

Pretensioned double girder bridge

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6. System 001 : Results deck

Part A : CALCULATION ASSUMPTIONS

Pretensioned double girder bridge

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1. GENERAL / MEASUREMENT

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1.1 CONSTRUCTION TYPE

The bridge is designed as a prestressed bridge with two spans and constructed with two main girders.

All abutments have bearing.

End abutments have moving joints.

All foundation are carried out with concrete piles.

Link plates are installed at each support.

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1.2 MEASUREMENTS

1.2.1 Theoretical geometry

"sketch"

PLAN

Overview

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"Sketch"

SECTION A-A

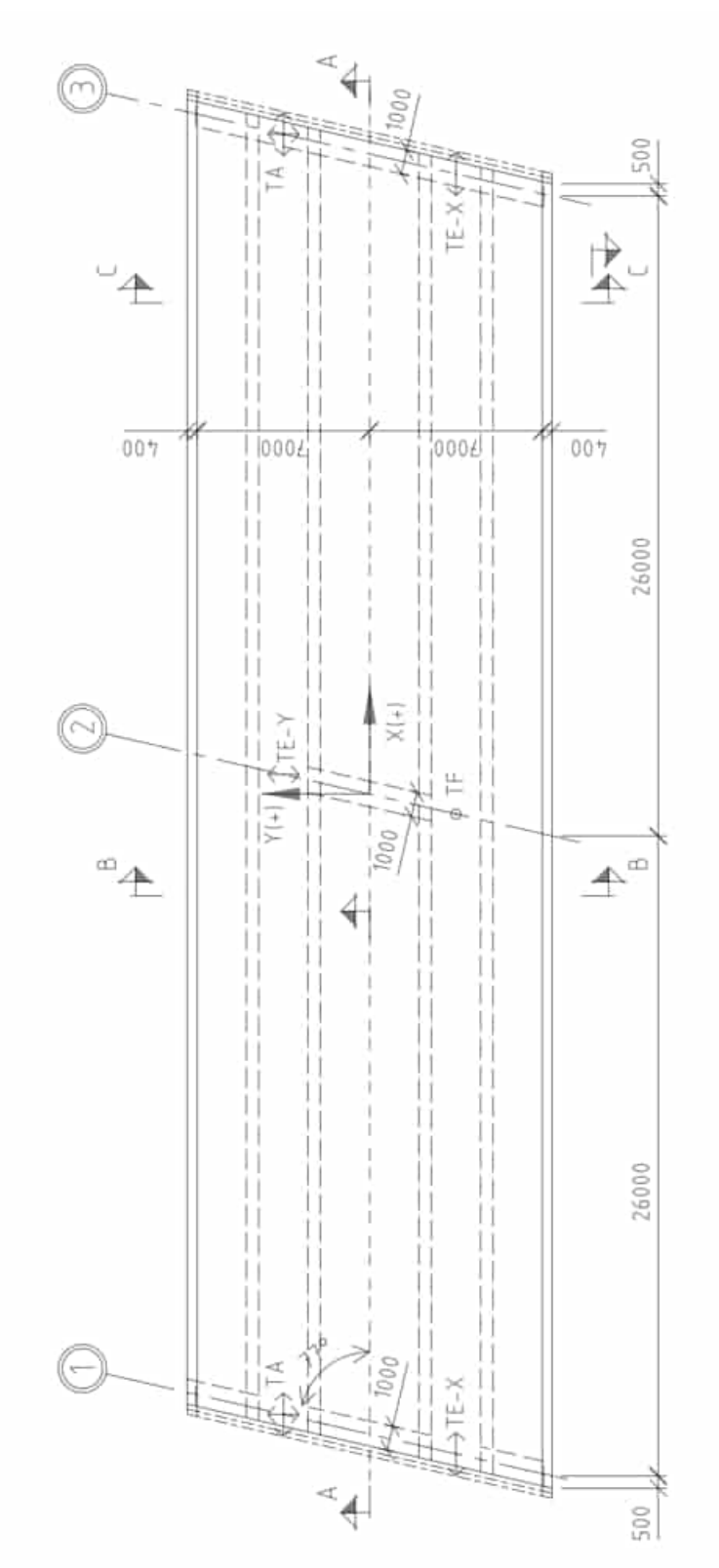
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"Sketch"

SECTION B-B

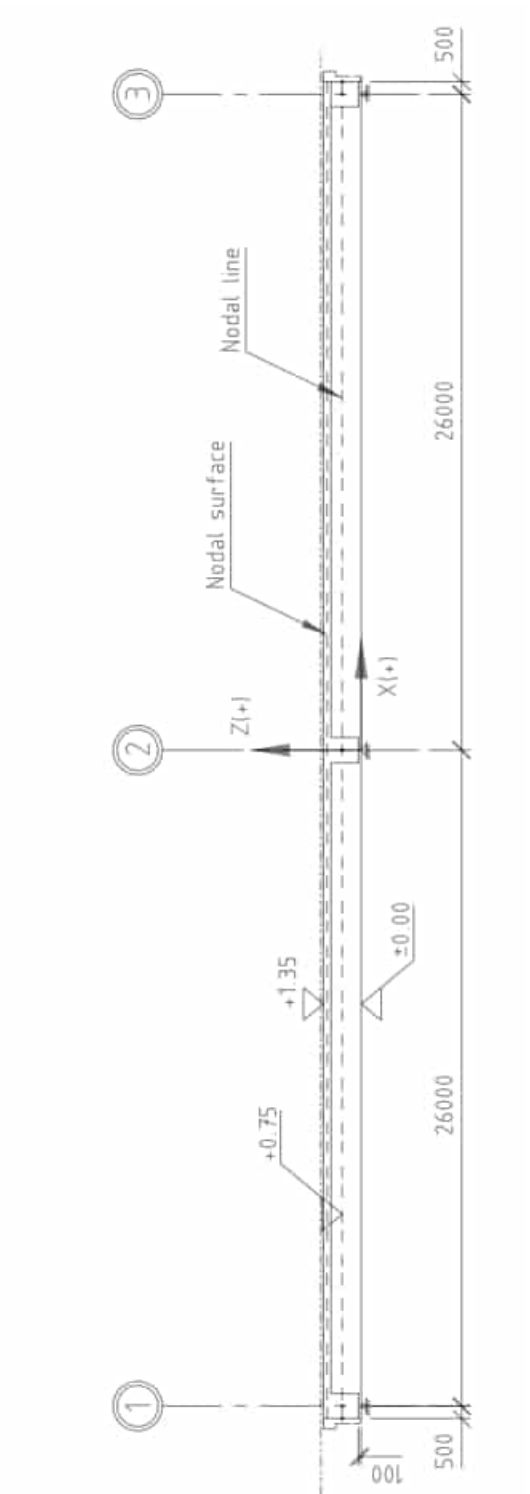
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:6
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1.2.2 Simplified geometry (used for calculatuons)



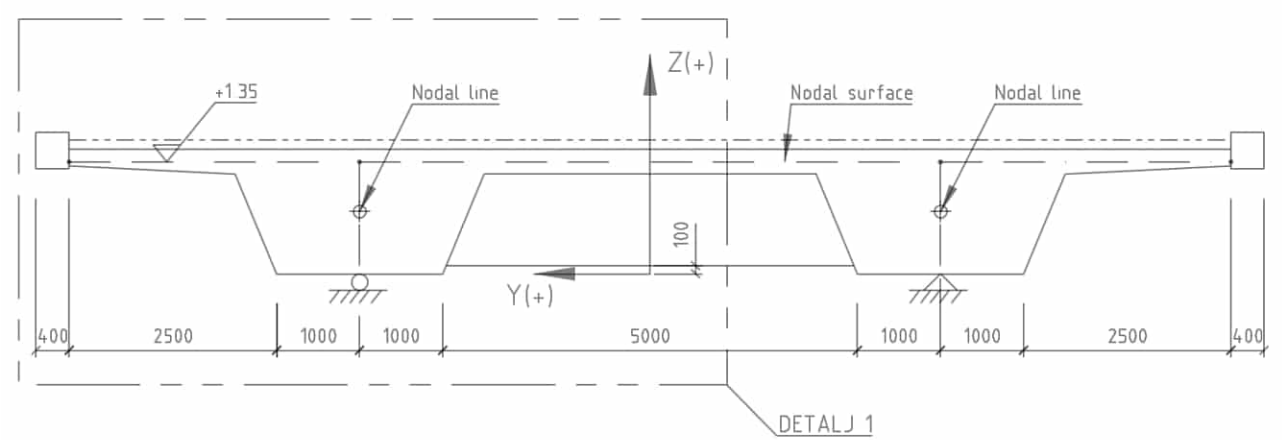
PLAN

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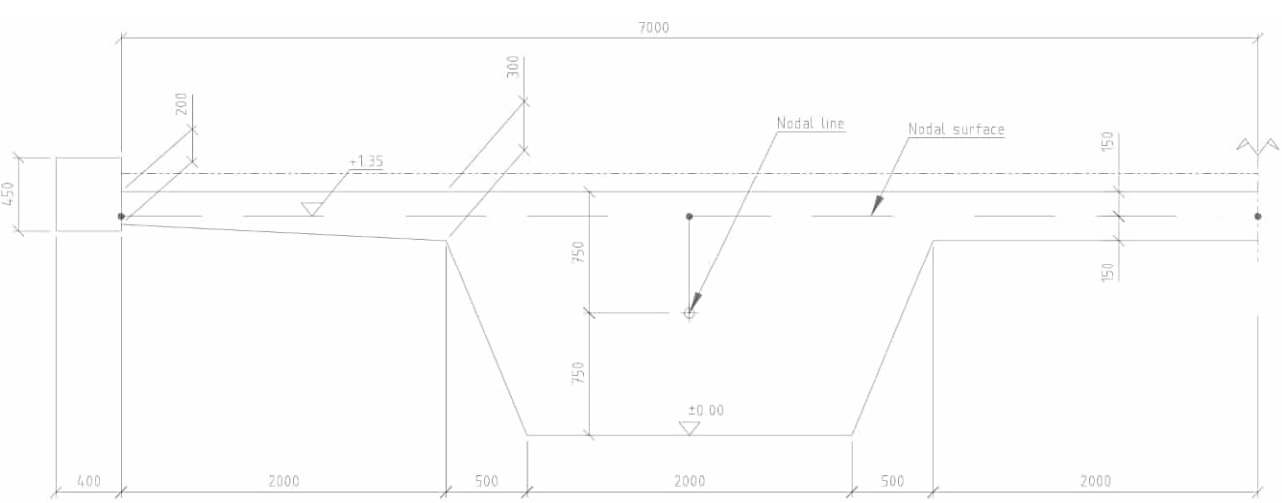


SECTION A-A

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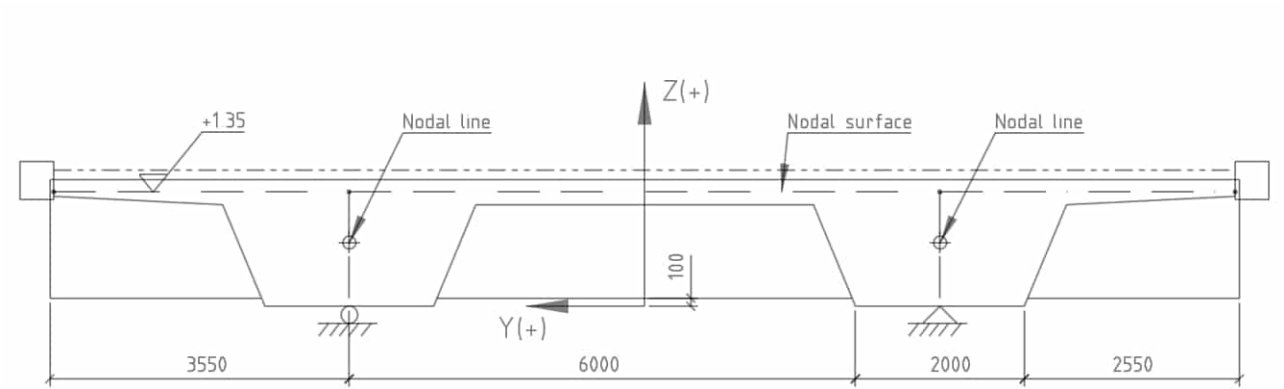


SECTION B-B
At support in middle.



DETAIL 1

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SECTION C-C
At end supports.

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1.3 FOUNDATION

Foundation consists of concrete piles Hercules HP270-0816 (SP3).

	Support 1	Support 2	Support 3
Section	14/531	14/557	14/583
Level PPL	+14.08	+14.29	+14.57
Level bridge center	+14.03	+14.24	+14.52
Level bottom of slab	+7.60	+3.50	+8.09
Level top of piles	+7.80	+3.70	+8.29
Level bottom of pile	-13.5	-9.0	-4.0
Pile length	~21	~13	~12
-	m	m	m

	Part A – CALCULATION ASSUMPTION	Status :	Page: A1:11
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4 CODE DOCUMENTS

Documents	Version	Name
SS-EN 1990-1997	-	Svensk Standard Eurokod 1-7
TRVINFRA-00226	2.0	KRAV, Bro och broliknande konstruktion, Allmänna krav
TRVINFRA-00227	2.0	KRAV, Bro och broliknande konstruktion, Byggande
TRVINFRA-00228	2.0	KRAV, Bro och broliknande konstruktion, Brounderhåll
TRVINFRA-00331	2.0	KRAV, Bro och broliknande konstruktion, Bärighetsberäkning
TSFS 2018:57		Transportstyrelsens föreskrifter och allmänna råd om tillämpning av eurokoder
TDOK 2013:0667	2.0	Trafikverkets tekniska krav för geokonstruktioner. TK Geo 13
TDOK 2013:0668	2.0	Trafikverkets tekniska råd för geokonstruktioner. TR Geo 13
AMA Anläggning 23		AMA, Svensk Byggtjänst
TDOK 2023:0125	2.0	TRVAMA Anläggning 23
SS 137006:2015	-	Betongkonstruktioner – Utförande – Tillämpning av SS-EN 13670:2009 i Sverige

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:12
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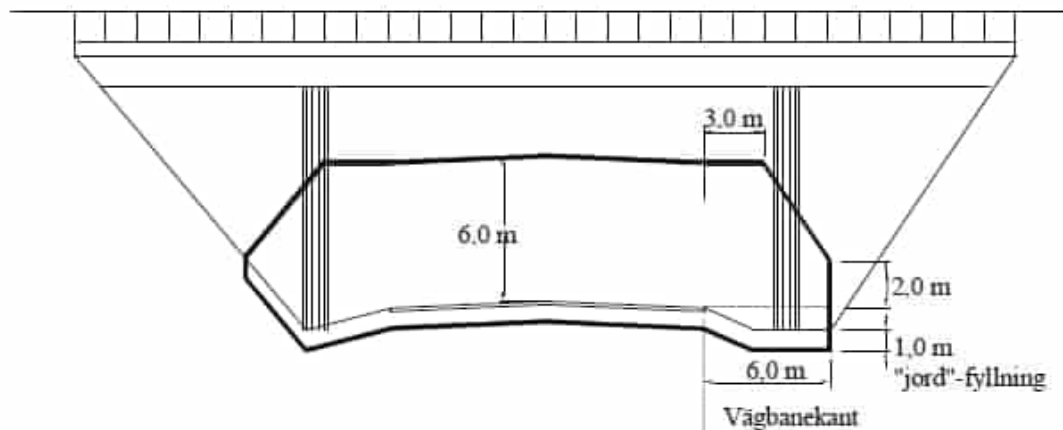
1.5 TECHNICAL SERVICE LIFE

Technical life span 120 years (L100).

1.6 ENVIRONMENT

Exponeringsklasser är bestämda enligt TSFS 2018:57 avsnitt 5.3.2.3 samt SS-EN 206-1.

In TSFS 2021:57 figure 1.1, the road environment is defined according to the figure below. Which means that the superstructure including edge beam is within the area ± 9 m ($\therefore 6$ m + 6.5 m /2) from the center of underlying road.



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:13
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1.7 MATERIAL

Concrete : C35/45 & C40/50 (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 : 5 mm waterproofing mat, 50 mm PGJA and 40 mm ABS (total 95 mm).

Pretension: VSL 15 ϕ 16 ($f_{yk} / f_{uk} = 1640 \text{ MPa} / 1860 \text{ MPa}$)

Concrete (see SS-EN 1992-1-1, Table 3.1): C35/45 ($f_{ck} = 35 \text{ MPa}$) for superstructure
C30/37 ($f_{ck} = 30 \text{ MPa}$) for substructure

Reinforcement (SS-EN 10080 & SS 212540): K500CT ($f_{yk} = 500 \text{ MPa}$)

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:14
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1.8 GEOTECHNICAL CLASS

Geotechnical class GK2

1.9 SAFETY CLASS

Geotechnical resistance: SK 2

Bridge structure : SK 3

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:15
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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
▫ Abutment below ground	XC2/XF3	L100	0.50	1.0
▫ Abutment in air	XC4/XF3	L100	0.50	1.2
▫ Bottomslab in general	XC2/XF3	L100	0.50	1.0
▫ Bottomslab underside	XC2/XF3	L100	0.50	1.0
▫ Linkslab in general	XD3/XF2	L100	0.40	1.8
▫ Linkslab 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

Footnote:

1.) TRVINFRA-00227 section 5.3.2.3

2.) TSFS table 12.1

3.) TSFS table 12.3

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A1:16
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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 including link slab:						
▫ Wing wall against fill	30	20	30	10	40	0.20
▫ Wing wall from fill	30	20	30	10	40	0.20
▫ Frame legs below ground	20	20	20	10	30	0.40
▫ Frame legs above ground	25	20	25	10	35	0.30
▫ Bottom slab (general)	20	20	20	10	30	0.40
▫ Underside of bottom slab	20	20	20	10	30	0.40
▫ Link slab (general)	45	20	45	10	55	0.15
▫ Underside of link slab	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
-	mm	mm	mm	mm	mm	mm

Footnotes:

1.) TSFS table 12.1

2.) SS-EN 1992-1-1 section 4.4.1.2 table 4.2

3.) SS-EN 1992-1-1 section 4.4.1.3

4.) TSFS tabele 12.2

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

	Part A – CALCULATION ASSUMPTION	Status :	Page: A1:17
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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 $f_{ctk,0.05}/\zeta$

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2. SYSTEM ANALYSIS

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2.3	CROSS SECTION PROPERTIES	page 2:11-25
2.4	MATERIAL	page 2:26
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2.6	MESH	page 2:31-41
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2.10	FLANGE WIDTH	page 2:52

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	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:2
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2.1 GENERAL

The bridge is built using pretensioned concrete in longitudinal direction. The bridge has 2 girders.

The bridge is curved with radius 1200 m with skewed support lines.

The system analysis is performed using a simplified geometry.

The bridge is founded on concrete piles.

Supports 1 & 3 have movable bearings in longitudinal direction.

Support 2 has fixed bearing in longitudinal 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.

The superstructure consists of components bridge deck, longitudinal girders and transversal girders at each support.

Bridge deck is defined by using shell elements applied to nodal surface in superstructure.

Longitudinal beams are defined using beam elements applied to nodal line in superstructure.

Transversal beams defined relative nodal surface in superstructure.

Longitudinal beam will be connected to bridge deck using Rigid constraints (= Tied Mesh).

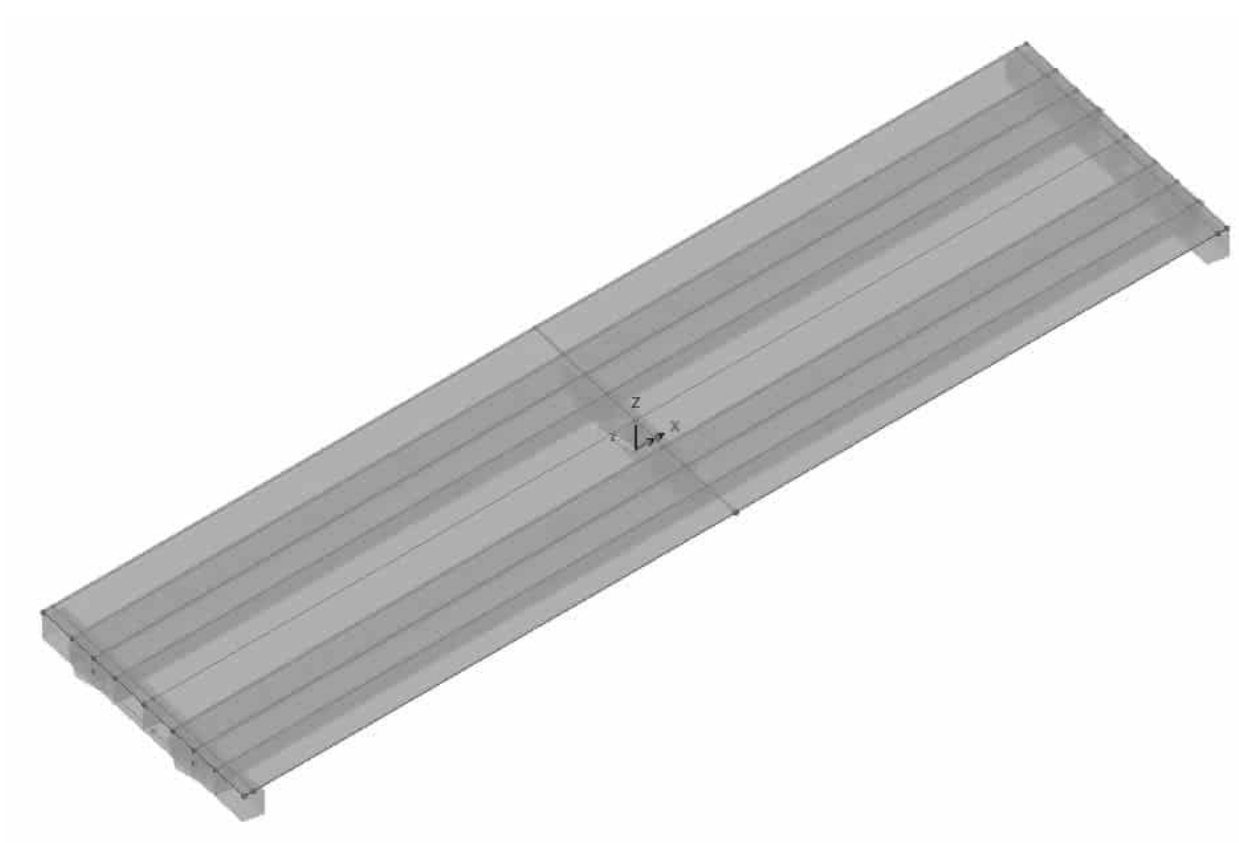
Entire structure is modelled using isotropic material.

The bearings are modelled as Joint elements with no rotational stiffness.

At each support, “super-nodes” are introduced at the level of the UK bearing. These “super-nodes” are rigidly connected to each bearing to obtain reaction forces at each support.

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	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:3
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OVERVIEW

Appendices:

Appendix	Namn
1	Input receipt
2	Results reactions
3	Results bearings
4	Results longitudinal girders
5	Results transversal girders
6	Results bridge deck

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:4
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2.2 SKETCH SYSTEM ANALYSIS

2.2.1 Geometry

To describe geometry first POINTS are defined.

Beam elements are defined by applying attributes to LINES.

Shell elements are defined by applying attributes to SURFACES.

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

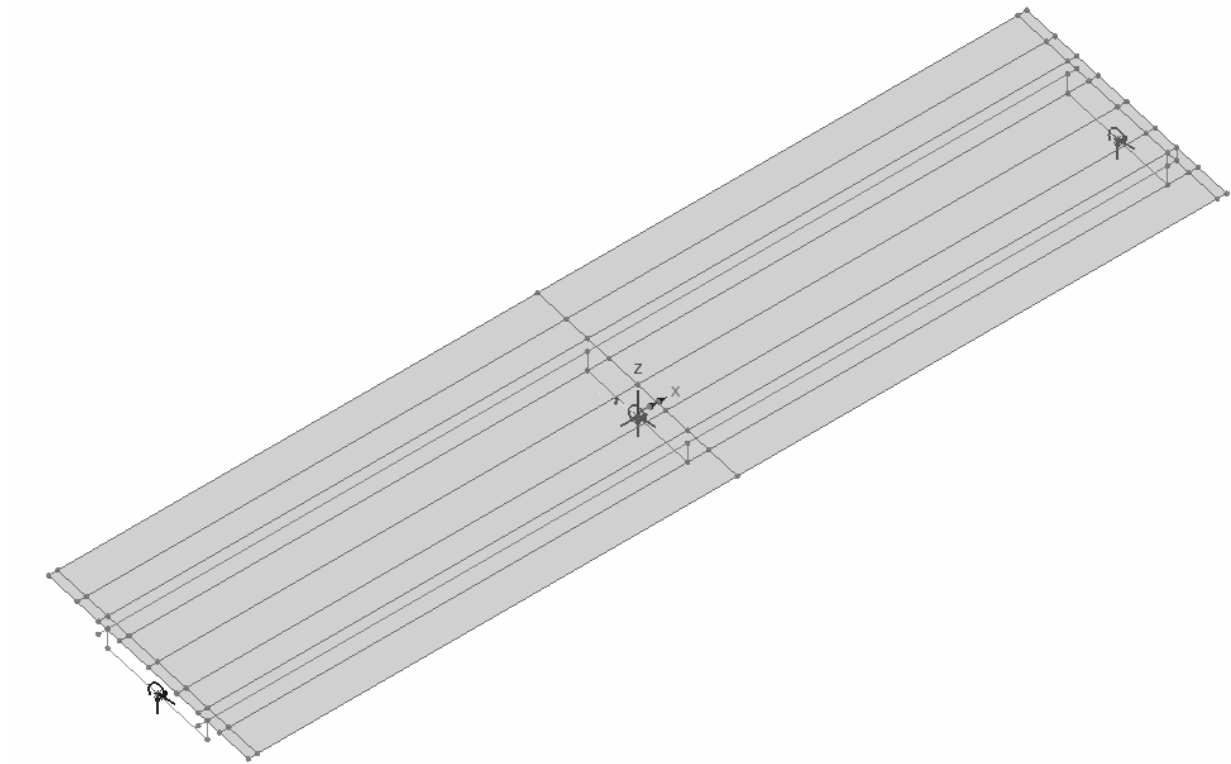
All coordinates needed to describe POINTS are found in attachment 1.

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

All LINES need to describe SURFACE are found in attachment 1.

