

Pretensioned single girder bridge

CONTENTS

Part	Pages	Date	Rev. Date	Rev.
A. CALCULATION ASSUMPTIONS				
1. GENERAL & MEASUREMENTS	1:1 - 1:25			
2. SYSTEM ANALYSIS	2:1 - 2:71			
3. LOADS	3:1 - 3:190			

Appendix	
1.	System 001 : Input receipt
2.	System 001 : Results reactions
3.	System 001 : Results bearings
4.	System 001 : Results girder

	Part A - CALCULATION ASSUMPTIONS Prensioned single girder bridge	Status :	Page: A1:1
		Date :	Created :

1. GENERAL / MEASUREMENT

1.1	CONSTRUCTION TYPE	page 1:2
1.2	MEASUREMENTS	page 1:3-18
1.3	FOUNDATION	page 1:20
1.4	CODE OCH TENDER DOCUMENTS	page 1:20
1.5	TECHNICAL SERVICE LIFE	page 1:20
1.6	ENVIRONMENT	page 1:20
1.7	MATERIAL	page 1:21
1.8	GEOTECHNICAL CLASS	page 1:22
1.9	SAFETY CLASS	page 1:22
1.10	CONCRETE COVER AND CRACK CRITERIA	page 1:23-25

	Part A - CALCULATION ASSUMPTIONS Prensoned single girder bridge	Status :	Page: A1:2
		Date :	Created :

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 ("tätakaka") cast inside sheet pile box ("spontlåda").

	Part A - CALCULATION ASSUMPTIONS Prensioned single girder bridge	Status :	Page: A1:3
		Date :	Created :

1.2 MEASURMENT

1.2.1 Overview

"Sketch"

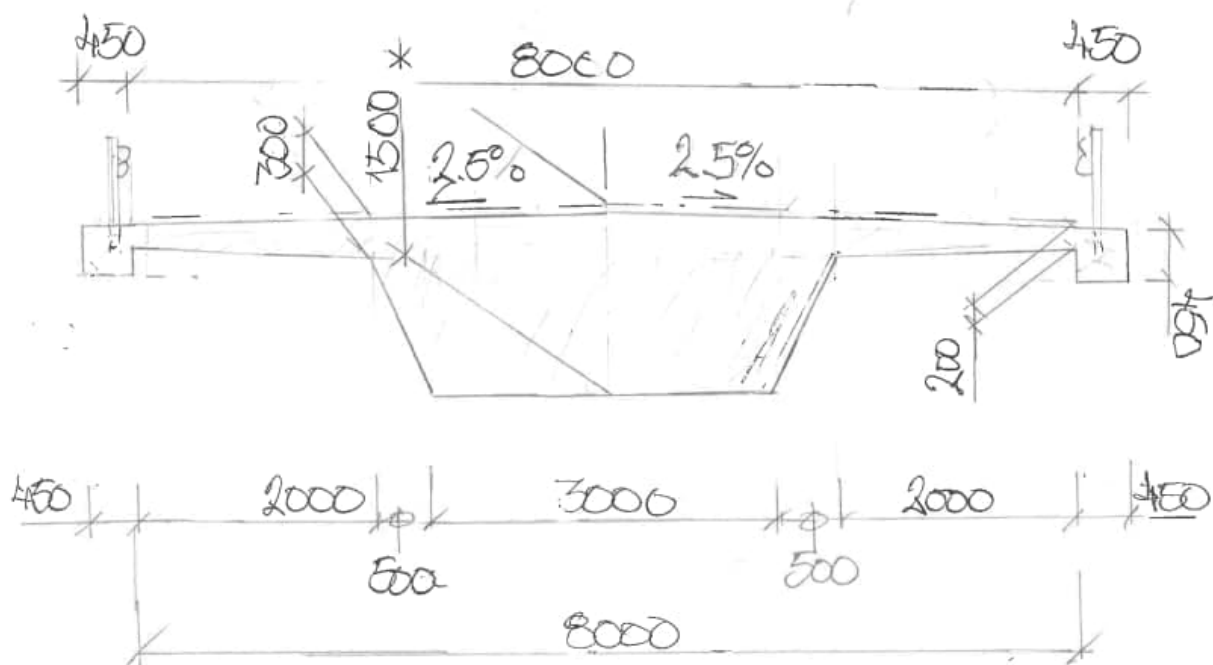
PLAN

"Sketch"

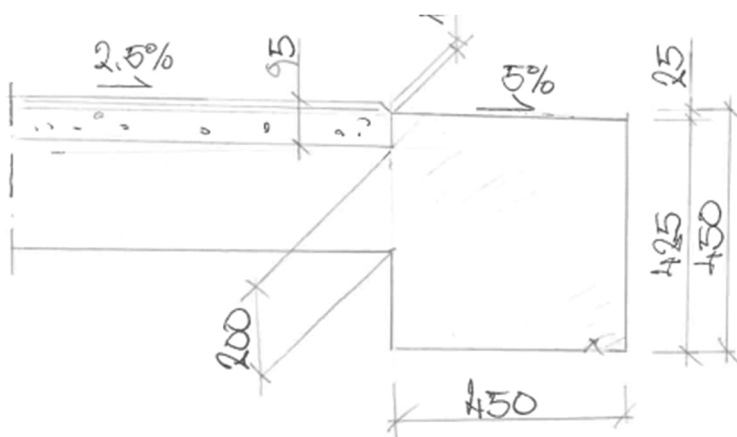
ELEVATION

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:4
		Date :	Created :

1.2.2 Superstructure

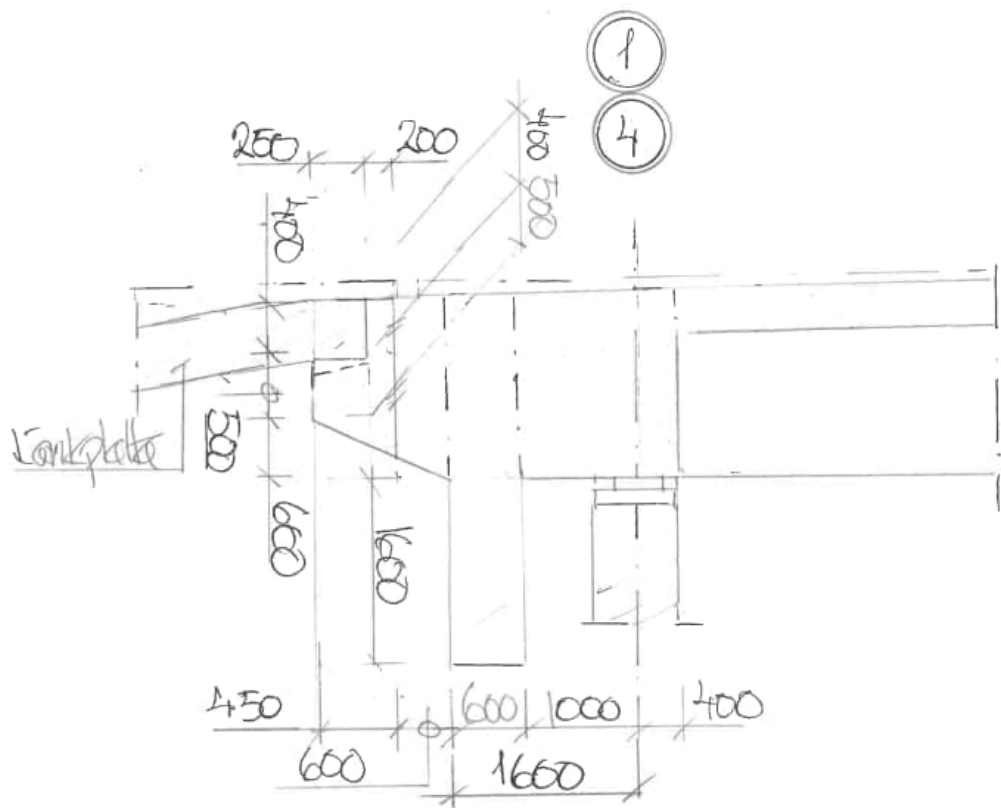


SECTION A-A

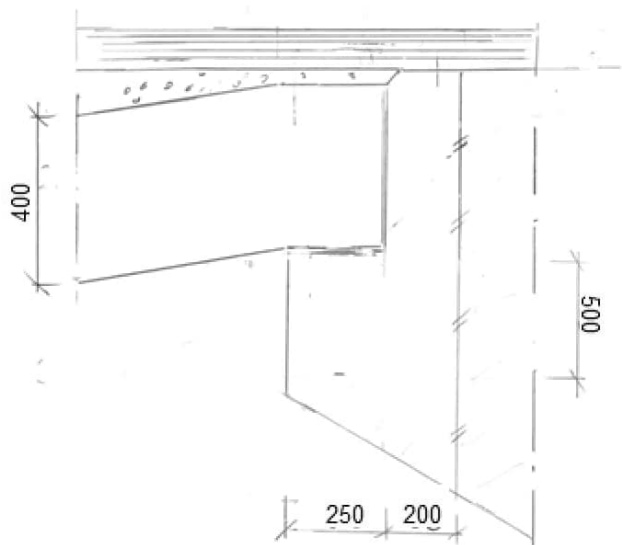


DETAIL 1 Edge beam.

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:5
		Date :	Created :



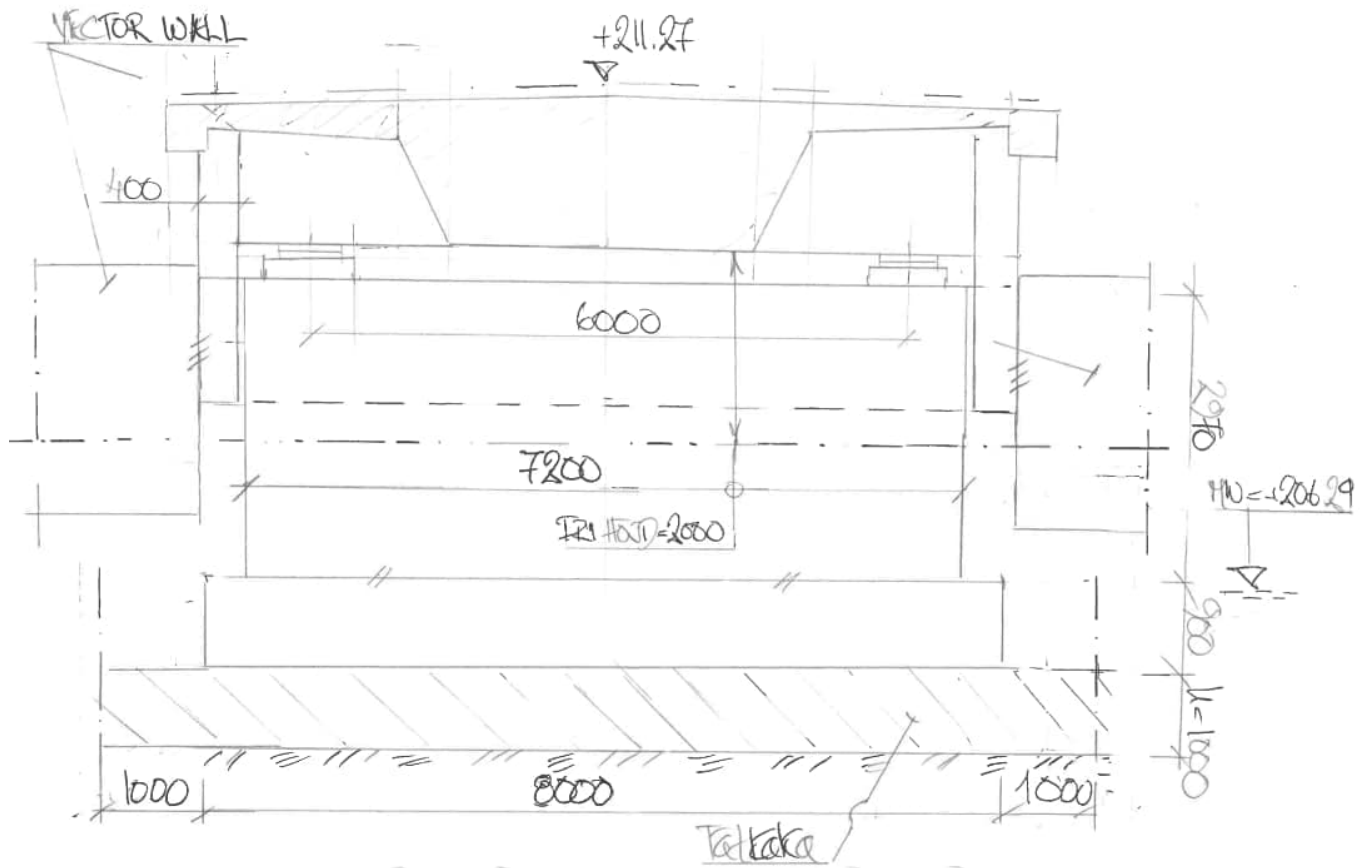
SEKTION D-D
Broände.



DETALJ 2
Detalj upplag länklplatta.

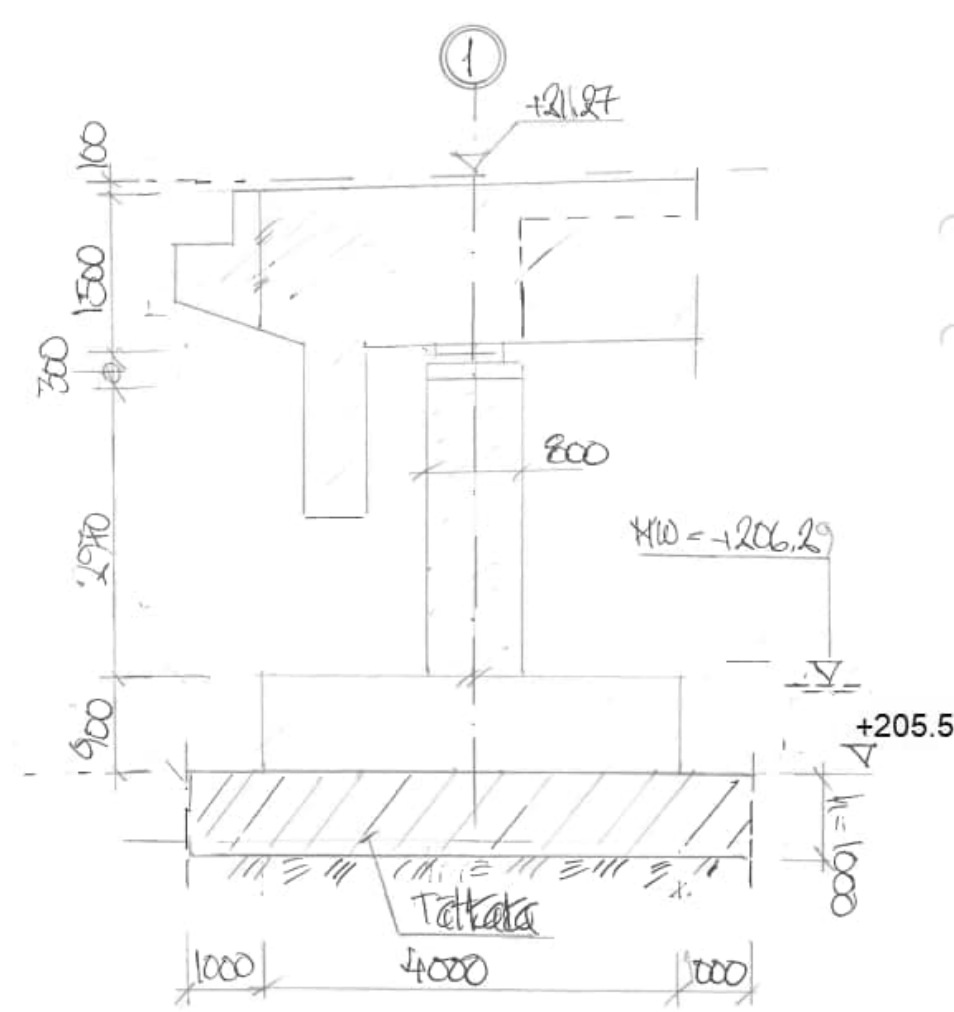
	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:6
		Date :	Created :

1.2.3 Substructure



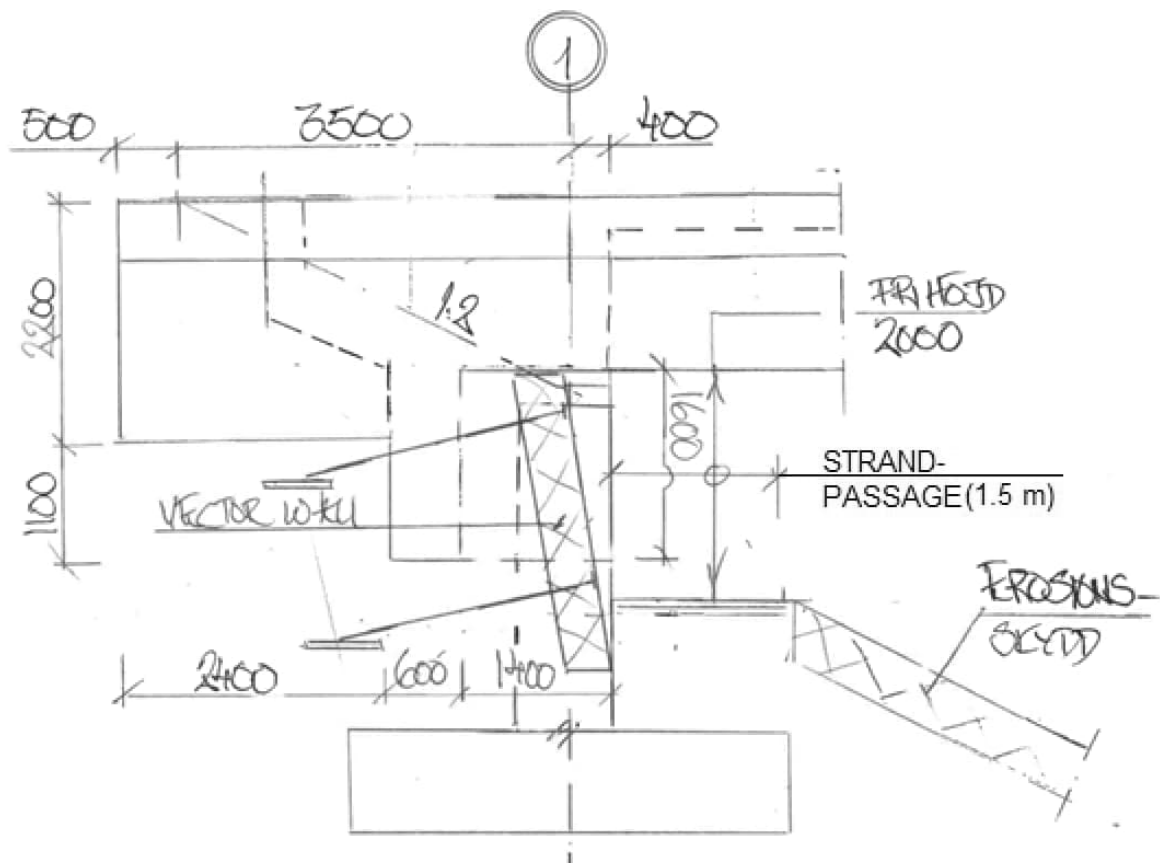
SECTION B-B

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:7
		Date :	Created :



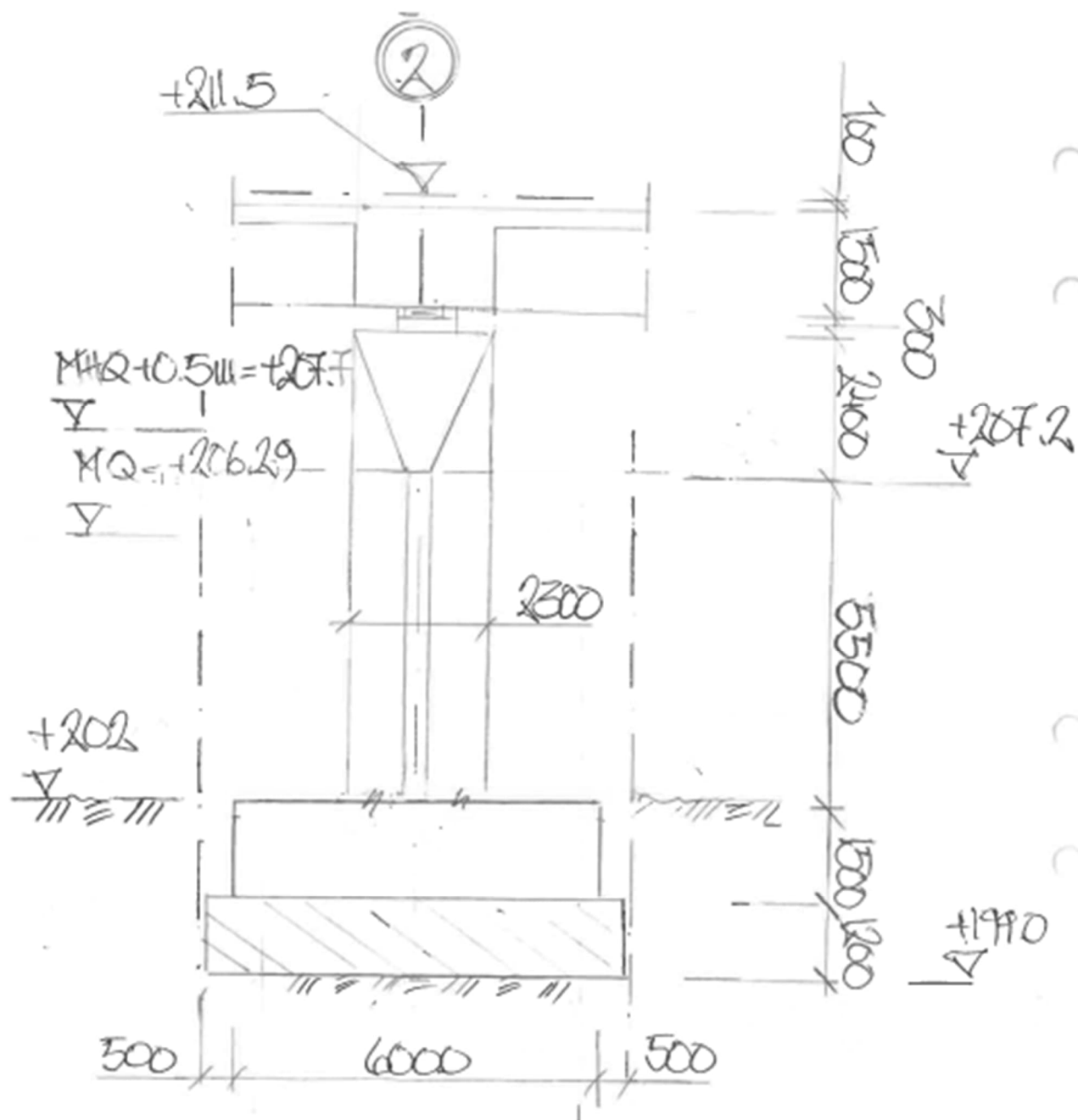
SECTION C-C

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:8
		Date :	Created :



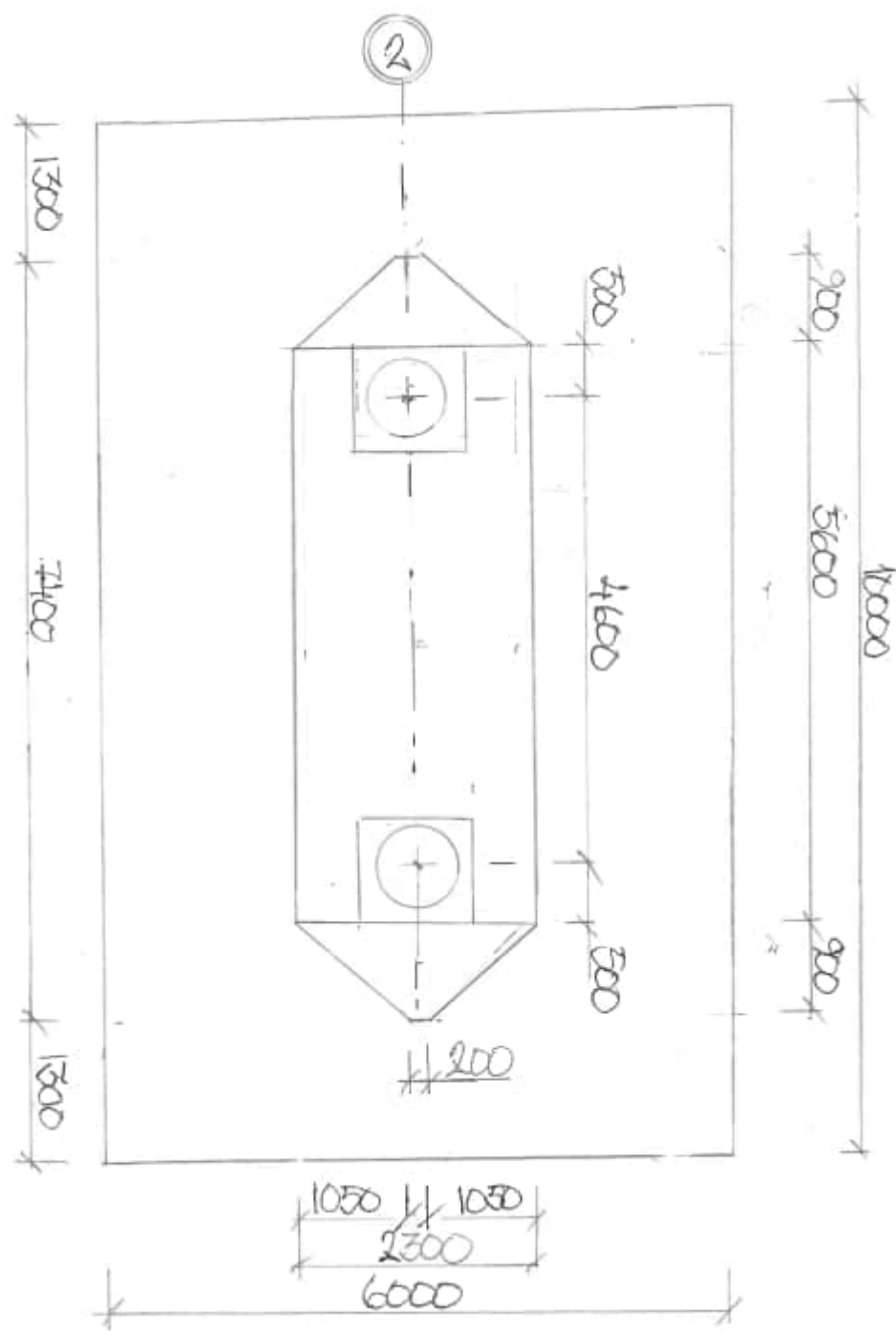
VY F-F
Stöd 1. Gäller även stöd 4.

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:10
		Date :	Created :



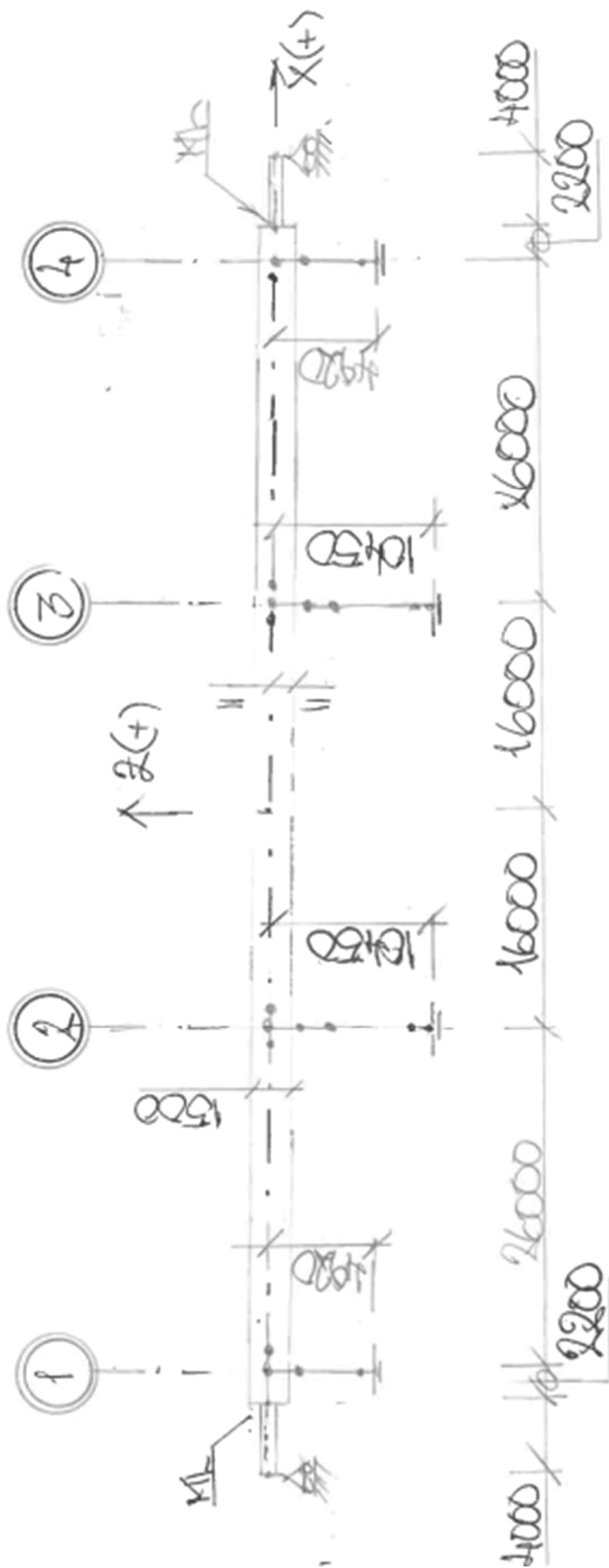
VY E-E

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:11
		Date :	Created :



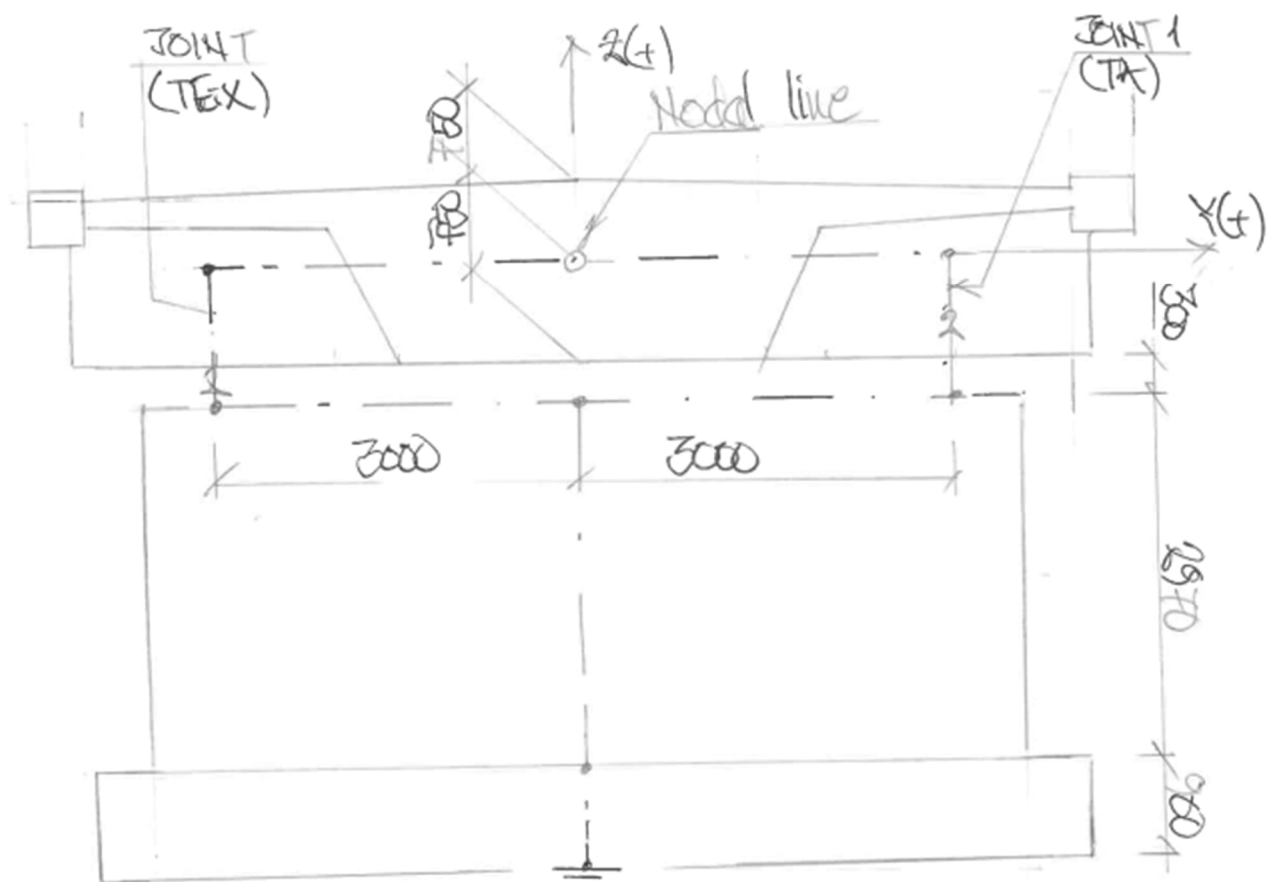
PLAN
Valid for support 3.

	Part A - CALCULATION ASSUMPTIONS Prensoned single girder bridge	Status :	Page: A1:13
		Date :	Created :



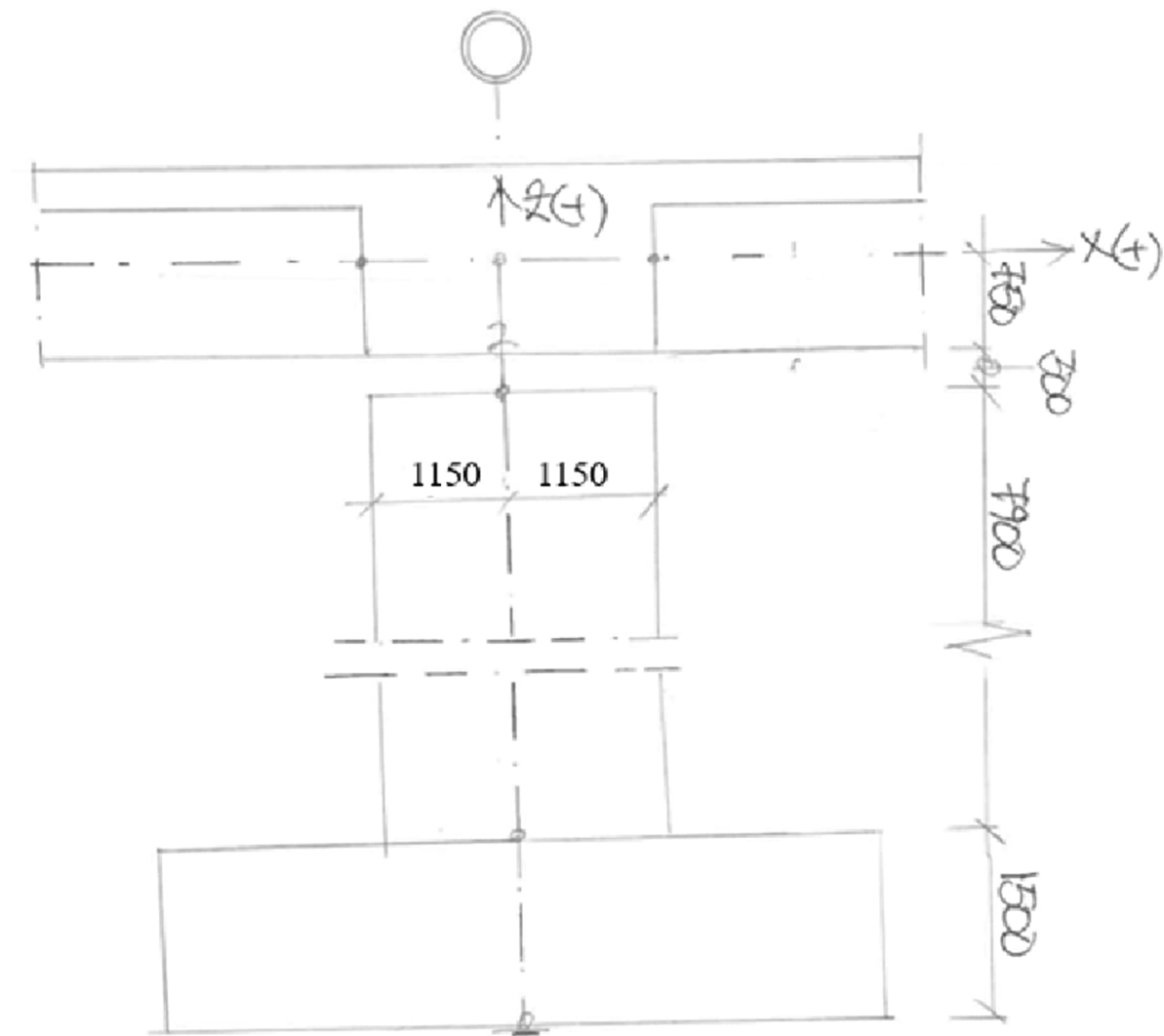
SECTION A-A

	Part A - CALCULATION ASSUMPTIONS Prensoned single girder bridge	Status :	Page: A1:16
		Date :	Created :



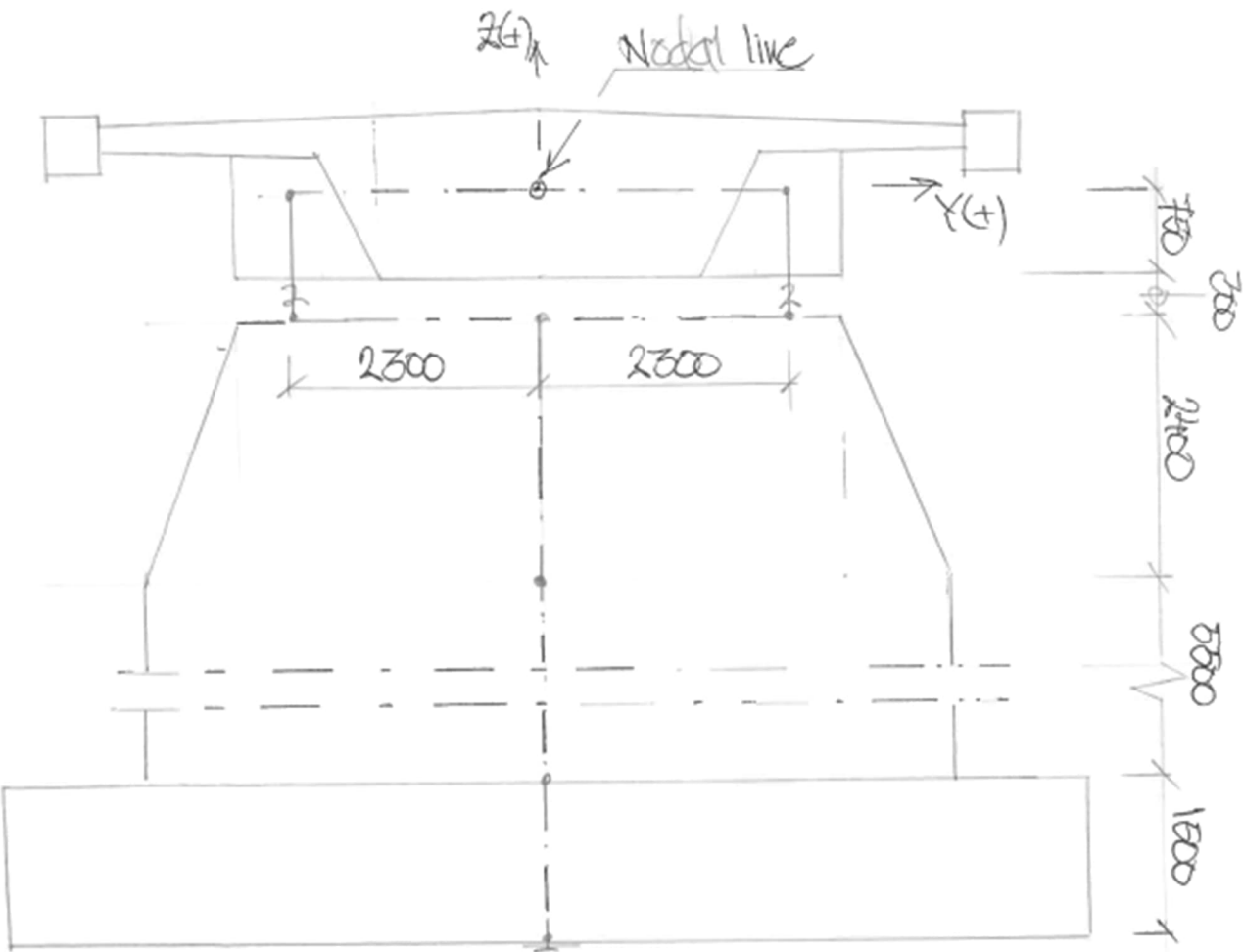
SECTION D-D

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:17
		Date :	Created :



SECTION E-E

	Part A - CALCULATION ASSUMPTIONS Prensed single girder bridge	Status :	Page: A1:18
		Date :	Created :



SECTION F-F

	Part A - CALCULATION ASSUMPTIONS Prensioned single girder bridge	Status :	Page: A1:19
		Date :	Created :

1.3 FOUNDATION

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

Beneath glaciofluvial gravel on top of rock is found.

..

	Part A - CALCULATION ASSUMPTIONS Prensoned single girder bridge	Status :	Page: A1:20
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Prestressed single girder bridge	Status :	Page: A1:21
		Date :	Created :

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 equivalent

	Part A - CALCULATION ASSUMPTIONS Prensioned single girder bridge	Status :	Page: A1:22
		Date :	Created :

1.8 GEOTECHNICAL CLASS

Geotechnical class GK2

1.9 SAFETY CLASS

Geotechnical resistance: SK 2

Brigde structure : SK 3

Retaining walls: SK 3

	Part A - CALCULATION ASSUMPTIONS Prensoned single girder bridge	Status :	Page: A1:23
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Prensiomed single girder bridge	Status :	Page: A1:24
		Date :	Created :

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 table 12.2

5.) TSFS chapter 12 paragraph 3§ $k_1 = c_{min} + 15$ mm when casting against building foil.

	Part A - CALCULATION ASSUMPTIONS Prestressed single girder bridge	Status :	Page: A1:25
		Date :	Created :

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 $\phi 90$

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 $f_{ctk,0.05}/\zeta$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:1
		Date :	Created :

2. SYSTEM ANALYSIS

2.1	GENERAL	page 2:2
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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:2
		Date :	Created :

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 pinned 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 “tåtkaka” 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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:3
		Date :	Created :

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.

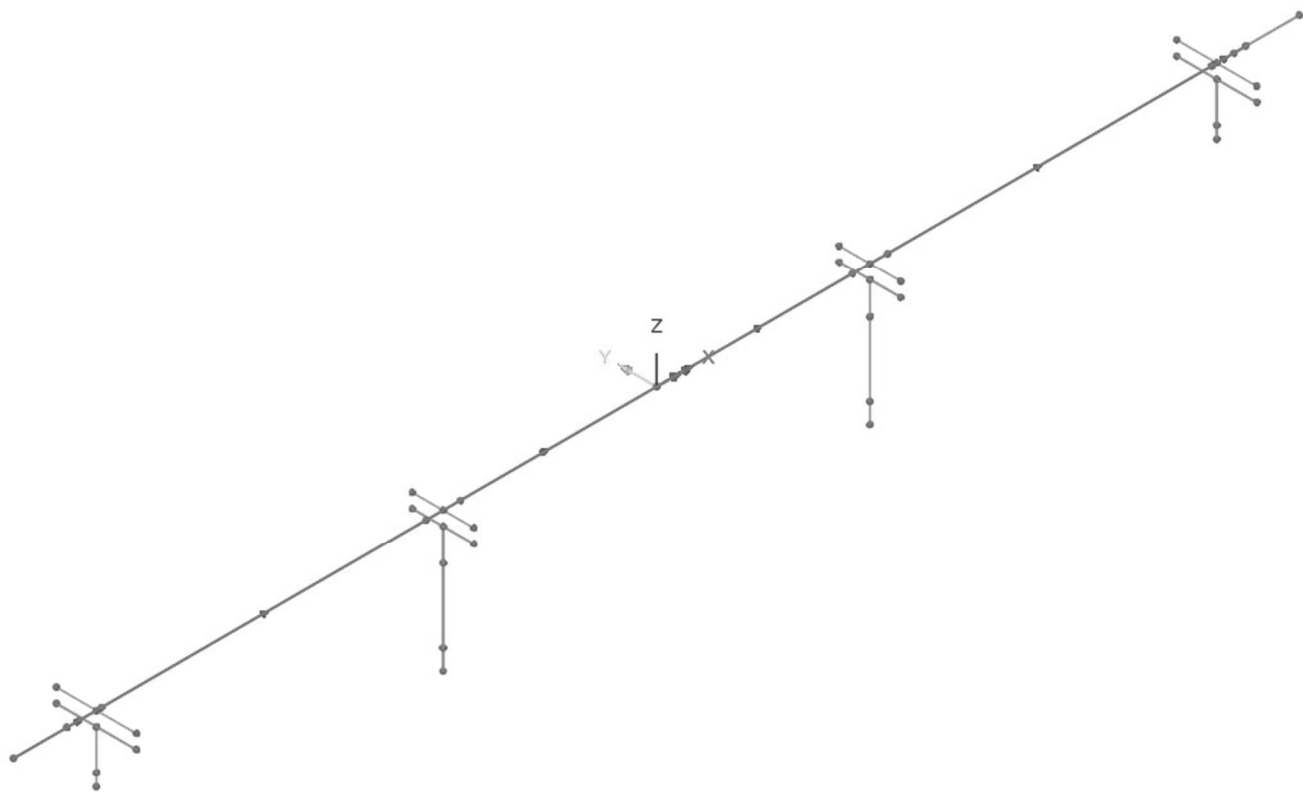
Attached pictures are retrieved from graphical sketches generated by FEM program of POINTS and LINES.

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:4
		Date :	Created :

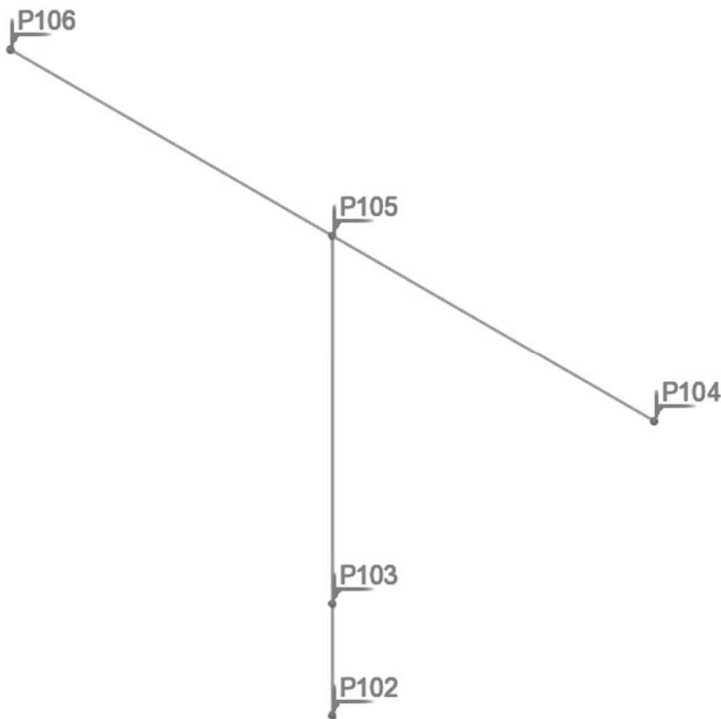
Overview :



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:5
		Date :	Created :

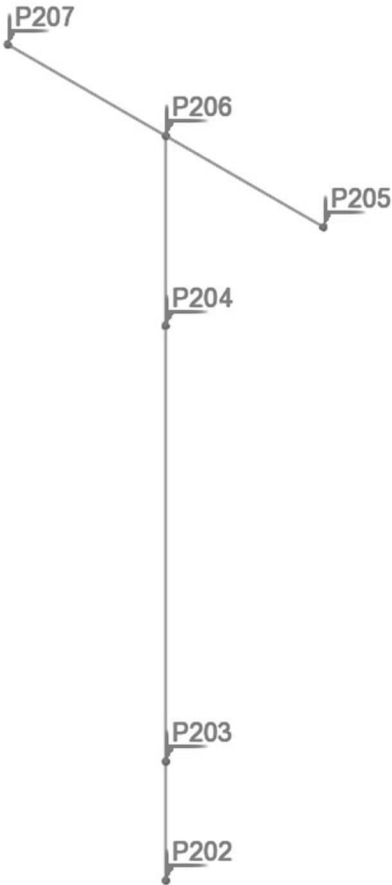
2.2.1.1 Geometry : POINTS

Abutment 1 (including Rigid:B) :



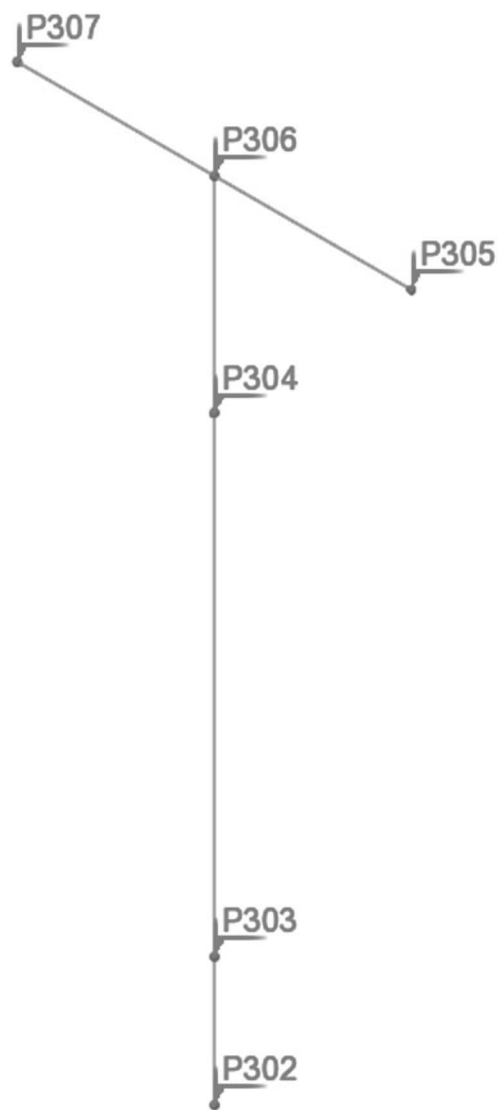
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:6
		Date :	Created :

Abutment 2 (including Rigid:B) :



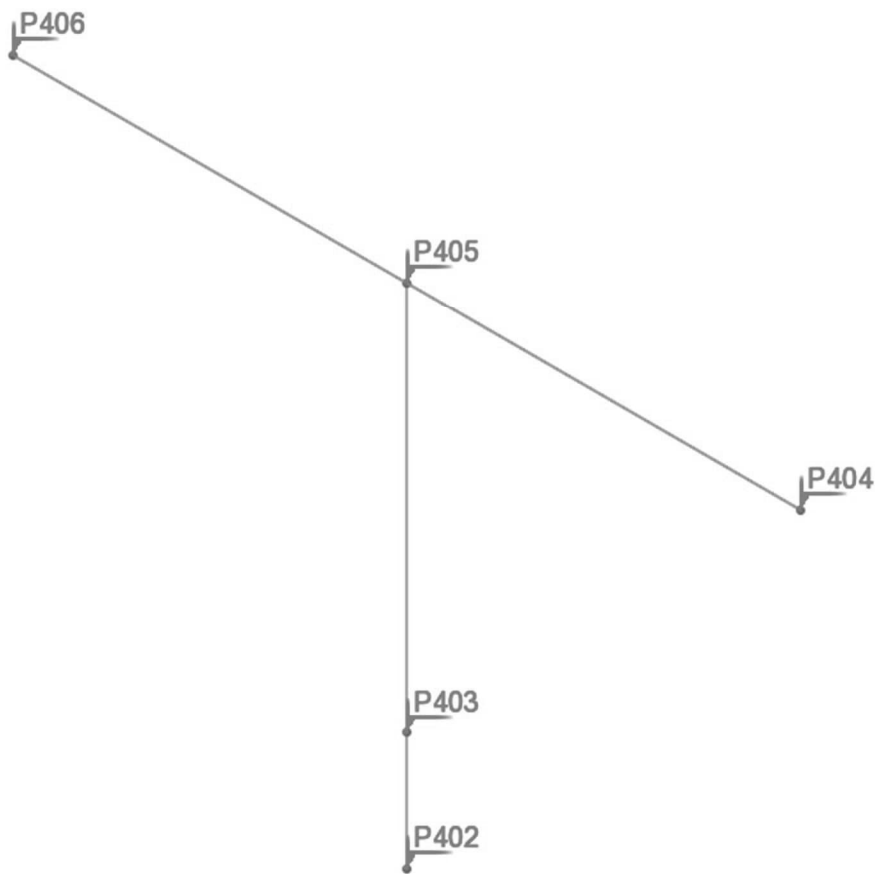
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:7
		Date :	Created :

Abutment 3 (including Rigid:B) :



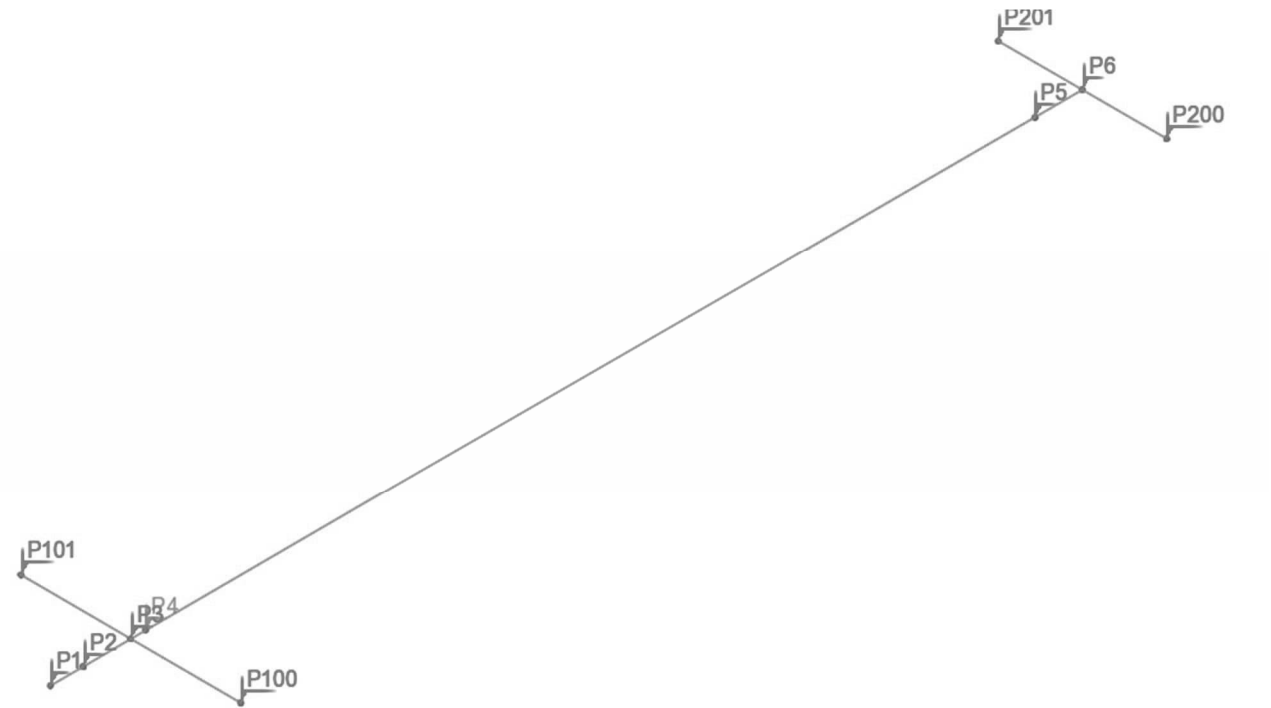
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:8
		Date :	Created :

Abutment 4 (including Rigid:B):



