	☐	☐	☐	☒	☐	☐
189	497	97	-	☐	☐	☐	☒	☐	☐
190	501	5	-	☐	☐	☐	☒	☐	☐
191	500	97	-	☐	☐	☐	☒	☐	☐
192	504	5	-	☐	☐	☐	☒	☐	☐
193	503	97	-	☐	☐	☐	☒	☐	☐
194	507	5	-	☐	☐	☐	☒	☐	☐
195	506	97	-	☐	☐	☐	☒	☐	☐
196	510	5	-	☐	☐	☐	☒	☐	☐
197	509	97	-	☐	☐	☐	☒	☐	☐
198	513	5	-	☐	☐	☐	☒	☐	☐
199	512	97	-	☐	☐	☐	☒	☐	☐
200	515	97	-	☐	☐	☐	☒	☐	☐
201	516	5	-	☐	☐	☐	☒	☐	☐
202	518	100	-	☐	☐	☐	☒	☐	☐
203	519	5	-	☐	☐	☐	☒	☐	☐
204	522	5	-	☐	☐	☐	☒	☐	☐
205	521	100	-	☐	☐	☐	☒	☐	☐
206	524	100	-	☐	☐	☐	☒	☐	☐
207	525	5	-	☐	☐	☐	☒	☐	☐
208	528	5	-	☐	☐	☐	☒	☐	☐
209	527	100	-	☐	☐	☐	☒	☐	☐
210	531	5	-	☐	☐	☐	☒	☐	☐
211	530	100	-	☐	☐	☐	☒	☐	☐
212	534	5	-	☐	☐	☐	☒	☐	☐
213	533	100	-	☐	☐	☐	☒	☐	☐
214	537	5	-	☐	☐	☐	☒	☐	☐
215	536	100	-	☐	☐	☐	☒	☐	☐
216	491	5	Left	☐	☐	☐	☒	☐	☐
217	493	5	Left	☐	☐	☐	☒	☐	☐
218	496	5	Left	☐	☐	☐	☒	☐	☐
219	499	5	Left	☐	☐	☐	☒	☐	☐
220	502	5	Left	☐	☐	☐	☒	☐	☐
221	505	5	Left	☐	☐	☐	☒	☐	☐
222	508	5	Left	☐	☐	☐	☒	☐	☐
223	511	5	Left	☐	☐	☐	☒	☐	☐
224	514	5	Left	☐	☐	☐	☒	☐	☐
225	517	5	Left	☐	☐	☐	☒	☐	☐
226	520	5	Left	☐	☐	☐	☒	☐	☐
227	523	5	Left	☐	☐	☐	☒	☐	☐
228	526	5	Left	☐	☐	☐	☒	☐	☐
229	529	5	Left	☐	☐	☐	☒	☐	☐
230	532	5	Left	☐	☐	☐	☒	☐	☐
231	535	5	Left	☐	☐	☐	☒	☐	☐
232	540	100	-	☐	☐	☐	☒	☐	☐
233	543	100	-	☐	☐	☐	☒	☐	☐
234	546	100	-	☐	☐	☐	☒	☐	☐
235	549	99	-	☐	☐	☐	☒	☐	☐
236	552	99	-	☐	☐	☐	☒	☐	☐
237	555	99	-	☐	☐	☐	☒	☐	☐
238	558	99	-	☐	☐	☐	☒	☐	☐
239	561	101	-	☐	☐	☐	☒	☐	☐
240	14	4	-	☐	☐	☐	☒	☐	☐
241	538	4	Left	☐	☐	☐	☒	☐	☐
242	541	4	Left	☐	☐	☐	☒	☐	☐
243	544	4	Left	☐	☐	☐	☒	☐	☐
244	547	4	Left	☐	☐	☐	☒	☐	☐
245	550	4	Left	☐	☐	☐	☒	☐	☐
246	553	4	Left	☐	☐	☐	☒	☐	☐
247	556	4	Left	☐	☐	☐	☒	☐	☐
248	559	4	Left	☐	☐	☐	☒	☐	☐
249	564	101	-	☐	☐	☐	☒	☐	☐
250	567	101	-	☐	☐	☐	☒	☐	☐
251	569	101	-	☐	☐	☐	☒	☐	☐
252	587	96	-	☐	☐	☐	☒	☐	☐
253	117	3	-	☐	☐	☐	☒	☐	☐
254	562	3	Left	☐	☐	☐	☒	☐	☐
255	565	3	Left	☐	☐	☐	☒	☐	☐
256	568	3	Left	☐	☐	☐	☒	☐	☐
257	571	3	Left	☐	☐	☐	☒	☐	☐
258	574	3	Left	☐	☐	☐	☒	☐	☐
259	577	3	Left	☐	☐	☐	☒	☐	☐
260	580	3	Left	☐	☐	☐	☒	☐	☐
261	583	3	Left	☐	☐	☐	☒	☐	☐
262	586	3	Left	☐	☐	☐	☒	☐	☐
263	590	3	Left	☐	☐	☐	☒	☐	☐
264	243	53	-	☐	☐	☐	☒	☐	☐
265	246	53	-	☐	☐	☐	☒	☐	☐
266	243	52	-	☐	☐	☐	☒	☐	☐
267	246	70	-	☐	☐	☐	☒	☐	☐
268	254	56	-	☐	☐	☐	☒	☐	☐
269	256	56	-	☐	☐	☐	☒	☐	☐
270	256	57	-	☐	☐	☐	☒	☐	☐
271	254	68	-	☐	☐	☐	☒	☐	☐

1.13 CROSS-SECTIONS



Section No.	Matl. No.	J [cm⁴] / A [cm²]	I_y [cm⁴] / A_y [cm²]	I_z [cm⁴] / A_z [cm²]	Principal Axes α [°]	Rotation α' [°]	Overall Dimensions [mm] Width b	Height h
3	KB(L) I 400-50/30 | Ferona - DIN 1025-1:1995							
	2	274.31 133.00	35373.00 58.80	1191.25 55.22	0.00	0.00	155.0	430.0
4	HEA 140 | Ferona - DIN 1025-3:1994							
	2	8.16 31.40	1030.00 19.83	389.00 6.25	0.00	0.00	140.0	133.0
5	QRO 100x5 (warmgefertigt)							
	2	439.00 18.70	279.00 8.01	279.00 8.01	0.00	0.00	100.0	100.0
6	SB 150/900/700							
	1	1629518.88 3675.00	1245416.63 2818.18	1274765.67 2806.61	0.00	0.00	900.0	700.0
7	Obdélník 300/300							
	1	113940.00 900.00	67500.00 750.00	67500.00 750.00	0.00	0.00	300.0	300.0
8	Plochá ocel 10/200							
	2	6.46 20.00	666.67 16.67	1.67 16.67	0.00	0.00	10.0	200.0

1.14 MEMBER HINGES



Release No.	Reference System	Axial/Shear Release or Spring[kN/m] u_x	u_y	u_z	Moment Release or Spring[kNm/rad] φ_x	φ_y	φ_z	Comment
1	Local x,y,z	☐	☐	☐	☐	☒	☒	

2.1 LOAD CASES

Load Case	Load Case Description	EN 1990 + EN 1991-3; Jeøáby | CEN Action Category	Active	Self-Weight - Factor in Direction X	Y	Z
LC1	Dead load + close door	Permanent	☒	0.000	0.000	-1.000
LC2	Active load from crane 1 - position 1	Imposed from Cranes - category A: Class 1-7	☐			
LC3	Active load from crane 1 - position 2	Imposed from Cranes - category A: Class 1-7	☐			
LC4	Active load	Imposed - Category E: storage areas	☐			
LC5	Dead load + open door	Permanent	☒	0.000	0.000	-1.000
LC6	Active load from crane 2 - position 1	Imposed from Cranes - category A: Class 1-7	☐			
LC7	Active load from crane 2 - position 2	Imposed from Cranes - category A: Class 1-7	☐			
LC8	Active load from crane 3 - position 1	Imposed from Cranes - category A: Class 1-7	☐			
LC9	Active load from crane 3 - position 2	Imposed from Cranes - category A: Class 1-7	☐			

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor	Load Case	
CO1	STR	1.35*ZS1	1	1.35	LC1	Dead load + close door
CO2	STR	1.35*ZS5	1	1.35	LC5	Dead load + open door
CO3	STR	1.35*ZS1 + 1.35*ZS2	1	1.35	LC1	Dead load + close door
			2	1.35	LC2	Active load from crane 1 - position 1
CO4	STR	1.35*ZS1 + 1.35*ZS3	1	1.35	LC1	Dead load + close door
			2	1.35	LC3	Active load from crane 1 - position 2
CO5	STR	1.35*ZS1 + 1.35*ZS6	1	1.35	LC1	Dead load + close door
			2	1.35	LC6	Active load from crane 2 - position 1
CO6	STR	1.35*ZS1 + 1.35*ZS7	1	1.35	LC1	Dead load + close door
			2	1.35	LC7	Active load from crane 2 - position 2
CO7	STR	1.35*ZS1 + 1.35*ZS8	1	1.35	LC1	Dead load + close door
			2	1.35	LC8	Active load from crane 3 - position 1
CO8	STR	1.35*ZS1 + 1.35*ZS9	1	1.35	LC1	Dead load + close door
			2	1.35	LC9	Active load from crane 3 - position 2
CO9	STR	1.35*ZS2 + 1.35*ZS5	1	1.35	LC2	Active load from crane 1 - position 1
			2	1.35	LC5	Dead load + open door
CO10	STR	1.35*ZS3 + 1.35*ZS5	1	1.35	LC3	Active load from crane 1 - position 2
			2	1.35	LC5	Dead load + open door
CO11	STR	1.35*ZS5 + 1.35*ZS6	1	1.35	LC5	Dead load + open door
			2	1.35	LC6	Active load from crane 2 - position 1
CO12	STR	1.35*ZS5 + 1.35*ZS7	1	1.35	LC5	Dead load + open door
			2	1.35	LC7	Active load from crane 2 - position 2
CO13	STR	1.35*ZS5 + 1.35*ZS8	1	1.35	LC5	Dead load + open door
			2	1.35	LC8	Active load from crane 3 - position 1
CO14	STR	1.35*ZS5 + 1.35*ZS9	1	1.35	LC5	Dead load + open door
			2	1.35	LC9	Active load from crane 3 - position 2
CO15	STR	1.35*ZS1 + 1.5*ZS4	1	1.35	LC1	Dead load + close door
			2	1.50	LC4	Active load
CO16	STR	1.5*ZS4 + 1.35*ZS5	1	1.50	LC4	Active load
			2	1.35	LC5	Dead load + open door
CO17	STR	1.35*ZS1 + 1.35*ZS2 + 1.5*ZS4	1	1.35	LC1	Dead load + close door
			2	1.35	LC2	Active load from crane 1 - position 1
			3	1.50	LC4	Active load
CO18	STR	1.35*ZS1 + 1.35*ZS3 + 1.5*ZS4	1	1.35	LC1	Dead load + close door
			2	1.35	LC3	Active load from crane 1 - position 2
			3	1.50	LC4	Active load
CO19	STR	1.35*ZS1 + 1.5*ZS4 + 1.35*ZS6	1	1.35	LC1	Dead load + close door
			2	1.50	LC4	Active load
			3	1.35	LC6	Active load from crane 2 - position 1
CO20	STR	1.35*ZS1 + 1.5*ZS4 + 1.35*ZS7	1	1.35	LC1	Dead load + close door

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor	Load Case	
			2	1.50	LC4	Active load
			3	1.35	LC7	Active load from crane 2 - position 2
CO21	STR	1.35*ZS1 + 1.5*ZS4 + 1.35*ZS8	1	1.35	LC1	Dead load + close door
			2	1.50	LC4	Active load
			3	1.35	LC8	Active load from crane 3 - position 1
CO22	STR	1.35*ZS1 + 1.5*ZS4 + 1.35*ZS9	1	1.35	LC1	Dead load + close door
			2	1.50	LC4	Active load
			3	1.35	LC9	Active load from crane 3 - position 2
CO23	STR	1.35*ZS2 + 1.5*ZS4 + 1.35*ZS5	1	1.35	LC2	Active load from crane 1 - position 1
			2	1.50	LC4	Active load
			3	1.35	LC5	Dead load + open door
CO24	STR	1.35*ZS3 + 1.5*ZS4 + 1.35*ZS5	1	1.35	LC3	Active load from crane 1 - position 2
			2	1.50	LC4	Active load
			3	1.35	LC5	Dead load + open door
CO25	STR	1.5*ZS4 + 1.35*ZS5 + 1.35*ZS6	1	1.50	LC4	Active load
			2	1.35	LC5	Dead load + open door
			3	1.35	LC6	Active load from crane 2 - position 1
CO26	STR	1.5*ZS4 + 1.35*ZS5 + 1.35*ZS7	1	1.50	LC4	Active load
			2	1.35	LC5	Dead load + open door
			3	1.35	LC7	Active load from crane 2 - position 2
CO27	STR	1.5*ZS4 + 1.35*ZS5 + 1.35*ZS8	1	1.50	LC4	Active load
			2	1.35	LC5	Dead load + open door
			3	1.35	LC8	Active load from crane 3 - position 1
CO28	STR	1.5*ZS4 + 1.35*ZS5 + 1.35*ZS9	1	1.50	LC4	Active load
			2	1.35	LC5	Dead load + open door
			3	1.35	LC9	Active load from crane 3 - position 2
CO29	S Ch	ZS1	1	1.00	LC1	Dead load + close door
CO30	S Ch	ZS5	1	1.00	LC5	Dead load + open door
CO31	S Ch	ZS1 + ZS4	1	1.00	LC1	Dead load + close door
			2	1.00	LC4	Active load
CO32	S Ch	ZS4 + ZS5	1	1.00	LC4	Active load
			2	1.00	LC5	Dead load + open door
CO33	S Fr	ZS1	1	1.00	LC1	Dead load + close door
CO34	S Fr	ZS5	1	1.00	LC5	Dead load + open door
CO35	S Fr	ZS1 + 0.9*ZS4	1	1.00	LC1	Dead load + close door
			2	0.90	LC4	Active load
CO36	S Fr	0.9*ZS4 + ZS5	1	0.90	LC4	Active load
			2	1.00	LC5	Dead load + open door
CO37	S Qp	ZS1	1	1.00	LC1	Dead load + close door
CO38	S Qp	ZS5	1	1.00	LC5	Dead load + open door
CO39	S Qp	ZS1 + 0.8*ZS4	1	1.00	LC1	Dead load + close door
			2	0.80	LC4	Active load
CO40	S Qp	0.8*ZS4 + ZS5	1	0.80	LC4	Active load
			2	1.00	LC5	Dead load + open door

2.7 RESULT COMBINATIONS

Result Combin	Description	Loading
RC1	MSU (STR/GEO) - trvalá/doèasná - rovn. 6.10	CO1/s or CO2/s or CO3/s or CO4/s or CO5/s or CO6/s or CO7/s or CO8/s or CO9/s or CO10/s or CO11/s or CO12/s or CO13/s or CO14/s or CO15/s or CO16/s or CO17/s or CO18/s or CO19/s or CO20/s or CO21/s or CO22/s or CO23/s or CO24/s or CO25/s or CO26/s or CO27/s or CO28/s
RC2	MSP - charakteristická	CO29/s or CO30/s or CO31/s or CO32/s
RC3	MSP - èastá	CO33/s or CO34/s or CO35/s or CO36/s
RC4	MSP - kvazistálá	CO37/s or CO38/s or CO39/s or CO40/s

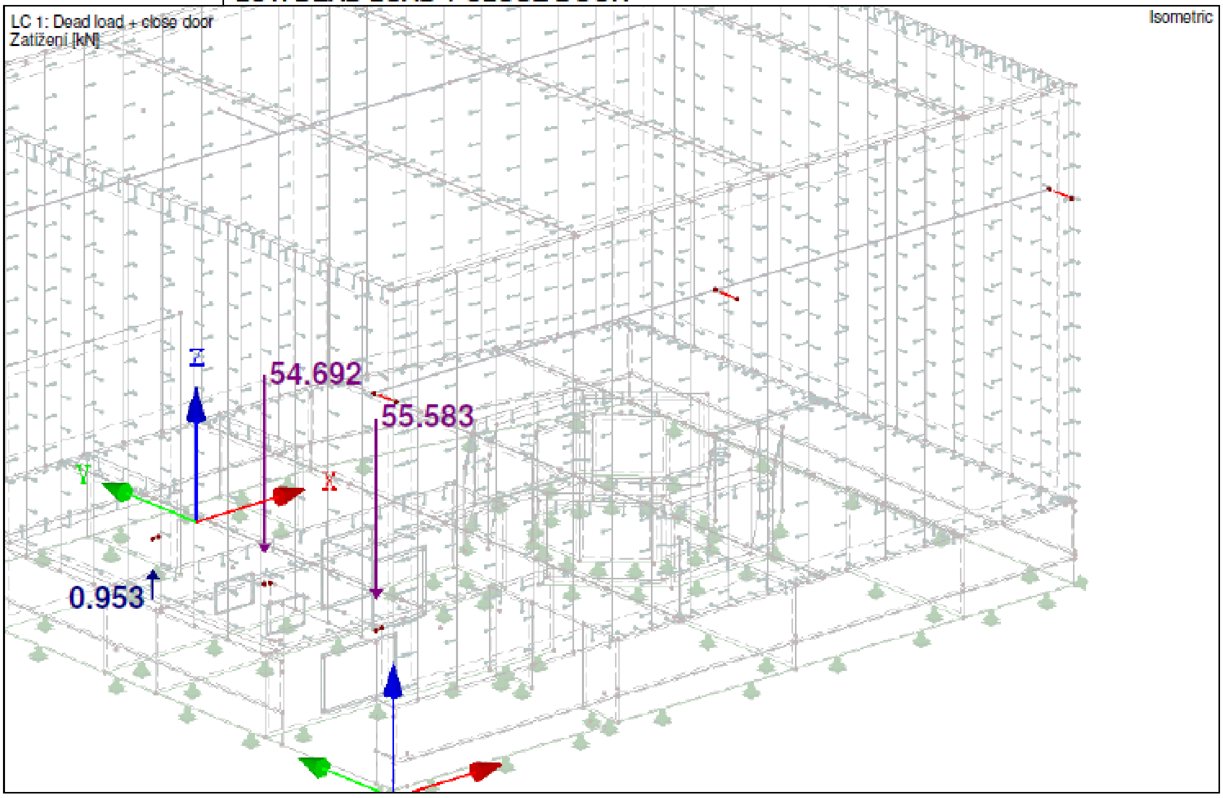
3.1 NODAL LOADS - BY COMPONENTS - COORDINATE SYSTEM

LC1: Dead load + close door

LC1
Dead load + close door

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	1184	0 | Global XYZ	0.000	0.000	-54.692	0.000	0.000	0.000
2	1178	0 | Global XYZ	0.000	0.000	-55.583	0.000	0.000	0.000
3	1188	0 | Global XYZ	0.000	0.000	0.953	0.000	0.000	0.000

LC1: DEAD LOAD + CLOSE DOOR



LC2
Active load from crane 1
- position 1

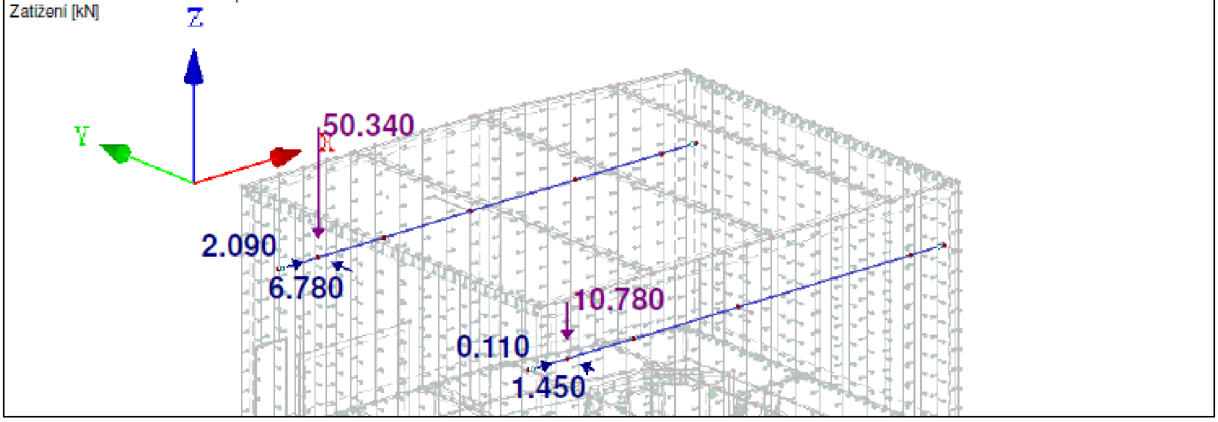
3.1 NODAL LOADS
- BY COMPONENTS
COORDINATE SYSTEM

LC2: Active load from crane 1 - position 1

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	116	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000
2	117	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000

LC2: ACTIVE LOAD FROM CRANE 1 - POSITION 1

LC 2: Active load from crane 1 - position 1
Zatížení [kN]
Isometric



LC3
Active load from crane 1
- position 2

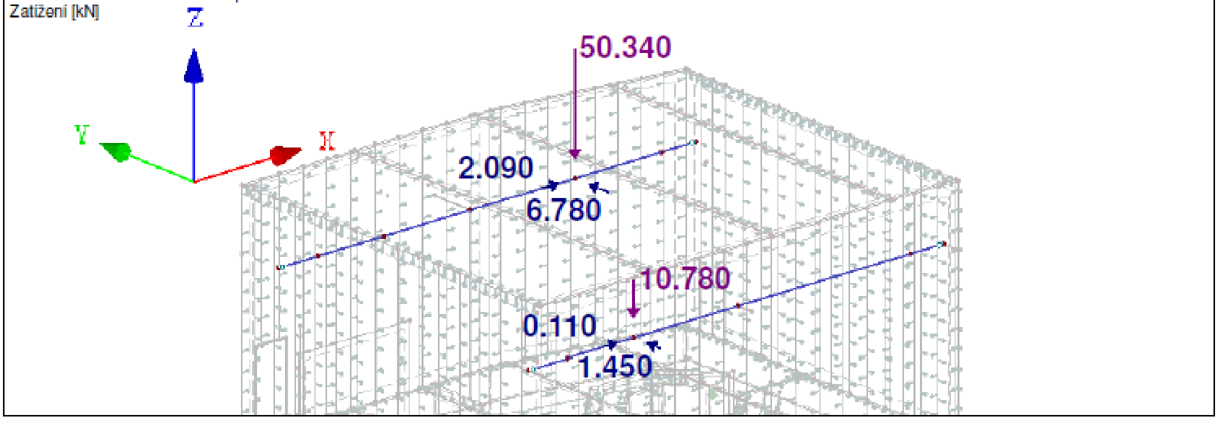
3.1 NODAL LOADS
- BY COMPONENTS
COORDINATE SYSTEM

LC3: Active load from crane 1 - position 2

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	125	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000
2	188	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000

LC3: ACTIVE LOAD FROM CRANE 1 - POSITION 2

LC 3: Active load from crane 1 - position 2
Zatížení [kN]
Isometric



Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	11/24
						Sheet:	1

LC4
Active load

3.3 LINE LOADS

LC4: Active load

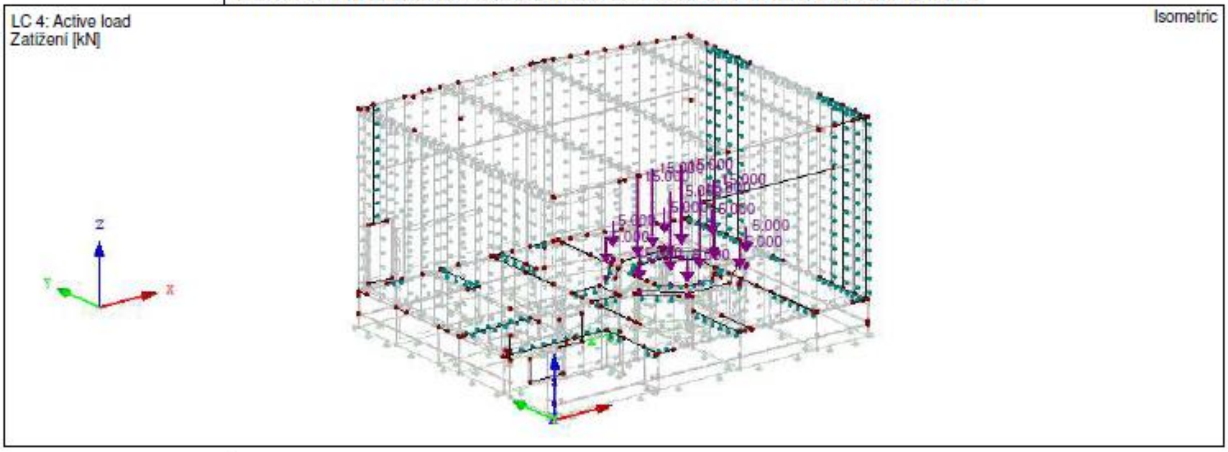
No.	Reference to	On Lines No.	Load Type	Load Distribution	Load Direction	Symbol	Load Parameters Value	Unit
1	Lines	210,214,215,221,224,230	Force	Concentr.	ZL	P	-15.000	kN
						A	0.520	m
2	List of lines	307	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m
3	List of lines	258,271,272	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m
4	List of lines	828,263,264	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m
5	List of lines	871,278,280	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m
6	List of lines	281	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m
7	List of lines	244,144,146	Force	n x P	ZL	P	-5.000	kN
						n	2	
						A	0.160	m
						B	1.540	m

3.4 SURFACE LOADS

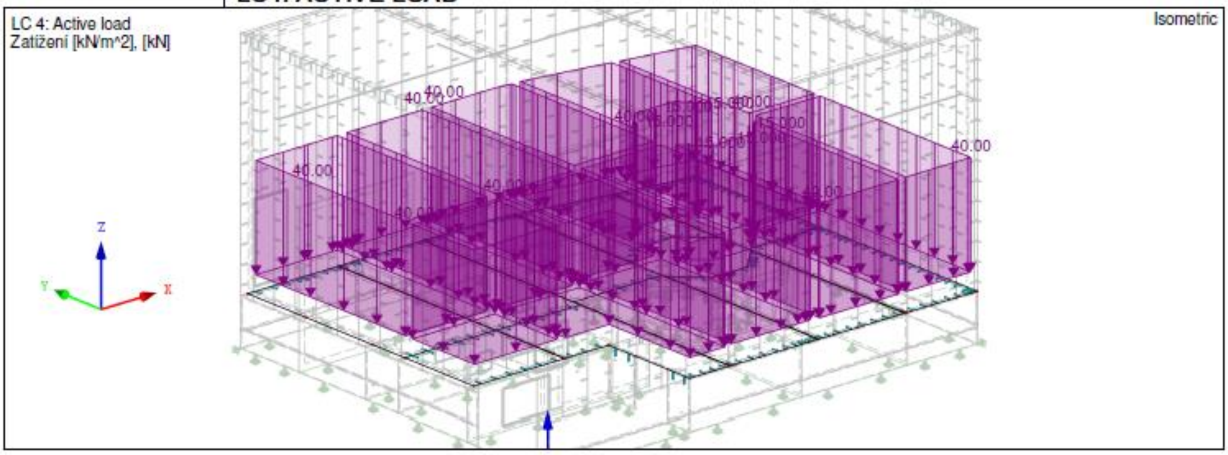
LC4: Active load

No.	On Surfaces No.	Load Type	Load Distribution	Load Direction	Symbol	Load Parameters Value	Unit
1	90,91,95-102	Force	Uniform	ZL	p	-40.00	kN/m²

