Pretensioned single girder bridge

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1. GENERAL / MEASUREMENT

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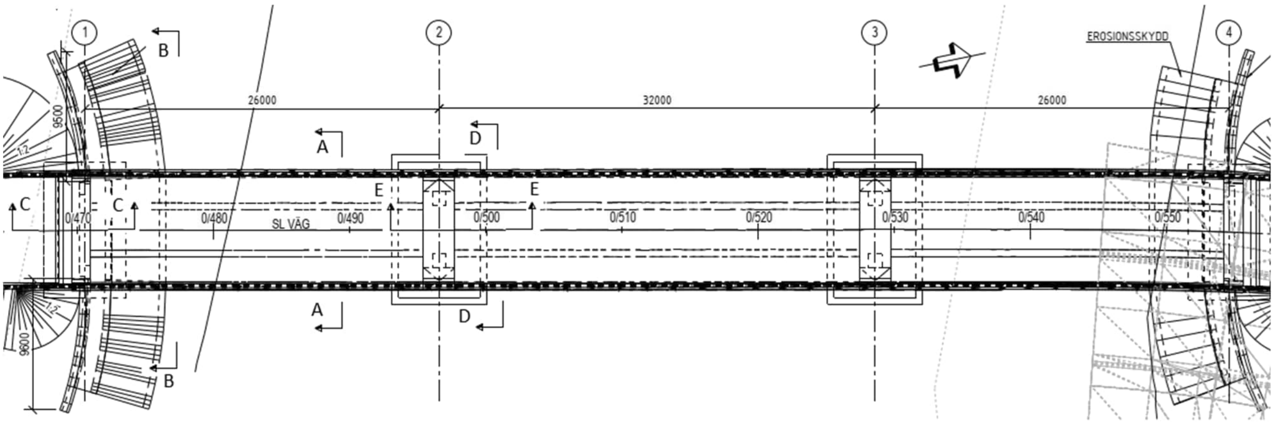
1.1 CONSTRUCTION TYPE

Bridge is constructed using reinforced concrete. Superstructure is modelled with one longitudinal beam that are pretensioned.

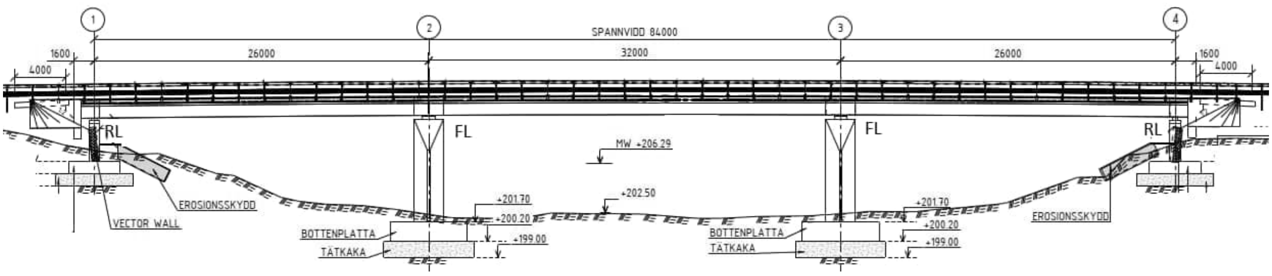
Bottom slabs are founded on underwater concrete slab (“tätkaka”) cast inside sheet pile box (“spontlåda”).

1.2 MEASURMENT

1.2.1 Overview

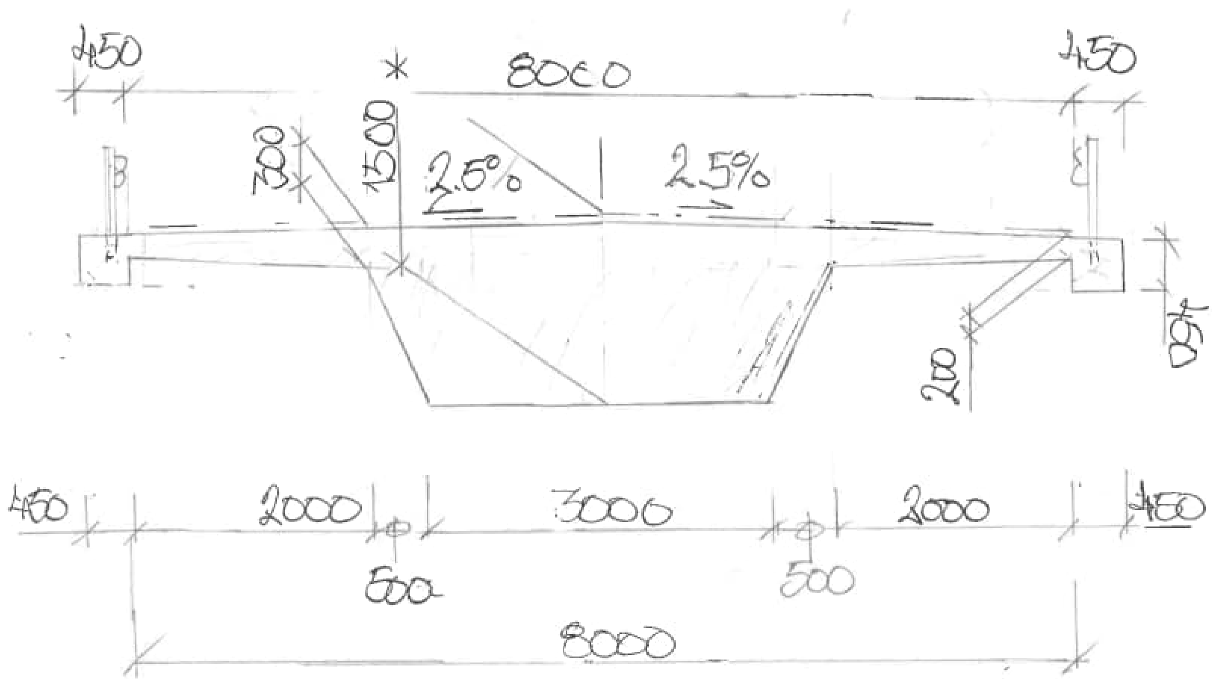


PLAN

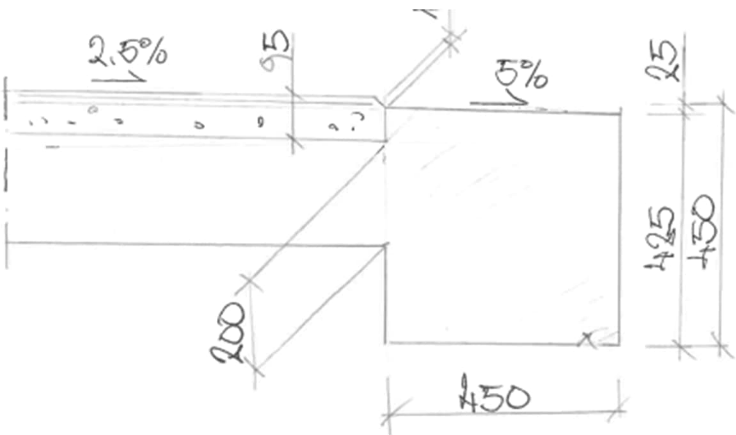


ELEVATION

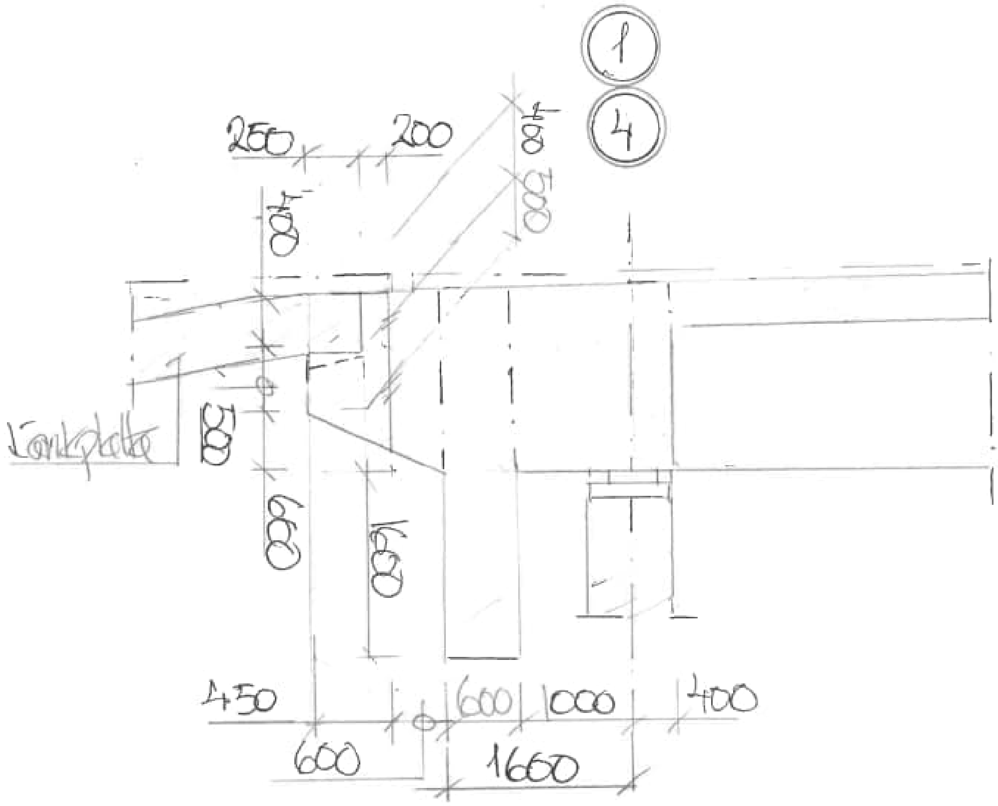
1.2.2 Superstructure



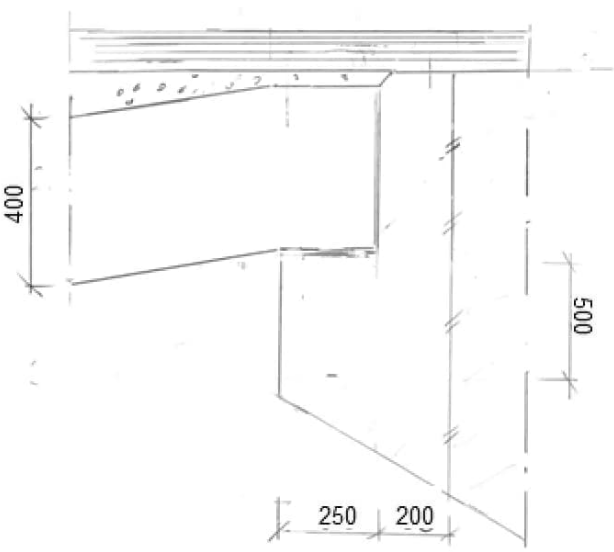
SECTION A-A



DETAIL 1
Edge beam.

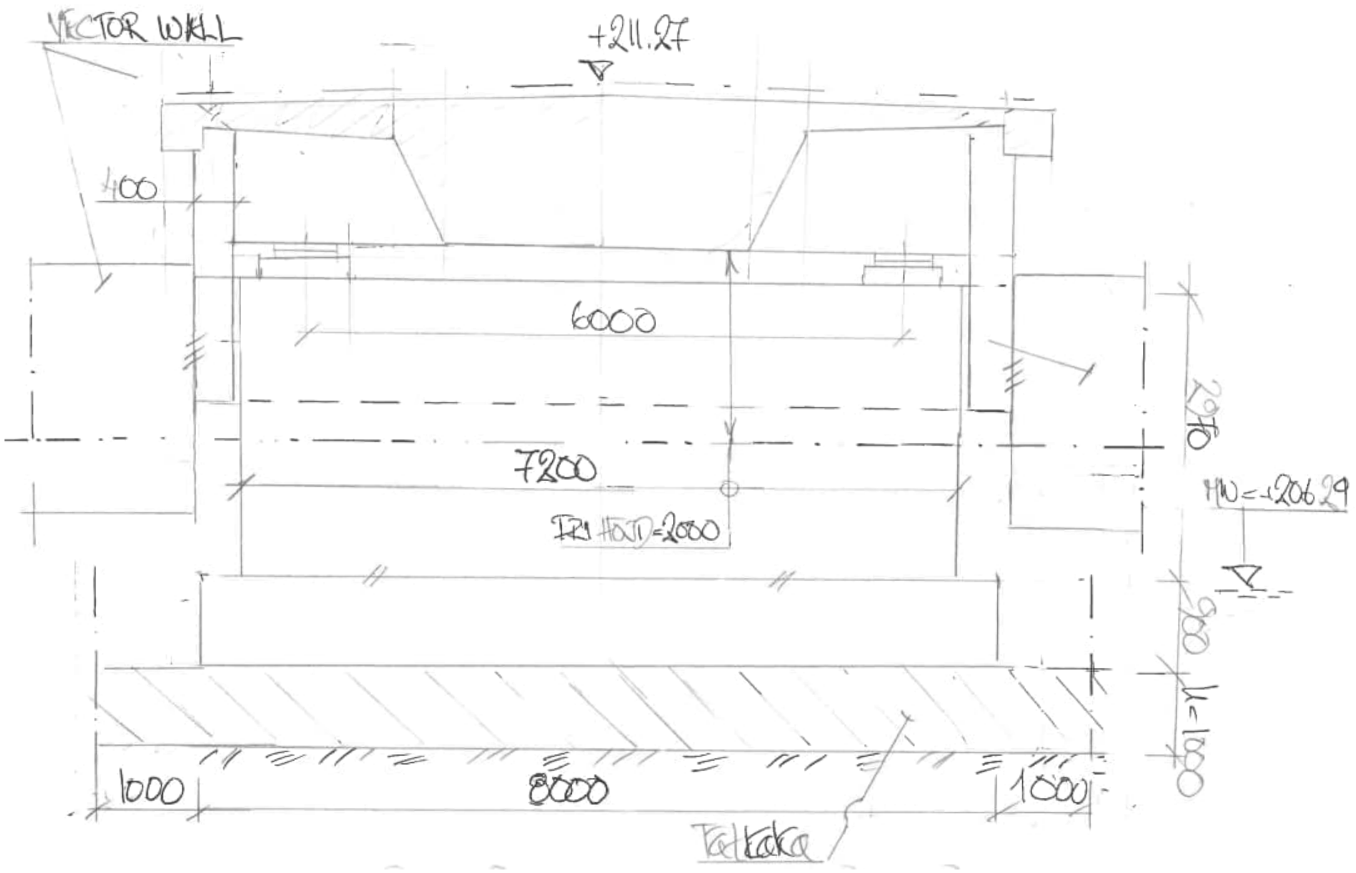


SEKTION D-D
Broände.

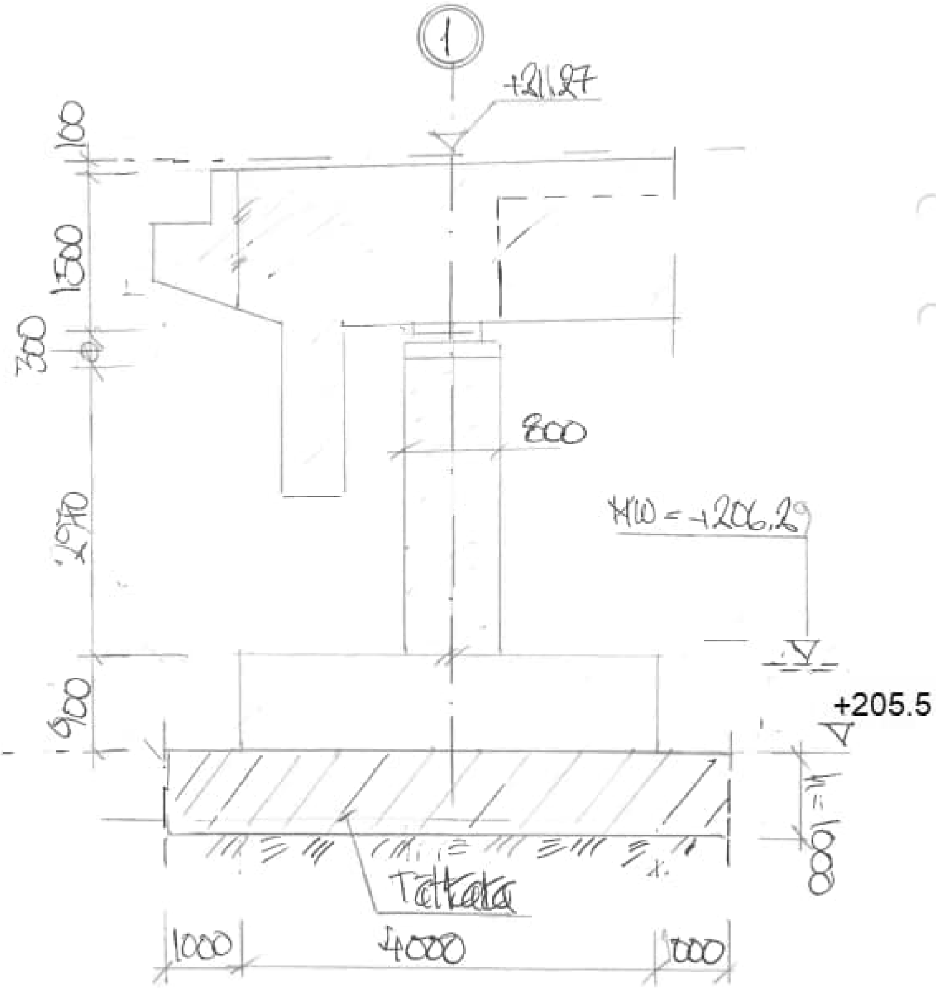


DETALJ 2
Detalj upplag länklplatta.

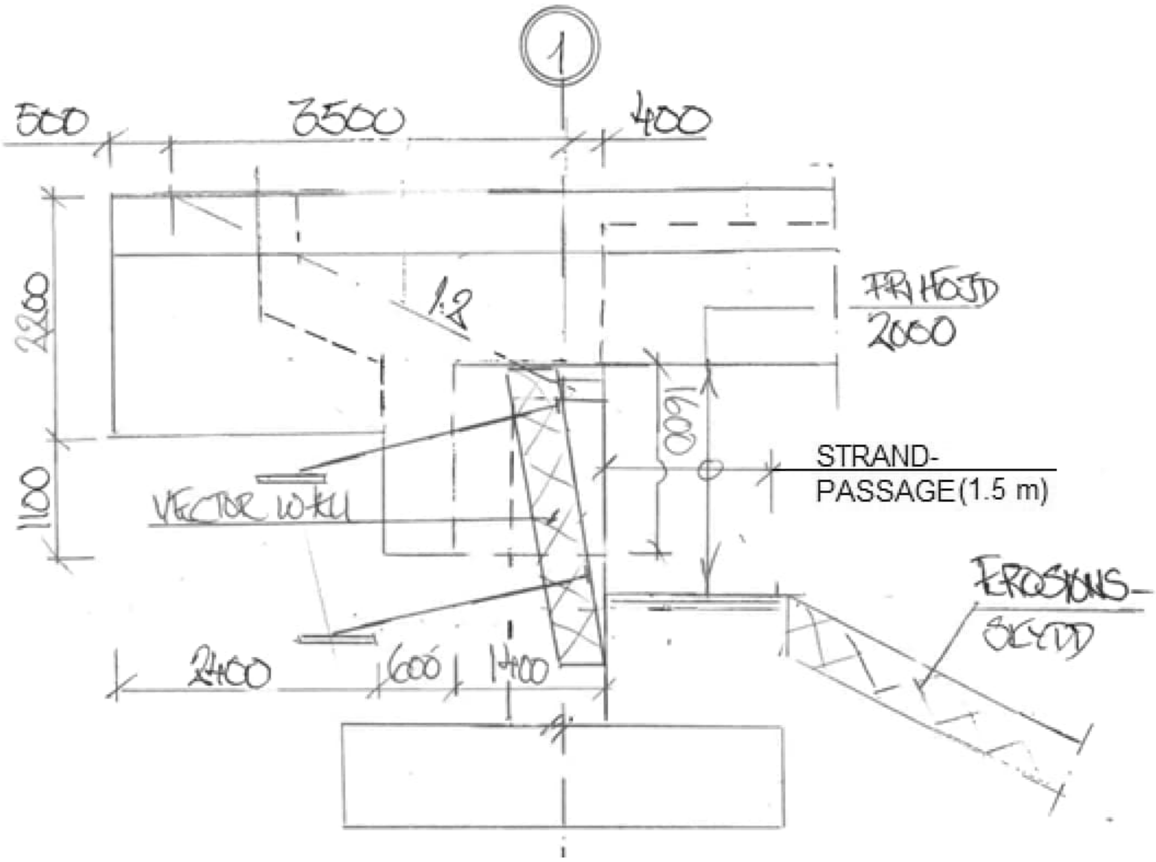
1.2.3 Substructure



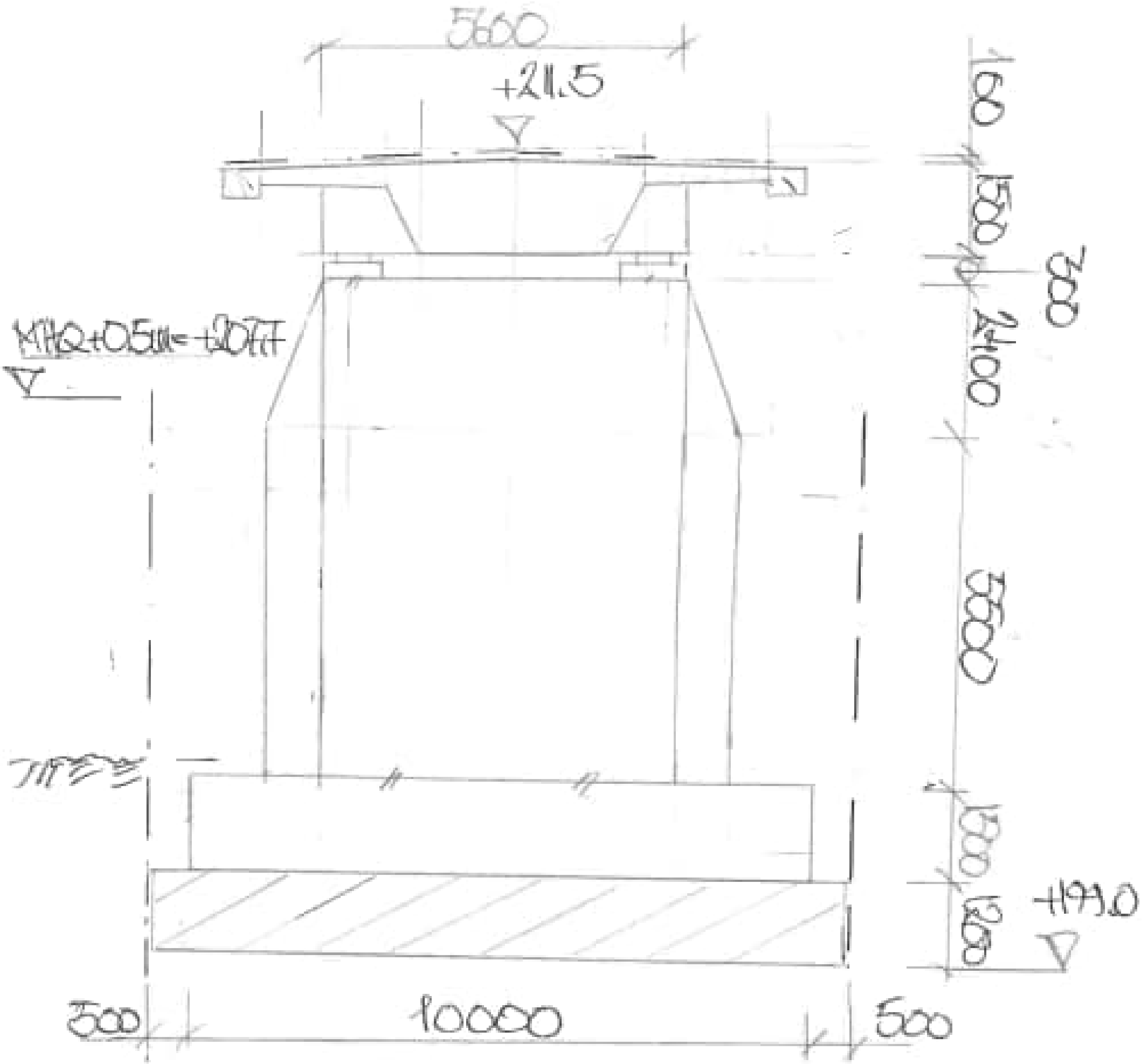
SECTION B-B


1
+211,27
100
1500
300
800
HHW = +206,29
2970
900
+205.5
1000
Tätkaka
1000
4000
1000

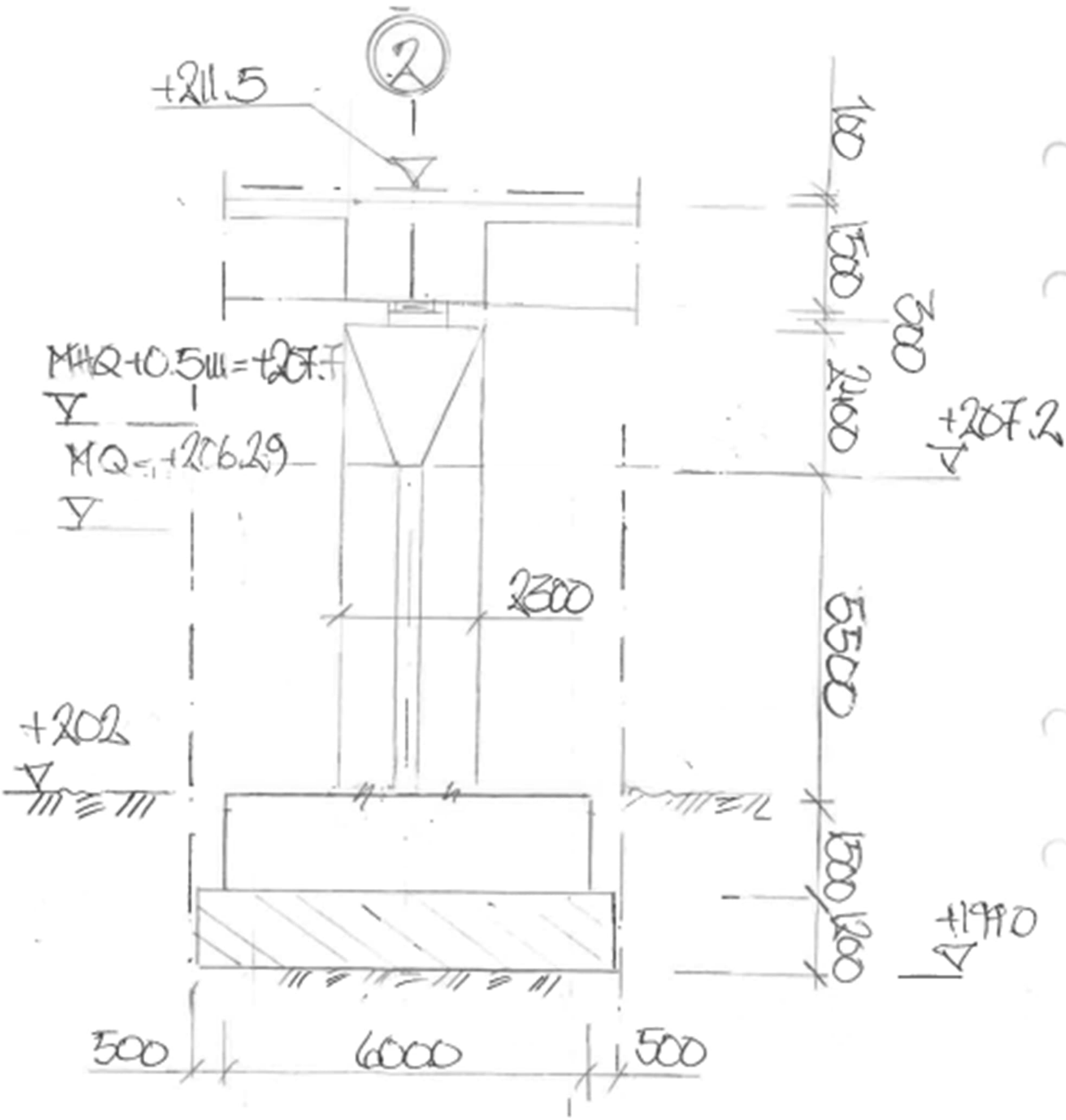
SECTION C-C



VY F-F
Stöd 1. Gäller även stöd 4.

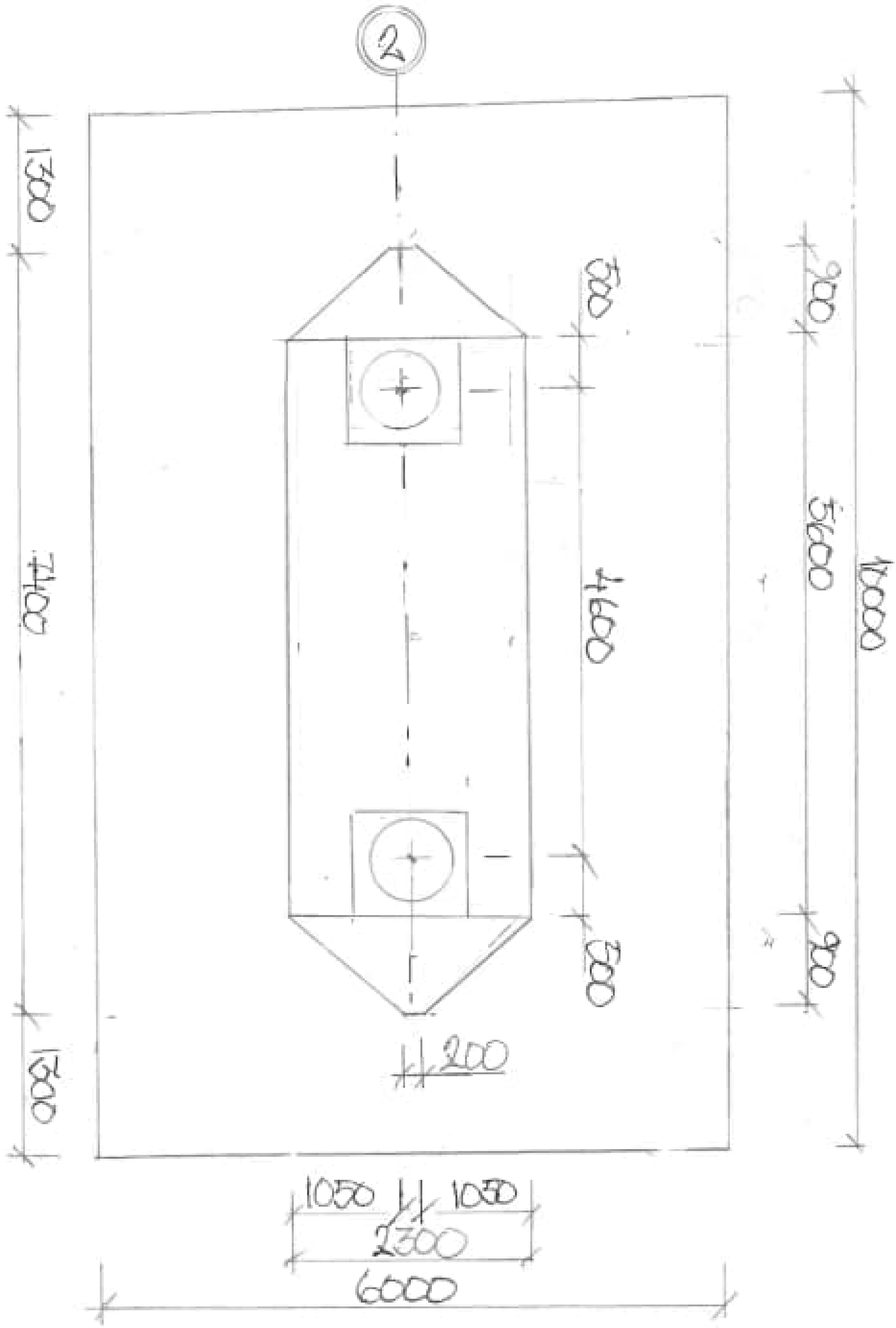


SECTION D-D



2
+211.5
MHQ+0.5m=+207.7
MQ=+206.29
+202
+207.2
+199.0
100
1500
2400
500
2300
5500
1500
1200
500
6000
500

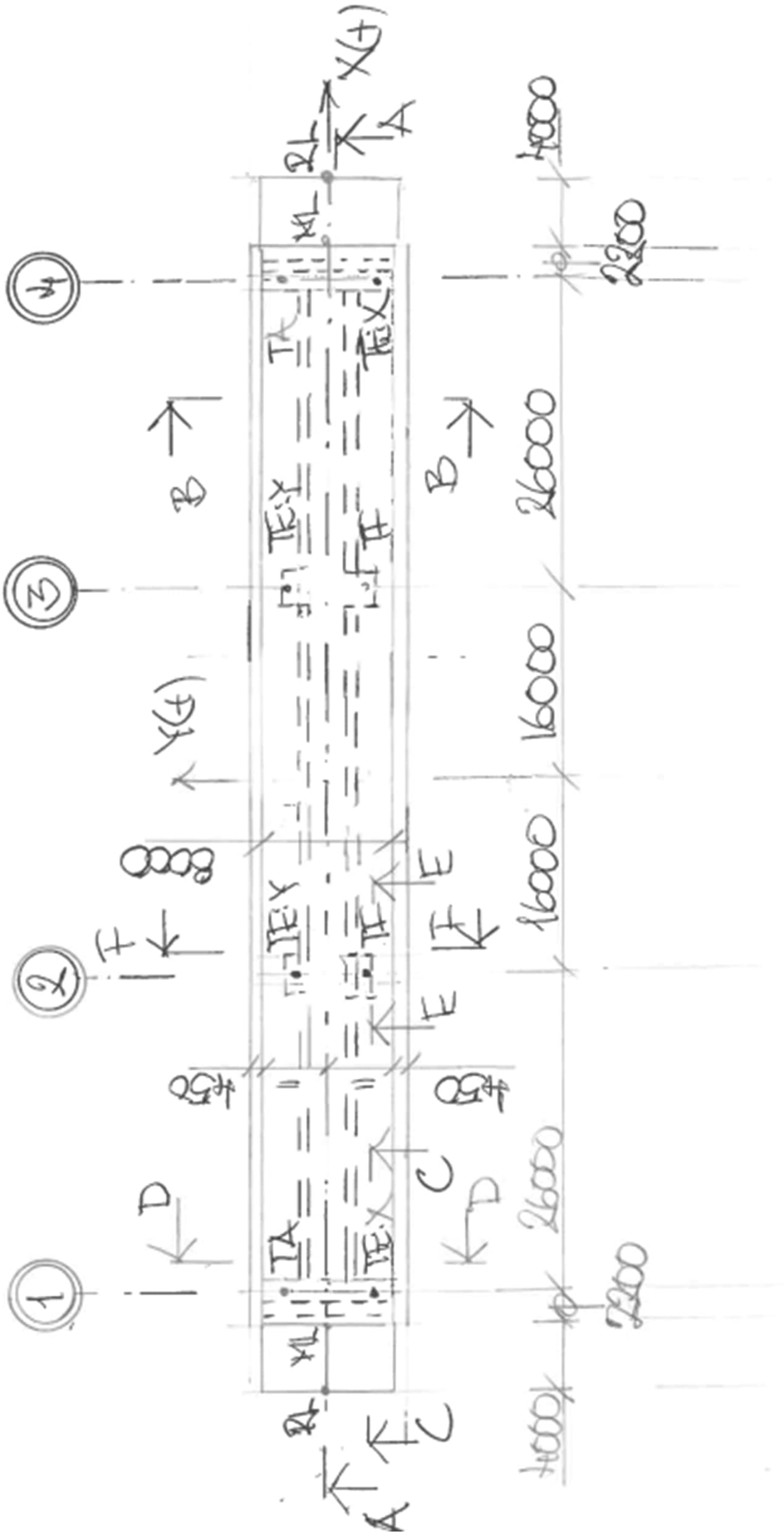
VY E-E



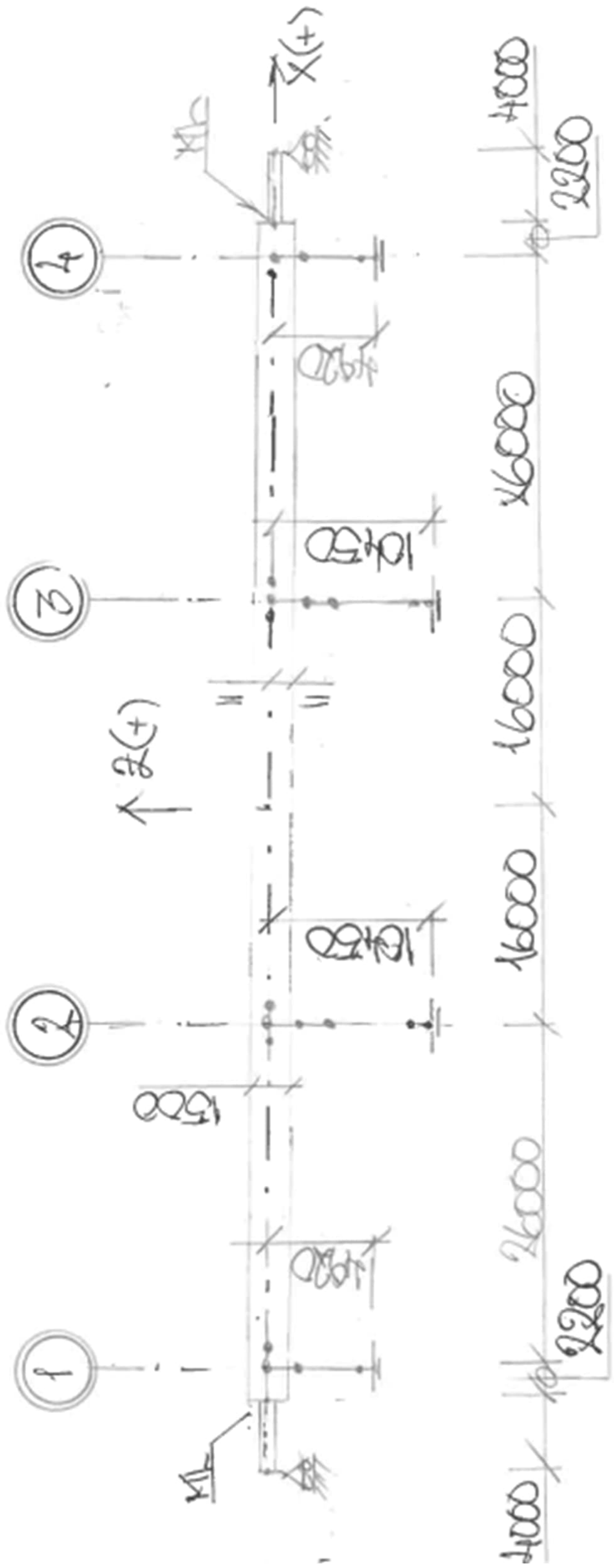
PLAN

Valid for support 3.

1.2.2 Simplified geometry system analysis

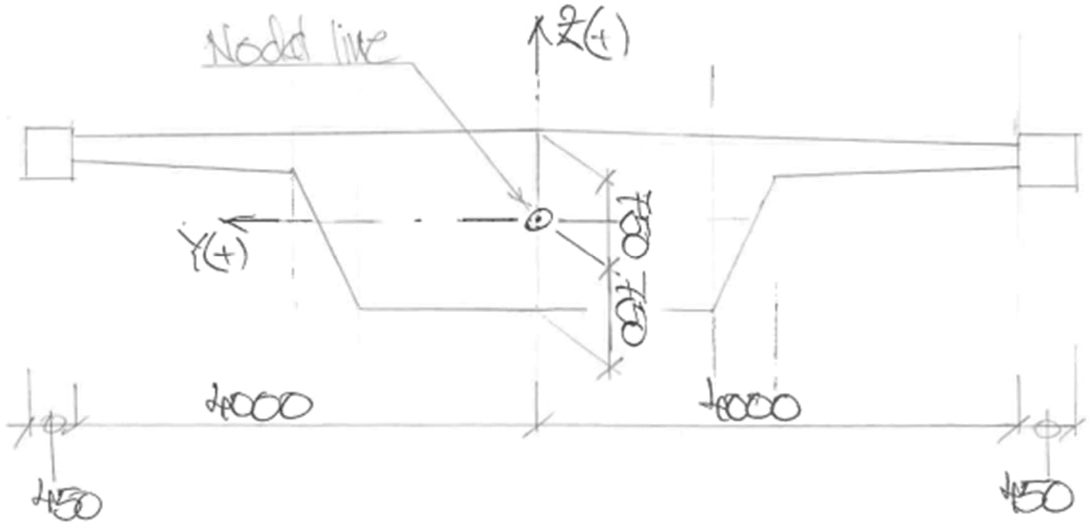


PLAN

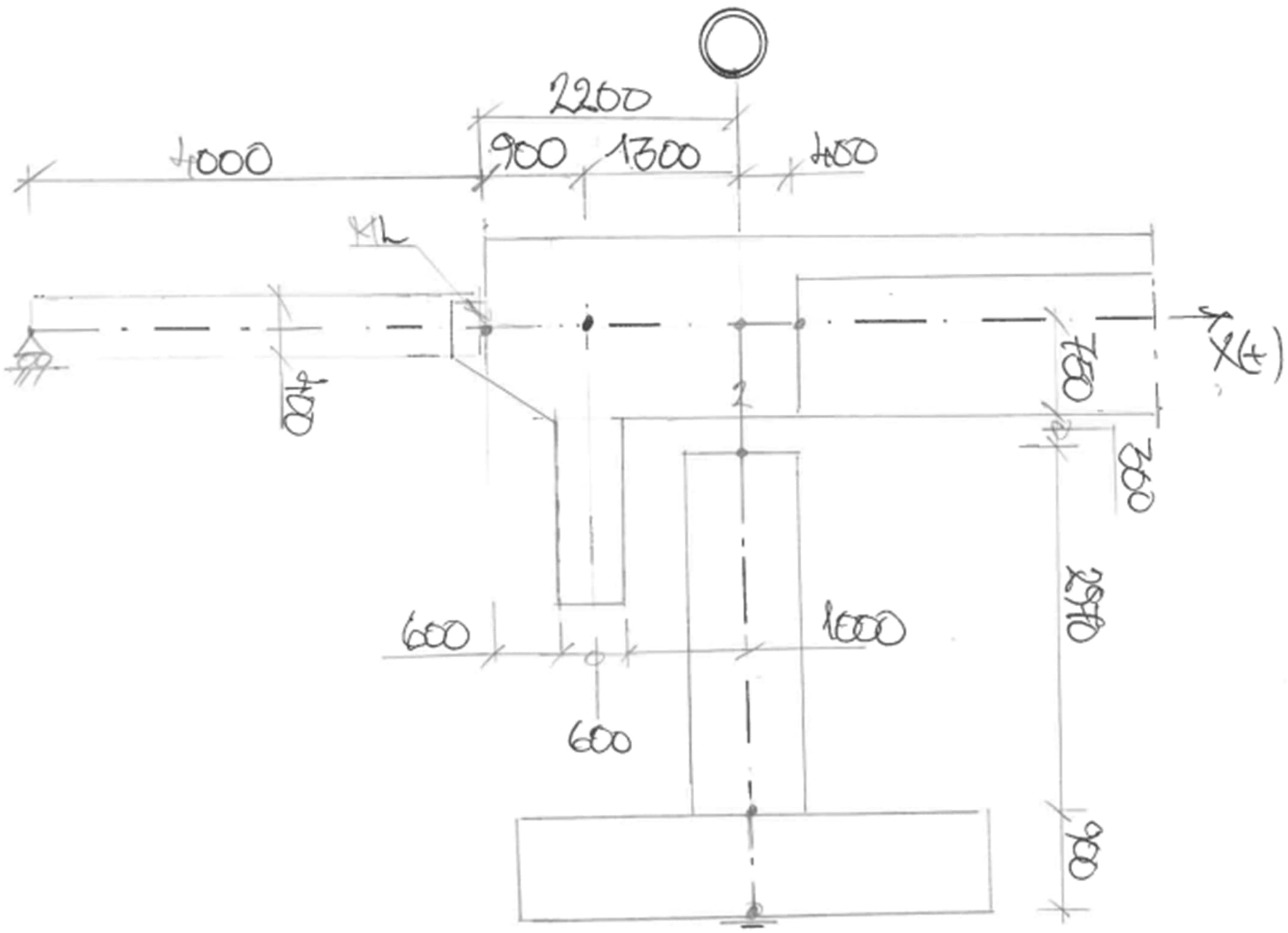


X(+)
Z(+)
4000
2200
16000
16000
16000
26000
10450
10450
1520
2200
4000

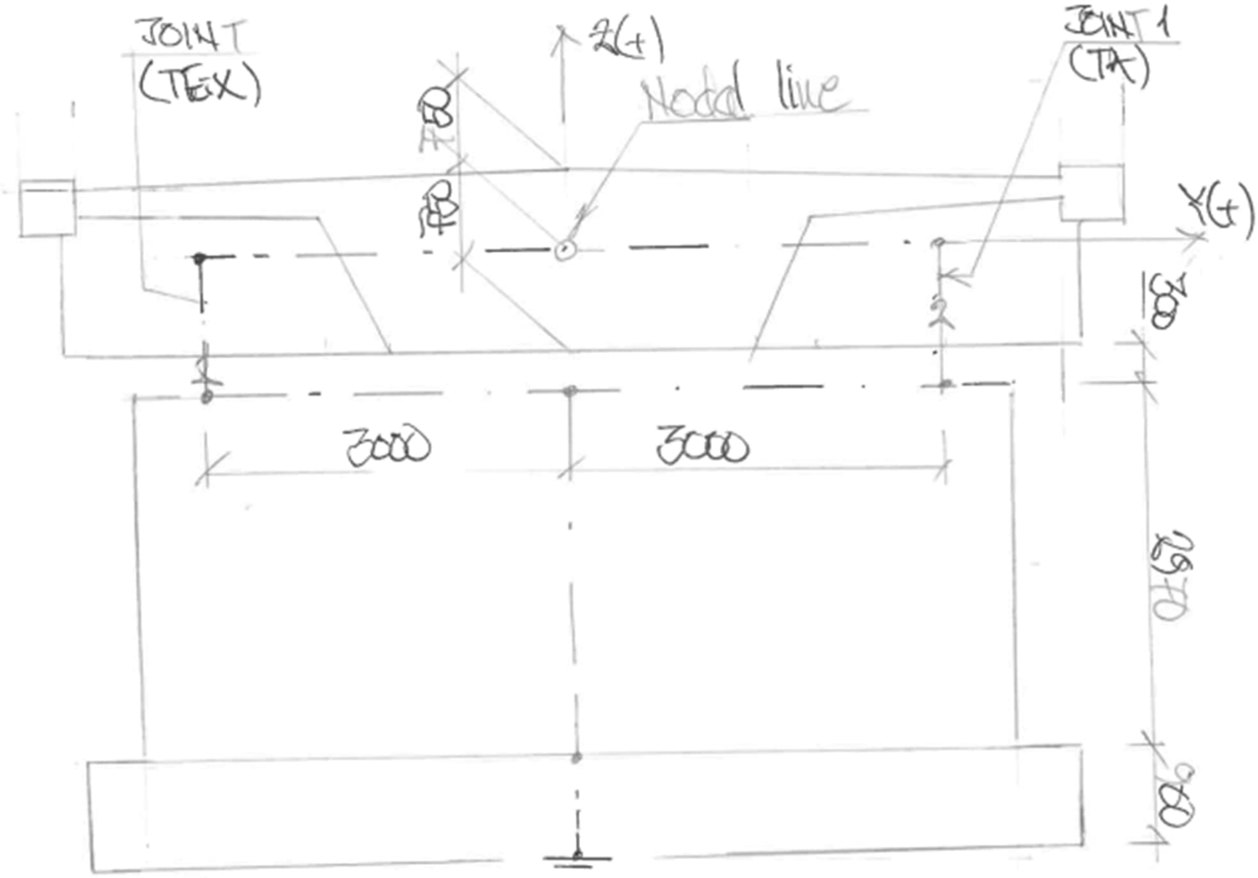
SECTION A-A



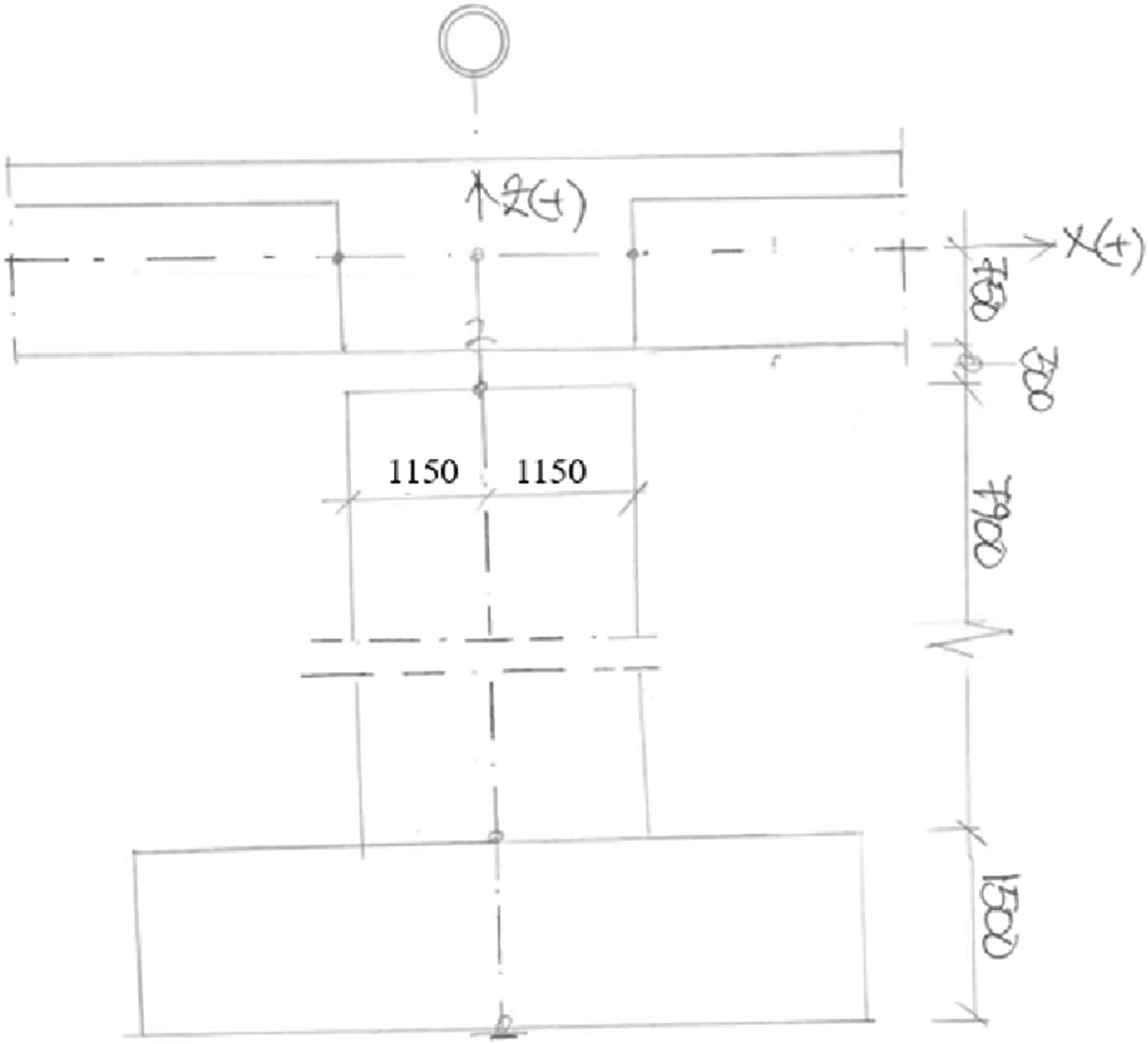
SECTION B-B



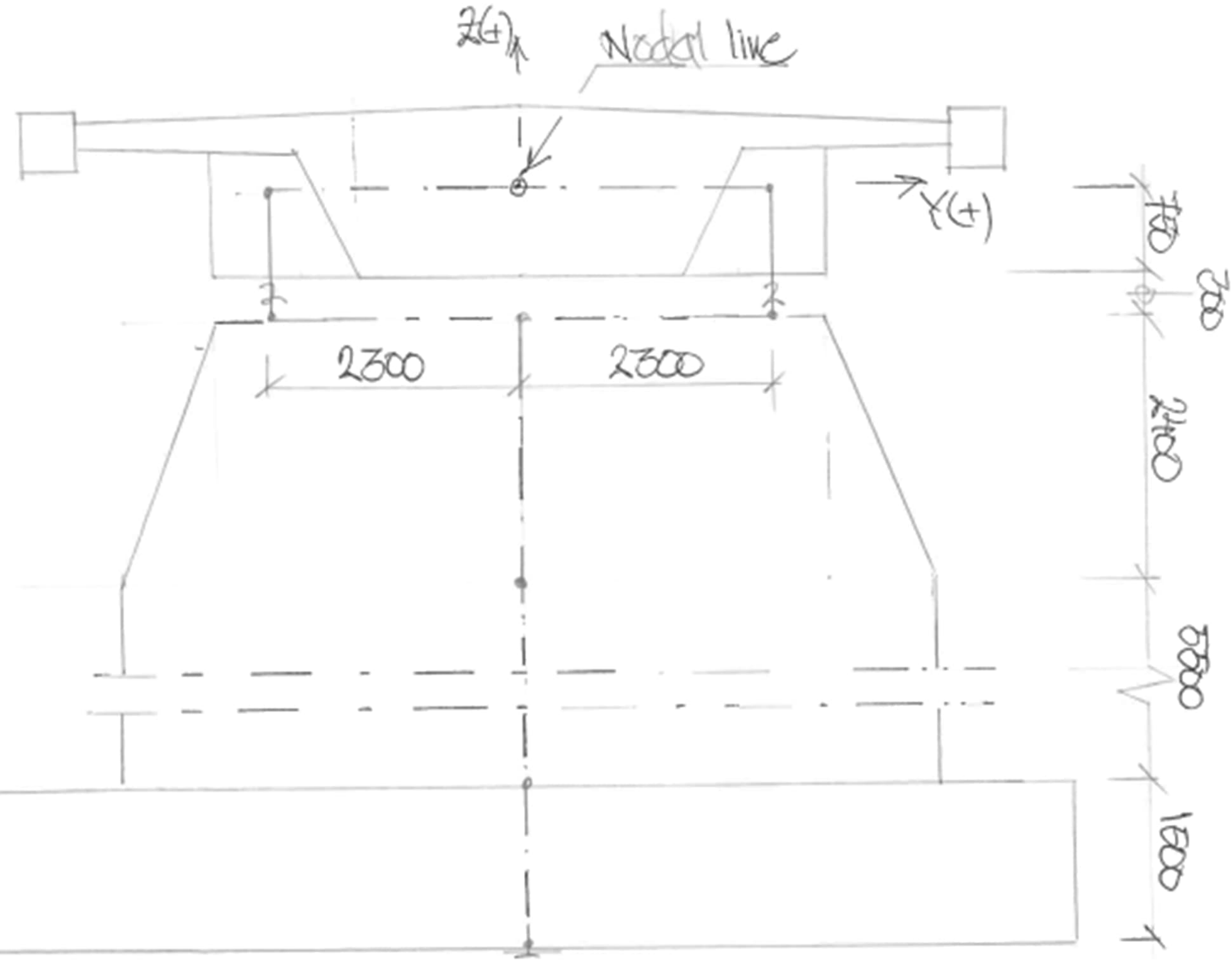
SECTION C-C



SECTION D-D



SECTION E-E



SECTION F-F

1.3 FOUNDATION

Bottom slabs are underwater cast concrete in side a sheet piled box.

Beneath glaciofluvial gravel on top of rock is found.

1.4 CODE OCH TENDER DOCUMENTS

- ”Bro och broliknande konstruktion allmänna krav” (TRVINFRA-00226 v5)
- ”Bro och broliknande konstruktion byggande” (TRVINFRA-0027 v6)
- ”TSFS 2018:57 med ändringar tom TSFS 2022:50”
- ”AMA Anläggning 23”
- ”TRV ändringar och tillägg till AMA 23” (TDOK 2023:0125 v3)
- ”Geokonstruktion dimensionering och utformning” (TRVINFRA-00230 v2)
- Document SS-EN 1990 to SS-EN 1999, see TRVINFRA section A.1.2.3.2

1.5 TECHNICAL SERVICE LIFE

Technical life span 120 years (L100).

1.6 ENVIRONMENT

Road traffic enviroment (“vägmiljö”) is assumed for the overlying traffic road since salt is used at winter, see TB section B1.

1.7 MATERIAL

Concrete :	C30/37 & C35/45 (CEM I 42.5 N, Anläggningscement klass N)
Reinforcement :	B500B
Compacted fill :	”Förtärkningslagermaterial” according to AMA CEB.415
Backfill :	”Grovkrossad sprängsten” according to AMA CEB.524
Surfacing :	See document RKFM
Pretension:	VSL system or eqivalent

1.8 GEOTECHNICAL CLASS

Geotechnical class GK2

1.9 SAFETY CLASS

Geotechnical resistance: SK 2

Brigde structure : SK 3

Retaining walls: SK 3

1.10 CONCRETE COVER AND CRACK CRITERIA

Class identification bridge components :

Bridge components	Exposure class[1.)]	Life spann	max vct_{ekv}[2.)]	ζ [3.)]
Substructure incl. linkplate:				
▫ Wingwall towards filling	XD1/XF4	L100	0.45	1.5
▫ Wingwall from filling	XD1/XF4	L100	0.45	1.5
▫ Abutement below ground	XC2/XF3	L100	0.50	1.0
▫ Abutement in air	XC4/XF3	L100	0.50	1.2
▫ Bottom slab in general	XC2/XF3	L100	0.50	1.0
▫ Bottom slab underside	XC2/XF3	L100	0.50	1.0
▫ Link slab in general	XD3/XF2	L100	0.40	1.8
▫ Link slab underside	XD3/XF2	L100	0.40	1.8
Superstructure:				
▫ Edge beam	XD3/XF4	L100	0.40	1.8
▫ Bridge deck	XD1/XF4	L100	0.40	1.5
▫ End shield towards filling	XD1/XF4	L100	0.40	1.5
▫ End shield from filling	XC2/XF3	L100	0.50	1.0

Footnote:
[1.)] TRVINFRA-00227 section 5.3.2.3
[2.)] TSFS table 12.1
[3.)] TSFS table 12.3

Design parameters low corrosion sensitive reinforcement (rebars):

$c_{min.dur}$: minimum cover with regard to environmental impact

$c_{min.b}$: minimum cover with regard to adhesion requirements
Δc_{dev} : execution tolerance
$c_{min} = \max(c_{min.b}; c_{min.dur}; 10mm)$: SS-EN 1992-1-1 eq. 4.2
$c_{nom} = c_{min} + \Delta c_{dev}$: SS-EN 1992-1-1 eq. 4.1, noted as BM on the drawing

Construction part	$c_{min.dur}$ 1.)	$c_{min.b}$ 2.)	c_{min}	c_{dev} 3.)	c_{nom}	$w_{k,till}$ 4.)
Substructure incl. linkplate:						
▫ Wingwall towards filling	30	20	30	10	40	0.20
▫ Wingwall from filling	30	20	30	10	40	0.20
▫ Abutement below ground	20	20	20	10	30	0.40
▫ Abutement in air	25	20	25	10	35	0.30
▫ Bottom slab in general	20	20	20	10	30	0.40
▫ Bottom slab underside	20	20	20	10	30	0.40
▫ Link slab in general	45	20	45	10	55	0.15
▫ Link slab underside	45	20	45	10	60 5.)	0.15
Superstructure:						
▫ Edge beam	45	20	45	10	55	0.15
▫ Bridge deck	25	20	25	10	35	0.20
▫ End shield towards filling	25	20	25	10	35	0.20
▫ End shield from filling	25	20	25	10	35	0.40

Footnotes:
1.) TSFS table 12.1
2.) SS-EN 1992-1-1 section 4.4.1.2 table 4.2
3.) SS-EN 1992-1-1 section 4.4.1.3
4.) TSFS tabele 12.2
5.) TSFS chapter 12 paragraph 3§ $k_1 = c_{min}$ + 15 mm vhen casting against building foil.

Design parameters high corrosion sensitive reinforcement (pretension):

$c_{min.dur}$: minimum cover with regard to environmental impact

$c_{min.b}$: minimum cover with regard to adhesion requirements
Δc_{dev} : execution tolerance
$c_{min} = \max(c_{min.b}; c_{min.dur}; 10mm)$: SS-EN 1992-1-1 eq. 4.2
$c_{nom} = c_{min} + \Delta c_{dev}$: SS-EN 1992-1-1 eq. 4.1, noted as BM on the drawing

Construction part	$c_{min.dur}$ [1.)]	$c_{min.b}$ [2.)]	c_{min}	c_{dev} [3.)]	c_{nom}	$w_{k,till}$ [4.)]
Superstructure:						
▫ Top bridge deck	25	90	90	10	100	*
▫ Other part of bridge deck	25	90	90	10	100	*
	mm	mm	mm	mm	mm	mm

Footnotes:
1.) TSFS table 12.1
2.) SS-EN 1992-1-1 section 4.4.1.2 (3) specifies pretension tube ϕ90
3.) SS-EN 1992-1-1 section 4.4.1.3
4.) TSFS table 12.2 states that crack width is not needed when ”tensile stress” for SLS-F is less than $f_{ctk.0.05}/\zeta$

2. SYSTEM ANALYSIS

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2.2 SKETCH SYSTEM ANALYSIS page 2:3-12
2.3 CROSS SECTION PROPERTIES page 2:13-38
2.4 MATERIAL page 2:39-41
2.5 BOUNDARY CONDITIONS page 2:42-61
2.6 MESH page 2:62-70
2.7 SEARCH AREA page 2:71

2.1 GENERAL

The bridge is built using reinforced concrete.

The superstructure is designed as single longitudinal T-beam .

A link slab is attached to superstructure using joint without moment (ML). This is done by introducing pined end-release in link slab. A fictious beam with length of 4 m and roller support is used in FEM-modell.

All concrete structures are modelled 3D-beam elements located at nodal lines.

At supports fictious transversal rigid beams (Rigid:T) are added to superstructure to transfer loads to bearings.

At supports fictious transversal rigid beams (Rigid:B) are addes top of abutments to transfer lo bearing load to substructure.

Between transversal rigid beams bearing are defined using joints.

Entire structure is modelled using isotropic material.

Bridge foundation consists of “tätkaka” on glaciofluvial gravel on top of rock.

Wingwalls are not modelled statically since considered inactive in vertical direction. This is due cracking and the use of only minimal reinforcement in this direction.

Edge beams are not modelled statically since considered inactive. This assumption is considered on safe side. The assumption will facilitate future replacement of edge beams.

In system analysis gross cross section may be used for longitudinal beams in superstructure, see SS-EN 1992-1-1 section 5.3.2.1 point (4).

In FEM-analysis constant cross section is used for longitudinal beams along entire span length, see SS-EN 1992-1-1 section 5.3.2.1 (4).

Attachments:

Attachment	Name
1	Input receipt
2	Results reactions
3	Results abutments
4	Results longitudinal beams

2.2 SKETCH SYSTEM ANALYSIS

2.2.1 Geometry

In order to describe geometry first POINTS are defined.

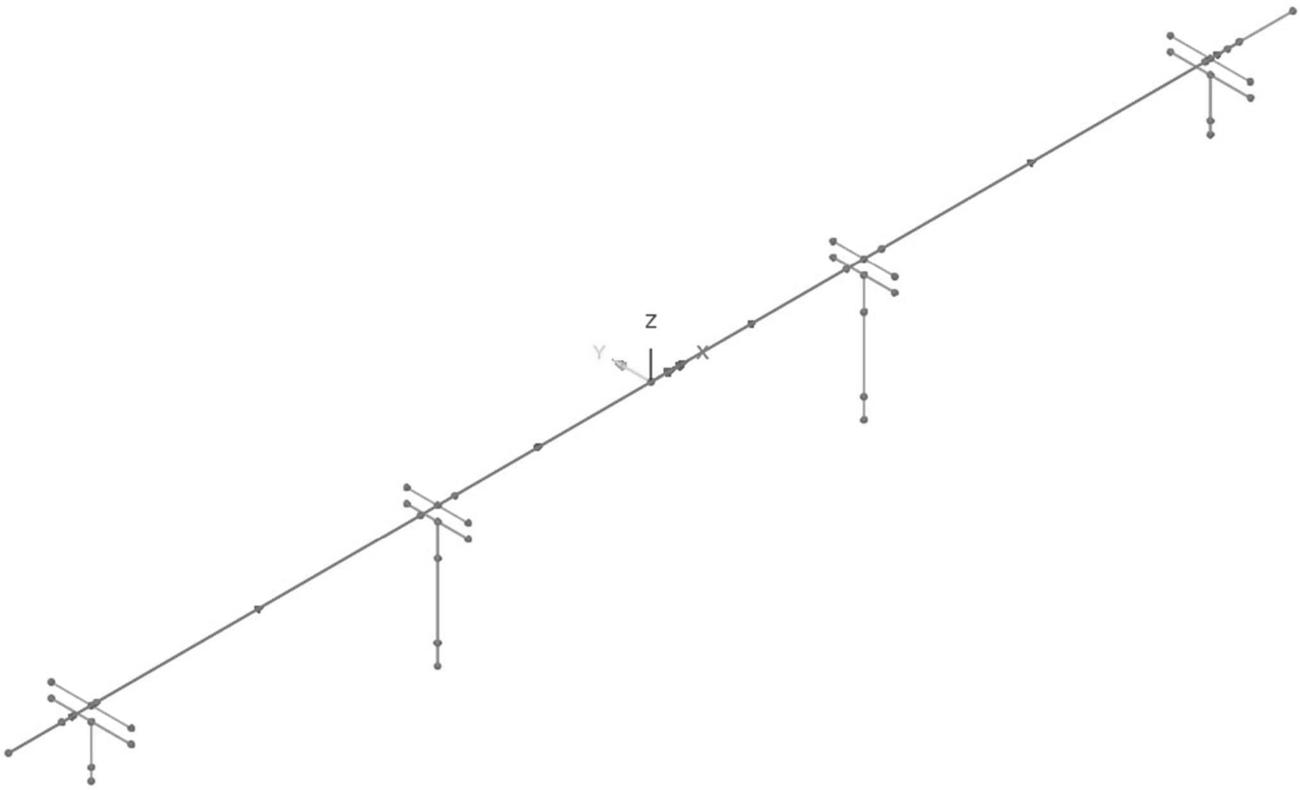
Beam elements are defined by applying attributes to LINES.

Attached pictures are retrieved from graphical sketches generated by FEM program of POINTS and LINES.

All coordinates needed to describe POINTS are found in attachment 1.

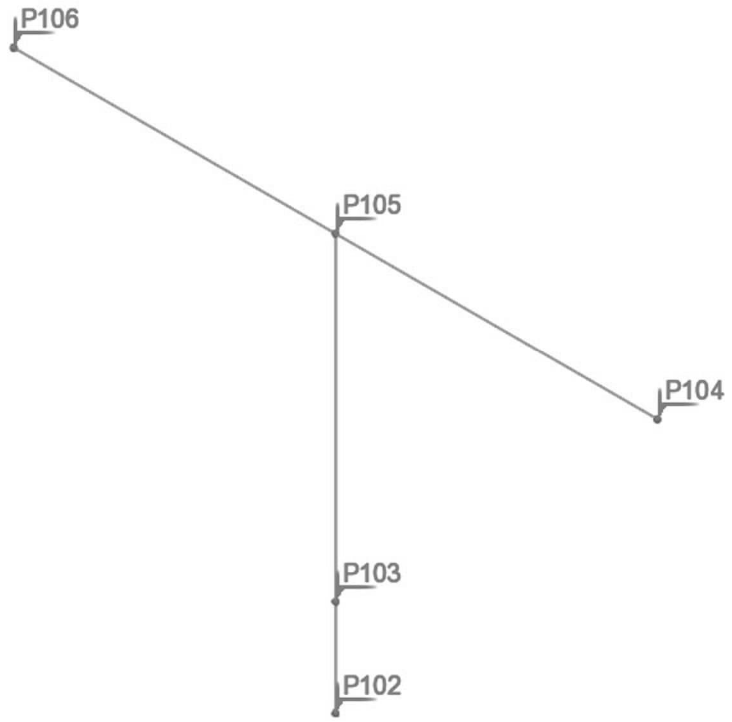
All POINTS needed to describe LINES are found in attachment 1.

Overview :

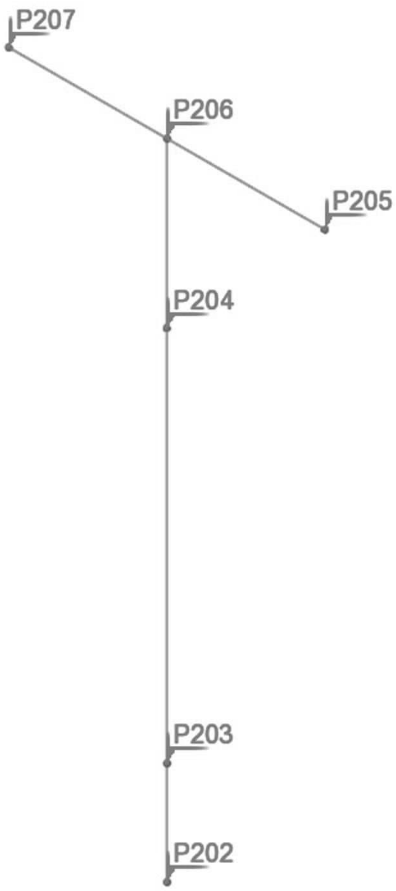


2.2.1.1 Geometry : POINTS

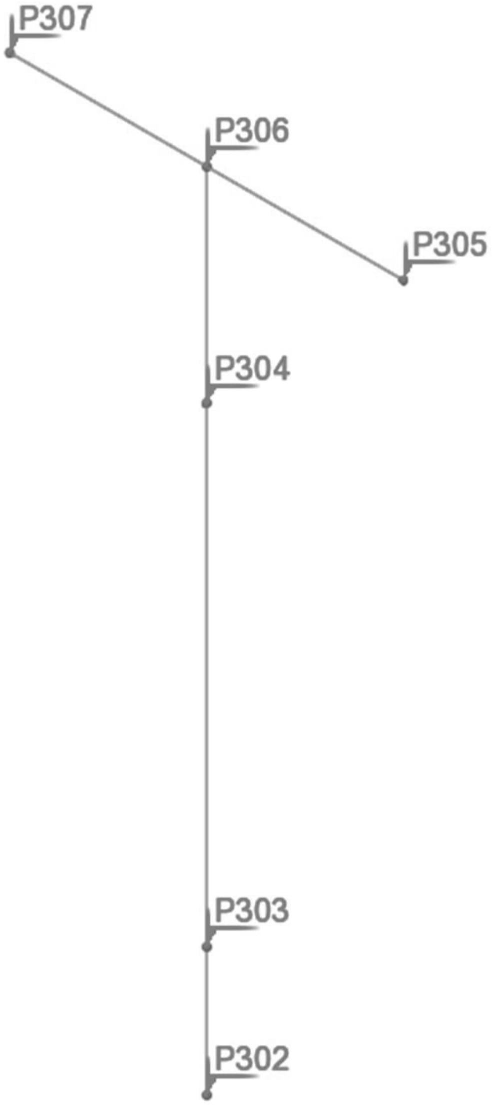
Abutment 1 (including Rigid:B) :



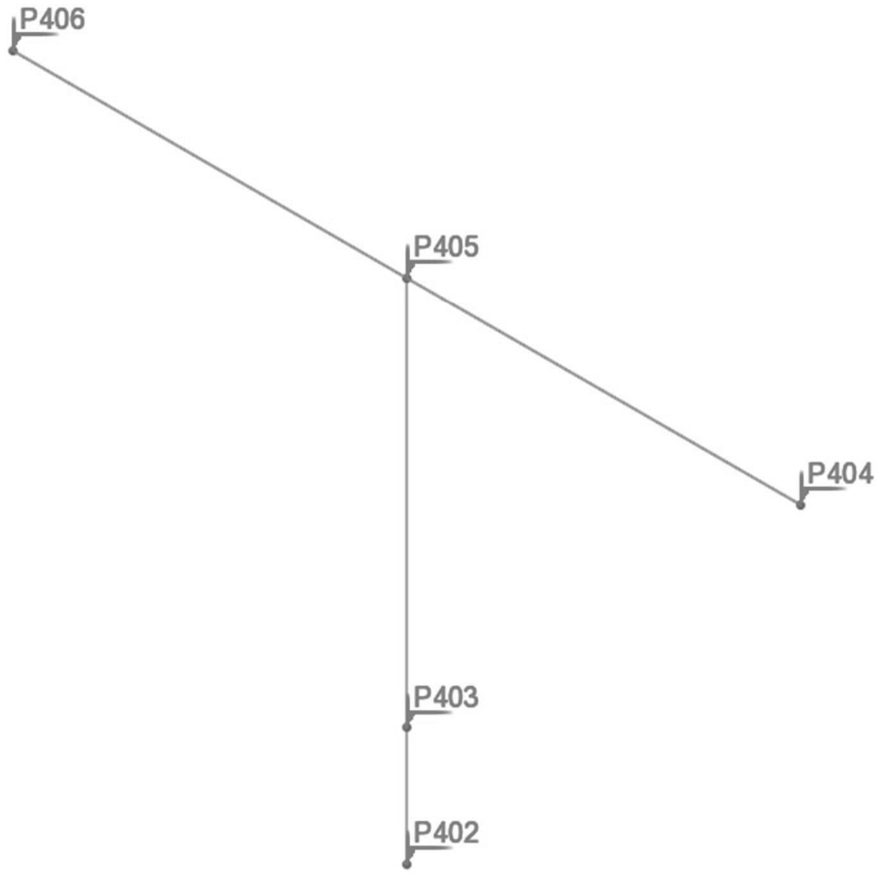
Abutment 2 (including Rigid:B) :



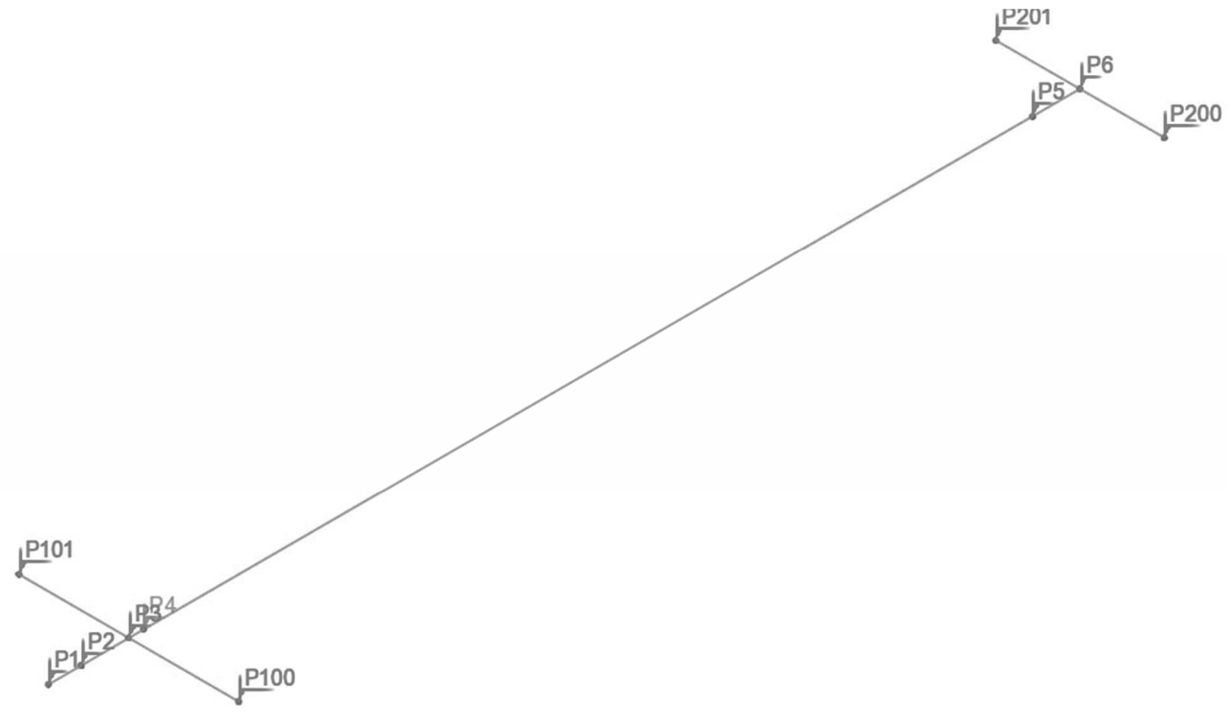
Abutment 3 (including Rigid:B) :



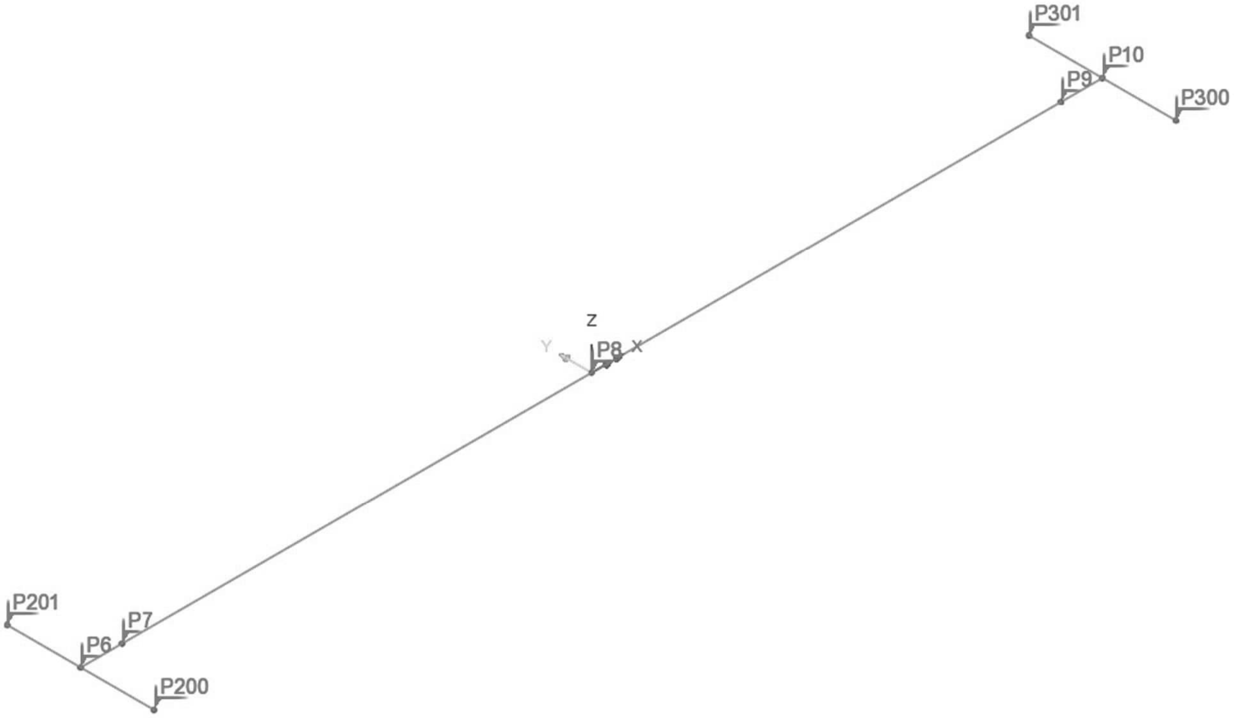
Abutment 4 (including Rigid:B) :



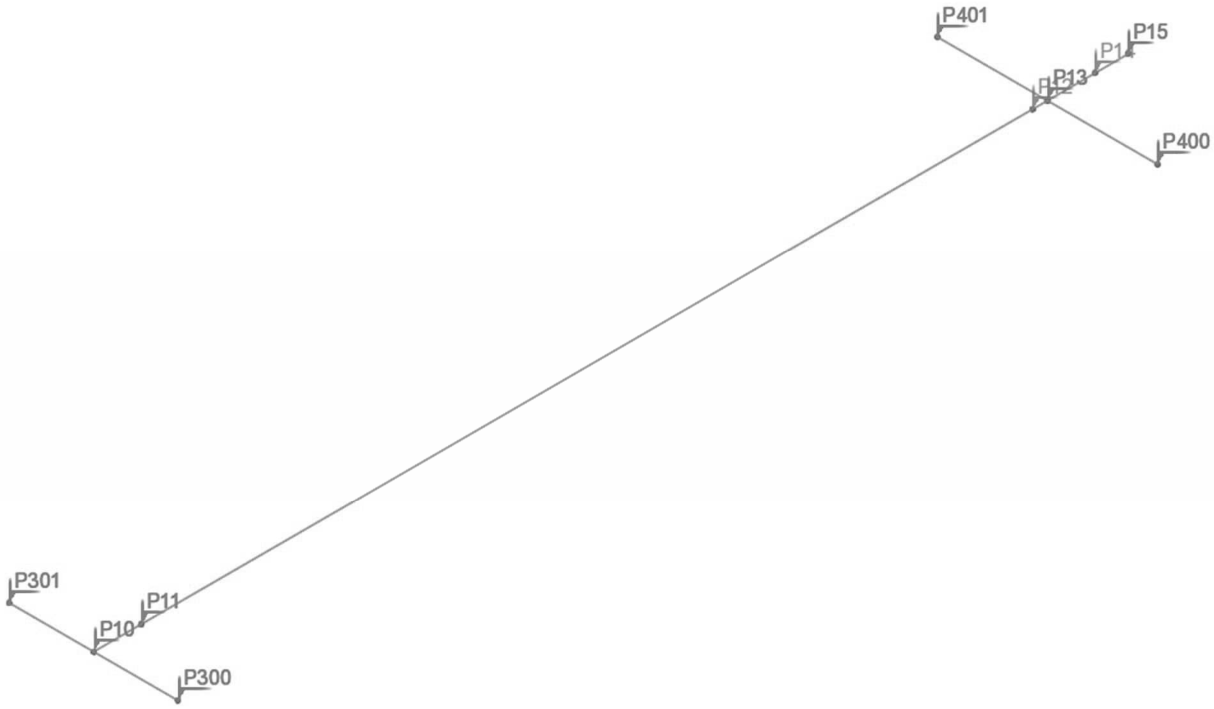
Superstructure – spann 1 (including Rigid:T) :



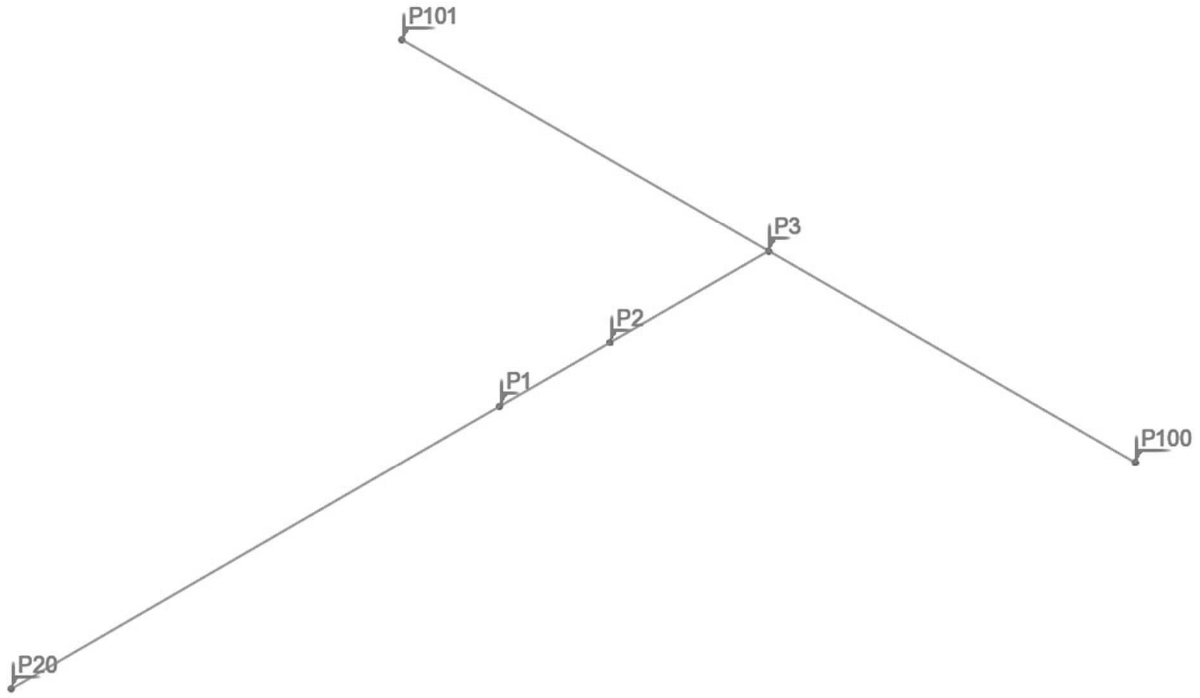
Superstructure – spann 2 (including Rigid:T) :



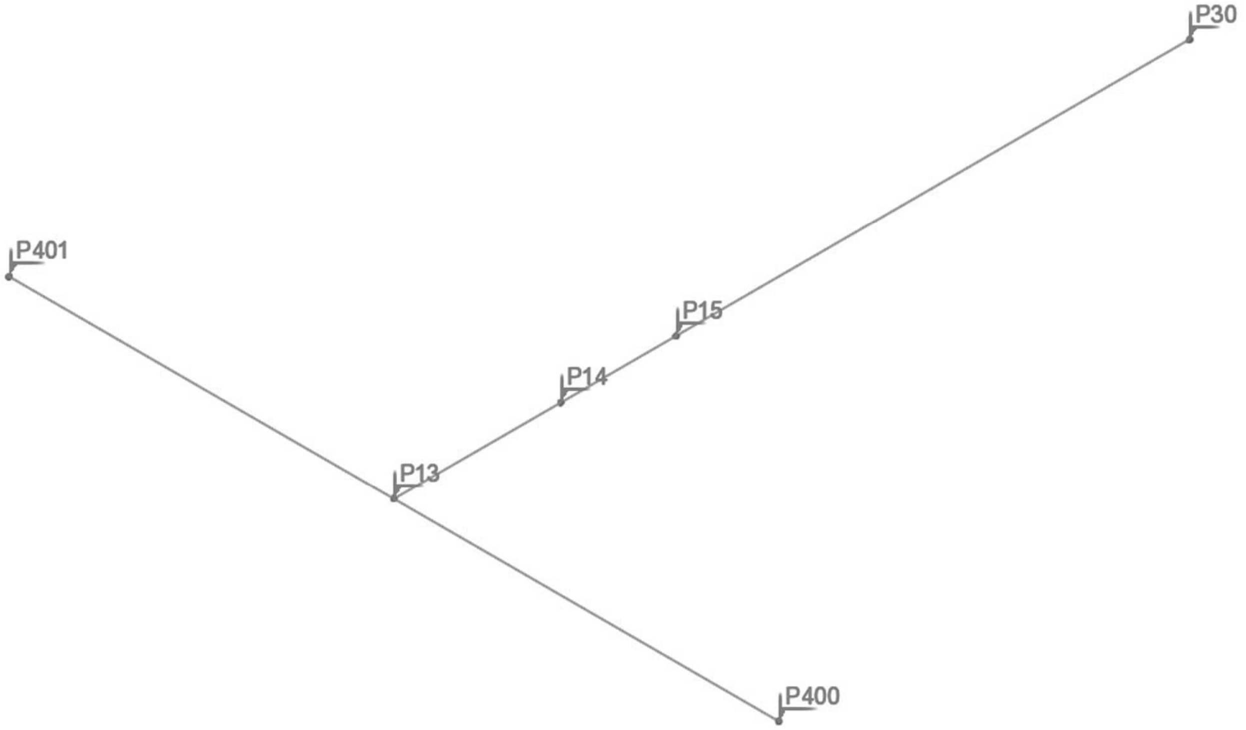
Superstructure – spann 3 (including Rigid:T) :



Link slab at support 1 :



Link slab at support 4 :



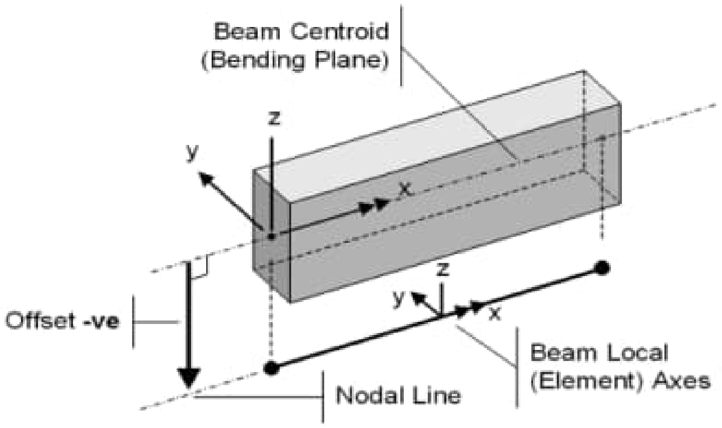
2.2.1.2 Geometry : LINES

See attachment 1.

2.3 CROSS SECTION PROPERTIES

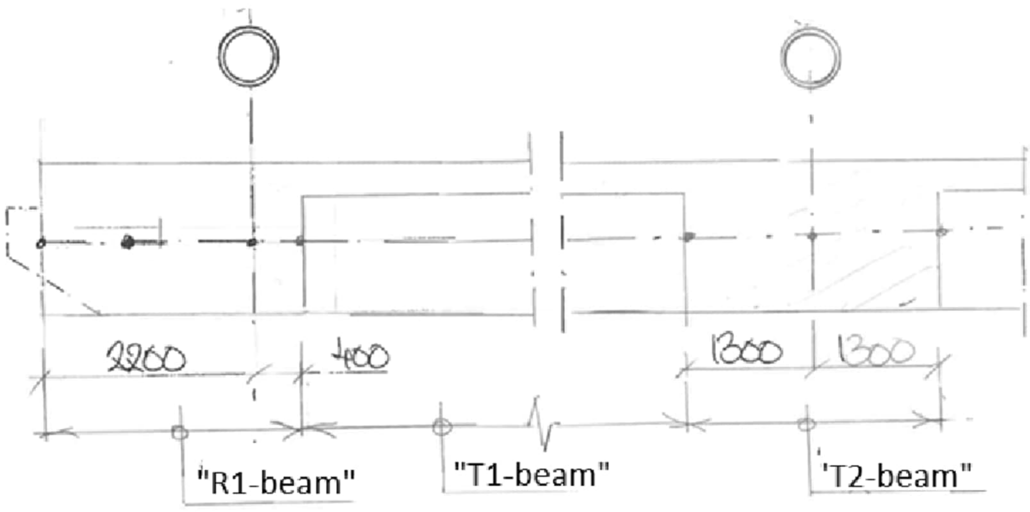
The structure only contain 3D-beams (”Thick beam” / BMS3).

Principal sketch of geometry associated to 3D beam elements are seen below.



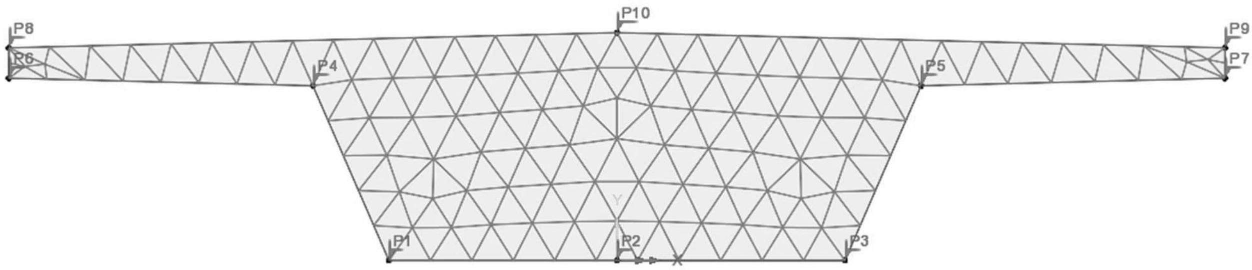
2.3.1 Longitudinal beam: T1-beam

The cross section is constant apart for areas at location supports, as seen in sketch below.



In order to determine exact rotational stiffness (Vlasov & St Venant) a FEM-anlaysis is performed. This is done using “Section Property Calculator” for an arbitrary section.

Definition of arbitrary section



Point	x	y
1	-1.5	0
2	0	0
3	1.5	0
4	-2.0	1.15
5	2.0	1.15
6	-4.0	1.20
7	4.0	1.20
8	-4.0	1.40
9	4.0	1.40
10	0	1.50
-	m	m

Cross section properties

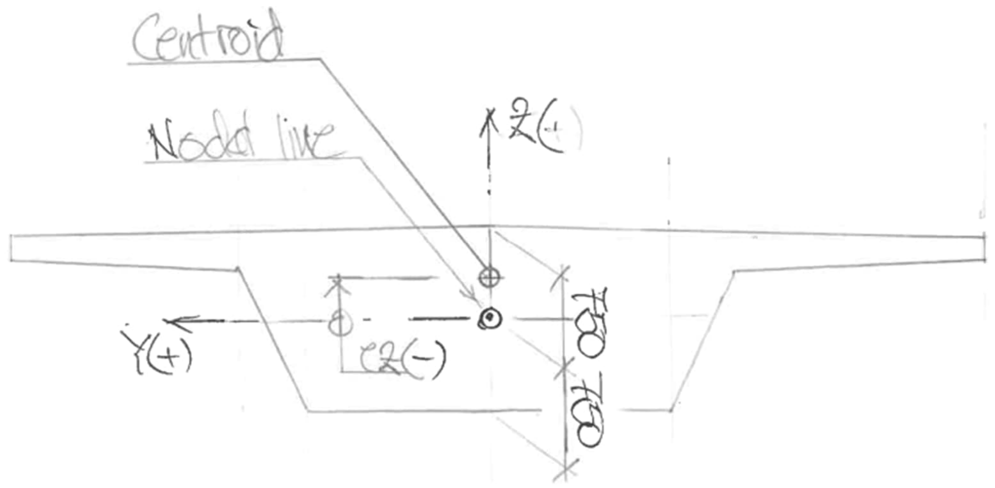
Section Details

Calculated properties

		Value
Cross sectional area	A	6.325
Second moment of area about x axis	Ixx	1.18484
Second moment of area about y axis	Iyy	14.7927
Product moment of area	Ixy	-1.89594E-15
Torsional constant	J	2.89917
Effective shear area in x direction	Asx	5.33467
Effective shear area in y direction	Asy	2.07906
Radius of gyration about x axis	kx	0.432813
Radius of gyration about y axis	ky	1.5293
Warping torsional constant about shear centre	Cw	0.642747
Shear centre x distance from centroid	xo	-2.57777E-6
Shear centre y distance from centroid	yo	-0.115161
Monosymmetry constant about x	betax	3.3089
Monosymmetry constant about y	betay	2.03617E-6
Wagner constant 1st moment of square radius about x	Ixr	3.64763
Wagner constant 1st moment of square radius about y	Iyr	4.99667E-12
Wagner constant 4th moment of area about origin	Irr	109.434
Wagner constant 2nd moment of warping about origin	Iwr	68.3524E-6
Plastic section modulus about x axis	Zpx	2.37684
Plastic section modulus about y axis	Zpy	7.74583
Plastic torsional section modulus	Zpt	4.77977
Plastic neutral axis, distance from centroid along x axis	xp	-26.8779E-18
Plastic neutral axis, distance from centroid along y axis	yp	0.0703815
Centroid X from geometry origin	Xc	-17.0044E-18
Centroid Y from geometry origin	Yc	-0.858696
Principal axes angle	theta	0.0

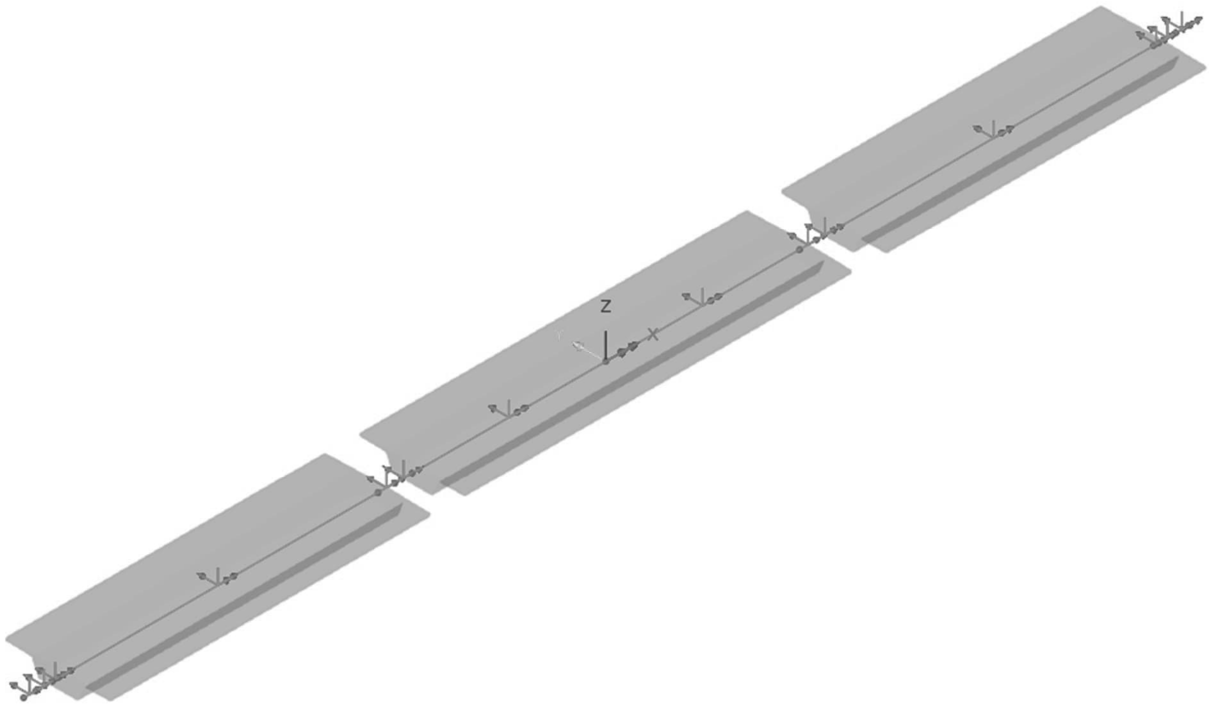
Results “T1-beam”

ez = 0.750 m + Y_c = 0.750 m - 0.858 m = -0.109 m



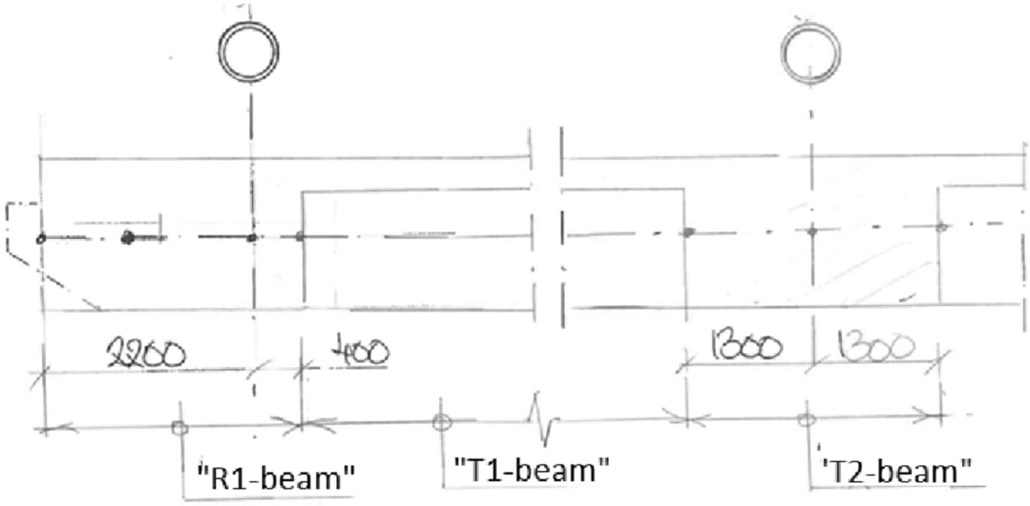
Data	“T1-beam”	Unit
A	6.325	m^2
Iyy	1.185	m^4
Izz	14.793	m^4
Iyz	0	m^4
J	2.899	m^4
ez	-0.109	m
-	m	-

Graphic visualization

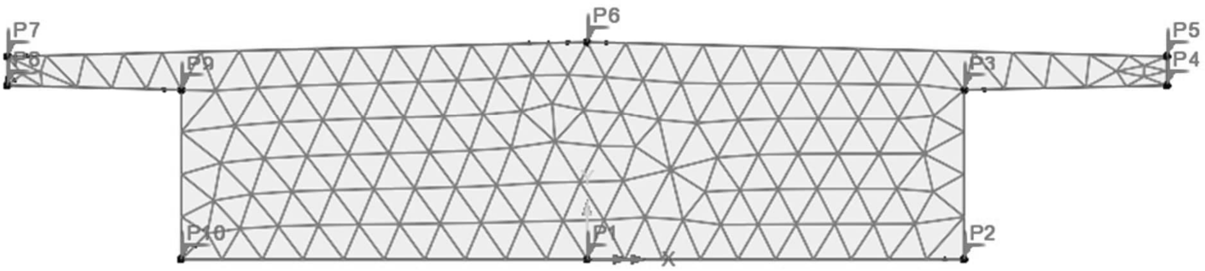


2.3.2 Longitudinal beam: T2-beam

The cross section is occurs locally at support 2 & 3, as seen in sketch below. Calculation is performed using "Section Property Calculator" for an arbitrary section.