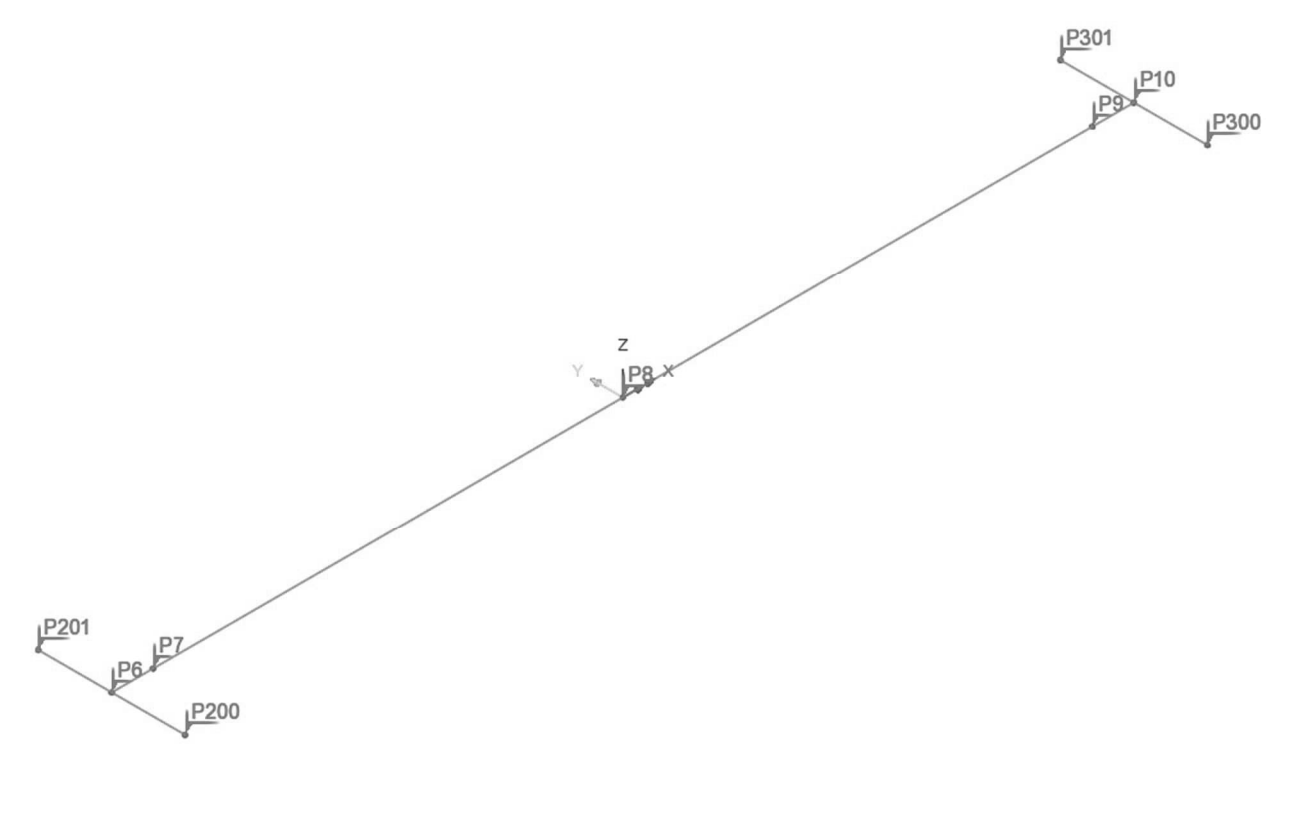
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:9
		Date :	Created :

Superstructure – spann 1 (including Rigid:T):

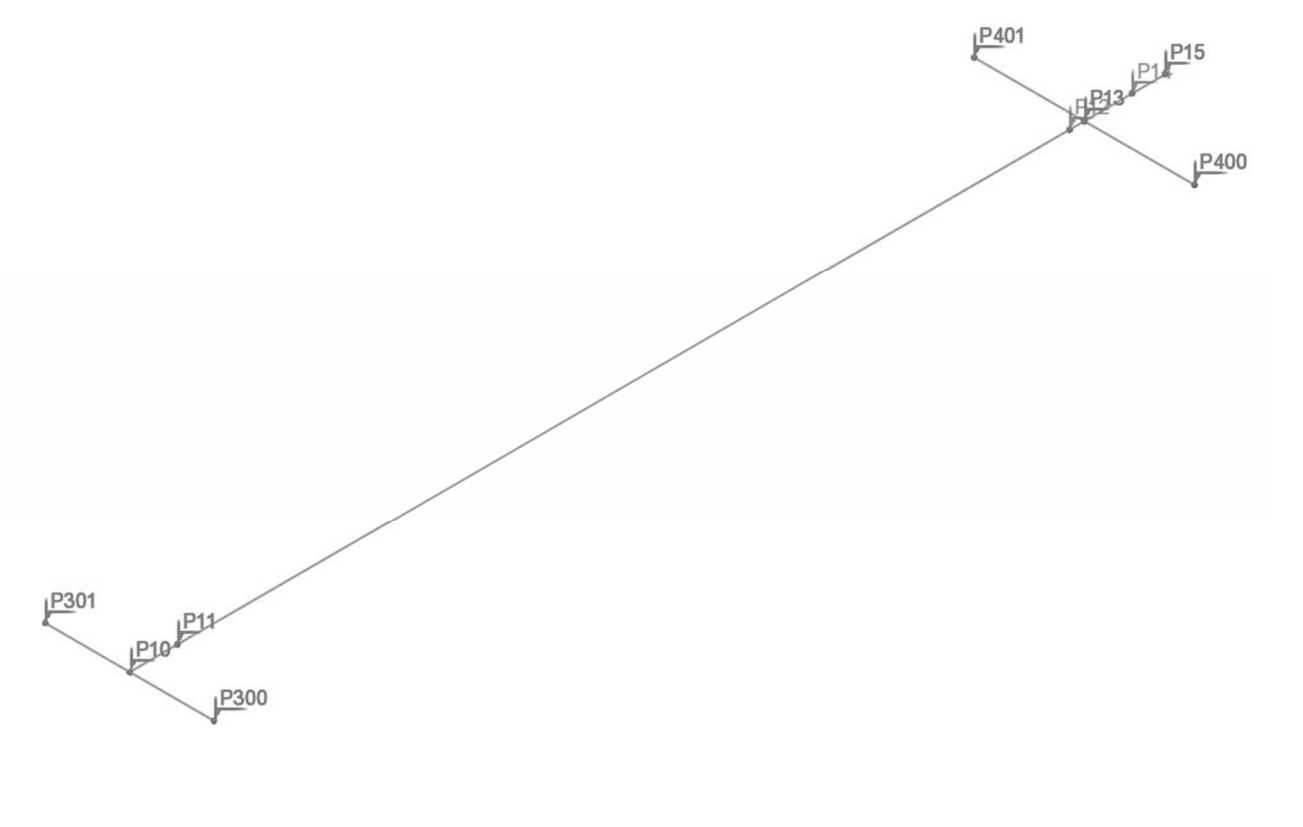


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:10
		Date :	Created :

Superstructure – spann 2 (including Rigid:T) :

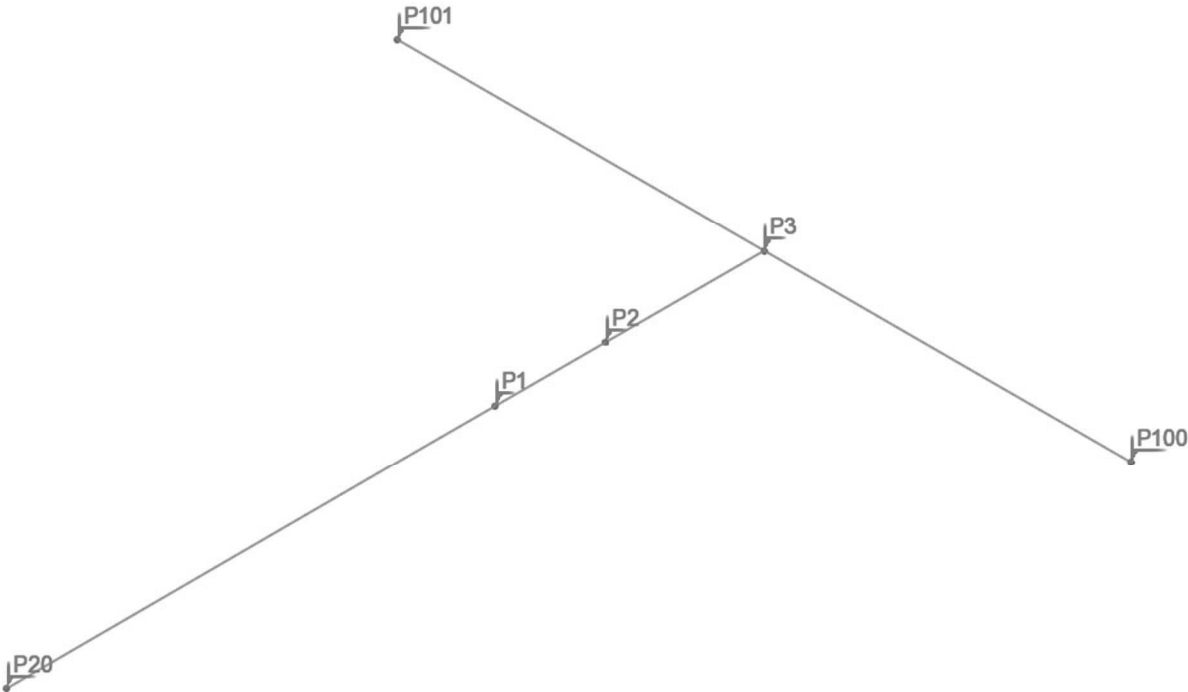


Superstructure – spann 3 (including Rigid:T) :

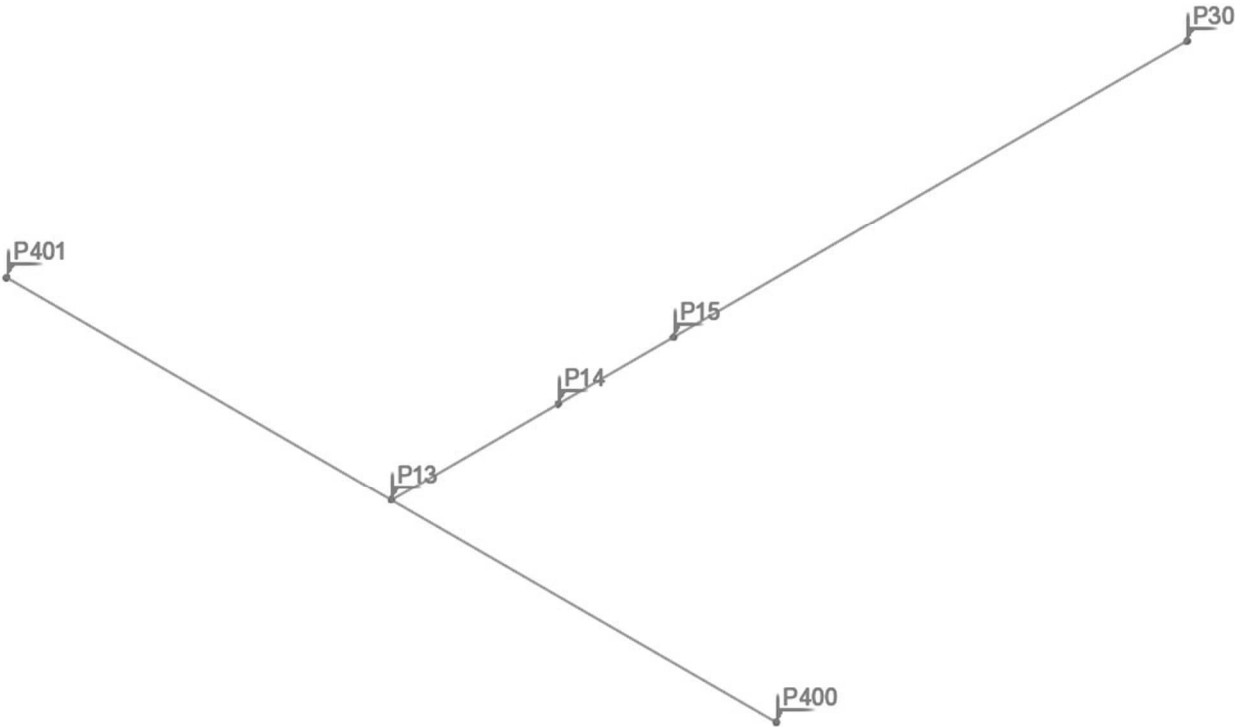


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:11
		Date :	Created :

Link slab at support 1 :



Link slab at support 4 :



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:12
		Date :	Created :

2.2.1.2 Geometry : LINES

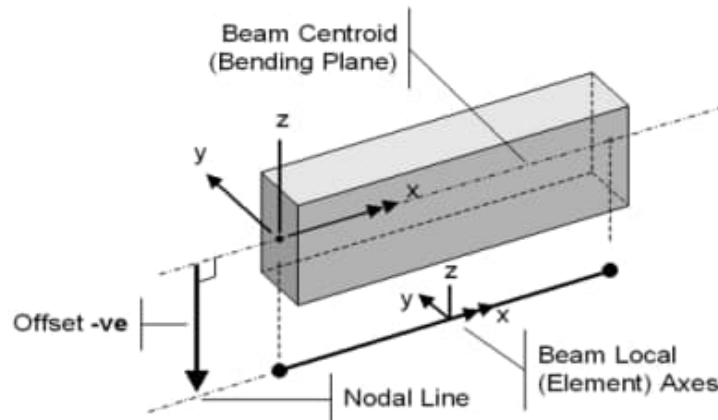
See attachment 1.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:13
		Date :	Created :

2.3 CROSS SECTION PROPERTIES

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

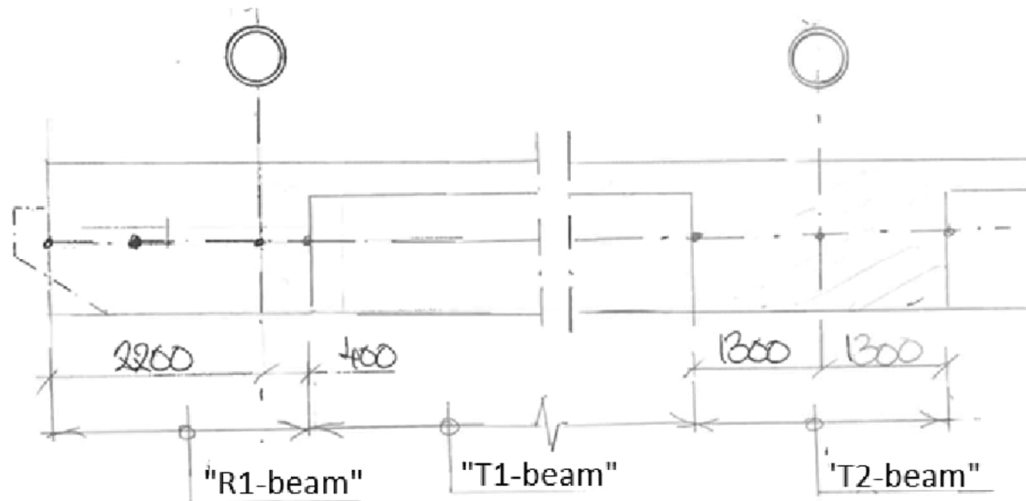
Principal sketch of geometry associated to 3D beam elements are seen below.



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:14
		Date :	Created :

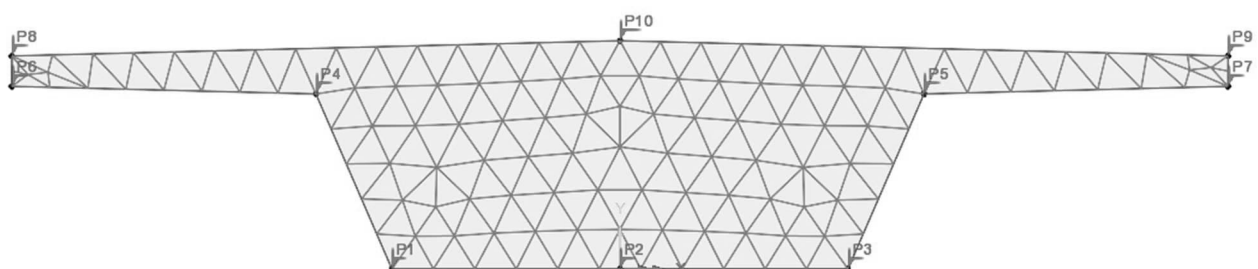
2.3.1 Longitudinal beam: T1-beam

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

	Part A - CALCULATION ASSUMPTIONS	Status :	Page: A2:15
	Pretensioned single girder bridge	Date :	Created :

Cross section properties

Section Details

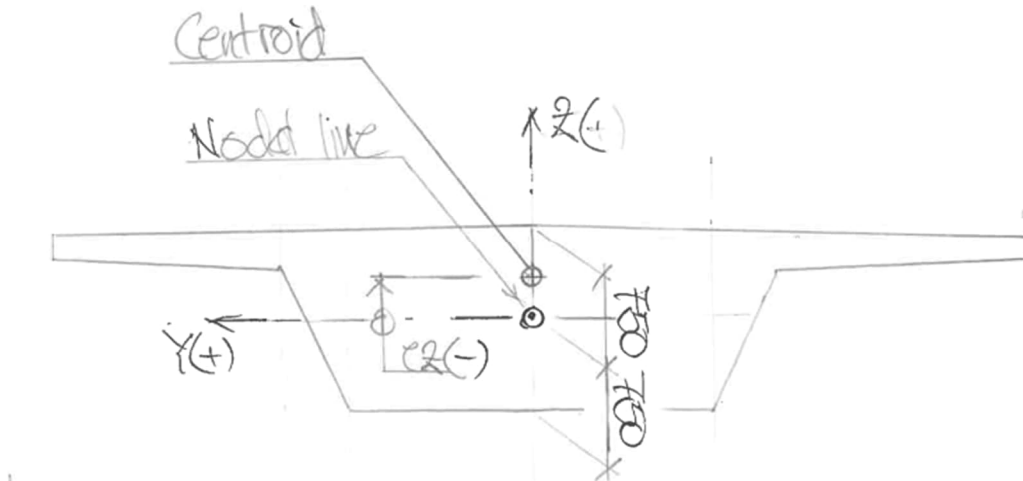
Calculated properties

		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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:16
		Date :	Created :

Results “T1-beam”

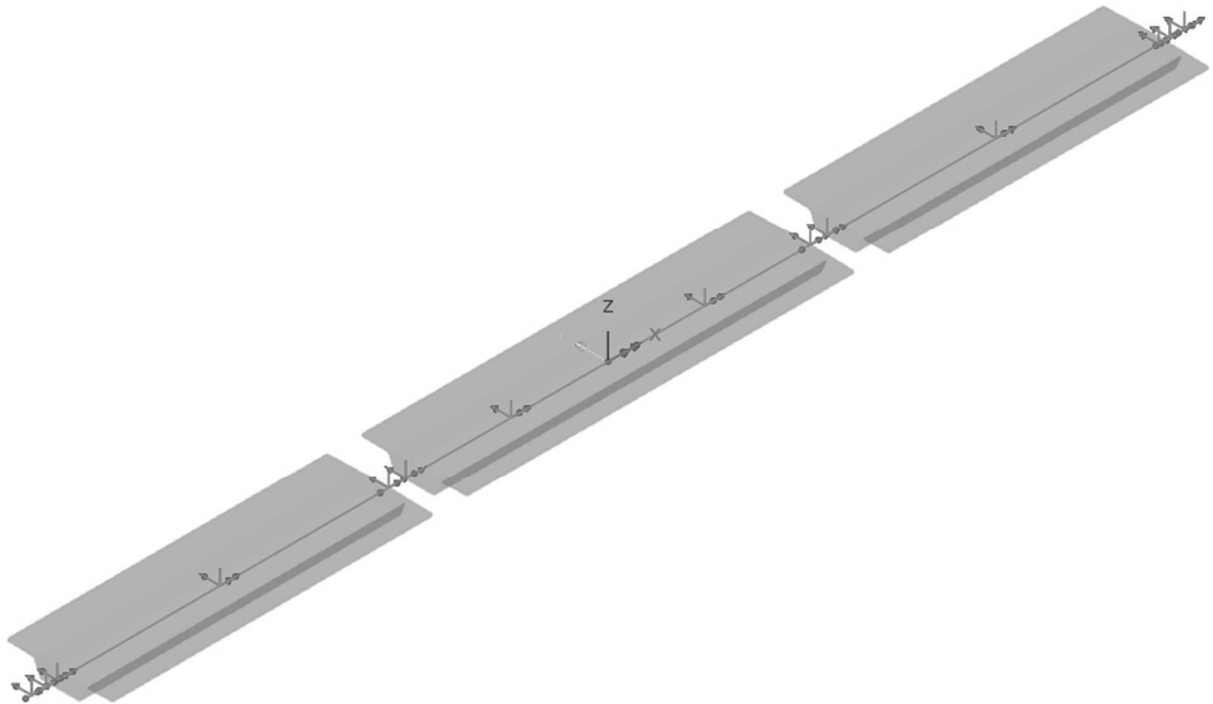
$$e_z = 0.750 \text{ m} + Y_c = 0.750 \text{ m} - 0.858 \text{ m} = -0.109 \text{ m}$$



Data	“T1-beam”	Unit
A	6.325	m ²
I _{yy}	1.185	m ⁴
I _{zz}	14.793	m ⁴
I _{yz}	0	m ⁴
J	2.899	m ⁴
e _z	-0.109	m
-	m	-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:17
		Date :	Created :

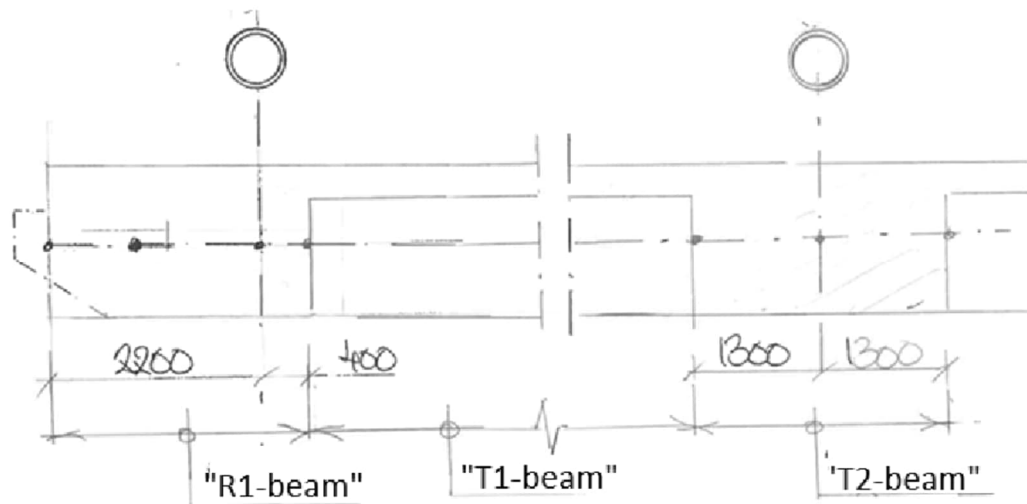
Graphic visualization



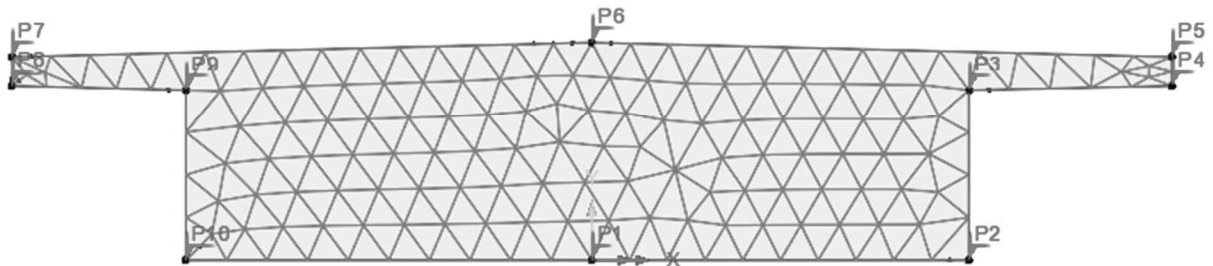
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:18
		Date :	Created :

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.



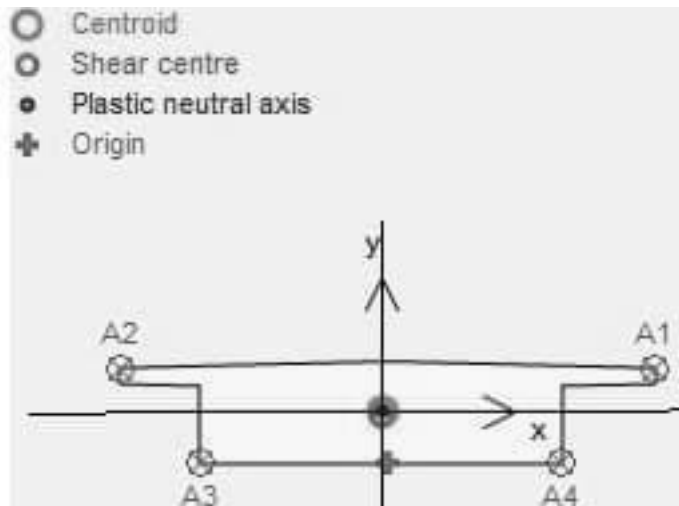
Definition of arbitrary section



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

	Part A - CALCULATION ASSUMPTIONS	Status :	Page: A2:19
	Pretensioned single girder bridge	Date :	Created :

Cross section properties



Section Details

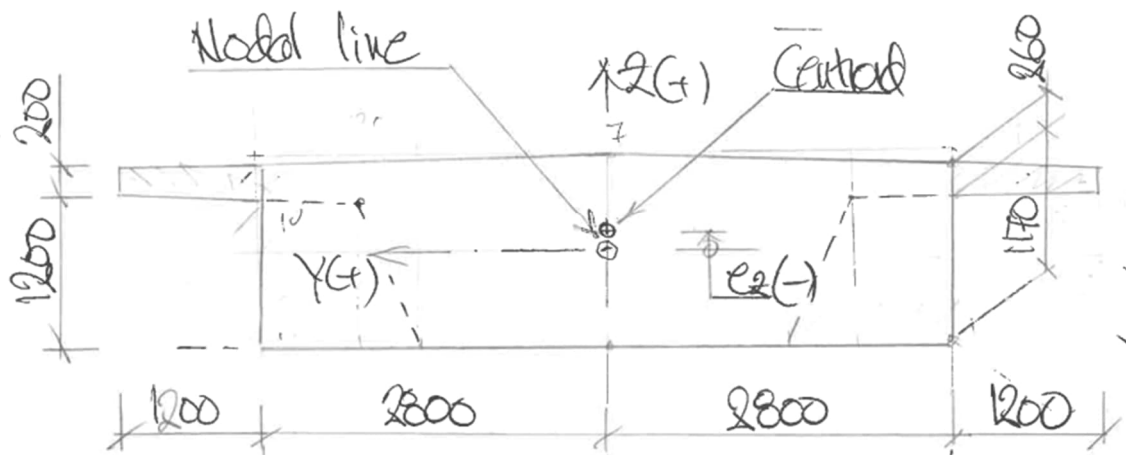
Calculated properties

		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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:20
		Date :	Created :

Results “T2-beam”

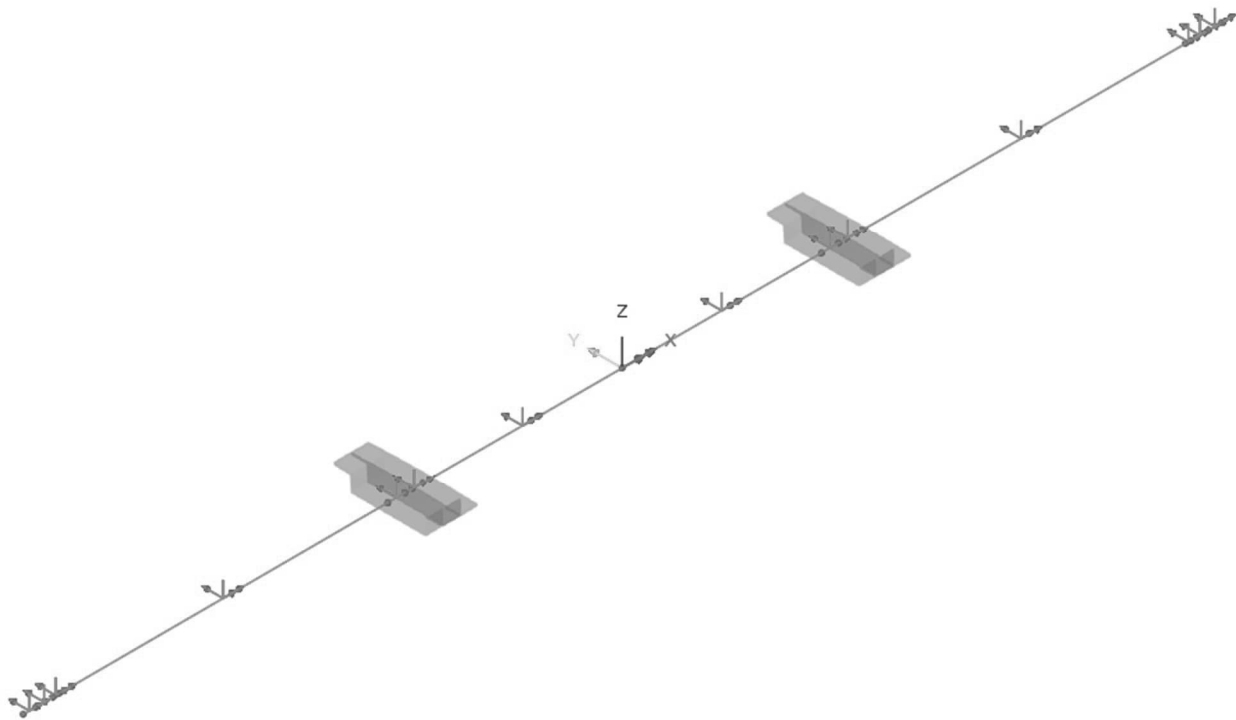
$$e_z = 0.750 \text{ m} + Y_c = 0.750 \text{ m} - 0.768 \text{ m} = -0.018 \text{ m}$$



Data	“T2-beam”	Unit
A	8.756	m ²
I _{yy}	1.638	m ⁴
I _{zz}	27.533	m ⁴
I _{yz}	0	m ⁴
J	4.978	m ⁴
e _z	-0.023	m
-	m	-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:21
		Date :	Created :

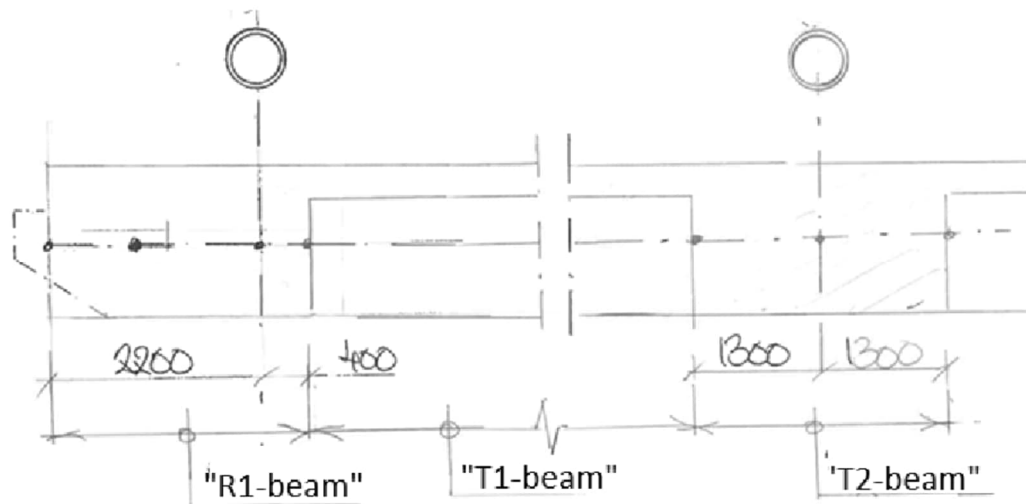
Graphic visualization



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:22
		Date :	Created :

2.3.3 Longitudinal beam: Rectangular beam

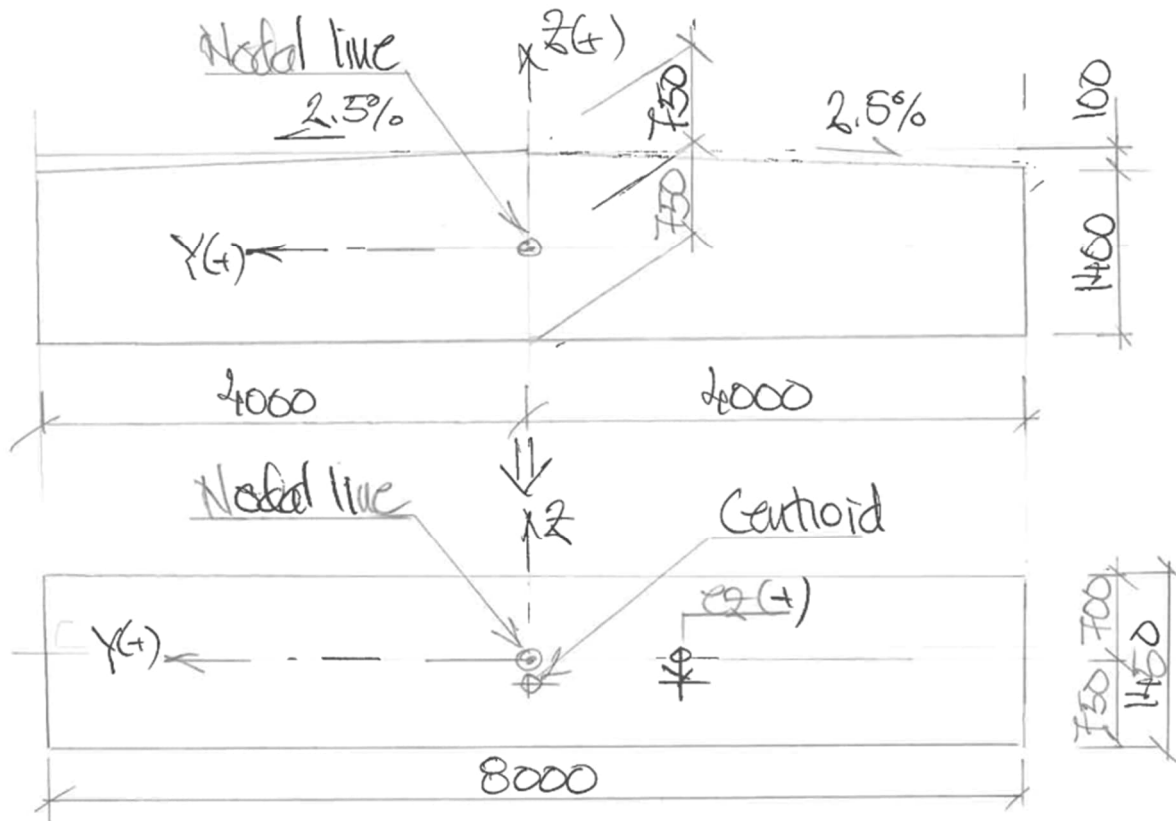
The cross section is occurs locally at support 1 & 4, as seen in sketch below. Calculation is performed using “Section Property Calculator” for a parametric section type rectangular solid.



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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:23
		Date :	Created :

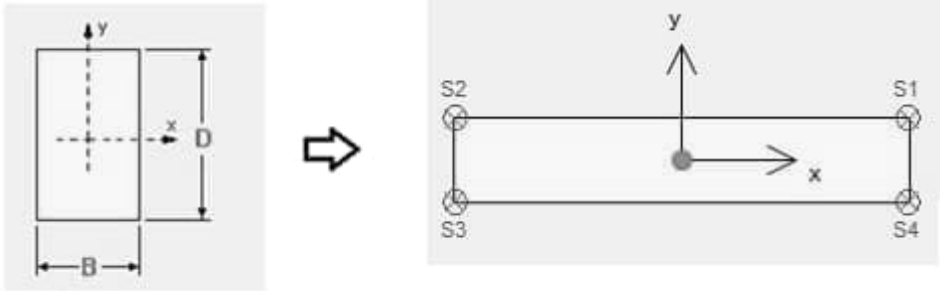
Equivalent "R1-beam"



$$e_z = 0.750 \text{ m} + Y_c = 0.750 \text{ m} - 0.725 \text{ m} = +0.025 \text{ m} :$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:24
		Date :	Created :

Input rectangular cross section



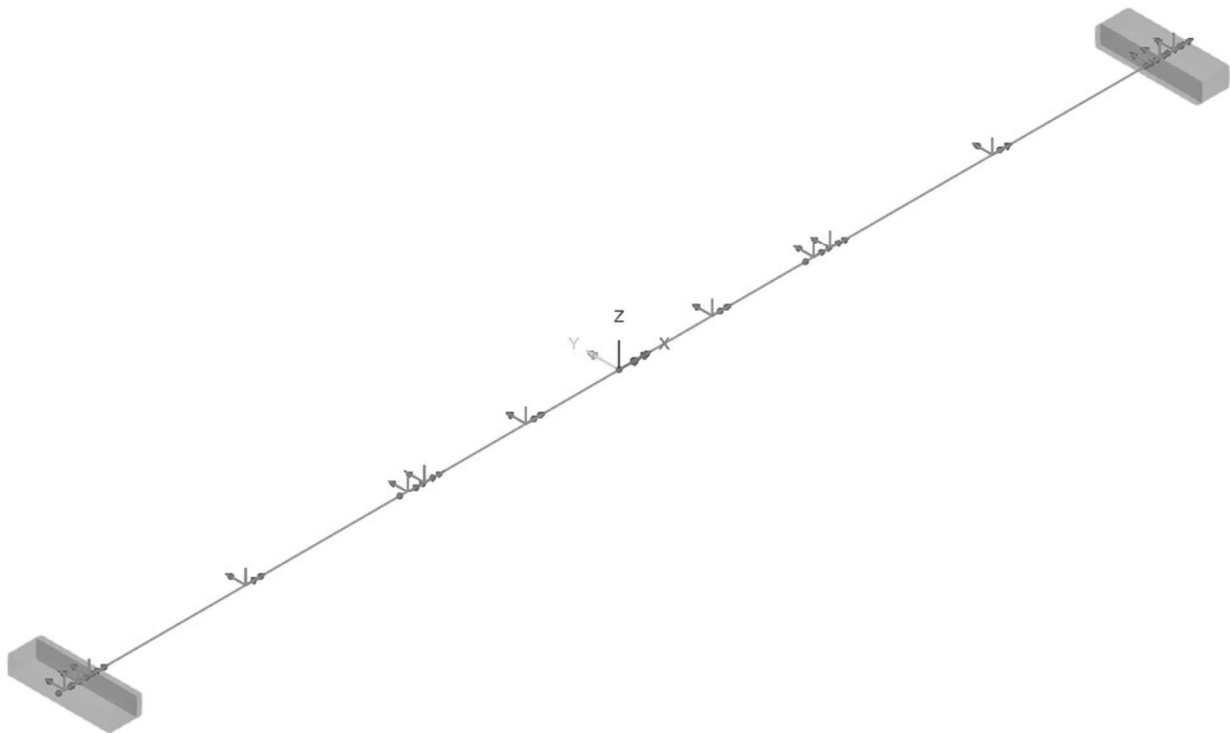
Data	“R2-beam”
D	1.465
B	5.600
-	m

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:25
		Date :	Created :

Graphic visualization

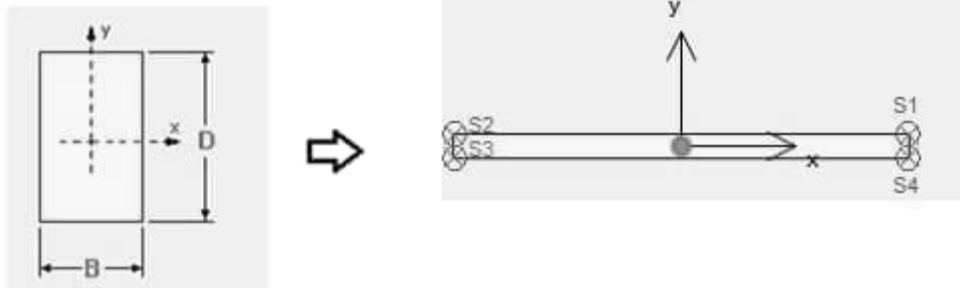


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:26
		Date :	Created :

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



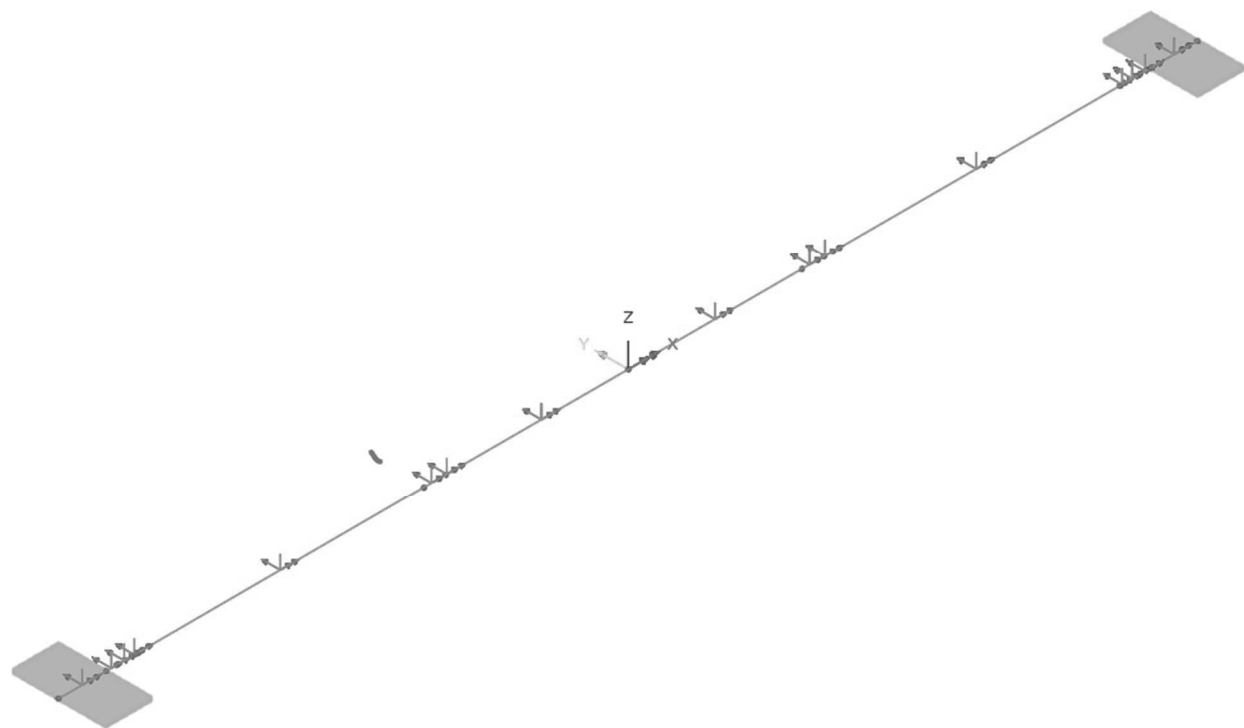
Data	“R2-beam”
D	0.400
B	8.000
-	m

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:27
		Date :	Created :

Graphic visualization

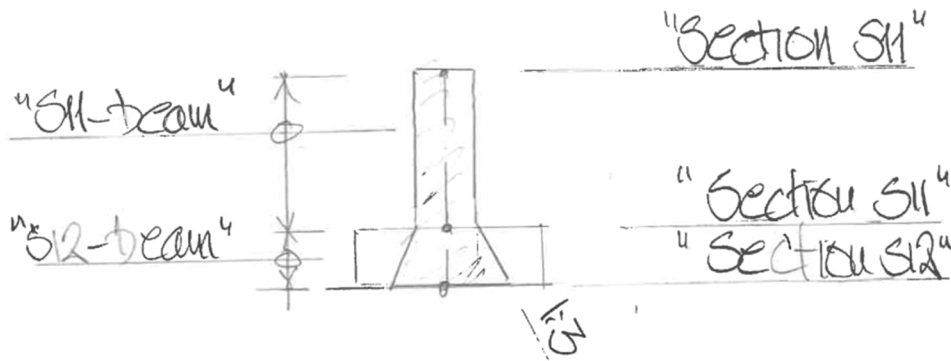


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:28
		Date :	Created :

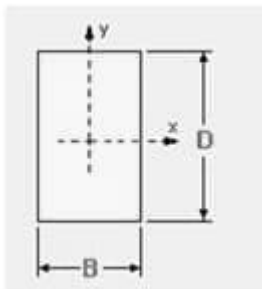
2.3.5 Support 1 & 4: Rectangular beams

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:29
		Date :	Created :

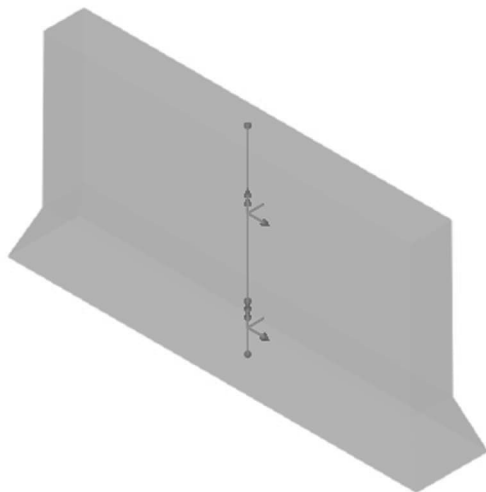
Results

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



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:30
		Date :	Created :

Definition of “ S11-beam”

Analysis category
3D

Definition

☒ From library / calculator
☐ Enter properties

Rotation about centroid
0 °
Mirrored about axis
None

Reinforcement (only used for RC design checks)
None

ez origin
Centroid
ey origin
Same as ez

Cross sectional area (A)	5.76
Second moment of area about y axis (Iyy)	0.3072
Second moment of area about z axis (Izz)	24.8832
Product moment of area (Iyz)	0.0
Torsional constant (J)	1.14283
Effective shear area in y direction (Asy)	4.80005
Effective shear area in z direction (Asz)	4.8051
Eccentricity in y direction (ey)	0.0
Eccentricity in z direction (ez)	0.0

Visualise...
Tapering >>
Section details...

Name
S11-beam
(8)

Parametric Sections
Rectangular Sections
6:Section S11 (RSS D=0.8 B=7.2)

100%

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:31
		Date :	Created :

Definition of “ S12-beam”

Analysis category
3D

☒ Specify shape interpolation
☐ Symmetric section

Distance interpretation
☒ Scaled to fit each line individually
☐ Along reference path Path1

	Section	Shape Interpolation	Distance
1	Section S12 (RSS D=1.4 B=8)	Start	0.0
2	Section S11 (RSS D=0.8 B=7.2)	Linear	0.9

Edit...
Insert
Delete
Flip

ez origin Centroid ey origin Same as ez
Interpolation of properties Linear approximation

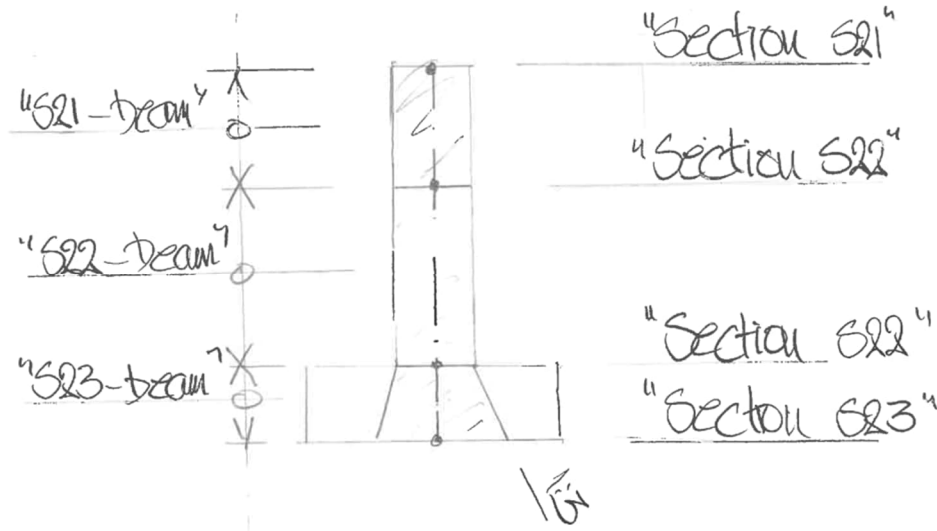
Alignment
Align all to section Vertical Individual eccentricities
1 Horizontal Individual eccentricities

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:32
		Date :	Created :

2.3.6 Support 2 & 3: Rectangular beams

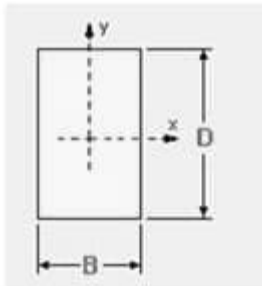
This link slabs are modelled using “Section Property Calculator” for parametric section type rectangular solid.

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



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:33
		Date :	Created :

Input rectangular cross sections

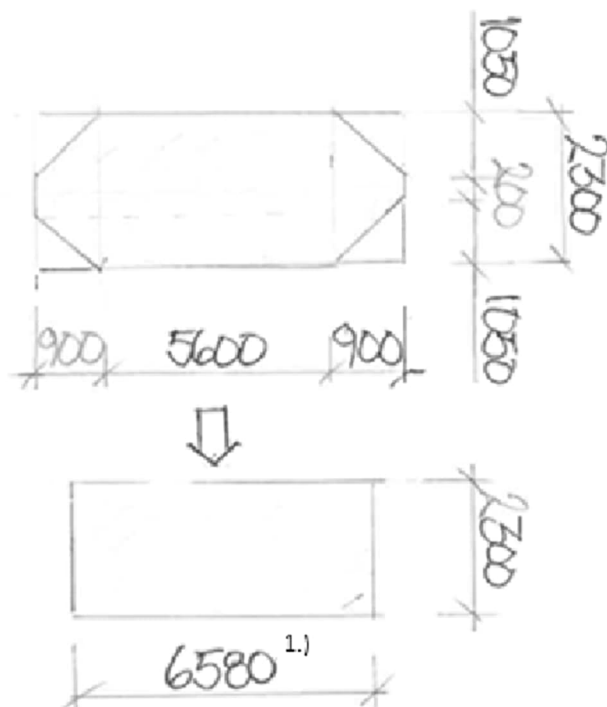


Data	“Section S21”	“Section S22”	“Section S23”
D	2.30	2.30	3.00
B	5.60	6.58 ^{1.)}	7.28 ^{2.)}
-	m	m	m

Footnote

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

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



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:34
		Date :	Created :

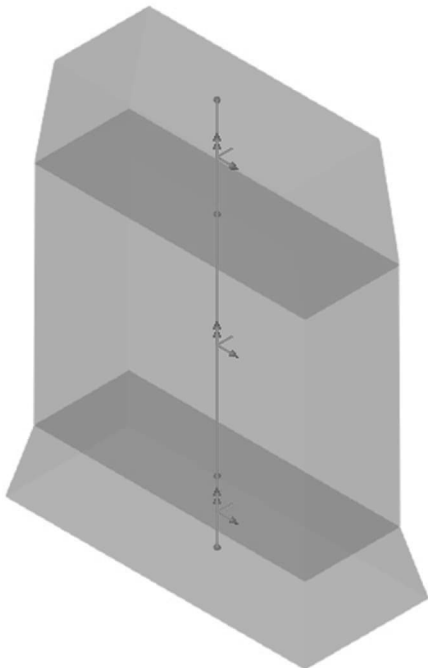
Results

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



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:35
		Date :	Created :

Definition of “ S11-beam”

Analysis category
3D

Definition

☒ From library / calculator
☐ Enter properties

Rotation about centroid
0 °
Mirrored about axis
None

Reinforcement (only used for RC design checks)
None

ez origin
Centroid
ey origin
Same as ez

Cross sectional area (A)	5.76
Second moment of area about y axis (Iyy)	0.3072
Second moment of area about z axis (Izz)	24.8832
Product moment of area (Iyz)	0.0
Torsional constant (J)	1.14283
Effective shear area in y direction (Asy)	4.80005
Effective shear area in z direction (Asz)	4.8051
Eccentricity in y direction (ey)	0.0
Eccentricity in z direction (ez)	0.0

Visualise...
Tapering >>
Section details...

Name
S11-beam
(8)

Parametric Sections
Rectangular Sections
6:Section S11 (RSS D=0.8 B=7.2)

100%

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:36
		Date :	Created :

Definition of “ S12-beam”

Analysis category

☒ Specify shape interpolation
☐ Symmetric section

Distance interpretation
☒ Scaled to fit each line individually
☐ Along reference path

	Section	Shape Interpolation	Distance
1	Section S12 (RSS D=1.4 B=8)	Start	0.0
2	Section S11 (RSS D=0.8 B=7.2)	Linear	0.9

Edit...
Insert
Delete
Flip

ez origin ey origin
Interpolation of properties

Alignment
Align all to section
Vertical
Horizontal

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:37
		Date :	Created :

2.3.7 Rigid beams

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

Analysis category
3D

Definition

☐ From library / calculator
☒ Enter properties

Usage
3D Thick Beam (Any beam)

Reinforcement (only used for RC design checks)
None

ez origin
Centroid
ey origin
Same as ez

Cross sectional area (A)
Second moment of area about y axis (I _{yy})
Second moment of area about z axis (I _{zz})
Product moment of area (I _{yz})
Torsional constant (J)
Effective shear area in y direction (A _{sy})
Effective shear area in z direction (A _{sz})
Eccentricity in y direction (e _y)
Eccentricity in z direction (e _z)

Visualise...
Tapering >>

EU Sections
HE Shapes (EN53-62)
HE 1000 M

100%

Value
1.0E3
1.0E3
1.0E3
0.0
1.0E3
1.0E3
1.0E3
0.0
0.0

Section details...