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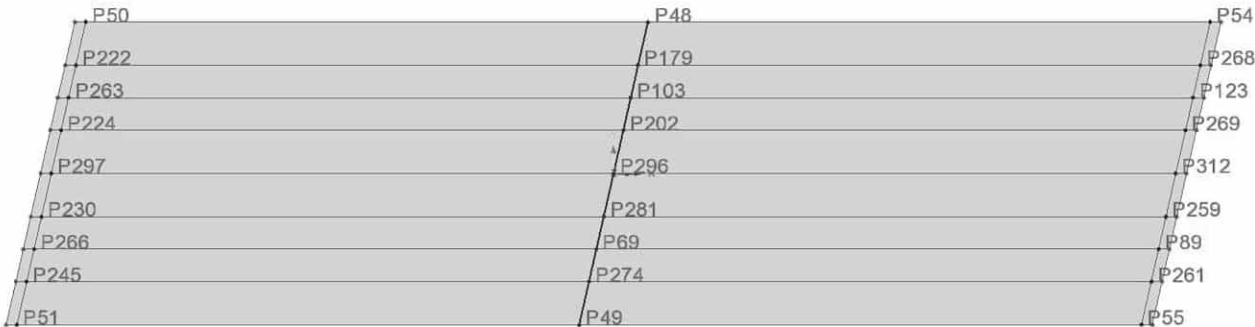
Overview:



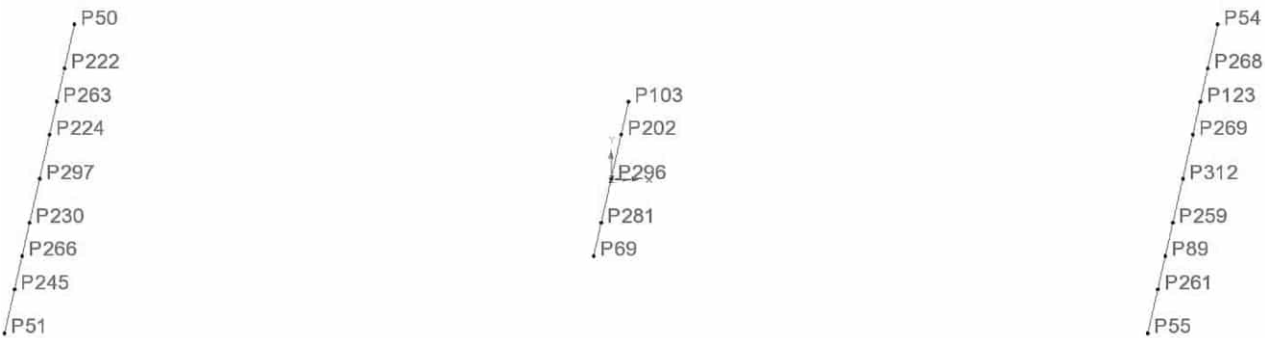
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:6
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2.2.1.1 Geometry : POINTS

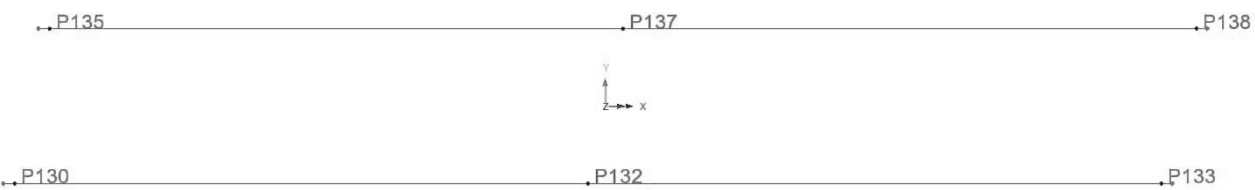
Bridge deck (nodal surface):



Transversal girders:

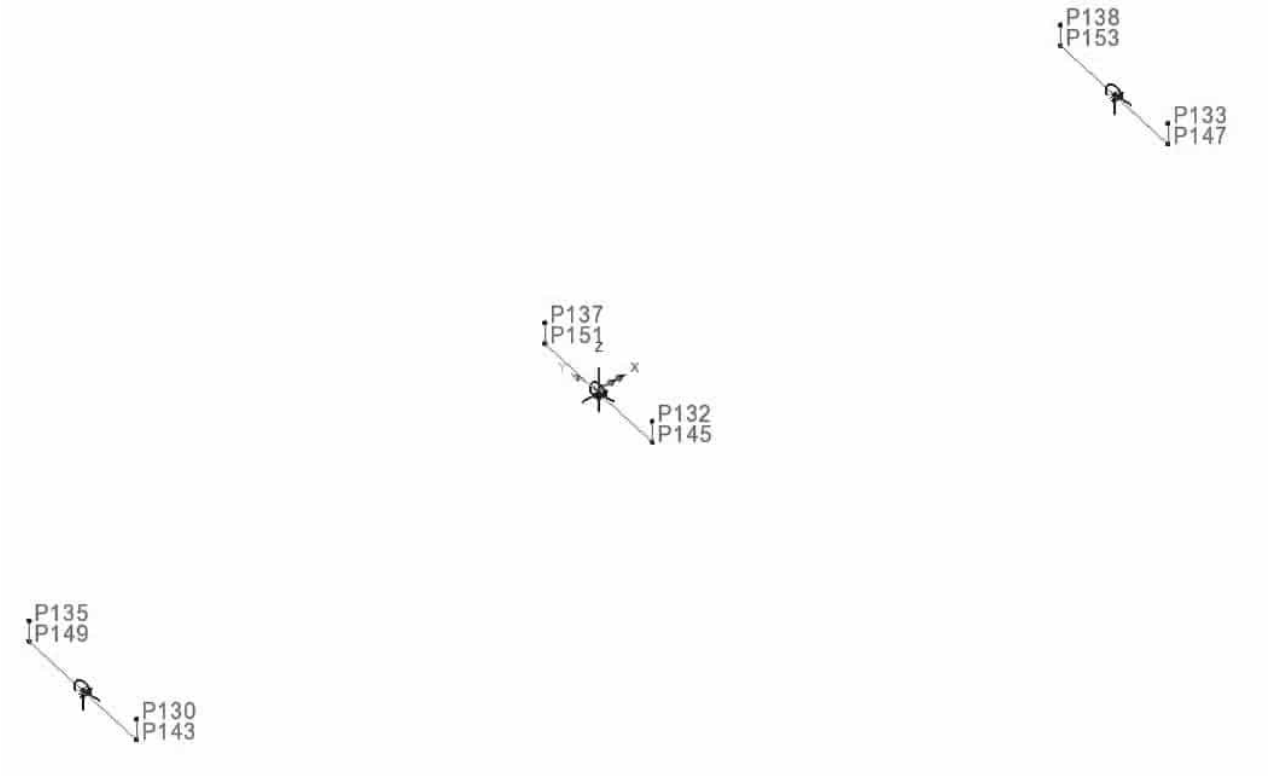


Longitudinal beams (nodal line 1-2):



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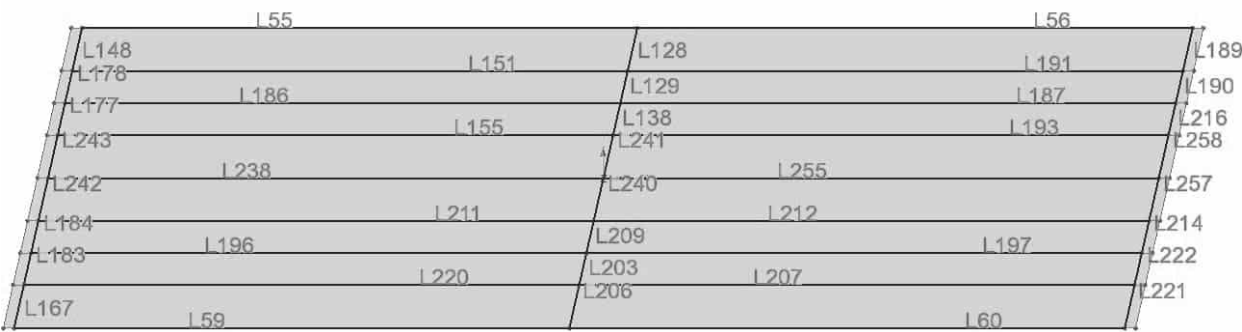
Bearings and supernodes:



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2.2.1.2 Geometry: LINES

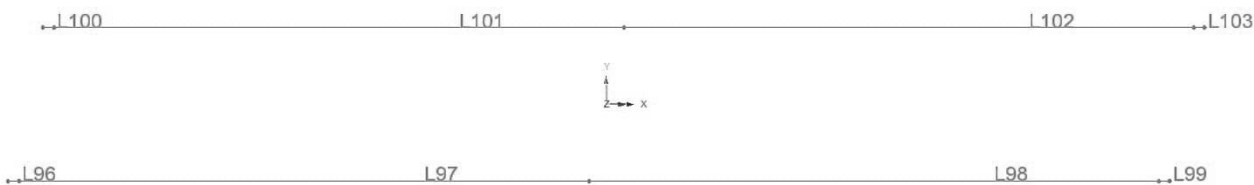
Bridge deck (nodal surface):



Transversal girders:

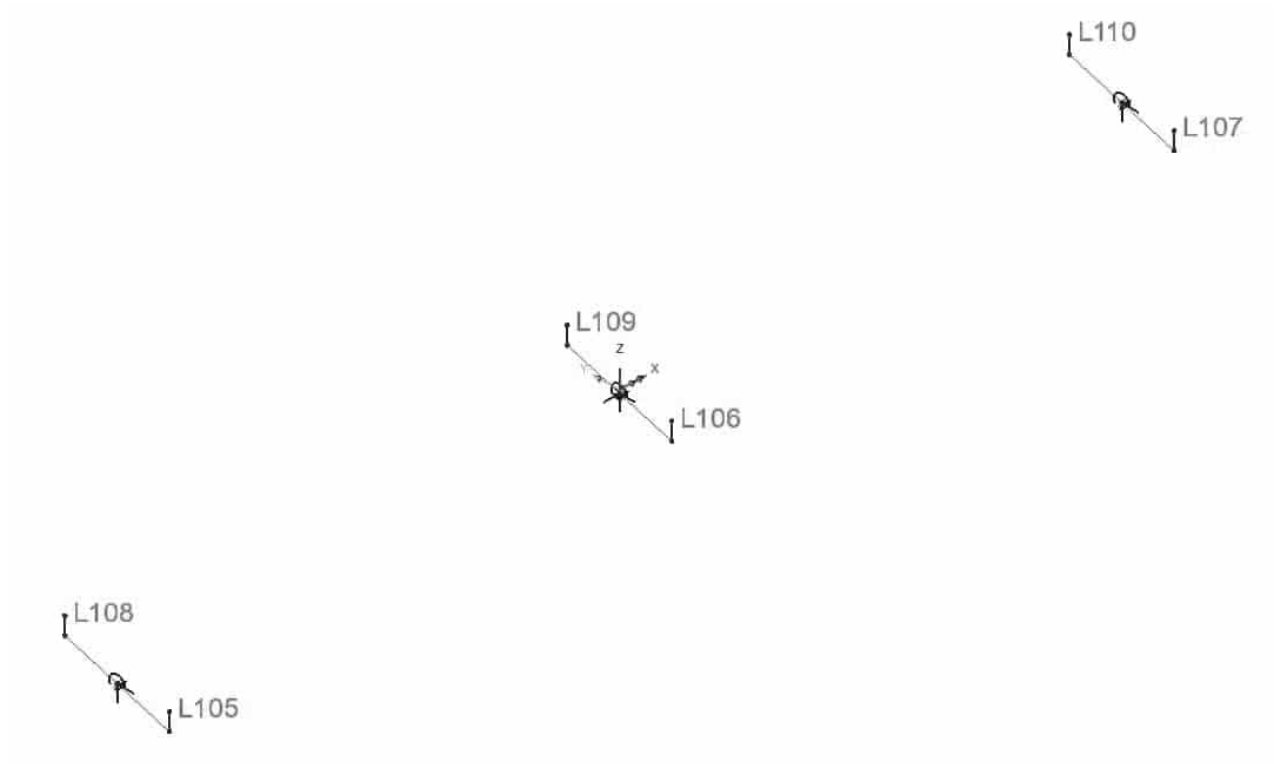


Longitudinal girders (nodal line 1-2):



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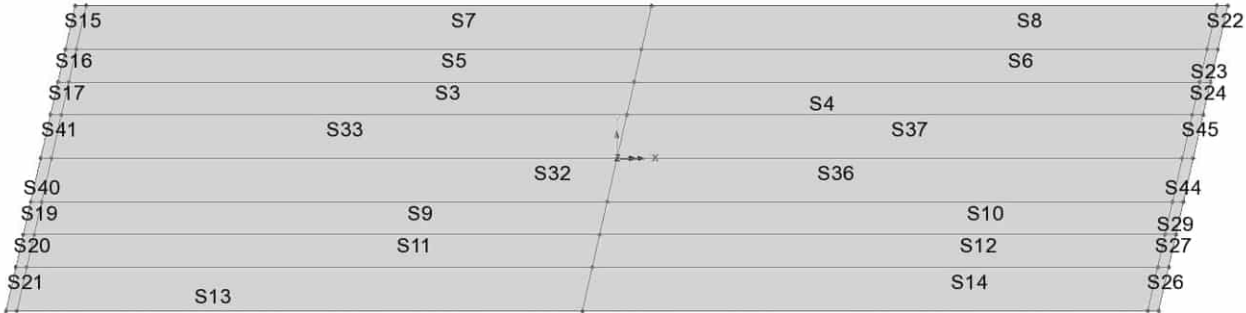
Bearings and supernodes:



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:10
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2.2.1.3 Geometry: SURFACES

Bridge deck (nodal surface):

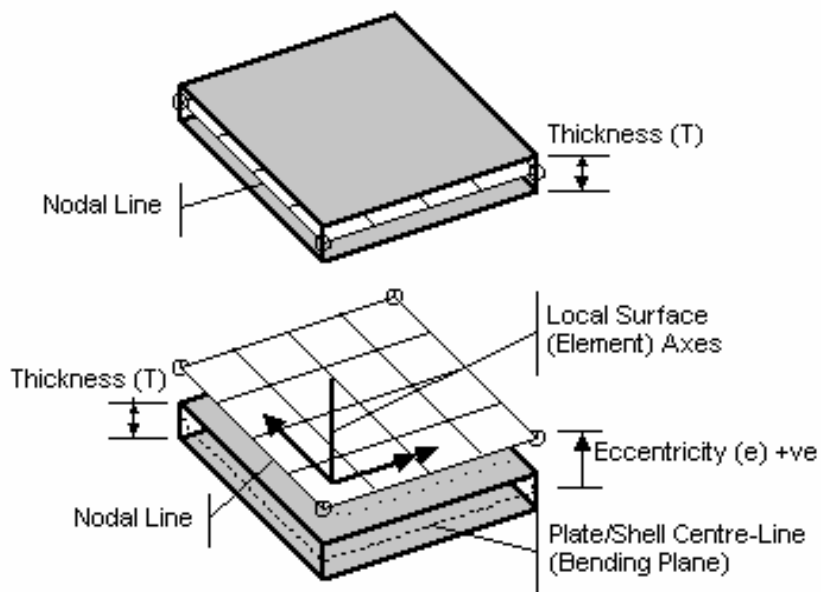


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:11
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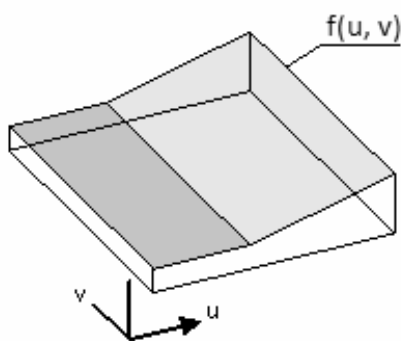
2.3 CROSS SECTION PROPERTIES

2.3.1 Shell element

Principle figures of geometry associated to shell elements ("Thick shell" / QTS4) are seen below.

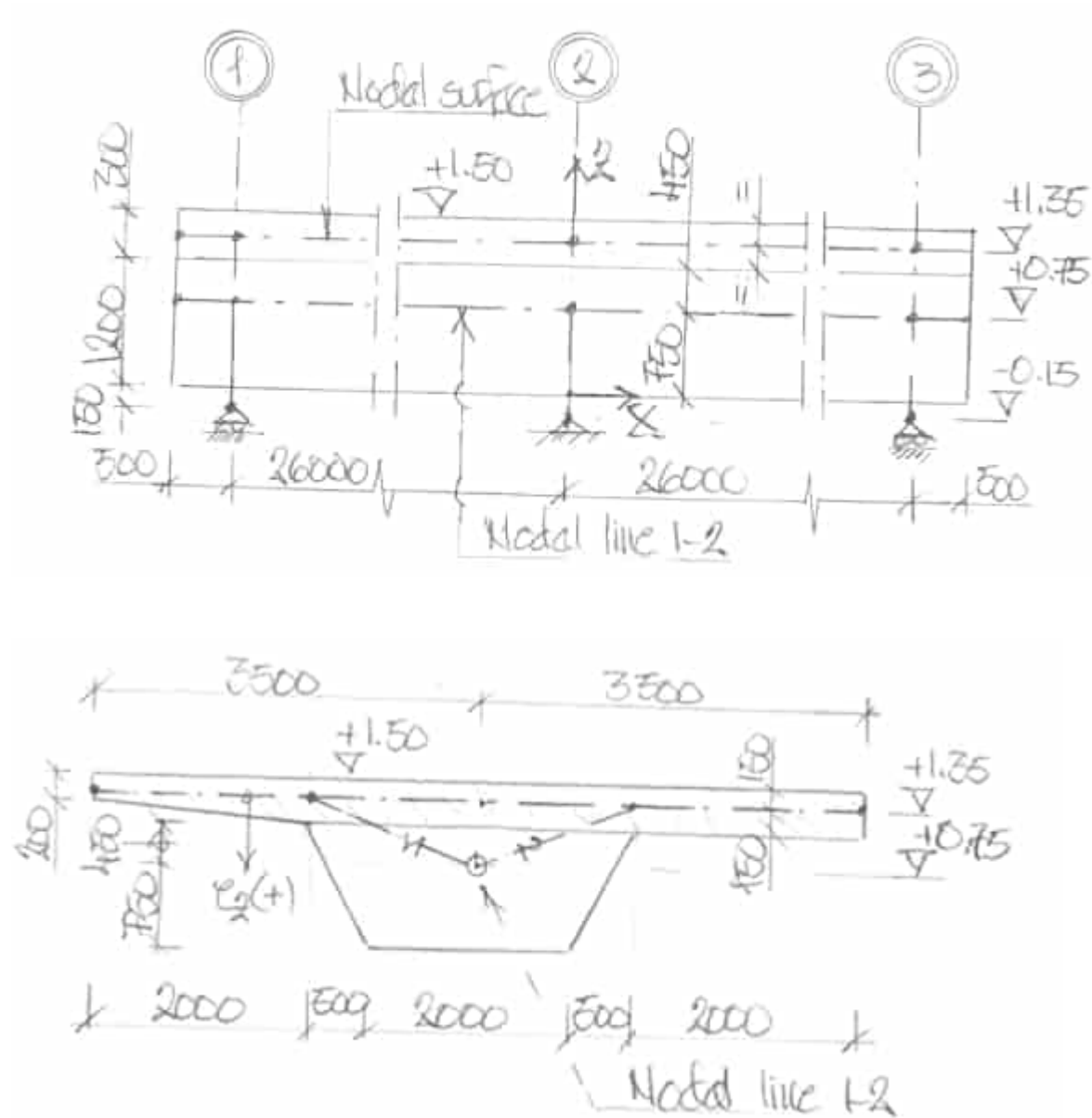


Varying thickness in shell element is handled using "Function variation". This makes it possible to create a function $f(u, v)$ as seen below.



	Part A – CALCULATION ASSUMPTION	Status :	Page: A2:12
	Pretensioned double girder bridge	Date:	Created:

Geometry superstructure:



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:13
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Surface function thickness :

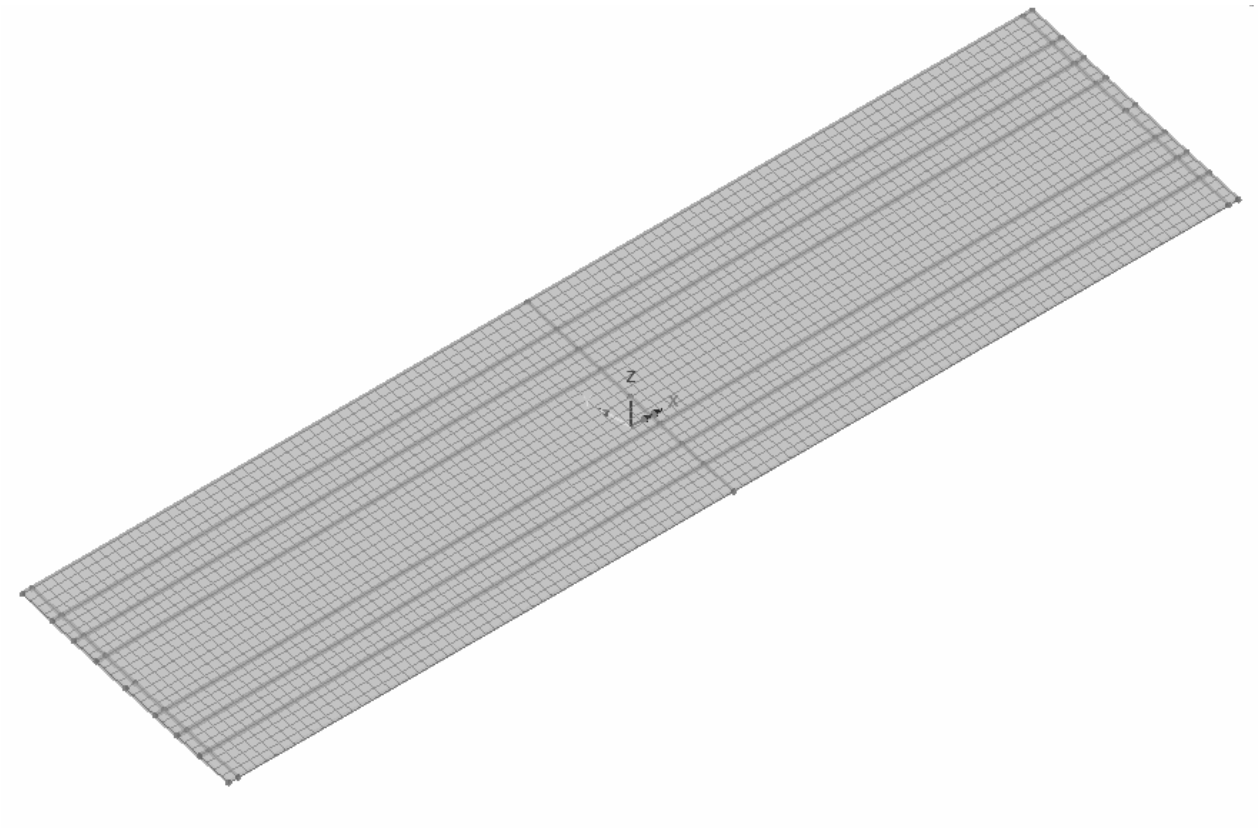
Variation	Funktion(u,v)	Remark
$t1$	$0.30 - 0.10 \cdot v$	Outer deck left side
$t2$	0.30	Inner deck
$t3$	$0.20 + 0.10 \cdot v$	Outer deck right
-	M	-

Surface function eccentricities:

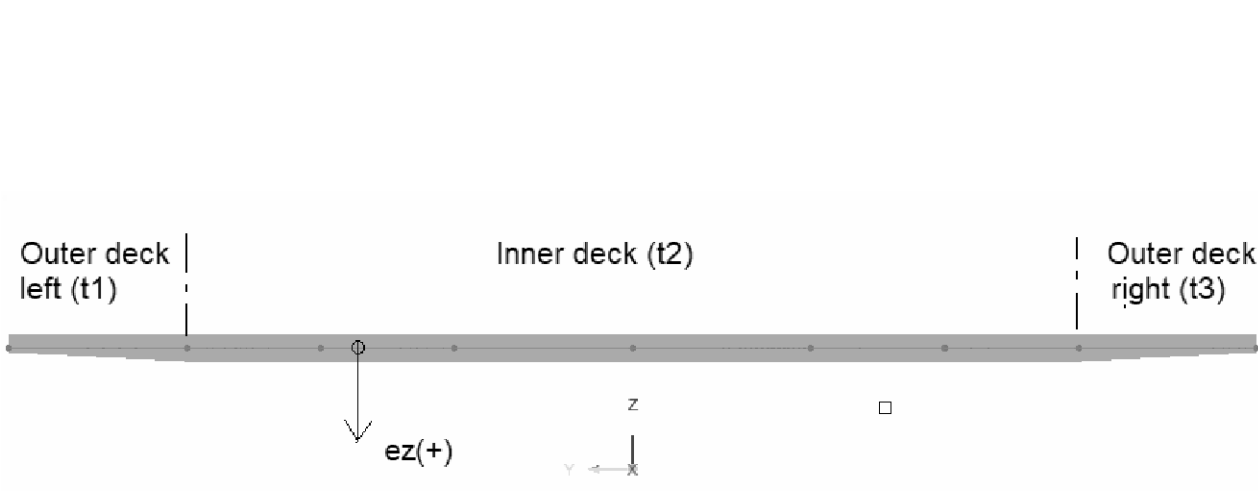
Variation	Funktion(u,v)	Remark
$e1$	$-0.05 \cdot v$	Outer deck left side
$e2$	0	Inner deck
$e3$	$-0.05 + 0.05 \cdot v$	Outer deck right
-	m	-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:14
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Bridge deck:



Overview

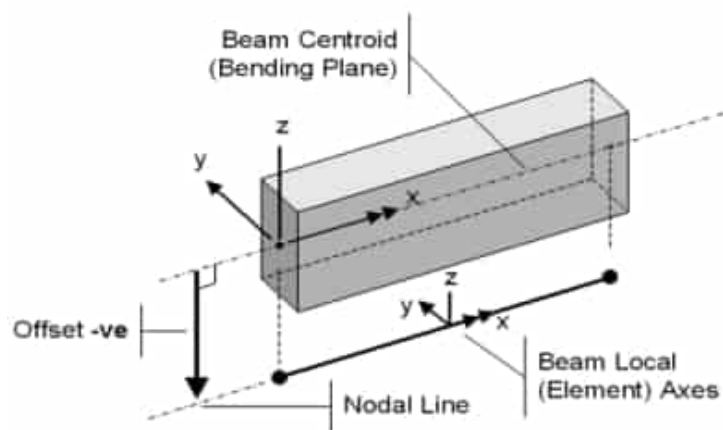


Section in transversal direction

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2.3.2 3D-beams ("Thick beam" / BMS3)

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



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2.3.2.1 Rigid beams at supports

A fictive rigid beam is introduced at bottom of each support. The beam has infinite stiffness in all directions.

Geometric Line

Analysis category
3D

Definition

☐ From library / calculator

☒ Enter properties

Usage
3D Thick Beam (Any beam)

EU Sections

HE Shapes (EN53-62)

HE 1000 M

100%

Reinforcement (only used for RC design checks)
None

ez origin
Centroid

ey origin
Same as ez

	Value
Cross sectional area (A)	1.0E3
Second moment of area about y axis (Iyy)	1.0E3
Second moment of area about z axis (Izz)	1.0E3
Product moment of area (Iyz)	0.0
Torsional constant (J)	1.0E3
Effective shear area in y direction (Asy)	1.0E3
Effective shear area in z direction (Asz)	1.0E3
Eccentricity in y direction (ey)	0.0
Eccentricity in z direction (ez)	0.0

Visualise...

Section details...