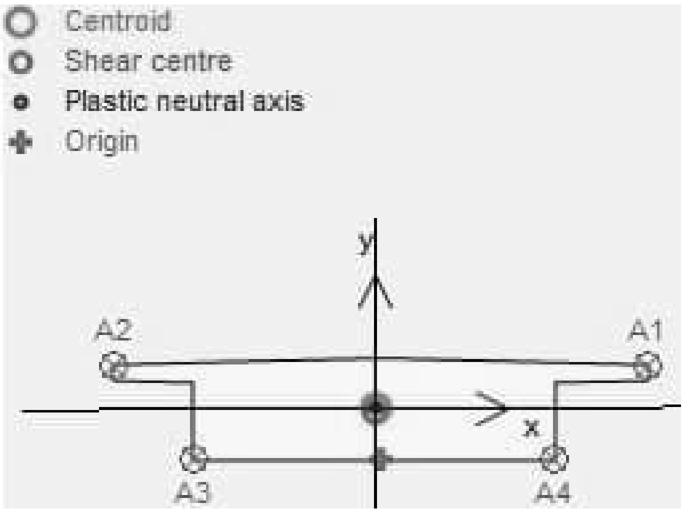


Definition of arbitrary section



Point	x	y
1	0	0
2	2.8	0
3	2.8	1.17
4	4.0	1.20
5	4.0	1.40
6	0	1.50
7	-4.0	1.40
8	-4.0	1.20
9	-2.8	1.17
10	-2.8	0
-	m	m

Cross section properties



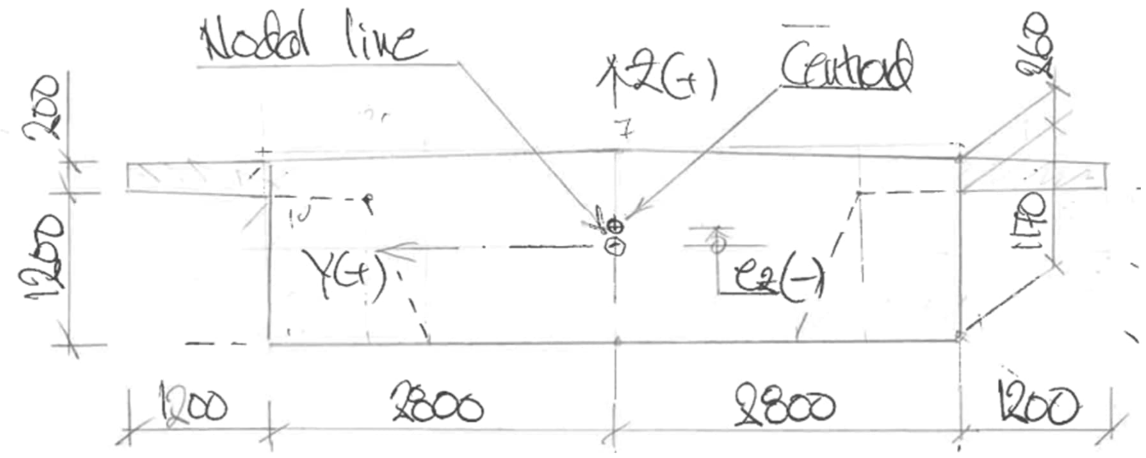
Section Details

Calculated properties

		Value
Cross sectional area	A	8.756
Second moment of area about x axis	Ixx	1.63794
Second moment of area about y axis	Iyy	27.5331
Product moment of area	Ixy	-2.78561E-15
Torsional constant	J	4.97776
Effective shear area in x direction	Asx	7.6109
Effective shear area in y direction	Asy	5.31414
Radius of gyration about x axis	kx	0.43251
Radius of gyration about y axis	ky	1.77327
Warping torsional constant about shear centre	Cw	3.12092
Shear centre x distance from centroid	xo	-7.14726E-6
Shear centre y distance from centroid	yo	-0.0730907
Monosymmetry constant about x	betax	1.58752
Monosymmetry constant about y	betay	16.6908E-6
Wagner constant 1st moment of square radius about x	Ixr	2.36075
Wagner constant 1st moment of square radius about y	Iyr	0.14466E-9
Wagner constant 4th moment of area about origin	Irr	186.978
Wagner constant 2nd moment of warping about origin	Iwr	0.114759E-3
Plastic section modulus about x axis	Zpx	3.30552
Plastic section modulus about y axis	Zpy	13.2565
Plastic torsional section modulus	Zpt	7.84241
Plastic neutral axis, distance from centroid along x axis	xp	-0.162061E-15
Plastic neutral axis, distance from centroid along y axis	yp	0.0133845
Centroid X from geometry origin	Xc	-0.206835E-15
Centroid Y from geometry origin	Yc	-0.768407
Principal axes angle	theta	0.0

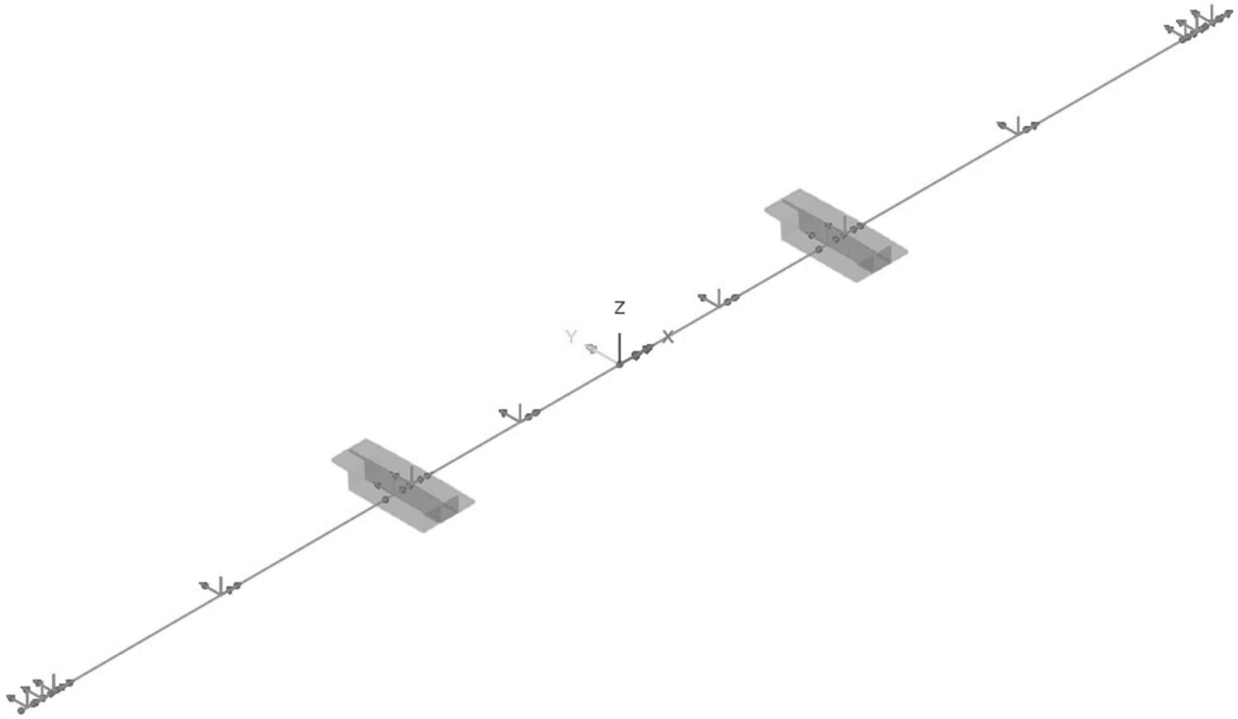
Results “T2-beam”

ez = 0.750 m + Y_c = 0.750 m - 0.768 m = -0.018 m



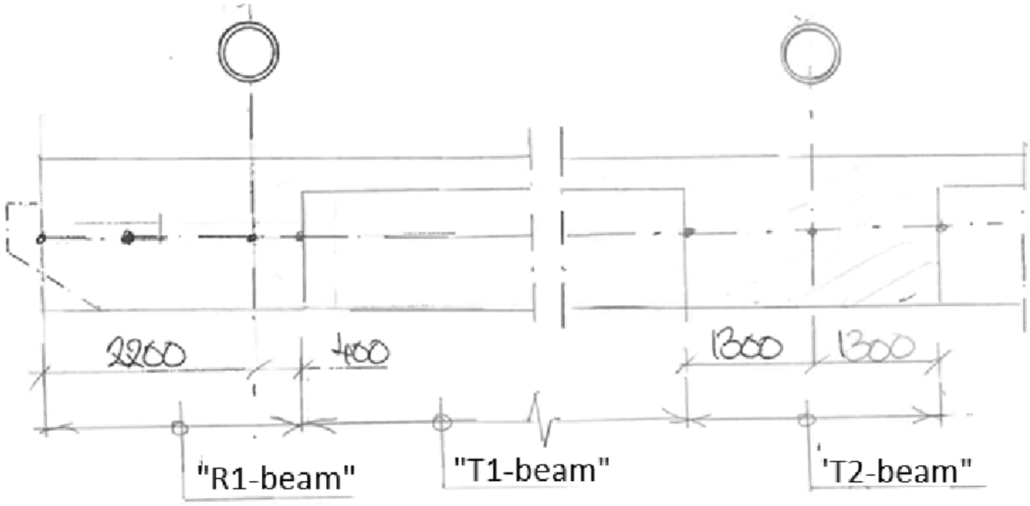
Data	“T2-beam”	Unit
A	8.756	m^2
Iyy	1.638	m^4
Izz	27.533	m^4
Iyz	0	m^4
J	4.978	m^4
ez	-0.023	m
-	m	-

Graphic visualization



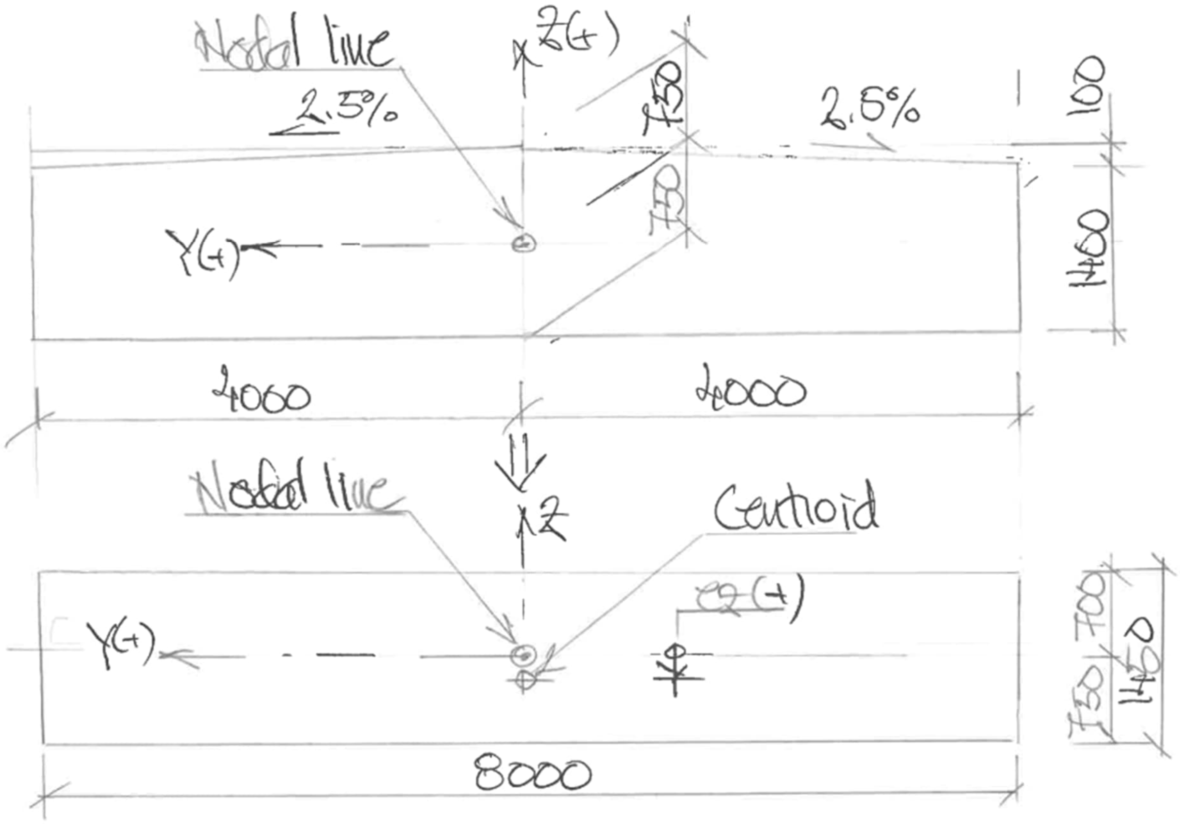
2.3.3 Longitudinal beam: Rectangular beam

The cross section is occurs locally at support 1 & 4, as seen in sketch below. Calculation is performed using “Section Property Calculator” for a parametric section type rectangular solid.



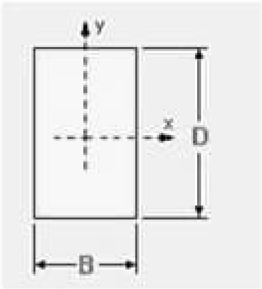
In these areas exact cross section is simplified to equivalent rectangular cross sections.

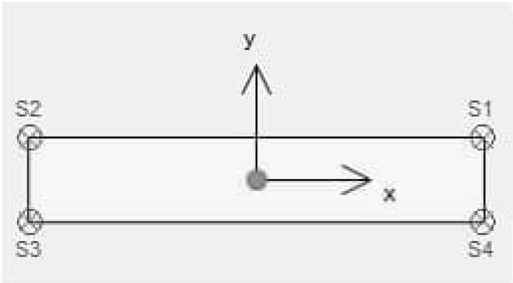
Equivalent "R1-beam"



ez = 0.750 m + Y_c = 0.750 m - 0.725 m = +0.025 m :

Input rectangular cross section



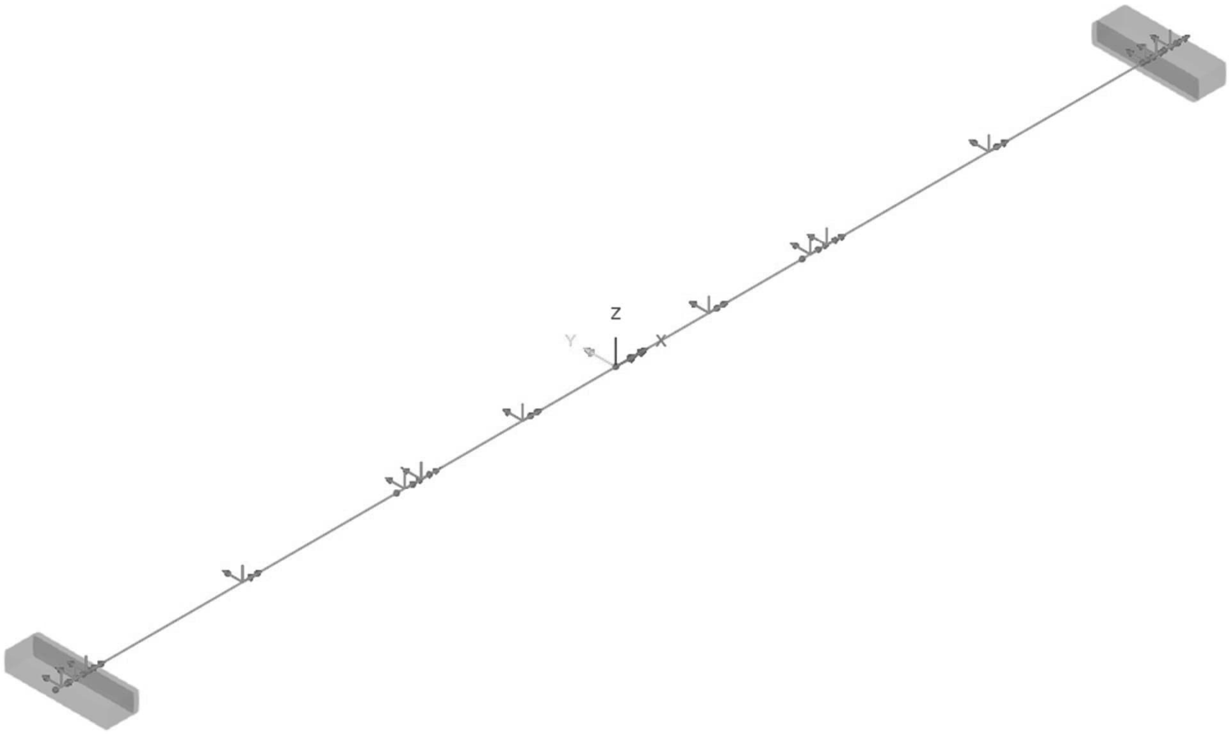


Data	“R2-beam”
D	1.465
B	5.600
-	m

Results

Data	“R1-beam”	Unit
A	11.600	m^2
Iyy	2.034	m^4
Izz	61.867	m^4
Iyz	0	m^4
J	7.202	m^4
ez	+0.025	m

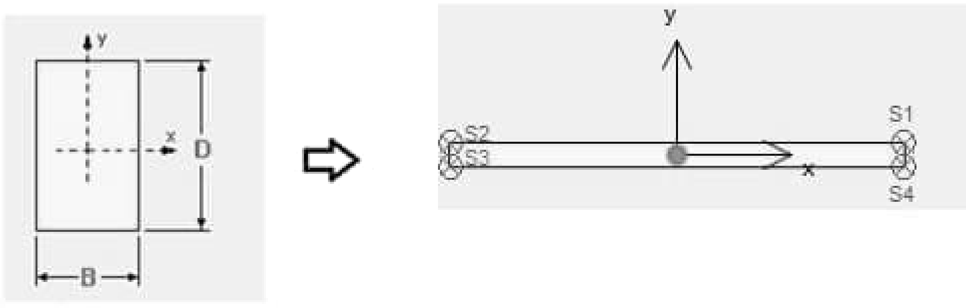
Graphic visualization



2.3.4 Link slabs: Rectangular beams

This link slabs are modelled using “Section Property Calculator” for parametric section type rectangular solid.

Input rectangular cross section

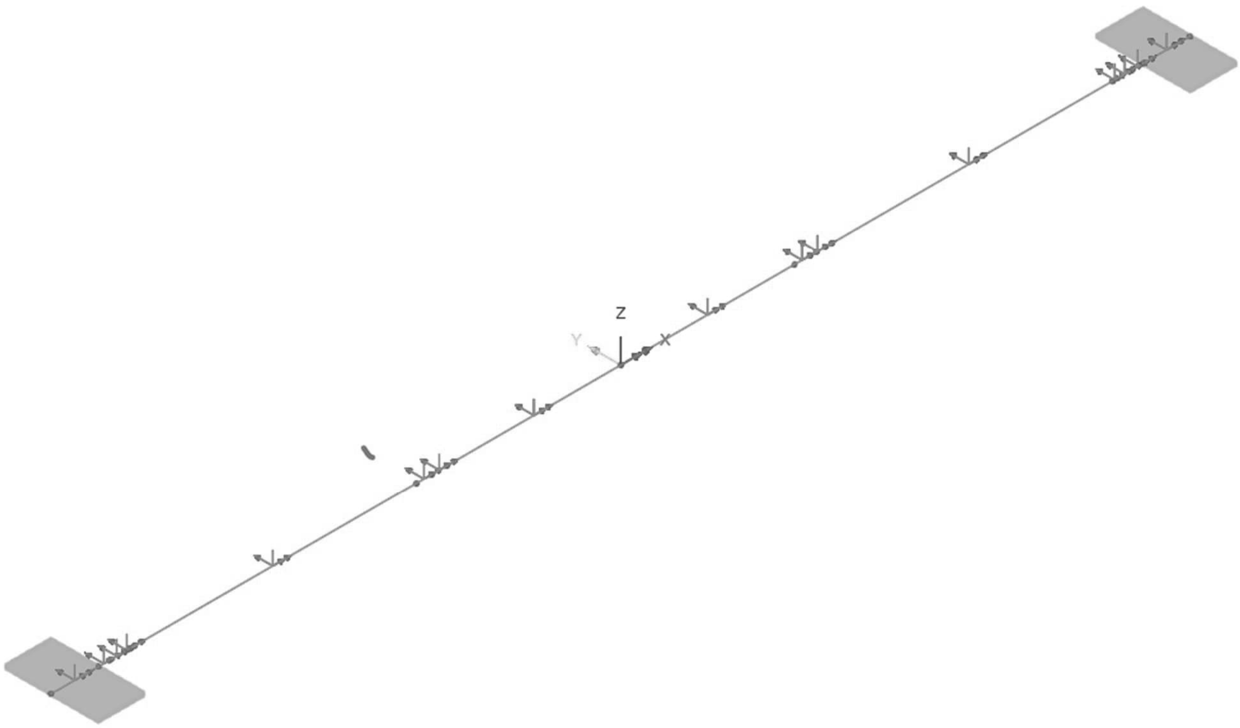


Data	“R2-beam”
D	0.400
B	8.000
-	m

Results

Data	“R2-beam”	Unit
A	3.200	m^2
Iyy	0.043	m^4
Izz	17.067	m^4
Iyz	0	m^4
J	0.165	m^4
ez	0	m

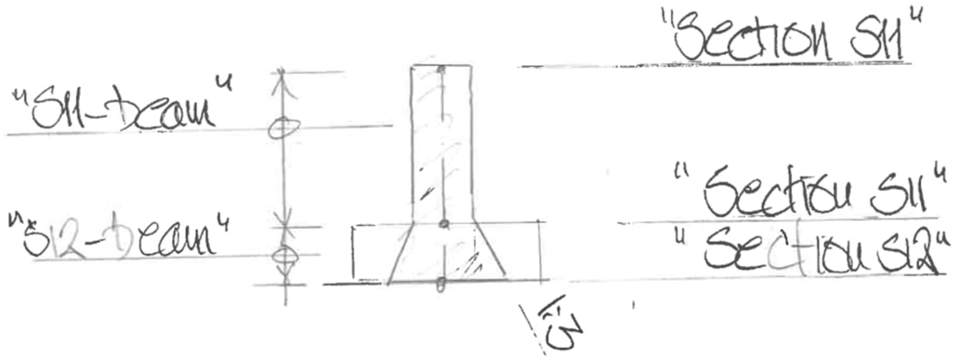
Graphic visualization



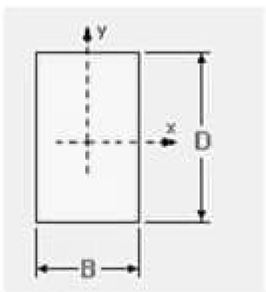
2.3.5 Support 1 & 4: Rectangular beams

This link slabs are modelled using “Section Property Calculator” for parametric section type rectangular solid.

In areas where beam vary the function “Multiple varying section” is applied.



Input rectangular cross sections



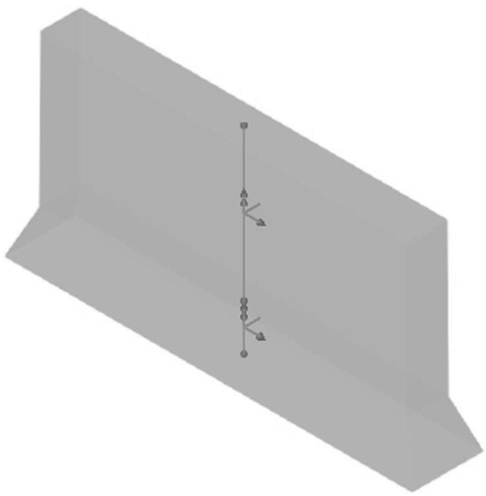
Data	“Section S11”	“Section S12”
D	0.800	1.400
B	7.200	8.000
-	m	m

Results

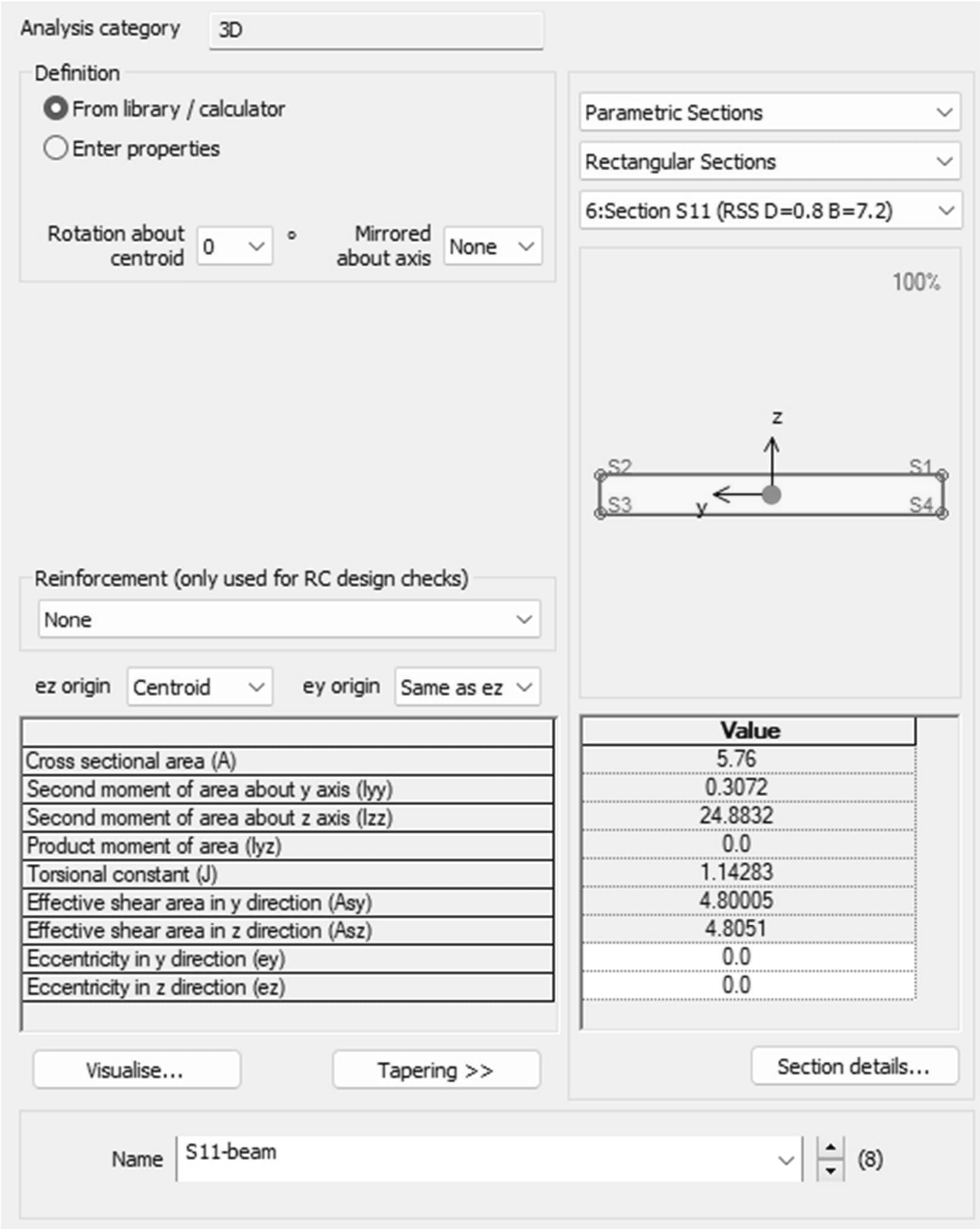
Data	“Section S11”	“Section S12”	Unit
A	5.760	11.200	m^2
Iyy	0.3072	1.829	m^4
Izz	24.883	59.733	m^4
Iyz	0	0	m^4
J	1.143	6.510	m^4
ez	0	0	m

Remark
Chosen cross section are simplified thus with regard to cross section areas, thus a weightless material needs is applied.

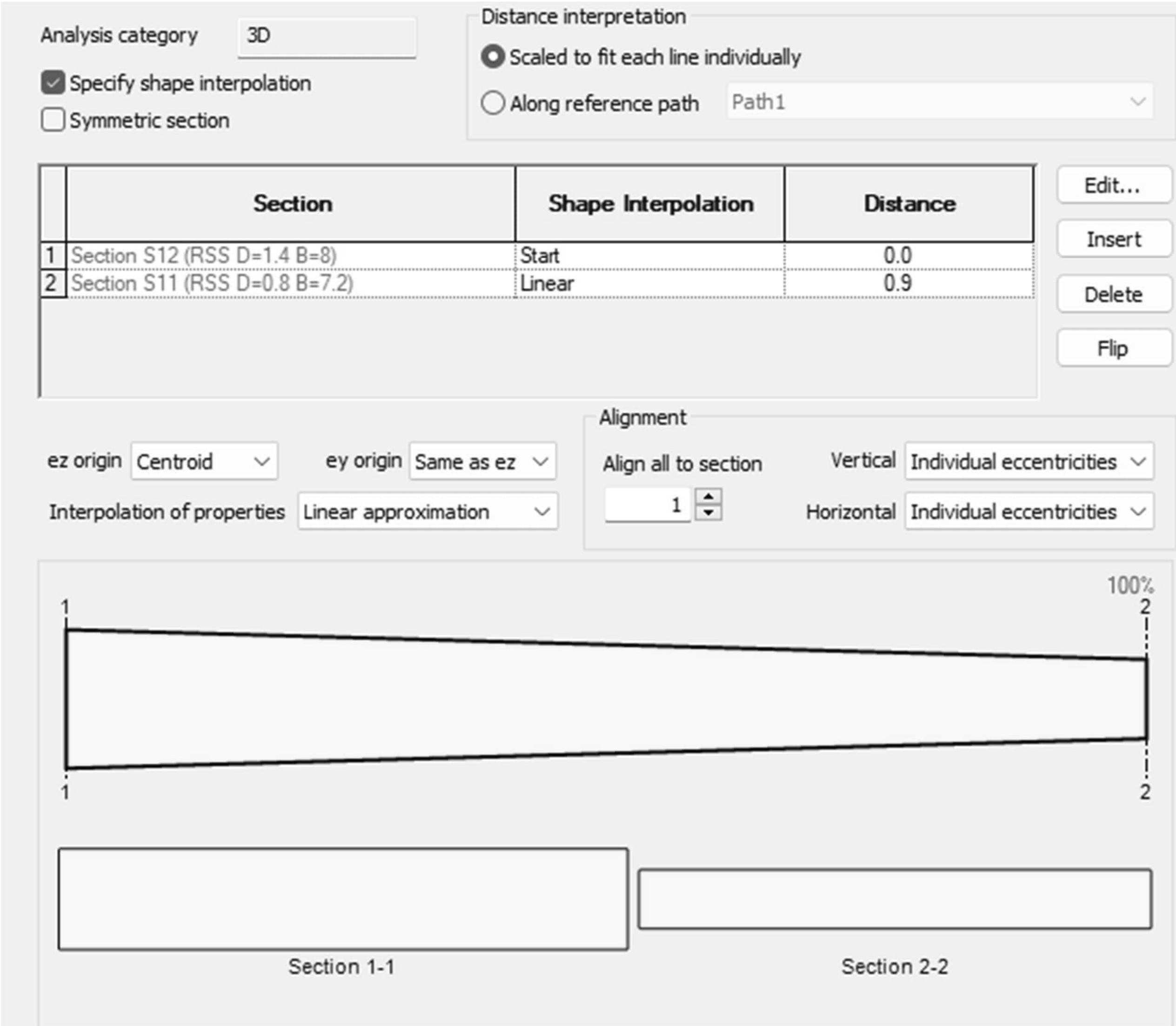
Graphic visualization



Definition of " S11-beam"



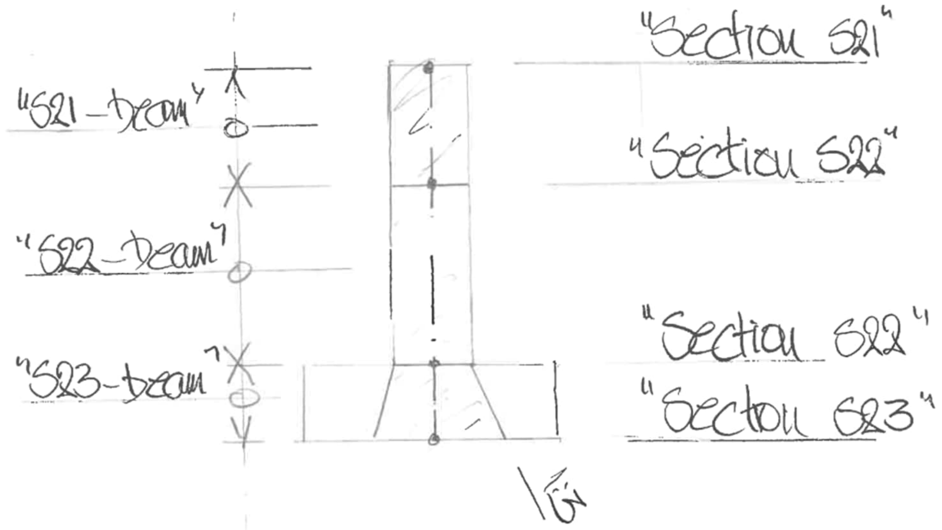
Definition of " S12-beam"



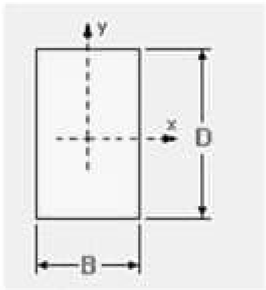
2.3.6 Support 2 & 3: Rectangular beams

This link slabs are modelled using “Section Property Calculator” for parametric section type rectangular solid.

In areas where beam vary the function “Multiple varying section” is applied.



<u>Input rectangular cross sections</u>

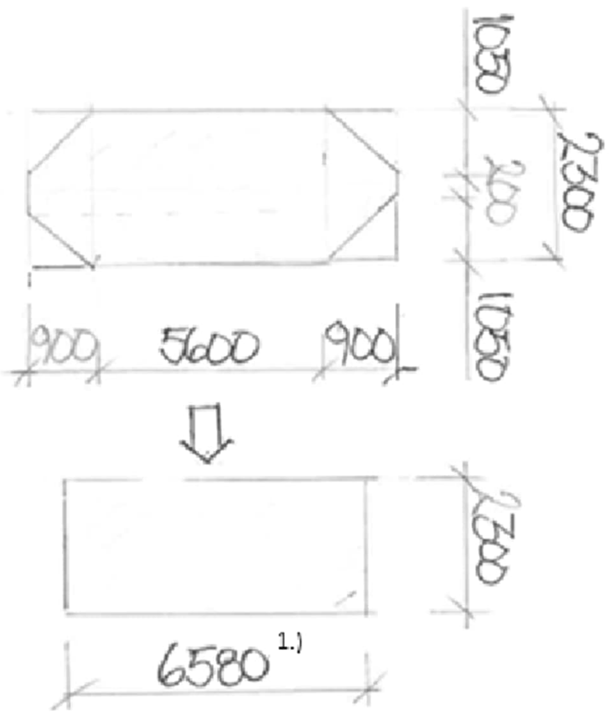


Data	"Section S21"	"Section S22"	"Section S23"
D	2.30	2.30	3.00
B	5.60	6.58[1.)]	7.28[2.)]
-	m	m	m

<u>Footnote</u>

1.) $B = 5.60m + 2 \cdot \frac{2.3m \cdot 0.9m - 0.9m \cdot 1.05m}{2.3m} = 6.58\text{m}$

2.) $B = 6.58m + 2 \cdot \frac{1.05m}{3} = 7.58\text{m}$



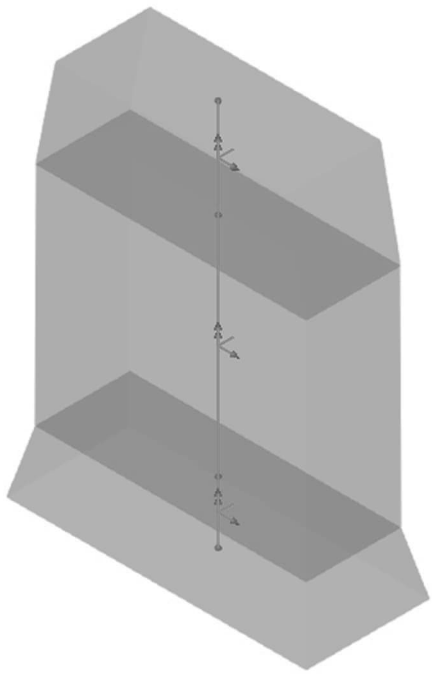
Results

Data	"Section S21"	"Section S22"	"Section S34"	Unit
A	12.880	15.134	21.840	m^2
Iyy	5.678	6.672	16.380	m^4
Izz	33.660	54.064	48.524	m^4
Iyz	0	0	0	m^4
J	16.840	20.811	48.524	m^4
ez	0	0	0	m

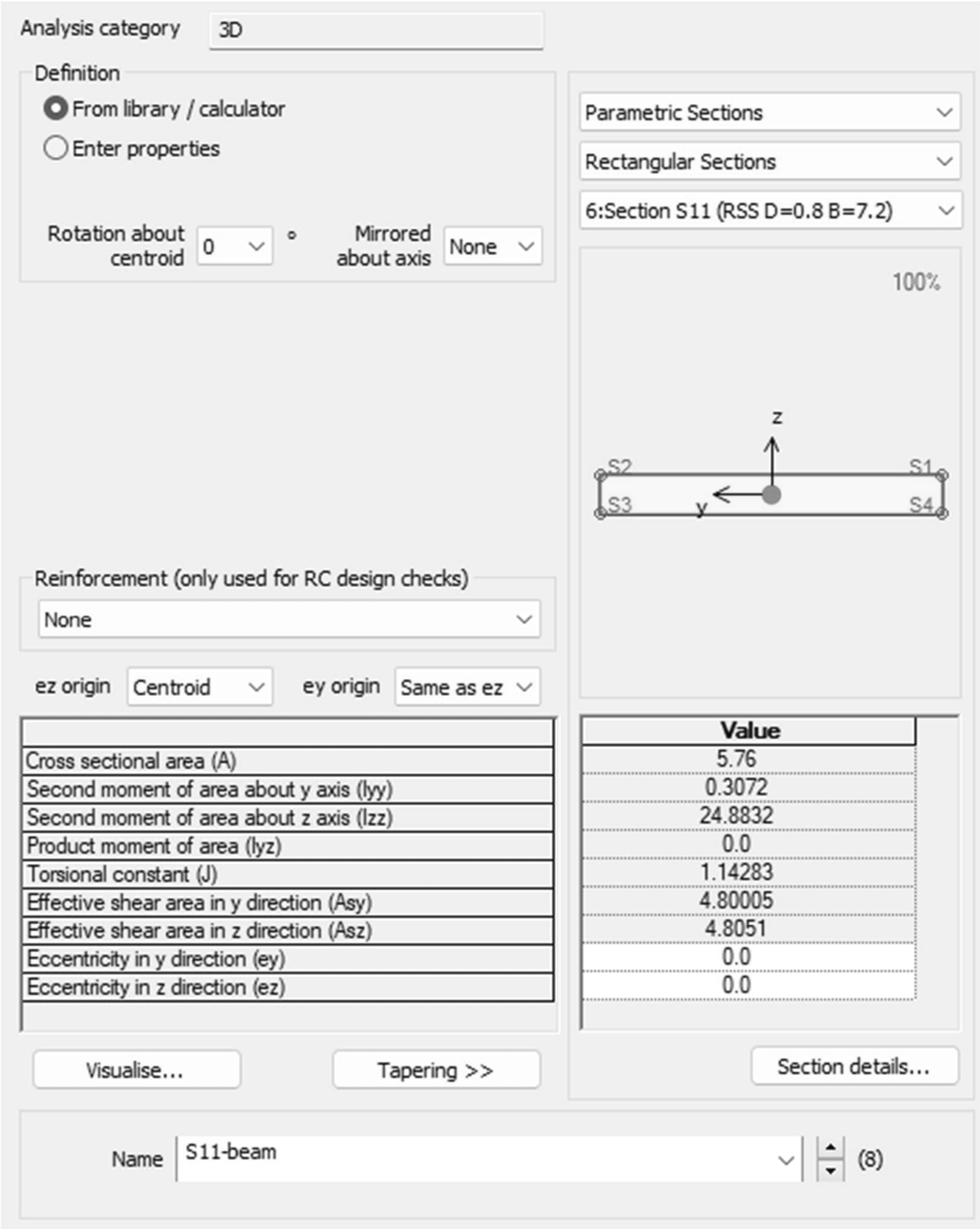
Remark

Chosen cross section are simplified thus with regard to cross section areas, thus a weightless material needs is applied.

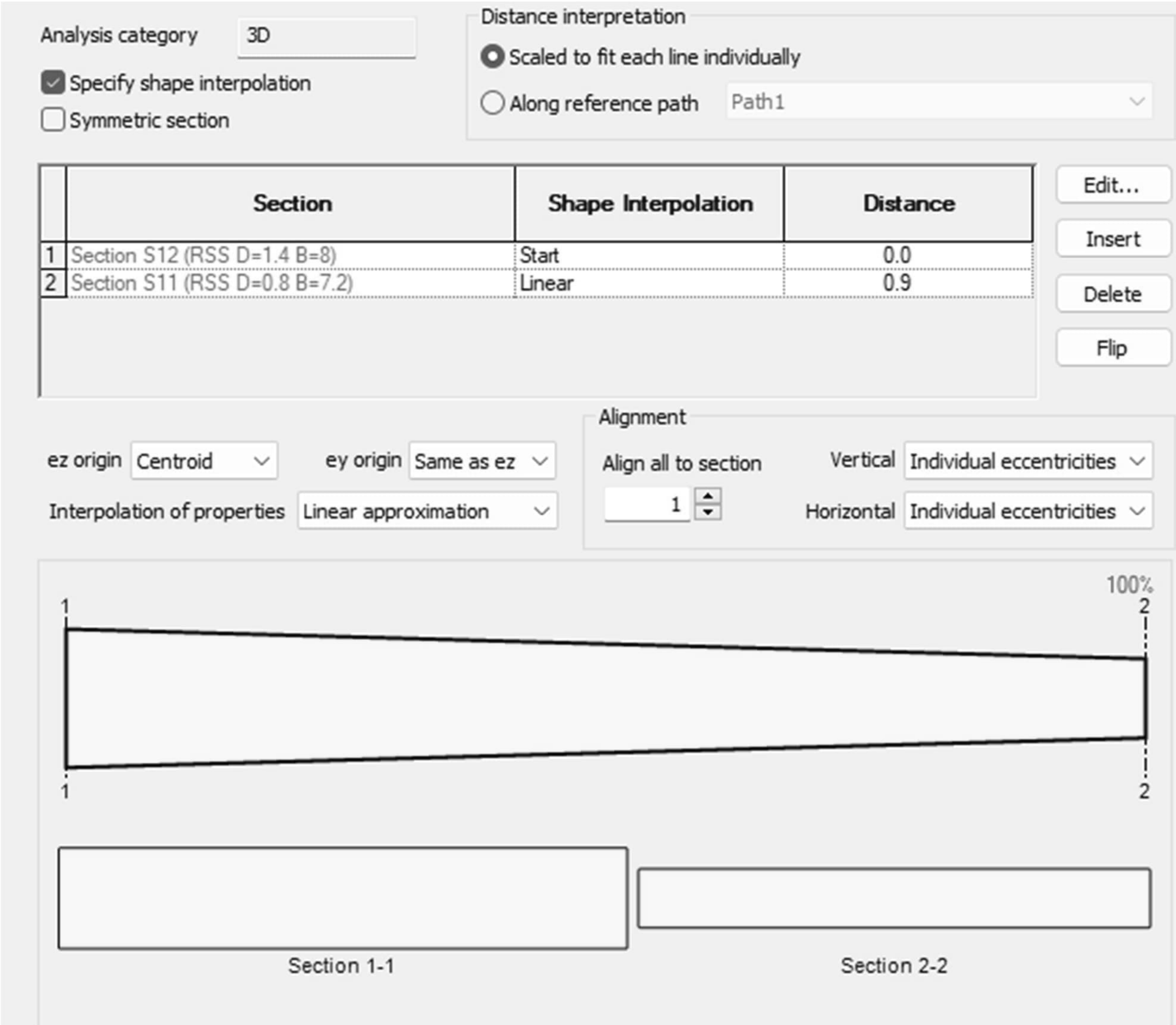
Graphic visualization



Definition of “ S11-beam”

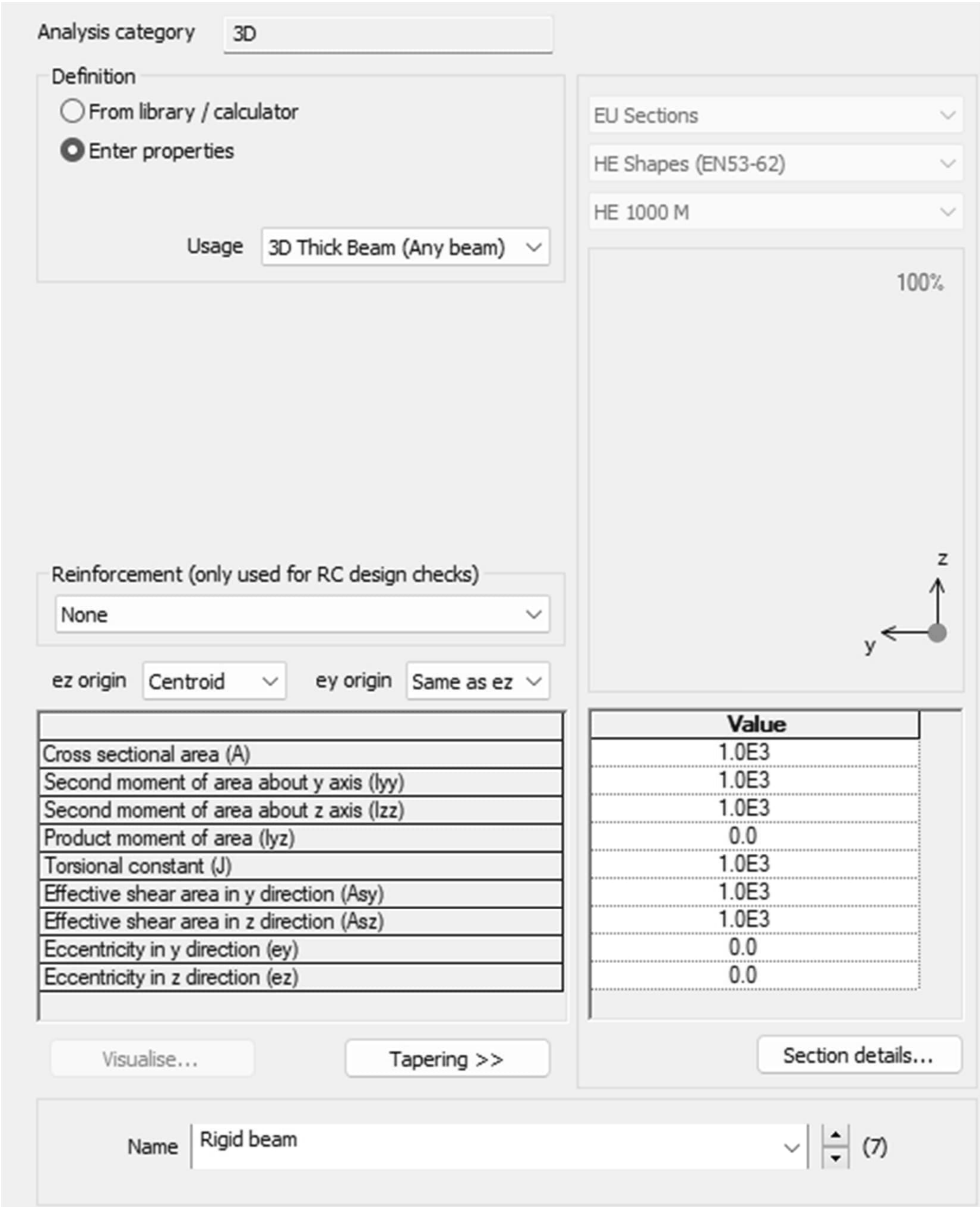


Definition of " S12-beam"



2.3.7 Rigid beams

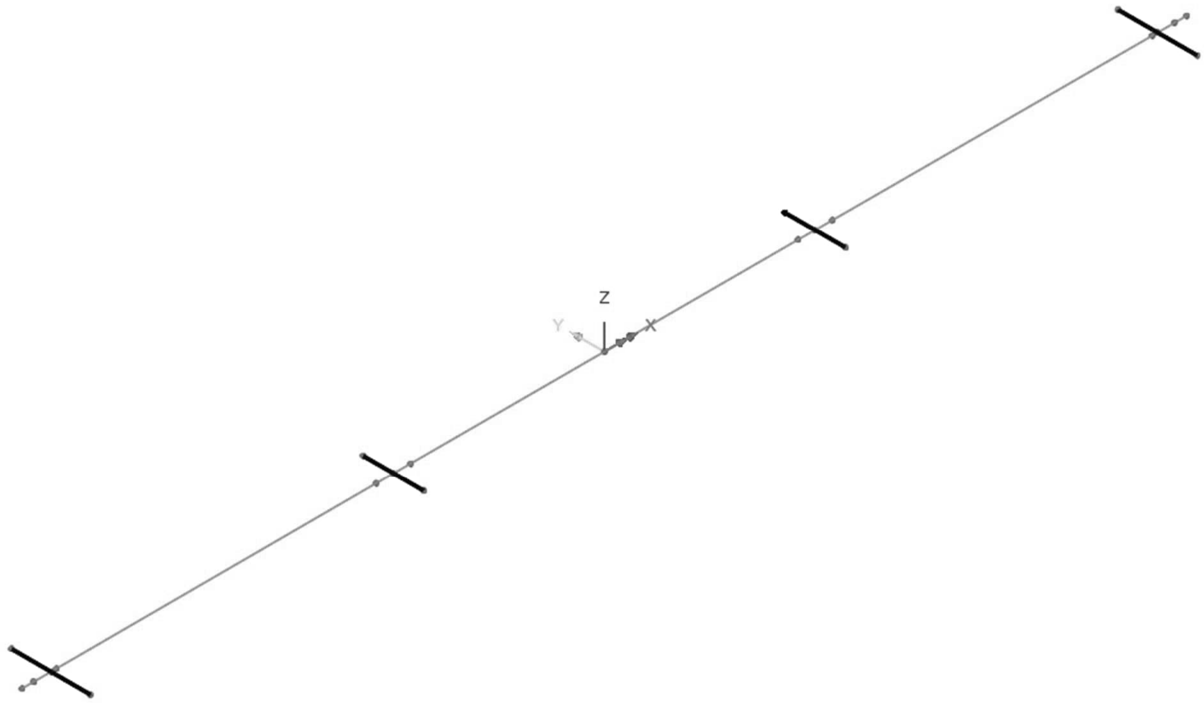
A fictive rigid beam is introduced at supports in order to model bearings.



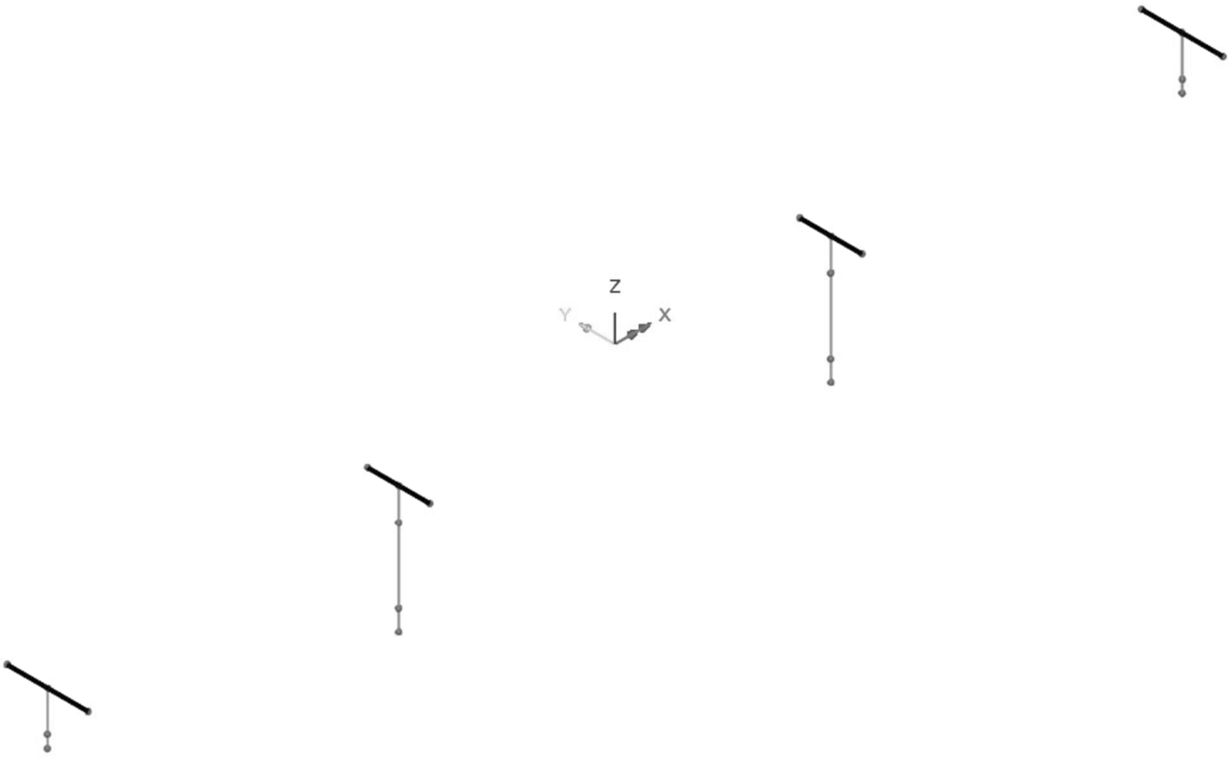
<u>Remark</u>

Due to high fictive cross sectional area a weightless material needs to be applied.

Graphic visualization superstructure (Rigid:T)



Graphic visualization substructure (Rigid:B)



2.4 MATERIAL

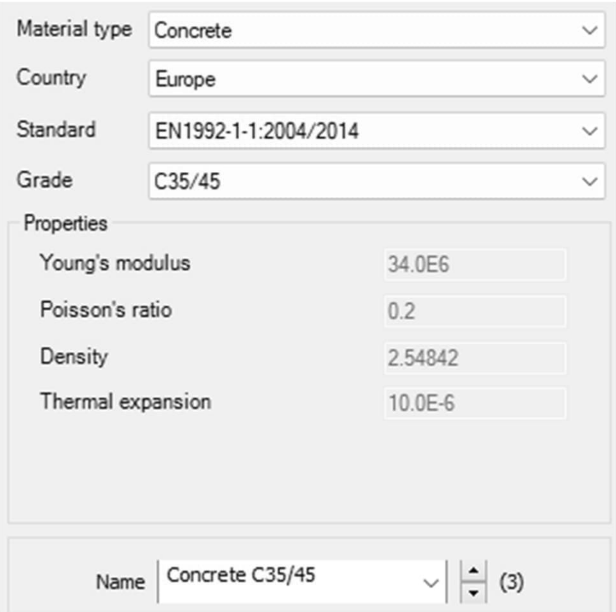
Material properties seen below are to be used.

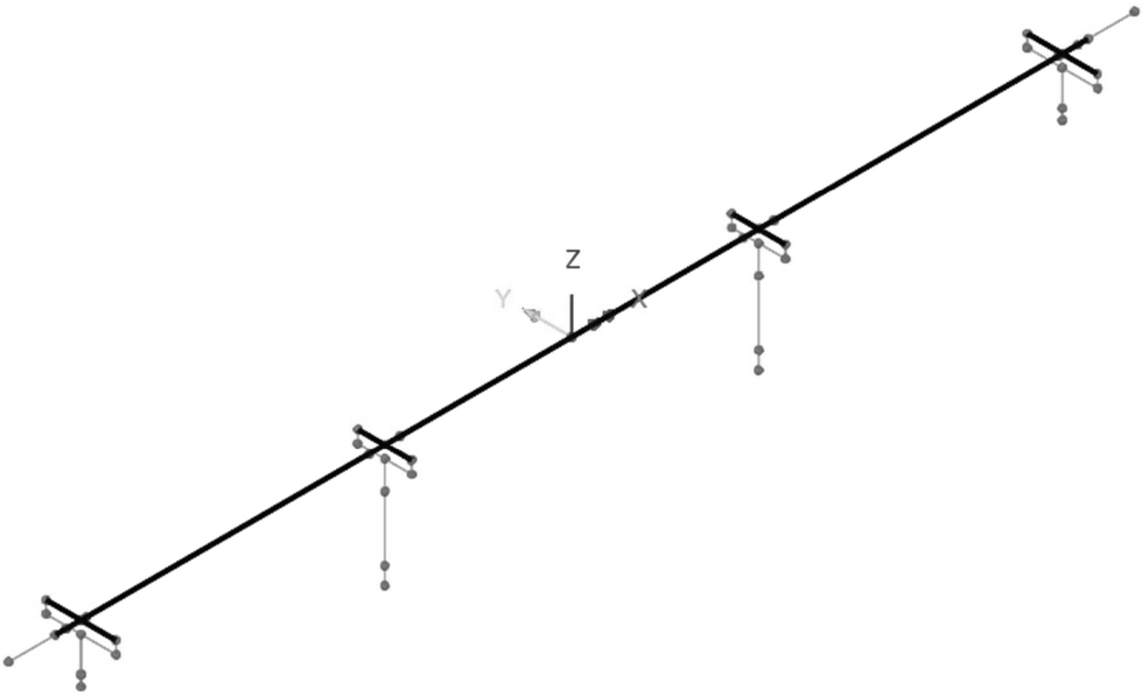
Substructure C30/37 : E_{cm} = 33 GPa

Superstructure C35/45 : E_{cm} = 34 GPa

2.4.2.1 Material : Isotropic concrete C35/45

Applied to superstructure.

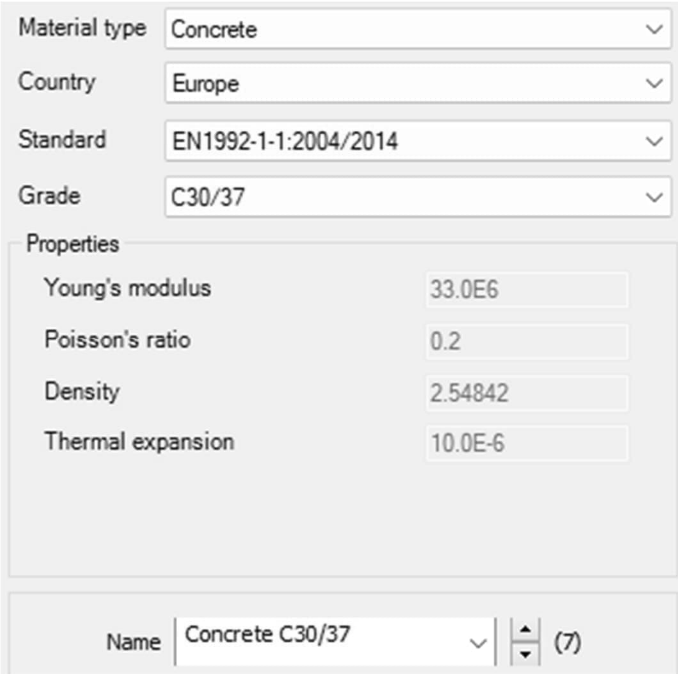


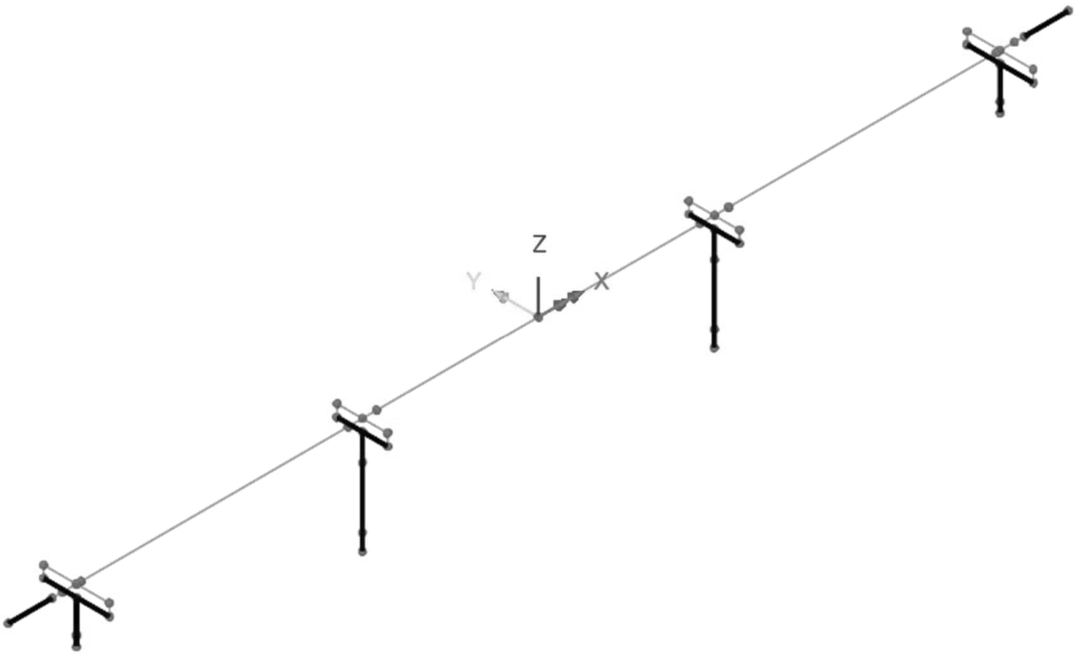


Overview

2.4.2.2 Material : Isotropic concrete C30/37

Applied to substructure and link slabs.

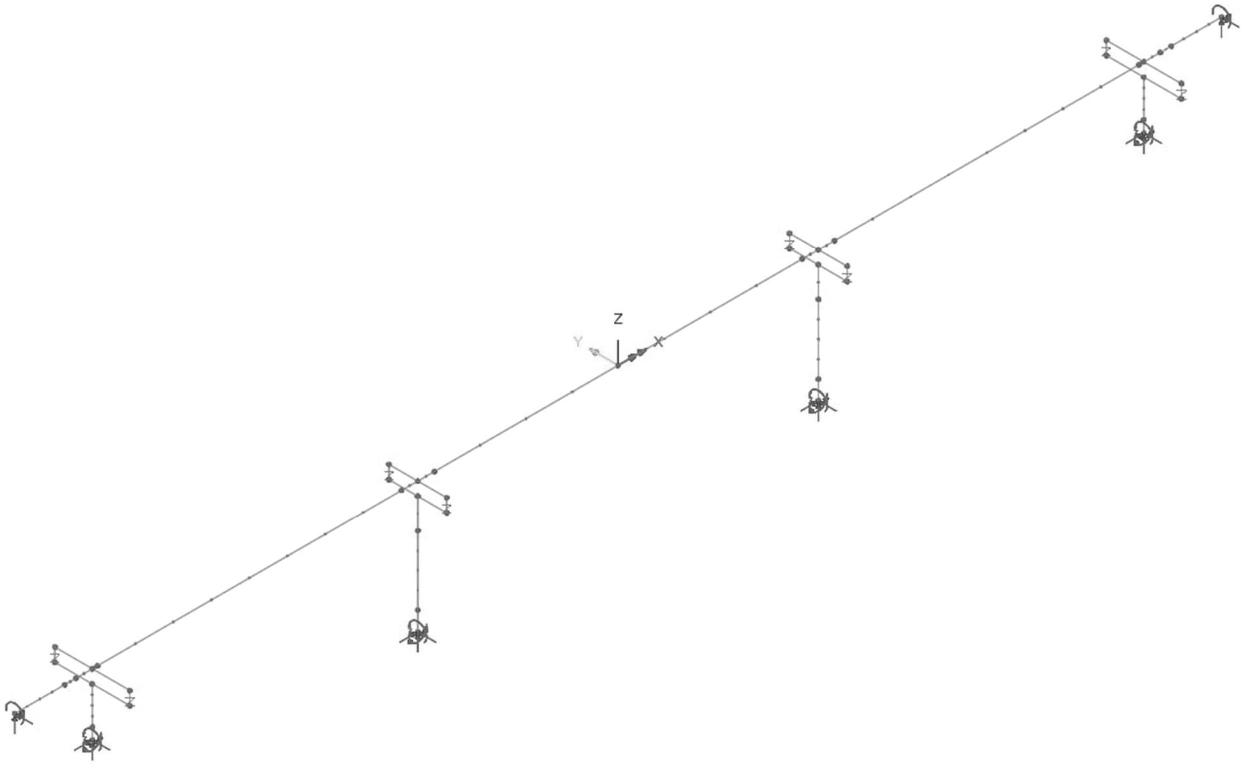




Overview

2.5 BOUNDARY CONDITIONS

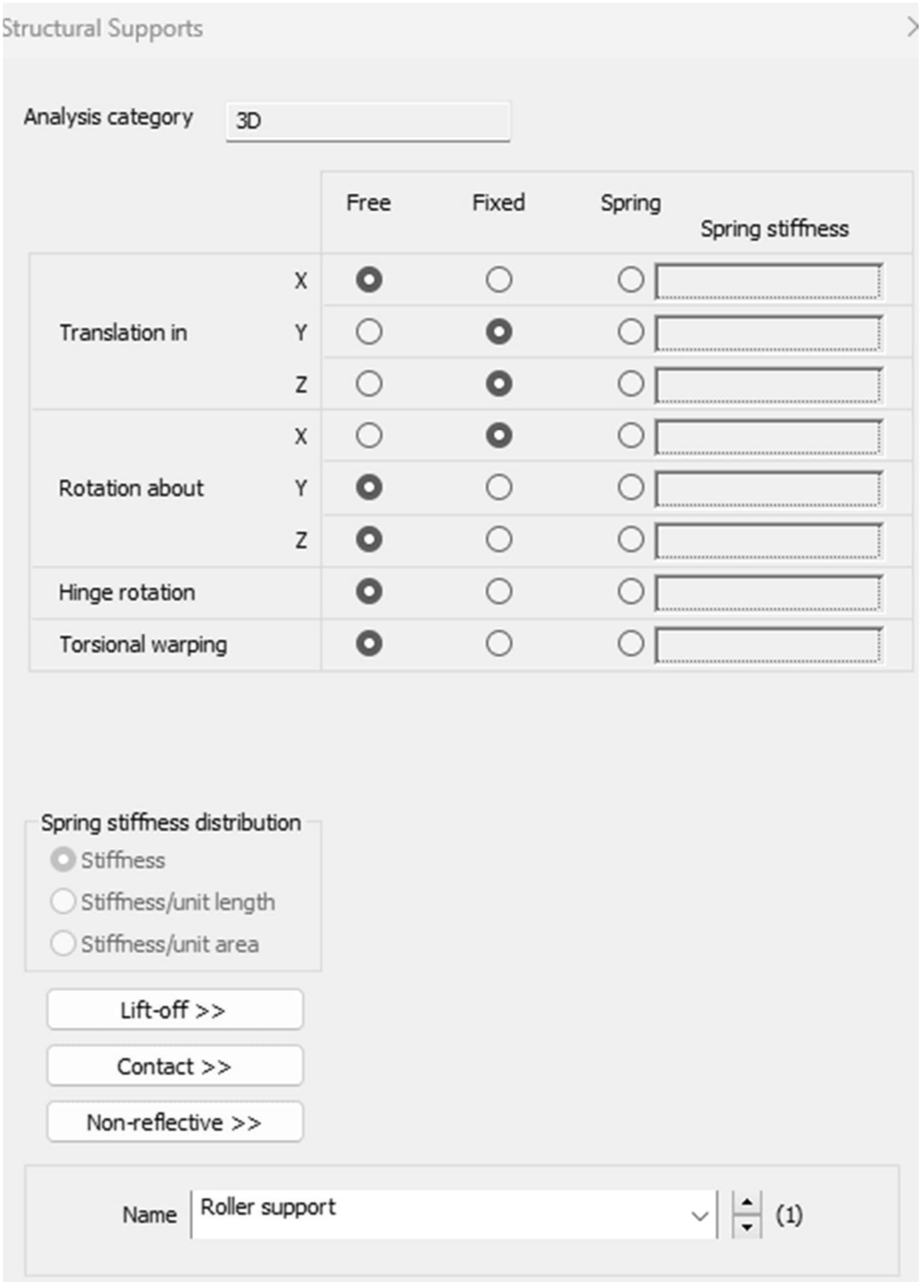
Supports are introduced at every support and free end of link slab.



Overview

2.5.1 Boundary conditions link slab

At a distance 1 m from freed edge of link slab a fictive point support (Roller support) as seen below.

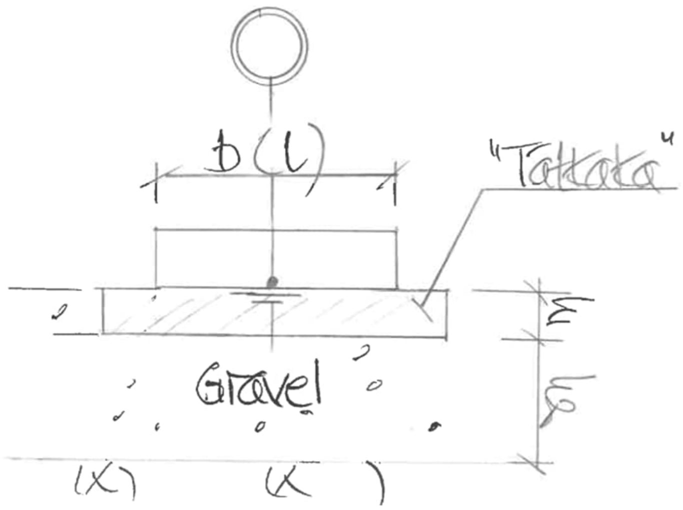


2.5.2 Boundary conditions abutments

Boundary conditions for each support is modelled using super nodes.

The super nodes are location at centre of rigid beam abutment, see sketches below.

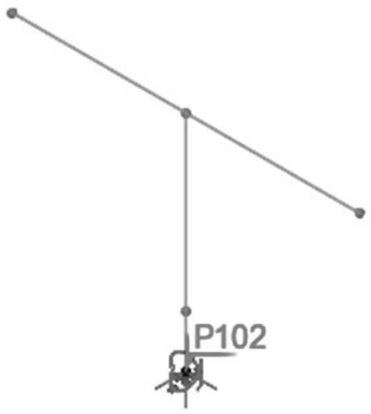
No deformation in “Tätkaka” (C25/35) is considered.



Geotechnical section at support

Support	b	l	h_1	h_2	Ek
1	4.00	9.00	1.00	6.00	50
2	6.00	10.00	1.20	2.00	50
3	6.00	10.00	1.20	4.00	50
4	4.00	8.00	1.00	9.00	50
-	m	m	m	m	MPa

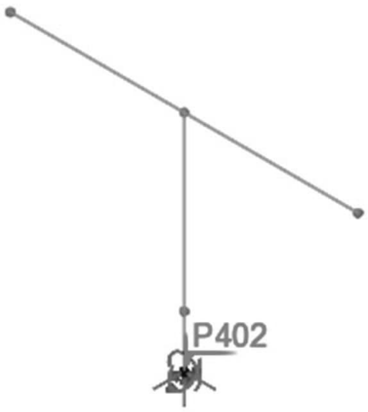
Support 1:



Support 2:

Support 3:

Support 4 :



Rotational stiffness of foundation is determined using PROG G3.005 performed in Mathcad. All formulas and partial results are shown.

Since the distance to solid ground (H) is less than twice the width of the bottom plate (2B), the method according to TRVINFRA-00227 appendix B5.1 is not applicable. Instead, a derived method for cases where H < 2B is used.

Stiffness transversal direction (Rotation X-X) :

$K_{Rx} = 2025 \cdot 10^3 \frac{kNm}{rad}$: support 1, see page A2:53

$K_{Rx} = 12500 \cdot 10^3 \frac{kNm}{rad}$: support 2, see page A2:59

$K_{Rx} = 6250 \cdot 10^3 \frac{kNm}{rad}$: support 3, see page A2:59

$K_{Rx} = 1286 \cdot 10^3 \frac{kNm}{rad}$: support 4, see page A2:53

Stiffness longitudinal direction (Rotation Y-Y) :

$K_{Ry} = 400 \cdot 10^3 \frac{kNm}{rad}$: support 1, see page A2:53

$K_{Ry} = 4500 \cdot 10^3 \frac{kNm}{rad}$: support 2, see page A2:59

$K_{Ry} = 2250 \cdot 10^3 \frac{kNm}{rad}$: support 3, see page A2:59

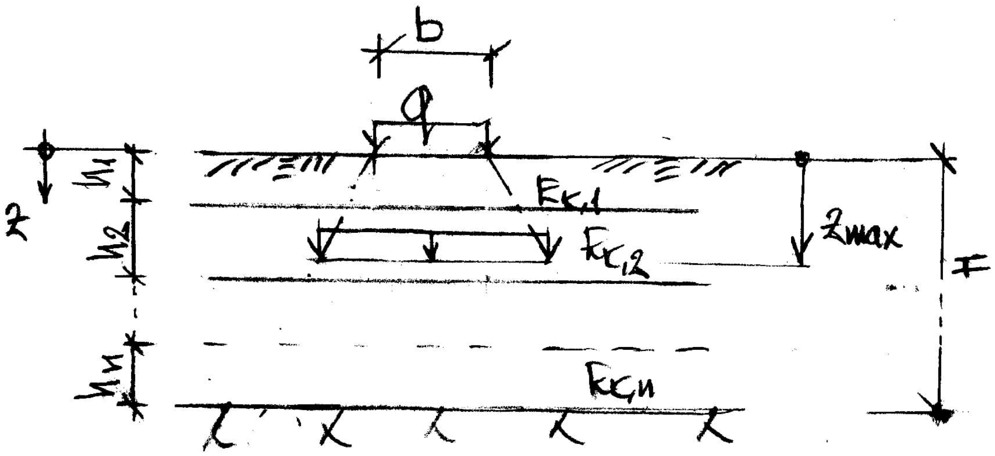
$K_{Ry} = 254 \cdot 10^3 \frac{kNm}{rad}$: support 4, see page A2:53

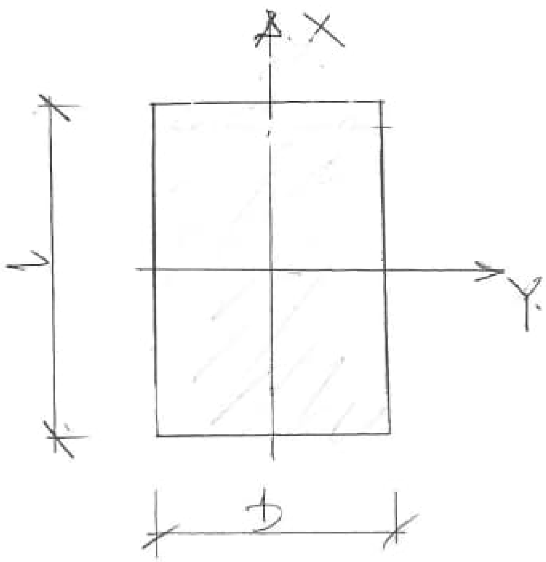
Objekt : Support 1 (4)

PRINCIPFIGUR

Geometri och undergrund

Beräkningen av ekivalent styvhet i grund är utförd enligt Råd Brobyggande bilaga 106. Den ekvivalenta E-modulen förutsätter lastspridning 2:1. Bestämningen har skett för en fiktiv lasten motsvarande q (= 100 kPa) .

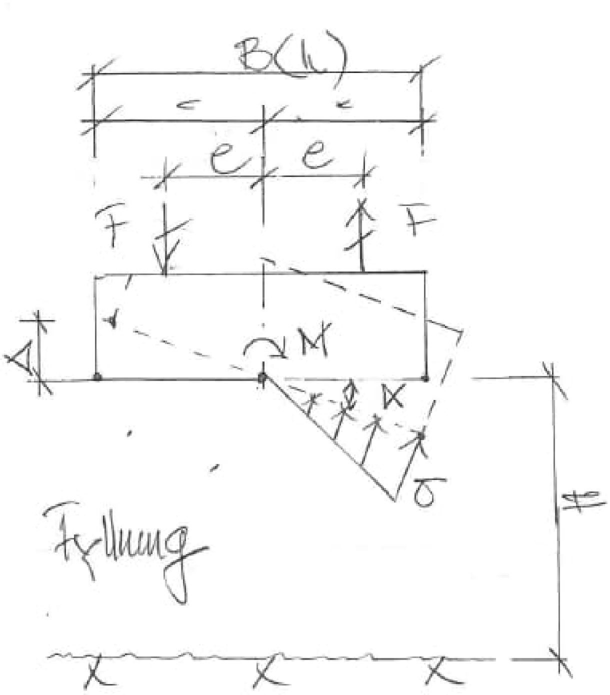




TEORI

När avståndet till fast botten är mindre än 2B så tilllämpas härled formel nedan som även förekommer i BH sida 594 (avsnitt 6.4:22 Beräkningsmodell).

När avstånd till fast botten är större än 2B tillämpas Råd Brobyggnade bilaga 107.



$$\Delta = \alpha \cdot \frac{B}{2} \;; \qquad \varepsilon = \frac{\Delta}{H} = \frac{\alpha \cdot \frac{B}{2}}{H}$$

$$\sigma = \varepsilon \cdot E'_k = \frac{E'_k \cdot \alpha \cdot B}{2 \cdot H}$$

$$F = \sigma \cdot \frac{B}{2} \cdot \frac{1}{2} \cdot L = \frac{E'_k \cdot \alpha \cdot B}{2 \cdot H} \cdot \frac{B \cdot L}{4} = \frac{E'_k \cdot \alpha \cdot B^2 \cdot L}{8 \cdot H}$$

$$M = F \cdot 2e \;; \qquad e = \frac{B}{3} \;;$$

$$M = F \cdot \frac{2 \cdot B}{3} = \alpha \cdot \frac{L \cdot B^3 \cdot E'_k}{12 \cdot H}$$

$$\Rightarrow \frac{\alpha}{M} = \frac{12 \cdot H}{L \cdot B^3 \cdot E'_k}$$

INDATA

Geometri

Bottenplatta : $b = 4.0m$ $l = 9.0m$

Underliggande jordmaterial

Antal skikt (minst 2 skickt erfordras): $n = 2st$

Skikt	E_k	h
1	50	3.00
2	50	3.00
-	MPa	m

BERÄKNINGAR

Total skikttjocklek

$$H = \sum_{i=1}^{n} h_i$$

$H = 6\,m$

Sättningsområde

$$z_{max} = \min(2 \cdot b, H)$$

$z_{max} = 6\,m$

Nivåer för respektive skikt

$$z_s = \left| \begin{array}{l} \text{for } i \in 1..n \\ \quad \left| \begin{array}{l} z_{2 \cdot i} \leftarrow z_{2 \cdot i-1} + h_i - 1mm \\ z_{2 \cdot i+1} \leftarrow z_{2 \cdot i} + 1mm \end{array} \right. \\ z \end{array} \right.$$

$$z_s^T = (0.000 \quad 3.000 \quad 3.001 \quad 6.000 \quad 6.001)\,m$$

Funktion för sättningsmodul

$$E_{sk} := \left| \begin{array}{l} \text{for } i \in 1..n-1 \\ \quad \left| \begin{array}{l} E_{2\cdot i} \leftarrow E_{k_i} \\ E_{2\cdot i+1} \leftarrow E_{k_{i+1}} \end{array} \right. \\ E \end{array} \right.$$

$$E_{sk}^{T} = (50 \;\; 50 \;\; 50 \;\; 50 \;\; 1000)\cdot \text{MPa}$$

$$E_k := \text{linterp}\left(z_s, E_{sk}, z\right)$$

Påkänningar enligt 2:1

$$q = 100\text{kPa}$$

$$\Delta\sigma_v = q\cdot\frac{b\cdot l}{(b+z)\cdot(l+z)}$$

Karakteristisk sättning

$$s_k = \int_{0m}^{H} \frac{\Delta\sigma_v}{E_k}\,dz \qquad s_k = 5.8\cdot\text{mm}$$

Ekvivalent sättningsmodul

$$E'_k = \frac{\int_{0m}^{z_{max}} \Delta\sigma_v\,dz}{s_k} \qquad E'_k = 50\cdot\text{MPa}$$

Funktion för styvhet grunden när H < 2B
(Se härledning avsnitt TEORI)

$$k_{\theta k}(B,L) = \frac{L\cdot B^3\cdot E'_k}{12H}$$

RESULTAT

Resultat då H < 2B :

Rotation kring plattans korta riktning (x-x riktning):

$$k_{\theta k}(b,l) = 400000 \cdot \frac{kNm}{rad}$$

$$C_{\phi} = \frac{1}{k_{\theta k}(b,l)} \qquad 10^{9} \cdot C_{\phi} = 2500 \cdot \frac{rad}{kNm}$$

Rotation kring plattans långa riktning (y-y riktning):

$$k_{\theta k}(l,b) = 2025000 \cdot \frac{kNm}{rad}$$

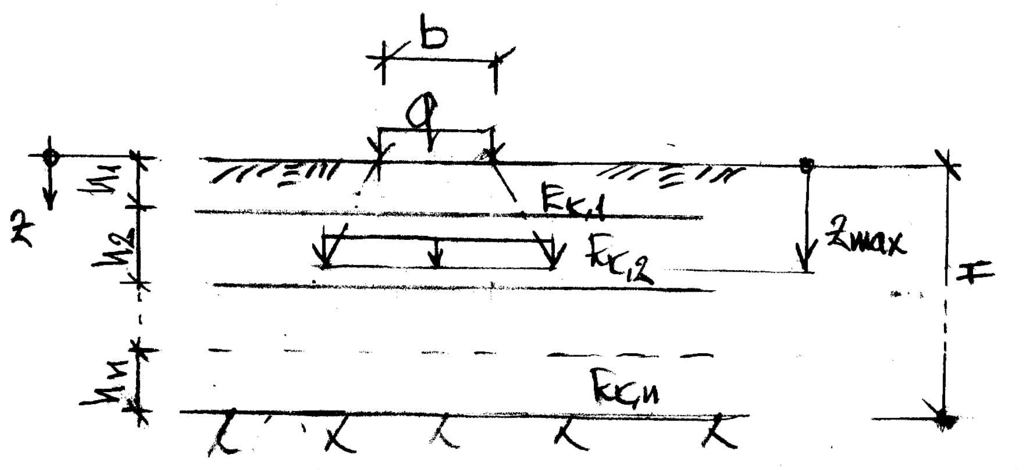
$$C_{\eta} = \frac{1}{k_{\theta k}(l,b)} \qquad 10^{9} \cdot C_{\eta} = 494 \cdot \frac{rad}{kNm}$$

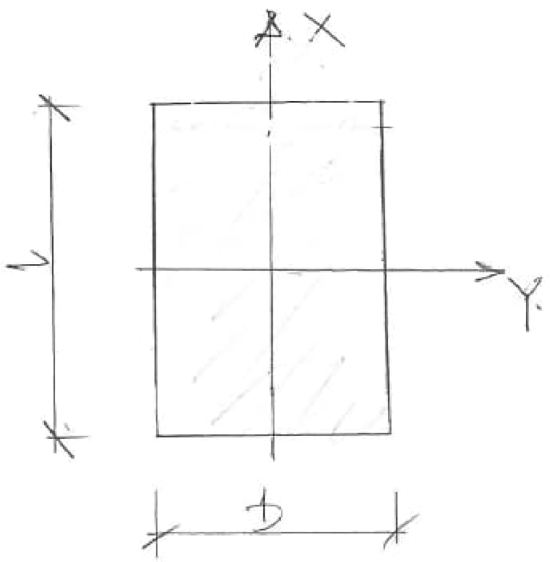
Objekt : Support 2 (3)

PRINCIPFIGUR

Geometri och undergrund

Beräkningen av ekivalent styvhet i grund är utförd enligt Råd Brobyggande bilaga 106. Den ekvivalenta E-modulen förutsätter lastspridning 2:1. Bestämningen har skett för en fiktiv lasten motsvarande q (= 100 kPa) .

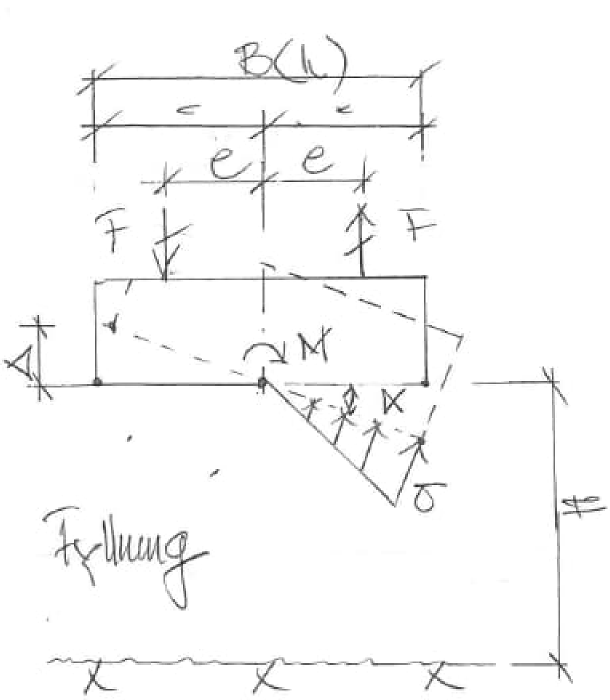




TEORI

När avståndet till fast botten är mindre än 2B så tilllämpas härled formel nedan som även förekommer i BH sida 594 (avsnitt 6.4:22 Beräkningsmodell).

När avstånd till fast botten är större än 2B tillämpas Råd Brobyggnade bilaga 107.



$$\Delta = \alpha \cdot \frac{B}{2} \; ; \qquad \varepsilon = \frac{\Delta}{H} = \frac{\alpha \cdot \frac{B}{2}}{H}$$

$$\sigma = \varepsilon \cdot E'_k = \frac{E'_k \cdot \alpha \cdot B}{2 \cdot H}$$

$$F = \sigma \cdot \frac{B}{2} \cdot \frac{1}{2} \cdot L = \frac{E'_k \cdot \alpha \cdot B}{2 \cdot H} \cdot \frac{B \cdot L}{4} = \frac{E'_k \cdot \alpha \cdot B^2 \cdot L}{8 \cdot H}$$

$$M = F \cdot 2e \; ; \qquad e = \frac{B}{3} \; ;$$

$$M = F \cdot \frac{2 \cdot B}{3} = \alpha \cdot \frac{L \cdot B^3 \cdot E'_k}{12 \cdot H}$$

$$\Rightarrow \frac{\alpha}{M} = \frac{12 \cdot H}{L \cdot B^3 \cdot E'_k}$$

INDATA

Geometri

Bottenplatta : $b = 6.0m$ $l = 10.0m$

Underliggande jordmaterial

Antal skikt (minst 2 skickt erfordras): $n = 2st$

Skikt	E_k	h
1	50	1.00
2	50	1.00
-	MPa	m

BERÄKNINGAR

Total skikttjocklek

$$H = \sum_{i=1}^{n} h_i$$

$H = 2\,m$

Sättningsområde

$$z_{max} = \min(2 \cdot b, H)$$

$z_{max} = 2\,m$

Nivåer för respektive skikt

$$z_s = \left| \begin{array}{l} \text{for } i \in 1..n \\ \quad \left| \begin{array}{l} z_{2 \cdot i} \leftarrow z_{2 \cdot i-1} + h_i - 1mm \\ z_{2 \cdot i+1} \leftarrow z_{2 \cdot i} + 1mm \end{array} \right. \\ z \end{array} \right.$$

$z_s = (0.000 \quad 1.000 \quad 1.001 \quad 2.000 \quad 2.001)\,m$

Funktion för sättningsmodul

$$E_{sk} := \left| \begin{array}{l} \text{for } i \in 1..n-1 \\ \quad \left| \begin{array}{l} E_{2\cdot i} \leftarrow E_{k_i} \\ E_{2\cdot i+1} \leftarrow E_{k_{i+1}} \end{array} \right. \\ E \end{array} \right.$$

$$E_{sk}^{T} = (50 \quad 50 \quad 50 \quad 50 \quad 1000)\cdot MPa$$

$$E_k := \text{linterp}\left(z_s, E_{sk}, z\right)$$

Påkänningar enligt 2:1

$$q = 100kPa$$

$$\Delta\sigma_v = q\cdot\frac{b\cdot l}{(b+z)\cdot(l+z)}$$

Karakteristisk sättning

$$s_k = \int_{0m}^{H} \frac{\Delta\sigma_v}{E_k}\,dz$$

$$s_k = 3.2\cdot mm$$

Ekvivalent sättningsmodul

$$E'_k = \frac{\int_{0m}^{z_{max}} \Delta\sigma_v\,dz}{s_k}$$

$$E'_k = 50\cdot MPa$$

Funktion för styvhet grunden när H < 2B
(Se härledning avsnitt TEORI)

$$k_{\theta k}(B,L) = \frac{L\cdot B^3\cdot E'_k}{12H}$$

RESULTAT

Resultat då H < 2B :

Rotation kring plattans korta riktning (x-x riktning):

$$k_{\theta k}(b,l) = 4500000 \cdot \frac{kNm}{rad}$$

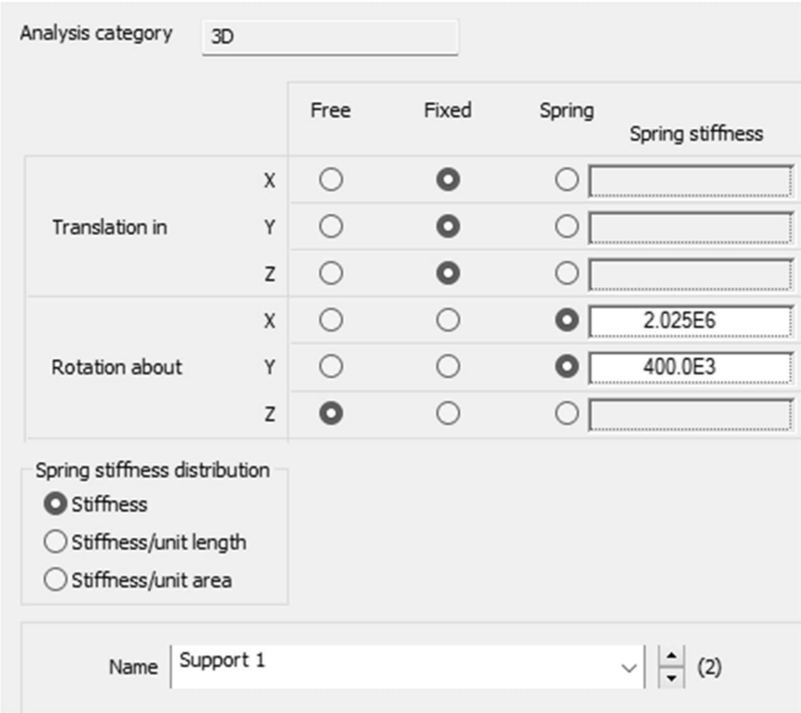
$$C_{\phi} = \frac{1}{k_{\theta k}(b,l)} \qquad 10^{9} \cdot C_{\phi} = 222 \cdot \frac{rad}{kNm}$$

Rotation kring plattans långa riktning (y-y riktning):

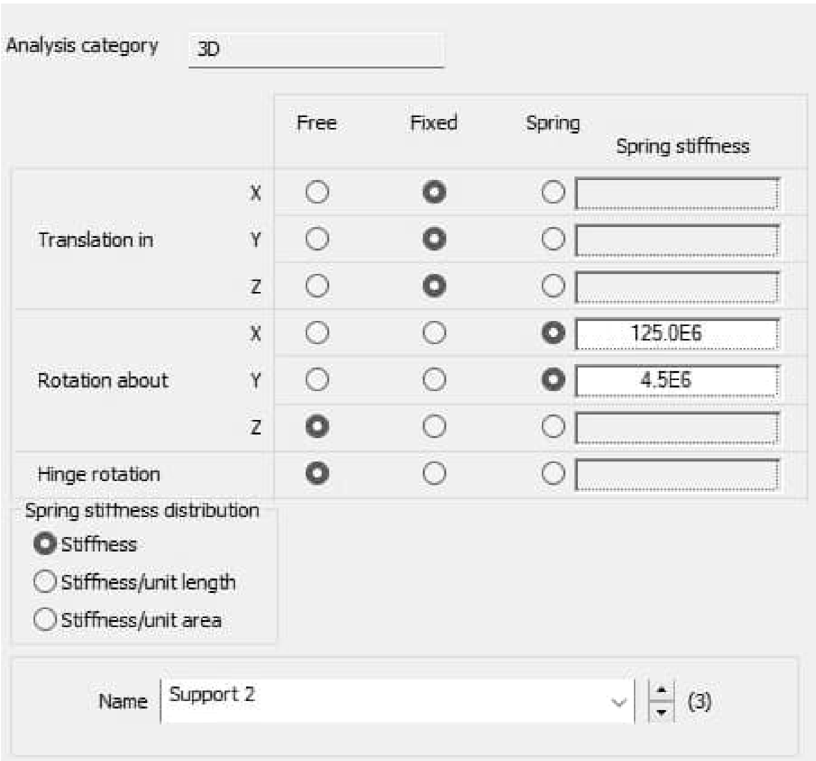
$$k_{\theta k}(l,b) = 12500000 \cdot \frac{kNm}{rad}$$

$$C_{\eta} = \frac{1}{k_{\theta k}(l,b)} \qquad 10^{9} \cdot C_{\eta} = 80 \cdot \frac{rad}{kNm}$$

Boundary support 1:



Boundary support 2:



Boundary support 3:

Analysis category: 3D

		Free	Fixed	Spring	Spring stiffness
Translation in	X	○	●	○	
	Y	○	●	○	
	Z	○	●	○	
Rotation about	X	○	○	●	6.25E6
	Y	○	○	●	2.25E6
	Z	●	○	○	
Hinge rotation		●	○	○	

Spring stiffness distribution
- ● Stiffness
- ○ Stiffness/unit length
- ○ Stiffness/unit area

Name: Support 3 (4)

Boundary support 4:

Analysis category: 3D

		Free	Fixed	Spring	Spring stiffness
Translation in	X	○	●	○	
	Y	○	●	○	
	Z	○	●	○	
Rotation about	X	○	○	●	1.286E6
	Y	○	○	●	254.0E3
	Z	●	○	○	

Spring stiffness distribution
- ● Stiffness
- ○ Stiffness/unit length
- ○ Stiffness/unit area

Name: Support 4 (5)

2.6 MESH

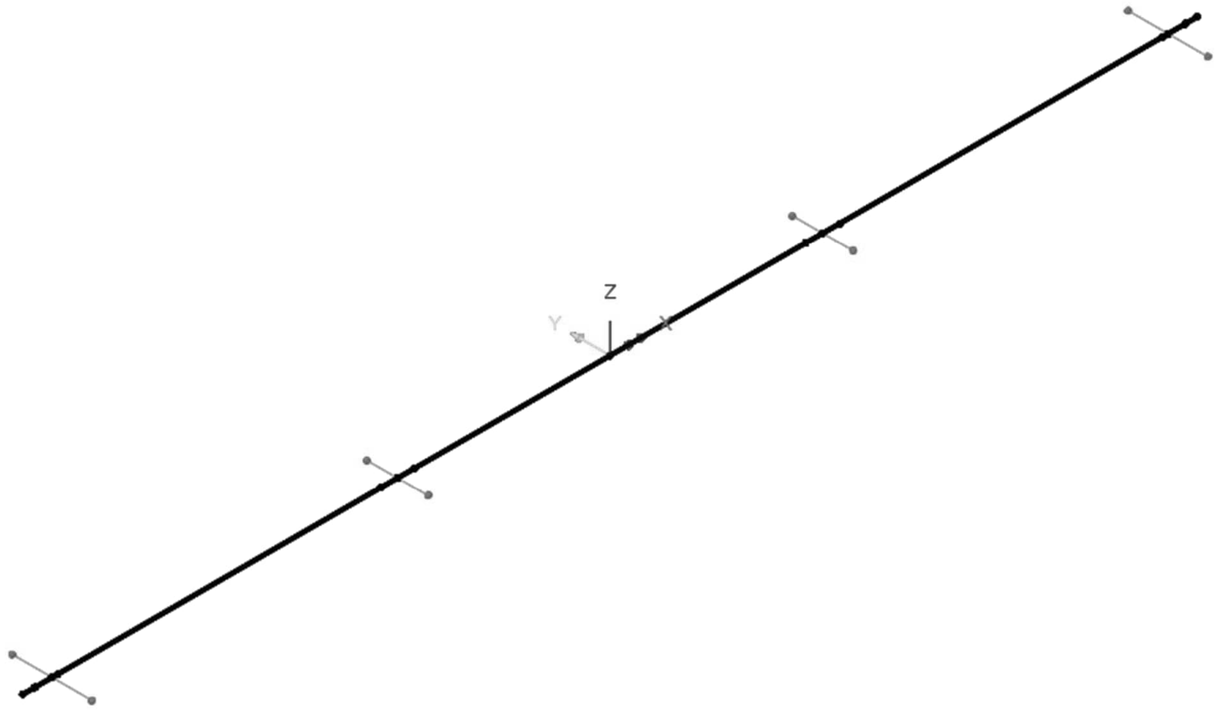
2.6.1 Beam element (BMI21) : linear

Longititudinal beams in superstructure are modelled using beam elements.