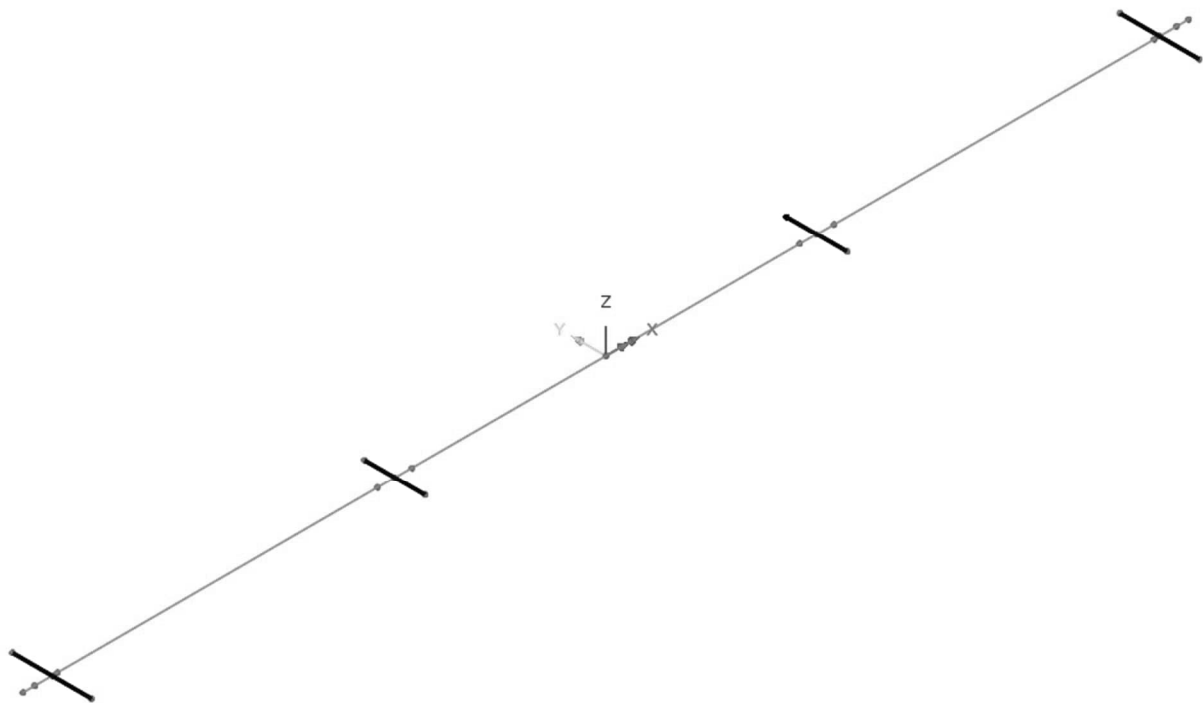
Name
Rigid beam
(7)

Remark

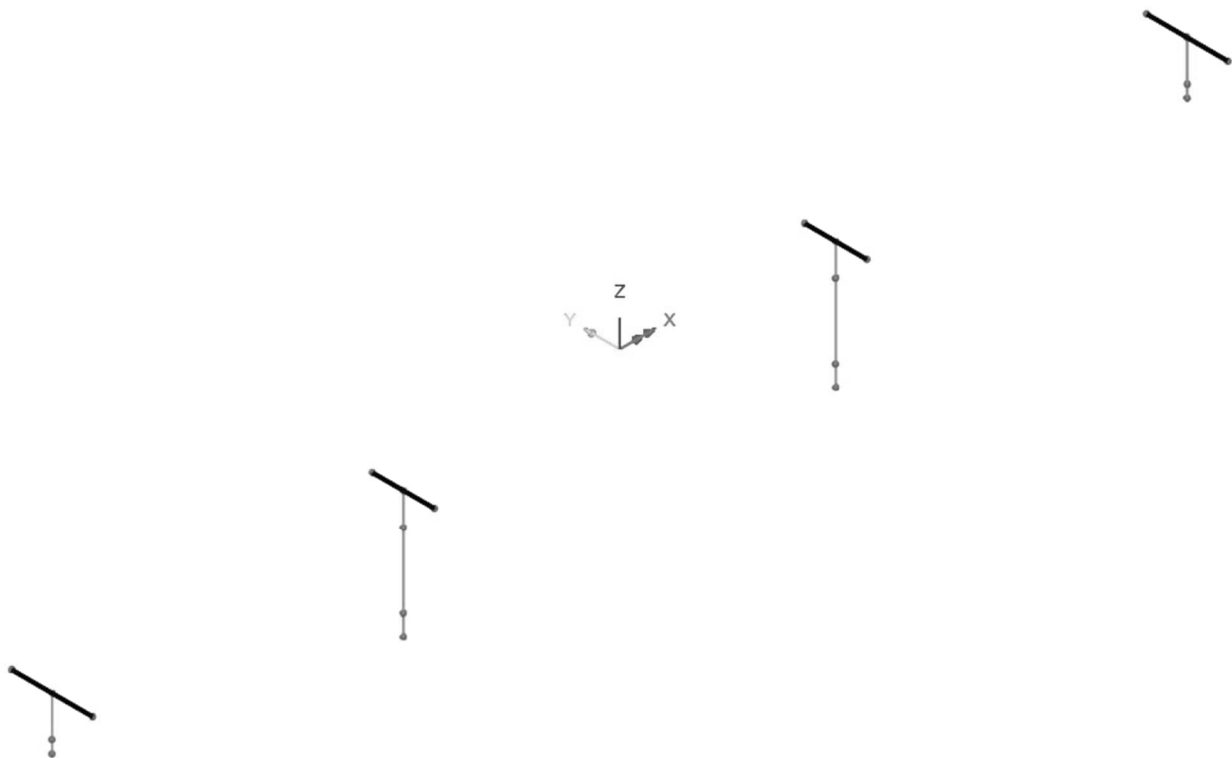
Due to high fictive cross sectional area a weightless material needs to be applied.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:38
		Date :	Created :

Graphic visualization superstructure (Rigid:T)



Graphic visualization substructure (Rigid:B)



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:39
		Date :	Created :

2.4 MATERIAL

Material properties seen below are to be used.

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:40
		Date :	Created :

2.4.2.1 Material : Isotropic concrete C35/45

Applied to superstructure.

Material type

Concrete

Country

Europe

Standard

EN1992-1-1:2004/2014

Grade

C35/45

Properties

Young's modulus

34.0E6

Poisson's ratio

0.2

Density

2.54842

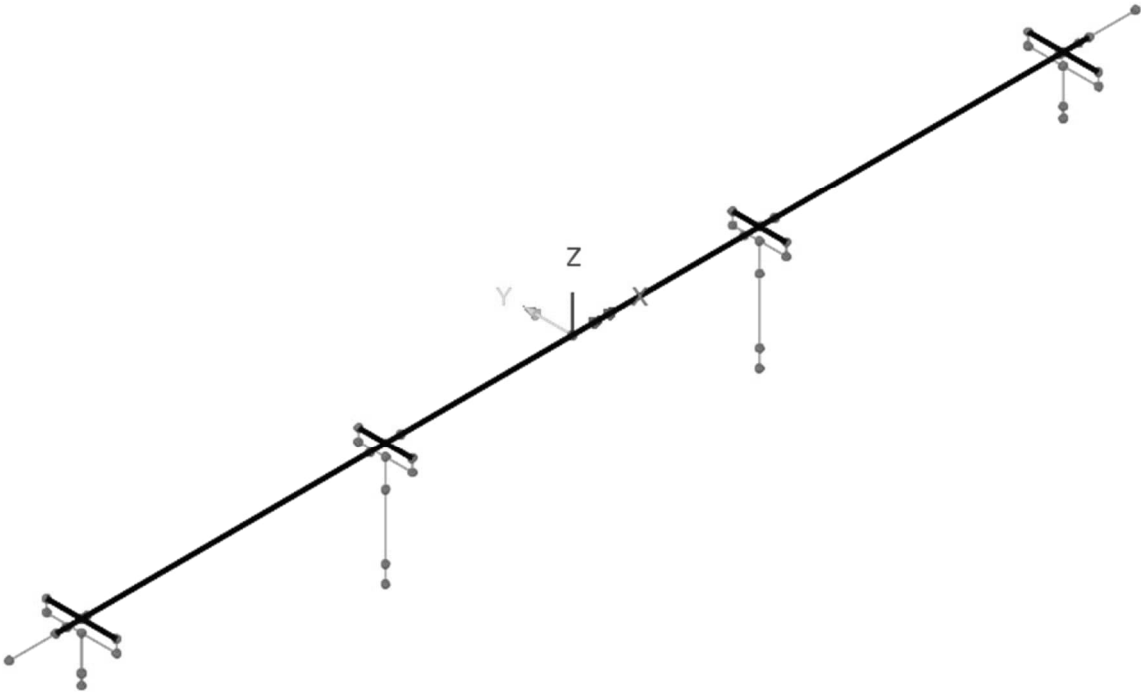
Thermal expansion

10.0E-6

Name

Concrete C35/45

(3)



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:41
		Date :	Created :

2.4.2.2 Material : Isotropic concrete C30/37

Applied to substructure and link slabs.

Material type

Concrete

Country

Europe

Standard

EN1992-1-1:2004/2014

Grade

C30/37

Properties

Young's modulus

33.0E6

Poisson's ratio

0.2

Density

2.54842

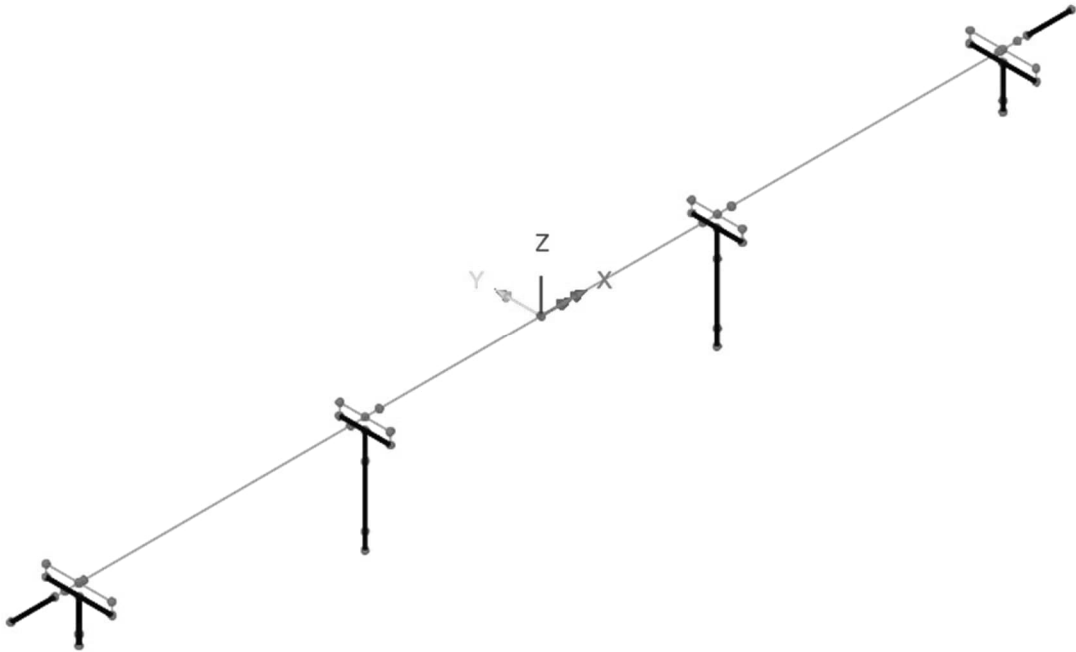
Thermal expansion

10.0E-6

Name

Concrete C30/37

(7)

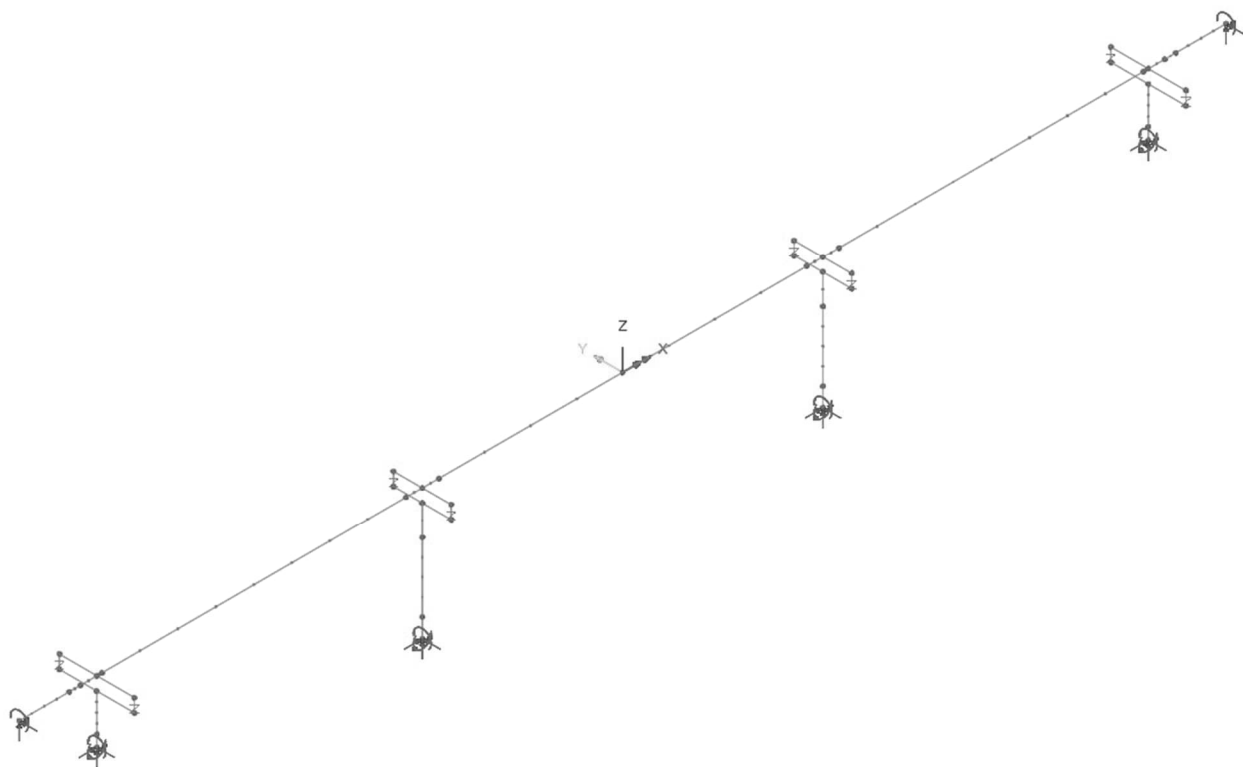


Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:42
		Date :	Created :

2.5 BOUNDARY CONDITIONS

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



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:43
		Date :	Created :

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.

Structural Supports

Analysis category
3D

		Free	Fixed	Spring	Spring stiffness
Translation in	X	☒	☐	☐	
	Y	☐	☒	☐	
	Z	☐	☒	☐	
Rotation about	X	☐	☒	☐	
	Y	☒	☐	☐	
	Z	☒	☐	☐	
Hinge rotation		☒	☐	☐	
Torsional warping		☒	☐	☐	

Spring stiffness distribution
☒ Stiffness
☐ Stiffness/unit length
☐ Stiffness/unit area

Lift-off >>

Contact >>

Non-reflective >>

Name
Roller support
(1)

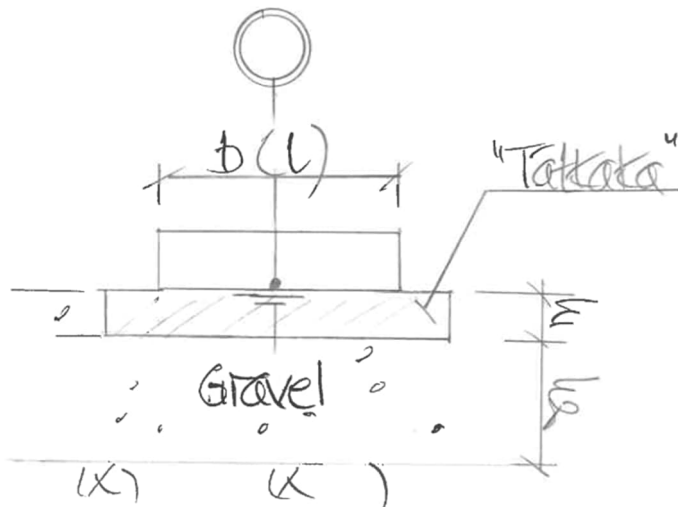
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:44
		Date :	Created :

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 “Tätkä” (C25/35) is considered.

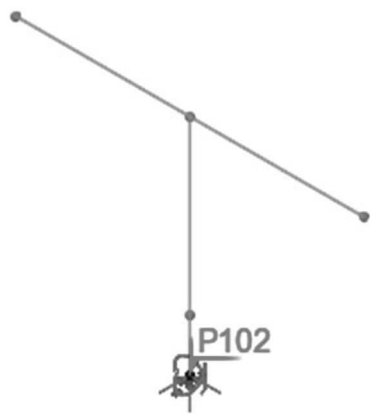


Geotechnical section at support

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:45
		Date :	Created :

Support 1:



Support 2:

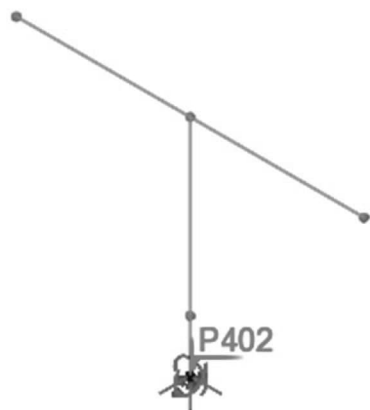


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:46
		Date :	Created :

Support 3:



Support 4 :



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:47
		Date :	Created :

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):

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

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

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

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

Stiffness longitudinal direction (Rotation Y-Y):

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

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

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

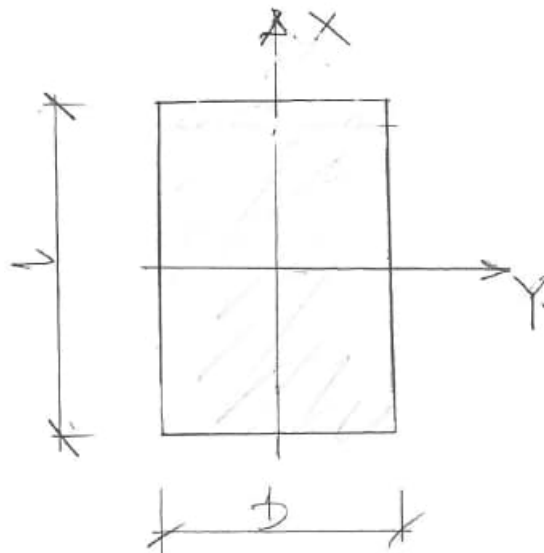
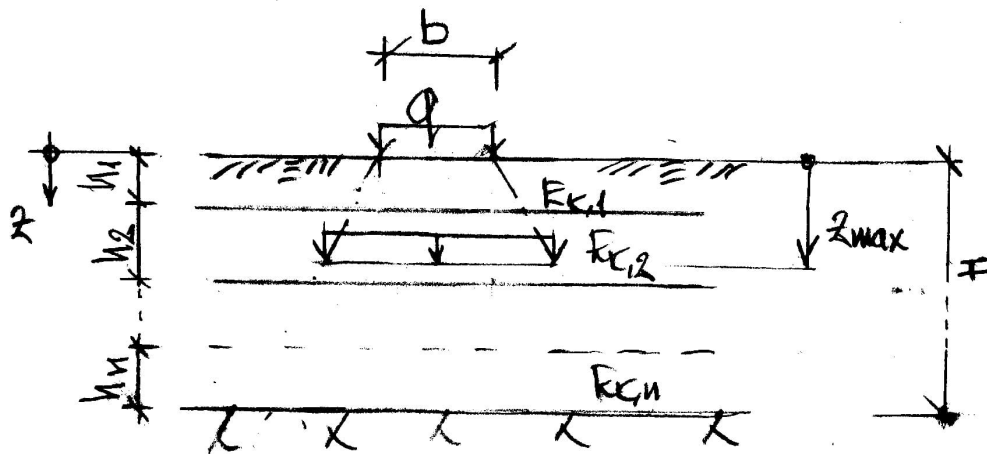
$$K_{Ry} = 254 \cdot 10^3 \frac{kNm}{rad} \quad : \text{support 4, see page A2:53}$$

Objekt : Support 1 (4)

PRINCIPFIGUR

Geometri och undergrund

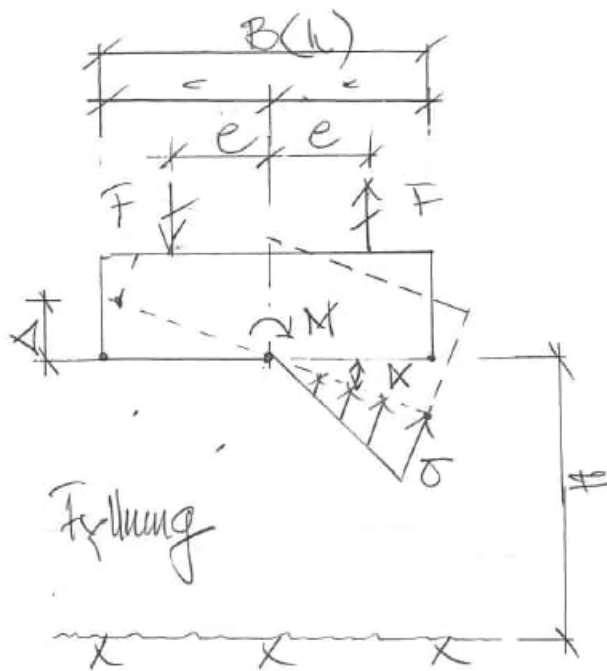
Beräkningen av ekvivalent styvhet i grund är utförd enligt Råd Brobyggande bilaga 106. Den ekvivalenta E-modulen förutsätter lastspridning 2:1. Bestämningen har skett för en fiktiv lasten motsvarande $q (= 100 \text{ kPa})$.



TEORI

När avståndet till fast botten är mindre än $2B$ så tillämpas 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.



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

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

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

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

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

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

INDATA**Geometri**

Bottenplatta : $b = 4.0\text{m}$ $l_w = 9.0\text{m}$

Underliggande jordmaterial

Antal skikt (minst 2 skickt erfordras) : $n = 2\text{st}$

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

BERÄKNINGAR**Total skikt tjocklek**

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

$$H = 6 \text{ m}$$

Sättningsområde

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

$$z_{\max} = 6 \text{ m}$$

Nivåer för respektive skikt

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

$$z_s^T = (0.000 \quad 3.000 \quad 3.001 \quad 6.000 \quad 6.001) \text{ m}$$

Funktion för sättningsmodul

$$E_{sk} := \begin{cases} \text{for } i \in 1..n-1 \\ \quad \begin{cases} E_{2,i} \leftarrow E_{k_i} \\ E_{2,i+1} \leftarrow E_{k_{i+1}} \end{cases} \\ E \end{cases}$$

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

$$E_k := \text{interp}(z_s, E_{sk}, z)$$

Påkänningar enligt 2:1

$$q_{\text{an}} = 100 \text{ kPa}$$

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

Karakteristisk sättning

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

$$s_k = 5.8 \cdot \text{mm}$$

Ekvivalent sättningsmodul

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

$$E'_k = 50 \cdot \text{MPa}$$

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):

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

$$C_{\phi} = \frac{1}{k_{\theta K}(b,l)}$$

$$10^9 \cdot C_{\phi} = 2500 \cdot \frac{\text{rad}}{\text{kNm}}$$

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

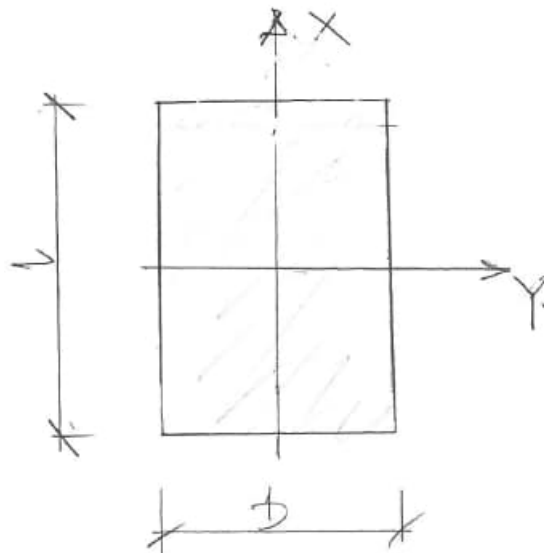
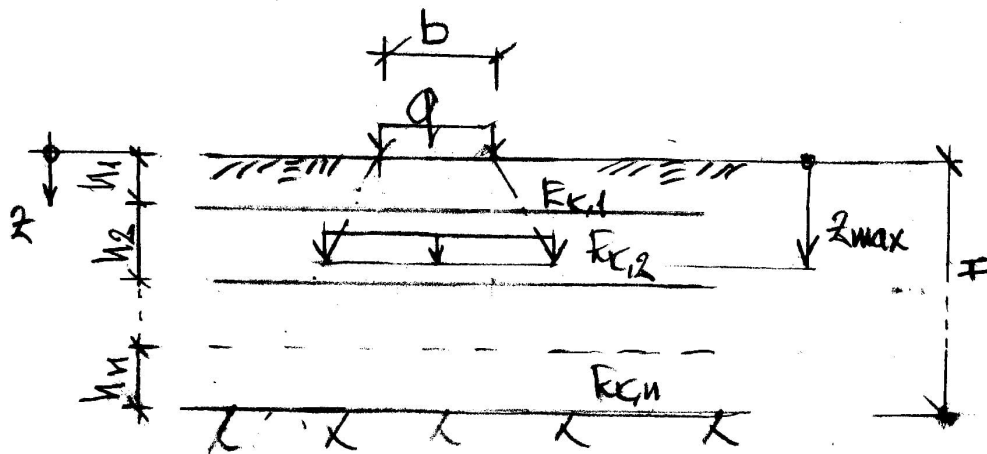
$$k_{\theta K}(l,b) = 2025000 \cdot \frac{\text{kNm}}{\text{rad}}$$

$$C_{\eta} = \frac{1}{k_{\theta K}(l,b)}$$

$$10^9 \cdot C_{\eta} = 494 \cdot \frac{\text{rad}}{\text{kNm}}$$

Objekt : Support 2 (3)**PRINCIPFIGUR****Geometri och undergrund**

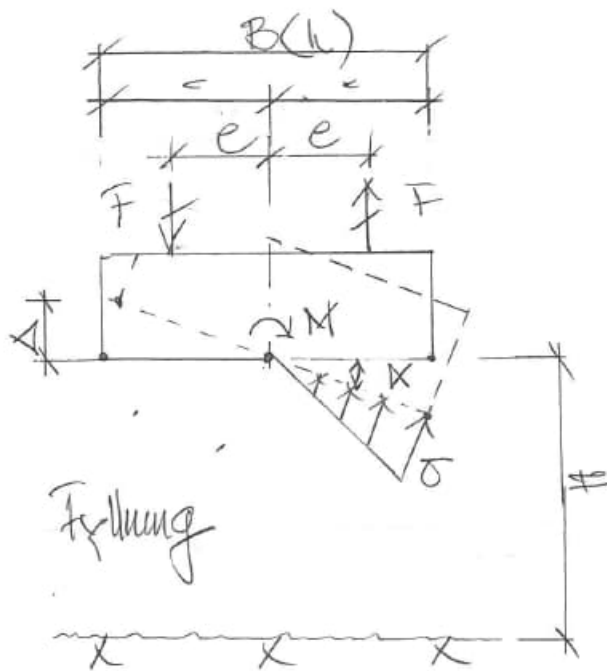
Beräkningen av ekvivalent styvhet i grund är utförd enligt Råd Brobyggande bilaga 106. Den ekvivalenta E-modulen förutsätter lastspridning 2:1. Bestämningen har skett för en fiktiv lasten motsvarande q ($= 100 \text{ kPa}$).



TEORI

När avståndet till fast botten är mindre än $2B$ så tillämpas 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.



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

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

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

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

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

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

INDATA**Geometri**

Bottenplatta : $b = 6.0\text{m}$ $l_w = 10.0\text{m}$

Underliggande jordmaterial

Antal skikt (minst 2 skickt erfordras) : $n = 2\text{st}$

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

BERÄKNINGAR

Total skikttjocklek

$$H = \sum_{i=1}^n h_i \quad H = 2 \text{ m}$$

Sättningsområde

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

Nivåer för respektive skikt

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

$$z_s = (0.000 \quad 1.000 \quad 1.001 \quad 2.000 \quad 2.001) \text{ m}$$

Funktion för sättningsmodul

$$E_{sk} := \begin{cases} \text{for } i \in 1..n-1 \\ \quad \begin{cases} E_{2,i} \leftarrow E_{k_i} \\ E_{2,i+1} \leftarrow E_{k_{i+1}} \end{cases} \\ E \end{cases}$$

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

$$E_k := \text{interp}(z_s, E_{sk}, z)$$

Påkänningar enligt 2:1

$$q_{\text{an}} = 100 \text{ kPa}$$

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

Karakteristisk sättning

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

$$s_k = 3.2 \cdot \text{mm}$$

Ekvivalent sättningsmodul

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

$$E'_k = 50 \cdot \text{MPa}$$

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):

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

$$C_{\phi} = \frac{1}{k_{\theta k}(b, l)}$$

$$10^9 \cdot C_{\phi} = 222 \cdot \frac{\text{rad}}{\text{kNm}}$$

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

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

$$C_{\eta} = \frac{1}{k_{\theta k}(l, b)}$$

$$10^9 \cdot C_{\eta} = 80 \cdot \frac{\text{rad}}{\text{kNm}}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:60
		Date :	Created :

Boundary support 1:

Analysis category 3D

		Free	Fixed	Spring	Spring stiffness
Translation in	X	☐	☒	☐	
	Y	☐	☒	☐	
	Z	☐	☒	☐	
Rotation about	X	☐	☐	☒	2.025E6
	Y	☐	☐	☒	400.0E3
	Z	☒	☐	☐	

Spring stiffness distribution
☒ Stiffness
☐ Stiffness/unit length
☐ Stiffness/unit area

Name Support 1 (2)

Boundary support 2:

Analysis category 3D

		Free	Fixed	Spring	Spring stiffness
Translation in	X	☐	☒	☐	
	Y	☐	☒	☐	
	Z	☐	☒	☐	
Rotation about	X	☐	☐	☒	125.0E6
	Y	☐	☐	☒	4.5E6
	Z	☒	☐	☐	
Hinge rotation		☒	☐	☐	

Spring stiffness distribution
☒ Stiffness
☐ Stiffness/unit length
☐ Stiffness/unit area

Name Support 2 (3)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:61
		Date :	Created :

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)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:62
		Date :	Created :

2.6 MESH

2.6.1 Beam element (BMI21) : linear

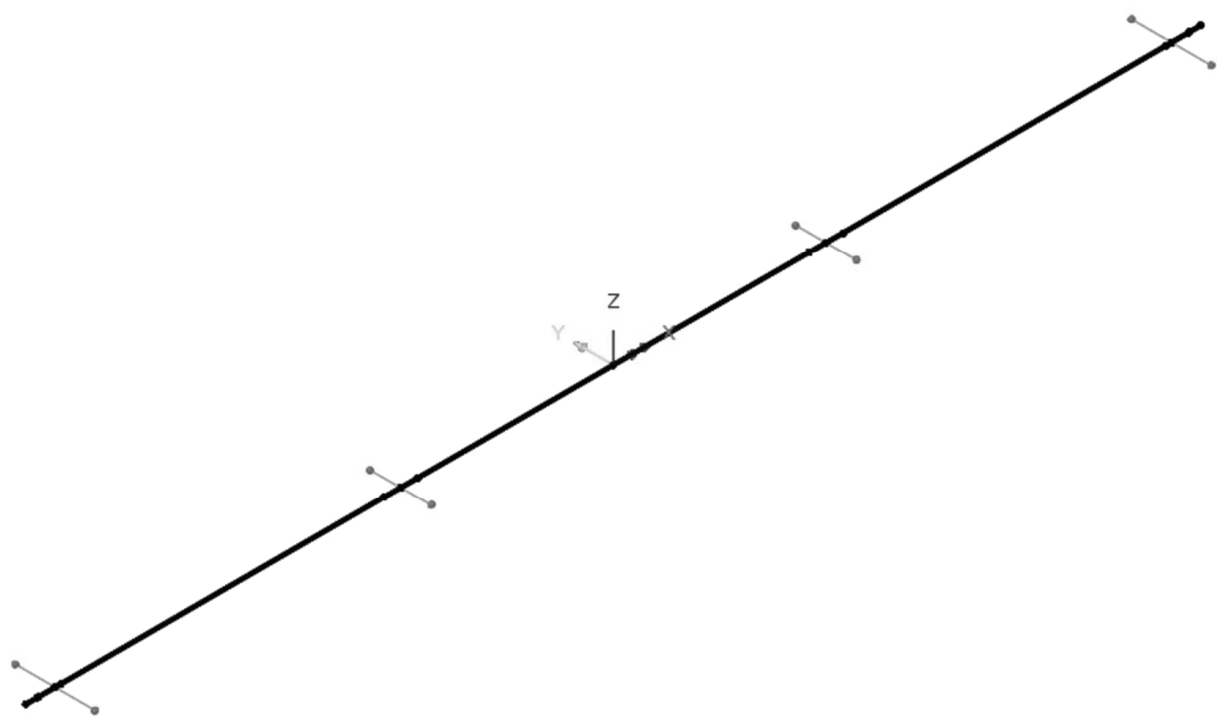
Longitudinal beams in superstructure are modelled using beam elements.

Beams elements are modelled with various subdivisions as seen below.

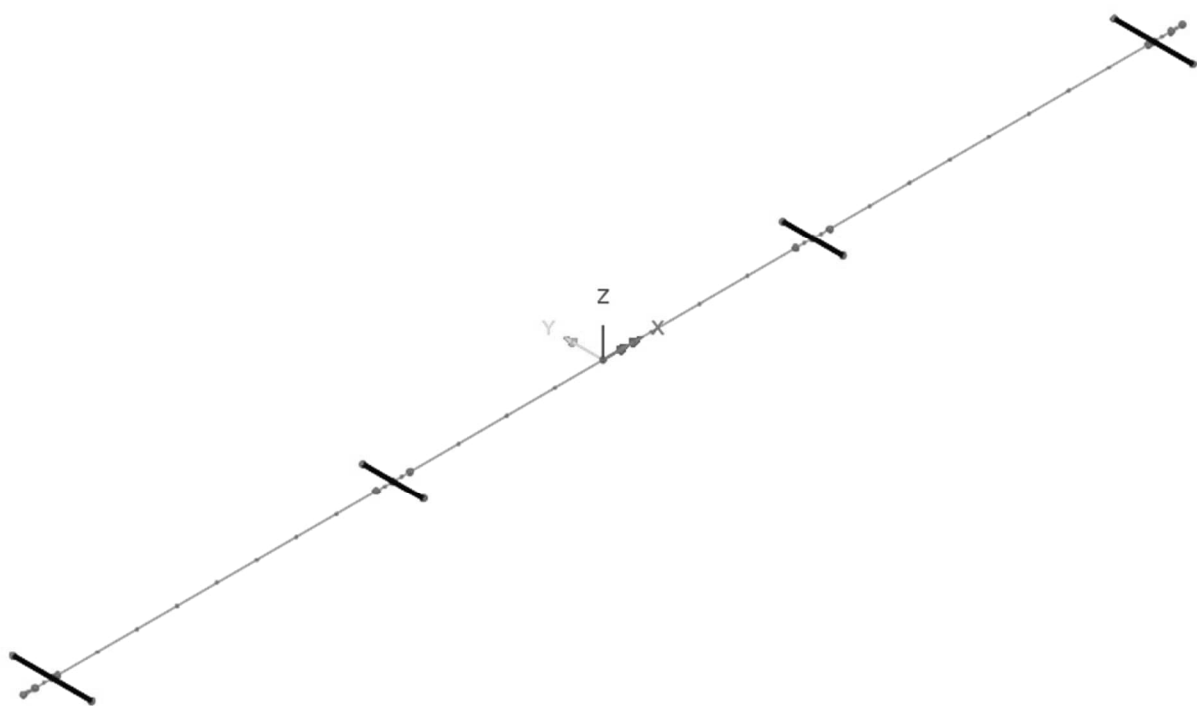
Typ	Divisions	End release: Start	End release: End
Element 1	1	None	None
Element 2	2	None	None
Element 4	4	None	None
Element 8	8	None	None
Element 4L:ML	4	None	Pinned
Element 4R:ML	4	Pinned	None

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:63
		Date :	Created :

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

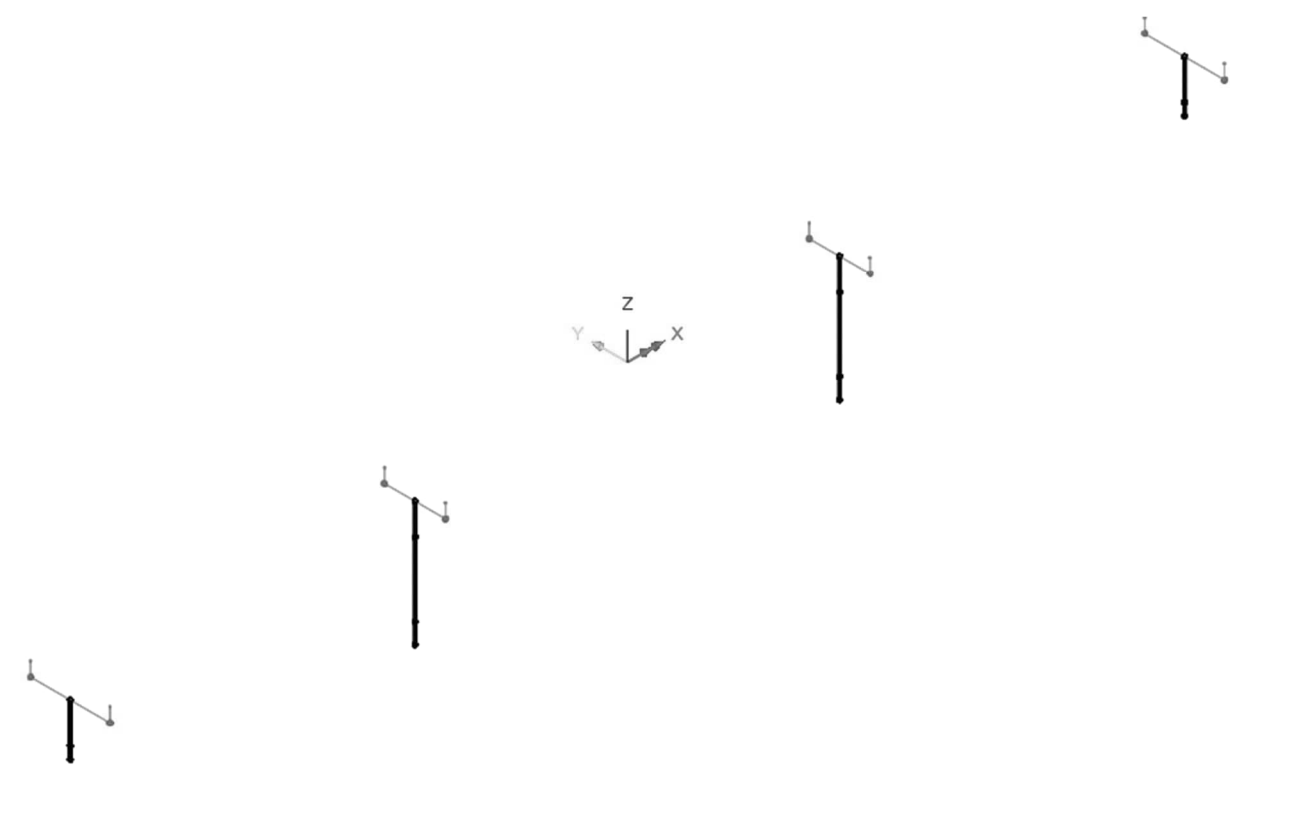


Rigid beam – superstructure (Element 1):

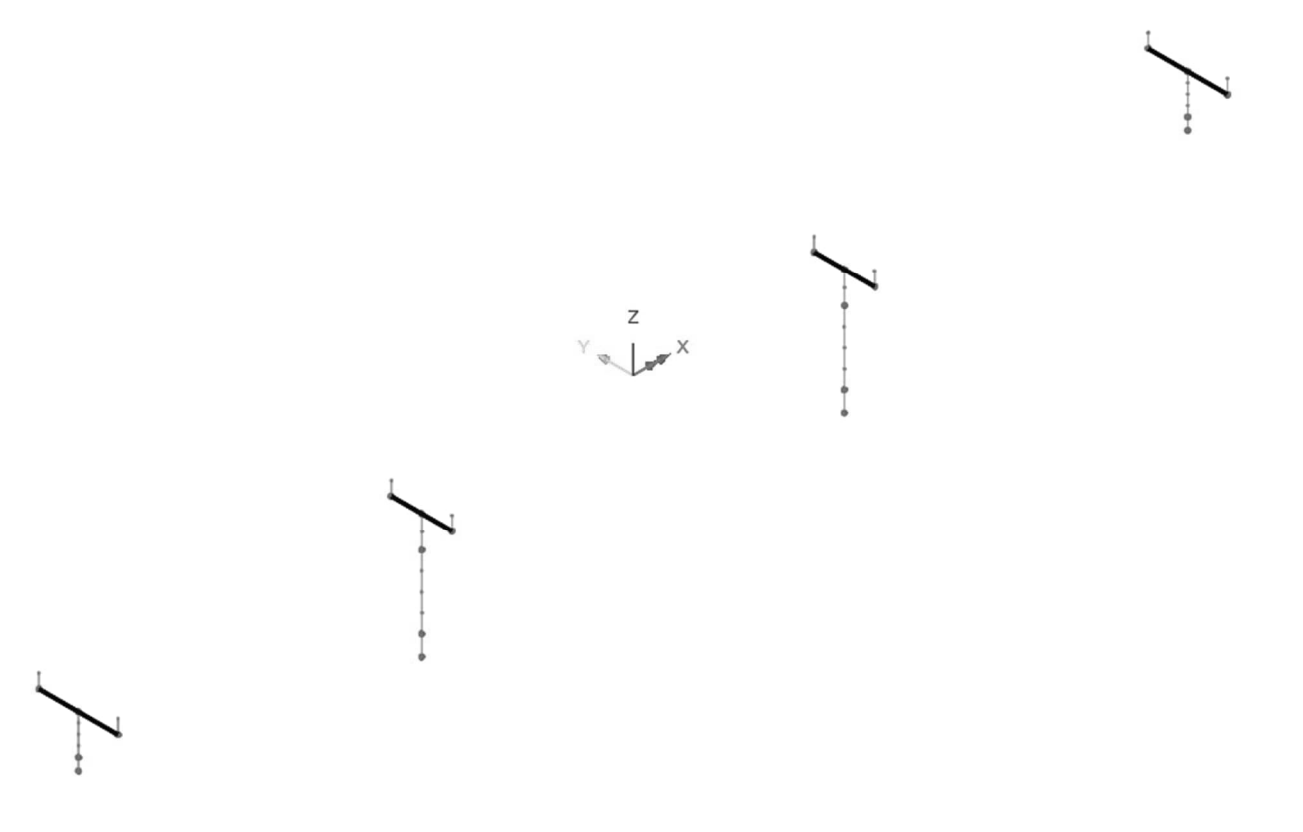


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:64
		Date :	Created :

Abutments (Element 1, 2 & 4):

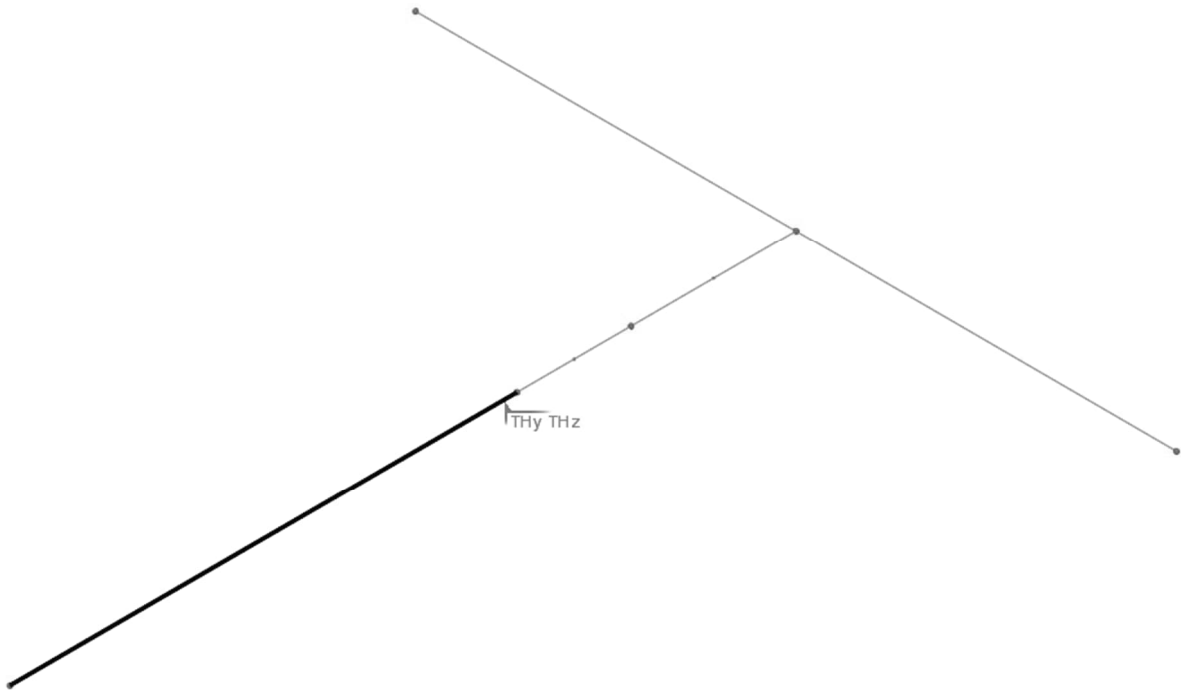


Rigid beam – abutments (Element 1):

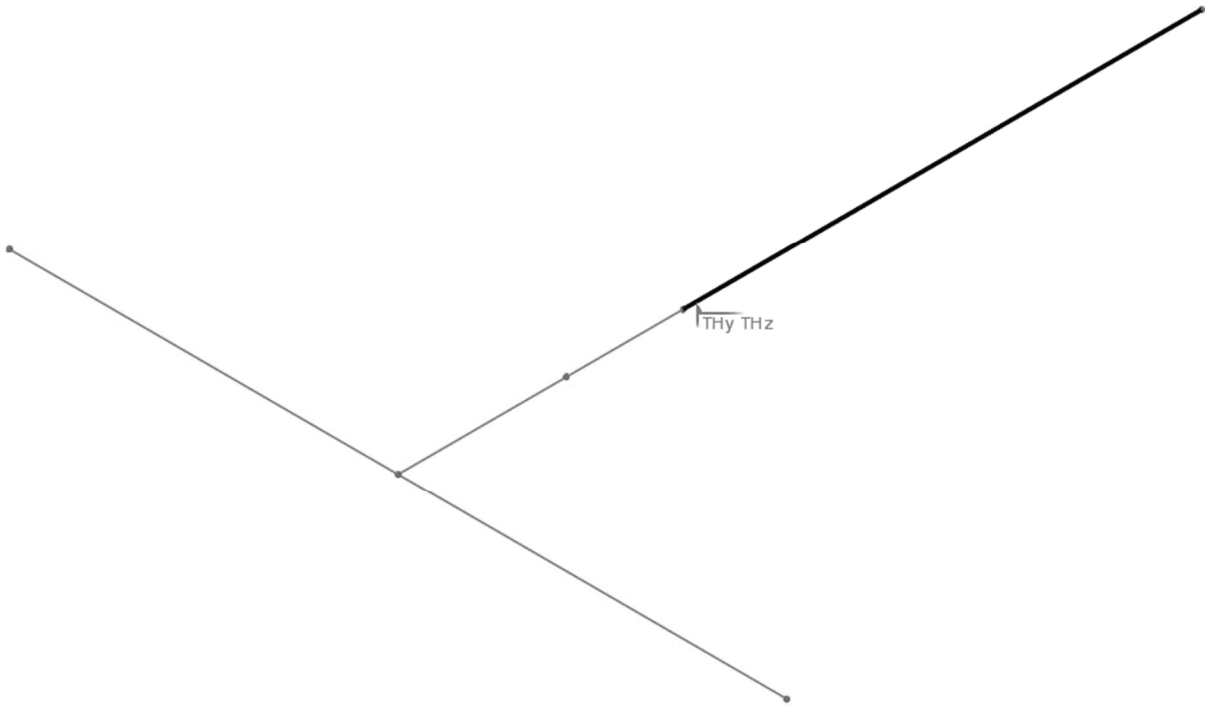


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:65
		Date :	Created :

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



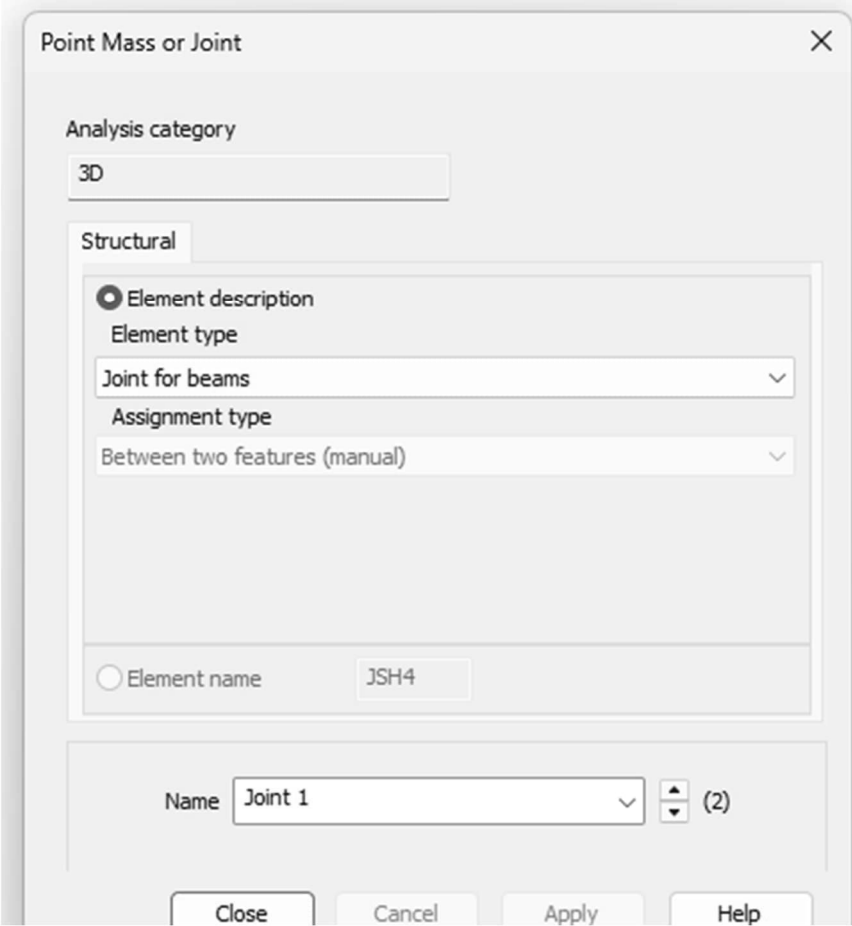
Link slab – support 4 (Element 4R:ML):



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:66
		Date :	Created :

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.

Freedom

U, V, W: at nodes 1 and 2 (active nodes).