Name
Rigid beam - supports
(6)

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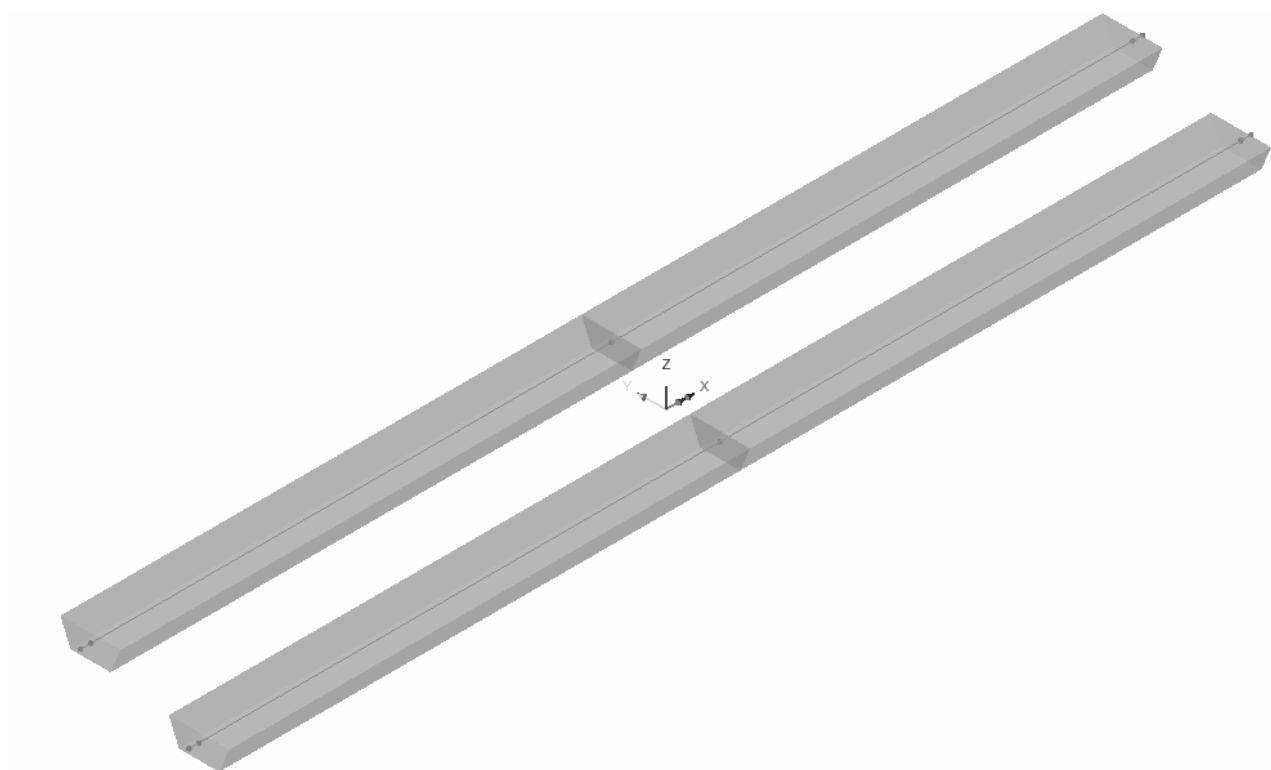
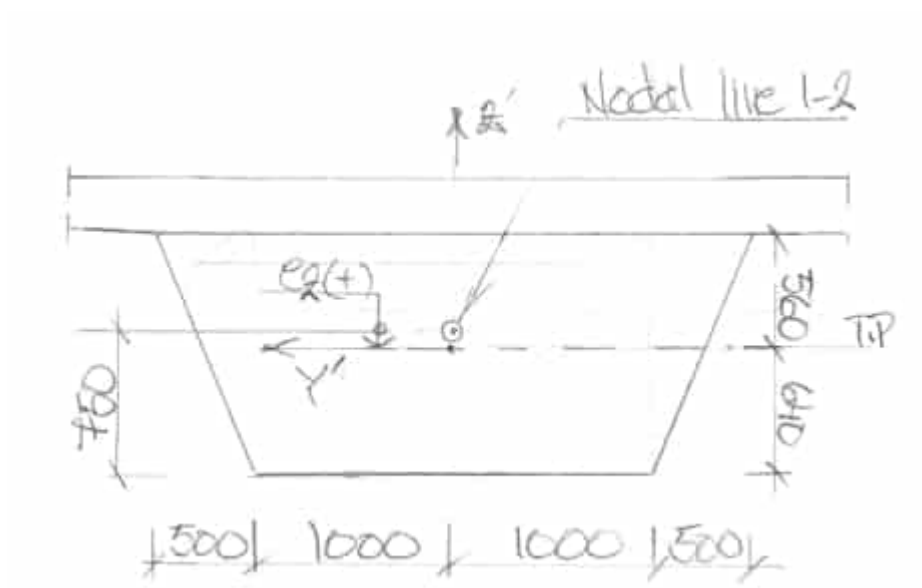


Overview

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2.3.2.2 Longitudinal girdes

Determination of cross section properties is performed using function *Section Property Calculator*. The girders are defined as an arbitrary section termed "Trapets".

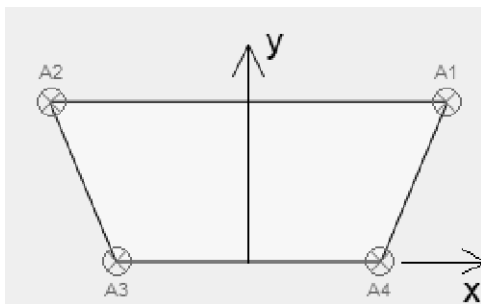


Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:19
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Input - arbitrary crosssections

Punkt	x	y
A1	1.50	1.20
A2	-1.50	1.20
A3	-1.00	0
A4	1.00	0
-	m	m



	Part A – CALCULATION ASSUMPTION	Status :	Page: A2:20
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Results cross section

Analysis category3D

Definition

From library / calculator

Rotation about centroid0°

Mirrored about axisNone

Enter properties

Usage3D Thick Beam (Any beam)

Reinforcement (only used for RC design checks)

None

ez originCentroid

ey originSame as ez

Cross sectional area (A)	3,0
Second moment of area about y axis (Iyy)	0,3552
Second moment of area about z axis (Izz)	1,625
Product moment of area (Iyz)	65,8365E-18
Torsional constant (J)	0,980915
Effective shear area in y direction (Asy)	2,53731
Effective shear area in z direction (Asz)	2,37684
Eccentricity in y direction (ey)	0,0
Eccentricity in z direction (ez)	0,11

Visualise...

Tapering >>

Section details...

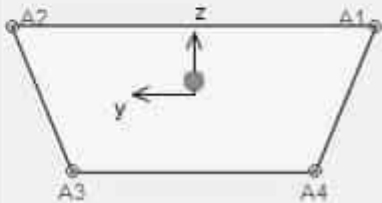
NameTrapets

(4)

Arbitrary Sections

1:Trapets

100%



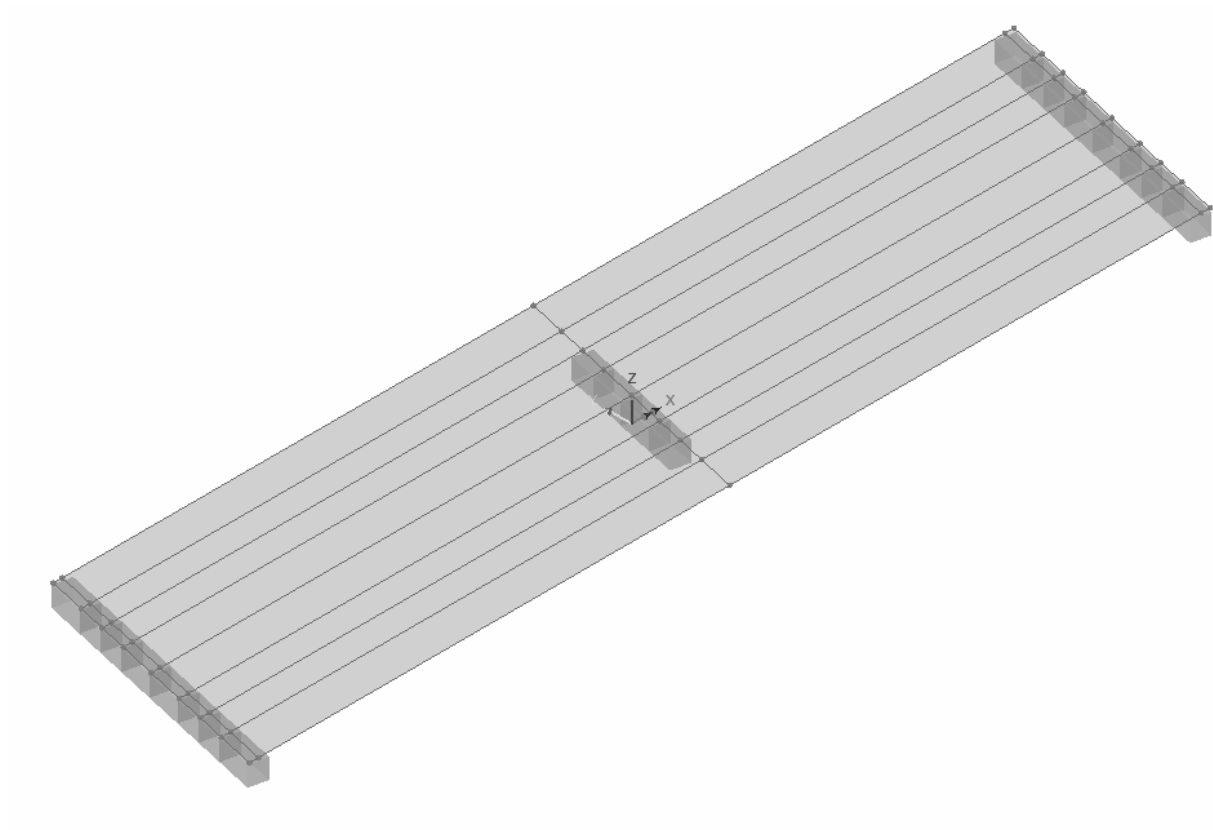
Value
3,0
0,3552
1,625
65,8365E-18
0,980915
2,53731
2,37684
0,0
0,11

File : A2 System analysis
Datum : 2025-12-19
Tid : 22:22

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:21
		Date:	Created:

2.3.2.3 Transversal girders

There are 3 transversal girders (TVB 1, TVB 2 and TVB 3) as visualized below.



Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:22
		Date:	Created:

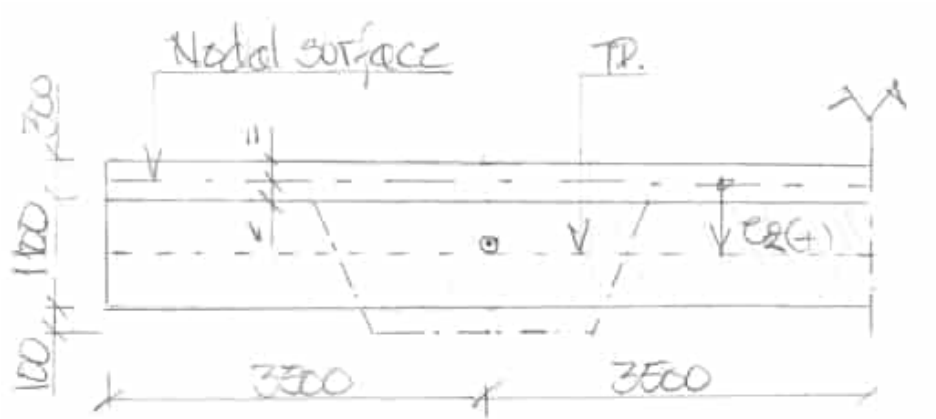
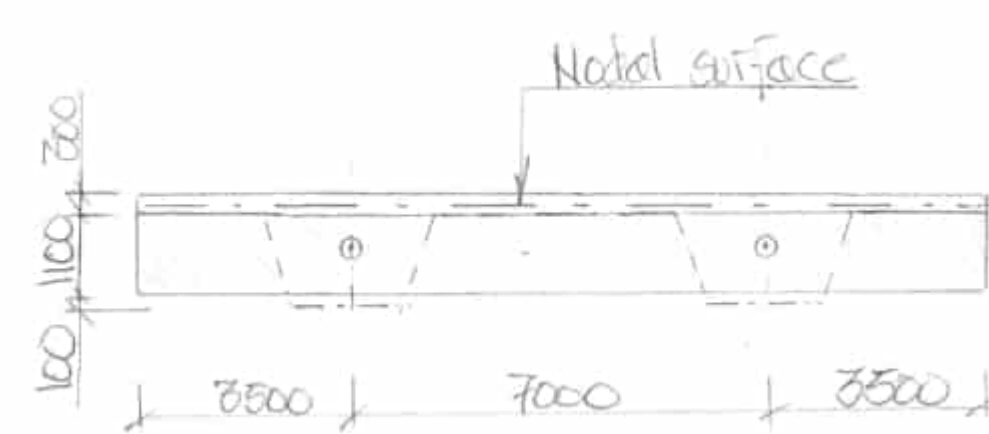
Input – cross section



Data	TVB
D	1.10
B	1.00
-	m

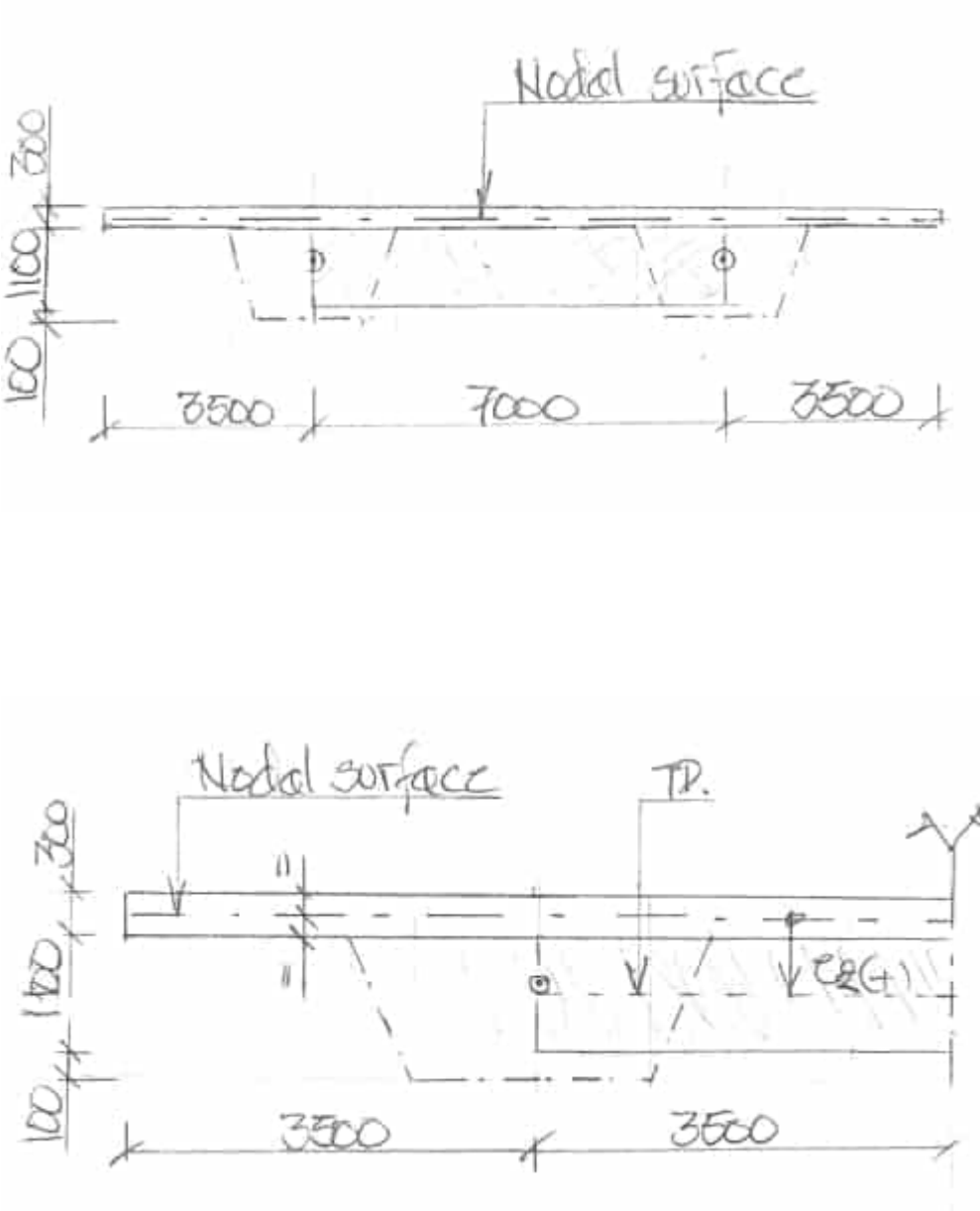
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:24
		Date:	Created:

Geometry transversal girder at en supports (TVB 1 & TVB 3):



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:25
		Date:	Created:

Geometry transversal girder at mid support (TVB 2):



	Part A – CALCULATION ASSUMPTION	Status :	Page: A2:26
	Pretensioned double girder bridge	Date:	Created:

2.4 MATERIAL

The transverse contraction coefficient for uncracked concrete is assumed to be 0.2 for uncracked concrete according to SS-EN 1992-1-1, section 3.1.3 (4). Material properties corresponding to uncracked concrete are applied to all structural components in the system calculation.

Superstructure C34/45 : $E_{cm} = 34 \text{ GPa}$

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	C35/45 (1)

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:27
		Date:	Created:

2.5 BOUNDARY CONDITIONS

All boundary conditions at each support are modelled as *Point Supports*.

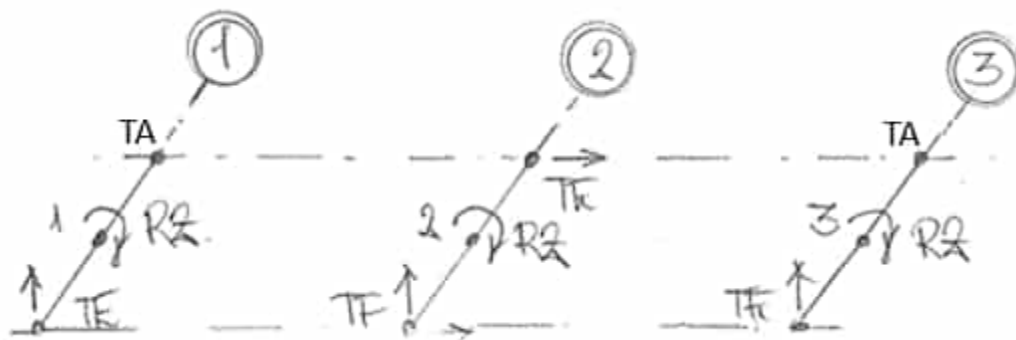
The boundary conditions in these “super-nodes” are modelled according to a local coordinate system oriented parallel to each support line as shown in the figure. This is intended to obtain reactions transformed into the directions of each support line.

Support	Point	Direction	TX	TY	TZ	RX	RY	RZ
1	P154	Local	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
2	P155	Local	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
3	P156	Local	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
-	-	-	kN/m	kN/m	kN/m	kNm/rad	kNm/rad	kNm/rad

Bearings are connected to rigid support beams called "rigid beams-supports."

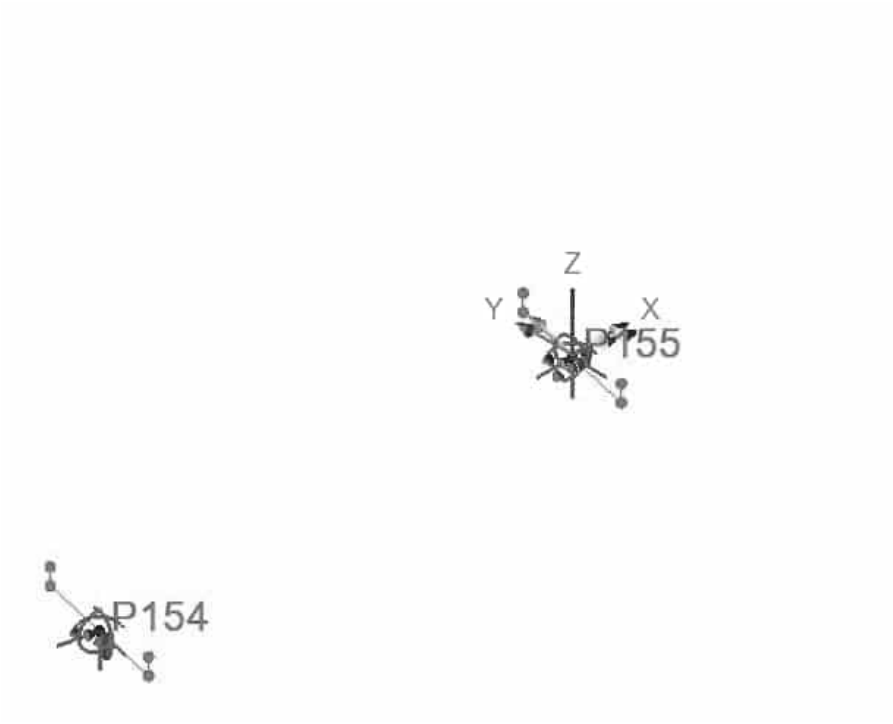
For these to be able to withstand bearing forces, they must be made rotationally stiff, see page A2:35-36. This corresponds to RX = "Fixed" and RY = "Fixed."

RZ is "Fixed." This is due to the incline of the supports and the design of the bearings regarding orientation and placement. To prevent each support from rotating freely under bearing forces, this "super-node" must be locked against rotation in the plane, see sketch below.



PLAN

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:28
		Date:	Created:



Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:29
		Date:	Created:

Supernode – support 1:

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

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

Lift-off >>

Contact >>

Name (1)

Supernode – support 2:

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

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

Lift-off >>

Contact >>

Name (2)

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:30
		Date:	Created:

Supernode – support 3:

Analysis category

3D

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

Spring stiffness distribution

☒ Stiffness

☐ Stiffness/unit length

☐ Stiffness/unit area

Lift-off >>

Contact >>

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:31
		Date:	Created:

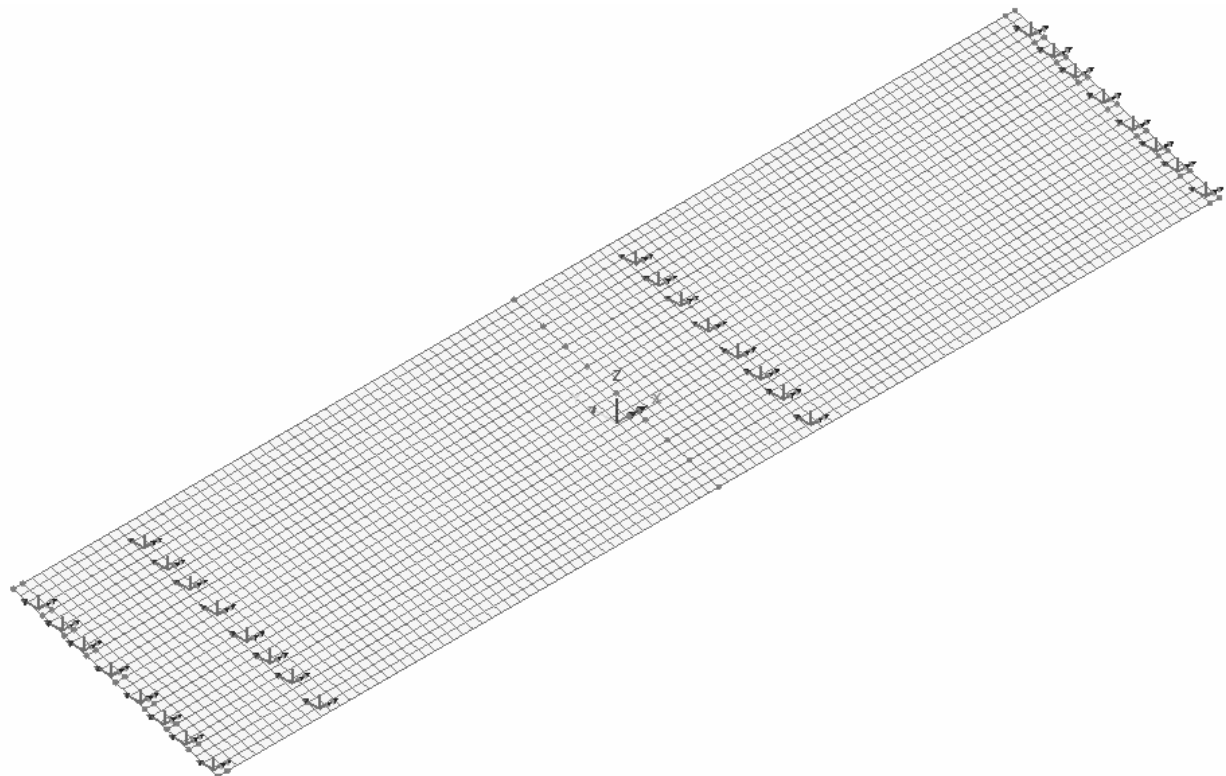
2.6 MESH

2.6.1 Shell element (QTS4): linear

Bridge deck is model using shell elements.

Shell elements are modelled with various subdivisions as seen below.

Type	x-divisions	y-divisions
Element 1 x 3	1	3
Element 1 x 4	1	4
Element 52 x 3	52	3
Element 52 x 4	52	4



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:32
		Date:	Created:

2.6.2 Beam element (BMI21) : linear

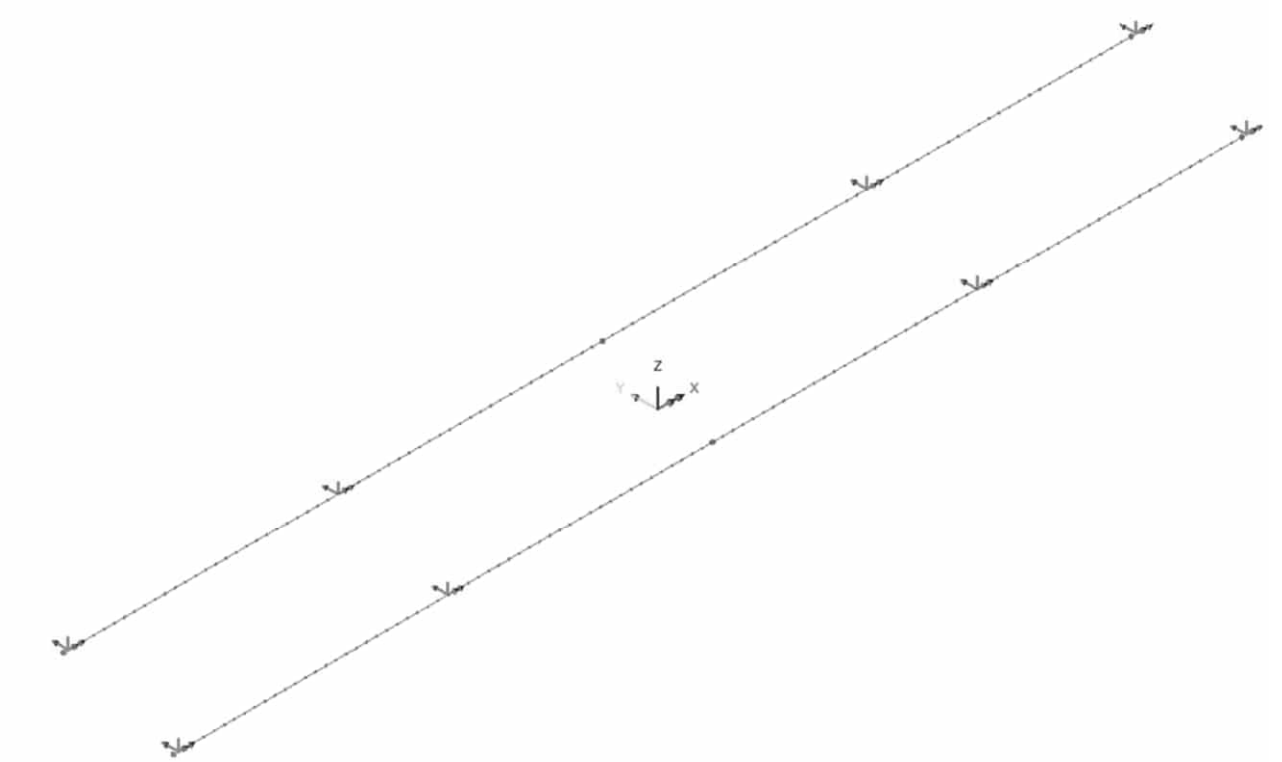
Longitudinal & transversal girders in superstructure are modelled using beam elements. This also applies to rigid beam at supports.

Beams elements are modelled with various subdivisions as seen below.