LC4: ACTIVE LOAD - ASSUMED LOADS ON THE FIXING POINTS



LC4: ACTIVE LOAD



Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	12/24
						Sheet:	1

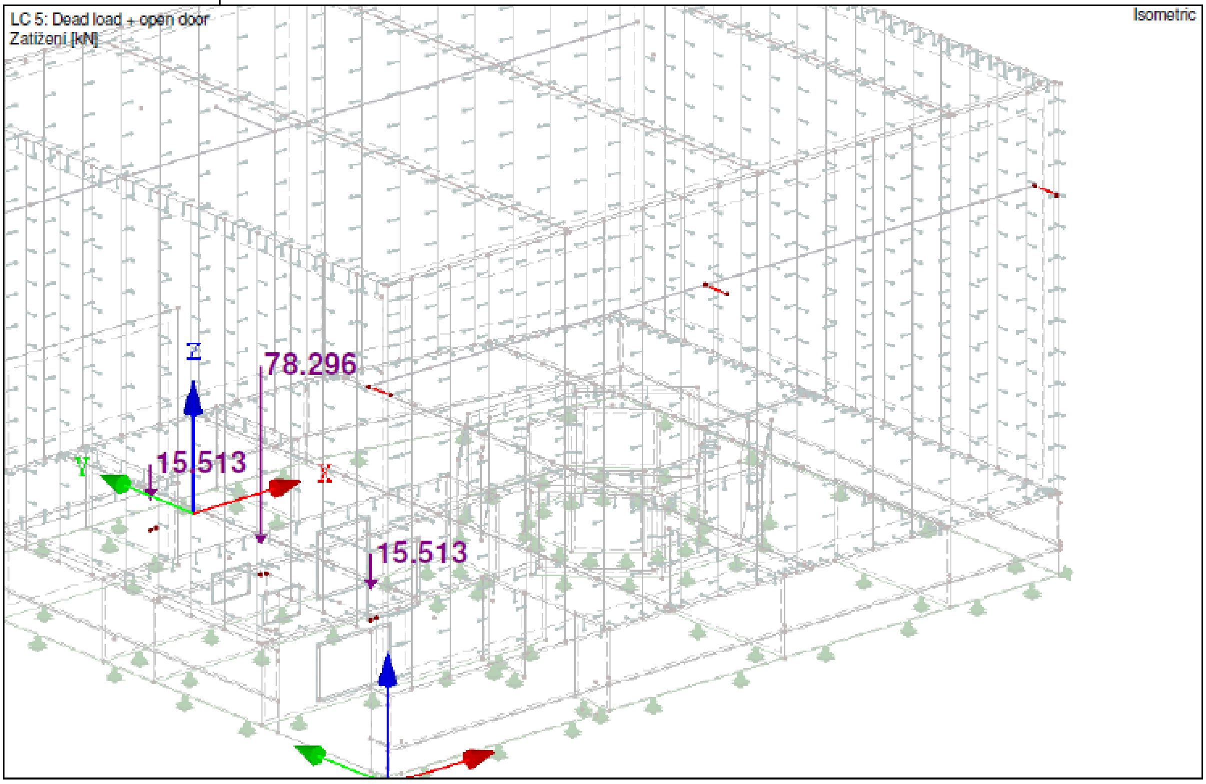
LC5
Dead load + open door

3.1 NODAL LOADS - BY COMPONENTS - COORDINATE SYSTEM

LC5: Dead load + open door

	On Nodes	Coordinate	Force [kN]			Moment [kNm]		
No.	No.	System	P_X / P_U	P_Y / P_V	P_Z / P_W	M_X / M_U	M_Y / M_V	M_Z / M_W
1	1178,1188	0 | Global XYZ	0.000	0.000	-15.513	0.000	0.000	0.000
2	1184	0 | Global XYZ	0.000	0.000	-78.296	0.000	0.000	0.000

LC5: DEAD LOAD + OPEN DOOR



Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	13/24
						Sheet:	1

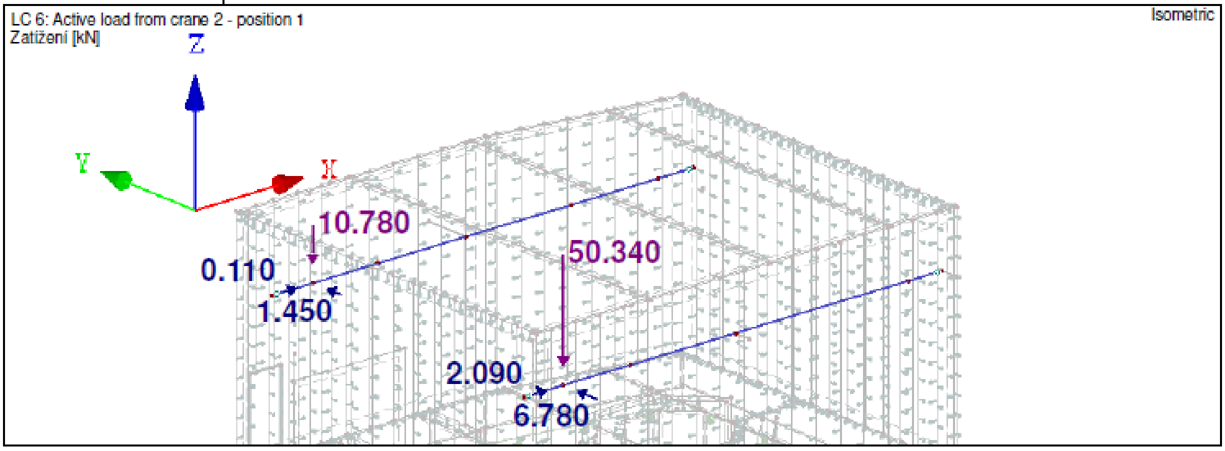
LC6
Active load from crane 2
- position 1

3.1 NODAL LOADS - BY COMPONENTS COORDINATE SYSTEM

LC6: Active load from crane 2 - position 1

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	116	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000
2	117	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000

LC6: ACTIVE LOAD FROM CRANE 2 - POSITION 1



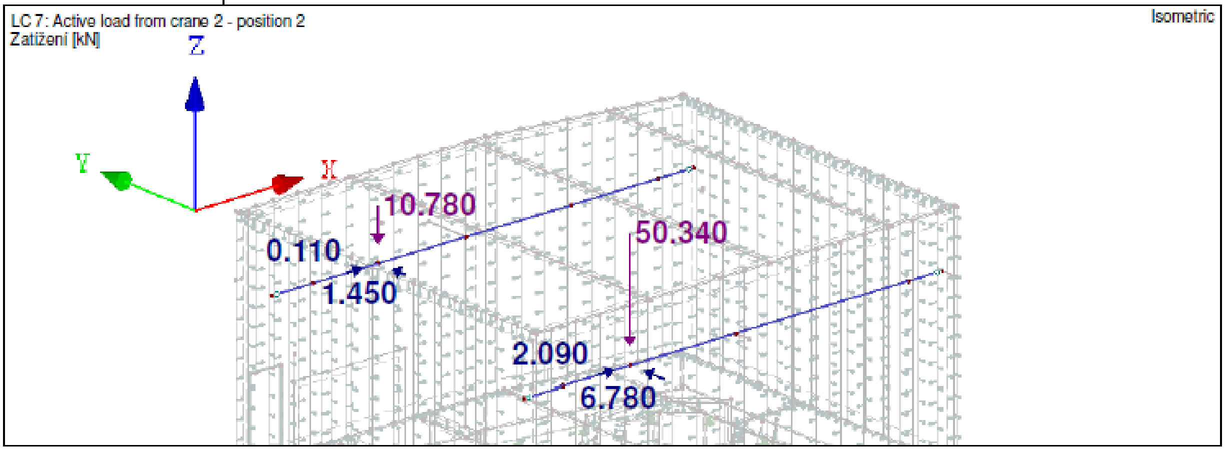
LC7
Active load from crane 2
- position 2

3.1 NODAL LOADS - BY COMPONENTS COORDINATE SYSTEM

LC7: Active load from crane 2 - position 2

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	122	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000
3	125	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000

LC7: ACTIVE LOAD FROM CRANE 2 - POSITION 2



Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	14/24
						Sheet:	1

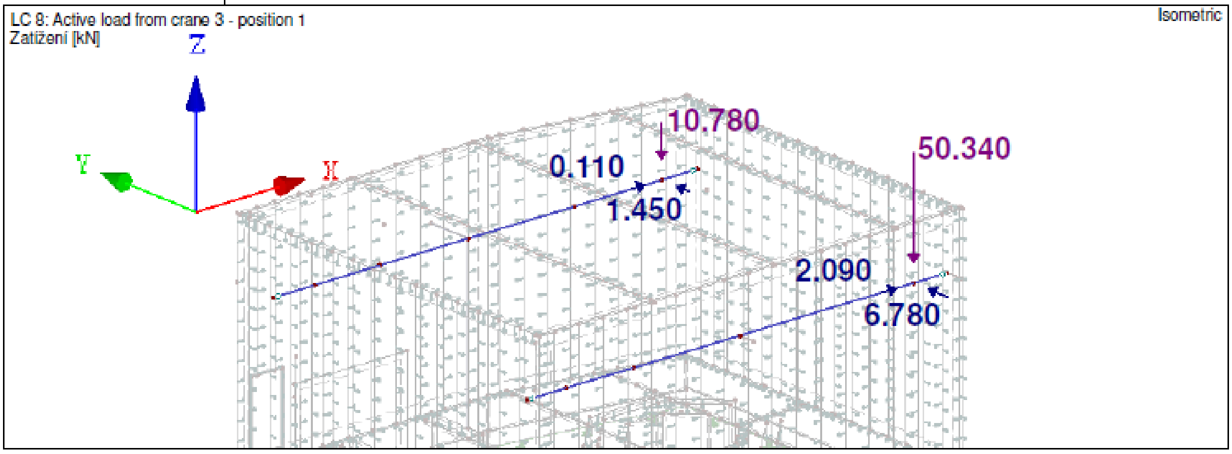
LC8
Active load from crane 3
- position 1

3.1 NODAL LOADS - BY COMPONENTS COORDINATE SYSTEM

LC8: Active load from crane 3 - position 1

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	185	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000
2	186	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000

LC8: ACTIVE LOAD FROM CRANE 3 - POSITION 1



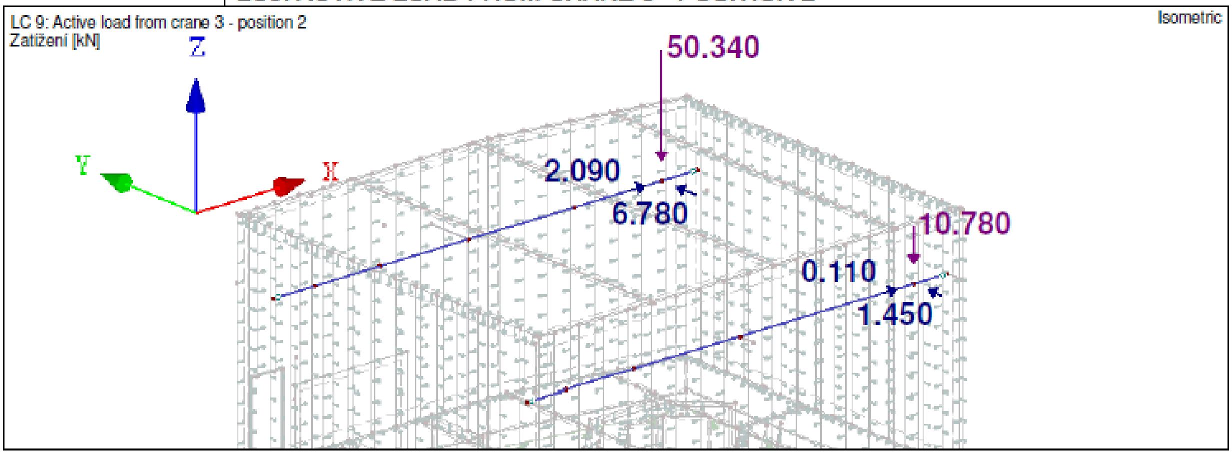
LC9
Active load from crane 3
- position 2

3.1 NODAL LOADS - BY COMPONENTS COORDINATE SYSTEM

LC9: Active load from crane 3 - position 2

No.	On Nodes No.	Coordinate System	Force [kN] P_X / P_U	P_Y / P_V	P_Z / P_W	Moment [kNm] M_X / M_U	M_Y / M_V	M_Z / M_W
1	186	0 | Global XYZ	0.110	1.450	-10.780	0.000	0.000	0.000
3	185	0 | Global XYZ	2.090	6.780	-50.340	0.000	0.000	0.000

LC9: ACTIVE LOAD FROM CRANE 3 - POSITION 2



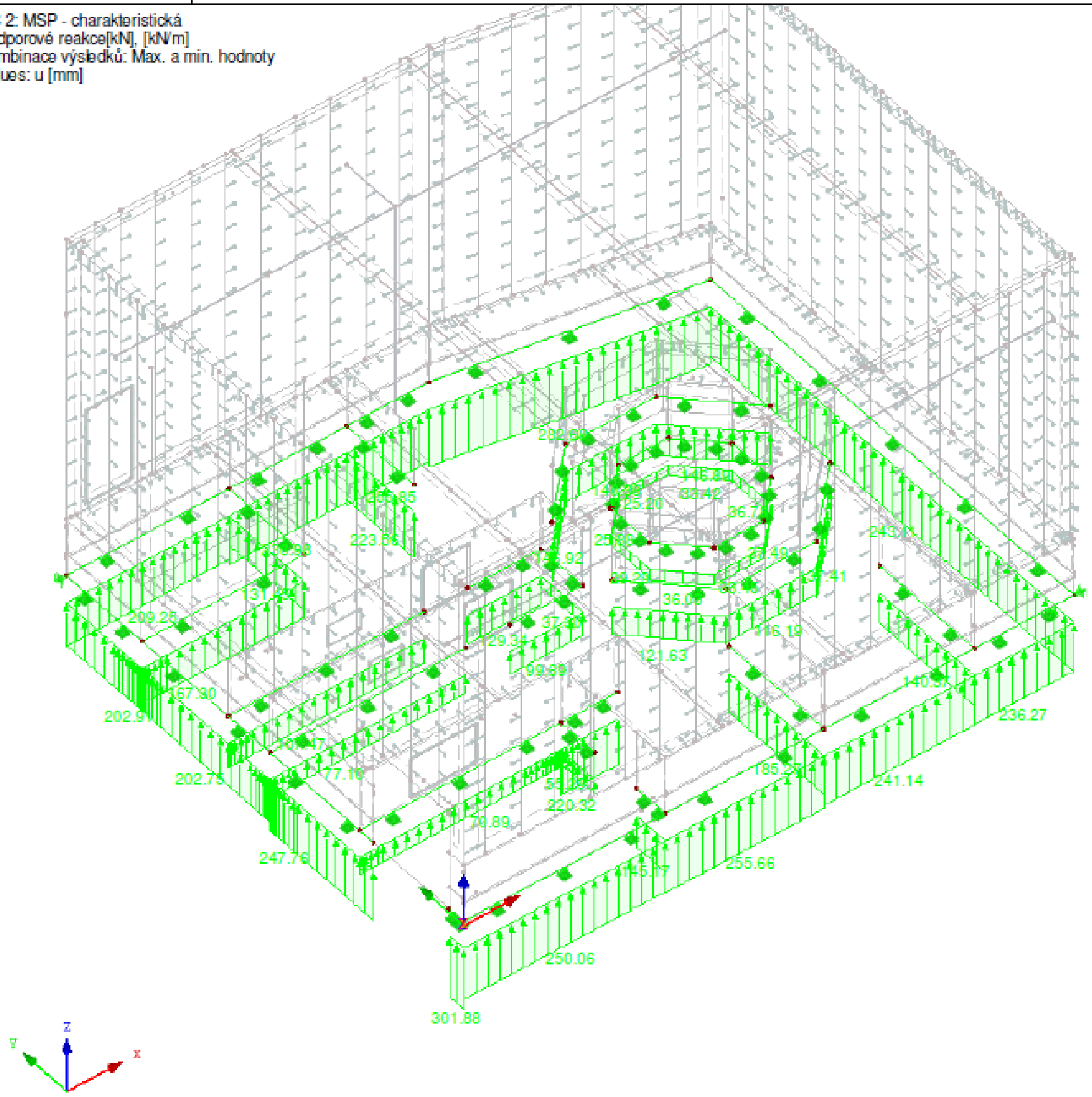
2.2.1 ASSESSMENT OF FOUNDATION UNDER THE CAVE

Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	15/24
						Sheet:	1

PODPOROVÉ REAKCE

RC 2: MSP - charakteristická
Podporové reakce[kN], [kN/m]
Kombinace výsledků: Max. a min. hodnoty
Values: u [mm]

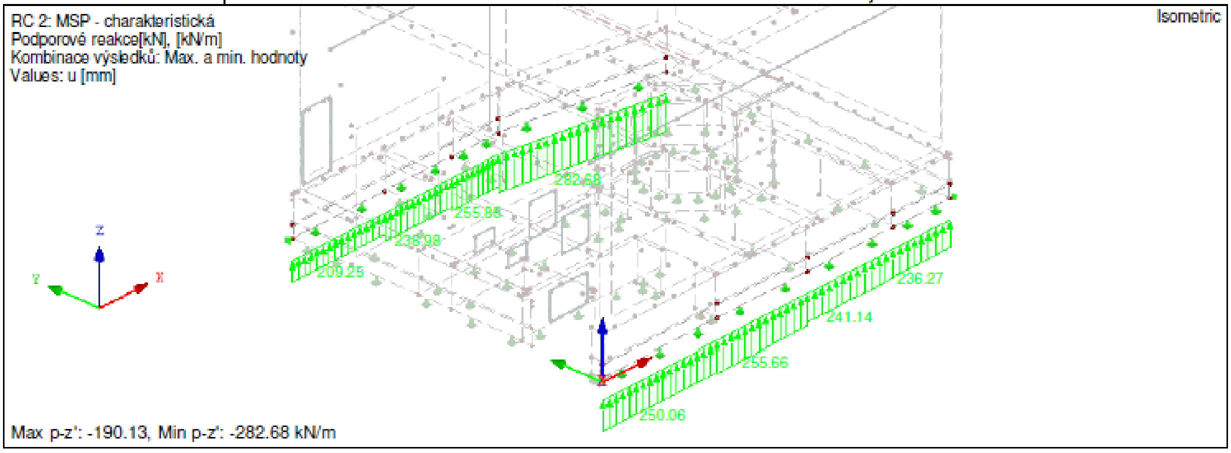
Isometric



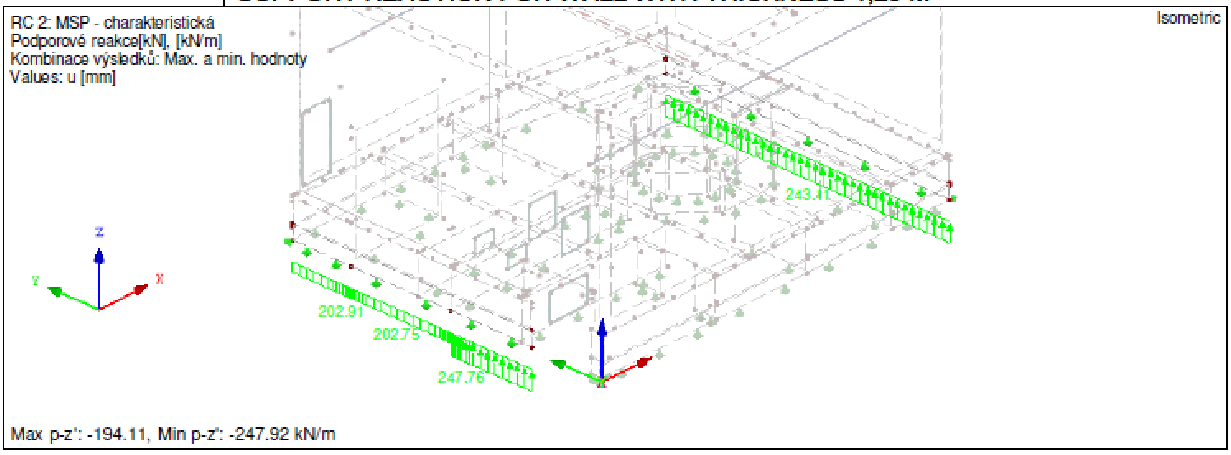
Max p-z': -13.98, Min p-z': -297.77 kN/m

Date: 31.07.2019 | Project: Beer - Nuvia | Model: Prefabrication model | Page: 16/24 | Sheet: 1

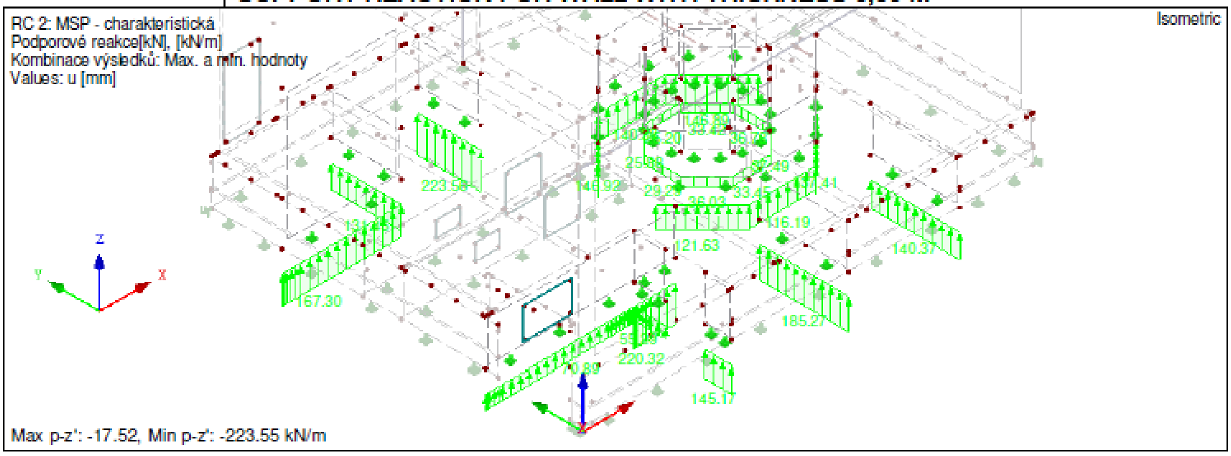
SUPPORT REACTION FOR WALL WITH THICKNESS 1,60 M

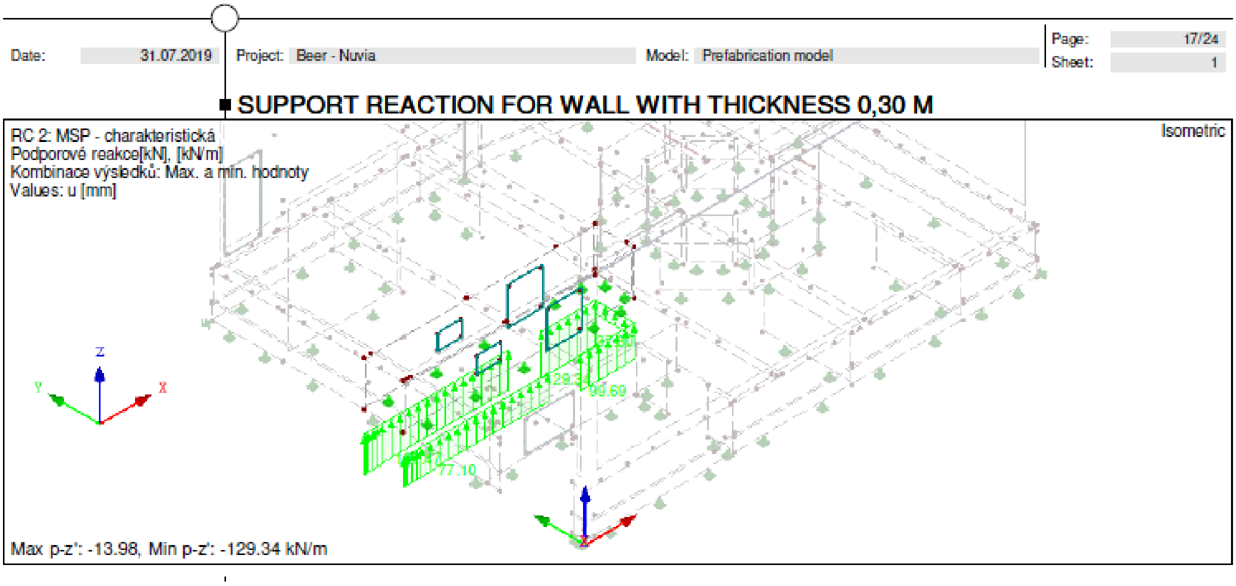


SUPPORT REACTION FOR WALL WITH THICKNESS 1,25 M



SUPPORT REACTION FOR WALL WITH THICKNESS 0,60 M





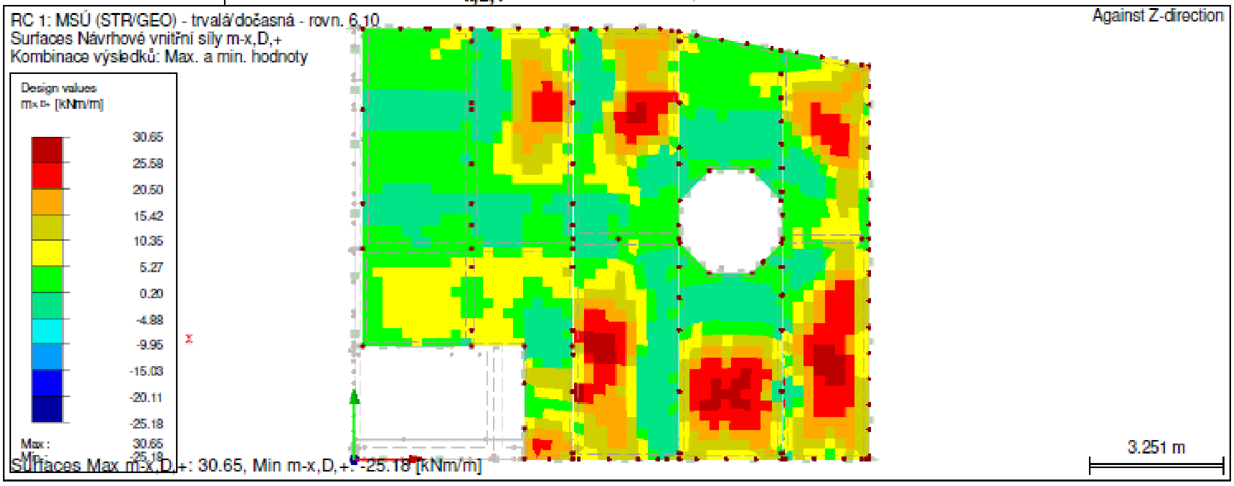
Th. of wall [m]	Bearing capacity [t/m^2]	Load on wall [kN/m]	Results [t/m2]	Comparison [%]
1,60	20	282,68	18,01	0,900
1,25	20	247,92	20,22	1,011
0,60	36	223,55	37,98	1,055
0,30	40	129,34	43,50	1,088

The overload on the floor is acceptable under the value 1,15 % according to communication with Antonio Bianchi and Gabor Laszlo. The max overload on the floor is 1,088 % and the load applied to the floor is satisfactory.