Node Coordinates

X, Y, Z: at each node.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:67
		Date :	Created :

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, θ_x , θ_y , θ_z : 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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:68
		Date :	Created :

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

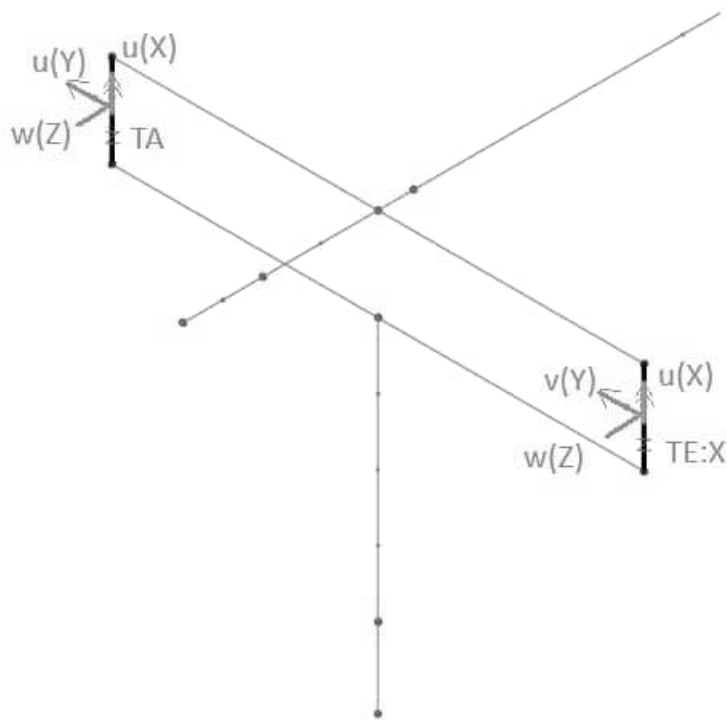
Cancel

Apply

Help

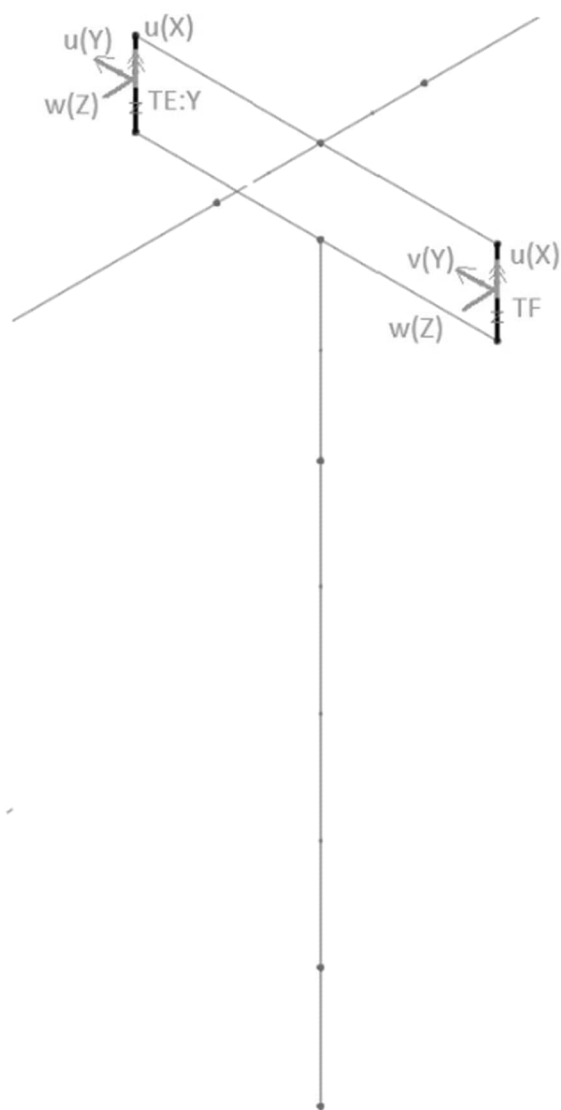
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:69
		Date :	Created :

Joints support 1 :



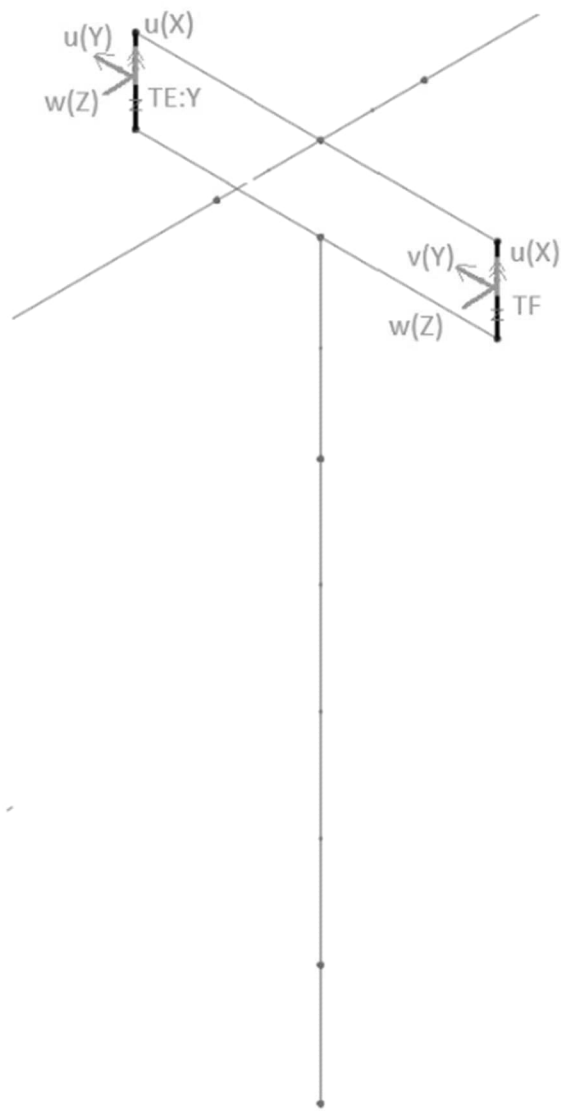
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:70
		Date :	Created :

Joints support 2.:



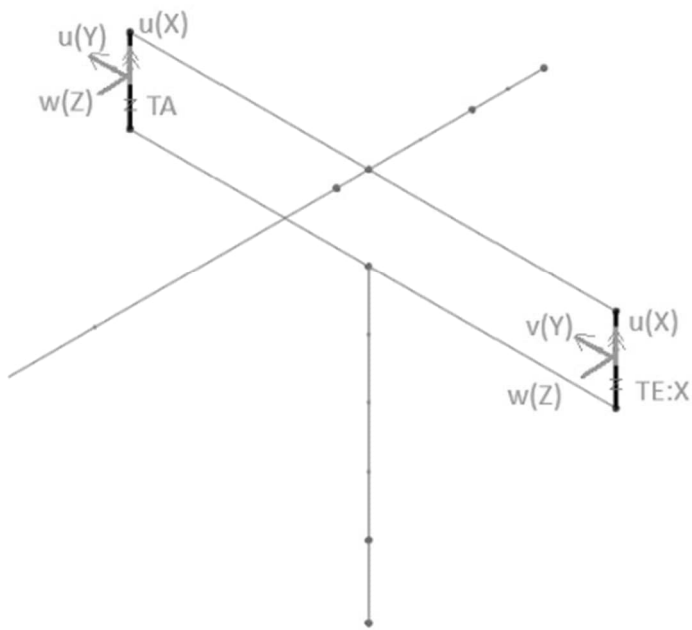
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:71
		Date :	Created :

Joints support 3.:



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:72
		Date :	Created :

Joints support 4 :

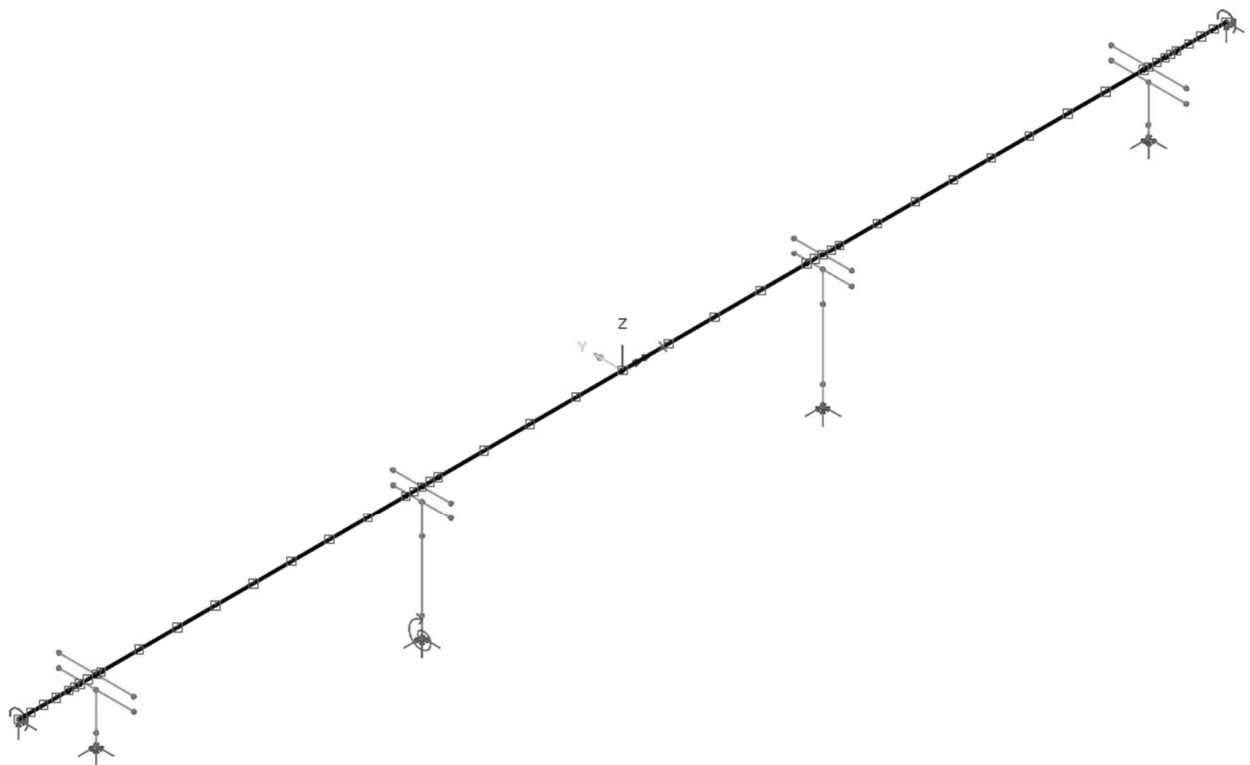


	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A2:73
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:1
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:2
		Date :	Created :

3.1 DEAD WEIGHT

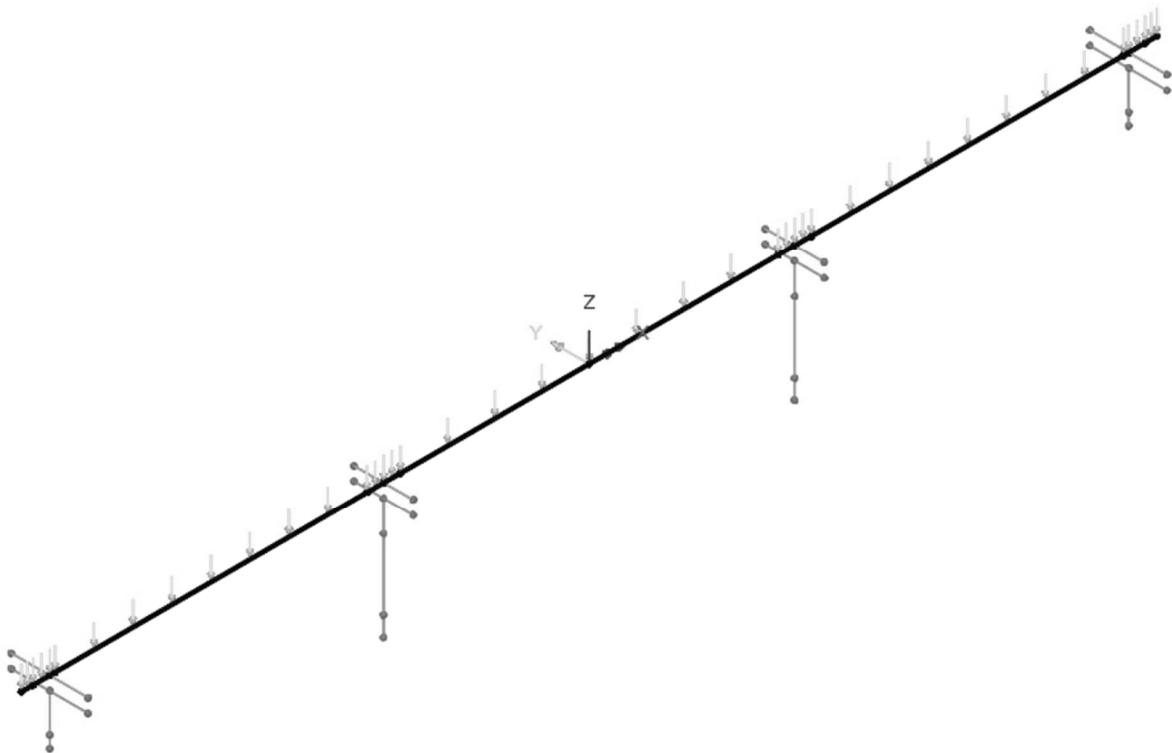
$\gamma_c = 25 \cdot \frac{kN}{m^3}$
: concrete

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

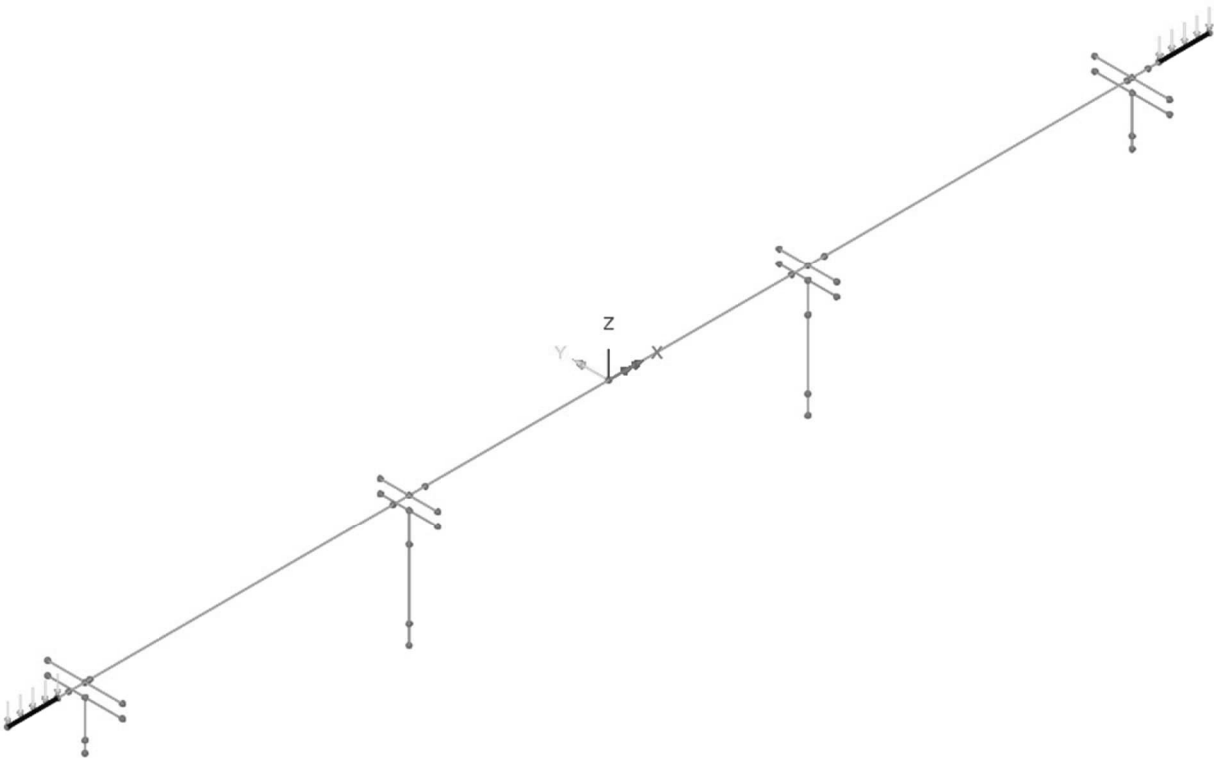
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:3
		Date :	Created :

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

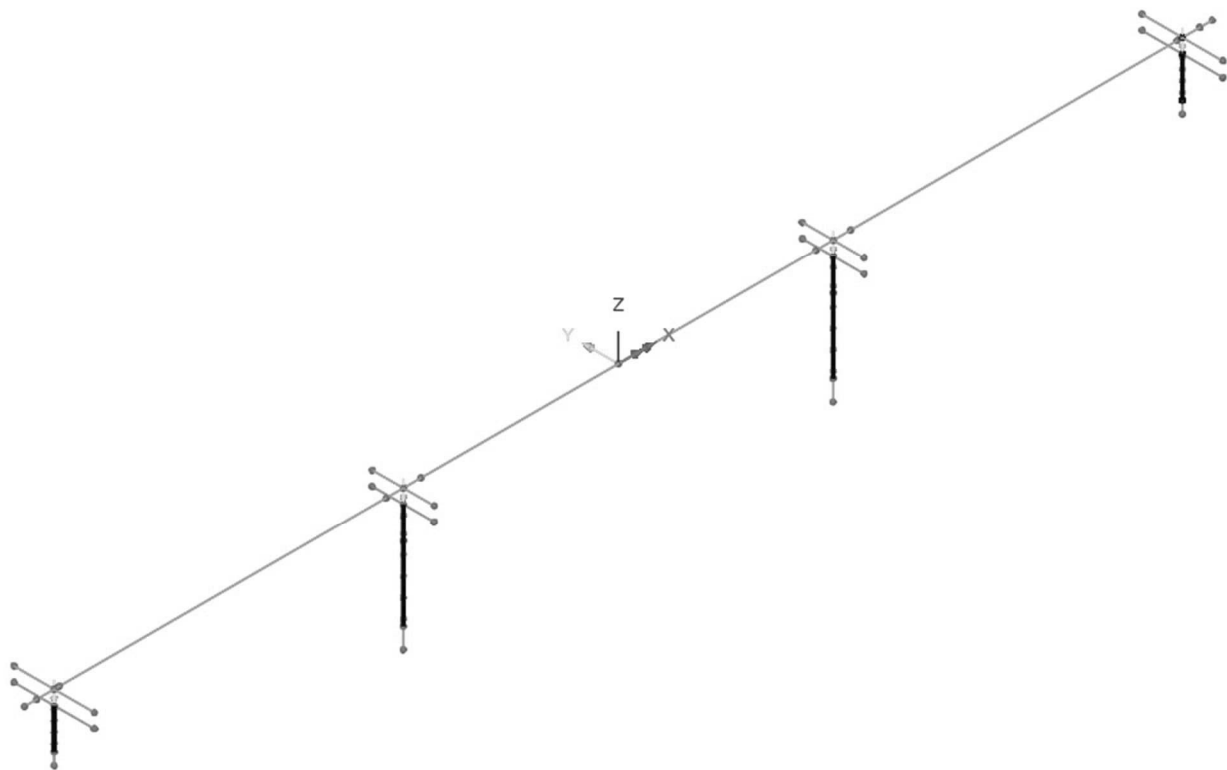
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:4
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:5
		Date :	Created :

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.

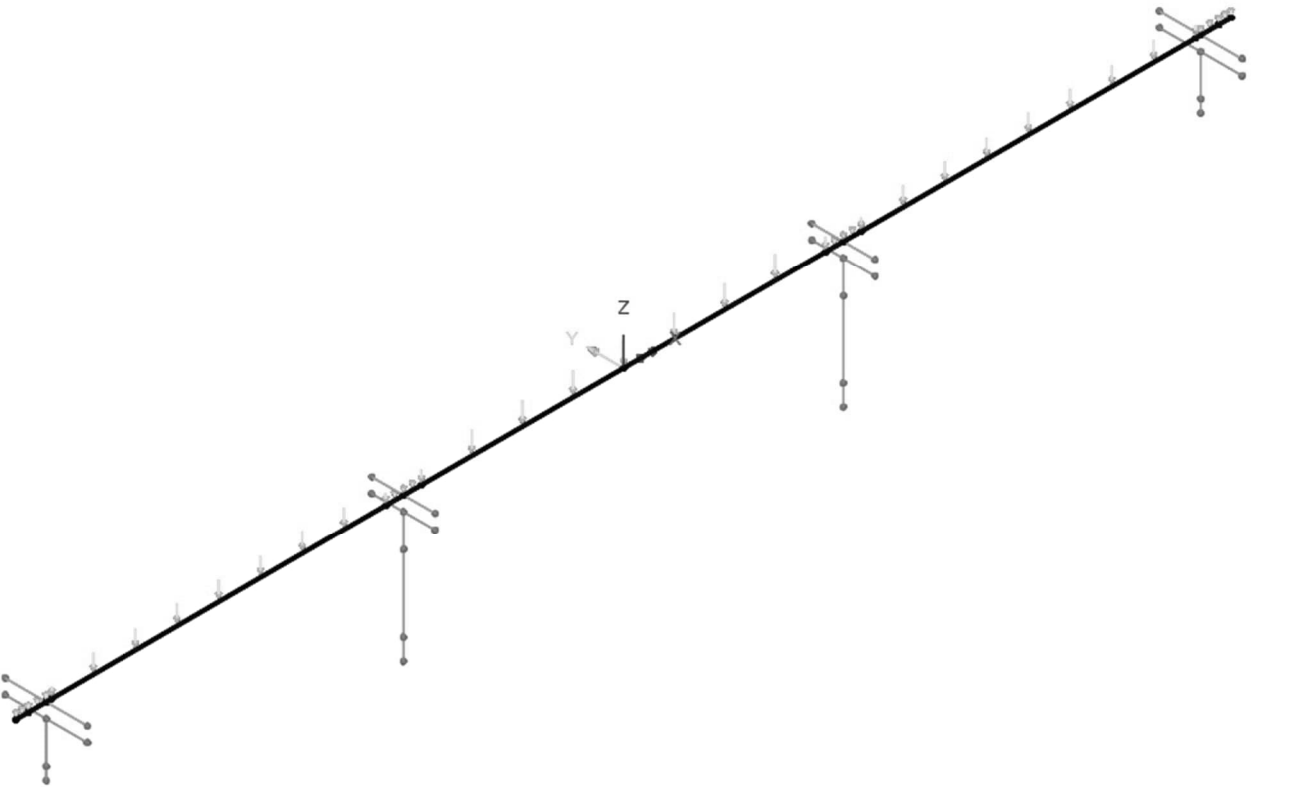
$p_{r\ddot{a}cke} = 0.7 \frac{kN}{m}$
: weight railing

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

Load (loadcase) : EGEN 4

Structural loading : Global distributed

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

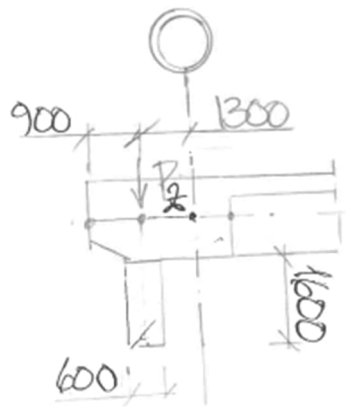


Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:6
		Date :	Created :

3.1.5
End-shield

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

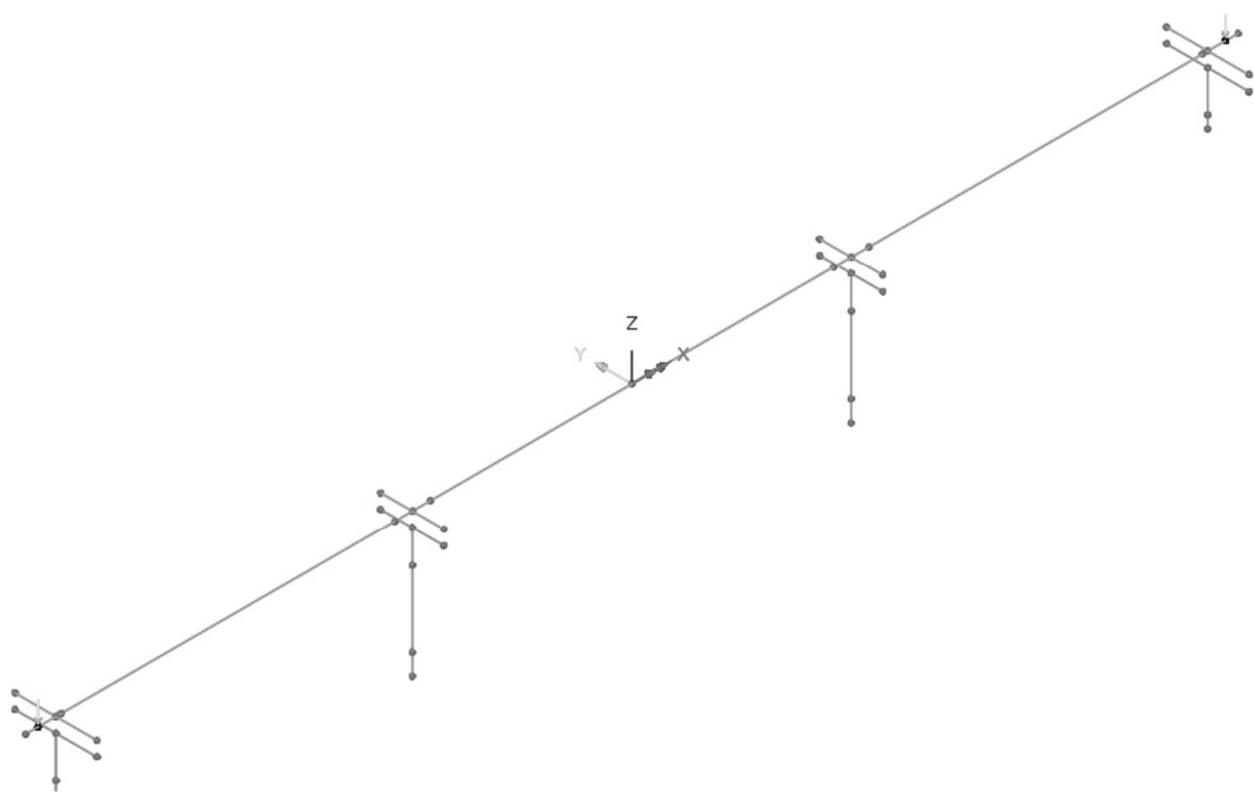


$$p_z = 0.60m \cdot 1.60m \cdot 25 \frac{kN}{m^3} = -24 \frac{kN}{m} \rightarrow P_z = B \cdot p_z = -8.0m \cdot 24 \frac{kN}{m} = -192kN$$

Load (loadcase) : EGEN 5

Structural loading : Concentrated

Concentrated load in Z (P_z) : -192 kN

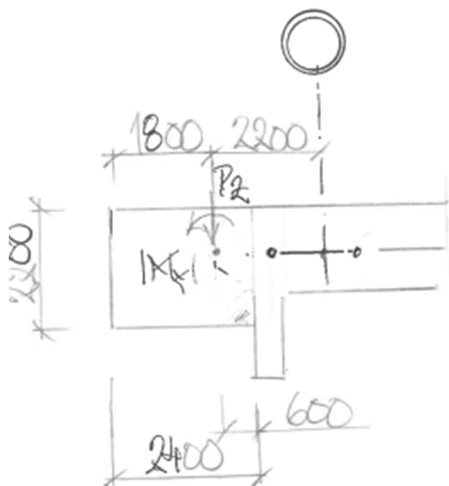


Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:7
		Date :	Created :

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

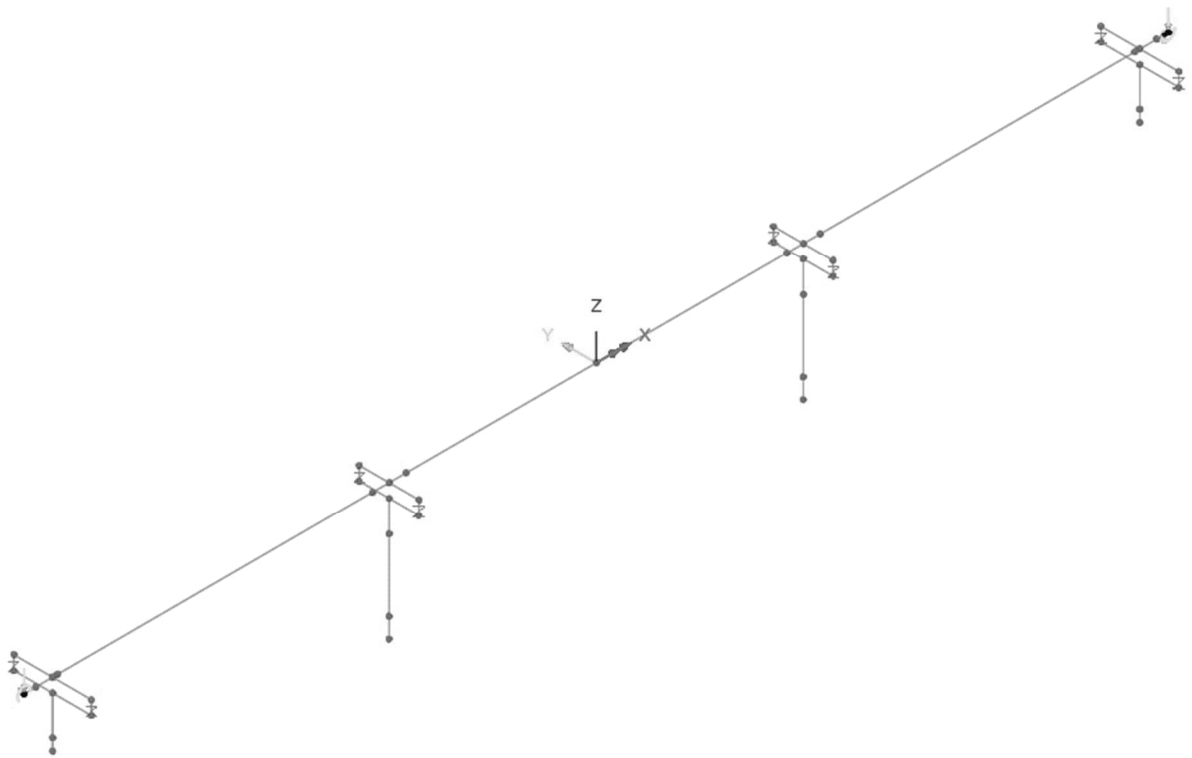
Moment about Y-axis (M_z) : +64 kNm

Loadcase : EGEN 6

Load: EGEN 6:V

Load: EGEN 6:H

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:8
		Date :	Created :



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:9
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:10
		Date :	Created :

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

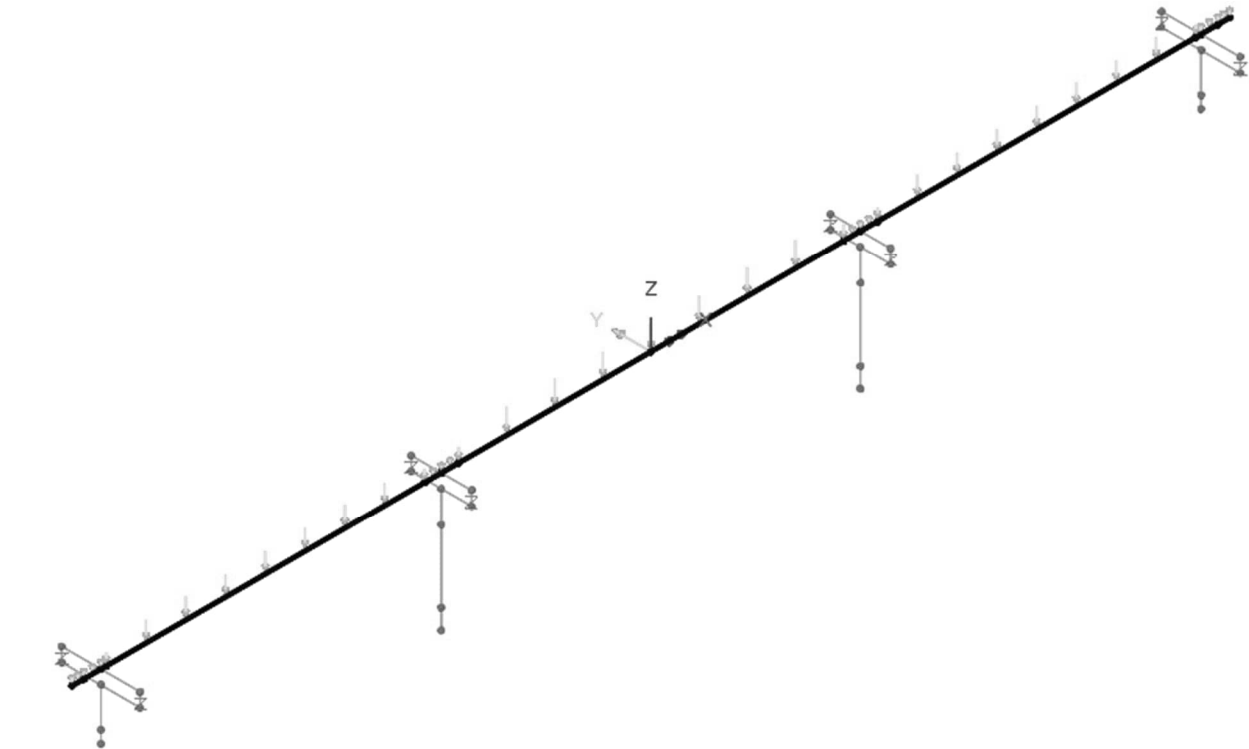
$q_{belägg} = \gamma_{beläggning} \cdot t + q_{matta} = 23 \frac{kN}{m^3} \cdot 0.09m + 0.11kPa = 2.2kPa$

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

Load (loadcase) : BELAGG.1

Structural loading : Global distributed

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



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:11
		Date :	Created :

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).

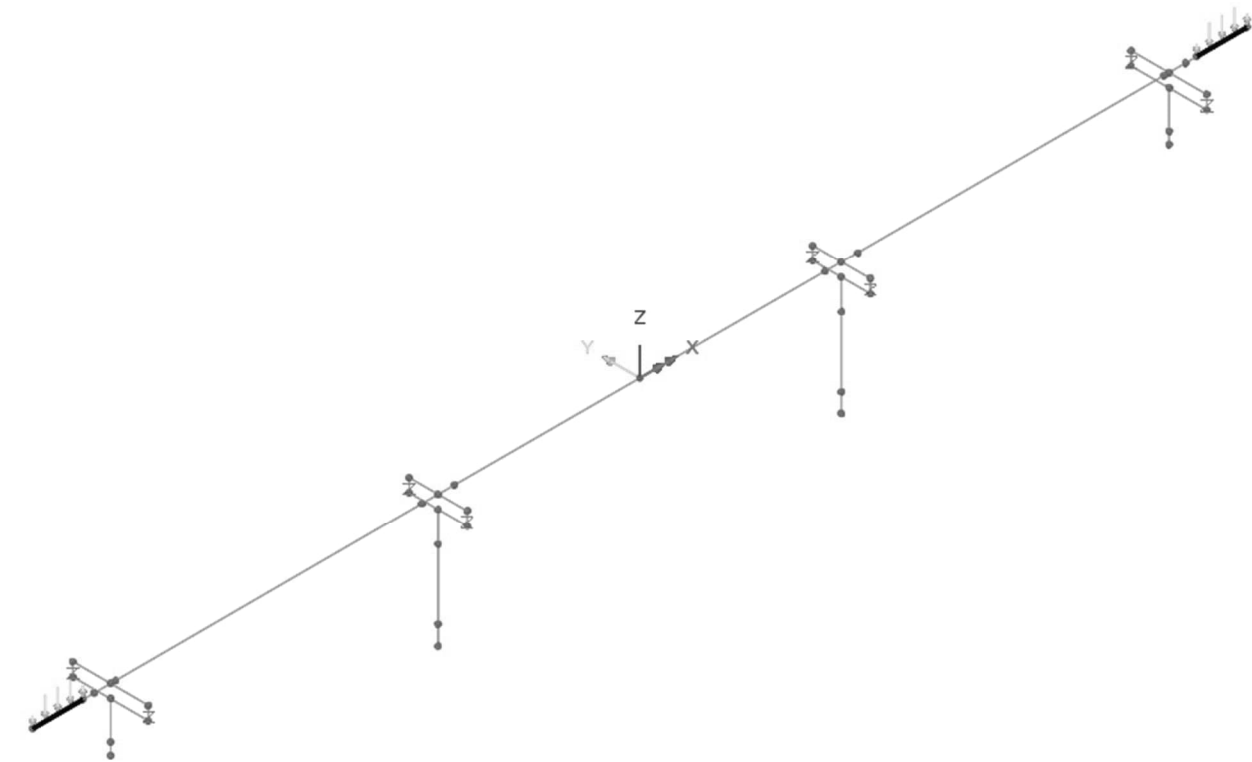
$$q_{bel\ddot{a}gg} = 2.2kPa + 22\frac{kN}{m^3} \cdot 0.25m = 8.0kPa$$

$$\rightarrow p_z = B \cdot q_{bel\ddot{a}gg} = 8.0m \cdot 8.0kPa = -64\frac{kN}{m}$$

Loadcase : *BELAGG 2*

Structural loading : Global distributed

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



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:12
		Date :	Created :

3.2.3 Load combination surfacing: BELAGG

Basic load combination BELAGG :

Loadcase	Factor
BELAGG 1	1.00
BELAGG 2	1.00

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:13
		Date :	Created :

3.3 EARTH PRESSURE

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

$$\varphi_k = 45^\circ$$

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

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

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

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.

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

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

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

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

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

Earth pressure for design method 3 (D3):

Design coefficients associated to $A1(\text{design loads}) + A2(\text{geotechnical loads}) + M2 + R3$ according to SS-EN 1997-1 section 2.4.7.3.4.4 is applied.

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

$$\rightarrow \varphi_d = \arctan\left(\frac{\tan\varphi_k}{\gamma_m}\right) = \arctan\left(\frac{\tan 45^\circ}{1.3}\right) = 38^\circ$$

Remark

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:14
		Date :	Created :

Earth pressure in FEM-analysis:

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

$$K_0 = 0.29$$

$$K_a = 0.17$$

$$K_p = 5.82$$

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:16
		Date :	Created :

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

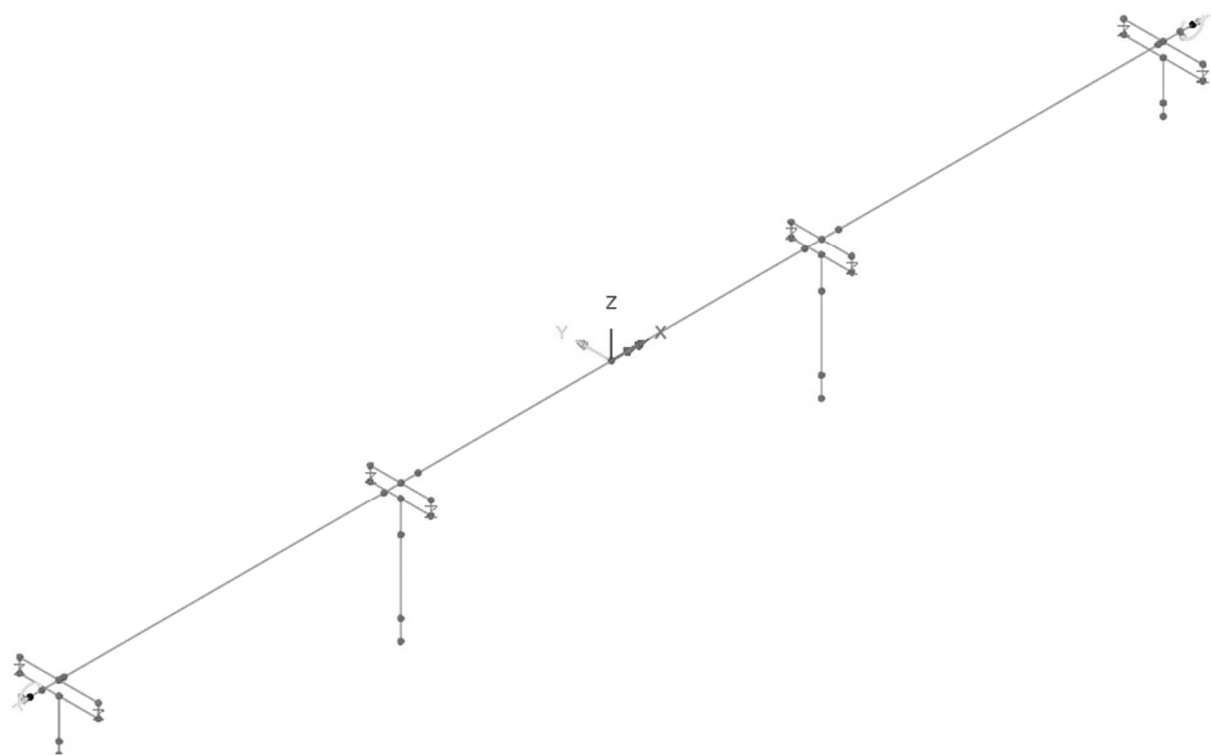
Concentrated load in X (P_x) : -236kN

Moment about Y axis (M_y) : +303 kNm

Loadcase : JORD 1

Load: JORD 1:V

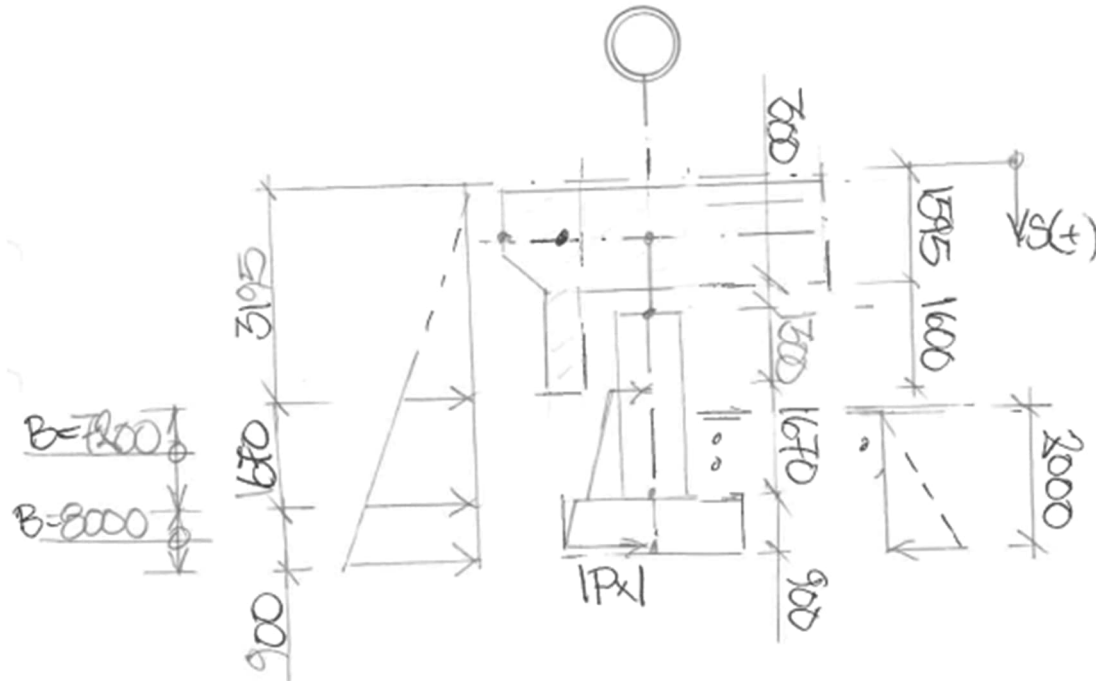
Load: JORD 1:H



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:17
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:18
		Date :	Created :

Load : JORD21: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	202.0	1.67	137.0
2				

Name

JORD 21:V

▼

▲▼

(12)

Load : JORD 22: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	264.0	0.9	224.0
2				

Name

JORD 22:V

▼

▲▼

(13)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:19
		Date :	Created :

Load : JORD21: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	-202.0	1.67	-137.0
2				

Name

JORD 21:H

(14)

Load : JORD 22: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	-264.0	0.9	-224.0
2				

Name

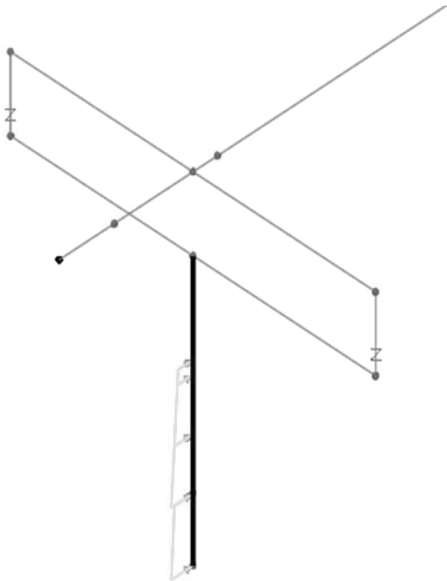
JORD 22:H

(15)

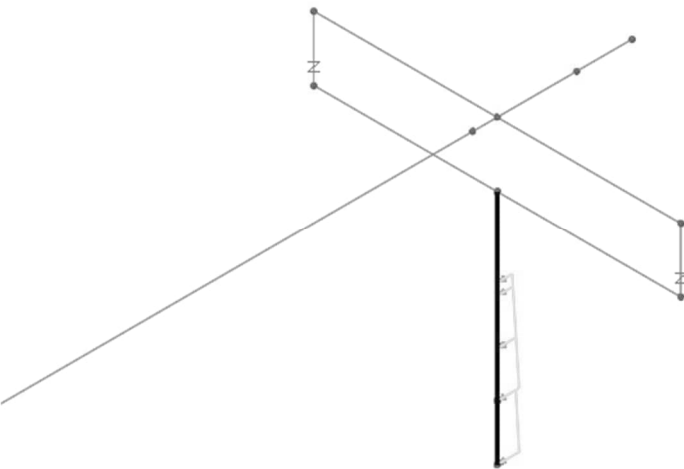
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:20
		Date :	Created :

Loadcase : JORD 2

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



Overview 3D
Abutement 1

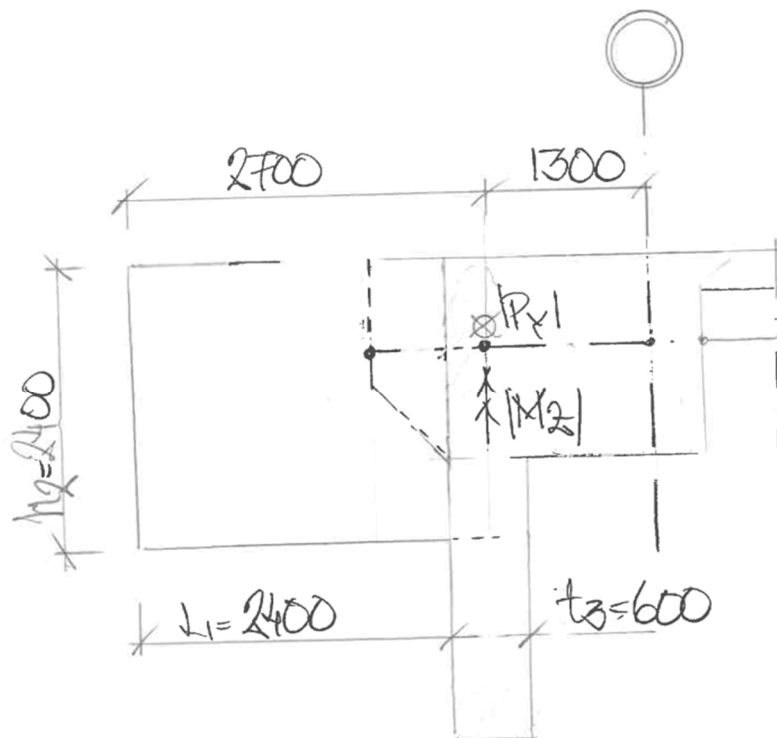


Overview 3D
Abutement 4

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:21
		Date :	Created :

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).



$$t_3 = 0.6m$$

$$h_2 = 2.4m$$

$$h_3 = 2.4m$$

$$h_4 = 0.1m$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:22
		Date :	Created :

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

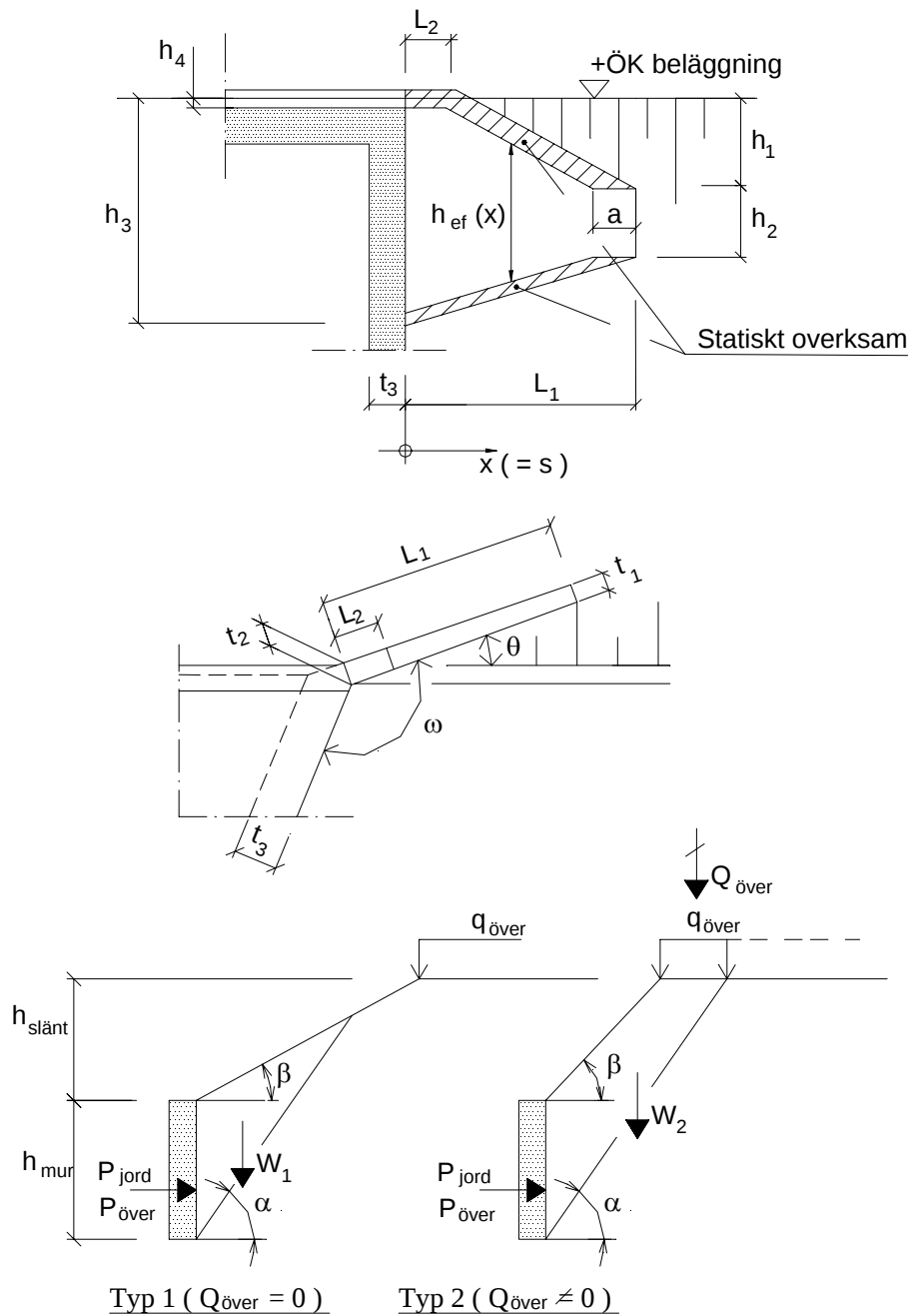
$M_{SLS-Q} = 35 \frac{kNm}{m}$: see page A3:33

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 :**

$L_1 = 2.4\text{m}$

$L_2 = 1\text{m}$

$h_1 = 1\text{m}$

$h_2 = 2.40\text{m}$

$h_3 = 2.401\text{m}$

$h_4 = 0.10\text{m}$

$t_1 = 0.40\text{m}$

$t_2 = 0.40\text{m}$

$t_3 = 0.60\text{m}$

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

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

Avstånd till brytpunkt för effektiv höjd : $a = 1\text{m}$

Material :

Jordmaterial :

$\gamma_{\text{jord}} = 20 \frac{\text{kN}}{\text{m}^3}$

$K_o = 0.29$

$K_a = 0.17$

Betong :

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

Laster :

Överlast :

$q_{\text{över}} = 20\text{kPa}$

Lastkoefficienter :**Jordtryck**

$\psi\gamma_{\text{ULS.1}} = 1.49$

$\psi\gamma_{\text{SLS.1}} = 1.34$

Överlast

$\psi\gamma_{\text{ULS.2}} = 1.71$

$\psi\gamma_{\text{SLS.2}} = 0$

BERÄKNING**Jordtryck enligt Culmans metod :**

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

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

$$\text{Vingmurens höjd : } h_{\text{mur}} = \text{mur}_{\text{ök}} - \text{mur}_{\text{uk}}$$

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

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

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

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

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

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

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

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

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

Vilojordtrycksresultant enligt Culmann under inverkan av jordlast + överlast :

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

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

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

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

Snittkrafter jordtryck + överlast :

$$H'_{j\text{jord}}(x_s) = \int_{x_s}^{L_1} p_{j\text{jord}}(s) ds$$

$$M'_{j\text{jord}}(x_s) = \int_{x_s}^{L_1} (s - x_s) \cdot p_{j\text{jord}}(s) ds$$

$$H'_{\text{över}}(x_s) = \int_{x_s}^{L_1} p_{\text{över}}(s) ds$$

$$M'_{\text{över}}(x_s) = \int_{x_s}^{L_1} (s - x_s) \cdot p_{\text{över}}(s) ds$$

Lastkombinering - Lk ULS och Lk SLS :Snittkraft i frontmur för inspänningssnitt :

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

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

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

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

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 :

$$\Delta h = h_3 - h_2 - h_1$$

$$\Delta h = 0.000 \cdot m$$

Nivå överkant effektiv vingmur :

$$Nivå_{ök} = \text{interp} \left[\left(0 \cdot m \quad L_2 \quad L_1 - a \quad L_1 \right), \left(h_3 - h_4 \quad h_3 - h_4 \quad h_3 - h_1 \quad h_3 - h_1 \right), s \right]$$

Nivå underkant effektiv vingmur :

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

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 :

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

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

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

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

RESULTAT**Mellanresultat**

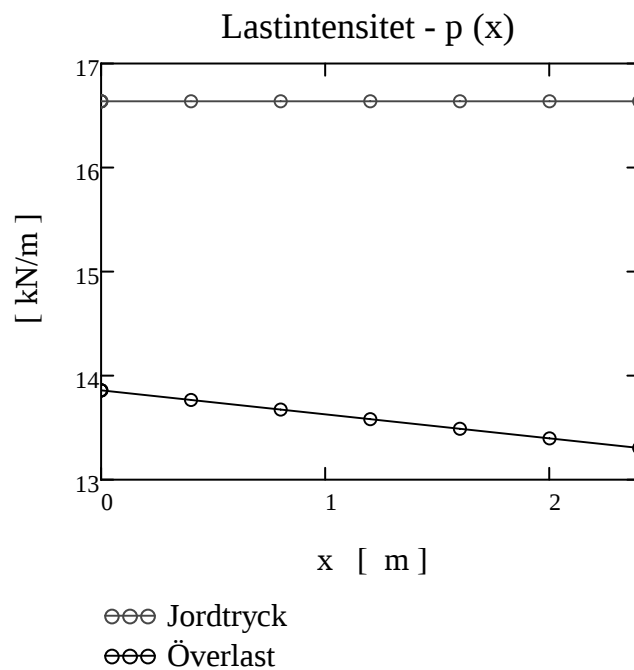
$\varphi = 45^\circ$: Dimensionerande friktionsvinkel tillhörande K_0

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

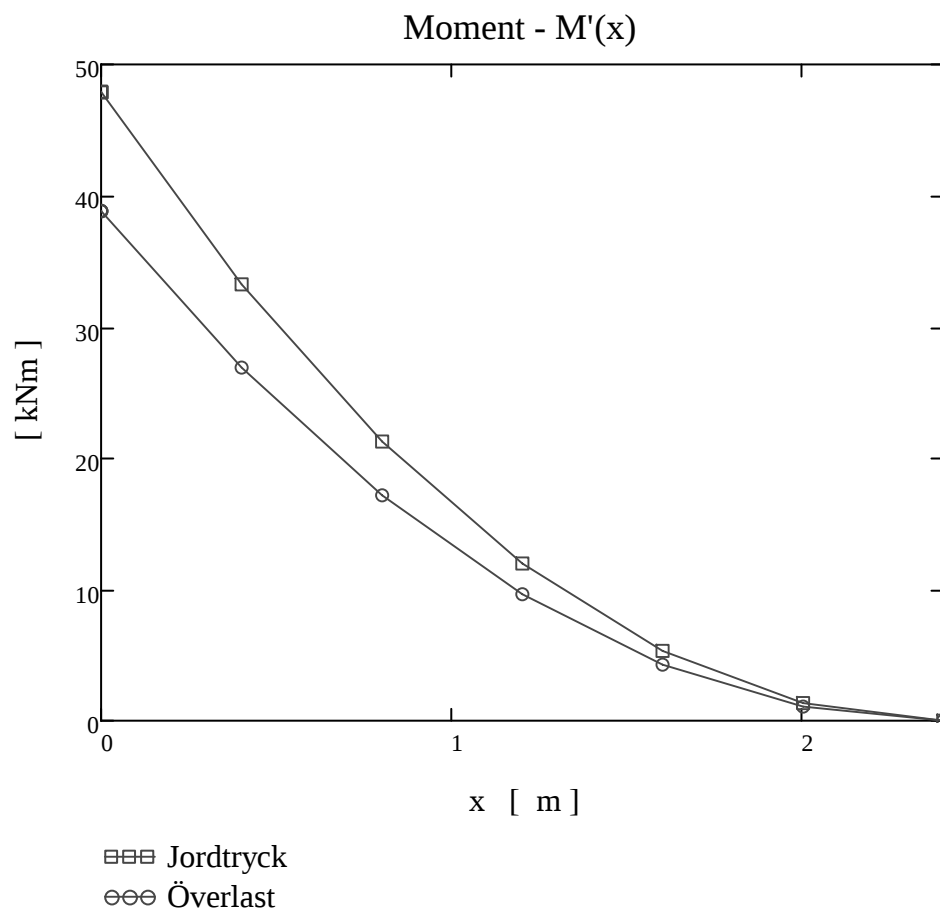
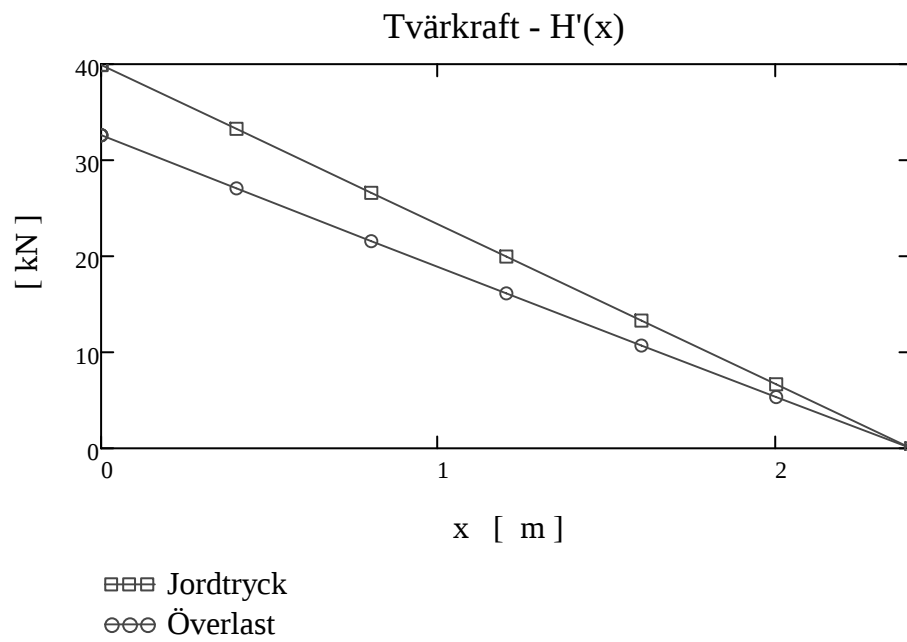
Utvärdering av jordtryck + överlast samt tillhörande farligaste brottvinkel redovisad i tabellform :

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

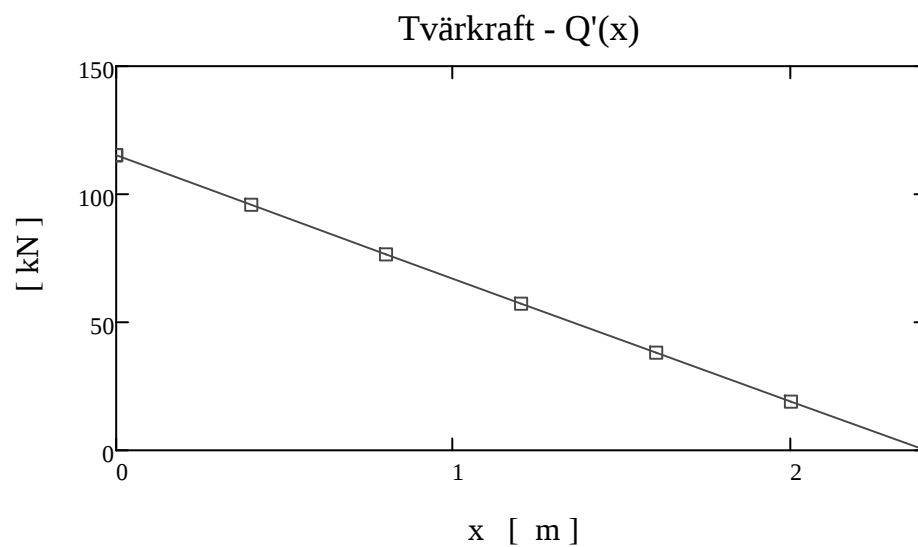
Utvärdering av jordtryck + överlast i diagramform :



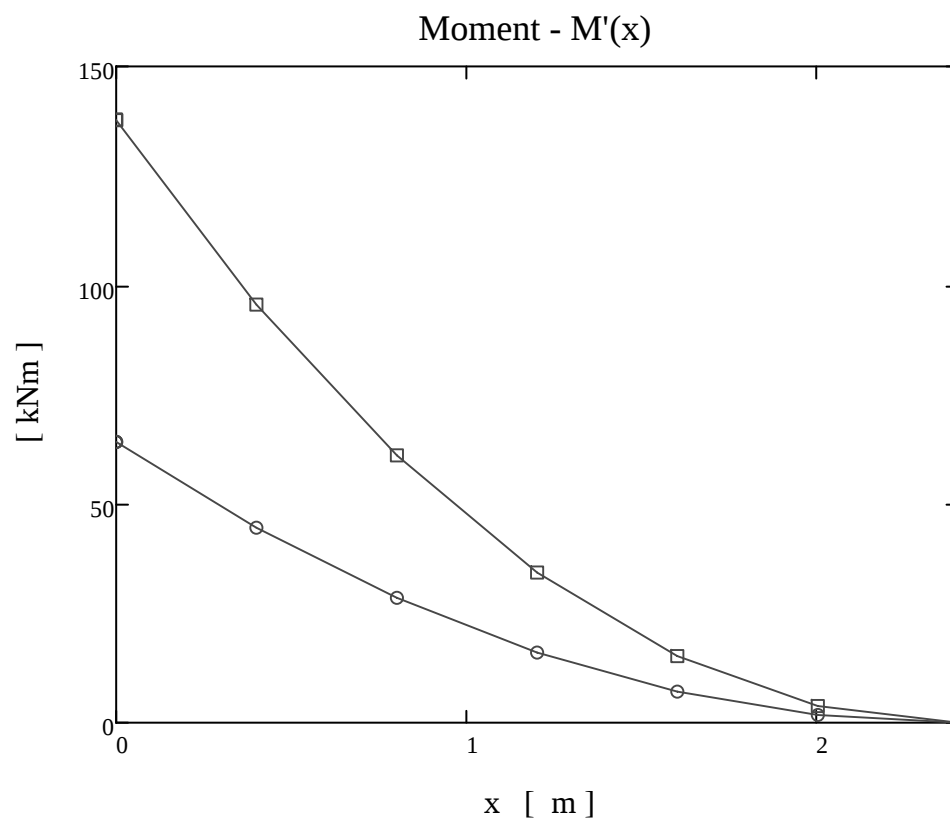
Uvärdering av snittkrafter tillhörande jordtryck + överlast i diagramform :



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



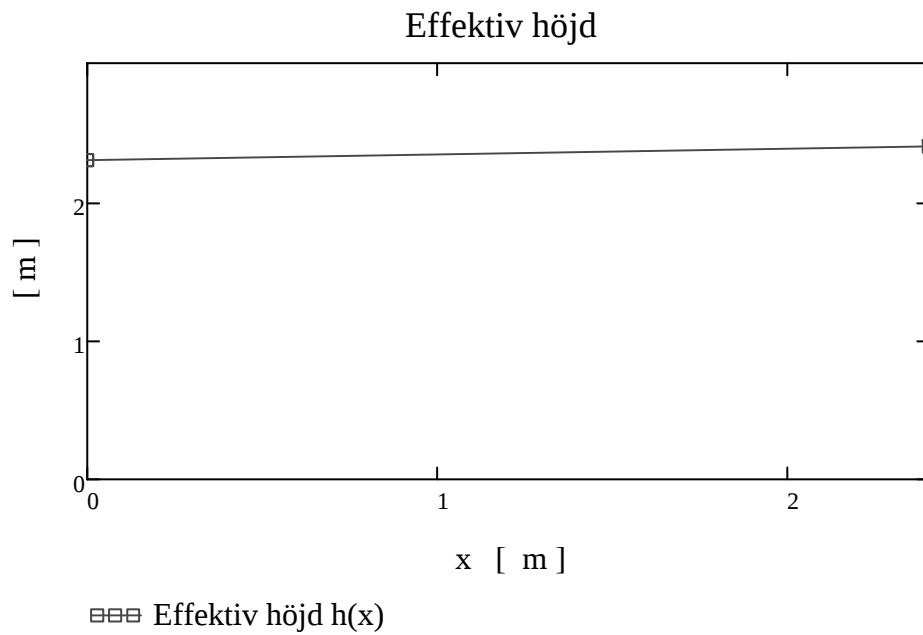
□□□ Lk ULS



□□□ Lk ULS

○●○ Lk SLS

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 :

$$V_{egen} = 58 \cdot kN$$

$$M_{egen} = 69 \cdot kNm$$

$$x_{tp} = \frac{M_{egen}}{V_{egen}}$$

$$x_{tp} = 1.2 \cdot m$$

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

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

$$p_{\text{egen}} = M_{\text{egen}} \cdot \frac{6}{H_{\text{ef}}^2} \cdot \sin(\omega)$$

$$p_{\text{egen}} = 78 \cdot \frac{\text{kN}}{\text{m}}$$

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

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

$$p_{\text{jord}} = 0 \cdot \frac{\text{kN}}{\text{m}}$$

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

$$p_{\text{över}} = 0 \cdot \frac{\text{kN}}{\text{m}}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:34
		Date :	Created :

3.3.4 Summary earth pressure: JORD

Combination of occurring load cases.