Name	Divisions	End release: Start	End release: End	Structure
Element 1	1	None	None	Girder
Element 3	3	None	None	Girder
Element 4	4	None	None	Girder
Element 52	52	None	None	Girder
Support	1	None	None	Rigid beam support

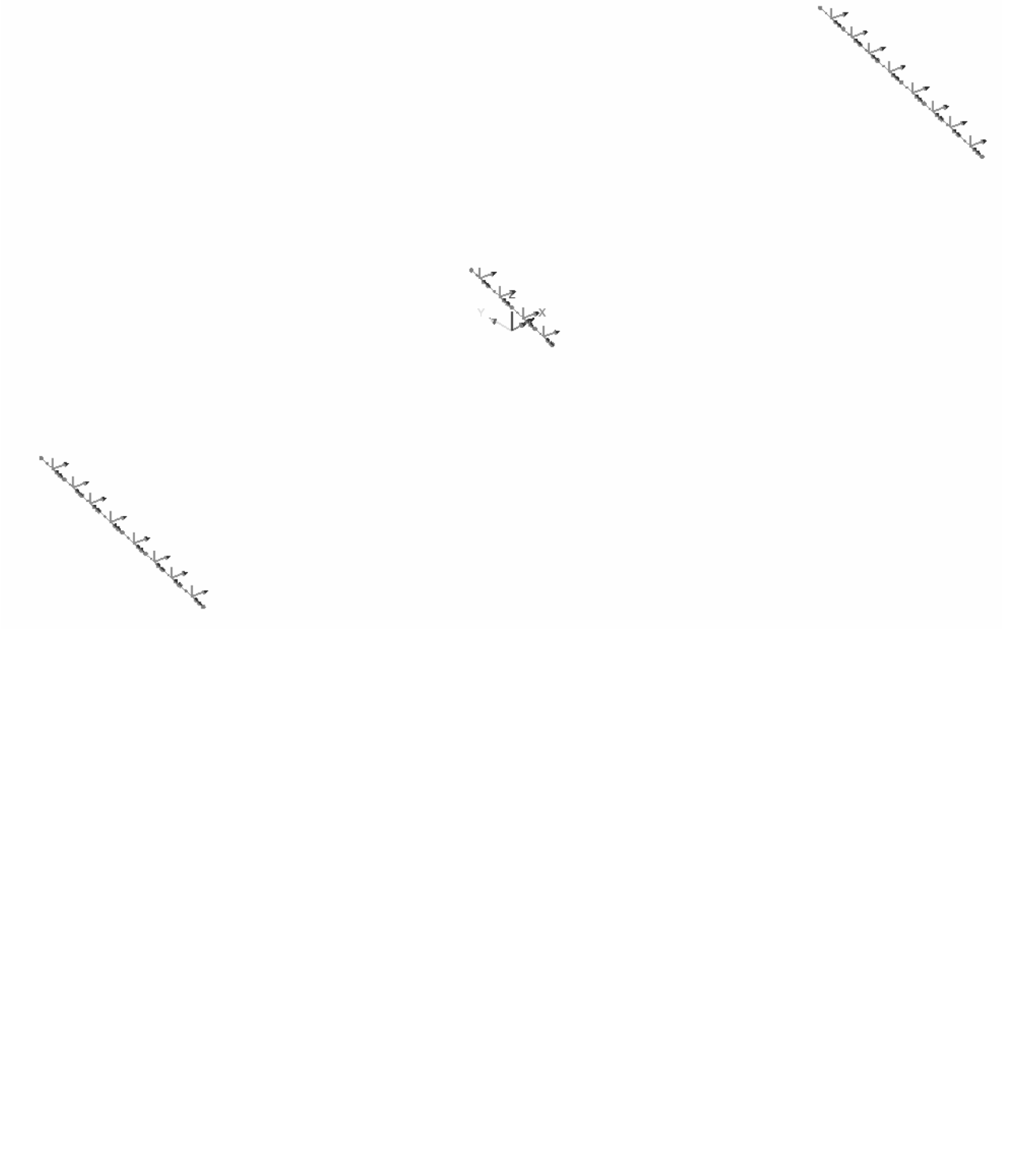
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:33
		Date:	Created:

2.6.2.1 Longitudinal girders



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:34
		Date:	Created:

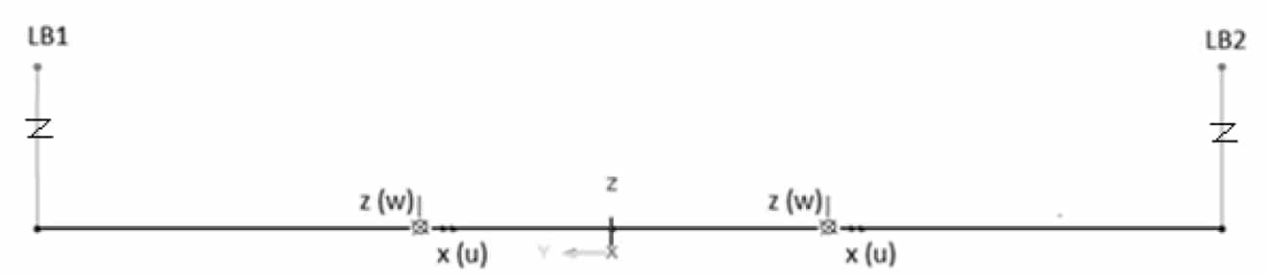
2.6.2.2 Transversal griders



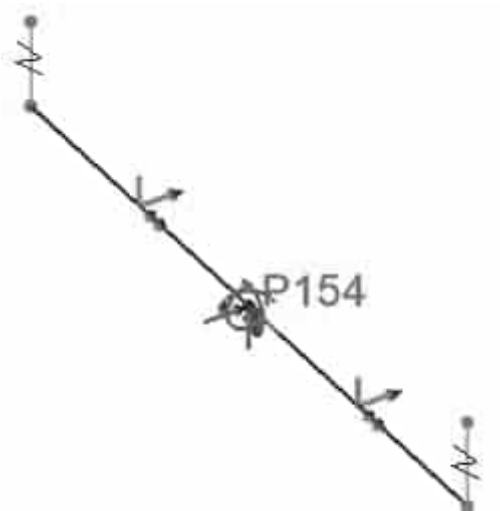
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:35
		Date:	Created:

2.6.2.3 Rigid beams at supports

Bearings (joints) are conected to boundary supports ("supernodes") with fictious rigid beams as seen below.

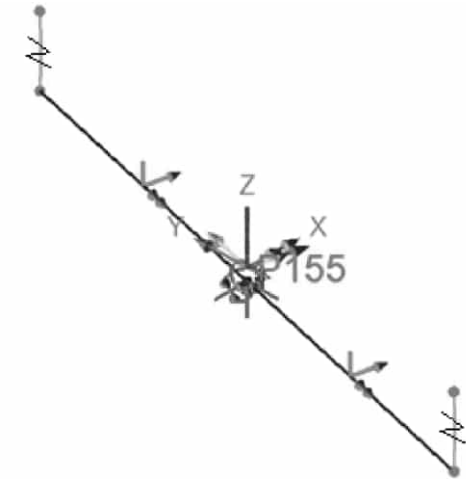


Rigid beam supernode – support 1:

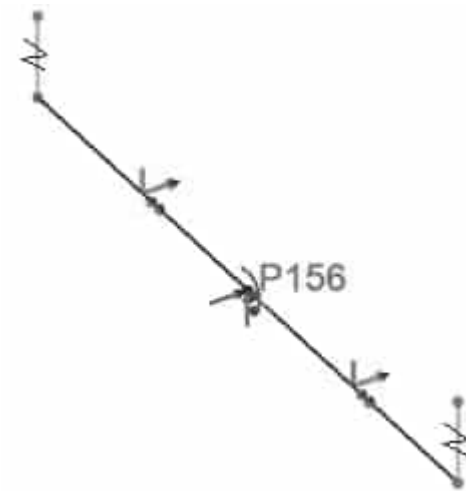


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:36
		Date:	Created:

Rigid beam supernode – support 2:



Rigid beam supernode – support 3:



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:37
		Date:	Created:

2.6.3 Joint elements between points (JNT4): linear

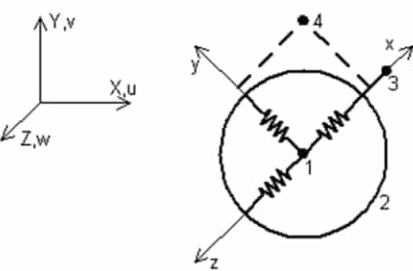
Bearings are modelled using joint element, see presentation below.

Element type: Joint no rotational stiffness

Assignment type: Between two features (manual)

Mesh direction: Nodal line (master) → Node rigid beam (slave)

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.

Joint materials (“Joint 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	1E+06	0
Joint material - TE:Y	1E+06	0	1E+06
-	kN/m	kN/m	kN/m

Remark

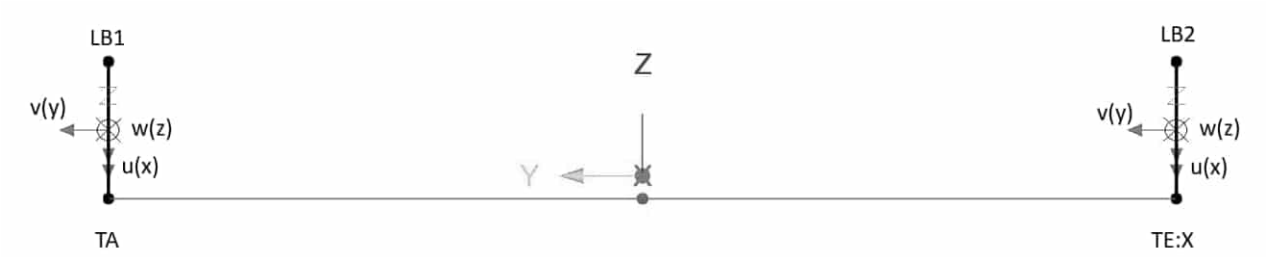
The local coordinate system in rigid beams is denoted x(u), u(v), and z(w).

The global coordinate system is denoted X, Y, and Z.

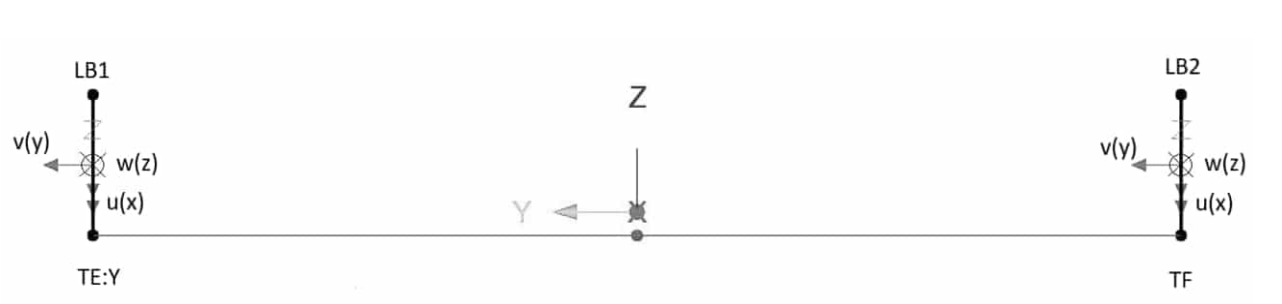
These two coordinate systems differ from each other. When describing bearings, the local coordinate system is applied.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:39
		Date:	Created:

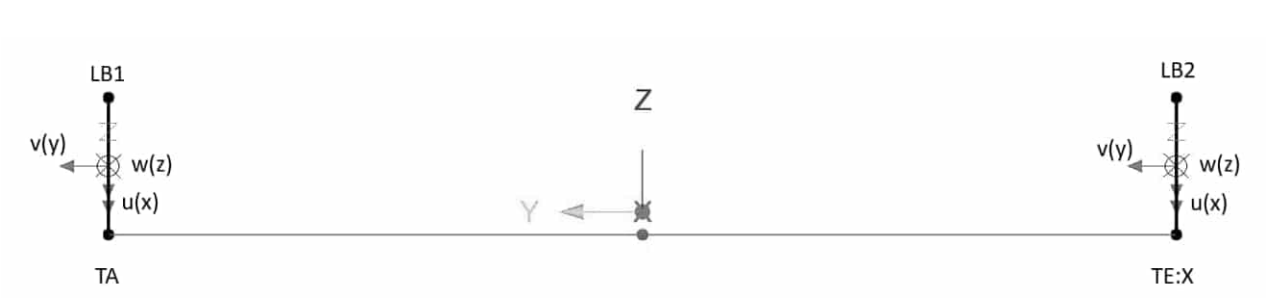
Bearings – support 1:



Bearings – support 2:



Bearings – support 3:



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:40
		Date:	Created:

2.6.4 Stel anslutning (Tied Mesh)

Deck is modelled as shell elements. They are defined by nodal surface.

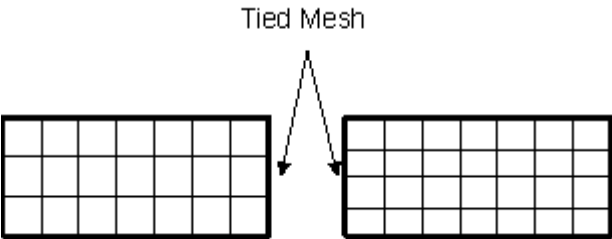
Ribs are modelled as rectangular beam elements. They are defined by nodal lines.

Longitudinal girders are tied to bridge deck using constant constraints.

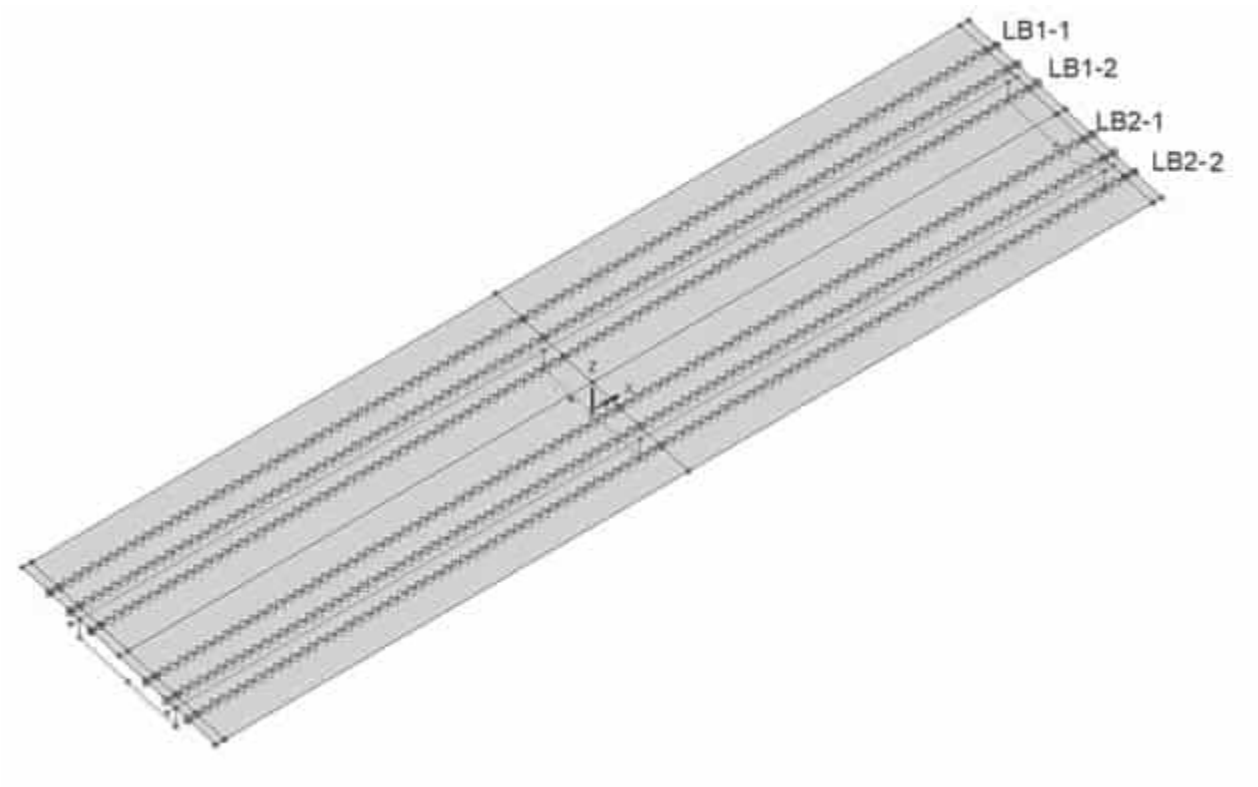
Longitudinal girder are master nodes.



Connection Tied Mesh”: type Rigid constraint



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:41
		Date:	Created:

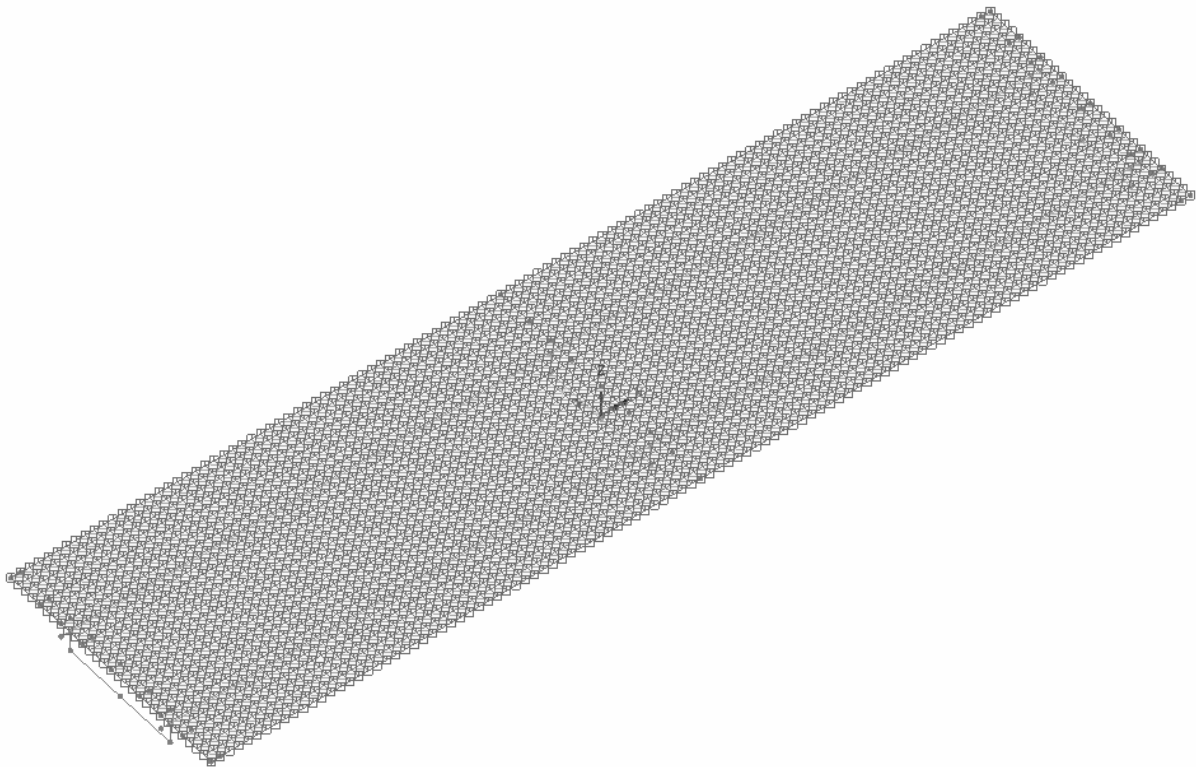


Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:42
		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 : Bridge deck

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:43
		Date:	Created:

2.8 SLICE RESULTANTS BEAMS/SHELLS

Slice resultant beams are needed at location of all girders.

2.8.1 Longitudinal girders

Equivalent forces will be determined at the 8th subpoints for each main girders. This is done by examining the load effects in the Nodal surface and Nodal line for the respective main girders LB 1 and LB 2.

FEM-program uses script called 'Slice Resultant Beams/Shells' to handle this, see the presentation below.

Beam	Path line	Extent	Remark
LB1	304	Girder LB1	Width = 7.00 m
LB2	306	Girder LB2	Width = 7.00 m
-	-	-	-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:44
		Date:	Created:

2.8.1.1 Slice beam ball LB1

Slice Resultants Beams/Shells

Slice path

Selected lines 304

Update

Slice locations

☐ Incremental distances from start of path e.g. 1@10;2@5

☒ Absolute distances from start of path e.g. 10;15;20

☐ Parametric distances from start of path e.g. 0.1;0.2

☐ Constant spacing e.g. 1.25

0,5;3,75;7,0;10,25;13,5;16,75;20,0;23,25;26,5;29,75;33,0;36,25;39,5;4

☐ Include additional slices at points along path

Distance from reference origin to start of path (chainage) 0,0

Slice Options

Moments about ☒ Neutral axis ☐ Slice path

☒ Slice width 7,0 ☐ Include whole elements only

☒ Smooth corners on path

Extent Girder LB1 v

Rotation about x 0,0

Name Longitudinal girder - LB1 v (3)

Overview

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	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:45
		Date:	Created:

2.8.1.2 Slice beam ball LB2

Slice Resultants Beams/Shells

Slice path

Selected lines 306

Update

Slice locations

☐ Incremental distances from start of path e.g. 1@10;2@5

☒ Absolute distances from start of path e.g. 10;15;20

☐ Parametric distances from start of path e.g. 0.1;0.2

☐ Constant spacing e.g. 1.25

0,5;3,75;7,0;10,25;13,5;16,75;20,0;23,25;26,5;29,75;33,0;36,25;39,5;

☐ Include additional slices at points along path

Distance from reference origin to start of path (chainage) 0,0

Slice Options

Moments about ☒ Neutral axis ☐ Slice path

☒ Slice width 7,0 ☐ Include whole elements only

☒ Smooth corners on path

Extent Grider LB2

Rotation about x 0,0

Name Longitudinal girder - LB2 (33)

A 3D perspective view of a bridge girder structure. The structure is a long, narrow rectangular prism with a grid of internal reinforcement or cross-bracing. A black line, representing the slice path, runs diagonally across the top surface of the girder. The label 'L306' is placed near the end of this path. A 3D coordinate system is shown at one end of the girder, with axes labeled X, Y, and Z. The X-axis points along the length of the girder, the Y-axis points across its width, and the Z-axis points vertically upwards.

Overview

File : A2 System analysis
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Tid : 22:22

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:46
		Date:	Created:

2.8.2 Transversal girders

Equivalent forces will be determined along t 8th subpoints for each main beam. This is done by examining the load effects in the Nodal surface and Nodal line for the respective main beams LB 1 and LB 2.

The FEM-program uses script called 'Slice Resultant Beams/Shells' to handle this, see the presentation below.

Beam	Path line	Extent	Remark
TVB1	307	Girder TVB 1-3	Width = 1.00 m
TVB2	309	Girder TVB 1-3	Width = 1.00 m
TVB3	308	Girder TVB 1-3	Width = 1.00 m
-	-	-	-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:47
		Date:	Created:

2.8.21.1 Slice beam ball TVB1

Slice Resultants Beams/Shells

Slice path

Selected lines 307

Update

Slice locations

☐ Incremental distances from start of path e.g. 1@10;2@5

☒ Absolute distances from start of path e.g. 10;15;20

☐ Parametric distances from start of path e.g. 0.1;0.2

☐ Constant spacing e.g. 1.25

0,1;3,5;3,7;7,2;10,7;10,9;14,3

☐ Include additional slices at points along path

Distance from reference origin to start of path (chainage)

0,0

Slice Options

Moments about

☒ Neutral axis ☐ Slice path

☒ Slice width 1,0 ☐ Include whole elements only

☒ Smooth corners on path

Extent

Girder TVB 1-3

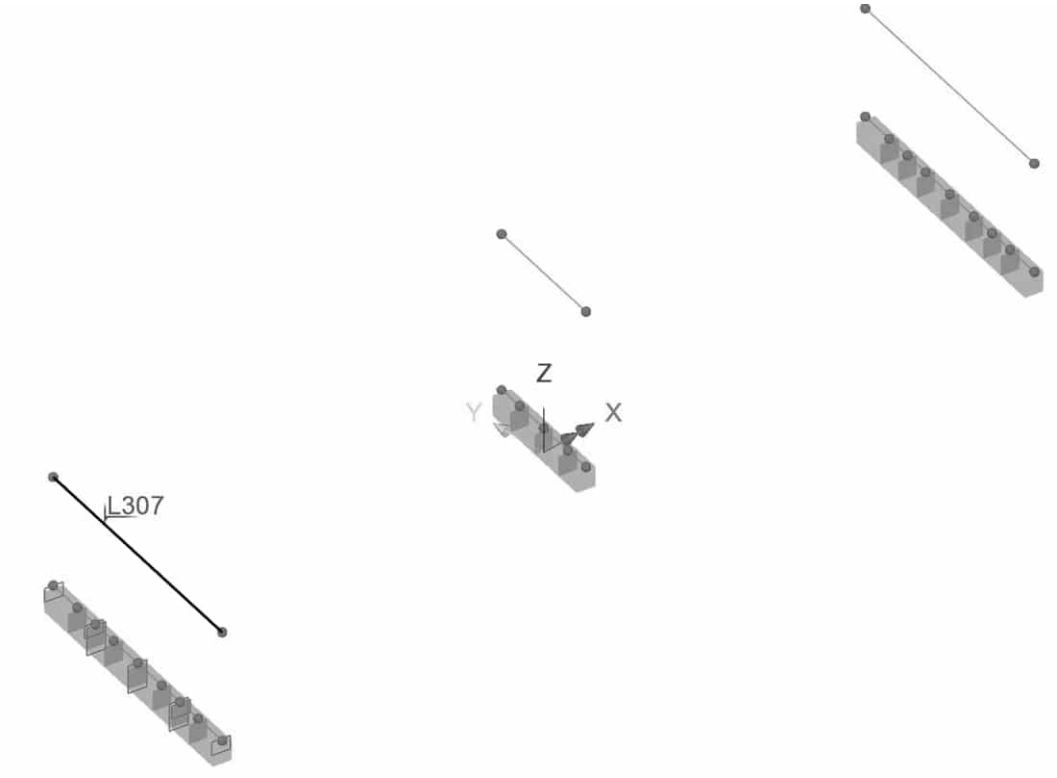
Rotation about x

0,0

Name

Transversal girder - TVB1

(1)



Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:48
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2.8.2.2 Slice beam ball TVB2

Slice Resultants Beams/Shells

Slice path

Selected lines 309

Update

Slice locations

☐ Incremental distances from start of path e.g. 1@10;2@5

☒ Absolute distances from start of path e.g. 10;15;20

☐ Parametric distances from start of path e.g. 0.1;0.2

☐ Constant spacing e.g. 1.25

0,1;3,6;7,1

☐ Include additional slices at points along path

Distance from reference origin to start of path (chainage)

0,0

Slice Options

Moments about ☒ Neutral axis ☐ Slice path

☒ Slice width 1 ☐ Include whole elements only

☒ Smooth corners on path

Extent

Girder TVB 1-3

Rotation about x

0,0

Name

Tansversal girder - TVB2

(2)

L309

Z

Y

X

Overview

File : A2 System analysis
Datum : 2025-12-19
Tid : 22:22

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:50
		Date:	Created:

2.9 LOCAL COORDINDATE SYSTEM

To obtain transformed reactions, guideline directions are established by creating a local coordinate system as described below. The system is applied at the positions of points P154, P155, and P156.