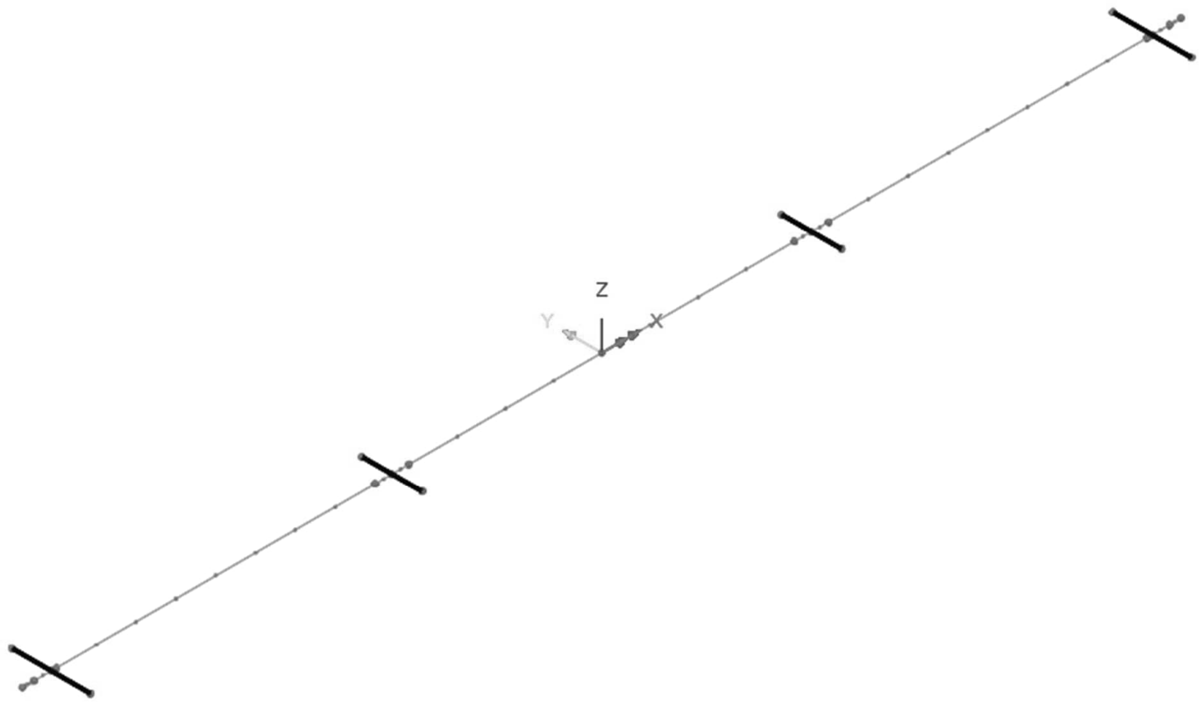
Beams elements are modelled with various subdivisions as seen below.

Typ	Divisions	End release: Start	End release: End
Element 1	1	None	None
Element 2	2	None	None
Element 4	4	None	None
Element 8	8	None	None
Element 4L:ML	4	None	Pinned
Element 4R:ML	4	Pinned	None

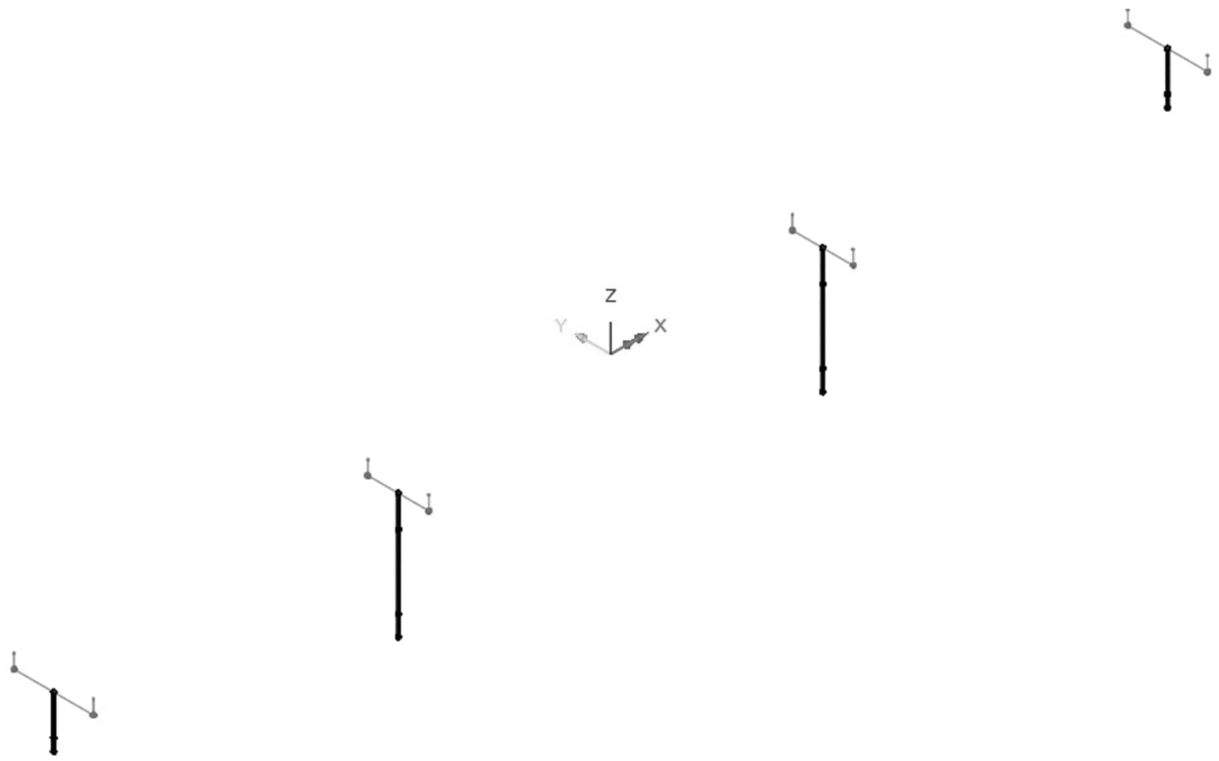
Longitudinal beam – superstructure (Element 1, 2 & 8):



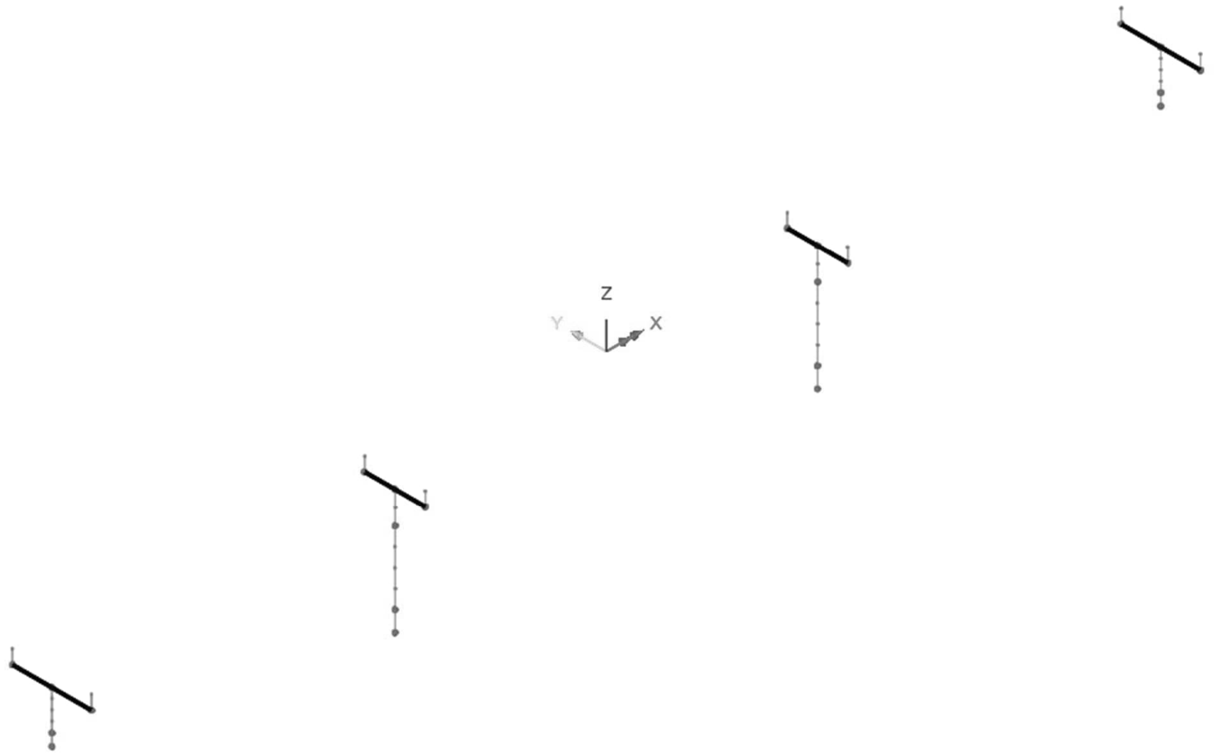
Rigid beam – superstructure (Element 1):



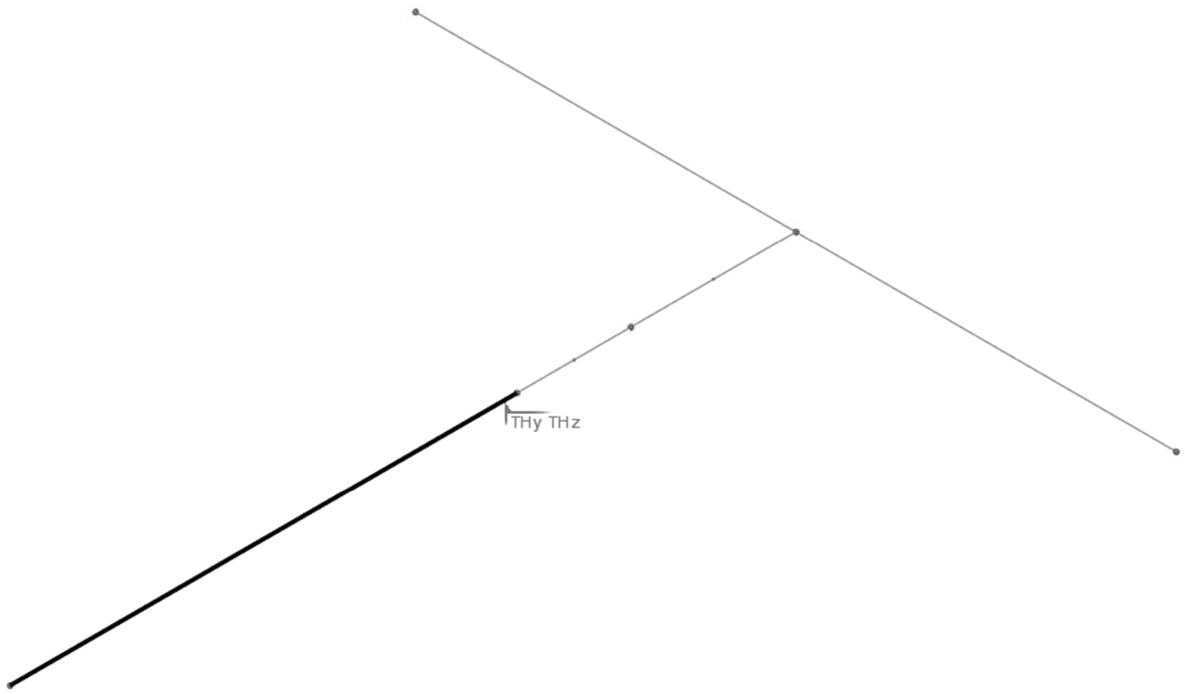
Abutments (Element 1, 2 & 4):



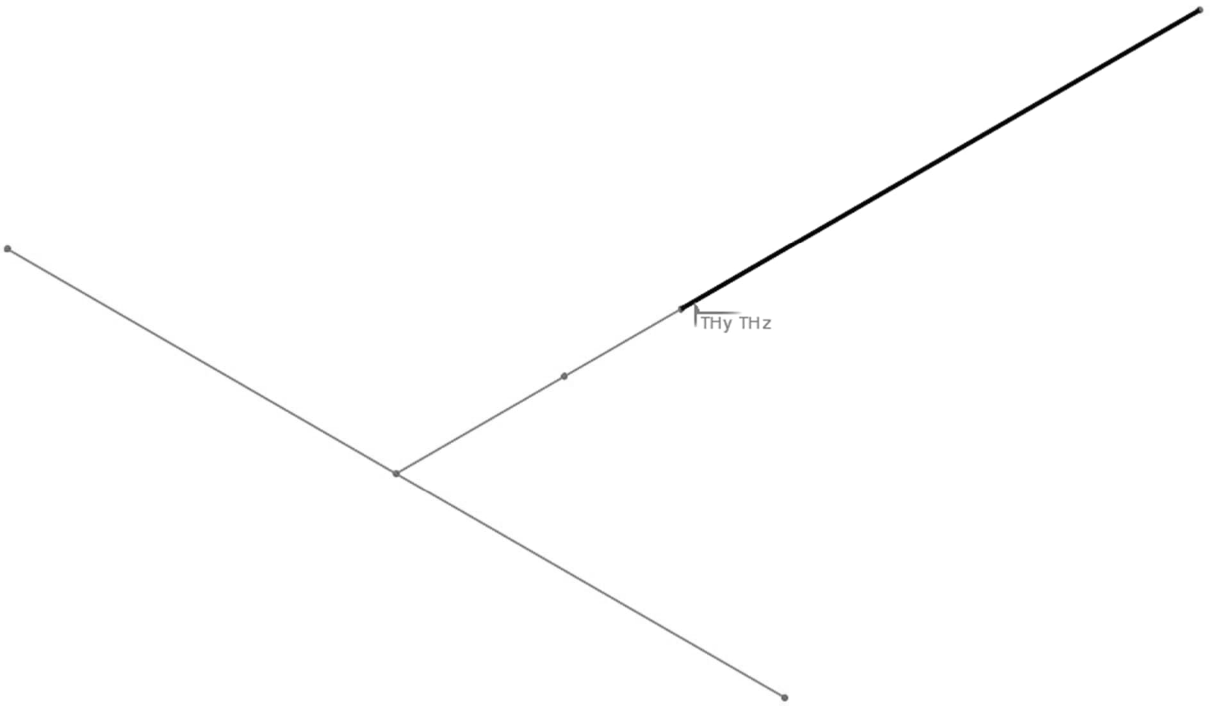
Rigid beam – abutments (Element 1):



Link slab – support 1 (Element 4L:ML):

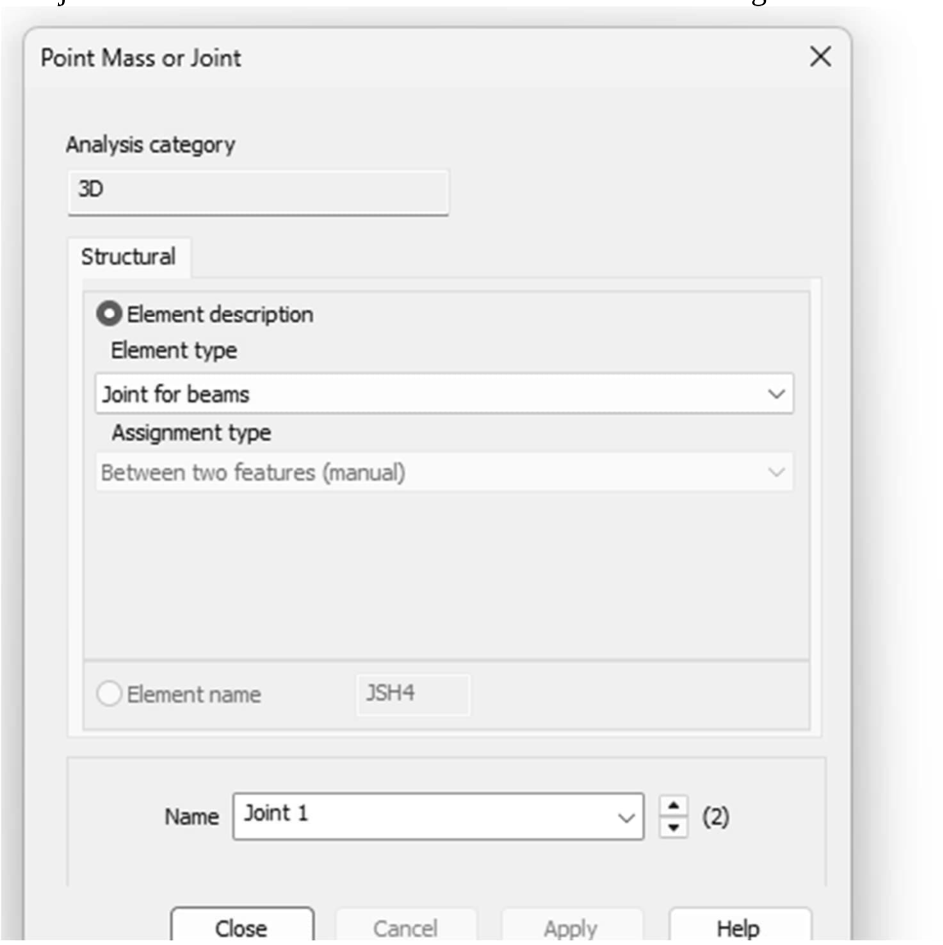


Link slab – support 4 (Element 4R:ML):

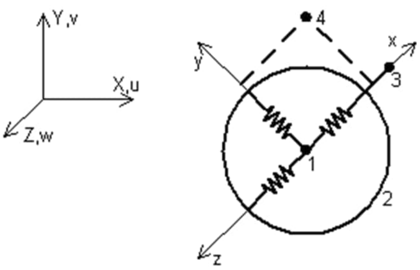


2.6.2 Joint element for beams (JSH4) : linear

Connection between link slab & superstructure is of type joint element, see presentation below.
The joint uses no rotational stiffness in order achieve a hinge.



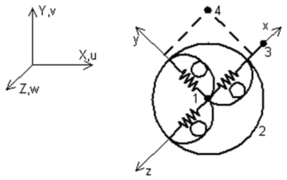
Element Name	JNT4



Element Group	Joints
Element Subgroup	3D Joints
Element Description	A 3D joint element which connects two nodes by three springs in the local x, y and z-directions.
Number Of Nodes	4. The 3rd and 4th nodes are used to define the local x-axis and local xy-plane.
Freedoms	U, V, W: at nodes 1 and 2 (active nodes).
Node Coordinates	X, Y, Z: at each node.

General

Element Name JSH4, JL46



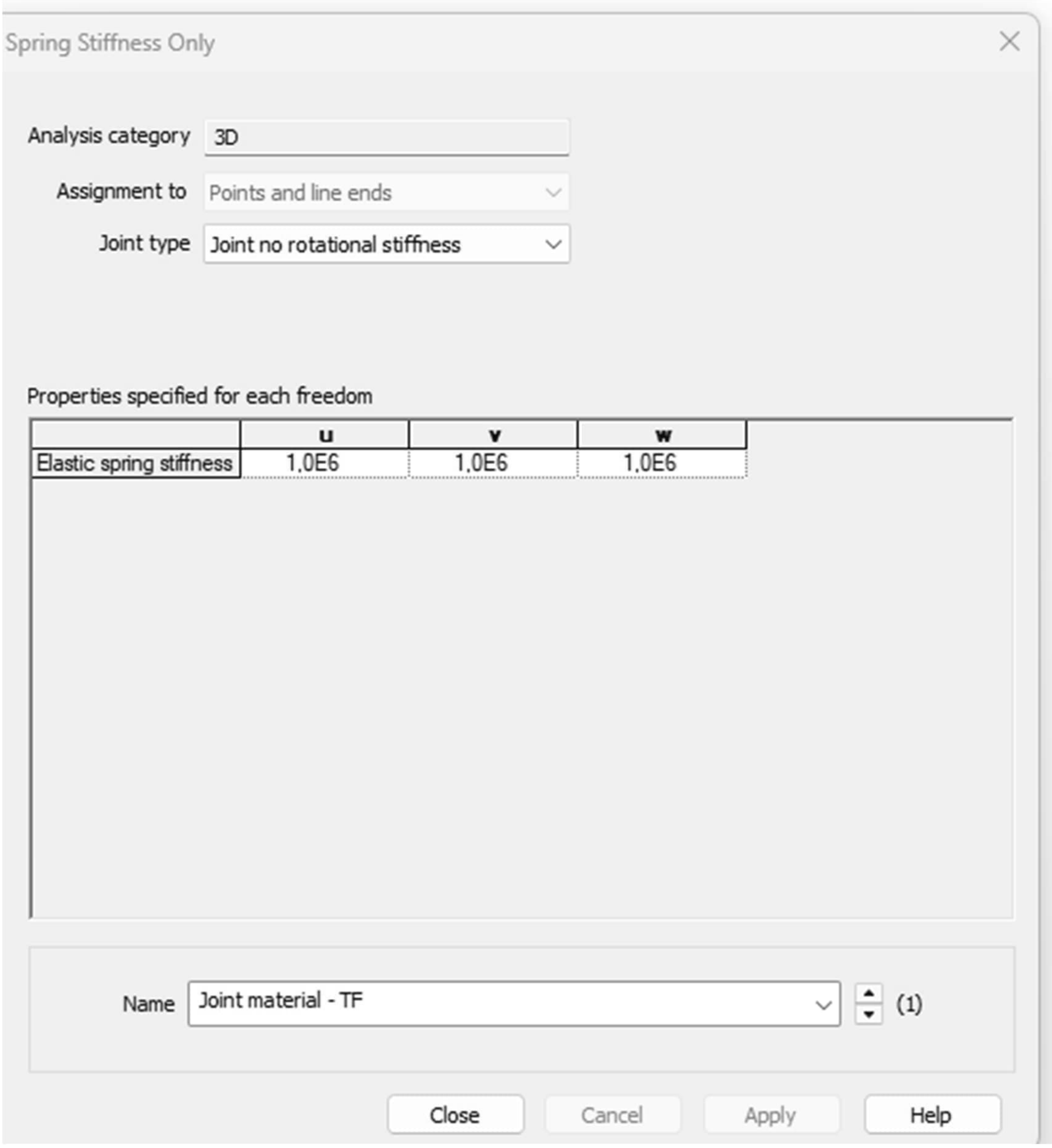
Element Group	Joints
Element Subgroup	3D Joints
Element Description	3D joint elements which connects two nodes by six springs in the local x, y and z-directions. Use JL46 for semiloof beam end nodes.
Number Of Nodes	4. The 3rd and 4th nodes are used to define the local x-axis and local xy-plane respectively.
Freedoms	U, V, W, θx, θy, θz: at nodes 1 and 2 (active nodes).
Node Coordinates	X, Y, Z: at each node.

Geometric Properties

ez	Eccentricity measured from the joint xy-plane to the nodal line.
dy	Parametric distance factor (between 0.0 and 1.0), which defines the position of the shear spring for the local y direction between nodes 1 and 2. It is measured from node 1 (dy=0) along the local x direction.
dz	Parametric distance factor (between 0.0 and 1.0), which defines the position of the shear spring for the local z direction between nodes 1 and 2. It is measured from node 1 (dz=0) along the local x direction

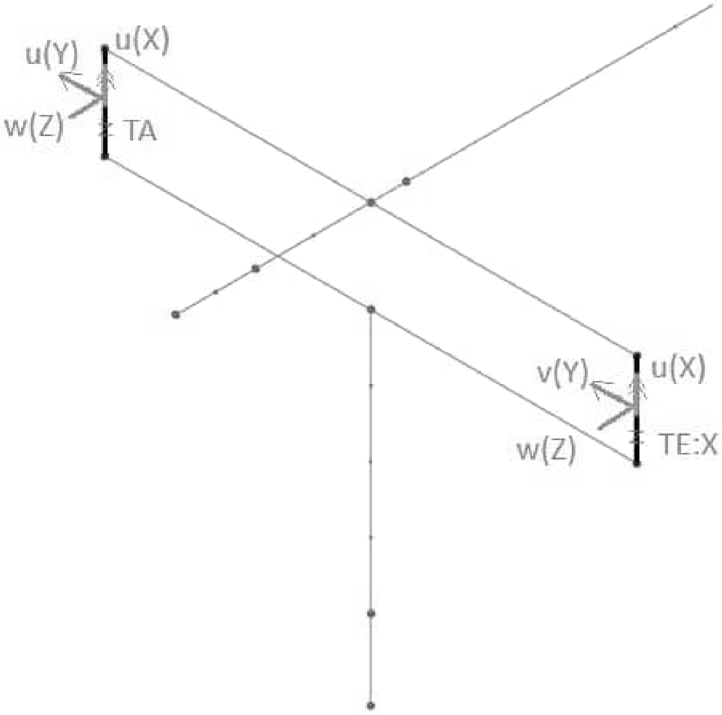
Joint types with no rotational stiffness:

Material	u (X)	v (Y)	w (Z)
Joint material - TF	1E+06	1E+06	1E+06
Joint material - TA	1E+06	0	0
Joint material - TE:X	1E+06	1.00E+06	0
Joint material - TE:Y	1E+06	0	1E+06
-	kN/m	kN/m	kN/m

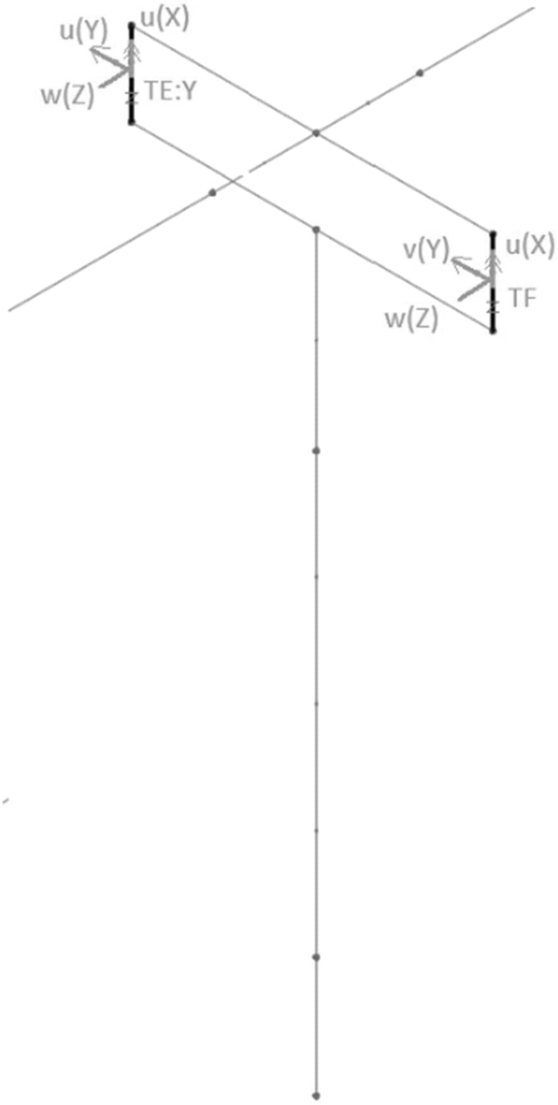


Spring Stiffness Only
Analysis category
3D
Assignment to
Points and line ends
Joint type
Joint no rotational stiffness
Properties specified for each freedom
u
v
w
Elastic spring stiffness
1,0E6
1,0E6
1,0E6
Name
Joint material - TF
(1)
Close
Cancel
Apply
Help

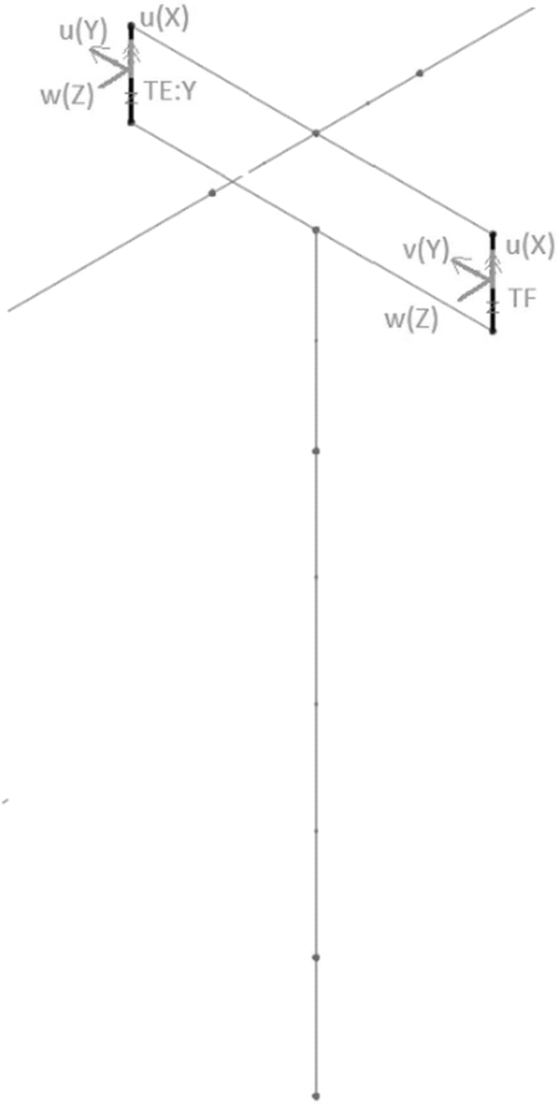
Joints support 1 :



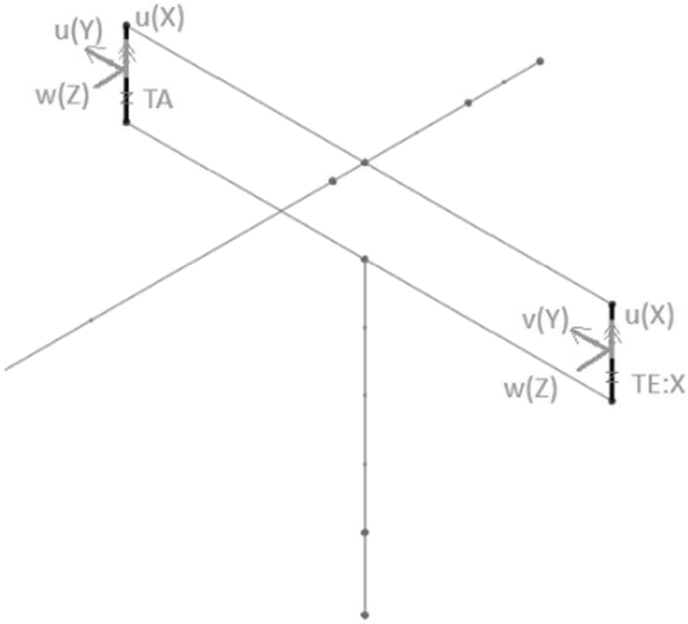
Joints support 2 :



Joints support 3 :



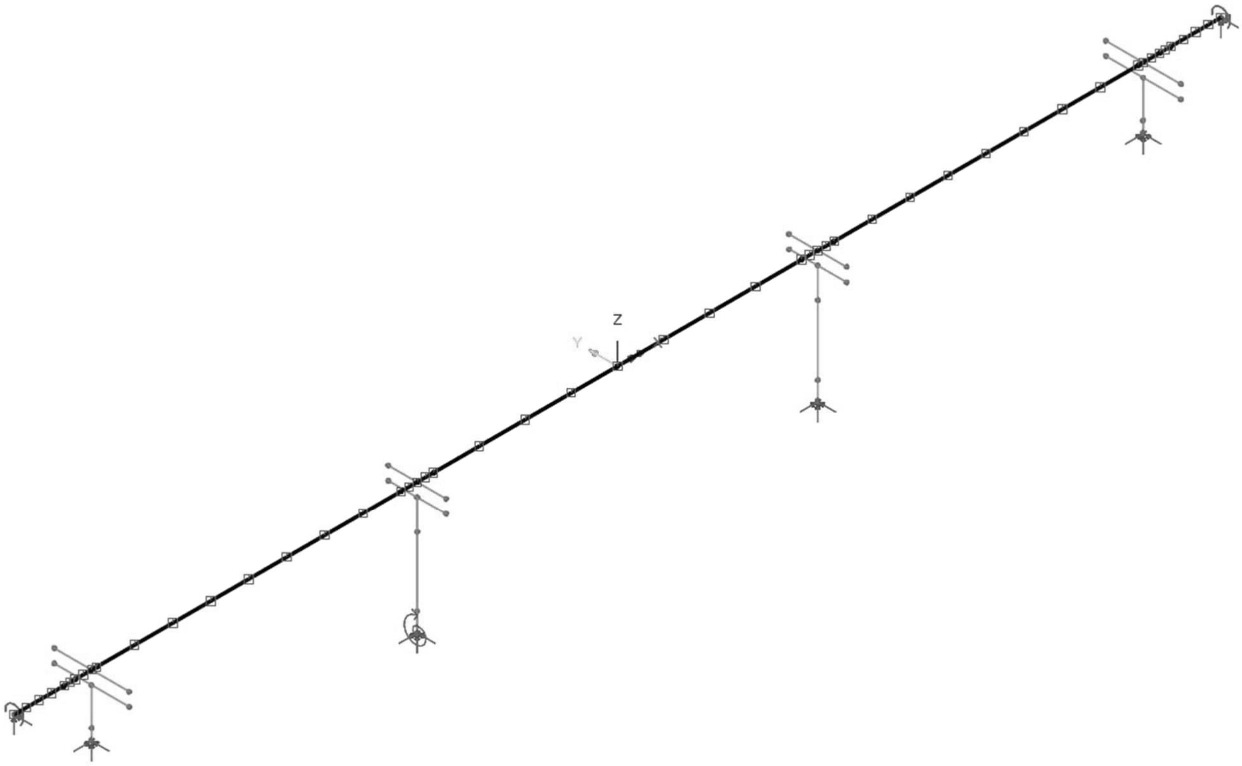
Joints support 4 :



2.7 SEARCH AREA

Discrete load can be applied to structure as geometrical load areas. In FEM program load areas are termed Search Area.

Search area : “Superstructure”



Remark
Contains longitudinal beam including link slab.

3. LOADS

3.1	DEAD WEIGHT	page 3:2-9
3.2	SURFACING	page 3:10-12
3.3	EARTH PRESSURE	page 3:13-34
3.4	SUPPORT SETTLEMENT	page 3:35-41
3.5	CREEP	page 3:42-46
3.6	SHRINKAGE	page 3:47-51
3.7	TRAFFIC LOAD	page 3:52-72
3.8	BRAKING LOAD	page 3:73-77
3.9	LATERAL LOAD	page 3:78-83
3.10	WIND LOAD	page 3:84-90
3.11	SURCHARGE	page 3:91-99
3.12	TEMPERATURE	page 3:100-113
3.13	ICE LOAD	page 3:114-132
3.14	PRESTRESS	page 3:133-173
3.15	LOAD COMBINATIONS	page 3:174-190

3.1 DEAD WEIGHT

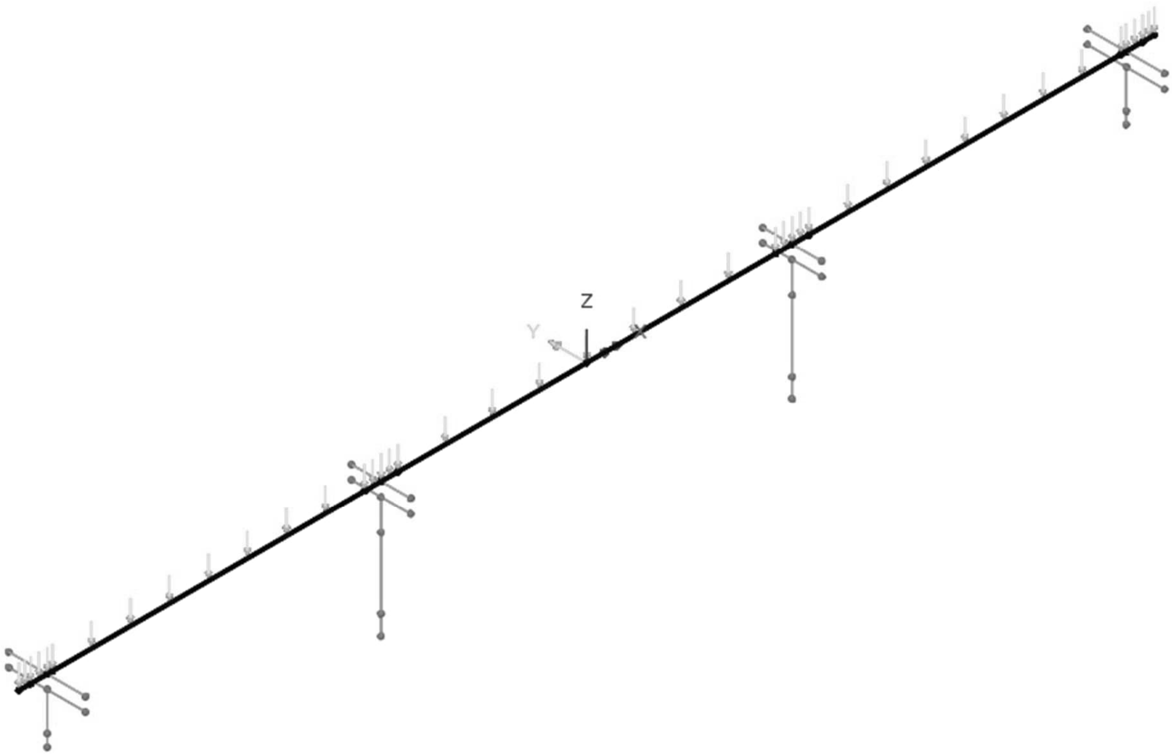
$\gamma_c = 25 \cdot \frac{kN}{m^3}$: concrete

3.1.1 Superstructure - superstructure

Load (loadcase) : EGEN 1

Structural loading : Body force

Linear acceleration in Z (a_z) : -10 $\frac{m}{s^2}$



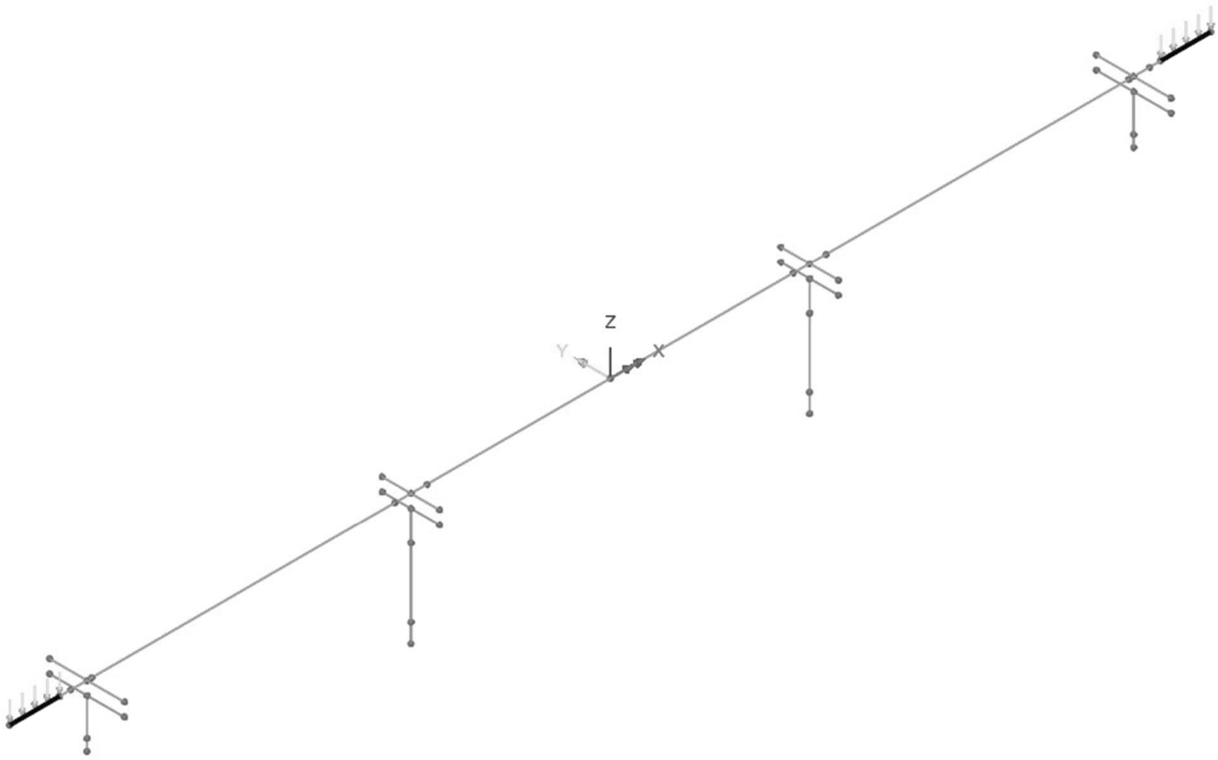
Overview 3D

3.1.2 Link slabs

Load (loadcase) : EGEN 2

Structural loading : Body force

Linear acceleration in Z (a_z) : -10 $\frac{m}{s^2}$



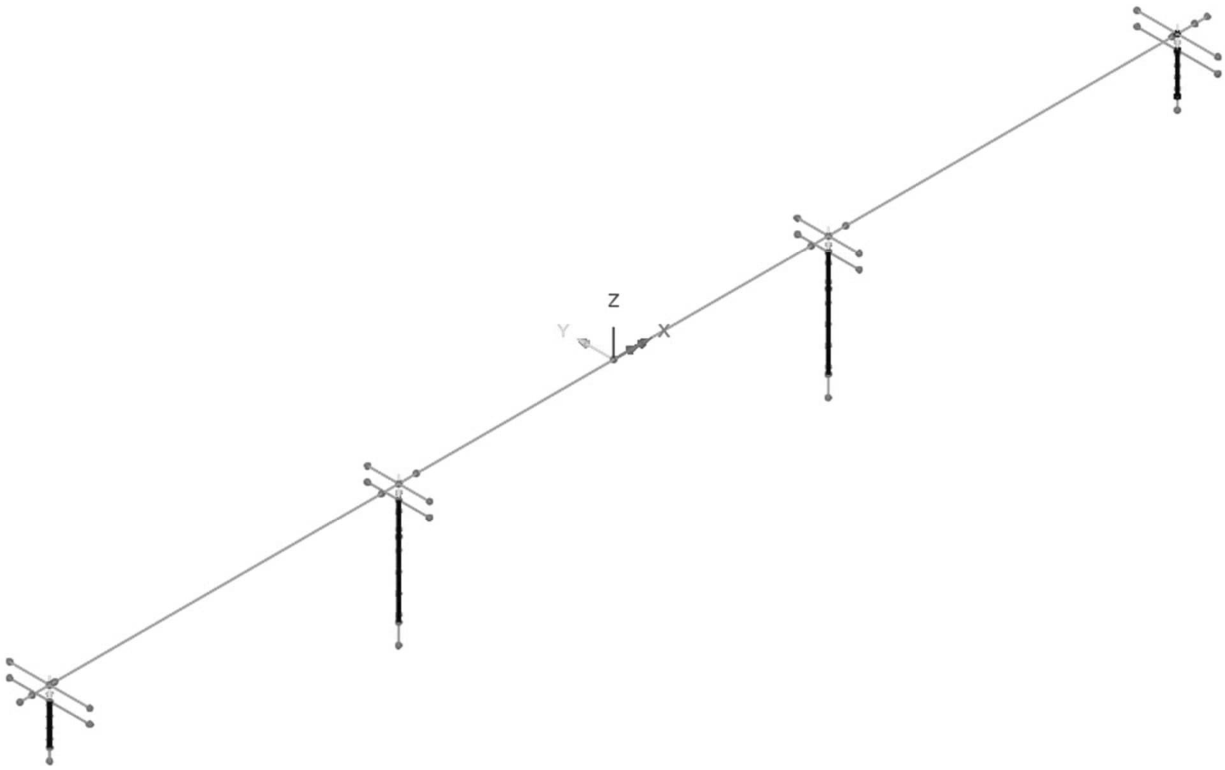
Overview 3D

3.1.3 Abutments

Load (loadcase) : EGEN 3

Structural loading : Body force

Linear acceleration in Z (a_z) : -10 $\frac{m}{s^2}$



Overview 3D

3.1.4 Edge beams including railing

Along each edge bream a line load is introduced. The load includes weight of both edge beams and railings.

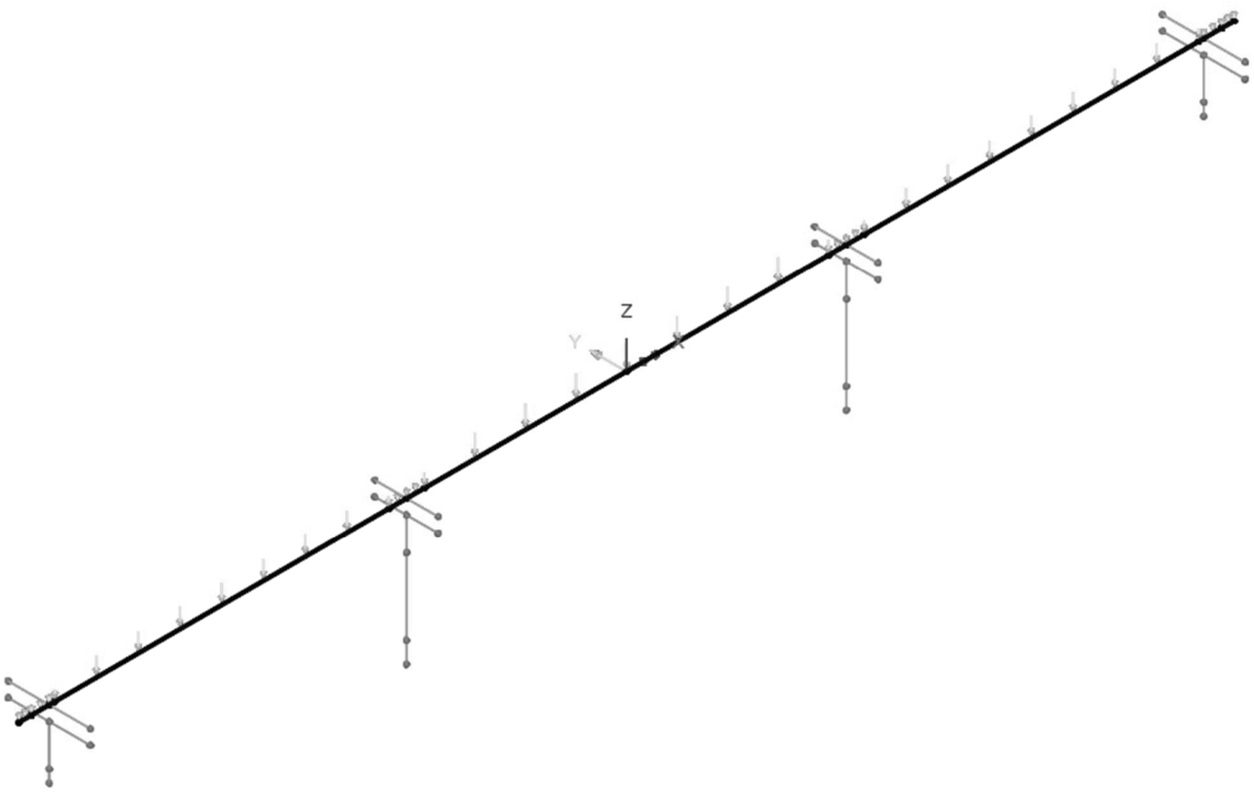
$p_{räcke} = 0.7\frac{kN}{m}$: weight railing

$$\rightarrow p_z = 2p_{räcke} + 2p_{KB} = 2 \cdot 0.7\frac{kN}{m} + 2 \cdot 0.45m \cdot 0.45m \cdot 25\frac{kN}{m^3} = -12\frac{kN}{m}$$

Load (loadcase) : EGEN 4

Structural loading : Global distributed

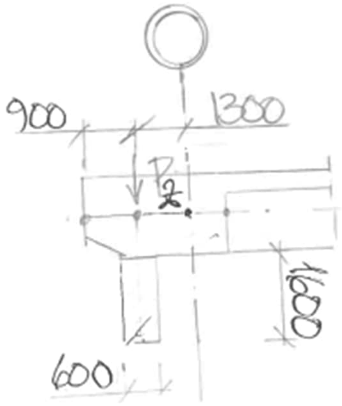
Line load per unit length in Z direction: -6 $\frac{kN}{m}$



Overview 3D

3.1.5 End-shield

The end-shields are alike as seen in sketch below.

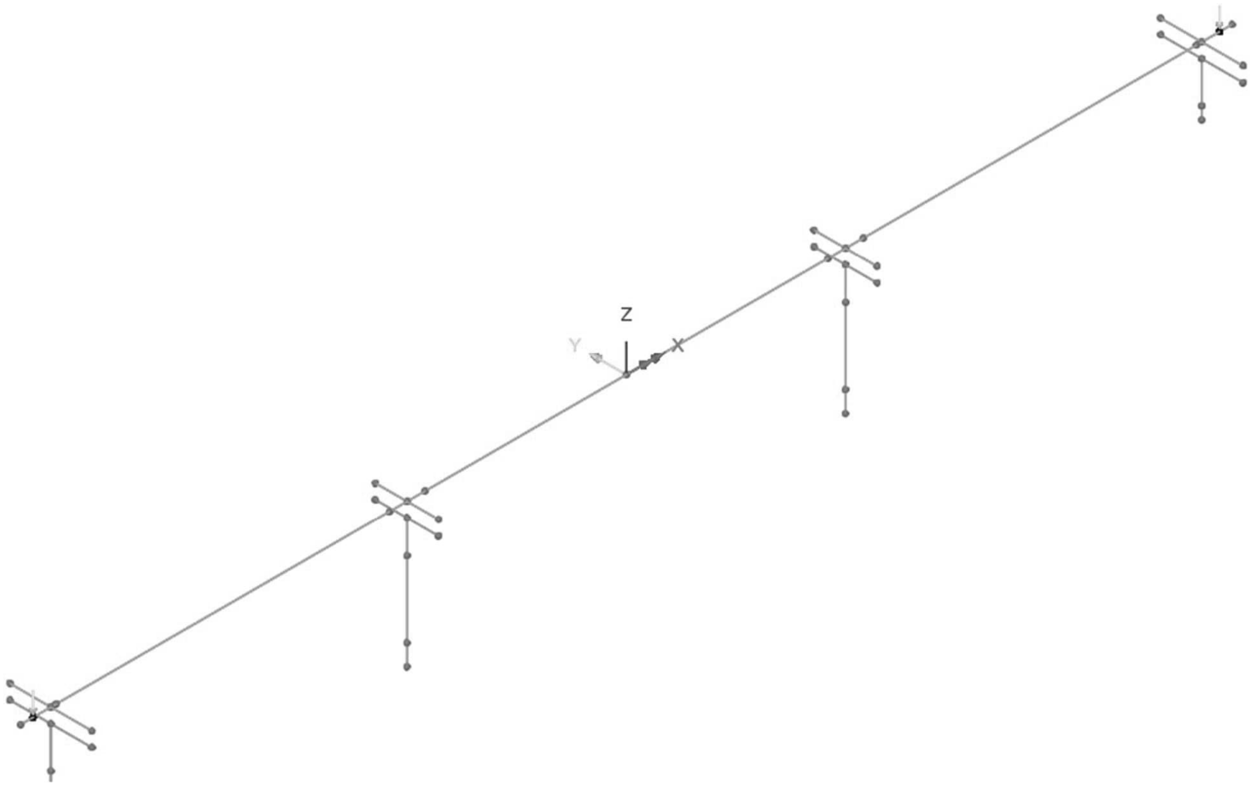


$$p_z = 0.60m \cdot 1.60m \cdot 25\frac{kN}{m^3} = -24\frac{kN}{m} \quad \rightarrow P_z = B \cdot p_z = -8.0m \cdot 24\frac{kN}{m} = -192kN$$

Load (loadcase) : EGEN 5

Structural loading : Concentrated

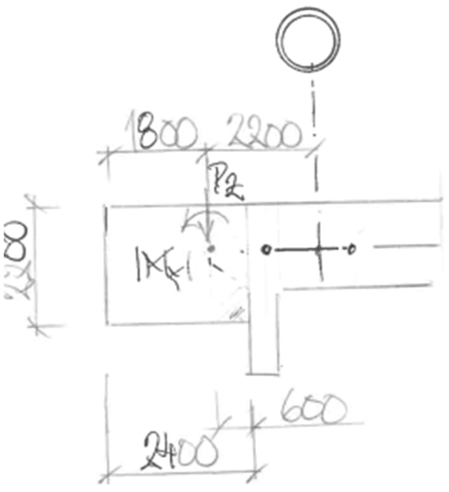
Concentrated load in Z (P_z) : -192 kN



Overview 3D

3.1.6 Wingwalls

All wingwalls are alike and seen in sketch below.



$$P_z = 2 \cdot 0.40m \cdot 2.20m \cdot 2.4m \cdot 25\frac{kN}{m^3} = -106kN$$

$$|M_y| = 106kN \cdot \left(\frac{2.4m}{2} - 0.6m\right) = 64kNm$$

Load : EGEN 6:V

Structural loading : Concentrated

Concentrated load in Z (P_z) : -106 kN

Moment about Y-axis (M_z) : -64 kNm

Load : EGEN 6:H

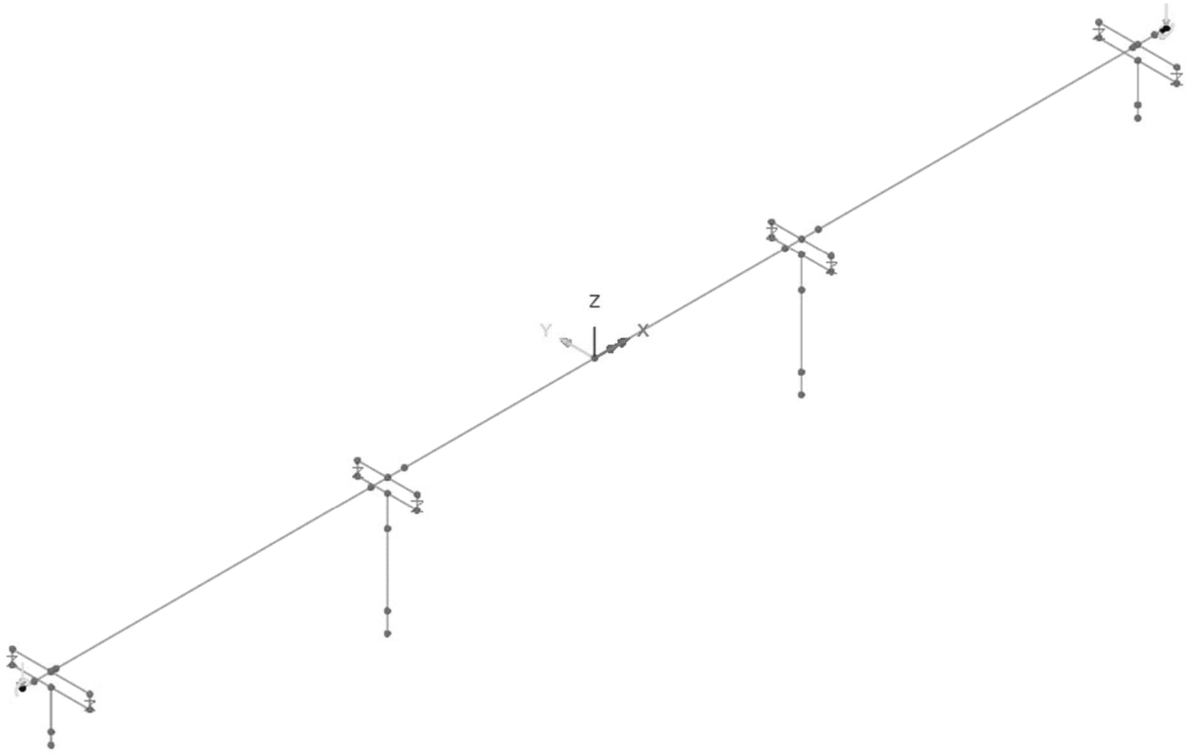
Structural loading : Concentrated

Concentrated load in Z (P_z) : -106 kN

Moment about Y-axis (M_z) : +64 kNm

Loadcase : EGEN 6

Load: EGEN 6:V
Load: EGEN 6:H



Overview 3D

3.1.7 Load combination deadweight : EGEN

Basic load combination EGEN :

Loadcase	Factor
EGEN 1	1.00
EGEN 2	1.00
EGEN 3	1.00
EGEN 4	1.00
EGEN 5	1.00
EGEN 6	1.00

3.2 SURFACING

3.2.1 Load on superstructure

Thickness pavement with a thickness of 95 mm built as follows:

- Wearing course ABS 11 — 40 mm
- Combined protective and binder course PGJA — 50 mm
- Waterproofing layer — 5 mm

$\gamma = 23\frac{kN}{m^3}$: course

$q_{matta} = 0.11kPa$: waterproofing

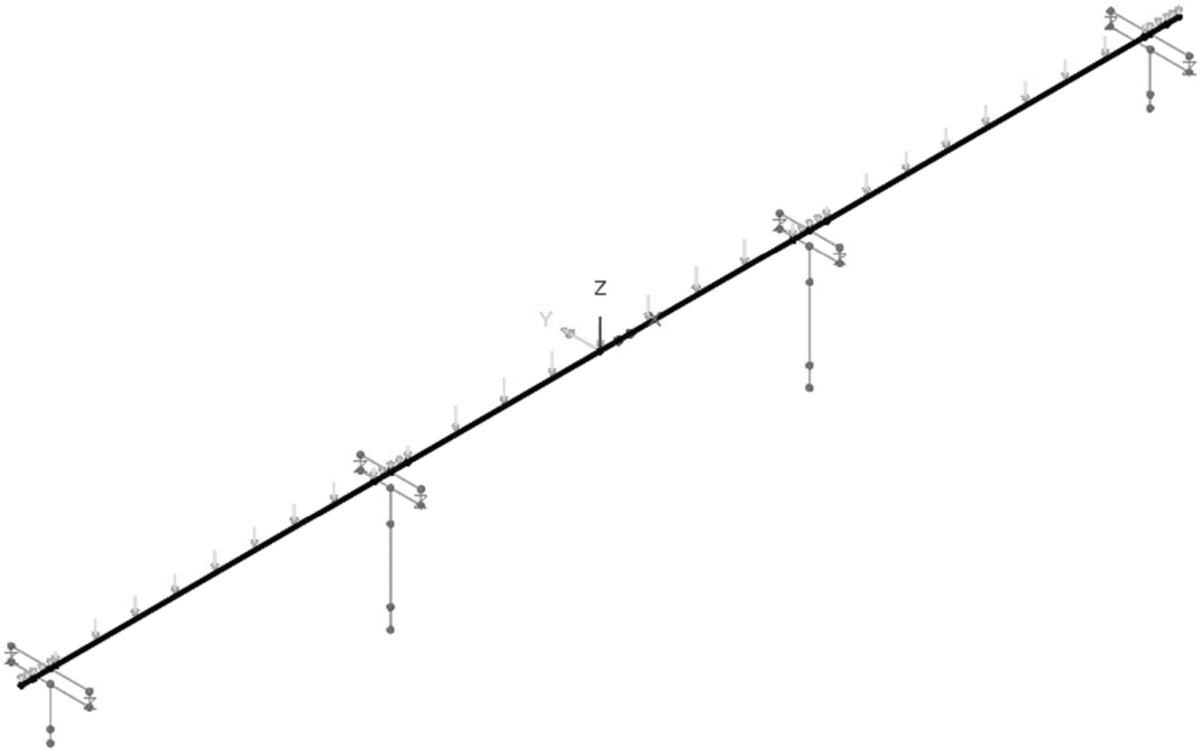
$$q_{belägg} = \gamma_{beläggning} \cdot t + q_{matta} = 23\frac{kN}{m^3} \cdot 0.09m + 0.11kPa = 2.2kPa$$

$$\rightarrow p_z = B \cdot q_{belägg} = 8.0m \cdot 2.2kPa = -18\frac{kN}{m}$$

Load (loadcase) : BELAGG 1

Structural loading : Global distributed

Surface load per unit length in Z direction: -18 $\frac{kN}{m}$



Overview

3.2.2 Load on link slab

On the upper side of the link plate, there is a 95 mm pavement and an overfill with varying thickness (100-400 mm).

The overfill is considered equivalent to the base layer. In the static model, a fictitious load corresponding to the weights for the pavement and overfill is introduced (an average thickness of 250 mm is applied.

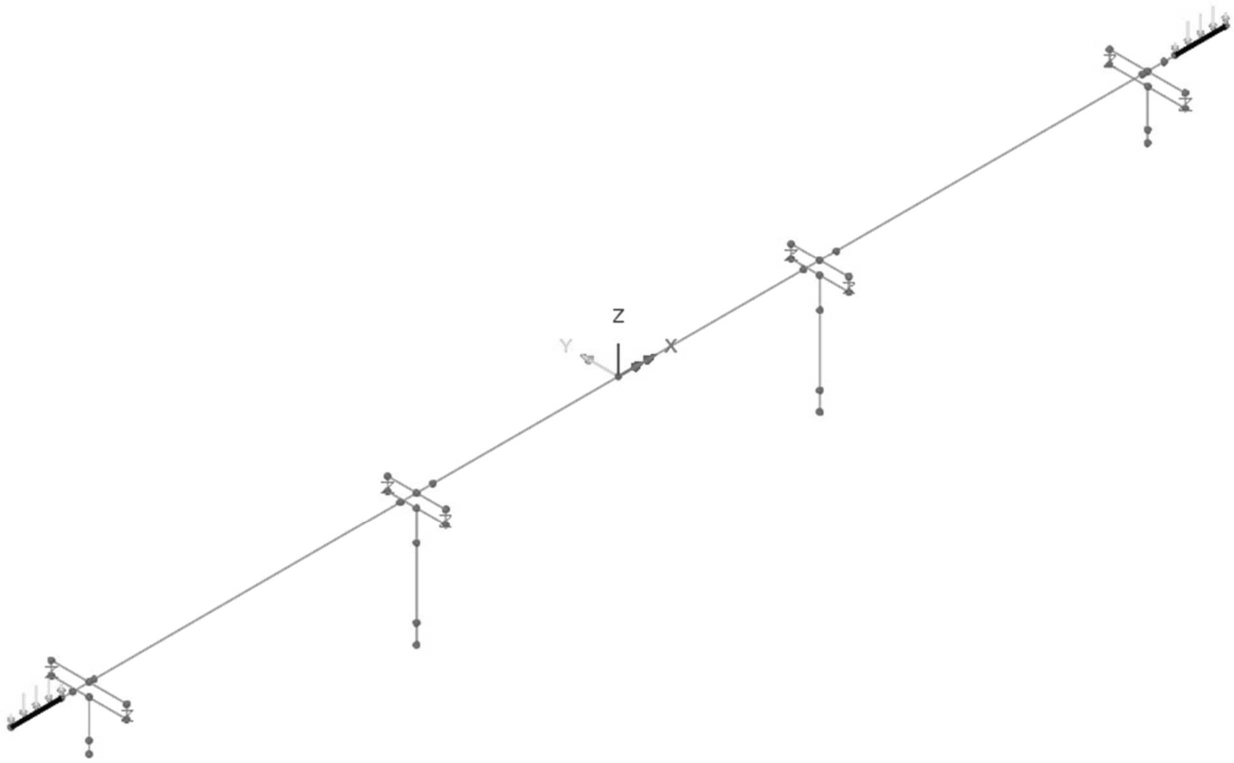
$$q_{belägg} = 2.2kPa + 22\frac{kN}{m^3} \cdot 0.25m = 8.0kPa$$

$$\rightarrow p_z = B \cdot q_{belägg} = 8.0m \cdot 8.0kPa = -64\frac{kN}{m}$$

Loadcase : BELAGG 2

Structural loading : Global distributed

Surface load per unit length in Z direction: -64 $\frac{kN}{m}$



Overview

3.2.3 Load combination surfacing: BELAGG

Basic loadcomination BELAGG :

Loadcase	Factor
BELAGG 1	1.00
BELAGG 2	1.00

3.3 EARTH PRESSURE

Earth pressure in filling corresponds to coarse crushed blasted rock (AMA CEB.524).

φ_k = 45°

$\gamma = 20\frac{kN}{m^3}$

$\gamma' = 13\frac{kN}{m^3}$

$$X_d = \frac{1}{\gamma_m} \cdot \eta \cdot \overline{X} \equiv \frac{1}{\gamma_m} \cdot X_k$$

Earth pressure coefficient for design method 2 (D2) :
Design coefficients associated to *A1 + M1 + R2* according to SS-EN 1997-1 section 2.4.7.3.4.3 is applied.

$\gamma_{m.D2}$ = 1.0 : see TSFS chapter 38 table 38.3 for M1

$\rightarrow \varphi_d = artctan\left(\frac{tan\varphi_k}{\gamma_{m.D2}}\right) = arctan\left(\frac{tan45°}{1.0}\right) = 45°$

$K_0 = 1 - \sin(\varphi_d) = 0.29$

$K_a = tan^2\left(45° - \frac{\varphi_d}{2}\right) = 0.17$

$K_p = tan^2\left(45° + \frac{\varphi_d}{2}\right) = 5.82$

Earth pressure for design method 3 (D3) :
Design coefficients associated to *A1(design loads) + A2(geotechnical loads) + M2 + R3* according to SS-EN 1997-1 section 2.4.7.3.4.4 is applied.

$\gamma_{m.D3}$ = 1.3 : see TSFS chapter 8 table 38.3 för M2

$\rightarrow \varphi_d = artctan\left(\frac{tan\varphi_k}{\gamma_m}\right) = arctan\left(\frac{tan45°}{1.3}\right) = 38°$

Remark
These are not used in FEM-analysis. This is done by adjusting load coefficients.

Earth pressure in FEM-analysis:

During design earth press coefficients associated to method D2 will used applied, however the load coefficients are adjusted according verification, see pages A3:170.

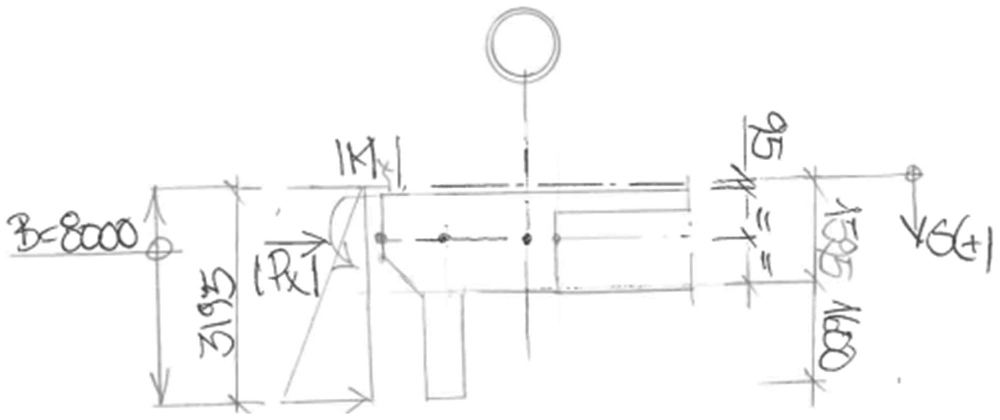
$K_0 = 0.29$

$K_a = 0.17$

$K_p = 5.82$

$$q_{vilo}(s) = K_0 \cdot \gamma \cdot s = 0.29 \cdot 20 \frac{kN}{m^3} \cdot s(+) = s(+) \cdot 5.8 kPa$$

3.3.1 Load against superstructure at support 1 & 4



$q_{vilo}\ (0m) = 0kPa$

$q_{vilo}\ (3.195m) = 3.195m \cdot 5.8\frac{kN}{m^3} = 19kPa$

$\rightarrow p_{vilo}\ (3.195m) = 19kPa \cdot 8.0m = 148\frac{kN}{m}$

$|P_x| = 148\frac{kN}{m} \cdot \frac{3.195m}{2} = 236kN$

$\left|M_y\right| = 236kN \cdot \left(\frac{2 \cdot 3.195m}{3} - 0.845m\right) = 303kNm$

Load : JORD 1:V

Structural loading : Concentrated

Concentrated load in X (P_x) : +236kN

Moment about Y axis (M_y) : -303 kNm

Load : JORD 1:H

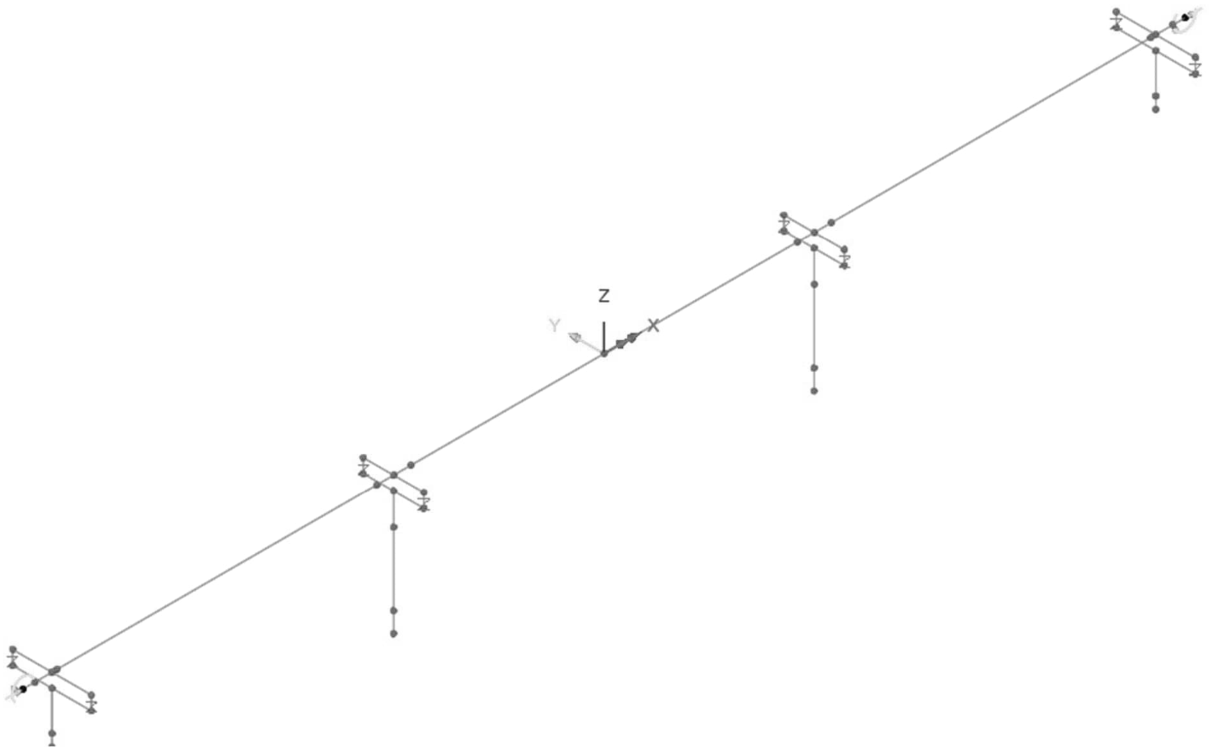
Structural loading : Concentrated

Concentrated load in X (P_x) : -236kN

Moment about Y axis (M_y) : +303 kNm

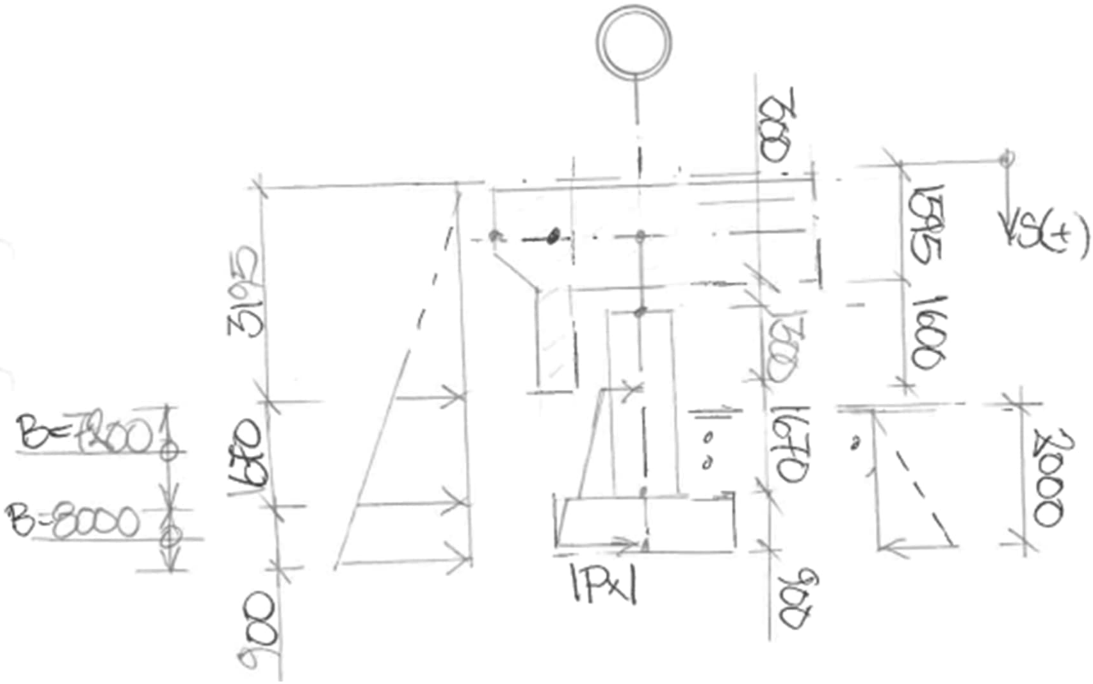
Loadcase : JORD 1

Load: JORD 1:V
Load: JORD 1:H



Overview

3.3.2 Load against abutments at support 1 & 4



$$q_{vilo}\ (3.195m) = 3.195m \cdot 5.8\frac{kN}{m^3} = 19kPa$$

$$\rightarrow\ |p_x(B = 7.2m)| = 19kPa \cdot 7.2m = 137\frac{kN}{m}$$

$$q_{vilo}\ (4.865m) = 4.865m \cdot 5.8\frac{kN}{m^3} = 28kPa$$

$$\rightarrow\ |p_x(B = 7.2m)| = 28kPa \cdot 7.2m = 202\frac{kN}{m}$$

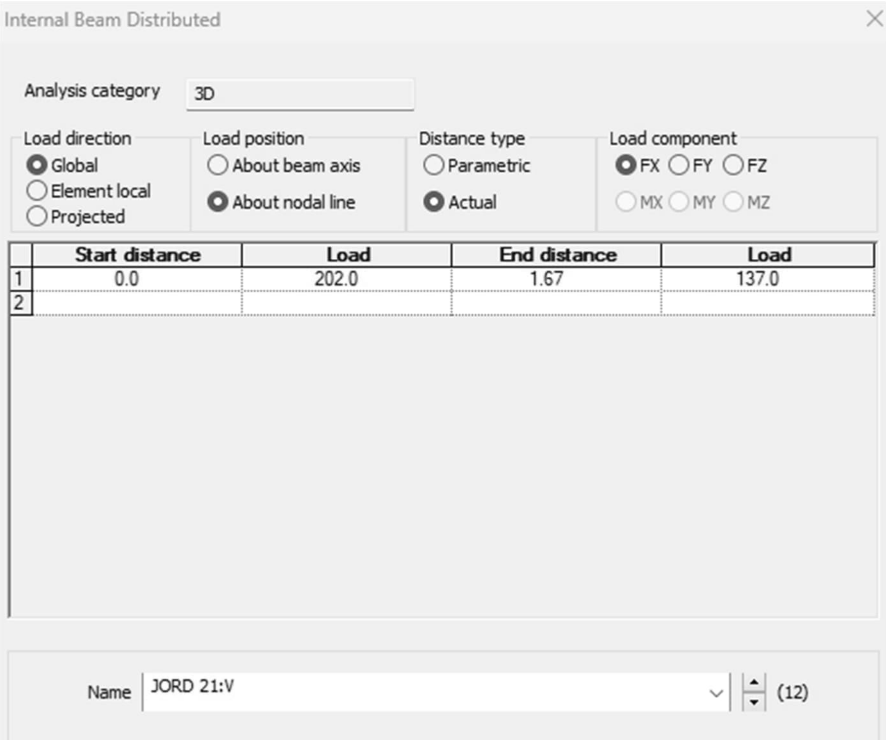
$$|p_x(B = 8.0m)| = 28kPa \cdot 8.0m = 224\frac{kN}{m}$$

$$q_{vilo}\ (5.665m) = 5.665m \cdot 5.8\frac{kN}{m^3} = 33kPa$$

$$\rightarrow\ |p_x(B = 8.0m)| = 33kPa \cdot 7.2m = 264\frac{kN}{m}$$

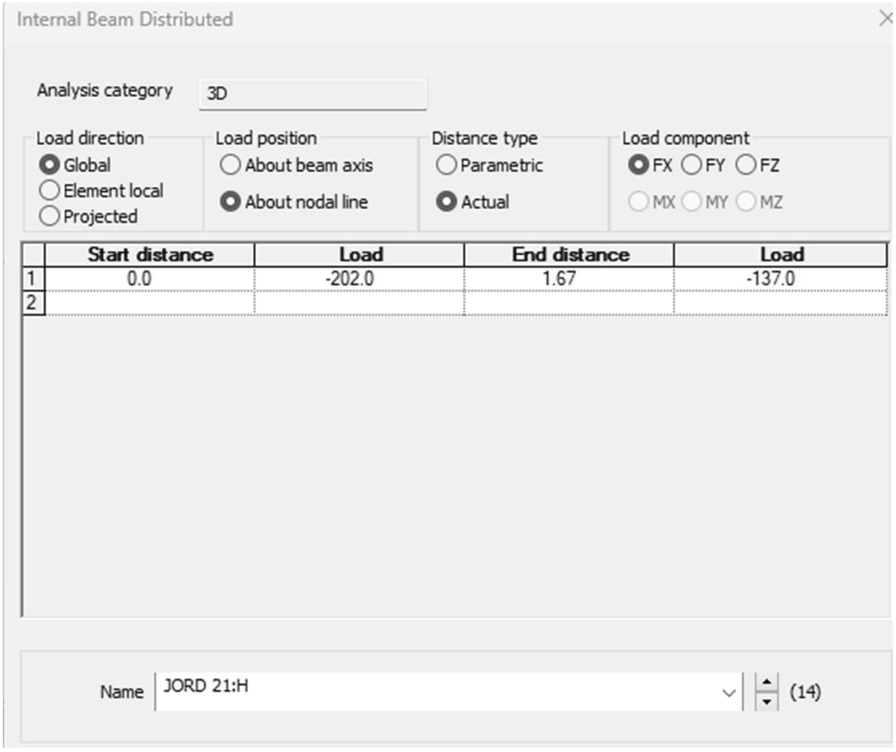
Remark
Load on side from filling is neglected on safe side.

Load : JORD21:V



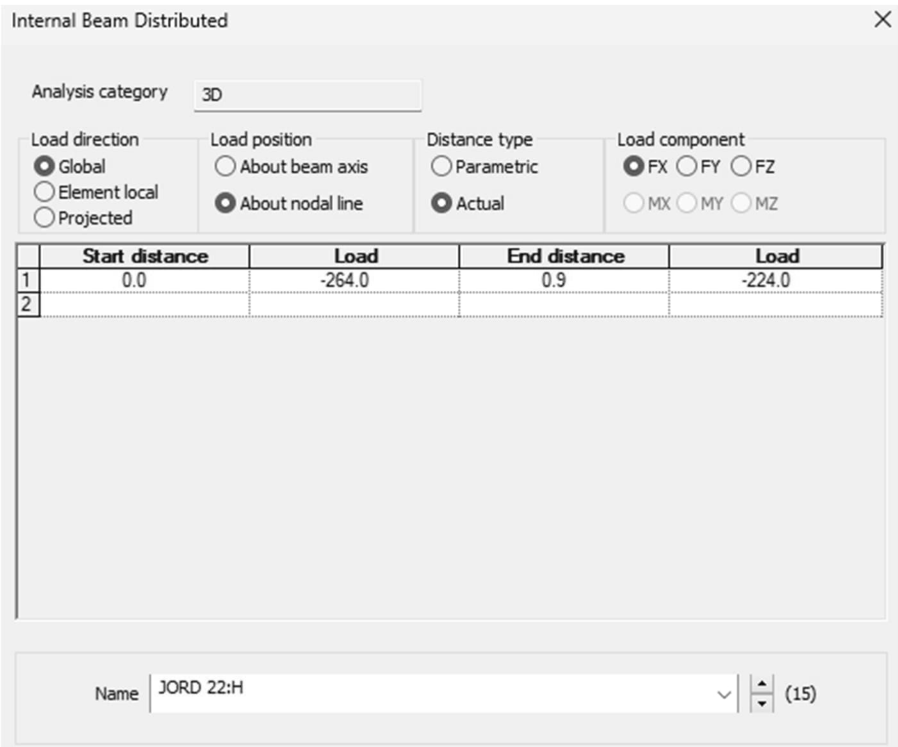
Load : JORD 22:V

Load : JORD21:H



	Start distance	Load	End distance	Load
1	0.0	-202.0	1.67	-137.0
2				

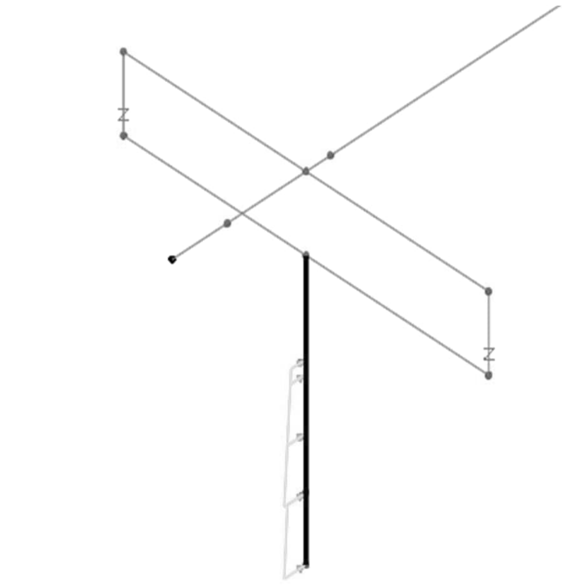
Load : JORD 22:H



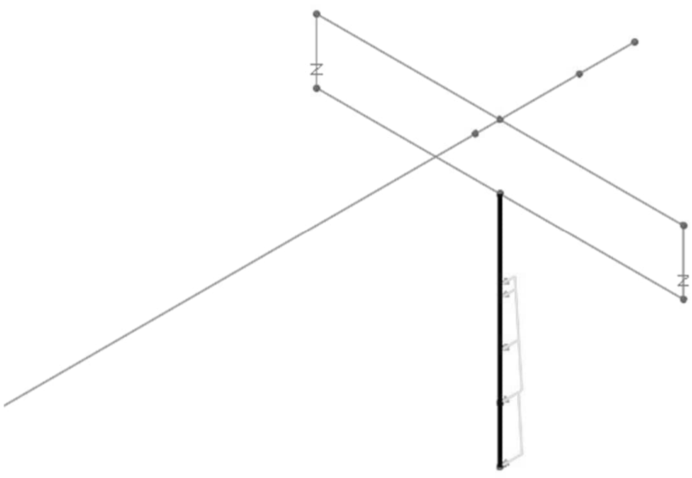
	Start distance	Load	End distance	Load
1	0.0	-264.0	0.9	-224.0
2				

Loadcase : JORD 2

Load: JORD 21:V
Load: JORD 22:V
Load: JORD 21:H
Load: JORD 22:H



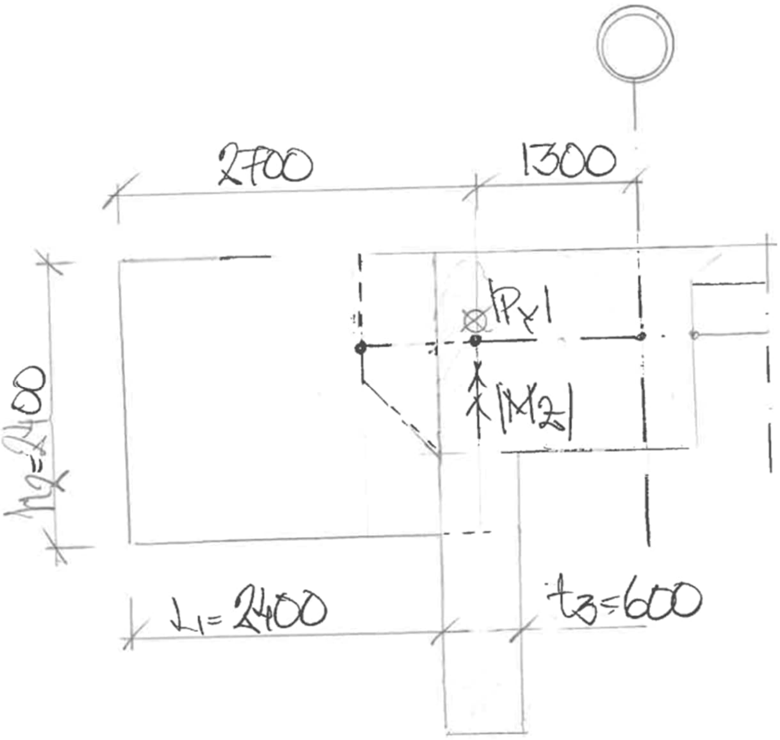
Overview 3D
Abutement 1



Overview 3D
Abutement 4

3.3.3 Load against wingwalls

Design software K2.002 is used to determine earth pressure against wingwalls according to Culmans´s theory. All wingwalls are assumed to have same length (L = 4 m).



$t_3 = 0.6m$

$h_2 = 2.4m$

$h_3 = 2.4m$

$h_4 = 0.1m$

Effective height along edge end-shield:

$H_{ef} = 2.3m$: see page A3:33

Load at abutment edge quasi-load status (SLS-Q):

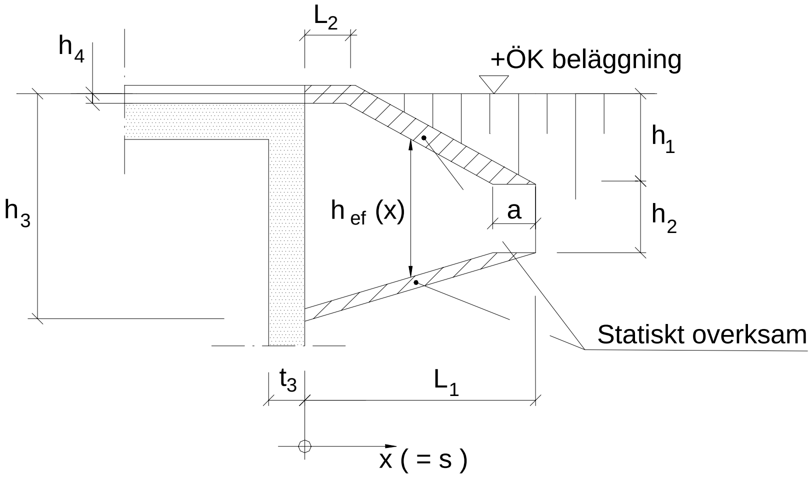
$N_{SLS-Q} = +23\frac{kNm}{m}$: see page A3:33

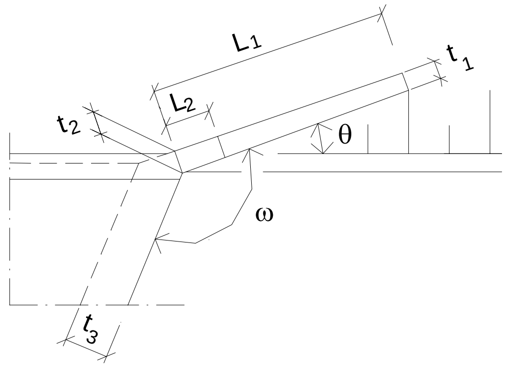
$M_{SLS-Q} = 35\frac{kNm}{m}$: see page A3:33

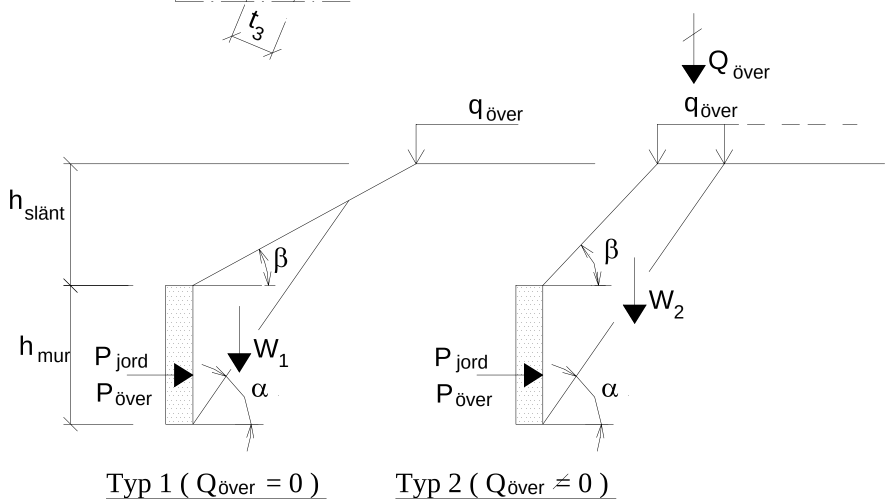
Remark.
Since all wingwall are equal the total load in transversal direction and balanced, thus this load is not applied to 3D beam model.