Basic loadcombination JORD :

Loadcase	Factor
JORD 1	1
JORD 2	1

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:35
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:36
		Date :	Created :

3.4.1 Vertical settlement

3.4.1.1 Support 1

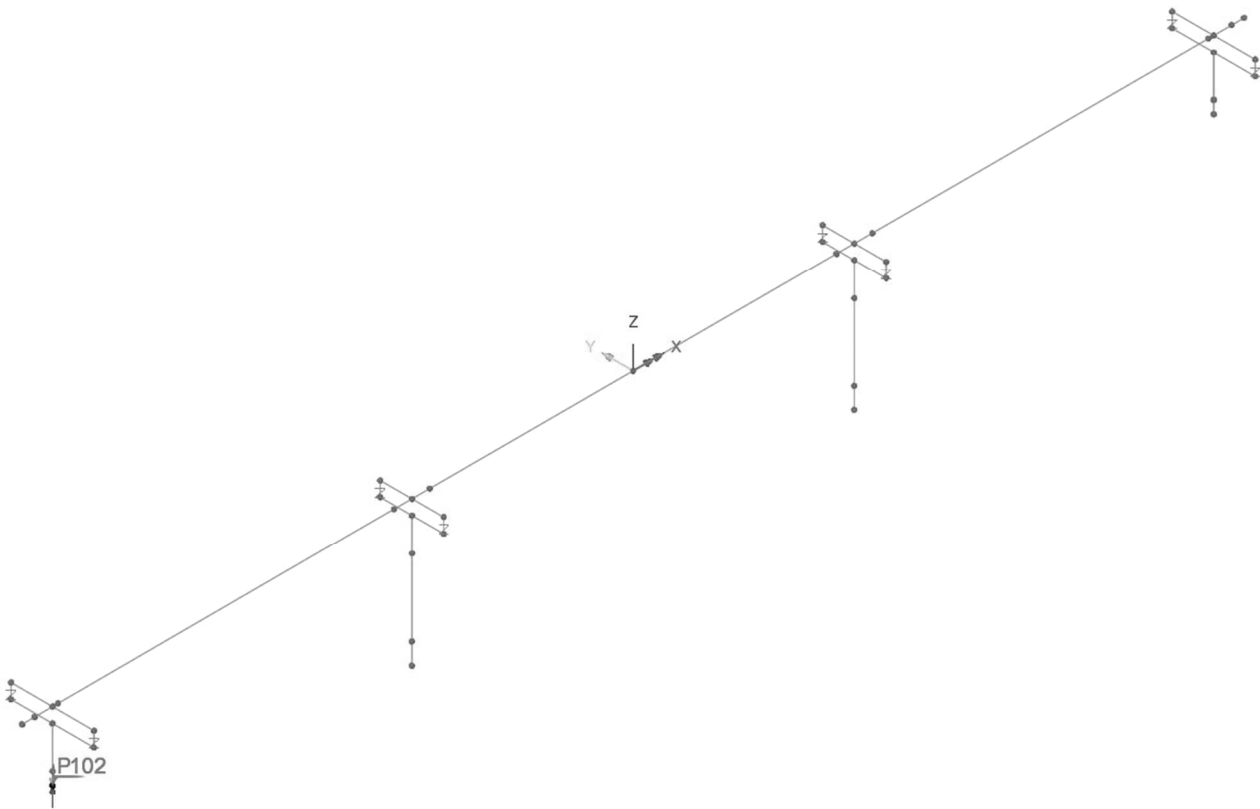
Load (loadcase) : STOD_1Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_1Z

Point : P102



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:37
		Date :	Created :

3.4.1.2 Support 2

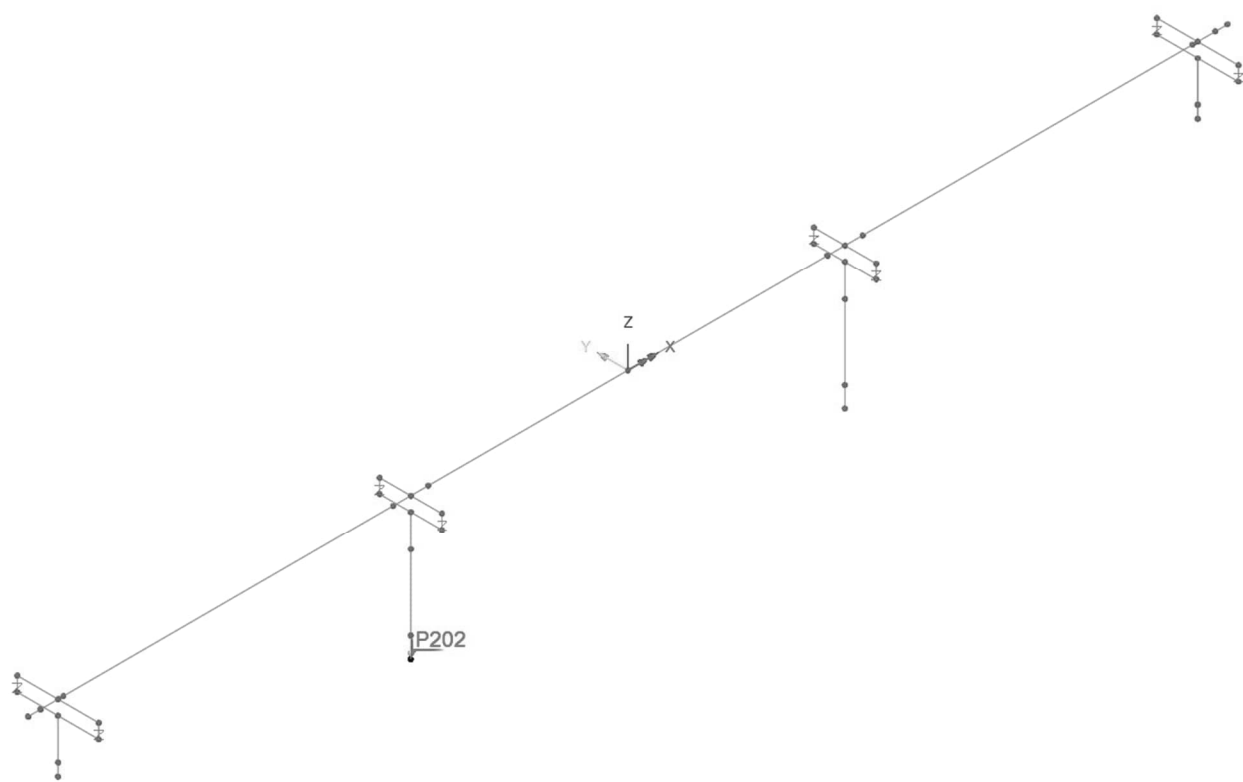
Load: STOD_2Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P202



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:38
		Date :	Created :

3.4.1.3 Support 3

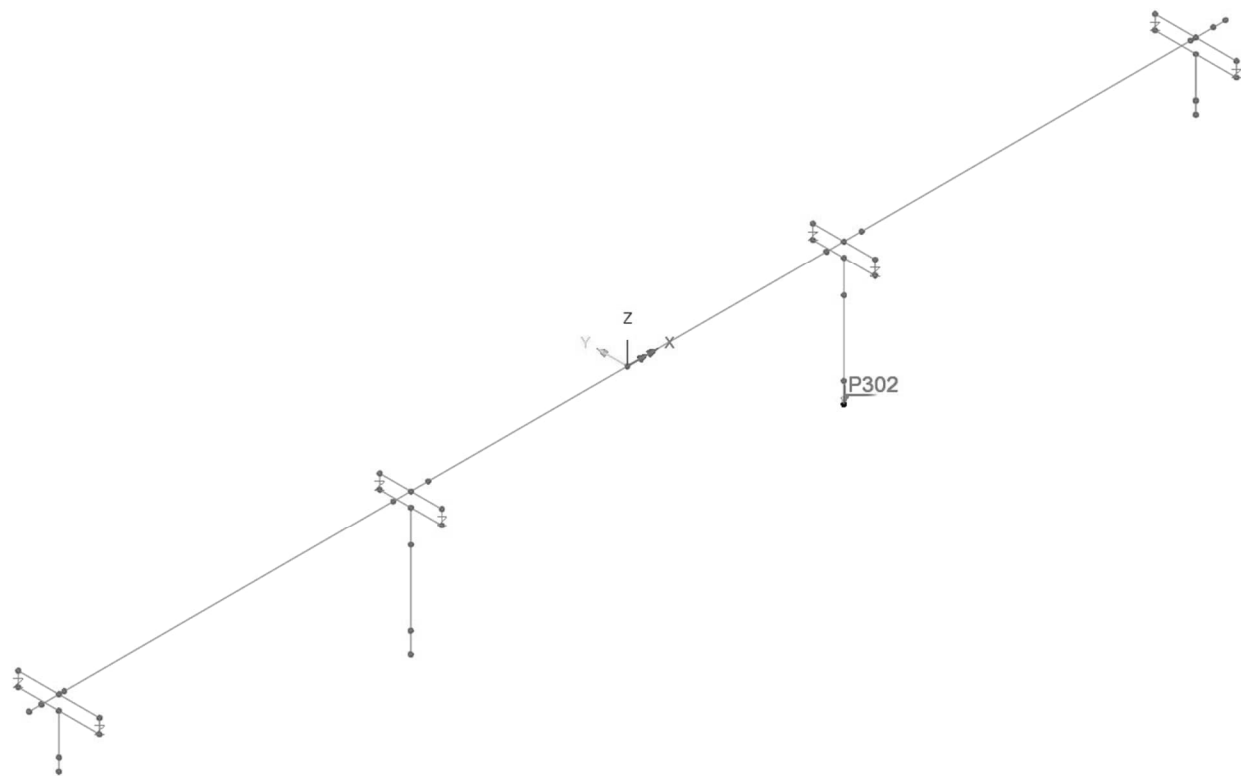
Load: STOD_3Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P302



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:39
		Date :	Created :

3.4.1.4 Support 4

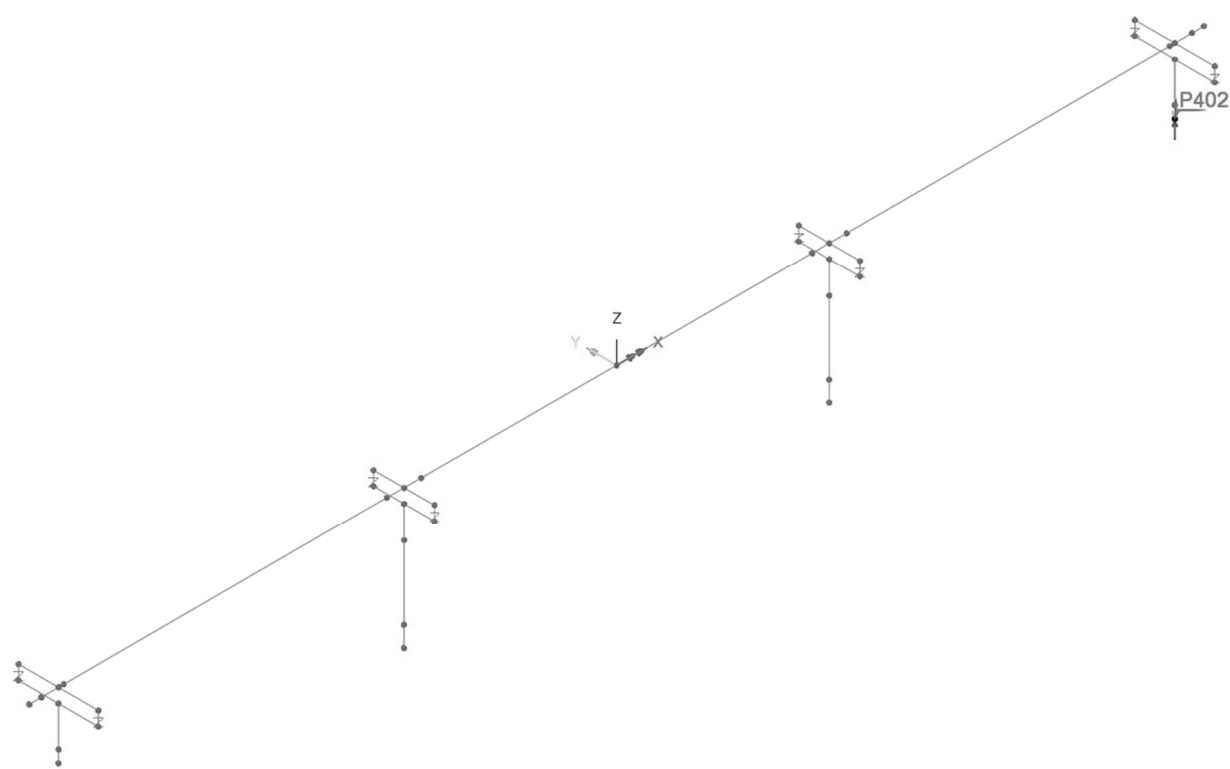
Load: STOD_4Z

Structural loading : Perscribed Displacement

Translation at point in Z direction : -0.015 m

Loadcase : STOD_2Z

Point : P402



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:40
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:41
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:42
		Date :	Created :

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 .

$$t_0 = 5 \text{ days}$$

$$t_1 = 120 \text{ years}$$

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 $t = 1.50 \text{ m} \rightarrow \phi(t_1, t_0) = 1.90$

: 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 ($\therefore$ support settlement, shrinkage and temperature).

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:43
		Date :	Created :

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.

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

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

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

Note:

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 :** $b = \frac{3.0\text{m} + 4.0\text{m}}{2} = 3.5\text{m}$ **Tvärsnittetshöjd :** h = 1.5m**Tvärsnittsarea :** $A_c = b \cdot h = 5.25 \cdot \text{m}^2$ **Omkrets i kontakt med "luft" :** $u = 2 \cdot b = 7\text{m}$ **Bärverkets ekvivalenta tjocklek :** $h_0 = \frac{2 \cdot A_c}{u} = 1.5\text{m}$ **Studerad tidpunkt för bestämning av krypning :** $t_1 = 120\text{år}$ $t_1 = 43800 \cdot \text{dag}$ **Tidpunkt för pålastning (= formrivning):** $t_0 = 5\text{dag}$

Indatakvitto

 $f_{cm} = 43 \cdot \text{MPa}$

BERÄKNING

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

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

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

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

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

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

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

$$\beta_H = \begin{cases} \text{if } f_{cm} \leq 35\text{MPa} \\ \quad \left| \begin{array}{l} \beta_{H,max} \leftarrow 1500 \\ \beta_H \leftarrow \beta_{H,max} \quad \text{if } 1.5 \cdot \left[1 + (0.012 \cdot 100RH)^{18} \right] \cdot \frac{h_0}{\text{mm}} + 250 > \beta_{H,max} \\ \beta_H \leftarrow 1.5 \cdot \left[1 + (0.012 \cdot 100RH)^{18} \right] \cdot \frac{h_0}{\text{mm}} + 250 \quad \text{otherwise} \end{array} \right. \\ \text{if } f_{cm} > 35\text{MPa} \\ \quad \left| \begin{array}{l} \beta_{H,max} \leftarrow 1500 \cdot \alpha_3 \\ \beta_H \leftarrow \beta_{H,max} \quad \text{if } 1.5 \cdot \left[1 + (0.012 \cdot 100RH)^{18} \right] \cdot \frac{h_0}{\text{mm}} + 250 > \beta_{H,max} \\ \beta_H \leftarrow 1.5 \cdot \left[1 + (0.012 \cdot 100RH)^{18} \right] \cdot \frac{h_0}{\text{mm}} + 250 \cdot \alpha_3 \quad \text{otherwise} \end{array} \right. \\ \beta_H \end{cases}$$

$$\beta_H = 1353$$

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

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:47
		Date :	Created :

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.

$$t_s = 0 \text{ days}$$

$$t_1 = 120 \text{ years}$$

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

Superstructure (b = 3.50 m; C35/45):

For $t = 1.50 \text{ m} \rightarrow \varepsilon_{cs}(t_1) = 0.023\%$

: 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 $\therefore T = -25^\circ\text{C}$.

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 :

$$b = \frac{3.0\text{m} + 4.0\text{m}}{2} = 3.5\text{m}$$

Tvärsnitteshöjd :

$$h = 1.5\text{m}$$

Tvärsnittsarea :

$$A_c = b \cdot h = 5.25 \cdot \text{m}^2$$

Omkrets i kontakt med "luft" :

$$u = 2 \cdot b = 7\text{m}$$

Bärverkets ekvivalenta tjocklek :

$$h_0 = \frac{2 \cdot A_c}{u} = 1.5\text{m}$$

Studerad tidpunkt för bestämning av krypning :

$$t_1 = 120\text{år}$$

$$t_1 = 43800 \cdot \text{dag}$$

Tidpunkt för pålastning (= formrivning):

$$t_0 = 5\text{dag}$$

Cementklass (S, N, R) :

Klass = "N"

Betongens ålder då uttorkningskrypning påbörjas :

$$t_s = 0\text{dag}$$

Indatakvitto

$$f_{cm} = 43 \cdot \text{MPa}$$

$$f_{ck} = 35 \cdot \text{MPa}$$

$$f_{ck.kub} = 45 \cdot \text{MPa}$$

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

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

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

Thout

$$RH_0 = 100\cdot\%$$

$$\beta_{RH} = 1.55 \cdot \left[1 - \left(\frac{RH}{RH_0} \right)^3 \right] = 0.76$$

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

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

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

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

$$\epsilon_{cd} = \beta_{ds} \cdot k_h \cdot \epsilon_{cd,0} = 0.017\cdot\%$$

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

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

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

$$\epsilon_{\text{ca},\alpha} = 2.5 \cdot \left(\frac{f_{\text{ck}}}{\text{MPa}} - 10 \right) \cdot 10^{-6} = 0.006 \cdot \%$$

$$\epsilon_{\text{ca}} = \beta_{\text{as}} \cdot \epsilon_{\text{ca},\alpha} = 0.006 \cdot \%$$

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:51
		Date :	Created :

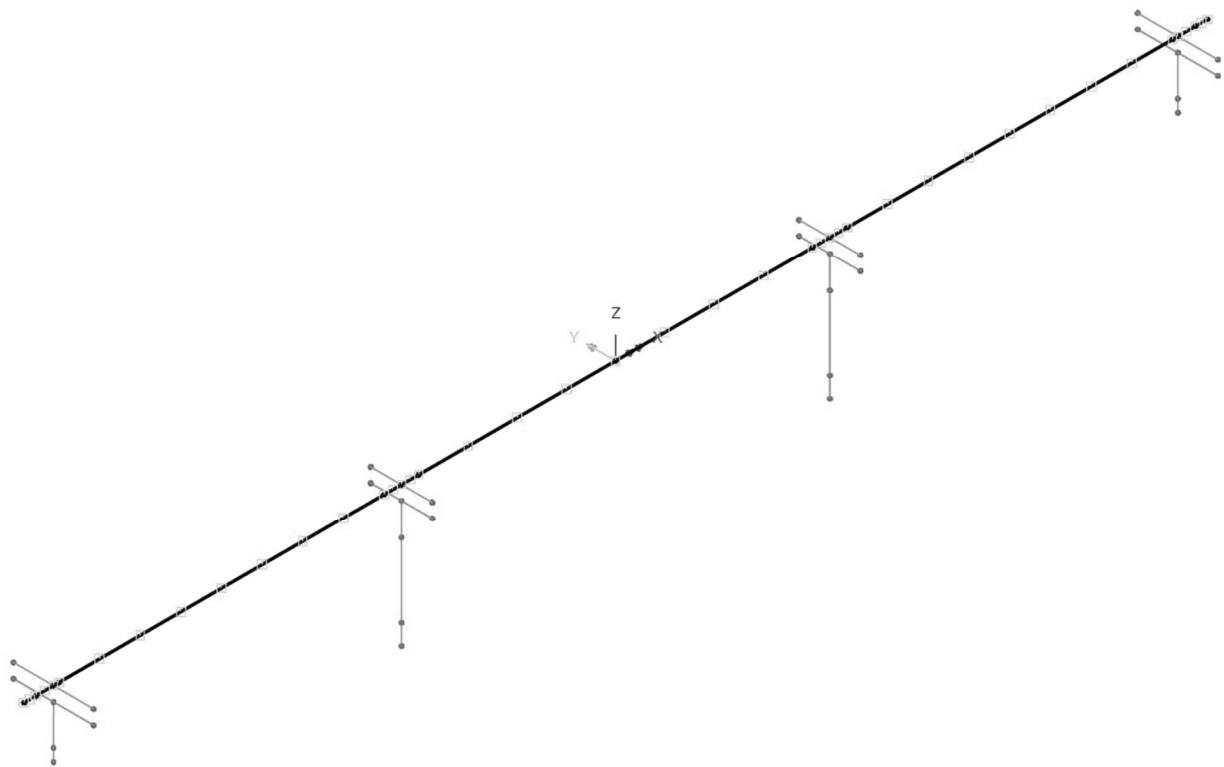
Loadcase : KRYMP

Structural loading : Temperature

Definition : Element

Initial temperature : 0 °C

Final temperature : -25 °C



Overview 3D

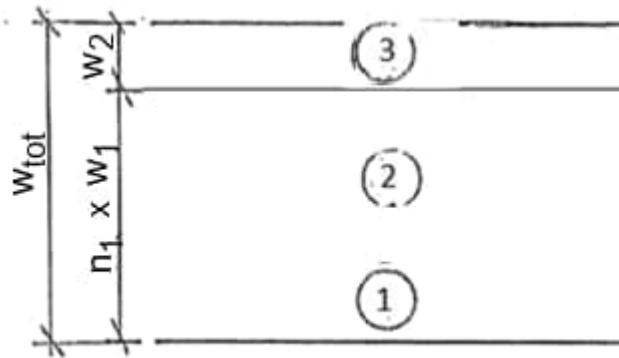
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:52
		Date :	Created :

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 : $w_{tot} = 8.0 \text{ m}$

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

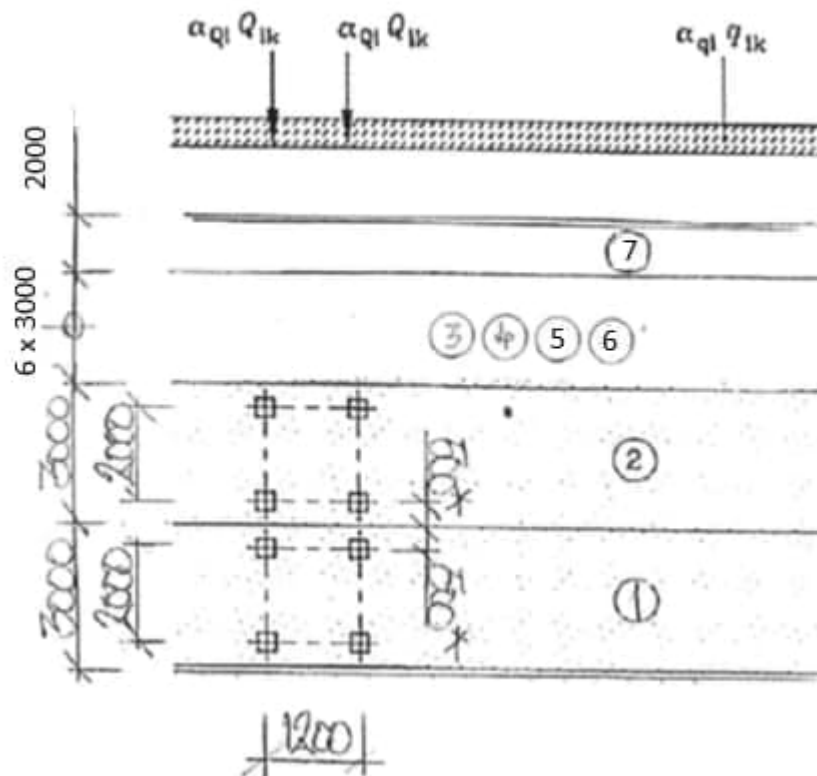
Full traffic width : $w_1 = 3.0\text{m}$

Remaining width : $w_2 = 2.0\text{m}$

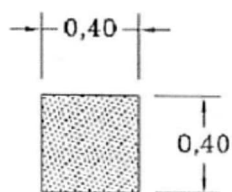
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:53
		Date :	Created :

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.



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:54
		Date :	Created :

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

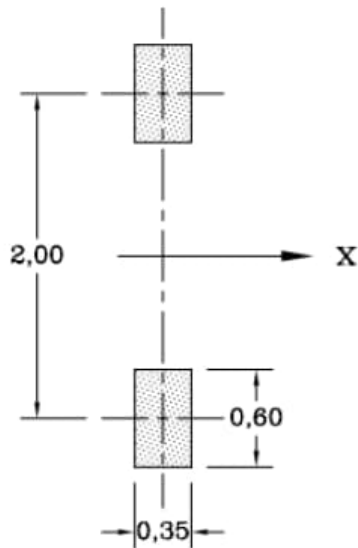
Remark

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:55
		Date :	Created :

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

$Q_k = 400 \text{ kN}$: characteristic value

$Q'_k = \beta_k \cdot Q_k = 360 \text{ kN}$: 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.

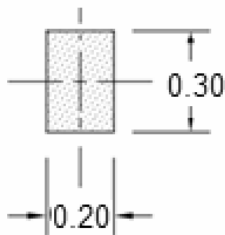
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:56
		Date :	Created :

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

$\varepsilon_{\text{dyn}} = 25 \%$: dynamic factor ^{1.)}

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

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

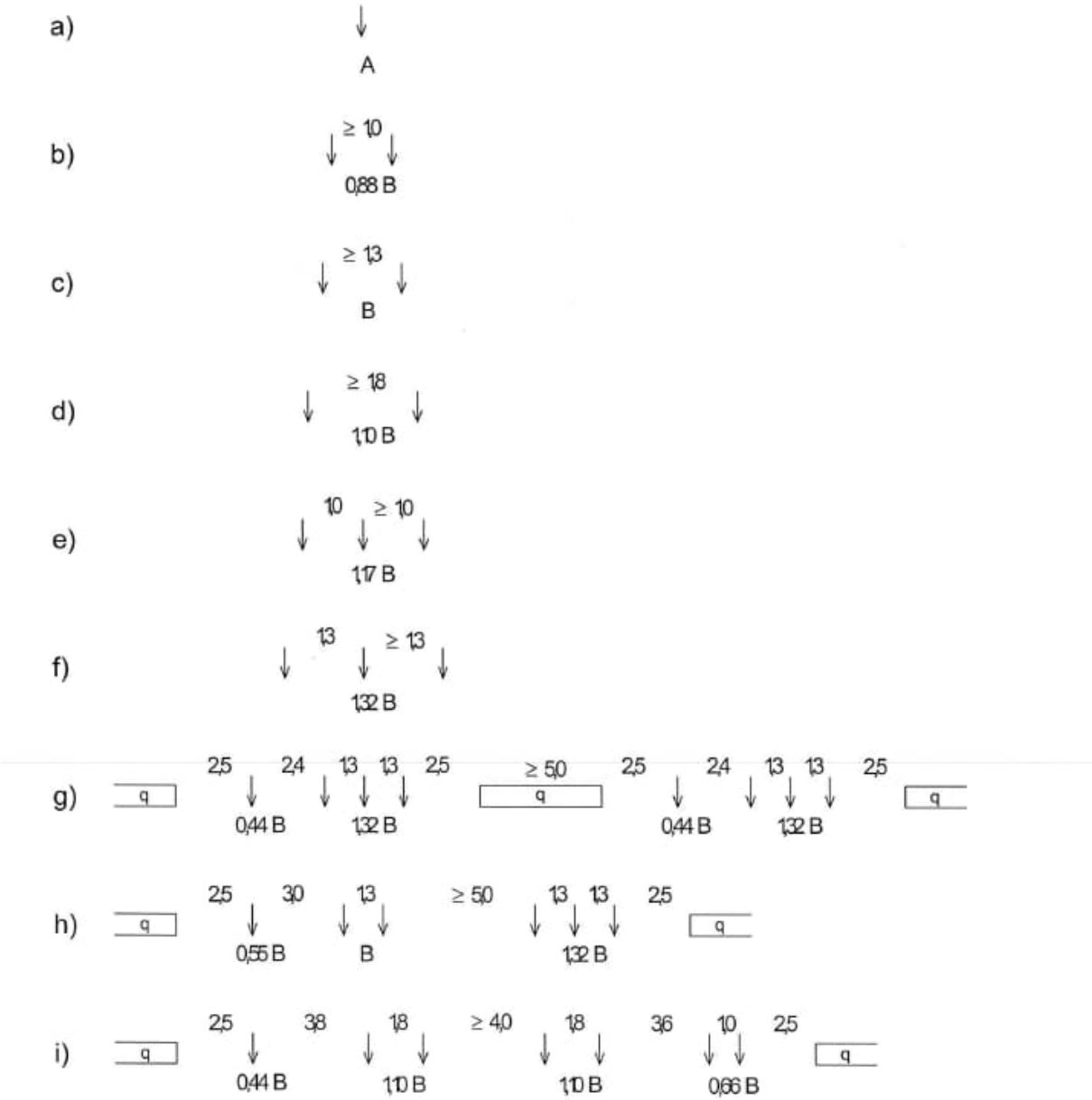
$p = 5 \frac{\text{kN}}{\text{m}}$: surface load

Footnote:

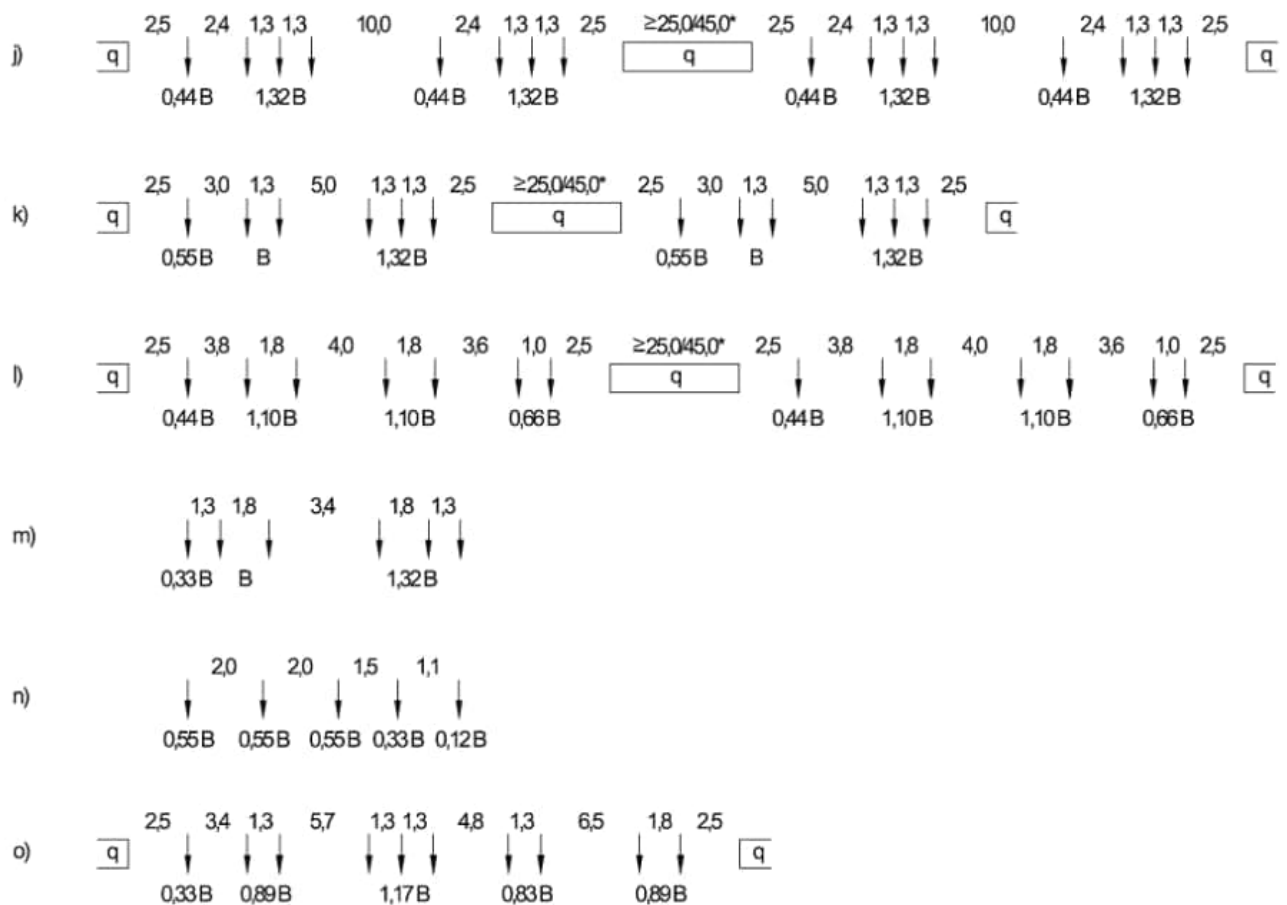
^{1.)} TRVINFRA-00227 table 7.1-5 section 4.2.1(1) states apply 25 % ..

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:57
		Date :	Created :

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



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:58
		Date :	Created :



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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:59
		Date :	Created :

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	<i>Influence Envelope</i>
Inf2 - Reaction	FX, FY, FZ, MX, MY	Reaction	<i>Influence Envelope</i>
Inf3 - Bearing	Fx	3D Joint	<i>Direct Influence</i>
Inf4 - Bearing	Fy	3D Joint	<i>Direct Influence</i>
Inf5 - Bearing	Fz	3D Joint	<i>Direct Influence</i>

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:60
		Date :	Created :

Inf1 – Beam :

Direct Method Influence Envelope

EntityForce/Moment - Thick 3D Beam

DirectionElement local0.0

Standard

Fx

Fy

Fz

Mx

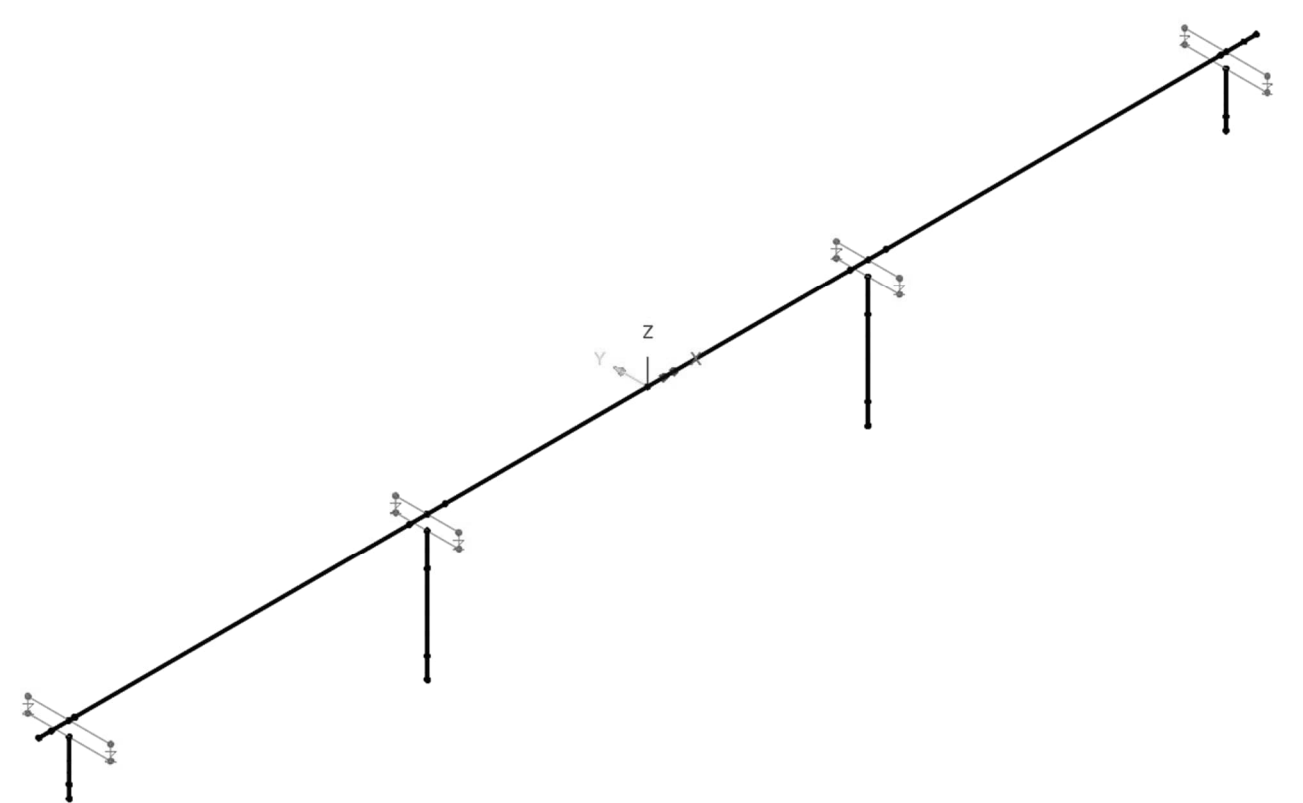
My

Mz

Include coincident effects

NameInf1 - Beam

(2)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:61
		Date :	Created :

Inf2 – Reactions :

Direct Method Influence Envelope

Entity
Reaction

Direction
Nodal 0.0

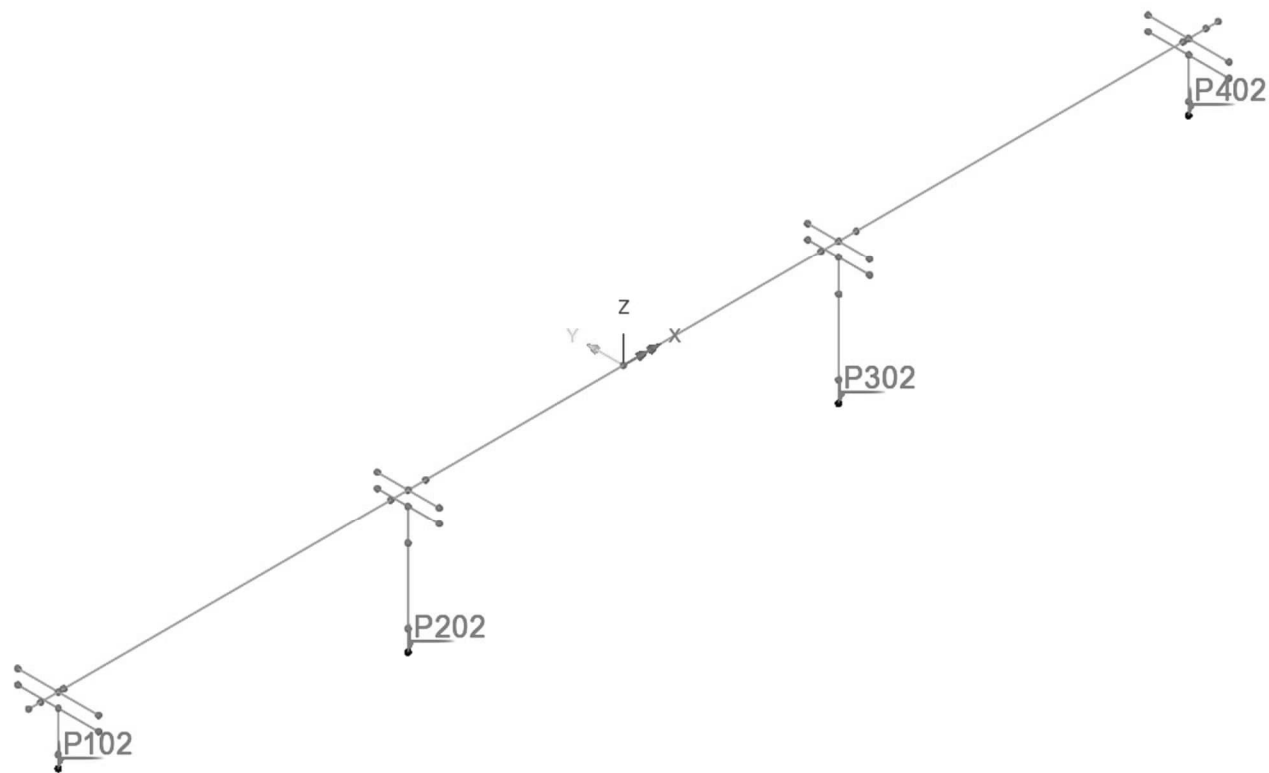
☒ Standard

☒ FX
☒ FY
☒ FZ
☒ MX
☒ MY
☐ MZ

☒ Include coincident effects

Name
Inf2 - Reactions

(1)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:62
		Date :	Created :

Inf3 – Bearing (Fx):

Direct Method Influence ✕

Entity

Force/Moment - 3D Joint (JSH4,JL46) ▼

Direction

Element local ▼

0.0

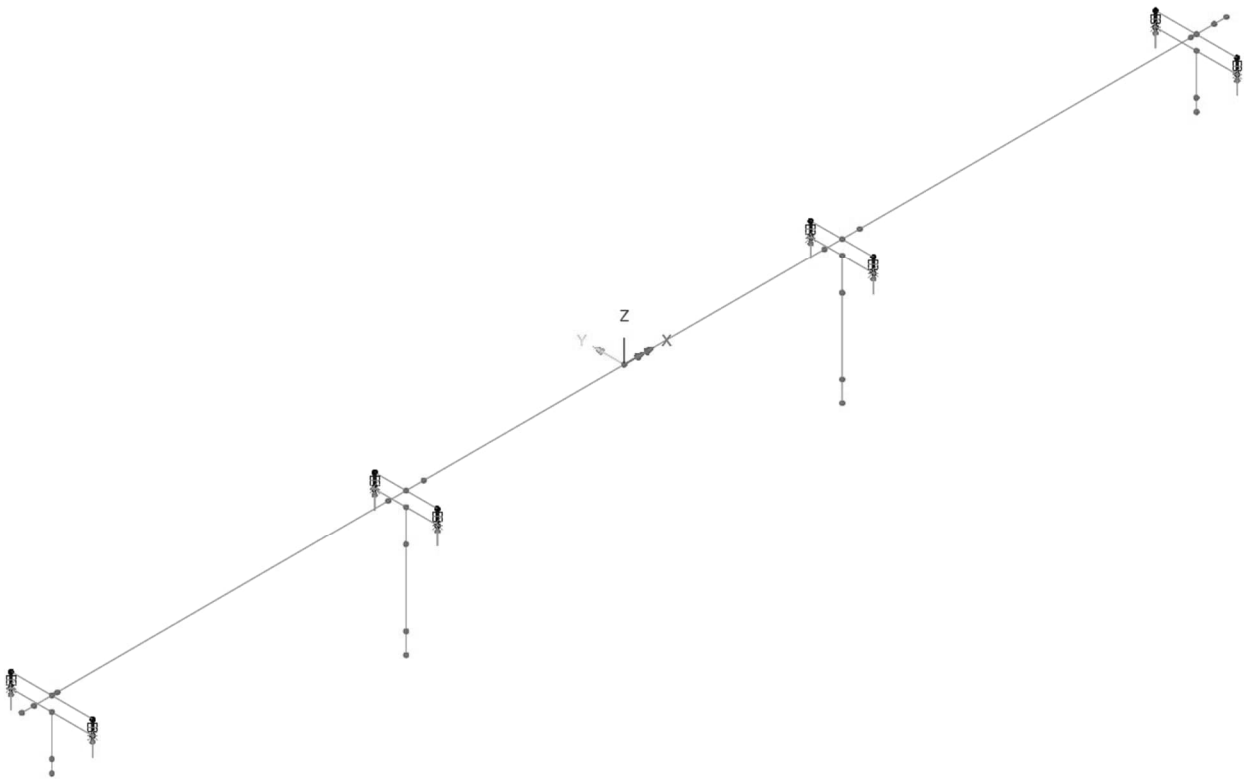
Component

Fx ▼

Coincident effects (TLO)...

Name

Inf3 - Bearing ▼ ⬆ ⬇ ⬆ ⬇ (1)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:63
		Date :	Created :

Inf4 – Bearing (Fy) :

Direct Method Influence

Entity

Force/Moment - 3D Joint (JSH4,JL46)

Direction

Element local

0.0

Component

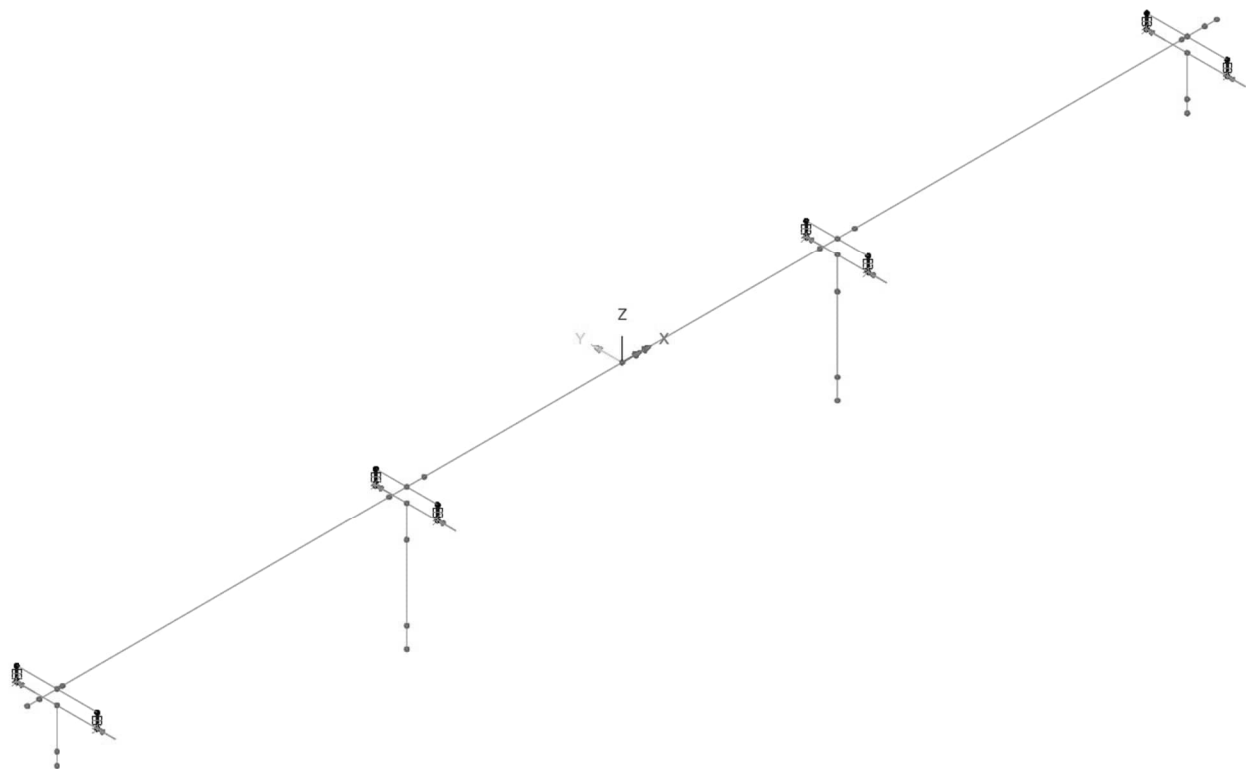
Fy

Coincident effects (TLO)...

Name

Inf4 - Bearing

(2)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:64
		Date :	Created :

Inf5 – Bearing (Fz) :

Direct Method Influence

Entity

Force/Moment - 3D Joint (JSH4,JL46)

Direction

Element local

0.0

Component

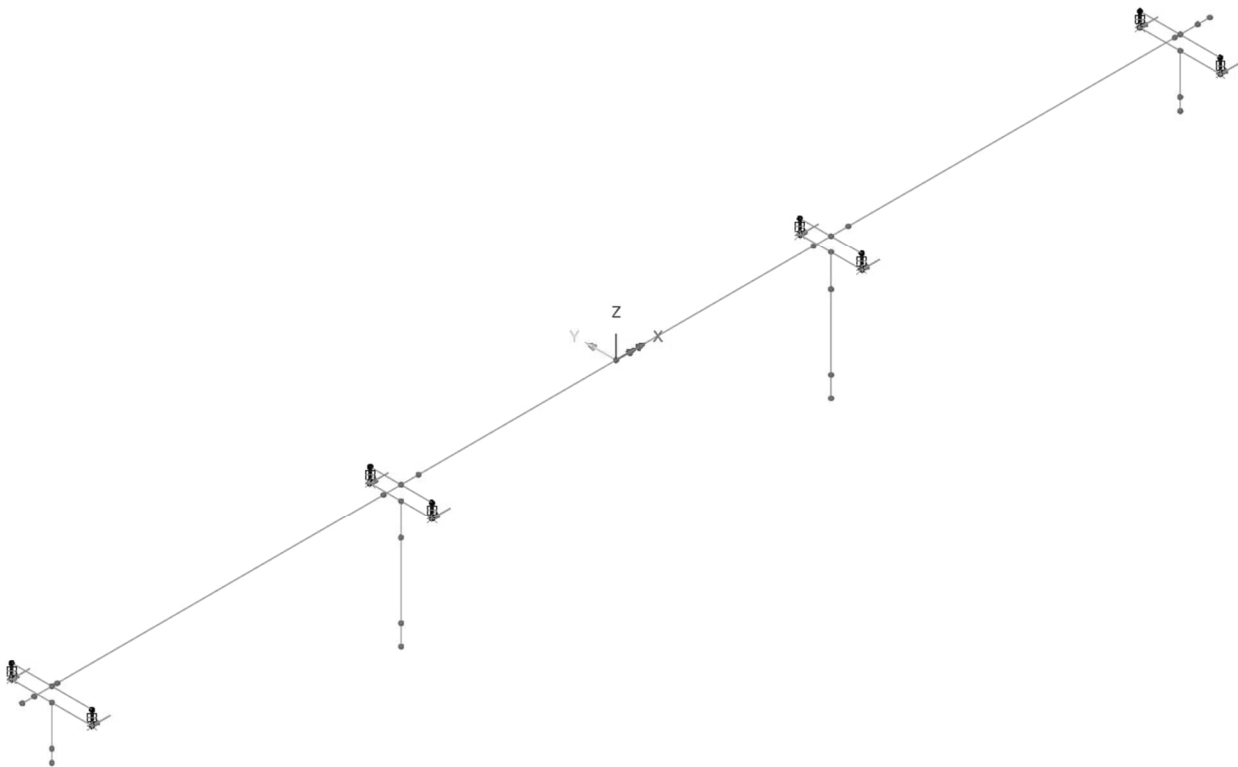
Fz

Coincident effects (TLO)...

Name

Inf5 - Bearing

(3)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:65
		Date :	Created :

3.7.5.2 Influence surface analysis

Influence surfaces :

Search area: Superstructure

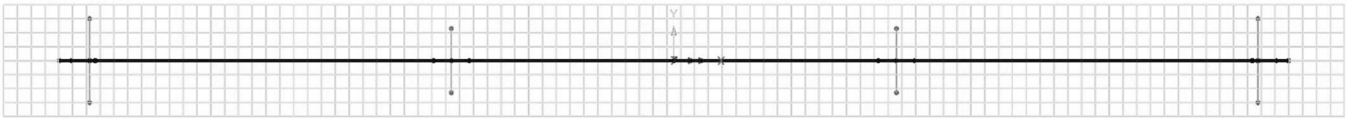
Definition type: Grid

Path: Centerline X

Transverse width: 8.0 m

Longitudinal spacing: 1.0 m

Transversal spacing: 1.0 m



PLAN

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:66
		Date :	Created :

3.7.5.3 Traffic load analysis (VLO)

Loading options

Country

Sweden

Optional code settings...

Design code

EN1991-2 Sweden 2011

Optional loading parameters...

Solution process

☐ View onerous effects table

Set influence surfaces...

☒ Create loading patterns

Define carriageways...