Coordinates type

☒ Cartesian

☐ Cylindrical

☐ Spherical

☐ Surface

☒ Rotate

☐ Scale

☐ Matrix

Angle

-13.0

About axis

☐ X-axis

☐ Y-axis

☒ Z-axis

Origin

X

0.0

Y

0.0

Z

0.0

Local coordinate generated from selection

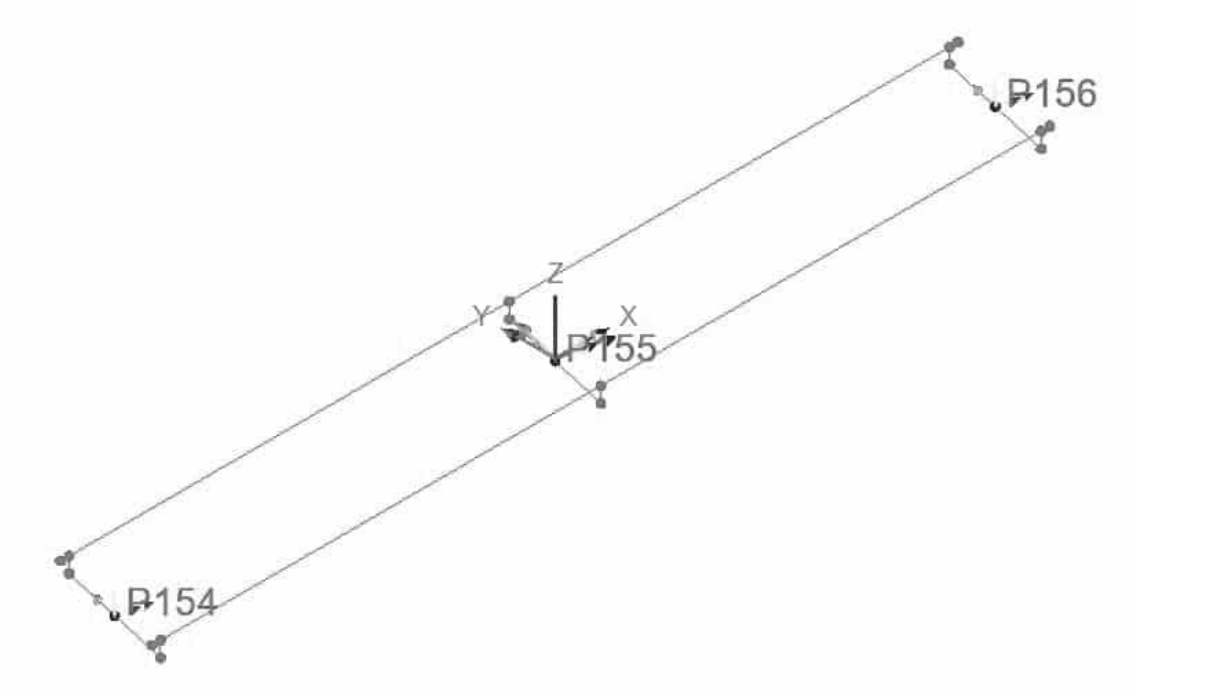
No Local coordinate attributes created from selector

Use

Name

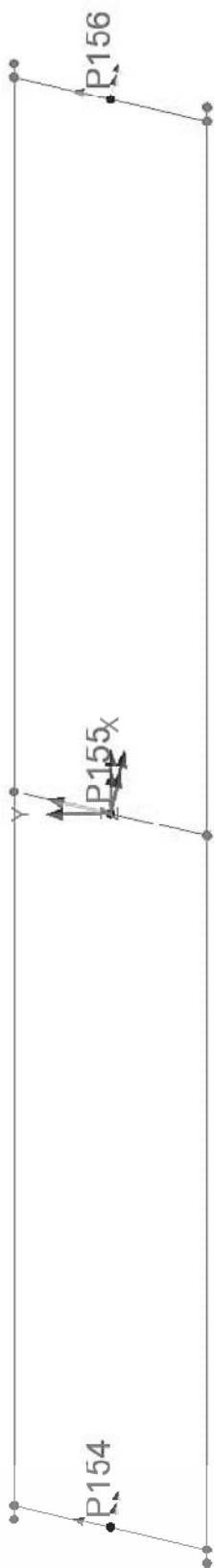
Local system

(1)



Overview

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:51
		Date:	Created:



PLAN

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A2:52
		Date:	Created:

2.10 FLANGE WIDTH

Determination of effective flange width according to SS-EN 1992-1-1, section 5.3.2.1.

The check below shows that the participating flange width corresponds to the gross cross-section, i.e., no reduction of the cross-section. When determining the equivalent internal forces for the main beams LB1 and LB2, the entire gross cross-section for half of the bridge is used. This also applies when determining the load-bearing capacity.

$$l_0 = 0.85L = 0.85 \cdot 26m = 22.1m$$

Controll "cantilever" :

$$\min(0.2b_1 + 0.1l_0; 0.2l_0, b_1) = \min(0.2 \cdot 2.0m + 0.1 \cdot 22.1m ; 0.2 \cdot 22.1m, 2.0m) = 2.0m$$

$$\rightarrow b_{ef,1} = 2.0m$$

Controll "slab" between longitudinal girders :

$$\min(0.2b_2 + 0.1l_0; 0.2l_0, b_2) = \min(0.2 \cdot 2.0m + 0.1 \cdot 22.1m; 0.2 \cdot 22.1m; 2.0m) = 2.0m$$

$$\rightarrow b_{ef,2} = 2.0m$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:1
		Date :	Created :

3. LASTER

3.1	DEAD WEIGHT	page 3:2-6
3.2	SURFACING	page 3:7
3.3	EARTH PRESSURE	page 3:8
3.4	SUPPORT SETTLEMENT	page 3:9-14
3.5	CREEP	page 3:15-19
3.6	SHRINKAGE	page 3:20-24
3.7	TRAFFIC LOAD	page 3:25-44
3.8	BRAKING LOAD	page 3:45-48
3.9	LATERAL LOAD	page 3:49-52
3.10	WIND LOAD	page 3:53-58
3.11	SURCHARGE	page 3:59
3.12	TEMPERATURE	page 3:60-65
3.13	PRESTRESS	page 3:65-99
3.14	LOAD COMBINATIONS	page 3:100-111

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:2
		Date :	Created :

3.1 DEAD WEIGHT

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

3.1.1 Loas bridge deck

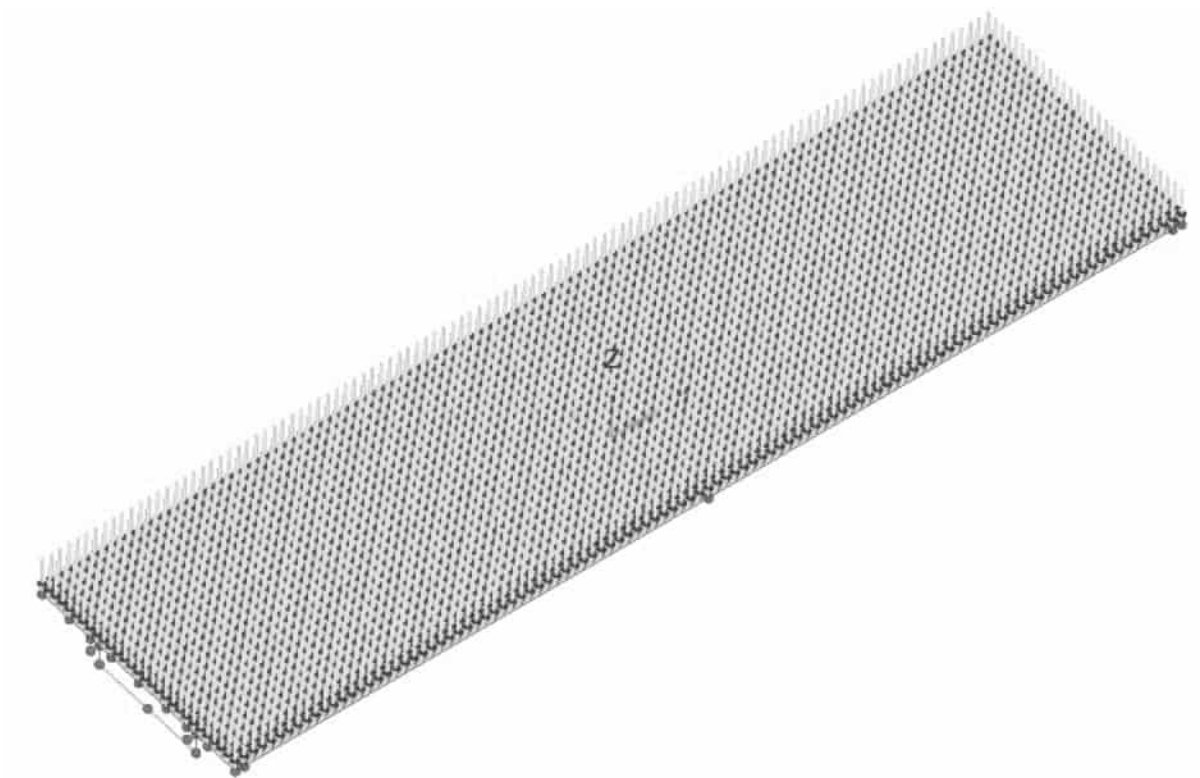
Load : EGEN 1

Structural loading : Body force

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

Load case : EGEN 1

Loading assignment: Assign to surfaces



Overview 3D

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:3
		Date :	Created :

3.1.2 Longitudinal & transversal girders

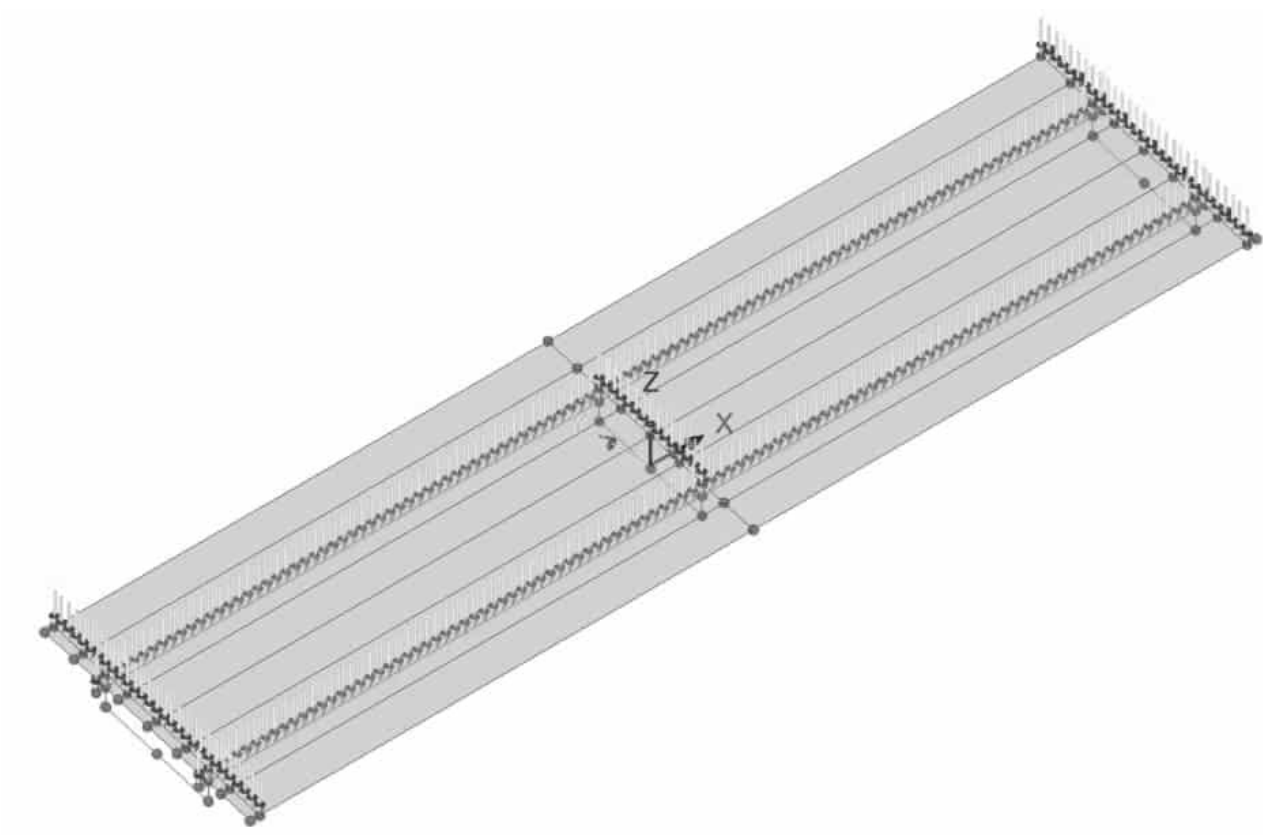
Load : EGEN 2

Structural loading : Body force

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

Load case : EGEN 2

Loading assignment: Assign to lines



Overview 3D

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3.1.3 Edge beams & railings

Refers to both the railing on the divider beam and the edge beams.

Weight of divider beam incl. railing

$$p_{r\ddot{a}cke} = 0.5 \frac{kN}{m}$$

$$\rightarrow p_z = p_{r\ddot{a}cke} + p_{KB} = 0.5 \frac{kN}{m} + 0.20m \cdot 0.40m \cdot 25 \frac{kN}{m^3} = -2 \frac{kN}{m}$$

Remark

To be able to accommodate future reconstruction of the bridge deck, this load has not been considered in the system analysis.

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Weight of edge beam incl. railing

A fictitious line load is applied to each edge beam as described below. The load also includes the bridge railing.

$$p_{r\ddot{a}cke} = 0.5 \frac{kN}{m}$$

$$\rightarrow p_z = p_{r\ddot{a}cke} + p_{KB} = 0.5 \frac{kN}{m} + 0.40m \cdot 0.45m \cdot 25 \frac{kN}{m^3} = -5 \frac{kN}{m}$$

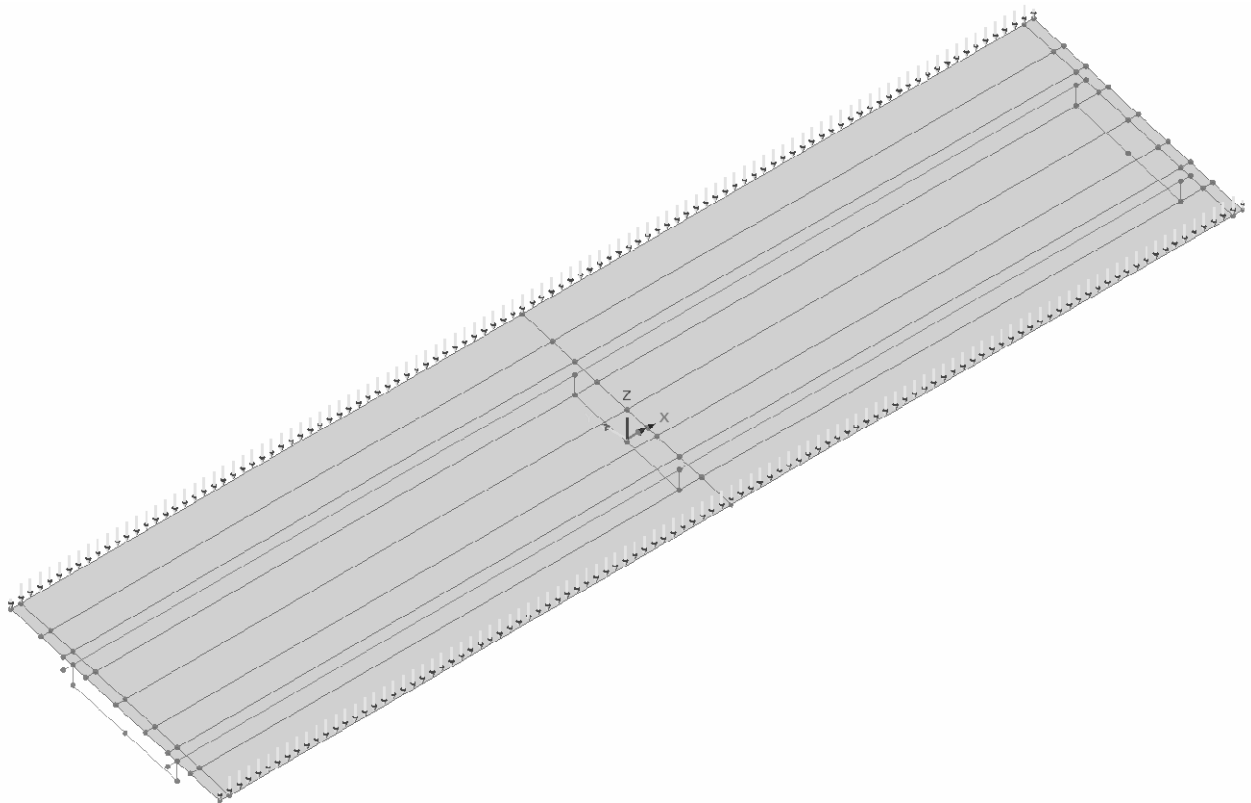
Load : EGEN 3

Structural loading : Body force

Line load (p_z) : -5 kN/m

Load case : EGEN 3

Loading assignment: Assign to lines



Overview 3D

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3.1.4 Load combinations

Basic load combination EGEN:

Load case	Factor
EGEN 1	1.00
EGEN 2	1.00
EGEN 3	1.00

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:7
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3.2 SURFACING

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

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

$$q_{matta} = 0.11 kPa \quad : \text{waterproofing}$$

Surfacing load is seen below:

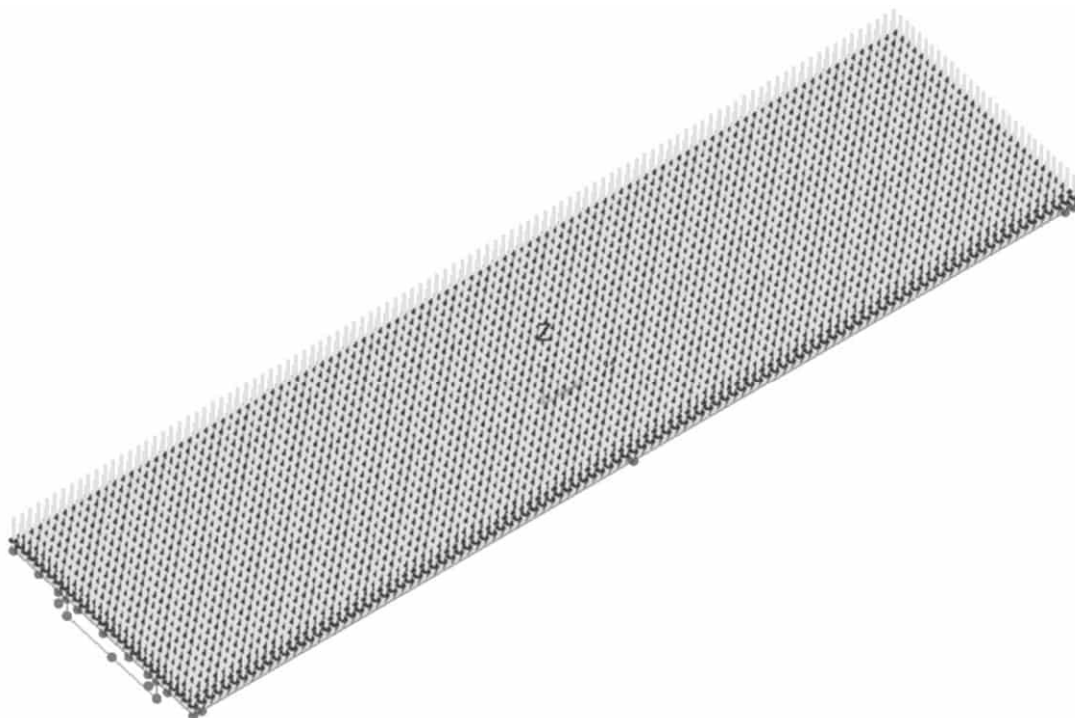
$$q_{belägg} = \gamma_{beläggning} \cdot t + q_{matta} = 23 \frac{kN}{m^3} \cdot 0.09m + 0.11 kPa = 2.2 kPa$$

Load : BELAGG

Structural loading : Global distributed

Load per unit area in Z direction (q_z) : $-3 \frac{kN}{m^2}$

Load case: BELAGG



Overview 3D

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:8
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3.3 EARTH PRESSURE

$$\gamma_{m,\phi} = 1.30$$

$$\gamma = 22 \frac{kN}{m^3}$$

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

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

$$\rightarrow \varphi_d = \arctan\left(\frac{\tan\varphi_k}{\gamma_m}\right) = \arctan\left(\frac{\tan 45^\circ}{1.0}\right) = 45^\circ \quad : \text{design method D2}$$

$$\rightarrow \varphi_d = \arctan\left(\frac{\tan\varphi_k}{\gamma_m}\right) = \arctan\left(\frac{\tan 45^\circ}{1.3}\right) = 38^\circ \quad : \text{design method D3}$$

Earth pressure coefficients are seen below.

$$K_o = 1 - \sin(\varphi_d)$$

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

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

φ_d	K_a	K_o	K_p	Metod
38°	0.24	0.38	4.20	D3
45°	0.17	0.29	5.82	D2

Design is carried out according to method D2 according to TK Geo section 3.16.1. Dimensionering utförs enligt metod D2 enligt TK Geo avsnitt 3.16.1.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:9
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3.4 SUPPORT SETTLEMENT

The effect of support displacement shall be considered according to TRVINFRA-00227 section 7.2.1.1.1.1. Only vertical support displacement and horizontal support displacement in the longitudinal direction of the bridge need to be considered. In addition, it is stated that horizontal and vertical support displacements do not need to be combined.

The bridge is founded on pointed concrete piles. According to common calculation practice, a vertical settlement difference between supports corresponding to 10 mm is applied.

A horizontal support displacement in the bridge's longitudinal direction (x-direction) corresponding to ± 5 mm is applied; however, only translation occurs, i.e., no associated restraint forces arise.

Note

TRVINFRA-00227 section 7.2-10 specifies ± 5 mm for the control of expansion joints.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:10
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3.4.1 Vertical settlement

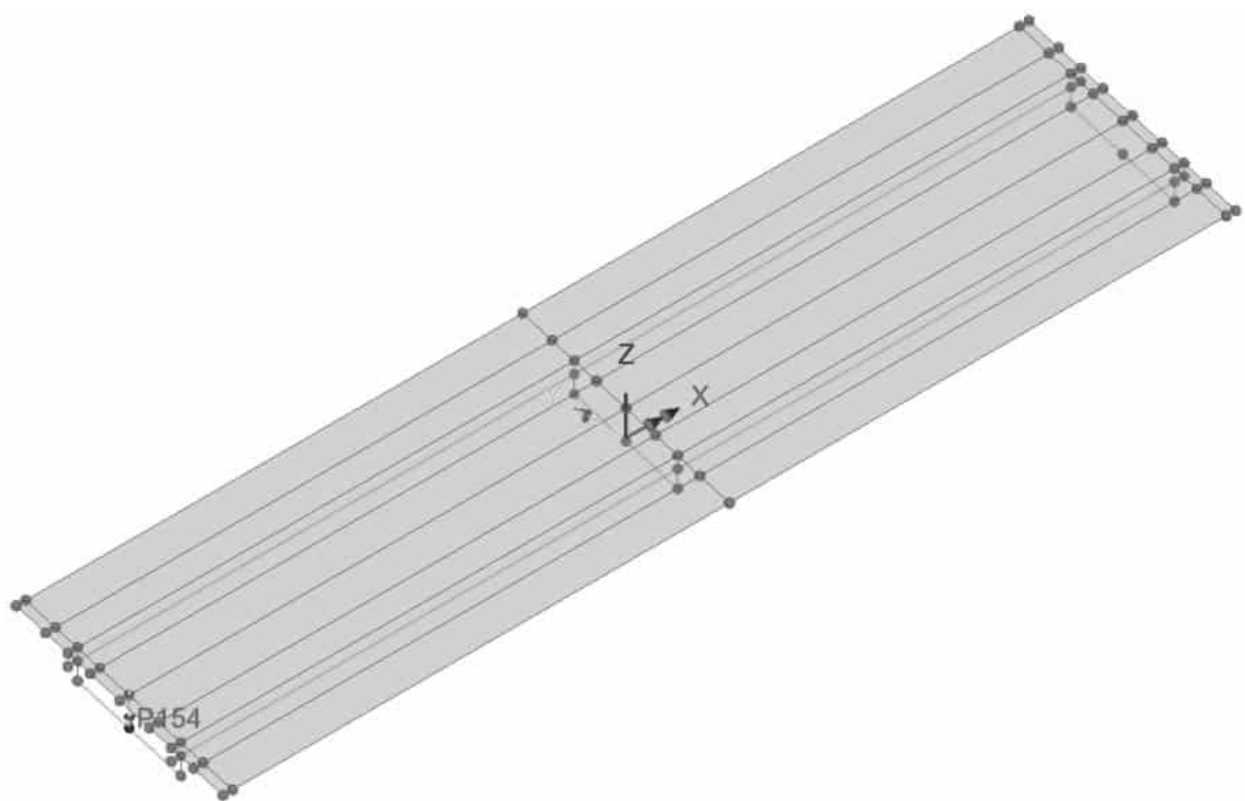
Load: STOD_1Z

Structural loading : Prescribed Displacement

Translation at point in Z direction : -0.010 m

Load case : STOD_1Z

Point : P154



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:11
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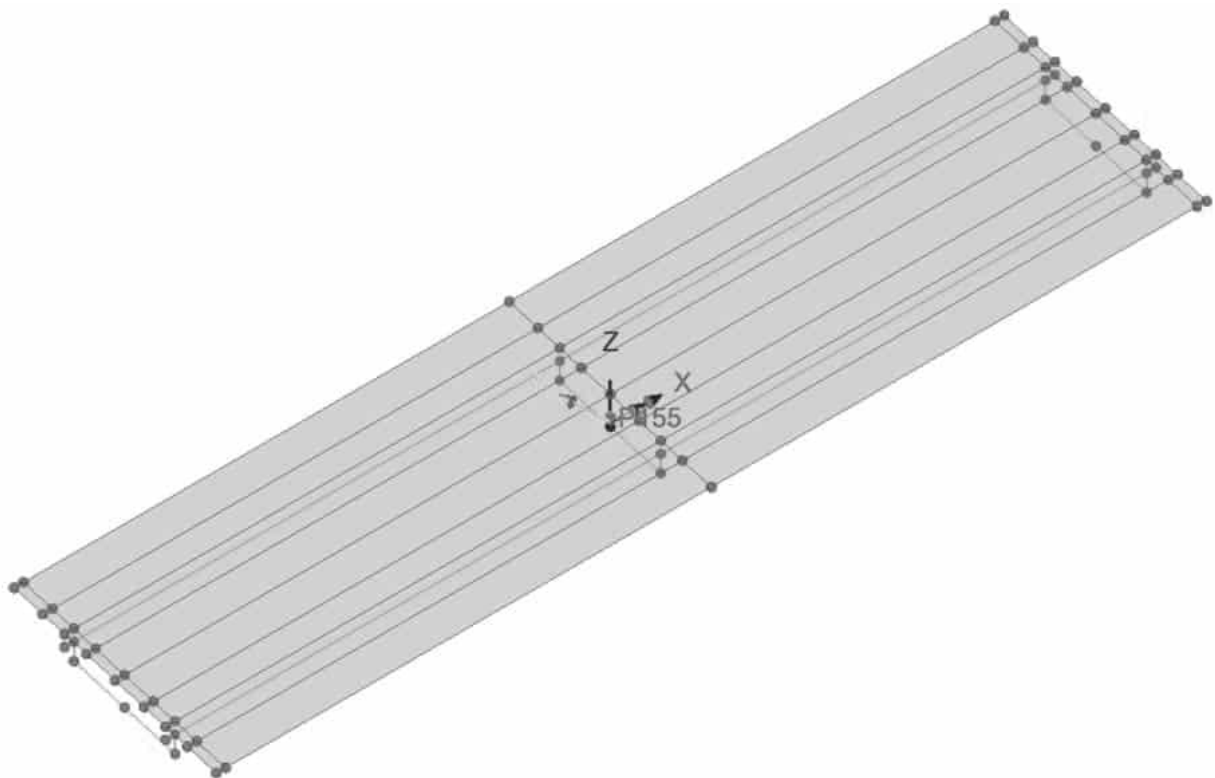
Load: STOD_2Z

Structural loading : Prescribed Displacement

Translation at point in Z direction : -0.010 m

Load case : STOD_2Z

Point : P155



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:12
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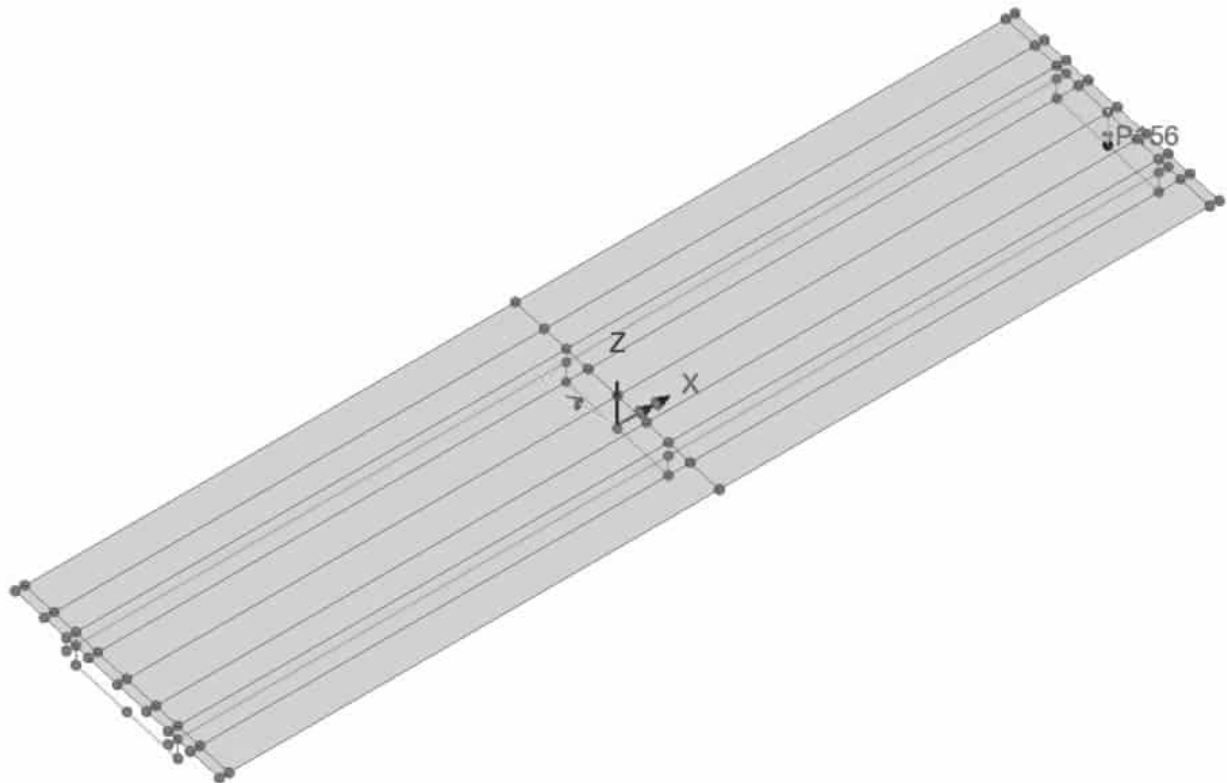
Load: STOD_3Z

Structural loading : Prescribed Displacement

Translation at point in Z direction : -0.010 m

Load case : STOD_3Z

Point : P156



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:13
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3.4.2 Horizontal settlement

Horizontal settlement in longitudinal direction only causes translation.