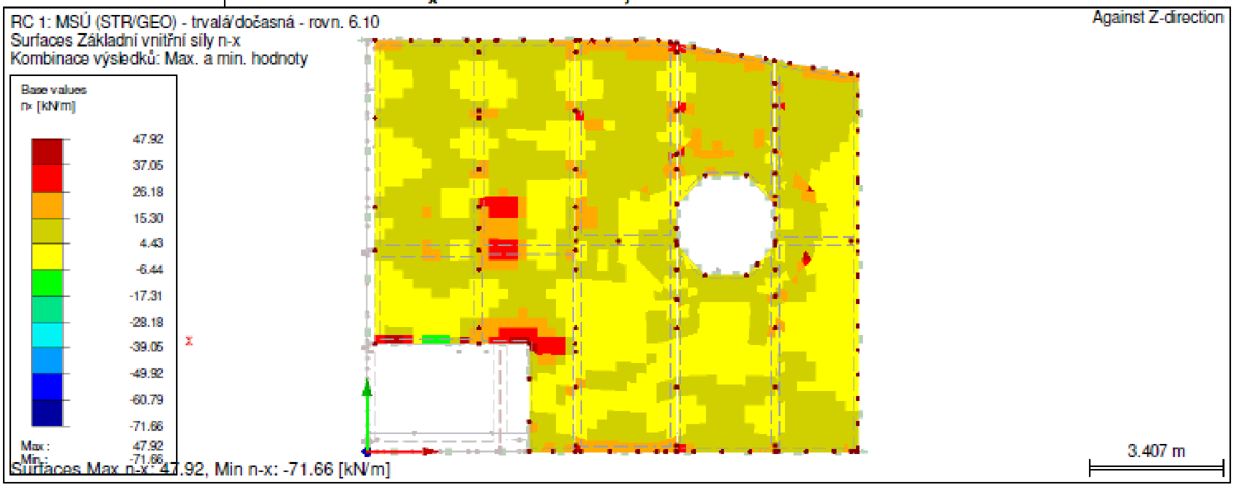
2.2.2 ASSESSMENT MAIN TYPES OF PRE-CAST PANELS

Date: 31.07.2019 | Project: Beer - Nuvia | Model: Prefabrication model | Page: 18/24 | Sheet: 1

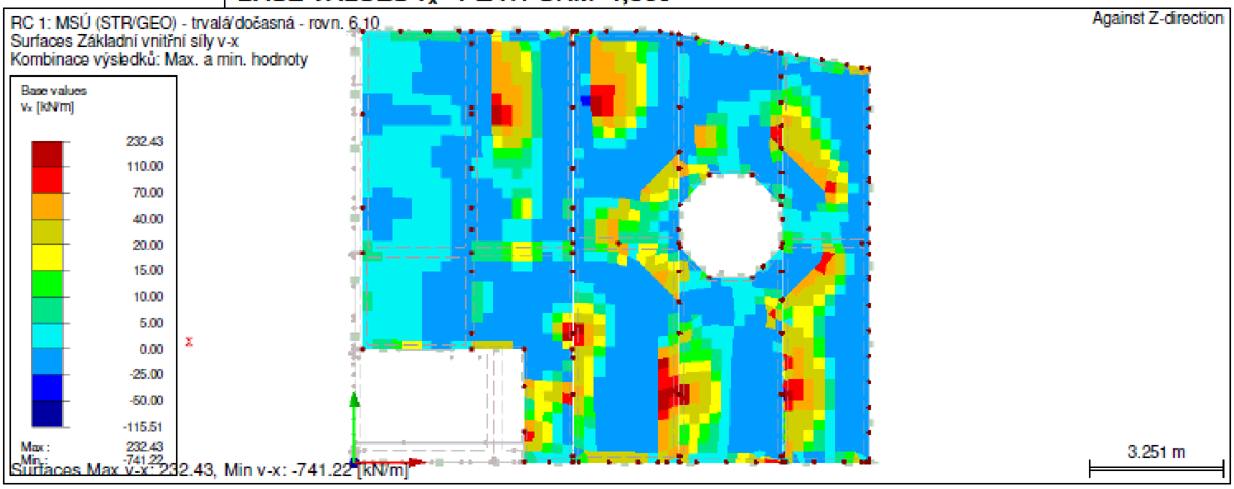
DESIGN VALUES $m_{x,D,+}$ - PLATFORM -1,500



BASE VALUES n_x - PLATFORM -1,500



BASE VALUES v_x - PLATFORM -1,500

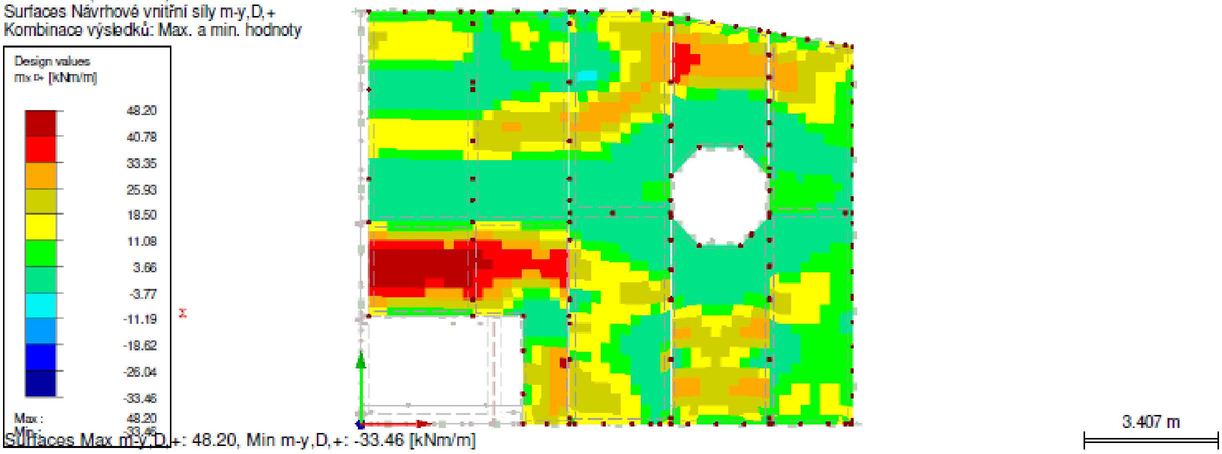


Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	19/24
						Sheet:	1

DESIGN VALUES $m_{y,D,+}$ - PLATFORM -1,500

RC 1: MSÚ (STR/GEO) - trvalá/dočasná - rovn. 6.10
Surfaces Návrhové vnitřní síly m-y,D,+
Kombinace výsledků: Max. a min. hodnoty

Against Z-direction

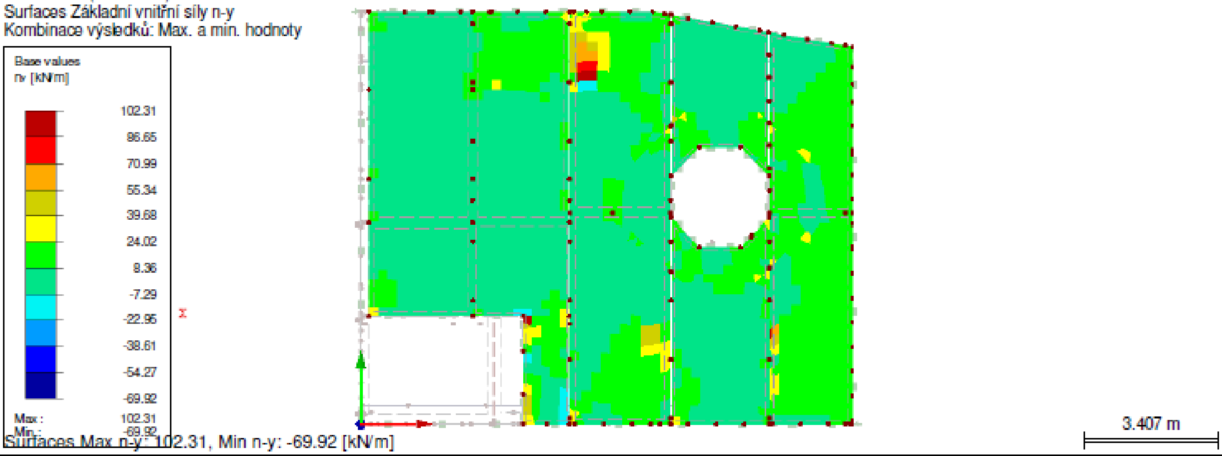


Surfaces Max m-y,D,+: 48.20, Min m-y,D,+: -33.46 [kNm/m]

BASE VALUES n_y - PLATFORM -1,500

RC 1: MSÚ (STR/GEO) - trvalá/dočasná - rovn. 6.10
Surfaces Základní vnitřní síly n-y
Kombinace výsledků: Max. a min. hodnoty

Against Z-direction

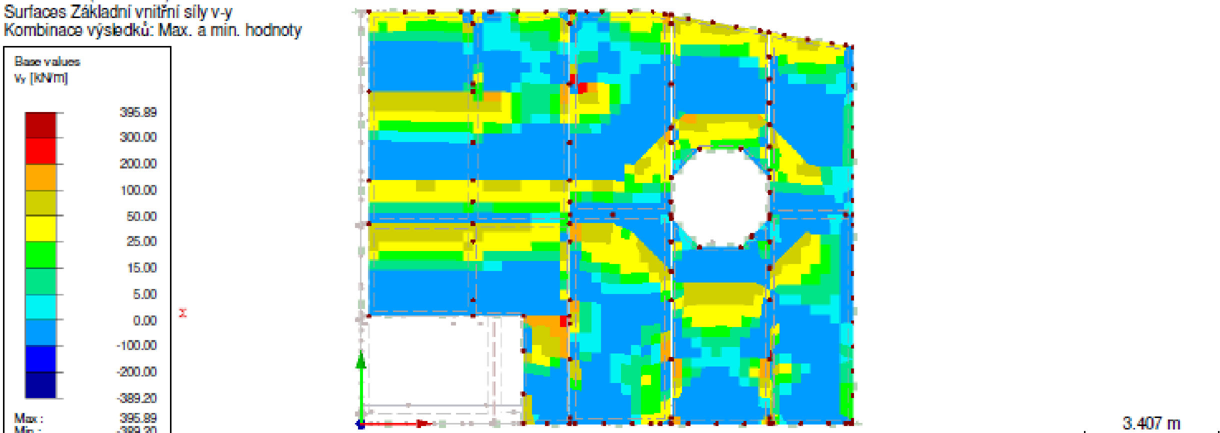


Surfaces Max n-y: 102.31, Min n-y: -69.92 [kN/m]

BASE VALUES v_y - PLATFORM -1,500

RC 1: MSÚ (STR/GEO) - trvalá/dočasná - rovn. 6.10
Surfaces Základní vnitřní síly v-y
Kombinace výsledků: Max. a min. hodnoty

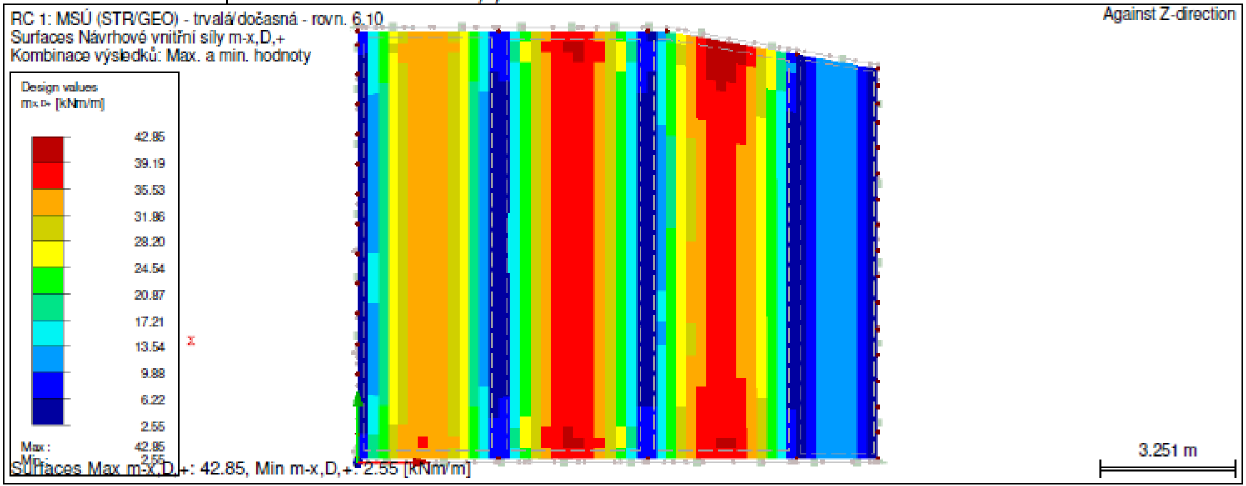
Against Z-direction



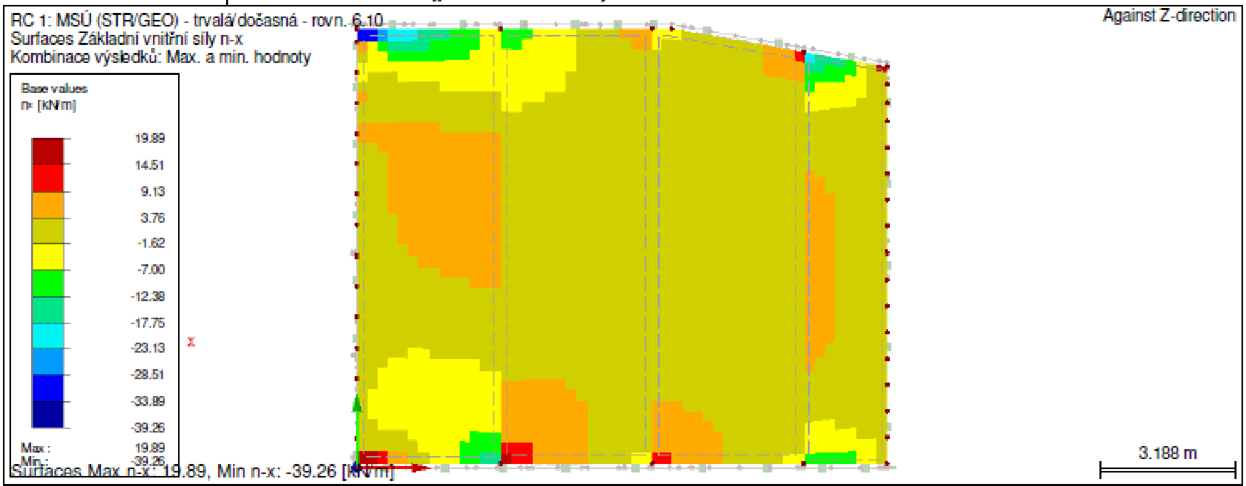
Surfaces Max v-y: 395.89, Min v-y: -389.20 [kN/m]

Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	20/24
						Sheet:	1

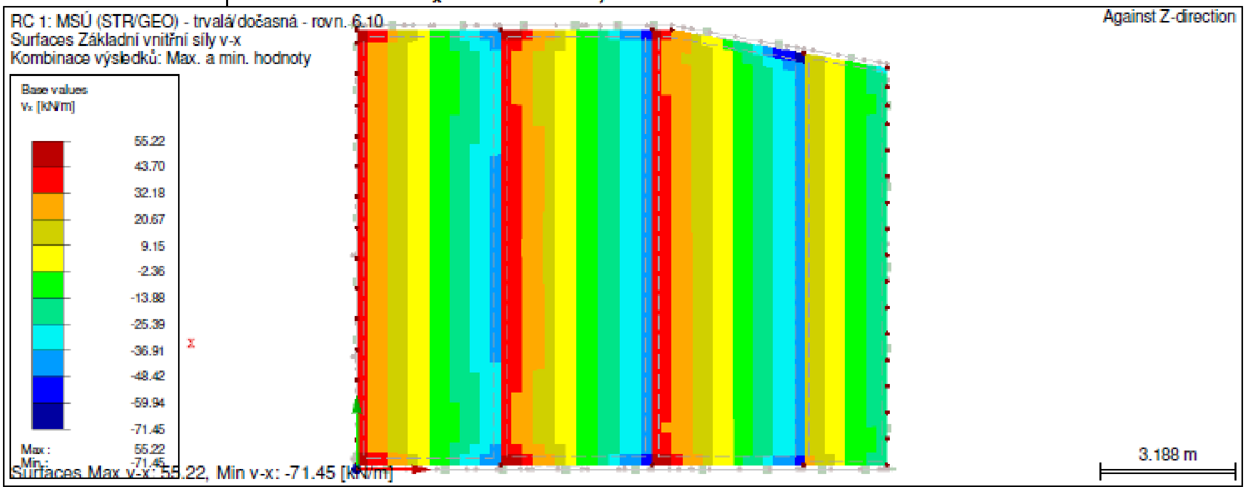
DESING VALUES $M_{x,D,+}$ - CEILING +4,500



BASE VALUES n_x - CEILING +4,500

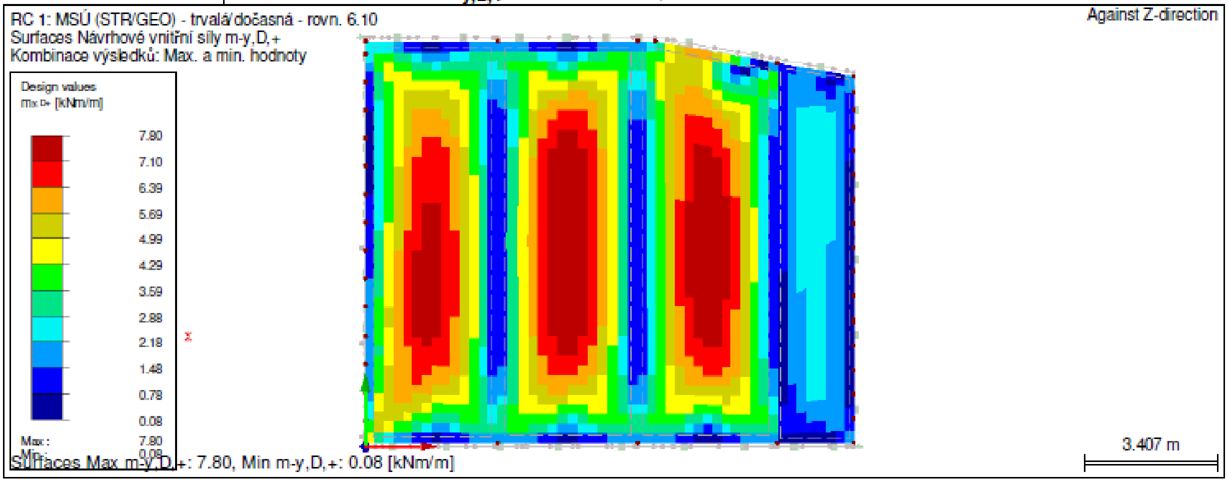


BASE VALUES v_x - CEILING +4,500

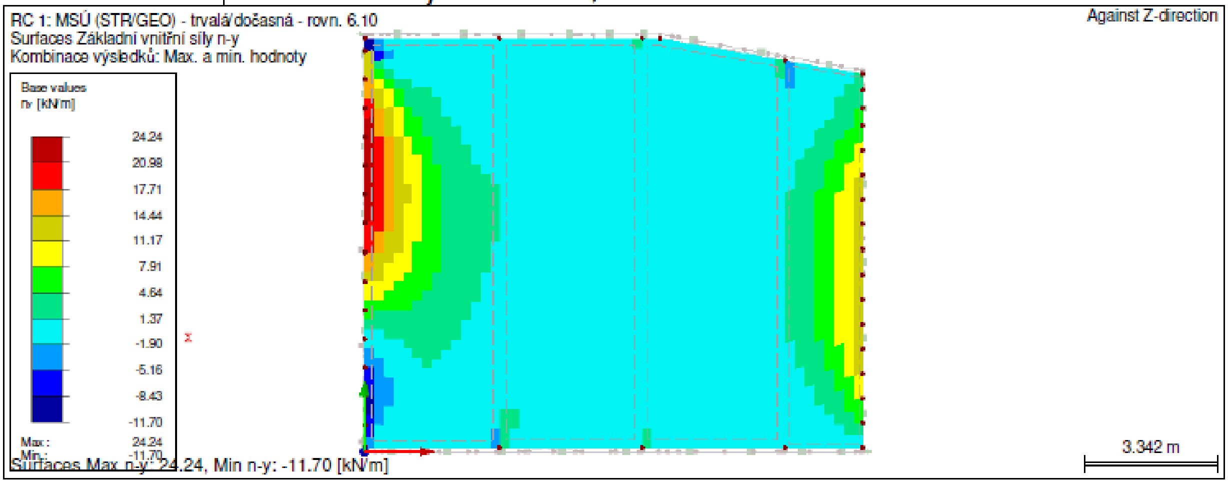


Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	21/24
						Sheet:	1

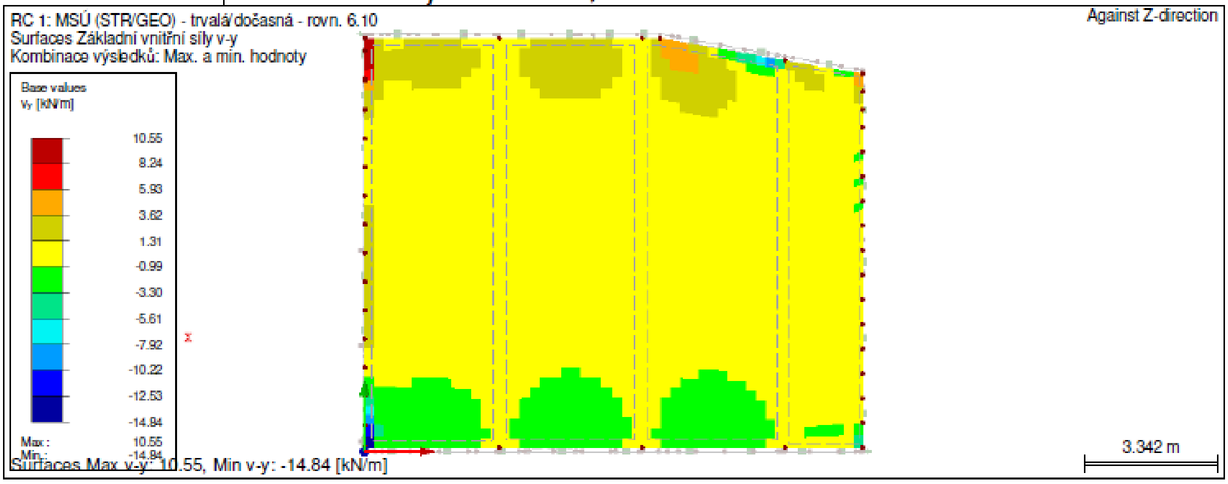
DESING VALUES $M_{y,D,+}$ - CEILING +4,500



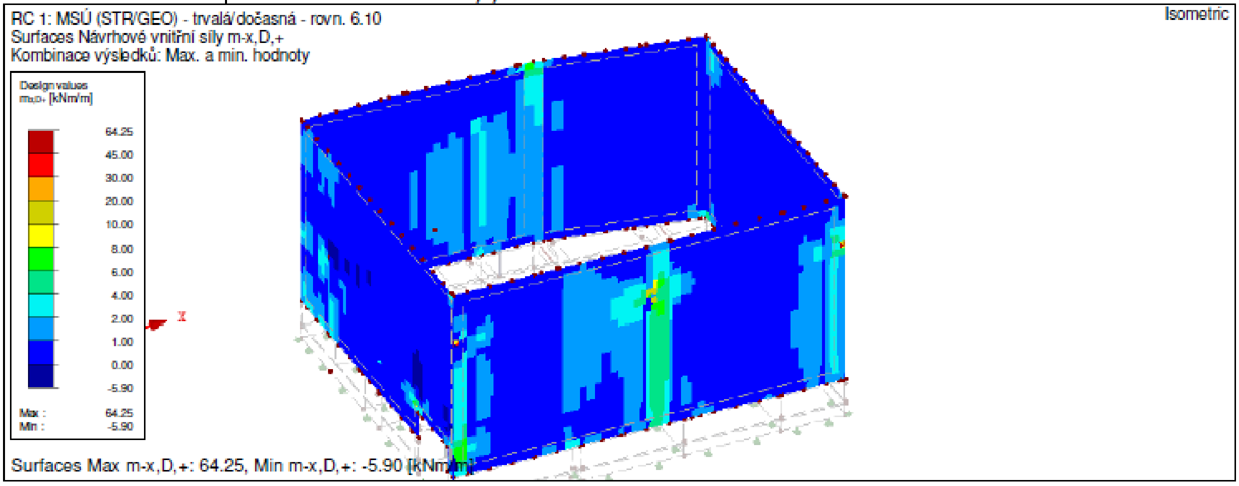
BASE VALUES n_y - CEILING +4,500



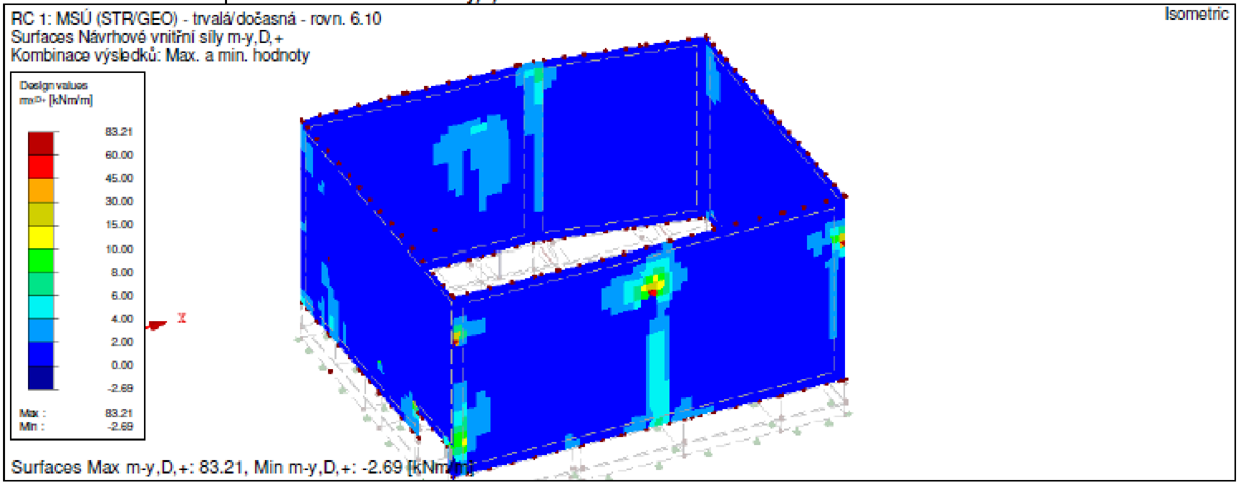
BASE VALUES v_y - CEILING +4,500



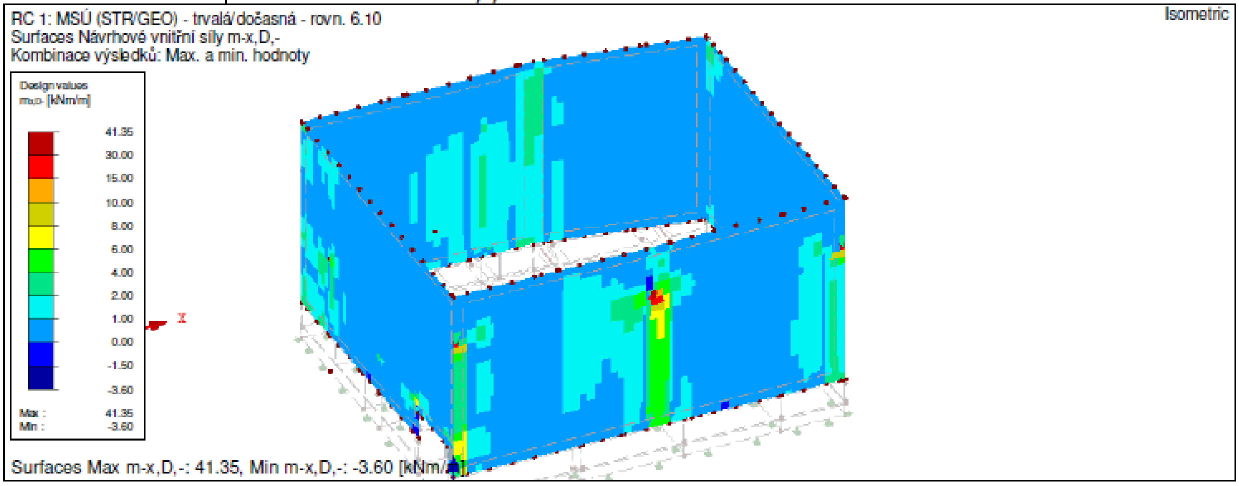
DESIGN VALUES $M_{x,D,+}$ - WALLS



DESIGN VALUES $M_{y,D,+}$ - WALLS

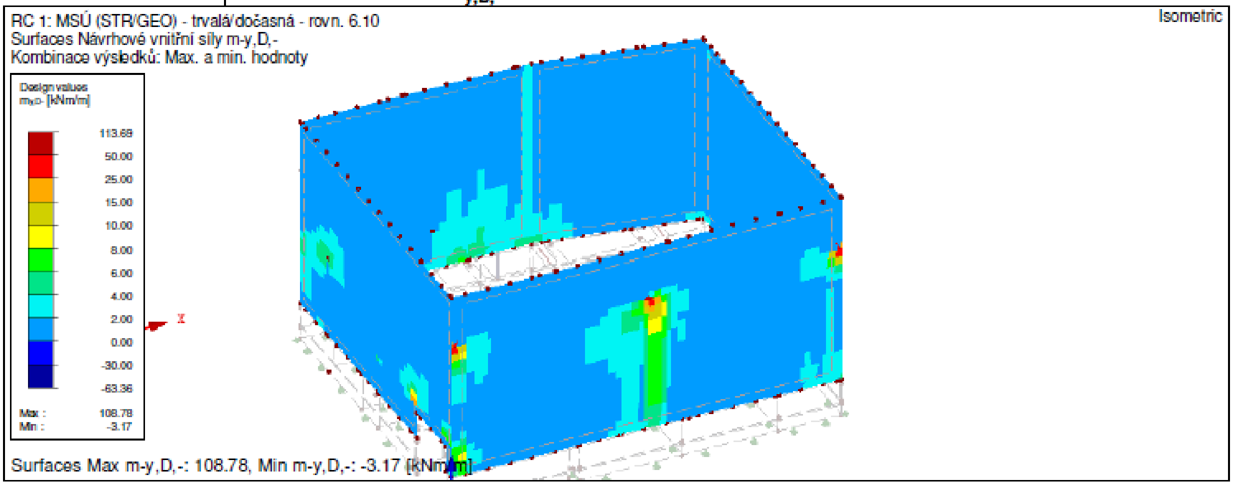


DESIGN VALUES $M_{x,D,-}$ - WALLS

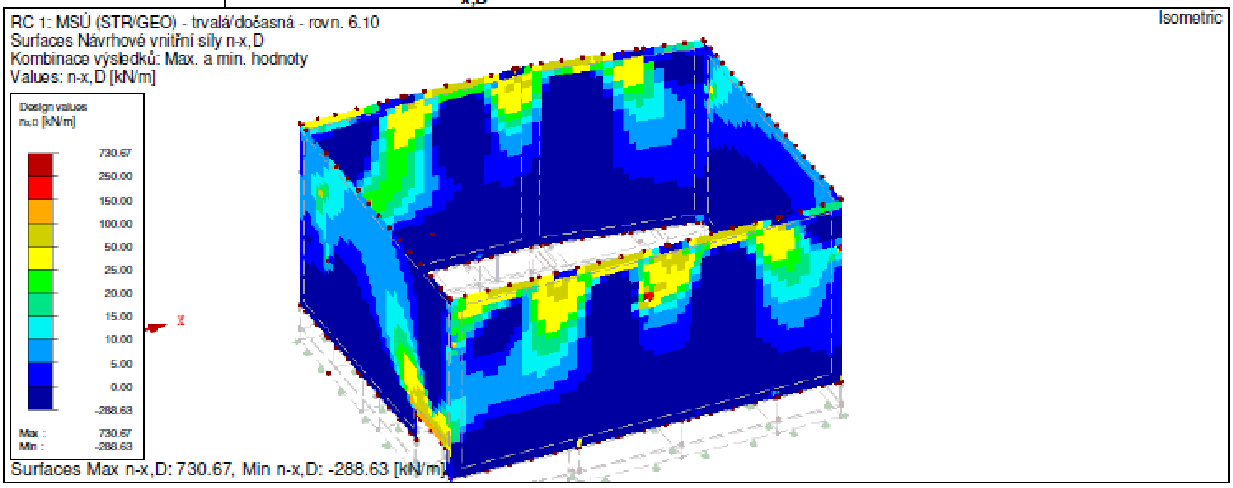


Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	23/24
						Sheet:	1

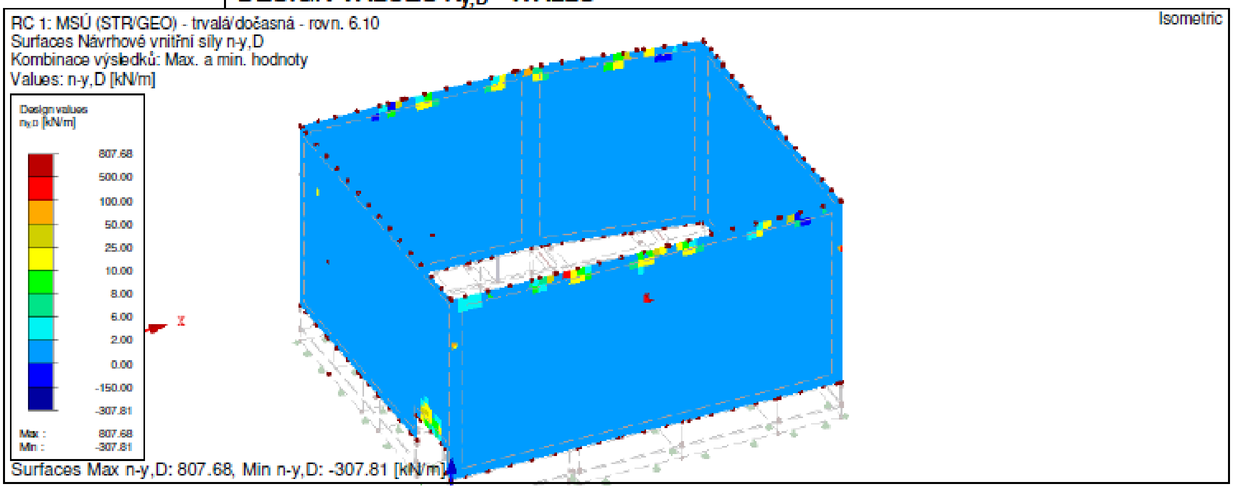
DESIGN VALUES $M_{y,D,-}$ - WALLS



DESIGN VALUES $N_{x,D}$ - WALLS



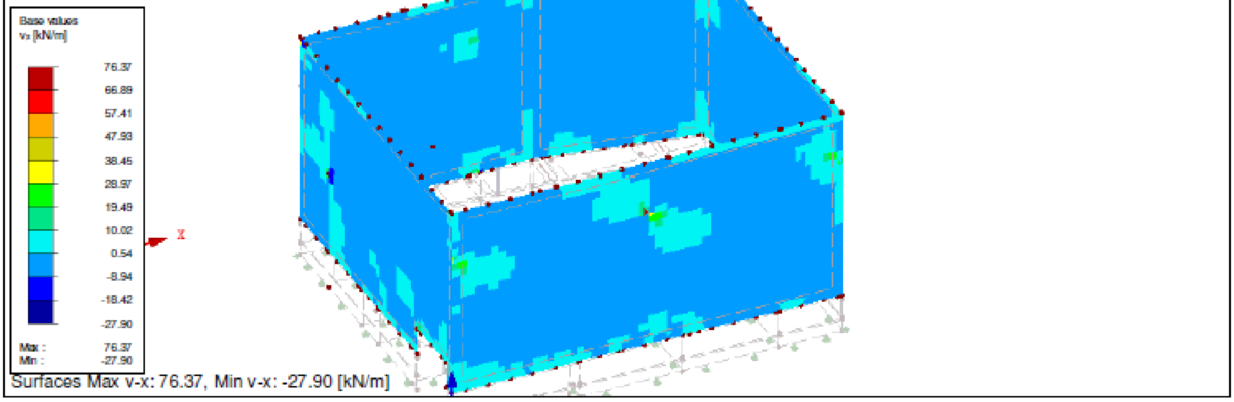
DESIGN VALUES $N_{y,D}$ - WALLS



Date:	31.07.2019	Project:	Beer - Nuvia	Model:	Prefabrication model	Page:	24/24
						Sheet:	1