☒ All chosen influences ☐ Most onerous

☒ Create envelopes

☒ By design case ☐ By influence and design case

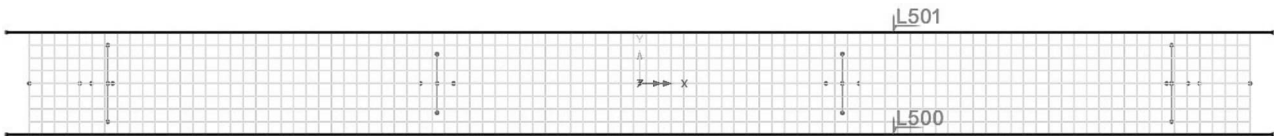
Vehicle longitudinal incremental movement: 0.25 m

Vehicle transverse incremental movement: 0.25 m

Vehicle direction: both

Definition of carriageway (kerbs): L500 & L501

Influence surfaces: Include all (positive & negative)



PLAN

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:67
		Date :	Created :

3.7.5.4 Envelope : LM 1

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

Representative values required	Load groups to include
☒ Characteristic	☒ Group 1a - LM1
☐ Combination (psi0)	☐ Group 4 - LM4
☐ Frequent (psi1)	☐ Complementary load model
☐ Infrequent (psi1,infq)	Dynamic amplification (additional) 20 %
☐ Quasi-permanent (psi2)	Vehicle(s) None ...
	☐ Group 5 - LM3
	Vehicle(s) None ...
	☐ Include associated LM1

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:68
		Date :	Created :

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.

Representative values required ☒ Characteristic ☐ Combination (psi0) ☐ Frequent (psi1) ☐ Infrequent (psi1,infq) ☐ Quasi-permanent (psi2)	Load groups to include ☐ Group 1a - LM1 ☐ Group 4 - LM4 ☐ Complementary load model Dynamic amplification (additional) 20 % Vehicle(s) None ... ☒ Group 5 Vehicle(s) LM2 ... ☐ Include associated LM1
--	--

Point

Analysis category 3D

☒ Arbitrary
☐ Grid x 1 y 1

Untransformed load direction
☐ X ☐ Y
☒ Z ☐ Surface normal
☐ XYZ global
☐ XYZ transformable

Projection vector
☒ Project in load direction

X component 0.0
Y component 0.0
Z component 1.0

	X	Y	Z	Load
1	0	1.00	10	-200
2	0	-1.00	10	-200

Name LM2

(new)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:69
		Date :	Created :

3.7.5.6 Envelope : EG A

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

The screenshot shows a software dialog box titled "EN1991-2 Sweden 2011 - USER". It is divided into two main sections:

- Representative values required:**
 - ☒ Characteristic
 - ☐ Combination (psi0)
 - ☐ Frequent (psi1)
 - ☐ Infrequent (psi1,infq)
 - ☐ Quasi-permanent (psi2)
- Load groups to include:**
 - ☐ Group 1a - LM1
 - ☐ Group 4 - LM4
 - ☒ Complementary load model
 - Dynamic amplification (additional): 25 %
 - Vehicle(s): Type a
 - ☐ Group 5 - LM3
 - Vehicle(s): SV1800200low
 - ☒ Include associated LM1

Dynamic amplification (additional): 25 %

Vehicle selection: Type a

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:70
		Date :	Created :

3.7.5.7 Envelope : EG B

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

The screenshot shows a software interface for selecting load models. It is divided into two main sections: 'Representative values required' and 'Load groups to include'.

- Representative values required:**
 - ☒ Characteristic
 - ☐ Combination (psi0)
 - ☐ Frequent (psi1)
 - ☐ Infrequent (psi1,infq)
 - ☐ Quasi-permanent (psi2)
- Load groups to include:**
 - ☐ Group 1a - LM1
 - ☐ Group 4 - LM4
 - ☒ Complementary load model
 - Dynamic amplification (additional): 25 %
 - Vehicle(s): Type b; Type c; Type d; Typ
 - ☐ Group 5 - LM3
 - Vehicle(s): None
 - ☐ Include associated LM1

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.

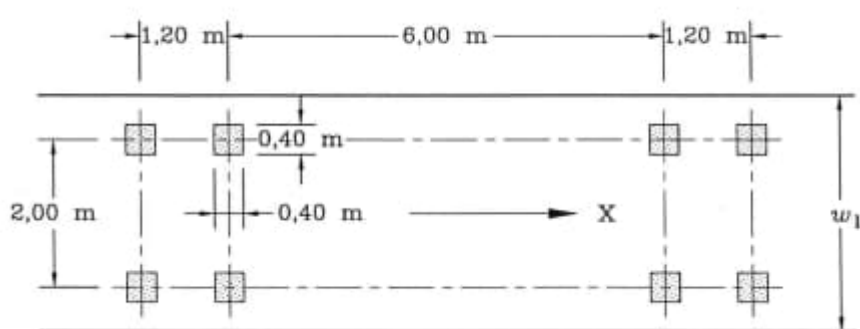
Envelope...TRAFIK..:

Envelope
LM 1
LM 2
EG A
EG B

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:71
		Date :	Created :

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.



$Q_k = 120 \text{ kN}$: 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 $\rightarrow N_{obs} = 103\,300$ 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

$\rightarrow N_o$

Trafikuppgifter enligt teknisk beskrivning Oxberg (15822-00-1010):

Medel ÅDT tung (120 år) = 283 fordon/dygn $\rightarrow N_{obs} = 103\,300$ 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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:72
		Date :	Created :

$b_s = 125,000$ vehicles/year

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:73
		Date :	Created :

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

Representative values required

☒ Characteristic

☐ Combination (psi0)

☐ Frequent (psi1)

☐ Infrequent (psi1,infq)

☐ Quasi-permanent (psi2)

Load groups to include

☐ Group 1a - LM1

☐ Group 4 - LM4

☐ Complementary load model

Dynamic amplification (additional)

20

 %

Vehicle(s)

None

...

☒ Group 5

Vehicle(s)

UTM3

...

☐ Include associated LM1

Point

Analysis category

3D

☒ Arbitrary

☐ Grid

x

y

1

1

Untransformed load direction

☐ X

☐ Y

☒ Z

☐ Surface normal

☐ XYZ global

☐ XYZ transformable

Projection vector

☒ Project in load direction

X component

Y component

Z component

0.0

0.0

1.0

	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

Name

UTM3

▼

▲

▼

(new)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:74
		Date :	Created :

3.8 BRAKING LOAD

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

Load acts at level of surfacing.

$$L = 2.2 \text{ m} + 26.0 \text{ m} + 32.0 \text{ m} + 26.0 \text{ m} + 2.2 \text{ m} = 88.4 \text{ m}$$

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 $\rightarrow L_{broms} = 32.4 \text{ m}$ (for axle loads)

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

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

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

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:75
		Date :	Created :

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.

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:76
		Date :	Created :

Load case : BROMS +

Global Distributed ✕

Analysis category 3D

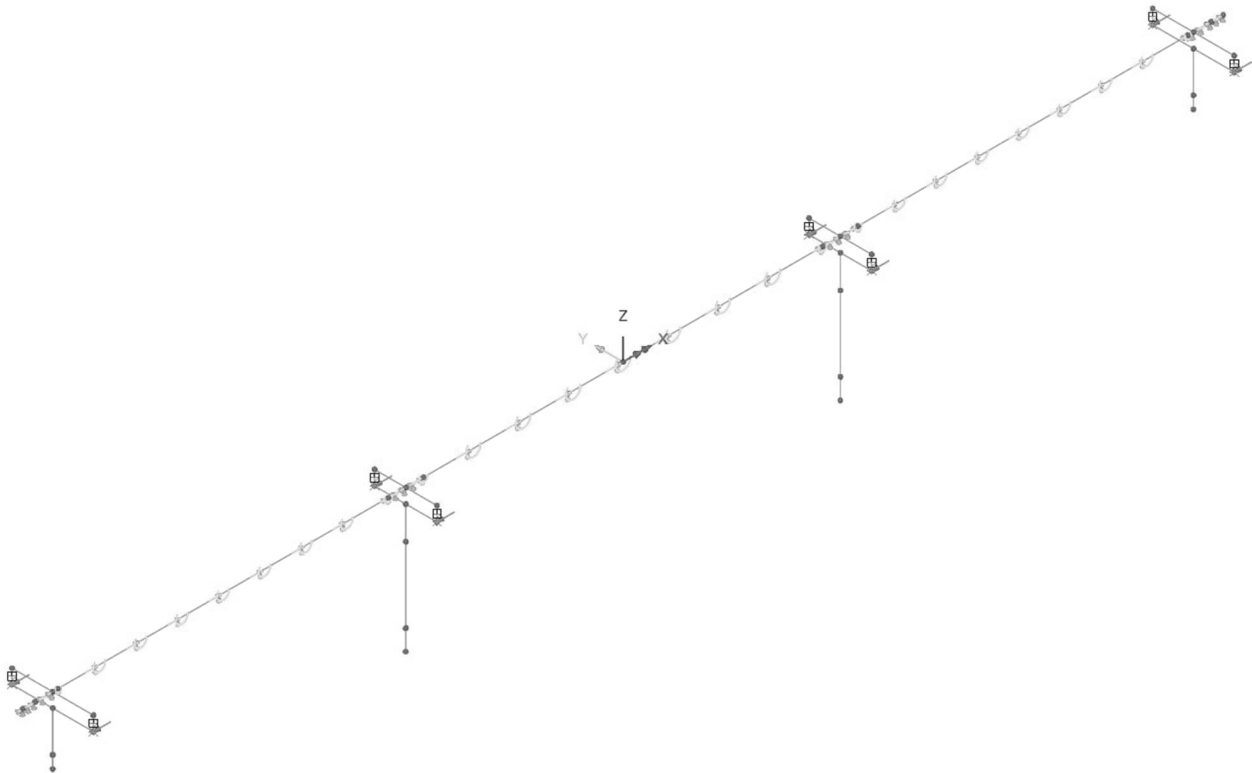
☐ Total

☒ 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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:77
		Date :	Created :

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

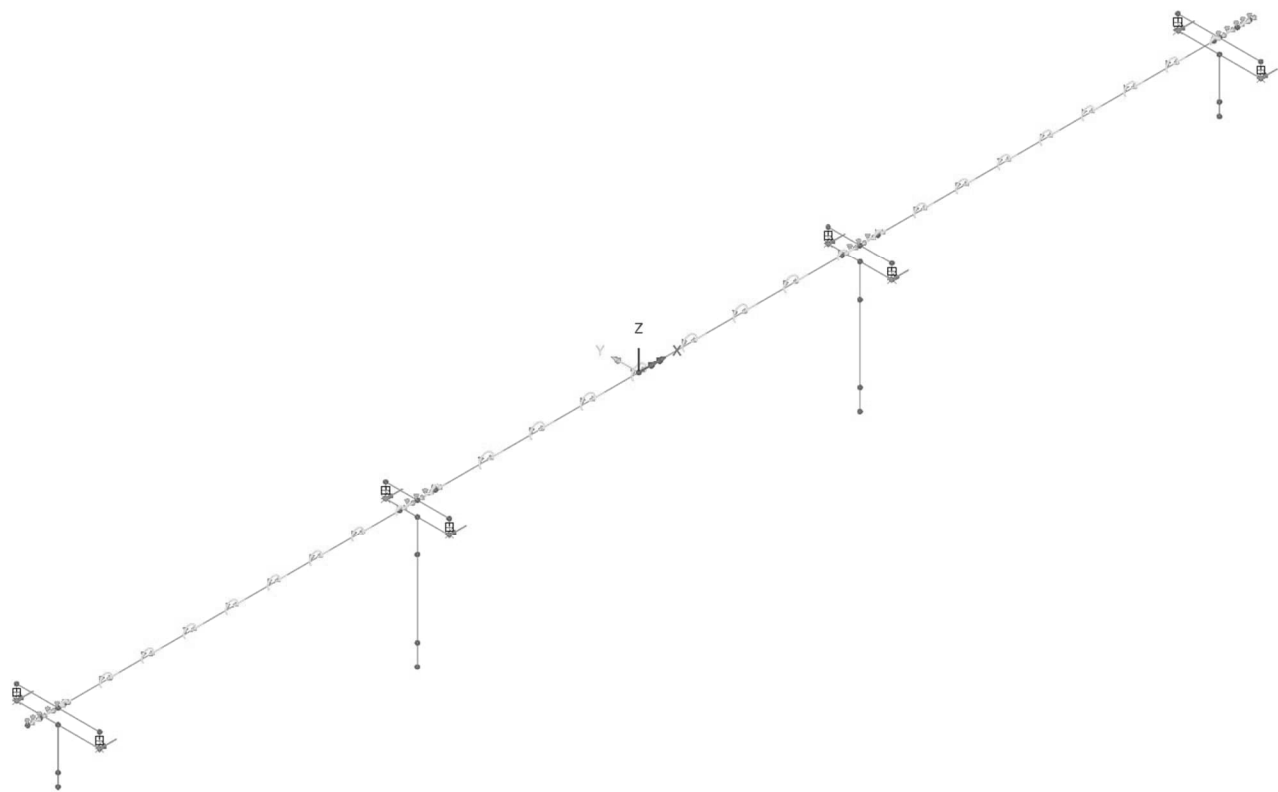
Name

BROMS-

▼

▲▼

(24)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:78
		Date :	Created :

3.8.2 Load combination (BROMS)

Envelope BROMS :

Load case
BROMS +
BROMS -

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:79
		Date :	Created :

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 :

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

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

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

Last definition:

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

$$P_y = 130kN$$

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

Note:

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:80
		Date :	Created :

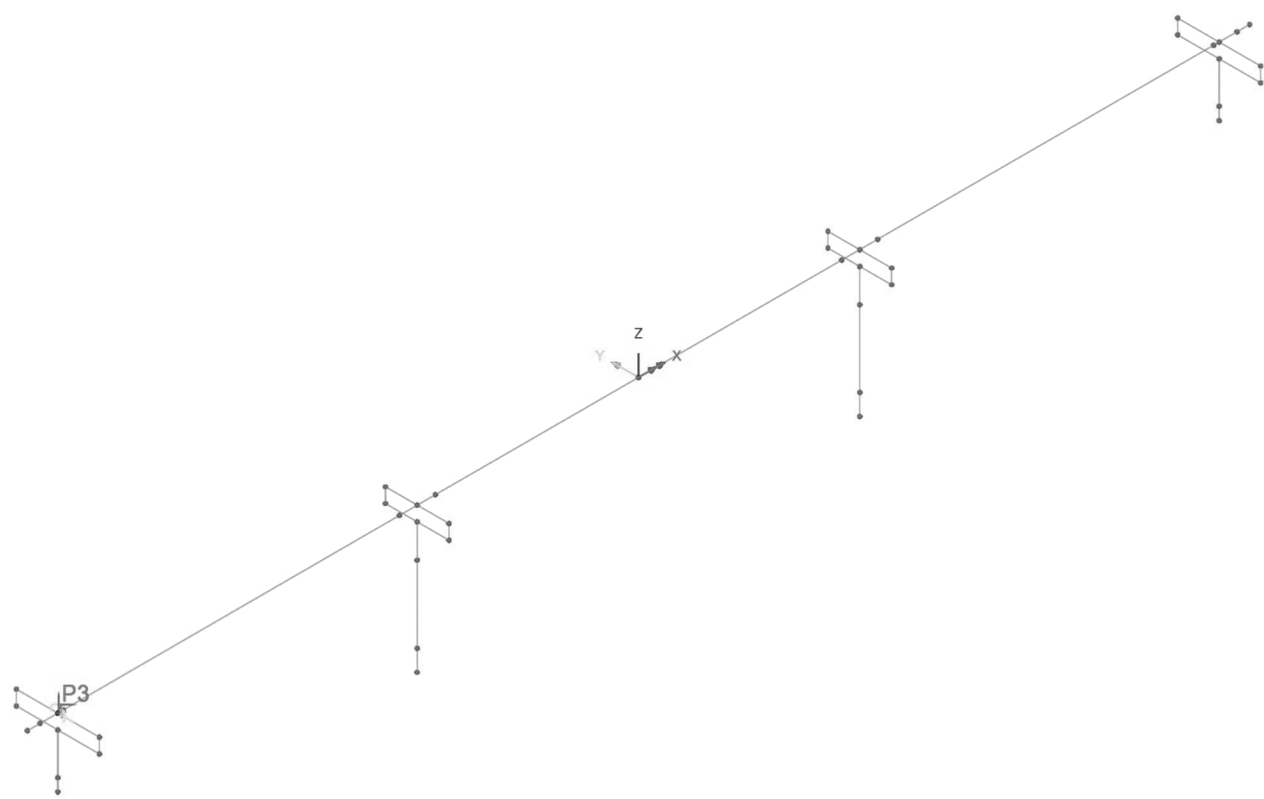
Load case : *SIDO 1+*

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:81
		Date :	Created :

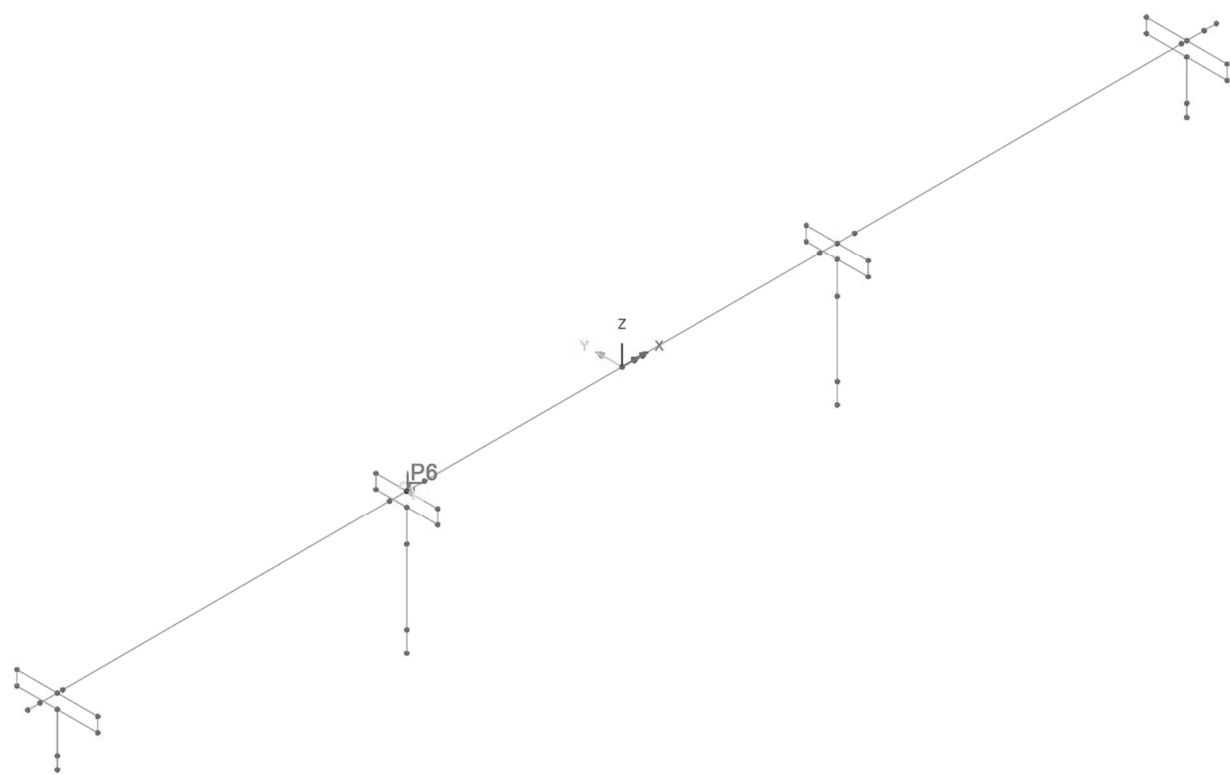
Load case : SIDO 2+

Concentrated ✕

Analysis category

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 ▼ ▲ (26)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:82
		Date :	Created :

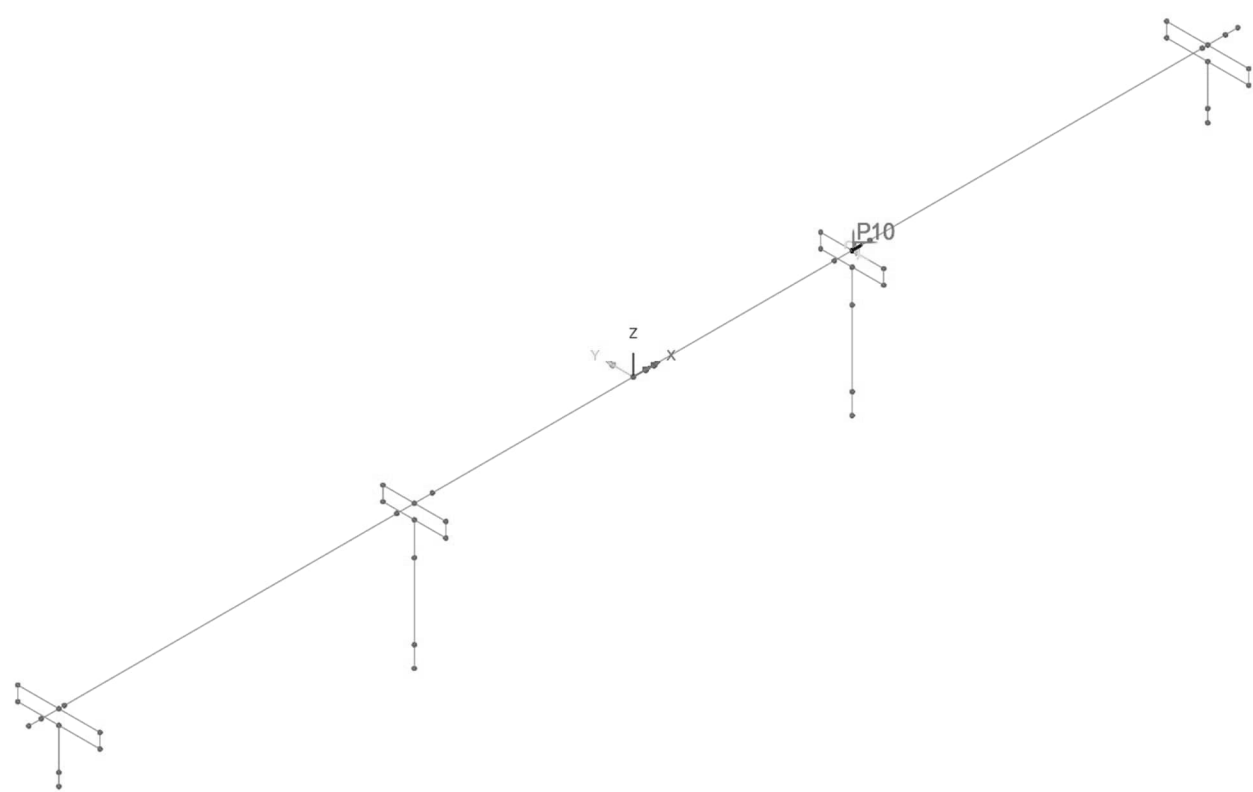
Load case : *SIDO 3+*

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:83
		Date :	Created :

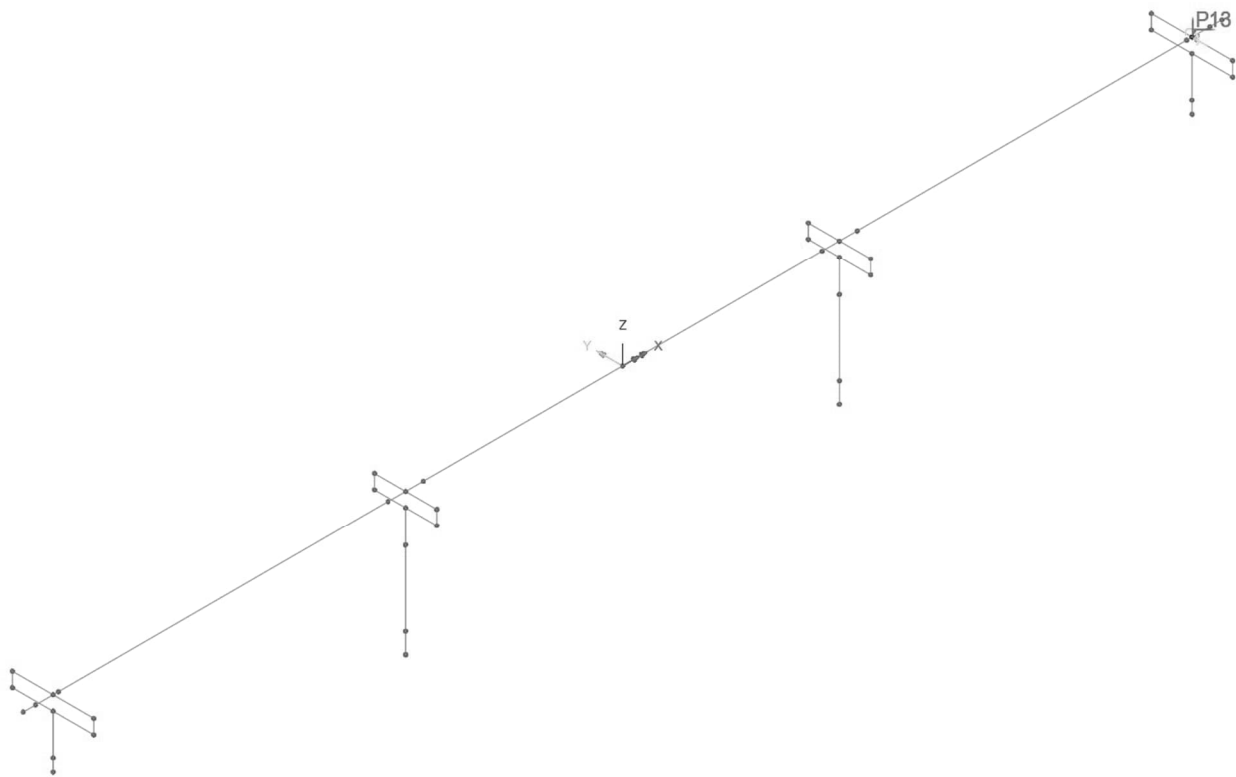
Load case : *SIDO 4+*

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:84
		Date :	Created :

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-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:85
		Date :	Created :

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) :

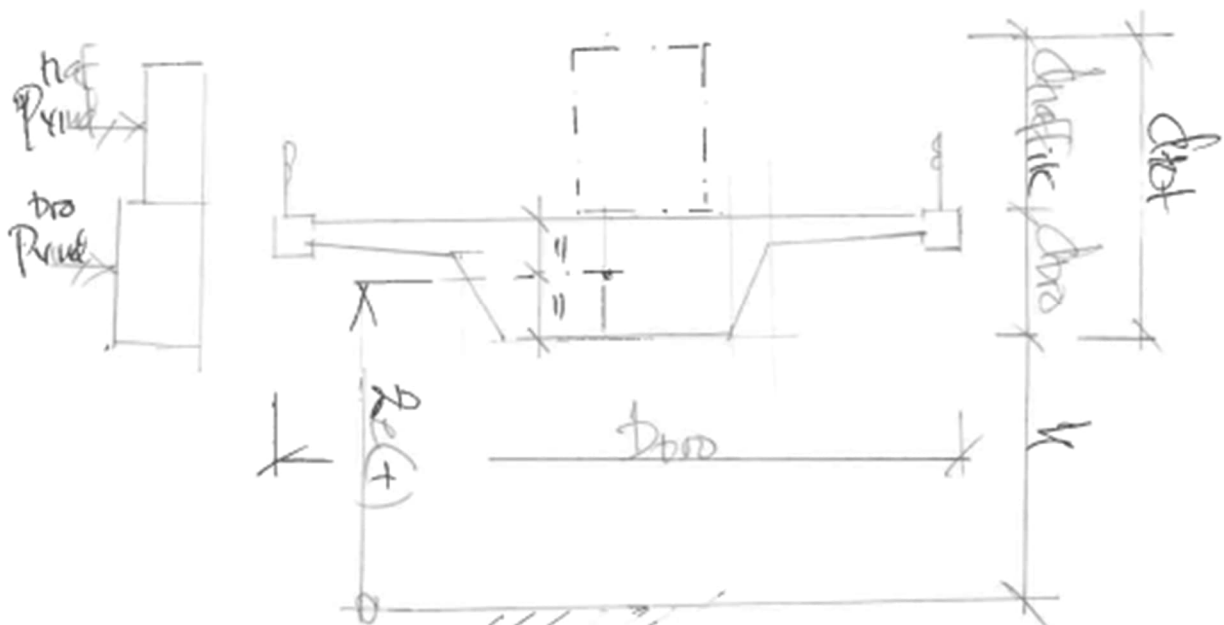
$$\psi_k = 1.00$$

$$\psi_0 = 0.30$$

$$\psi_1 = 0.20$$

$$\psi_2 = 0$$

Load intensity:



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:86
		Date :	Created :

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

Reference height $z_e = 6\text{ m}$: SS-EN 1991-1-4 section 8.3.1 (6)

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

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

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

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

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

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

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

$\rightarrow \frac{b_{bro}}{d_{tot}} = \frac{1.6\text{m}}{3.6\text{m}} = 0.44$

$c_{f.x0}\left(\frac{b_{bro}}{d_{tot}} = 0.44\right) = 1.8$: 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)

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:87
		Date :	Created :

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 on bridge together load associated to traffic can be reduced according to SS-EN 1991-1-4 section 8.1 (4)

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

Remark

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:88
		Date :	Created :

3.10.1 Definition of load

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

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



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

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

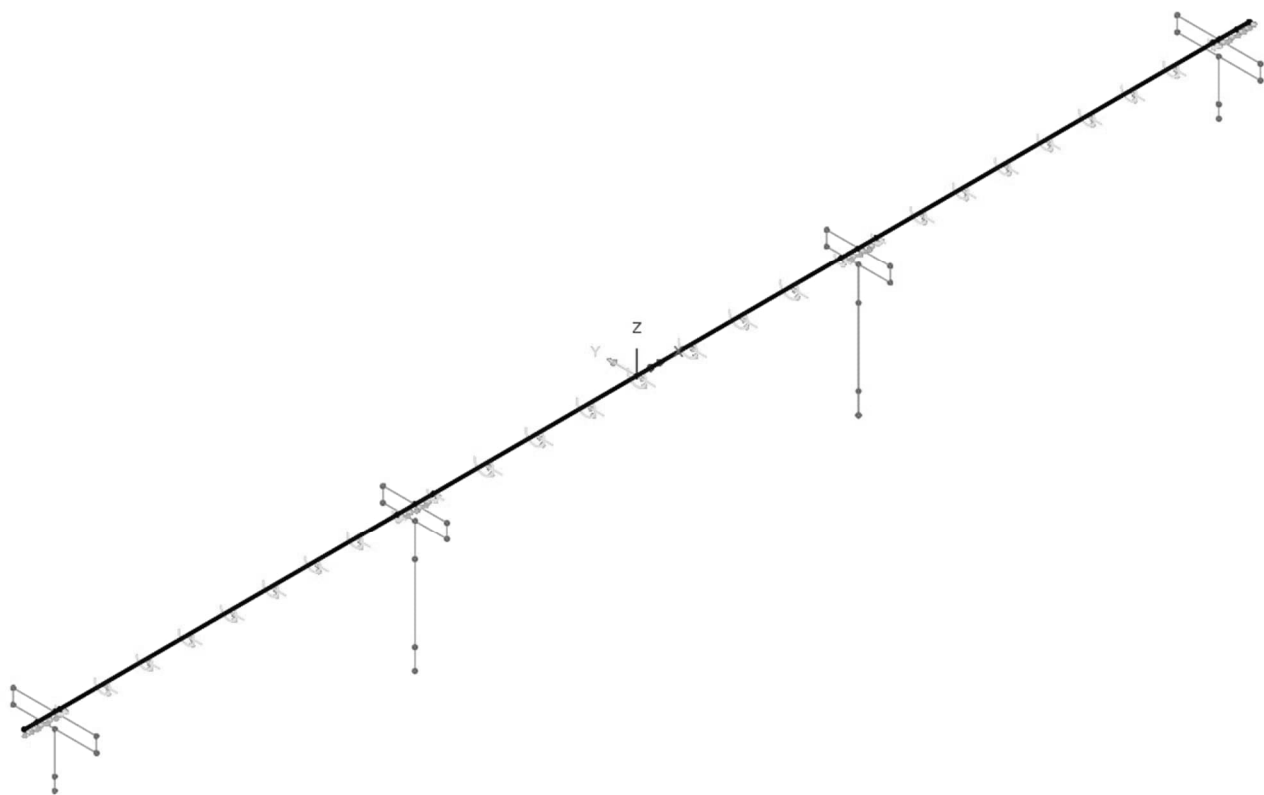
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:89
		Date :	Created :

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) : $-3.6 \frac{kNm}{m}$



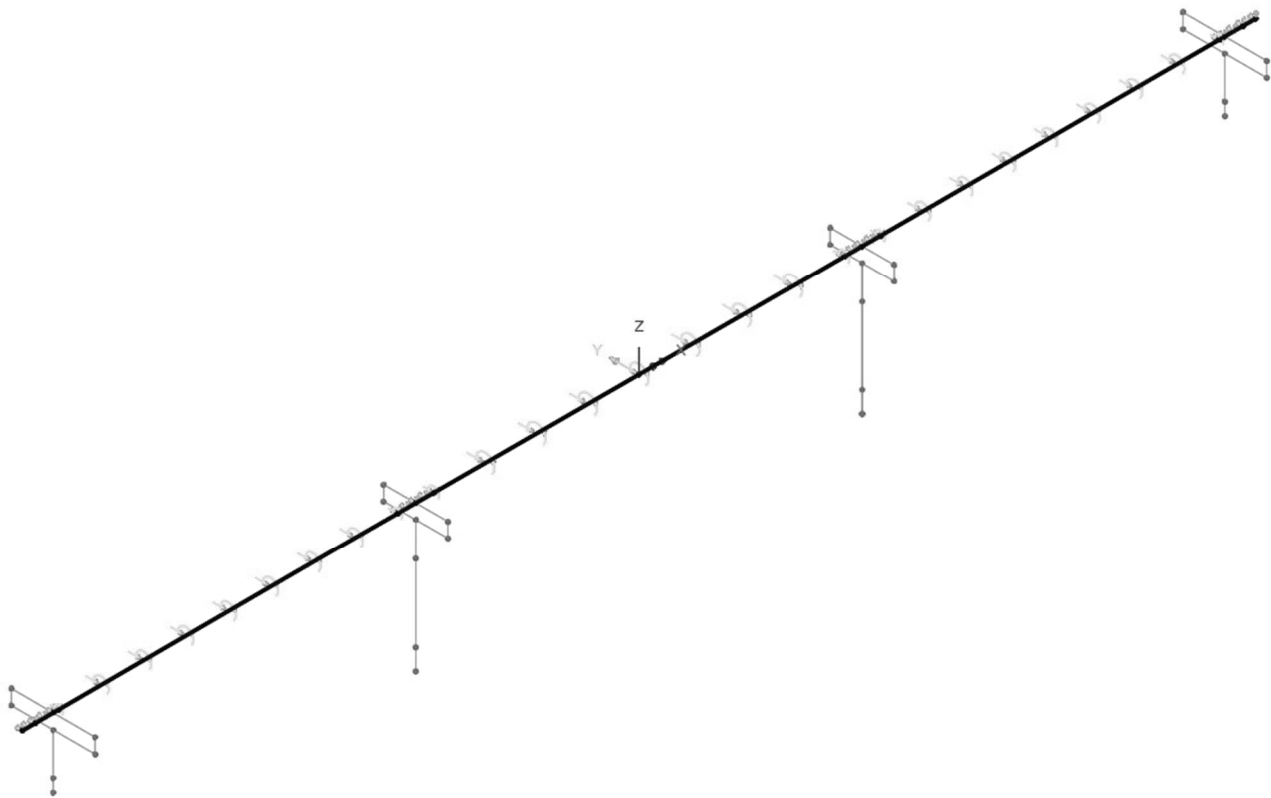
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:90
		Date :	Created :

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) : $3.6 \frac{kNm}{m}$



	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:91
		Date :	Created :

3.10.2 Load combination

Envelope VIND:

Load case
VIND+
VIND-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:92
		Date :	Created :

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

$$q_{över}(s) = K_0 \cdot q_{ytlast}$$

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

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

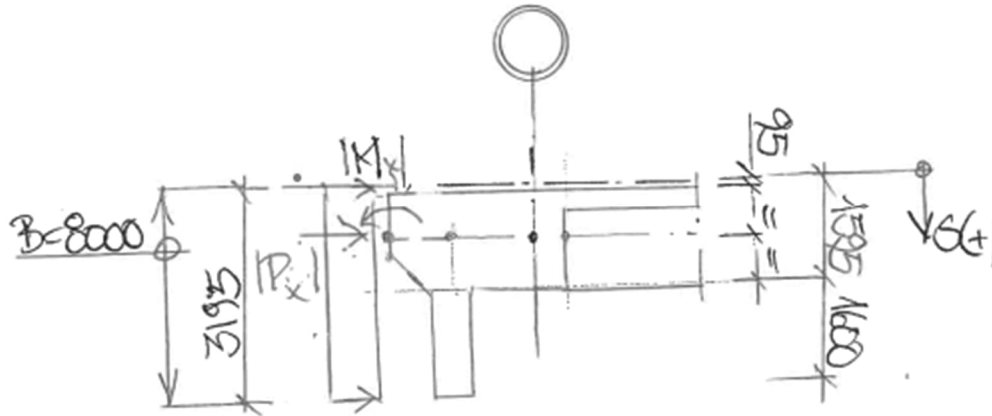
Remark

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:93
		Date :	Created :

3.11.1 Load abutment 1& 4



$$q_{ytlast} = 6kPa$$

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

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

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

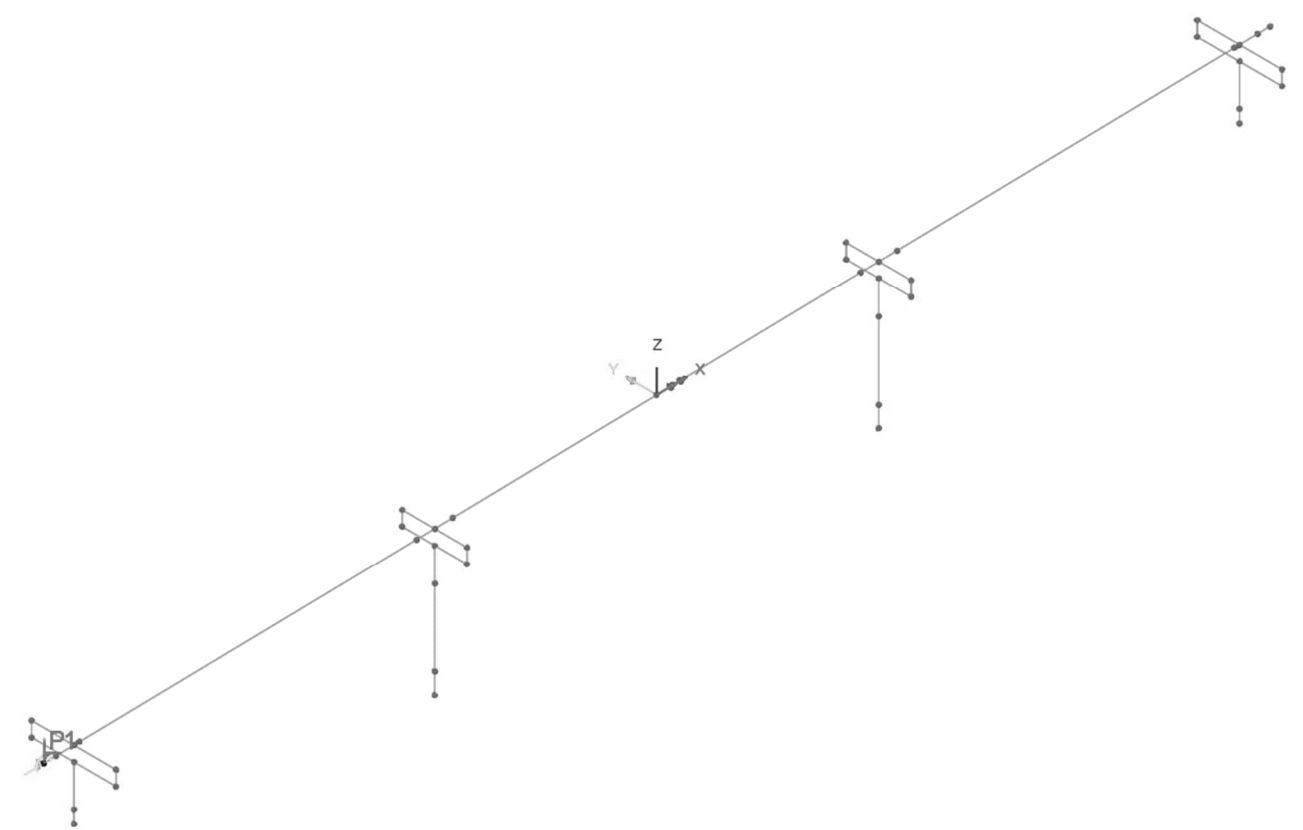
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:94
		Date :	Created :

Load : OVER 1:V

Structural loading : Concentrated

Concentrated load in X (P_x) : +153 kN

Moment about Y axis (M_y) : -115 kNm



Overview

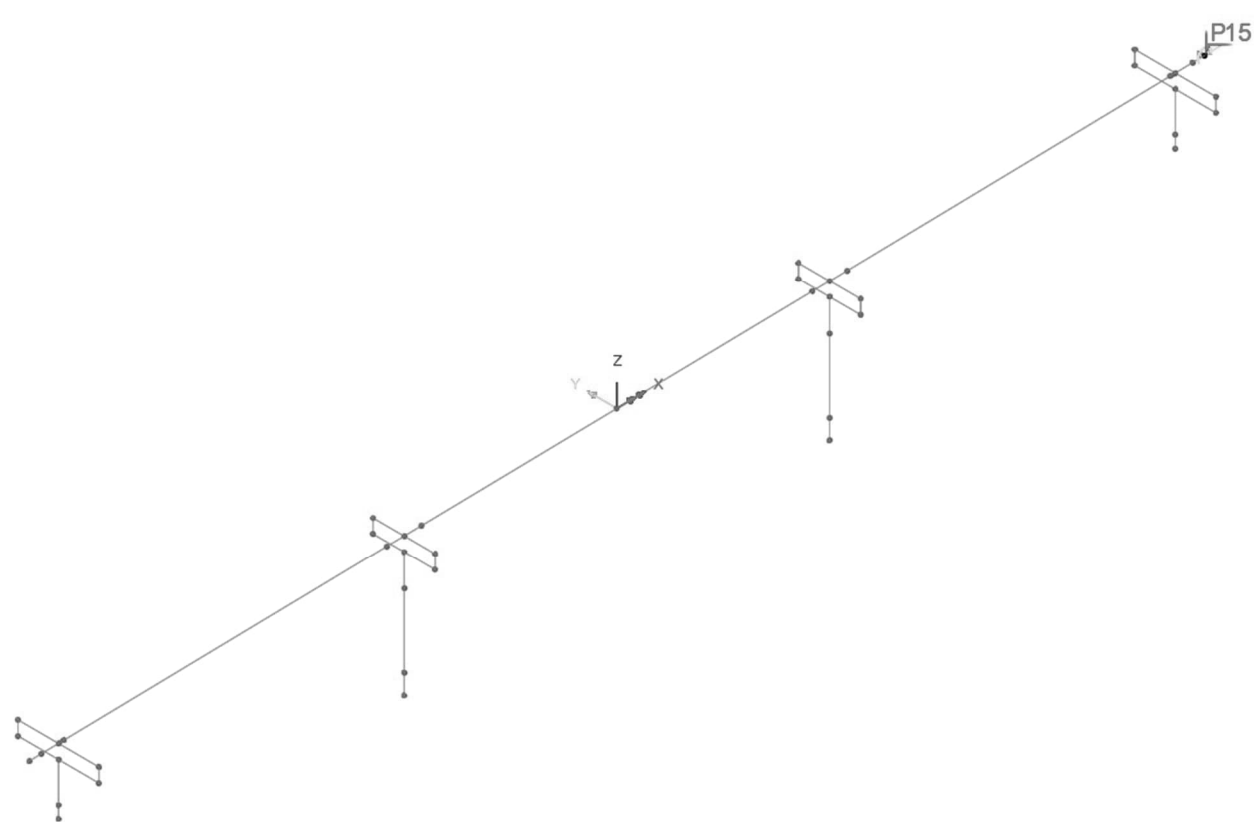
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:95
		Date :	Created :

Load : OVER 1:H

Structural loading : Concentrated

Concentrated load in X (P_x) : -153 kN

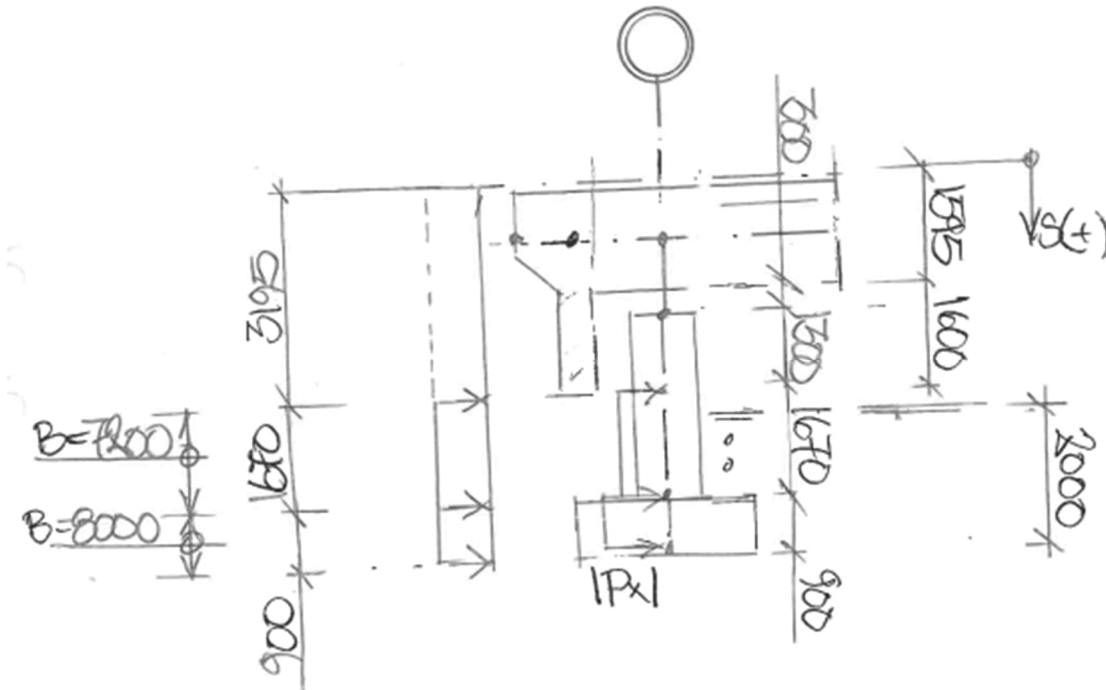
Moment about Y axis (M_y) : -115 kNm



Overview

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:96
		Date :	Created :

3.11.2 Load against abutments at support 1 & 4



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

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

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

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

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

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:97
		Date :	Created :

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)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:98
		Date :	Created :

Load : OVER21:H

Internal Beam Distributed

Analysis category3D

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				

NameOVER 21:H

(35)

Load : OVER22:H

Internal Beam Distributed

Analysis category3D

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				

NameOVER 22:H

(36)

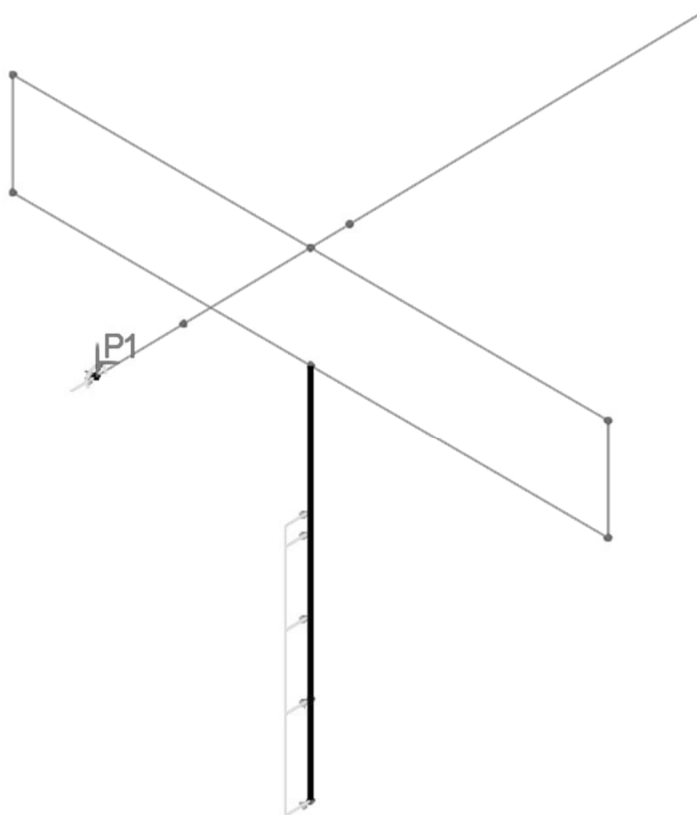
File : A3 Loads
Datum : 2026-03-03
Tid : 08:24

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:99
		Date :	Created :

3.11.4 Load combination

Basic loadcombination OVER:V:

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

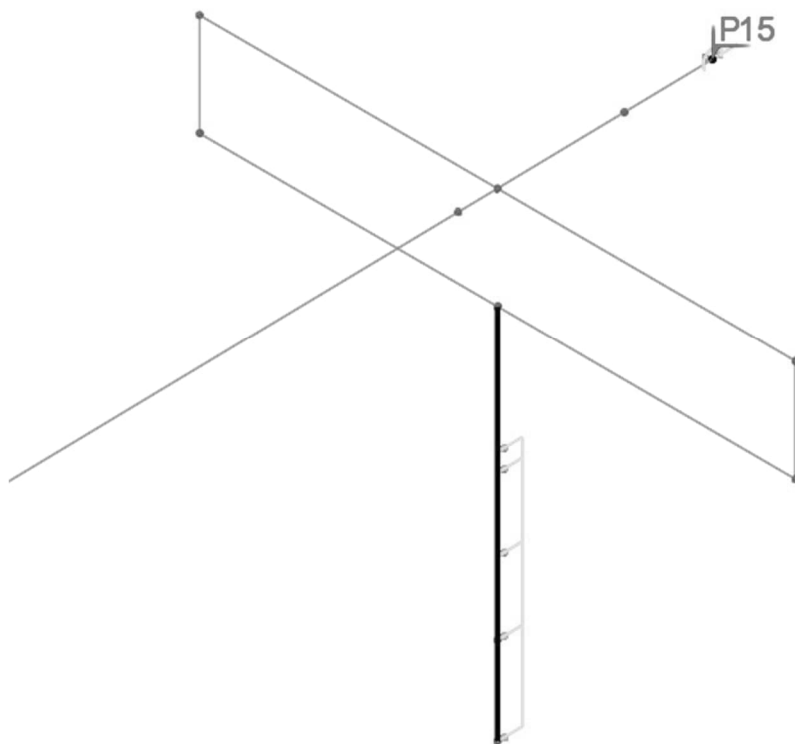


Overview 3D
Abutement 1

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:100
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:101
		Date :	Created :

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, $T_{\text{mont}} = +10^{\circ} \text{C}$: EN 1991-1-5A.1(3)

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

Concrete beam $\Rightarrow$ type 3

Location : Oxberg

$T_{\text{max}} = +34^{\circ}\text{C}$: TSFS 2018:57 chapter 8 sketch 8.1

$T_{\text{min}} = -44^{\circ}\text{C}$: TSFS 2018:57 chapter 8 sketch 8.2

Duration coefficients :

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

$$\psi_0 = 0.60$$

$$\psi_1 = 0.60$$

$$\psi_2 = 0.50$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:102
		Date :	Created :

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) :

$$T_e(T) = \text{interp} \left[(-50 \ 0 \ 30 \ 50)^T \cdot ^\circ\text{C}, (-42 \ 7 \ 32 \ 52)^T \cdot ^\circ\text{C}, T \right]$$

$$T_{e.\max} = T_e(T_{\max}) = 36^\circ\text{C}$$

$$T_{e.\min} = T_e(T_{\min}) = -36^\circ\text{C}$$

$$T^+ = T_{e.\max} - T_0 = +36^\circ\text{C} - 10^\circ\text{C} = +26^\circ\text{C}$$

$$T^- = T_{e.\min} - T_0 = -36^\circ\text{C} - 10^\circ\text{C} = -46^\circ\text{C}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:103
		Date :	Created :

Load : JTEMP+

Structural loading : Temperature

Final temperature : +26C

Initial temperature : ± 0 C

Loadcase : JTEMP+

Load : JTEMP-

Structural loading : Temperature

Final temperature : -46C

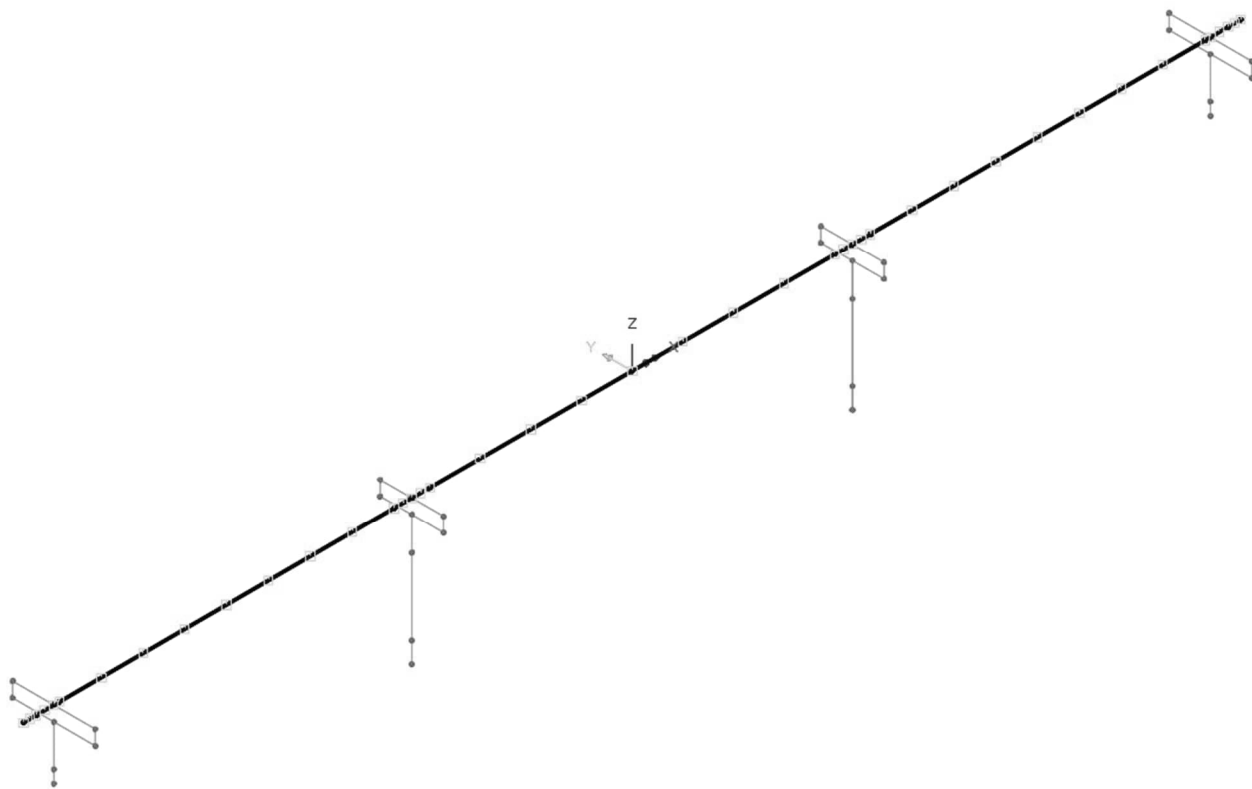
Initial temperature : ± 0 C

Loadcase : JTEMP-

Envelope JTEMP :

Loadcase
JTEMP+
JTEMP-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:104
		Date :	Created :



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:105
		Date :	Created :

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

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

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

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

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 $v_p = h \cdot 0.5\% = 3200\text{mm} \cdot 0.5\% = 16\text{ mm} \ll v_t = 38\text{mm}$.