Thus, this settlement is not included in the system calculation, since does not give rise to constraint forces.

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3.4.3 Load combination

Load combination smart STOD:

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

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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 t1.

Time for first loading (= time when formwork was removed) is termed t0.

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

$$t_2 = 120 \text{ years}$$

Bridge consists of parts with different thicknesses as seen below.

Creep is determine using Mathcad program PROG A001.

Superstructure (b = 2.5 m):

For t = 1.50 m → $\phi(t_2, t_0) = 1.9$

: see page A3:19

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

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:16
	Pretensioned double girder bridge	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.

$$f_{KRYMP} = \frac{1}{1 + \varphi_{ef}} = \frac{1}{1 + 1.9} = 0.34$$

$$f_{STÖD} = \frac{1}{1 + \varphi_{ef}} = \frac{1}{1 + 1.9} = 0.34$$

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

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).

Object: Superstructure**INPUT****Number of sections** $N := 2 \text{ pcs}$ **Geometry & concrete (C30/37, C35/45, C40/50 & C45/55)**

Section	B	H	Concrete
1	2,5	1,5	C35/45
2	2,5	1,5	C35/45
-	m	m	-

Relative humidity $RH := 80\%$ **Time of loading (i.e. removal formwork)** $t_0 := 5 \text{ days}$ **Studied time for determination of creep** $t_2 := 120 \text{ year} \quad t_2 = 43800 \text{ days}$

Input receipt

 $f_{cm} = [43 \ 43] \text{ MPa}$

CALCULATION**Area**

$$A_c := B \cdot H$$

Perimeter exposed to "air"

$$u := 2 \cdot B$$

Effective thickness structure

$$h_0 := \frac{2 \cdot A_c}{u}$$

Creep coefficients

The expressions for determining the creep coefficients are taken from SS-EN 1992-1-1 Annex B.1.

$$\alpha_1 := \left(\frac{35 \cdot \text{MPa}}{f_{cm}} \right)^{0.7} = \begin{bmatrix} 0.87 \\ 0.87 \end{bmatrix}$$

$$\alpha_2 := \left(\frac{35 \cdot \text{MPa}}{f_{cm}} \right)^{0.2} = \begin{bmatrix} 0.96 \\ 0.96 \end{bmatrix}$$

$$\alpha_3 := \left(\frac{35 \cdot \text{MPa}}{f_{cm}} \right)^{0.5} = \begin{bmatrix} 0.902 \\ 0.902 \end{bmatrix}$$

$$\varphi_{RH} := \begin{cases} \text{if } f_{cm} \leq 35 \text{ MPa} \\ \quad \varphi_{RH} \leftarrow 38 \cdot \text{MPa} \\ \text{else} \\ \quad \varphi_{RH} \leftarrow \left(1 + \frac{1 - RH}{0.1 \cdot \sqrt[3]{\frac{h_0}{\text{mm}}}} \cdot \alpha_1 \right) \cdot \alpha_2 \end{cases}$$

$$\varphi_{RH} = \begin{bmatrix} 1.105 \\ 1.105 \end{bmatrix}$$

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

$$\beta_{f_{cm}} := \frac{16.8}{\sqrt{\frac{f_{cm}}{\text{MPa}}}} = \begin{bmatrix} 2.56 \\ 2.56 \end{bmatrix}$$

$$\begin{aligned}
 \beta_H := & \text{if } f_{cm} \leq 35 \cdot \text{MPa} & \beta_H = \begin{bmatrix} 1353 \\ 1353 \end{bmatrix} \\
 & \parallel \beta_{H,max} \leftarrow 1500 \\
 & \parallel \text{if } 1.5 \cdot \left(1 + (0.012 \cdot 100 \cdot RH)^{18} \right) \cdot \frac{h_0}{mm} + 250 > \beta_{H,max} \\
 & \parallel \parallel \beta_H \leftarrow \beta_{H,max} \\
 & \parallel \text{else} \\
 & \parallel \parallel \beta_H \leftarrow 1.5 \cdot \left(1 + (0.012 \cdot 100 \cdot RH)^{18} \right) \cdot \frac{h_0}{mm} + 250 \\
 & \text{if } f_{cm} > 35 \cdot \text{MPa} \\
 & \parallel \beta_{H,max} \leftarrow 1500 \cdot \alpha_3 \\
 & \parallel \text{if } 1.5 \cdot \left(1 + (0.012 \cdot 100 \cdot RH)^{18} \right) \cdot \frac{h_0}{mm} + 250 > \beta_{H,max} \\
 & \parallel \parallel \beta_H \leftarrow \beta_{H,max} \\
 & \parallel \text{else} \\
 & \parallel \parallel \beta_H \leftarrow 1.5 \cdot \left(1 + (0.012 \cdot 100 \cdot RH)^{18} \right) \cdot \frac{h_0}{mm} + 250 \cdot \alpha_3
 \end{aligned}$$

$$\beta_c := \left(\frac{t_2 - t_0}{\beta_H + t_2 - t_0} \right)^{0.3} = \begin{bmatrix} 0.99 \\ 0.99 \end{bmatrix}$$

$$\varphi_{t0} := \varphi_{RH} \cdot \beta_{fcm} \cdot \beta_0 = \begin{bmatrix} 1.91 \\ 1.91 \end{bmatrix}$$

RESULTS

$$\varphi_{t2} := \varphi_{t0} \cdot \beta_c = \begin{bmatrix} 1.90 \\ 1.90 \end{bmatrix}$$

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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_2 .

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

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

$$t_2 = 120 \text{ years}$$

Shrinkage is determined using Mathcad program PROG A002 after time t_2 .

Superstructure:

Shrinkage $\varepsilon_{cs} = 0.023\%$ is applied to all construction parts for safety. The movement corresponds to that which occurs due to an imaginary temperature load $\therefore T = -23^\circ\text{C}$.

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).

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:21
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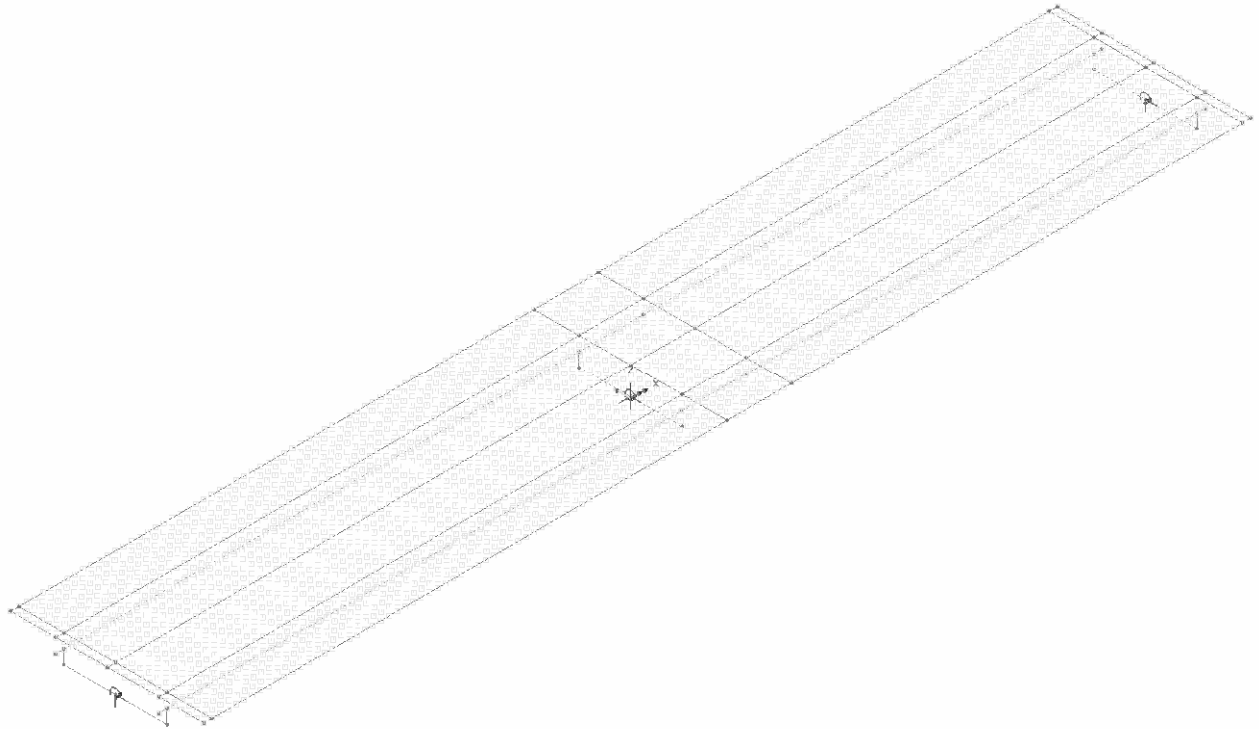
Loadcase : KRYMP

Structural loading : Temperature

Definition : Nodal lines & surfaces

Initial temperature : 0 °C

Final temperature : -23 °C



Remark

The load has been applied to the bridge deck, longitudinal girders & transversal beam in the superstructure. However, this does not produce any load effects, only translations.

Object: Superstructure**Number of sections** $N := 2 \text{ pcs}$ **Geometry & concrete (C30/37, C35/45, C40/50 & C45/55)**

Section	B	H	Concrete
1	2,5	1,5	C35/45
2	2,5	1,5	C35/45
-	m	m	-

Relative humidity $RH := 80\%$ **Time of load (i.e. removal formwork)** $t_0 := 5 \cdot \text{days}$ **Studied time for determination of shrinkage** $t_2 := 120 \text{ year}$ $t_2 = 43800 \text{ days}$ **Cement class (S, N, R)** $Klass := \text{"N"}$ **Concrete age when drying starts** $t_s := 0 \cdot \text{days}$

Input receipt

$$f_{cm} = [43 \ 43] \text{ MPa}$$

$$f_{ck} = [35 \ 35] \text{ MPa}$$

$$f_{cmo} = 10 \text{ MPa}$$

CALCULATION**Area**

$$A_c := B \cdot H$$

Perimeter exposed to "air"

$$u := 2 \cdot B$$

Effective thickness structure

$$h_0 := \frac{2 \cdot A_c}{u} = \left[\begin{array}{c} 1.5 \\ 1.5 \end{array} \right] m$$

Basic value of drying shrinkage see SS-EN 1992-1-1, Annex B.2

$$\alpha_{ds1} := \left\| \begin{array}{l} \text{if } Klass = "S" \\ \quad \left\| \begin{array}{c} 3.0 \\ \text{if } Klass = "N" \\ \quad \left\| \begin{array}{c} 4.0 \\ \text{if } Klass = "R" \\ \quad \left\| \begin{array}{c} 6.0 \end{array} \right\| \end{array} \right\| \end{array} \right\| \end{array} \right\| = 4.00$$

$$\alpha_{ds2} := \left\| \begin{array}{l} \text{if } Klass = "S" \\ \quad \left\| \begin{array}{c} 0.13 \\ \text{if } Klass = "N" \\ \quad \left\| \begin{array}{c} 0.12 \\ \text{if } Klass = "R" \\ \quad \left\| \begin{array}{c} 0.11 \end{array} \right\| \end{array} \right\| \end{array} \right\| \end{array} \right\| = 0.12$$

$$RH_o := 100\%$$

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

$$\varepsilon_{cd,0} := 0.85 \cdot \left((220 + 110 \cdot \alpha_{ds1}) \cdot e^{-\alpha_{ds2} \cdot \frac{f_{cm}}{f_{cmo}}} \right) \cdot 10^{-6} \cdot \beta_{RH} = \left[\begin{array}{c} 2.533 \cdot 10^{-4} \\ 2.533 \cdot 10^{-4} \end{array} \right]$$

Basic drying shrinkage (SS-EN 1992-1-1, section 3.1.4, see equations 3.9 and 3.1

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

$$\beta_{ds} := \frac{t_2 - t_s}{t_2 - t_s + 0.04 \cdot \sqrt{\left(\frac{h_0}{\text{mm}} \right)^3}} = \begin{bmatrix} 0.95 \\ 0.95 \end{bmatrix}$$

$$\varepsilon_{cd} := \beta_{ds} \cdot k_h \cdot \varepsilon_{cd,0} = \begin{bmatrix} 1.684 \cdot 10^{-4} \\ 1.684 \cdot 10^{-4} \end{bmatrix}$$

Autogenous shrinkage, see EN 1992-1-1 §3.1.4, eqns. 3.11–3.13

$$\beta_{as} := 1 - e^{-0.2 \cdot \sqrt{t_2}} = 1.00$$

$$\varepsilon_{ca,\alpha} := 2.5 \cdot \left(\frac{f_{ck}}{\text{MPa}} - 10 \right) \cdot 10^{-6} = \begin{bmatrix} 6.25 \cdot 10^{-5} \\ 6.25 \cdot 10^{-5} \end{bmatrix}$$

$$\varepsilon_{ca} := \beta_{as} \cdot \varepsilon_{ca,\alpha} = \begin{bmatrix} 6.25 \cdot 10^{-5} \\ 6.25 \cdot 10^{-5} \end{bmatrix}$$

RESULTS**Total shrinkage, see SS-EN 1992-1-1 §3.1.4, eqn. 3.8**

$$\varepsilon_{cs} := \varepsilon_{cd} + \varepsilon_{ca} = \begin{bmatrix} 2.309 \cdot 10^{-4} \\ 2.309 \cdot 10^{-4} \end{bmatrix}$$

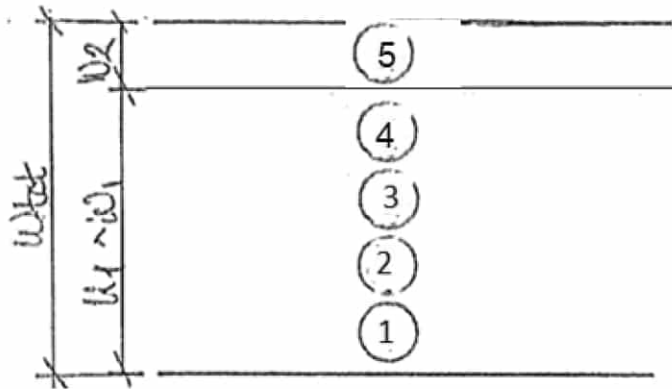
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:25
		Date :	Created :

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 : $w_{tot} = 14.1\text{ m}$

Number of traffic lanes : $n_1 = \text{Integer} \left[\frac{w_{tot}}{3.0\text{m}} \right] = 4\text{ lanes}$

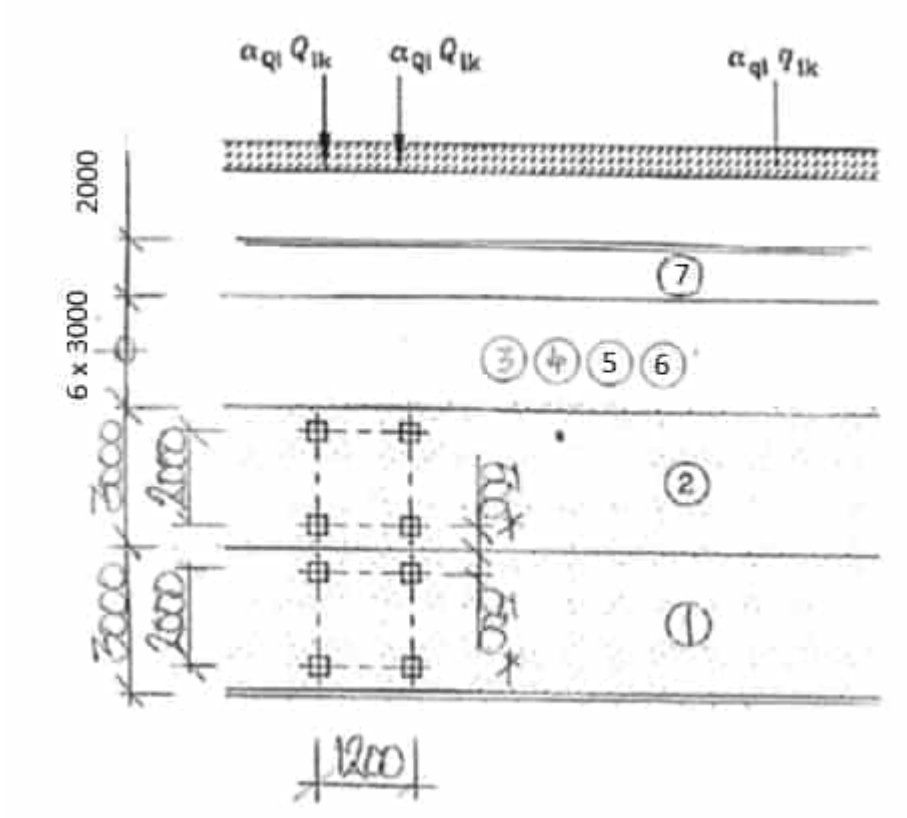
Full traffic width : $w_1 = 3.0\text{m}$

Remaining width : $w_2 = 2.1\text{m}$

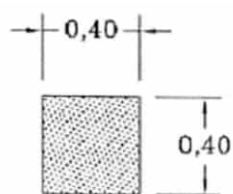
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:26
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3.7.2 Load model 1 (LM 1)

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



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



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Axle loads:

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	-

Surface loads:

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

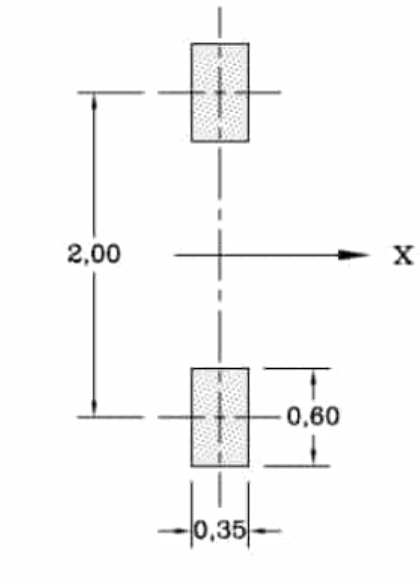
Remark

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

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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.

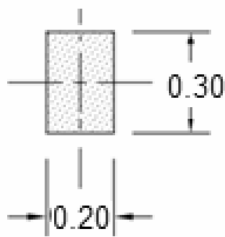
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:29
		Date :	Created :

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

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

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

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

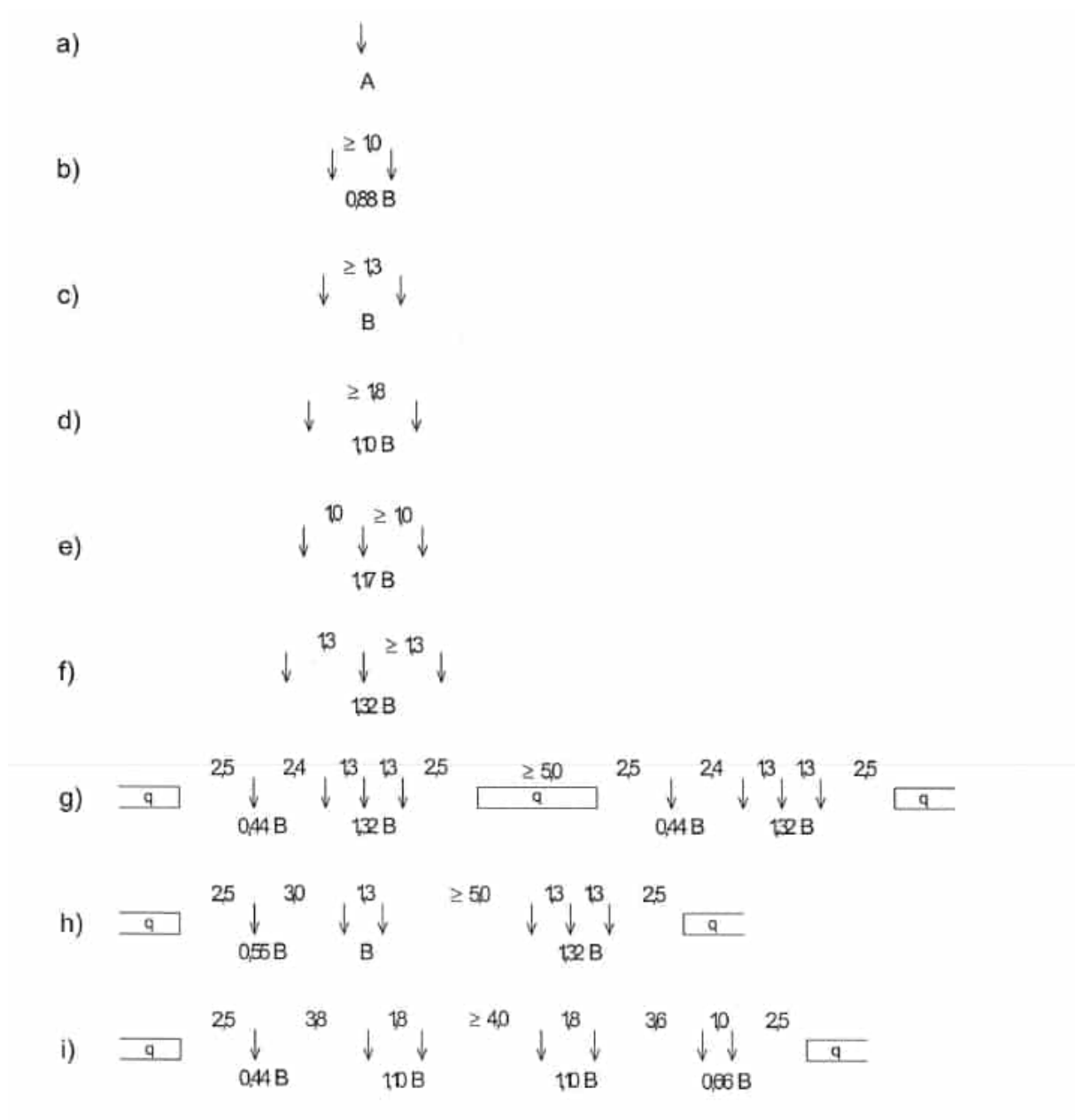
$p = 5 \frac{\text{kN}}{\text{m}}$: surface load

Footnote:

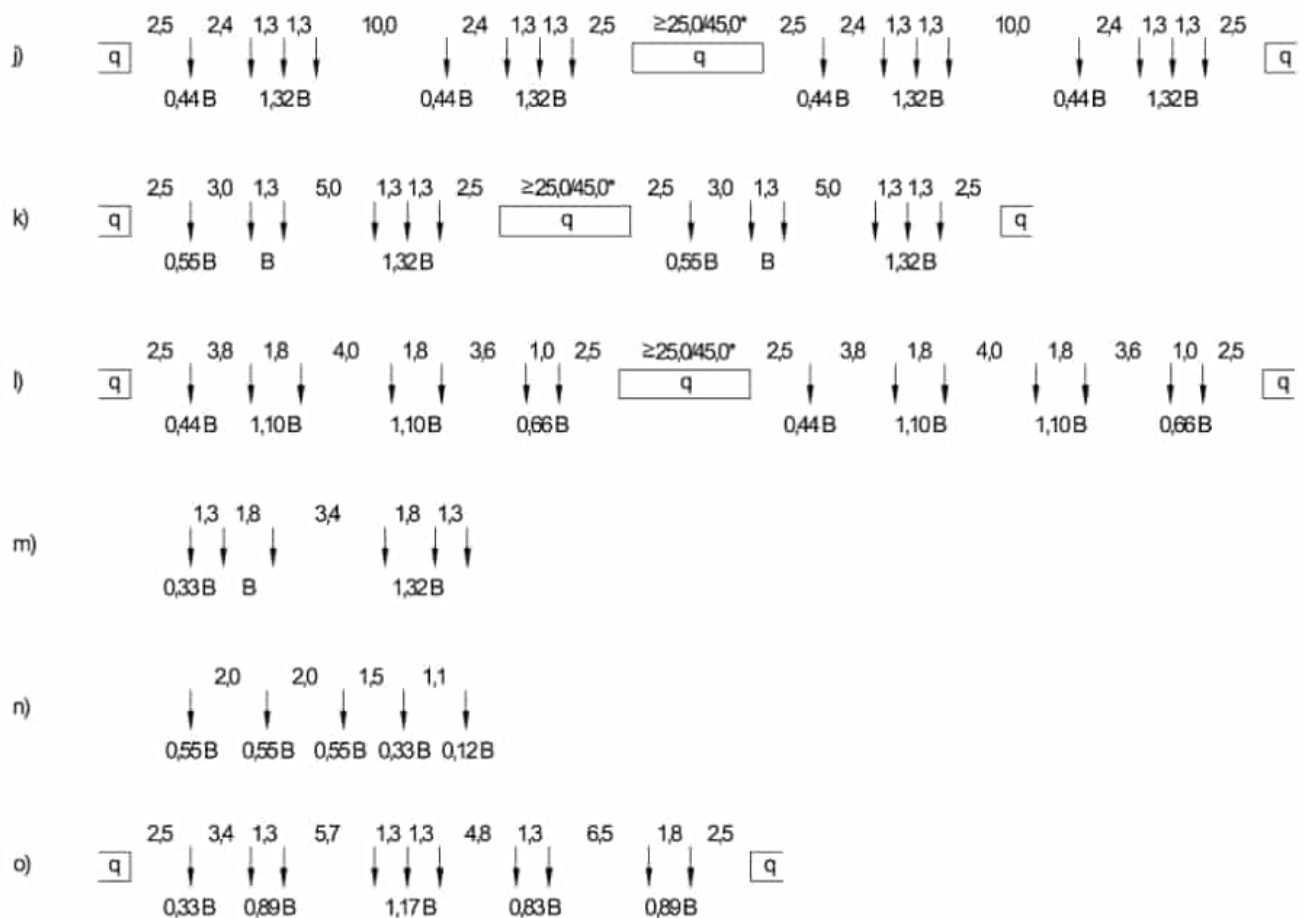
^{1.)} TRVINFRA-00227 table 7.1-5 section 4.2.1(1) states apply 25 % ..

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



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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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:32
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3.7.5 Vehicle Load Optimization (VLO)

3.7.5.1 Influence components

Influence surfaces are created using *Direct Method Influence Envelope*. This is done by applying *Influence components* seen below.