Objekt : Vingmur L = 2.4 m

PRINCIPFIGUR







Jordtryck enligt Culmans metod

INDATA

Geometri :

$L_1 = 2.4m$ $L_2 = 1mm$

$h_1 = 1mm$ $h_2 = 2.40m$ $h_3 = 2.401m$ $h_4 = 0.10m$

$t_1 = 0.40m$ $t_2 = 0.40m$ $t_3 = 0.60m$

Vinkel vinge-ramben på baksidan : $\omega = 91°$

Vinkel vinge-vägbankskrön på baksidan : $\theta = 1°$

Avstånd till brytpunkt för effektiv höjd : $a = 1mm$

Material :

Jordmaterial : $\gamma_{jord} = 20\frac{kN}{m^3}$ $K_o = 0.29$ $K_a = 0.17$

Betong : $\gamma_{btg} = 25\frac{kN}{m^3}$

Laster :

Överlast : $q_{över} = 20kPa$

Lastkoefficienter :

Jordtryck

$\psi\gamma_{ULS.1} = 1.49$ $\psi\gamma_{SLS.1} = 1.34$

Överlast

$\psi\gamma_{ULS.2} = 1.71$ $\psi\gamma_{SLS.2} = 0$

BERÄKNING

Jordtryck enligt Culmans metod :

Nivå överkant vingmur : $mur_{ök} = \text{linterp}\left[\left(0m \;\; L_2 \;\; L_1\right), \left(h_3 \;\; h_3 \;\; h_3 - h_1\right), s\right]$

Nivå underkant vingmur : $mur_{uk} = \text{linterp}\left[\left(0m \;\; L_1\right), \left(0m \;\; h_3 - h_1 - h_2\right), s\right]$

Vingmurens höjd : $h_{mur} = mur_{ök} - mur_{uk}$

Släntens höjd : $h_{slänt} = \text{linterp}\left[\left(0m \;\; L_2 \;\; L_1\right), \left(0m \;\; 0m \;\; h_1\right), s\right]$

Friktionsvinkel: $\varphi = \text{asin}\left(1 - K_o\right)$

Lutning hos slänten ned till överkant vingmur mätt vinkelrätt mot vingen :

$$\beta = \text{atan}\left[\frac{h_1}{\left(L_1 - L_2\right)\tan(\theta)}\right]$$

Vertikallast för brottfigur typ 1 (= brottlinje i slänt, sålunda inget tillskott av överlast) :

$$W_1 = h_{mur} \cdot \sin\left(\frac{\pi}{2} - \alpha\right) \cdot \left(h_{mur} \cdot \cos\left(\frac{\pi}{2} - \alpha\right) + \frac{h_{mur} \cdot \sin\left(\frac{\pi}{2} - \alpha\right)}{\tan(\alpha - \beta)}\right) \cdot \frac{\gamma_{jord}}{2}$$

Vertikallaster för brottfigur typ 2 (= brottlinje hamnar ovanför slänt vilket ger ett bidrag från överlast) :

$$W_2 = \left[\left(h_{mur} + h_{slänt}\right)^2 \cdot \tan\left(\frac{\pi}{2} - \alpha\right) - \frac{h_{slänt}^{\;2}}{\tan(\beta)}\right] \cdot \frac{\gamma_{jord}}{2}$$

$$Q_{över}(q) = q \cdot \left[\left(h_{mur} + h_{slänt}\right) \cdot \tan\left(\frac{\pi}{2} - \alpha\right) - \frac{h_{slänt}(s)}{\tan(\beta)}\right]$$

Vilojordtrycksresultant enligt Culmann under inverkan av jordlast + överlast :

$$p_o(q) = \left| \begin{array}{l} W_{jord} \leftarrow W_1 \ \text{ if } \left(h_{mur} + h_{slänt}\right)\cdot \tan(90° - \alpha) < \dfrac{h_{slänt}}{\tan(\beta)} \\ W_{jord} \leftarrow W_2 + Q_{över}(q) \ \text{ otherwise} \\ p_{aktiv} \leftarrow W_{jord}\cdot \tan(\alpha - \varphi) \\ p_{aktiv}\cdot \dfrac{K_o}{K_a} \end{array} \right.$$

Utvärdera största last av jordtryck och överlast genom att kontrollera N_a antal vinklar mellan φ och 90°. Överlastens lasteffekt fås som skillnaden mellan jordtrycksresultant med och utan överlast.

$$p_{jord}(s) = \left| \begin{array}{l} N_\alpha \leftarrow 20st \\ \Delta\alpha \leftarrow \dfrac{90° - \varphi}{N_\alpha - 1} \\ \alpha \leftarrow \varphi \\ p_{max} \leftarrow p_o(0kPa) \\ \text{for } i \in 2..N_\alpha \\ \quad \left| \begin{array}{l} \alpha \leftarrow \alpha + \Delta\alpha \\ p_{vilo} \leftarrow p_o(0kPa) \\ \text{if } p_{vilo} > p_{max} \\ \quad \left| \begin{array}{l} p_{max} \leftarrow p_{vilo} \\ \alpha_{max} \leftarrow \alpha \end{array} \right. \end{array} \right. \end{array} \right.$$

$$p_{över}(s) = \left| \begin{array}{l} N_\alpha \leftarrow 20st \\ \Delta\alpha \leftarrow \dfrac{90° - \varphi}{N_\alpha - 1} \\ \alpha \leftarrow \varphi \\ p_{max} \leftarrow p_o\left(q_{över}\right) - p_o(0kPa) \\ \text{for } i \in 2..N_\alpha \\ \quad \left| \begin{array}{l} \alpha \leftarrow \alpha + \Delta\alpha \\ p_{över} \leftarrow p_o\left(q_{över}\right) - p_o(0kPa) \\ \text{if } p_{över} > p_{max} \\ \quad \left| \begin{array}{l} p_{max} \leftarrow p_{över} \\ \alpha_{max} \leftarrow \alpha \end{array} \right. \end{array} \right. \end{array} \right.$$

Snittkrafter jordtryck + överlast :

$$H'_{jord}\left(x_s\right) = \int_{x_s}^{L_1} p_{jord}(s)\, ds \qquad M'_{jord}\left(x_s\right) = \int_{x_s}^{L_1} \left(s - x_s\right)\cdot p_{jord}(s)\, ds$$

$$H'_{över}\left(x_s\right) = \int_{x_s}^{L_1} p_{över}(s)\, ds \qquad M'_{över}\left(x_s\right) = \int_{x_s}^{L_1} \left(s - x_s\right)\cdot p_{över}(s)\, ds$$

Lastkombinering - Lk ULS och Lk SLS :

Snittkraft i frontmur för inspänningssnitt :

$$N'_{ULS.front} = \left(\psi\gamma_{ULS.1} \cdot H'_{jord}(0\cdot m) + \psi\gamma_{ULS.2} \cdot H'_{över}(0\cdot m)\right) \cdot \sin(\omega)$$

$$M'_{ULS.front} = \psi\gamma_{ULS.1} \cdot M'_{jord}(0\cdot m) + \psi\gamma_{ULS.2} \cdot M'_{över}(0\cdot m) + N'_{ULS.front} \cdot \frac{t_3}{2}$$

$$N'_{SLS.front} = \left(\psi\gamma_{SLS.1} \cdot H'_{jord}(0\cdot m) + \psi\gamma_{SLS.2} \cdot H'_{över}(0\cdot m)\right) \cdot \sin(\omega)$$

$$M'_{SLS.front} = \psi\gamma_{SLS.1} \cdot M'_{jord}(0\cdot m) + \psi\gamma_{SLS.2} \cdot M'_{över}(0\cdot m) + N'_{SLS.front} \cdot \frac{t_3}{2}$$

Snittkrafter i vingmur :

$$Q'_{ULS}(s) = \psi\gamma_{ULS.1} \cdot H'_{jord}(s) + \psi\gamma_{ULS.2} \cdot H'_{över}(s)$$

$$M'_{ULS}(s) = \psi\gamma_{ULS.1} \cdot M'_{jord}(s) + \psi\gamma_{ULS.2} \cdot M'_{över}(s)$$

$$M'_{SLS}(s) = \psi\gamma_{SLS.1} \cdot M'_{jord}(s) + \psi\gamma_{SLS.2} \cdot M'_{över}(s)$$

Beräkning av effektiv höjd :

$$\Delta h = h_3 - h_2 - h_1 \qquad \Delta h = 0.000\cdot m$$

Nivå överkant effektiv vingmur :

$$Nivå_{ök} = \mathrm{linterp}\left[\left(0m \;\; L_2 \;\; L_1 - a \;\; L_1\right), \left(h_3 - h_4 \;\; h_3 - h_4 \;\; h_3 - h_1 \;\; h_3 - h_1\right), s\right]$$

Nivå underkant effektiv vingmur :

$$Nivå_{uk} = \mathrm{linterp}\left[\left(0m \;\; L_1 - L_2 \;\; L_1\right), \left(\frac{a}{L}\cdot\Delta h \;\; \Delta h \;\; \Delta h\right), s\right]$$

Effektiv höjd vingmur :

$$h_{ef}(s) = Nivå_{ök} - Nivå_{uk}$$

Dimensionerande snittkrafter (Lk ULS och Lk SLS) fördelade på effektiv höjd :

Snittkraft i frontmur för inspänningssnitt :

$$H_{ef} = h_{ef}(0m)$$

$$N_{ULS.front} = \frac{N'_{ULS.front}}{H_{ef}}$$

$$M_{ULS.front} = \frac{M'_{ULS.front}}{H_{ef}}$$

$$N_{SLS.front} = \frac{N'_{SLS.front}}{H_{ef}}$$

$$M_{SLS.front} = \frac{M'_{SLS.front}}{H_{ef}}$$

Snittkrafter i vingmur :

$$Q_{ULS.ving} = \frac{Q'_{ULS}(s)}{h_{ef}(s)}$$

$$M_{ULS.ving} = \frac{M'_{ULS}(s)}{h_{ef}(s)}$$

$$M_{SLS.ving} = \frac{M'_{SLS}(s)}{h_{ef}(s)}$$

Egenvikt vingmur :

$$t = t_2 - \frac{t_2 - t_1}{L_1} \cdot s$$

$$A(s) = h_{mur} \cdot t$$

$$V_{egen} = \gamma_{btg} \cdot \int_0^{L_1} A(s)\, ds$$

$$M_{egen} = \gamma_{btg} \cdot \int_0^{L_1} A(s) \cdot s\, ds$$

RESULTAT

Mellanresultat

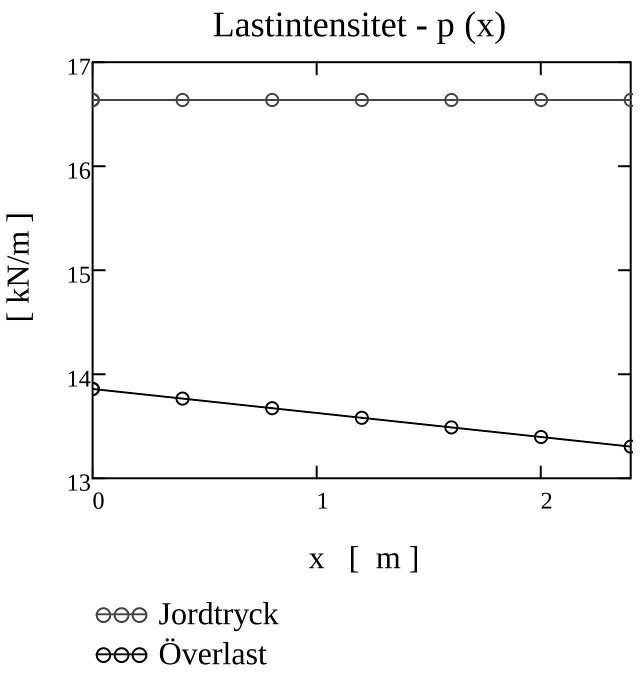
$\varphi = 45 \cdot °$: Dimensionerande friktionsvinkel tillhörande K_o

$\beta = 1 \cdot °$: Lutning hos slänten ned till överkant vingmur mätt vinkelrätt mot vingen

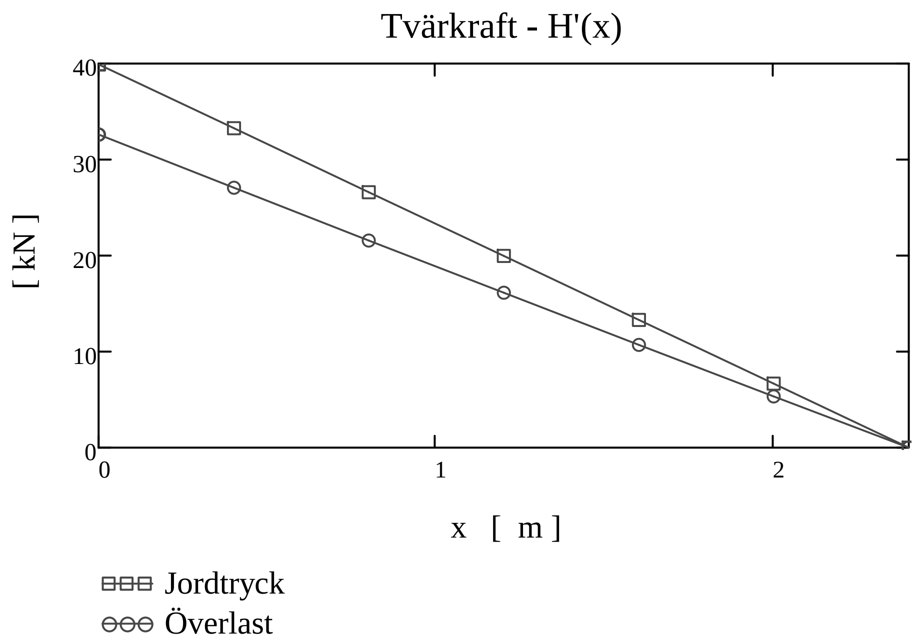
Utvärdering av jordtryck + överlast samt tilhörande farligaste brottvinkel redovisad i tabellform :

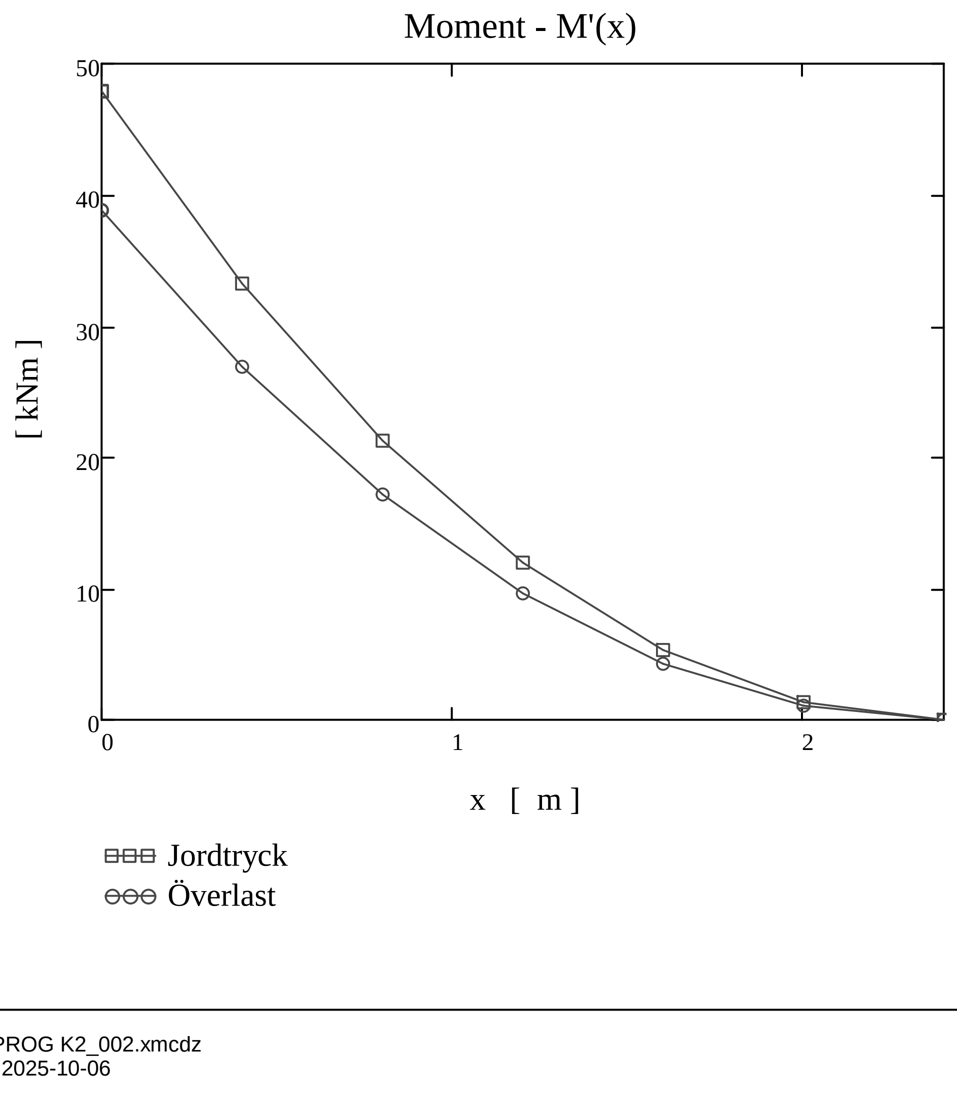
x	p_{jord}	α_{tillh}	$p_{över}$	α_{tillh}
0	16.6	66	13.9	66
0.000	16.6	66	13.9	66
0.001	16.6	66	13.9	66
0.001	16.6	66	13.9	66
0.40	16.6	66	13.8	66
0.80	16.6	66	13.7	66
1.20	16.6	66	13.6	66
1.60	16.6	66	13.5	66
2.00	16.6	66	13.4	66
2.40	16.6	66	13.3	66
m	kN/m	grader	kN/m	grader

Utvärdering av jordtryck + överlast i diagramform :

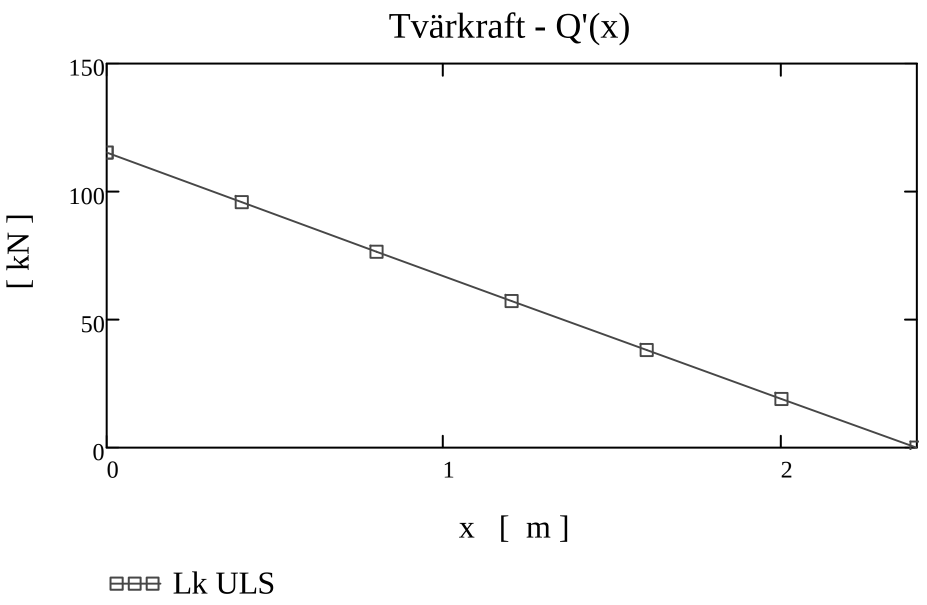


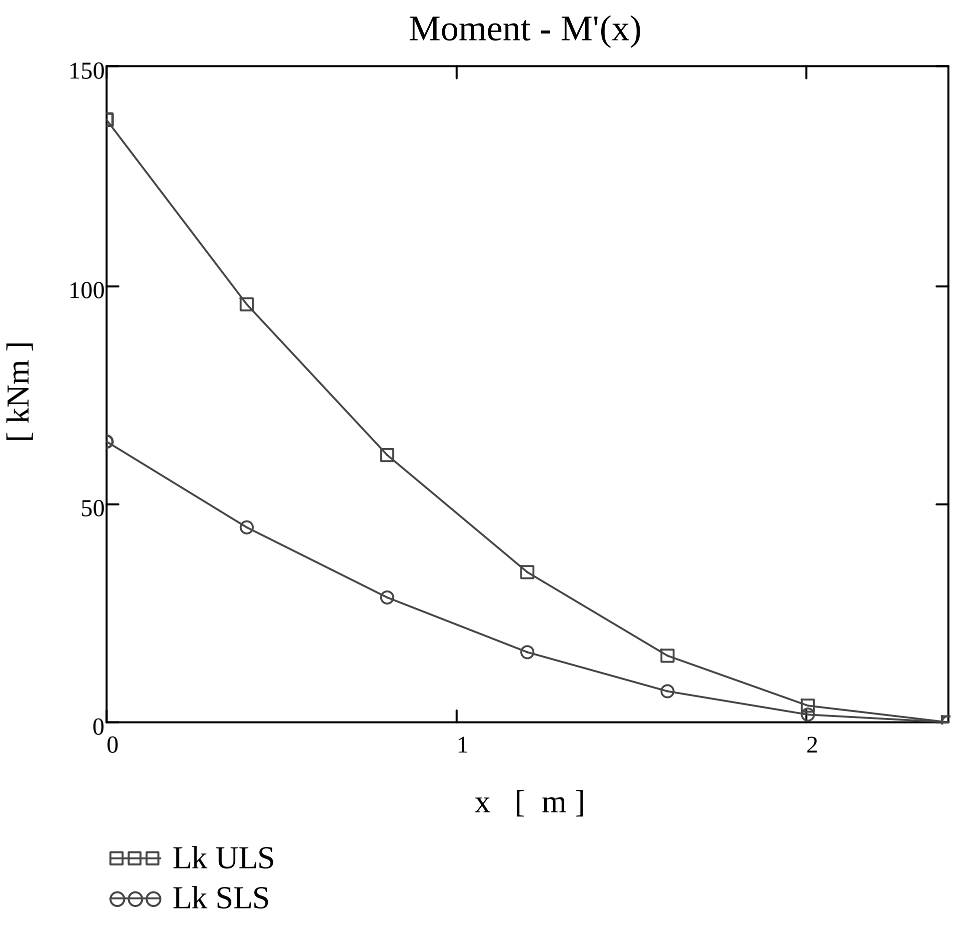
Uvärdering av snittkrafter tillhörande jordtryck + överlast i diagramform :



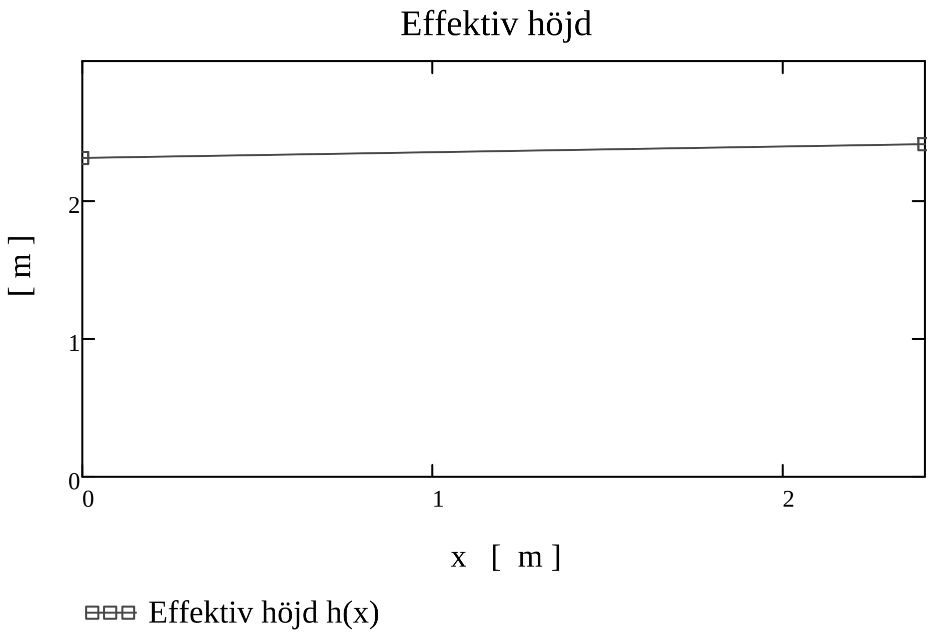


Uvärdering av dimensionerande snittkrafter för Lk ULS och Lk SLS i diagramform :





Uvärdering av effektivhöjd i diagramform :



Resultat

Dimensionerande snittkrafter i frontmur för inspänningssnitt

Effektiv höjd i inspänningssnitt : $H_{ef} = h_{ef}(0m)$ $H_{ef} = 2.3 \cdot m$

$N_{ULS.front}$	$M_{ULS.front}$	$N_{SLS.front}$	$M_{SLS.front}$
50	75	23	35
kN/m	kNm/m	kN/m	kNm/m

Dimensionerande snittkrafter i vingmur

x	$Q_{ULS.ving}$	$M_{ULS.ving}$	$M_{SLS.ving}$	t (x)
0	50	60	28	0.400
0.000	50	60	28	0.400
0.001	50	60	28	0.400
0.001	50	60	28	0.400
0.40	41	41	19	0.400
0.80	33	26	12	0.400
1.20	24	15	7	0.400
1.60	16	6	3	0.400
2.00	8	2	1	0.400
2.40	0	0	0	0.400
m	kN/m	kNm/m	kNm/m	m

Egenvikt vingmur

Egenvikt ger upphov till en triangulär linjelast med största intensiteten enligt nedan :

$V_{egen} = 58 \cdot kN$ $M_{egen} = 69 \cdot kNm$

$$x_{tp} = \frac{M_{egen}}{V_{egen}}$$ $x_{tp} = 1.2\,m$

Last vinkelrätt mot frontmur / ramben av egentyngd + jordtryck + överlast

Egenvikt ger upphov till en triangulär linjelast med största intensiteten enligt nedan :

$$p_{egen} = M_{egen} \cdot \frac{6}{H_{ef}^{\,2}} \cdot \sin(\omega) \qquad p_{egen} = 78 \cdot \frac{kN}{m}$$

Jordtryck + överlast ger upphov till en reaktangulär linjelast med intensiteten enligt nedan :

$$p_{jord} = -\frac{H'_{jord}(0m)}{H_{ef}} \cdot \cos(\omega) \qquad p_{jord} = 0 \cdot \frac{kN}{m}$$

$$p_{över} = -\frac{H'_{över}(0m)}{H_{ef}} \cdot \cos(\omega) \qquad p_{över} = 0 \cdot \frac{kN}{m}$$

3.3.4 Summary earth pressure: JORD

Combination of occurring load cases.

Basic loadcombination JORD :

Loadcase	Factor
JORD 1	1
JORD 2	1

3.4 SUPPORT SETTLEMENT

Load effect of support settlement shall be considered in TRVINFRA-00227 section 7.2.1.1.1.1.

Only horizontal support displacement in the longitudinal direction of the bridge needs to be considered. Additionally, it is stated that horizontal and vertical support displacements do not need to be combined.

A horizontal support displacement in the longitudinal direction of the bridge (x-direction) of ± 10 mm for each support is applied.

Vertical settlement difference (Z-direction) corresponding to support settlement of 15 mm is assumed to occur for all supports.

A verification will be performed to demonstrate that this is on the safe side.

When determining associated load effects, reduction is carried out with consideration to creep and cracking.

Note:
The impact of support settlement in serviceability limit state (SLS) according to SS-EN 1992-1-1 §2.3.1.3. If this occurs, a gradual crack development should be applied according to SS-EN 1992-1-1 §5.4(3). Reduction is carried out with consideration to creep and cracking.

The impact of support settlement is not considered in the ultimate limit state (ULS) according to SS-EN 1992-1-1 §2.3.1.3 for this type of bridge.

3.4.1 Vertical settlement

3.4.1.1 Support 1

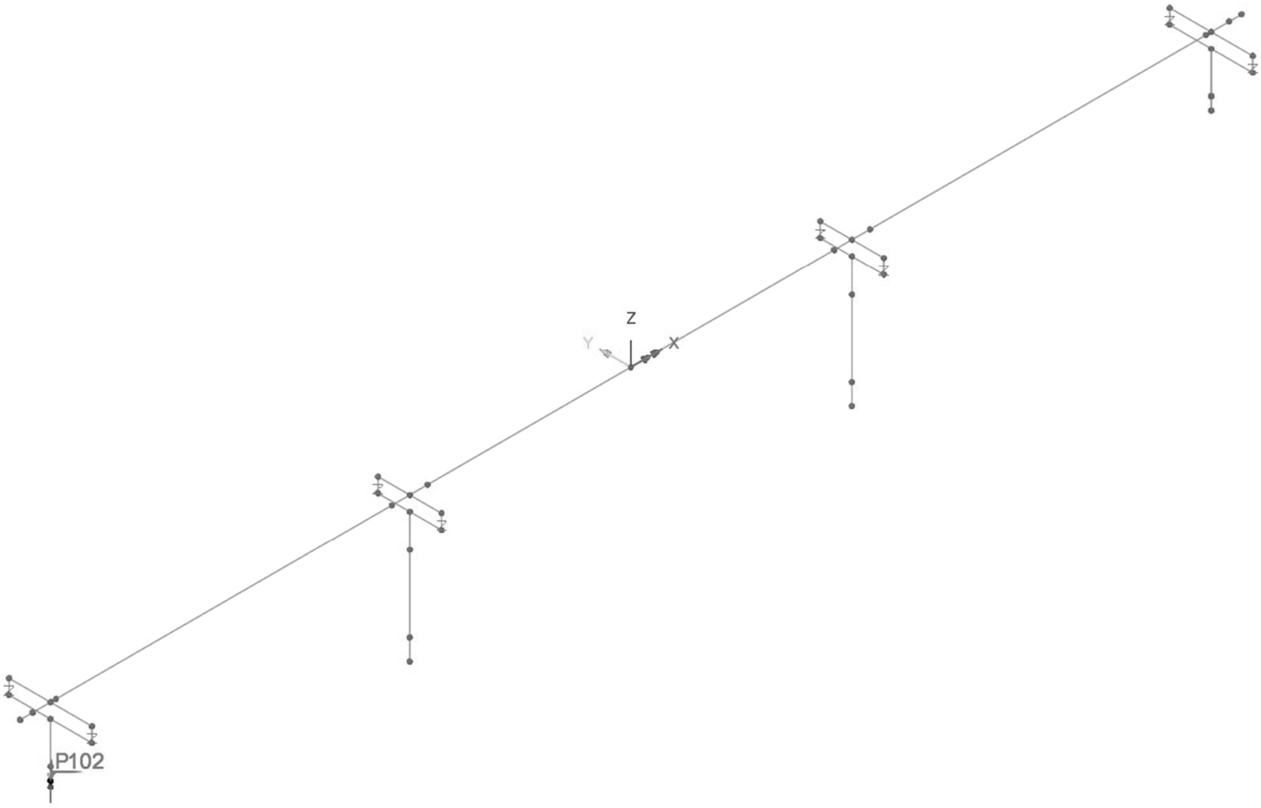
Load (loadcase) : STOD_1Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_1Z

Point : P102



Overview 3D

3.4.1.2 Support 2

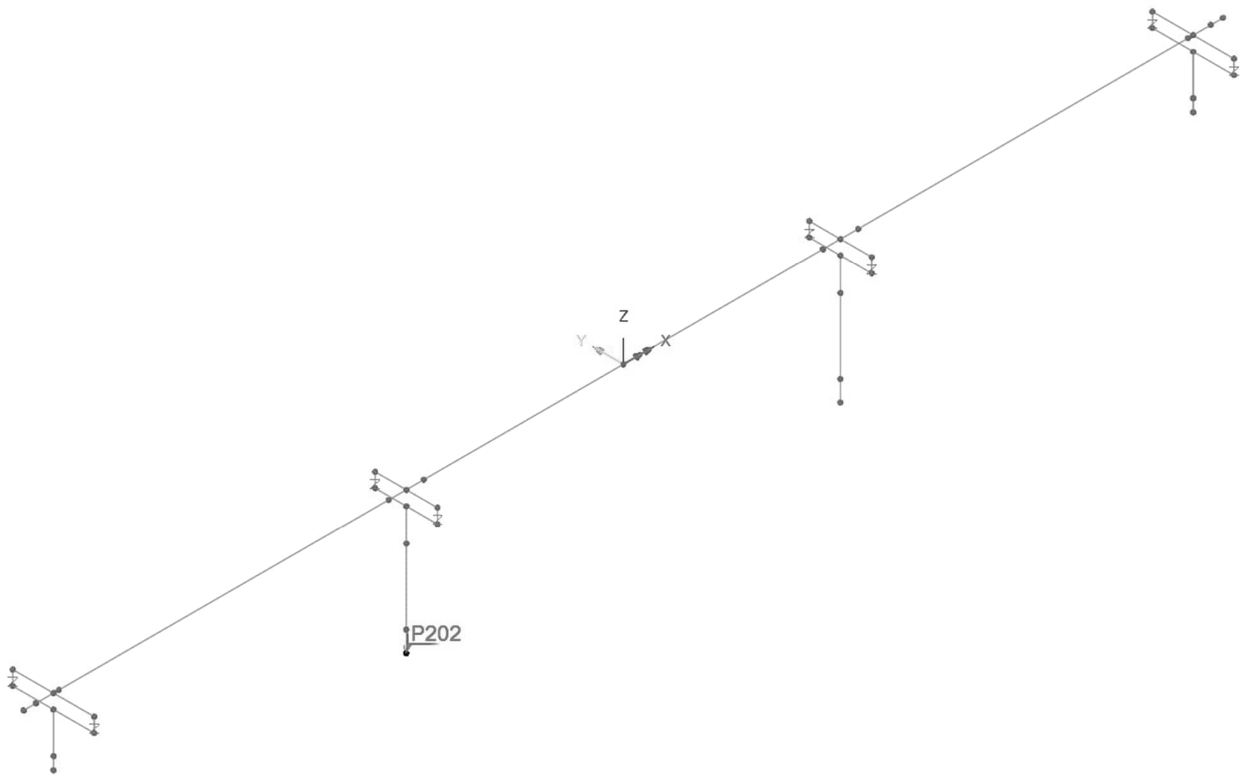
Load: STOD_2Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P202



Overview 3D

3.4.1.3 Support 3

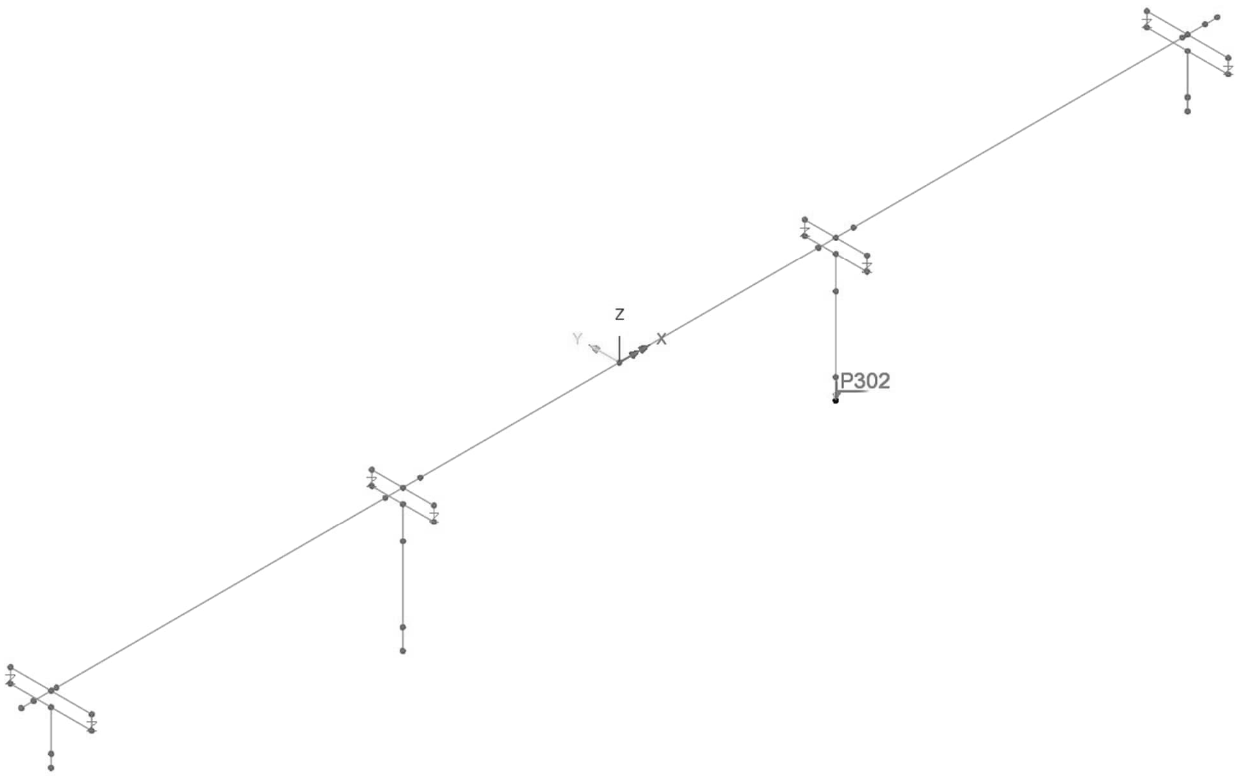
Load: STOD_3Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P302



Overview 3D

3.4.1.4 Support 4

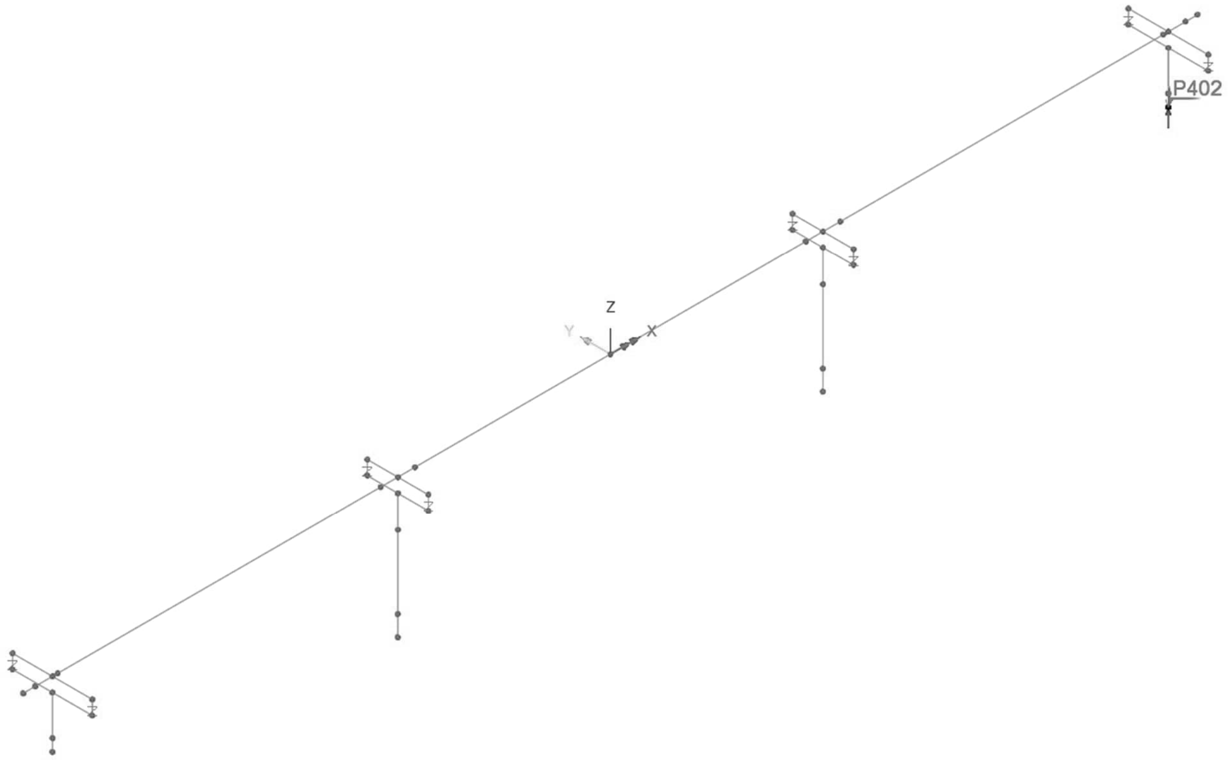
Load: STOD_4Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P402



Overview 3D

3.4.2 Horizontal settlement

3.4.2.1 Support 2

Load : STOD_2X

Structural loading : Prescribed Displacement

Translation at point in X direction : 0.010 m

Loadcase : STOD_1X+

Point : P202

3.4.2.2 Support 3

Load : STOD_3X

Structural loading : Prescribed Displacement

Translation at point in X direction : 0.010 m

Loadcase : STOD_2X+

Point : P302

3.4.3 Load combination settlement: STOD

Basic load cases :

Load case	Load	Factor
STOD_2X-	STOD_2X+	-1
STOD_3X-	STOD_3X+	-1

Envelope STOD-X :

Load case
STOD_2X+
STOD_2X+
STOD_3X-
STOD_3X-

Load combination smart *STOD-Z :*

Load case	Permanent factor	Variable factor
STOD_1Z	0	1
STOD_2Z	0	1
STOD_3Z	0	1
STOD_4Z	0	1

Envelope STOD :

Load case
STOD-X
STOD-Z

3.5 CREEP

Total creep is determined according to SS-EN 1992-1-1 §3.1.4 and TRVINFRA-00227 section 7.1.6.4 for RH 80% at time t_1.

Time for first loading (= time when formwork was removed) is termed t_0.

$t_0 = 5\ days$

$t_1 = 120\ years$

Bridge consists of parts with different thicknesses as seen below.

Creep is determine using Mathcad program PROG A001.

Superstructure (b = 3.50 m; C35/45):
For t = 1.50 m → $\phi(t_1, t_0) = 1.90$: see page A3:46

Creep $\phi(t_1, t_0) = 1.9$ is used for the entire bridge on safe side since reduces stiffness and associated constraint forces (∴ support settlement, shrinkage and temperature).

$$\varepsilon_{cc}(t_1, t_0) = \varphi(t_1, t_0) \cdot \frac{\sigma_c}{E_c}$$

To study the effect concrete stiffness according to SS-EN 1992-1-1 5.8.7 creep values seen below are used.

Load cases	φ
Permanent	1.9
Variable excluding temperature	0
Temperature	0.3*

* = According to Swedish work practice

$$E^{system} = \frac{E_{cm}}{1+\varphi}$$

Instead of adjusting E-modulus the load coefficients are adjusted.

$$f_{KRYMP} = \frac{1}{1+\varphi_{ef}} = \frac{1}{1+1.90} = 0.34$$

$$f_{STÖD} = \frac{1}{1+\varphi_{ef}} = \frac{1}{1+1.90} = 0.34$$

$$f_{JTEMP} = \frac{1}{1+\varphi_{ef}} = \frac{1}{1+0.3} = 0.77$$

<u>Note:</u>
According to TRVINFRA-00227 section 7.2.1.1.2.4, no reduction is permitted for uneven temperature across the cross-section. This is because this temperature variation is considered to have a very short duration (only over the day).

Objekt: Superstructure

Betong (C30/37, C35/45, C40/50 och C45/55): BTG = "C35/45"

Relativ fuktighet : RH = 80%

Tvärsnittetsbredd : $b = \frac{3.0m + 4.0m}{2} = 3.5\,m$

Tvärsnittetshöjd : $h = 1.5m$

Tvärsnittsarea : $A_c = b \cdot h = 5.25 \cdot m^2$

Omkrets i kontakt med "luft" : $u = 2 \cdot b = 7\,m$

Bärverkets ekvivalenta tjocklek : $h_0 = \frac{2 \cdot A_c}{u} = 1.5\,m$

Studerad tidpunkt för bestämning av krypning : $t_1 = 120\text{år}$ $t_1 = 43800 \cdot dag$

Tidpunkt för pålastning (= formrivning): $t_0 = 5dag$

Indatakvitto

$f_{cm} = 43 \cdot MPa$

BERÄKNING

Uttryck för bestämning av kryptalet är hämtat från SS-EN 1992-1-1 Bilaga B.1.

$$\alpha_1 = \left(\frac{35MPa}{f_{cm}}\right)^{0.7} = 0.87$$

$$\alpha_2 = \left(\frac{35MPa}{f_{cm}}\right)^{0.2} = 0.96$$

$$\alpha_3 = \left(\frac{35MPa}{f_{cm}}\right)^{0.5} = 0.9$$

$$\varphi_{RH} = \begin{cases} 1 + \dfrac{1 - RH}{0.1\sqrt[3]{\dfrac{h_0}{mm}}} & \text{if } f_{cm} \le 35MPa \\ \left(1 + \dfrac{1 - RH}{0.1\sqrt[3]{\dfrac{h_0}{mm}}}\cdot\alpha_1\right)\cdot\alpha_2 & \text{otherwise} \end{cases} = 1.1$$

$$\beta_0 = \frac{1}{0.1 + t_0^{0.20}} = 0.68$$

$$\beta_{fcm} = \frac{16.8}{\sqrt{\dfrac{f_{cm}}{MPa}}} = 2.56$$

$$\beta_H = \begin{array}{|l} \text{if } f_{cm} \le 35\text{MPa} \\ \quad \begin{array}{|l} \beta_{H.max} \leftarrow 1500 \\ \beta_H \leftarrow \beta_{H.max} \quad \text{if } 1.5\cdot\left[1 + (0.012\cdot100RH)^{18}\right]\cdot\dfrac{h_0}{mm} + 250 > \beta_{H.max} \\ \beta_H \leftarrow 1.5\cdot\left[1 + (0.012\cdot100RH)^{18}\right]\cdot\dfrac{h_0}{mm} + 250 \quad \text{otherwise} \end{array} \\ \text{if } f_{cm} > 35\text{MPa} \\ \quad \begin{array}{|l} \beta_{H.max} \leftarrow 1500\cdot\alpha_3 \\ \beta_H \leftarrow \beta_{H.max} \quad \text{if } 1.5\cdot\left[1 + (0.012\cdot100RH)^{18}\right]\cdot\dfrac{h_0}{mm} + 250 > \beta_{H.max} \\ \beta_H \leftarrow 1.5\cdot\left[1 + (0.012\cdot100RH)^{18}\right]\cdot\dfrac{h_0}{mm} + 250\cdot\alpha_3 \quad \text{otherwise} \end{array} \\ \beta_H \end{array}$$

$$\beta_H = 1353$$

$$\beta_c = \left(\frac{t_1 - t_0}{\beta_H + t_1 - t_0}\right)^{0.3} = 0.99$$

$$\varphi_{t0} = \varphi_{RH}\cdot\beta_{fcm}\cdot\beta_0 = 1.91$$

$$\varphi_{t1} = \varphi_{t0}\cdot\beta_c = 1.90$$

3.6 SHRINKAGE

Total shrinkage according to SS-EN 1992-1-1 §3.1.4 and TRVINFRA-00227 section 7.1.6.4 for RH 80% at time t_1.

Determination of load effect from shrinkage should consider the reduced concrete stiffness from creep.

$t_s = 0\ days$

$t_1 = 120\ years$

Shrinkage is determined using Mathcad program PROG A002 after time t_1.

Superstructure (b = 3.50 m; C35/45):
For t = 1.50 m → $\varepsilon_{cs}(t_1) = 0.023\%$: see page A3:49

Shrinkage $\varepsilon_{cs} = 0.025\%$ is applied to all construction parts for safety. The movement corresponds to that which occurs due to an imaginary temperature load ∴ T = -25°C.

Remark
Shrinkage must be considered for service state (SLS) see SS-EN 1992-1-1 §2.3.2.2(1).

Shrinkage does not have to be used for ultimate state (ULS) see SS-EN 1992-1-1 §2.3.2.2(2).

Objekt: Superstructure

Betong (C30/37, C35/45, C40/50 och C45/55): BTG = "C35/45"

Relativ fuktighet (se KBB avsnitt B.3.3.6): RH = 80%

Tvärsnittetsbredd : $b = \frac{3.0m + 4.0m}{2} = 3.5\,m$

Tvärsnittetshöjd : $h = 1.5m$

Tvärsnittsarea : $A_c = b \cdot h = 5.25 \cdot m^2$

Omkrets i kontakt med "luft" : $u = 2 \cdot b = 7\,m$

Bärverkets ekvivalenta tjocklek : $h_0 = \frac{2 \cdot A_c}{u} = 1.5\,m$

Studerad tidpunkt för bestämning av krympning : $t_1 = 120$år $t_1 = 43800 \cdot dag$

Tidpunkt för pålastning (= formrivning): $t_0 = 5dag$

Cementklass (S, N, R) : Klass = "N"

Betongens ålder då uttorkningskrympning påbörjas : $t_s = 0dag$

Indatakvitto

$f_{cm} = 43 \cdot MPa$ $f_{ck} = 35 \cdot MPa$ $f_{ck.kub} = 45 \cdot MPa$

BERÄKNING

Grundvärdet för krympning från uttorkning (SS-EN 1992-1-1 Bilaga B.2)

$$\alpha_{ds1} = \begin{vmatrix} 3.0 & \text{if Klass} = \text{"S"} \\ 4.0 & \text{if Klass} = \text{"N"} \\ 6.0 & \text{if Klass} = \text{"R"} \end{vmatrix} = 4.00$$

$$\alpha_{ds2} = \begin{vmatrix} 0.13 & \text{if Klass} = \text{"S"} \\ 0.12 & \text{if Klass} = \text{"N"} \\ 0.11 & \text{if Klass} = \text{"R"} \end{vmatrix} = 0.12$$

Thout

$$RH_o = 100 \cdot \%$$

$$\beta_{RH} = 1.55 \cdot \left[1 - \left(\frac{RH}{RH_o}\right)^3\right] = 0.76$$

$$\varepsilon_{cd.0} = 0.85 \left[(220 + 110 \cdot \alpha_{ds1}) \cdot e^{-\alpha_{ds2} \cdot \frac{f_{cm}}{f_{cmo}}}\right] \cdot 10^{-6} \cdot \beta_{RH} = 0.025 \cdot \%$$

Grundvärdet för krympning från uttorkning (SS-EN 1992-1-1 avsnitt 3.1.4 ekv. 3.9 och 3.10)

$$k_h = \text{linterp}\left[\left(0 \quad 100 \quad 200 \quad 300 \quad 500 \quad 10^4\right) mm^T, (1.00 \quad 1.00 \quad 0.85 \quad 0.75 \quad 0.70 \quad 0.70)^T, h_0\right] = 0.70$$

$$\beta_{ds} = \frac{t_1 - t_s}{t_1 - t_s + 0.04 \sqrt{\left(\frac{h_0}{mm}\right)^3}} = 0.95$$

$$\varepsilon_{cd} = \beta_{ds} \cdot k_h \cdot \varepsilon_{cd.0} = 0.017 \cdot \%$$

Autogen krympning (SS-EN 1992-1-1 avsnitt 3.1.4 ekv. 3.11, 3.12 och 3.13)

$$k_h = \text{linterp}\left[\left(0\ \ 100\ \ 200\ \ 300\ \ 500\ \ 10^4\right)\text{mm}^T, \left(1.00\ \ 1.00\ \ 0.85\ \ 0.75\ \ 0.70\ \ 0.70\right)^T, h_0\right] = 0.70$$

$$\beta_{as} = 1 - e^{-0.2\cdot\sqrt{t_1}} = 1.00$$

$$\varepsilon_{ca.\propto} = 2.5\cdot\left(\frac{f_{ck}}{MPa} - 10\right)\cdot 10^{-6} = 0.006\cdot\%$$

$$\varepsilon_{ca} = \beta_{as}\cdot\varepsilon_{ca.\propto} = 0.006\cdot\%$$

Total krympning (SS-EN 1992-1-1 avsnitt 3.1.4 ekv. 3.8)

$$\varepsilon_{cs} = \varepsilon_{cd} + \varepsilon_{ca} = 0.023\cdot\%$$

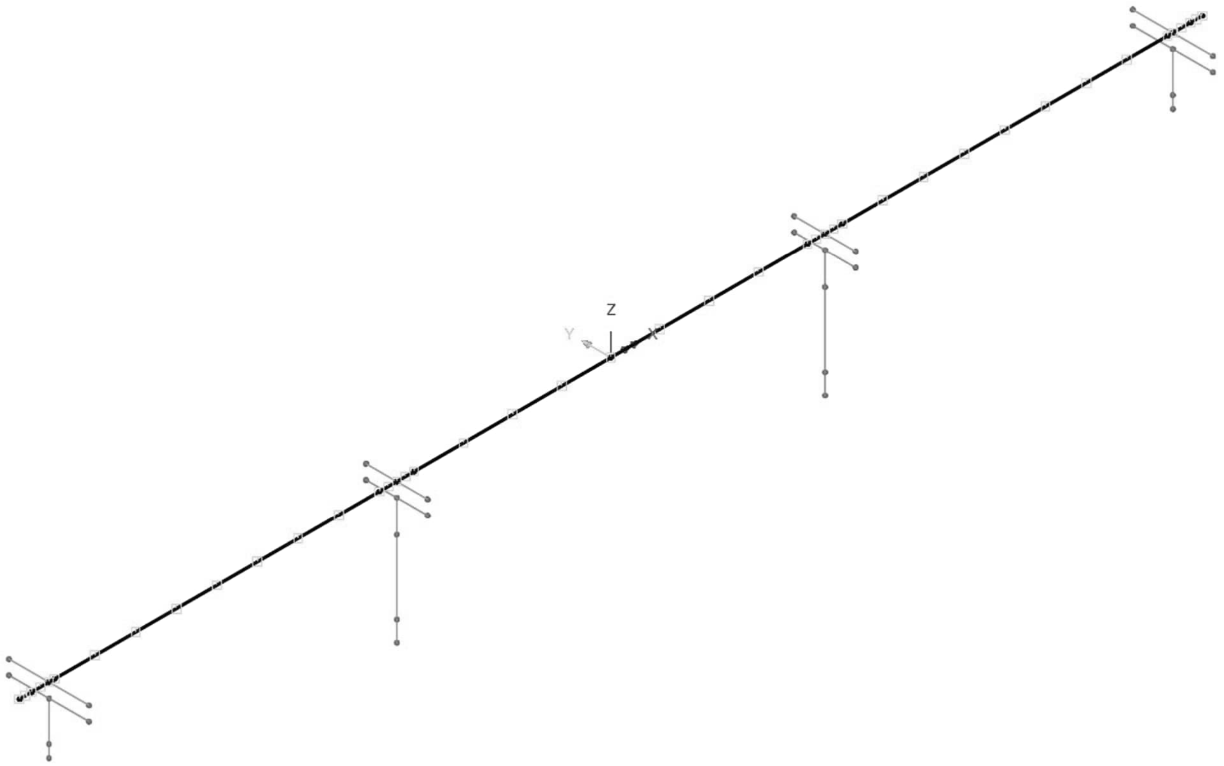
Loadcase : KRYMP

Structural loading : Temperature

Definition : Element

Initial temperature : 0 °C

Final temperature : -25 °C



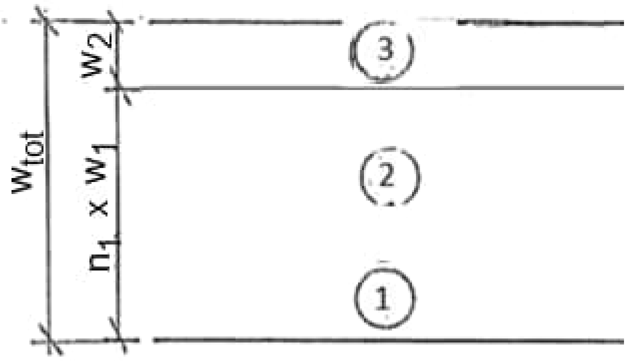
Overview 3D

3.7 TRAFFIC

Evaluation of vertical traffic is performed for LM 1 and LM 2 according to SS-EN 1991-2 section 4.3.

Evaluation will also be performed EG A/B = 180kN/300 kN according to TRVFS 2011:12 chapter 6 point 3§.

3.7.1 Traffic lane division



Total traffic width : $w_{tot} = 8.0\ m$

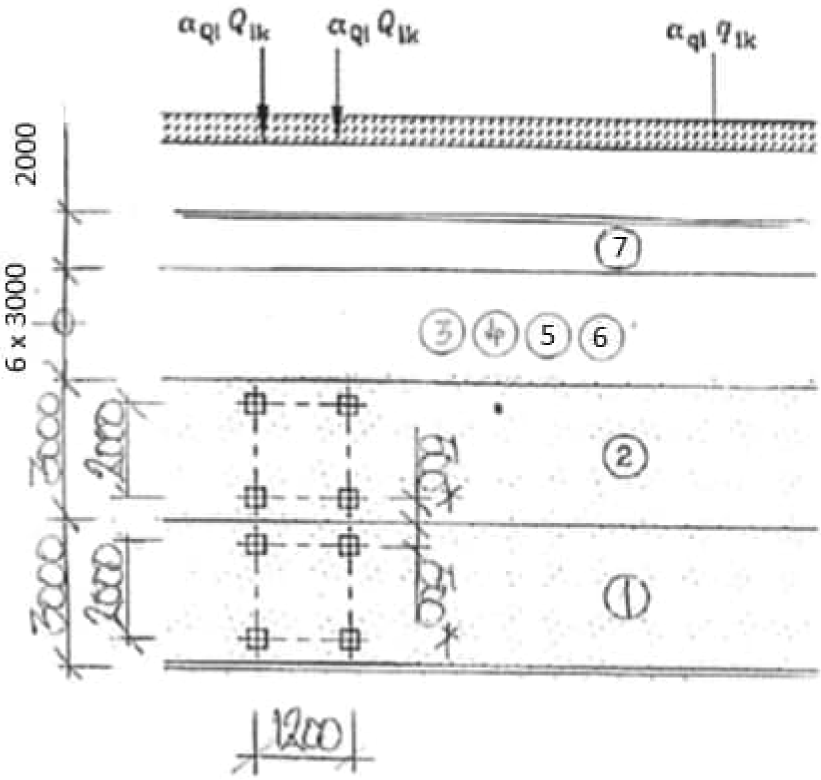
Number of traffic lanes : $n_1 = Integer\left[\frac{w_{tot}}{3.0m}\right] = 2\ lanes$

Full traffic width : $w_1 = 3.0m$

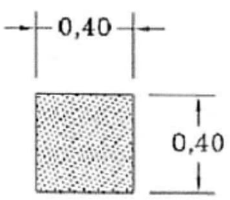
Remaining width : $w_2 = 2.0m$

3.7.2 Load model 1 (LM 1)

Characteristic values according to SS-EN 1991-2 §4.3.2.



* = When studying local effects 250 mm is to be assumed.



Axellaster :

α_Q : national adaptation factor according to TRVFS 2011:12 table 7.1

$Q'_k = \alpha_Q \cdot Q_k$: characteristic value including national adaptation factor

Traffic lane	Q_k	α_Q	Q'_k	Remark
1	300	0,9	270	LM1- 2 x 270 kN
2	200	0,9	180	LM1- 2 x 180 kN
3-6	100	0	0	No load
-	kN	-	kN	-

Utbredda laster :

α_q : national adaptation factor according to TRVFS 2011:12 table 7.1

$q'_k = \alpha_q \cdot q_k$: characteristic value including national adaptation factor

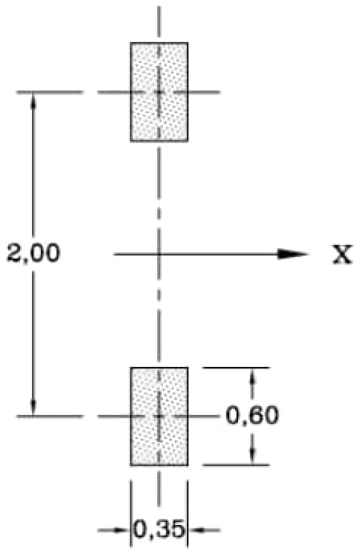
Traffic lande	q_k	α_q	q'_k
1	9.0	0.8	7.2
2-7	2.5	1.0	2.5
-	kPa	-	kPa

Remark

Evaluation is performed using Vehicle Load Optimisation (VLO), see section 3.7.4.

3.7.3 Load model 2 (LM 2)

Characteristic vertical load according to SS-EN 1991-2 §4.3.3.



$\beta_Q = \alpha_Q = 0.90$: national adaptation factor

Q_k = 400 kN : characteristic value

$Q'_k = \beta_k \cdot Q_k$ = 360 kN : characteristic value including national adaptation factor

Tire pressure

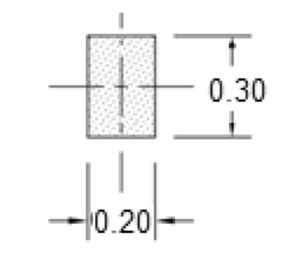
TSFS Chapter 11 Section 4 states that the same contact surface as LM 1 may be used.

3.7.4 Load model EG A/B

Calculation is performed using traffic load EG A/B = 180 kN/300 kN excluding dynamic factor.

Traffic load EG A/B are applied to two traffic lanes. Traffic on first lane is multiplied by 1.00 while second lane is multiplied 0.80.

The center distance between the wheel pressures is 2.0 meters according to TSFS chapter 11 §2.



Wheel pressure

$\varepsilon_{dyn} = 25$ % : dynamic factor [1.)]

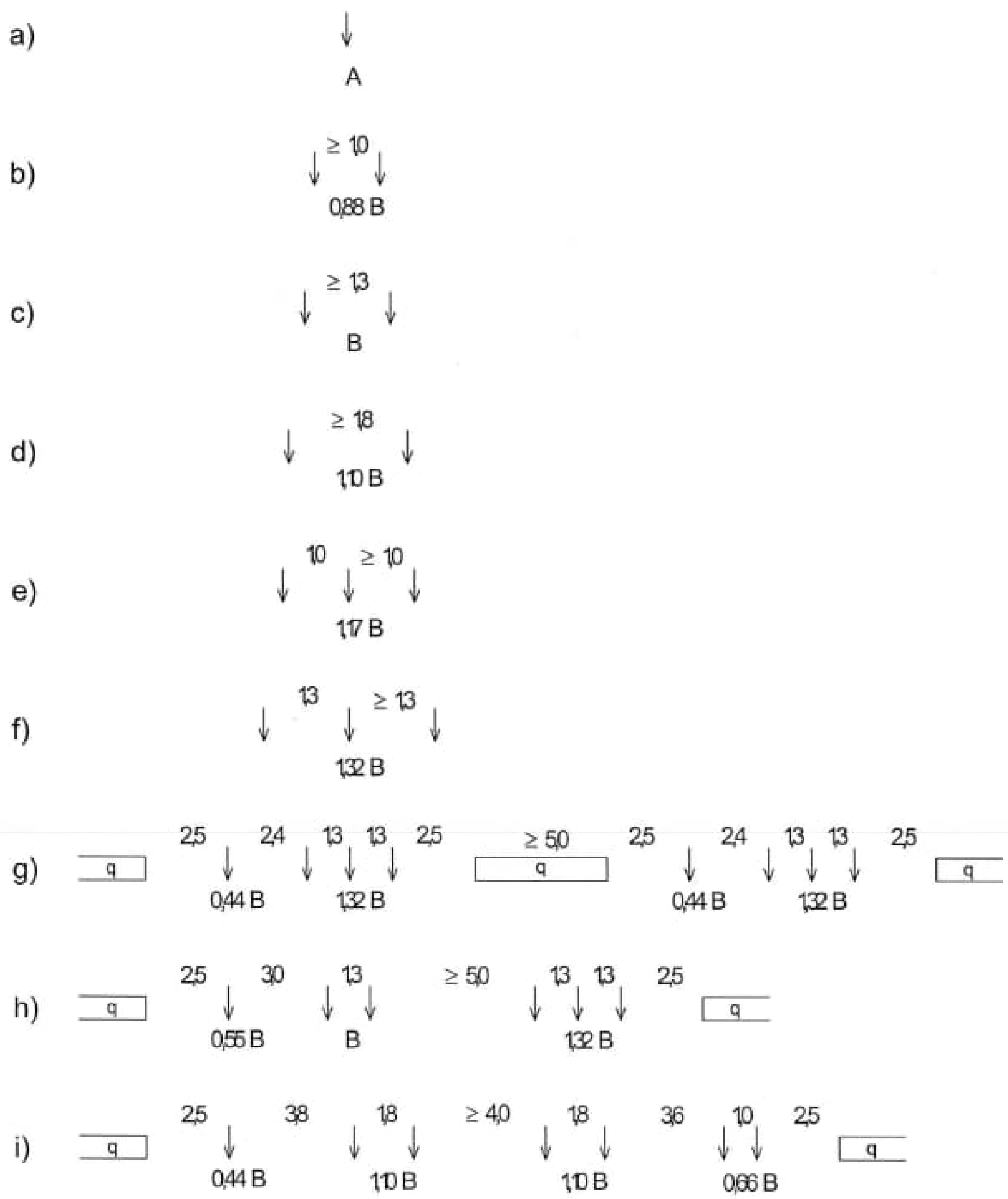
$A' = A \cdot (1 + \varepsilon_{dyn}) = 180$ kN·(1+0.25) = 225 kN : single load including dynamic factor

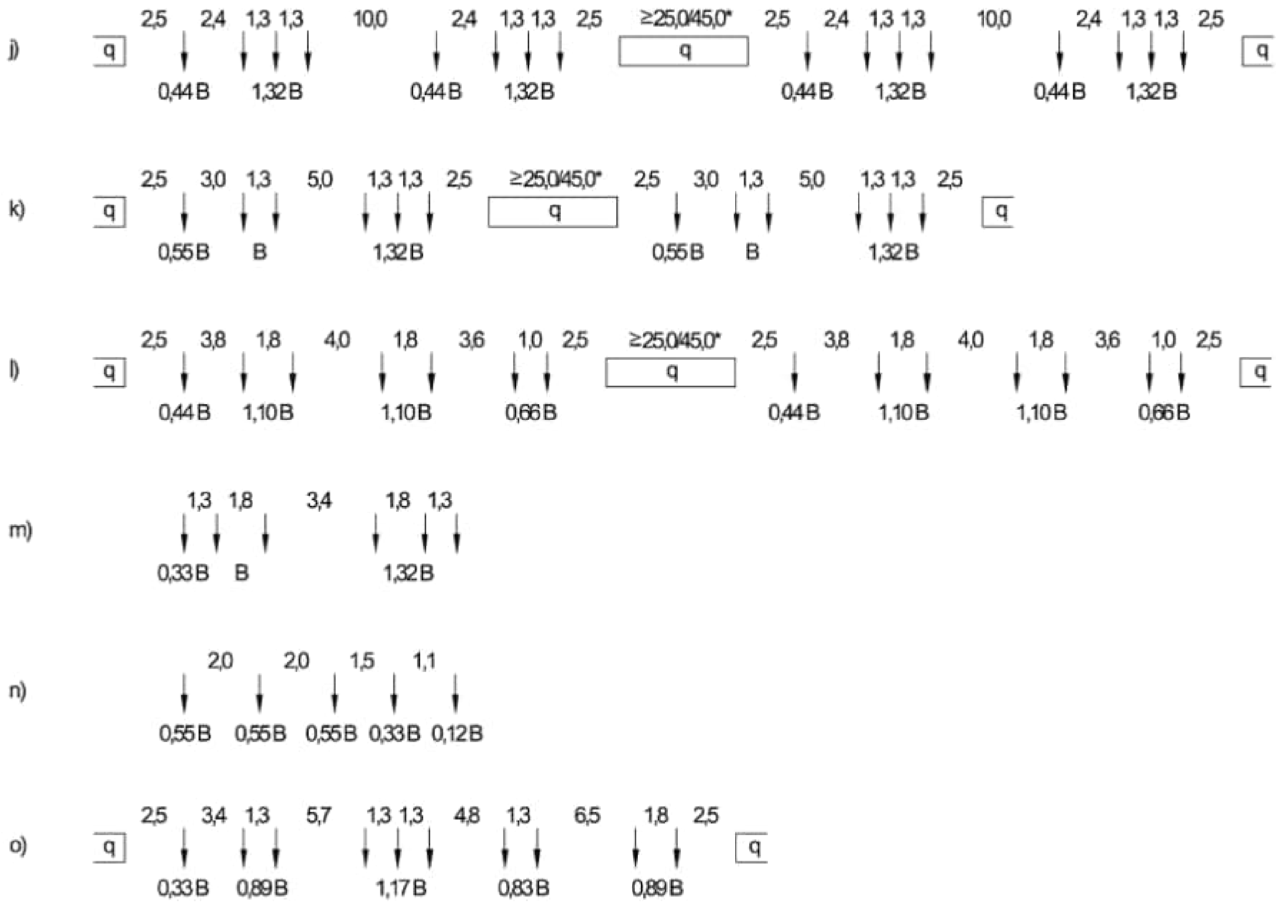
$B' = B \cdot (1 + \varepsilon_{dyn}) = 300$ kN·(1+0.25) = 375 kN : tandem load including dynamic factor

$p = 5\frac{kN}{m}$: surface load

Footnote:
[1.)] TRVINFRA-00227 table 7.1-5 section 4.2.1(1) states apply 25 % ..

Graphic presentation of common vehicle types:
(Vehicle types according to TRVINFRA-00331 Appendix 1)





Note:
Evaluation is carried out with the script Vehicle Load Optimization (VLO), see sections 3.5.3 and 3.5.4.
Since there is no motorway, * = 45 m is applied according to TRVINFRA-00331 section 8.3.2.2.1 for vehicle types j, k, and l.

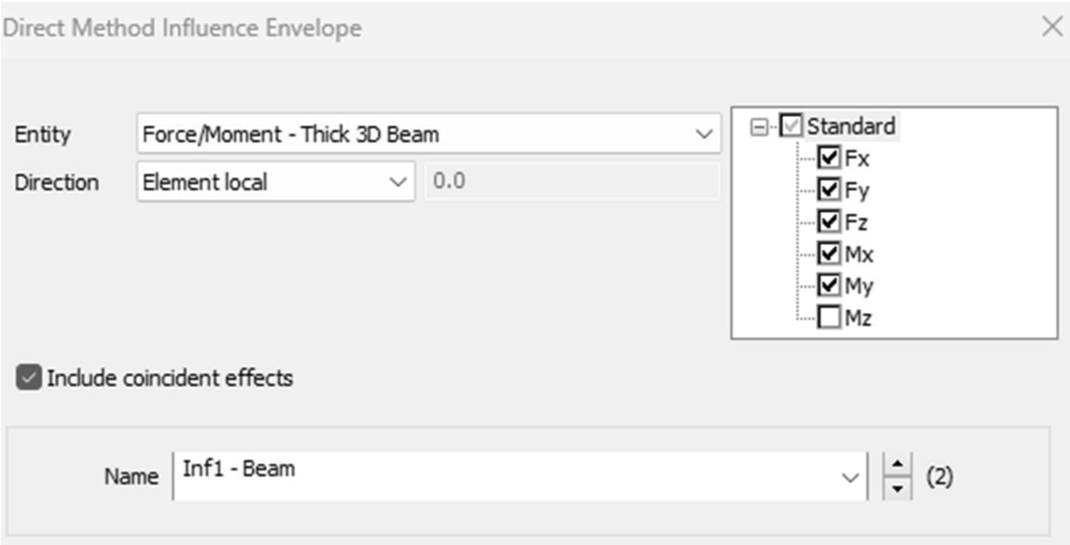
3.7.5 Vehicle Load Optimization (VLO)

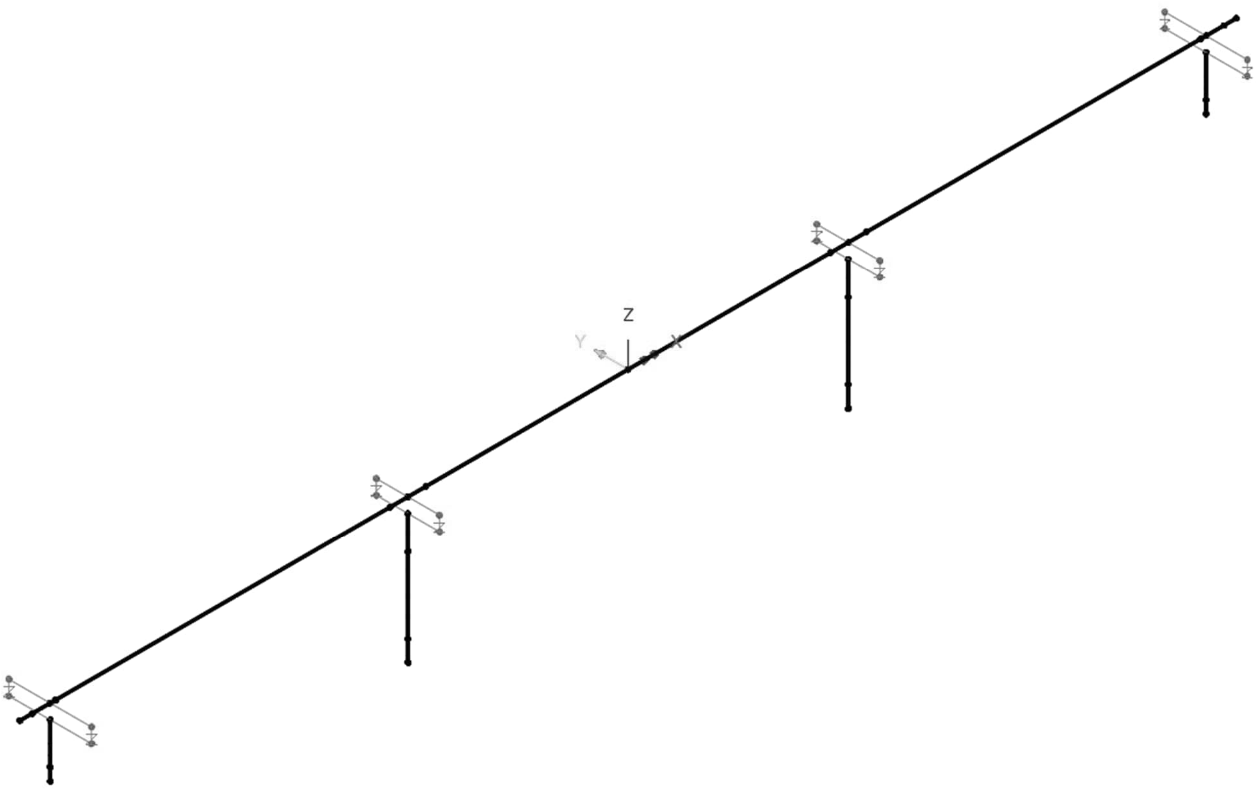
3.7.5.1 Influence components

Influence surfaces are created using *Method Influence Envelope* or *Method direct Influence* for indicated components.

Influence	Components	Entity	Method
Inf1 - Beam	Fx, Fy, Fz, Mx, My	Forces 3D-beam	*Influence Envelope*
Inf2 - Reaction	FX, FY, FZ, MX, MY	Reaction	*Influence Envelope*
Inf3 - Bearing	Fx	3D Joint	*Direct Influence*
Inf4 - Bearing	Fy	3D Joint	*Direct Influence*
Inf5 - Bearing	Fz	3D Joint	*Direct Influence*

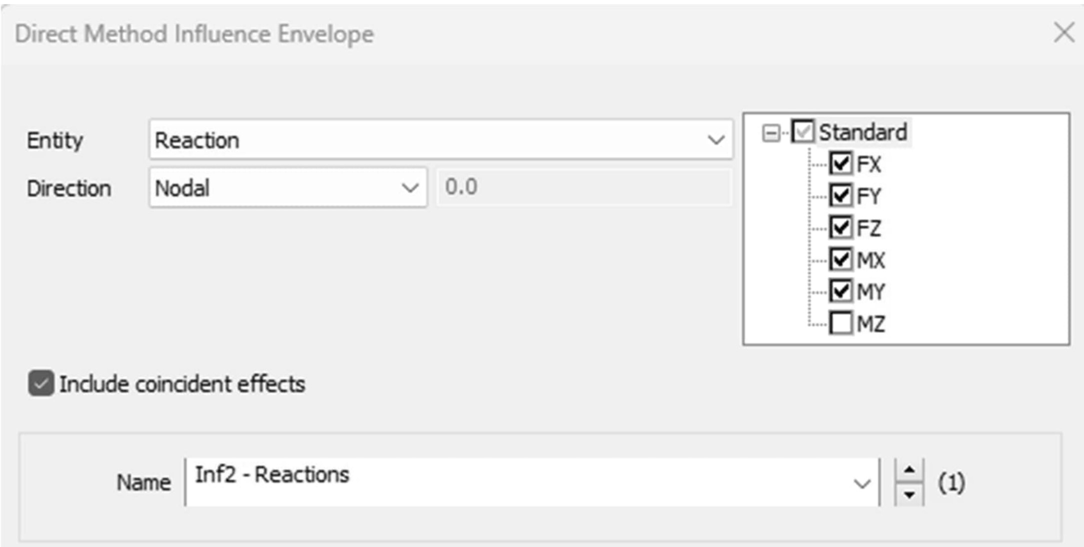
Inf1 – Beam :

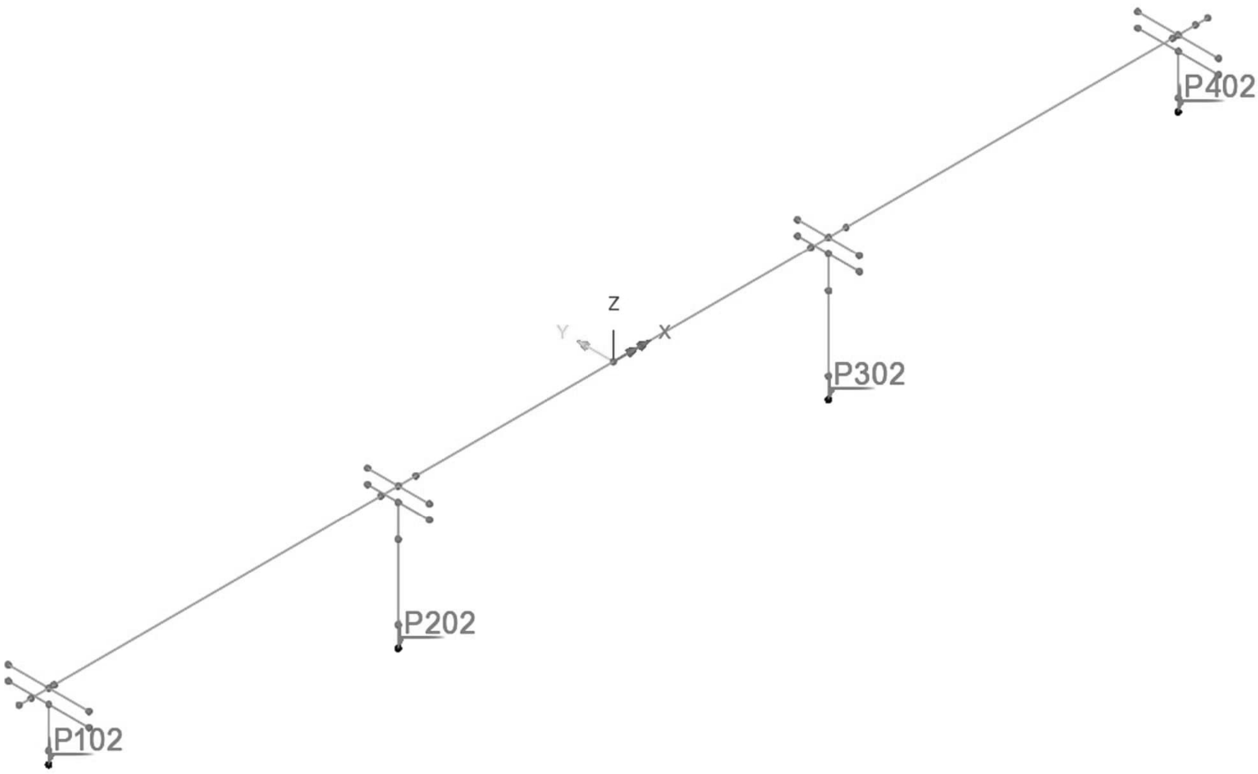




Overview 3D

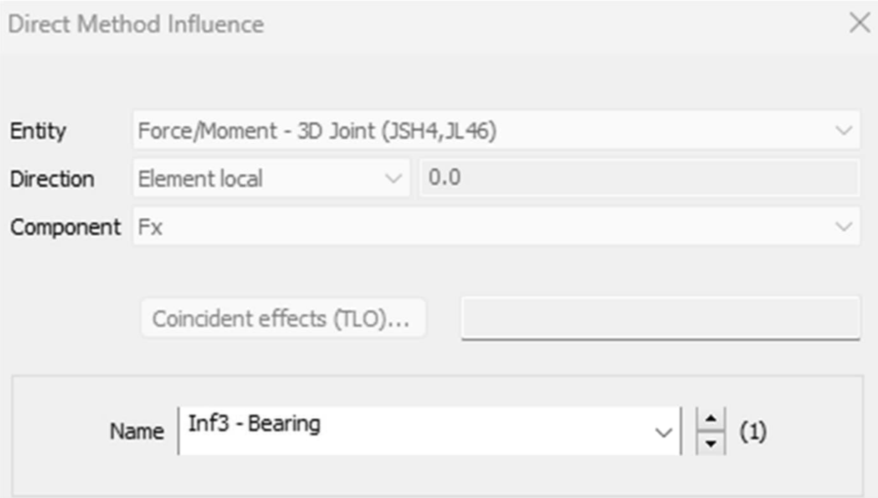
Inf2 – Reactions :

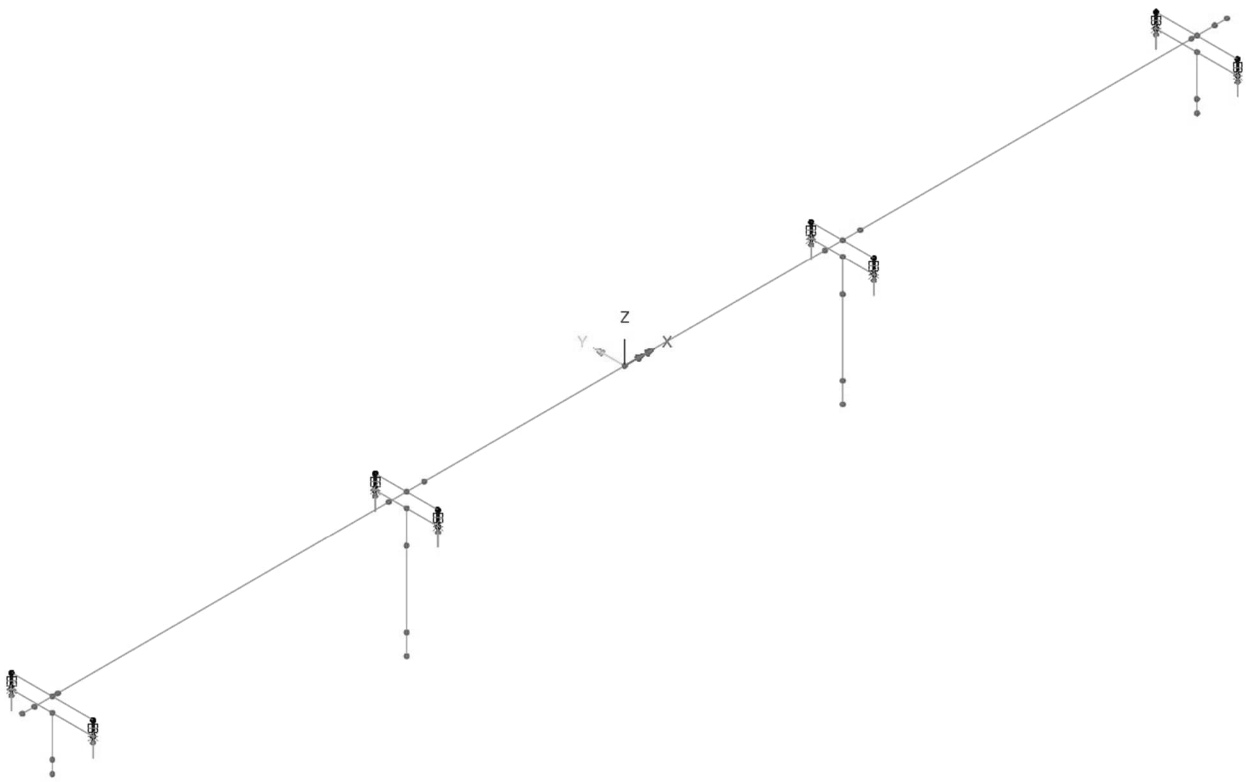




Overview 3D

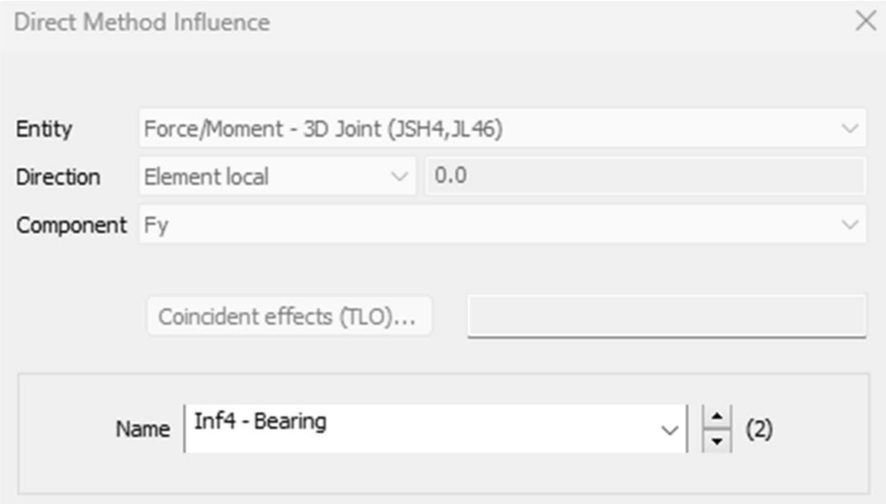
Inf3 – Bearing (Fx):

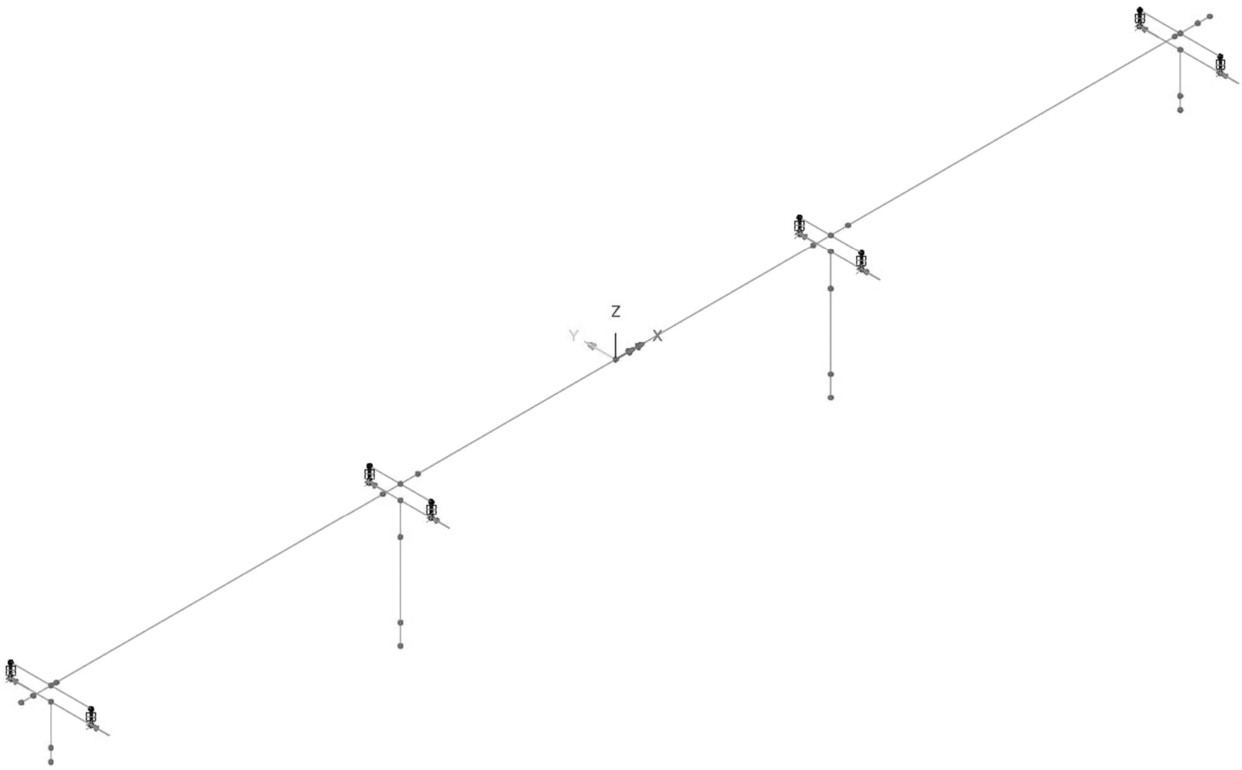




Overview 3D

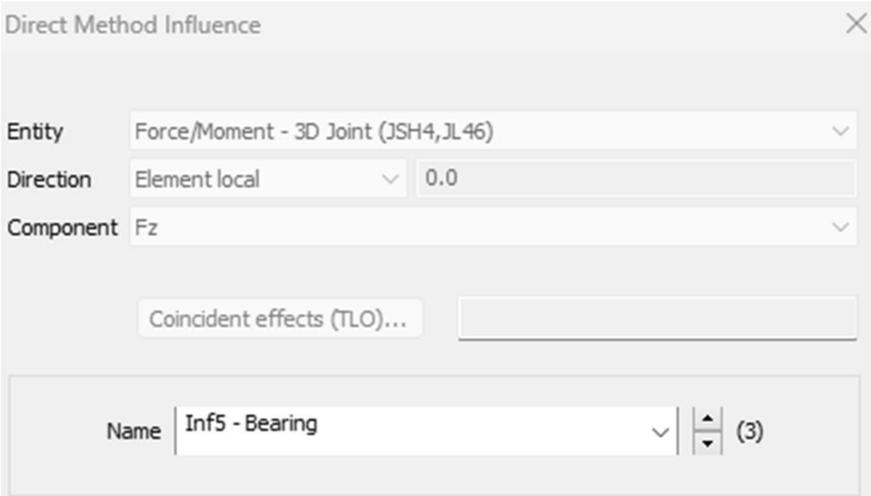
Inf4 – Bearing (Fy) :

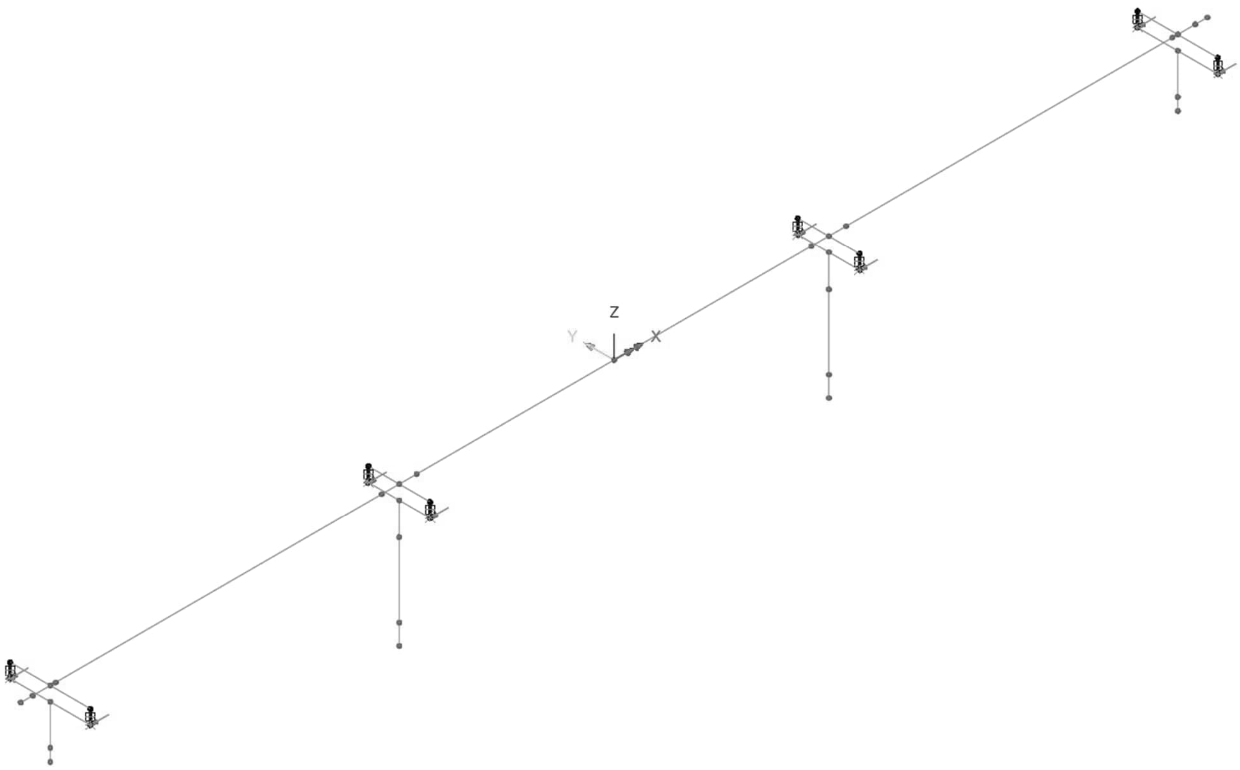




Overview 3D

Inf5 – Bearing (Fz) :





Overview 3D

3.7.5.2 Influence surface analysis

Influence surfaces :

Search area: Superstructure

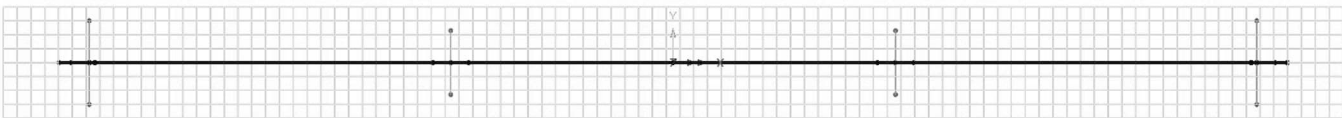
Definition type: Grid

Path: Centerline X

Transverse width: 8.0 m

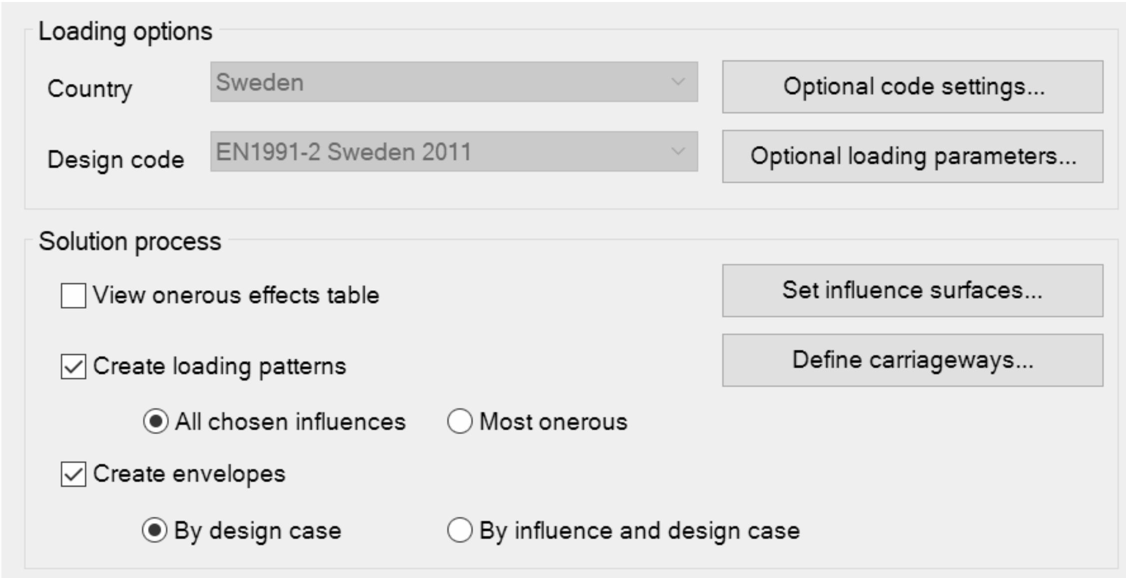
Longitudinal spacing: 1.0 m

Transversal spacing: 1.0 m

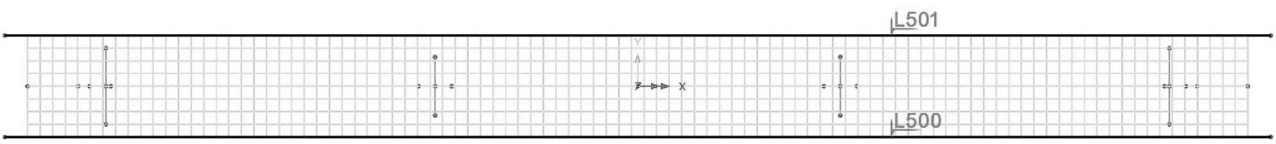


PLAN

3.7.5.3 Traffic load analysis (VLO)



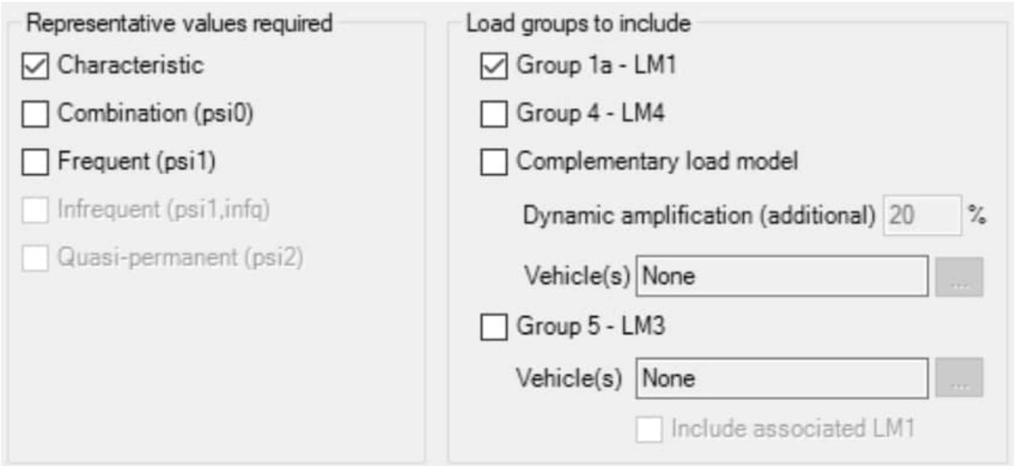
Vehicle longitudinal incremental movement:	0.25 m
Vehicle transverse incremental movement:	0.25 m
Vehicle direction:	both
Definition of carriageway (kerbs):	L500 & L501
Influence surfaces:	Include all (positive & negative)



PLAN

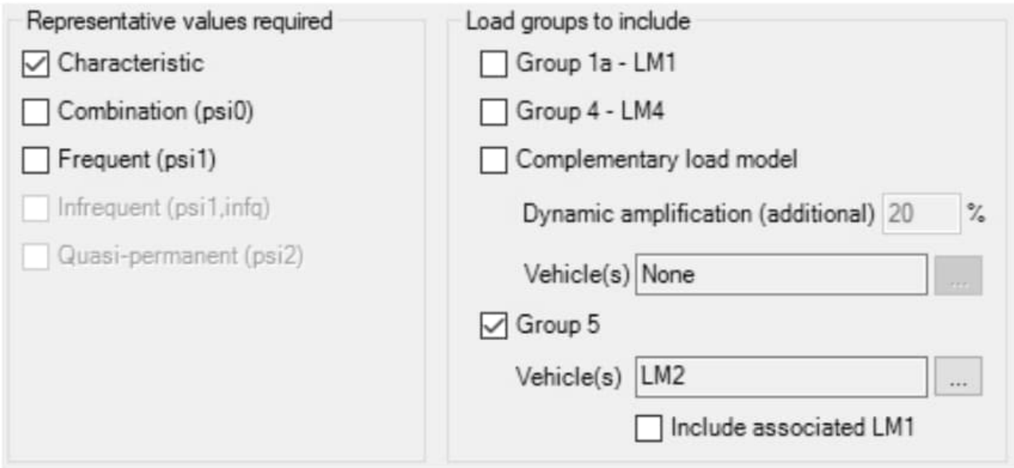
3.7.5.4 Envelope : LM 1

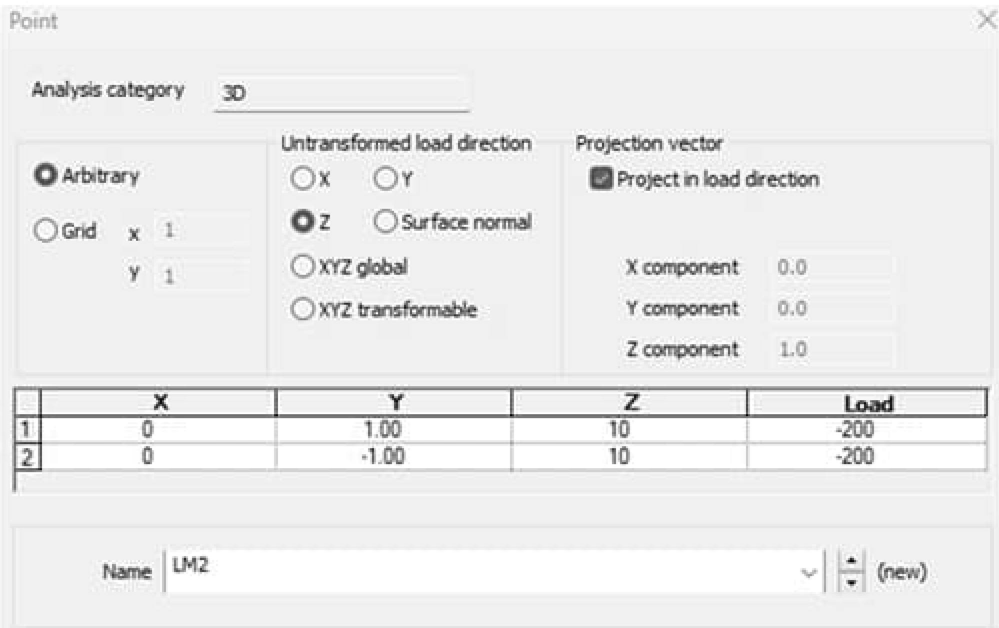
Load model 1 (LM1) defined in SS-EN 1991-2 section 4.3.2.