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:106
		Date :	Created :

Recommendation EC

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:

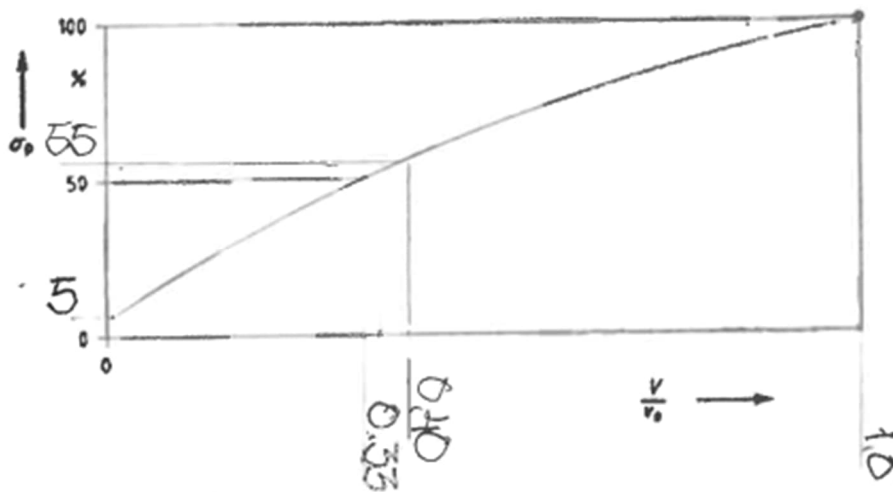
$$0.5\sigma_p \rightarrow \frac{v}{h} = 1\%$$

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

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

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

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



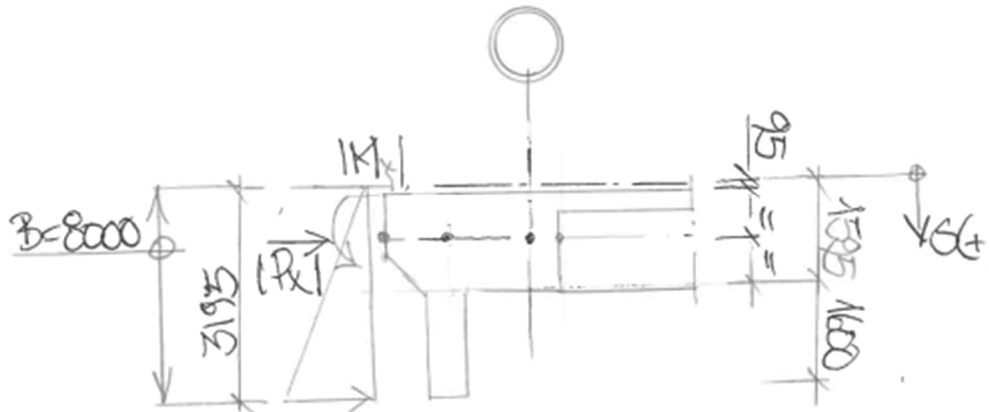
$$\frac{v_t}{v_p} = \frac{38\text{mm}}{96\text{mm}} = 0.40 \rightarrow \Delta p = 0.55 \cdot (p_p - p_0)$$

Remark

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:107
		Date :	Created :

Passive earth pressure



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

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

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

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

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

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

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).

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:108
		Date :	Created :

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

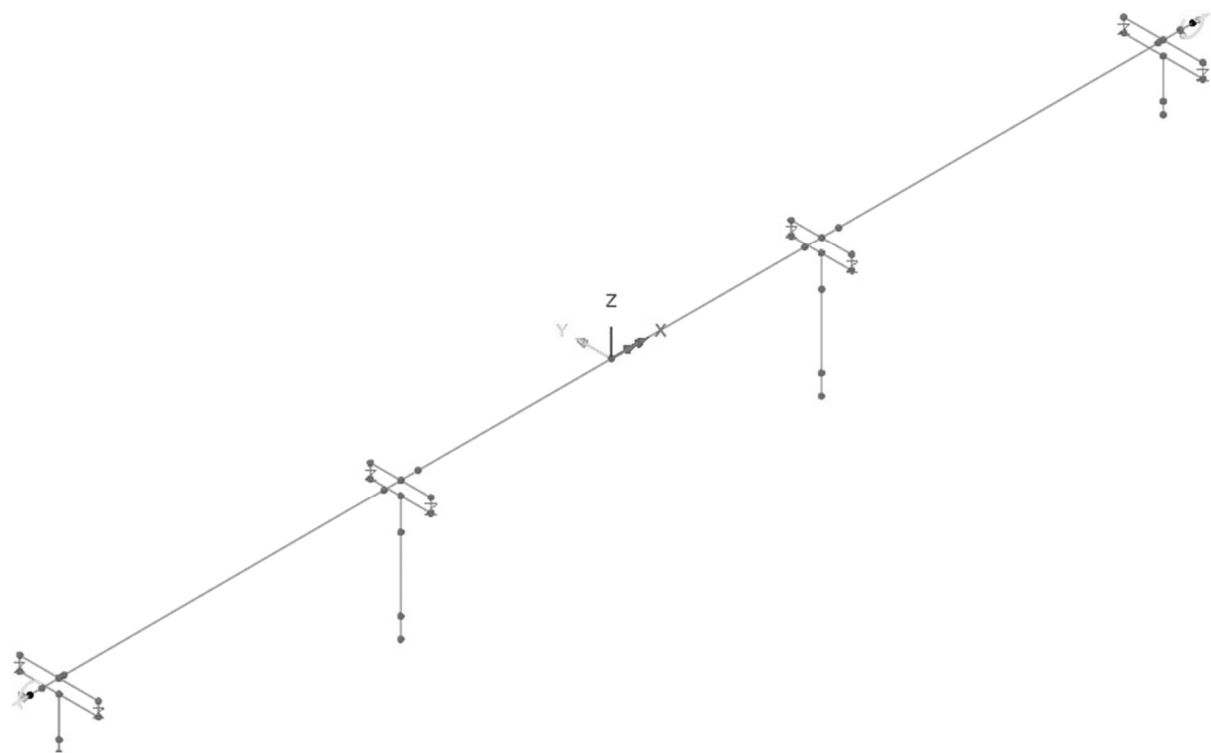
Structural loading : Concentrated

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:109
		Date :	Created :

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.

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

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

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

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

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.

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:110
		Date :	Created :

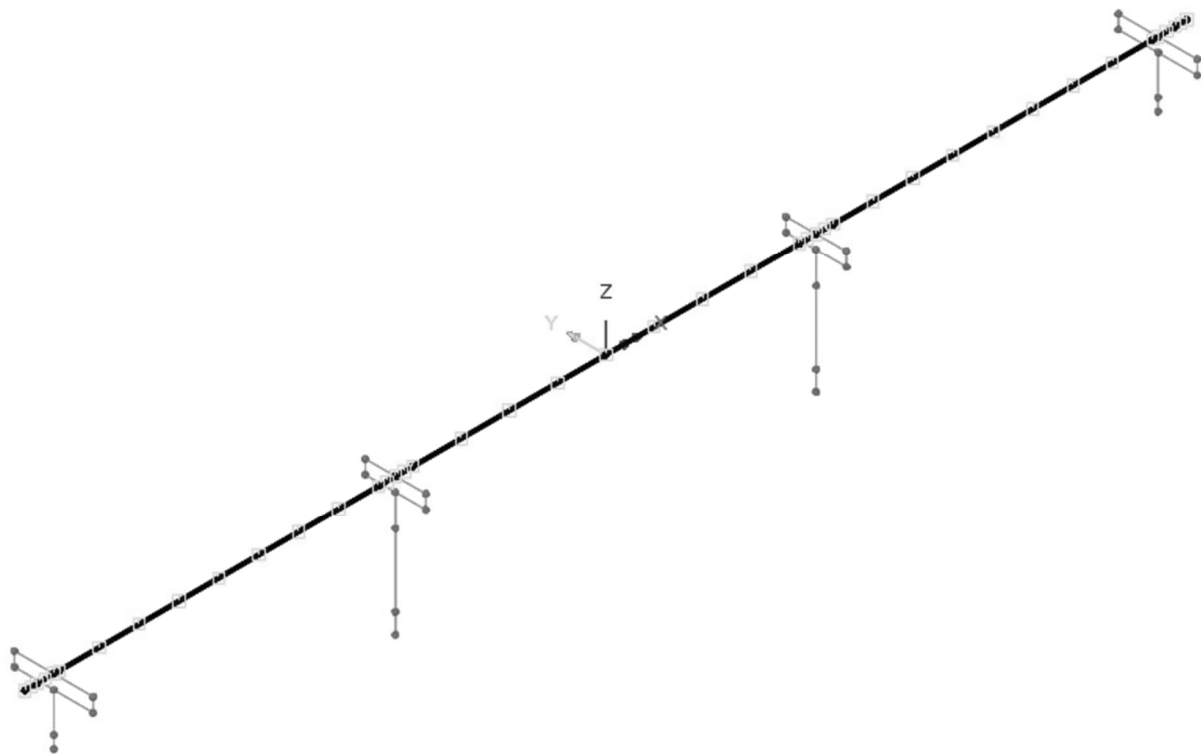
Loadcase : OJTEMP 1+

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : +7 °C/m

Initial Z temperature gradient : 0°C/m



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:111
		Date :	Created :

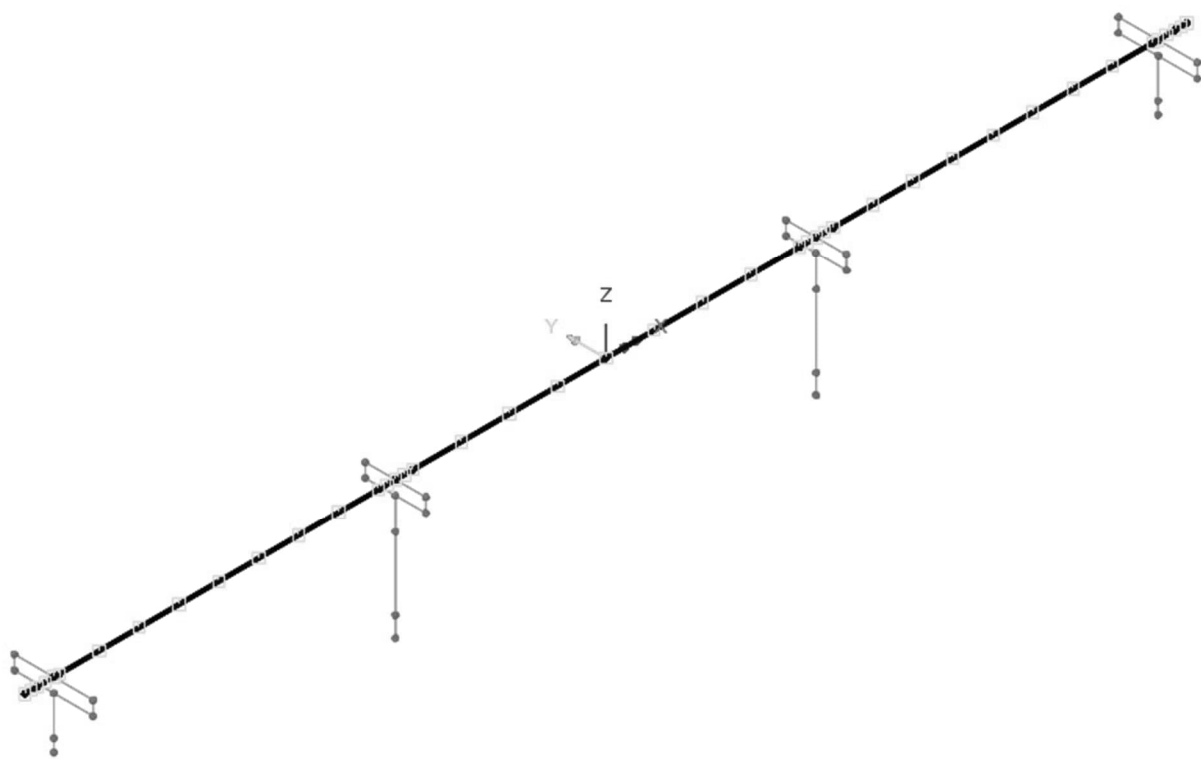
Loadcase : OJTEMP 1-

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : -5°C/m

Initial Z temperature gradient : 0°C/m



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:112
		Date :	Created :

Envelope OJTEMP 1 :

Load case
OJTEMP 1+
OJTEMP 1-

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:113
		Date :	Created :

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).

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:114
		Date :	Created :

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.

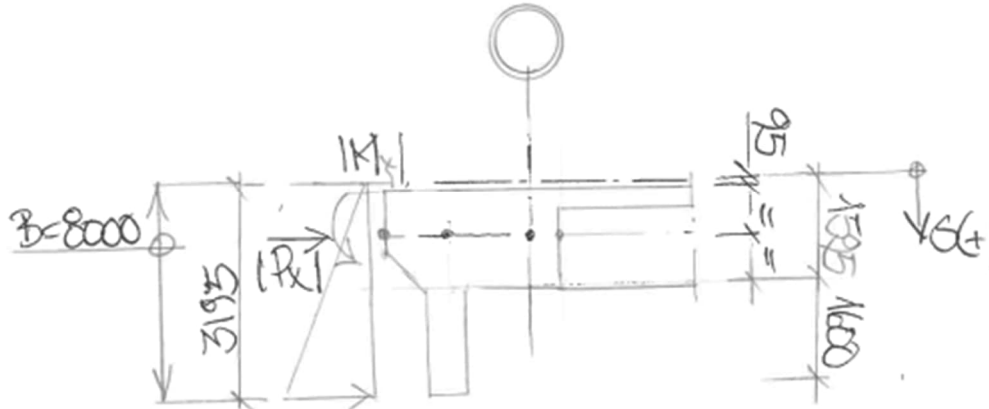
Envelope TEMP :

Load case
TEMP-1
TEMP-2

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:116
		Date :	Created :

3.13.1 Defintion of load at support 1 & 2

At end-shield increased earth pressure arises.



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

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

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:117
		Date :	Created :

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-

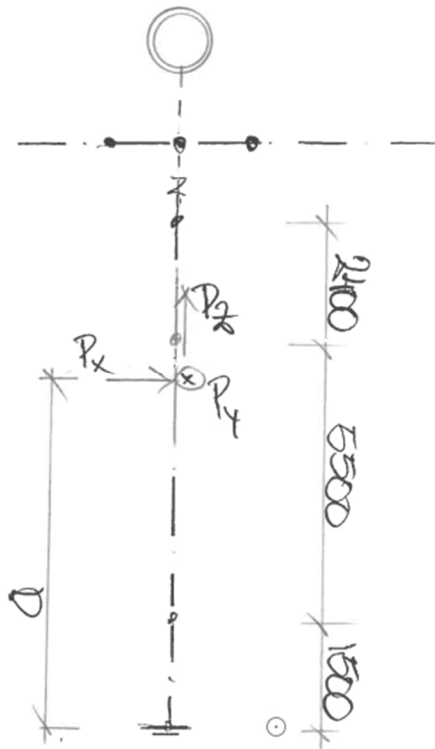
Structural loading : Concentrated

Concentrated load in X (P_x) : -4500 kN

Moment about Y axis (M_y) : +3213 kNm

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:118
		Date :	Created :

3.13.1 Definition of load at support 2 & 3



$$P_x = \mp 2320 kN$$

$$P_y = \mp 378 kN$$

$$P_z = 771 kN$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:119
		Date :	Created :

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)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:120
		Date :	Created :

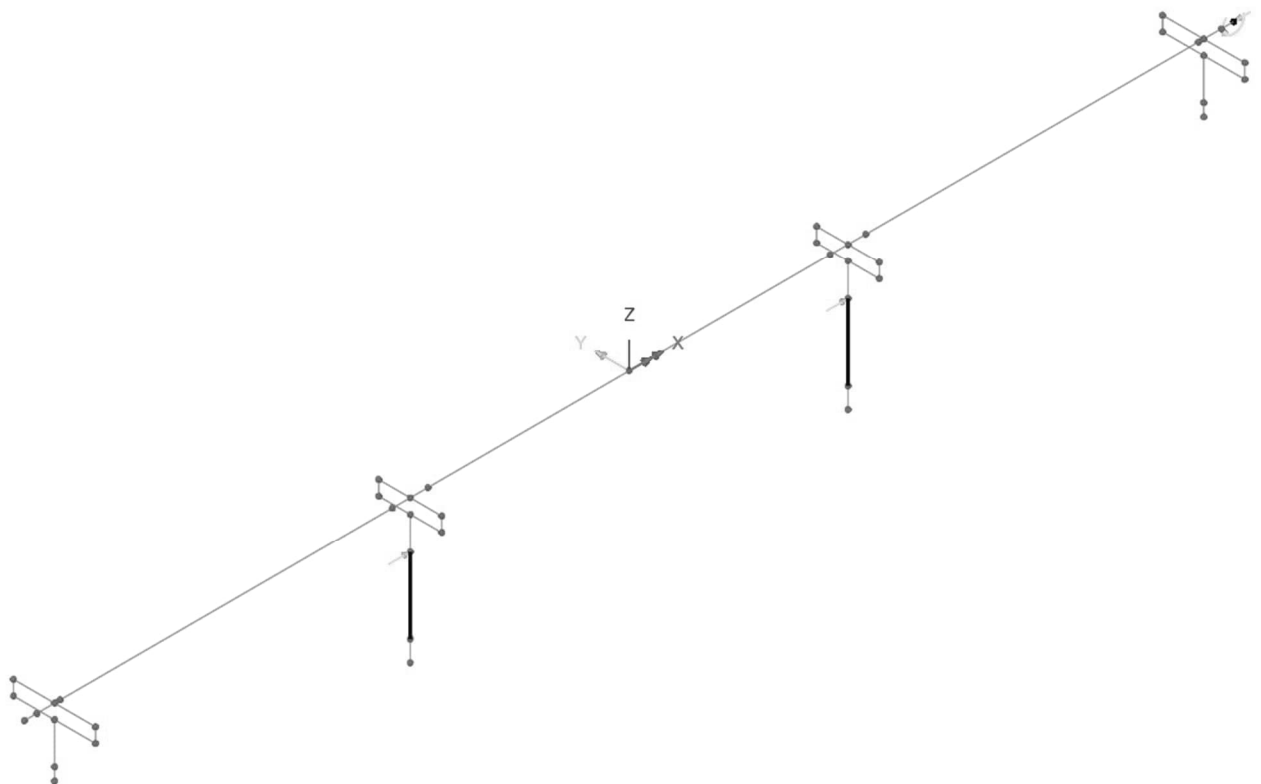
Loadcase: ICE HIGH X+

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

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

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

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



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:121
		Date :	Created :

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 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-

(59)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:122
		Date :	Created :

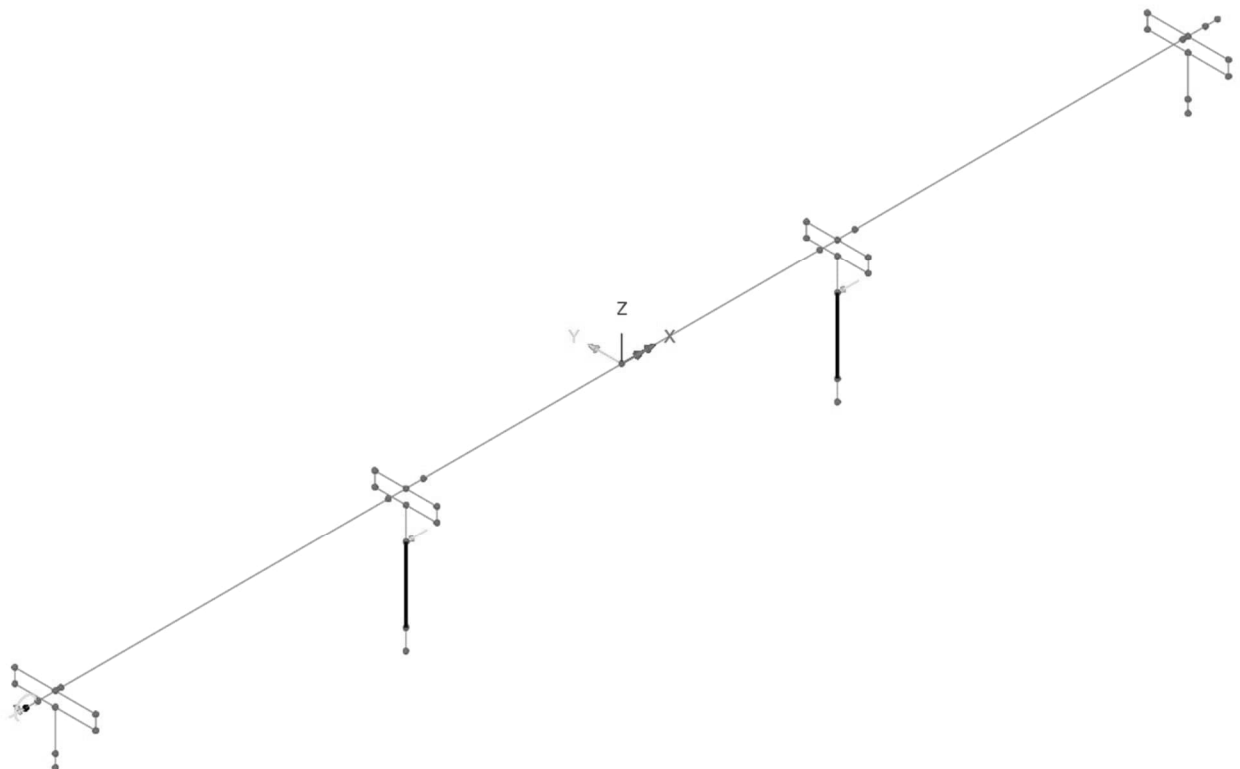
Loadcase: ICE HIGH X:-

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

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

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

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



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:123
		Date :	Created :

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)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:124
		Date :	Created :

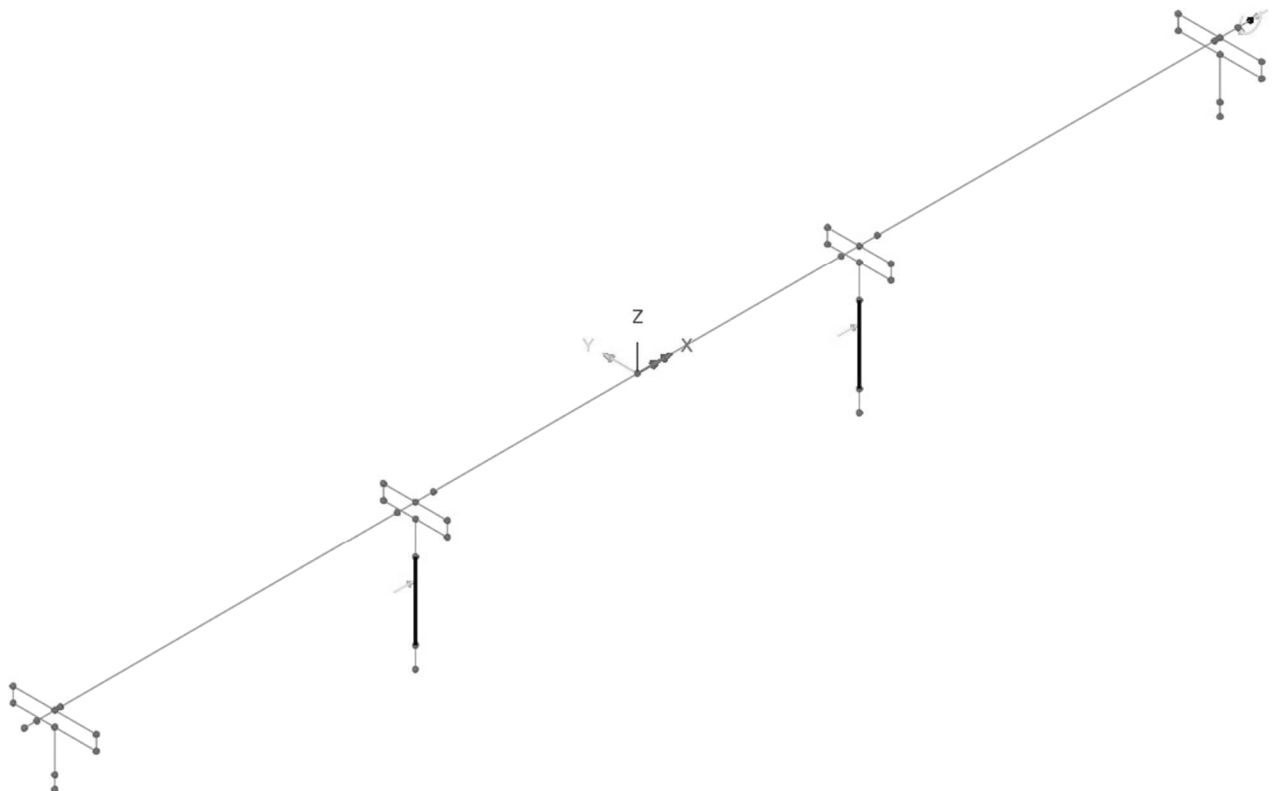
Loadcase: ICE LOW X+

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

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

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

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



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:125
		Date :	Created :

Load : ICE HIGH 2X-

Internal Beam Point

Analysis category3D

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 category3D

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)

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:126
		Date :	Created :

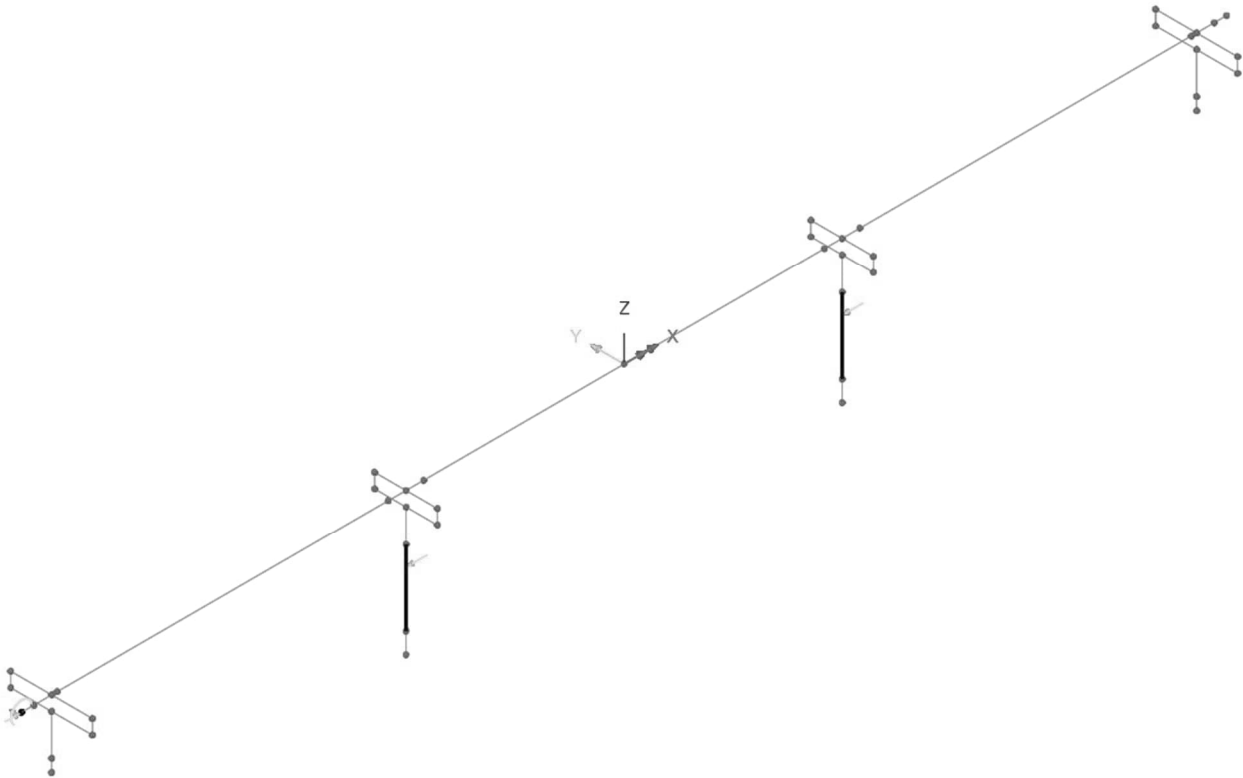
Loadcase: ICE LOW X-

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

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

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

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



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:127
		Date :	Created :

Load case : ICE HIGH 2Y+

Internal Beam Point

Analysis category

3D

Load direction

☒ Global

☐ Element local

Load position

☐ About beam axis

☒ About nodal line

Distance type

☐ Parametric

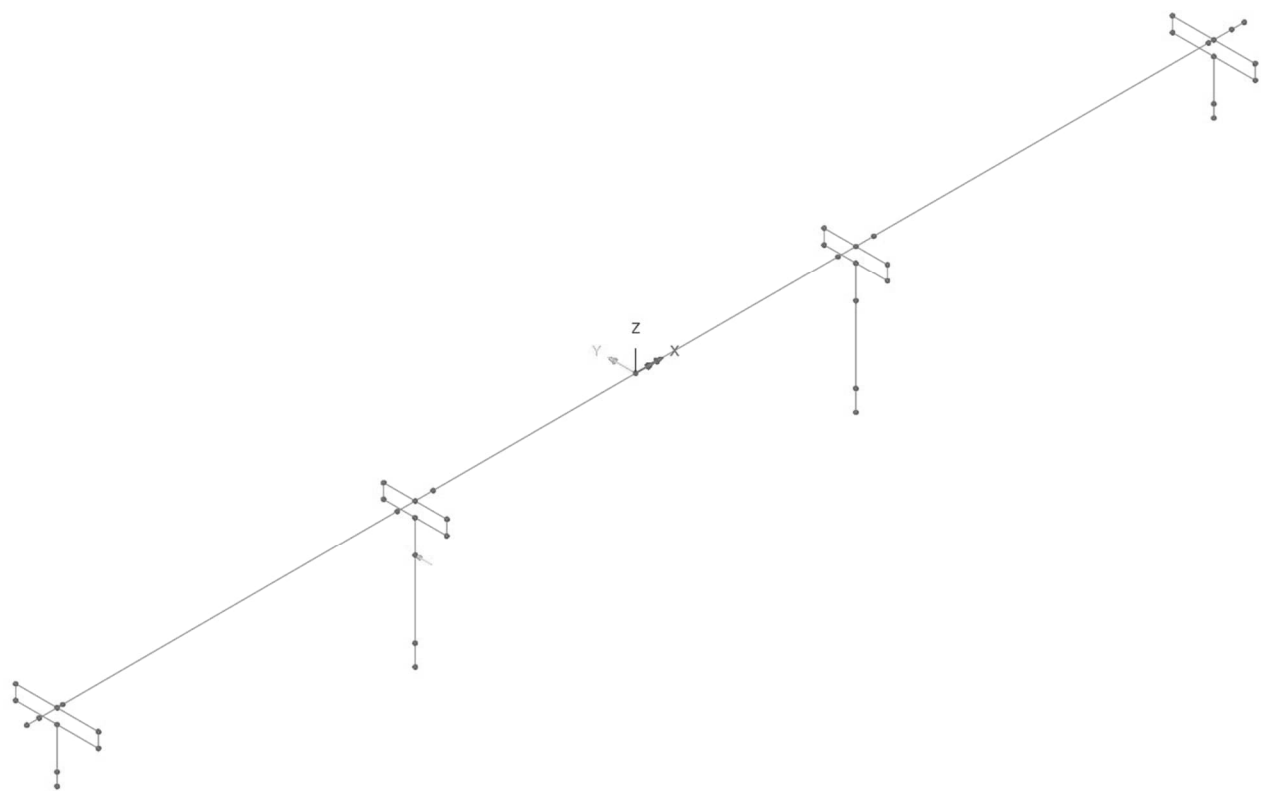
☒ Actual

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

Name

ICE HIGH 2Y+

(51)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:128
		Date :	Created :

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

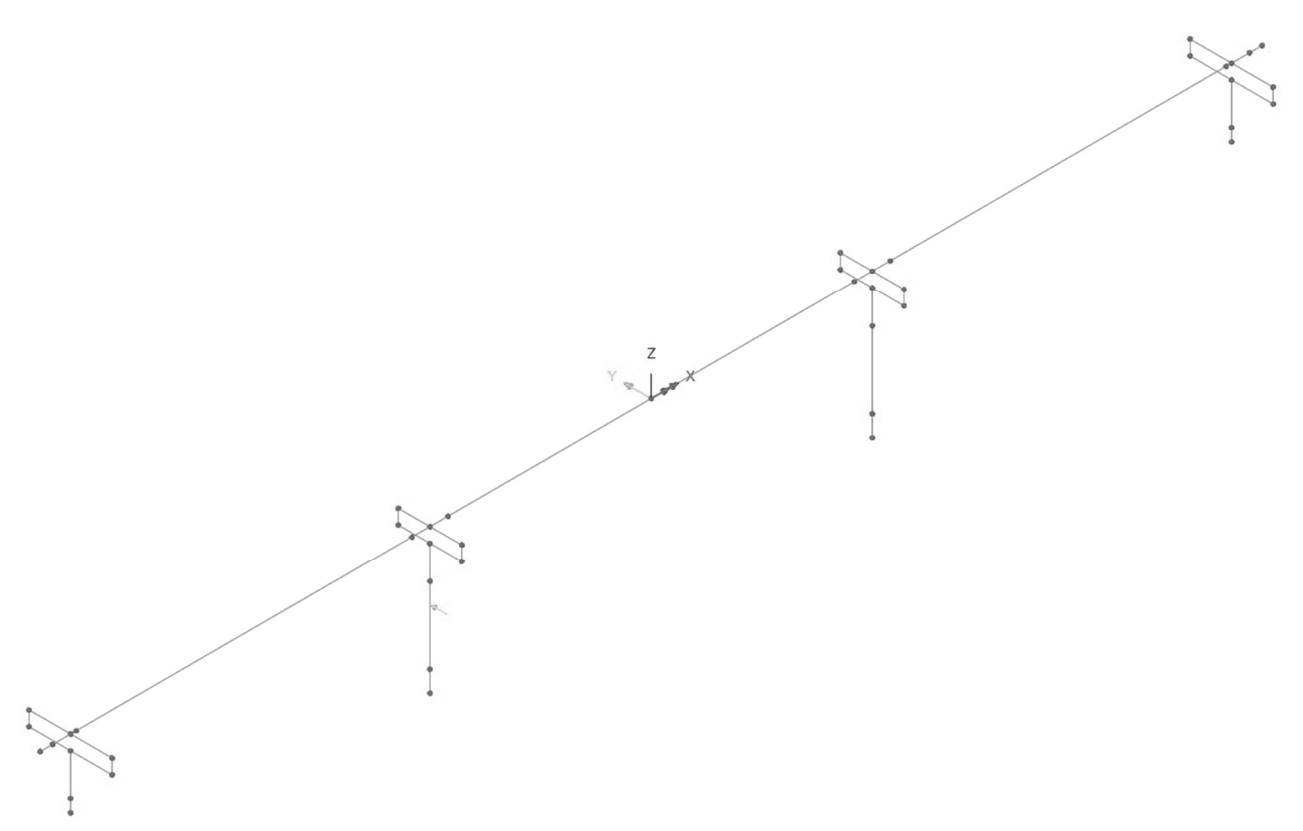
☒ Actual

	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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:129
		Date :	Created :

Load case : ICE HIGH 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	5.5	0.0	378.0	0.0	0.0	0.0	0.0
2							

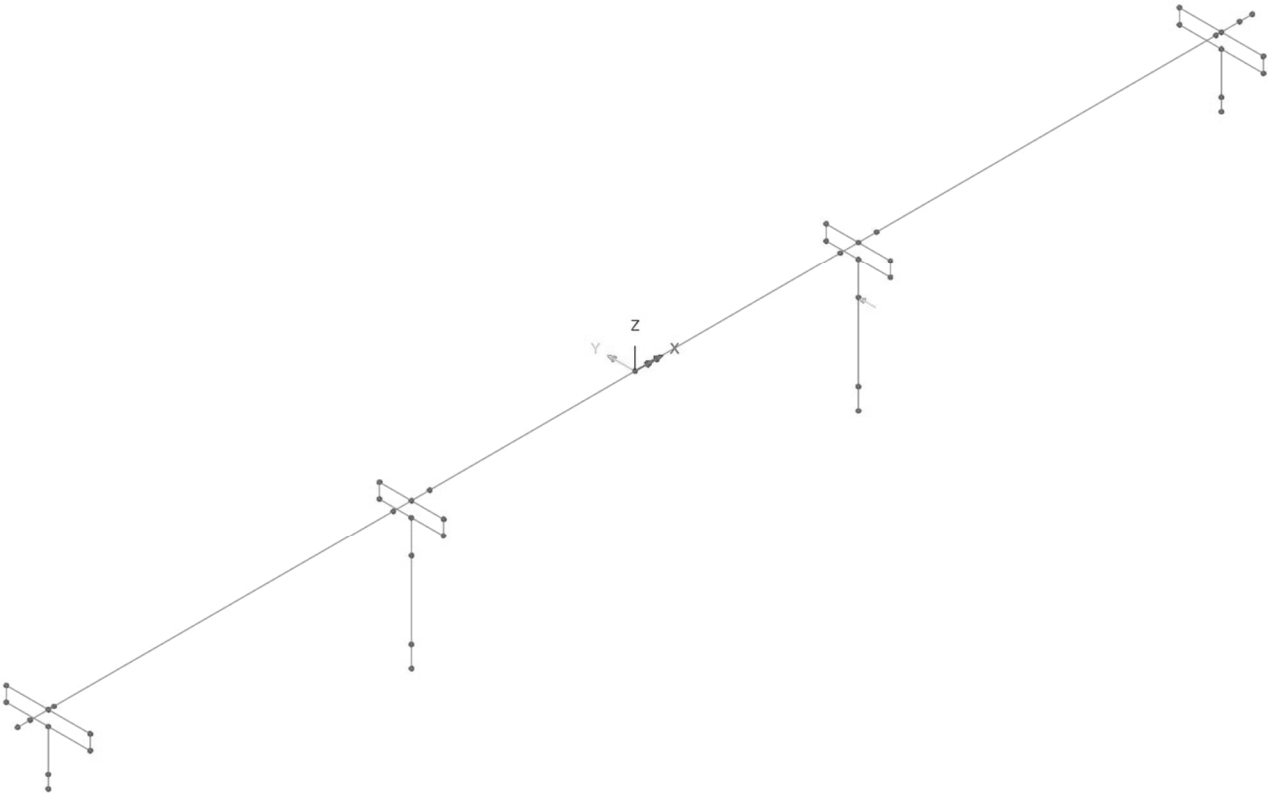
Name

ICE HIGH 3Y+

▼

▲▼

(53)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:130
		Date :	Created :

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

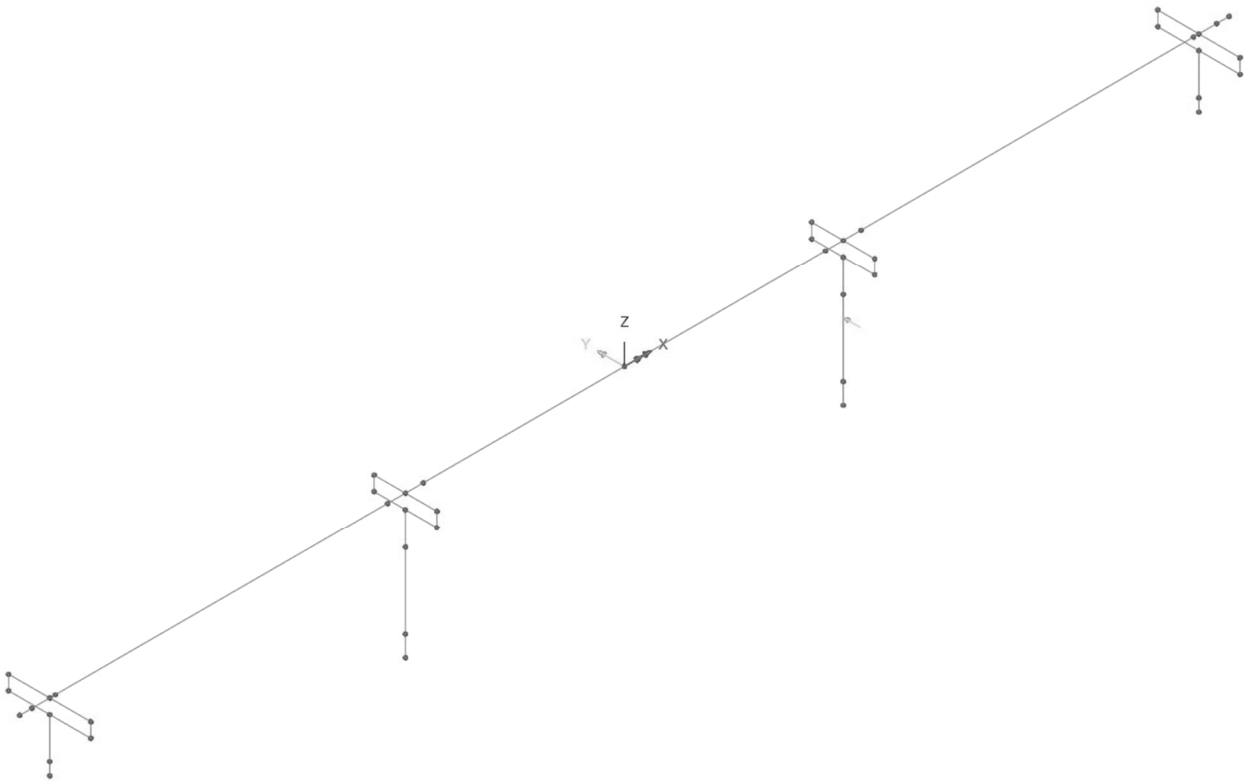
☒ Actual

	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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:131
		Date :	Created :

Load case : ICE 2Z

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							

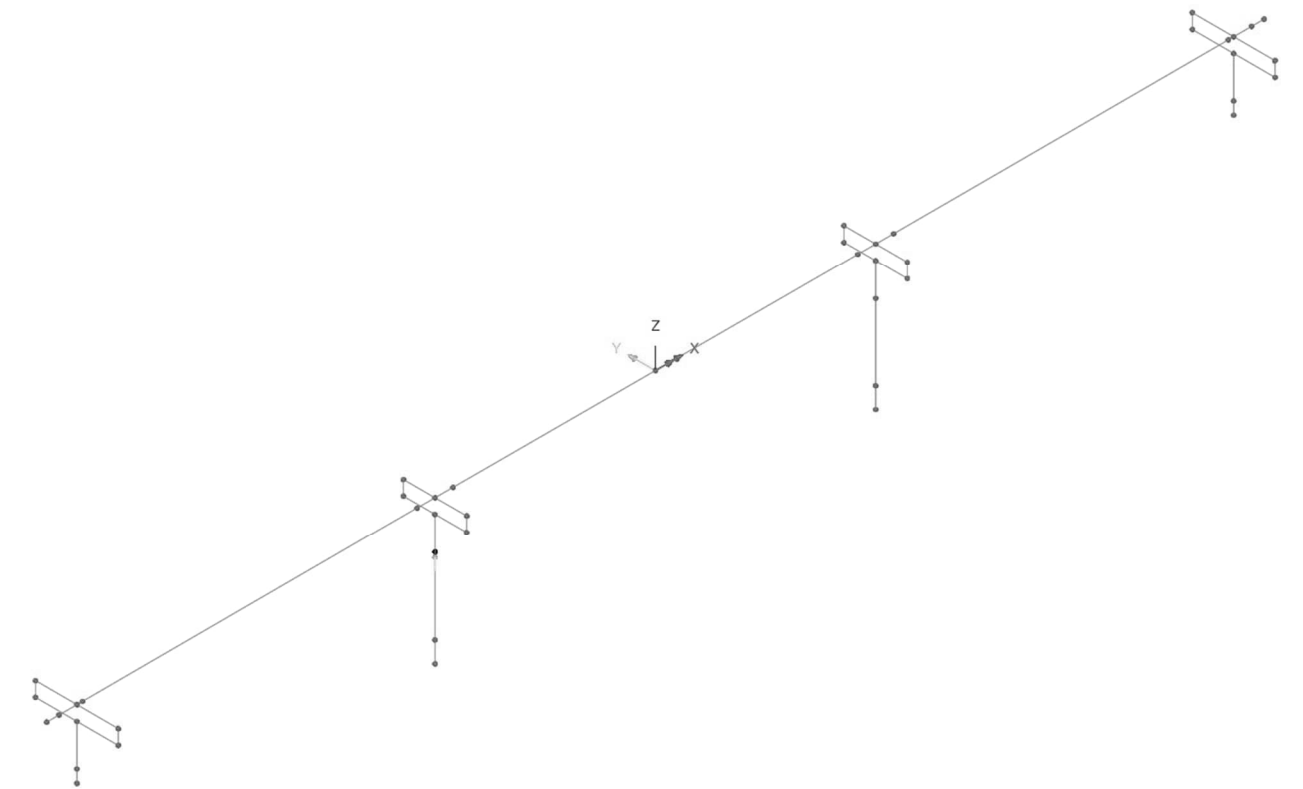
Name

ICE 2Z

▼

▲▼

(55)



Overview 3D

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:132
		Date :	Created :

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

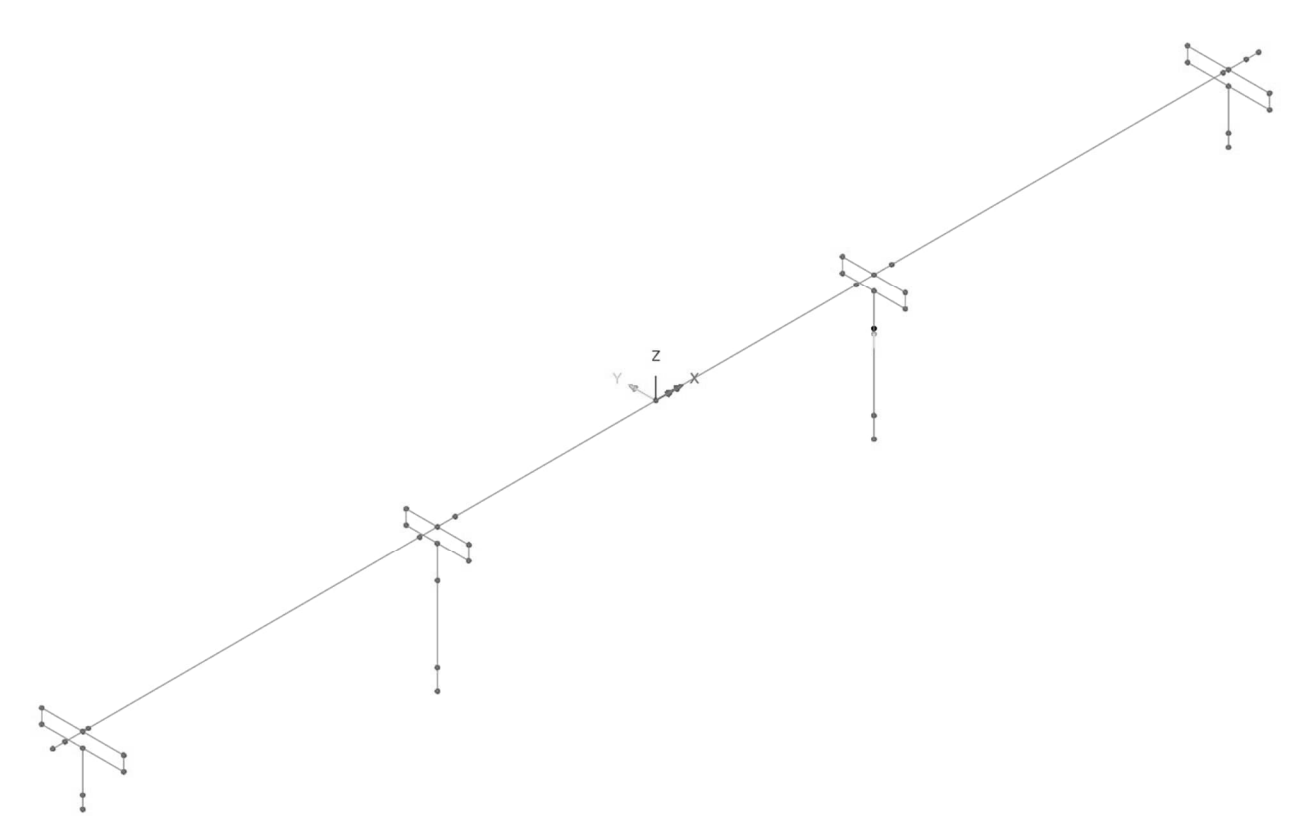
☒ Actual

	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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:133
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:134
		Date :	Created :

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 t_0 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
t_0	0 %	PT-T0	1.00 x PT-T0
t_1	6 %	PT-T1	0.94 x PT-T0
t_2	16 %	PT-T2	0.84 x PT-T0

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:135
		Date :	Created :

3.14.1 General

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

Material :

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

$$f_{pk} = 1860 \text{ MPa}$$

$$E_{sk} = 195 \text{ GPa}$$

$$\mu = 0.18$$

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

Casting tube :

80 mm / 86 mm

Slip during locking:

6 mm

Permissible curvature :

$$R_{\min} = 5.7 \text{ m}$$

Cabel area :

$$A_p = 15 \cdot 150 \text{ mm}^2 = 2250 \text{ mm}^2$$

Anchor plate :

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

Ultimate load :

$$F_u = 2250 \text{ mm}^2 \cdot 1860 \text{ MPa} = 4185 \text{ kN}$$

Permissible stress before locking :

See SS-EN 1992-1-1 section 5.10.2.1

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

Permissible stress after locking :

See SS-EN 1992-1-1 section 5.10.3

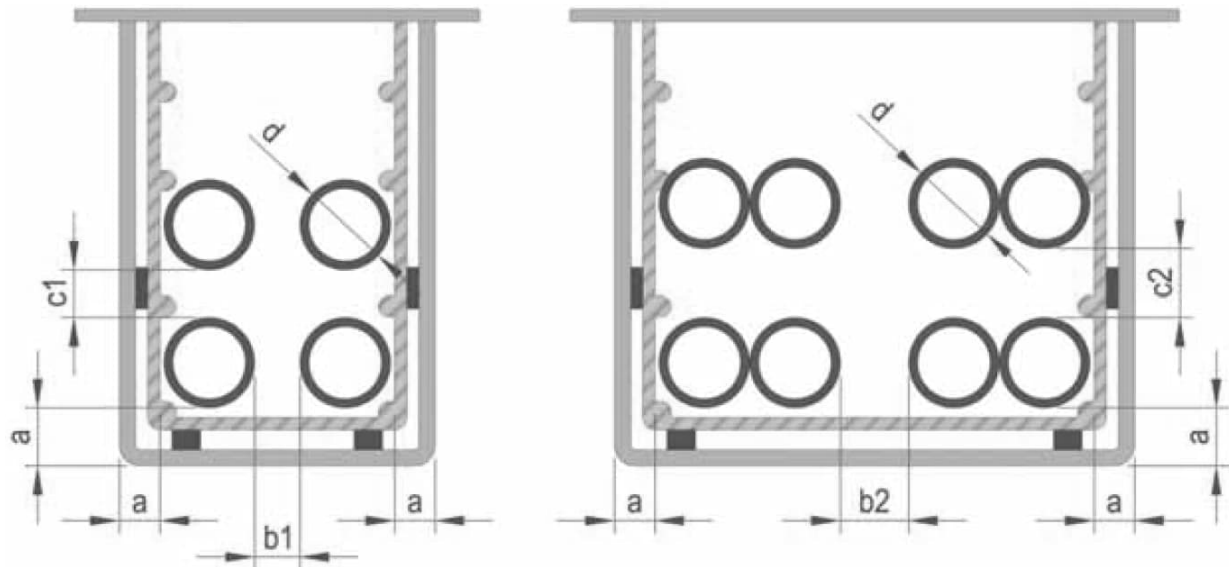
$$\sigma_{p, \max}^{\text{after}} = \min(0.75 f_{pk}; 0.85 f_{p0.1k}) = \min(1395 \text{ MPa}; 1394 \text{ MPa}) = 1394 \text{ MPa}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:136
		Date :	Created :

3.14.2 Execution

Associated to pre tension system VSL 6-15.

Recommended measurements :



$d = 90 \text{ mm}$

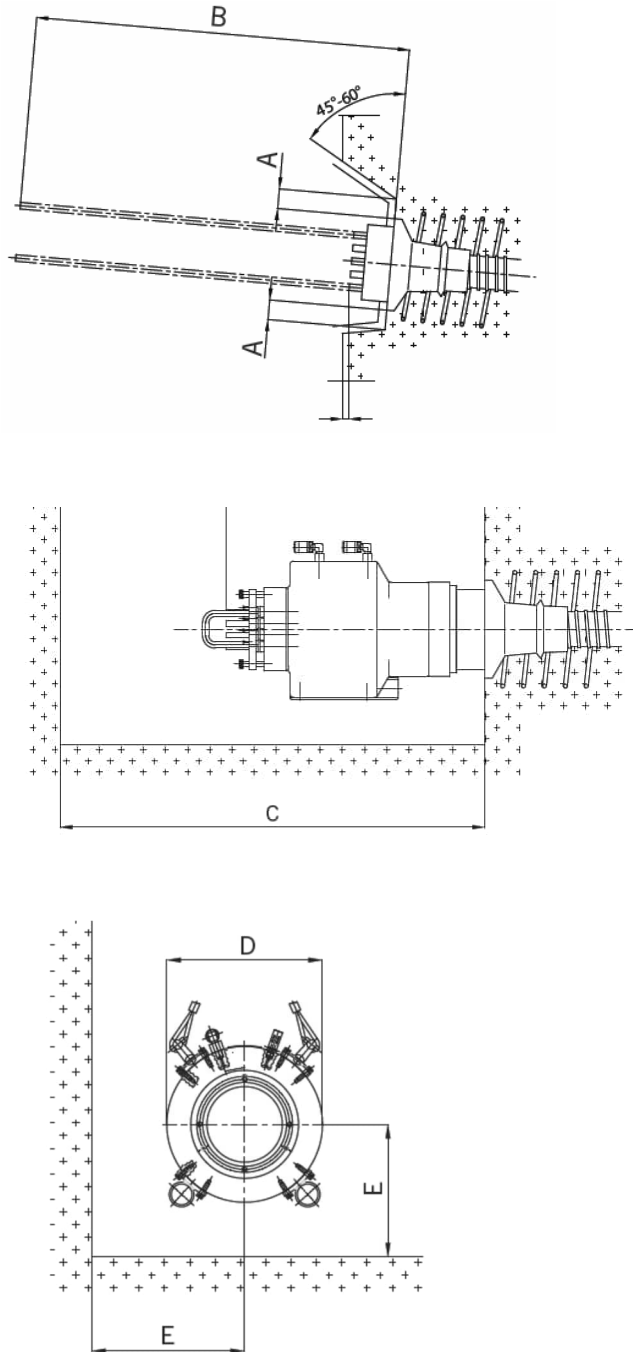
$a > 50 \text{ mm}$

$b1, c1 > 0.7d = 63 \text{ mm}$ but 100 chosen !

$b2, c2 > 1.0d = 90 \text{ mm}$ but 100 mm chosen !