BASE VALUES V_x - WALLS

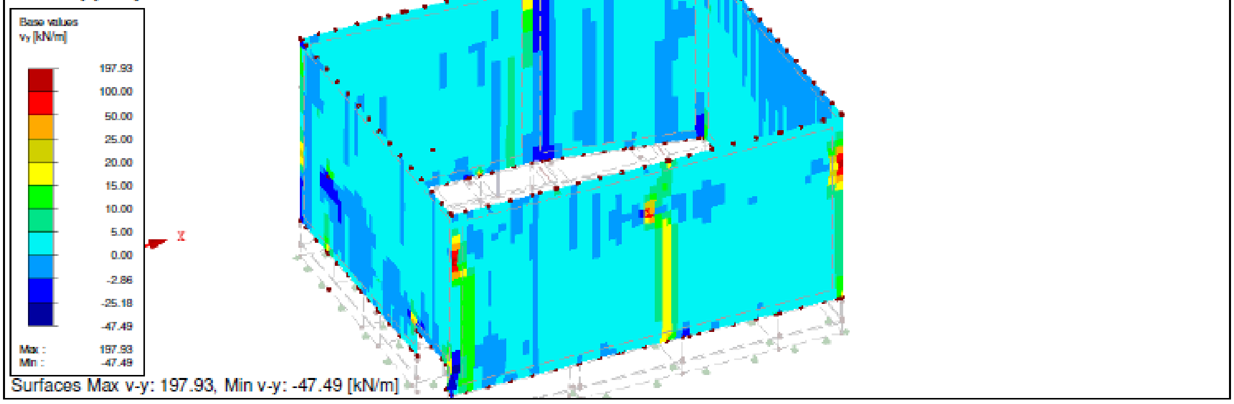
RC 1: MSÚ (STR/GEO) - trvalá/dočasná - rovn. 6.10
Surfaces Základní vnitřní síly v-x
Kombinace výsledků: Max. a min. hodnoty
Values: v-x [kN/m]



Surfaces Max v-x: 76.37, Min v-x: -27.90 [kN/m]

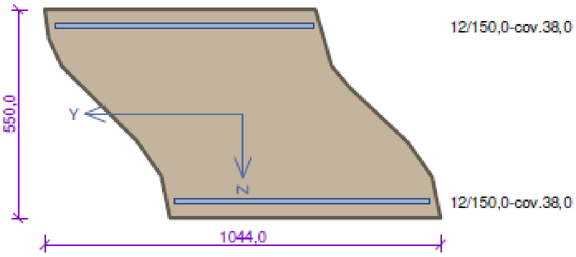
BASE VALUES V_y - WALLS

RC 1: MSÚ (STR/GEO) - trvalá/dočasná - rovn. 6.10
Surfaces Základní vnitřní síly v-y
Kombinace výsledků: Max. a min. hodnoty
Values: v-y [kN/m]



Surfaces Max v-y: 197.93, Min v-y: -47.49 [kN/m]

Wall tl. 550 mm



Member type: wall
Environment: XC1

Concrete: C 30/37
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 33000 MPa
Longitudinal steel: B500B (f_{yk} = 500,0 MPa; E_s = 200000 MPa)
Transverse steel: B500 (f_{yk} = 500,0 MPa; E_s = 200000 MPa)

Buckling
Buckling not considered

Reinforcement in compression not considered.

Boundary stirrups
Profile: 8 mm; Distance: 150,0 mm; Cover: 30,0 mm

Check of min and max reinforcement level

Wall (total reinforcement):
ρ_s = 0,00276 ≥ $\rho_{s,min}$ = 0,002 ⇒ **Pass**
ρ_s = 0,00276 ≤ $\rho_{s,max}$ = 0,04 ⇒ **Pass**
Minimum area of horizontal reinf.: $A_{sh,min}$ = 391,9 mm^2

Check stirrup principles

Min stirrup diameter d = 6 mm ⇒ **Pass**
Max stirrup spacing $s_{cl,max}$ = 180,0 mm ⇒ **Pass**

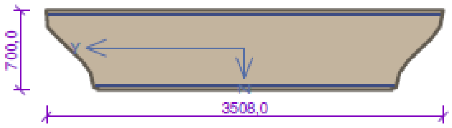
Check of ultimate limit state

no.	Name	N_{Ed} / N_{Rd} [kN]	M_{Edy} / M_{Rdy} [kNm]	M_{Edz} / M_{Rdz} [kNm]	V_{Edz} / V_{Rdz} [kN]	V_{Edy} / V_{Rdy} [kN]	Analysis
1	Envelope of load X direction	150,00	30,00	0,00	50,00	30,00	Pass
		503,82	86,58	-0,37	107,18	64,31	

Ultimate limit state PASS

PASS

Ceiling part th. 700 mm



Member type: slab
Environment: XC1

Concrete: C 30/37
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 33000 MPa
Longitudinal steel: B500B (f_{yk} = 500,0 MPa; E_s = 200000 MPa)
Transverse steel: B500 (f_{yk} = 500,0 MPa; E_s = 200000 MPa)

Buckling
Buckling not considered

Reinforcement in compression not considered.

Section without shear reinforcement.

Check of min and max reinforcement level

Slab (reinforcement in tension - min, total reinforcement - max):

$\rho_{s,t}$ = 0,00213 $\geq$ $\rho_{s,min}$ = 0,00151
$\rho_{s,t,CSN}$ = 0,00199 $\geq$ $\rho_{s,min,CSN}$ = 0,0018 $\Rightarrow$ **Pass**
ρ_s = 0,00416 $\leq$ $\rho_{s,max}$ = 0,04 $\Rightarrow$ **Pass**

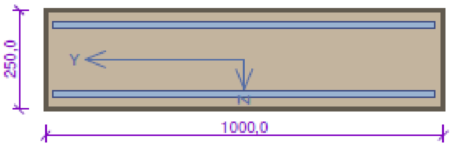
Check of ultimate limit state

no.	Name	N_{Ed} / N_{Rd} [kN]	M_{Edy} / M_{Rdy} [kNm]	M_{Edz} / M_{Rdz} [kNm]	V_{Edz} / V_{Rdz} [kN]	V_{Edy} / V_{Rdy} [kN]	Analysis
1	Envelope of load	24,44	42,85	0,00	71,45	0,00	Pass
		4191,72	1291,20	0,28	652,77	0,00	

Ultimate limit state PASS

PASS

Platform th.250mm



Member type: slab
Environment: XC1

Concrete: C 30/37
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 33000 MPa
Longitudinal steel: B500B (f_{yk} = 500,0 MPa; E_s = 200000 MPa)
Transverse steel: B500 (f_{yk} = 500,0 MPa; E_s = 200000 MPa)

Buckling
Buckling not considered

Reinforcement in compression not considered.

Ties vertical
Profile: 8 mm; Distance: 150,0 mm; Legs: 6

Check of min and max reinforcement level

Slab (reinforcement in tension - min, total reinforcement - max):
$\rho_{s,t}$ = 0,00759 $\geq$ $\rho_{s,min}$ = 0,00151
$\rho_{s,t,CSN}$ = 0,00643 $\geq$ $\rho_{s,min,CSN}$ = 0,0018 $\Rightarrow$ **Pass**
ρ_s = 0,0118 $\leq$ $\rho_{s,max}$ = 0,04 $\Rightarrow$ **Pass**

Shear reinforcement ratio

$\rho_{w,min}$ = 0,000876 $\leq$ ρ_w = 0,00201 $\Rightarrow$ **Pass**
Max stirrup spacing $s_{l,max}$ = 159,0 mm $\Rightarrow$ **Pass**
Max stirrup legs spacing $s_{t,max}$ = 318,0 mm

Check of ultimate limit state

no.	Name	N_{Ed} / N_{Rd} [kN]	M_{Edy} / M_{Rdy} [kNm]	M_{Edz} / M_{Rdz} [kNm]	V_{Edz} / V_{Rdz} [kN]	V_{Edy} / V_{Rdy} [kN]	Analysis
1	Envelope of load	102,31	48,20	0,00	144,00	0,00	Pass
		1373,98	129,20	0,00	171,06	0,00	

Ultimate limit state PASS

PASS

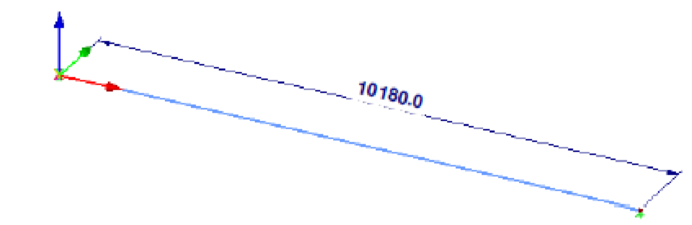
2.2.3 SPATIAL MODEL AND ASSESSMENT OF CEILING BEAM

Date:	02.08.2019	Project:		Model:	Beer - Stropní nosník	Page:	1/5
						Sheet:	1

MODEL

Isometric

Průřezy
1: user Ceiling bean



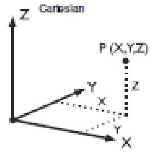
MODEL - GENERAL DATA

General	Model name	:	Beer - Stropní nosník
	Type of model	:	3D
	Positive direction of global axis Z	:	Upward
	Classification of load cases and combinations	:	According to Standard: EN 1990 National Annex: ČSN - Česká Republika
	☒ Automatically create combinations	:	☒ Load Combinations
Options	☐ RF-FORM-FINDING - Find initial equilibrium shapes of membrane and cable structures		
	☐ RF-CUTTING-PATTERN		
	☐ Piping analysis		
	☐ Use CQC Rule		
	☐ Enable CAD/BIM model		
	Standard Gravity		
	g	:	10.00 m/s²

FE MESH SETTINGS

General	Target length of finite elements	l_{FE}	:	0.5 m
	Maximum distance between a node and a line to integrate it into the line	ε	:	0.0 m
	Maximum number of mesh nodes (in thousands)		:	500
Members	Number of divisions of members with cable, elastic foundation, taper, or plastic characteristic		:	10
	☒ Activate member divisions for large deformation or post-critical analysis			
	☒ Use division for members with node lying on them			
Surfaces	Maximum ratio of FE rectangle diagonals	Δ_D	:	1.800
	Maximum out-of-plane inclination of two finite elements	α	:	0.50 °
	Shape direction of finite elements		:	Triangles and quadrangles ☒ Same squares where possible

1.1 NODES



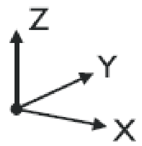
Node No.	Node Type	Reference Node	Coordinate System	Node Coordinates X [m]	Y [m]	Z [m]	Comment
1	Standard	-	Cartesian	0.000	0.000	0.000	
2	Standard	-	Cartesian	10.180	0.000	0.000	

1.2 LINES

Line No.	Line Type	Nodes No.	Line Length L [m]		Comment
1	Polyline	1,2	10.180	X	

1.3 MATERIALS

Matl. No.	Modulus E [MPa]	Modulus G [MPa]	Poisson's Ratio ν [-]	Spec. Weight γ [kN/m³]	Coeff. of Th. Exp. α [1/K]	Partial Factor γ_M [-]	Material Model
1	Concrete C30/37 | DIN 1045-1:2008-08						
	28300.000	11791.700	0.200	25.00	1.00E-05	1.00	Isotropic Linear Elastic
2	Steel S 235 | DIN EN 1993-1-1:2010-12						
	210000.000	80769.200	0.300	78.50	1.20E-05	1.00	Isotropic Linear Elastic



1.7 NODAL SUPPORTS

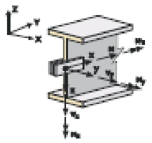
Support No.	Nodes No.	Axis System	Column in Z	Support Conditions u_X	u_Y	u_Z	φ_X	φ_Y	φ_Z
2	1	Global X,Y,Z	☐	☒	☒	☒	☒	☐	☒
3	2	Global X,Y,Z	☐	☐	☒	☒	☐	☐	☒

1.13 CROSS-SECTIONS

Section No.	Matl. No.	J [mm⁴] / A [mm²]	I_y [mm⁴] / A_y [mm²]	I_z [mm⁴] / A_z [mm²]	Principal Axes α [°]	Rotation α' [°]	Overall Dimensions [mm] Width b	Height h
1	user Ceiling beam							
	1	14200000512.0 337000.0	8259999744.0 338000.0	14400000000.0 292000.0	0.00	0.00	970.0	680.0

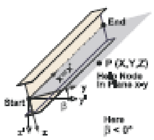
1.13.2 CROSS-SECTIONS - STIFFNESS REDUCTION

Section No.	Description	Factor I_t [-]	Factor I_y [-]	Factor I_z [-]	Factor A_x [-]	Factor A_y [-]	Factor A_z [-]
1	user Ceiling beam	1.00	1.00	1.00	1.01	1.00	1.00



1.14 MEMBER HINGES

Release No.	Reference System	Axial/Shear Release or Spring[MN/m] u_x	u_y	u_z	Moment Release or Spring[MNm/rad] φ_x	φ_y	φ_z	Comment
1	Local x,y,z	☐	☐	☐	☐	☒	☒	



1.17 MEMBERS

Mbr. No.	Line No.	Member	Rotation Type	β [°]	Cross-Section Start	End	Hinge No. Start	End	Ecc. No.	Div. No.	Length L [m]	
1	1	Beam	Angle	0.00	1	1	-	-	-	-	10.180	X

2.1 LOAD CASES

Load Case	Load Case Description	EN 1990 | ČSN Action Category	Self-Weight - Factor in Direction Active	X	Y	Z
LC1	Vlastí tíha + Stálé	Permanent	☒	0.000	0.000	-1.000
LC2	Užitné	Imposed - Category H: roofs	☐			

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor	Load Case	
CO1	STR	1.35*ZS1	1	1.35	LC1	Vlastí tíha + Stálé
CO2	STR	1.35*ZS1 + 1.5*ZS2	1	1.35	LC1	Vlastí tíha + Stálé
			2	1.50	LC2	Užitné
CO3	S Ch	ZS1	1	1.00	LC1	Vlastí tíha + Stálé
CO4	S Ch	ZS1 + ZS2	1	1.00	LC1	Vlastí tíha + Stálé
			2	1.00	LC2	Užitné
CO5	S Fr	ZS1	1	1.00	LC1	Vlastí tíha + Stálé
CO6	S Qp	ZS1	1	1.00	LC1	Vlastí tíha + Stálé

2.7 RESULT COMBINATIONS

Result Combin	Description	Loading
RC1	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10	CO1/s or CO2/s
RC2	MSP - charakteristická	CO3/s or CO4/s
RC3	MSP - èastá	CO5/s
RC4	MSP - kvazistálá	CO6/s

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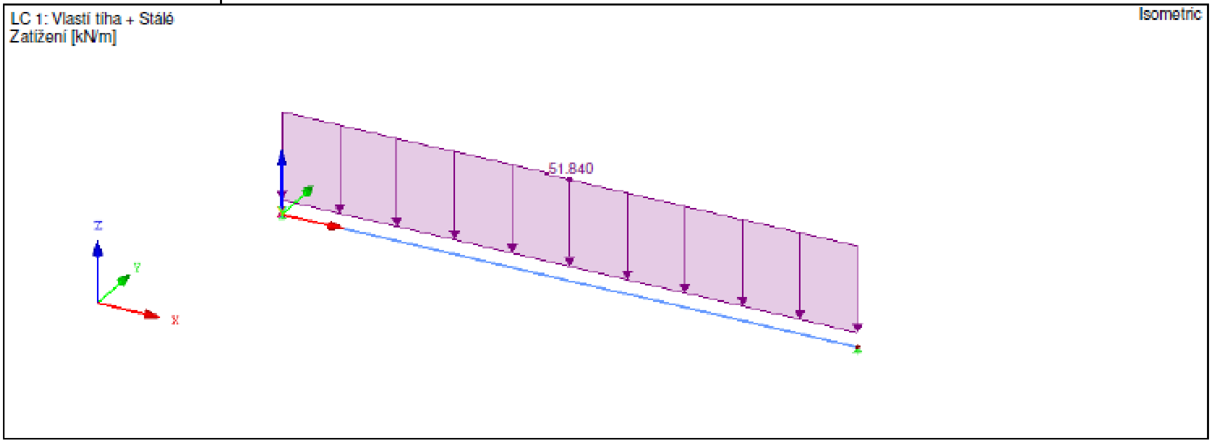
LC1
Vlastí tíha + Stálé

3.2 MEMBER LOADS

LC1: Vlastí tíha + Stálé

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	1	Force	Uniform	ZL	True Length	p	-51.840	kN/m

LC1: VLASTÍ TÍHA + STÁLÉ



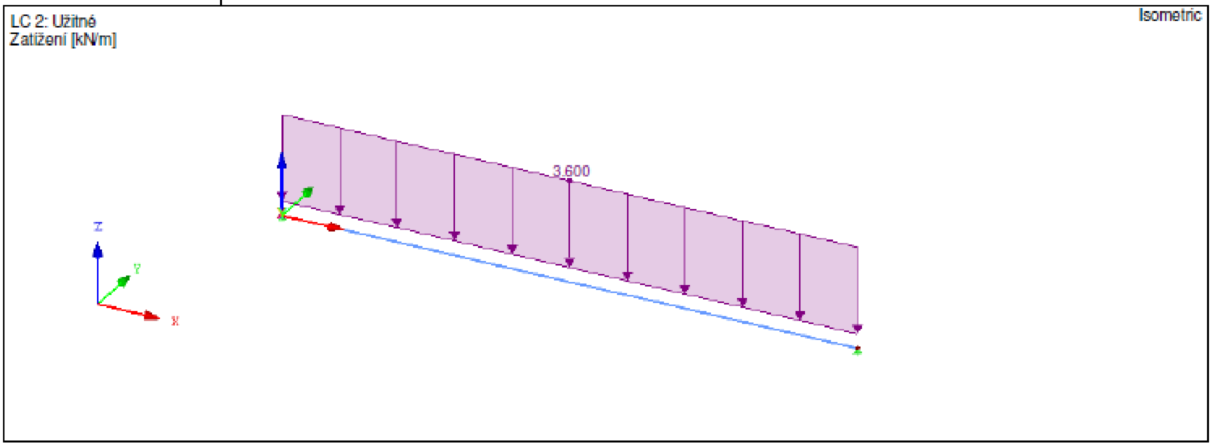
LC2
Užitné

3.2 MEMBER LOADS

LC2: Užitné

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	1	Force	Uniform	ZL	True Length	p	-3.600	kN/m

LC2: UŽITNÉ



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4.1 NODES - SUPPORT FORCES

Result Combinations

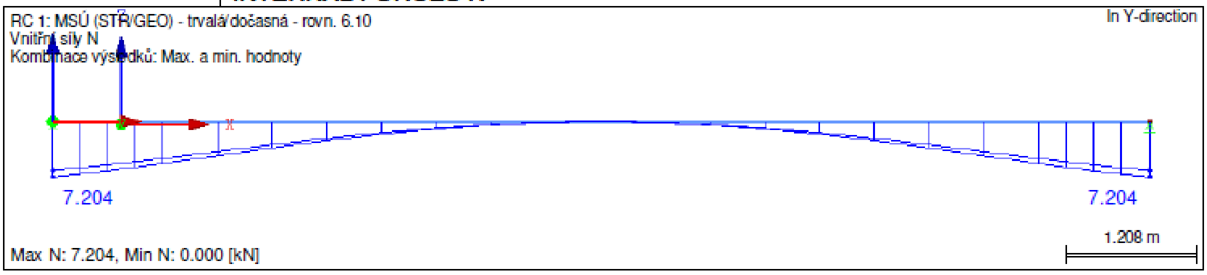
Node No.	RC		Support Forces [kN] $P_{X'}$	$P_{Y'}$	$P_{Z'}$	Support Moments [kNm] $M_{X'}$	$M_{Y'}$	$M_{Z'}$	
1	RC1	Max	0.000	0.000	-414.111	0.000	0.000	0.000	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10
		Min	0.000	0.000	-441.597	0.000	0.000	0.000	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10
2	RC1	Max	0.000	0.000	-414.111	0.000	0.000	0.000	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10
		Min	0.000	0.000	-441.597	0.000	0.000	0.000	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10

4.12 CROSS-SECTIONS - INTERNAL FORCES

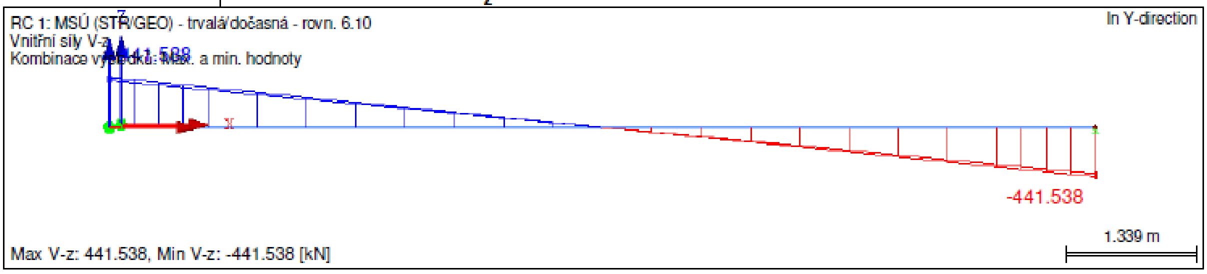
Result Combinations

Member No.	RC	Node No.	Location x [m]		Forces [kN] N	V_y	V_z	Moments [kNm] M_T	M_y	M_z	Corresponding Load Cases
	Section No. 1: user Ceiling beam										
1	RC1	1	0.000	MAX N	7.204	0.000	441.538	0.000	0.000	0.000	CO 2
1	RC1		5.090	MIN N	0.000	0.000	0.000	0.000	1053.910	0.000	CO 1
1	RC1	1	0.000	MAX V_y	7.204	0.000	441.538	0.000	0.000	0.000	CO 2
1	RC1	2	10.180	MIN V_y	7.204	0.000	-441.538	0.000	0.000	0.000	CO 2
1	RC1	1	0.000	MAX V_z	7.204	0.000	441.538	0.000	0.000	0.000	CO 2
1	RC1	2	10.180	MIN V_z	7.204	0.000	-441.538	0.000	0.000	0.000	CO 2
1	RC1	1	0.000	MAX M_T	6.335	0.000	414.063	0.000	0.000	0.000	CO 1
1	RC1	1	0.000	MIN M_T	6.335	0.000	414.063	0.000	0.000	0.000	CO 1
1	RC1		5.090	MAX M_y	0.000	0.000	0.000	0.000	1123.860	0.000	CO 2
1	RC1	1	0.000	MIN M_y	6.335	0.000	414.063	0.000	0.000	0.000	CO 1
1	RC1	1	0.000	MAX M_z	6.335	0.000	414.063	0.000	0.000	0.000	CO 1
1	RC1		4.581	MIN M_z	0.108	0.000	44.160	0.000	1112.630	0.000	CO 2

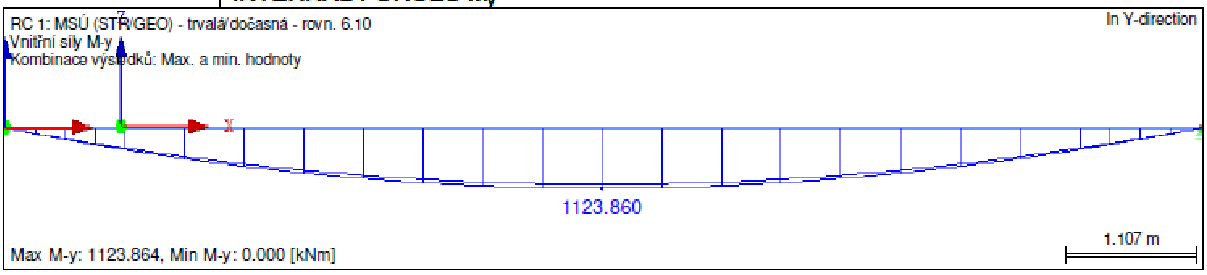
INTERNAL FORCES N



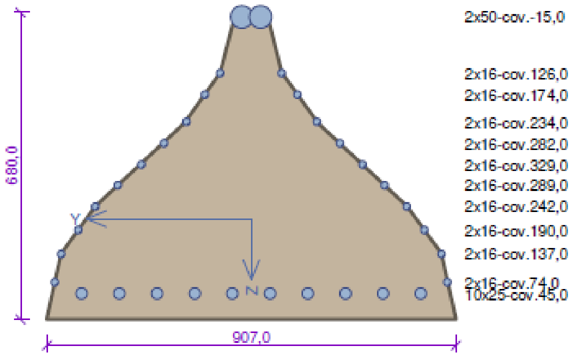
INTERNAL FORCES V_z



INTERNAL FORCES M_y



Ceiling beam



Member type: beam
Environment: XC1

Concrete: C 30/37
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 33000 MPa
Longitudinal steel: B500B (f_{yk} = 500,0 MPa; E_s = 200000 MPa)
Transverse steel: B500 (f_{yk} = 500,0 MPa; E_s = 200000 MPa)

Buckling
Buckling not considered

Reinforcement in compression considered.