Inf1 – Reactions :

The screenshot shows the 'Direct Method Influence Envelope' dialog box. The 'Entity' is set to 'Reaction' and the 'Direction' is 'Nodal' with a value of '0,0'. A list of components is shown on the right: 'Standard' (checked), 'FX' (checked), 'FY' (checked), 'FZ' (checked), 'MX' (checked), 'MY' (checked), and 'MZ' (unchecked). The 'Include coincident effects' checkbox is checked. The 'Name' field is 'Inf1 - Reaction' with a count of (1).

Inf2 – Bearings :

The screenshot shows the 'Direct Method Influence Envelope' dialog box. The 'Entity' is set to 'Force/Moment - 3D Joint (JNT4,JL43)' and the 'Direction' is 'Element local' with a value of '0,0'. A list of components is shown on the right: 'Standard' (checked), 'Fx' (checked), 'Fy' (checked), and 'Fz' (checked). The 'Include coincident effects' checkbox is checked. The 'Name' field is 'Inf2 - Bearings' with a count of (2).

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:34
	Pretensioned double girder bridge	Date :	Created :

Inf4 – Longitudinal girders :

Direct Method Influence Envelope

Entity: Beam/Shell Slice Resultants

Direction: None 0,0

☒ Include coincident effects

Name: Inf4 - Longitudinal girders (4)

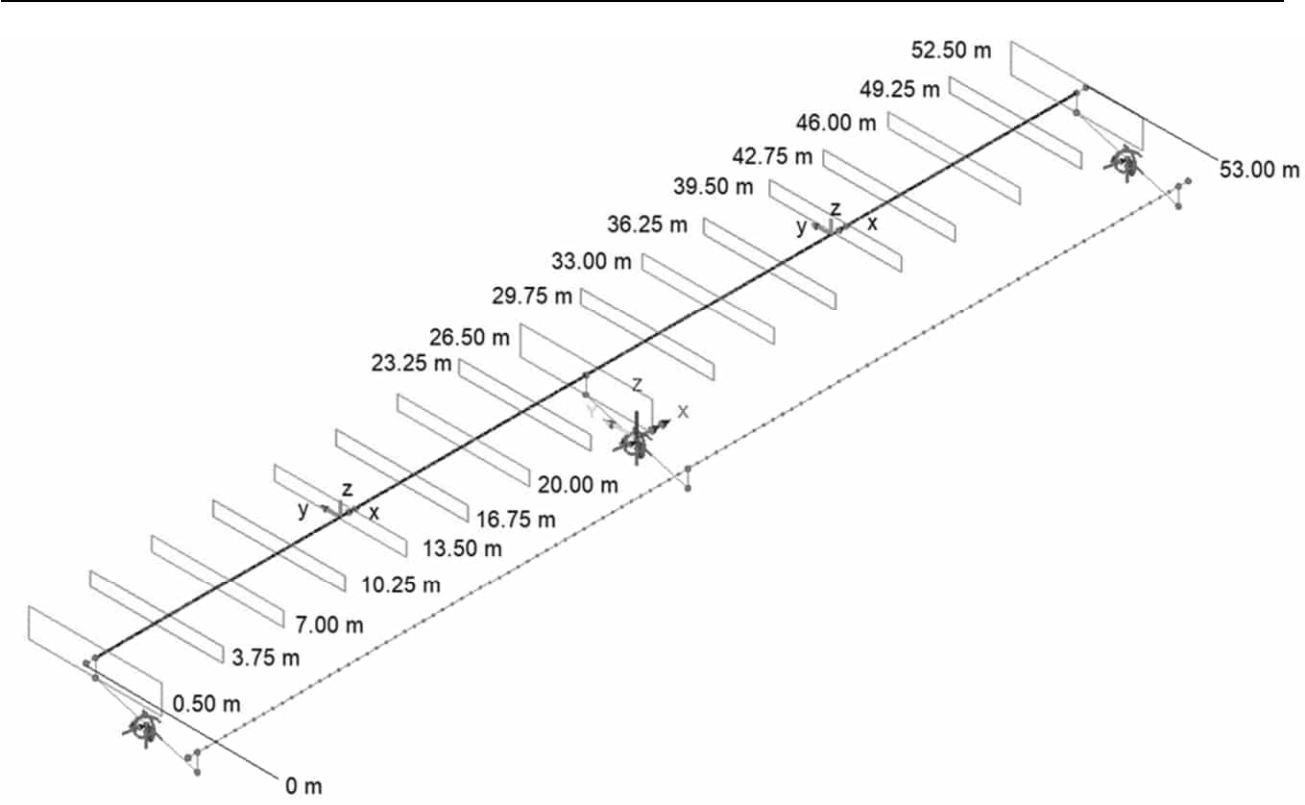
Standard

- ☒ Fx
- ☐ Fy
- ☒ Fz
- ☒ Mx
- ☒ My
- ☐ Mz

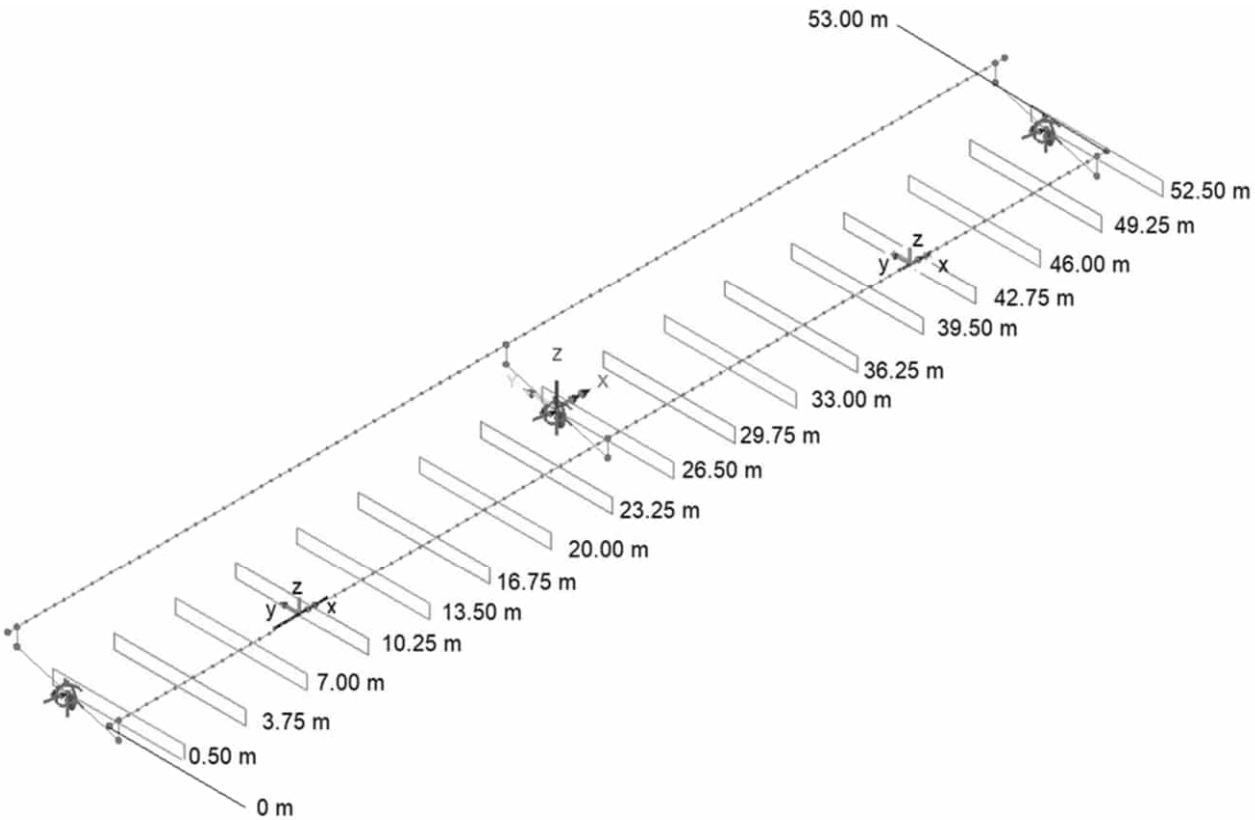
Definition "Slice resultants beams/shells"

Each longitudinal girder (LB 1 & LB 2) has 19 "slices" according to sketches below, see also pages A2:445-47.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:35
		Date :	Created :



Slice LB1



Slice LB2

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:37
		Date :	Created :

Influence surfaces :

Search area: Superstructure

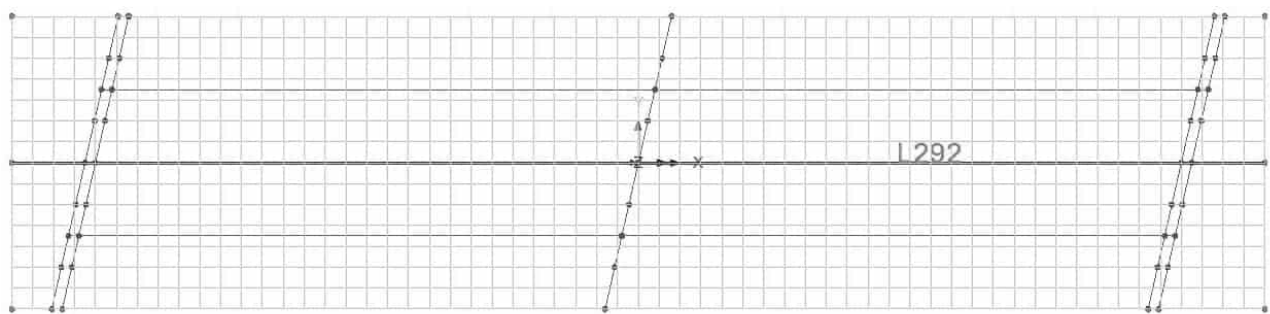
Definition type: Grid

Centerline (path): L292

Transverse width: 14.0 m

Longitudinal spacing: 0.5 m

Transversal spacing: 0.5 m



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:38
		Date :	Created :

Vehicle load optimisation options:

Loading options

Country
Sweden

Design code
EN1991-2 Sweden 2011

Optional code settings...

Optional loading parameters...

Solution process

☐ View onerous effects table

☒ Create loading patterns

☒ Create envelopes

☒ All chosen influences

☐ Most onerous

☒ By design case

☐ By influence and design case

Set influence surfaces...

Define carriageways...

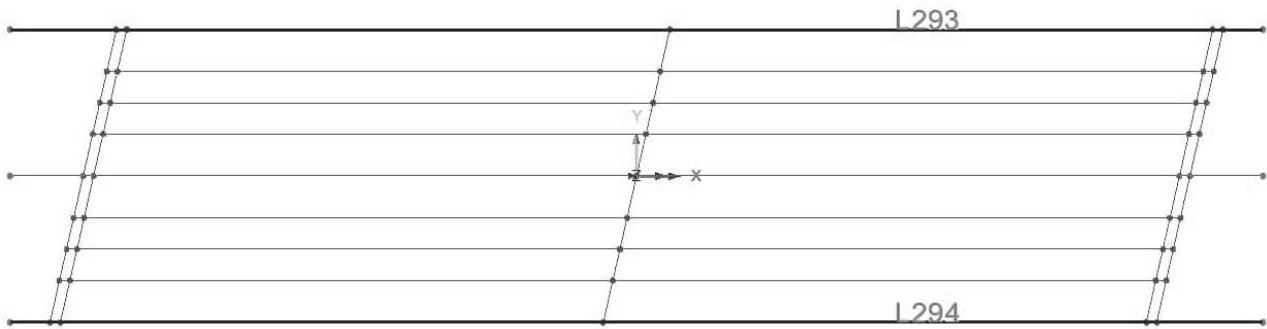
Vehicle longitudinal incremental movement:
0.5 m

Vehicle transverse incremental movement:
0.5 m

Vehicle direction:
both

Definition of carriageway (kerbs):
L293 & L294

Influence surfaces:
Include all (positive & negative)



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:39
		Date :	Created :

3.7.5.1 Envelope : LM 1

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

EN1991-2 Sweden 2011

Representative values required

- ☒ Characteristic
- ☐ Combination (psi0)
- ☐ Frequent (psi1)
- ☐ Infrequent (psi1,infq)
- ☐ Quasi-permanent (psi2)

Load groups to include

- ☒ Group 1a - LM1
 - Dynamic amplification (additional) 20 %
 - Vehicle(s) None
- ☐ Group 1b - LM2
- ☐ Group 4 - LM4
- ☐ Complementary load model
- ☐ Group 5 - LM3
 - Vehicle(s) None
 - ☐ Include associated LM1
- ☐ Output for each load group

3.7.5.2 Envelope : LM 2

Load model 2 (LM2) defined in SS-EN 1991-2 section 4.3.3.

EN1991-2 Sweden 2011

Representative values required

- ☒ Characteristic
- ☐ Combination (psi0)
- ☐ Frequent (psi1)
- ☐ Infrequent (psi1,infq)
- ☐ Quasi-permanent (psi2)

Load groups to include

- ☐ Group 1a - LM1
- ☒ Group 1b - LM2
 - Dynamic amplification (additional) 20 %
 - Vehicle(s) None
- ☐ Group 4 - LM4
- ☐ Complementary load model
- ☐ Group 5 - LM3
 - Vehicle(s) None
 - ☐ Include associated LM1
- ☐ Output for each load group

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:40
		Date :	Created :

3.7.5.3 Envelope : EG A

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

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) None

☐ Include associated LM1

Dynamic amplification (additional): 25 %

Vehicle selection: Type a

3.7.5.4 Envelope : EG B

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

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 g, Type h, Type i, Type

☐ Group 5 - LM3

Vehicle(s) None

☐ Include associated LM1

Dynamic amplification (additional): 25 %

Vehicle selection: Type b → o

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:41
		Date :	Created :

3.7.5.5 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 ASSUMPTION	Status :	Page: A3:43
	Pretensioned double girder bridge	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

1

y

1

☐ X☒ Z☐ XYZ global☐ XYZ transformable

☐ Y☐ Surface normal

Projection vector

☒ Project in load direction

X component

0.0

Y component

0.0

Z component

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)

File : A3 Loads
Datum : 2025-12-22
Tid : 14:31

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:44
		Date :	Created :

3.8 BRAKING LOAD

Load acts at level of surfacing.

Braking load act on bridge deck and at top of end abutments. Both are to considered.

3.8.1 Braking load at top of abutment

Braking load according to SS-EN 1991-2 §4.9.2 acts on top of abutment at location of expansion joint.

$$Q_{broms} = 0.6\alpha_{Q1} \cdot Q_{1k} = 0.6 \cdot 0.9 \cdot 300kN = 162kN$$

Remark

This load case is not consider in systedmtta lastfall är inte införd i systemberäkning.

3.8.2 Braking load on bridge deck

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

Load acts at level of surfacing.

$$L = 0.5 \text{ m} + 26.0\text{m} + 26.0 \text{ m} + 0.5 \text{ m} = 53.0 \text{ m}$$

Load modell LM 1 :

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

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

$$Q_{broms} = 0.6 \cdot (2 \cdot 270kN) + 0.1 \cdot 7.2kPa \cdot 3.0m \cdot 53.0m = 324kN + 114kN = 438kN$$

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

Typ o is dimensioning.

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

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

$$Q_{broms} = 0.35 \cdot (0.33 + 2 \cdot 0.89 + 1.17 + 0.83) \cdot B = 0.35 \cdot 4.11 \cdot 300kN$$

Remark

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

The impact of the resisting earth pressure against the frame legs is neglected on the safe side.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:45
		Date :	Created :

3.8.2.1 Load definition

The load case is applied at centre of the bridge deck as a line load with a load length of $0.5w_{tot}$ on the safe side.

Lastfallet är införd i centrum av brobana som en linjelast med lastlängd $0.5w_{tot}$ på säker sida.

$$p_x = \frac{Q_{broms}}{0.5w_{tot}} = \frac{438kN}{0.5 \cdot 14.0m} = 63 \frac{kN}{m}$$

$$m_y = p_x \cdot (0.15m + t_{bel}) = 3 \frac{kN}{m} \cdot (0.15m + 0.095m) = 15 \frac{kNm}{m}.$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:46
		Date :	Created :

Load case : BROMS 1+

Structural loading : Global distributed

Line load (p_x) : 63 kN/m

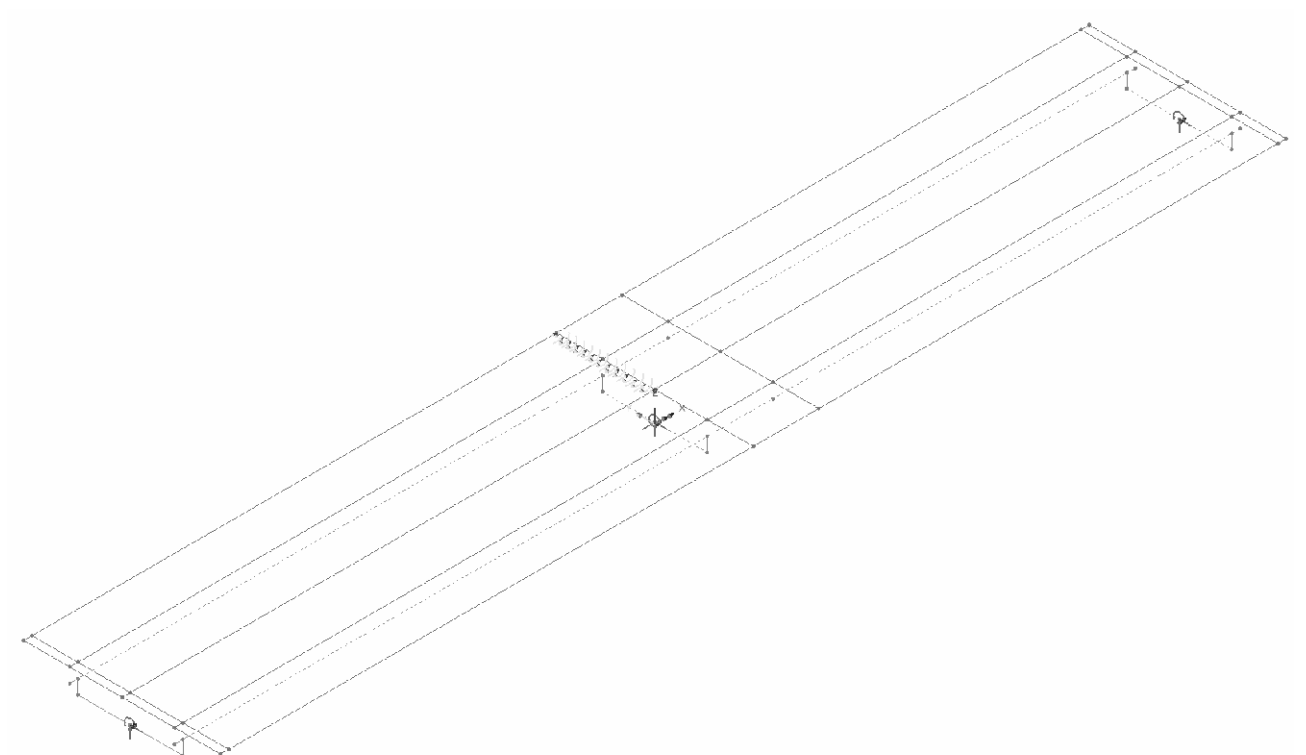
Line load (m_y) : 15 kNm/m

Analysis category

☐ Total
 ☒ Per unit length
 ☐ Per unit area

Component	Value
X Direction	73.0
Y Direction	0.0
Z Direction	0.0
Moment about X axis	0.0
Moment about Y axis	18.0
Moment about Z axis	0.0

Name (5)



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:47
		Date :	Created :

Load case : BROMS 2+

Structural loading : Global distributed

Line load (p_x) : 63 kN/m

Line load (m_y) : 15 kNm/m

☐ Total

☒ Per unit length

☐ Per unit area

Component	Value
X Direction	73.0
Y Direction	0.0
Z Direction	0.0
Moment about X axis	0.0
Moment about Y axis	18.0
Moment about Z axis	0.0

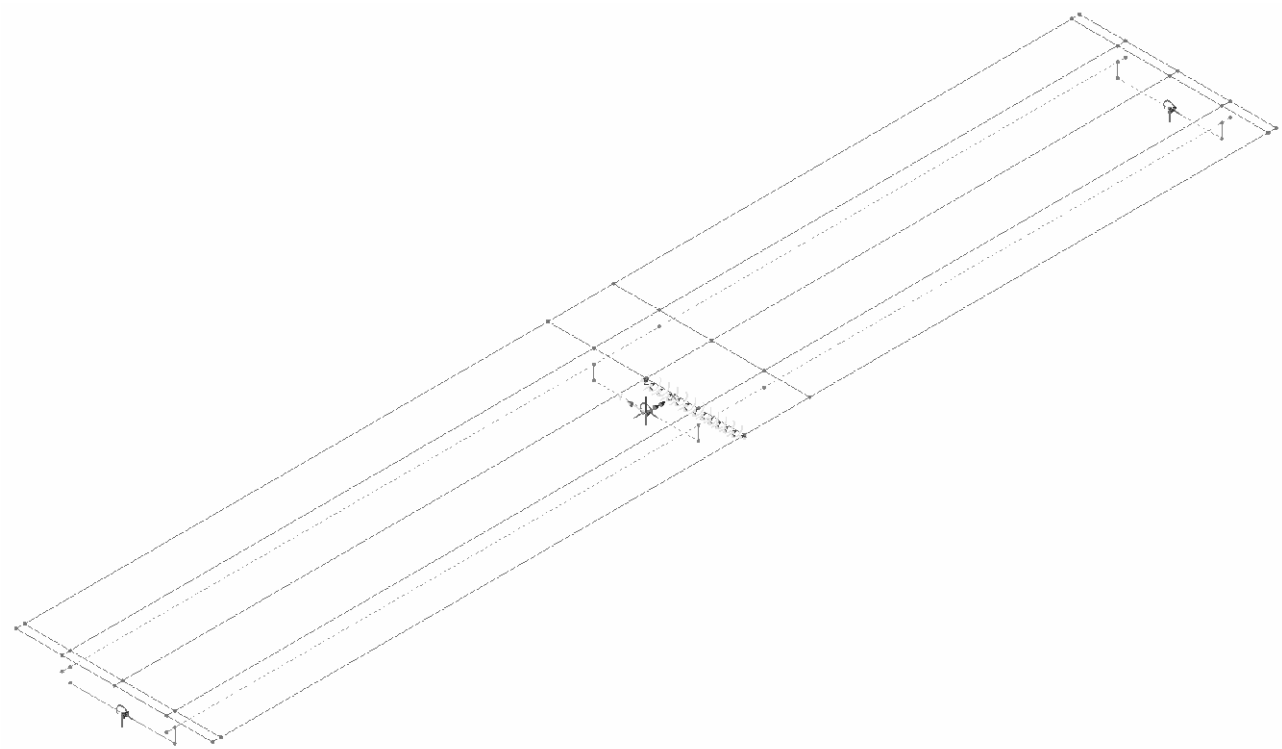
Name

BROMS 2+

▼

▲▼

(6)



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:48
		Date :	Created :

3.8.2.2 Load combination (BROMS)

Basic load cases :

Load case	Load	Factor
BROMS 1-	BROMS 1+	-1
BROMS 2-	BROMS 2+	-1

Envelope BROMS :

Load case
BROMS 1+
BROMS 1-
BROMS 2+
BROMS 2-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:49
		Date :	Created :

3.9 LATERAL FORCE

The lateral force is determined according to SS-EN 1991-2 §4.4.2. The load occurs orthogonal to the braking force and is considered to occur as a result of skew braking or centrifugal forces (R = 1200 m).

Load model LM 1 :

$$Q_{tk} = 0.25Q_{lk} = 0.25 \cdot 438kN = 110kN \quad : \text{skewed braking}$$

$$Q_{tk.2} = \frac{40m}{R} \sum \alpha_{Qi} \cdot (2Q_{ik}) = \frac{40m}{1200m} \cdot 2 \cdot (270kN + 180kN) = 30kN \quad : \text{centrifugal force}$$

Lastmodell EG B = 300 kN (se TSFS kapitel 11 punkt 2§) :
Type o is considered dimensioning.

$$Q_{tk} = 0.25Q_{lk} = 0.25 \cdot 431kN = 107kN \quad : \text{skewed braking}$$

$$Q_{tk.2} = \frac{40m}{R} \cdot Q_v = \frac{40m}{1200m} \cdot (4.11 \cdot 300kN) = 41kN \quad : \text{centrifugal force}$$

Remark

Lateral force corresponding to vehicle LM1 is chosen in system analysis.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:50
		Date :	Created :

3.9.1 Load definition

The load is defined as a line load acting along the marked line.