3.7.5.5 Envelope : LM 2

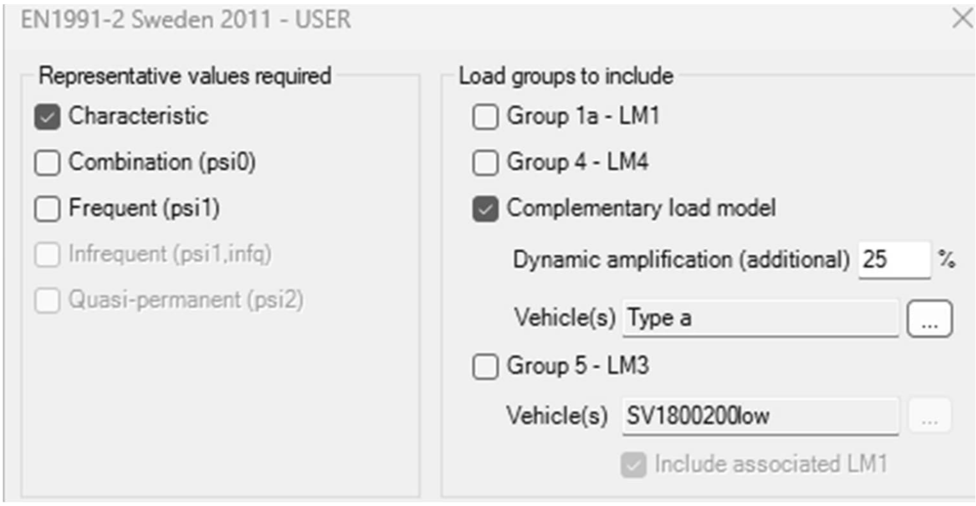
Load model 2 (LM2) defined in SS-EN 1991-2 section 4.3.3. The load is defined in Group 5 vehicle) since Group 1b is not defined in present version of software.





3.7.5.6 Envelope : EG A

EG A is defined as complementary load model with options seen below.

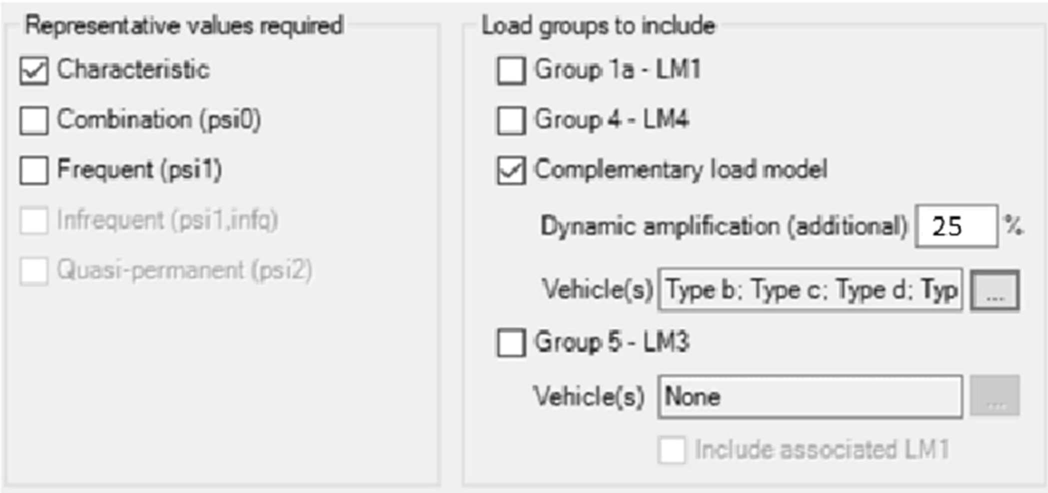


Dynamic amplification (additional): 25 %

Vehicle selection: Type a

3.7.5.7 Envelope : EG B

EG B is defined as complementary load model with options seen below.



Dynamic amplification (additional): 25 %

Vehicle selection: Type b → o

3.7.5.8 Combined traffic load (TRAFIK)

There are a total 4 different traffic loads termed LM 1, LM2, EG A and EG B.

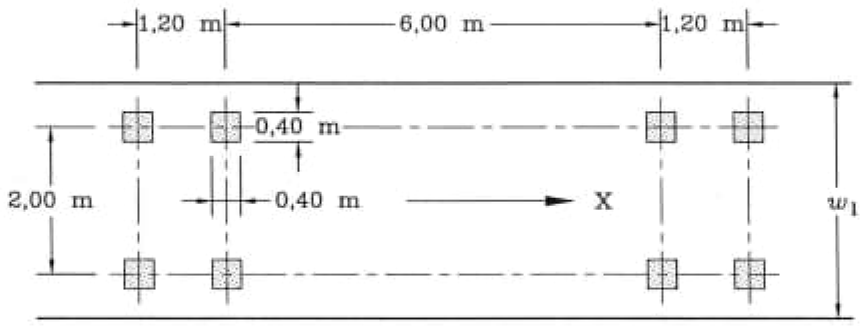
The envelope is used to identify the most onerous load effect.

Envelope TRAFIK :

Envelope
LM 1
LM 2
EG A
EG B

3.7.5.9 Fatigue model

Fatigue model 3 (UTM3) defined in SS-EN 1991-2 section 4.6.4. The load is defined in Group 5 (special vehicle) in present version of software.



Q_k = 120 kN : characteristic value including nation adaptation factors.

Traffic data according to document 1C070001 section B1:

· Reference speed: 80 km/h

· Annual average heavy traffic (120 years): 283 vehicles/day → N_{obs} = 103 300 vehicles/year.

Traffic category:
TRVINFRA-0027 table 7.1-5(h) gives traffic category 3

Reference values for the number of heavy vehicles:
According to SS-EN 1991-2 section 4.6.1 table 4.5(n), Category 3 is obtained

→ N_o
Trafikuppgifter enligt teknisk beskrivning Oxberg (15822-00-1010):
Medel ÅDT tung (120 år) = 283 fordon/dygn → N_{obs} = 103 300 fordon/år.

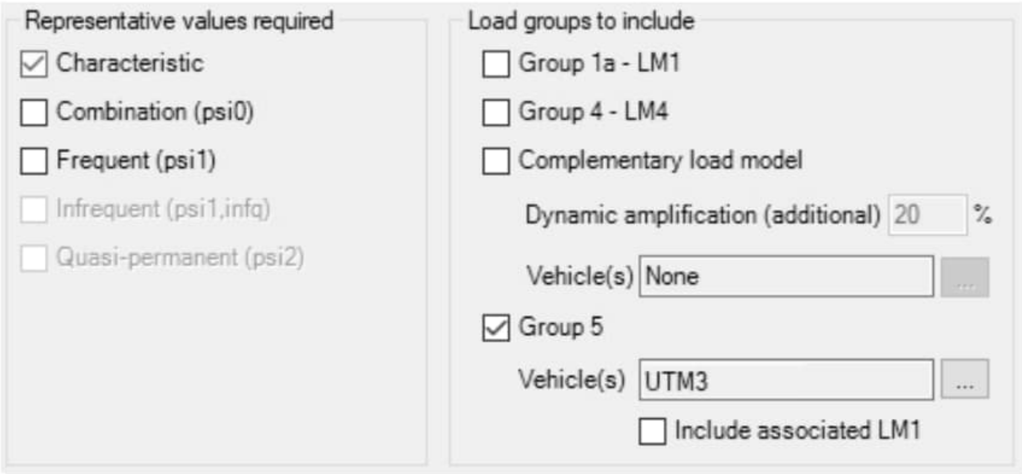
TRVINFRA-0027 tabell 7.1-5 (h) ger trafikkategori 4.

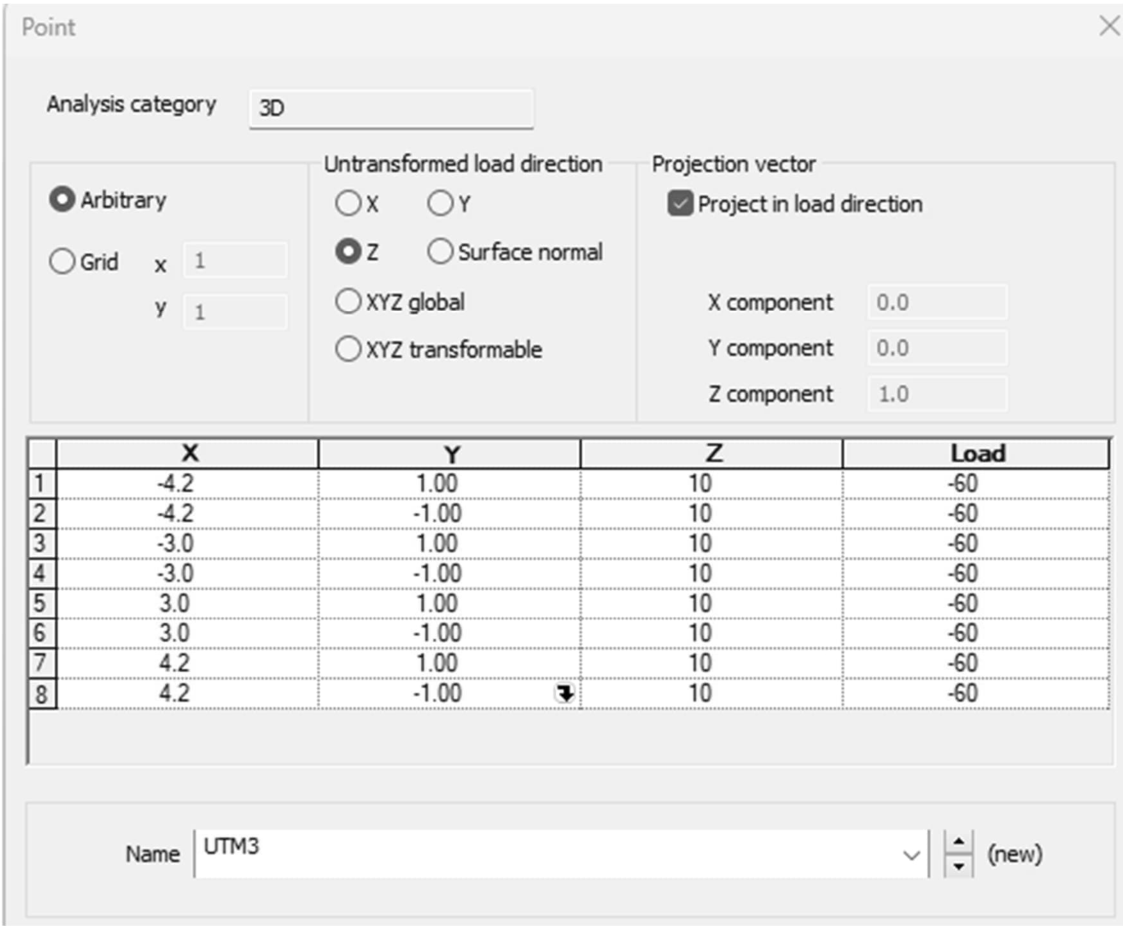
Riktvärden för antalet tunga fordon:
Enligt SS-EN 1991-2 avsnitt 4.6.1 tabell 4.5(n) erhålles för N_{obs} = 125 000 fordon/år för trafikkategori 3.

Anm.
På säker sida tillämpas N_{obs} = 125 000 fordon/år vid dimensionering.

$_{bs}$ = 125,000 vehicles/year

The load definition:
The load UTM3 is defined as a special vehicle in "load group 5."





	X	Y	Z	Load
1	-4.2	1.00	10	-60
2	-4.2	-1.00	10	-60
3	-3.0	1.00	10	-60
4	-3.0	-1.00	10	-60
5	3.0	1.00	10	-60
6	3.0	-1.00	10	-60
7	4.2	1.00	10	-60
8	4.2	-1.00	10	-60

3.8 BRAKING LOAD

Braking load is defined by SS-EN 1991-2 §4.4.1.

Load acts at level of surfacing.

L = 2.2 m + 26.0 m + 32.0 m + 26.0 m + 2.2 m = 88.4 m

Loade model LM 1 :

$$Q_{lk} = 0.6\alpha_{Q1} \cdot (2Q_{ik}) + 0.1\alpha_{q1} \cdot q_{1k} \cdot w_1 \cdot L$$

$$180kN \cdot \alpha_{Q1} \leq Q_{lk} \leq 900kN$$

$$Q_{broms} = 0.6 \cdot (2 \cdot 270kN) + 0.1 \cdot 7.2kPa \cdot 3.0m \cdot 88.4m = 324kN + 191kN = 515kN$$

Lastmodell EG B = 300 kN (see TSFS chapter 11 §2) :

Typ o is dimensioning → L_{broms} = 32.4 m (for axle loads)

$$Q_{lk} = 0.35 \cdot \sum Q_{EG\ B} + 0.1 \cdot p \cdot L_q$$

$$Q_{lk} \leq 500kN$$

$$Q_{broms} = 0.35 \cdot (0.33 + 0.89 + 1.17 + 0.83 + 0.89) \cdot B + 0.1 \cdot 5\frac{kN}{m} \cdot (88.4m - 32.4m) =$$
$$= 0.35 \cdot 4.11 \cdot 300kN + 28kN = 459kN$$

Remark
The braking force associated with LM 1 is applied on the safe side in the system calculation.

The impact of the earth pressure resisting against end-shield is neglected on the safe side.

No load on end-shield is assumed, instead load is distributed at support 2 & 3. The assumption is on safe side.

3.8.1 Load definition

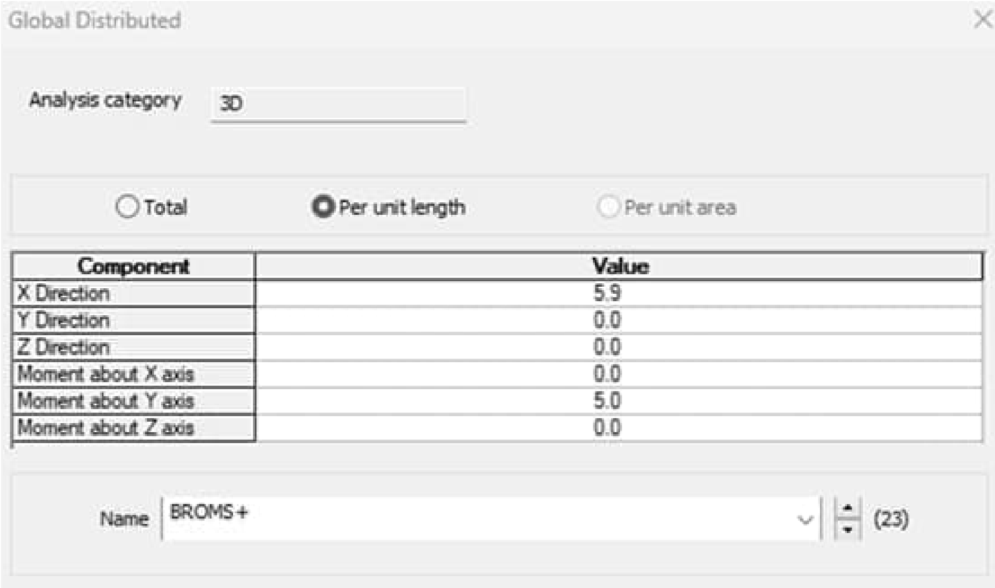
The load acts on pavement, however nodal line is located 0.85 meters below.

The braking force is considered evenly distributed over the entire bridge deck.

$$p_x = \frac{Q_{broms}}{L} = \frac{515kN}{88.4m} = 5.9\frac{kN}{m}$$

$$m_y = p_x \cdot (0.15m + t_{bel}) = 5.9\frac{kN}{m} \cdot (0.75m + 0.10m) = 5.0\frac{kNm}{m}$$

Load case : BROMS +

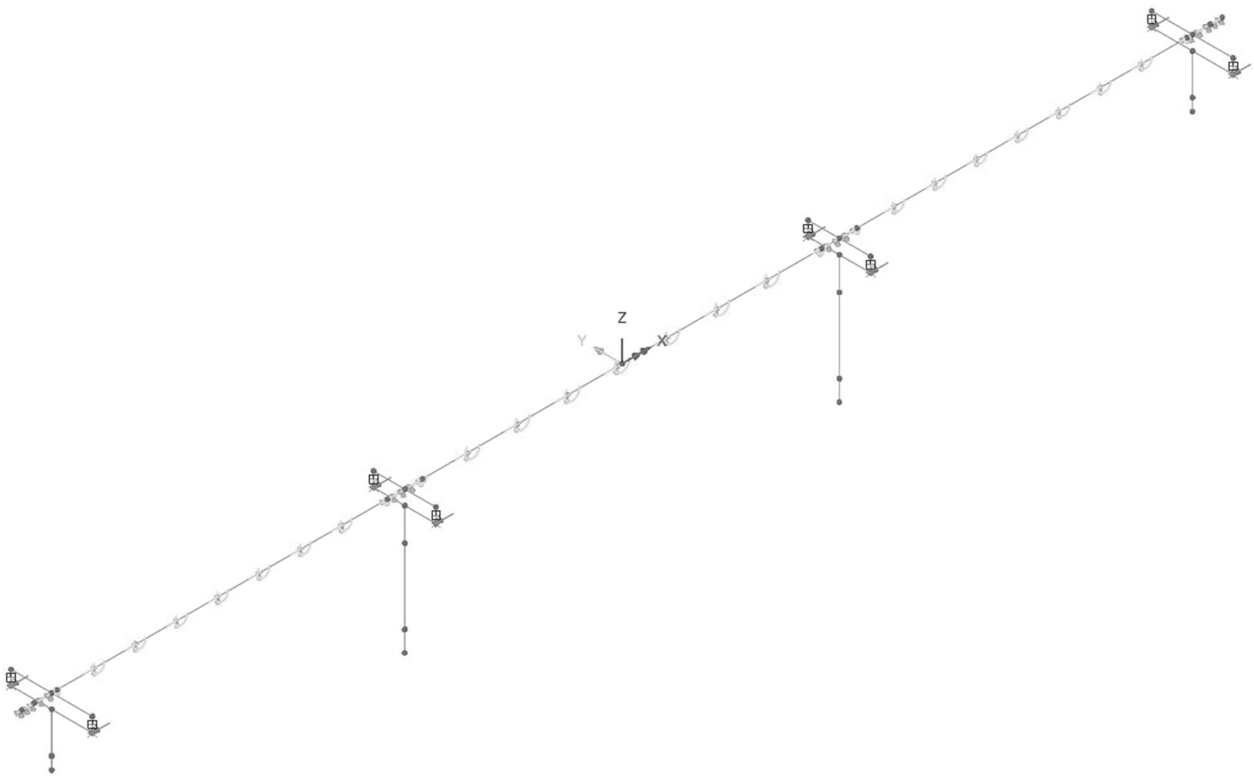

Global Distributed

Analysis category: 3D

Total / **Per unit length** / Per unit area

Component	Value
X Direction	5.9
Y Direction	0.0
Z Direction	0.0
Moment about X axis	0.0
Moment about Y axis	5.0
Moment about Z axis	0.0

Name: BROMS + (23)



Overview 3D

Loadcase : BROMS-

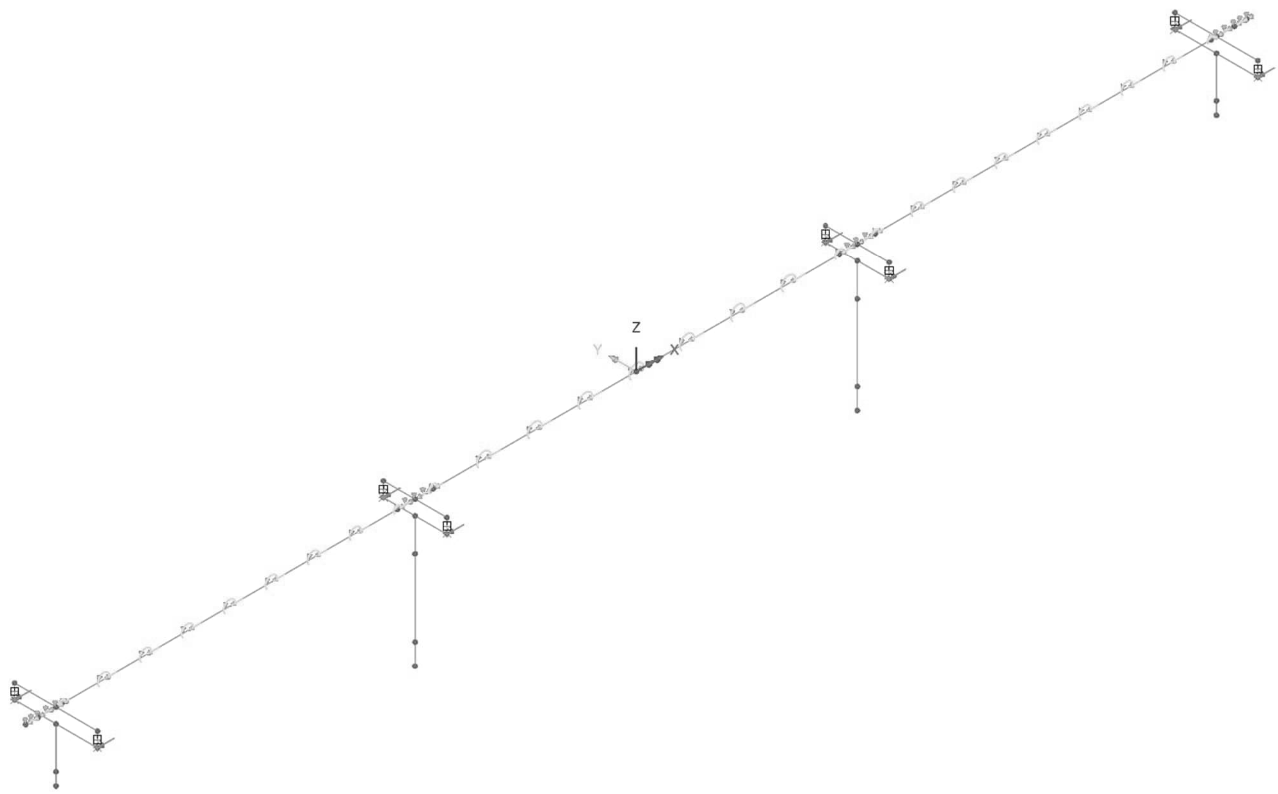
Global Distributed

Analysis category: 3D

○ Total ● Per unit length ○ Per unit area

Component	Value
X Direction	-5.9
Y Direction	0.0
Z Direction	0.0
Moment about X axis	0.0
Moment about Y axis	-5.0
Moment about Z axis	0.0

Name: BROMS- (24)



Overview 3D

3.8.2 Load combination (BROMS)

Envelope BROMS :

Load case
BROMS +
BROMS -

3.9 LATERAL FORCE

Lateral force is defined by SS-EN 1991-2 §4.4.2.

The load is orthogonal to braking force and acts due to skewed braking.

The acting load acts at the level of the pavement and evenly distributed over the load length.

Load model LM 1 :

$Q_{tk} = 0.25 Q_{lk} = 0.25 \cdot 515 kN = 130 kN$: skewed braking

Load model EG B = 300 kN (see TSFS chapter 11 §2) :

$Q_{tk} = 0.25 Q_{lk} = 0.25 \cdot 459 kN = 115 kN$: skewed braking

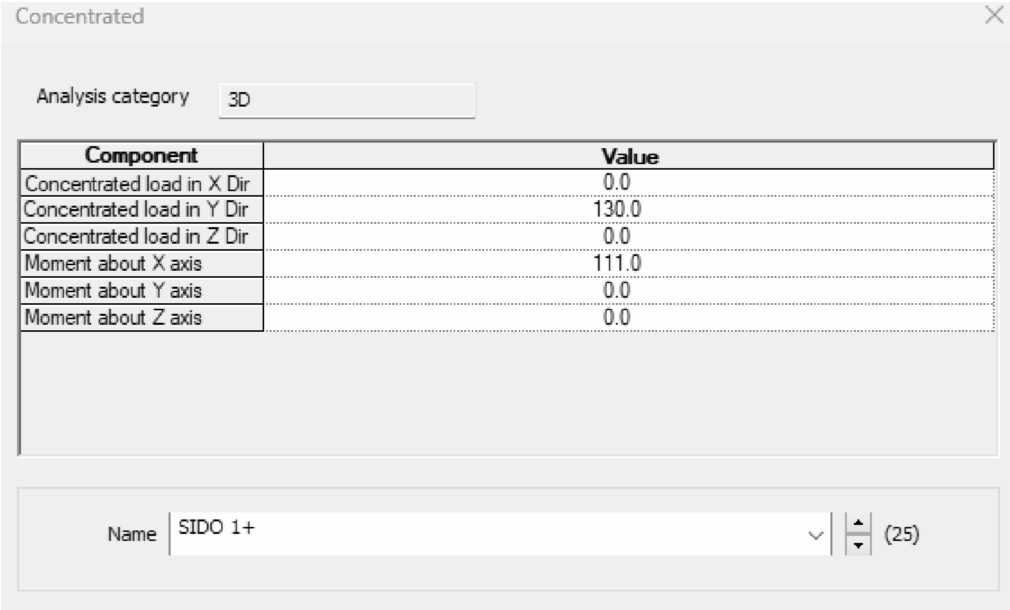
Last definition:
The load is applied as a line load along nodal line of superstructure, which is located 0.85 m below.

$P_y = 130 kN$

$M_x = P_y \cdot (0.75m + t_{bel}) = 130 kN \cdot (0.75m + 0.10m) = 111\ kNm$

Note:
The braking force associated with LM 1 is applied on the safe side in the system calculation.

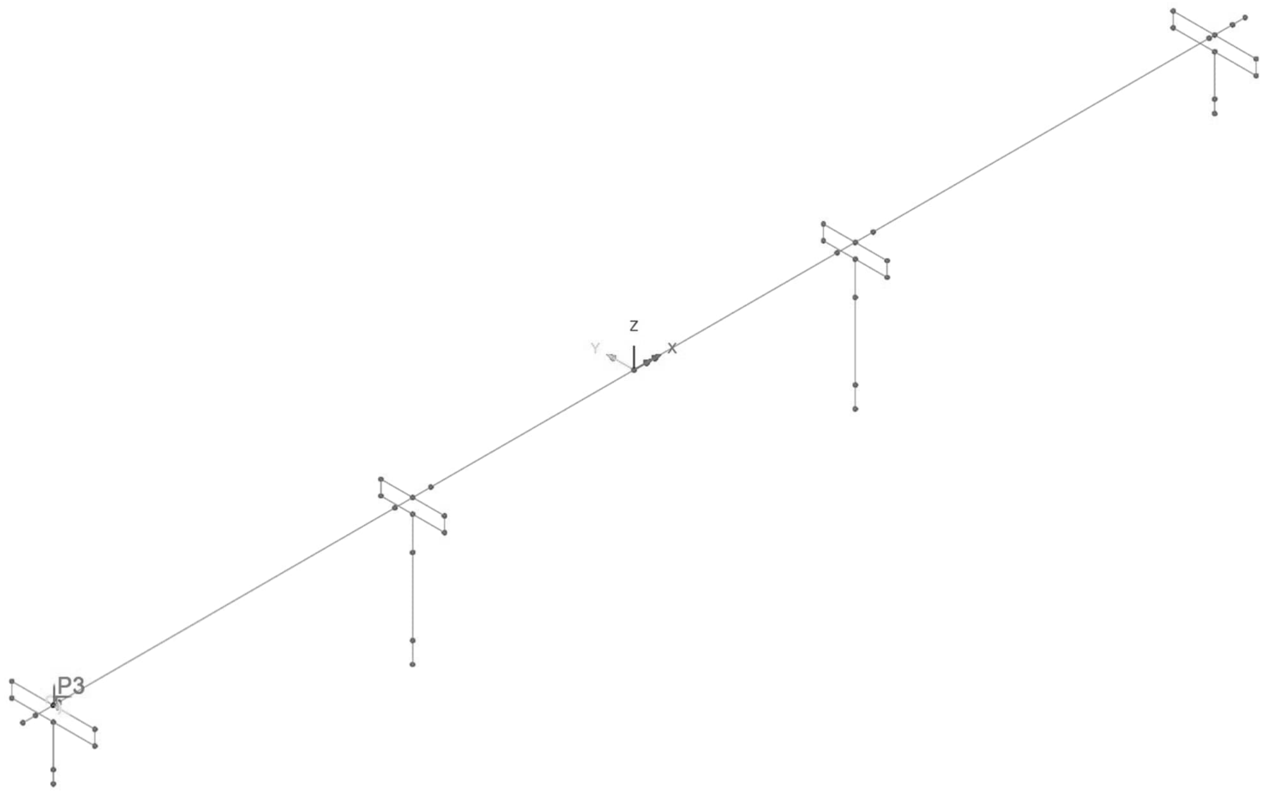
Load case : SIDO_1+


Concentrated

Analysis category: 3D

Component	Value
Concentrated load in X Dir	0.0
Concentrated load in Y Dir	130.0
Concentrated load in Z Dir	0.0
Moment about X axis	111.0
Moment about Y axis	0.0
Moment about Z axis	0.0

Name: SIDO 1+ (25)



Overview_3D

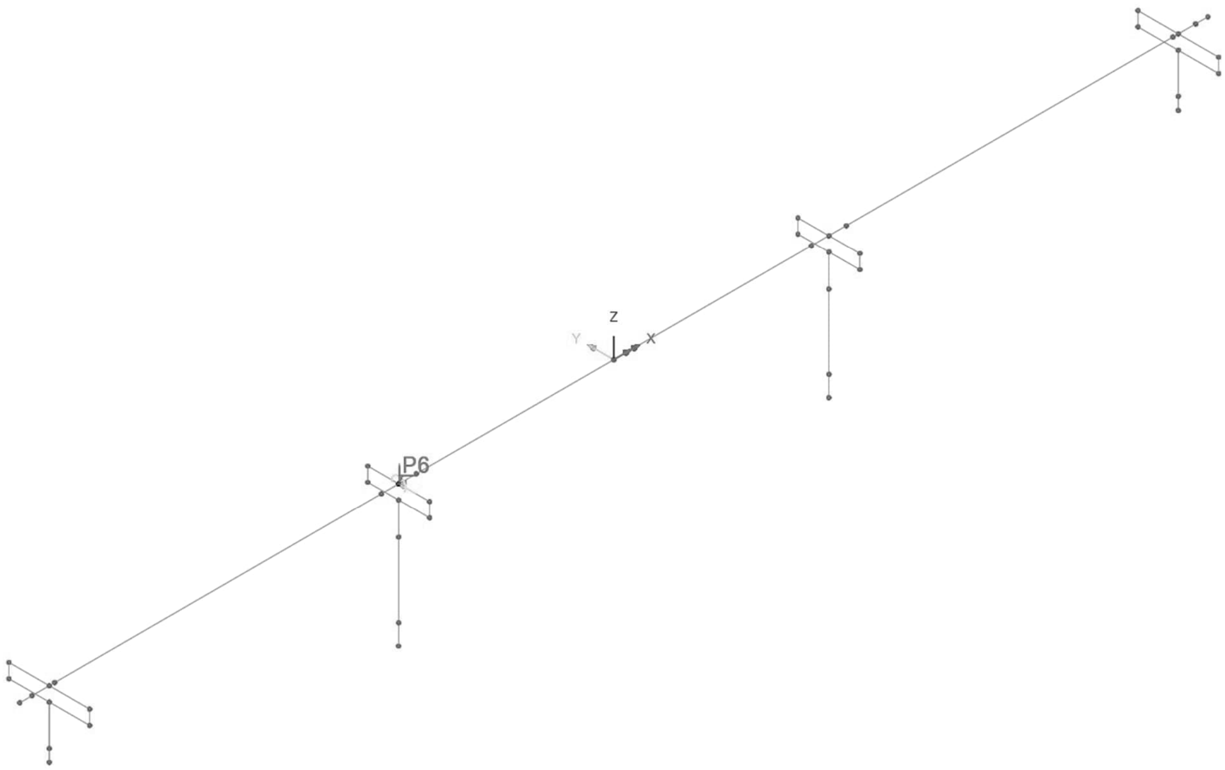
Load case : SIDO_2+

Concentrated

Analysis category: 3D

Component	Value
Concentrated load in X Dir	0.0
Concentrated load in Y Dir	130.0
Concentrated load in Z Dir	0.0
Moment about X axis	111.0
Moment about Y axis	0.0
Moment about Z axis	0.0

Name: SIDO 2+ (26)



Overview_3D

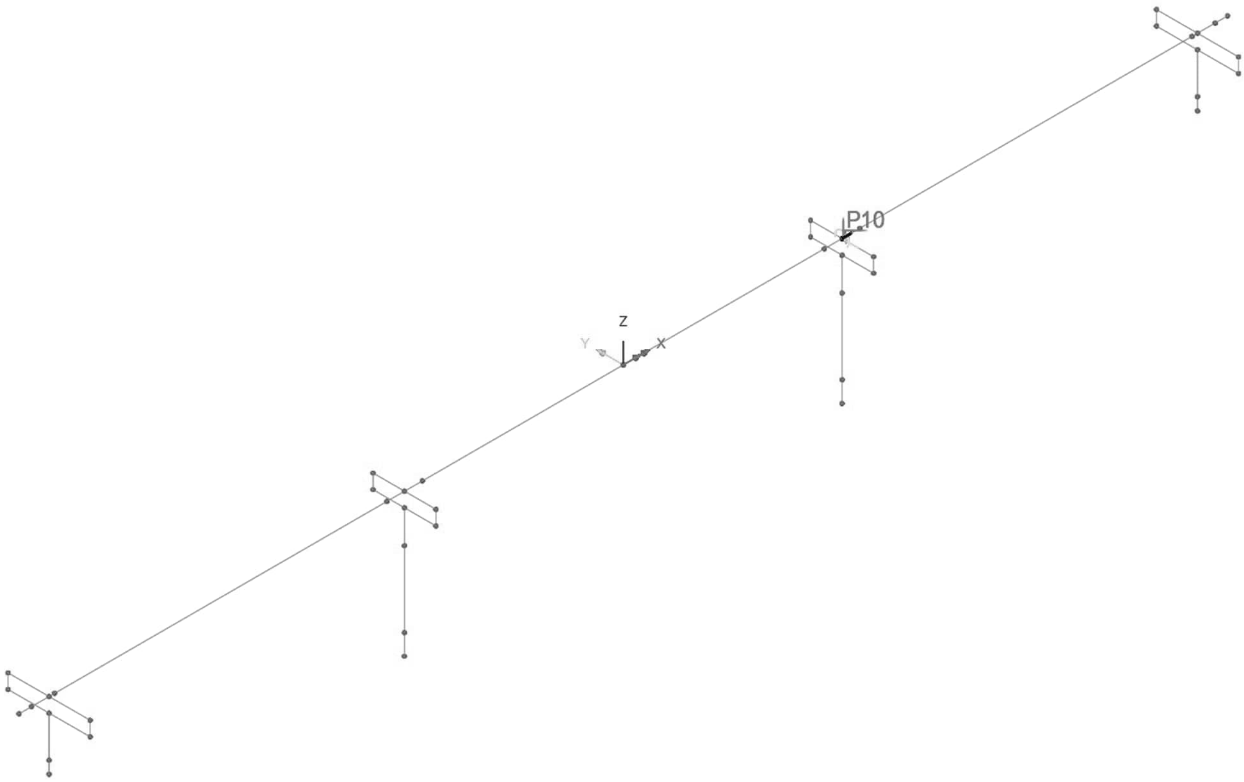
Load case : SIDO_3+

Concentrated

Analysis category: 3D

Component	Value
Concentrated load in X Dir	0.0
Concentrated load in Y Dir	130.0
Concentrated load in Z Dir	0.0
Moment about X axis	111.0
Moment about Y axis	0.0
Moment about Z axis	0.0

Name: SIDO 3+ (27)



Overview_3D

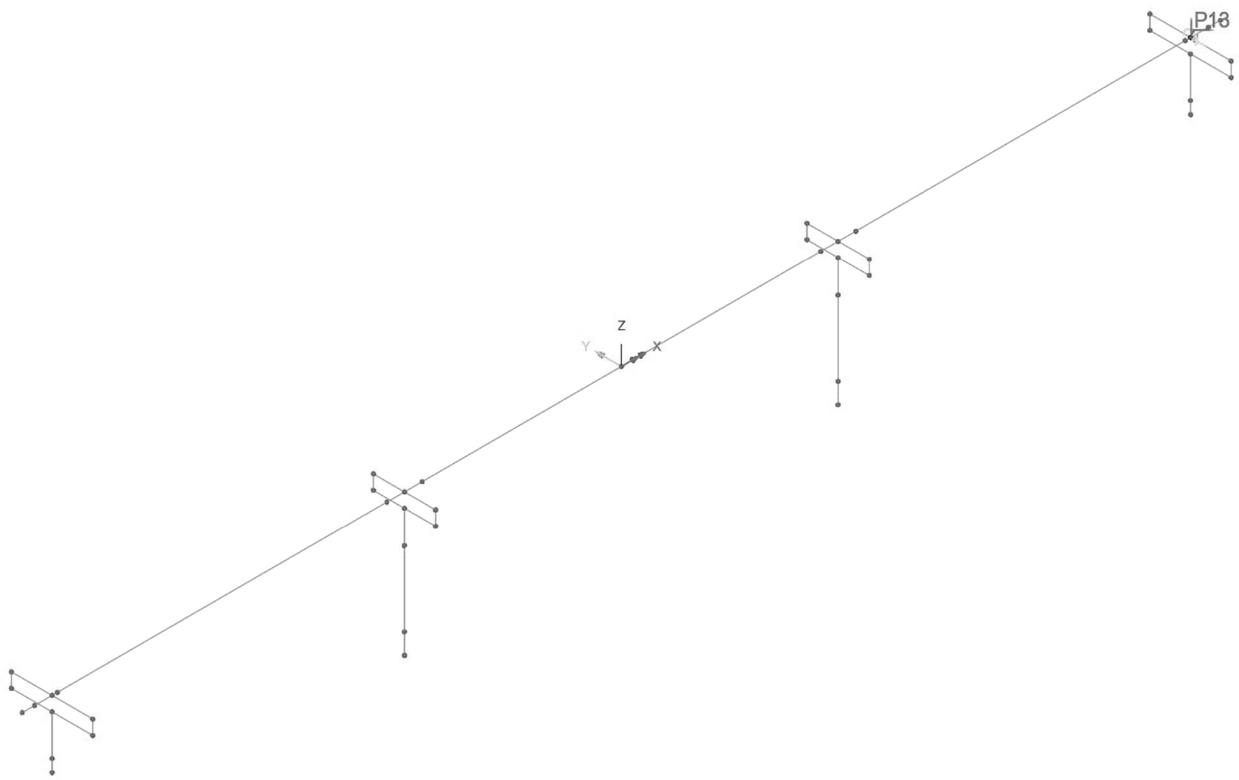
Load case : SIDO 4+

Concentrated

Analysis category: 3D

Component	Value
Concentrated load in X Dir	0.0
Concentrated load in Y Dir	130.0
Concentrated load in Z Dir	0.0
Moment about X axis	111.0
Moment about Y axis	0.0
Moment about Z axis	0.0

Name: SIDO 4+ (28)



Overview 3D

3.9.2.2 Load combination

Basic load cases :

Load case	Load	Factor
SIDO 1-	SIDO 1+	-1
SIDO 2-	SIDO 2+	-1
SIDO 3-	SIDO 3+	-1
SIDO 4-	SIDO 4+	-1

Envelope SIDO :

Load case
SIDO_1+
SIDO_2+
SIDO_3+
SIDO_4+
SIDO_1-
SIDO_2-
SIDO_3-
SIDO_4-

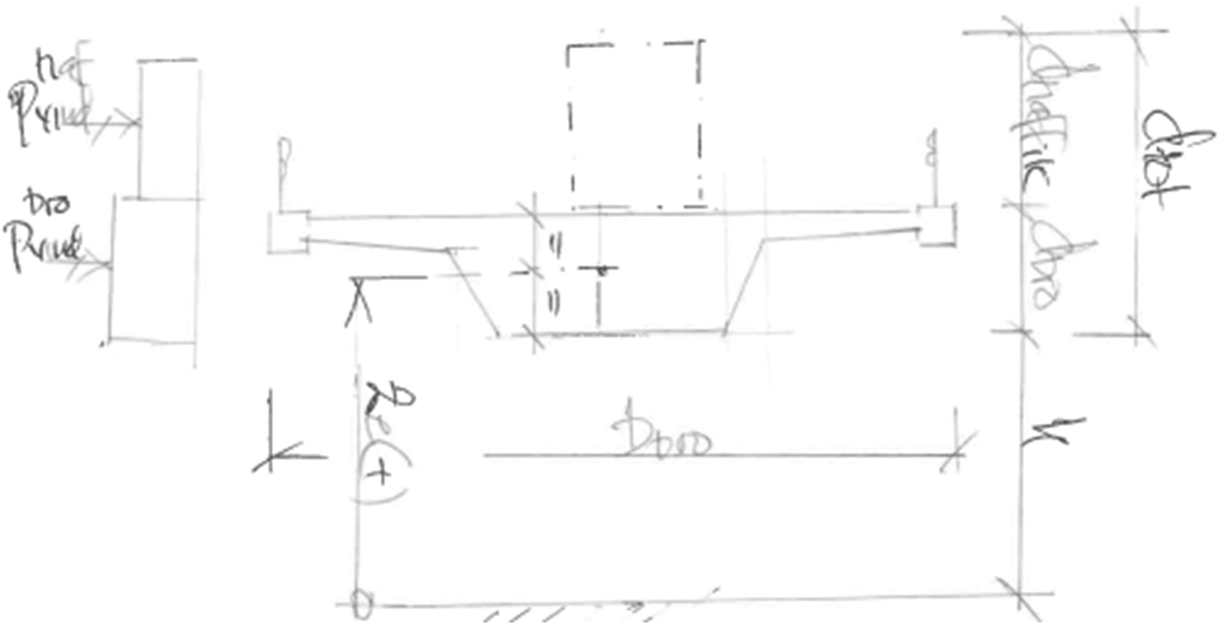
3.10 WIND LOAD

Windload on bridges is defined by EN 1991-1-4 chapter 8.

Duration coefficients (see SS-EN 1990 attachment A2 table A2.1) :

$\psi_k = 1.00$
$\psi_0 = 0.30$
$\psi_1 = 0.20$
$\psi_2 = 0$

Load intensity:



Terrain type II is applied on safe side according to SS-EN 1991-1-4 table 4.1.

Reference height z_e = 6 m : SS-EN 1991-1-4 section 8.3.1 (6)

$v_b(Oxberg; z_e = 10m; z_0 = 0.05m) = 22\frac{m}{s}$: TRVFS 2018:57 chapter 7 figure 7.1

$q_p\left(z_e = 6m, Terrängtyp\ II, v_b = 22\frac{m}{s}\right) = 0.56kPa$: TRVFS 2011:12 attachment 4 table 4.2

$q_b = \frac{1}{2} \cdot \rho \cdot v_b^2 = \frac{1}{2} \cdot 1.25\frac{kg}{m^3} \cdot \left(22\frac{m}{s}\right)^2 = 0.30\frac{kN}{m^2}$: SS-EN 1991-1-4 chapter 4.5

$c_e = \frac{q_p}{q_b} = \frac{0.56kPa}{0.30kPa} = 1.87$: SS-EN 1991-1-4 chapter 4.5

$d_{bro} = 1.5 + 0.1m = 1.6m$: construction height incl. pavement

$d_{traf} = 2.0m$: traffic height

$d_{tot} = 1.6m + 2.0m = 3.6m$

$\rightarrow \frac{b_{bro}}{d_{tot}} = \frac{8.9m}{3.6m} = 2.5$

$c_{f.x0}\left(\frac{b_{bro}}{d_{tot}} = 2.5\right) = 1.8$: SS-EN 1991-1-4 sketch 8.3

$c_{f.x} = c_{f.x0} = 1.8$: SS-EN 1991-1-4 section 8.3.1 (1)

$C = c_e \cdot c_{f.x} = 1.87 \cdot 1.8 = 3.37$

Wind load on structure (below pavement) :

$$\frac{A_{ref.x}^{bro}}{L} \equiv d_{bro}$$

$$p_{vind}^{bro} = \frac{F_w}{L} = \frac{1}{2} \cdot \rho \cdot v_b^2 \cdot C \cdot \frac{A_{ref.x}^{bro}}{L} = \frac{1}{2} \cdot 1.25 \frac{kg}{m^3} \cdot \left(22 \frac{m}{s}\right)^2 \cdot 3.37 \cdot 1.6m = 1.6 \frac{kN}{m}$$

Wind load on traffic (above pavement) :

$$\frac{A_{ref.x}^{traf}}{L} \equiv d_{traf}$$

$$p_{vind}^{traf} = \frac{F_w}{L} = \frac{1}{2} \cdot \rho \cdot v_b^2 \cdot C \cdot \frac{A_{ref.x}^{bro}}{L} = \frac{1}{2} \cdot 1.25 \frac{kg}{m^3} \cdot \left(22 \frac{m}{s}\right)^2 \cdot 3.37 \cdot 2.0m = 2.0 \frac{kN}{m}$$

Reduction of wind load on traffic:
When traffic load acts om bridge together load associated to traffic can be reduced according to SS-EN 1991-1-4 section 8.1 (4)

$$p_{vind}^{traf.red} = \psi_0 \cdot \frac{F_w}{L} = \psi_0 \cdot \frac{1}{2} \cdot \rho \cdot v_{b.0}^2 \cdot C \cdot \frac{A_{ref.x}^{bro}}{L} = 0.3 \cdot \frac{1}{2} \cdot 1.25 \frac{kg}{m^3} \cdot \left(23 \frac{m}{s}\right)^2 \cdot 3.37 \cdot 2.00m = 0.7 \frac{kN}{m}$$

Remark
This reduction is not considered on safe side thus is not applied.

3.10.1 Definition of load

Load is applied as a line load acting along each edge beam.

$p_{vind} = p_{vind}^{bro} + p_{vind}^{traf} = 1.6\frac{kN}{m} + 2.0\frac{kN}{m} = 3.6\frac{kN}{m}$

$$|p_y| = 3.6\frac{kN}{m}$$

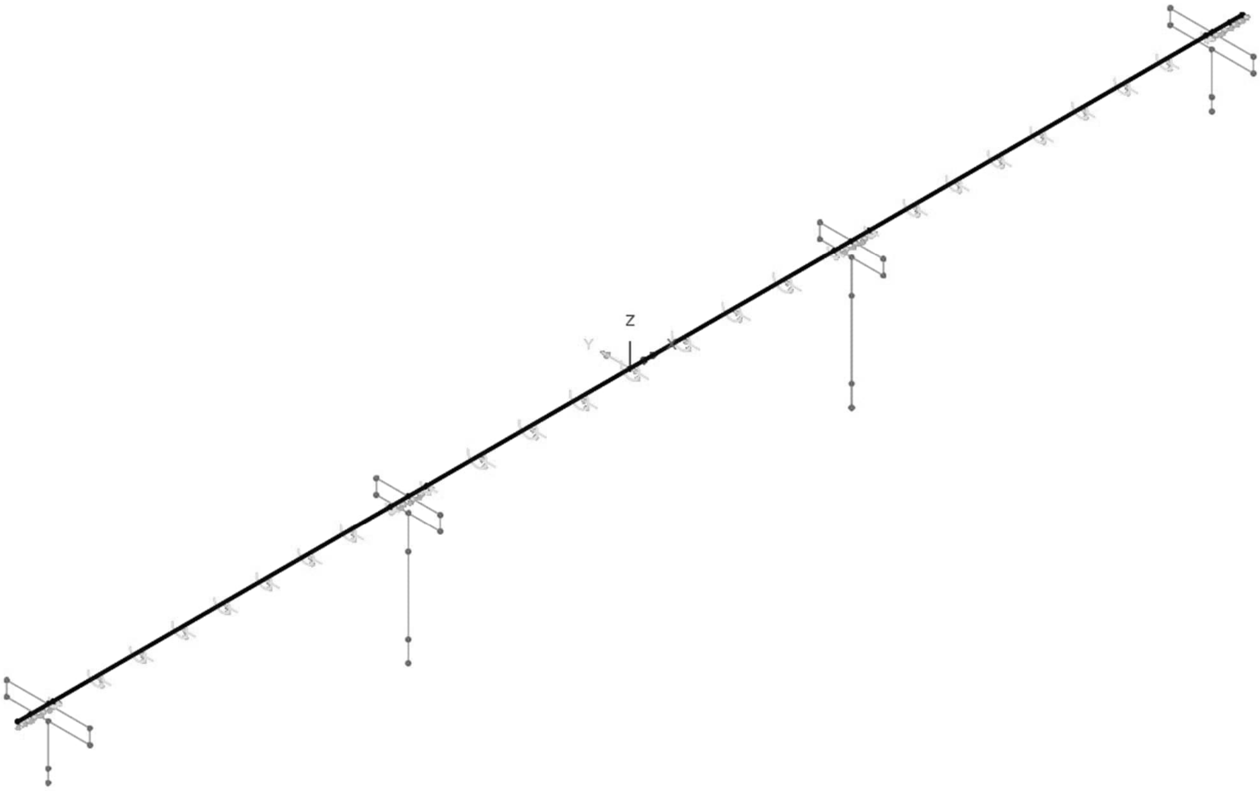
$$|m_x| = p_y \cdot \left[\frac{d_{tot} - d_{bro}}{2}\right] = 3.6\frac{kN}{m} \cdot \left[\frac{3.6m - 1.6m}{2}\right] = 3.6\frac{kNm}{m}$$

Load : VIND+

Structural loading : Global distributed

Line load in Y direction (p_y) : +3.6 $\frac{kN}{m}$

Line moment about X axis (m_x) : -3.6 $\frac{kNm}{m}$

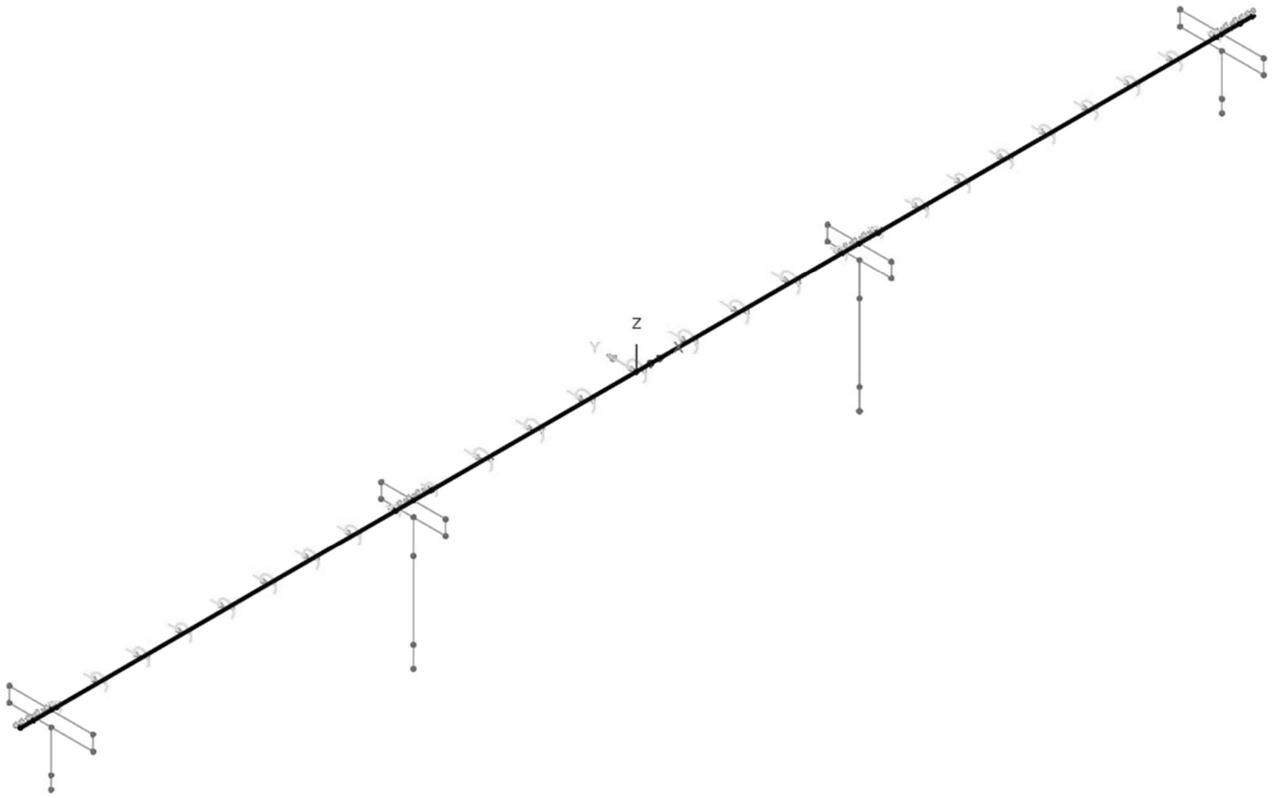


Load : VIND-

Structural loading : Global distributed

Line load in Y direction (p_y) : -3.6 $\frac{kN}{m}$

Line moment about X axis (m_x) : 3.6 $\frac{kNm}{m}$



3.10.2 Load combination

Envelope VIND :

Load case
VIND+
VIND-

3.11 SURCHARGE

TSFS chapter 11 section §8 describes load seen below.

$q_{ytlast.1} = 20kPa$: road width 6.0 m

$q_{ytlast.2} = 10kPa$: remaining width

$q_{över}(s) = K_0 \cdot q_{ytlast}$

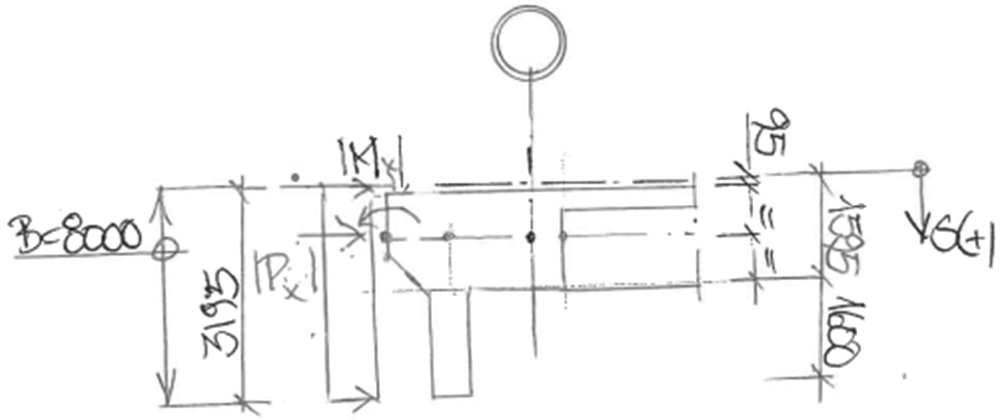
$q_{ytlast}^{b=6.0m} = 0.29 \cdot 20kPa = 6kPa$

$q_{ytlast}^{övrigt} = 0.29 \cdot 10kPa = 3kPa$

Remark
On safe side 20 kPa is assumed along entire width.

No load on end-shield is assumed, instead load is distributed at support 2 & 3. The assumption is on safe side.

3.11.1 Load abutment 1& 4



$q_{ytlast} = 6kPa$

$p_x = 6kPa \cdot 8.0 = 48\frac{kN}{m}$

$|P_x| = 48\frac{kN}{m} \cdot 3.195 = 153kN$

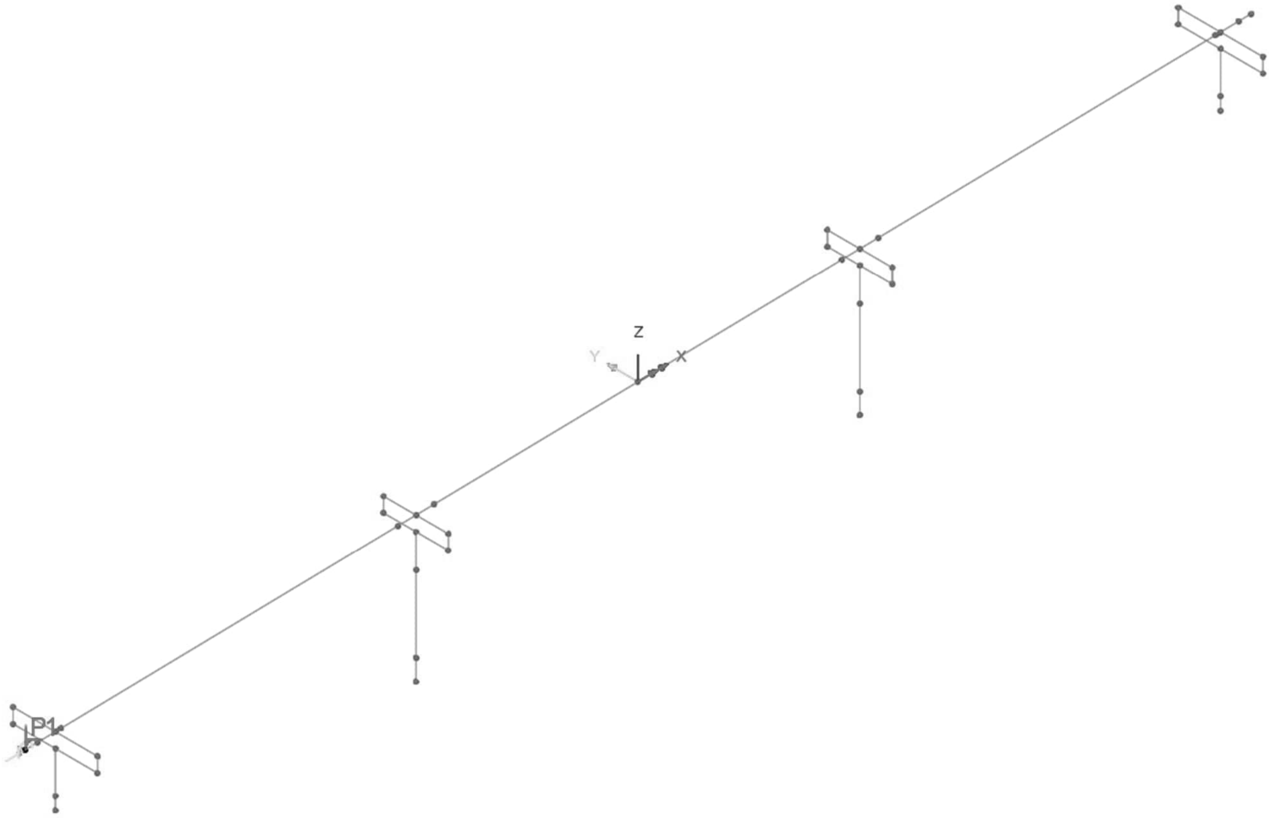
$|M_y| = 153kN \cdot \left(\frac{3.195m}{2} - 0.845m\right) = 115kNm$

Load : OVER 1:V

Structural loading : Concentrated

Concentrated load in X (P_x) : +153 kN

Moment about Y axis (M_y) : -115 kNm



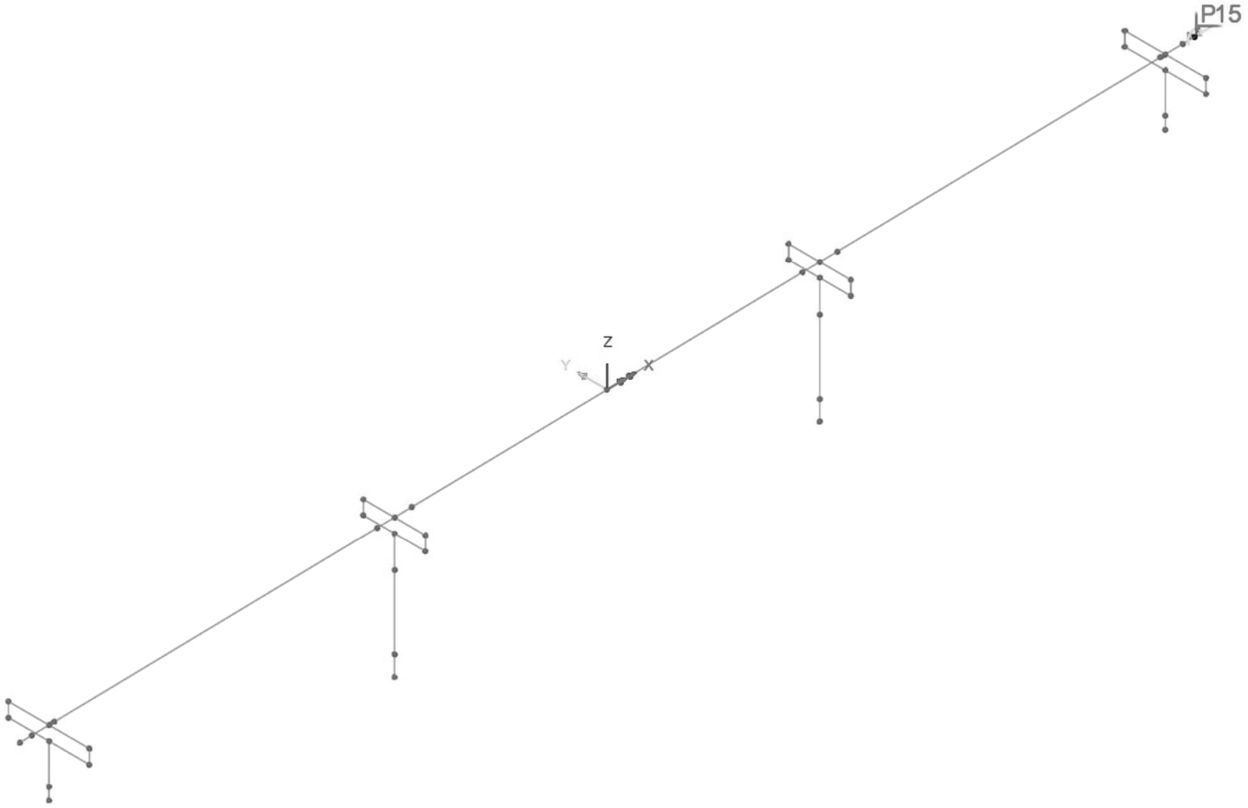
Overview

Load : OVER 1:H

Structural loading : Concentrated

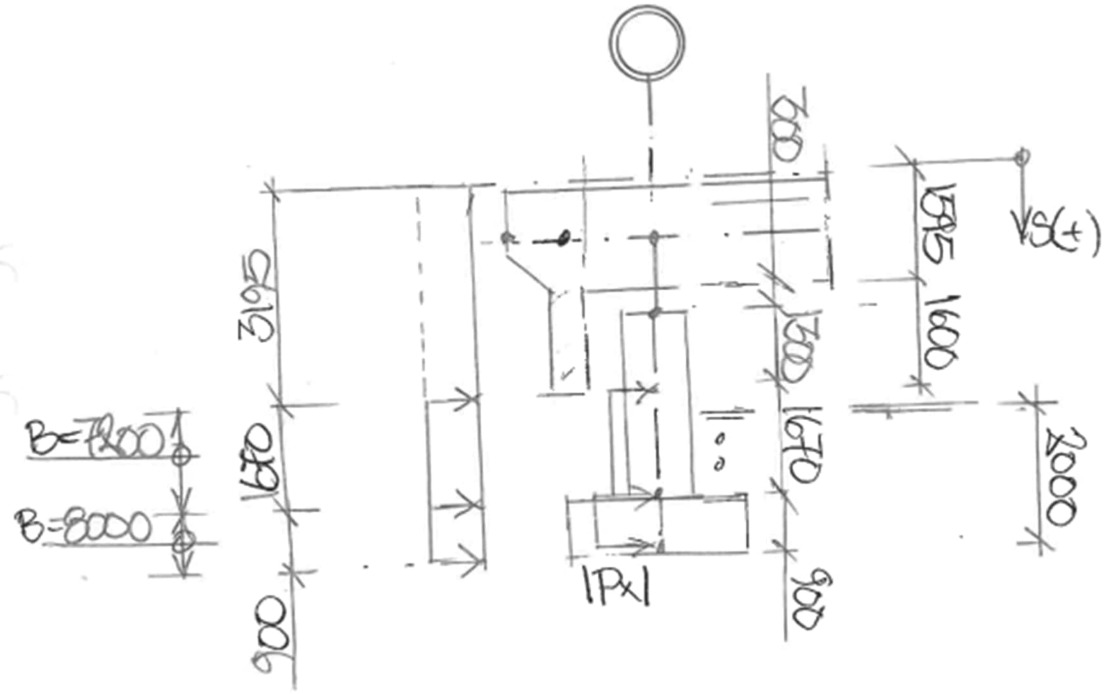
Concentrated load in X (P_x) : -153 kN

Moment about Y axis (M_y) : -115 kNm



Overview

3.11.2 Load against abutments at support 1 & 4



$q_{ytlast}(3.195m) = 6kPa$

$$\rightarrow |p_x(B = 7.2m)| = 6kPa \cdot 7.2m = 42\frac{kN}{m}$$

$q_{ytlast}(4.865m) = 6kPa$

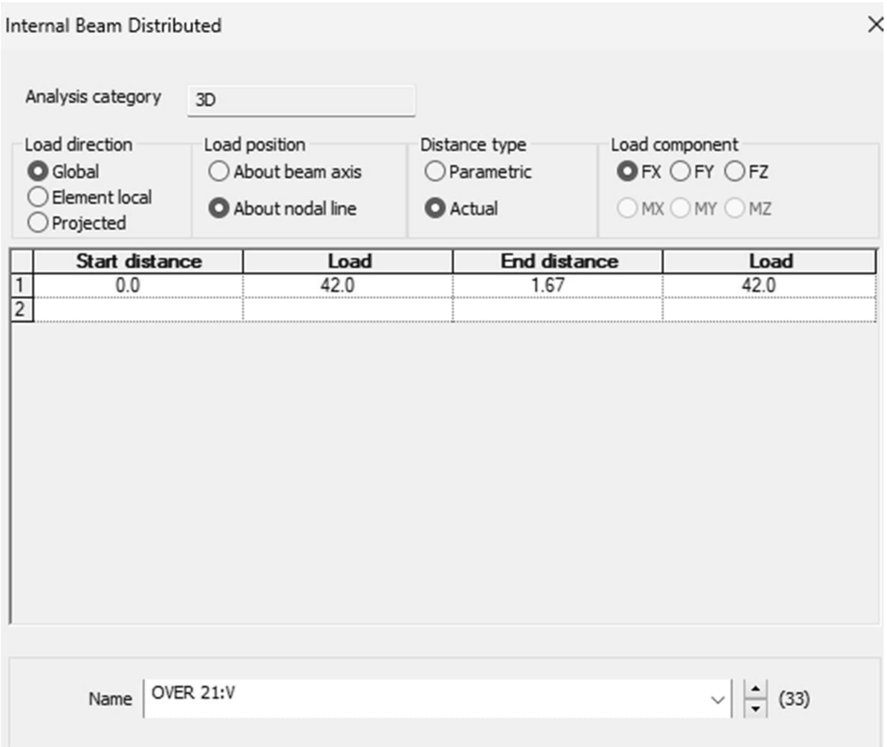
$$\rightarrow |p_x(B = 7.2m)| = 6kPa \cdot 7.2m = 42\frac{kN}{m}$$

$$|p_x(B = 8.0m)| = 6kPa \cdot 8.0m = 48\frac{kN}{m}$$

$q_{ytlast}(5.665m) = 6kPa$

$$\rightarrow |p_x(B = 8.0m)| = 6kPa \cdot 8.0m = 48\frac{kN}{m}$$

Load : OVER21:V



Internal Beam Distributed

Analysis category: 3D

Load direction: (•) Global ( ) Element local ( ) Projected

Load position: ( ) About beam axis (•) About nodal line

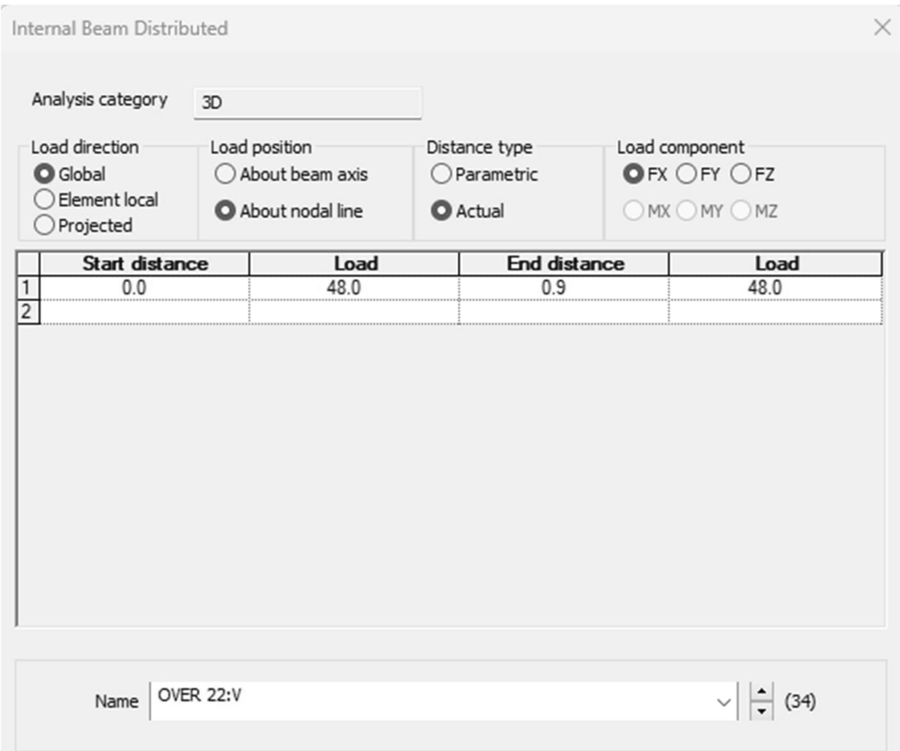
Distance type: ( ) Parametric (•) Actual

Load component: (•) FX ( ) FY ( ) FZ ( ) MX ( ) MY ( ) MZ

	Start distance	Load	End distance	Load
1	0.0	42.0	1.67	42.0
2				

Name: OVER 21:V (33)

Load : OVER22:V



Internal Beam Distributed

Analysis category: 3D

Load direction: (•) Global ( ) Element local ( ) Projected

Load position: ( ) About beam axis (•) About nodal line

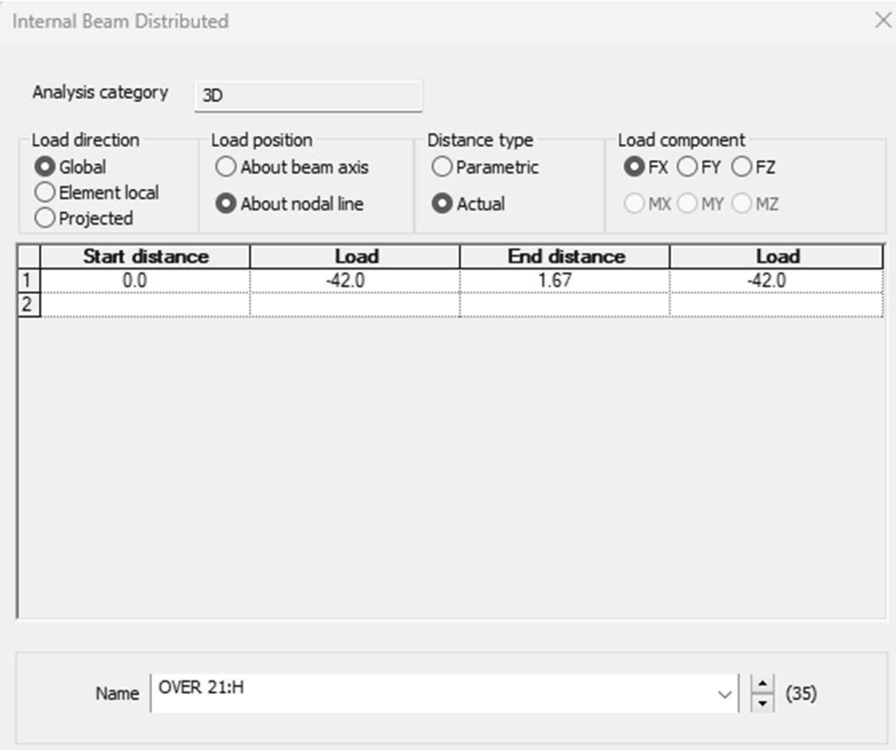
Distance type: ( ) Parametric (•) Actual

Load component: (•) FX ( ) FY ( ) FZ ( ) MX ( ) MY ( ) MZ

	Start distance	Load	End distance	Load
1	0.0	48.0	0.9	48.0
2				

Name: OVER 22:V (34)

Load : OVER21:H


Internal Beam Distributed

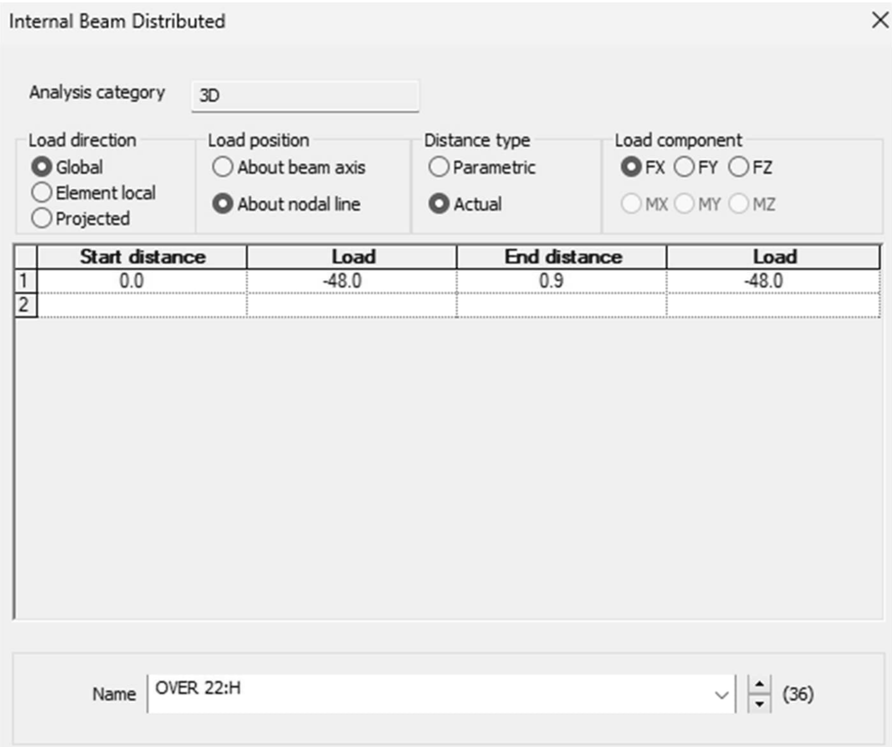
Analysis category: 3D

Load direction: (•) Global ( ) Element local ( ) Projected
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual
Load component: (•) FX ( ) FY ( ) FZ ( ) MX ( ) MY ( ) MZ

	Start distance	Load	End distance	Load
1	0.0	-42.0	1.67	-42.0
2				

Name: OVER 21:H (35)

Load : OVER22:H


Internal Beam Distributed

Analysis category: 3D

Load direction: (•) Global ( ) Element local ( ) Projected
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual
Load component: (•) FX ( ) FY ( ) FZ ( ) MX ( ) MY ( ) MZ

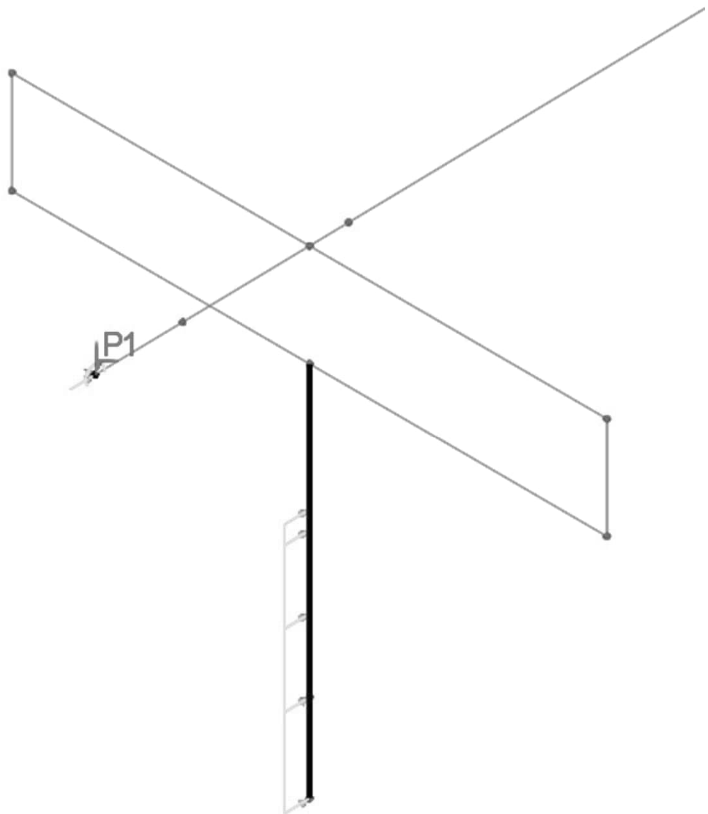
	Start distance	Load	End distance	Load
1	0.0	-48.0	0.9	-48.0
2				

Name: OVER 22:H (36)

3.11.4 Load combination

Basic loadcombination OVER:V :

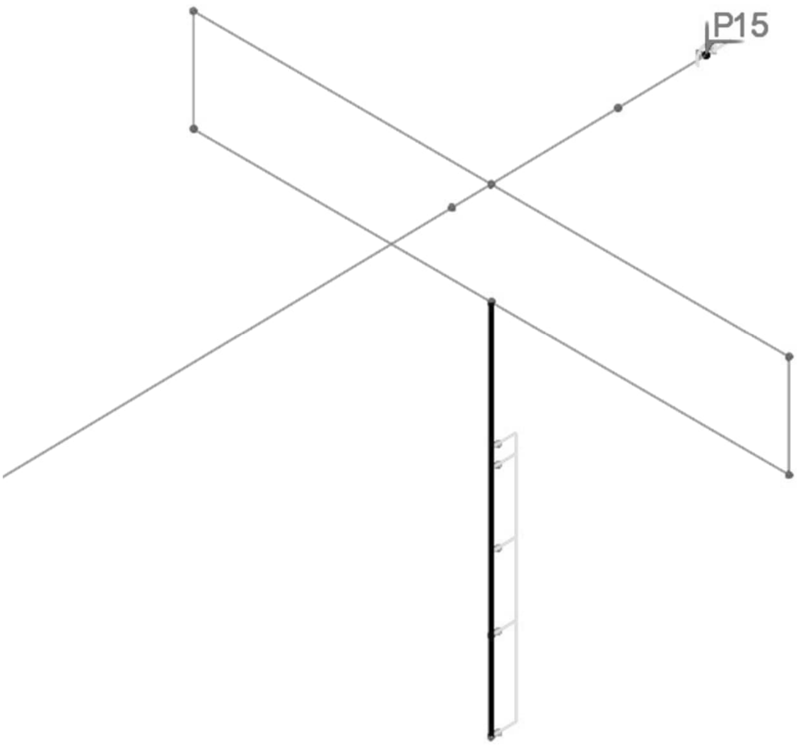
Loadcase	Factor
OVER 1:V	1
OVER 21:V	1
OVER 22:V	1



Overview 3D
Abutement 1

Basic loadcombination OVER:H :

Loadcase	Factor
OVER 1:H	1
OVER 21:V	1
OVER 22:H	1



Overview 3D
Abutement 4

Load combination smart OVER :

Loadcase	Permanent factor	Variable factor
OVER:V	0	1
OVER:H	0	1

3.12 TEMPERATURE

Temperature effect bridges according to TSFS section B.3.2.5 and EN 1991-1-5 chapter 6.

Effect in service state see SS-EN 1992-1-1 §2.3.1.2. If used then apply effect of gradual cracking according to SS-EN 1992-1-1 §5.4(3).

Effect in ultimate state is not required according to SS-EN 1992-1-1 §2.3.1.2. If used apply reduced stiffness according to SS-EN 1992-1-1 §5.4(3).

Casting temperature, T_{mont} = +10° C : EN 1991-1-5A.1(3)

Expansion coefficient, $\alpha = 12 \cdot 10^{-6}$

Concrete beam ⇒ type 3

Location : Oxberg

$T_{max} = +34°C$: TSFS 2018:57 chapter 8 sketch 8.1
$T_{min} = -44°C$: TSFS 2018:57 chapter 8 sketch 8.2

Duration coefficients :

Coefficients according to SS-EN 1990/A1 table A2.3

$\psi_0 = 0.60$
$\psi_1 = 0.60$
$\psi_2 = 0.50$

3.12.1 Even temperature over entire bridge (JTEMP)

Even temperature over entire bridge according to EN 1991-1-5 section 6.1.3.3. This temperature change is seasonal.

Uniform temperature change across the entire bridge is given by EN 1991-1-5, section 6.1.3.3. This temperature change is seasonal and primarily causes translation from the bridge's movement center towards the respective supports. This movement is considered to give rise to increased earth pressure due to the movement.

Function according to SS EN 1991-1-5 sketch 6.1 (bridge type 3) :

$$T_e(T) = \mathrm{linterp}\left[(-50 \;\; 0 \;\; 30 \;\; 50)^T \cdot °C, (-42 \;\; 7 \;\; 32 \;\; 52)^T \cdot °C, T\right]$$

$$T_{e.max} = T_e\left(T_{max}\right) = 36\,°C$$

$$T_{e.min} = T_e\left(T_{min}\right) = -36\,°C$$

$$T^+ = T_{e.max} - T_0 = +36℃ - 10℃ = +26℃$$

$$T^- = T_{e.min} - T_0 = -36℃ - 10℃ = -46℃$$

Load : JTEMP+

Structural loading : Temperature

Final temperature : +26C

Initial temperature : ±0 C

Loadcase : JTEMP+

Load : JTEMP-

Structural loading : Temperature

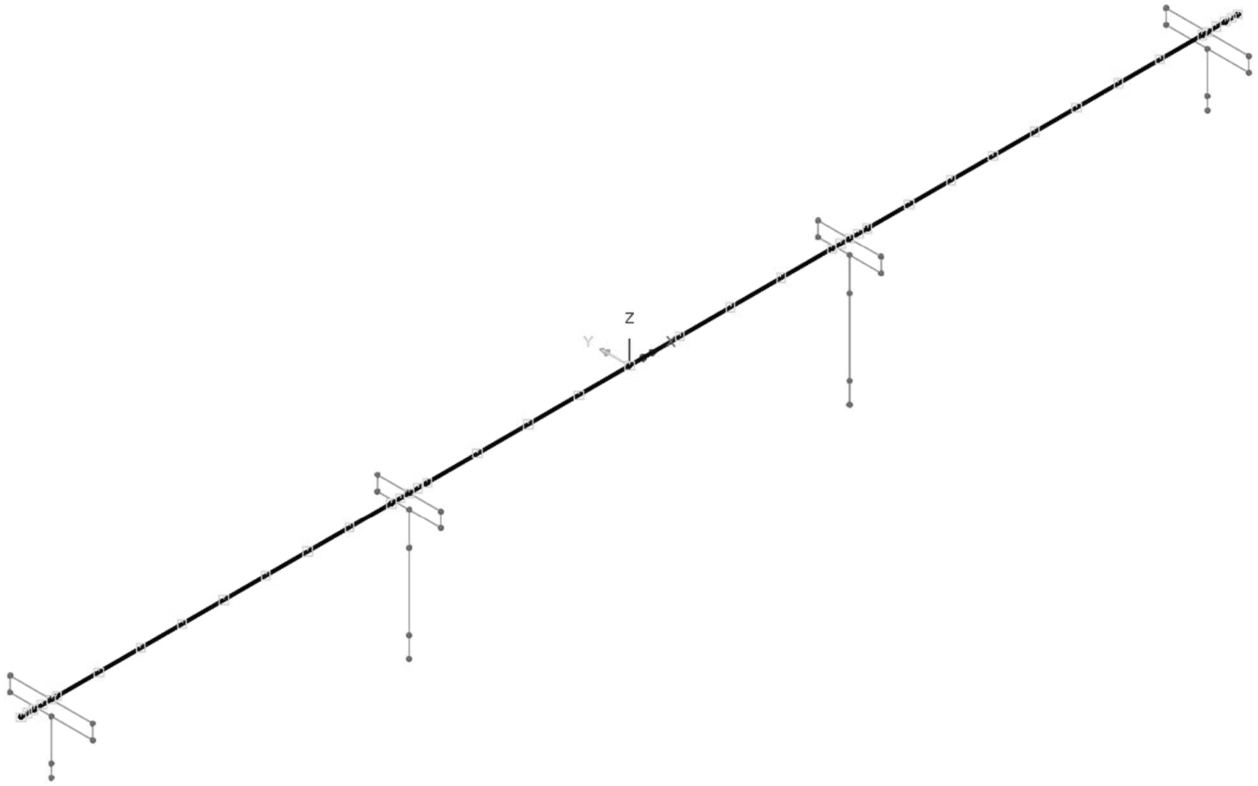
Final temperature : -46C

Initial temperature : ±0 C

Loadcase : JTEMP-

Envelope JTEMP :

Loadcase
JTEMP+
JTEMP-



Overview 3D

3.12.2 Increased earth pressure due to movement (DELTA-P)

This section is used to ensure that movements for Δq(s) do not exceed the limit for passive earth pressure

The increased earth pressure caused by the movement of end-shield.

$$v_t = (T^+ - T^-) \cdot \alpha \cdot \frac{L_{bro}}{2} = (26℃ + 46℃) \cdot 1.2 \cdot 10^{-5} \cdot \frac{88400mm}{2} = 38mm$$

Recommendation TRV

Passive earth pressure is “recommended” by TRVINFRA-00227, section 7.2.1.1.2.1.3 :

$$\sigma_p \rightarrow \frac{v_p}{h} = 0.5\%$$

Passive earth pressure arises since $v_p = h \cdot 0.5\% = 3200mm \cdot 0.5\% = 16$ mm $\ll v_t = 38mm$.

Remark

This recommendation is a lot less sophisticated than recommendation according to EC is considered, even so it is applied.

SS-EN 1990 section 6.1 (2) and TRVINFRA 00227 section 7.2.8.1.2 states temperature movement and ice load cannot physically act at same time. In design this assumption is made.

<u>Recommendation EC</u>

Passive earth pressure is increased according to SS-EN 1997-1, section C.3. During this check, "fast jord" and "väggens rörelsesätt typ b" is applied for table C.2:

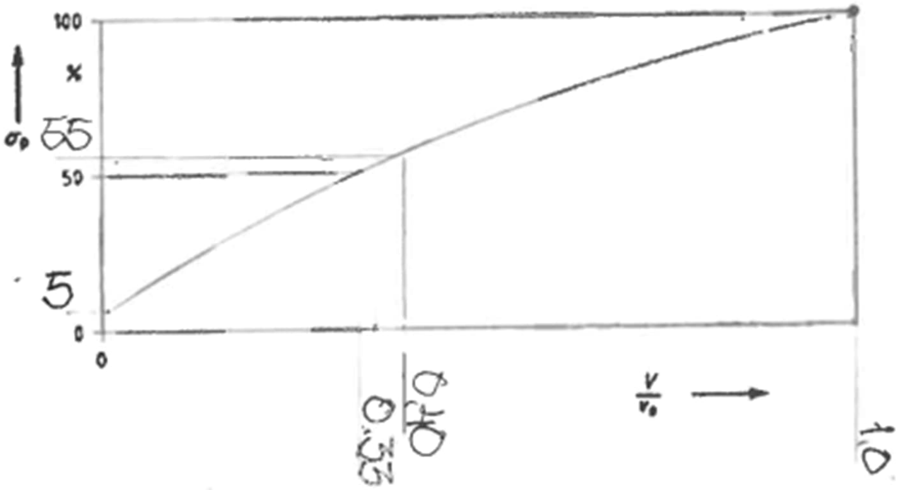
$$0.5\sigma_p \rightarrow \frac{v}{h} = 1\%$$

$$\sigma_p \rightarrow \frac{v_p}{h} = 3\% \rightarrow 6\%$$ but 3 % is chosen on safe side !

Passive earth pressure does not arise since $v_p = h \cdot 3\% = 3200mm \cdot 3\% = 96$ mm > $v_t = 38mm$.

$$\frac{K_0}{K_p} = \frac{0.29}{5.82} = 5\%$$

$$\frac{v(0.5\sigma_p)}{v(\sigma_p)} = \frac{1\% \cdot h}{3\% \cdot h} = 0.33$$

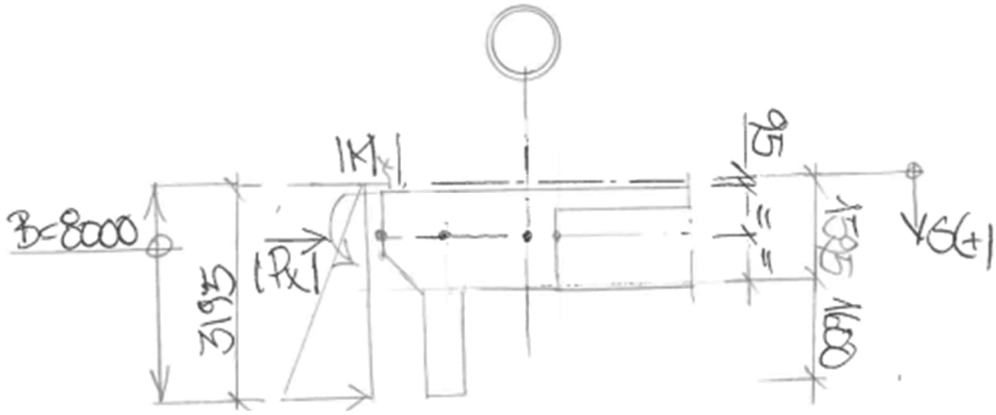


$$\frac{v_t}{v_p} = \frac{38mm}{96mm} = 0.40 \rightarrow \Delta p = 0.55 \cdot (p_p - p_0)$$

<u>Remark</u>

EC recommendation only results in 55 % of passive earth pressure, thus a lot less than TRV recommendation. Despite this it is not applied in design.

Passive earth pressure



$$\frac{v_t}{v_p} = \frac{38mm}{16mm} = 2.4 > 1.0 \rightarrow \Delta p = 1.0 \cdot (p_p - p_0)$$

$P_x^{vilo} = 236kN$: see page A3:15

$M_y^{vilo} = 303kNm$: see page A3:15

$$\rightarrow P_x^{passiv} = \frac{K_p}{K_0} \cdot P_x^{vilo} = \frac{5.82}{0.29} \cdot 236kN = 4736kN$$

$$P_x^{temp} = 1.0 \cdot (P_x^{passiv} - P_x^{vilo}) = 1.0 \cdot (4736kN - 236kN) = 4500kN$$

$$M_y^{temp} = P_x^{temp} \cdot \left(\frac{2 \cdot 3.195m}{3} - 0.845m\right) = 5783kNm$$

Note:
No reduction is made considering creep or cracking, as this is not an internal constraint load. This applies to both ultimate limit state (ULS) and serviceability limit state (SLS).

Load : DELTA-P:V

Structural loading : Concentrated

Concentrated load in X (P_x) : +4500kN

Moment about Y axis (M_y) : -5783 kNm

Load : DELTA-P:H

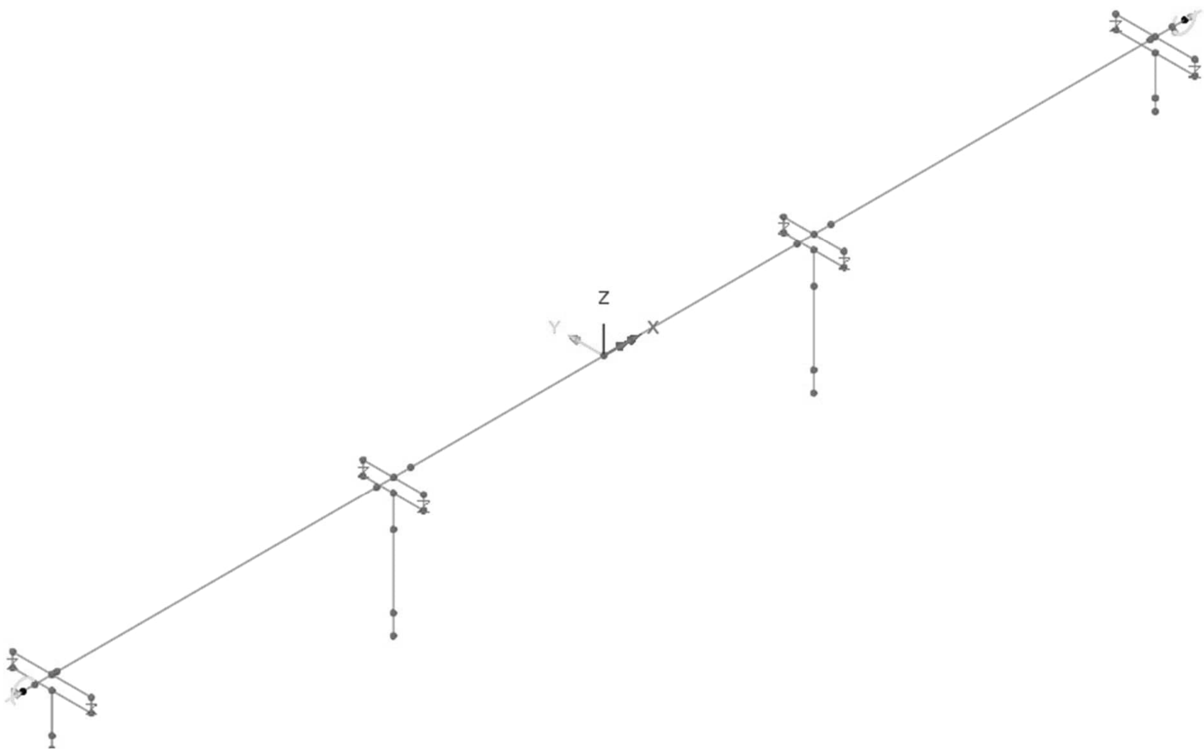
Structural loading : Concentrated

Concentrated load in X (P_x) : -4500kN

Moment about Y axis (M_y) : +5783 kNm

Loadcase : DELTA-P

Load: DELTA-P:V
Load: DELTA-P:H



Overview

3.12.3 Uneven temperature of entire cross section (OJTEMP1)

Determined according to EN 1991-1-5 § 6.1.4.1. When assessing the impact, a coating with a thickness of 110 mm is applied on the safe side.

$$k_{1.sur}(t = 100mm) = 0.7$$

$$k_{2.sur}(t = 100mm) = 1.0$$

$\Delta T_{max} = +15°C \cdot k_{1.sur} = +11°C$: : upper surface warmer

$\Delta T_{min} = -8°C \cdot k_{2.sur} = -8°C$: : lower surface warmer

The occurring temperature change ΔT refers to the linear difference between the temperature at the top and bottom of the bridge deck slab.

Uneven temperature is indicated as a temperature gradient $\frac{\delta T}{\delta Z}$ when defined in FEM program.