Boundary stirrups
Profile: 10 mm; Distance: 150,0 mm; Cover: 50,0 mm

Bent-up bars vertical
Profile: 25 mm; Count: 5; Pitch: 45,00 °;

Check of min and max reinforcement level

Beam (reinforcement in tension - min, total reinforcement - max):
$\rho_{s,t}$ = 0,0136 ≥ $\rho_{s,min}$ = 0,00151 ⇒ **Pass**
ρ_s = 0,0381 ≤ $\rho_{s,max}$ = 0,04 ⇒ **Pass**

Shear reinforcement ratio - Check vertically

$\rho_{w,min}$ = 0,000876 ≤ ρ_w = 0,0426 ⇒ **Pass**
Max stirrup spacing $s_{l,max}$ = 400,0 mm ⇒ **Pass**
Max stirrup legs spacing $s_{t,max}$ = 454,4 mm

Shear reinforcement ratio - Check horizontally

$\rho_{w,min}$ = 0,000876 ≤ ρ_w = 0,00352 ⇒ **Pass**
Max stirrup spacing $s_{l,max}$ = 400,0 mm ⇒ **Pass**
Max stirrup legs spacing $s_{t,max}$ = 557,7 mm

Check of ultimate limit state

no.	Name	N_{Ed} / N_{Rd} [kN]	M_{Edy} / M_{Rdy} [kNm]	M_{Edz} / M_{Rdz} [kNm]	V_{Edz} / V_{Rdz} [kN]	V_{Edy} / V_{Rdy} [kN]	Analysis
1	Max My	0,00	1133,54	0,00	0,00	0,00	Pass
		0,00	1483,35	0,00	0,00	0,00	
2	Max Vz	7,20	0,00	0,00	441,54	0,00	Pass
		5990,43	1482,18	0,63	525,57	0,00	

Ultimate limit state PASS

PASS

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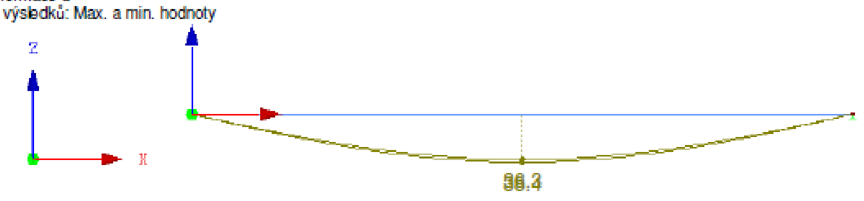
GLOBAL DEFORMATIONS u

RC 2: MSP - charakteristická
Globální deformace u
Kombinace výsledků: Max. a min. hodnoty

In Y-direction



Max u: 38.4, Min u: 0.0 [mm]
Factor of deformations: 19.00

2.033 m

Ceiling beam

$U_{lim1} = L_1/250$ $L_1 =$ 10180 mm

$U_{lim1} =$ 40,72 mm > Ufin= 38,4 mm **PASS**

2.3 CRANE BEAM

2.3.1 SPATIAL MODEL OF CRANE BEAM

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					Beam for crane
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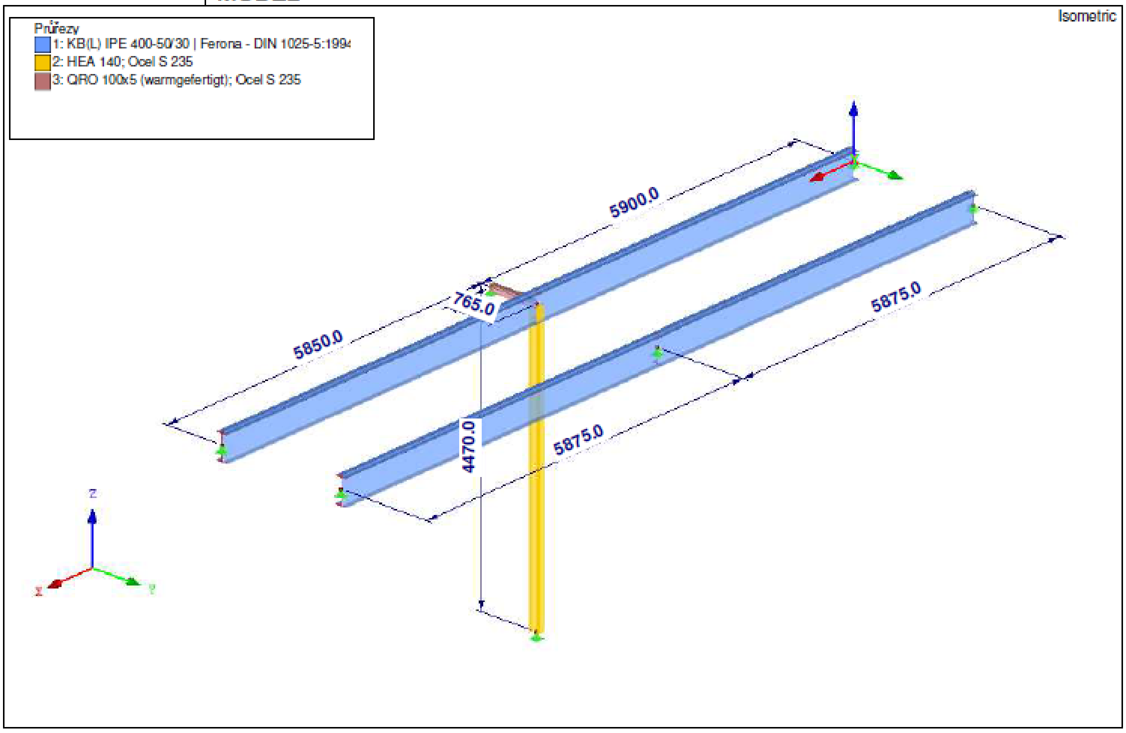
MODEL



MODEL - GENERAL DATA

General	Model name	:	Beer - crane
	Model description	:	Beam for crane
	Type of model	:	3D
	Positive direction of global axis Z	:	Upward
	Classification of load cases and combinations	:	According to Standard: EN 1990 + EN 1991-3; Jeøáby National Annex: CEN - EU
	☒ Automatically create combinations	:	☒ Load Combinations
Options	☐ RF-FORM-FINDING - Find initial equilibrium shapes of membrane and cable structures		
	☐ RF-CUTTING-PATTERN		
	☐ Piping analysis		
	☐ Use CQC Rule		
	☐ Enable CAD/BIM model		
	Standard Gravity		
	g	:	10.00 m/s²

FE MESH SETTINGS

General	Target length of finite elements	l_{FE}	:	0.5 m
	Maximum distance between a node and a line to integrate it into the line	ε	:	0.0 m
	Maximum number of mesh nodes (in thousands)		:	500
Members	Number of divisions of members with cable, elastic foundation, taper, or plastic characteristic		:	10
	☒ Activate member divisions for large deformation or post-critical analysis			
	☒ Use division for members with node lying on them			
Surfaces	Maximum ratio of FE rectangle diagonals	Δ_D	:	1.800
	Maximum out-of-plane inclination of two finite elements	α	:	0.50 °
	Shape direction of finite elements		:	Triangles and quadrangles ☒ Same squares where possible

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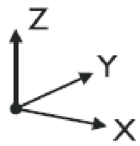
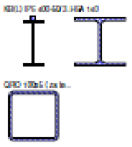
1.3 MATERIALS

Matl. No.	Modulus E [MPa]	Modulus G [MPa]	Poisson's Ratio ν [-]	Spec. Weight γ [kN/m³]	Coeff. of Th. Exp. α [1/K]	Partial Factor γ_M [-]	Material Model
1	Steel S 235 | EN 10025-2:2004-11						
	210000.000	80769.200	0.300	78.50	1.20E-05	1.00	Isotropic Linear Elastic
2	Steel S 235 | EN 10025-2:2004-11						
	210000.000	80769.200	0.300	78.50	1.20E-05	1.00	Isotropic Linear Elastic



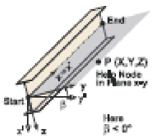
1.7 NODAL SUPPORTS

Support No.	Nodes No.	Axis System	Column in Z	Support Conditions u_X	u_Y	u_Z	φ_X	φ_Y	φ_Z
1	4,8	Global X,Y,Z	☐	☒	☒	☒	☐	☐	☒
2	2,6,7	Global X,Y,Z	☐	☐	☒	☒	☐	☐	☒
3	1,5	Global X,Y,Z	☐	☒	☒	☒	☒	☐	☒



1.13 CROSS-SECTIONS

Section No.	Matl. No.	J [mm⁴] / A [mm²]	I_y [mm⁴] / A_y [mm²]	I_z [mm⁴] / A_z [mm²]	Principal Axes α [°]	Rotation α' [°]	Overall Dimensions [mm] Width b	Height h
1	KB(L) IPE 400-50/30 | Ferona - DIN 1025-5:1994							
	1	1325316.8 9950.0	290297120.0 4245.7	13512500.0 3374.1	0.00	0.00	180.0	430.0
2	HEA 140							
	1	81300.0 3142.0	10330000.0 1983.0	3893000.0 625.5	0.00	0.00	140.0	133.0
3	QRO 100x5 (warmgefertigt)							
	1	4390000.0 1870.0	2790000.0 800.7	2790000.0 800.7	0.00	0.00	100.0	100.0



1.17 MEMBERS

Mbr. No.	Line No.	Member	Rotation Type	β [°]	Cross-Section Start	End	Hinge No. Start	End	Ecc. No.	Div. No.	Length L [m]	
1	1	Beam	Angle	0.00	1	1	-	-	-	-	5.900	X
2	2	Beam	Angle	90.00	2	2	-	-	-	-	4.470	Z
3	3	Beam	Angle	0.00	1	1	-	-	-	-	5.850	X
4	4	Beam	Angle	0.00	1	1	-	-	-	-	5.875	X
5	5	Beam	Angle	0.00	1	1	-	-	-	-	5.875	X
6	6	Beam	Angle	0.00	3	3	-	-	-	-	0.765	Y

2.1 LOAD CASES

Load Case	Load Case Description	EN 1990 + EN 1991-3; Jeøáby | CEN Action Category	Active	Self-Weight - Factor in Direction X	Y	Z
LC1		Permanent	☒	0.000	0.000	-1.000
LC2	Self weight of the crane 1	Permanent from Cranes	☒	0.000	0.000	0.000
LC3	Self weight of the crane 2	Permanent from Cranes	☒	0.000	0.000	0.000
LC4	Self weight of the crane 3	Permanent from Cranes	☒	0.000	0.000	0.000
LC5	Acceleration of the crane bridge 1	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000
LC6	Acceleration of the crane bridge 2	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000
LC7	Acceleration of the crane bridge 3	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000
LC8	Skewing of the bridge crane 1	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000
LC9	Skewing of the bridge crane 2	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000
LC10	Skewing of the bridge crane 3	Imposed from Cranes - category A: Class 1-7	☒	0.000	0.000	0.000

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor	Load Case	
CO1	STR	1.35*ZS1 + 1.35*ZS2	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
CO2	STR	1.35*ZS1 + 1.35*ZS3	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
CO3	STR	1.35*ZS1 + 1.35*ZS4	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
CO4	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS5	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC5	Acceleration of the crane bridge 1
CO5	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS6	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC6	Acceleration of the crane bridge 2
CO6	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS7	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC7	Acceleration of the crane bridge 3
CO7	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS8	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC8	Skewing of the bridge crane 1
CO8	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS9	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC9	Skewing of the bridge crane 2

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor		Load Case
CO9	STR	1.35*ZS1 + 1.35*ZS2 + 1.35*ZS10	1	1.35	LC1	
			2	1.35	LC2	Self weight of the crane 1
			3	1.35	LC10	Skewing of the bridge crane 3
CO10	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS5	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC5	Acceleration of the crane bridge 1
CO11	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS6	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC6	Acceleration of the crane bridge 2
CO12	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS7	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC7	Acceleration of the crane bridge 3
CO13	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS8	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC8	Skewing of the bridge crane 1
CO14	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS9	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC9	Skewing of the bridge crane 2
CO15	STR	1.35*ZS1 + 1.35*ZS3 + 1.35*ZS10	1	1.35	LC1	
			2	1.35	LC3	Self weight of the crane 2
			3	1.35	LC10	Skewing of the bridge crane 3
CO16	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS5	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC5	Acceleration of the crane bridge 1
CO17	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS6	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC6	Acceleration of the crane bridge 2
CO18	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS7	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC7	Acceleration of the crane bridge 3
CO19	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS8	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC8	Skewing of the bridge crane 1
CO20	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS9	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC9	Skewing of the bridge crane 2
CO21	STR	1.35*ZS1 + 1.35*ZS4 + 1.35*ZS10	1	1.35	LC1	
			2	1.35	LC4	Self weight of the crane 3
			3	1.35	LC10	Skewing of the bridge crane 3
CO22	S Ch	ZS1 + ZS2	1	1.00	LC1	
			2	1.00	LC2	Self weight of the crane 1
CO23	S Ch	ZS1 + ZS3	1	1.00	LC1	
			2	1.00	LC3	Self weight of the crane 2
CO24	S Ch	ZS1 + ZS4	1	1.00	LC1	
			2	1.00	LC4	Self weight of the crane 3
CO25	S Fr	ZS1 + ZS2	1	1.00	LC1	
			2	1.00	LC2	Self weight of the crane 1
CO26	S Fr	ZS1 + ZS3	1	1.00	LC1	
			2	1.00	LC3	Self weight of the crane 2
CO27	S Fr	ZS1 + ZS4	1	1.00	LC1	
			2	1.00	LC4	Self weight of the crane 3
CO28	S Qp	ZS1 + ZS2	1	1.00	LC1	
			2	1.00	LC2	Self weight of the crane 1
CO29	S Qp	ZS1 + ZS3	1	1.00	LC1	
			2	1.00	LC3	Self weight of the crane 2
CO30	S Qp	ZS1 + ZS4	1	1.00	LC1	
			2	1.00	LC4	Self weight of the crane 3

2.7 RESULT COMBINATIONS

Result Combin	Description	Loading
RC1	MSÚ (STR/GEO) - trvalá/doèasná - rovn. 6.10	CO1/s or CO2/s or CO3/s or CO4/s or CO5/s or CO6/s or CO7/s or CO8/s or CO9/s or CO10/s or CO11/s or CO12/s or CO13/s or CO14/s or CO15/s or CO16/s or CO17/s or CO18/s or CO19/s or CO20/s or CO21/s
RC2	MSP - charakteristická	CO22/s or CO23/s or CO24/s
RC3	MSP - èastá	CO25/s or CO26/s or CO27/s
RC4	MSP - kvazistálá	CO28/s or CO29/s or CO30/s

LC2
Self weight of the crane 1

3.2 MEMBER LOADS
LC2: Self weight of the crane 1

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-4.820	kN
							P_2	-4.690	rad
							A	0.250	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-3.340	kN
							P_2	-3.330	rad
							A	0.250	m
							B	2.000	m

LC3
Self weight of the crane 2

3.2 MEMBER LOADS
LC3: Self weight of the crane 2

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-4.820	kN
							P_2	-4.690	rad
							A	1.937	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-3.340	kN
							P_2	-3.330	rad
							A	1.973	m
							B	2.000	m

LC4
Self weight of the crane 3

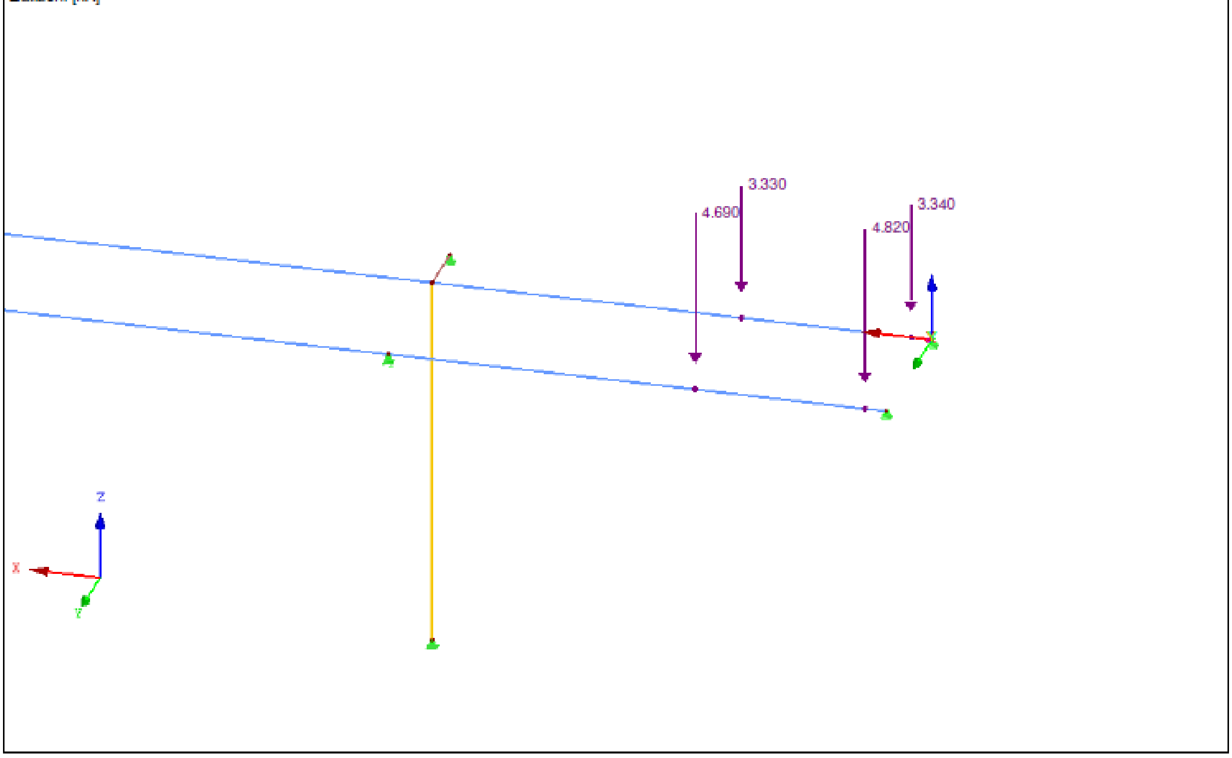
3.2 MEMBER LOADS
LC4: Self weight of the crane 3

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	Concentr.	ZL	True Length	P	-4.820	kN
							A	4.875	m
3	Members	5	Force	Concentr.	ZL	True Length	P	-4.690	kN
							A	1.000	m
4	Members	1	Force	Concentr.	ZL	True Length	P	-3.340	kN
							A	4.875	m
5	Members	3	Force	Concentr.	ZL	True Length	P	-3.330	kN
							A	1.000	m

LC2: SELF WEIGHT OF THE CRANE 1

LC 2: Self weight of the crane 1
Zatížení [kN]

Isometric



LC5
Acceleration of the crane bridge 1

3.2 MEMBER LOADS

LC5: Acceleration of the crane bridge 1

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-23.100	kN
							P_2	-23.200	rad
							A	0.250	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-4.700	kN
							P_2	-4.770	rad
							A	0.250	m
							B	2.000	m
3	Members	4	Force	Concentr.	YL	True Length	P	0.614	kN
							A	0.250	m
4	Members	1,4	Force	Concentr.	XL	True Length	P	0.263	kN
							A	0.000	m
5	Members	4	Force	Concentr.	YL	True Length	P	-0.614	kN
							A	2.250	m
6	Members	1	Force	2 x Φ	YL	True Length	P_1	0.125	kN
							P_2	-0.125	rad
							A	0.250	m
							B	2.000	m

LC6
Acceleration of the crane bridge 2

3.2 MEMBER LOADS

LC6: Acceleration of the crane bridge 2

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-23.100	kN
							P_2	-23.200	rad
							A	1.937	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-4.770	kN
							P_2	-4.700	rad
							A	1.973	m
							B	2.000	m
3	Members	4	Force	2 x Φ	YL	True Length	P_1	0.614	kN
							P_2	-0.614	rad
							A	1.937	m
							B	2.000	m
4	Members	1,4	Force	Concentr.	XL	True Length	P	0.263	kN
							A	0.000	m
5	Members	1	Force	2 x Φ	YL	True Length	P_1	0.125	kN
							P_2	-0.125	rad
							A	1.937	m
							B	2.000	m

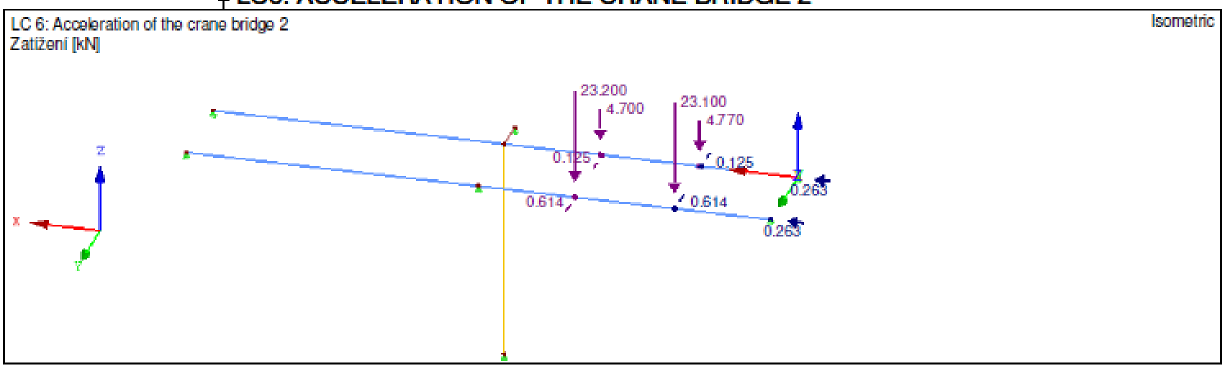
LC7
Acceleration of the crane bridge 3

3.2 MEMBER LOADS

LC7: Acceleration of the crane bridge 3

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Load Parameters Symbol	Value	Unit
1	Members	4	Force	Concentr.	ZL	True Length	P	-23.100	kN
							A	4.875	m
3	Members	5	Force	Concentr.	ZL	True Length	P	-23.200	kN
							A	1.000	m
4	Members	1	Force	Concentr.	ZL	True Length	P	-4.700	kN
							A	4.875	m
5	Members	3	Force	Concentr.	ZL	True Length	P	-4.770	kN
							A	1.000	m
8	Members	4	Force	Concentr.	YL	True Length	P	0.614	kN
							A	4.875	m
9	Members	1,4	Force	Concentr.	XL	True Length	P	0.263	kN
							A	0.000	m
10	Members	5	Force	Concentr.	YL	True Length	P	-0.614	kN
							A	1.000	m
11	Members	1	Force	Concentr.	YL	True Length	P	0.125	kN
							A	4.875	m
12	Members	3	Force	Concentr.	YL	True Length	P	-0.125	kN
							A	1.000	m

LC6: ACCELERATION OF THE CRANE BRIDGE 2



Date: 29.07.2019 | Project: | Model: Beer - crane, Beam for crane | Page: 6/10

LC8
Skewing of the bridge crane 1

3.2 MEMBER LOADS
LC8: Skewing of the bridge crane 1

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-23.100	kN
							P_2	-23.200	rad
							A	0.250	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-4.700	kN
							P_2	-4.770	rad
							A	0.250	m
							B	2.000	m
5	Members	4	Force	Concentr.	YL	True Length	P	4.810	kN
							A	2.250	m
6	Members	1	Force	Concentr.	YL	True Length	P	0.812	kN
							A	2.250	m
7	Members	4	Force	Concentr.	XL	True Length	P	3.020	kN
							A	0.000	m
8	Members	1	Force	Concentr.	XL	True Length	P	2.120	kN
							A	0.000	m

LC9
Skewing of the bridge crane 2

3.2 MEMBER LOADS
LC9: Skewing of the bridge crane 2

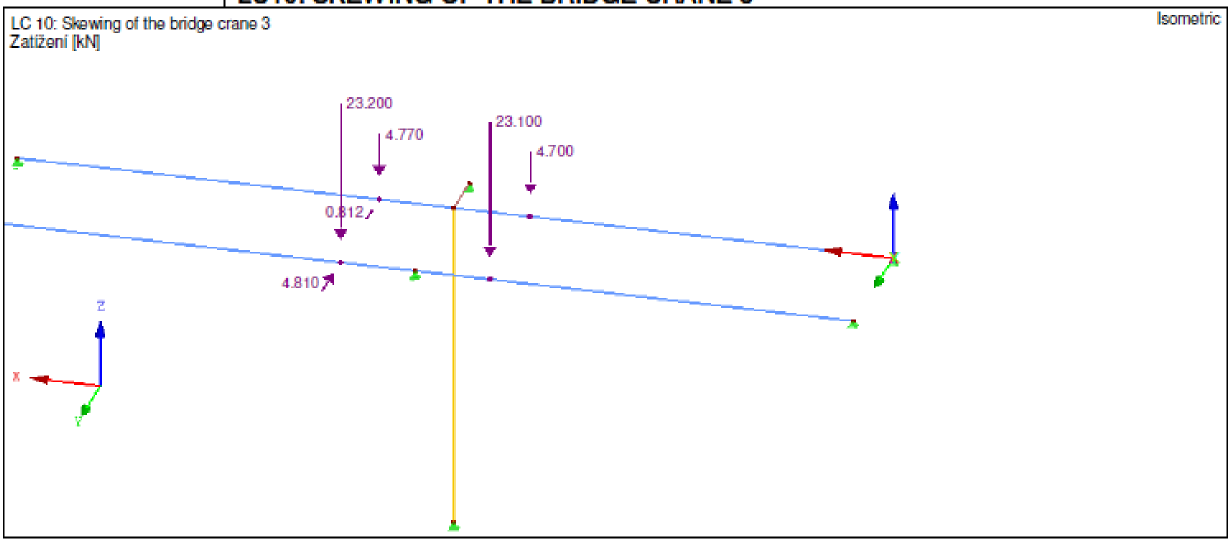
No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Symbol	Value	Unit
1	Members	4	Force	2 x Φ	ZL	True Length	P_1	-23.100	kN
							P_2	-23.200	rad
							A	1.937	m
							B	2.000	m
2	Members	1	Force	2 x Φ	ZL	True Length	P_1	-4.770	kN
							P_2	-4.700	rad
							A	1.973	m
							B	2.000	m
3	Members	4	Force	Concentr.	YL	True Length	P	4.840	kN
							A	3.937	m
5	Members	1	Force	Concentr.	YL	True Length	P	0.868	kN
							A	3.937	m

LC10
Skewing of the bridge crane 3

3.2 MEMBER LOADS
LC10: Skewing of the bridge crane 3

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Symbol	Value	Unit
1	Members	4	Force	Concentr.	ZL	True Length	P	-23.100	kN
							A	4.875	m
3	Members	5	Force	Concentr.	ZL	True Length	P	-23.200	kN
							A	1.000	m
4	Members	1	Force	Concentr.	ZL	True Length	P	-4.700	kN
							A	4.875	m
5	Members	3	Force	Concentr.	ZL	True Length	P	-4.770	kN
							A	1.000	m
10	Members	5	Force	Concentr.	YL	True Length	P	-4.810	kN
							A	1.000	m
12	Members	3	Force	Concentr.	YL	True Length	P	-0.812	kN
							A	1.000	m

LC10: SKEWING OF THE BRIDGE CRANE 3



2.3.2 ASSESSMENT OF ANCHORING THE CRANE BEAM

Date:	29.07.2019	Project:		Model:	Beer - crane Beam for crane
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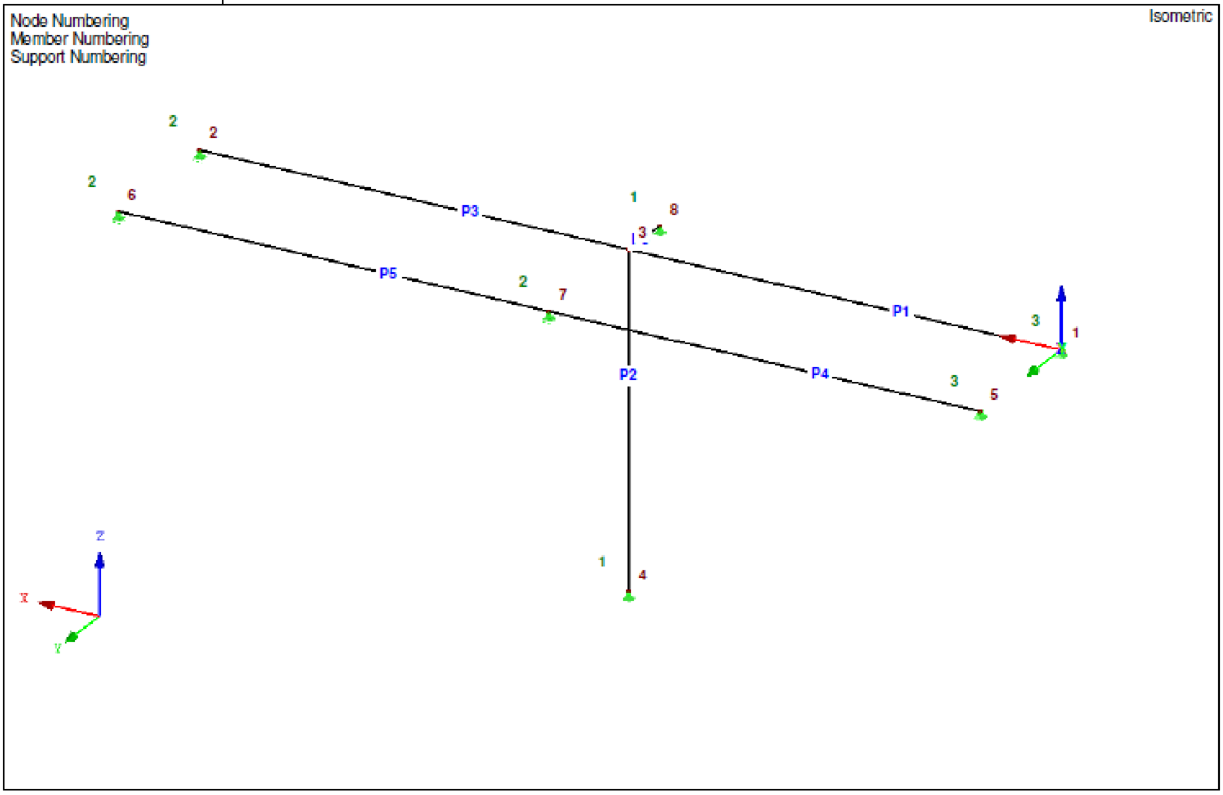
MODEL