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:137
		Date :	Created :

Demand for space during tensioning :



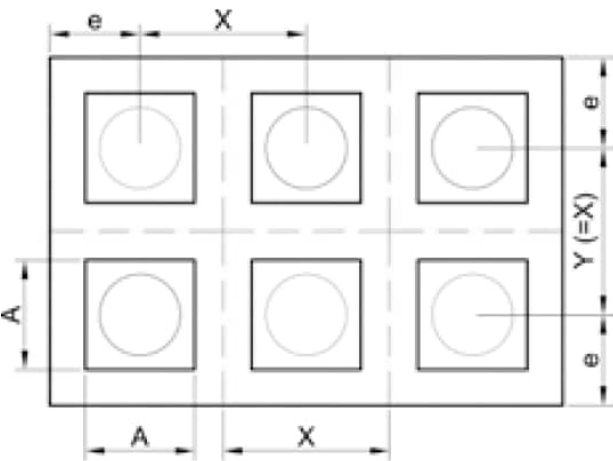
A = 70 mm

B = 1200 mm

C = 1700 mm

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:138
		Date :	Created :

Measurements of cables VSL 6-15 :



$A = 290 \text{ mm}$

$e \geq 175 \text{ mm} + TB$

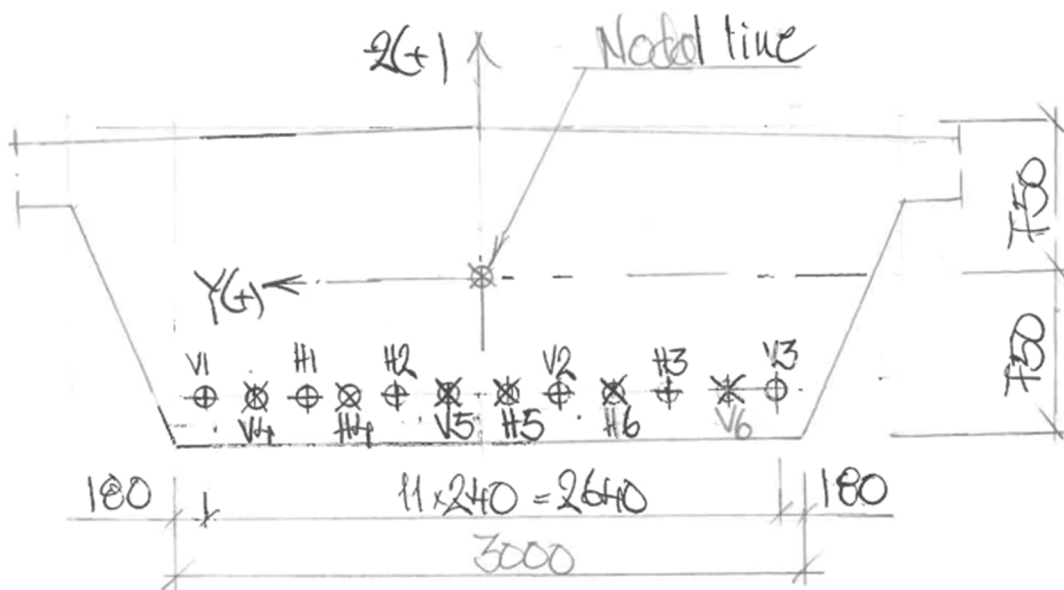
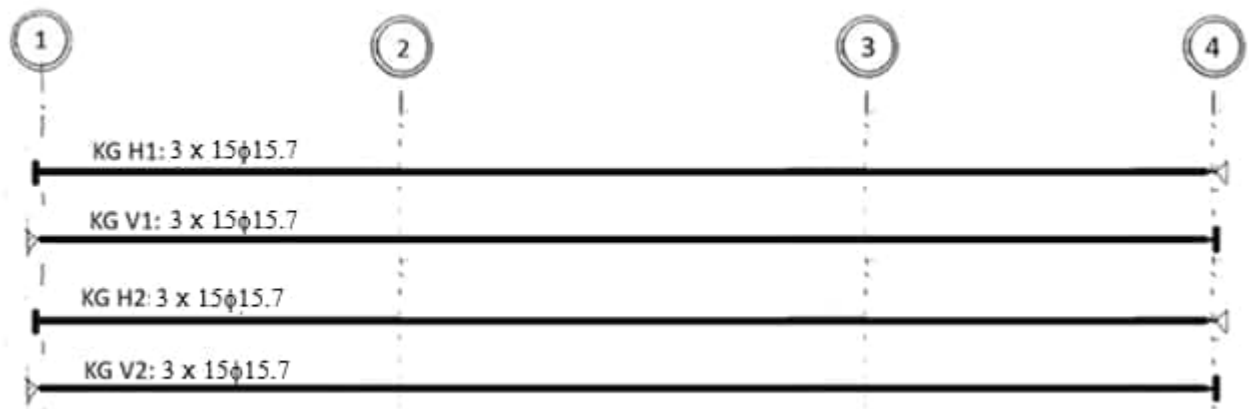
$X \geq 400 \text{ mm}$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:139
		Date :	Created :

3.14.3 Preliminary cable location

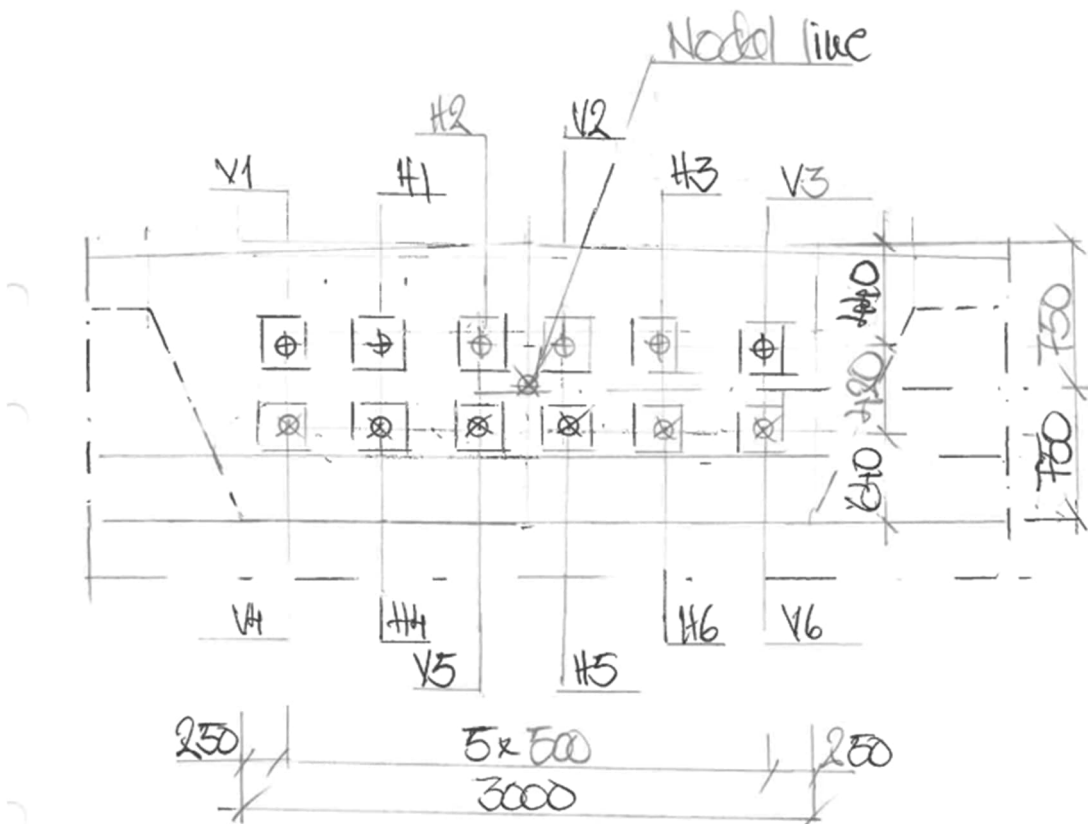
In the static model cables are simplified (= 3 cables are modelled as one fictive cable as seen below).

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



Cross section

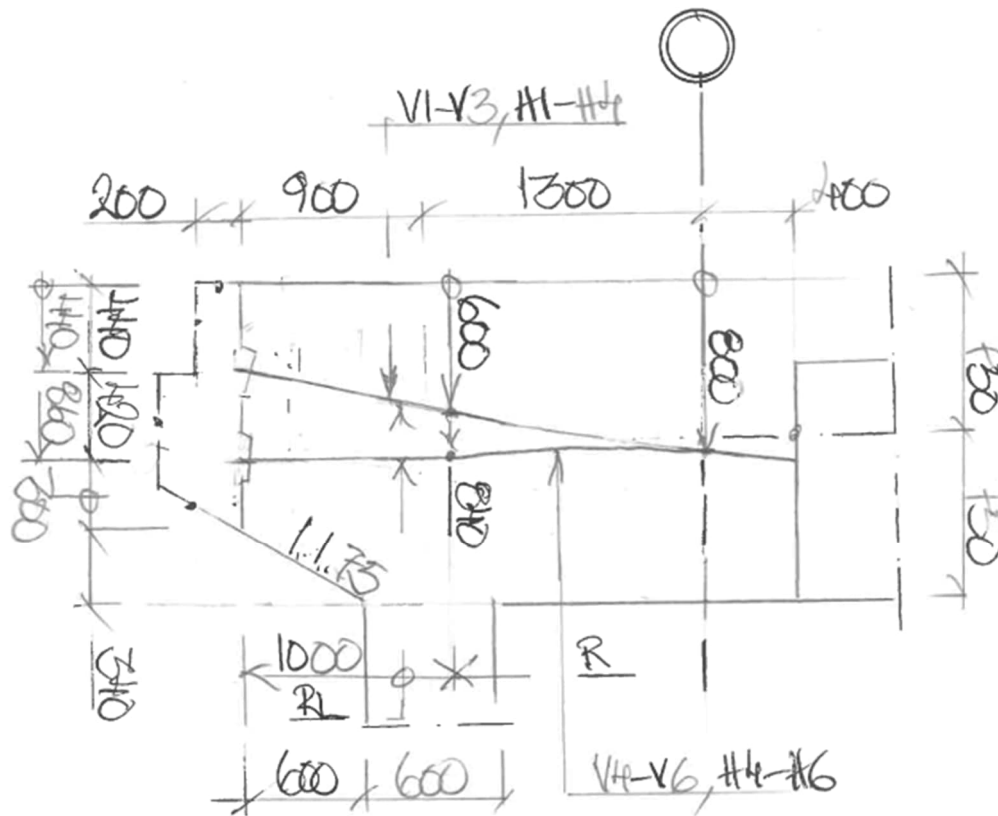
	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:140
		Date :	Created :



Detail 1

Cross section at end of tendon.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:141
		Date :	Created :



Detail 2.
Longitudinal section at end of tendon.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:143
		Date :	Created :

Tendon profile KG V1 & KG 1:

See spread sheet input see page A3:144.

$x(+)$: $x_p(+)$

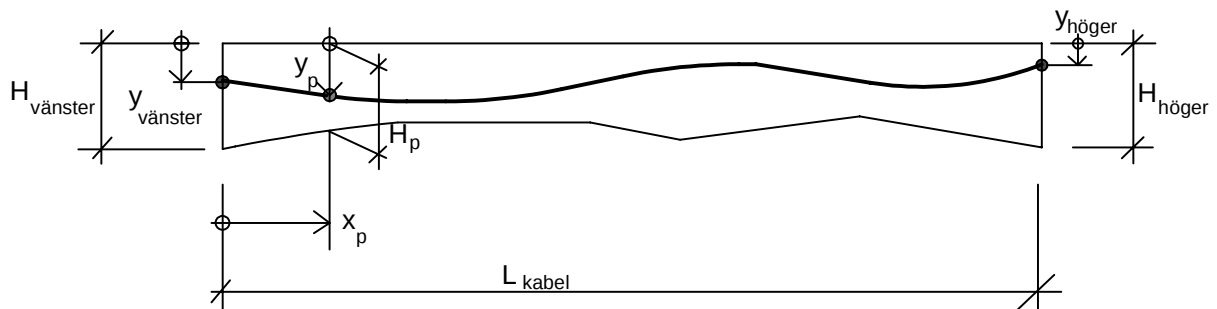
$y(+)$: 0 m

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

$x(+)$	$z(+)$	
0	0.31	$\leftarrow 0.75 \text{ m} - 0.44 \text{ m}$
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	$\leftarrow 0.75 \text{ m} - 0.44 \text{ m}$
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:

$$L_{\text{kabel}} = 2.2\text{m} + 26\text{m} + 32\text{m} + 26\text{m} + 2.2\text{m} = 88.4\text{m}$$

Ange antalet kända brytpunkter:

$$N_{\text{brytpunkter}} = 17 \cdot \text{st}$$

Fiktionskoefficienter spännarmering:

$$\mu = 0.18 \quad k = 0.005 \cdot \frac{\text{rad}}{\text{m}}$$

Draghållfasthet spännarmering:

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

$$f_{pk} = 1860\text{MPa}$$

E-modul spännarmering:

$$E_s = 195 \cdot \text{GPa}$$

Area spännarmering:

$$A_s = 2250\text{mm}^2$$

PROG B2.001/ 2001-12-01 (T026)

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

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

Vald uppspänningskraft:

$$V_{\delta} = 3320 \text{ kN} = 3320 \cdot \text{kN}$$

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

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

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**

$C_{\text{ps}} = \text{pspline}(x_p, y_p)$: 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

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

$$\beta_v = \mu \cdot (\alpha_v + k \cdot X) \quad : \text{exponent friktionsförluster}$$

$$\beta_v = \mu \cdot (\alpha_v + k \cdot x) \quad : \text{exponent friktionsförluster}$$

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

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

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

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

Friktionsförlust funktion mät ifrån "höger" sida

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

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

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

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

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

$$X_{mh} = \begin{cases} x_{\text{skär}} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Passiv"} \\ \text{if Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{\text{start}} \leftarrow L_{\text{kabel}} - 2m \\ x_{\text{skär}} \leftarrow \text{root}(V_{\text{max}} - V_{\text{ö}} \cdot \text{interp}(X, \eta_{hf}, x_{\text{start}}), x_{\text{start}}) \end{cases} \end{cases}$$

Bestämning skärning mellan kurva kabelkraft vänster resp. höger

$$X_m = \begin{cases} x_{\text{skär}} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Passiv"} \\ x_{\text{skär}} \leftarrow 0m & \text{if Typ} = \text{"Passiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{\text{start}} \leftarrow 0.5 \cdot L_{\text{kabel}} \\ x_{\text{skär}} \leftarrow \text{root}(V_{\text{ö}} \cdot \text{interp}(X, \eta_{vf}, x_{\text{start}}) - V_{\text{ö}} \cdot \text{interp}(X, \eta_{hf}, x_{\text{start}}), x_{\text{start}}) \end{cases} \end{cases}$$

Bestämning av kabelkraft efter lösning i resp. balkändeKabelkraft på vänster sida :

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

Kabelkraft på höger sida :

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

Bestämning av eftersläppning / "låsglidning"Vänster sida :

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

Höger sida :

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

Bestämning kabelförlängning före låsningVänster sida :

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

Höger sida :

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

Bestäm funktion för bestämning av godtycklig kabelkraft före låsning

$$P_{\text{före}} = \begin{cases} V_{\delta} \cdot \text{linterp}(X, \eta_{\text{vf}}, x) & \text{if } x \leq X_m \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{hf}}, x) & \text{if } x > X_m \end{cases}$$

Bestäm funktion för bestämning av godtycklig kabelkraft efter låsning

$$P_{\text{efter}} = \begin{cases} P_{\text{ve}} \cdot \text{linterp}(X, \eta_{\text{ve}}, x) & \text{if } x \leq X_{\text{mv}} \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{vf}}, x) & \text{if } X_{\text{mv}} < x < X_m \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{hf}}, x) & \text{if } X_m \leq x \leq X_{\text{mh}} \\ P_{\text{he}} \cdot \text{linterp}(X, \eta_{\text{he}}, x) & \text{if } x > X_{\text{mh}} \end{cases}$$

PROG B2.001/ 2001-12-01 (T026)

Utställningsdata 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 :

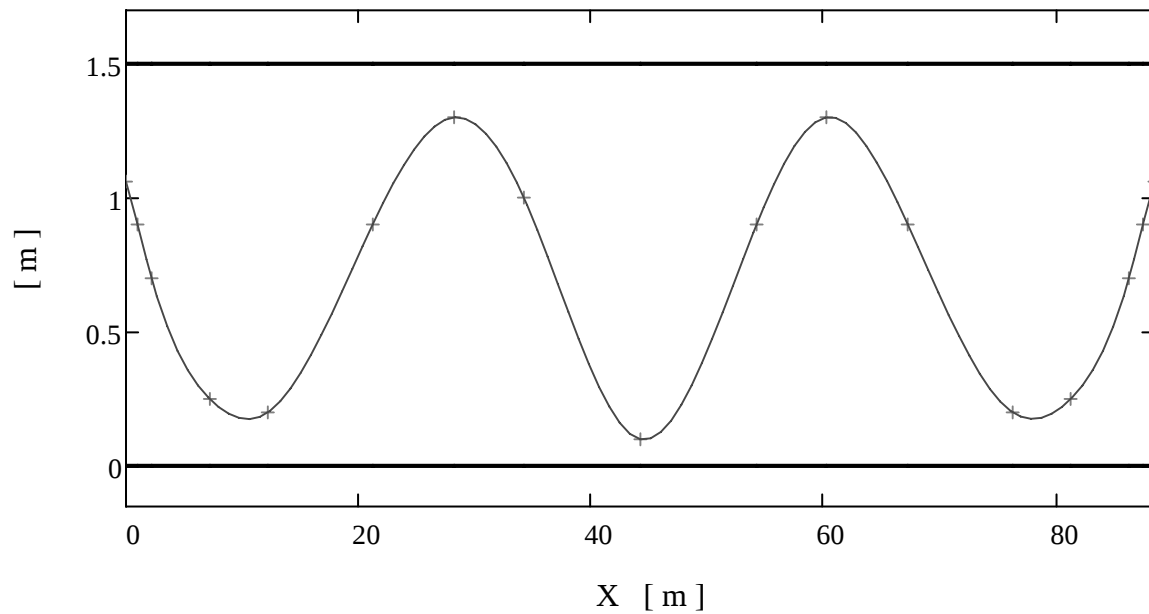
Punkt	y' (m)	Anm.
1	0.440	Förankringar
2	0.600	-
3	1.302	-
4	1.306	-
5	1.140	-
6	0.856	-
7	0.555	-
8	0.305	-
9	0.200	-
10	0.334	-
11	0.714	-
12	1.162	-
13	1.400	-

ger

q _{sp} (m)
1.060
0.900
0.198
0.194
0.360
0.644
0.945
1.195
1.300
1.166
0.786
0.338
0.100

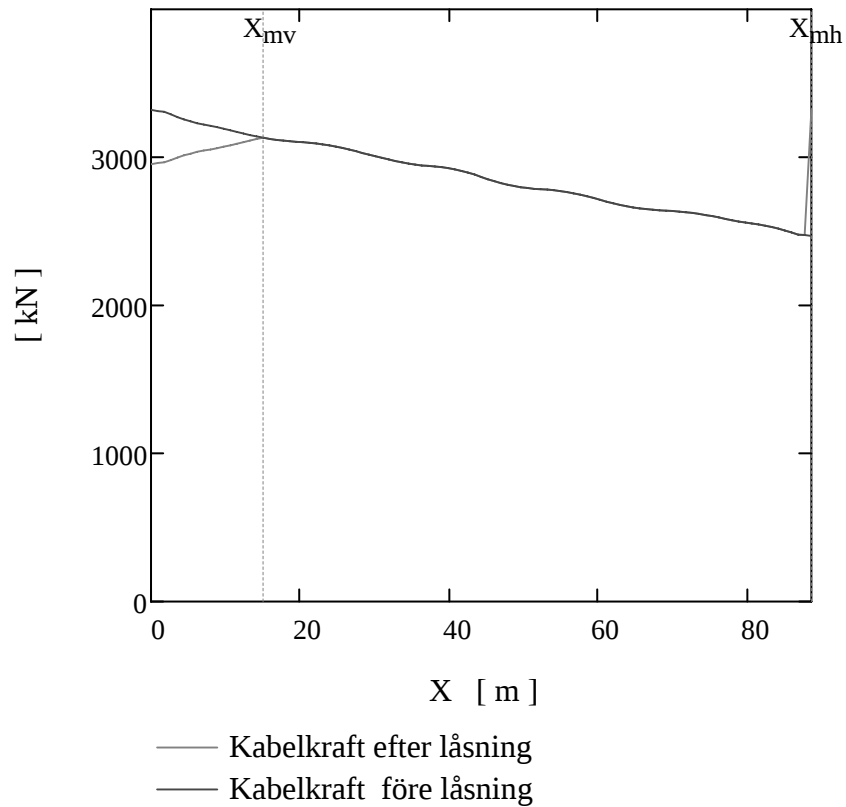
$$q_{sp} = H - y'$$

PROG B2.001/ 2001-12-01 (T026)

RESULTATGrafisk uppritning av balk och kabelföring

- +++ Brytpunkter
- Interpolerad kurva
- Balk ÖK
- Balk UK

PROG B2.001/ 2001-12-01 (T026)

Grafisk uppritning av kabelkrafterMinsta krökningsradie

$$R_{\min} = 38.8 \cdot \text{m}$$

Kabelförlängning före låsning

$$L_v = 579 \cdot \text{mm} \quad : \text{vänster sida}$$

$$L_h = 0 \cdot \text{mm} \quad : \text{högers sida}$$

Låsglidning

$$\Delta L_v = 6 \cdot \text{mm} \quad : \text{vänster sida}$$

$$\Delta L_h = 0 \cdot \text{mm} \quad : \text{högers sida}$$

Kabelkraft i balkände efter låsning

$$P_{ve} = 2951 \cdot \text{kN}$$

: vänster sida

$$P_{he} = 2325 \cdot \text{kN}$$

: högers sida

Läge för maximal kabelkraft efter låsning

$$X_{mv} = 15.005 \text{ m}$$

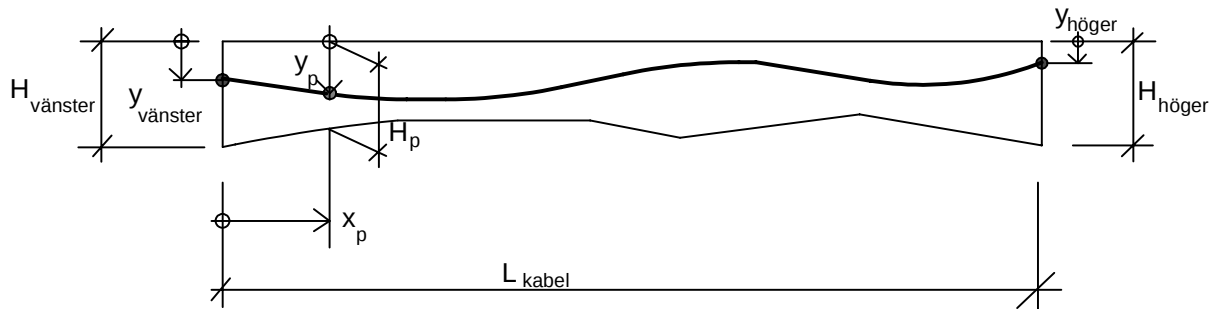
: vänster sida

$$X_{mh} = 88.4 \cdot \text{m}$$

: högers sida

Läge för lägsta kabelkraft

$$X_m = 88.4 \text{ m}$$

Object: Cables V4-V6 (H4-H6)**PRINCIPFIGUR****INDATA**

Total kabellängd:

$$L_{\text{kabel}} = 2.2\text{m} + 26\text{m} + 32\text{m} + 26\text{m} + 2.2\text{m} = 88.4\text{m}$$

Ange antalet kända brytpunkter:

$$N_{\text{brytpunkter}} = 17 \cdot \text{st}$$

Fiktionskoefficienter spännarmering:

$$\mu = 0.18 \quad k = 0.005 \cdot \frac{\text{rad}}{\text{m}}$$

Draghållfasthet spännarmering:

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

$$f_{pk} = 1860\text{MPa}$$

E-modul spännarmering:

$$E_s = 195 \cdot \text{GPa}$$

Area spännarmering:

$$A_s = 2250\text{mm}^2$$

PROG B2.001/ 2001-12-01 (T026)

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

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

Vald uppspänningskraft:

$$V_{\delta} = 3320 \text{ kN} = 3320 \cdot \text{kN}$$

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

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

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**

$\underline{C} = \text{pspline}(x_p, y_p)$: 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

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

$$\beta_v = \mu \cdot (\alpha_v + k \cdot X) \quad : \text{exponent friktionsförluster}$$

$$\beta_v = \mu \cdot (\alpha_v + k \cdot x) \quad : \text{exponent friktionsförluster}$$

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

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

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

$$X_{mv} = \begin{cases} x_{skär} \leftarrow 0\text{m} & \text{if Typ} = \text{"Passiv"} \\ \text{if Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{start} \leftarrow 2\text{m} \\ x_{skär} \leftarrow \text{root}(V_{max} - V_{\ddot{o}} \cdot \text{lininterp}(X, \eta_{vf}, x_{start}), x_{start}) \end{cases} \end{cases}$$

Friktionsförlust funktion mät ifrån "höger" sida

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

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

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

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

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

$$X_{mh} = \begin{cases} x_{\text{skär}} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Passiv"} \\ \text{if Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{\text{start}} \leftarrow L_{\text{kabel}} - 2m \\ x_{\text{skär}} \leftarrow \text{root}(V_{\text{max}} - V_{\text{ö}} \cdot \text{interp}(X, \eta_{hf}, x_{\text{start}}), x_{\text{start}}) \end{cases} \end{cases}$$

Bestämning skärning mellan kurva kabelkraft vänster resp. höger

$$X_m = \begin{cases} x_{\text{skär}} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Passiv"} \\ x_{\text{skär}} \leftarrow 0m & \text{if Typ} = \text{"Passiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{\text{start}} \leftarrow 0.5 \cdot L_{\text{kabel}} \\ x_{\text{skär}} \leftarrow \text{root}(V_{\text{ö}} \cdot \text{interp}(X, \eta_{vf}, x_{\text{start}}) - V_{\text{ö}} \cdot \text{interp}(X, \eta_{hf}, x_{\text{start}}), x_{\text{start}}) \end{cases} \end{cases}$$

Bestämning av kabelkraft efter lösning i resp. balkändeKabelkraft på vänster sida :

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

Kabelkraft på höger sida :

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

Bestämning av eftersläppning / "låsglidning"Vänster sida :

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

Höger sida :

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

Bestämning kabelförlängning före låsningVänster sida :

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

Höger sida :

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

Bestäm funktion för bestämning av godtycklig kabelkraft före låsning

$$P_{\text{före}} = \begin{cases} V_{\delta} \cdot \text{linterp}(X, \eta_{\text{vf}}, x) & \text{if } x \leq X_m \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{hf}}, x) & \text{if } x > X_m \end{cases}$$

Bestäm funktion för bestämning av godtycklig kabelkraft efter låsning

$$P_{\text{efter}} = \begin{cases} P_{\text{ve}} \cdot \text{linterp}(X, \eta_{\text{ve}}, x) & \text{if } x \leq X_{\text{mv}} \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{vf}}, x) & \text{if } X_{\text{mv}} < x < X_m \\ V_{\delta} \cdot \text{linterp}(X, \eta_{\text{hf}}, x) & \text{if } X_m \leq x \leq X_{\text{mh}} \\ P_{\text{he}} \cdot \text{linterp}(X, \eta_{\text{he}}, x) & \text{if } x > X_{\text{mh}} \end{cases}$$

PROG B2.001/ 2001-12-01 (T026)

Utställningsdata 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	-

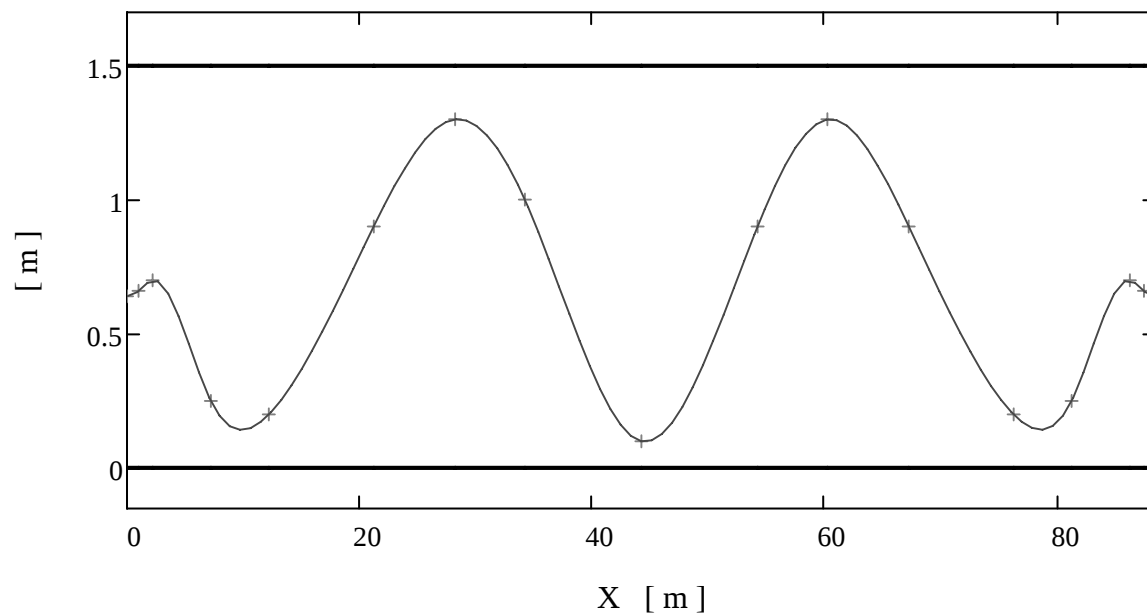
Kabeläge :

Punkt	y' (m)	Anm.
1	0.860	Förankringar
2	0.840	-
3	1.340	-
4	1.309	-
5	1.118	-
6	0.842	-
7	0.556	-
8	0.309	-
9	0.200	-
10	0.334	-
11	0.715	-
12	1.162	-
13	1.400	-

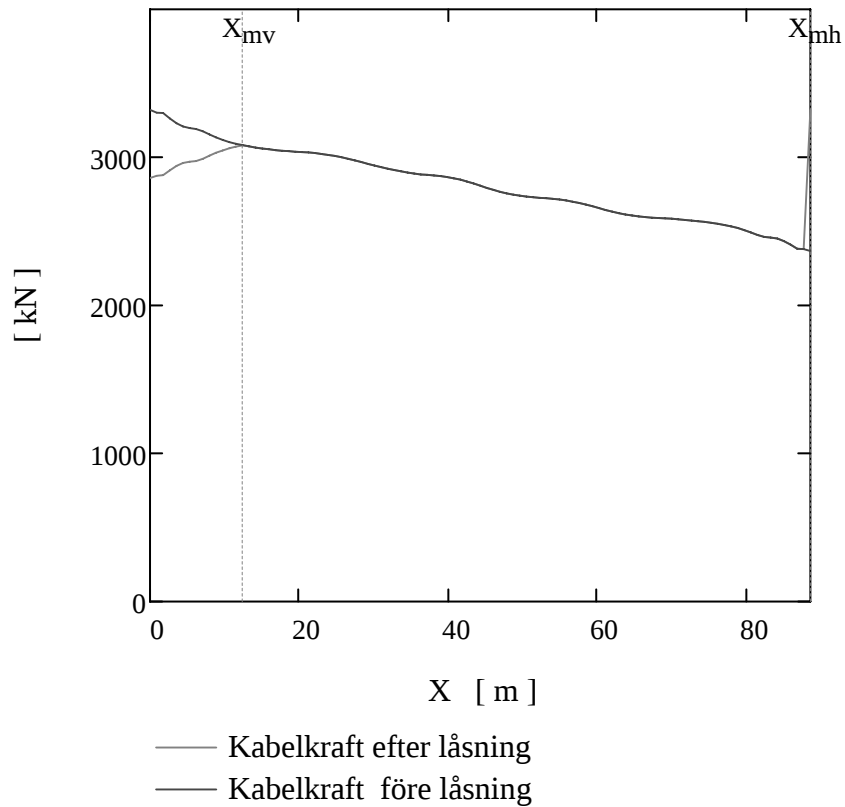
ger

q _{sp} (m)
0.640
0.660
0.160
0.191
0.382
0.658
0.944
1.191
1.300
1.166
0.785
0.338
0.100

$$q_{sp} = H - y'$$

RESULTATGrafisk uppritning av balk och kabelföring

PROG B2.001/ 2001-12-01 (T026)

Grafisk uppritning av kabelkrafterMinsta krökningsradie

$$R_{\min} = 14.6 \cdot \text{m}$$

Kabelförlängning före låsning

$$L_v = 567 \cdot \text{mm}$$

: vänster sida

$$L_h = 0 \cdot \text{mm}$$

: högers sida

Låsglidning

$$\Delta L_v = 6 \cdot \text{mm}$$

: vänster sida

$$\Delta L_h = 0 \cdot \text{mm}$$

: högers sida

Kabelkraft i balkände efter låsning

$$P_{ve} = 2857 \cdot \text{kN}$$

: vänster sida

$$P_{he} = 2194 \cdot \text{kN}$$

: högers sida

Läge för maximal kabelkraft efter låsning

$$X_{mv} = 12.384 \text{ m}$$

: vänster sida

$$X_{mh} = 88.4 \cdot \text{m}$$

: högers sida

Läge för lägsta kabelkraft

$$X_m = 88.4 \text{ m}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:168
		Date :	Created :

Tendon properties:

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

Tendon Properties

Design code EN1992-1-1:2004 / 2014 Eurocode 2

☐ Losses based on time inputs and calculated stresses
☒ Approximate losses, requiring input of estimated stresses

Elastic shortening
☐ Based on design code Set losses...
☐ User-defined Set losses...
☒ Ignore effects

General

Tendon area	2.25E3	mm ²
Modulus of elasticity for tendon	195.0E6	kN/m ²
Concrete stress at transfer	10.0E3	kN/m ²

Instantaneous losses

Modulus of elasticity of concrete at transfer	32.0E6	kN/m ²
Unintentional angular displacement	5.0E-3	rad/m
Duct friction coefficient	0.18	

Long term losses

Include	No
---------	----

Name VSL 6-15 ▼ ▲ (1)

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)	$\mu = 0.16 - 0.22$ $k = 0.004 - 0.008$	$\mu = 0.18$ $k = 0.005 \text{ (} k^* = 9 \times 10^{-4} \text{)}$

$$\mu = 0.18$$

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:169
		Date :	Created :

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

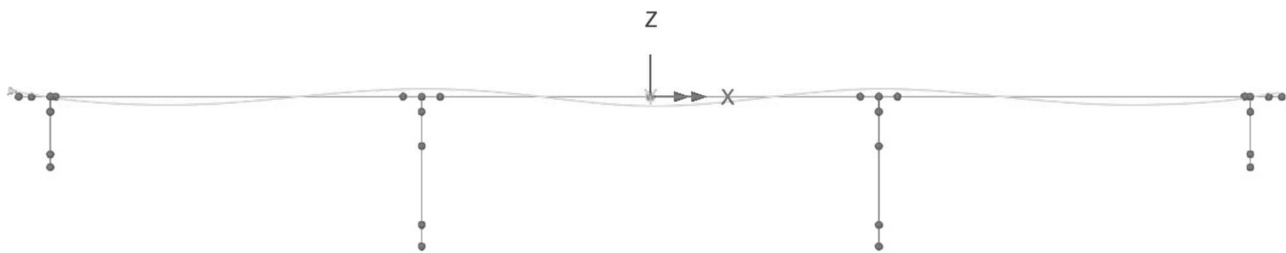
☐ Jacking at end 2

	Value
Angle	0.0
Slip	0.0

Name

PT- KG V1

(43)



ELEVATION

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:170
		Date :	Created :

KG H1: Cables H1, H2 & H3

Tendon

Analysis category3D

Profile1:KG 1

Property1:VSL 6-15

	Value
Prestress force	3.32E3

☐ Jacking at end 1

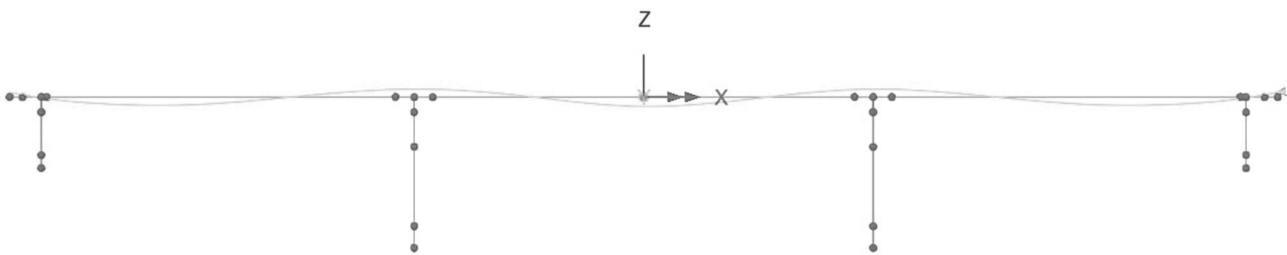
	Value
Angle	0.0
Slip	0.0

☒ Jacking at end 2

	Value
Angle	0.0
Slip	6.0E-3

NamePT- KG H1

(45)



ELEVATION

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:171
		Date :	Created :

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

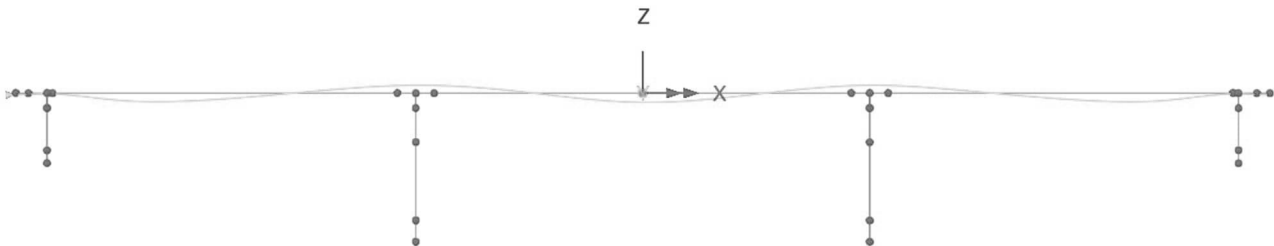
☐ Jacking at end 2

	Value
Angle	0.0
Slip	0.0

Name

PT- KG V2

(44)



ELEVATION

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:172
		Date :	Created :

KG H2: Cables H4, H5 & H6

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	0.0

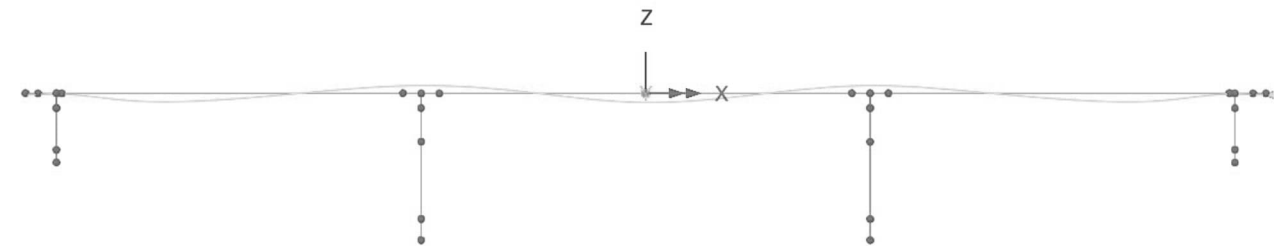
☒ Jacking at end 2

	Value
Angle	0.0
Slip	6.0E-3

Name

PT- KG H2

(46)



ELEVATION

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:173
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:174
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:175
		Date :	Created :

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.

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

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

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:

$$\Psi \gamma_{ULS-A} = \gamma_d \cdot 1.35 \cdot \eta_{sup,G} = 1.0 \cdot 0.89 \cdot 1.35 \cdot 1.1 = 1.49 \quad \leftarrow \text{dimensioning}$$

$$\Psi \gamma_{ULS-B} = \gamma_d \cdot 0.89 \cdot 1.35 \cdot \eta_{sup,G} = 1.0 \cdot 0.89 \cdot 1.35 \cdot 1.1 = 1.33$$

- Load coefficient surcharge:

$$\Psi \gamma_{ULS-A} = \gamma_d \cdot \psi_0 \cdot 1.50 = 1.0 \cdot 0.75 \cdot 1.50 = 1.13$$

$$\Psi \gamma_{ULS-B} = \gamma_d \cdot 1.50 = 1.0 \cdot 1.50 = 1.50 \quad \leftarrow \text{dimensioning}$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:176
		Date :	Created :

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.

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

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

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: $\psi \gamma_{\text{över}} = \gamma_d \cdot 1.40 = 0.91 \cdot 1.40 = 1.27$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:177
		Date :	Created :

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

$$K_o(D2) = 1 - \sin(\varphi_d) = 1 - \sin 45^\circ = 0.29$$

$$K_o(D3) = 1 - \sin(\varphi_d) = 1 - \sin 38^\circ = 0.39$$

$$\text{Earth pressure} \rightarrow 1.48^{1.)} \cdot K_o(D2) = 0.43 \equiv 1.10 \cdot K_o(D3) = 0.43 \quad \text{i.e. OK!}$$

$$\text{Surcharge} \rightarrow 1.71^{2.)} \cdot K_o(D2) = 0.50 \equiv 1.27 \cdot K_o(D3) = 0.50 \quad \text{i.e. OK!}$$

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:178
		Date :	Created :

Permanent loads:

(Refers to RKFM appendix 2, page 22)

Nr	Load		$\Psi\gamma_{ULS-A}$	$\Psi\gamma_{ULS-B}$		$\Psi\gamma_{ULS}$
1	Egentyngd	max	1.35	1.20		1.20
		min	1.00	1.00		1.00
2	Beläggning	max	1.49	1.33		1.33
		min	0.90	0.90		0.90
3	Överfyllnad	max	1.49	1.33		1.33
		min	0.90	0.90		0.90
4	Jordtryck	max	1.49	1.33	$\Rightarrow$	1.48 ^{1.)}
		min	0.90	0.90		0.90
5	Vattentryck	max	1.35	1,09		1,09
		min	1.00	1.00		1.00
6	Stödförskjutning	max	1.35	1.20		1.20
		min	1.00	1.00		1.00
7	Krympning	max	1.35	1.20		1.20
		min	1.00	1.00		1.00
8	Spännkraft	max	1.35	1.35		1.35
		min	1.00	1.00		1.00

Remark

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:179
		Date :	Created :

Variable loads:

(Refers to RKFM appendix 2, page 22)

Nr	Load	$\Psi\gamma_{\text{ULS-A}}$	$\Psi\gamma_{\text{ULS-B}}$		$\Psi\gamma_{\text{ULS}}$
	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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:180
		Date :	Created :

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	$0.41 = (1.20 \times 0.34^{4.})$
KRYMP	0	$0.41 = (1.20 \times 0.34^{4.})$
PT-t0	$0.84 (= 0.84 \cdot 1.00)^{3.})$	$0.51 (= 1.35 - 0.84)^{5.})$

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:181
		Date :	Created :

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.

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

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

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

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

$$E_{Sd} = \sum_{j \geq 1} G_{k,j} + \sum_{i > 0} \psi_{2,i} \cdot Q_{k,i} = \psi \gamma_{SLS,Q} \cdot \left(\sum_{j > 1} G_{k,j} + \sum_{i > 1} Q_{k,i} \right)$$

When designing, load coefficients according to equations 6.14a, 6.15b, and 6.16b are applied. Refer to the derivation in Appendix 2.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:182
		Date :	Created :

Adjustment of load coefficients for geotechnical loads:

$$K_o(D2) = 1 - \sin(\varphi_d) = 1 - \sin 45^\circ = 0.29$$

$$K_o(D3) = 1 - \sin(\varphi_d) = 1 - \sin 38^\circ = 0.39$$

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:183
		Date :	Created :

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.)}
		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

← 1.48 is used on all safe side !

Footnote:

^{6.)} Load coefficient page A3:182 is applied.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:184
		Date :	Created :

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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:185
		Date :	Created :

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	$0.34 = (1.0 \times 0.34^{8.)})$
KRYMP	0	$0.34 = (1.0 \times 0.34^{8.)})$
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 (= $0.84 \cdot PT-t0$) 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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:186
		Date :	Created :

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	$0.34 = (1.0 \times 0.34^{10.})$
KRYMP	0	$0.34 = (1.0 \times 0.34^{10.})$
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.

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:187
		Date :	Created :

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.

$$E_{Sd} = \sum_{j \geq 1} G_{k,j} + P + A_d + \psi_{1,1} \cdot Q_{k,1} + \sum_{i > 1} \psi_{2,i} \cdot Q_{k,i} = \dots$$

$$\psi \gamma_{EXC} \cdot \left(\sum_{j \geq 1} G_{k,j} + P + A_d + \sum_{i \geq 1} Q_{k,i} \right)$$

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:188
		Date :	Created :

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.

$$E_{sd} = \sum_{j \geq 1} G_{k,j} + P + \psi_{1,1} \cdot Q_{k,1} + \sum_{i > 1} \psi_{2,i} \cdot Q_{k,i} + Q_{fat} = \psi \gamma_{UTM} \cdot \left(\sum_{j \geq 1} G_{k,j} + P + \sum_{i \geq 1} Q_{k,i} + Q_{fat} \right)$$

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:189
		Date :	Created :

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

	Part A - CALCULATION ASSUMPTIONS Pretensioned single girder bridge	Status :	Page: A3:190
		Date :	Created :

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).

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 1
		Date :	Created :

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 $L105 \rightarrow L110$ and $L114 \rightarrow L119$.

Assignment to Surfaces:
3T17;19T24

This expression means that the assignment occurs to the surfaces $S3 \rightarrow S17$ and $S19 \rightarrow S24$.

Assignment to Points:
6; 13

This expression means that the assignment occurs at point P6 and P13.

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 2
		Date :	Created :

Table of Contents

1.	Points	3
2.	Lines	4
3.	MESH: Line	5
4.	MESH: Joint	6
5.	Geometric: Line	7-17
6.	Isometric material	18
7.	Joint material	19
8.	Support	20-21
9.	Search area	22
10.	Body load	23
11.	Global distributed	24-26
12.	Concentrated load	27-32
13.	Beam distributed load	33-36
14.	Beam point load	37-41
15.	Prescribed load	42-44
16.	Temperature and shrinkage load	45-46
17.	Prestress	47-58
18.	Direct Influence Method	59-60
19.	Load groups: traffic	61
20.	VLO Analysis	62-66
18.	Basic Combination	67-68
19.	Smart Combination	69-74
20.	Envelopes	75-76

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 3
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 4
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 5
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 6
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 7
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 8
	Prestensioned single girder bridge	Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 9
		Date :	Created :

Attribute: 4 Title: T1-beam

Sub Type = Line Geometric

Assigned in: Analysis 1

Property

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 10
		Date :	Created :

Attribute: 6 Title: T2-beam

Sub Type = Line Geometric

Assigned in: Analysis 1

Property

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 11
	Prestensioned single girder bridge	Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 12
		Date :	Created :

Attribute: 7 Title: Rigid beam

Sub Type = Line Geometric

Assigned in: Analysis 1

Property

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 13
		Date :	Created :

Attribute: 8 Title: S11-beam (Section S11 (RSS D=0.8 B=7.2))

Sub Type = Line Geometric

Assigned in: Analysis 1

Property

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 14
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 15
	Prestensioned single girder bridge	Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 16
	Prestensioned single girder bridge	Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 17
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 18
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 19
	Prestensioned single girder bridge	Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 20
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 21
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 22
		Date :	Created :

9. Search Area

Attribute: 1 Title: Superstructure
Sub Type = Search Area

Assignment to Lines:
1T14;20;30

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 23
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 24
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 25
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 26
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 27
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 28
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 29
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 30
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 31
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 32
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 33
		Date :	Created :

13. Beam distributed load

Attribute: 12 Title: JORD 21:V

Sub Type = Beam Distributed Load

Property

Distance type
Load direction
Distance to start of load
Distance to end of load
Magnitude of distributed load in x direction at start
Magnitude of distributed load in y direction at start
Magnitude of distributed load in z direction at start
Magnitude of distributed moment about x direction at start
Magnitude of distributed moment about y direction at start
Magnitude of distributed moment about z direction at start
Magnitude of distributed load in x direction at start
Magnitude of distributed load in y direction at start
Magnitude of distributed load in z direction at start
Magnitude of distributed moment about x direction at start
Magnitude of distributed moment about y direction at start
Magnitude of distributed moment about z direction at start

Symbol

type
dirType
DStart
DEnd
startPx
startPy
startPz
startMx
startMy
startMz
endPx
endPy
endPz
endMx
endMy
endMz

Value

"Actual"
"Global(nodal)"
0.0
1.7
202.0
0.0
0.0
0.0
0.0
0.0
137.0
0.0
0.0
0.0
0.0
0.0
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

Distance type
Load direction
Distance to start of load
Distance to end of load
Magnitude of distributed load in x direction at start
Magnitude of distributed load in y direction at start
Magnitude of distributed load in z direction at start
Magnitude of distributed moment about x direction at start
Magnitude of distributed moment about y direction at start
Magnitude of distributed moment about z direction at start
Magnitude of distributed load in x direction at start
Magnitude of distributed load in y direction at start
Magnitude of distributed load in z direction at start
Magnitude of distributed moment about x direction at start
Magnitude of distributed moment about y direction at start
Magnitude of distributed moment about z direction at start

Symbol

type
dirType
DStart
DEnd
startPx
startPy
startPz
startMx
startMy
startMz
endPx
endPy
endPz
endMx
endMy
endMz

Value

"Actual"
"Global(nodal)"
0.0
0.9
264.0
0.0
0.0
0.0
0.0
0.0
0.0
224.0
0.0
0.0
0.0
0.0
0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0

Assignment to Lines:

102

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 34
		Date :	Created :

Attribute: 14 Title: JORD 21:H

Sub Type = Beam Distributed Load

Property

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 end	endPx	-137.0
Magnitude of distributed load in y direction at end	endPy	0.0
Magnitude of distributed load in z direction at end	endPz	0.0
Magnitude of distributed moment about x direction at end	endMx	0.0
Magnitude of distributed moment about y direction at end	endMy	0.0
Magnitude of distributed moment about z direction at end	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

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 end	endPx	-224.0
Magnitude of distributed load in y direction at end	endPy	0.0
Magnitude of distributed load in z direction at end	endPz	0.0
Magnitude of distributed moment about x direction at end	endMx	0.0
Magnitude of distributed moment about y direction at end	endMy	0.0
Magnitude of distributed moment about z direction at end	endMz	0.0

Loadcase ID: 10 Title: JORD 2 Factor = 1.0

Assignment to Lines:

402

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 35
		Date :	Created :

Attribute: 33 Title: OVER 21:V

Sub Type = Beam Distributed Load

Property

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 end	endPx	42.0
Magnitude of distributed load in y direction at end	endPy	0.0
Magnitude of distributed load in z direction at end	endPz	0.0
Magnitude of distributed moment about x direction at end	endMx	0.0
Magnitude of distributed moment about y direction at end	endMy	0.0
Magnitude of distributed moment about z direction at end	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

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 end	endPx	48.0
Magnitude of distributed load in y direction at end	endPy	0.0
Magnitude of distributed load in z direction at end	endPz	0.0
Magnitude of distributed moment about x direction at end	endMx	0.0
Magnitude of distributed moment about y direction at end	endMy	0.0
Magnitude of distributed moment about z direction at end	endMz	0.0

Loadcase ID: 3356 Title: OVER:V Factor = 1.0

Assignment to Lines:

102

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 36
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 37
		Date :	Created :

14. Beam point load

Attribute: 43 Title: ICE HIGH 2X+

Sub Type = Beam Point Load

Property

Distance type
Load direction
Distance
Point load in x direction
Point load in y direction
Point load in z direction
Moment about x axis
Moment about y axis
Moment about z axis

Symbol

type
dirType
d
Px
Py
Pz
Mx
My
Mz

Value

1
"Global(nodal)"
5.5
2320.0
0.0
0.0
0.0
0.0
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

Distance type
Load direction
Distance
Point load in x direction
Point load in y direction
Point load in z direction
Moment about x axis
Moment about y axis
Moment about z axis

Symbol

type
dirType
d
Px
Py
Pz
Mx
My
Mz

Value

1
"Global(nodal)"
4.0
2320.0
0.0
0.0
0.0
0.0
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

Distance type
Load direction
Distance
Point load in x direction
Point load in y direction
Point load in z direction
Moment about x axis
Moment about y axis
Moment about z axis

Symbol

type
dirType
d
Px
Py
Pz
Mx
My
Mz

Value

1
"Global(nodal)"
5.5
2320.0
0.0
0.0
0.0
0.0
0.0

Loadcase ID: 3380 Title: ICE HIGH X+ Factor = 1.0

Assignment to Lines:

303

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 38
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 39
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 40
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 41
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 42
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 43
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 44
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 45
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 46
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 47
	Prestensioned single girder bridge	Date :	Created :

17. Prestress

17.1 KG V1

Tendon Summary - PT- KG V1 assignment 1

General

Design code

Value

EN1992-1-1:2004 / 2014 Eurocode 2

Units

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 48
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 49
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 50
		Date :	Created :

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	mm ²
Modulus of elasticity for tendon	195000000.000	kN/m ²
Concrete stress at transfer	10000.000	kN/m ²
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/m ²
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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 51
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 52
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 53
		Date :	Created :

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	mm ²
Modulus of elasticity of tendon	195000000.000	kN/m ²
Concrete stress at transfer	10000.000	kN/m ²
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/m ²
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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 54
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 55
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 56
		Date :	Created :

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	mm ²
Modulus of elasticity of tendon	195000000.000	kN/m ²
Concrete stress at transfer	10000.000	kN/m ²
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/m ²
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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 57
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 58
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 59
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 60
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 61
		Date :	Created :

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
 Axle 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 axle
 Axle load: 120 kN

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 62
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 63
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 64
		Date :	Created :

Type: VLO – UTM3 ~ Characteristic Representative values : Charateristic

Design code : EN 1991-2 Sweden 2011

Load groups : UTM3

Longitudinal increment : 0.25 m

Transverse increment : 0.50 m

Vehicle direction : Both

Kerbs : L500, L501

Minimum width vehicle : 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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 65
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 66
		Date :	Created :

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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 67
		Date :	Created :

21. Basic combination

Loadcase ID: 17 Title: STOD_2X-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
15	0	-1.0	STOD_2X+

Loadcase ID: 18 Title: STOD_3X-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
16	0	-1.0	STOD_3X+

Loadcase ID: 3346 Title: SIDO 1-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
3342	0	-1.0	SIDO 1+

Loadcase ID: 3347 Title: SIDO 2-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
3343	0	-1.0	SIDO 2+

Loadcase ID: 3348 Title: SIDO 3-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
3344	0	-1.0	SIDO 3+

Loadcase ID: 3349 Title: SIDO 4-

Sub Type: Basic Combination

Loadcase Results

File	Factor	Title	Type
3345	0	-1.0	SIDO 4+

Loadcase ID: 3377 Title: PT - t0

Sub Type: Basic Combination

Loadcase Results

File	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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 68
		Date :	Created :

Loadcase ID: 3378 Title: PT - t1

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
3377	0	0.94	PT - t0

Loadcase ID: 3379 Title: PT - t2

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
3377	0	0.84	PT - t0

Loadcase ID: 3406 Title: EGEN

Sub Type: Basic Combination

Loadcase	Results		
File	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	Results		
File	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	Results		
File	Factor	Title	Type
9	5	1.0	JORD 1
10	5	1.0	JORD 2

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 69
		Date :	Created :

22. Smart combination

Loadcase ID: 21 Title: STOD-Z

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 70
		Date :	Created :

Loadcase ID: 3394 Title: ICE HIGH Y

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 71
		Date :	Created :

Loadcase ID: 3409 Title: ULS-PERM_0

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	Title	Type		
3356	5	0.0	1.0	OVER:V
3357	5	0.0	1.0	OVER:H

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 72
		Date :	Created :

Loadcase ID: 3419 Title: ULS

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 73
		Date :	Created :

Loadcase ID: 3425 Title: SLS-K-VAR

Sub Type: Smart Combination

Loadcases to consider: 6

Variable Loadcases: 1

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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)

	Appendix 1: Input receipt SYSTEM 001 Prestensioned single girder bridge	Status :	Page: 74
		Date :	Created :

Loadcase ID: 3431 Title: SLS-F

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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	Results			
File	Permanent			
Factor	Variable			
Factor	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)

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 75
	Prestensioned single girder bridge	Date :	Created :

23. Envelopes

Loadcase ID: 19 Title: STOD-X

Sub Type: Envelope

Loadcase	Results	
File	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	Results	
File	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	Results	
File	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	Results	
File	Title	Type
3352	0	VIND+
3353	0	VIND-

Loadcase ID: 3360 Title: JTEMP

Sub Type: Envelope

Loadcase	Results	
File	Title	Type
3358	0	JTEMP+
3359	0	JTEMP-

Loadcase ID: 3365 Title: OJTEMP 1

Sub Type: Envelope

Loadcase	Results	
File	Title	Type
3363	0	OJTEMP 1+
3364	0	OJTEMP 1-

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 76
	Prestensioned single girder bridge	Date :	Created :

Loadcase ID: 3371 Title: TEMP

Sub Type: Envelope

Loadcase	Results	
File	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	Results	
File	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	Results	
File	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	Results	
File	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	Results	
File	Title	Type
3340	5	BROMS+
3341	5	BROMS-