$\frac{\delta T^{max}}{\delta Z} = \frac{+11°C}{1.50m} = +7\frac{°C}{m}$: maximal temperature gradient

$\frac{\delta T^{min}}{\delta Z} = \frac{-8°C}{1.50m} = -5\frac{°C}{m}$: minimal temperature gradient

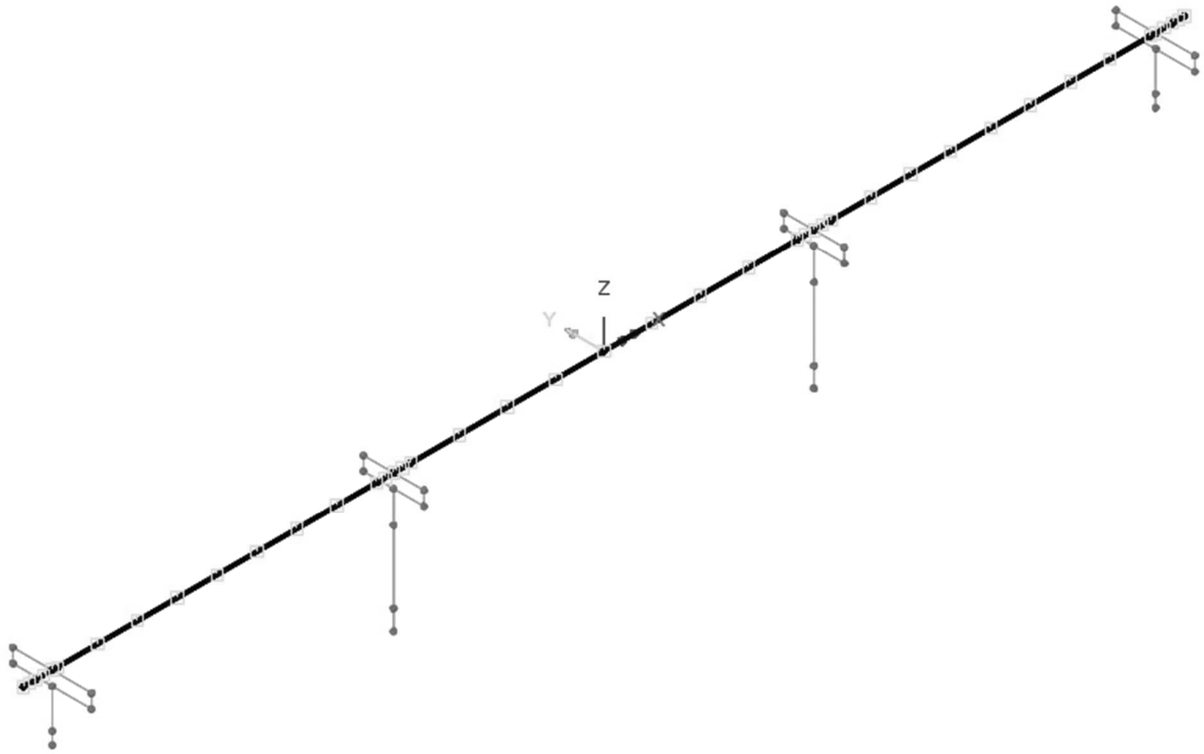
Loadcase : OJTEMP 1+

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : +7 °C/m

Initial Z temperature gradient : 0°C/m



Overview 3D

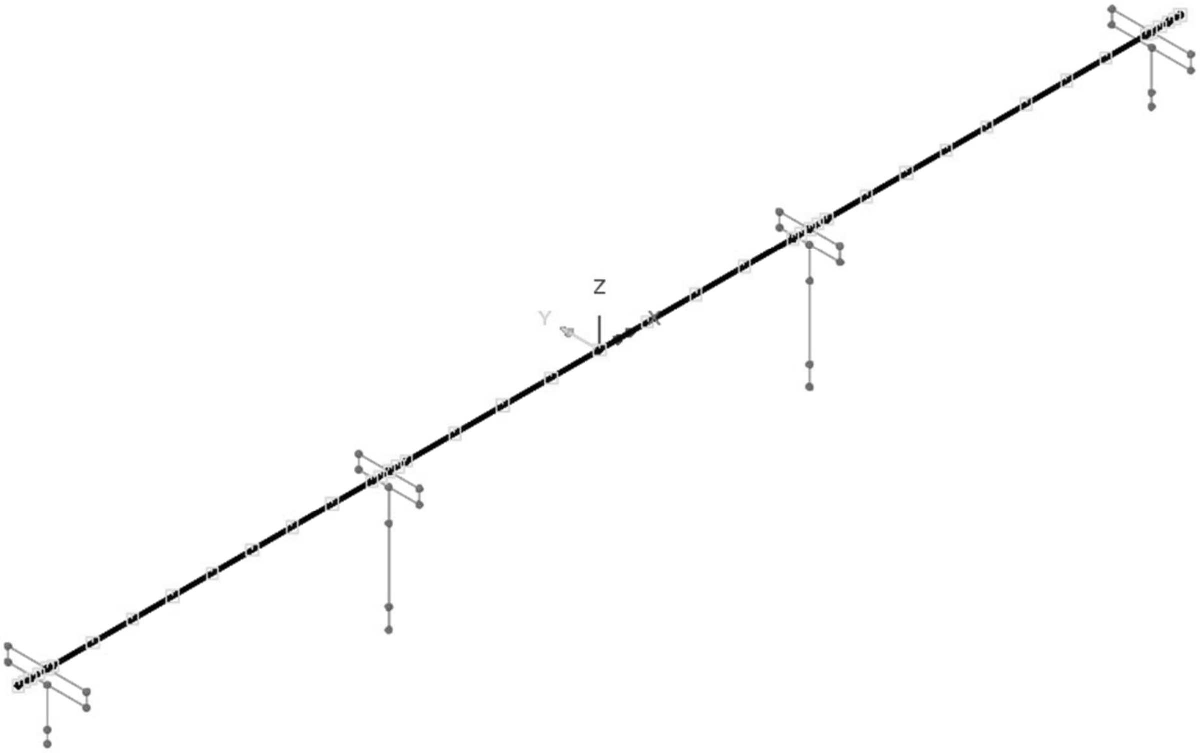
Loadcase : OJTEMP 1-

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : -5°C/m

Initial Z temperature gradient : 0°C/m



Overview 3D

Envelope OJTEMP 1 :

Load case
OJTEMP 1+
OJTEMP 1-

3.12.4 Uneven temperature differences between different construction parts

This section states that these effects should be combined with those caused by uniform temperature across the entire bridge (TEMP 1). It handles differences of uneven temperature
See SS-EN 1991-1-5 section 6.1.6 and TRVINFRA-00227 section 7.2.1.1.2.4.

However no differences is consider in superstructure. Only differences with substructure occurs but this does not result in load effects for this bridge type, thus load is disregarded.

Remark
Since temperature load is not considered in the ultimate limit state (ULS).

3.12.5 Combining load case JTEMP and OJTEMP 1

Load combination is conducted according to SS-EN 1991-1-5, section 6.1.5. For such a combination, $\omega_M = 0.75$ och $\omega_N = 0.35$ shall be applied as shown below.

Alternative 1 ($\omega_M = 0.75$) : $T + \omega_M \cdot \Delta T$

Alternative 2 ($\omega_N = 0.35$) : $\omega_N \cdot T + \Delta T$

Load combination smart TEMP-1 :

Loadcase	Permanent factor	Variable factor
JTEMP	0	0.77 (= 0.77[1.)] x 1.00)
OJTEMP 1	0	0.75 (= 1.00[1.)] x 0.75)
DELTA-P	0	1.0

Load combination smart TEMP-2 :

Loadcase	Permanent factor	Variable factor
JTEMP	0	0.27 (= 0.77[1.)] x 0.35)
OJTEMP 1	0	1.00 (= 1.00[1.)] x 1.00)
DELTA-P	0	1.0

Note:
[1.)] Impact of creep results in reduced rigidity, see page A3:46.

Envelope TEMP :

Load case
TEMP-1
TEMP-2

3.13 ICE LOAD

Ice load is defined in document TB (18222-00-010) section GC.3. and TRVINFRA-00227, section 7.2.1.1.2.6.2.

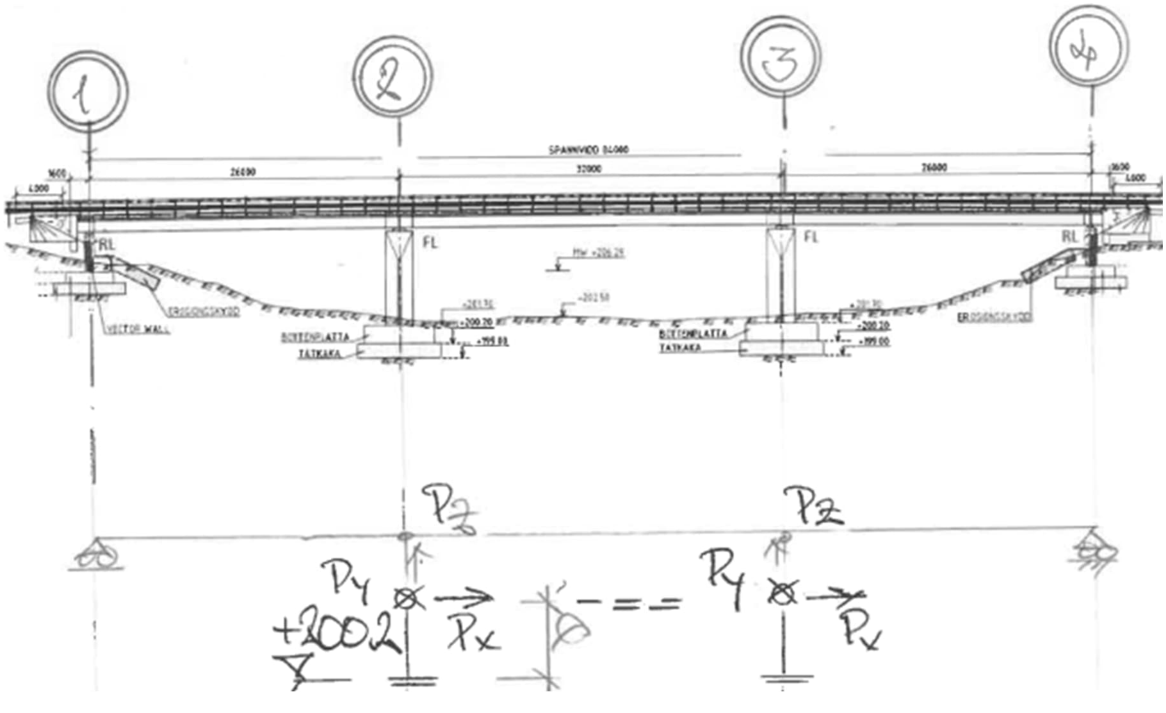
Ice loads do not act in X, Y and Z direction simultaneously.

TRVINFRA-00227 table 7.1-4 → $\psi_0 = \psi_1 = 0.40$; $\psi_2 = 0$

MHQ = +207.20 → a_H = 207.20 m - 200.20 m = 7.00 m : high ice level

MLQ = +205.74 → a_L = 205.74 m - 200.20 m = 5.54 m : low ice level

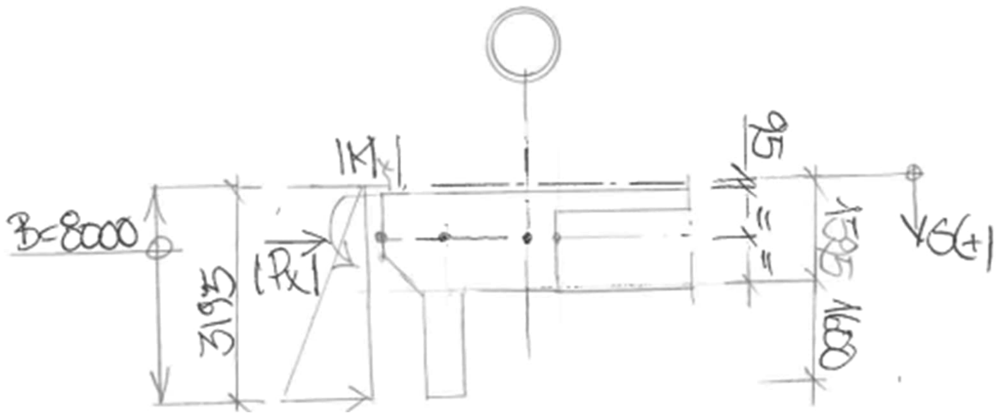
Level bottom slab: +200.20



Remark
Ice load is not considered to act in combination with seasonal even temperature over entire bridge (JTEMP), see page A3:104.

3.13.1 Defintion of load at support 1 & 2

At end-shield increased earth pressure arises.



$$|P_x| = f \cdot \left(P_x^{passiv} - P_x^{vilo}\right) = f \cdot 4500kN$$

$$\left|M_y\right| = f \cdot 4500kN \cdot \left(\frac{2 \cdot 3.195m}{3} - 0.845m\right) = f \cdot 5783kNm$$

$$\Delta_{is}(f = 1) = 63.9mm$$

Load : PASSIV 1X+

Structural loading : Concentrated

Concentrated load in X (P_x) : +4500 kN

Moment about Y axis (M_y) : -3213 kNm

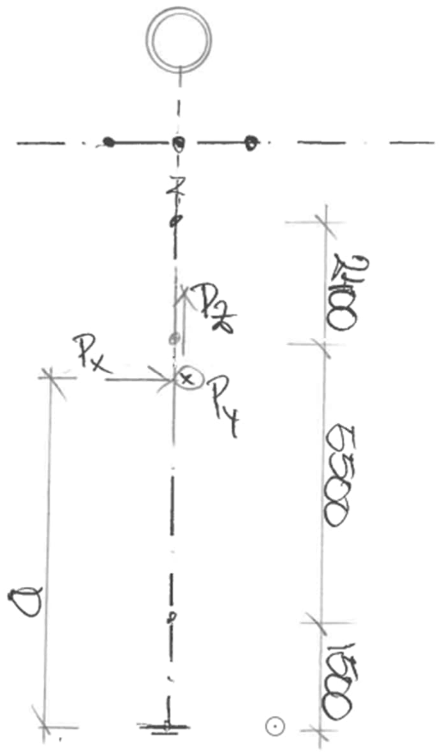
Load : PASSIV 4X-

Structural loading : Concentrated

Concentrated load in X (P_x) : -4500 kN

Moment about Y axis (M_y) : +3213 kNm

3.13.1 Defintion of load at support 2 & 3

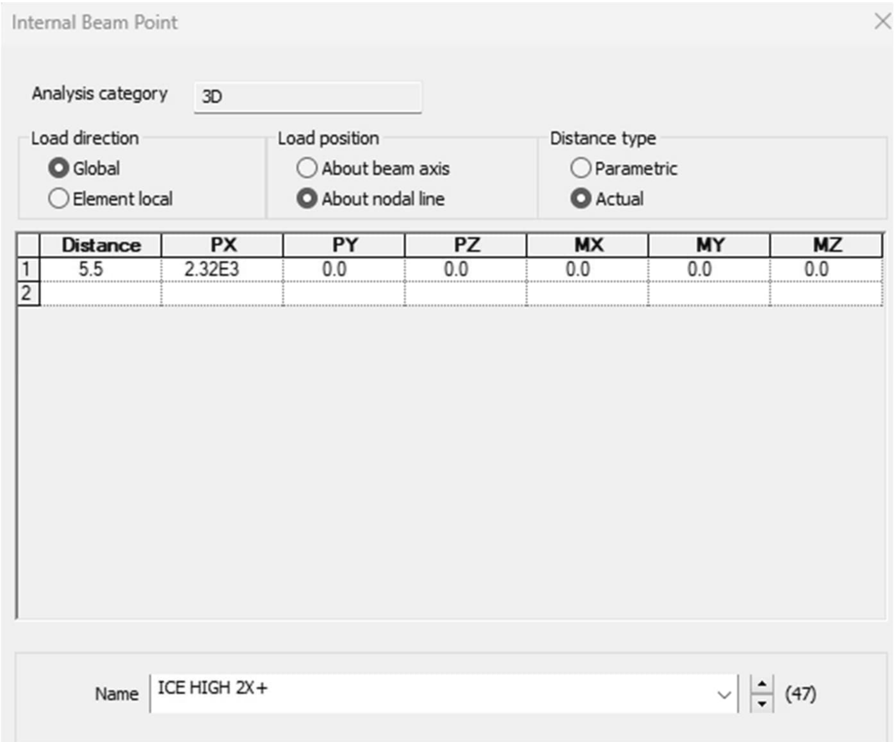


$P_x = \mp 2320kN$

$P_y = \mp 378kN$

$P_z = 771kN$

Load : ICE HIGH 2X+


Internal Beam Point

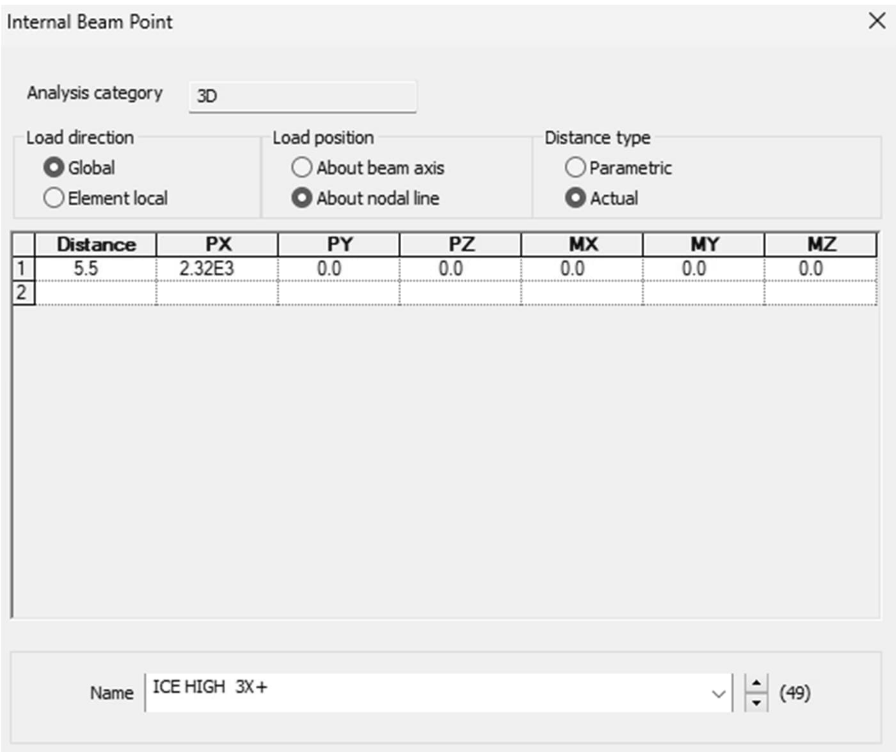
Analysis category: 3D

Load direction: (•) Global ( ) Element local
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name: ICE HIGH 2X+ (47)

Load : ICE HIGH 3X+


Internal Beam Point

Analysis category: 3D

Load direction: (•) Global ( ) Element local
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name: ICE HIGH 3X+ (49)

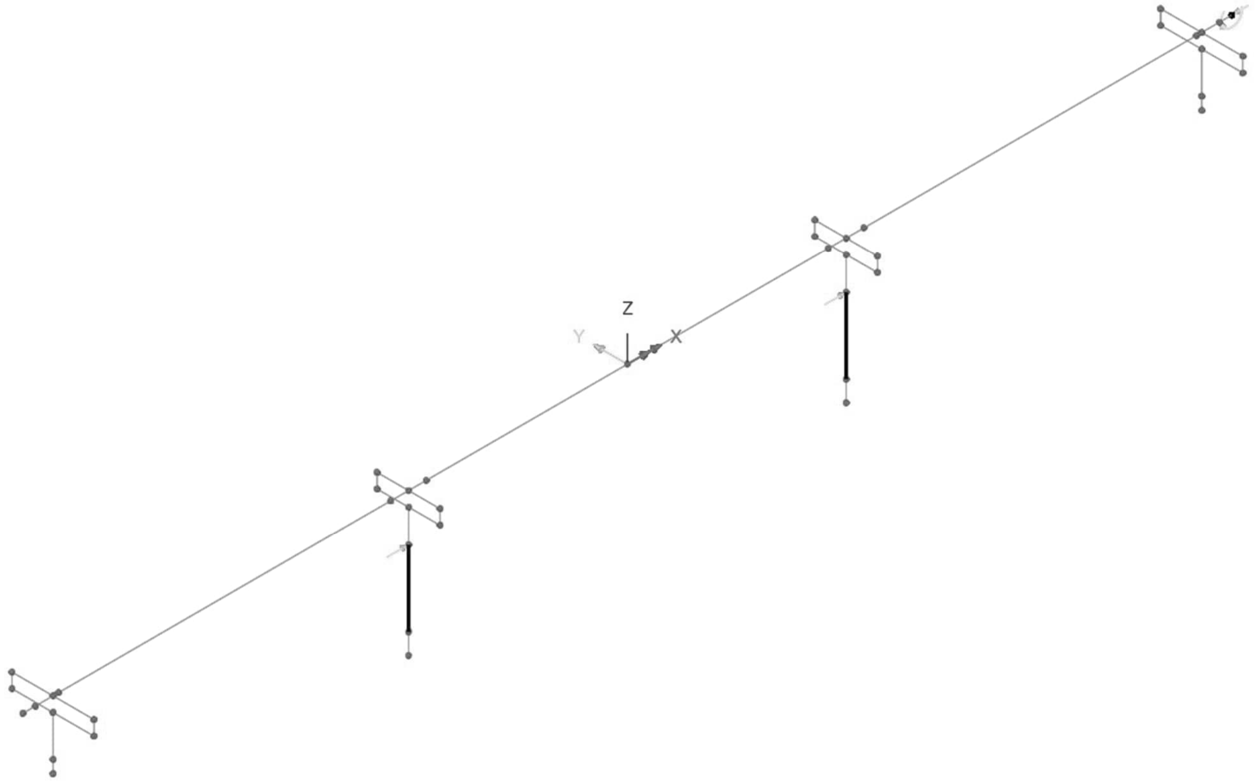
Loadcase: ICE HIGH X+

$\Delta_{is}(f=0)=47.17\text{mm}$

$\Delta_{ice}(f=0.5903)=9.445\text{ mm assumed}\rightarrow \frac{v_{ice}}{v_p}=\frac{9.445\text{mm}}{16\text{mm}}=0.5903$

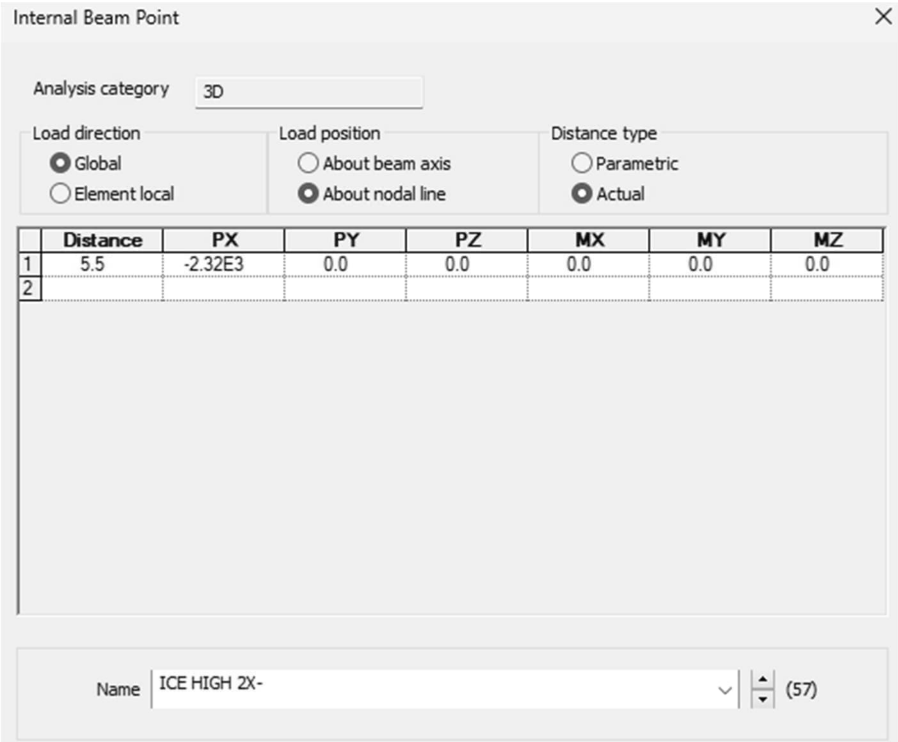
$v_{ice}=47.17\text{mm} - f \cdot 63.9\text{mm}=9.449\text{ mm} \approx \Delta_{ice}(f=0.5903)$ which was to be proven !

Load	Factor
ICE HIGH 2X-	1
ICE HIGH 3X-	1
PASSIV 1X+	f = 0.5903



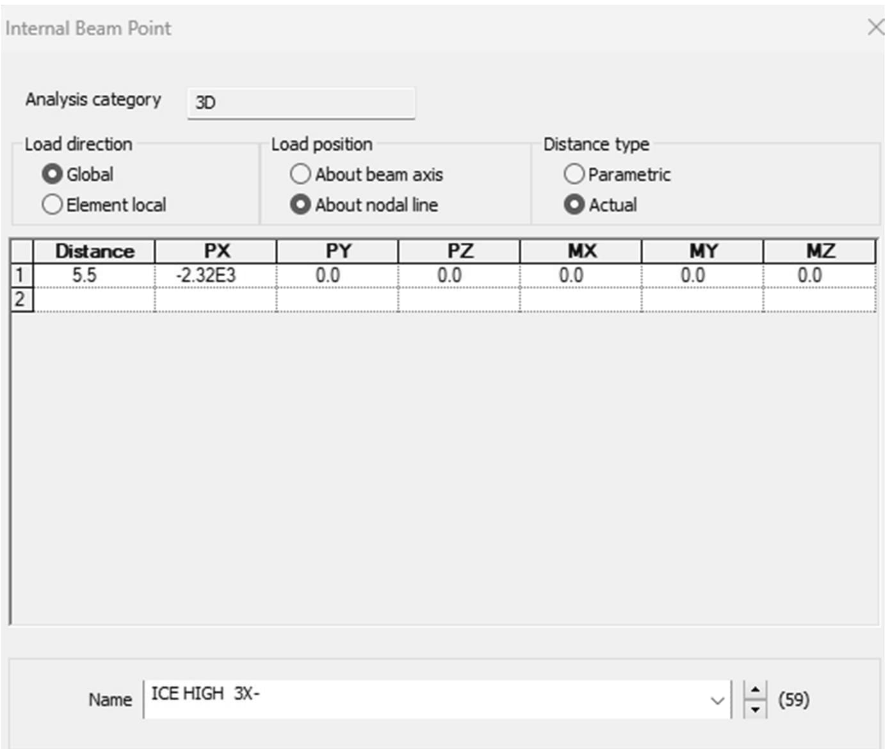
Overview 3D

Load : ICE HIGH 2X-



	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	-2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Load : ICE HIGH 3X-



	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	-2.32E3	0.0	0.0	0.0	0.0	0.0
2							

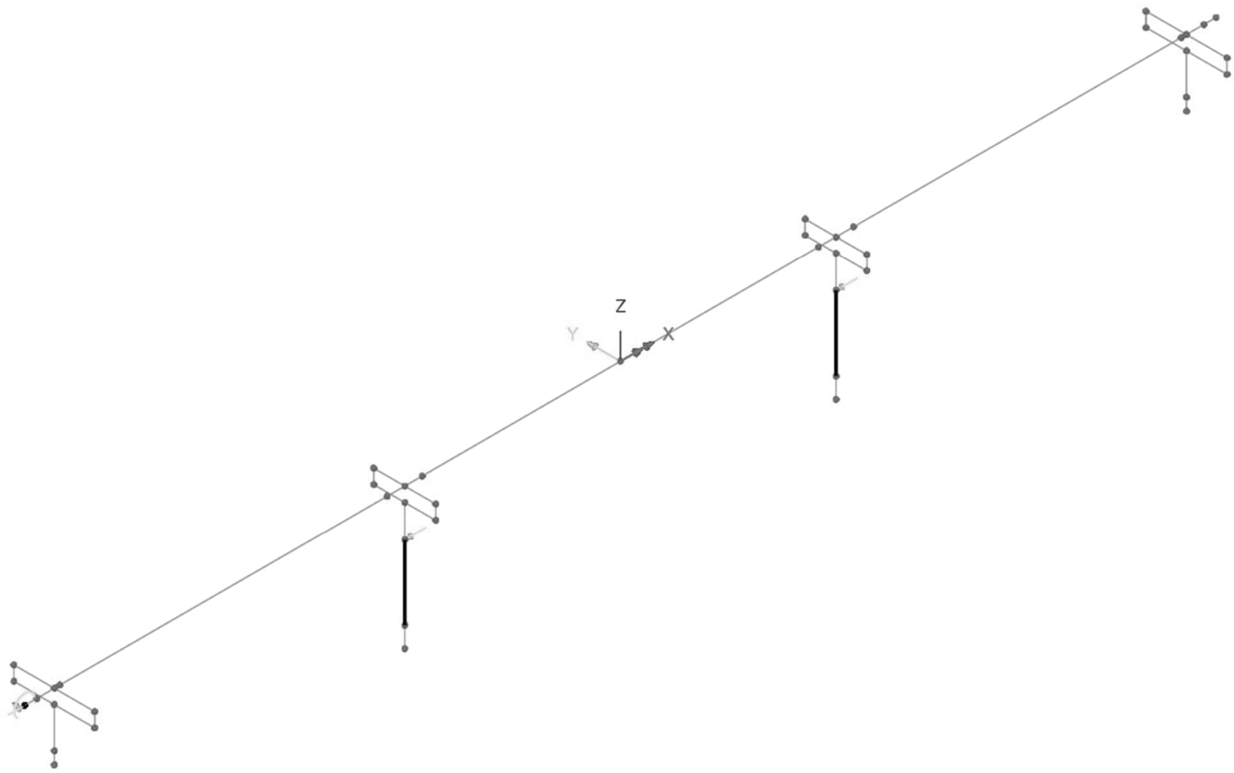
Loadcase: ICE HIGH X-

$\Delta_{is}(f=0)=47.17mm$

$\Delta_{ice}(f=0.5903)=9.445\ mm\ \text{assumed}\rightarrow \frac{v_{ice}}{v_p}=\frac{9.445mm}{16mm}=0.5903$

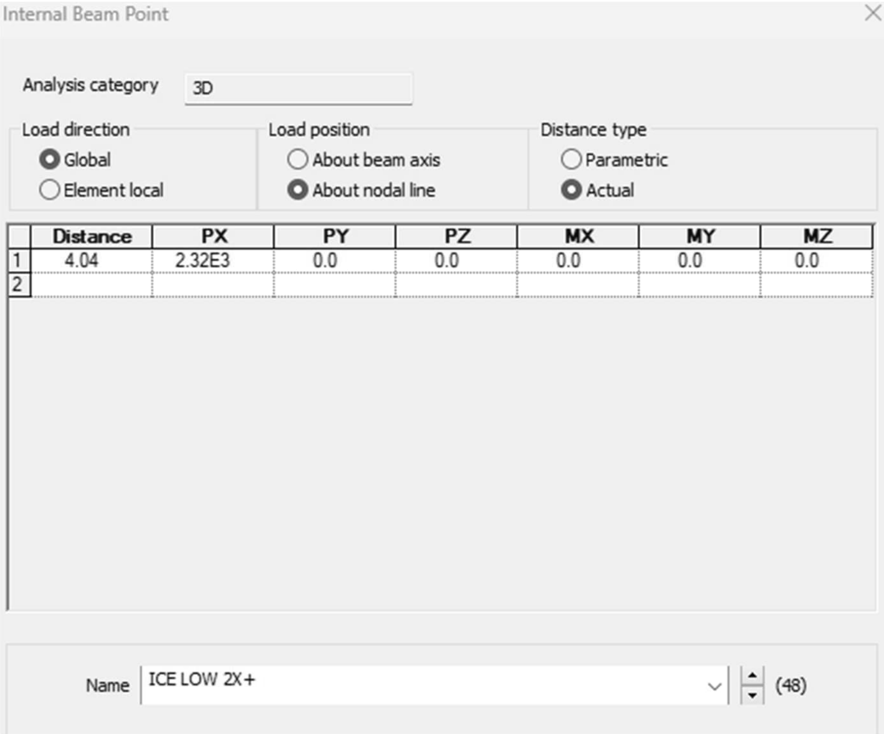
$v_{ice}=47.17mm - f\cdot 63.9mm=9.449\ mm \approx \Delta_{ice}(f=0.5903)$ which was to be proven !

Load	Factor
ICE HIGH 2X-	1
ICE HIGH 3X-	1
PASSIV 1X+	f = 0.5903



Overview 3D

Load : ICE LOW 2X+


Internal Beam Point

Analysis category 3D

Load direction: (•) Global ( ) Element local

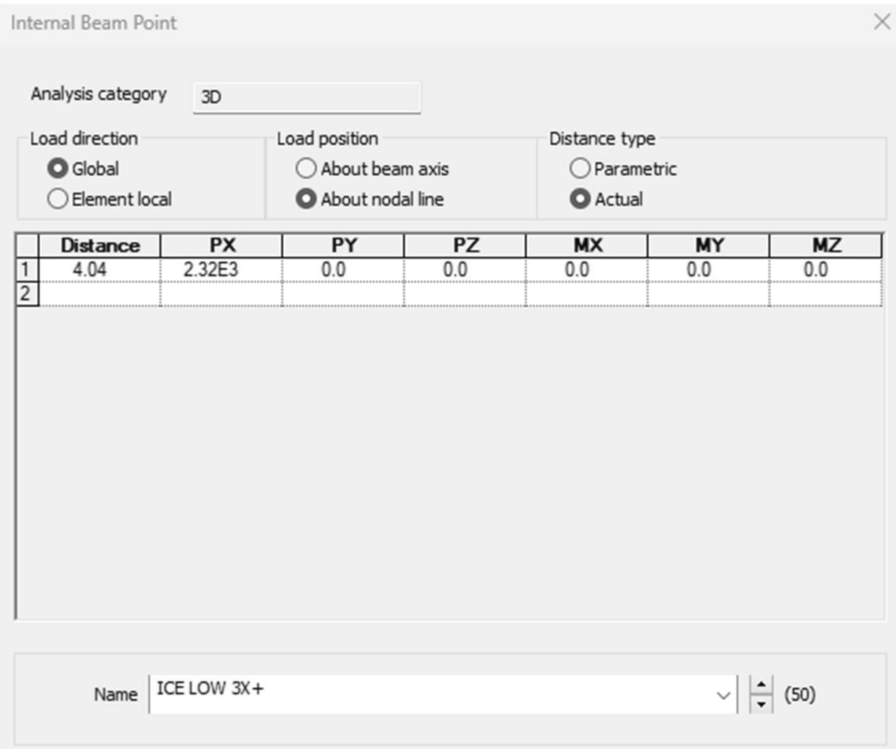
Load position: ( ) About beam axis (•) About nodal line

Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	4.04	2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name ICE LOW 2X+ (48)

Load: ICE HIGH 3X+


Internal Beam Point

Analysis category 3D

Load direction: (•) Global ( ) Element local

Load position: ( ) About beam axis (•) About nodal line

Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	4.04	2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name ICE LOW 3X+ (50)

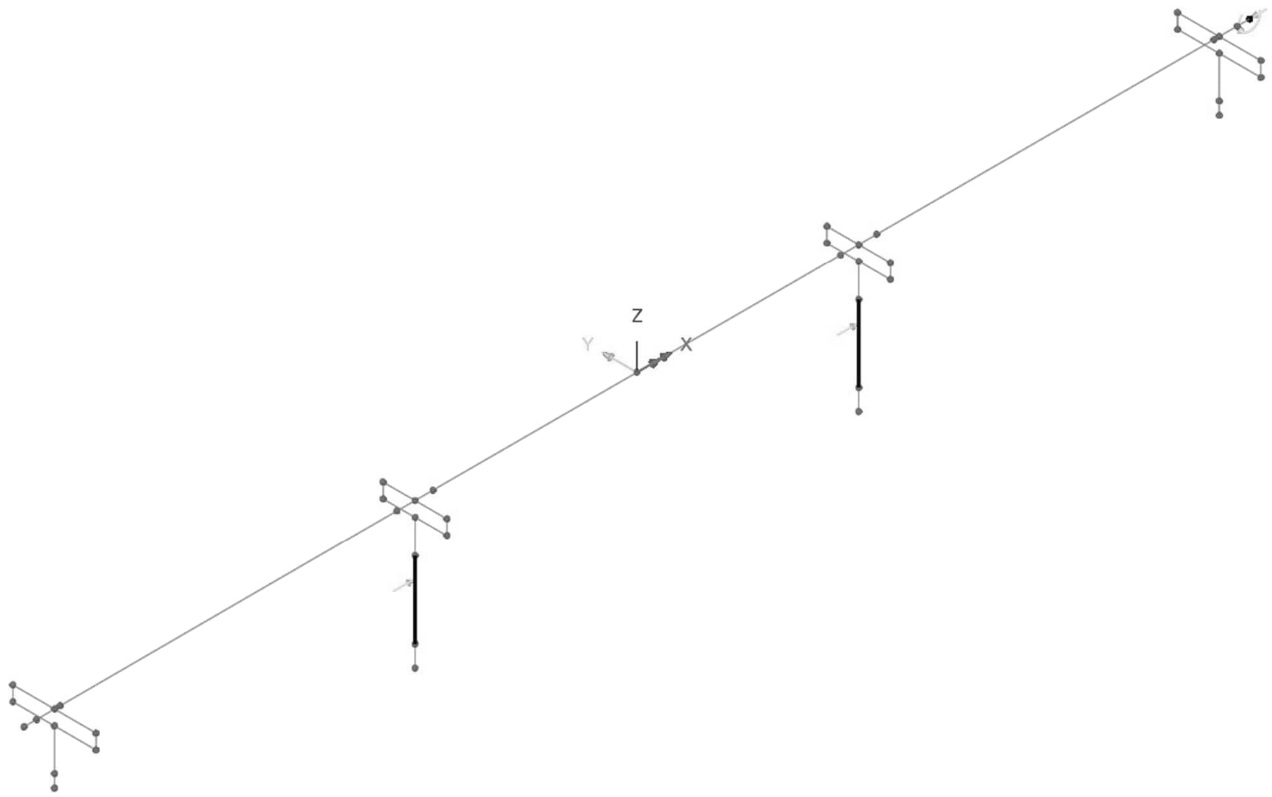
Loadcase: ICE LOW X+

$\Delta_{is}(f=0)=37.12\text{mm}$

$\Delta_{ice}(f=0.4646)=7.433\text{ mm assumed}\rightarrow \frac{v_{ice}}{v_p}=\frac{7.433\text{mm}}{16\text{mm}}=0.4646$

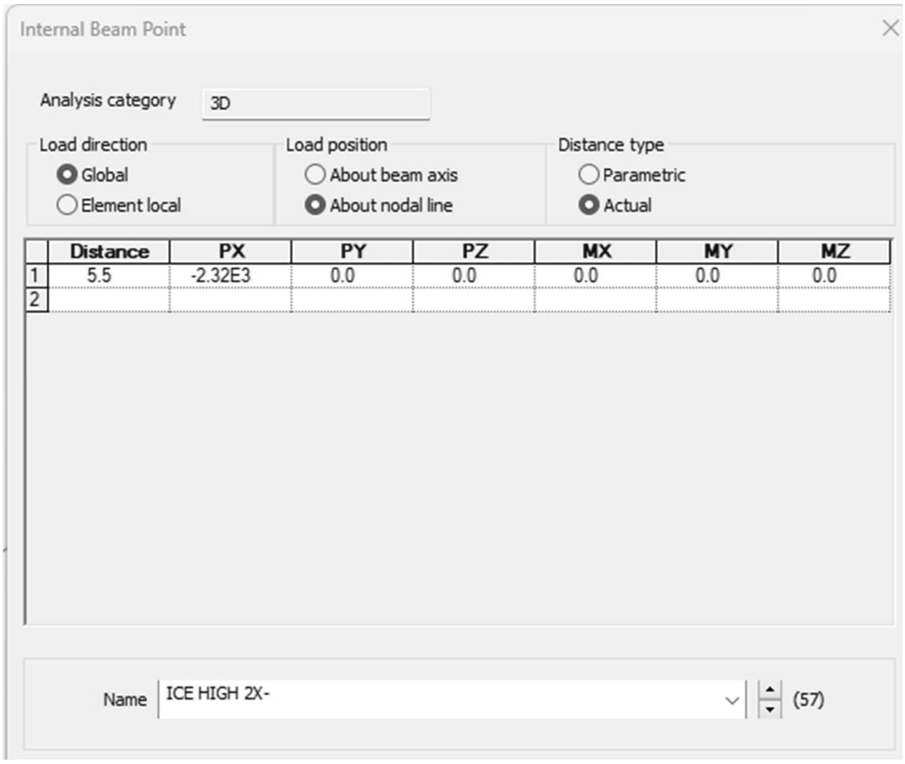
$v_{ice}=37.12\text{ mm - f}\cdot 63.9\text{mm}=97.434\text{ mm}\approx \Delta_{ice}(f=0.4646)$ which was to be proven !

Load	Factor
ICE LOW 2X+	1
ICE HIGH 3X+	1
PASSIV 4X-	f = 0.4646



Overview 3D

Load : ICE HIGH 2X-


Internal Beam Point

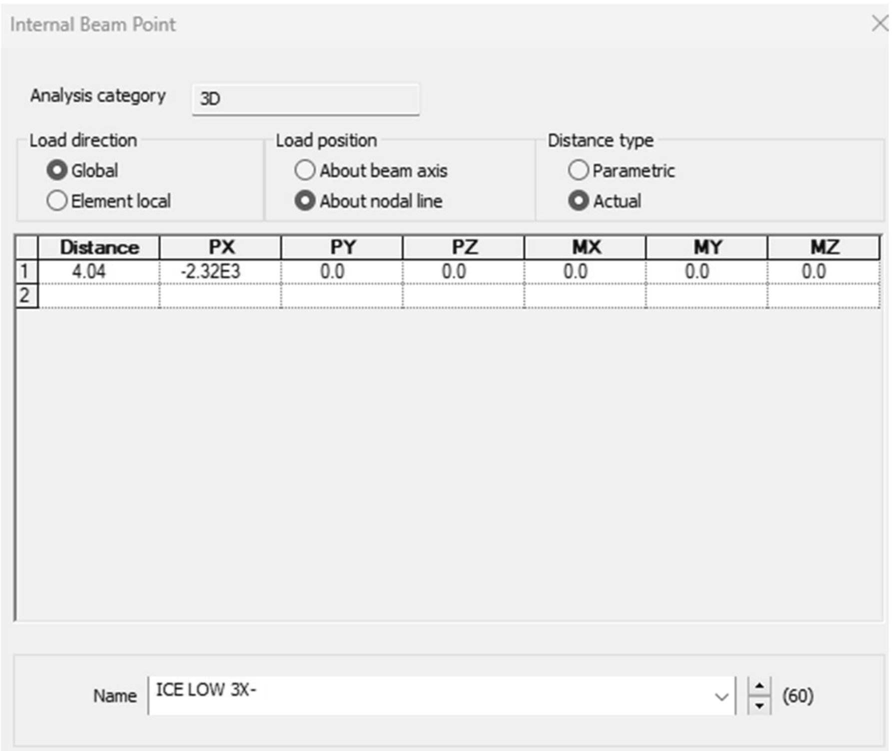
Analysis category: 3D

Load direction: (•) Global ( ) Element local
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	-2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name: ICE HIGH 2X- (57)

Load : ICE LOW 3X-


Internal Beam Point

Analysis category: 3D

Load direction: (•) Global ( ) Element local
Load position: ( ) About beam axis (•) About nodal line
Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	4.04	-2.32E3	0.0	0.0	0.0	0.0	0.0
2							

Name: ICE LOW 3X- (60)

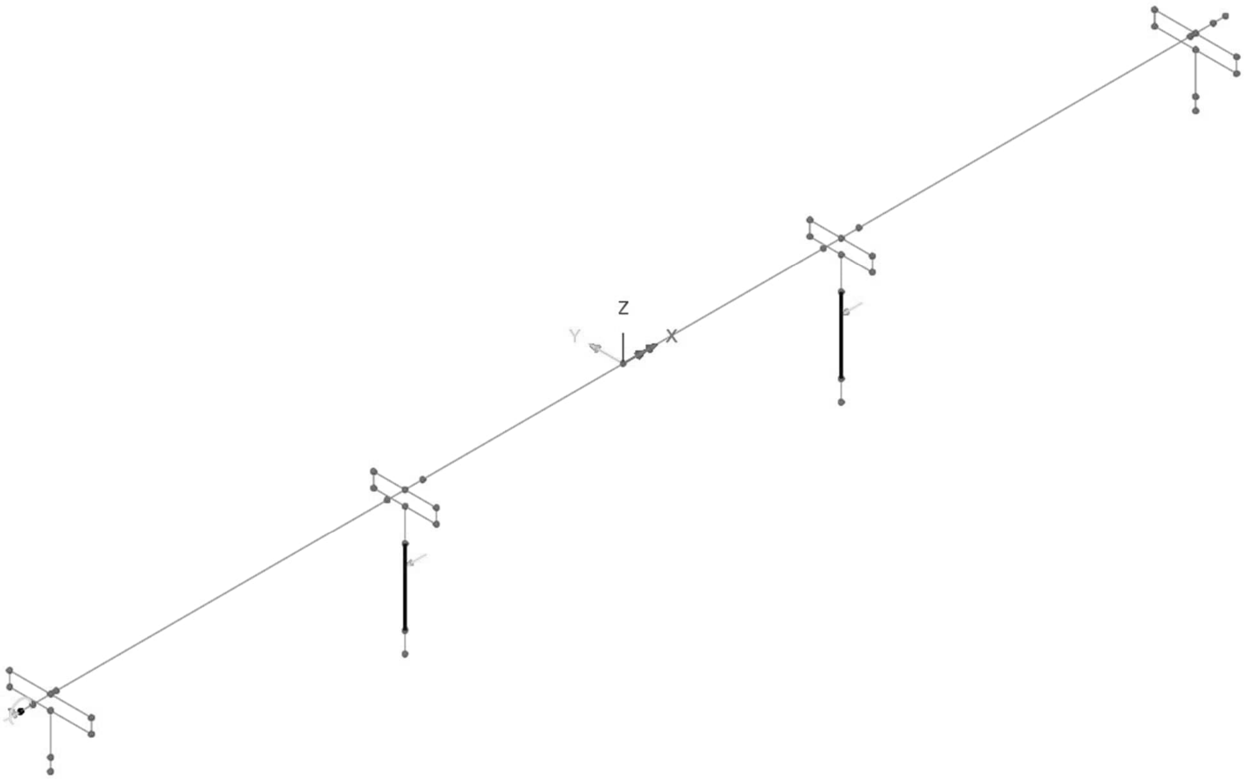
Loadcase: ICE LOW X-

$$\Delta_{is}(f=0)=37.12mm$$

$$\Delta_{ice}(f=0.4646)=7.433\text{ mm assumed}\rightarrow\frac{v_{ice}}{v_p}=\frac{7.433mm}{16mm}=0.4646$$

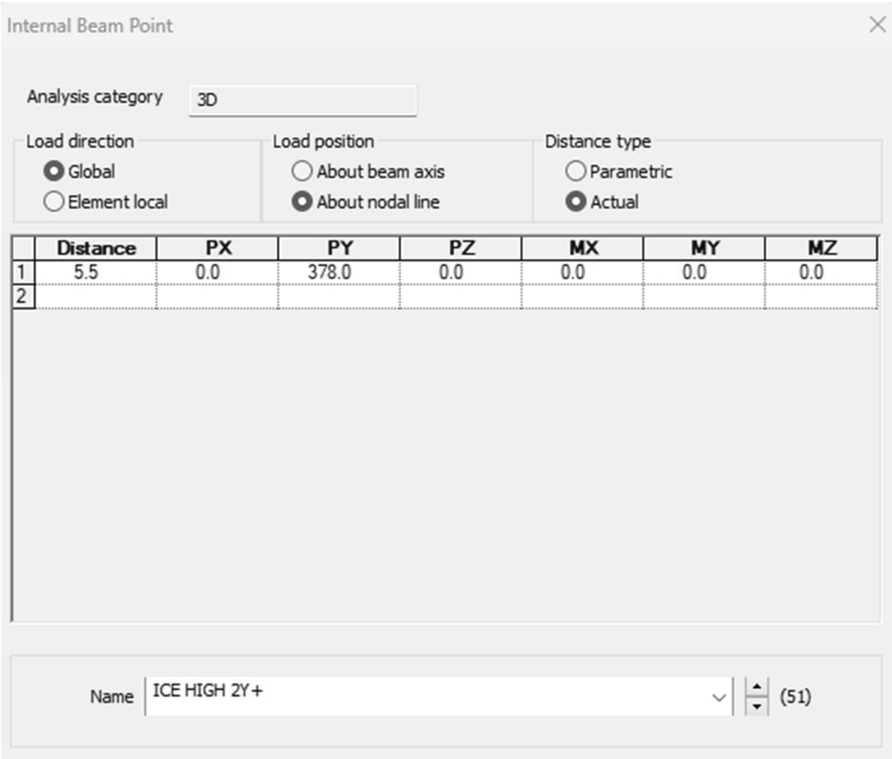
$$v_{ice}=37.12\text{ mm - f}\cdot 63.9mm=97.434\text{ mm}\approx\Delta_{ice}(f=0.4646)\text{which was to be proven !}$$

Load	Factor
ICE HIGH 2X-	1
ICE HIGH 3X-	1
PASSIV 1X+	0.4646

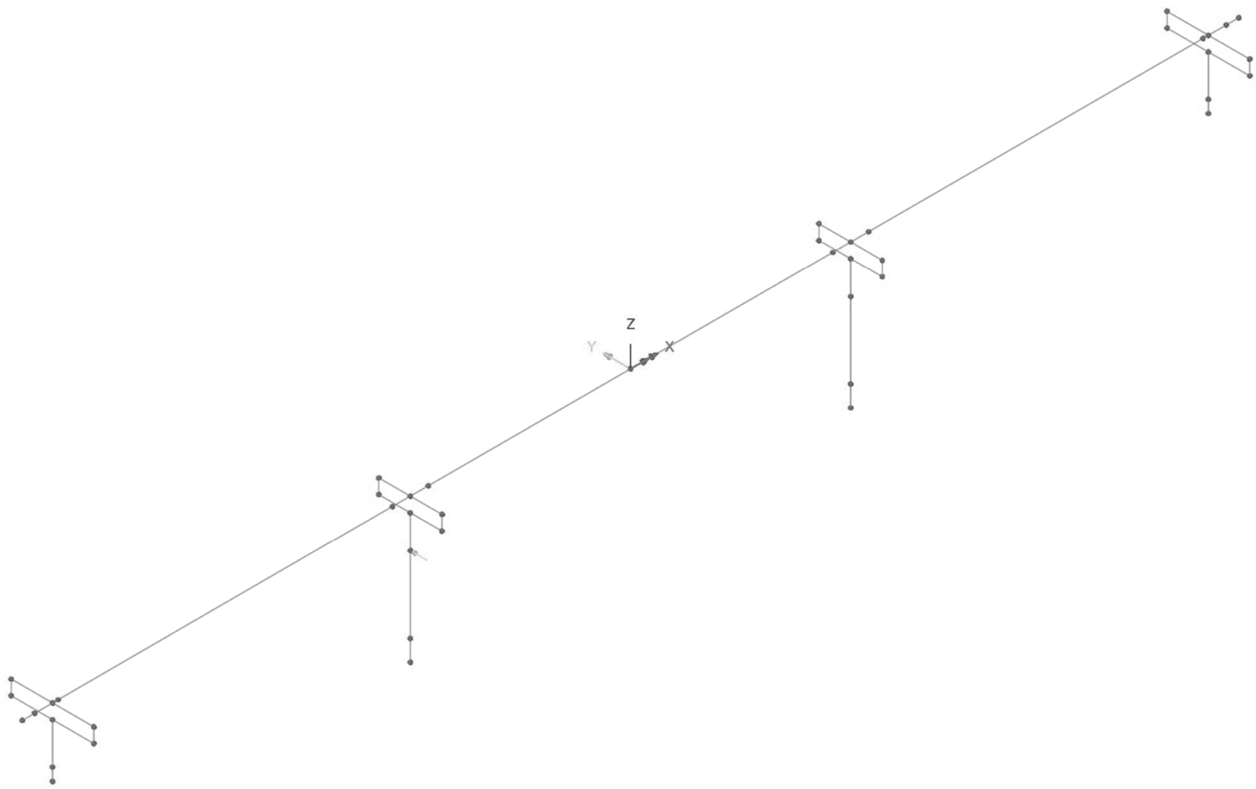


Overview 3D

Load case : ICE HIGH 2Y+

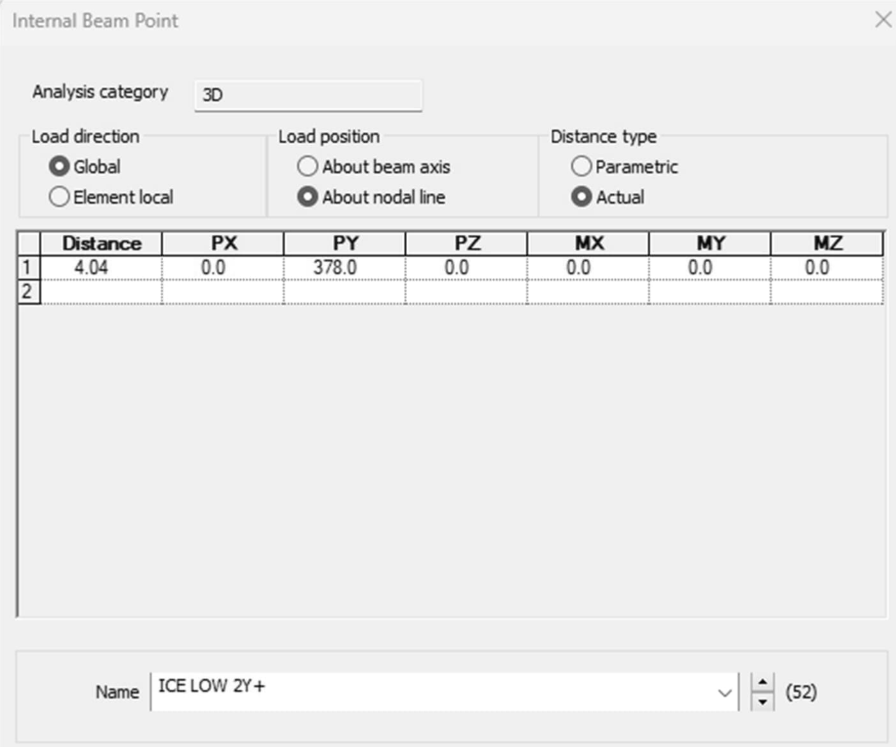


	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	0.0	378.0	0.0	0.0	0.0	0.0
2							



Overview 3D

Load case : ICE LOW 2Y+


Internal Beam Point

Analysis category: 3D

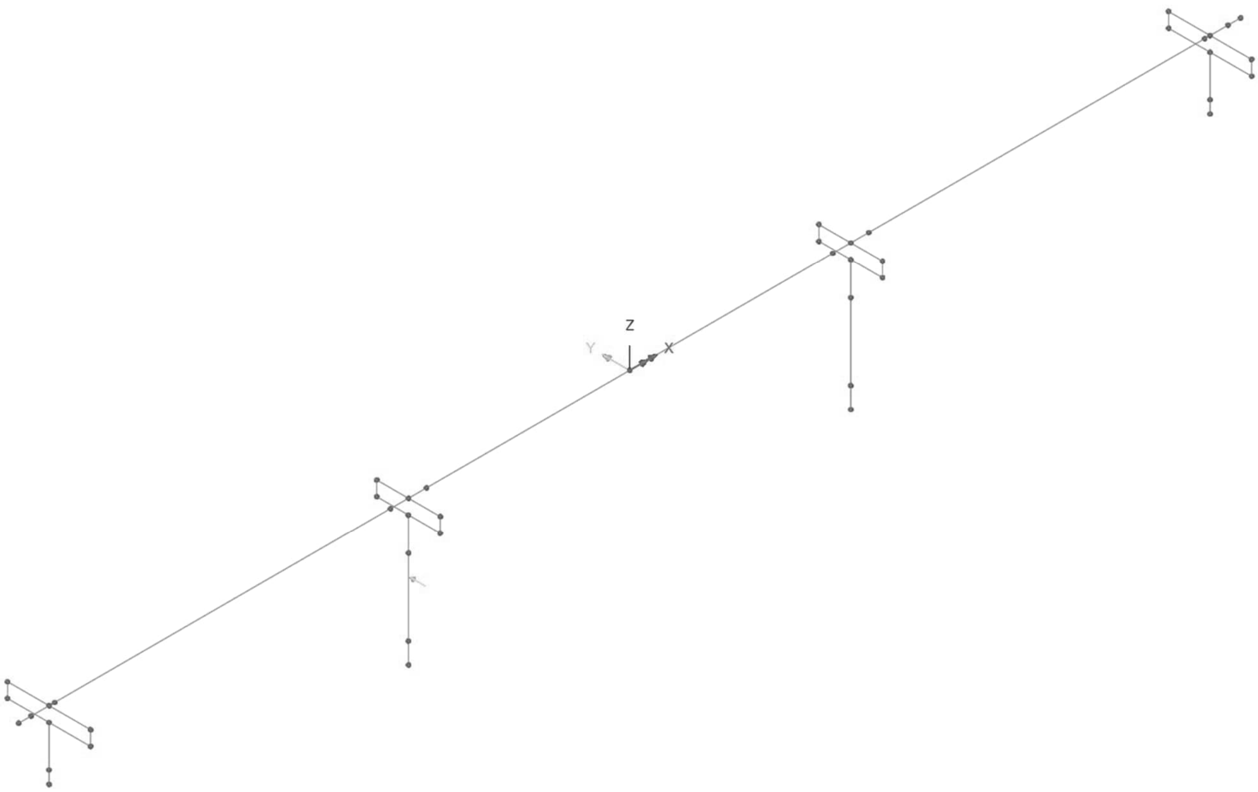
Load direction: (•) Global ( ) Element local

Load position: ( ) About beam axis (•) About nodal line

Distance type: ( ) Parametric (•) Actual

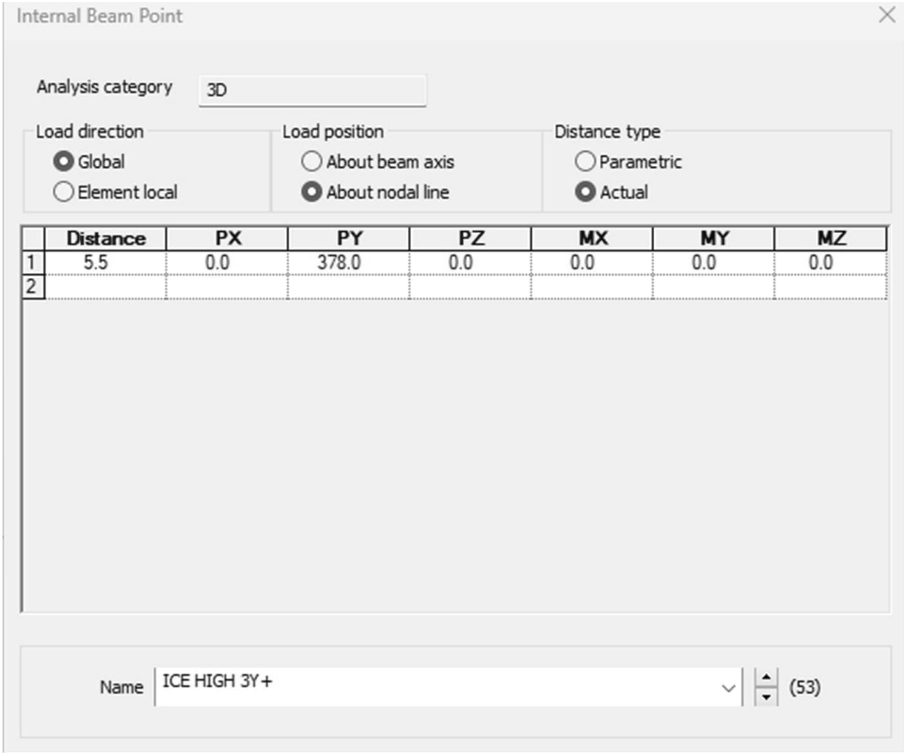
	Distance	PX	PY	PZ	MX	MY	MZ
1	4.04	0.0	378.0	0.0	0.0	0.0	0.0
2							

Name: ICE LOW 2Y+ (52)

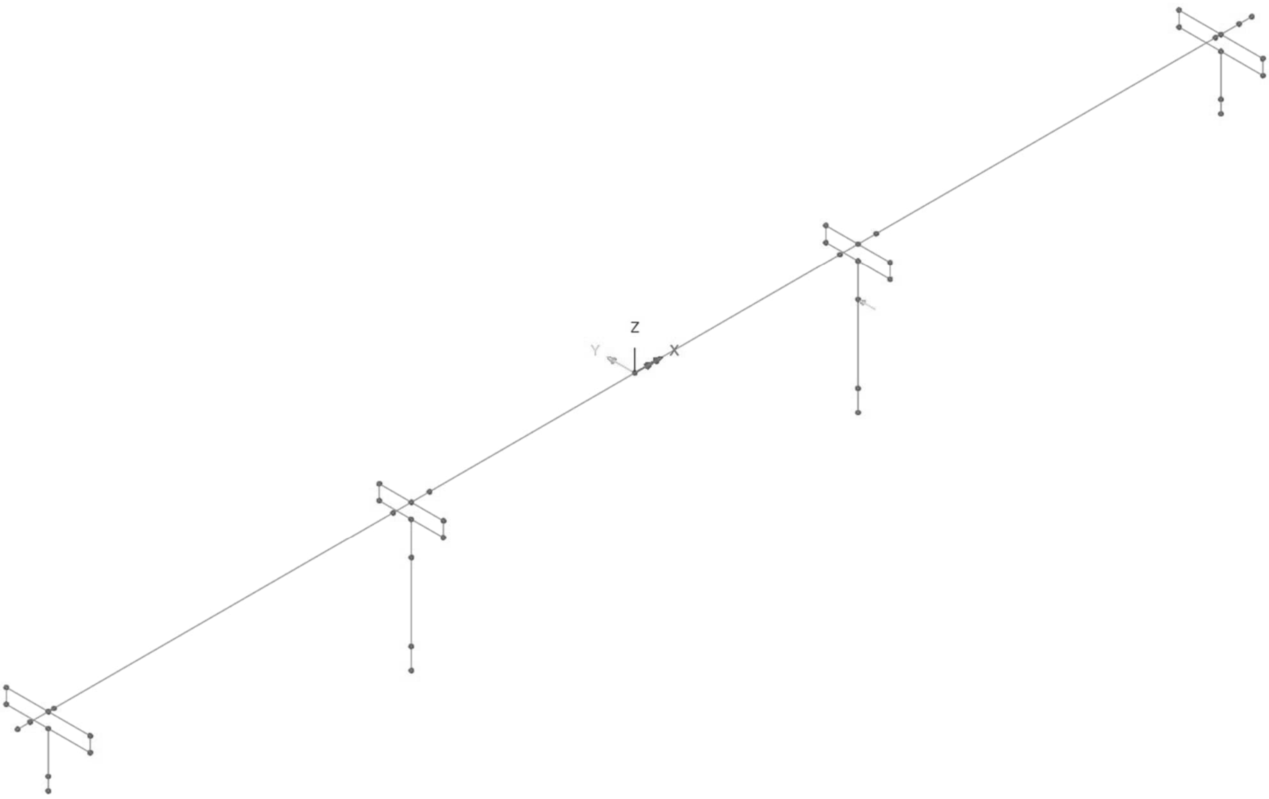


Overview 3D

Load case : ICE HIGH 3Y+

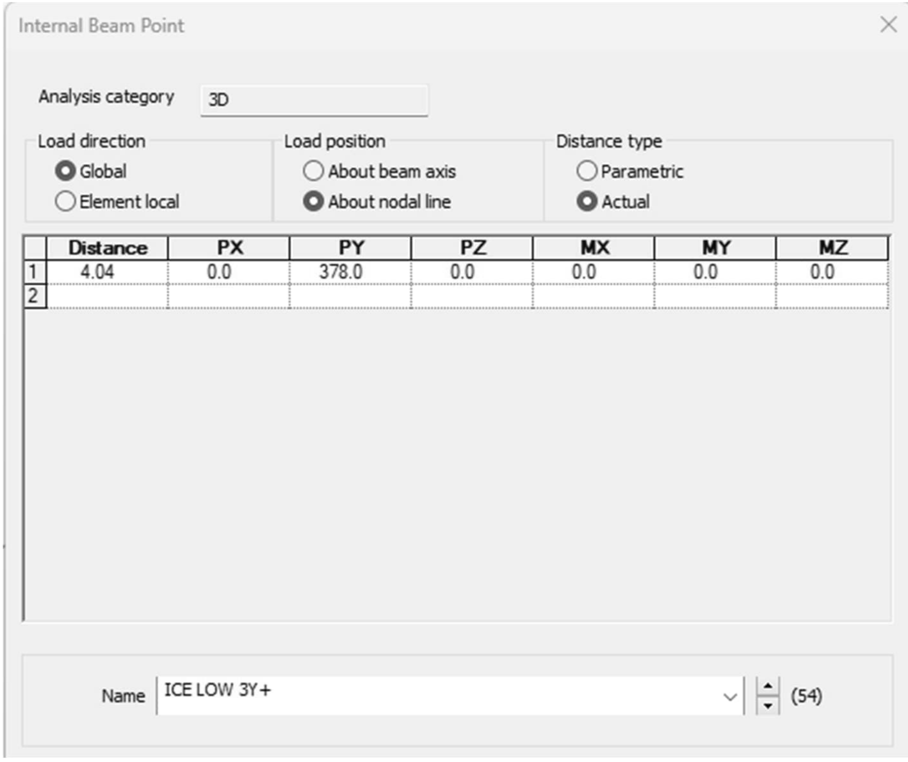


	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	0.0	378.0	0.0	0.0	0.0	0.0
2							



Overview 3D

Load case : ICE LOW 3Y+



Internal Beam Point

Analysis category: 3D

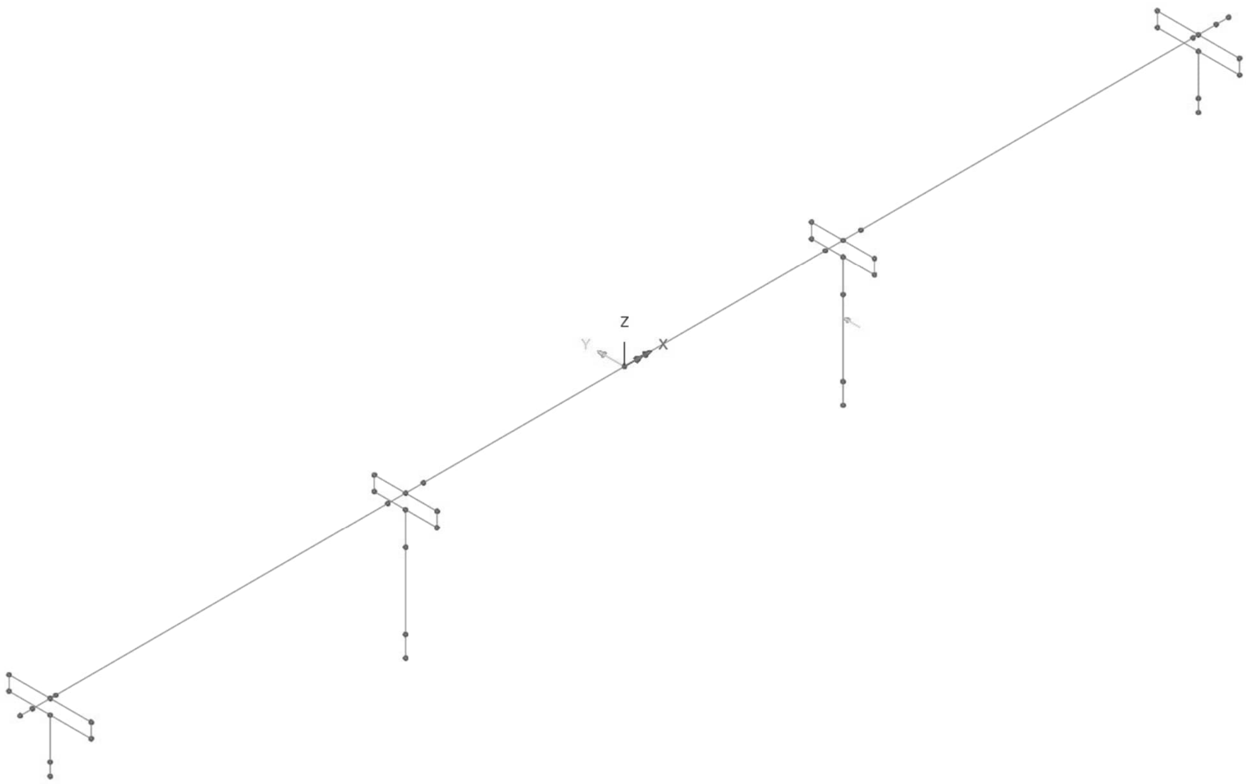
Load direction: (•) Global ( ) Element local

Load position: ( ) About beam axis (•) About nodal line

Distance type: ( ) Parametric (•) Actual

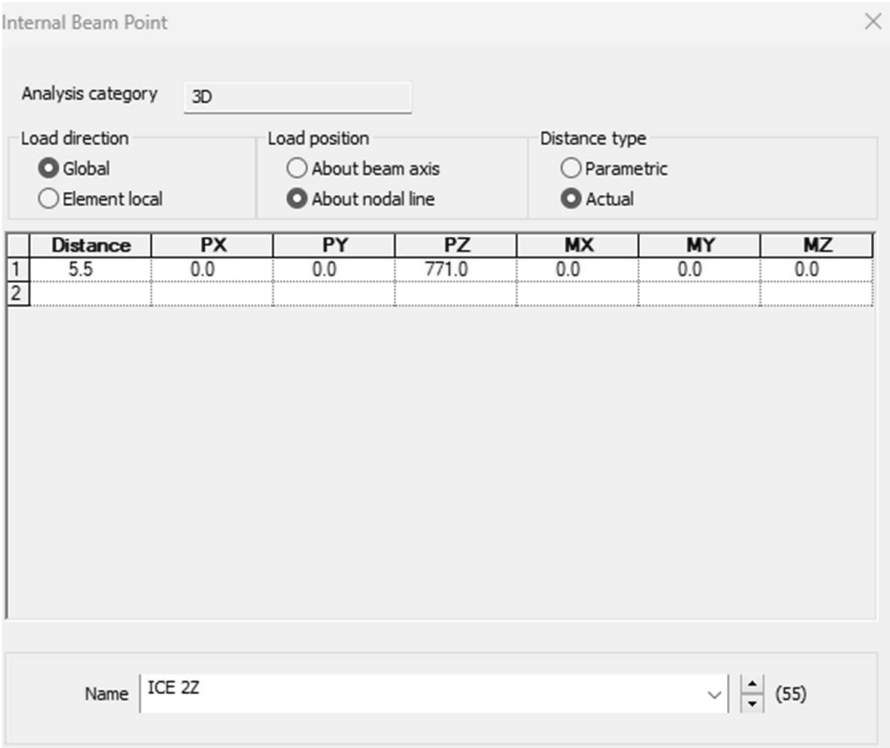
	Distance	PX	PY	PZ	MX	MY	MZ
1	4.04	0.0	378.0	0.0	0.0	0.0	0.0
2							

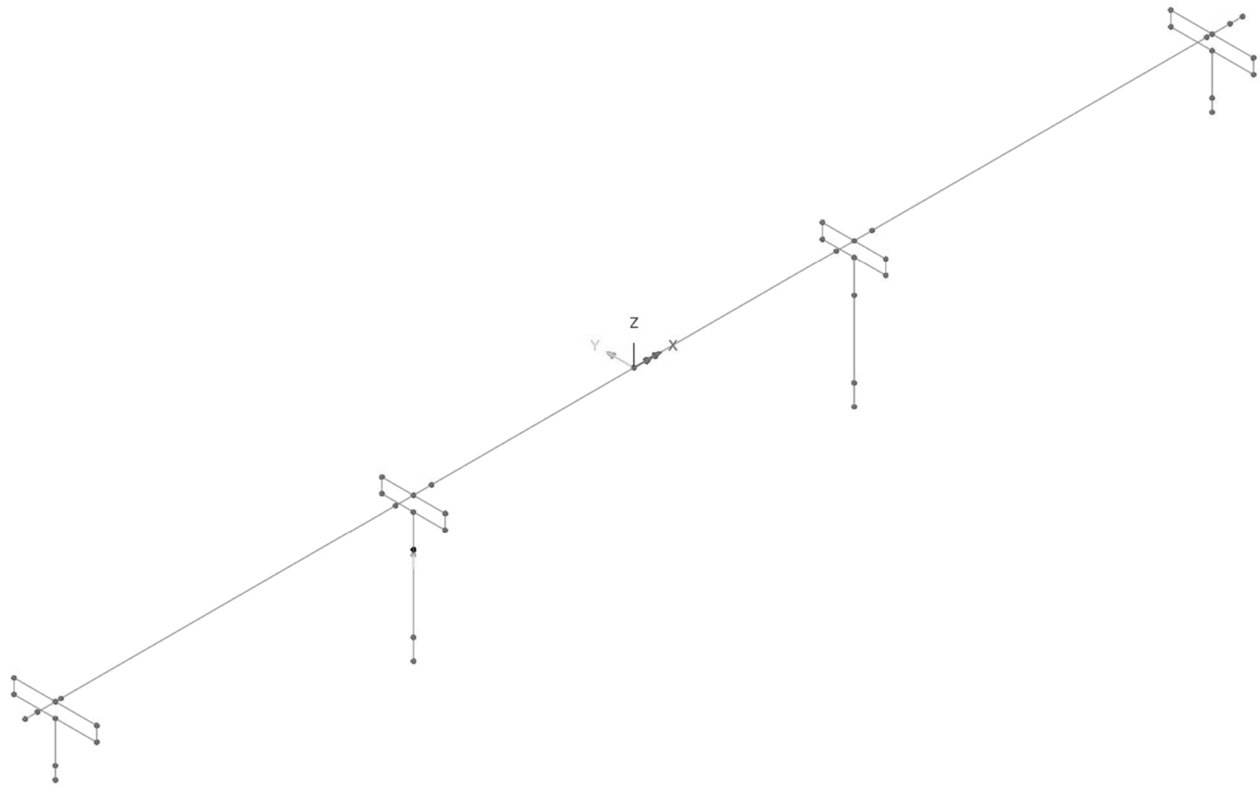
Name: ICE LOW 3Y+ (54)



Overview 3D

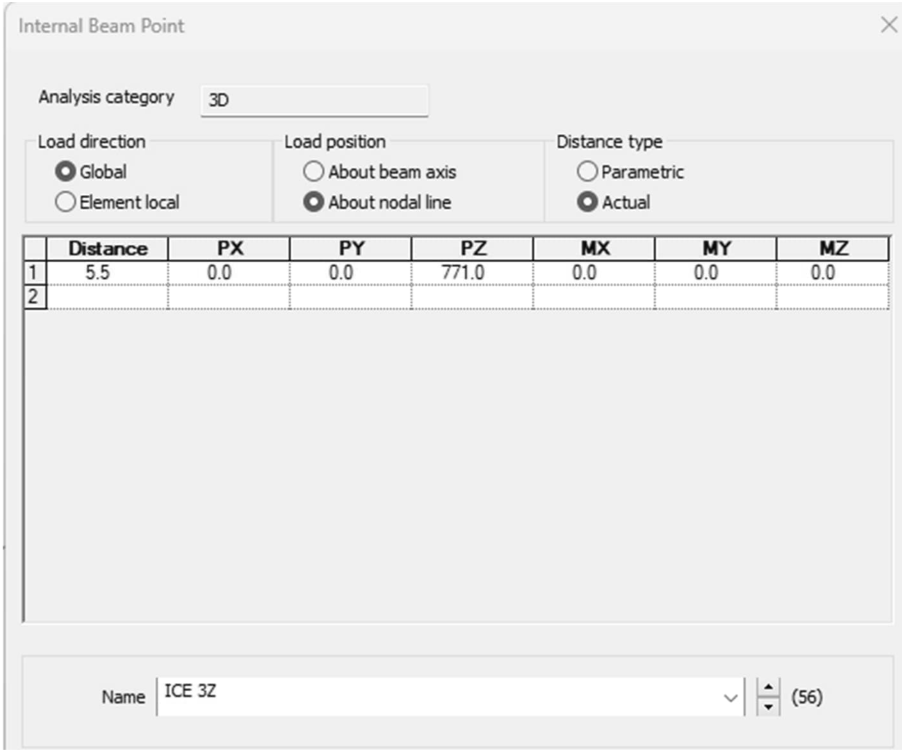
Load case : ICE 2Z





Overview 3D

Load case : ICE 3Z


Internal Beam Point

Analysis category: 3D

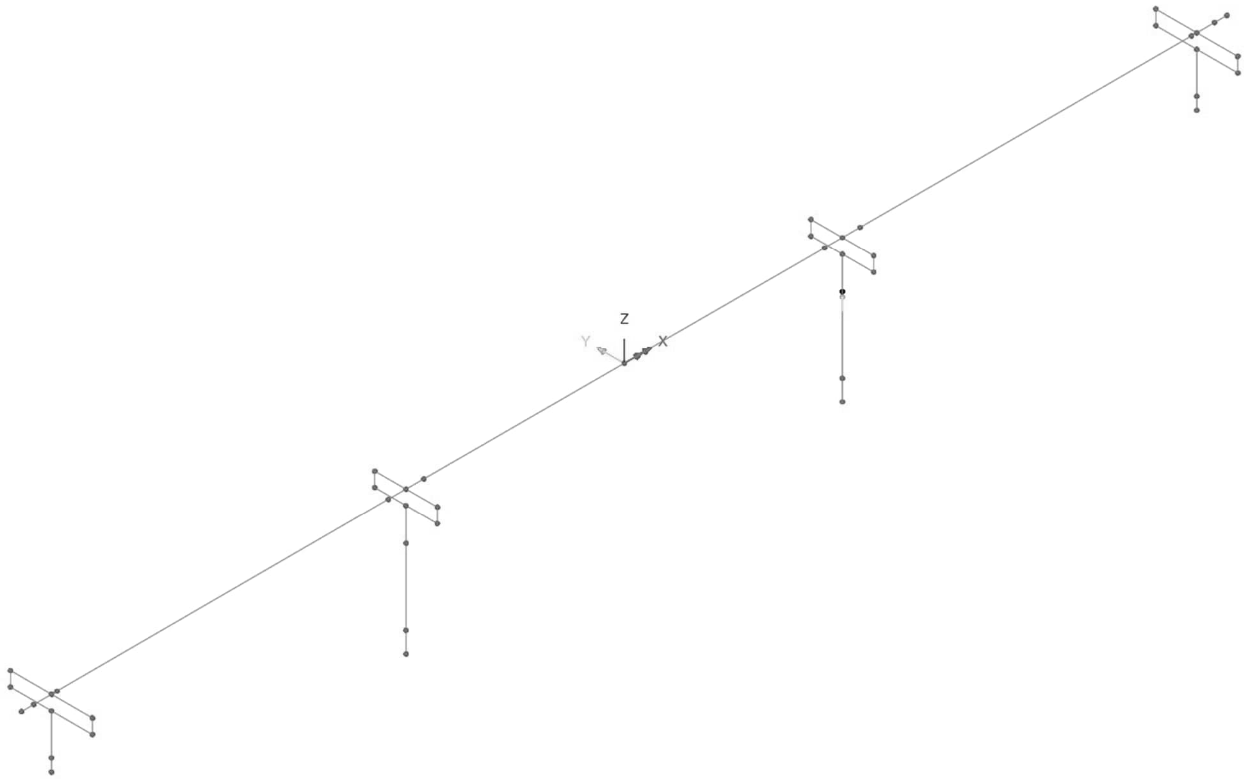
Load direction: (•) Global ( ) Element local

Load position: ( ) About beam axis (•) About nodal line

Distance type: ( ) Parametric (•) Actual

	Distance	PX	PY	PZ	MX	MY	MZ
1	5.5	0.0	0.0	771.0	0.0	0.0	0.0
2							

Name: ICE 3Z (56)



Overview 3D

3.13.2 Load combination

Load combination smart ICE HIGH Y :

Loadcase	Permanent factor	Variable factor
ICE HIGH 2Y+	0	+1
ICE HIGH 2Y+	0	-1
ICE HIGH 3Y+	0	+1
ICE HIGH 3Y+	0	-1

Load combination smart ICE LOW Y :

Loadcase	Permanent factor	Variable factor
ICE LOW 2Y+	0	+1
ICE LOW 2Y+	0	-1
ICE LOW 3Y+	0	+1
ICE LOW 3Y+	0	-1

Load combination smart ICE Z :

Loadcase	Permanent factor	Variable factor
ICE Z	0	+1
ICE Z	0	+1

Envelope ICE :

Load case
ICE HIGH X+
ICE LOW X+
ICE HIGH X-
ICE LOW X
ICE HIGH Y
ICE LOW Y
ICE Z

3.14 PRESTESS

Analysis of pre tensioned cable is studied at times : t_0 (5 days), t_1(30 days) and t_2 (120 years).

The preliminary location of cables is determined with program PROG B2.001.

The location is imported as a spread sheet into FEM program as a tension profile. The location is defined with to nodal lines.

Initial prestress loss at time t0 is only due to friction. This is determined with FEM program and program PROG B2.001.

Determination of time loses (η_t) is made in separate program PROG B2.002. Preliminary analysis will use losses seen below. They will be verified later during detailed design.

Time	η_t	Load combination	Load case
t0	0 %	PT-T0	1.00 x PT-T0
t1	6 %	PT-T1	0.94 x PT-T0
t2	16 %	PT-T2	0.84 x PT-T0

3.14.1 General

Pre tensions system VSL 6-15 (d = 15.7 mm; Y1860S7). Externally grouted anchorage type GC.

Material :

$f_{p0.1k} = 1640\,MPa$

$f_{pk} = 1860 MPa$

$E_{sk} = 195 GPa$

$\mu = 0.18$

$k = 0.005 \cdot \frac{1}{m}$

Casting tube :
80 mm / 86 mm

Slip during locking:
6 mm

Permissible curvature :

$R_{\min} = 5.7 m$

Cabel area :

$A_p = 15 \cdot 150\,mm^2 = 2250\,mm^2$

Anchor plate :
290 mm x 290 mm (same for both passiv and active anchorage)

Ultimate load :

$F_u = 2250 mm^2 \cdot 1860\,MPa = 4185 kN$

Permissible stress before locking :
See SS-EN 1992-1-1 section 5.10.2.1

$\sigma_{p,\max}^{före} = \min(0.8\, f_{pk}; 0.9\, f_{p0.1k}) = \min(1488\,MPa; 1476\,MPa) = 1476\,MPa$

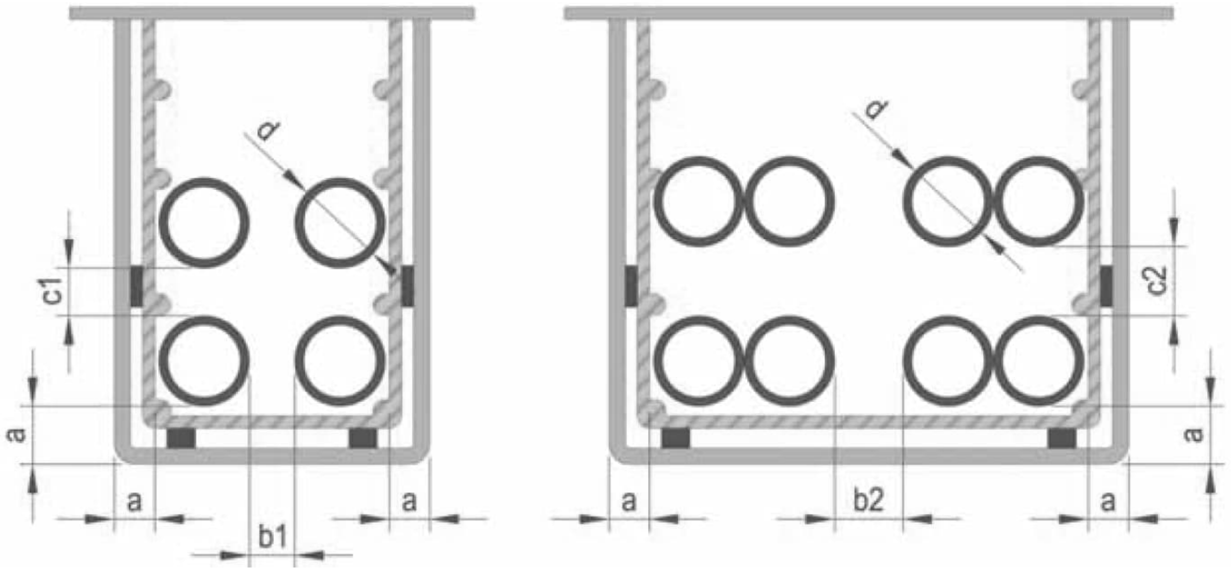
Permissible stress after locking :
See SS-EN 1992-1-1 section 5.10.3

$\sigma_{p,\max}^{efter} = \min(0.75\, f_{pk}; 0.85\, f_{p0.1k}) = \min(1395\,MPa; 1394\,MPa) = 1394\,MPa$

3.14.2 Execution

Associated to pre tension system VSL 6-15.

Recommended measurements :



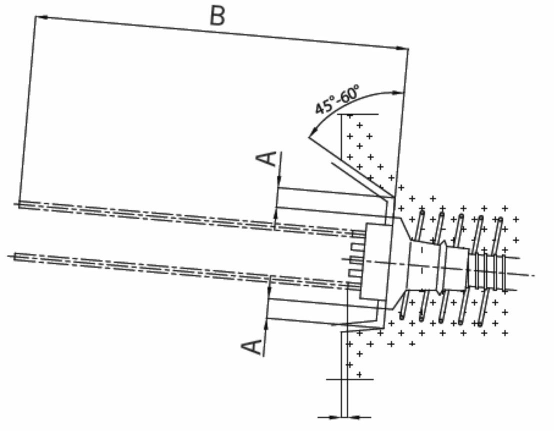
d = 90 mm

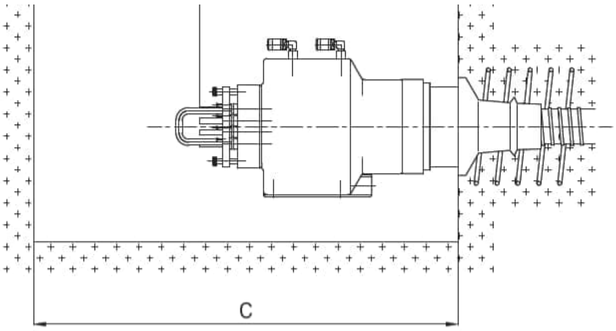
a > 50 mm

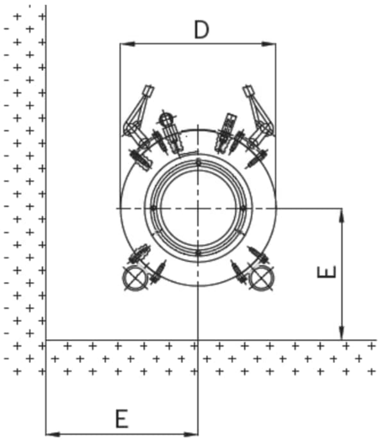
b1, c1 > 0.7d = 63 mm but 100 chosen !

b2, c2 > 1.0d = 90 mm but 100 mm chosen !

Demand for space during tensioning :





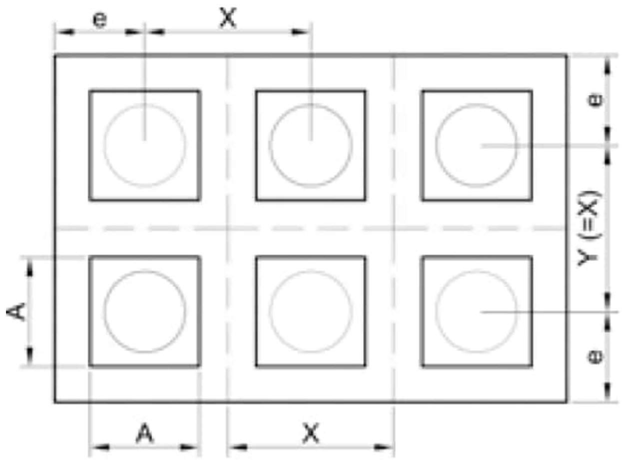


A = 70 mm

B = 1200 mm

C = 1700 mm

Measurements of cables VSL 6-15 :



A = 290 mm

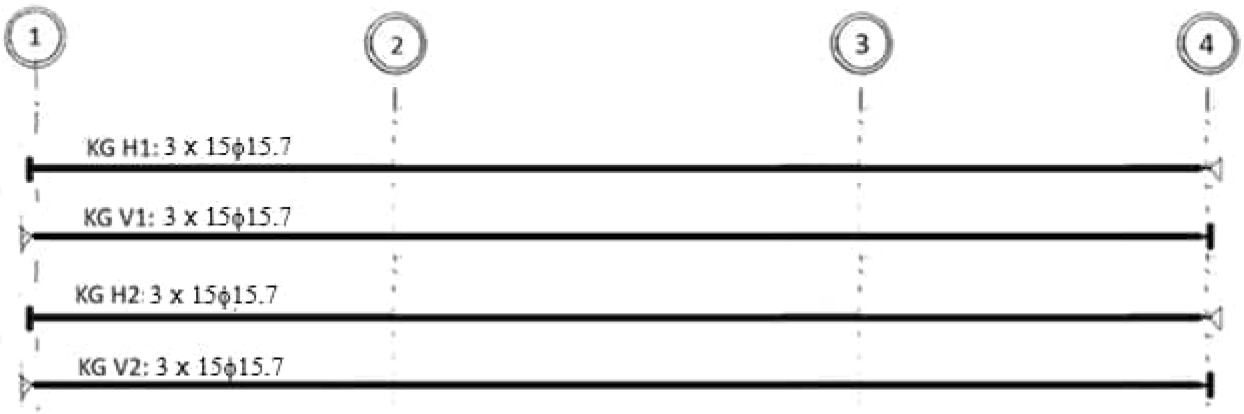
e ≥ 175 mm + TB

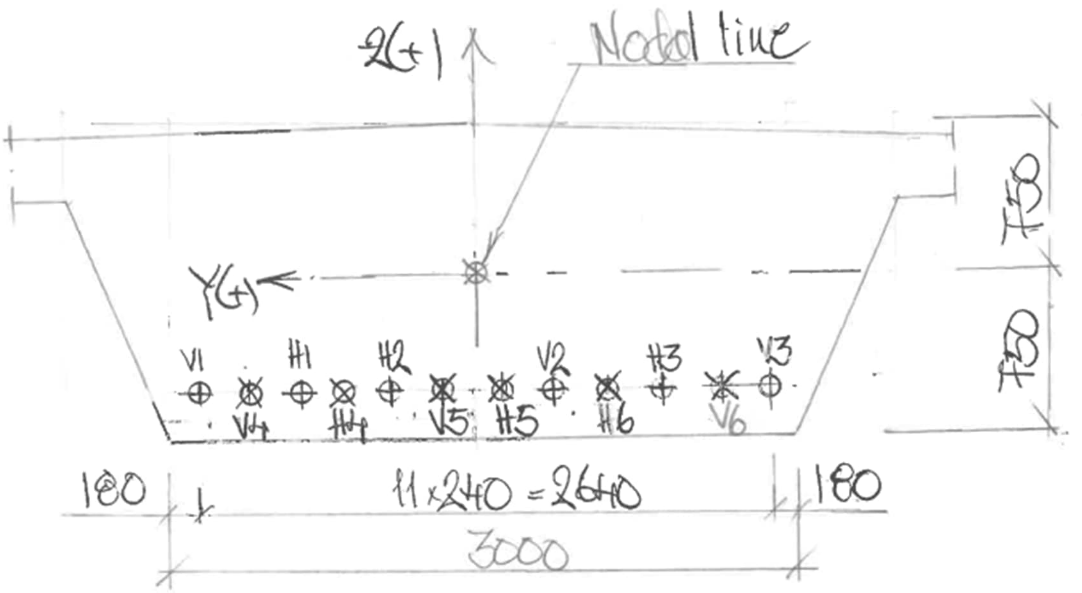
X ≥ 400 mm

3.14.3 Preliminary cable location

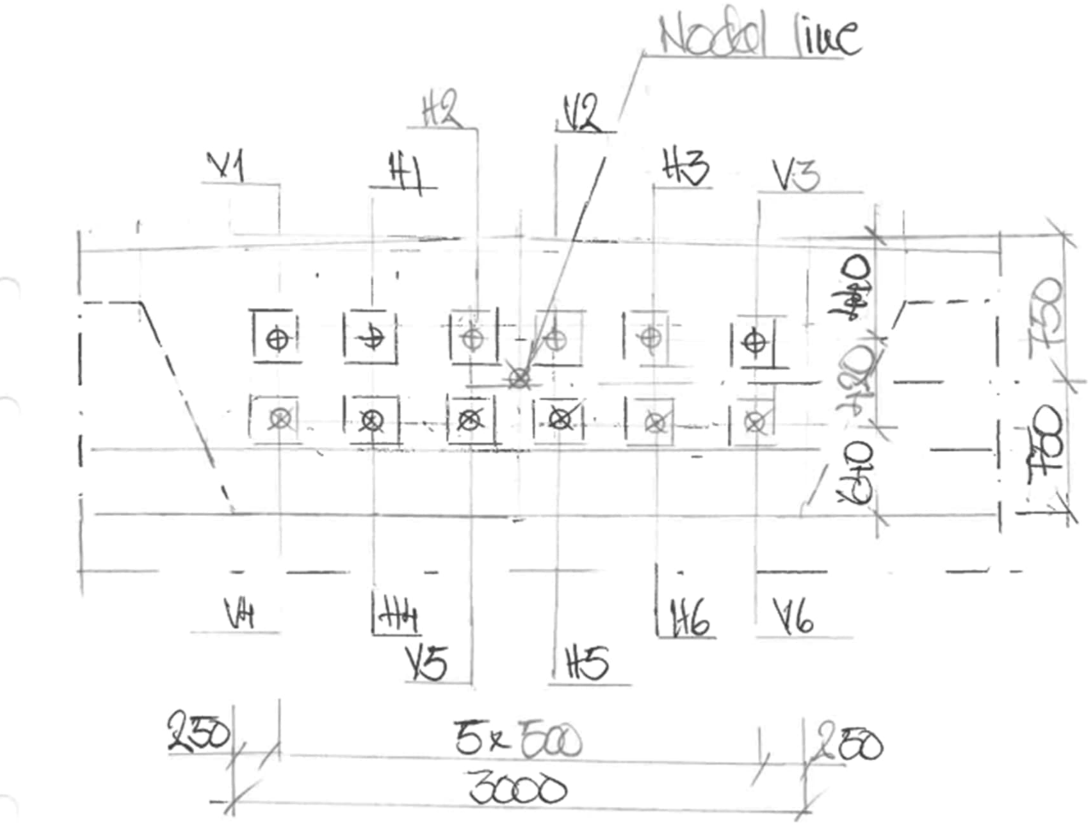
In the static model cables are simplified (= 3 cables are modelled as one fictive cable as seen below).

Profiles can be defined using “global coordinates” or as “local coordinates mapped to lines”. The later of this method is used.

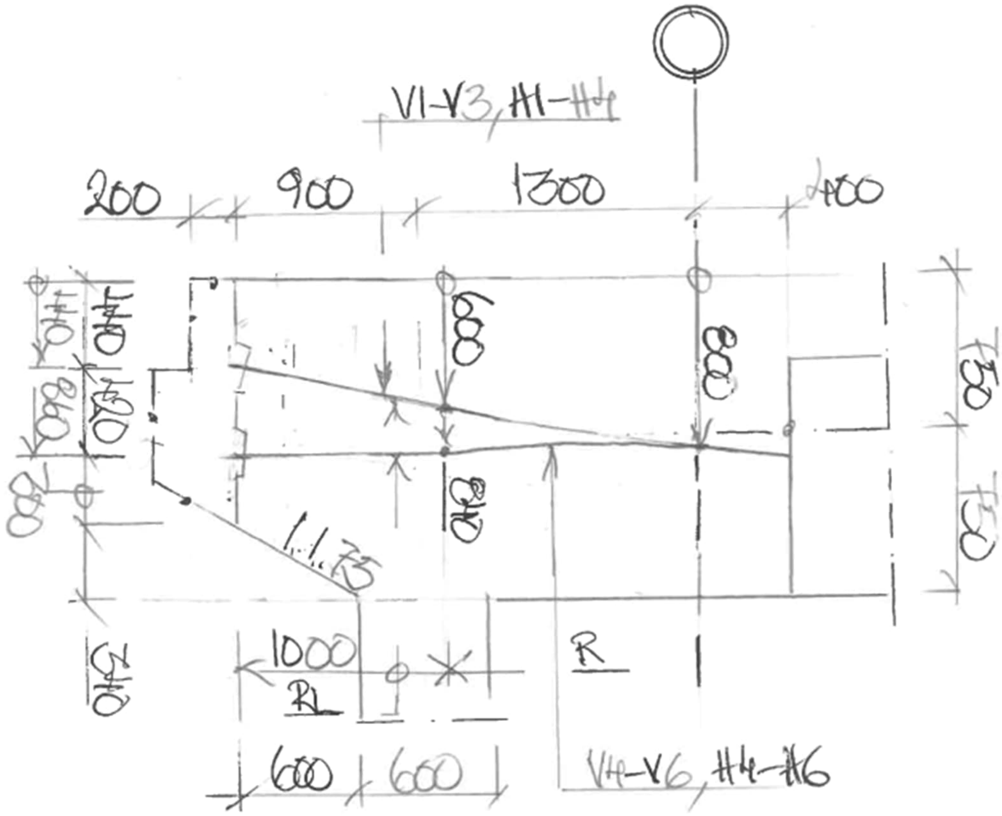




Cross section

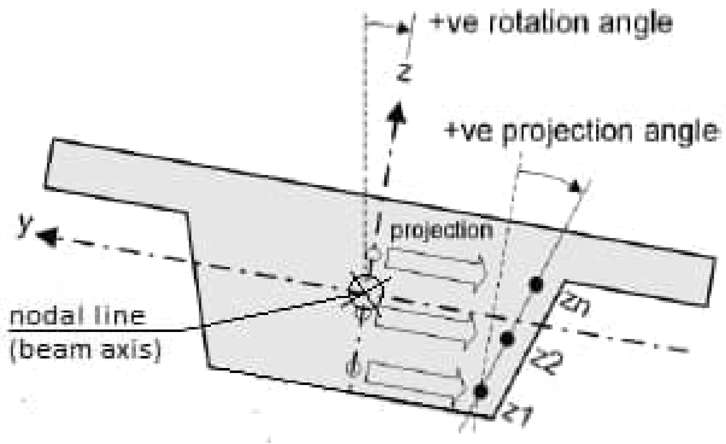


Detail 1
Cross section at end of tendon.