■ 4.1 NODES - SUPPORT FORCES

Result Combinations

Node No.	RC		Support Forces [kN] P_X	P_Y	P_Z	Support Moments [kNm] M_X	M_Y	M_Z	
1	RC1	Max P_X	3.287	0.783	-12.159	-0.002	0.000	1.030	CO 19
		Min P_X	-0.017	0.000	-6.165	-0.001	0.000	0.000	CO 2
		Max P_Y	3.287	0.783	-12.159	-0.002	0.000	1.030	CO 19
		Min P_Y	-0.017	0.000	-6.165	-0.001	0.000	0.000	CO 2
		Max P_Z	0.000	0.000	-2.664	-0.002	0.000	0.000	CO 3
		Min P_Z	3.278	0.783	-18.602	-0.001	0.000	1.030	CO 7
		Max M_X	-0.009	0.000	-9.108	-0.001	0.000	0.000	CO 1
		Min M_X	0.531	0.031	-3.024	-0.003	0.000	0.060	CO 18
		Max M_Y	-0.009	0.000	-9.108	-0.001	0.000	0.000	CO 1
		Min M_Y	-0.009	0.000	-9.108	-0.001	0.000	0.000	CO 1
		Max M_Z	3.287	0.783	-12.159	-0.002	0.000	1.030	CO 19
		Min M_Z	0.260	0.047	-15.660	-0.002	0.000	-0.120	CO 10
2	RC1	Max P_X	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Min P_X	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Max P_Y	0.000	0.007	-1.110	0.000	0.000	-0.013	CO 10
		Min P_Y	0.000	-0.143	-2.965	0.000	0.000	0.269	CO 21
		Max P_Z	0.000	0.006	-0.674	0.000	0.000	-0.011	CO 11
		Min P_Z	0.000	-0.143	-2.965	0.000	0.000	0.269	CO 21
		Max M_X	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Min M_X	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Max M_Y	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Min M_Y	0.000	0.000	-1.980	0.000	0.000	0.000	CO 1
		Max M_Z	0.000	-0.143	-2.965	0.000	0.000	0.269	CO 21
		Min M_Z	0.000	0.007	-1.110	0.000	0.000	-0.013	CO 10
4	RC1	Max P_X	0.040	-0.037	-23.330	0.000	0.000	0.000	CO 14
		Min P_X	0.000	-0.027	-17.519	0.000	0.000	0.000	CO 3
		Max P_Y	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Min P_Y	0.000	-0.048	-29.472	0.000	0.000	0.000	CO 21
		Max P_Z	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Min P_Z	0.000	-0.048	-29.472	0.000	0.000	0.000	CO 18
		Max M_X	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Min M_X	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Max M_Y	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Min M_Y	0.010	-0.018	-11.766	0.000	0.000	0.000	CO 1
		Max M_Z	0.030	-0.030	-18.798	0.000	0.000	0.000	CO 10
		Min M_Z	0.024	-0.041	-25.863	0.000	0.000	0.000	CO 20
5	RC1	Max P_X	4.077	4.365	-58.248	0.000	0.000	5.559	CO 7
		Min P_X	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Max P_Y	4.077	4.365	-58.248	0.000	0.000	5.559	CO 7
		Min P_Y	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Max P_Z	0.000	0.000	-2.632	0.000	0.000	0.000	CO 3
		Min P_Z	0.355	0.267	-58.248	0.000	0.000	-0.520	CO 4
		Max M_X	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Min M_X	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Max M_Y	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Min M_Y	0.000	0.000	-11.899	0.000	0.000	0.000	CO 1
		Max M_Z	4.077	4.365	-58.248	0.000	0.000	5.559	CO 7
		Min M_Z	0.355	0.267	-58.248	0.000	0.000	-0.520	CO 4
6	RC1	Max P_X	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Min P_X	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Max P_Y	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Min P_Y	0.000	-0.502	-3.132	0.000	0.000	0.922	CO 9
		Max P_Z	0.000	0.000	3.787	0.000	0.000	0.000	CO 11
		Min P_Z	0.000	-0.064	-3.972	0.000	0.000	0.118	CO 18
		Max M_X	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Min M_X	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Max M_Y	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Min M_Y	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
		Max M_Z	0.000	-0.502	-3.132	0.000	0.000	0.922	CO 9
		Min M_Z	0.000	0.000	-1.763	0.000	0.000	0.000	CO 1
7	RC1	Max P_X	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Min P_X	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Max P_Y	0.000	4.869	-53.002	0.000	0.000	-5.682	CO 8
		Min P_Y	0.000	-5.991	-71.355	0.000	0.000	-4.466	CO 9
		Max P_Z	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Min P_Z	0.000	0.000	-79.783	0.000	0.000	-1.140	CO 18
		Max M_X	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Min M_X	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Max M_Y	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Min M_Y	0.000	0.000	-11.566	0.000	0.000	0.000	CO 1
		Max M_Z	0.000	-0.267	-30.558	0.000	0.000	0.432	CO 4
		Min M_Z	0.000	4.869	-53.002	0.000	0.000	-5.682	CO 8
8	RC1	Max P_X	0.066	-0.020	-0.276	0.000	0.000	-0.015	CO 16
		Min P_X	-0.771	0.907	-0.296	0.000	0.000	0.174	CO 14
		Max P_Y	-0.770	0.911	-0.322	0.000	0.000	0.174	CO 20
		Min P_Y	-0.566	-0.971	-0.301	0.000	0.000	0.128	CO 9
		Max P_Z	0.000	0.018	-0.180	0.000	0.000	0.000	CO 1
		Min P_Z	-0.566	-0.961	-0.358	0.000	0.000	0.128	CO 21
		Max M_X	0.000	0.018	-0.180	0.000	0.000	0.000	CO 1
		Min M_X	0.000	0.018	-0.180	0.000	0.000	0.000	CO 1
		Max M_Y	0.000	0.018	-0.180	0.000	0.000	0.000	CO 1
		Min M_Y	0.000	0.018	-0.180	0.000	0.000	0.000	CO 1
		Max M_Z	-0.771	0.907	-0.296	0.000	0.000	0.174	CO 14
		Min M_Z	0.066	-0.020	-0.276	0.000	0.000	-0.015	CO 16

2.3.2.1 ASSESSMENT OF CENTRAL ANCHORING

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Profis Anchor 2.8.3

Company:		Page:	1
Specifier:		Project:	
Address:		Fastening Point:	
Phone I Fax:	|	Date:	29.07.2019
E-Mail:			

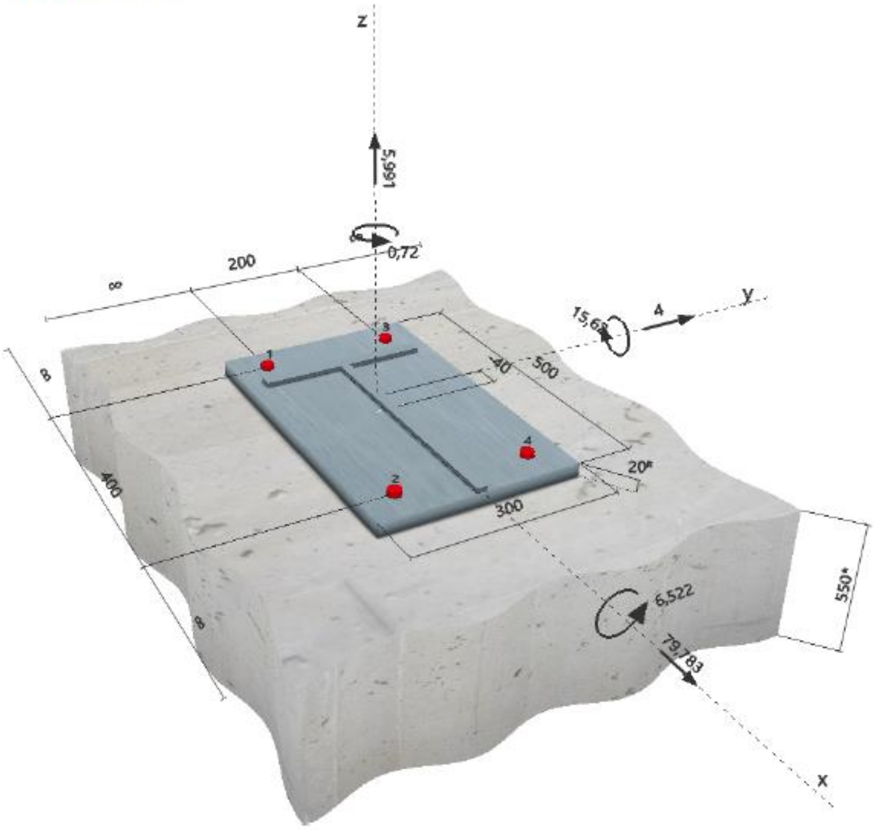
Specifier's comments:

1 Input data

Anchor type and size:	**HIT-RE 500 V3 + HIT-V (8.8) M20**
Effective embedment depth:	$h_{ef,act}$ = 150 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 16/0143
Issued I Valid:	12/07/2017 | -
Proof:	Design method ETAG BOND (EOTA TR 029)
Stand-off installation:	e_b = 0 mm (no stand-off); t = 20 mm
Baseplate:	l_x x l_y x t = 500 mm x 300 mm x 20 mm; (Recommended plate thickness: not calculated
Profile:	T profile; (L x W x T x FT) = 410 mm x 250 mm x 15 mm x 20 mm
Base material:	cracked concrete, C20/25, $f_{c,cube}$ = 25,00 N/mm^2; h = 550 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement

R - The anchor calculation is based on a rigid baseplate assumption.

Geometry [mm] & Loading [kN, kNm]



Input data and results must be checked for agreement with the existing conditions and for plausibility!

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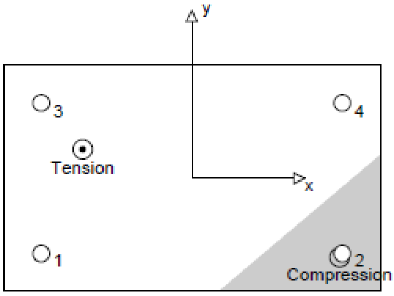
2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	15,354	20,231	20,226	0,440
2	0,000	20,286	20,226	1,560
3	27,674	19,671	19,666	0,440
4	6,871	19,728	19,666	1,560

max. concrete compressive strain: 0,23 [‰]
max. concrete compressive stress: 6,81 [N/mm^2]
resulting tension force in (x/y)=(-145/38): 49,899 [kN]
resulting compression force in (x/y)=(197/-105): 43,908 [kN]

Anchor forces are calculated based on the assumption of a rigid baseplate.

3 Tension load (EOTA TR 029, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilisation β_N [%]	Status
Steel failure*	27,674	130,667	22	OK
Combined pullout-concrete cone failure**	49,899	85,082	59	OK
Concrete cone failure**	49,899	74,631	67	OK
Splitting failure**	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (anchors in tension)

3.1 Steel failure

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
196,000	1,500	130,667	27,674

3.2 Combined pullout-concrete cone failure

$A_{p,N}$ [mm^2]	$A^0_{p,N}$ [mm^2]	$\tau_{Rk,ucr,25}$ [N/mm^2]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]
472 500	202 500	15,00	450	225	∞

ψ_c	$\tau_{Rk,cr}$ [N/mm^2]	k	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,000	8,00	2,300	1,000	1,000

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
78	0,742	5	0,978	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Sd} [kN]
75,398	127,624	1,500	85,082	49,899

3.3 Concrete cone failure

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
472 500	202 500	225	450

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
78	0,742	5	0,978	1,000	1,000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7,200	66,136	1,500	74,631	49,899

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4 Shear load (EOTA TR 029, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilisation β_V [%]	Status
Steel failure (without lever arm)*	20,286	78,400	26	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure**	79,883	232,970	35	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (relevant anchors)

4.1 Steel failure (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
98,000	1,250	78,400	20,286

4.2 Pryout failure (concrete cone relevant)

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k-factor	k_1
552 500	202 500	225	450	2,000	7,200

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0	0,998	7	0,970	1,000	1,000

$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
66,136	1,500	232,970	79,883

5 Combined tension and shear loads (EOTA TR 029, Section 5.2.4)

β_N	β_V	α	Utilisation $\beta_{N,V}$ [%]	Status
0,669	0,343	1,500	75	OK

$\beta_N^\alpha + \beta_V^\alpha \leq 1{,}0$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk}	=	20,499 [kN]	δ_N	=	0,218 [mm]
V_{Sk}	=	14,571 [kN]	δ_V	=	0,583 [mm]
			δ_{NV}	=	0,622 [mm]

Long term loading:

N_{Sk}	=	20,499 [kN]	δ_N	=	0,348 [mm]
V_{Sk}	=	14,571 [kN]	δ_V	=	0,874 [mm]
			δ_{NV}	=	0,941 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

7 Warnings

- The anchor design methods in PROFIS Anchor require rigid baseplates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required baseplate thickness with FEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with EOTA TR 029, Section 7!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of EOTA TR029! For larger diameters of the clearance hole see Chapter 1.1. of EOTA TR029!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- Characteristic bond resistances depend on short- and long-term temperatures.
- Please contact Hilti to check feasibility of HIT-V rod supply.
- Edge reinforcement is not required to avoid splitting failure

Fastening meets the design criteria!

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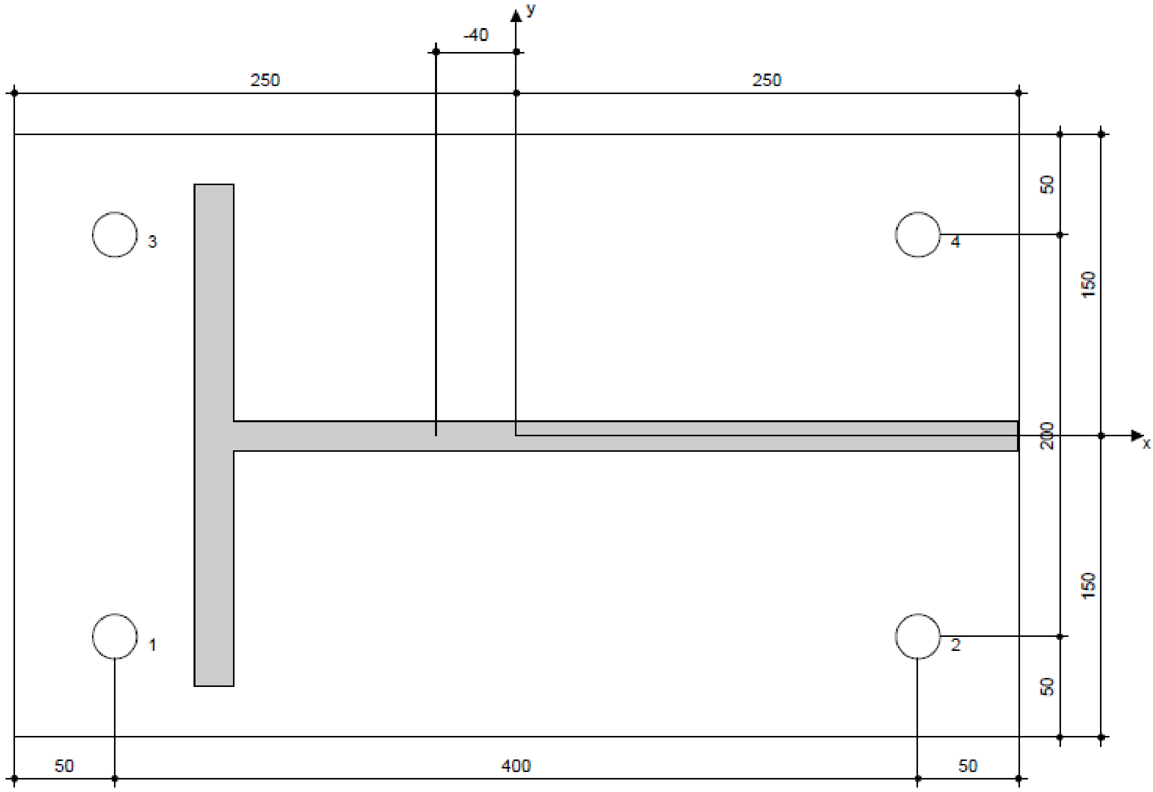
8 Installation data

Baseplate, steel: -
Profile: T profile; (L x W x T x FT) = 410 mm x 250 mm x 15 mm x 20 mm
Hole diameter in the fixture: d_f = 22 mm
Plate thickness (input): 20 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and size: HIT-RE 500 V3 + HIT-V (8.8) M20
Installation torque: 0,150 kNm
Hole diameter in the base material: 22 mm
Hole depth in the base material: 150 mm
Minimum thickness of the base material: 194 mm

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-200	-100	-	-	-	-
2	200	-100	-	-	-	-
3	-200	100	-	-	-	-
4	200	100	-	-	-	-

2.3.2.2 ASSESSMENT OF EDGE ANCHORING

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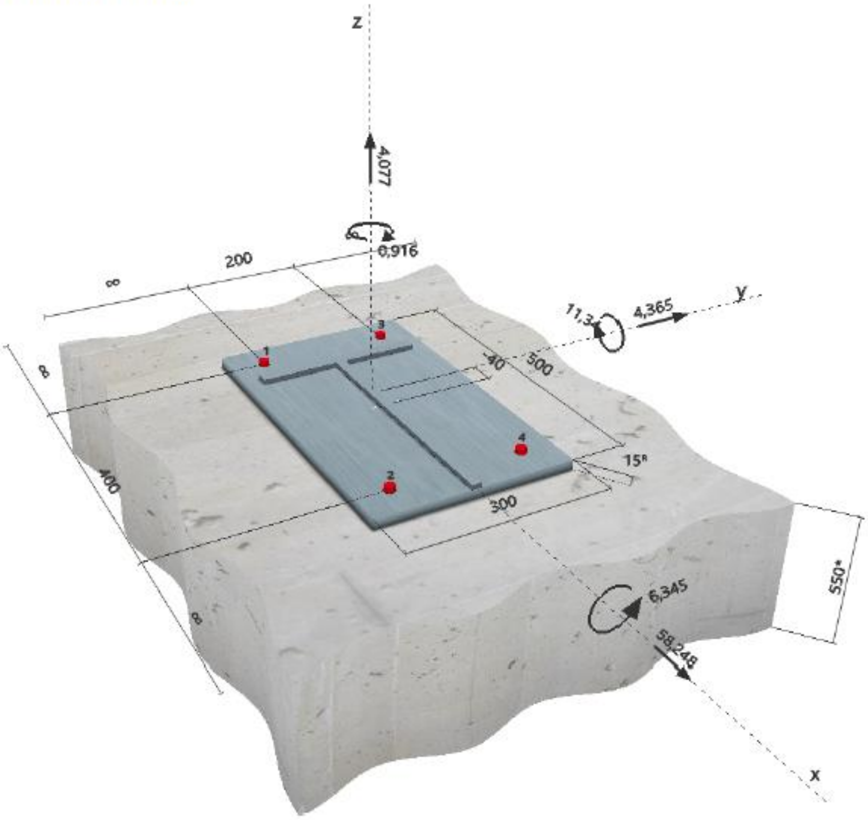
Specifier's comments:

1 Input data

Anchor type and size:	**HIT-RE 500 V3 + HIT-V (8.8) M16**
Effective embedment depth:	$h_{ef,act}$ = 150 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 16/0143
Issued I Valid:	12/07/2017 | -
Proof:	Design method ETAG BOND (EOTA TR 029)
Stand-off installation:	e_b = 0 mm (no stand-off); t = 15 mm
Baseplate:	l_x x l_y x t = 500 mm x 300 mm x 15 mm; (Recommended plate thickness: not calculated
Profile:	T profile; (L x W x T x FT) = 410 mm x 250 mm x 15 mm x 20 mm
Base material:	cracked concrete, C20/25, $f_{c,cube}$ = 25,00 N/mm^2; h = 550 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) no longitudinal edge reinforcement

R - The anchor calculation is based on a rigid baseplate assumption.

Geometry [mm] & Loading [kN, kNm]



Input data and results must be checked for agreement with the existing conditions and for plausibility!

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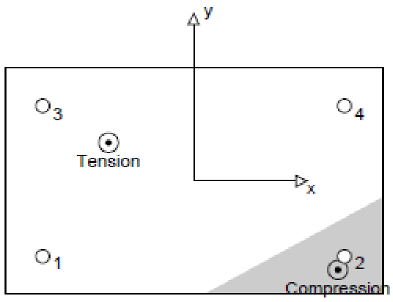
2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	9,888	14,185	14,017	2,182
2	0,000	14,017	14,017	0,001
3	21,700	15,264	15,107	2,182
4	8,805	15,107	15,107	0,001

max. concrete compressive strain: 0,24 [‰]
max. concrete compressive stress: 7,23 [N/mm²]
resulting tension force in (x/y)=(-113/51): 40,393 [kN]
resulting compression force in (x/y)=(191/-118): 36,316 [kN]

Anchor forces are calculated based on the assumption of a rigid baseplate.

3 Tension load (EOTA TR 029, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilisation β_N [%]	Status
Steel failure*	21,700	83,733	26	OK
Combined pullout-concrete cone failure**	40,393	73,477	55	OK
Concrete cone failure**	40,393	79,143	52	OK
Splitting failure**	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (anchors in tension)

3.1 Steel failure

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
125,600	1,500	83,733	21,700

3.2 Combined pullout-concrete cone failure

$A_{p,N}$ [mm²]	$A^0_{p,N}$ [mm²]	$\tau_{Rk,ucr,25}$ [N/mm²]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]
472 500	202 500	16,00	450	225	∞

ψ_c	$\tau_{Rk,cr}$ [N/mm²]	k	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,000	8,00	2,300	1,098	1,018

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
46	0,830	18	0,927	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Sd} [kN]
60,319	110,215	1,500	73,477	40,393

3.3 Concrete cone failure

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
472 500	202 500	225	450

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
46	0,830	18	0,927	1,000	1,000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7,200	66,136	1,500	79,143	40,393

Input data and results must be checked for agreement with the existing conditions and for plausibility!

4 Shear load (EOTA TR 029, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilisation β_V [%]	Status
Steel failure (without lever arm)*	15,264	50,240	31	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure**	58,411	206,351	29	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (relevant anchors)

4.1 Steel failure (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
62,800	1,250	50,240	15,264

4.2 Pryout failure (bond relevant)

$A_{p,N}$ [mm^2]	$A^0_{p,N}$ [mm^2]	$\tau_{Rk,ucr,25}$ [N/mm^2]	$c_{cr,Np}$ [mm]	$s_{cr,Np}$ [mm]	c_{min} [mm]
552 500	202 500	16,00	225	450	∞

ψ_c	$\tau_{Rk,cr}$ [N/mm^2]	k	k-factor	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,000	8,00	2,300	2,000	1,134	1,025

$e_{c1,V}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,V}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
1	0,994	19	0,924	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
60,319	154,763	1,500	206,351	58,411

5 Combined tension and shear loads (EOTA TR 029, Section 5.2.4)

β_N	β_V	α	Utilisation $\beta_{N,V}$ [%]	Status
0,550	0,304	1,500	58	OK

$\beta_N^\alpha + \beta_V^\alpha \leq 1{,}0$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 16,074 [kN]		δ_N = 0,171 [mm]
V_{Sk} = 11,307 [kN]		δ_V = 0,452 [mm]
		δ_{NV} = 0,483 [mm]

Long term loading:

N_{Sk} = 16,074 [kN]		δ_N = 0,405 [mm]
V_{Sk} = 11,307 [kN]		δ_V = 0,678 [mm]
		δ_{NV} = 0,790 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

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7 Warnings

- The anchor design methods in PROFIS Anchor require rigid baseplates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required baseplate thickness with FEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with EOTA TR 029, Section 7!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of EOTA TR029! For larger diameters of the clearance hole see Chapter 1.1. of EOTA TR029!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- Characteristic bond resistances depend on short- and long-term temperatures.
- Please contact Hilti to check feasibility of HIT-V rod supply.
- Edge reinforcement is not required to avoid splitting failure

Fastening meets the design criteria!

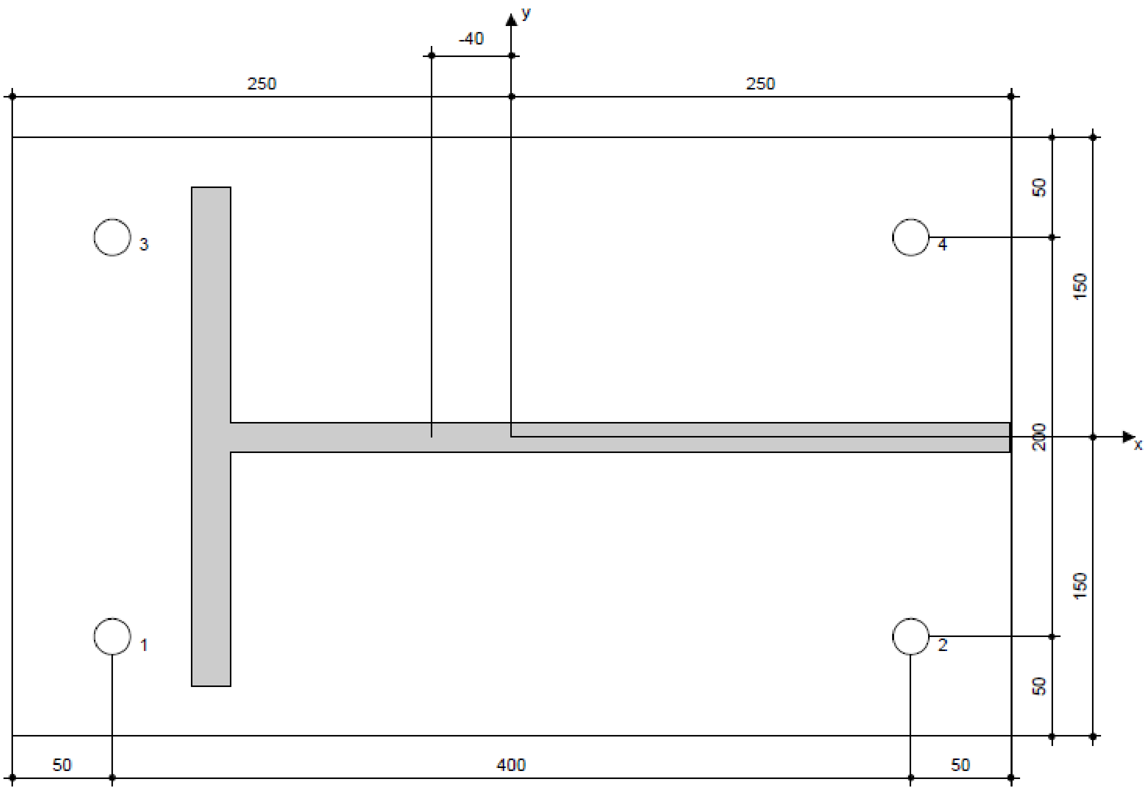
8 Installation data

Baseplate, steel: -
Profile: T profile; (L x W x T x FT) = 410 mm x 250 mm x 15 mm x 20 mm
Hole diameter in the fixture: d_f = 18 mm
Plate thickness (input): 15 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and size: HIT-RE 500 V3 + HIT-V (8.8) M16
Installation torque: 0,080 kNm
Hole diameter in the base material: 18 mm
Hole depth in the base material: 150 mm
Minimum thickness of the base material: 186 mm

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-200	-100	-	-	-	-
2	200	-100	-	-	-	-
3	-200	100	-	-	-	-
4	200	100	-	-	-	-

9 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

2.3.3 ASSESSMENT OF CRANE BEAM FOR MSÚ (STR)

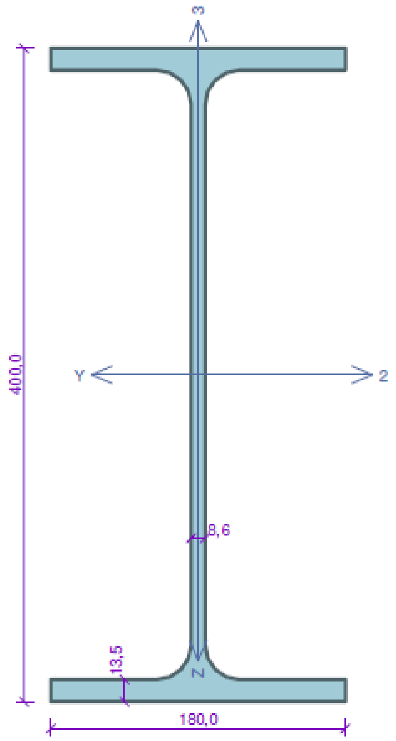
Date: 29.07.2019 | Project: | Model: Beer - crane | Beam for crane | Page: 9/10

■ 4.12 CROSS-SECTIONS - INTERNAL FORCES

Result Combinations

Member No.	RC	Node No.	Location x [m]		Forces [kN] N	V_y	V_z	Moments [kNm] M_T	M_y	M_z	Corresponding Load Cases
	Section No. 1: KB(L) IPE 400-50/30 | Ferona - DIN 1025-5:1994										
4	RC1	5	0.000	MAX N	4.159	-4.365	58.242	-0.008	0.000	-5.559	CO 7
1	RC1	3	5.900	MIN N	-0.092	-0.046	-12.351	-0.002	-11.683	0.061	CO 10
5	RC1	7	0.000	MAX V_y	-0.004	5.991	34.383	0.000	-31.115	4.466	CO 9
4	RC1	5	0.000	MIN V_y	4.158	-4.365	54.088	-0.008	0.000	-5.559	CO 13
4	RC1	5	0.000	MAX V_z	0.437	-0.267	58.248	0.001	0.000	0.520	CO 4
4	RC1	7	5.875	MIN V_z	0.056	-0.407	-47.641	0.000	-40.448	0.366	CO 11
4	RC1	7	5.875	MAX M_T	0.056	4.869	-47.641	0.007	-40.448	-5.682	CO 14
4	RC1	5	0.000	MIN M_T	4.158	-4.365	54.088	-0.008	0.000	-5.559	CO 13
4	RC1		1.937	MAX M_y	0.061	0.422	-5.837	-0.001	63.682	0.422	CO 11
4	RC1	7	5.875	MIN M_y	0.056	-0.407	-47.641	0.000	-40.448	0.366	CO 11
5	RC1	7	0.000	MAX M_z	-0.004	5.991	34.383	0.000	-31.115	4.466	CO 9
4	RC1	7	5.875	MIN M_z	0.047	4.869	-43.487	0.006	-37.704	-5.682	CO 8
	Section No. 2: HEA 140										
2	RC1	3	0.000	MAX N	-10.278	0.009	0.017	0.000	-0.079	0.043	CO 1
2	RC1	4	4.470	MIN N	-29.472	0.000	0.050	0.000	0.000	0.000	CO 18
2	RC1	4	4.470	MAX V_y	-23.330	0.045	0.039	0.000	0.000	0.000	CO 14
2	RC1	3	0.000	MIN V_y	-16.031	0.000	0.026	0.000	-0.123	0.001	CO 3
2	RC1	4	4.470	MAX V_z	-29.472	0.000	0.050	0.000	0.000	0.000	CO 21
2	RC1	3	0.000	MIN V_z	-10.278	0.009	0.017	0.000	-0.079	0.043	CO 1
2	RC1	3	0.000	MAX M_T	-21.842	0.033	0.035	0.000	-0.167	0.180	CO 11
2	RC1	4	4.470	MIN M_T	-25.863	0.027	0.043	0.000	0.000	0.000	CO 20
2	RC1	4	4.470	MAX M_y	-23.330	0.045	0.039	0.000	0.000	0.000	CO 14
2	RC1	3	0.000	MIN M_y	-27.983	0.000	0.044	0.000	-0.213	0.002	CO 21
2	RC1	3	0.000	MAX M_z	-21.842	0.033	0.035	0.000	-0.166	0.181	CO 14
2	RC1	4	4.470	MIN M_z	-11.766	0.010	0.018	0.000	0.000	0.000	CO 1
	Section No. 3: QRO 100x5 (za tepla)										
6	RC1	8	0.765	MAX N	0.911	-0.770	-0.321	0.000	0.000	0.174	CO 20
6	RC1	3	0.000	MIN N	-0.971	-0.566	-0.149	0.000	0.172	-0.305	CO 9
6	RC1	3	0.000	MAX V_y	-0.020	0.066	-0.125	0.000	0.153	0.036	CO 16
6	RC1	3	0.000	MIN V_y	0.907	-0.771	-0.144	0.000	0.168	-0.416	CO 14
6	RC1	3	0.000	MAX V_z	0.018	0.000	-0.029	0.000	0.080	0.000	CO 1
6	RC1	8	0.765	MIN V_z	-0.961	-0.566	-0.358	0.000	0.000	0.128	CO 21
6	RC1	3	0.000	MAX M_T	0.911	-0.771	-0.170	0.000	0.188	-0.415	CO 20
6	RC1	8	0.765	MIN M_T	0.911	-0.770	-0.321	0.000	0.000	0.174	CO 20
6	RC1	3	0.000	MAX M_y	-0.961	-0.566	-0.207	0.000	0.216	-0.305	CO 21
6	RC1	8	0.765	MIN M_y	-0.045	0.055	-0.296	0.000	0.000	-0.012	CO 11
6	RC1	8	0.765	MAX M_z	0.907	-0.771	-0.296	0.000	0.000	0.174	CO 14
6	RC1	3	0.000	MIN M_z	0.907	-0.771	-0.144	0.000	0.168	-0.416	CO 14

Crane IPE - 400



Standard **EN 1993-1-1/Czech Rep.**.

Section capacity	:	γ_{M0}	=	1,000
Section resistance when checking stability	:	γ_{M1}	=	1,000
Perforated section capacity	:	γ_{M2}	=	1,250

Section IPE 400
Cross-sectional area: $A = 8{,}446E03$ mm^2
Centre of gravity position:
$y_T = 90{,}0$ mm $z_T = 200{,}0$ mm
Second moments of area:
$I_y = 2{,}313E08$ mm^4 $I_z = 1{,}318E07$ mm^4
Cross-section moduli:
$W_{y,1} = -1{,}156E06$ mm^3 $W_{z,1} = 1{,}464E05$ mm^3
$W_{y,2} = 1{,}156E06$ mm^3 $W_{z,2} = -1{,}464E05$ mm^3
Torsion constant:
$I_k = 5{,}108E05$ mm^4
Warping constant:
$I_\omega = 4{,}900E11$ mm^6
Plastic cross-section moduli:
$W_{pl,y} = 1{,}307E06$ mm^3 $W_{pl,z} = 2{,}290E05$ mm^3

Material: EN 10210-1 : S 235
Material characteristics:

Yield strength	f_y	:	235,0	MPa
Ultimate strength	f_u	:	360,0	MPa
Elastic modulus	E	:	210000	MPa
Shear modulus	G	:	81000	MPa

Internal forces in system of cross-section coordinates
Load with maximal utilization
Envelope of load

N =	4,159	kN			
V_z =	58,248	kN	M_y =	63,682	kNm
V_y =	5,991	kN	M_z =	-5,682	kNm
T_t =	0,008	kNm			
T_ω =	0,000	kNm	B =	0,000	kNm^2

Buckling parameters
Length: 12,450 m
L_z = 12,450 m
L_y = 12,450 m

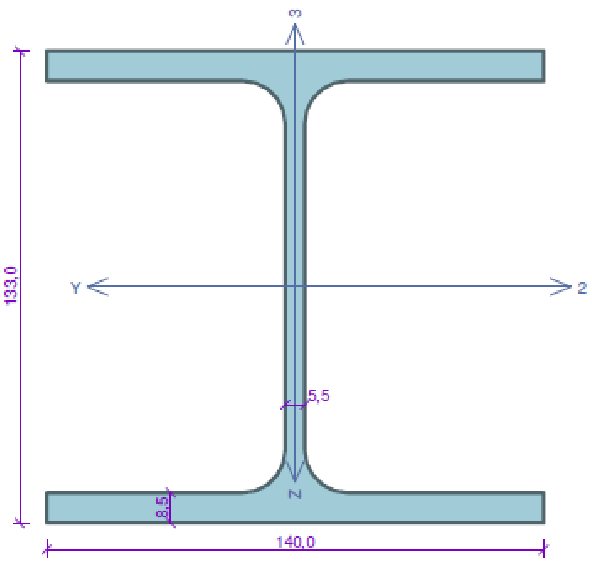
LTB parameters
End condition factors: k_y = - k_z = 1.0 k_w = 1.0
l_{z1} = 6,000 m M_y: Shape no.4 z_P = 1,000
l_{y1} = No input M_z: Shape N/A

Results - Decisive load: Envelope of load; **Cross-section class:** 1
Check of shear due to torsion:
Stress: $\tau_t = 0{,}211$ MPa; $\tau_w = 0{,}000$ MPa
Strength: $\tau_{Rd} = 135{,}677$ MPa
0,211+0,000 < 135,677 **Pass**
Check of shear due to shear force V_z:
58,248 kN < 578,990 kN **Pass**
Check of shear due to shear force V_y:
5,991 kN < 566,357 kN **Pass**
Internal forces: N = 4,159 kN; M_y = 63,682 kNm; M_z = -5,682 kNm
Critical combination check: simple tension and bending moment:
Resistances: N_R = 1984,810 kN; $M_{y,R}$ = 136,692 kNm; $M_{z,R}$ = -53,815 kNm
| 0,002 + 0,466 + 0,106 | = | 0,574 | < 1 **Pass**
Member slenderness: 315,2

Section ok

PASS

Column for crane - HEA 140



Standard **EN 1993-1-1/Czech Rep..**

Section capacity	:	γ_{M0}	=	1,000
Section resistance when checking stability	:	γ_{M1}	=	1,000
Perforated section capacity	:	γ_{M2}	=	1,250

Section HE 140 A
Cross-sectional area: $A = 3{,}142E03\ mm^2$
Centre of gravity position:
$y_T = 70{,}0\ mm$ $z_T = 66{,}5\ mm$
Second moments of area:
$I_y = 1{,}033E07\ mm^4$ $I_z = 3{,}893E06\ mm^4$
Cross-section moduli:
$W_{y,1} = -1{,}554E05\ mm^3$ $W_{z,1} = 5{,}562E04\ mm^3$
$W_{y,2} = 1{,}554E05\ mm^3$ $W_{z,2} = -5{,}562E04\ mm^3$
Torsion constant:
$I_k = 8{,}130E04\ mm^4$
Warping constant:
$I_\omega = 1{,}506E10\ mm^6$
Plastic cross-section moduli:
$W_{pl,y} = 1{,}735E05\ mm^3$ $W_{pl,z} = 8{,}485E04\ mm^3$

Material: EN 10210-1 : S 235
Material characteristics:

Yield strength	f_y	:	235,0	MPa
Ultimate strength	f_u	:	360,0	MPa
Elastic modulus	E	:	210000	MPa
Shear modulus	G	:	81000	MPa

Internal forces in system of cross-section coordinates
Load with maximal utilization
Envelope of load

$N = -79{,}783$ kN
$V_z = 0{,}860$ kN $M_y = 2{,}470$ kNm
$V_y = 0{,}090$ kN $M_z = -0{,}230$ kNm
$T_t = 0{,}000$ kNm
$T_\omega = 0{,}000$ kNm $B = 0{,}000\ kNm^2$

Buckling parameters
Length: 4,500 m
$L_z = 4{,}500$ m $k_z = 1{,}000$ $L_{cr,z} = 4{,}500$ m
$L_y = 4{,}500$ m $k_y = 1{,}000$ $L_{cr,y} = 4{,}500$ m

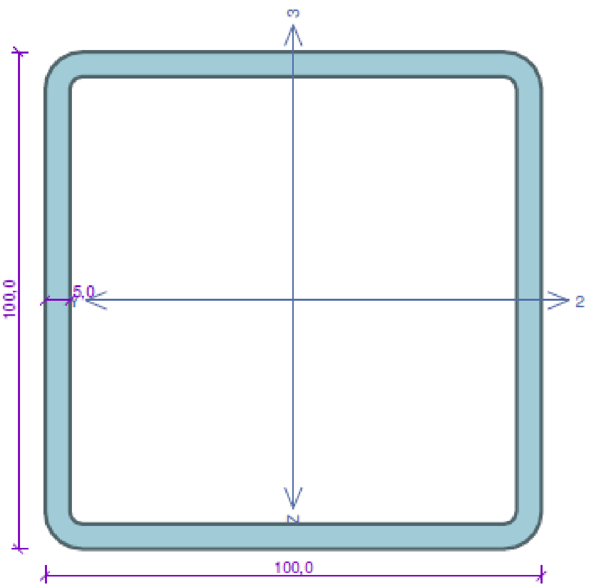
LTB parameters
Buckling neglected

Results - Decisive load: Envelope of load; **Cross-section class:** 1
Check of shear due to shear force V_z:
0,860 kN < 137,407 kN **Pass**
Check of shear due to shear force V_y:
0,090 kN < 288,891 kN **Pass**
Internal forces: $N = -79{,}783$ kN; $M_y = 2{,}470$ kNm; $M_z = -0{,}230$ kNm
Critical combination check: buckling compression and bending moment:
Buckling Y: Resistances: $N_R = -518{,}479$ kN; $M_{y,R} = 39{,}094$ kNm; $M_{z,R} = -24{,}711$ kNm
| 0,154 + 0,063 + 0,009 | = | 0,226 | < 1 **Pass**
Buckling Z: Resistances: $N_R = -268{,}723$ kN; $M_{y,R} = 40{,}772$ kNm; $M_{z,R} = -19{,}940$ kNm
| 0,297 + 0,061 + 0,012 | = | 0,369 | < 1 **Pass**
Member slenderness: 127,8

Section ok

PASS

Bracetling - 100x100x5



Standard **EN 1993-1-1/Czech Rep.**.

Section capacity	:	γ_{M0}	=	1,000
Section resistance when checking stability	:	γ_{M1}	=	1,000
Perforated section capacity	:	γ_{M2}	=	1,250

Section MSH 100 x 100 x 5.0
Cross-sectional area: A = 1,870E03 mm^2
Centre of gravity position:
y_T = 50,0 mm z_T = 50,0 mm
Second moments of area:
I_y = 2,790E06 mm^4 I_z = 2,790E06 mm^4
Cross-section moduli:
$W_{y,1}$ = -5,527E04 mm^3 $W_{z,1}$ = 5,527E04 mm^3
$W_{y,2}$ = 5,527E04 mm^3 $W_{z,2}$ = -5,527E04 mm^3
Torsion constant:
I_k = 4,287E06 mm^4
Plastic cross-section moduli:
$W_{pl,y}$ = 6,566E04 mm^3 $W_{pl,z}$ = 6,566E04 mm^3

Material: EN 10210-1 : S 235
Material characteristics:

Yield strength	f_y	:	235,0	MPa
Ultimate strength	f_u	:	360,0	MPa
Elastic modulus	E	:	210000	MPa
Shear modulus	G	:	81000	MPa

Internal forces in system of cross-section coordinates
Load with maximal utilization
Envelope of load

N =	-6,220	kN			
V_z =	0,750	kN	M_y =	0,500	kNm
V_y =	5,170	kN	M_z =	-4,480	kNm
T_t =	0,300	kNm			
T_ω =	0,000	kNm	B =	0,000	kNm^2

Buckling parameters
Length: 1,275 m
L_z = 1,275 m k_z = 1,000 $L_{cr,z}$ = 1,275 m
L_y = 1,275 m k_y = 1,000 $L_{cr,y}$ = 1,275 m

Results - Decisive load: Envelope of load; **Cross-section class:** 1
Check of shear due to torsion:
Stress: τ_t = 3,324 MPa; τ_w = 0,000 MPa
Strength: τ_{Rd} = 135,677 MPa
3,324+0,000 < 135,677 **Pass**
Check of shear due to shear force V_z:
0,750 kN < 125,736 kN **Pass**
Check of shear due to shear force V_y:
5,170 kN < 125,736 kN **Pass**
Internal forces: N = -6,220 kN; M_y = 0,500 kNm; M_z = -4,480 kNm
Critical combination check: buckling compression and bending moment:
Buckling Y: Resistances: N_R = -424,131 kN; $M_{y,R}$ = 15,429 kNm; $M_{z,R}$ = -15,429 kNm
| 0,015 + 0,032 + 0,290 | = | 0,337 | < 1 **Pass**
Buckling Z: Resistances: N_R = -424,131 kN; $M_{y,R}$ = 15,429 kNm; $M_{z,R}$ = -15,429 kNm
| 0,015 + 0,032 + 0,290 | = | 0,337 | < 1 **Pass**
Member slenderness: 33,0

Section ok

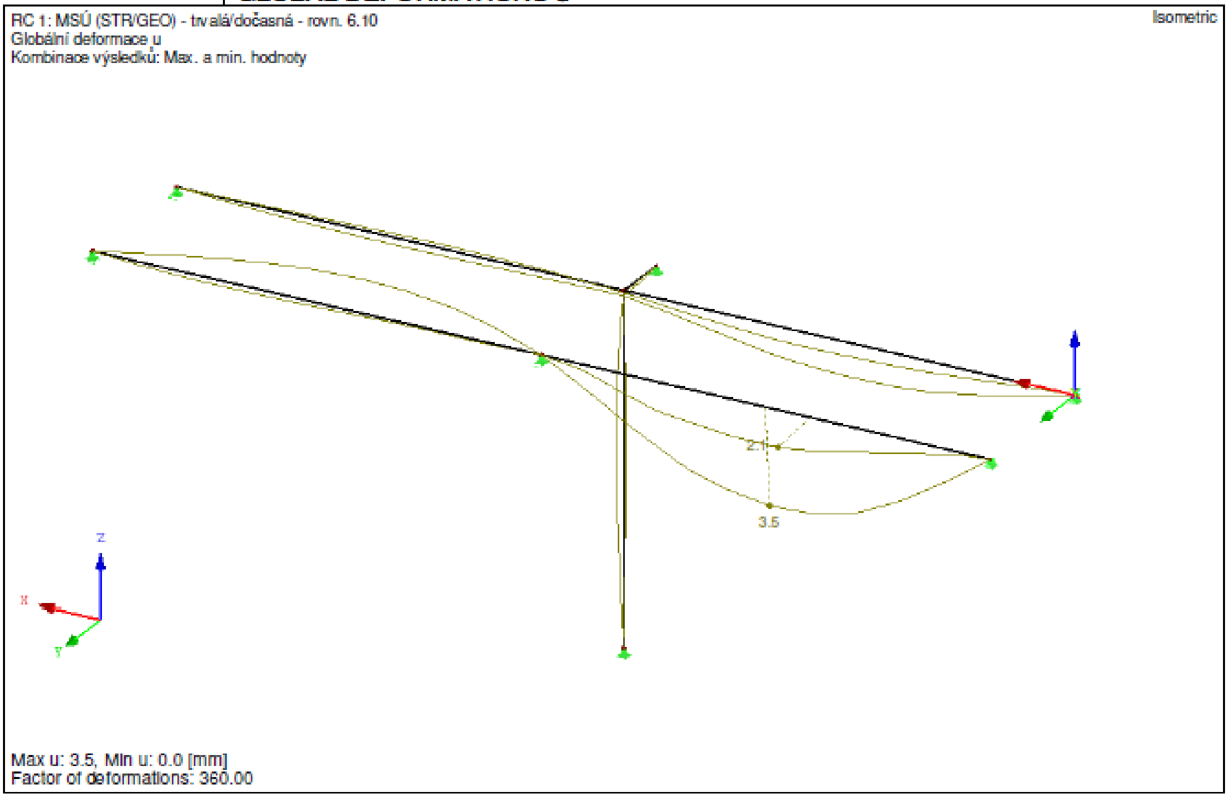
PASS

2.3.4 ASSESSMENT OF CRANE BEAM FOR MSP- CHARACTERISTIC

Date: 29.07.2019 | Project: | Model: Beer - crane | Page: 10/10

Beam for crane

GLOBAL DEFORMATIONS u



Beam for crane IPE 400

$U_{lim1} = L_1/500$ $L_1 =$ 5850 mm

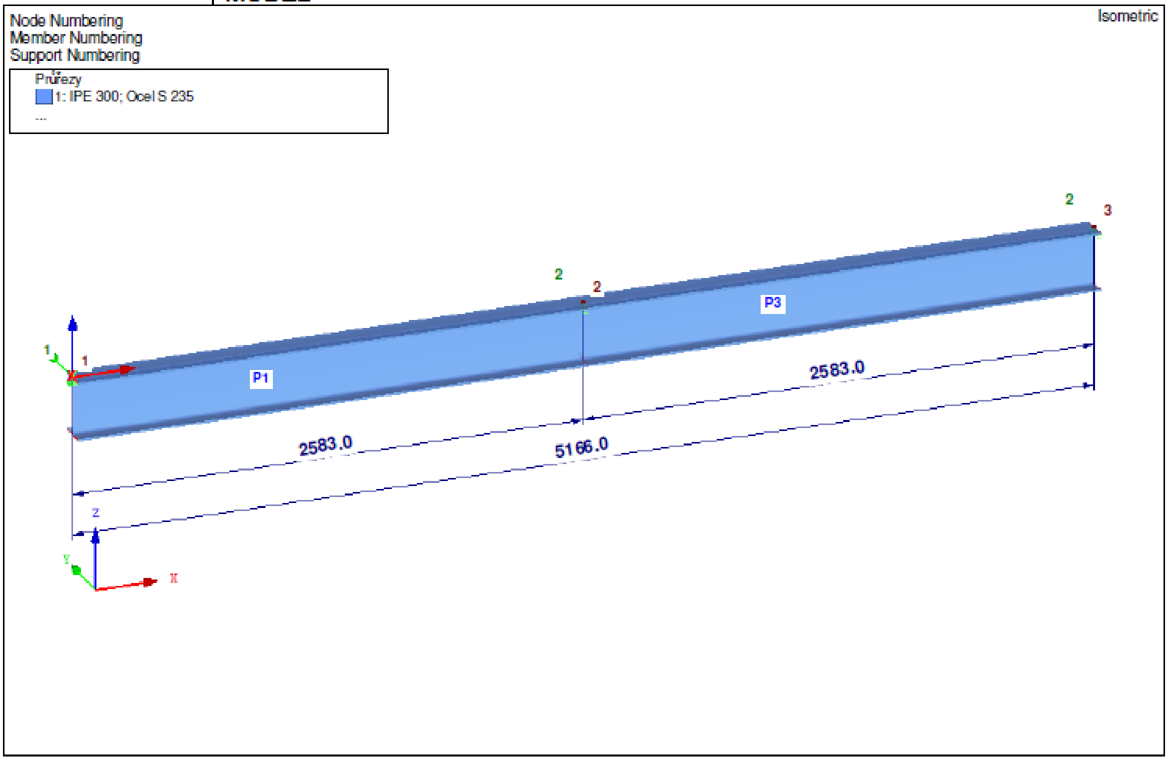
$U_{lim1} =$ 11,70 mm > Ufin= 3,5 mm PASS

2.4 HEAVY DOOR

2.4.1 RECALCULATION OF DOOR WEIGHT INTO SUPPORTS

Date: 29.07.2019 Project: Heavy door beam Model: Recaculation of force Page: 1/4

MODEL



MODEL - GENERAL DATA

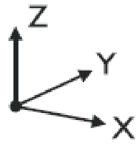
General	Model name	:	Pøepoèet sil
	Type of model	:	2D-XZ (ux/uz/φy)
	Positive direction of global axis Z	:	Upward
	Classification of load cases and combinations	:	According to Standard: EN 1990 + EN 1991-3; Jeøáby National Annex: CEN - EU
Options	☐ RF-FORM-FINDING - Find initial equilibrium shapes of membrane and cable structures		
	☐ RF-CUTTING-PATTERN		
	☐ Piping analysis		
	☐ Use CQC Rule		
	☐ Enable CAD/BIM model		
	Standard Gravity		
	g	:	10.00 m/s²

FE MESH SETTINGS

General	Target length of finite elements	l_{FE}	:	0.5 m
	Maximum distance between a node and a line to integrate it into the line	ε	:	0.0 m
	Maximum number of mesh nodes (in thousands)		:	500
Members	Number of divisions of members with cable, elastic foundation, taper, or plastic characteristic		:	10
	☒ Activate member divisions for large deformation or post-critical analysis			
	☒ Use division for members with node lying on them			
Surfaces	Maximum ratio of FE rectangle diagonals	Δ_D	:	1.800
	Maximum out-of-plane inclination of two finite elements	α	:	0.50 °
	Shape direction of finite elements		:	Triangles and quadrangles ☒ Same squares where possible

1.3 MATERIALS

Matl. No.	Modulus E [MPa]	Modulus G [MPa]	Poisson's Ratio ν [-]	Spec. Weight γ [kN/m³]	Coeff. of Th. Exp. α [1/K]	Partial Factor γ_M [-]	Material Model
1	Steel S 235 | EN 10025-2:2004-11						
	210000.000	80769.200	0.300	78.50	1.20E-05	1.00	Isotropic Linear Elastic

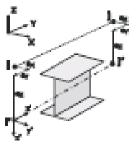


1.7 NODAL SUPPORTS

Support No.	Nodes No.	Axis System	Support or Spring [kN/m] [kNm/rad] u_X	u_Z	φ_Y	Comment
1	1	Global X,Y,Z	☒	☒	☐	
2	2,3	Global X,Y,Z	☐	☒	☐	

1.13 CROSS-SECTIONS

Section No.	Matl. No.	J [mm⁴] A [mm²]	I_y [mm⁴] A_y [mm²]	I_z [mm⁴] A_z [mm²]	Principal Axes α [°]	Rotation α' [°]	Overall Dimensions [mm] Width b	Height h
1	IPE 300							
	1	5381.0	83560000.0	1981.9	0.00	0.00	150.0	300.0

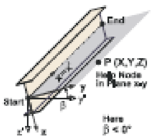


1.15/1 MEMBER ECCENTRICITIES - ABSOLUTE

Ecc. No.	Reference System	Member Start [mm] $e_{i,x}$	$e_{i,z}$	Member End [mm] $e_{j,x}$	$e_{j,z}$	Member hinge location Member Start	Member End
1	Global	0.0	-150.0	0.0	-150.0	at member	at member

1.15/2 MEMBER ECCENTRICITIES - RELATIVE

Ecc. No.	Cross-Section Alignment y-Axis	z-Axis	Transverse offset from cross-section of another obj. Object Type	Object No.	y-Axis	z-Axis	Axial offset from adjacent Member Sta	Member End
1	Middle	Middle	None	0	Middle	Middle	☐	☐



1.17 MEMBERS

Mbr. No.	Line No.	Member	Rotation Type	β [°]	Cross-Section Start	End	Hinge No. Start	End	Ecc. No.	Div. No.	Length L [m]	
1	1	Beam	Angle	0.00	1	1	-	-	1	-	2.583	X
3	3	Beam	Angle	0.00	1	1	-	-	1	-	2.583	X

2.1 LOAD CASES

Load Case	Load Case Description	EN 1990 + EN 1991-3; Jeøáby | CEN Action Category	Self-Weight - Factor in Direction Active	X	Y	Z
LC1		Permanent	☒	0.000		-1.000
LC2		Permanent	☒	0.000		-1.000

2.5 LOAD COMBINATIONS

Load Combin.	DS	Load Combination Description	No.	Factor	Load Case	
CO1		1.35*ZS1	1	1.35	LC1	
CO2		1.35*ZS2	1	1.35	LC2	

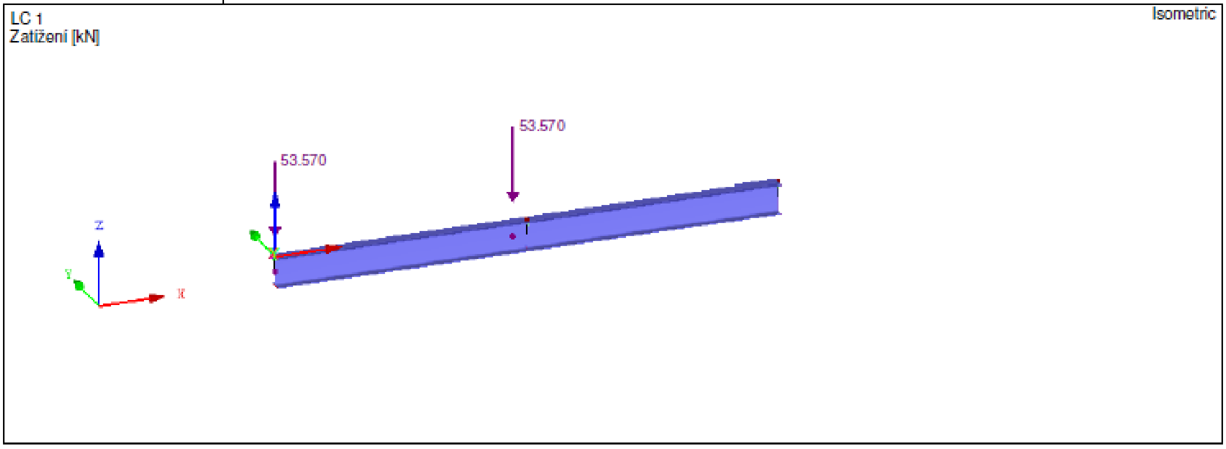
Date:	29.07.2019	Project:	Heavy door beam	Model:	Recaculation of force	Page:	3/4

LC1

3.2 MEMBER LOADS LC1

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Symbol	Load Parameters Value	Unit
1	Members	1	Force	2 x Φ	ZL	True Length	P_1	-53.570	kN
							P_2	-53.570	rad
							A	0.000	m
							B	2.440	m

LC1

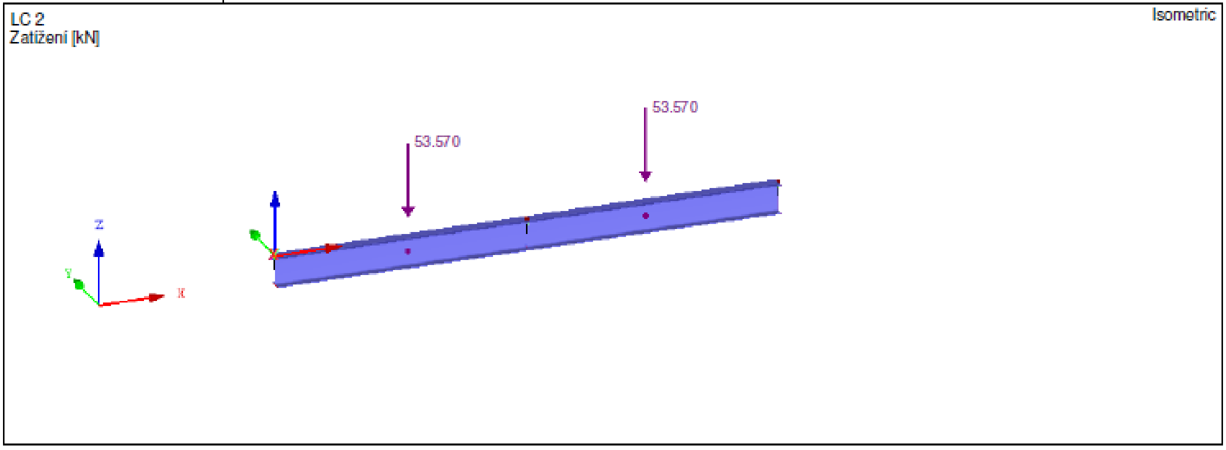


LC2

3.2 MEMBER LOADS LC2

No.	Reference to	On Members No.	Load Type	Load Distribution	Load Direction	Reference Length	Symbol	Load Parameters Value	Unit
1	Members	1	Force	Concentr.	ZL	True Length	P	-53.570	kN
							A	1.363	m
2	Members	3	Force	Concentr.	ZL	True Length	P	-53.570	kN
							A	1.220	m