<u>Detail 2,</u>
Longitudinal section at end of tendon.

Principle sketch:



Summary input - pretensioned cables:

Cable	Area	Slip	Left side	Right side	Max. prestress before	Min. prestress after	Pretension force	Location y(+)
KG-V1	2250	6	Active	Passive	1476	1394	3150*	0
KG-H1	2250	6	Passive	Active	1476	1394	3150*	0
KG-V2	2250	6	Active	Passive	1476	1394	3150*	0
KG-H2	2250	6	Passive	Active	1476	1394	3150*	0
-	mm^2	mm	-	-	MPa	MPa	kN	m

* = chosen prestress 1400 MPa

Loadcase	Cables	Fictive load
KG V1	3	3 x KG-V1
KG H1	3	3 x KG-H1
KG V2	3	3 x KG-V2
KG H2	3	3 x KG-H2

Tendon profile KG V1 & KG 1:
See spread sheet input see page A3:144.

x(+) : $x_p(+)$

y(+) : 0 m

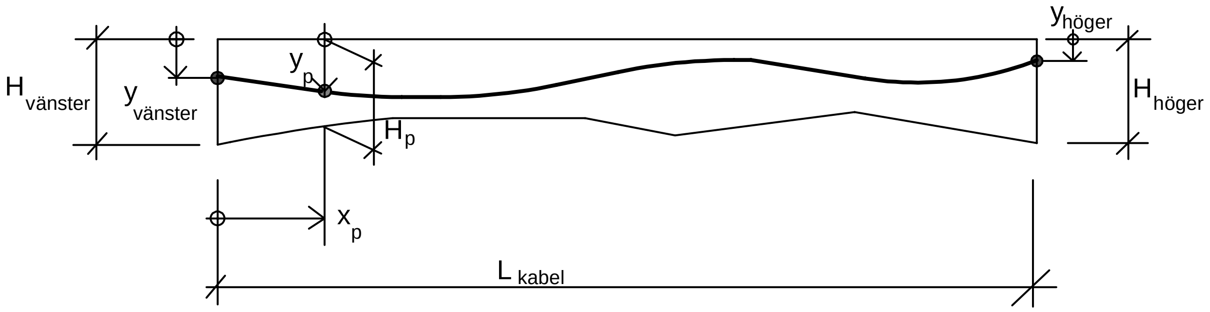
z(+): 0.75 m - $y_p(+)$

x(+)	z(+)	
0	0.31	← 0.75 m – 0.44 m
1.00	0.15	
2.20	-0.05	
7.20	-0.50	
12.20	-0.55	
21.20	0.15	
28.20	0.55	
34.20	0.25	
44.20	-0.65	
54.20	0.15	
60.20	0.55	
67.20	0.15	
76.20	-0.55	
81.20	-0.50	
86.20	-0.05	
87.40	0.15	
88.40	0.31	← 0.75 m – 0.44 m
m	m	

Remark
Profile used for tendons V1-V3 & H1-H3. Cables are placed at nodal line in transversal direction.

Object: Cables V1-V3 (H1-H3)

PRINCIPFIGUR



INDATA

Total kabellängd: $L_{kabel} = 2.2m + 26m + 32m + 26m + 2.2m = 88.4\,m$

Ange antalet kända brytpunkter: $N = 17 \cdot st$

Fiktionskoefficienter spännarmering: $\mu = 0.18$ $k = 0.005 \cdot \frac{rad}{m}$

Draghållfasthet spännarmering : $f_{p0.1k} = 1640MPa$

$f_{pk} = 1860MPa$

E-modul spännarmering: $E_s = 195 \cdot GPa$

Area spännarmering : $A_s = 2250mm^2$

Största tillåtna spännkraft före låsning enligt SS-EN 1992-1-1 avsnitt 5.10.2.1 :

$$\min\left(0.8\cdot f_{pk}, 0.9\cdot f_{p0.1k}\right)\cdot A_s = 3321\cdot kN$$

Vald uppspänningskraft:

$$V_ö = 3320kN = 3320\cdot kN$$

Största tillåtna spännkraft efter låsning enligt SS-EN 1992-1-1 avsnitt 5.10.3 :

$$\min\left(0.75\cdot f_{pk}, 0.85\cdot f_{p0.1k}\right)\cdot A_s = 3136\cdot kN$$

Typ av förankring ("Passiv" eller "Aktiv") / vald maximal kabelkraft efter låsning :

Snitt	Typ	V_{max} [kN]
Vänster	Aktiv	3130
Höger	Passiv	3130

Ge brytpunkter i kabelföring :

Snitt	x_p (m)	y_p (mm)	H_p (mm)
1	0	440	1500
2	1.000	600	1500
3	2.200	800	1500
4	7.200	1250	1500
5	12.200	1300	1500
6	21.200	600	1500
7	28.200	200	1500
8	34.200	500	1500
9	44.200	1400	1500
10	54.200	600	1500
11	60.200	200	1500
12	67.200	600	1500
13	76.200	1300	1500
14	81.200	1250	1500
15	86.200	800	1500
16	87.400	600	1500
17	88.400	440	1500

STEP 2 ⇒

x	w
0	0.31
1.00	0.15
2.20	-0.05
7.20	-0.50
12.20	-0.55
21.20	0.15
28.20	0.55
34.20	0.25
44.20	-0.65
54.20	0.15
60.20	0.55
67.20	0.15
76.20	-0.55
81.20	-0.50
86.20	-0.05
87.40	0.15
88.40	0.31

FEM ⇒

x(+)	z(+)
0	0.31
1.00	0.15
2.20	-0.05
7.20	-0.50
12.20	-0.55
21.20	0.15
28.20	0.55
34.20	0.25
44.20	-0.65
54.20	0.15
60.20	0.55
67.20	0.15
76.20	-0.55
81.20	-0.50
86.20	-0.05
87.40	0.15
88.40	0.31

BERÄKNING

Skapa matematiska funktioner för balk och kabel

$C = \text{pspline}\left(x_p, y_p\right)$: bestämning av koefficienter parabel splinefunktioner

$y(x) = \text{interp}\left(C, x_p, y_p, x\right)$: kabelföring (= splinefunktioner)

$y'(x) = \frac{d}{dx} y(x)$: lutning kabelföring

$y''(x) = \frac{d^2}{dx^2} y(x)$: lutningsförändring kabelföring

$R_{min} = \frac{1}{\max(y''(x))}$: minsta kökningsradie

Friktionsförlust funktion mät ifrån "vänster" sida

$$\alpha_v = \text{if}\left(i > 1, \sum_{j=2}^{i} \left| y'(x_j) - y'(x_{j-1}) \right|, 0\right)$$: ackumulerade vinkeländringar

$$\beta_v = \mu \cdot (\alpha_v + k \cdot X)$$: exponent friktionsförluster

$$\beta_v = \mu \cdot (\alpha_v + k \cdot x)$$: exponent friktionsförluster

$$\eta_{vf} = e^{-\beta_v}$$: friktionsförluster före låsning

$$\eta_{ve} = e^{\beta_v}$$: friktionsförlust efter låsning

Bestämning av läge för maximal kabelkraft **efter** låsning :

$$X_{mv} = \begin{array}{|l} x_{skär} \leftarrow 0m \quad \text{if} \quad Typ = \text{"Passiv"} \\ \text{if} \quad Typ = \text{"Aktiv"} \\ \quad \begin{array}{|l} x_{start} \leftarrow 2m \\ x_{skär} \leftarrow \text{root}(V_{max} - V_{ö} \cdot \text{linterp}(X, \eta_{vf}, x_{start}), x_{start}) \end{array} \end{array}$$

Friktionsförlust funktion mät ifrån "höger" sida

$$\alpha_h = \text{if}\left(i < n, \sum_{j=i+1}^{n} \left|y'(x_j) - y'(x_{j-1})\right|, 0\right)$$: ackumulerade vinkeländringar

$$\beta_h = \mu \cdot \left[\alpha_h + k \cdot (L_{kabel} - x)\right]$$: exponent friktionsförluster

$$\eta_{hf} = e^{-\beta_h}$$: friktionsförluster före låsning

$$\eta_{he} = e^{\beta_h}$$: friktionsförlust efter låsning

Bestämning av läge för maximal kabelkraft **efter** låsning :

$$X_{mh} = \begin{array}{|l} x_{skär} \leftarrow L_{kabel} \ \text{if} \ Typ = \text{"Passiv"} \\ \text{if} \ Typ = \text{"Aktiv"} \\ \quad \begin{array}{|l} x_{start} \leftarrow L_{kabel} - 2m \\ x_{skär} \leftarrow \text{root}\left(V_{max} - V_ö \cdot \text{linterp}(X, \eta_{hf}, x_{start}), x_{start}\right) \end{array} \end{array}$$

Bestämning skärning mellan kurva kabelkraft vänster resp. höger

$$X_m = \begin{array}{|l} x_{skär} \leftarrow L_{kabel} \ \text{if} \ Typ = \text{"Aktiv"} \wedge Typ = \text{"Passiv"} \\ x_{skär} \leftarrow 0m \ \text{if} \ Typ = \text{"Passiv"} \wedge Typ = \text{"Aktiv"} \\ \text{if} \ Typ = \text{"Aktiv"} \wedge Typ = \text{"Aktiv"} \\ \quad \begin{array}{|l} x_{start} \leftarrow 0.5 \cdot L_{kabel} \\ x_{skär} \leftarrow \text{root}\left(V_ö \cdot \text{linterp}(X, \eta_{vf}, x_{start}) - V_ö \cdot \text{linterp}(X, \eta_{hf}, x_{start}), x_{start}\right) \end{array} \end{array}$$

Bestämning av kabelkraft efter låsning i resp. balkände

Kabelkraft på vänster sida :

$$P_{ve} = \begin{cases} V_{max} \cdot \mathrm{linterp}(X, \eta_{hf}, 0m) & \text{if } Typ = \text{"Passiv"} \\ \dfrac{V_{max}}{\mathrm{linterp}(X, \eta_{ve}, X_{mv})} & \text{if } Typ = \text{"Aktiv"} \end{cases}$$

Kabelkraft på höger sida :

$$P_{he} = \begin{cases} V_{max} \cdot \mathrm{linterp}(X, \eta_{vf}, L_{kabel}) & \text{if } Typ = \text{"Passiv"} \\ \dfrac{V_{max}}{\mathrm{linterp}(X, \eta_{he}, X_{mh})} & \text{if } Typ = \text{"Aktiv"} \end{cases}$$

Bestämning av eftersläppning / "låsglidning"

Vänster sida :

$$\Delta L_v = if\left[Typ = \text{"Aktiv"}, \frac{1}{A_s \cdot E_s} \int_0^{X_{mv}} \left(V_{ö} \cdot linterp\left(X, \eta_{vf}, x\right) - P_{ve} \cdot linterp\left(X, \eta_{ve}, x\right)\right) dx, 0\right]$$

Höger sida :

$$\Delta L_h = if\left[Typ = \text{"Aktiv"}, \frac{1}{A_s \cdot E_s} \int_{X_{mh}}^{L_{kabel}} \left(V_{ö} \cdot linterp\left(X, \eta_{hf}, x\right) - P_{ve} \cdot linterp\left(X, \eta_{he}, x\right)\right) dx, 0\right]$$

Bestämning kabelförlängning före låsning

Vänster sida :

$$L_v = \frac{1}{A_s \cdot E_s} \int_0^{X_m} \left(V_{ö} \cdot linterp\left(X, \eta_{vf}, x\right)\right) dx$$

Höger sida :

$$L_h = \frac{1}{A_s \cdot E_s} \int_{X_m}^{L_{kabel}} \left(V_{ö} \cdot linterp\left(X, \eta_{hf}, x\right)\right) dx$$

Bestäm funktion för bestämning av godtycklig kabelkraft före låsning

$$P_{före} = \begin{vmatrix} V_{ö} \cdot \text{linterp}(X, \eta_{lvf}, x) & \text{if } x \le X_m \\ V_{ö} \cdot \text{linterp}(X, \eta_{lhf}, x) & \text{if } x > X_m \end{vmatrix}$$

Bestäm funktion för bestämning av godtycklig kabelkraft efter låsning

$$P_{efter} = \begin{vmatrix} P_{ve} \cdot \text{linterp}(X, \eta_{lve}, x) & \text{if } x \le X_{mv} \\ V_{ö} \cdot \text{linterp}(X, \eta_{lvf}, x) & \text{if } X_{mv} < x < X_m \\ V_{ö} \cdot \text{linterp}(X, \eta_{lhf}, x) & \text{if } X_m \le x \le X_{mh} \\ P_{he} \cdot \text{linterp}(X, \eta_{lhe}, x) & \text{if } x > X_{mh} \end{vmatrix}$$

Utstättningsdata kabelläge i tabellform
(Godtyckliga punkter väljs nedan)

Punkter :

Punkt	x´ (m)	Anm.
1	0.00	-
2	1.00	-
3	8.70	-
4	12.00	-
5	15.20	-
6	18.50	-
6	21.70	-
8	25.00	-
9	28.20	-
10	32.20	-
11	36.20	-
12	40.20	-
13	44.20	-

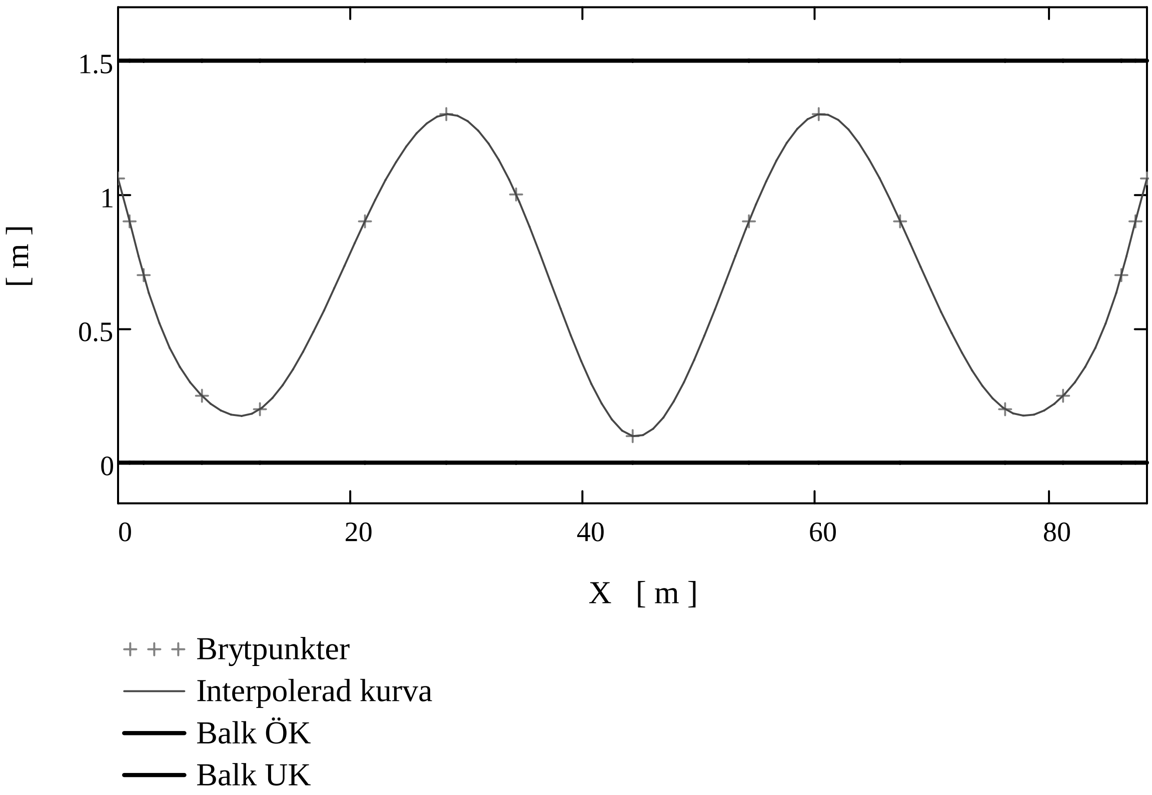
Kabeläge :

Punkt	y´ (m)	Anm.		q_{sp} (m)
1	0.440	Förankringar		1.060
2	0.600	-		0.900
3	1.302	-		0.198
4	1.306	-		0.194
5	1.140	-		0.360
6	0.856	-	ger	0.644
7	0.555	-		0.945
8	0.305	-		1.195
9	0.200	-		1.300
10	0.334	-		1.166
11	0.714	-		0.786
12	1.162	-		0.338
13	1.400	-		0.100

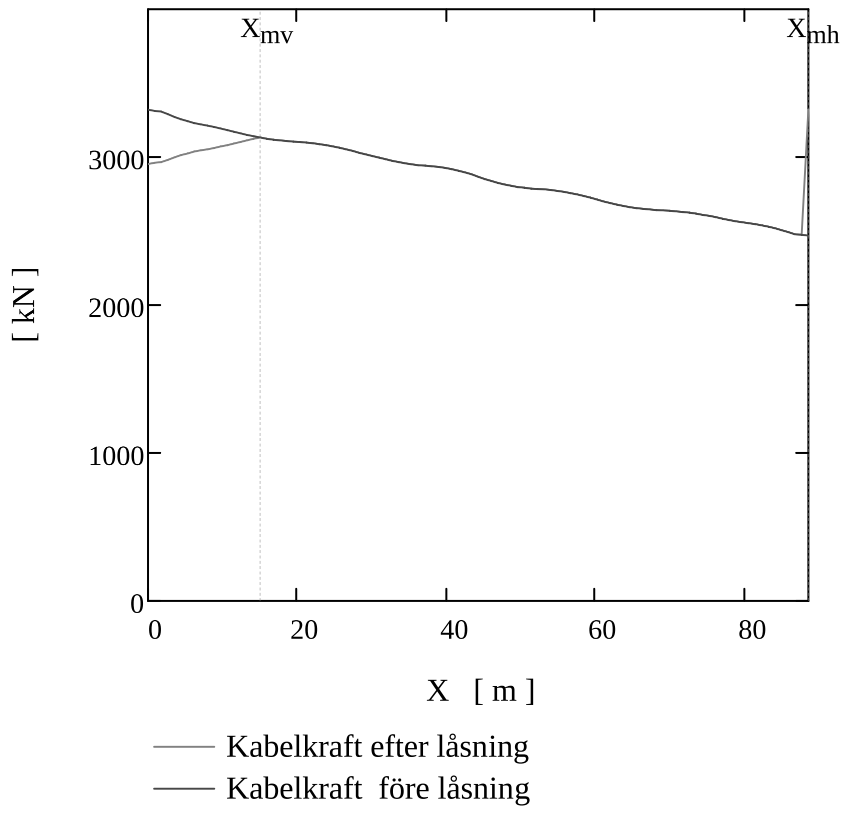
$q_{sp} = H - y´$

RESULTAT

Grafisk uppritning av balk och kabelföring



Grafisk uppritning av kabelkrafter



Minsta krökningsradie

$R_{min} = 38.8 \cdot m$

Kabelförlängning före låsning

$L_v = 579 \cdot mm$: vänster sida

$L_h = 0 \cdot mm$: högers sida

Låsglidning

$\Delta L_v = 6 \cdot mm$: vänster sida

$\Delta L_h = 0 \cdot mm$: högers sida

Kabelkraft i balkände efter låsning

$P_{ve} = 2951 \cdot kN$: vänster sida

$P_{he} = 2325 \cdot kN$: högers sida

Läge för maximal kabelkraft efter låsning

$X_{mv} = 15.005\,m$: vänster sida

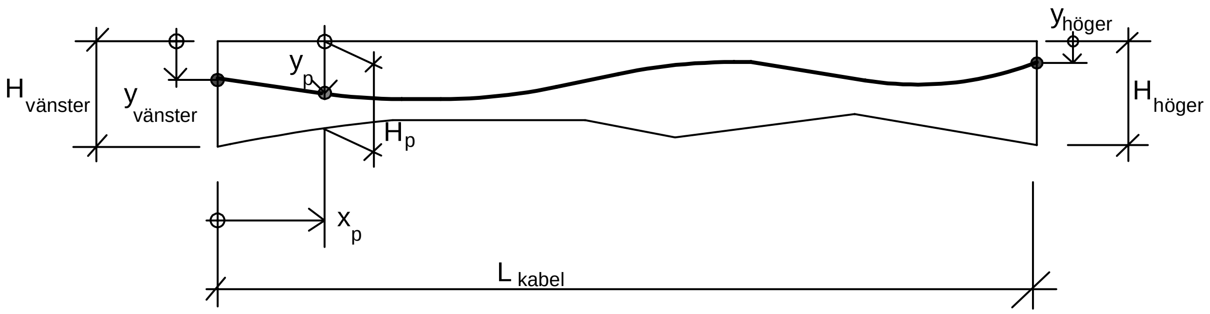
$X_{mh} = 88.4 \cdot m$: högers sida

Läge för lägsta kabelkraft

$X_m = 88.4\,m$

Object: Cables V4-V6 (H4-H6)

PRINCIPFIGUR



INDATA

Total kabellängd: $L_{kabel} = 2.2m + 26m + 32m + 26m + 2.2m = 88.4\,m$

Ange antalet kända brytpunkter: $N = 17 \cdot st$

Fiktionskoefficienter spännarmering: $\mu = 0.18$ $k = 0.005 \cdot \frac{rad}{m}$

Draghållfasthet spännarmering : $f_{p0.1k} = 1640MPa$

$f_{pk} = 1860MPa$

E-modul spännarmering: $E_s = 195 \cdot GPa$

Area spännarmering : $A_s = 2250mm^2$

Största tillåtna spännkraft före låsning enligt SS-EN 1992-1-1 avsnitt 5.10.2.1 :

$$\min\left(0.8\cdot f_{pk}, 0.9\cdot f_{p0.1k}\right)\cdot A_s = 3321\cdot kN$$

Vald uppspänningskraft:

$$V_{ö} = 3320kN = 3320\cdot kN$$

Största tillåtna spännkraft efter låsning enligt SS-EN 1992-1-1 avsnitt 5.10.3 :

$$\min\left(0.75\cdot f_{pk}, 0.85\cdot f_{p0.1k}\right)\cdot A_s = 3136\cdot kN$$

Typ av förankring ("Passiv" eller "Aktiv") / vald maximal kabelkraft efter låsning :

Snitt	Typ	V_{max} [kN]
Vänster	Aktiv	3080
Höger	Passiv	3080

Ge brytpunkter i kabelföring :

Snitt	x_p (m)	y_p (mm)	H_p (mm)
1	0	860	1500
2	1.000	840	1500
3	2.200	800	1500
4	7.200	1250	1500
5	12.200	1300	1500
6	21.200	600	1500
7	28.200	200	1500
8	34.200	500	1500
9	44.200	1400	1500
10	54.200	600	1500
11	60.200	200	1500
12	67.200	600	1500
13	76.200	1300	1500
14	81.200	1250	1500
15	86.200	800	1500
16	87.400	840	1500
17	88.400	860	1500

STEP 2 ⇒

x	w
0	-0.11
1.00	-0.09
2.20	-0.05
7.20	-0.50
12.20	-0.55
21.20	0.15
28.20	0.55
34.20	0.25
44.20	-0.65
54.20	0.15
60.20	0.55
67.20	0.15
76.20	-0.55
81.20	-0.50
86.20	-0.05
87.40	-0.09
88.40	-0.11

FEM ⇒

x(+)	z(+)
0	-0.11
1.00	-0.09
2.20	-0.05
7.20	-0.50
12.20	-0.55
21.20	0.15
28.20	0.55
34.20	0.25
44.20	-0.65
54.20	0.15
60.20	0.55
67.20	0.15
76.20	-0.55
81.20	-0.50
86.20	-0.05
87.40	-0.09
88.40	-0.11

BERÄKNING

Skapa matematiska funktioner för balk och kabel

$C = \text{pspline}(x_p, y_p)$: bestämning av koefficienter parabel splinefunktioner

$y(x) = \text{interp}(C, x_p, y_p, x)$: kabelföring (= splinefunktioner)

$y'(x) = \frac{d}{dx} y(x)$: lutning kabelföring

$y''(x) = \frac{d^2}{dx^2} y(x)$: lutningsförändring kabelföring

$R_{min} = \frac{1}{\max(y''(x))}$: minsta kökningsradie

Friktionsförlust funktion mät ifrån "vänster" sida

$$\alpha_v = \text{if}\left(i > 1, \sum_{j=2}^{i} \left|y'(x_j) - y'(x_{j-1})\right|, 0\right)$$: ackumulerade vinkeländringar

$$\beta_v = \mu\cdot(\alpha_v + k\cdot X)$$: exponent friktionsförluster

$$\beta_v = \mu\cdot(\alpha_v + k\cdot x)$$: exponent friktionsförluster

$$\eta_{vf} = e^{-\beta_v}$$: friktionsförluster före låsning

$$\eta_{ve} = e^{\beta_v}$$: friktionsförlust efter låsning

Bestämning av läge för maximal kabelkraft **efter** låsning :

$$X_{mv} = \begin{array}{|l} x_{skär} \leftarrow 0m \quad \text{if} \quad Typ = \text{"Passiv"} \\ \text{if} \quad Typ = \text{"Aktiv"} \\ \quad \begin{array}{|l} x_{start} \leftarrow 2m \\ x_{skär} \leftarrow \text{root}\left(V_{max} - V_{ö}\cdot\text{linterp}\left(X, \eta_{vf}, x_{start}\right), x_{start}\right) \end{array} \end{array}$$

Friktionsförlust funktion mät ifrån "höger" sida

$$\alpha_h = \text{if}\left(i < n, \sum_{j=i+1}^{n} \left|y'(x_j) - y'(x_{j-1})\right|, 0\right)$$: ackumulerade vinkeländringar

$$\beta_h = \mu \cdot \left[\alpha_h + k \cdot \left(L_{kabel} - x\right)\right]$$: exponent friktionsförluster

$$\eta_{hf} = e^{-\beta_h}$$: friktionsförluster före låsning

$$\eta_{he} = e^{\beta_h}$$: friktionsförlust efter låsning

Bestämning av läge för maximal kabelkraft **efter** låsning :

$$X_{mh} = \left| \begin{array}{l} x_{skär} \leftarrow L_{kabel} \ \text{ if } \ Typ = \text{"Passiv"} \\ \text{if } \ Typ = \text{"Aktiv"} \\ \quad \left| \begin{array}{l} x_{start} \leftarrow L_{kabel} - 2m \\ x_{skär} \leftarrow \text{root}\left(V_{max} - V_{ö} \cdot \text{linterp}\left(X, \eta_{hf}, x_{start}\right), x_{start}\right) \end{array} \right. \end{array} \right.$$

Bestämning skärning mellan kurva kabelkraft vänster resp. höger

$$X_m = \left| \begin{array}{l} x_{skär} \leftarrow L_{kabel} \ \text{ if } \ Typ = \text{"Aktiv"} \wedge Typ = \text{"Passiv"} \\ x_{skär} \leftarrow 0m \ \text{ if } \ Typ = \text{"Passiv"} \wedge Typ = \text{"Aktiv"} \\ \text{if } \ Typ = \text{"Aktiv"} \wedge Typ = \text{"Aktiv"} \\ \quad \left| \begin{array}{l} x_{start} \leftarrow 0.5 \cdot L_{kabel} \\ x_{skär} \leftarrow \text{root}\left(V_{ö} \cdot \text{linterp}\left(X, \eta_{vf}, x_{start}\right) - V_{ö} \cdot \text{linterp}\left(X, \eta_{hf}, x_{start}\right), x_{start}\right) \end{array} \right. \end{array} \right.$$

Bestämning av kabelkraft efter låsning i resp. balkände

Kabelkraft på vänster sida :

$$P_{ve} = \begin{cases} V_{max} \cdot \text{linterp}(X, \eta_{hf}, 0m) & \text{if } Typ = \text{"Passiv"} \\ \dfrac{V_{max}}{\text{linterp}(X, \eta_{ve}, X_{mv})} & \text{if } Typ = \text{"Aktiv"} \end{cases}$$

Kabelkraft på höger sida :

$$P_{he} = \begin{cases} V_{max} \cdot \text{linterp}(X, \eta_{vf}, L_{kabel}) & \text{if } Typ = \text{"Passiv"} \\ \dfrac{V_{max}}{\text{linterp}(X, \eta_{he}, X_{mh})} & \text{if } Typ = \text{"Aktiv"} \end{cases}$$

Bestämning av eftersläppning / "låsglidning"

Vänster sida :

$$\Delta L_v = \text{if}\left[\text{Typ} = \text{"Aktiv"}, \frac{1}{A_s \cdot E_s}\int_0^{X_{mv}} \left(V_ö \cdot \text{linterp}(X, \eta_{vf}, x) - P_{ve} \cdot \text{linterp}(X, \eta_{ve}, x)\right) dx, 0\right]$$

Höger sida :

$$\Delta L_h = \text{if}\left[\text{Typ} = \text{"Aktiv"}, \frac{1}{A_s \cdot E_s}\int_{X_{mh}}^{L_{kabel}} \left(V_ö \cdot \text{linterp}(X, \eta_{hf}, x) - P_{ve} \cdot \text{linterp}(X, \eta_{he}, x)\right) dx, 0\right]$$

Bestämning kabelförlängning före låsning

Vänster sida :

$$L_v = \frac{1}{A_s \cdot E_s}\int_0^{X_m} \left(V_ö \cdot \text{linterp}(X, \eta_{vf}, x)\right) dx$$

Höger sida :

$$L_h = \frac{1}{A_s \cdot E_s}\int_{X_m}^{L_{kabel}} \left(V_ö \cdot \text{linterp}(X, \eta_{hf}, x)\right) dx$$

Bestäm funktion för bestämning av godtycklig kabelkraft före låsning

$$P_{före} = \begin{cases} V_{ö} \cdot \text{linterp}(X, \eta_{lvf}, x) & \text{if } x \le X_m \\ V_{ö} \cdot \text{linterp}(X, \eta_{lhf}, x) & \text{if } x > X_m \end{cases}$$

Bestäm funktion för bestämning av godtycklig kabelkraft efter låsning

$$P_{efter} = \begin{cases} P_{ve} \cdot \text{linterp}(X, \eta_{lve}, x) & \text{if } x \le X_{mv} \\ V_{ö} \cdot \text{linterp}(X, \eta_{lvf}, x) & \text{if } X_{mv} < x < X_m \\ V_{ö} \cdot \text{linterp}(X, \eta_{lhf}, x) & \text{if } X_m \le x \le X_{mh} \\ P_{he} \cdot \text{linterp}(X, \eta_{lhe}, x) & \text{if } x > X_{mh} \end{cases}$$

Utstättningsdata kabelläge i tabellform
(Godtyckliga punkter väljs nedan)

Punkter :

Punkt	x´ (m)	Anm.
1	0.00	-
2	1.00	-
3	8.70	-
4	12.00	-
5	15.20	-
6	18.50	-
6	21.70	-
8	25.00	-
9	28.20	-
10	32.20	-
11	36.20	-
12	40.20	-
13	44.20	-

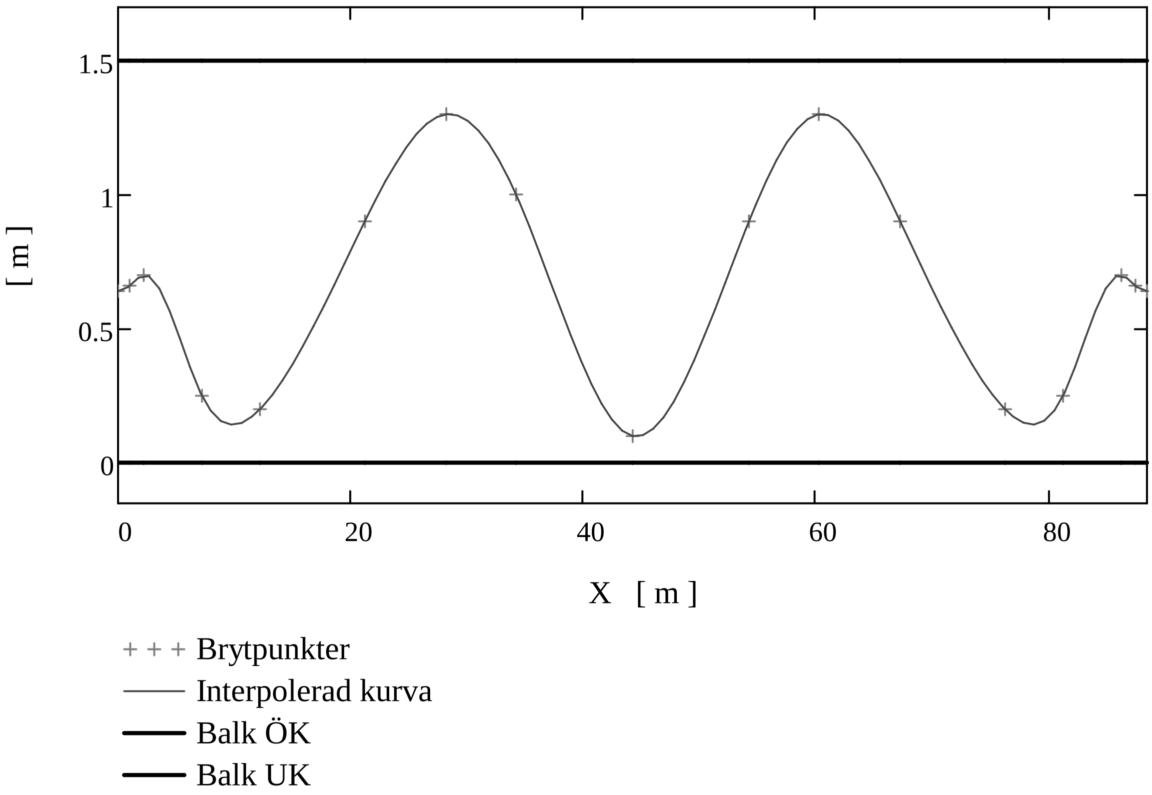
Kabeläge :

Punkt	y´ (m)	Anm.		q_{sp} (m)
1	0.860	Förankringar		0.640
2	0.840	-		0.660
3	1.340	-		0.160
4	1.309	-		0.191
5	1.118	-		0.382
6	0.842	-	ger	0.658
7	0.556	-		0.944
8	0.309	-		1.191
9	0.200	-		1.300
10	0.334	-		1.166
11	0.715	-		0.785
12	1.162	-		0.338
13	1.400	-		0.100

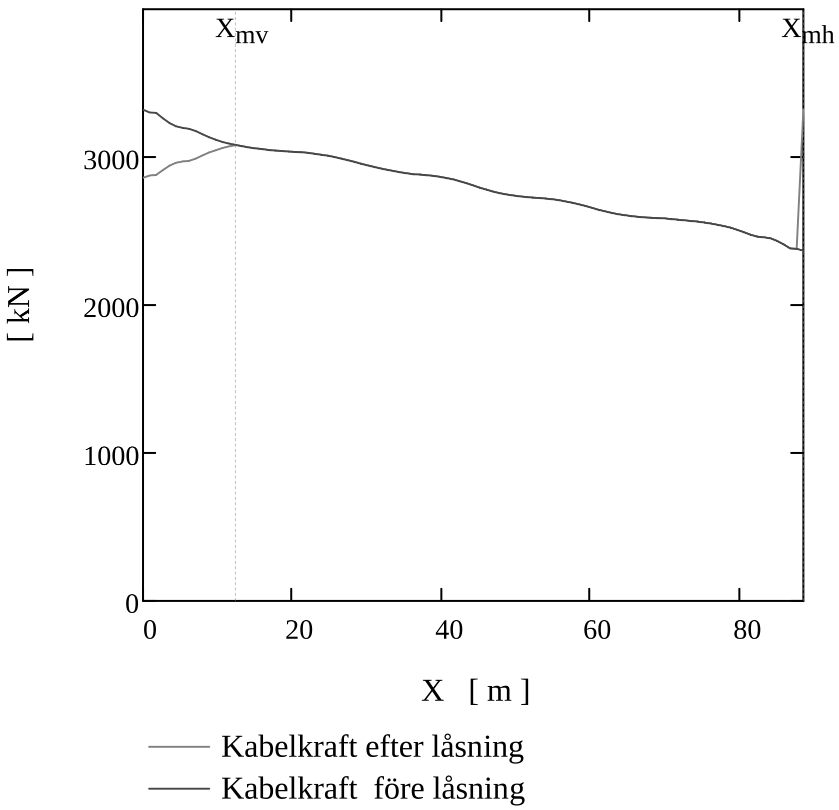
$q_{sp} = H - y´$

RESULTAT

Grafisk uppritning av balk och kabelföring



Grafisk uppritning av kabelkrafter



Minsta krökningsradie

$R_{min} = 14.6 \cdot m$

Kabelförlängning före låsning

$L_v = 567 \cdot mm$: vänster sida

$L_h = 0 \cdot mm$: högers sida

Låsglidning

$\Delta L_v = 6 \cdot mm$: vänster sida

$\Delta L_h = 0 \cdot mm$: högers sida

Kabelkraft i balkände efter låsning

$P_{ve} = 2857 \cdot kN$: vänster sida

$P_{he} = 2194 \cdot kN$: högers sida

Läge för maximal kabelkraft efter låsning

$X_{mv} = 12.384\, m$: vänster sida

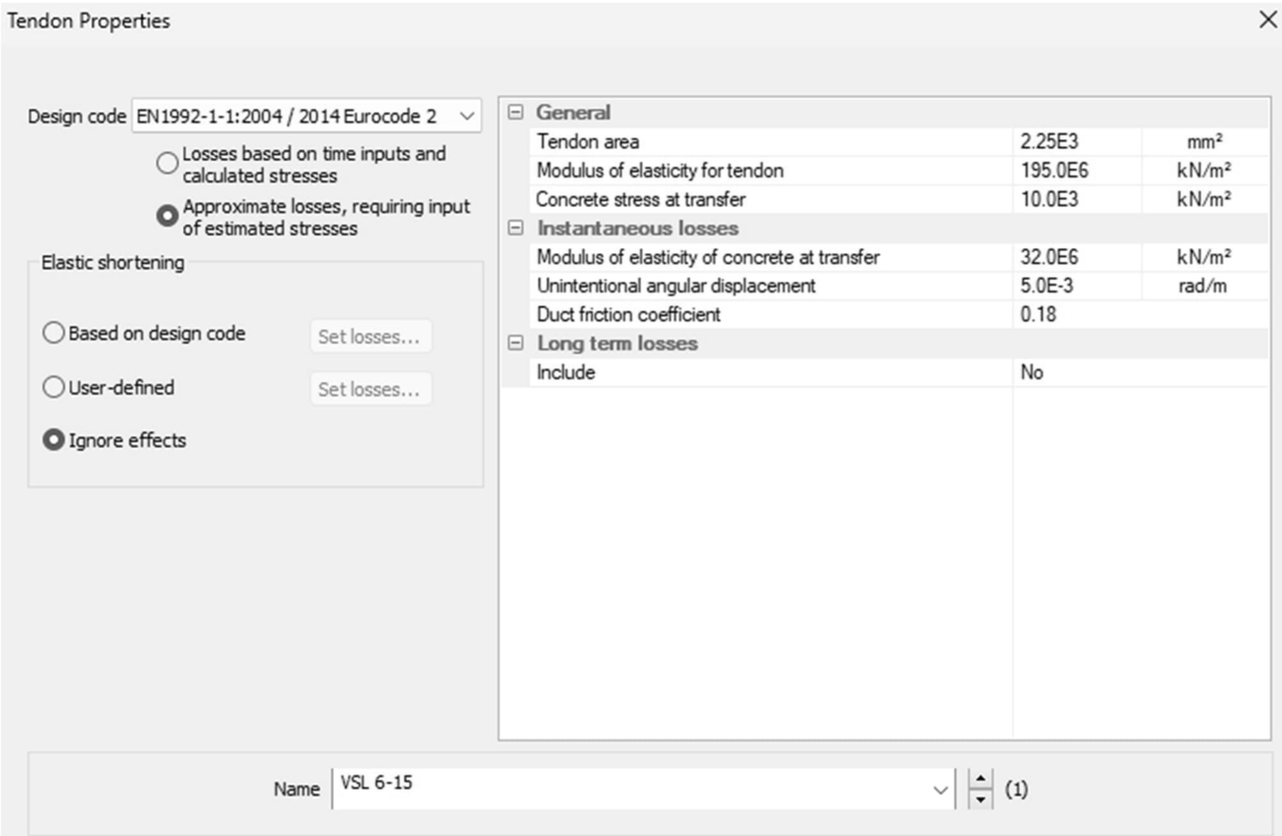
$X_{mh} = 88.4 \cdot m$: högers sida

Läge för lägsta kabelkraft

$X_m = 88.4\, m$

Tendon properties:

Calculation of "long term losses" is not performed in FEM program but separately, thus "Include: No" table below.



Friktionskoefficienter VSL

$$P_{(x)} = P_o \cdot e^{-\mu(\alpha + k \cdot x)}$$

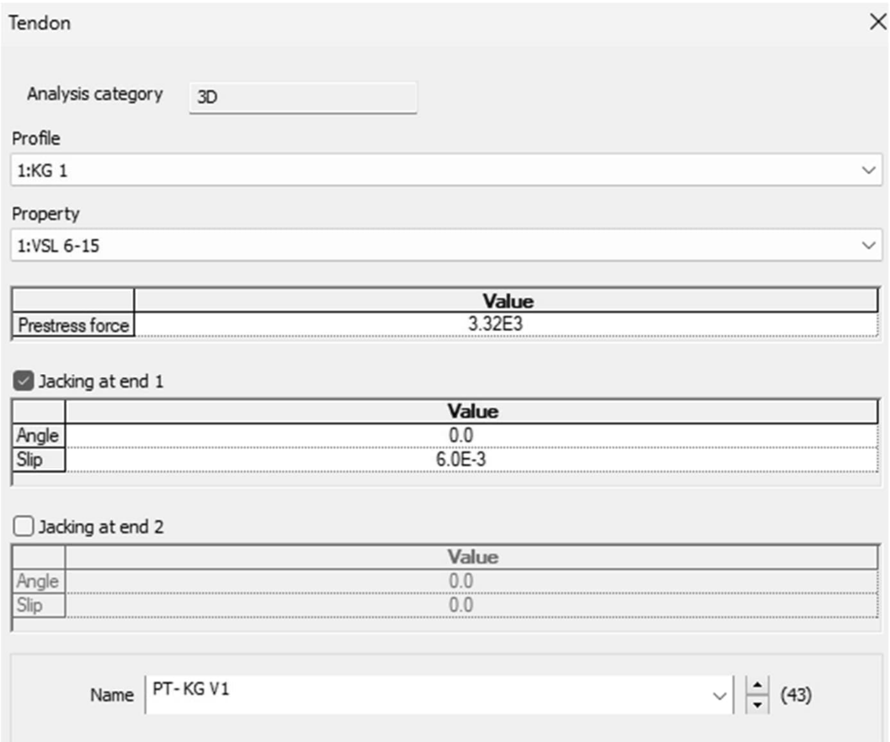
Type of tendon and duct	Range	Recommended value
Internal bonded tendon with corrugated steel duct (bare strand)	μ = 0.16 - 0.22 k = 0.004 - 0.008	μ = 0.18 k = 0.005 ($k^* = 9 \times 10^{-4}$)

μ = 0.18

$$k = 0.005 \frac{rad}{m}$$

3.14.4 Load definition

KG V1: Cables V1, V2 & V3


Tendon

Analysis category: 3D

Profile: 1:KG 1

Property: 1:VSL 6-15

	Value
Prestress force	3.32E3

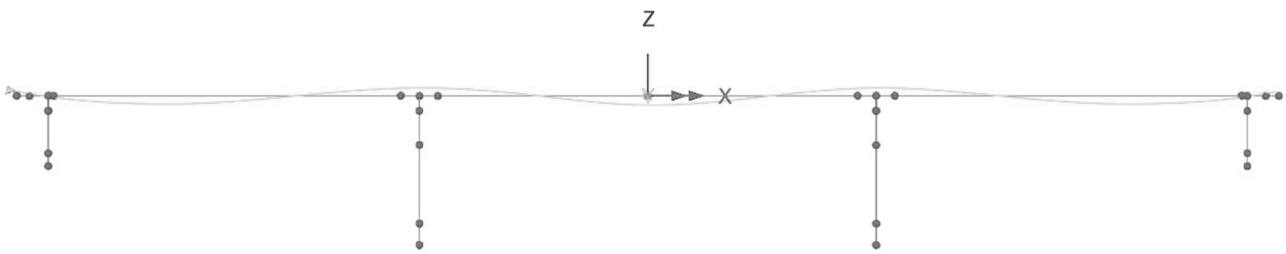
☑ Jacking at end 1

	Value
Angle	0.0
Slip	6.0E-3

☐ Jacking at end 2

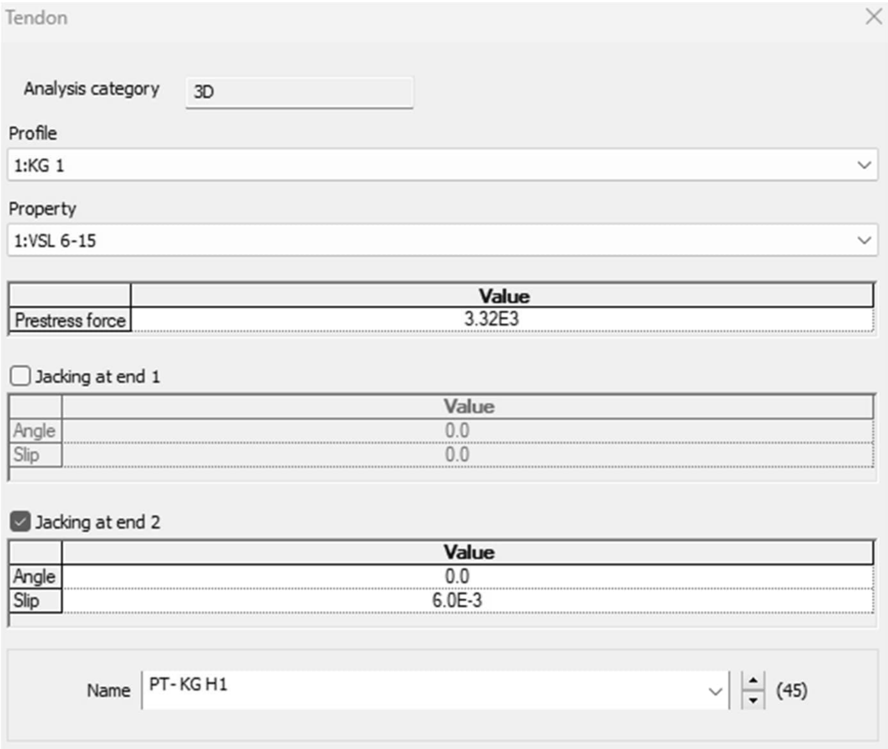
	Value
Angle	0.0
Slip	0.0

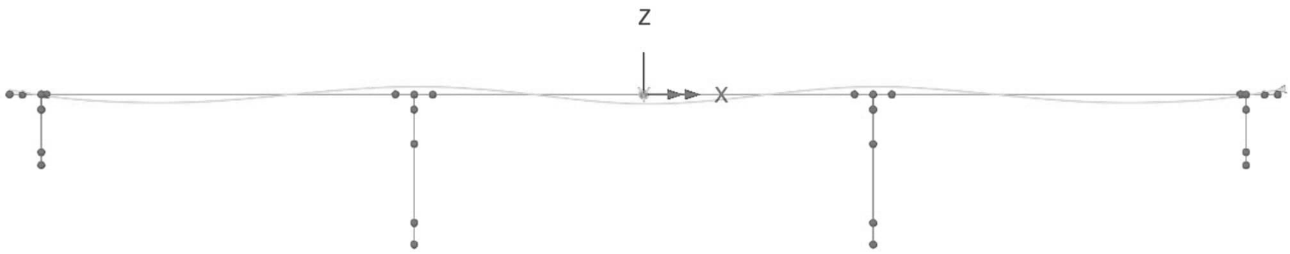
Name: PT- KG V1 (43)



ELEVATION

KG H1: Cables H1, H2 & H3





ELEVATION

KG V2: Cables V4, V5 & V6


Tendon

Analysis category: 3D

Profile: 2:KG 2

Property: 1:VSL 6-15

	Value
Prestress force	3.32E3

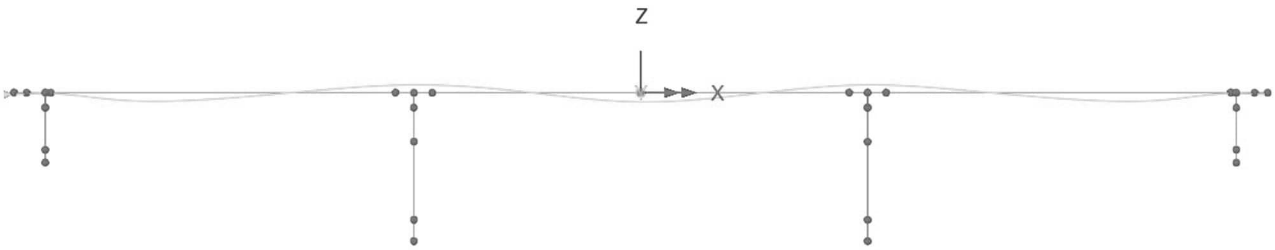
☑ Jacking at end 1

	Value
Angle	0.0
Slip	6.0E-3

☐ Jacking at end 2

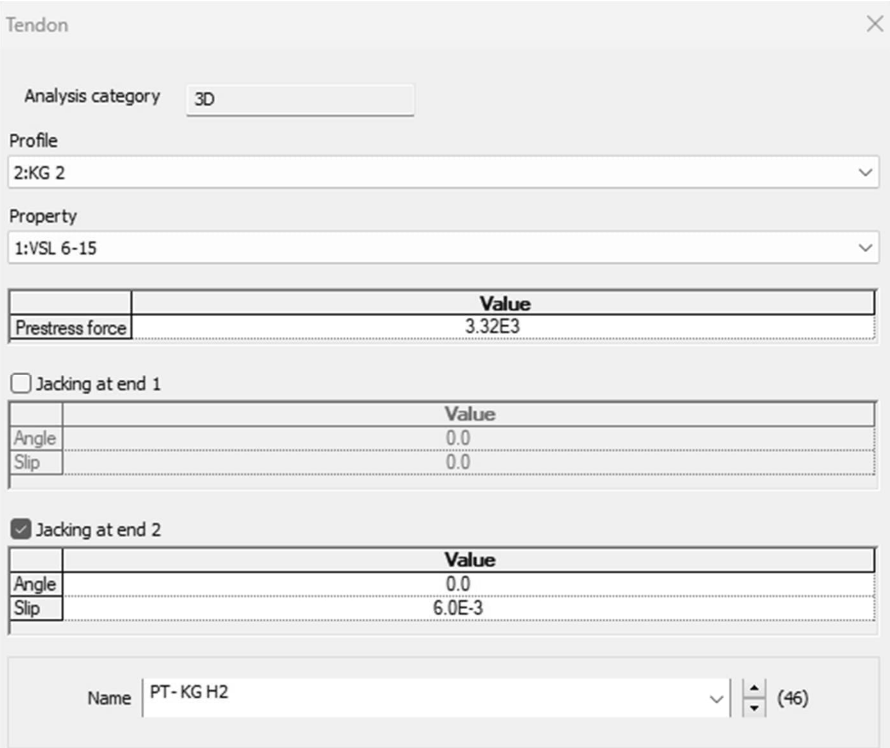
	Value
Angle	0.0
Slip	0.0

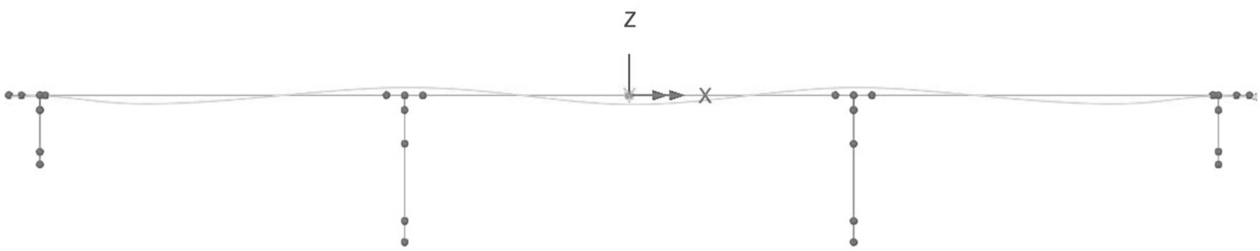
Name: PT- KG V2 (44)



ELEVATION

KG H2: Cables H4, H5 & H6





ELEVATION

3.14.4 Load combination

Load combination basis PT-t0:

Load case	Factor
KG V1	3.00
KG H1	3.00
KG V2	3.00
KG H2	3.00

Load combination basis PT-t1:

Load case	Factor
PT – t0	0.94

Load combination basis PT-t2:

Load case	Factor
PT – t0	0.84

3.15 LOAD COMBINATIONS

Verification of load capacity shall be carried out for several limit states as detailed in this section.

Fatigue Limit State:
The risk of fatigue according to the partial factor method is checked using equation 6.69 provided in document SS-EN 1992-1-1.

Other Limit States:
For other limit states, section 6.4.3 of EN-1990 is applied.

3.15.1 Ultimate Limit States (ULS)

When checking the ultimate limit state, the load factors vary depending on the type of failure as detailed below:

STR: Verification of structural bearing capacity

GEO: Verification of geotechnical bearing capacity

For checking the ultimate limit state, TRVNFRA-00227 section 7.1.6.3 specifies requirements for load combinations as follows.

Design Method D2 (Set B):
Design Method D2 (Set B) according to TSFS 2018:57 Table 4.4 shall be applied for the structural bearing capacity of the construction (STR; SK 3).

Design Method is defined according to EN-1990 equations 6.10a and 6.10b as detailed below.

$$E_{Sd}^{10a} = \sum_{j\geq 1} \gamma_{G.j} \cdot G_{k,j} + \gamma_{Q.1} \cdot \psi_{0,1} \cdot Q_{k.1} + \sum_{i>1} \gamma_{Q.i} \cdot \psi_{0,i} \cdot Q_{k,i} = \psi\gamma_{ULS-A} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

$$E_{sd}^{10b} = \sum_{j\geq 1} \xi_j \cdot \gamma_{G.j} \cdot G_{k,j} + \gamma_{Q.1} \cdot Q_{k.1} + \sum_{i>1} \gamma_{Q.i} \cdot \psi_{0,i} \cdot Q_{k,i} = \psi\gamma_{ULS-B} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

Equation 6.10a refers to the (ULS-A) case where the permanent loads are dominant, usually during the construction phase.

Equation 6.10b refers to the (ULS-B) case where the variable loads are dominant.
Design method 2 (set B) according to TSFS 2018:57 table 4.4 shall be applied for the structural capacity (STR; SK3).

A1 (construction loads)
All load factors are greater than set C.

A2 (geotechnical loads)

- Load coefficient earth pressure:
  $\Psi\gamma_{ULS-A} = \gamma_d \cdot 1.35 \cdot \eta_{sup.G} = 1.0 \cdot 0.89 \cdot 1.35 \cdot 1.1 = 1.49$ ← dimensioning
  $\Psi\gamma_{ULS-B} = \gamma_d \cdot 0.89 \cdot 1.35 \cdot \eta_{sup.G} = 1.0 \cdot 0.89 \cdot 1.35 \cdot 1.1 = 1.33$

- Load coefficient surcharge:
  $\Psi\gamma_{ULS-A} = \gamma_d \cdot \psi_0 \cdot 1.50 = 1.0 \cdot 0.75 \cdot 1.50 = 1.13$
  $\Psi\gamma_{ULS-B} = \gamma_d \cdot 1.50 = 1.0 \cdot 1.50 = 1.50$ ← dimensioning

Design method D3 (set C):

Design method D3 (set C) according to TSFS 2018:57 table 4.5 shall be applied for determining geotechnical bearing capacity (GEO; SK 2).

The design method is defined according to EN-1990 equation 6.10a and 6.10b as presented below.

$$E_{Sd}^{10a} = \sum_{j\geq 1} \gamma_{G.j} \cdot G_{k,j} + \gamma_{Q.1} \cdot \psi_{0,1} \cdot Q_{k.1} + \sum_{i>1} \gamma_{Q.i} \cdot \psi_{0,i} \cdot Q_{k,i} = \psi\gamma_{ULS-GA} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

$$E_{sd}^{10b} = \sum_{j\geq 1} \xi_j \cdot \gamma_{G.j} \cdot G_{k,j} + \gamma_{Q.1} \cdot Q_{k.1} + \sum_{i>1} \gamma_{Q.i} \cdot \psi_{0,i} \cdot Q_{k,i} = \psi\gamma_{ULS-GB} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

Equation 6.10a refers to the (ULS-GA) case where the permanent loads are dominant, usually during the construction phase.
Equation 6.10b (ULS-GB) refers to the case where the variable loads are dominant.

Design method 3 (set C) according to TSFS 2018:57 table 4.5 shall be applied for determining geotechnical bearing capacity (GEO).

A1 (construction loads)
All load factors are less than set B.

A2 (geotechnical loads)
- Load coefficient earth pressure: $\psi\gamma_{jord} = \gamma_d \cdot 1.1 \cdot \eta_{sup.G} = 0.91 \cdot 1.1 \cdot 1.1 = 1.10$

- Load coefficient surcharge: $\psi\gamma_{\text{över}} = \gamma_d \cdot 1.40 = 0.91 \cdot 1.40 = 1.27$

Simplified Design Method ULS:

To limit the number of load combinations, design method D2 (STR) is also applied for checking geotechnical bearing capacity (GEO). This is done by adjusting load coefficients associated with the geotechnical loads.
When applying the geotechnical loads, the earth pressure coefficient corresponding to D2 is applied.

Check load coefficients associated with the geotechnical loads

$$K_o(D2) = 1 - sin(\varphi_d) = 1 - sin45^\circ = 0.29$$

$$K_o(D3) = 1 - sin(\varphi_d) = 1 - sin38^\circ = 0.39$$

Earth pressure→ 1.48[1.)] $\cdot K_0(D2) = 0.43 \equiv 1.10 \cdot K_0(D3) = 0.43$ i.e. OK!

Surcharge → 1.71[2.)] $\cdot K_0(D2) = 0.50 \equiv 1.27 \cdot K_0(D3) = 0.50$ i.e. OK!

Footnote
[1.)] Last coefficient $\psi\gamma_{ULS} = 1.48$ is applied instead of 1.33.
[2.)] Last coefficient $\psi\gamma_{ULS} = 1.71$ is applied instead of 1.50.

Permanent loads:
(Refers to RKFM appendix 2, page 22)

Nr	Load		$\psi\gamma_{ULS-A}$	$\psi\gamma_{ULS-B}$
1	Egentyngd	max	1.35	1.20
		min	1.00	1.00
2	Beläggning	max	1.49	1.33
		min	0.90	0.90
3	Överfyllnad	max	1.49	1.33
		min	0.90	0.90
4	Jordtryck	max	1.49	1.33
		min	0.90	0.90
5	Vattentryck	max	1.35	1,09
		min	1.00	1.00
6	Stödförskjutning	max	1.35	1.20
		min	1.00	1.00
7	Krympning	max	1.35	1.20
		min	1.00	1.00
8	Spännkraft	max	1.35	1.35
		min	1.00	1.00

⇒

$\psi\gamma_{ULS}$
1.20
1.00
1.33
0.90
1.33
0.90
1.48[1.)]
0.90
1,09
1.00
1.20
1.00
1.20
1.00
1.35
1.00

Remark
ULS-A is not considered critical during operational use. Instead ULS-B is used as design values.

Variable loads:
(Refers to RKFM appendix 2, page 22)

Nr	Load	$\psi\gamma_{ULS\text{-}A}$	$\psi\gamma_{ULS\text{-}B}$		$\psi\gamma_{ULS}$
	Lastmodell LM 1 :				
9	Boggiesystem	1.13	1.03/1.50		1.03/1.50
10	Utbredd last	0.60	0.60/1.50		0.60/1.50
11	Bromskraft	0.84	0.84/1.13		0.84/1.13
12	Sidokraft	0.84	0.84/1.13		0.84/1.13
13	Centrifugalkraft	0.84	0.84/1.13		0.84/1.13
	Lastmodell LM 2 :				
14	Enstaka axellast	0	0/1.50		0/1.50
	Typfordon EG A/B :				
15	Typfordon EG A/B	1.13	1.13/1.50		1.13/1.50
16	Bromskraft	0.84	0.84/1.13		0.84/1.13
17	Sidokraft	0.84	0.84/1.13		0.84/1.13
18	Centrifugalkraft	0.84	0.84/1.13	⇒	0.84/1.13
19	Temperatur	0.90	0.90/1.50		0.90/1.50
	Vindlaster:				
20	Vindlast mot bro	0.45	0.45/1.50		0.45/1.50
21	Vindlast mot trafik	0.45	0.45/1.50		0.45/1.50
22	Överlast	1.13	1.13/1.50		1.13/1.71[2.)]
23	Istryck	0.60	0.60/1.50		0.60/1.50

Remark
ULS-A is not considered critical during operational use. Instead ULS-B is used as design values.

Load combination smart *ULS-PERM :*
(ULS-PERM_0 is identical but does not contain load case PT-t0)

Load case	Permanent factor	Variable factor
EGEN	1.00	0.20
BELÄGG	0.90	0.43
JORD	0.90	0.58
STOD	0	0.41 = (1.20 x 0.34 [4.)])
KRYMP	0	0.41 = (1.20 x 0.34[4.)])
PT-t0	0.84 (= 0.84·1.00) [3.)]	0.51 (= 1.35 - 0.84) [5.)]

Footnotes:
[4.)] The effect of creep results in reduced stiffness; see page A3:43.
[5.)] Load case pretension varies from PT-t0 to PT-t2 (= 0.84·PT-t0) is applied.

Although the load cases STOD and KRYMP do not need to be considered according to SS-EN 1992-1-1, this is done on the safe side.

Envelope ALT :

Load case
ICE
TEMP

Load combination smart *ULS-VAR :*
(Load cases to consider : 6 / Variable load cases : 1)

Load case	Permanent factor	Variable factor
TRAFIK	1.03	0.47
BROMS	0.84	0.29
SIDO	0.84	0.29
OVER	1.13	0.58
VIND	0.45	1.05
ALT	0.90	0.60

Load combination smart *ULS :*
(ULS-0 is identical but does not contain load case PT-t0)

Load case	Permanent factor	Variable factor
ULS-PERM	1	0
ULS-VAR	0	1

3.16.2 Service limit state (SLS)

The service limit state is divided into 3 load combinations based on their duration. The load combinations are presented below.

Load combination	Duration
SLS:K	Characteristic
SLS:F	Frequent
SLS:Q	Quasi-permanent

Load Combination SLS:K according to EN 1990 equation 6.14b is presented below.

$$E_{Sd} = \sum_{j\geq 1} G_{k,j} + Q_{k.1} + \sum_{i>1} \psi_{0,i} \cdot Q_{k,i} = \psi\gamma_{SLS.K} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

Load Combination SLS:F according to EN 1990 equation 6.15b is presented below.

$$E_{Sd} = \sum_{j\geq 1} G_{k,j} + \psi_1 \cdot Q_{k.1} + \sum_{i>1} \psi_{2,i} \cdot Q_{k,i} = \psi\gamma_{SLS.2} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

Load Combination SLS:Q according to EN 1990 equation 6.16b is presented below.

$$E_{Sd} = \sum_{j\geq 1} G_{k,j} + \sum_{i>0} \psi_{2,i} \cdot Q_{k,i} = \psi\gamma_{SLS.Q} \cdot (\sum_{j>1} G_{k,j} + \sum_{i>1} Q_{k,i})$$

When designing, load coefficients according to equations 6.14a, 6.15b, and 6.16b are applied. Refer to the derivation in Appendix 2.

Adjustment of load coefficients for geotechnical loads:

$K_o(D2) = 1 - sin(\varphi_d) = 1 - sin45^\circ = 0.29$

$K_o(D3) = 1 - sin(\varphi_d) = 1 - sin38^\circ = 0.39$

LC	Earth pressue
SLS-K	$\frac{K0(D3)}{K0(D2)} \cdot 1.1 = \frac{0.39}{0.29} \cdot 1.1 = 1.48$
SLS-F	$\frac{K0(D3)}{K0(D2)} \cdot 1.1 = \frac{0.39}{0.29} \cdot 1.1 = 1.48$
SLS-Q	$\frac{K0(D3)}{K0(D2)} \cdot 1.0 = \frac{0.39}{0.29} \cdot 1.0 = 1.34$

LC	Temparature
SLS-K	$\frac{K0(D3)}{K0(D2)} \cdot 1.0 = \frac{0.39}{0.29} \cdot 1.00 = 1.34$
SLS-F	$\frac{K0(D3)}{K0(D2)} \cdot 0.60 = \frac{0.39}{0.29} \cdot 0.60 = 0.81$
SLS-Q	0

LC	Surcharge
SLS-K	$\frac{K0(D3)}{K0(D2)} \cdot 1.0 = \frac{0.39}{0.29} \cdot 1.00 = 1.34$
SLS-F	$\frac{K0(D3)}{K0(D2)} \cdot 0.75 = \frac{0.39}{0.29} \cdot 0.75 = 1.01$
SLS-Q	0

Permanent loads:
(Refers to RKFM appendix 2, page 40)

Nr	Load		$\psi\gamma_{SLS-K}$	$\psi\gamma_{SLS-F}$	$\psi\gamma_{SLS-Q}$	
1	Egentyngd	max	1.00	1.00	1.00	
		min	1.00	1.00	1.00	
2	Beläggning	max	1.10	1.10	1.00	
		min	0.90	0.90	1.00	
3	Överfyllnad	max	1.10	1.10	1.00	
		min	0.90	0.90	1.00	
4	Jordtryck	max	1.48 [6.)]	1.48 [6.)]	1.34 [6.)]	← 1.48 is used on all safe side !
		min	0.90	0.90	1.00	
5	Vattentryck	max	1.00	1.00	1,00	
		min	1.00	1.00	1.00	
6	Stödförskjutning	max	1.00	1.00	1.00	
		min	1.00	1.00	1.00	
7	Krympning	max	1.00	1.00	1.00	
		min	1.00	1.00	1.00	
8	Spännkraft	max	1.00	1.00	1.00	
		min	1.00	1.00	1.00	

Footnote:
[6.)] Load coefficient page A3:182 is applied.

Variable loads:
(Refers to RKFM appendix 2, page 40)

Nr	Load	$\psi\gamma_{SLS-K}$	$\psi\gamma_{SLS-F}$	$\psi\gamma_{SLS-Q}$
	Lastmodell LM 1 :			
9	Boggiesystem	0.75/1.00	0/0.75	0
10	Utbredd last	0.40/1.00	0/0.40	0
11	Bromskraft	0.56/0.75	0/0.56	0
12	Sidokraft	0.56/0.75	0/0.56	0
13	Centrifugalkraft	0.56/0.75	0/0.56	0
	Lastmodell LM 2 :			
14	Enstaka axellast	0.75/1.00	0/0.75	0
	Typfordon EG A/B :			
15	Typfordon EG A/B	0.75/1.00	0/0.75	0
16	Bromskraft	0.56/0.75	0/0.56	0
17	Sidokraft	0.56/0.75	0/0.56	0
18	Centrifugalkraft	0.56/0.75	0/0.56	0
19	Temperatur	0.60/1.00	0.50/0.60	0.50
	Vindlaster:			
20	Vindlast mot bro	0.30/1.00	0/0.30	0
21	Vindlast mot trafik	0.30/1.00	0/0.30	0
22	Överlast	0.75/1.34 [7.)]	0/1.01 [7.)]	0
23	Istryck	0.40/1.00	0/0.40	0

Footnote:
[7.)] Load coefficients according to page A3:182 is applied.

Load combination smart SLS-PERM :

Loadcase	Permanent factor	Variable factor
EGEN	1.00	0
BELÄGG	0.90	0.20
JORD	0.90	0.58
STOD	0	0.34 = (1.0 x 0.34[8.)])
KRYMP	0	0.34 = (1.0 x 0.34[8.)])
PT-t0	0.84[9.)]	0.16[9.)]

Footnotes:
[8.)] The effect of creep results in reduced stiffness; see page A3:43
[9.)] Load case pretension varies from PT-t0 to PT-t2 (= 0.84·PT-t0) is applied.

Envelope ALT :

Load case
ICE
TEMP

Load combination smart *SLS-K-VAR* :
(Load cases to consider : 6 / Variable load cases : 1)

Load case	Permanent factor	Variable factor
TRAFIK	0.75	0.25
BROMS	0.56	0.19
SIDO	0.56	0.19
OVER	0.75	0.59
VIND	0.30	0.70
ALT	0.60	0.40

Load combination smart *SLS-F-VAR* :

Load case	Permanent factor	Variable factor
TRAFIK	0	0.75
BROMS	0	0.56
SIDO	0	0.56
OVER	0	0.95
VIND	0	0.30
ALT	0	0.60

Load combination smart *SLS-K* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	0
SLS-K-VAR	0	1

Load combination smart *SLS-F* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	0
SLS-F-VAR	0	1

Load combination smart *SLS-Q* :

Load case	Permanent factor	Variable factor
EGEN	1.00	0
BELÄGG	1.00	0.20
JORD	1.00	0.34
STOD	0	0.34 = (1.0 x 0.34[10.)])
KRYMP	0	0.34 = (1.0 x 0.34[10.)])
PT-t0	0.84[11.)]	0
TEMP	0	0.50

Footnotes:

[10.)] The effect of creep results in reduced stiffness; see page A3:43

[11.)] Load case pretension PT-t2 (= 0.84·PT-t0) is assumed.

3.15.3 Accidental load combination

The accidental load case is also designated as exceptional load combination EXC according to SS-EN 1990 section 6.4.3.3 equation 6.11a as shown below.
The accidental load case is denoted as A_d and consists of cable loss or impact load.

$$E_{Sd} = \sum_{j\geq 1} G_{k,j} + P + A_d + \psi_{1,1} \cdot Q_{k,1} + \sum_{i>1} \psi_{2,i} \cdot Q_{k,i} = \cdots$$

$$\psi\gamma_{EXC} \cdot \left(\sum_{j\geq 1} G_{k,j} + P + A_d + \sum_{i\geq 1} Q_{k,j}\right)$$

3.15.4 Fatigue load combination

Fatigue is considered according to SS EN 1992-1-1, 6.8.4 and 6.8.6, and SS EN 1992-2, 6.8 and Appendix NN.

The risk of fatigue is checked using a simplified method, denoted as the λ-method.
Load combination according to equation SS-EN 1992-1-1 section 6.8.3 equation 6.69.

In this load combination, the traffic load is considered to consist of UTM, whereby other traffic loads are excluded.

$$E_{Sd} = \sum_{j\geq 1} G_{k,j} + P + \psi_{1,1} \cdot Q_{k,1} + \sum_{i>1} \psi_{2,i} \cdot Q_{k,i} + Q_{fat} = \psi\gamma_{UTM} \cdot (\sum_{j\geq 1} G_{k,j} + P + \sum_{i\geq 1} Q_{k,i} + Q_{fat})$$

Permanent loads:
(Refers to RKFM appendix 2, page 42)

Nr	Load		$\psi\gamma_{UTM}$
1	Egentyngd	max	1.00
		min	1.00
2	Beläggning	max	1.10
		min	0.90
3	Överfyllnad	max	1.10
		min	0.90
4	Jordtryck	max	1.48
		min	0.90
5	Vattentryck	max	1.00
		min	1.00
6	Stödförskjutning	max	1.00
		min	1.00
7	Krympning	max	1.00
		min	1.00
8	Spännkraft	max	1.00
		min	1.00

Variable loads:
(Refers to RKFM appendix 2, page 42)

Nr	Load	$\psi\gamma_{UTM}$
	Lastmodell LM 1 :	
9	Boggiesystem	-
10	Utbredd last	-
11	Bromskraft	-
12	Sidokraft	-
13	Centrifugalkraft	-
	Lastmodell LM 2 :	
14	Enstaka axellast	-
	Typfordon EG A/B :	
15	Typfordon EG A/B	-
16	Bromskraft	-
17	Sidokraft	-
18	Centrifugalkraft	-
19	Temperatur	0.60
	Vindlaster:	
20	Vindlast mot bro	0.30
21	Vindlast mot trafik	0.30
22	Överlast	1.01
23	UTM3	1.00

Load combination smart FAT :

Load case	Permanent factor	Variable factor
EGEN	1.00	0
BELÄGG	1.00	0
JORD	1.48	0
STOD	-	-
KRYMP	-	-
PT-t0	0.84	-
VIND	-	-
UTM	-	1.00
OVER	-	-
TEMP	-	-

Load cases BELÄGG, STOD and KRYMP are not fatigue loads, thus load coefficient 1.0 is applied.

Load cases pretension is not a fatigue loads, thus load coefficient lowest load value of value is assumed PT-t2 (= 0.84·PT-t0) is applied.

Load case JORD is not a fatigue load, thus load coefficient highest load coefficient is applied.

Load cases TEMP, VIND and OVER are not fatigue loads, thus load is not considered.

During verification STR, the load case TEMP can be neglected according to SS-EN 1992-1-1 section 2.3.1.2(2).

Title: Indatakvitto

Model Units: kN,m,t,s,C
Report Units: kN,m,t,s,C

Model Title: System 001
Model File: System 001

Clarification of definitions.

In the report, the letter “T” is used to describe a range. The letter is an abbreviation of “to”.

See example of assignment below.

Assignment to Lines:
105T110;114T119

This expression means that the assignment occurs to the lines L105 → L110 and L114 → L119.

Assignment to Surfaces:
3T17;19T24

This expression means that the assignment occurs to the surfaces S3 → S17 and S19 → S24.

Assignment to Points:
6; 13

This expression means that the assignment occurs at point P6 and P13.

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1. Points

Point	X coordinate	Y coordinate	Z coordinate
1	44.2	0.0	0.0
2	43.3	0.0	0.0
3	42.0	0.0	0.0
4	41.6	0.0	0.0
5	17.3	0.0	0.0
6	16.0	0.0	0.0
7	14.7	0.0	0.0
8	0.0	0.0	0.0
9	14.7	0.0	0.0
10	16.0	0.0	0.0
11	17.3	0.0	0.0
12	41.6	0.0	0.0
13	42.0	0.0	0.0
14	43.3	0.0	0.0
15	44.2	0.0	0.0
20	48.2	0.0	0.0
30	48.2	0.0	0.0
100	42.0	3.0	0.0
101	42.0	3.0	0.0
102	42.0	0.0	4.9
103	42.0	0.0	4.0
104	42.0	3.0	1.1
105	42.0	0.0	1.1
106	42.0	3.0	1.1
200	16.0	2.3	0.0
201	16.0	2.3	0.0
202	16.0	0.0	10.4
203	16.0	0.0	8.9
204	16.0	0.0	3.5
205	16.0	2.3	1.1
206	16.0	0.0	1.1
207	16.0	2.3	1.1
300	16.0	2.3	0.0
301	16.0	2.3	0.0
302	16.0	0.0	10.4
303	16.0	0.0	8.9
304	16.0	0.0	3.5
305	16.0	2.3	1.1
306	16.0	0.0	1.1
307	16.0	2.3	1.1
400	42.0	3.0	0.0
401	42.0	3.0	0.0
402	42.0	0.0	4.9
403	42.0	0.0	4.0
404	42.0	3.0	1.1
405	42.0	0.0	1.1
406	42.0	3.0	1.1

2. Lines

Line	Points	Line	Points
1	1,2	2	2,3
3	3,4	4	4,5
5	5,6	6	6,7
7	7,8	8	8,9
9	9,10	10	10,11
11	11,12	12	12,13
13	13,14	14	14,15
20	20,1	30	15,30
100	3,100	101	3,101
102	102,103	103	103,105
104	105,104	105	106,105
200	6,200	201	6,201
202	202,203	203	203,204
204	204,206	205	206,205
206	207,206	300	10,300
301	10,301	302	302,303
303	303,304	304	304,306
305	306,305	306	307,306
400	13,400	401	13,401
402	402,403	403	403,405
404	405,404	405	406,405

3. MESH:Line

Attribute: 1 Title: Element 1
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	1	None	None

Assignment to Lines: Beta angle = 0.0
3;12;100T102;104;105;200T202;205;206;300T302;305;306;400T402;404;405

Attribute: 3 Title: Element 4L:ML
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	4	None	THY THZ

Assignment to Lines: Beta angle = 0.0
20

Attribute: 4 Title: Element 8
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	8	None	None

Assignment to Lines: Beta angle = 0.0
4;11

Attribute: 5 Title: Element 4
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	4	None	None

Assignment to Lines: Beta angle = 0.0
7;8;103T403I100

Attribute: 7 Title: Element 2
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	2	None	None

Assignment to Lines: Beta angle = 0.0
1;2;5;6;9;10;13;14;204;304

Attribute: 8 Title: Element 4R:ML
Sub Type = Line Mesh **Element Type = BMI21**

Mesh spacing	**Nr. of elements**	**Start node end releases:**	**End node end releases:**
Uniform	4	THY THZ	None

Assignment to Lines: Beta angle = 0.0
30

4. MESH:Joint

Attribute: 2 Title: Joint 1
Sub Type = Point Mesh Element Type = JSH4

Property	**Symbol**	**Value**
Element defined by name	DefinedByName	false
Single feature joint	isSingleFtrJnt	false

Assignment to Points: Beta angle = 0.0, Interface secondary Point 101, Mesh from primary to secondary
104;106;205;207;305;307;404;406

5. Geometric : Line

5.1 Constant geometry

Attribute: 1 Title: R1-beam (R1-beam (RSS D=1.45 B=8))
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	**Symbol**	**Value**
Cross sectional area	A	11.6
Second moment of area about y axis	Iyy	2.0
Second moment of area about z axis	Izz	61.9
Product moment of area	Iyz	0.0
Torsional constant	J	7.2
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	0.0
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	616.2
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	9.7
Effective shear area in local y direction	Asy	9.7
Plastic area	Ap	11.6
Plastic modulus for bending about y	Zpy	4.2
Plastic modulus for bending about z	Zpz	23.2
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.0
Plastic torsional section modulus	Zpt	11.0
Warping torsional constant about shear centre	Cw	9.4
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	0.0
Monosymmetry constant about y	betay	0.0
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.4
Radius of gyration about z axis	kz	2.3
y axis extreme fibre, top	yt	4.0
y axis extreme fibre, bottom	yb	-4.0
z axis extreme fibre, top	zt	0.7
z axis extreme fibre, bottom	zb	-0.7
Shape code identifier	Type	1
Breadth of this section	B	8.0
Depth of this section	D	1.4
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
1T3;12T14

Attribute: 3 Title: R2-beam (R2-beam (RSS D=0.4 B=8))
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	**Symbol**	**Value**
Cross sectional area	A	3.2
Second moment of area about y axis	Iyy	0.0
Second moment of area about z axis	Izz	17.1
Product moment of area	Iyz	0.0
Torsional constant	J	0.2
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	0.0
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	164.3
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	2.7
Effective shear area in local y direction	Asy	2.7
Plastic area	Ap	3.2
Plastic modulus for bending about y	Zpy	0.3
Plastic modulus for bending about z	Zpz	6.4
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.0
Plastic torsional section modulus	Zpt	0.9
Warping torsional constant about shear centre	Cw	0.2
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	0.0
Monosymmetry constant about y	betay	0.0
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.1
Radius of gyration about z axis	kz	2.3
y axis extreme fibre, top	yt	4.0
y axis extreme fibre, bottom	yb	-4.0
z axis extreme fibre, top	zt	0.2
z axis extreme fibre, bottom	zb	-0.2
Shape code identifier	Type	1
Breadth of this section	B	8.0
Depth of this section	D	0.4
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
20;30

Attribute: 4 Title: T1-beam
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	**Symbol**	**Value**
Cross sectional area	A	6.3
Second moment of area about y axis	Iyy	1.2
Second moment of area about z axis	Izz	14.8
Product moment of area	Iyz	0.0
Torsional constant	J	2.9
Eccentricity in local z direction, relative to specified origin	ez0	-0.1
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	-0.1
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	3.6
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	109.4
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	2.1
Effective shear area in local y direction	Asy	5.3
Plastic area	Ap	6.3
Plastic modulus for bending about y	Zpy	2.4
Plastic modulus for bending about z	Zpz	7.7
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.1
Plastic torsional section modulus	Zpt	4.8
Warping torsional constant about shear centre	Cw	0.6
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	-0.1
Monosymmetry constant about y	betay	3.3
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.4
Radius of gyration about z axis	kz	1.5
y axis extreme fibre, top	yt	4.0
y axis extreme fibre, bottom	yb	-4.0
z axis extreme fibre, top	zt	0.6
z axis extreme fibre, bottom	zb	-0.9
Shape code identifier	Type	0
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
4;7;8;11

Attribute: 6 Title: T2-beam
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	Symbol	Value
Cross sectional area	A	8.8
Second moment of area about y axis	Iyy	1.6
Second moment of area about z axis	Izz	27.5
Product moment of area	Iyz	0.0
Torsional constant	J	5.0
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	2.4
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	187.0
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	5.3
Effective shear area in local y direction	Asy	7.6
Plastic area	Ap	8.8
Plastic modulus for bending about y	Zpy	3.3
Plastic modulus for bending about z	Zpz	13.3
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.0
Plastic torsional section modulus	Zpt	7.8
Warping torsional constant about shear centre	Cw	3.1
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	-0.1
Monosymmetry constant about y	betay	1.6
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.4
Radius of gyration about z axis	kz	1.8
y axis extreme fibre, top	yt	4.0
y axis extreme fibre, bottom	yb	-4.0
z axis extreme fibre, top	zt	0.7
z axis extreme fibre, bottom	zb	-0.8
Shape code identifier	Type	0
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
5;6;9;10

Attribute: 10 Title: S22-beam (Section S22 (RSS D=2.3 B=6.58))
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	Symbol	Value
Cross sectional area	A	15.1
Second moment of area about y axis	Iyy	6.7
Second moment of area about z axis	Izz	54.6
Product moment of area	Iyz	0.0
Torsional constant	J	20.8
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	0.0
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	408.1
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	12.6
Effective shear area in local y direction	Asy	12.6
Plastic area	Ap	15.1
Plastic modulus for bending about y	Zpy	8.7
Plastic modulus for bending about z	Zpz	24.9
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.0
Plastic torsional section modulus	Zpt	19.8
Warping torsional constant about shear centre	Cw	14.7
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	0.0
Monosymmetry constant about y	betay	0.0
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.7
Radius of gyration about z axis	kz	1.9
y axis extreme fibre, top	yt	3.3
y axis extreme fibre, bottom	yb	-3.3
z axis extreme fibre, top	zt	1.1
z axis extreme fibre, bottom	zb	-1.1
Shape code identifier	Type	1
Breadth of this section	B	6.6
Depth of this section	D	2.3
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
203;303

Attribute: 7 Title: Rigid beam
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	Symbol	Value
Cross sectional area	A	1000.0
Second moment of area about y axis	Iyy	1000.0
Second moment of area about z axis	Izz	1000.0
Product moment of area	Iyz	0.0
Torsional constant	J	1000.0
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	0.0
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	0.0
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	1000.0
Effective shear area in local y direction	Asy	1000.0
Radius of gyration about y axis	ky	1.0
Radius of gyration about z axis	kz	1.0
y axis extreme fibre, top	yt	0.0
y axis extreme fibre, bottom	yb	0.0
z axis extreme fibre, top	zt	0.0
z axis extreme fibre, bottom	zb	0.0
Shape code identifier	Type	-1
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
100;101;104;105;200;201;205;206;300;301;305;306;400;401;404;405

Attribute: 8 Title: S11-beam (Section S11 (RSS D=0.8 B=7.2))
Sub Type = Line Geometric
Assigned in: Analysis 1

Property	Symbol	Value
Cross sectional area	A	5.8
Second moment of area about y axis	Iyy	0.3
Second moment of area about z axis	Izz	24.9
Product moment of area	Iyz	0.0
Torsional constant	J	1.1
Eccentricity in local z direction, relative to specified origin	ez0	0.0
Eccentricity in local y direction, relative to specified origin	ey0	0.0
Eccentricity in local z direction, relative to beam centroid	ez	0.0
Eccentricity in local y direction, relative to beam centroid	ey	0.0
Wagner constant 1st moment of square radius about y (Iyr)	Iyr	0.0
Wagner constant 1st moment of square radius about z (Izr)	Izr	0.0
Wagner constant 4th moment of area about origin (Irr)	Irr	196.2
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0.0
Effective shear area in local z direction	Asz	4.8
Effective shear area in local y direction	Asy	4.8
Plastic area	Ap	5.8
Plastic modulus for bending about y	Zpy	1.2
Plastic modulus for bending about z	Zpz	10.4
Plastic neutral axis, distance from centroid along y axis	yp	0.0
Plastic neutral axis, distance from centroid along z axis	zp	0.0
Plastic torsional section modulus	Zpt	3.2
Warping torsional constant about shear centre	Cw	1.3
Shear centre about y axis	yo	0.0
Shear centre about z axis	zo	0.0
Monosymmetry constant about y	betay	0.0
Monosymmetry constant about z	betaz	0.0
Radius of gyration about y axis	ky	0.2
Radius of gyration about z axis	kz	2.1
y axis extreme fibre, top	yt	3.6
y axis extreme fibre, bottom	yb	-3.6
z axis extreme fibre, top	zt	0.4
z axis extreme fibre, bottom	zb	-0.4
Shape code identifier	Type	1
Breadth of this section	B	7.2
Depth of this section	D	0.8
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:
103;403

5.2 Multiple varying geometry

Symbol	**Property**
elementType	Element type
isSpecifyInterp	Interpolation order specified
isEqualSpacing	Equal spacing assumed
isSymmetry	Symmetry
distanceType	Distance type
vAlign	Vertical alignment eccentricity
hAlign	Horizontal alignment eccentricity
alignToRow	Section to which others are aligned
vAlignType	Vertical alignment type
hAlignType	Horizontal alignment type
interpMethod	Interpolation method
reinforcement	Reinforcement
A	Cross sectional area
Iyy	Second moment of area about y axis
Izz	Second moment of area about z axis
Iyz	Product moment of area
J	Torsional constant
ez0	Eccentricity in local z direction, relative to specified origin
ey0	Eccentricity in local y direction, relative to specified origin
ez	Eccentricity in local z direction, relative to beam centroid
ey	Eccentricity in local y direction, relative to beam centroid
Iyr	Wagner constant 1st moment of square radius about y (Iyr)
Izr	Wagner constant 1st moment of square radius about z (Izr)
Irr	Wagner constant 4th moment of area about origin (Irr)
Iwr	Wagner constant 2nd moment of warping about origin (Iwr)
Asz	Effective shear area in local z direction
Asy	Effective shear area in local y direction
Ap	Plastic area
Zpy	Plastic modulus for bending about y
Zpz	Plastic modulus for bending about z
yp	Plastic neutral axis, distance from centroid along y axis
zp	Plastic neutral axis, distance from centroid along z axis
Zpt	Plastic torsional section modulus
Cw	Warping torsional constant about shear centre
yo	Shear centre about y axis
zo	Shear centre about z axis
betay	Monosymmetry constant about y
betaz	Monosymmetry constant about z
ky	Radius of gyration about y axis
kz	Radius of gyration about z axis
yt	y axis extreme fibre, top
yb	y axis extreme fibre, bottom
zt	z axis extreme fibre, top
zb	z axis extreme fibre, bottom
name	Description
distanceAlongBeam	Distance along beam
interpolationOrder	Interpolation order
Type	Shape code identifier
B	Breadth of this section
D	Depth of this section

Attribute: 5 Title: S21-beam (Varying - 2 sections)
Sub Type = Multiple Varying Geometric
Assigned in: Analysis 1

Cross Section	name	interpolationOrder	distanceAlongBeam
Section 1	"Section S22 (RSS D=2.3 B=6.58)"	"Constant"	0.0
Section 2	"Section S21 (RSS D=2.3 B=5.6)"	"Linear"	2.4

Symbol	Section 1	Section 2
A	15.1	12.9
Iyy	6.7	5.7
Izz	54.6	33.7
Iyz	0.0	0.0
J	20.8	16.8
ez0	0.0	0.0
ey0	0.0	0.0
ez	0.0	0.0
ey	0.0	0.0
Iyr	0.0	0.0
Izr	0.0	0.0
Irr	408.1	192.5
Iwr	0.0	0.0
Asz	12.6	10.7
Asy	12.6	10.7
Ap	15.1	12.9
Zpy	8.7	7.4
Zpz	24.9	18.0
yp	0.0	0.0
zp	0.0	0.0
Zpt	19.8	16.0
Cw	14.7	7.5
yo	0.0	0.0
zo	0.0	0.0
betay	0.0	0.0
betaz	0.0	0.0
ky	0.7	0.7
kz	1.9	1.6
yt	3.3	2.8
yb	-3.3	-2.8
zt	1.1	1.1
zb	-1.1	-1.1
Type	1	1
B	6.6	5.6
D	2.3	2.3

Symbol	Value
elementType	"3D Thick Beam"
isSpecifyInterp	true
isEqualSpacing	false
isSymmetry	false
distanceType	"Parametric"
vAlign	0.0
hAlign	0.0
alignToRow	0
vAlignType	"IndividualOffsets"
hAlignType	"IndividualOffsets"
interpMethod	"Linear"
reinforcement	None

Assignment to Lines:
204;304

Attribute: 9 Title: S12-beam (Varying - 2 sections)
Sub Type = Multiple Varying Geometric
Assigned in: Analysis 1

Cross Section	name	interpolationOrder	distanceAlongBeam
Section 1	"Section S2 (RSS D=1.4 B=8)"	"Constant"	0.0
Section 2	"Section S1 (RSS D=0.8 B=7.2)"	"Linear"	0.9

Symbol	Section 1	Section 2
A	11.2	5.8
Iyy	1.8	0.3
Izz	59.7	24.9
Iyz	0.0	0.0
J	6.5	1.1
ez0	0.0	0.0
ey0	0.0	0.0
ez	0.0	0.0
ey	0.0	0.0
Iyr	0.0	0.0
Izr	0.0	0.0
Irr	593.5	196.2
Iwr	0.0	0.0
Asz	9.3	4.8
Asy	9.3	4.8
Ap	11.2	5.8
Zpy	3.9	1.2
Zpz	22.4	10.4
yp	0.0	0.0
zp	0.0	0.0
Zpt	10.3	3.2
Cw	8.6	1.3
yo	0.0	0.0
zo	0.0	0.0
betay	0.0	0.0
betaz	0.0	0.0
ky	0.4	0.2
kz	2.3	2.1
yt	4.0	3.6
yb	-4.0	-3.6
zt	0.7	0.4
zb	-0.7	-0.4
Type	1	1
B	8.0	7.2
D	1.4	0.8

Symbol	Value
elementType	"3D Thick Beam"
isSpecifyInterp	true
isEqualSpacing	false
isSymmetry	false
distanceType	"Parametric"
vAlign	0.0
hAlign	0.0
alignToRow	0
vAlignType	"IndividualOffsets"
hAlignType	"IndividualOffsets"
interpMethod	"Linear"
reinforcement	None

Assignment to Lines:
102;402

Attribute: 11 Title: S23-beam (Varying - 2 sections)
Sub Type = Multiple Varying Geometric
Assigned in: Analysis 1

Cross Section	name	interpolationOrder	distanceAlongBeam
Section 1	"Section S23 (RSS D=3 B=7.28)"	"Constant"	0.0
Section 2	"Section S22 (RSS D=2.3 B=6.58)"	"Linear"	1.5

Symbol	Section 1	Section 2
A	21.8	15.1
Iyy	16.4	6.7
Izz	96.5	54.6
Iyz	0.0	0.0
J	48.5	20.8
ez0	0.0	0.0
ey0	0.0	0.0
ez	0.0	0.0
ey	0.0	0.0
Iyr	0.0	0.0
Izr	0.0	0.0
Irr	933.6	408.1
Iwr	0.0	0.0
Asz	18.2	12.6
Asy	18.2	12.6
Ap	21.8	15.1
Zpy	16.4	8.7
Zpz	39.7	24.9
yp	0.0	0.0
zp	0.0	0.0
Zpt	35.4	19.8
Cw	36.5	14.7
yo	0.0	0.0
zo	0.0	0.0
betay	0.0	0.0
betaz	0.0	0.0
ky	0.9	0.7
kz	2.1	1.9
yt	3.6	3.3
yb	-3.6	-3.3
zt	1.5	1.1
zb	-1.5	-1.1
Type	1	1
B	7.3	6.6
D	3.0	2.3

Symbol	Value
elementType	"3D Thick Beam"
isSpecifyInterp	true
isEqualSpacing	false
isSymmetry	false
distanceType	"Parametric"
vAlign	0.0
hAlign	0.0
alignToRow	0
vAlignType	"IndividualOffsets"
hAlignType	"IndividualOffsets"
interpMethod	"Linear"
reinforcement	None

Assignment to Lines:
202;302

6. Isotropic material

Attribute: 3 Title: Concrete C35/45 (C35/45 | Concrete | EN1992-1-1:2004/2014)
Sub Type = Isotropic Material
Assigned in: Analysis 1

Property	Symbol	Value
Young's modulus	E	34000000.0
Poisson's ratio	nu	0.2
Density	rho	2.5
Coefficient of thermal expansion	alpha	0.0
Characteristic compressive cylinder strength of concrete at 28 days	fck	35000.0
Mean value of axial tensile strength of concrete	fctm	3200.0
Ultimate compressive strain limit 3	ecu3	0.0
Design compressive strength 3	fcd3	23333.3
Compressive strain limit 3	ec3	0.0
Modulus of elasticity 3	E3	13333333.3

Assignment to Lines:
1T14;100;101;200;201;300;301;400;401

Attribute: 7 Title: Concrete C30/37 (C30/37 | Concrete | EN1992-1-1:2004/2014)
Sub Type = Isotropic Material
Assigned in: Analysis 1

Property	Symbol	Value
Young's modulus	E	33000000.0
Poisson's ratio	nu	0.2
Density	rho	2.5
Coefficient of thermal expansion	alpha	0.0
Characteristic compressive cylinder strength of concrete at 28 days	fck	30000.0
Mean value of axial tensile strength of concrete	fctm	2900.0
Ultimate compressive strain limit 3	ecu3	0.0
Design compressive strength 3	fcd3	20000.0
Compressive strain limit 3	ec3	0.0
Modulus of elasticity 3	E3	11428571.4

Assignment to Lines:
20;30;102T105;202T206;302T306;402T405

7. Joint material

Attribute: 1 Title: Joint material - TF
Sub Type = Joint Material, Spring Stiffness Only
Assigned in: Analysis 1

	u	**v**	**w**
Number of degrees of freedom	nDOF	3	3
Joint type	JointType	"Solids / 3D space membranes"	"Solids / 3D space membranes"
Assignment type	Assignment	"Point"	"Point"
Elastic spring stiffness	K[0]	1000000.0	1000000.0
Elastic spring stiffness	K[1]	1000000.0	1000000.0
Elastic spring stiffness	K[2]	1000000.0	1000000.0

Assignment to Points:
205;305

Attribute: 2 Title: Joint material - TA
Sub Type = Joint Material, Spring Stiffness Only
Assigned in: Analysis 1

	u	**v**	**w**
Number of degrees of freedom	nDOF	3	3
Joint type	JointType	"Solids / 3D space membranes"	"Solids / 3D space membranes"
Assignment type	Assignment	"Point"	"Point"
Elastic spring stiffness	K[0]	1000000.0	1000000.0
Elastic spring stiffness	K[1]	0.0	0.0
Elastic spring stiffness	K[2]	0.0	0.0

Assignment to Points:
106;406

Attribute: 4 Title: Joint material - TE:X
Sub Type = Joint Material, Spring Stiffness Only
Assigned in: Analysis 1

	u	**v**	**w**
Number of degrees of freedom	nDOF	3	3
Joint type	JointType	"Solids / 3D space membranes"	"Solids / 3D space membranes"
Assignment type	Assignment	"Point"	"Point"
Elastic spring stiffness	K[0]	1000000.0	1000000.0
Elastic spring stiffness	K[1]	1000000.0	1000000.0
Elastic spring stiffness	K[2]	0.0	0.0