LC2



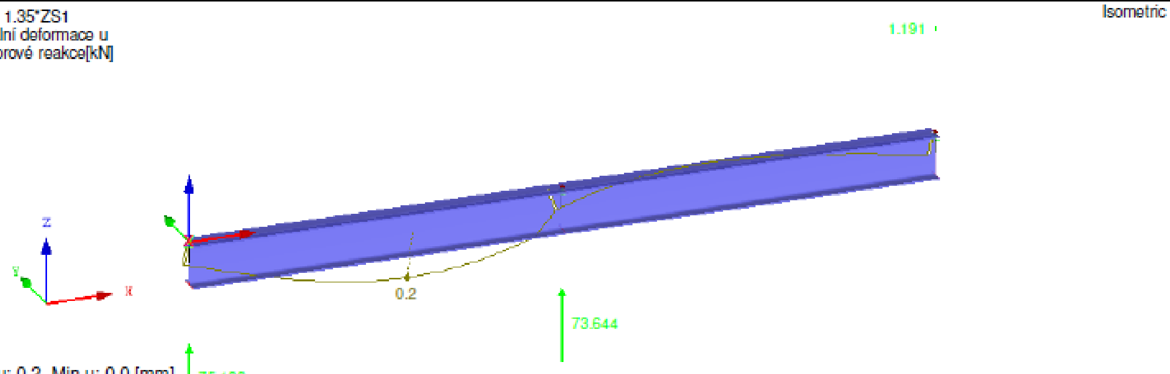
Date:	29.07.2019	Project:	Heavy door beam	Model:	Recaculation of force	Page:	4/4

4.1 NODES - SUPPORT FORCES

Node No.	LC/CO	Support Forces [kN] $P_{X'}$	$P_{Z'}$	Support Moments $M_{Y'}$ [kNm]
1	CO1	0.000	-75.132	0.000
	CO2	0.000	-21.598	0.000
2	CO1	0.000	-73.644	0.000
	CO2	0.000	-104.389	0.000
3	CO1	0.000	1.191	0.000
	CO2	0.000	-21.598	0.000

GLOBAL DEFORMATIONS u, SUPPORT REACTIONS

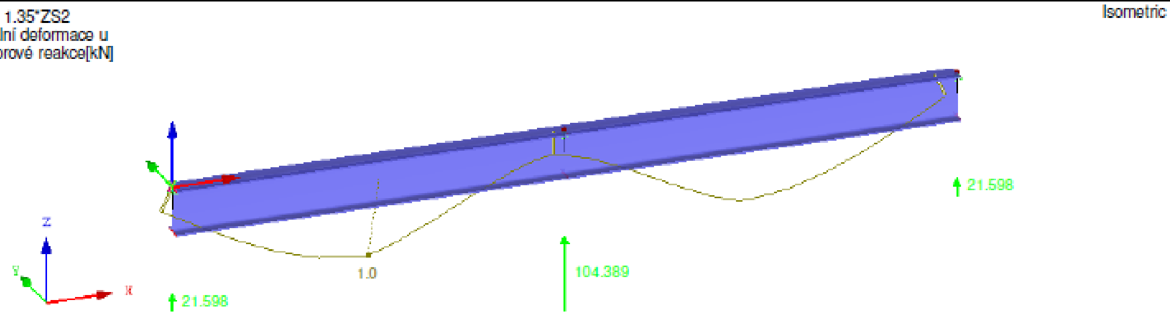
CO 1: 1.35*ZS1
Globální deformace u
Podporové reakce[kN]



Max u: 0.2, Min u: 0.0 [mm]
Factor of deformations: 1700.00
Max P-X': 0.000, Min P-X': 0.000 kN
Max P-Z': 1.191, Min P-Z': -75.132 kN

GLOBAL DEFORMATIONS u, SUPPORT REACTIONS

CO 2: 1.35*ZS2
Globální deformace u
Podporové reakce[kN]



Max u: 1.0, Min u: 0.1 [mm]
Factor of deformations: 520.00
Max P-X': 0.000, Min P-X': 0.000 kN
Max P-Z': -21.598, Min P-Z': -104.389 kN

2.4.2 ASSESSMENTS OF CENTER ANCHORING OF THE DOOR

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Profis Anchor 2.8.3

Company:		Page:	1
Specifier:		Project:	Nuvia - Beer
Address:		Fastening Point:	Střední podpora dveří
Phone I Fax:	|	Date:	29.07.2019
E-Mail:			

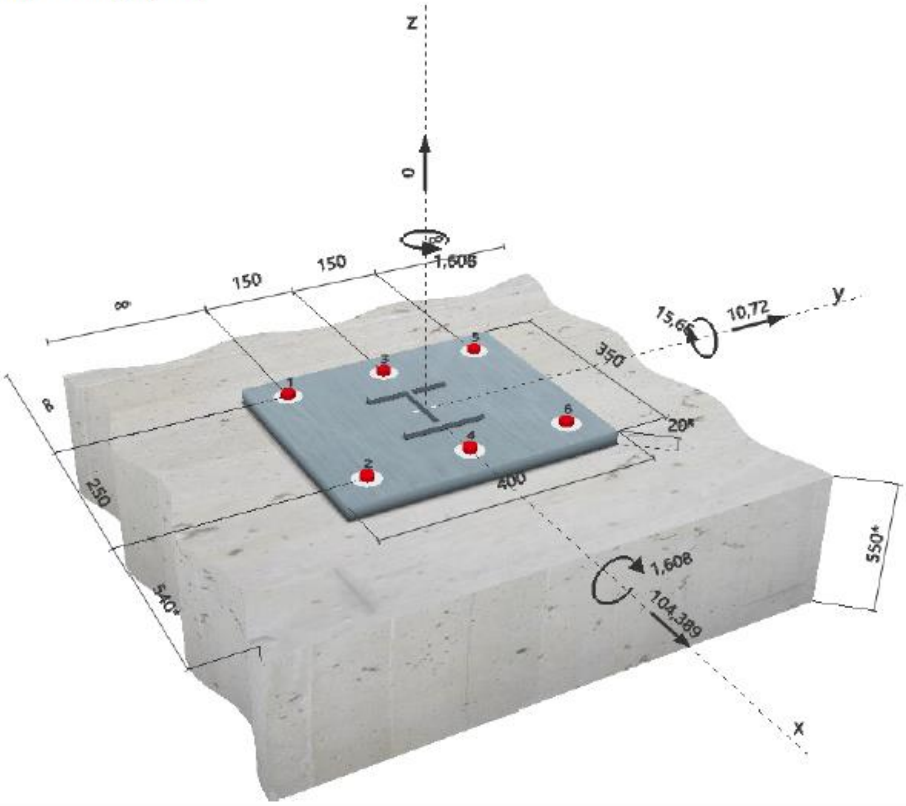
Specifier's comments:

1 Input data

Anchor type and size:	**HIT-RE 500 V3 + HIT-V (8.8) M20**
Seismic/Filling set or any suitable annular gap filling solution	
Effective embedment depth:	$h_{ef,act}$ = 250 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 16/0143
Issued I Valid:	12/07/2017 | -
Proof:	SOFA design method + fib (07/2011) - after ETAG BOND testing
Stand-off installation:	e_b = 0 mm (no stand-off); t = 20 mm
Baseplate:	l_x x l_y x t = 350 mm x 400 mm x 20 mm; (Recommended plate thickness: not calculated
Profile:	IPB/HEB; (L x W x T x FT) = 120 mm x 120 mm x 7 mm x 11 mm
Base material:	cracked concrete, C30/37, $f_{c,cyl}$ = 30,00 N/mm²; h = 550 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement

[R] - The anchor calculation is based on a rigid baseplate assumption.

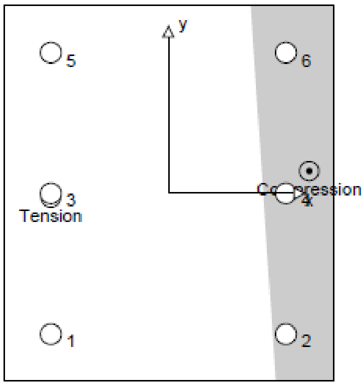
Geometry [mm] & Loading [kN, kNm]



Input data and results must be checked for agreement with the existing conditions and for plausibility!

Company:		Page:	2
Specifier:		Project:	Nuvia - Beer
Address:		Fastening Point:	Střední podpora dveří
Phone I Fax:	|	Date:	29.07.2019
E-Mail:			

2 Load case/Resulting anchor forces



Load case: Design loads

Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	19,837	18,724	18,711	0,693
2	0,000	18,931	18,711	2,881
3	18,996	17,412	17,398	0,693
4	0,000	17,635	17,398	2,881
5	18,154	16,100	16,086	0,693
6	0,000	16,341	16,086	2,881

max. concrete compressive strain: 0,15 [‰]
max. concrete compressive stress: 4,50 [N/mm²]
resulting tension force in (x/y)=(-125/-4): 56,987 [kN]
resulting compression force in (x/y)=(150/24): 56,987 [kN]

Anchor forces are calculated based on the assumption of a rigid baseplate.

3 Tension load SOFA (fib (07/2011), section 16.2.1)

	Load [kN]	Capacity [kN]	Utilisation β_N [%]	Status
Steel failure*	19,837	130,667	16	OK
Combined pullout-concrete cone failure**	56,987	143,193	40	OK
Concrete cone failure**	56,987	153,780	38	OK
Splitting failure**	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (anchors in tension)

3.1 Steel failure

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
196,000	1,500	130,667	19,837

3.2 Combined pullout-concrete cone failure

$A_{p,N}$ [mm²]	$A^0_{p,N}$ [mm²]	$\psi_{A,Np}$	$\tau_{Rk,ucr,25}$ [N/mm²]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]
489 706	320 000	1,530	15,00	566	283	790

ψ_c	$\tau_{Rk,cr}$ [N/mm²]	max $\tau_{Rk,cr}$ [N/mm²]	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,040	8,32	10,61	1,224	1,091

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
0	1,000	4	0,985	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Sd} [kN]
130,688	214,790	1,500	143,193	56,987

3.3 Concrete cone failure

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$\psi_{A,N}$	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
787 500	562 500	1,400	375	750

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0	1,000	4	0,988	1,000	1,000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7,700	166,710	1,500	153,780	56,987

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4 Shear load SOFA (fib (07/2011), section 16.2.2)

	Load [kN]	Capacity [kN]	Utilisation β_V [%]	Status
Steel failure (without lever arm)*	18,931	78,400	25	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure**	104,938	397,058	27	OK
Concrete edge failure in direction x+**	52,905	80,679	66	OK

* most unfavourable anchor **anchor group (relevant anchors)

4.1 Steel failure (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
98,000	1,250	78,400	18,931

4.2 Pryout failure (concrete cone relevant)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$\psi_{A,N}$	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k_4
1 050 000	562 500	1,867	375	750	2,000

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
2	0,996	15	0,961	1,000	1,000

$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
166,710	1,500	397,058	104,938

4.3 Concrete edge failure in direction x+

l_f [mm]	d_{nom} [mm]	k_V	α	β
240	20,0	1,700	0,055	0,048

c_1 [mm]	$A_{c,V}$ [mm^2]	$A^0_{c,V}$ [mm^2]	$\psi_{A,V}$
790	1 468 500	2 808 450	0,523

$\psi_{s,V}$	$\psi_{h,V}$	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$	$\psi_{90°,V}$
1,000	1,468	1,001	8	0,994	1,000	2,500

$V^0_{Rk,c}$ [kN]	n_1	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Sd} [kN]
317,149	2	1,500	80,679	52,905

Note: Resistance limit acc. to fib (07/2011) Eq. (10.2-6) is governing

5 Combined tension and shear loads SOFA (fib (07/2011), section 10.3)

	β_N	β_V	α	Utilisation $\beta_{N,V}$ [%]	Status
steel	0,152	0,241	2,000	9	OK
concrete	0,398	0,656	1,500	79	OK

$\beta_N^\alpha + \beta_V^\alpha <= 1$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 0,000 [kN]		δ_N = 0,000 [mm]	
V_{Sk} = 25,780 [kN]		δ_V = 1,031 [mm]	
		δ_{NV} = 1,031 [mm]	

Long term loading:

N_{Sk} = 0,000 [kN]		δ_N = 0,000 [mm]	
V_{Sk} = 25,780 [kN]		δ_V = 1,547 [mm]	
		δ_{NV} = 1,547 [mm]	

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

7 Warnings

- The anchor design methods in PROFIS Anchor require rigid baseplates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required baseplate thickness with FEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- Characteristic bond resistances depend on short- and long-term temperatures.
- Please contact Hilti to check feasibility of HIT-V rod supply.
- The design method fib (07/2011) assumes that no hole clearance between the anchors and the fixture is present. This can be achieved by filling the gap with mortar of sufficient compressive strength (e.g. by using the HILTI Seismic/Filling set) or by other suitable means
- The compliance with current standards (e.g. EC3) is the responsibility of the user
- Checking the transfer of loads into the base material is required in accordance with fib (07/2011)!

Fastening meets the design criteria!

8 Installation data

Baseplate, steel: -
Profile: IPB/HEB; (L x W x T x FT) = 120 mm x 120 mm x 7 mm x 11 mm
Hole diameter in the fixture: d_f = 22 mm
Plate thickness (input): 20 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

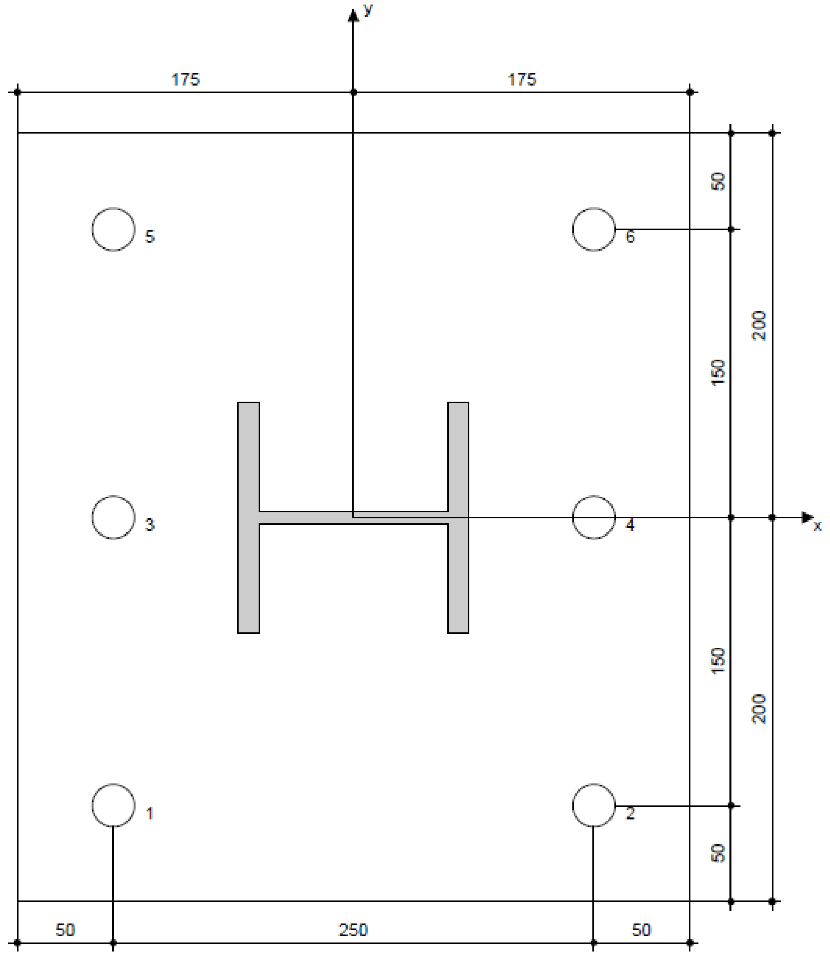
Anchor type and size: HIT-RE 500 V3 + HIT-V (8.8) M20
Installation torque: 0,150 kNm
Hole diameter in the base material: 22 mm
Hole depth in the base material: 250 mm
Minimum thickness of the base material: 294 mm

8.1 Recommended accessories

Drilling
- Suitable Rotary Hammer
- Properly sized drill bit

Cleaning
- Compressed air with required accessories to blow from the bottom of the hole
- Proper diameter wire brush

Setting
- Dispenser including cassette and mixer
- Seismic/Filling set
- Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-125	-150	-	790	-	-
2	125	-150	-	540	-	-
3	-125	0	-	790	-	-
4	125	0	-	540	-	-
5	-125	150	-	790	-	-
6	125	150	-	540	-	-

Input data and results must be checked for agreement with the existing conditions and for plausibility!

2.4.3 ASSESSMENTS OF EDGE ANCHORING OF THE DOOR

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Profis Anchor 2.8.3

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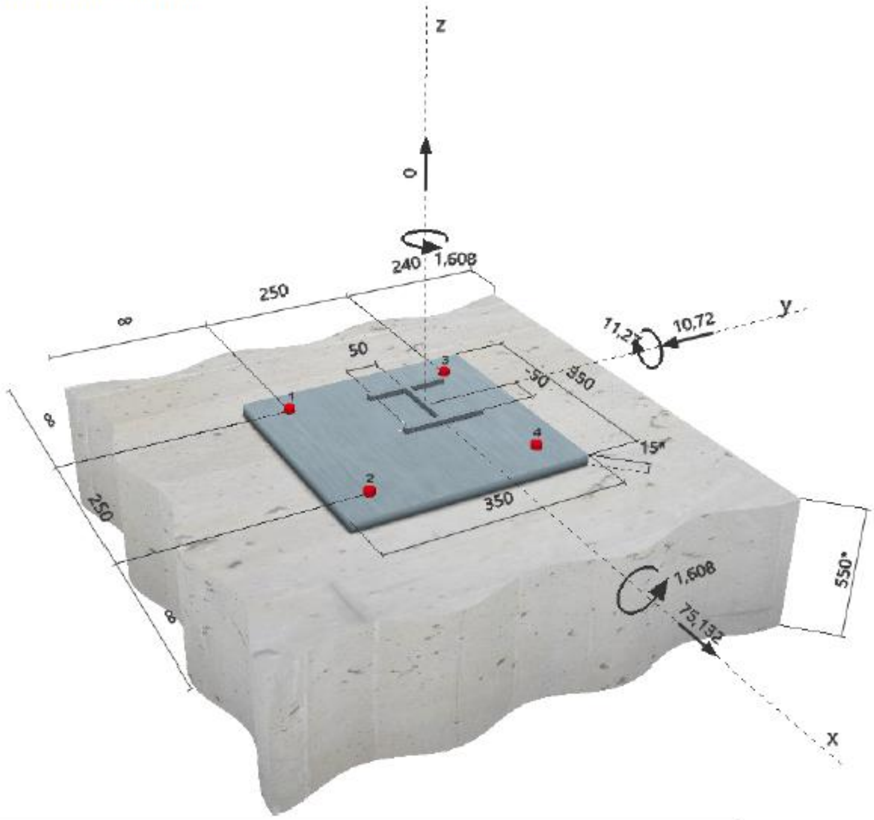
Specifier's comments:

1 Input data

Anchor type and size:	**HIT-RE 500 V3 + HIT-V (8.8) M16**
Effective embedment depth:	$h_{ef,act}$ = 150 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 16/0143
Issued I Valid:	12/07/2017 | -
Proof:	Design method ETAG BOND (EOTA TR 029)
Stand-off installation:	e_b = 0 mm (no stand-off); t = 15 mm
Baseplate:	l_x x l_y x t = 350 mm x 350 mm x 15 mm; (Recommended plate thickness: not calculated
Profile:	IPB/HEB; (L x W x T x FT) = 120 mm x 120 mm x 7 mm x 11 mm
Base material:	cracked concrete, C30/37, $f_{c,cube}$ = 37,00 N/mm²; h = 550 mm, Temp. short/long: 40/24 °C
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) no longitudinal edge reinforcement

[R] - The anchor calculation is based on a rigid baseplate assumption.

Geometry [mm] & Loading [kN, kNm]



Input data and results must be checked for agreement with the existing conditions and for plausibility!
PROFIS Anchor (c) 2003-2009 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

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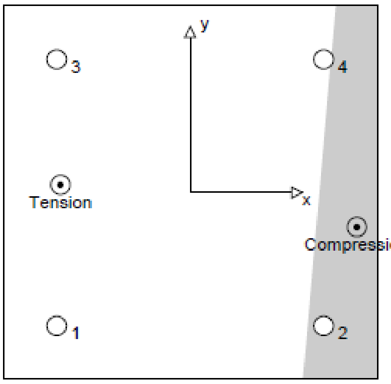
2 Load case/Resulting anchor forces



Load case: Design loads

Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	19,124	17,204	17,170	-1,067
2	0,000	17,699	17,170	-4,293
3	20,908	20,424	20,396	-1,067
4	0,573	20,842	20,396	-4,293

max. concrete compressive strain: 0,18 [‰]
max. concrete compressive stress: 5,38 [N/mm^2]
resulting tension force in (x/y)=(-121/7): 40,605 [kN]
resulting compression force in (x/y)=(156/-32): 40,605 [kN]

Anchor forces are calculated based on the assumption of a rigid baseplate.

3 Tension load (EOTA TR 029, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilisation β_N [%]	Status
Steel failure*	20,908	83,733	25	OK
Combined pullout-concrete cone failure**	40,605	59,848	68	OK
Concrete cone failure**	40,605	72,501	57	OK
Splitting failure**	N/A	N/A	N/A	N/A

* most unfavourable anchor **anchor group (anchors in tension)

3.1 Steel failure

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
125,600	1,500	83,733	20,908

3.2 Combined pullout-concrete cone failure

$A_{p,N}$ [mm^2]	$A^0_{p,N}$ [mm^2]	$\tau_{Rk,ucr,25}$ [N/mm^2]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]
427 500	202 500	16,00	450	225	240

ψ_c	$\tau_{Rk,cr}$ [N/mm^2]	k	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,040	8,32	2,300	1,231	1,059

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
80	0,738	34	0,867	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Sd} [kN]
62,730	89,773	1,500	59,848	40,605

3.3 Concrete cone failure

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
427 500	202 500	225	450

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
80	0,738	34	0,867	1,000	1,000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7,200	80,458	1,500	72,501	40,605

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4 Shear load (EOTA TR 029, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilisation β_V [%]	Status
Steel failure (without lever arm)*	20,842	50,240	42	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure**	75,893	197,311	39	OK
Concrete edge failure in direction y+**	40,791	143,865	29	OK

* most unfavourable anchor **anchor group (relevant anchors)

4.1 Steel failure (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
62,800	1,250	50,240	20,842

4.2 Pryout failure (bond relevant)

$A_{p,N}$ [mm²]	$A^0_{p,N}$ [mm²]	$\tau_{Rk,ucr,25}$ [N/mm²]	$c_{cr,Np}$ [mm]	$s_{cr,Np}$ [mm]	c_{min} [mm]
490 000	202 500	16,00	225	450	240

ψ_c	$\tau_{Rk,cr}$ [N/mm²]	k	k-factor	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1,040	8,32	2,300	2,000	1,315	1,080

$e_{c1,V}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,V}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
3	0,987	21	0,915	1,000	1,000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
62,730	147,983	1,500	197,311	75,893

4.3 Concrete edge failure in direction y+

h_{ef} [mm]	d_{nom} [mm]	k_1	α	β
150	16,0	1,700	0,079	0,058

c_1 [mm]	$A_{c,V}$ [mm²]	$A^0_{c,V}$ [mm²]
240	349 200	259 200

$\psi_{s,V}$	$\psi_{h,V}$	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
1,000	1,000	2,500	0	1,000	1,000

$V^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Sd} [kN]
64,072	1,500	143,865	40,791

5 Combined tension and shear loads (EOTA TR 029, Section 5.2.4)

β_N	β_V	α	Utilisation $\beta_{N,V}$ [%]	Status
0,678	0,415	1,500	83	OK

$\beta_N^\alpha + \beta_V^\alpha \leq 1{,}0$

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6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 15,487 [kN]	δ_N = 0,164 [mm]
V_{Sk} = 15,129 [kN]	δ_V = 0,605 [mm]
	δ_{NV} = 0,627 [mm]

Long term loading:

N_{Sk} = 15,487 [kN]	δ_N = 0,390 [mm]
V_{Sk} = 15,129 [kN]	δ_V = 0,908 [mm]
	δ_{NV} = 0,988 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

7 Warnings

- The anchor design methods in PROFIS Anchor require rigid baseplates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required baseplate thickness with FEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with EOTA TR 029, Section 7!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of EOTA TR029! For larger diameters of the clearance hole see Chapter 1.1. of EOTA TR029!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- Characteristic bond resistances depend on short- and long-term temperatures.
- Please contact Hilti to check feasibility of HIT-V rod supply.
- Edge reinforcement is not required to avoid splitting failure

Fastening meets the design criteria!

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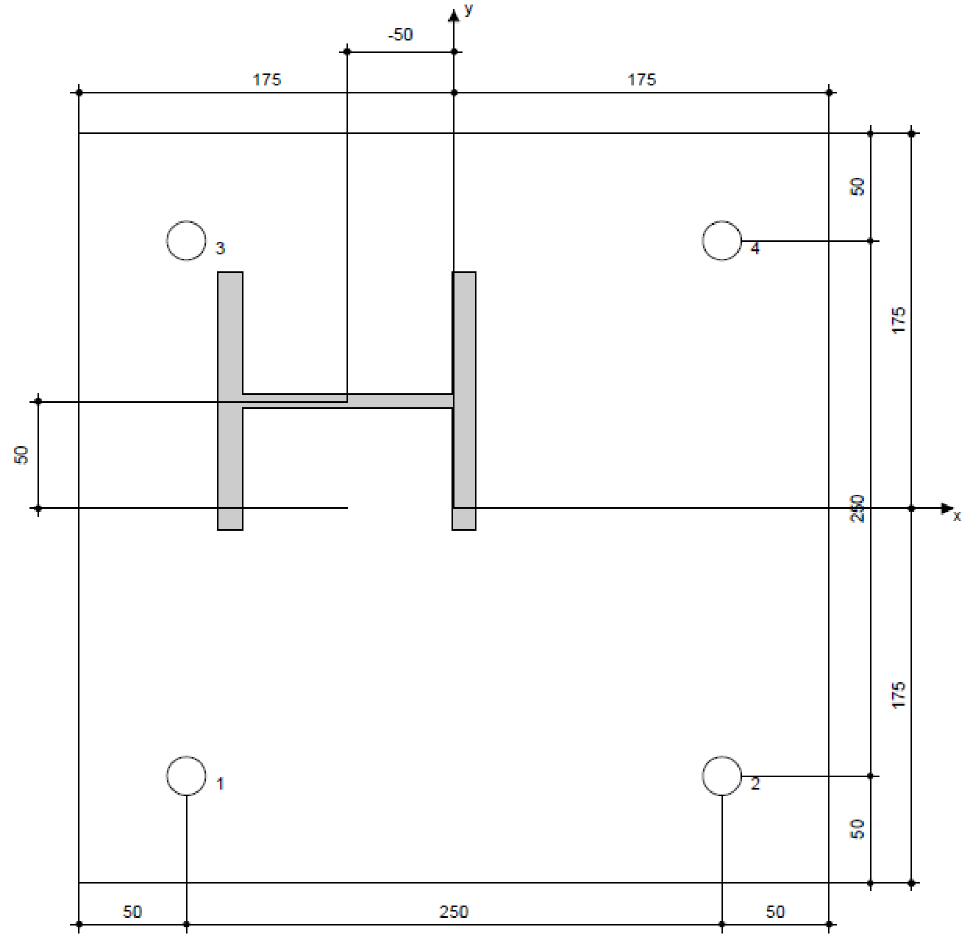
8 Installation data

Baseplate, steel: -
Profile: IPB/HEB; (L x W x T x FT) = 120 mm x 120 mm x 7 mm x 11 mm
Hole diameter in the fixture: d_f = 18 mm
Plate thickness (input): 15 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and size: HIT-RE 500 V3 + HIT-V (8.8) M16
Installation torque: 0,080 kNm
Hole diameter in the base material: 18 mm
Hole depth in the base material: 150 mm
Minimum thickness of the base material: 186 mm

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-125	-125	-	-	-	490
2	125	-125	-	-	-	490
3	-125	125	-	-	-	240
4	125	125	-	-	-	240

Input data and results must be checked for agreement with the existing conditions and for plausibility!

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9 Remarks; Your Cooperation Duties

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