Assignment to Points:
104;404

Attribute: 5 Title: Joint material - TE:Y
Sub Type = Joint Material, Spring Stiffness Only
Assigned in: Analysis 1

	u	**v**	**w**
Number of degrees of freedom	nDOF	3	3
Joint type	JointType	"Solids / 3D space membranes"	"Solids / 3D space membranes"
Assignment type	Assignment	"Point"	"Point"
Elastic spring stiffness	K[0]	1000000.0	1000000.0
Elastic spring stiffness	K[1]	0.0	0.0
Elastic spring stiffness	K[2]	1000000.0	1000000.0

Assignment to Points:
207;301;307

8. Support

Attribute: 1 Title: Roller support
Sub Type = Structural Support
Assigned in: Analysis 1

Property	Symbol	Value
Translation in X	U	"F"
Translation in Y	V	"R"
Translation in Z	W	"R"
Rotation about X	THX	"R"
Rotation about Y	THY	"F"
Rotation about Z	THZ	"F"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"

Assignment to Points:
20;30

Attribute: 2 Title: Support 1
Sub Type = Structural Support
Assigned in: Analysis 1

Property	Symbol	Value
Translation in X	U	"R"
Translation in Y	V	"R"
Translation in Z	W	"R"
Rotation about X	THX	"S"
Rotation about Y	THY	"S"
Rotation about Z	THZ	"F"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Spring stiffness distribution	springType	"Total"
Stiffness in rotation about X	THXstiff	2025000.0
Stiffness in rotation about Y	THYstiff	400000.0

Assignment to Points:
102

Attribute: 3 Title: Support 2
Sub Type = Structural Support
Assigned in: Analysis 1

Property	Symbol	Value
Translation in X	U	"R"
Translation in Y	V	"R"
Translation in Z	W	"R"
Rotation about X	THX	"S"
Rotation about Y	THY	"S"
Rotation about Z	THZ	"F"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Spring stiffness distribution	springType	"Total"
Stiffness in rotation about X	THXstiff	12500000.0
Stiffness in rotation about Y	THYstiff	4500000.0

Assignment to Points:
202

Attribute: 4 Title: Support 3
Sub Type = Structural Support
Assigned in: Analysis 1

Property	**Symbol**	**Value**
Translation in X	U	"R"
Translation in Y	V	"R"
Translation in Z	W	"R"
Rotation about X	THX	"S"
Rotation about Y	THY	"S"
Rotation about Z	THZ	"F"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Spring stiffness distribution	springType	"Total"
Stiffness in rotation about X	THXstiff	6250000.0
Stiffness in rotation about Y	THYstiff	2250000.0

Assignment to Points:
302

Attribute: 5 Title: Support 4
Sub Type = Structural Support
Assigned in: Analysis 1

Property	**Symbol**	**Value**
Translation in X	U	"R"
Translation in Y	V	"R"
Translation in Z	W	"R"
Rotation about X	THX	"S"
Rotation about Y	THY	"S"
Rotation about Z	THZ	"F"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Spring stiffness distribution	springType	"Total"
Stiffness in rotation about X	THXstiff	1286000.0
Stiffness in rotation about Y	THYstiff	254000.0

Assignment to Points:
402

9. Search Area

Attribute: 1 Title: Superstructure
Sub Type = Search Area

Assignment to Lines:
1T14;20;30

10. Body load

Attribute: 1 Title: EGEN 1
Sub Type = Gravity Load
Loadcase ID: 1 Title: EGEN 1 Factor = 1.0
Assignment to Lines:
1T14

Attribute: 2 Title: EGEN 2
Sub Type = Gravity Load
Loadcase ID: 2 Title: EGEN 2 Factor = 1.0
Assignment to Lines:
20;30

Attribute: 3 Title: EGEN 3
Sub Type = Gravity Load
Loadcase ID: 3 Title: EGEN 3 Factor = 1.0
Assignment to Lines:
103;203;204;303;304;403

11. Global distributed

Attribute: 4 Title: EGEN 4
Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	0.0
Z Direction	WZ	-12.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 4 Title: EGEN 4 Factor = 1.0
Assignment to Lines:
1T14

Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	0.0
Z Direction	WZ	-18.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 7 Title: BELAGG 1 Factor = 1.0
Assignment to Lines:
1T14

Attribute: 9 Title: BELAGG 2
Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	0.0
Z Direction	WZ	-64.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Attribute: 8 Title: BELAGG 1
Loadcase ID: 8 Title: BELAGG 2 Factor = 1.0
Assignment to Lines:
20;30

Attribute: 23 Title: BROMS+
Sub Type = Global Distributed Load

Property	**Symbol**	**Value**
Attribute type	type	"Length"
X Direction	WX	5.9
Y Direction	WY	0.0
Z Direction	WZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	5.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 3340 Title: BROMS+ Factor = 1.0
Assignment to Lines:
1T14

Attribute: 24 Title: BROMS-
Sub Type = Global Distributed Load

Property	**Symbol**	**Value**
Attribute type	type	"Length"
X Direction	WX	-5.9
Y Direction	WY	0.0
Z Direction	WZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-5.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 3341 Title: BROMS- Factor = 1.0
Assignment to Lines:
1T14

Attribute: 29 Title: VIND+
Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	3.6
Z Direction	WZ	0.0
Moment about X axis	MX	-3.6
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 3352 Title: VIND+ Factor = 1.0
Assignment to Lines:
1T14

Attribute: 30 Title: VIND-
Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	-3.6
Z Direction	WZ	0.0
Moment about X axis	MX	3.6
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Pore pressure flux	pwp	0.0
Keep global	keepGlobal	false

Loadcase ID: 3353 Title: VIND- Factor = 1.0
Assignment to Lines:
1T14

12. Concentrated load

Attribute: 5 Title: EGEN 5
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	-192.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 5 Title: EGEN 5 Factor = 1.0
Assignment to Points:
2;14

Attribute: 6 Title: EGEN 6:V
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	-106.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-64.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 6 Title: EGEN 6 Factor = 1.0
Assignment to Points:
1

Attribute: 7 Title: EGEN 6:H
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	-106.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	64.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 6 Title: EGEN 6 Factor = 1.0
Assignment to Points:
15

Attribute: 10 Title: JORD 1:V
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	652.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-838.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 9 Title: JORD 1 Factor = 1.0
Assignment to Points:
1

Attribute: 11 Title: JORD 1:H
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	-652.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	838.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 9 Title: JORD 1 Factor = 1.0
Assignment to Points:
15

Attribute: 25 Title: SIDO 1+
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	130.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	111.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3342 Title: SIDO 1+ Factor = 1.0
Assignment to Points:
3

Attribute: 26 Title: SIDO 2+
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	130.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	111.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3343 Title: SIDO 2+ Factor = 1.0
Assignment to Points:
6

Attribute: 27 Title: SIDO 3+
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	130.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	111.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3344 Title: SIDO 3+ Factor = 1.0
Assignment to Points:
10

Attribute: 28 Title: SIDO 4+
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	0.0
Concentrated load in Y Dir	PY	130.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	111.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3345 Title: SIDO 4+ Factor = 1.0
Assignment to Points:
13

Attribute: 31 Title: OVER 1:V
Sub Type = Concentrated Load

Property	**Symbol**	**Value**
Concentrated load in X Dir	PX	153.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-115.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3356 Title: OVER:V Factor = 1.0
Assignment to Points:
1

Attribute: 32 Title: OVER 1:H
Sub Type = Concentrated Load

Property	**Symbol**	**Value**
Concentrated load in X Dir	PX	-153.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-115.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3357 Title: OVER:H Factor = 1.0
Assignment to Points:
15

Attribute: 41 Title: DELTA-P:V
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	4500.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-5783.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3362 Title: DELTA-P Factor = 1.0
Assignment to Points:
1

Attribute: 42 Title: DELTA-P:H
Sub Type = Concentrated Load

Property	Symbol	Value
Concentrated load in X Dir	PX	-4500.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	5783.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3362 Title: DELTA-P Factor = 1.0
Assignment to Points:
15

Attribute: 57 Title: PASSIV 1X+
Sub Type = Concentrated Load

Property	**Symbol**	**Value**
Concentrated load in X Dir	PX	4500.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	-5783.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3382 Title: ICE HIGH X- Factor = 0.5903
Assignment to Points:
1
Loadcase ID: 3383 Title: ICE LOW X- Factor = 0.4646
Assignment to Points:
1

Attribute: 58 Title: PASSIV 4X-
Sub Type = Concentrated Load

Property	**Symbol**	**Value**
Concentrated load in X Dir	PX	-4500.0
Concentrated load in Y Dir	PY	0.0
Concentrated load in Z Dir	PZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	5783.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	L2	0.0
Pore pressure flux	PorePressure	0.0
Bi moment	Mb	0.0

Loadcase ID: 3380 Title: ICE HIGH X+ Factor = 0.5903
Assignment to Points:
15
Loadcase ID: 3381 Title: ICE LOW X+ Factor = 0.4646
Assignment to Points:
15

13. Beam distributed load

Attribute: 12 Title: JORD 21:V

Sub Type = Beam Distributed Load

Property	**Symbol**	**Value**
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	1.7
Magnitude of distributed load in x direction at start	startPx	202.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	137.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0

Assignment to Lines:

103

Attribute: 13 Title: JORD 22:V

Sub Type = Beam Distributed Load

Property	**Symbol**	**Value**
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	0.9
Magnitude of distributed load in x direction at start	startPx	264.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	224.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0

Assignment to Lines:

102

Attribute: 14 Title: JORD 21:H
Sub Type = Beam Distributed Load

Property	Symbol	Value
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	1.7
Magnitude of distributed load in x direction at start	startPx	-202.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	-137.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0
Assignment to Lines:
403

Attribute: 15 Title: JORD 22:H
Sub Type = Beam Distributed Load

Property	Symbol	Value
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	0.9
Magnitude of distributed load in x direction at start	startPx	-264.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	-224.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0
Assignment to Lines:
402

Attribute: 33 Title: OVER 21:V
Sub Type = Beam Distributed Load

Property	Symbol	Value
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	1.7
Magnitude of distributed load in x direction at start	startPx	42.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	42.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 3356 Title: OVER:V Factor = 1.0
Assignment to Lines:
103

Attribute: 34 Title: OVER 22:V
Sub Type = Beam Distributed Load

Property	Symbol	Value
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	0.9
Magnitude of distributed load in x direction at start	startPx	48.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	48.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 3356 Title: OVER:V Factor = 1.0
Assignment to Lines:
102

Attribute: 35 Title: OVER 21:H
Sub Type = Beam Distributed Load

Property	**Symbol**	**Value**
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	1.7
Magnitude of distributed load in x direction at start	startPx	-42.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	-42.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 3357 Title: OVER:H Factor = 1.0
Assignment to Lines:
403

Attribute: 36 Title: OVER 22:H
Sub Type = Beam Distributed Load

Property	**Symbol**	**Value**
Distance type	type	"Actual"
Load direction	dirType	"Global(nodal)"
Distance to start of load	DStart	0.0
Distance to end of load	DEnd	0.9
Magnitude of distributed load in x direction at start	startPx	-48.0
Magnitude of distributed load in y direction at start	startPy	0.0
Magnitude of distributed load in z direction at start	startPz	0.0
Magnitude of distributed moment about x direction at start	startMx	0.0
Magnitude of distributed moment about y direction at start	startMy	0.0
Magnitude of distributed moment about z direction at start	startMz	0.0
Magnitude of distributed load in x direction at start	endPx	-48.0
Magnitude of distributed load in y direction at start	endPy	0.0
Magnitude of distributed load in z direction at start	endPz	0.0
Magnitude of distributed moment about x direction at start	endMx	0.0
Magnitude of distributed moment about y direction at start	endMy	0.0
Magnitude of distributed moment about z direction at start	endMz	0.0

Loadcase ID: 3357 Title: OVER:H Factor = 1.0
Assignment to Lines:
402

14. Beam point load

Attribute: 43 Title: ICE HIGH 2X+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3380 Title: ICE HIGH X+ Factor = 1.0
Assignment to Lines:
203

Attribute: 44 Title: ICE LOW 2X+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3381 Title: ICE LOW X+ Factor = 1.0
Assignment to Lines:
203

Attribute: 45 Title: ICE HIGH 3X+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3380 Title: ICE HIGH X+ Factor = 1.0
Assignment to Lines:
303

Attribute: 46 Title: ICE LOW 3X+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3381 Title: ICE LOW X+ Factor = 1.0
Assignment to Lines:
303

Attribute: 47 Title: ICE HIGH 2Y+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	0.0
Point load in y direction	Py	378.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3384 Title: ICE HIGH 2Y+ Factor = 1.0
Assignment to Lines:
203

Attribute: 48 Title: ICE LOW 2Y+
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	0.0
Point load in y direction	Py	378.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3385 Title: ICE LOW 2Y+ Factor = 1.0
Assignment to Lines:
203

Attribute: 49 Title: ICE HIGH 3Y+
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	0.0
Point load in y direction	Py	378.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3386 Title: ICE HIGH 3Y+ Factor = 1.0
Assignment to Lines:
303

Attribute: 50 Title: ICE LOW 3Y+
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	0.0
Point load in y direction	Py	378.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3387 Title: ICE LOW 3Y+ Factor = 1.0
Assignment to Lines:
303

Attribute: 51 Title: ICE 2Z
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	0.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	771.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3388 Title: ICE 2Z Factor = 1.0
Assignment to Lines:
203

Attribute: 52 Title: ICE 3Z
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	0.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	771.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3389 Title: ICE 3Z Factor = 1.0
Assignment to Lines:
303

Attribute: 53 Title: ICE HIGH 2X-
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	-2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3382 Title: ICE HIGH X- Factor = 1.0
Assignment to Lines:
203

Attribute: 54 Title: ICE LOW 2X-
Sub Type = Beam Point Load

Property	**Symbol**	**Value**
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	-2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3383 Title: ICE LOW X- Factor = 1.0
Assignment to Lines:
203

Attribute: 55 Title: ICE HIGH 3X-
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	5.5
Point load in x direction	Px	-2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3382 Title: ICE HIGH X- Factor = 1.0
Assignment to Lines:
303

Attribute: 56 Title: ICE LOW 3X-
Sub Type = Beam Point Load

Property	Symbol	Value
Distance type	type	1
Load direction	dirType	"Global(nodal)"
Distance	d	4.0
Point load in x direction	Px	-2320.0
Point load in y direction	Py	0.0
Point load in z direction	Pz	0.0
Moment about x axis	Mx	0.0
Moment about y axis	My	0.0
Moment about z axis	Mz	0.0

Loadcase ID: 3383 Title: ICE LOW X- Factor = 1.0
Assignment to Lines:
303

15. Prescribed load

Attribute: 16 Title: STOD_1Z

Sub Type = Prescribed Load

Property	Symbol	Value
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	false
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	true
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 11 Title: STOD_1Z Factor = 1.0

Assignment to Points:

102

Attribute: 17 Title: STOD_2Z

Sub Type = Prescribed Load

Property	Symbol	Value
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	false
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	true
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 12 Title: STOD_2Z Factor = 1.0

Assignment to Points:

202

Attribute: 18 Title: STOD_3Z
Sub Type = Prescribed Load

Property	**Symbol**	**Value**
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	false
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	true
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 13 Title: STOD_3Z Factor = 1.0
Assignment to Points:
302

Attribute: 19 Title: STOD_4Z
Sub Type = Prescribed Load

Property	**Symbol**	**Value**
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	false
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	true
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 14 Title: STOD_4Z Factor = 1.0
Assignment to Points:
402

Attribute: 20 Title: STOD_2X+
Sub Type = Prescribed Load

Property	**Symbol**	**Value**
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	true
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	false
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 15 Title: STOD_2X+ Factor = 1.0
Assignment to Points:
202

Attribute: 21 Title: STOD_3X+
Sub Type = Prescribed Load

Property	**Symbol**	**Value**
Attribute type	type	"Total"
Prescribed displacement in X	U	0.0
Prescribed displacement in Y	V	0.0
Prescribed displacement in Z	W	0.0
Prescribed rotation about X	THX	0.0
Prescribed rotation about Y	THY	0.0
Prescribed rotation about Z	THZ	0.0
Prescribed hinge rotation	L2	0.0
Pore pressure	PorePressure	0.0
Fixed displacement in X	haveDispX	true
Fixed displacement in Y	haveDispY	false
Fixed displacement in Z	haveDispZ	false
Fixed rotation about X	haveRotX	false
Fixed rotation about Y	haveRotY	false
Fixed rotation about Z	haveRotZ	false
Fixed hinge rotation	haveRotLocal	false
Fixed pore pressure	havePorePres	false

Loadcase ID: 16 Title: STOD_3X+ Factor = 1.0
Assignment to Points:
302

16. Temperature and shrinkage load

Attribute: 22 Title: KRYMP
Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	-25.0
Final X temperature gradient	dT/dX	0.0
Final Y temperature gradient	dT/dY	0.0
Final Z temperature gradient	dT/dZ	0.0
Initial temperature	T0	0.0
Initial X temperature gradient	dT0/dX	0.0
Initial Y temperature gradient	dT0/dY	0.0
Initial Z temperature gradient	dT0/dZ	0.0

Loadcase ID: 25 Title: KRYMP Factor = 1.0
Assignment to Lines:
1T14

Attribute: 37 Title: JTEMP+
Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	26.0
Final X temperature gradient	dT/dX	0.0
Final Y temperature gradient	dT/dY	0.0
Final Z temperature gradient	dT/dZ	0.0
Initial temperature	T0	0.0
Initial X temperature gradient	dT0/dX	0.0
Initial Y temperature gradient	dT0/dY	0.0
Initial Z temperature gradient	dT0/dZ	0.0

Loadcase ID: 3358 Title: JTEMP+ Factor = 1.0
Assignment to Lines:
1T14

Attribute: 38 Title: JTEMP-
Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	-46.0
Final X temperature gradient	dT/dX	0.0
Final Y temperature gradient	dT/dY	0.0
Final Z temperature gradient	dT/dZ	0.0
Initial temperature	T0	0.0
Initial X temperature gradient	dT0/dX	0.0
Initial Y temperature gradient	dT0/dY	0.0
Initial Z temperature gradient	dT0/dZ	0.0

Loadcase ID: 3359 Title: JTEMP- Factor = 1.0
Assignment to Lines:
1T14

Attribute: 39 Title: OJTEMP 1+
Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	0.0
Final X temperature gradient	dT/dX	0.0
Final Y temperature gradient	dT/dY	0.0
Final Z temperature gradient	dT/dZ	7.0
Initial temperature	T0	0.0
Initial X temperature gradient	dT0/dX	0.0
Initial Y temperature gradient	dT0/dY	0.0
Initial Z temperature gradient	dT0/dZ	0.0

Loadcase ID: 3363 Title: OJTEMP 1+ Factor = 1.0
Assignment to Lines:
1T14

Attribute: 40 Title: OJTEMP 1-
Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	0.0
Final X temperature gradient	dT/dX	0.0
Final Y temperature gradient	dT/dY	0.0
Final Z temperature gradient	dT/dZ	-5.0
Initial temperature	T0	0.0
Initial X temperature gradient	dT0/dX	0.0
Initial Y temperature gradient	dT0/dY	0.0
Initial Z temperature gradient	dT0/dZ	0.0

Loadcase ID: 3364 Title: OJTEMP 1- Factor = 1.0
Assignment to Lines:
1T14

17. Prestress

17.1 KG V1

Tendon Summary - PT- KG V1 assignment 1

General	**Value**	**Units**
Design code	EN1992-1-1:2004 / 2014 Eurocode 2	
Initial tendon force	3320.000	kN
Tendon area	2250.000	mm²
Modulus of elasticity for tendon	195000000.000	kN/m²
Concrete stress at transfer	10000.000	kN/m²
Jacking	Jacking at end 1	None
Slip at end 1	0.006	m
Jack angle at end 1	0.000	deg
Instantaneous losses	**Value**	**Units**
Modulus of elasticity of concrete at transfer	32000000.000	kN/m²
Unintentional angular displacement	0.005	rad/m
Duct friction coefficient	0.180	

Tendon Profile (original input) - PT- KG V1 assignment 1

Segment type	**X**	**Y**	**Z**
Start	0.000	0.000	0.310
Straight	1.000	0.000	0.150
Spline	2.200	0.000	-0.050
Spline Continued	7.200	0.000	-0.500
Spline Continued	12.200	0.000	-0.550
Spline Continued	21.200	0.000	0.150
Spline Continued	28.200	0.000	0.550
Spline Continued	34.200	0.000	0.250
Spline Continued	44.200	0.000	-0.650
Spline Continued	54.200	0.000	0.150
Spline Continued	60.200	0.000	0.550
Spline Continued	67.200	0.000	0.150
Spline Continued	76.200	0.000	-0.550
Spline Continued	81.200	0.000	-0.500
Spline Continued	86.200	0.000	-0.050
Spline Continued	87.400	0.000	0.150
Spline Continued	88.400	0.000	0.310

Minimum radius = 0.000
Smoothing type: Cut corner

Tendon profile (sampling points) - PT- KG V1 assignment 1

X	Y	Z	Distance along profile	Angle change in profile	Eccentricity from beam in y	Eccentricity from beam in z
-44.200	0.000	0.310	0.000	0.000	0.000	0.310
-44.033	0.000	0.283	0.169	0.000	0.000	0.283
-43.867	0.000	0.257	0.338	0.000	0.000	0.257
-43.700	0.000	0.230	0.506	0.000	0.000	0.230
-43.533	0.000	0.203	0.675	0.000	0.000	0.203
-43.367	0.000	0.177	0.844	0.000	0.000	0.177
-43.200	0.000	0.150	1.013	0.473	0.000	0.150
-42.121	0.000	-0.032	2.107	1.767	0.000	-0.032
-41.038	0.000	-0.180	3.200	1.590	0.000	-0.180
-39.950	0.000	-0.298	4.294	1.367	0.000	-0.298
-38.860	0.000	-0.391	5.388	1.607	0.000	-0.391
-36.676	0.000	-0.514	7.576	1.706	0.000	-0.514
-34.489	0.000	-0.572	9.764	1.896	0.000	-0.572
-32.301	0.000	-0.558	11.951	2.105	0.000	-0.558
-30.116	0.000	-0.464	14.139	1.667	0.000	-0.464
-27.934	0.000	-0.306	16.327	0.984	0.000	-0.306
-25.755	0.000	-0.110	18.514	0.116	0.000	-0.110
-21.398	0.000	0.289	22.890	1.199	0.000	0.289
-19.215	0.000	0.444	25.078	1.639	0.000	0.444
-17.030	0.000	0.535	27.265	2.246	0.000	0.535
-14.842	0.000	0.541	29.453	2.370	0.000	0.541
-12.656	0.000	0.457	31.641	2.866	0.000	0.457
-8.298	0.000	0.070	36.016	1.302	0.000	0.070
-3.950	0.000	-0.417	40.391	1.877	0.000	-0.417
-1.769	0.000	-0.588	42.579	1.989	0.000	-0.588
-0.676	0.000	-0.636	43.673	1.727	0.000	-0.636
0.418	0.000	-0.652	44.766	1.797	0.000	-0.652
1.511	0.000	-0.632	45.860	1.557	0.000	-0.632
2.604	0.000	-0.583	46.954	1.810	0.000	-0.583
4.785	0.000	-0.416	49.142	1.812	0.000	-0.416
9.135	0.000	0.055	53.517	0.907	0.000	0.055
13.492	0.000	0.458	57.892	2.964	0.000	0.458
15.678	0.000	0.546	60.080	2.955	0.000	0.546
17.865	0.000	0.522	62.267	2.495	0.000	0.522
20.050	0.000	0.402	64.455	1.597	0.000	0.402
22.230	0.000	0.222	66.643	0.716	0.000	0.222
26.586	0.000	-0.193	71.018	0.650	0.000	-0.193
28.766	0.000	-0.376	73.206	1.284	0.000	-0.376
30.949	0.000	-0.510	75.394	1.900	0.000	-0.510
33.136	0.000	-0.572	77.582	2.021	0.000	-0.572
35.324	0.000	-0.556	79.769	1.679	0.000	-0.556
37.510	0.000	-0.476	81.957	1.793	0.000	-0.476
39.693	0.000	-0.328	84.145	2.876	0.000	-0.328
41.865	0.000	-0.071	86.332	2.545	0.000	-0.071
44.024	0.000	0.283	88.520	0.000	0.000	0.283

Prestress Losses - PT- KG V1 assignment 1

Distance along profile	Friction & Wobble	Anchorage	Long Term Losses	Force
0.000	0.000	351.438	0.000	2968.562
0.169	0.504	350.430	0.000	2969.066
0.338	1.009	349.421	0.000	2969.570
0.506	1.513	348.413	0.000	2970.074
0.675	2.017	347.405	0.000	2970.578
0.844	2.521	346.397	0.000	2971.082
1.013	3.025	345.389	0.000	2971.586
2.107	11.207	329.025	0.000	2979.768
3.200	32.757	285.924	0.000	3001.319
4.294	52.352	246.734	0.000	3020.914
5.388	69.553	212.333	0.000	3038.114
7.576	92.279	166.881	0.000	3060.840
9.764	115.851	119.737	0.000	3084.412
11.951	141.145	69.149	0.000	3109.706
14.139	168.314	14.811	0.000	3136.875
16.327	190.945	0.000	0.000	3129.055
18.514	206.736	0.000	0.000	3113.264
22.890	220.106	0.000	0.000	3099.894
25.078	237.832	0.000	0.000	3082.168
27.265	259.695	0.000	0.000	3060.305
29.453	287.190	0.000	0.000	3032.810
31.641	315.611	0.000	0.000	3004.389
36.016	354.244	0.000	0.000	2965.756
40.391	377.959	0.000	0.000	2942.041
42.579	401.008	0.000	0.000	2918.992
43.673	422.048	0.000	0.000	2897.952
44.766	440.560	0.000	0.000	2879.440
45.860	459.589	0.000	0.000	2860.411
46.954	476.346	0.000	0.000	2843.654
49.142	498.027	0.000	0.000	2821.973
53.517	525.076	0.000	0.000	2794.924
57.892	543.979	0.000	0.000	2776.021
60.080	575.114	0.000	0.000	2744.886
62.267	605.830	0.000	0.000	2714.170
64.455	632.317	0.000	0.000	2687.683
66.643	651.026	0.000	0.000	2668.974
71.018	667.492	0.000	0.000	2652.508
73.206	678.114	0.000	0.000	2641.886
75.394	693.928	0.000	0.000	2626.072
77.582	714.695	0.000	0.000	2605.305
79.769	736.277	0.000	0.000	2583.723
81.957	754.924	0.000	0.000	2565.076
84.145	774.352	0.000	0.000	2545.648
86.332	802.213	0.000	0.000	2517.787
88.520	827.177	0.000	0.000	2492.823

17.2 KG V2

Tendon Summary - PT- KG V2 assignment 1

General	**Value**	**Units**
Design code	EN1992-1-1:2004 / 2014 Eurocode 2	
Initial tendon force	3320.000	kN
Tendon area	2250.000	mm²
Modulus of elasticity for tendon	195000000.000	kN/m²
Concrete stress at transfer	10000.000	kN/m²
Jacking	Jacking at end 1	None
Slip at end 1	0.006	m
Jack angle at end 1	0.000	deg
Instantaneous losses	**Value**	**Units**
Modulus of elasticity of concrete at transfer	32000000.000	kN/m²
Unintentional angular displacement	0.005	rad/m
Duct friction coefficient	0.180	

Tendon Profile (original input) - PT- KG V2 assignment 1

Segment type	**X**	**Y**	**Z**
Start	0.000	0.000	-0.110
Straight	1.000	0.000	-0.090
Spline	2.200	0.000	-0.050
Spline Continued	7.200	0.000	-0.500
Spline Continued	12.200	0.000	-0.550
Spline Continued	21.200	0.000	0.150
Spline Continued	28.200	0.000	0.550
Spline Continued	34.200	0.000	0.250
Spline Continued	44.200	0.000	-0.650
Spline Continued	54.200	0.000	0.150
Spline Continued	60.200	0.000	0.550
Spline Continued	67.200	0.000	0.150
Spline Continued	76.200	0.000	-0.550
Spline Continued	81.200	0.000	-0.500
Spline Continued	86.200	0.000	-0.050
Spline Continued	87.400	0.000	-0.090
Spline Continued	88.400	0.000	-0.110

Minimum radius = 0.000
Smoothing type: Cut corner

Tendon profile (sampling points) - PT- KG V2 assignment 1

X	Y	Z	Distance along profile	Angle change in profile	Eccentricity from beam in y	Eccentricity from beam in z
-44.200	0.000	-0.110	0.000	0.000	0.000	-0.110
-44.033	0.000	-0.107	0.167	0.000	0.000	-0.107
-43.867	0.000	-0.103	0.333	0.000	0.000	-0.103
-43.700	0.000	-0.100	0.500	0.000	0.000	-0.100
-43.533	0.000	-0.097	0.667	0.000	0.000	-0.097
-43.367	0.000	-0.093	0.833	0.000	0.000	-0.093
-43.200	0.000	-0.090	1.000	2.066	0.000	-0.090
-42.654	0.000	-0.059	1.547	2.179	0.000	-0.059
-42.108	0.000	-0.050	2.094	2.107	0.000	-0.050
-41.561	0.000	-0.060	2.640	1.835	0.000	-0.060
-41.015	0.000	-0.088	3.187	2.027	0.000	-0.088
-39.926	0.000	-0.182	4.280	1.497	0.000	-0.182
-38.839	0.000	-0.304	5.374	0.228	0.000	-0.304
-38.296	0.000	-0.367	5.920	0.322	0.000	-0.367
-37.753	0.000	-0.428	6.467	1.188	0.000	-0.428
-36.664	0.000	-0.526	7.560	2.148	0.000	-0.526
-35.572	0.000	-0.583	8.654	1.911	0.000	-0.583
-34.479	0.000	-0.604	9.747	2.192	0.000	-0.604
-32.293	0.000	-0.562	11.934	1.900	0.000	-0.562
-30.109	0.000	-0.448	14.120	1.576	0.000	-0.448
-25.750	0.000	-0.099	18.494	0.476	0.000	-0.099
-21.393	0.000	0.287	22.867	1.013	0.000	0.287
-19.212	0.000	0.441	25.054	1.583	0.000	0.441
-17.027	0.000	0.534	27.241	2.261	0.000	0.534
-14.841	0.000	0.542	29.427	2.408	0.000	0.542
-12.656	0.000	0.458	31.614	2.880	0.000	0.458
-8.300	0.000	0.070	35.987	1.290	0.000	0.070
-3.954	0.000	-0.417	40.360	1.876	0.000	-0.417
-1.774	0.000	-0.588	42.547	1.985	0.000	-0.588
-0.681	0.000	-0.636	43.640	1.722	0.000	-0.636
0.412	0.000	-0.652	44.733	1.794	0.000	-0.652
1.505	0.000	-0.633	45.827	1.556	0.000	-0.633
2.597	0.000	-0.584	46.920	1.811	0.000	-0.584
4.778	0.000	-0.418	49.107	1.824	0.000	-0.418
9.125	0.000	0.054	53.480	0.885	0.000	0.054
13.480	0.000	0.458	57.853	2.987	0.000	0.458
15.665	0.000	0.546	60.040	2.999	0.000	0.546
17.851	0.000	0.520	62.226	2.487	0.000	0.520
20.034	0.000	0.399	64.413	1.504	0.000	0.399
22.214	0.000	0.221	66.600	0.519	0.000	0.221
26.569	0.000	-0.175	70.973	0.970	0.000	-0.175
30.931	0.000	-0.497	75.347	1.774	0.000	-0.497
33.116	0.000	-0.590	77.533	1.548	0.000	-0.590
34.209	0.000	-0.607	78.627	1.540	0.000	-0.607
35.302	0.000	-0.595	79.720	1.934	0.000	-0.595
36.394	0.000	-0.546	80.813	2.297	0.000	-0.546
37.484	0.000	-0.453	81.907	1.760	0.000	-0.453
38.570	0.000	-0.327	83.000	0.197	0.000	-0.327
39.655	0.000	-0.197	84.093	1.427	0.000	-0.197
40.744	0.000	-0.094	85.187	2.099	0.000	-0.094
41.290	0.000	-0.063	85.733	1.951	0.000	-0.063
41.836	0.000	-0.050	86.280	2.244	0.000	-0.050
42.383	0.000	-0.058	86.827	1.335	0.000	-0.058
42.929	0.000	-0.079	87.373	0.705	0.000	-0.079
44.022	0.000	-0.109	88.467	0.000	0.000	-0.109

Prestress Losses - PT- KG V2 assignment 1

Distance along profile	Friction & Wobble	Anchorage	Long Term Losses	Force
0.000	0.000	481.357	0.000	2838.643
0.167	0.498	480.361	0.000	2839.141
0.333	0.996	479.365	0.000	2839.639
0.500	1.494	478.370	0.000	2840.136
0.667	1.992	477.374	0.000	2840.634
0.833	2.490	476.378	0.000	2841.132
1.000	2.987	475.383	0.000	2841.630
1.547	26.064	429.229	0.000	2864.707
2.094	50.146	381.065	0.000	2888.789
2.640	73.314	334.730	0.000	2911.956
3.187	93.562	294.234	0.000	2932.204
4.280	117.193	246.971	0.000	2955.836
5.374	135.352	210.653	0.000	2973.995
5.920	139.194	202.969	0.000	2977.837
6.467	143.978	193.401	0.000	2982.621
7.560	158.925	163.507	0.000	2997.568
8.654	183.276	114.805	0.000	3021.919
9.747	205.114	71.130	0.000	3043.756
11.934	232.567	16.223	0.000	3071.210
14.120	256.971	0.000	0.000	3063.029
18.494	284.072	0.000	0.000	3035.928
22.867	300.518	0.000	0.000	3019.482
25.054	316.028	0.000	0.000	3003.972
27.241	336.802	0.000	0.000	2983.198
29.427	363.738	0.000	0.000	2956.262
31.614	391.785	0.000	0.000	2928.215
35.987	429.554	0.000	0.000	2890.446
40.360	452.553	0.000	0.000	2867.447
42.547	475.011	0.000	0.000	2844.989
43.640	495.474	0.000	0.000	2824.526
44.733	513.474	0.000	0.000	2806.526
45.827	531.996	0.000	0.000	2788.004
46.920	548.320	0.000	0.000	2771.680
49.107	569.462	0.000	0.000	2750.538
53.480	595.923	0.000	0.000	2724.077
57.853	614.154	0.000	0.000	2705.846
60.040	644.698	0.000	0.000	2675.302
62.226	674.993	0.000	0.000	2645.007
64.413	700.736	0.000	0.000	2619.264
66.600	718.204	0.000	0.000	2601.796
70.973	732.651	0.000	0.000	2587.349
75.347	750.659	0.000	0.000	2569.341
77.533	769.962	0.000	0.000	2550.038
78.627	784.830	0.000	0.000	2535.170
79.720	799.544	0.000	0.000	2520.456
80.813	817.277	0.000	0.000	2502.723
81.907	837.717	0.000	0.000	2482.283
83.000	853.834	0.000	0.000	2466.166
84.093	857.781	0.000	0.000	2462.219
85.187	871.207	0.000	0.000	2448.793
85.733	888.497	0.000	0.000	2431.503
86.280	904.545	0.000	0.000	2415.455
86.827	922.695	0.000	0.000	2397.305
87.373	933.900	0.000	0.000	2386.100
88.467	941.521	0.000	0.000	2378.479

17.3 KG H1

Tendon Summary - PT- KG H1 assignment 1

General	**Value**	**Units**
Design code	EN1992-1-1:2004 / 2014 Eurocode 2	
Initial tendon force	3320.000	kN
Tendon area	2250.000	mm²
Modulus of elasticity for tendon	195000000.000	kN/m²
Concrete stress at transfer	10000.000	kN/m²
Jacking	Jacking at end 2	None
Slip at end 2	0.006	m
Jack angle at end 2	0.000	deg
Instantaneous losses	**Value**	**Units**
Modulus of elasticity of concrete at transfer	32000000.000	kN/m²
Unintentional angular displacement	0.005	rad/m
Duct friction coefficient	0.180	

Tendon Profile (original input) - PT- KG H1 assignment 1

Segment type	**X**	**Y**	**Z**
Start	0.000	0.000	0.310
Straight	1.000	0.000	0.150
Spline	2.200	0.000	-0.050
Spline Continued	7.200	0.000	-0.500
Spline Continued	12.200	0.000	-0.550
Spline Continued	21.200	0.000	0.150
Spline Continued	28.200	0.000	0.550
Spline Continued	34.200	0.000	0.250
Spline Continued	44.200	0.000	-0.650
Spline Continued	54.200	0.000	0.150
Spline Continued	60.200	0.000	0.550
Spline Continued	67.200	0.000	0.150
Spline Continued	76.200	0.000	-0.550
Spline Continued	81.200	0.000	-0.500
Spline Continued	86.200	0.000	-0.050
Spline Continued	87.400	0.000	0.150
Spline Continued	88.400	0.000	0.310

Minimum radius = 0.000
Smoothing type: Cut corner

Tendon profile (sampling points) - PT- KG H1 assignment 1

X	Y	Z	Distance along profile	Angle change in profile	Eccentricity from beam in y	Eccentricity from beam in z
-44.200	0.000	0.310	0.000	0.000	0.000	0.310
-44.033	0.000	0.283	0.169	0.000	0.000	0.283
-43.867	0.000	0.257	0.338	0.000	0.000	0.257
-43.700	0.000	0.230	0.506	0.000	0.000	0.230
-43.533	0.000	0.203	0.675	0.000	0.000	0.203
-43.367	0.000	0.177	0.844	0.000	0.000	0.177
-43.200	0.000	0.150	1.013	0.473	0.000	0.150
-42.121	0.000	-0.032	2.107	1.767	0.000	-0.032
-41.038	0.000	-0.180	3.200	1.590	0.000	-0.180
-39.950	0.000	-0.298	4.294	1.367	0.000	-0.298
-38.860	0.000	-0.391	5.388	1.607	0.000	-0.391
-36.676	0.000	-0.514	7.576	1.706	0.000	-0.514
-34.489	0.000	-0.572	9.764	1.896	0.000	-0.572
-32.301	0.000	-0.558	11.951	2.105	0.000	-0.558
-30.116	0.000	-0.464	14.139	1.667	0.000	-0.464
-27.934	0.000	-0.306	16.327	0.984	0.000	-0.306
-25.755	0.000	-0.110	18.514	0.116	0.000	-0.110
-21.398	0.000	0.289	22.890	1.199	0.000	0.289
-19.215	0.000	0.444	25.078	1.639	0.000	0.444
-17.030	0.000	0.535	27.265	2.246	0.000	0.535
-14.842	0.000	0.541	29.453	2.370	0.000	0.541
-12.656	0.000	0.457	31.641	2.866	0.000	0.457
-8.298	0.000	0.070	36.016	1.302	0.000	0.070
-3.950	0.000	-0.417	40.391	1.877	0.000	-0.417
-1.769	0.000	-0.588	42.579	1.989	0.000	-0.588
-0.676	0.000	-0.636	43.673	1.727	0.000	-0.636
0.418	0.000	-0.652	44.766	1.797	0.000	-0.652
1.511	0.000	-0.632	45.860	1.557	0.000	-0.632
2.604	0.000	-0.583	46.954	1.810	0.000	-0.583
4.785	0.000	-0.416	49.142	1.812	0.000	-0.416
9.135	0.000	0.055	53.517	0.907	0.000	0.055
13.492	0.000	0.458	57.892	2.964	0.000	0.458
15.678	0.000	0.546	60.080	2.955	0.000	0.546
17.865	0.000	0.522	62.267	2.495	0.000	0.522
20.050	0.000	0.402	64.455	1.597	0.000	0.402
22.230	0.000	0.222	66.643	0.716	0.000	0.222
26.586	0.000	-0.193	71.018	0.650	0.000	-0.193
28.766	0.000	-0.376	73.206	1.284	0.000	-0.376
30.949	0.000	-0.510	75.394	1.900	0.000	-0.510
33.136	0.000	-0.572	77.582	2.021	0.000	-0.572
35.324	0.000	-0.556	79.769	1.679	0.000	-0.556
37.510	0.000	-0.476	81.957	1.793	0.000	-0.476
39.693	0.000	-0.328	84.145	2.876	0.000	-0.328
41.865	0.000	-0.071	86.332	2.545	0.000	-0.071
44.024	0.000	0.283	88.520	0.000	0.000	0.283

Prestress Losses - PT- KG H1 assignment 1

Distance along profile	Friction & Wobble	Anchorage	Long Term Losses	Force
0.000	827.177	0.000	0.000	2492.823
0.169	826.798	0.000	0.000	2493.202
0.338	826.419	0.000	0.000	2493.581
0.506	826.040	0.000	0.000	2493.960
0.675	825.661	0.000	0.000	2494.339
0.844	825.282	0.000	0.000	2494.718
1.013	821.194	0.000	0.000	2498.806
2.107	804.813	0.000	0.000	2515.187
3.200	789.730	0.000	0.000	2530.270
4.294	776.341	0.000	0.000	2543.659
5.388	760.952	0.000	0.000	2559.048
7.576	742.125	0.000	0.000	2577.875
9.764	721.613	0.000	0.000	2598.387
11.951	699.214	0.000	0.000	2620.786
14.139	680.259	0.000	0.000	2639.741
16.327	666.870	0.000	0.000	2653.130
18.514	660.668	0.000	0.000	2659.332
22.890	640.102	0.000	0.000	2679.898
25.078	620.957	0.000	0.000	2699.043
27.265	596.488	0.000	0.000	2723.512
29.453	570.724	0.000	0.000	2749.276
31.641	540.388	0.000	0.000	2779.612
36.016	517.983	0.000	0.000	2802.017
40.391	490.292	0.000	0.000	2829.708
42.579	466.940	0.000	0.000	2853.060
43.673	448.598	0.000	0.000	2871.402
44.766	429.496	0.000	0.000	2890.504
45.860	412.463	0.000	0.000	2907.537
46.954	393.007	0.000	0.000	2926.993
49.142	370.493	0.000	0.000	2949.507
53.517	350.408	0.000	0.000	2969.592
57.892	310.805	0.000	0.000	3009.195
60.080	276.750	0.000	0.000	3043.250
62.267	246.759	0.000	0.000	3073.241
64.455	225.217	0.000	0.000	3094.783
66.643	212.131	0.000	0.000	3107.869
71.018	193.486	0.000	0.000	3126.514
73.206	174.657	0.000	0.000	3145.343
75.394	149.586	38.569	0.000	3131.845
77.582	123.103	91.534	0.000	3105.363
79.769	99.864	138.012	0.000	3082.124
81.957	75.288	187.164	0.000	3057.548
84.145	39.383	258.975	0.000	3021.642
86.332	6.531	324.679	0.000	2988.790
88.520	0.000	337.740	0.000	2982.260

17.4 KG H2

Tendon Summary - PT- KG H2 assignment 1

General	**Value**	**Units**
Design code	EN1992-1-1:2004 / 2014 Eurocode 2	
Initial tendon force	3320.000	kN
Tendon area	2250.000	mm²
Modulus of elasticity for tendon	195000000.000	kN/m²
Concrete stress at transfer	10000.000	kN/m²
Jacking	Jacking at end 2	None
Slip at end 2	0.006	m
Jack angle at end 2	0.000	deg
Instantaneous losses	**Value**	**Units**
Modulus of elasticity of concrete at transfer	32000000.000	kN/m²
Unintentional angular displacement	0.005	rad/m
Duct friction coefficient	0.180	

Tendon Profile (original input) - PT- KG H2 assignment 1

Segment type	**X**	**Y**	**Z**
Start	0.000	0.000	-0.110
Straight	1.000	0.000	-0.090
Spline	2.200	0.000	-0.050
Spline Continued	7.200	0.000	-0.500
Spline Continued	12.200	0.000	-0.550
Spline Continued	21.200	0.000	0.150
Spline Continued	28.200	0.000	0.550
Spline Continued	34.200	0.000	0.250
Spline Continued	44.200	0.000	-0.650
Spline Continued	54.200	0.000	0.150
Spline Continued	60.200	0.000	0.550
Spline Continued	67.200	0.000	0.150
Spline Continued	76.200	0.000	-0.550
Spline Continued	81.200	0.000	-0.500
Spline Continued	86.200	0.000	-0.050
Spline Continued	87.400	0.000	-0.090
Spline Continued	88.400	0.000	-0.110

Minimum radius = 0.000
Smoothing type: Cut corner

Tendon profile (sampling points) - PT- KG H2 assignment 1

X	Y	Z	Distance along profile	Angle change in profile	Eccentricity from beam in y	Eccentricity from beam in z
-44.200	0.000	-0.110	0.000	0.000	0.000	-0.110
-44.033	0.000	-0.107	0.167	0.000	0.000	-0.107
-43.867	0.000	-0.103	0.333	0.000	0.000	-0.103
-43.700	0.000	-0.100	0.500	0.000	0.000	-0.100
-43.533	0.000	-0.097	0.667	0.000	0.000	-0.097
-43.367	0.000	-0.093	0.833	0.000	0.000	-0.093
-43.200	0.000	-0.090	1.000	2.066	0.000	-0.090
-42.654	0.000	-0.059	1.547	2.179	0.000	-0.059
-42.108	0.000	-0.050	2.094	2.107	0.000	-0.050
-41.561	0.000	-0.060	2.640	1.835	0.000	-0.060
-41.015	0.000	-0.088	3.187	2.027	0.000	-0.088
-39.926	0.000	-0.182	4.280	1.497	0.000	-0.182
-38.839	0.000	-0.304	5.374	0.228	0.000	-0.304
-38.296	0.000	-0.367	5.920	0.322	0.000	-0.367
-37.753	0.000	-0.428	6.467	1.188	0.000	-0.428
-36.664	0.000	-0.526	7.560	2.148	0.000	-0.526
-35.572	0.000	-0.583	8.654	1.911	0.000	-0.583
-34.479	0.000	-0.604	9.747	2.192	0.000	-0.604
-32.293	0.000	-0.562	11.934	1.900	0.000	-0.562
-30.109	0.000	-0.448	14.120	1.576	0.000	-0.448
-25.750	0.000	-0.099	18.494	0.476	0.000	-0.099
-21.393	0.000	0.287	22.867	1.013	0.000	0.287
-19.212	0.000	0.441	25.054	1.583	0.000	0.441
-17.027	0.000	0.534	27.241	2.261	0.000	0.534
-14.841	0.000	0.542	29.427	2.408	0.000	0.542
-12.656	0.000	0.458	31.614	2.880	0.000	0.458
-8.300	0.000	0.070	35.987	1.290	0.000	0.070
-3.954	0.000	-0.417	40.360	1.876	0.000	-0.417
-1.774	0.000	-0.588	42.547	1.985	0.000	-0.588
-0.681	0.000	-0.636	43.640	1.722	0.000	-0.636
0.412	0.000	-0.652	44.733	1.794	0.000	-0.652
1.505	0.000	-0.633	45.827	1.556	0.000	-0.633
2.597	0.000	-0.584	46.920	1.811	0.000	-0.584
4.778	0.000	-0.418	49.107	1.824	0.000	-0.418
9.125	0.000	0.054	53.480	0.885	0.000	0.054
13.480	0.000	0.458	57.853	2.987	0.000	0.458
15.665	0.000	0.546	60.040	2.999	0.000	0.546
17.851	0.000	0.520	62.226	2.487	0.000	0.520
20.034	0.000	0.399	64.413	1.504	0.000	0.399
22.214	0.000	0.221	66.600	0.519	0.000	0.221
26.569	0.000	-0.175	70.973	0.970	0.000	-0.175
30.931	0.000	-0.497	75.347	1.774	0.000	-0.497
33.116	0.000	-0.590	77.533	1.548	0.000	-0.590
34.209	0.000	-0.607	78.627	1.540	0.000	-0.607
35.302	0.000	-0.595	79.720	1.934	0.000	-0.595
36.394	0.000	-0.546	80.813	2.297	0.000	-0.546
37.484	0.000	-0.453	81.907	1.760	0.000	-0.453
38.570	0.000	-0.327	83.000	0.197	0.000	-0.327
39.655	0.000	-0.197	84.093	1.427	0.000	-0.197
40.744	0.000	-0.094	85.187	2.099	0.000	-0.094
41.290	0.000	-0.063	85.733	1.951	0.000	-0.063
41.836	0.000	-0.050	86.280	2.244	0.000	-0.050
42.383	0.000	-0.058	86.827	1.335	0.000	-0.058
42.929	0.000	-0.079	87.373	0.705	0.000	-0.079
44.022	0.000	-0.109	88.467	0.000	0.000	-0.109

Prestress Losses - PT- KG H2 assignment 1

Distance along profile	Friction & Wobble	Anchorage	Long Term Losses	Force
0.000	941.521	0.000	0.000	2378.479
0.167	941.164	0.000	0.000	2378.836
0.333	940.807	0.000	0.000	2379.193
0.500	940.450	0.000	0.000	2379.550
0.667	940.093	0.000	0.000	2379.907
0.833	939.736	0.000	0.000	2380.264
1.000	923.879	0.000	0.000	2396.121
1.547	906.232	0.000	0.000	2413.768
2.094	889.008	0.000	0.000	2430.992
2.640	873.752	0.000	0.000	2446.248
3.187	856.915	0.000	0.000	2463.085
4.280	842.871	0.000	0.000	2477.129
5.374	838.658	0.000	0.000	2481.342
5.920	834.920	0.000	0.000	2485.080
6.467	824.398	0.000	0.000	2495.602
7.560	805.024	0.000	0.000	2514.976
8.654	787.392	0.000	0.000	2532.608
9.747	767.385	0.000	0.000	2552.615
11.934	747.048	0.000	0.000	2572.952
14.120	729.184	0.000	0.000	2590.816
18.494	715.073	0.000	0.000	2604.927
22.867	696.465	0.000	0.000	2623.535
25.054	678.195	0.000	0.000	2641.805
27.241	654.125	0.000	0.000	2665.875
29.427	628.590	0.000	0.000	2691.410
31.614	598.782	0.000	0.000	2721.218
35.987	576.957	0.000	0.000	2743.043
40.360	549.857	0.000	0.000	2770.143
42.547	527.041	0.000	0.000	2792.959
43.640	509.128	0.000	0.000	2810.872
44.733	490.454	0.000	0.000	2829.546
45.827	473.790	0.000	0.000	2846.210
46.920	454.733	0.000	0.000	2865.267
49.107	432.588	0.000	0.000	2887.412
53.480	413.133	0.000	0.000	2906.867
57.853	374.155	0.000	0.000	2945.845
60.040	340.414	0.000	0.000	2979.586
62.226	311.130	0.000	0.000	3008.870
64.413	290.928	0.000	0.000	3029.072
66.600	280.004	0.000	0.000	3039.996
70.973	258.697	0.000	0.000	3061.303
75.347	229.448	0.000	0.000	3090.552
77.533	208.262	30.812	0.000	3080.927
78.627	190.096	67.143	0.000	3062.761
79.720	167.920	111.495	0.000	3040.585
80.813	141.964	163.407	0.000	3014.629
81.907	121.195	204.945	0.000	2993.860
83.000	116.068	215.200	0.000	2988.733
84.093	98.500	250.334	0.000	2971.165
85.187	73.997	299.341	0.000	2946.662
85.733	52.430	342.474	0.000	2925.095
86.280	27.691	391.953	0.000	2900.356
86.827	12.231	422.874	0.000	2884.896
87.373	3.265	440.804	0.000	2875.930
88.467	0.000	447.335	0.000	2872.665

18. Direct Method Influence

Attribute: 1 Title: Inf1 - Bearing (Fx)
Sub Type = Direct method influence
Assignment to Points:
104;106;205;207;305;307;404;406

Attribute: 2 Title: Inf2 - Bearing (Fy)
Sub Type = Direct method influence
Assignment to Points:
104;106;205;207;305;307;404;406

Attribute: 3 Title: Inf3 - Bearing (Fz)
Sub Type = Direct method influence
Assignment to Points:
104;106;205;207;305;307;404;406

Attribute: 4 Title: Inf4 - Reactions-FX (Internal) (FX)
Sub Type = Direct method influence
Assignment to Points:
102T402I100

Attribute: 5 Title: Inf5 - Reactions-FY (Internal) (FY)
Sub Type = Direct method influence
Assignment to Points:
102T402I100

Attribute: 6 Title: Inf6 - Reactions-FZ (Internal) (FZ)
Sub Type = Direct method influence
Assignment to Points:
102T402I100

Attribute: 7 Title: Inf7 - Reactions-MX (Internal) (MX)
Sub Type = Direct method influence
Assignment to Points:
102T402I100

Attribute: 8 Title: Inf8 - Reactions-MY (Internal) (MY)
Sub Type = Direct method influence
Assignment to Points:
102T402I100

Attribute: 9 Title: Inf9 - Beam-Fx (Internal) (Fx)
Sub Type = Direct method influence
Assignment to Points:
1T15;102;103;105;202;203;204;206;302;303;304;306;402;403;405
Assignment to Lines:
1;2;4T11;13;14;103;203;204;303;304;403

Attribute: 10 Title: Inf10 - Beam-Fy (Internal) (Fy)
Sub Type = Direct method influence
Assignment to Points:
1T15;102;103;105;202;203;204;206;302;303;304;306;402;403;405
Assignment to Lines:
1;2;4T11;13;14;103;203;204;303;304;403

Attribute: 11 Title: Inf11 - Beam-Fz (Internal) (Fz)
Sub Type = Direct method influence
Assignment to Points:
1T15;102;103;105;202;203;204;206;302;303;304;306;402;403;405
Assignment to Lines:
1;2;4T11;13;14;103;203;204;303;304;403

Attribute: 12 Title: Inf12 - Beam-Mx (Internal) (Mx)
Sub Type = Direct method influence
Assignment to Points:
1T15;102;103;105;202;203;204;206;302;303;304;306;402;403;405
Assignment to Lines:
1;2;4T11;13;14;103;203;204;303;304;403

Attribute: 13 Title: Inf13 - Beam-My (Internal) (My)
Sub Type = Direct method influence
Assignment to Points:
1T15;102;103;105;202;203;204;206;302;303;304;306;402;403;405
Assignment to Lines:
1;2;4T11;13;14;103;203;204;303;304;403

19. Load groups: traffic

Load groups : Eurocode Load Modell 1 (LM1)
Type: Tandem axle
Axle load - lane 1: 300 kN
Axle load - lane 2: 200 kN
Axel load - lane 3: 100 kN

Lane load
Surface load - lane 1: 9.0 kPa
Surface load - remaining: 2.5 kPa

Load groups : Eurocode Load Modell 2 (LM2)
Type: Single axle
Axle load: 360 kN

Load groups : Fatigue modell 3 (UTM3)
Type: Quadruple axel
Axle load: 120 kN

20. VLO Analysis

Type: VLO – LM1 ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : LM1
Longitudinal increment : 0.25 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L500, L501
UDL alfa factor : 0.8, 1, 1 , 1, 1
TS alfa factor : 0.9, 0.9,0
Influence attributes :

Inf1 - Bearing (Fx)

Inf2 - Bearing (Fy)

Inf3 - Bearing (Fz)

Inf4 - Reactions-FX

Inf5 - Reactions-FY

Inf6 - Reactions-FZ

Inf7 - Reactions-MX

Inf8 - Reactions-MY

Inf9 - Beam-Fx

Inf10 - Beam-Fy

Inf11 - Beam-Fz

Inf12 - Beam-Mx

Inf13 - Beam-My

Type: VLO – LM2 ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : LM2
Longitudinal increment : 0.25 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L500, L501
UDL alfa factor : 0.8, 1, 1 , 1, 1
TS alfa factor : 0.9, 0.9,0
Influence attributes :

Inf1 - Bearing (Fx)

Inf2 - Bearing (Fy)

Inf3 - Bearing (Fz)

Inf4 - Reactions-FX

Inf5 - Reactions-FY

Inf6 - Reactions-FZ

Inf7 - Reactions-MX

Inf8 - Reactions-MY

Inf9 - Beam-Fx

Inf10 - Beam-Fy

Inf11 - Beam-Fz

Inf12 - Beam-Mx

Inf13 - Beam-My

Type: VLO – UTM3 ~ CharacteristicRepresentative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : UTM3
Longitudinal increment : 0.25 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L500, L501
Minimum width vehicule : 2.0 m
Maximum width vehicle : 2.0 m
Influence attributes :

Inf1 - Bearing (Fx)

Inf2 - Bearing (Fy)

Inf3 - Bearing (Fz)

Inf4 - Reactions-FX

Inf5 - Reactions-FY

Inf6 - Reactions-FZ

Inf7 - Reactions-MX

Inf8 - Reactions-MY

Inf9 - Beam-Fx

Inf10 - Beam-Fy

Inf11 - Beam-Fz

Inf12 - Beam-Mx

Inf13 - Beam-My

Type: VLO – EG A ~ Characteristic

Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : Complementary load modell
Dynamic amplification : 25 %
Load model value A : 180 kN
Load model value B : 300 kN
Load modell valute q : 5 kN/m
Lane vehicule factor most onerous lane : 1.0
Lane vehicule factor second lane : 0.8
Type vehicules : a
Longitudinal increment : 0.25 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L500, L501
Minimum width vehicule : 2.0 m
Maximum width vehicle : 2.0 m
Influence attributes :
Inf1 - Bearing (Fx)
Inf2 - Bearing (Fy)
Inf3 - Bearing (Fz)
Inf4 - Reactions-FX
Inf5 - Reactions-FY
Inf6 - Reactions-FZ
Inf7 - Reactions-MX
Inf8 - Reactions-MY
Inf9 - Beam-Fx
Inf10 - Beam-Fy
Inf11 - Beam-Fz
Inf12 - Beam-Mx
Inf13 - Beam-My

Type: VLO – EG B ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : Complementary load modell
Dynamic amplification : 25 %
Load model value A : 180 kN
Load model value B : 300 kN
Load modell valute q : 5 kN/m
Lane vehicule factor most onerous lane : 1.0
Lane vehicule factor second lane : 0.8
Type vehicules : b, c, d, e, f, g,h,I,j,k,l,m,n,o
Longitudinal increment : 0.25 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L500, L501
Minimum width vehicule : 2.0 m
Maximum width vehicle : 2.0 m
Influence attributes :

Inf1 - Bearing (Fx)

Inf2 - Bearing (Fy)

Inf3 - Bearing (Fz)

Inf4 - Reactions-FX

Inf5 - Reactions-FY

Inf6 - Reactions-FZ

Inf7 - Reactions-MX

Inf8 - Reactions-MY

Inf9 - Beam-Fx

Inf10 - Beam-Fy

Inf11 - Beam-Fz

Inf12 - Beam-Mx

Inf13 - Beam-My

21. Basic combination

Loadcase ID: 17 Title: STOD_2X-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
15	0	-1.0	STOD_2X+

Loadcase ID: 18 Title: STOD_3X-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
16	0	-1.0	STOD_3X+

Loadcase ID: 3346 Title: SIDO 1-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3342	0	-1.0	SIDO 1+

Loadcase ID: 3347 Title: SIDO 2-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3343	0	-1.0	SIDO 2+

Loadcase ID: 3348 Title: SIDO 3-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3344	0	-1.0	SIDO 3+

Loadcase ID: 3349 Title: SIDO 4-
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3345	0	-1.0	SIDO 4+

Loadcase ID: 3377 Title: PT - t0
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3373	0	3.0	PT KG-V1
3374	0	3.0	PT KG-V2
3375	0	3.0	PT KG-H1
3376	0	3.0	PT KG-H2

Loadcase ID: 3378 Title: PT - t1
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3377	0	0.94	PT - t0

Loadcase ID: 3379 Title: PT - t2
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
3377	0	0.84	PT - t0

Loadcase ID: 3406 Title: EGEN
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
1	5	1.0	EGEN 1
2	5	1.0	EGEN 2
3	5	1.0	EGEN 3
4	5	1.0	EGEN 4
5	5	1.0	EGEN 5
6	5	1.0	EGEN 6

Loadcase ID: 3407 Title: BELAGG
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
7	5	1.0	BELAGG 1
8	5	1.0	BELAGG 2

Loadcase ID: 3408 Title: JORD
Sub Type: Basic Combination

Loadcase File	Results Factor	Title	Type
9	5	1.0	JORD 1
10	5	1.0	JORD 2

22. Smart combination

Loadcase ID: 21 Title: STOD-Z
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
11	0	0.0	1.0	STOD_1Z
12	0	0.0	1.0	STOD_2Z
13	0	0.0	1.0	STOD_3Z
14	0	0.0	1.0	STOD_4Z

Loadcase ID: 3367 Title: TEMP-1
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3360	0	0.0	0.77	JTEMP (Max)
3361	0	0.0	0.77	JTEMP (Min)
3365	0	0.0	0.75	OJTEMP 1 (Max)
3366	0	0.0	0.75	OJTEMP 1 (Min)
3362	0	0.0	1.0	DELTA-P

Loadcase ID: 3369 Title: TEMP-2
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3360	0	0.0	0.27	JTEMP (Max)
3361	0	0.0	0.27	JTEMP (Min)
3365	0	0.0	1.0	OJTEMP 1 (Max)
3366	0	0.0	1.0	OJTEMP 1 (Min)
3362	0	0.0	1.0	DELTA-P

Loadcase ID: 3394 Title: ICE HIGH Y
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3384	0	0.0	1.0	ICE HIGH 2Y+
3385	0	0.0	-1.0	ICE LOW 2Y+
3386	0	0.0	1.0	ICE HIGH 3Y+
3386	0	1.0	-1.0	ICE HIGH 3Y+

Loadcase ID: 3396 Title: ICE LOW Y
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3385	1	0.0	1.0	ICE LOW 2Y+
3385	1	0.0	-1.0	ICE LOW 2Y+
3387	1	0.0	1.0	ICE LOW 3Y+
3387	1	0.0	-1.0	ICE LOW 3Y+

Loadcase ID: 3398 Title: ICE Z
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3388	1	0.0	1.0	ICE 2Z
3389	1	0.0	1.0	ICE 3Z

Loadcase ID: 3404 Title: ULS-PERM
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3406	0	1.0	0.2	EGEN
3407	0	0.9	0.43	BELAGG
3408	0	0.9	0.58	JORD
23	0	0.0	0.41	STOD (Max)
24	0	0.0	0.41	STOD (Min)
25	5	0.0	0.41	KRYMP
3377	0	0.84	0.51	PT - t0

Loadcase ID: 3409 Title: ULS-PERM_0
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3406	0	1.0	0.2	EGEN
3407	0	0.9	0.43	BELAGG
3408	0	0.9	0.58	JORD
23	0	0.0	0.41	STOD (Max)
24	0	0.0	0.41	STOD (Min)
25	5	0.0	0.41	KRYMP
3377	0	0.84	0.51	PT - t0

Loadcase ID: 3411 Title: ULS-VAR
Sub Type: Smart Combination
Loadcases to consider: 6
Variable Loadcases: 1

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3413	0	1.03	0.47	TRAFIK (Max)
3414	0	1.03	0.47	TRAFIK (Min)
3415	0	0.84	0.29	BROMS (Max)
3416	0	0.84	0.29	BROMS (Min)
3350	0	0.84	0.29	SIDO (Max)
3351	0	0.84	0.29	SIDO (Min)
3417	0	1.13	0.58	OVER (Max)
3418	0	1.13	0.58	OVER (Min)
3354	0	0.45	1.05	VIND (Max)
3355	0	0.45	1.05	VIND (Min)
3402	0	0.9	0.6	ALT (Max)
3403	0	0.9	0.6	ALT (Min)

Loadcase ID: 3417 Title: OVER
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3356	5	0.0	1.0	OVER:V
3357	5	0.0	1.0	OVER:H

Loadcase ID: 3419 Title: ULS
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3404	0	1.0	0.0	ULS-PERM (Max)
3405	0	1.0	0.0	ULS-PERM (Min)
3411	0	0.0	1.0	ULS-VAR (Max)
3412	0	0.0	1.0	ULS-VAR (Min)

Loadcase ID: 3421 Title: ULS-0
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3409	0	1.0	0.0	ULS-PERM_0 (Max)
3410	0	1.0	0.0	ULS-PERM_0 (Min)
3411	0	0.0	1.0	ULS-VAR (Max)
3412	0	0.0	1.0	ULS-VAR (Min)

Loadcase ID: 3423 Title: SLS-PERM
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3406	0	1.0	0.0	EGEN
3407	0	0.9	0.2	BELAGG
3408	0	0.9	0.58	JORD
23	0	0.0	0.34	STOD (Max)
24	0	0.0	0.34	STOD (Min)
25	5	0.0	0.34	KRYMP
3377	0	0.84	0.16	PT - t0

Loadcase ID: 3425 Title: SLS-K-VAR
Sub Type: Smart Combination
Loadcases to consider: 6
Variable Loadcases: 1

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3413	0	0.75	0.25	TRAFIK (Max)
3414	0	0.75	0.25	TRAFIK (Min)
3415	0	0.56	0.19	BROMS (Max)
3416	0	0.56	0.19	BROMS (Min)
3350	0	0.56	0.19	SIDO (Max)
3351	0	0.56	0.19	SIDO (Min)
3417	0	0.75	0.59	OVER (Max)
3418	0	0.75	0.59	OVER (Min)
3354	0	0.3	0.7	VIND (Max)
3355	0	0.3	0.7	VIND (Min)
3402	0	0.6	0.4	ALT (Max)
3403	0	0.6	0.4	ALT (Min)

Loadcase ID: 3427 Title: SLS-F-VAR
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3413	0	0.0	0.75	TRAFIK (Max)
3414	0	0.0	0.75	TRAFIK (Min)
3415	0	0.0	0.56	BROMS (Max)
3416	0	0.0	0.56	BROMS (Min)
3350	0	0.0	0.56	SIDO (Max)
3351	0	0.0	0.56	SIDO (Min)
3417	0	0.0	0.95	OVER (Max)
3418	0	0.0	0.95	OVER (Min)
3354	0	0.0	0.3	VIND (Max)
3355	0	0.0	0.3	VIND (Min)
3402	0	0.0	0.6	ALT (Max)
3403	0	0.0	0.6	ALT (Min)

Loadcase ID: 3429 Title: SLS-K
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3423	0	1.0	0.0	SLS-PERM (Max)
3424	0	1.0	0.0	SLS-PERM (Min)
3425	0	0.0	1.0	SLS-K-VAR (Max)
3426	0	0.0	1.0	SLS-K-VAR (Min)

Loadcase ID: 3431 Title: SLS-F
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3423	0	1.0	0.0	SLS-PERM (Max)
3424	0	1.0	0.0	SLS-PERM (Min)
3427	0	0.0	1.0	SLS-F-VAR (Max)
3428	0	0.0	1.0	SLS-F-VAR (Min)

Loadcase ID: 3433 Title: SLS-Q
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3406	0	1.0	0.0	EGEN
3407	0	1.0	0.0	BELAGG
3408	0	1.0	0.34	JORD
23	0	0.0	0.34	STOD (Max)
24	0	0.0	0.34	STOD (Min)
25	5	0.0	0.34	KRYMP
3377	0	0.84	0.0	PT - t0
3371	0	0.0	0.5	TEMP (Max)
3372	0	0.0	0.5	TEMP (Min)

Loadcase ID: 3435 Title: FAT
Sub Type: Smart Combination
Loadcases to consider: All
Variable Loadcases: All

Loadcase File Factor Factor	Results Permanent Variable Title	Type		
3406	0	1.0	0.0	EGEN
3407	0	1.0	0.0	BELAGG
3408	0	1.48	0.0	JORD
3377	0	0.84	0.0	PT - t0
3437	0	0.0	1.0	UTM 3 (Max)
3438	0	0.0	1.0	UTM 3 (Min)

23. Envelopes

Loadcase ID: 19 Title: STOD-X
Sub Type: Envelope

Loadcase File	Results Title	Type
15	0	STOD_2X+
16	0	STOD_3X+
17	0	STOD_2X-
18	0	STOD_3X-

Loadcase ID: 23 Title: STOD
Sub Type: Envelope

Loadcase File	Results Title	Type
21	0	STOD-Z (Max)
22	0	STOD-Z (Min)
19	0	STOD-X (Max)
20	0	STOD-X (Min)

Loadcase ID: 3350 Title: SIDO
Sub Type: Envelope

Loadcase File	Results Title	Type
3342	5	SIDO 1+
3343	5	SIDO 2+
3344	5	SIDO 3+
3345	5	SIDO 4+
3346	0	SIDO 1-
3347	0	SIDO 2-
3348	0	SIDO 3-
3349	0	SIDO 4-

Loadcase ID: 3354 Title: VIND
Sub Type: Envelope

Loadcase File	Results Title	Type
3352	0	VIND+
3353	0	VIND-

Loadcase ID: 3360 Title: JTEMP
Sub Type: Envelope

Loadcase File	Results Title	Type
3358	0	JTEMP+
3359	0	JTEMP-

Loadcase ID: 3365 Title: OJTEMP 1
Sub Type: Envelope

Loadcase File	Results Title	Type
3363	0	OJTEMP 1+
3364	0	OJTEMP 1-

Loadcase ID: 3371 Title: TEMP
Sub Type: Envelope

Loadcase File	Results Title	Type
3367	0	TEMP-1 (Max)
3368	0	TEMP-1 (Min)
3369	0	TEMP-2 (Max)
3370	0	TEMP-2 (Min)

Loadcase ID: 3400 Title: ICE
Sub Type: Envelope

Loadcase File	Results Title	Type
3391	0	Loadcase / combination / envelope not found with ID 3391
3393	0	Loadcase / combination / envelope not found with ID 3393
3394	0	ICE HIGH Y (Max)
3395	0	ICE HIGH Y (Min)
3396	0	ICE LOW Y (Max)
3397	0	ICE LOW Y (Min)
3398	0	ICE Z (Max)
3399	0	ICE Z (Min)

Loadcase ID: 3402 Title: ALT
Sub Type: Envelope

Loadcase File	Results Title	Type
3400	0	ICE (Max)
3401	0	ICE (Min)
3371	0	TEMP (Max)
3372	0	TEMP (Min)

Loadcase ID: 3413 Title: TRAFIK
Sub Type: Envelope

Loadcase File	Results Title	Type
3320	0	VLO – LM 1~ Characteristic (Max)
3321	0	VLO – LM 1~ Characteristic (Min)
3322	0	VLO – LM 2~ Characteristic (Max)
3323	0	VLO – LM 2~ Characteristic (Min)
3324	0	VLO – EG A~ Characteristic (Max)
3325	0	VLO – EG B ~ Characteristic (Min)

Loadcase ID: 3415 Title: BROMS
Sub Type: Envelope

Loadcase File	Results Title	Type
3340	5	BROMS+
3341	5	BROMS-

Title: Results reactions

Model Units: kN,m,t,s,C
Report Units: kN,m,t,s,C

Model Title: System 001
Model File: System 001

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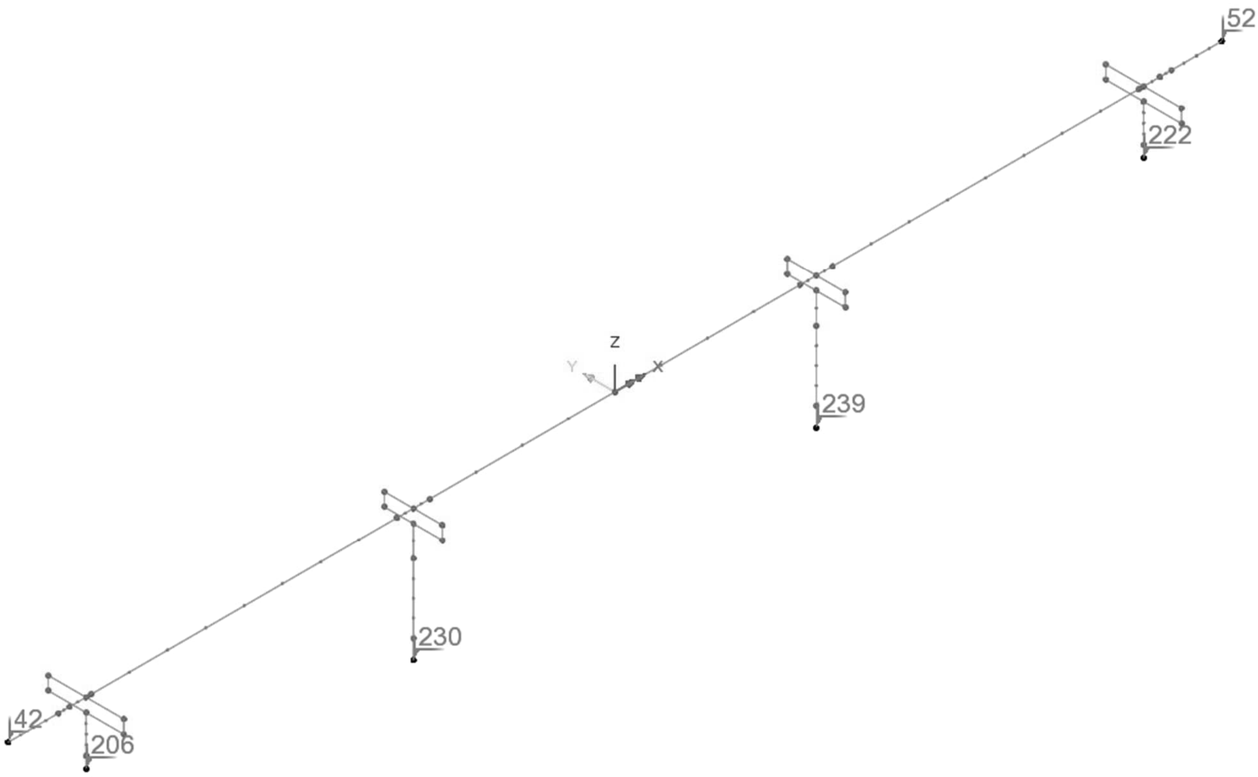
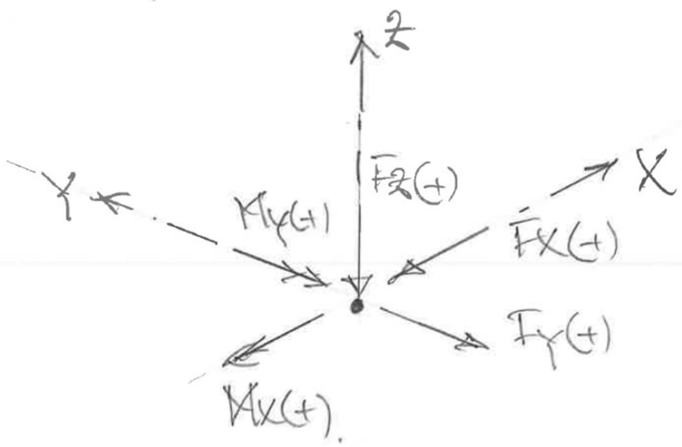
1. Reaction nodes



Overview
Nodes at supports

2. Sign convention



3. Results loadcase

EGEN 1

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	2252	0	0	N/A
230	-16.0	0.0	-10.5	1	0	5238	0	10	N/A
239	16.0	0.0	-10.5	-1	0	5238	0	-10	N/A
222	42.0	0.0	-4.9	0	0	2252	0	0	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	160	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	176	0	0	N/A
230	-16.0	0.0	-10.5	0	0	-16	0	1	N/A
239	16.0	0.0	-10.5	0	0	-16	0	-1	N/A
222	42.0	0.0	-4.9	0	0	176	0	0	N/A
52	48.2	0.0	0.0	N/A	0	160	0	N/A	N/A

EGEN 3

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	428	0	0	N/A
230	-16.0	0.0	-10.5	0	0	2921	0	0	N/A
239	16.0	0.0	-10.5	0	0	2921	0	0	N/A
222	42.0	0.0	-4.9	0	0	428	0	0	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

EGEN 4

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	144	0	0	N/A
222	42.0	0.0	-4.9	0	0	144	0	0	N/A
230	-16.0	0.0	-10.5	0	0	386	0	1	N/A
239	16.0	0.0	-10.5	0	0	386	0	-1	N/A

EGEN 5

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	203	0	0	N/A
230	-16.0	0.0	-10.5	0	0	-11	0	0	N/A
239	16.0	0.0	-10.5	0	0	-11	0	0	N/A
222	42.0	0.0	-4.9	0	0	203	0	0	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

EGEN 6

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	119	0	0	N/A
230	-16.0	0.0	-10.5	0	0	-13	0	1	N/A
239	16.0	0.0	-10.5	0	0	-13	0	-1	N/A
222	42.0	0.0	-4.9	0	0	119	0	0	N/A

EGEN

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	160	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	160	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	3322	0	0	N/A
222	42.0	0.0	-4.9	0	0	3322	0	0	N/A
230	-16.0	0.0	-10.4	1	0	8505	0	13	N/A
239	16.0	0.0	-10.4	-1	0	8505	0	-13	N/A

BELAGG
1

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	216	0	0	N/A
222	42.0	0.0	-4.9	0	0	216	0	0	N/A
230	-16.0	0.0	-10.5	0	0	579	0	1	N/A
239	16.0	0.0	-10.5	0	0	579	0	-1	N/A

BELAGG
2

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	128	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	141	0	0	N/A
230	-16.0	0.0	-10.5	0	0	-13	0	1	N/A
239	16.0	0.0	-10.5	0	0	-13	0	-1	N/A
222	42.0	0.0	-4.9	0	0	141	0	0	N/A
52	48.2	0.0	0.0	N/A	0	128	0	N/A	N/A

BELAGG

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	128	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	128	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	357	0	0	N/A
222	42.0	0.0	-4.9	0	0	357	0	0	N/A
230	-16.0	0.0	-10.4	0	0	567	0	2	N/A
239	16.0	0.0	-10.4	0	0	567	0	-2	N/A

JORD 1

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	41	0	0	N/A
230	-16.0	0.0	-10.4	-1	0	-41	0	-12	N/A
239	16.0	0.0	-10.4	1	0	-41	0	12	N/A
222	42.0	0.0	-4.9	0	0	41	0	0	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

JORD 2

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	0	0	-572	N/A
230	-16.0	0.0	-10.4	0	0	0	0	0	N/A
239	16.0	0.0	-10.4	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	503	0	0	0	572	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

JORD

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	41	0	-572	N/A
222	42.0	0.0	-4.9	503	0	41	0	572	N/A
230	-16.0	0.0	-10.4	-1	0	-41	0	-12	N/A
239	16.0	0.0	-10.4	1	0	-41	0	12	N/A

STOD_2X+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	161	0	0	0	1509	N/A
239	16.0	0.0	-10.4	-161	0	0	0	-1509	N/A

STOD_3X+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	-161	0	0	0	-1509	N/A
239	16.0	0.0	-10.4	161	0	0	0	1509	N/A

STOD_1Z

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	-51	0	0	N/A
222	42.0	0.0	-4.9	0	0	14	0	0	N/A
230	-16.0	0.0	-10.4	-1	0	104	0	-6	N/A
239	16.0	0.0	-10.4	1	0	-67	0	6	N/A

STOD_2Z

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	104	0	0	N/A
222	42.0	0.0	-4.9	0	0	-67	0	0	N/A
230	-16.0	0.0	-10.4	1	0	-243	0	6	N/A
239	16.0	0.0	-10.4	-1	0	206	0	-6	N/A

STOD_3Z

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	-67	0	0	N/A
222	42.0	0.0	-4.9	0	0	104	0	0	N/A
230	-16.0	0.0	-10.4	1	0	206	0	6	N/A
239	16.0	0.0	-10.4	-1	0	-243	0	-6	N/A

STOD_4Z

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	14	0	0	N/A
222	42.0	0.0	-4.9	0	0	-51	0	0	N/A
230	-16.0	0.0	-10.4	-1	0	-67	0	-6	N/A
239	16.0	0.0	-10.4	1	0	104	0	6	N/A

KRYMP

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	-128	0	0	0	-1207	N/A
239	16.0	0.0	-10.4	128	0	0	0	1207	N/A

BROMS+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	-6	0	0	N/A
222	42.0	0.0	-4.9	0	0	5	0	0	N/A
230	-16.0	0.0	-10.4	-343	0	0	0	-3224	N/A
239	16.0	0.0	-10.4	-179	0	0	0	-1679	N/A

BROMS-

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	6	0	0	N/A
222	42.0	0.0	-4.9	0	0	-5	0	0	N/A
230	-16.0	0.0	-10.4	343	0	0	0	3224	N/A
239	16.0	0.0	-10.4	179	0	0	0	1679	N/A

SIDO 1+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	94	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	3	N/A	N/A
206	-42.0	0.0	-4.9	0	-130	0	355	0	N/A
222	42.0	0.0	-4.9	0	5	0	5	0	N/A
230	-16.0	0.0	-10.4	0	4	0	69	0	N/A
239	16.0	0.0	-10.4	0	-8	0	112	0	N/A

SIDO 2+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	61	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	20	N/A	N/A
206	-42.0	0.0	-4.9	0	-57	0	221	0	N/A
222	42.0	0.0	-4.9	0	5	0	41	0	N/A
230	-16.0	0.0	-10.4	0	-23	0	184	0	N/A
239	16.0	0.0	-10.4	0	-55	0	519	0	N/A

SIDO 3+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	24	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	54	N/A	N/A
206	-42.0	0.0	-4.9	0	-8	0	79	0	N/A
222	42.0	0.0	-4.9	0	-36	0	124	0	N/A
230	-16.0	0.0	-10.4	0	-15	0	110	0	N/A
239	16.0	0.0	-10.4	0	-71	0	697	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

SIDO 4+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	3	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	107	N/A	N/A
206	-42.0	0.0	-4.9	0	3	0	8	0	N/A
222	42.0	0.0	-4.9	0	-122	0	261	0	N/A
230	-16.0	0.0	-10.4	0	2	0	18	0	N/A
239	16.0	0.0	-10.4	0	-13	0	281	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

VIND+

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	111	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	106	N/A	N/A
206	-42.0	0.0	-4.9	0	-100	0	399	0	N/A
222	42.0	0.0	-4.9	0	-67	0	243	0	N/A
230	-16.0	0.0	-10.4	0	-31	0	295	0	N/A
239	16.0	0.0	-10.4	0	-120	0	1232	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

VIND-

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	-111	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	-106	N/A	N/A
206	-42.0	0.0	-4.9	0	100	0	-399	0	N/A
222	42.0	0.0	-4.9	0	67	0	-243	0	N/A
230	-16.0	0.0	-10.4	0	31	0	-295	0	N/A
239	16.0	0.0	-10.4	0	120	0	-1232	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

PT KG-V1

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	0	0	0	0	0	N/A
239	16.0	0.0	-10.4	0	0	0	0	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

PT KG-V2

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	0	0	0	0	0	N/A
239	16.0	0.0	-10.4	0	0	0	0	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

PT KG-H1

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	0	0	0	0	0	N/A
239	16.0	0.0	-10.4	0	0	0	0	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

PT KG-H2

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	0	0	0	0	0	N/A
239	16.0	0.0	-10.4	0	0	0	0	0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

PT-t0

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	161	0	0	N/A
222	42.0	0.0	-4.9	0	0	205	0	0	N/A
230	-16.0	0.0	-10.4	-82	0	-126	0	-769	N/A
239	16.0	0.0	-10.4	82	0	-241	0	769	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

OVER-V

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-113	0	6	0	-141	N/A
222	42.0	0.0	-4.9	0	0	0	0	0	N/A
230	-16.0	0.0	-10.4	-101	0	-8	0	-947	N/A
239	16.0	0.0	-10.4	-52	0	2	0	-491	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

OVER-H

Node	X	Y	Z	FX	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	0	0	0	0	0	N/A
222	42.0	0.0	-4.9	113	0	-5	0	141	N/A
230	-16.0	0.0	-10.4	100	0	-1	0	944	N/A
239	16.0	0.0	-10.4	53	0	5	0	494	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

4. Results load – Fz

EG A: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	76.	0.	623.	-181.	52.	0
2185	16.8	0.0	-0.2	-76.	0.	623.	181.	-51.	0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG A: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-34.1	0.0	-18.5	-21.8	-33.0	0
2185	16.8	0.0	-0.2	34.2	0.0	-18.5	-21.8	33.2	0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG B: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	765.1	0.0	2030.2	-383.5	295.3	0.0
2185	16.8	0.0	-0.2	-731.6	0.0	2069.1	3889.5	-281.3	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG B: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-50.4	0.0	-27.2	-37.2	-49.1	N/A
2185	16.8	0.0	-0.2	51.1	0.0	-27.6	-33.4	49.5	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 1: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	389.9	0.0	1763.3	1762.5	194.9	0.0
2185	16.8	0.0	-0.2	-381.0	0.0	1768.6	-1763.1	-192.9	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 1: Min Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-69.6	0.0	-37.7	94.0	-67.6	0.0
2185	16.8	0.0	-0.2	71.0	0.0	-38.3	100.9	69.0	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 2: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-22.4	0.0	372.0	1596.1	7.4	N/A
2185	16.8	0.0	-0.2	22.3	0.0	372.0	1596.2	-7.4	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 2: Min Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-28.2	0.0	-15.4	-193.3	-27.3	N/A
2185	16.8	0.0	-0.2	28.3	0.0	-15.4	-193.4	27.4	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

UTM3: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	51.1	0.0	441.0	409.4	10.1	N/A
2185	16.8	0.0	-0.2	-52.4	0.0	442.9	411.6	-9.9	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

UTM3: Min Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
2149	-16.8	0.0	-0.2	-16.1	0.0	-8.7	99.1	-15.5	N/A
2185	16.8	0.0	-0.2	15.7	0.0	-8.5	108.0	15.3	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

5. Results loads – My

EG A: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	271.0	0.0	339.3	82.6	143.9	0
2185	16.8	0.0	-0.2	34.5	0.0	-18.4	10.8	33.8	0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG A: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	-34.4	0.0	-18.4	10.6	-33.6	0
2185	16.8	0.0	-0.2	-270.7	0.0	339.7	-77.0	-141.6	0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG B: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	973.0	0.0	1117.6	-1115.6	492.4	0.0
2185	16.8	0.0	-0.2	51.6	0.0	-27.6	15.7	50.4	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

EG B: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	-50.8	0.0	-27.2	17.1	-50.0	N/A
2185	16.8	0.0	-0.2	-982.5	0.0	1135.8	-1734.2	-483.5	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 1: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	784.2	0.0	1130.8	1927.3	402.5	0.0
2185	16.8	0.0	-0.2	71.6	0.0	-38.2	-7.6	70.2	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 1: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	-70.2	0.0	-37.7	-7.2	-68.7	0.0
2185	16.8	0.0	-0.2	-787.9	0.0	1137.6	-1306.1	-396.0	0.0
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 2: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	151.2	0.0	119.4	-605.6	89.4	N/A
2185	16.8	0.0	-0.2	28.7	0.0	-15.3	-31.9	28.0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

LM 2: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	-28.5	0.0	-15.3	-31.9	-27.9	N/A
2185	16.8	0.0	-0.2	-151.0	0.0	119.5	-608.2	-88.0	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

UTM3: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	192.2	0.0	164.0	172.4	107.2	N/A
2185	16.8	0.0	-0.2	15.9	0.0	-8.4	24.1	15.6	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

UTM3: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
2149	-16.8	0.0	-0.2	-16.2	0.0	-8.7	-22.1	-15.9	N/A
2185	16.8	0.0	-0.2	-191.2	0.0	162.6	171.8	-105.5	N/A
-	m	m	m	kN	kN	kN	kNm	kNm	kNm

6. Results loadcombination – Fx

SLS-Q: Max FX

Node	X	Y	Z	FX*	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	3856	0	-572	N/A
230	-16.0	0.0	-10.4	38	0	8876	0	355	N/A
239	16.0	0.0	-10.4	263	0	8709	0	2472	N/A
222	42.0	0.0	-4.9	674	0	3906	0	767	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

SLS-Q: Min FX

Node	X	Y	Z	FX*	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-674	0	4060	0	-767	N/A
230	-16.0	0.0	-10.4	-263	0	8806	0	-2472	N/A
239	16.0	0.0	-10.4	-38	0	8779	0	-355	N/A
222	42.0	0.0	-4.9	503	0	4083	0	572	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

ULS: Max FX

Node	X	Y	Z	FX*	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-452	0	3816	0	-515	0
230	-16.0	0.0	-10.4	2465	-113	11986	-78	9736	0
239	16.0	0.0	-10.4	2205	-93	9544	-73	7291	0
222	42.0	0.0	-4.9	938	0	3868	0	1088	0
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

ULS: Min FX

Node	X	Y	Z	FX*	FY	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	0	N/A	N/A
206	-42.0	0.0	-4.9	-938	-155	5089	478	-1088	0
230	-16.0	0.0	-10.4	-2702	-39	9690	-509	-11963	0
239	16.0	0.0	-10.4	-1968	119	11870	-2400	-5064	0
222	42.0	0.0	-4.9	452	-25	5122	115	515	0
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

7. Results loadcombination – Fy

SLS-Q: Max FY

Node	X	Y	Z	FX	FY*	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	3905	0	-572	N/A
230	-16.0	0.0	-10.4	-208	0	8806	0	-1959	N/A
239	16.0	0.0	-10.4	154	0	8709	0	1446	N/A
222	42.0	0.0	-4.9	674	0	4096	0	767	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

SLS-Q: Min FY

Node	X	Y	Z	FX	FY*	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-674	0	3993	0	-767	N/A
230	-16.0	0.0	-10.4	-71	0	8877	0	-671	N/A
239	16.0	0.0	-10.4	17	0	8779	0	158	N/A
222	42.0	0.0	-4.9	503	0	3858	0	572	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

ULS: Max FY

Node	X	Y	Z	FX	FY*	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	275	-363	N/A	N/A
206	-42.0	0.0	-4.9	-452	454	4914	-2435	-515	0
230	-16.0	0.0	-10.4	-566	573	11717	-626	-5315	0
239	16.0	0.0	-10.4	-111	822	9614	-4011	-1042	0
222	42.0	0.0	-4.9	744	304	5332	-411	847	0
52	48.2	0.0	0.0	N/A	0	275	-375	N/A	N/A

ULS: Min FY

Node	X	Y	Z	FX	FY*	FZ	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	362	363	N/A	N/A
206	-42.0	0.0	-4.9	-872	-454	4221	2435	-1006	0
230	-16.0	0.0	-10.4	267	-573	10354	626	2512	0
239	16.0	0.0	-10.4	278	-822	11709	4011	2613	0
222	42.0	0.0	-4.9	581	-304	4372	411	674	0
52	48.2	0.0	0.0	N/A	0	362	375	N/A	N/A

8. Results loadcombination – Fz

SLS-Q: Max FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-674	0	4116	0	-767	N/A
230	-16.0	0.0	-10.4	-144	0	9078	0	-1357	N/A
239	16.0	0.0	-10.4	144	0	8981	0	1357	N/A
222	42.0	0.0	-4.9	674	0	4153	0	767	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

SLS-Q: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	3768	0	-572	N/A
230	-16.0	0.0	-10.4	-55	0	8600	0	-518	N/A
239	16.0	0.0	-10.4	55	0	8503	0	518	N/A
222	42.0	0.0	-4.9	503	0	3805	0	572	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

ULS-PERM: Max Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	362	0	N/A	N/A
206	-42.0	0.0	-4.9	-744	0	4788	0	-847	N/A
230	-16.0	0.0	-10.4	-121	0	10945	0	-1135	N/A
239	16.0	0.0	-10.4	121	0	10848	0	1135	N/A
222	42.0	0.0	-4.9	744	0	4848	0	847	N/A
52	48.2	0.0	0.0	N/A	0	362	0	N/A	N/A

ULS-PERM: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	275	0	N/A	N/A
206	-42.0	0.0	-4.9	-452	0	3767	0	-515	N/A
230	-16.0	0.0	-10.4	-111	0	8658	0	-1042	N/A
239	16.0	0.0	-10.4	111	0	8502	0	1042	N/A
222	42.0	0.0	-4.9	452	0	3804	0	515	N/A
52	48.2	0.0	0.0	N/A	0	275	0	N/A	N/A

ULS-VAR: Max Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	-129	N/A	N/A
206	-42.0	0.0	-4.9	-128	-109	2912	-1352	-160	0
230	-16.0	0.0	-10.4	-345	-251	3487	-289	-3240	0
239	16.0	0.0	-10.4	-93	-175	3495	-1139	-875	0
222	42.0	0.0	-4.9	0	-141	2900	-994	0	0
52	48.2	0.0	0.0	N/A	0	0	-93	N/A	N/A

ULS-VAR: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	0	129	N/A	N/A
206	-42.0	0.0	-4.9	0	247	-407	-1061	0	0
230	-16.0	0.0	-10.4	286	33	-1402	-448	2684	0
239	16.0	0.0	-10.4	152	176	-1392	-1935	1431	0
222	42.0	0.0	-4.9	128	173	-412	-675	160	0
52	48.2	0.0	0.0	N/A	0	0	93	N/A	N/A

ULS: Max Fz

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	362	-129	N/A	N/A
206	-42.0	0.0	-4.9	-872	-109	7700	-1352	-1006	0
230	-16.0	0.0	-10.4	-465	-251	14432	-289	-4375	0
239	16.0	0.0	-10.4	28	-175	14343	-1139	260	0
222	42.0	0.0	-4.9	744	-141	7747	-994	847	0
52	48.2	0.0	0.0	N/A	0	362	-93	N/A	N/A

ULS: Min FZ

Node	X	Y	Z	FX	FY	FZ*	MX	MY	MZ
42	-48.2	0.0	0.0	N/A	0	275	129	N/A	N/A
206	-42.0	0.0	-4.9	-452	247	3361	-1061	-515	0
230	-16.0	0.0	-10.4	175	33	7256	-448	1641	0
239	16.0	0.0	-10.4	263	176	7110	-1935	2473	0
222	42.0	0.0	-4.9	581	173	3392	-675	674	0
52	48.2	0.0	0.0	N/A	0	275	93	N/A	N/A

9. Results loadcombination – Mx

SLS-Q: Max MX

Node	X	Y	Z	FX	FY	FZ	MX*	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-674	0	3998	0	-767	N/A
230	-16.0	0.0	-10.4	-17	0	8877	0	-158	N/A
239	16.0	0.0	-10.4	17	0	8779	0	158	N/A
222	42.0	0.0	-4.9	503	0	3942	0	572	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

SLS-Q: Min MX

Node	X	Y	Z	FX	FY	FZ	MX*	MY	MZ
42	-48.2	0.0	0.0	N/A	0	288	0	N/A	N/A
206	-42.0	0.0	-4.9	-503	0	3905	0	-572	N/A
230	-16.0	0.0	-10.4	-154	0	8806	0	-1446	N/A
239	16.0	0.0	-10.4	154	0	8709	0	1446	N/A
222	42.0	0.0	-4.9	674	0	4012	0	767	N/A
52	48.2	0.0	0.0	N/A	0	288	0	N/A	N/A

ULS: Max MX

Node	X	Y	Z	FX	FY	FZ	MX*	MY	MZ
42	-48.2	0.0	0.0	N/A	0	362	377	N/A	N/A
206	-42.0	0.0	-4.9	-872	-353	6100	3310	-1006	0
230	-16.0	0.0	-10.4	334	-143	11991	1784	3137	0
239	16.0	0.0	-10.4	277	-665	11901	7325	2607	0
222	42.0	0.0	-4.9	581	-189	5991	2253	674	0
52	48.2	0.0	0.0	N/A	0	362	348	N/A	N/A

ULS: Min MX

Node	X	Y	Z	FX	FY	FZ	MX*	MY	MZ
42	-48.2	0.0	0.0	N/A	0	275	-377	N/A	N/A
206	-42.0	0.0	-4.9	-452	353	5151	-3310	-515	0
230	-16.0	0.0	-10.4	-500	143	9951	-1784	-4696	0
239	16.0	0.0	-10.4	-111	665	9806	-7325	-1047	0
222	42.0	0.0	-4.9	744	189	5315	-2253	847	0
52	48.2	0.0	0.0	N/A	0	275	-348	N/A	N/A

10. Results loadcombination – My

SLS-Q: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
42	-48.2	0.0	0.0						
206	-42.0	0.0	-4.9	-503	0	3856	0	-572	N/A
230	-16.0	0.0	-10.4	38	0	8876	0	355	N/A
239	16.0	0.0	-10.4	263	0	8709	0	2472	N/A
222	42.0	0.0	-4.9	674	0	3906	0	767	N/A
52	48.2	0.0	0.0	N/A	0	0	0	N/A	N/A

SLS-Q: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
42	-48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A
206	-42.0	0.0	-4.9	-674	0	4060	0	-767	N/A
230	-16.0	0.0	-10.4	-263	0	8806	0	-2472	N/A
239	16.0	0.0	-10.4	-38	0	8779	0	-355	N/A
222	42.0	0.0	-4.9	503	0	4083	0	572	N/A
52	48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A

ULS: Max MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
42	-48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A
206	-42.0	0.0	-4.9	-452	0	3816	0	-515	0
230	-16.0	0.0	-10.4	2076	-113	11917	-78	11166	0
239	16.0	0.0	-10.4	1745	-93	9563	-73	8048	0
222	42.0	0.0	-4.9	938	0	3868	0	1088	0
52	48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A

ULS: Min MY

Node	X	Y	Z	FX	FY	FZ	MX	MY*	MZ
42	-48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A
206	-42.0	0.0	-4.9	-938	-155	5089	478	-1088	0
230	-16.0	0.0	-10.4	-2315	-39	9701	-509	-13409	0
239	16.0	0.0	-10.4	-1506	119	11802	-2400	-5805	0
222	42.0	0.0	-4.9	452	-25	5122	115	515	0
52	48.2	0.0	0.0	N/A	N/A	N/A	N/A	N/A	N/A