The load is distributed over a width of $0.5L_{\text{span}}$ on the safe side.

$$p_y = \frac{Q_{\text{sid}}}{0.5L_{\text{spann}}} = \frac{110\text{kN}}{0.5 \cdot 26\text{m}} = 9 \frac{\text{kN}}{\text{m}}$$

$$m_x = -p_y \cdot (0.15\text{m} + t_{\text{bel}}) = -9 \frac{\text{kN}}{\text{m}} \cdot (0.15\text{m} + 0.095\text{m}) = -2 \frac{\text{kNm}}{\text{m}}$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:51
		Date :	Created :

Load case : *SIDO+*

Structural loading : Global distributed

Line load (p_y) : 9 kN/m

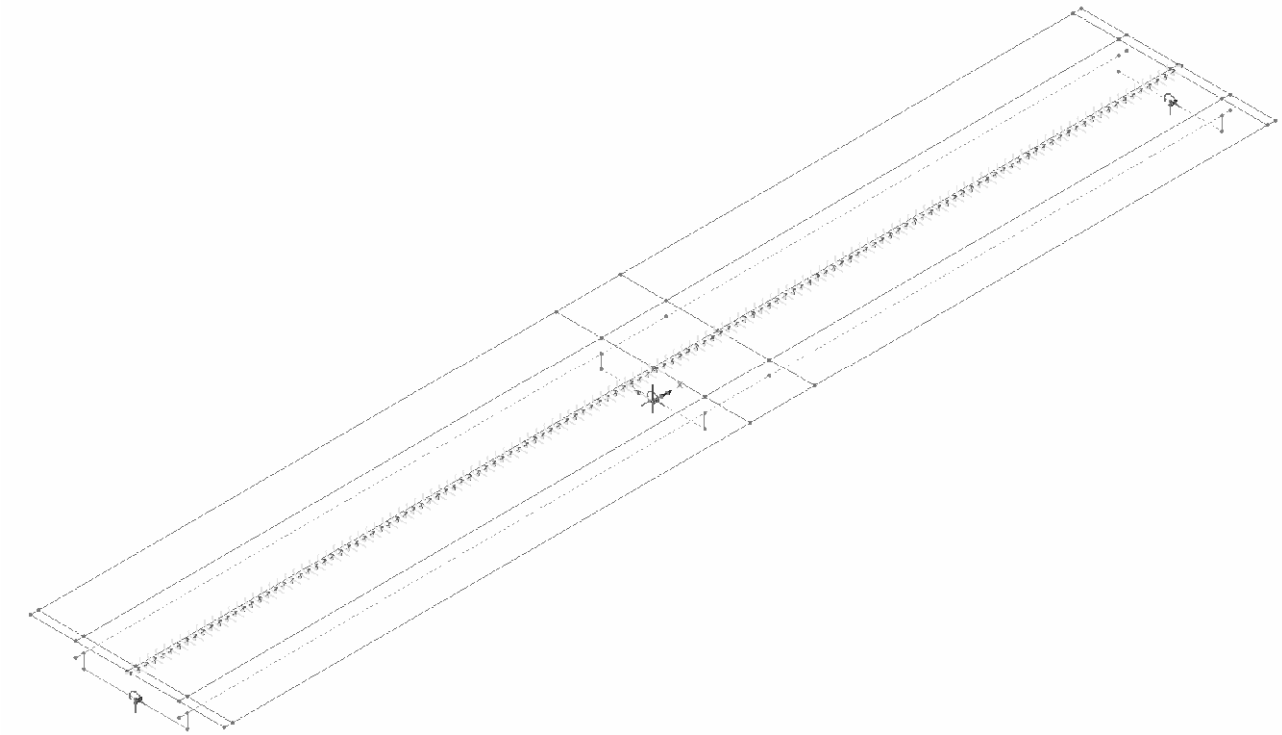
Line load (m_x) : -2 kNm/m

Analysis category

☐ Total ☒ Per unit length ☐ Per unit area

Component	Value
X Direction	0.0
Y Direction	9.0
Z Direction	0.0
Moment about X axis	-2.0
Moment about Y axis	0.0
Moment about Z axis	0.0

Name (7)



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:52
		Date :	Created :

3.9.2 Load combination

Basic load cases :

Load case	Load	Factor
SIDO-	SIDO+	-1

Envelope SIDO :

Load case
SIDO+
SIDO-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:53
		Date :	Created :

3.10 WIND LOAD

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

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

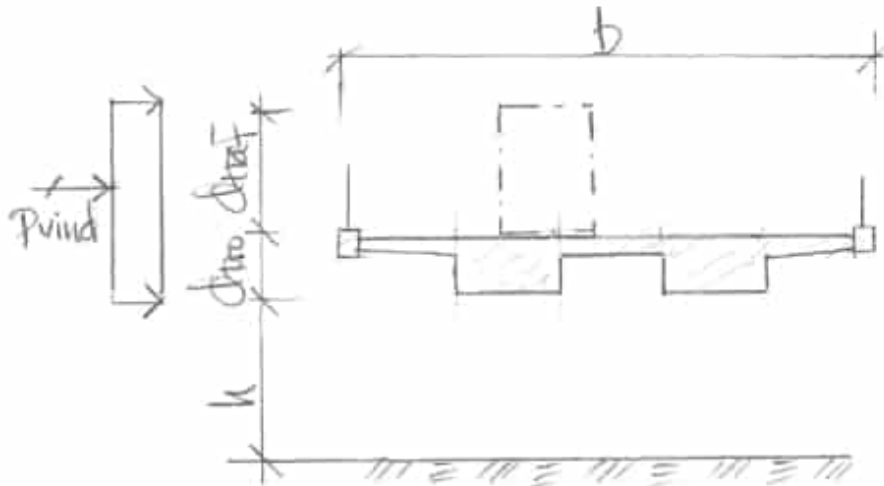
$$\psi_k = 1.00$$

$$\psi_0 = 0.30$$

$$\psi_1 = 0.20$$

$$\psi_2 = 0$$

Load intensity:



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

$h = 7$ m but 8 m is applied on safe side.

$$v_b(\text{Robertsfors}; z = 10\text{m}; z_0 = 0.05\text{m}) = 23 \frac{\text{m}}{\text{s}} \quad : \text{TSFS chapter 7 figure 7.1}$$

$$q_p \left(h = 8\text{m}, \text{Terrängtyp II}, v_b = 23 \frac{\text{m}}{\text{s}} \right) = 0.67\text{kPa} \quad : \text{TSFS chapter 7 table 7.1}$$

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

$$c_e = \frac{q_p}{q_b} = \frac{0.67\text{kPa}}{0.30\text{kPa}} = 2.23 \quad : \text{SS-EN 1991-1-4 chapter 4.5}$$

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:54
	Pretensioned double girder bridge	Date :	Created :

$$d_{bro} = 1.50m + (0.10m + 0.095m) = 1.70m \quad : \text{construction height incl. pavement}$$

$$d_{traf}^{red} = 2.0m - (0.10m + 0.095m) = 1.81m \quad : \text{traffic height pavement}$$

$$d_{tot} = 1.70m + 1.81m = 3.51m$$

$$\rightarrow \frac{b_{bro}}{d_{tot}} = \frac{14.0m}{3.51m} = 4.0$$

$$c_{f.x} \left(\frac{b_{bro}}{d_{tot}} = 4.0 \right) = 1.3 \quad : \text{SS-EN 1991-1-4 sketch 8.3}$$

$$C = c_e \cdot c_{f.x} = 2.23 \cdot 1.3 = 2.90$$

$$\frac{A_{ref.x}}{L} = d_{tot}$$

Wind load structure (below pavement) :

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

$$p_{vind}^{bro} = \frac{F_w}{L} = \frac{1}{2} \cdot \rho \cdot v_b^2 \cdot C \cdot \frac{A_{ref.x}^{bro}}{L} = \frac{1}{2} \cdot 1.25 \frac{kg}{m^3} \cdot \left(23 \frac{m}{s} \right)^2 \cdot 2.90 \cdot 1.7m = 1.6 \frac{kN}{m}$$

Wind load traffic (above pavement) :

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

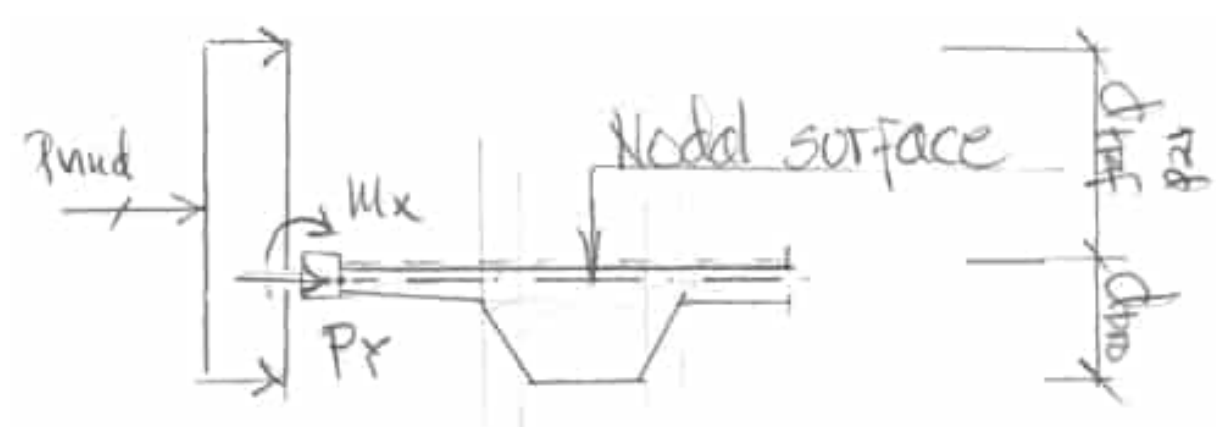
$$p_{vind}^{traf} = \frac{F_w}{L} = \frac{1}{2} \cdot \rho \cdot v_b^2 \cdot C \cdot \frac{A_{ref.x}^{traf}}{L} = \frac{1}{2} \cdot 1.25 \frac{kg}{m^3} \cdot \left(23 \frac{m}{s} \right)^2 \cdot 2.90 \cdot 1.81m = 1.7 \frac{kN}{m}$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:55
		Date :	Created :

3.10.1 Definition of load

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

$$p_{vind} = p_{vind}^{bro} + p_{vind}^{trafik} = 1.6 \frac{kN}{m} + 1.7 \frac{kN}{m} = 3.3 \frac{kN}{m}$$



$$p_y = 4 \frac{kN}{m}$$

→

$$m_x = -p_y \cdot \left(\frac{d_{tot}}{2} - 1.35m \right) = -3.3 \frac{kN}{m} \cdot \left(\frac{3.51m}{2} - 1.35m \right) = -2 \frac{kNm}{m}$$

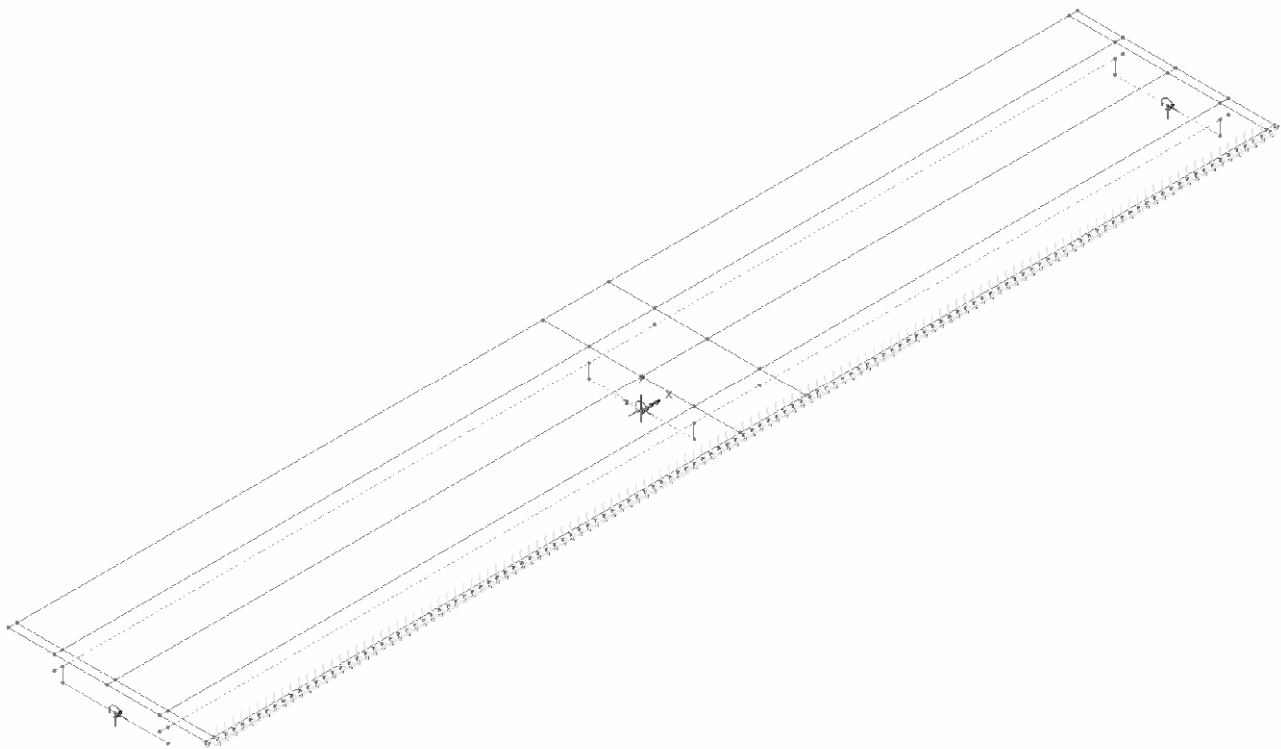
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:56
		Date :	Created :

Load : VIND+

Structural loading : Global distributed

Line load in Y direction (p_y) : $+4 \frac{kN}{m}$

Line moment about X axis (m_x) : $-2 \frac{kNm}{m}$



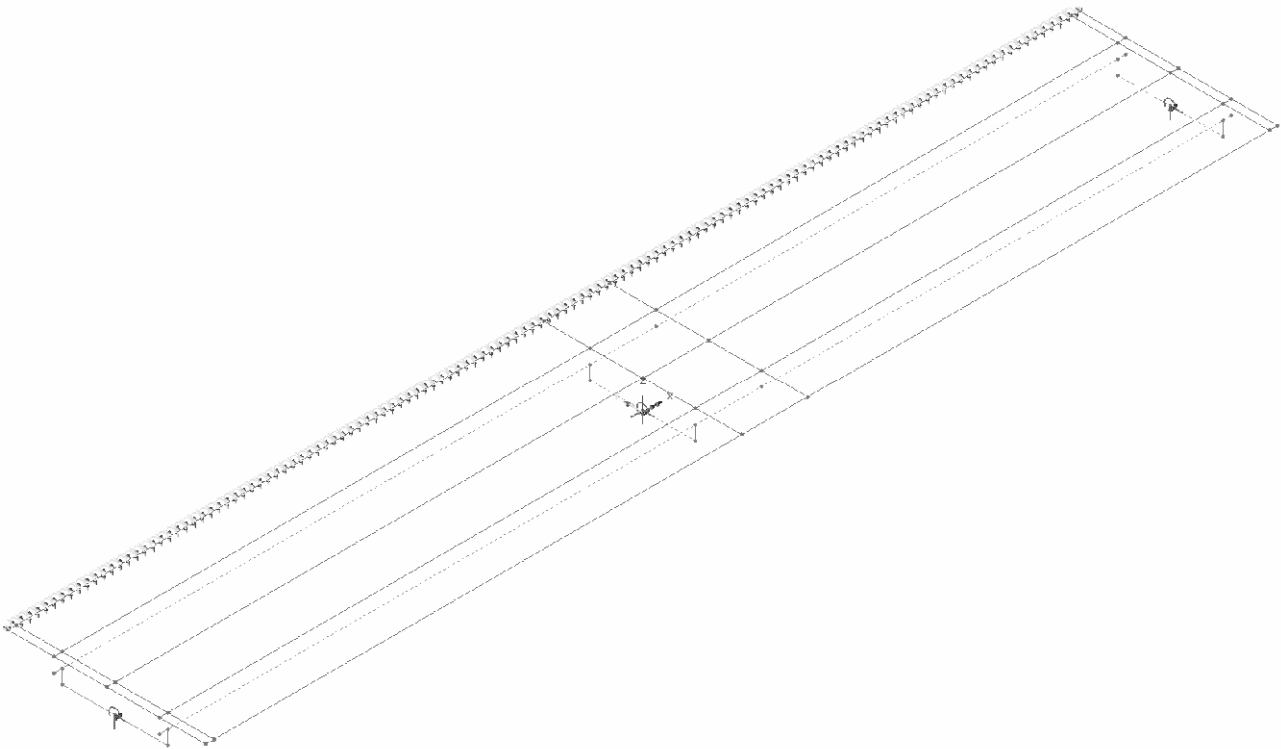
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:57
		Date :	Created :

Load : VIND-

Structural loading : Global distributed

Line load in Y direction (p_y) : $-4 \frac{kN}{m}$

Line moment about X axis (m_x) : $2 \frac{kNm}{m}$



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:58
		Date :	Created :

3.10.2 Load combination

Envelope VIND:

Load case
VIND+
VIND-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:59
		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

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

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:60
		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

Ort : Ånäset

$T_{\text{max}} = +32^{\circ}\text{C}$: TSFS chapter 8 sketch 8.1

$T_{\text{min}} = -40^{\circ}\text{C}$: TSFS 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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:61
		Date :	Created :

3.12.1 Even temperature over entire bridge (JTEMP)

Uniform temperature change across the entire bridge is given in EN 1991-1-5, section 6.1.3.3. This temperature change is seasonal and mainly causes translation from the bridge's movement centre in the direction of the respective support.

Funktion enligt SS EN 1991-1-5 figur 6.1 (funktion till bro typ 3) :

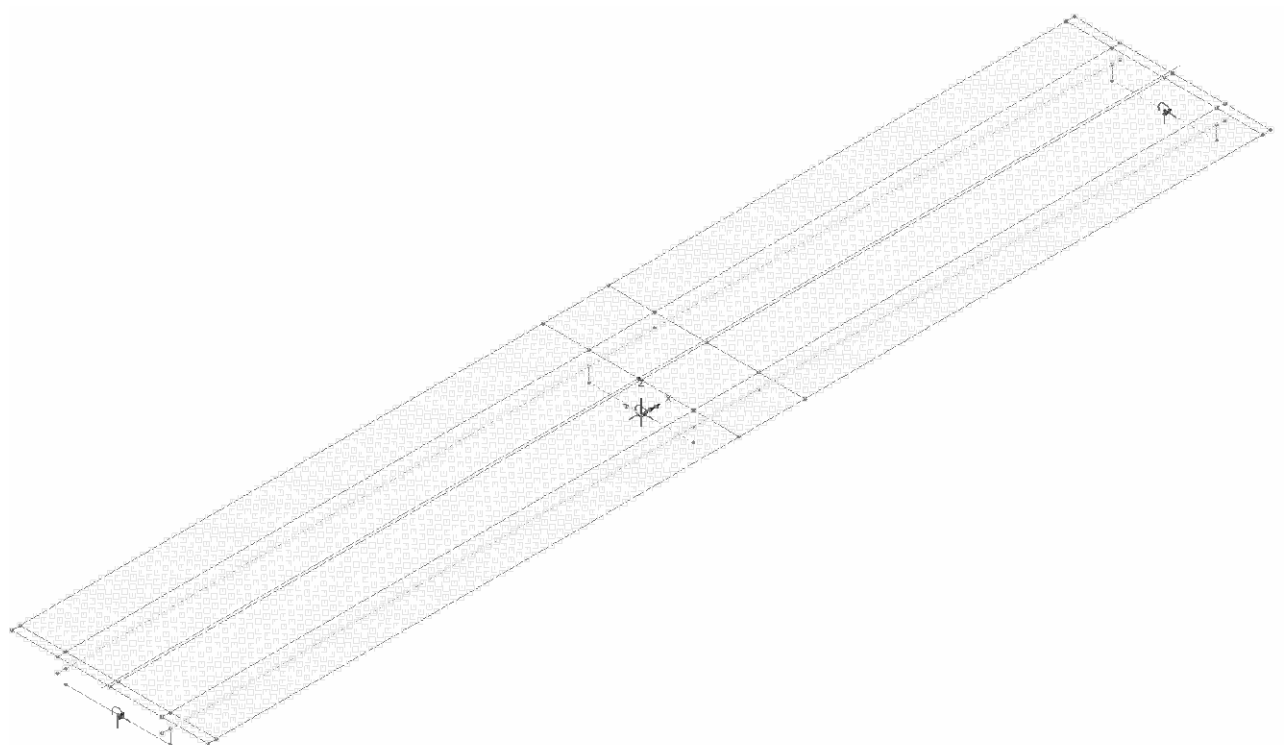
$$T_e(T) = \text{linterp}\left[(-50 \ 0 \ 30 \ 50)^T \cdot ^\circ\text{C}, (-42 \ 7 \ 32 \ 52)^T \cdot ^\circ\text{C}, T\right]$$

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

$$T_{e.\min} = T_e(T_{\min}) = -32^\circ\text{C}$$

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

$$T^- = T_{e.\min} - T_0 = -32^\circ\text{C} - 10^\circ\text{C} = -42^\circ\text{C}$$



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:62
		Date :	Created :

Load : JTEMP+

Structural loading : Temperature

Definition : Nodal lines & surfaces

Final temperature : +26 C

Initial temperature : ± 0 C

Load case : JTEMP+

Load : JTEMP-

Structural loading : Temperature

Definition : Nodal lines & surfaces

Final temperature : -42 C

Initial temperature : ± 0 C

Load case : JTEMP-

Envelope JTEMP:

Load case
JTEMP+
JTEMP-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:63
		Date :	Created :

3.12.2 Uneven temperature of entire cross section (OJTEMP)

Determined according to EN 1991-1-5 § 6.1.4.1. When assessing the impact, a coating with a thickness of 100 mm $\Rightarrow$ type 3

$$k_{1.sur} = 0.7$$

$$k_{2.sur} = 1.0$$

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

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

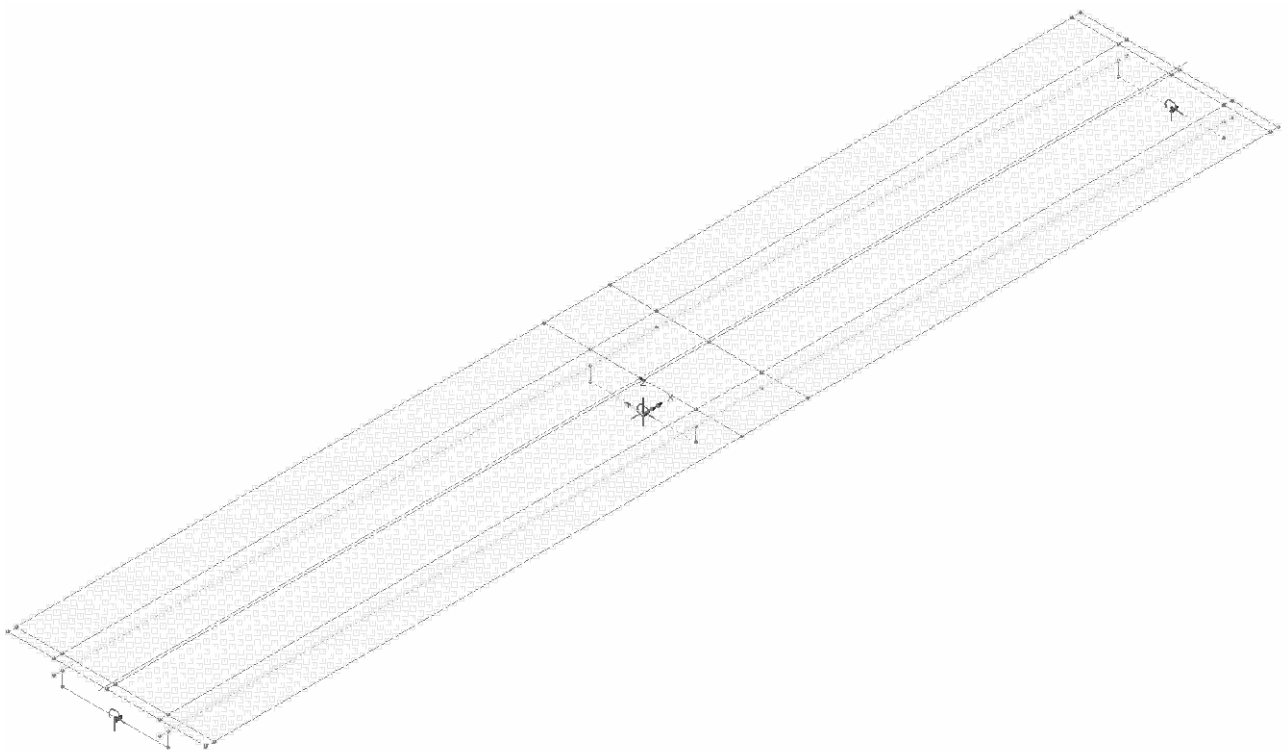
The occurring temperature change ΔT refers to the linear difference between the temperature at the top and bottom of superstructure.

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

$$\left| \frac{\delta T^{max}}{\delta Z} \right| = \left| \frac{11^{\circ}\text{C}}{1.5\text{m}} \right| = 8 \frac{^{\circ}\text{C}}{\text{m}} \quad : \text{maximal temperature gradient}$$

$$\left| \frac{\delta T^{min}}{\delta Z} \right| = \left| \frac{-8^{\circ}\text{C}}{1.5\text{m}} \right| = 6 \frac{^{\circ}\text{C}}{\text{m}} \quad : \text{minimal temperature gradient}$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:64
		Date :	Created :



Loadcase : OJTEMP+

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : +8 °C/m

Loadcase : OJTEMP-

Structural loading : Temperature

Definition : Element

Final Z temperature gradient : -6 °C/m

Envelope OJTEMP:

Load case
OJTEMP+
OJTEMP-

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:65
		Date :	Created :

3.12.3 Load combination

Load combination according to SS-EN 1991-1-5 § 6.1.5.

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 :

Load case	Permanent factor	Variable factor
JTEMP	0	1.00
OJTEMP	0	0.75

Load combination smart TEMP-2 :

Load case	Permanent factor	Variable factor
JTEMP	0	0.35
OJTEMP	0	1.00

Envelope TEMP :

Load case
TEMP-1
TEMP-2

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:66
		Date :	Created :

3.13 FÖRSPÄNNING

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 local coordinates associated to nodal lines (LB 1-3).

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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:67
		Date :	Created :

3.13.1 General

Pre tensions system VSL 6-15.

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

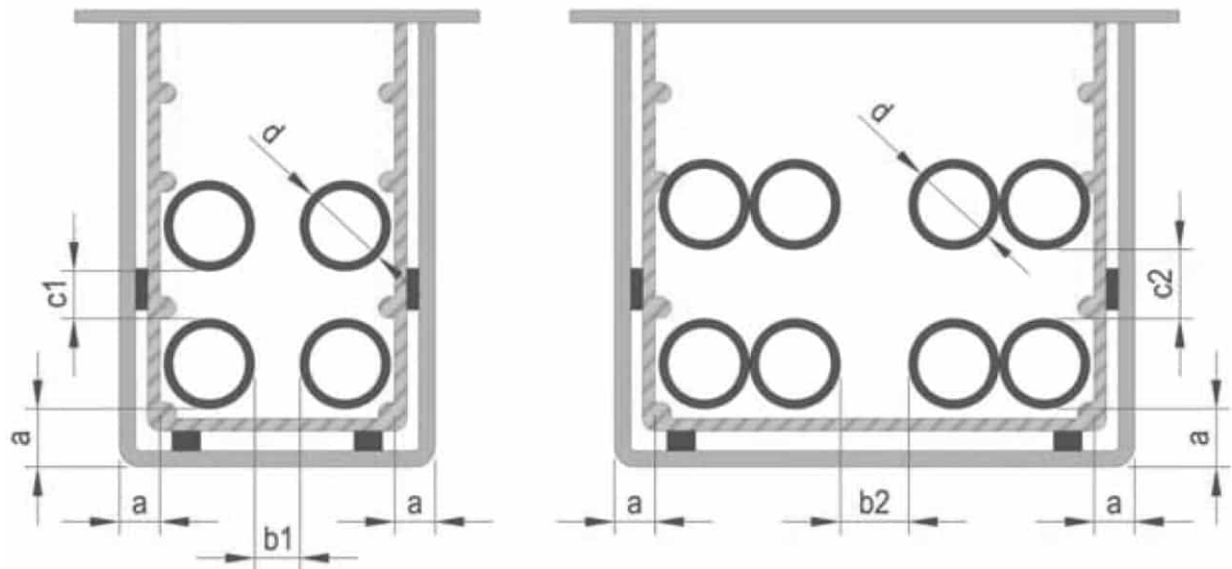
$$\sigma_{p, \max}^{\text{after}} = \min(0.75 f_{pk} ; 0.85 f_{p0.1k}) = \min(1395 \text{ MPa} ; 1394 \text{ MPa}) = 1394 \text{ MPa}$$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:68
		Date :	Created :

3.13.2 Execution

Associated to pre tension system VSL 6-15.

Recommended measurements :



$d = 90 \text{ mm}$

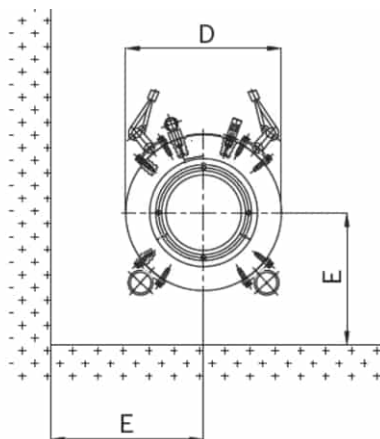
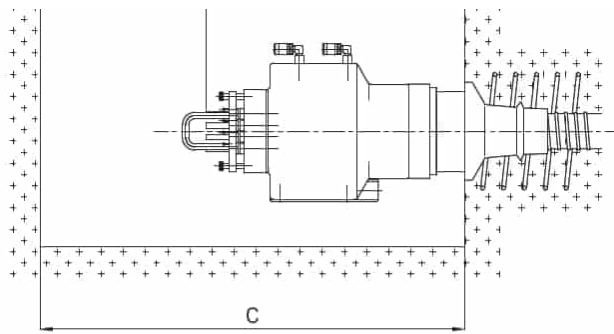
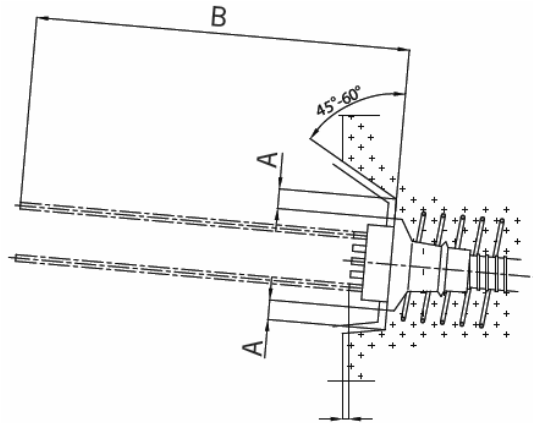
$a > 50 \text{ mm}$

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

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

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:69
		Date :	Created :

Demand for space during tensioning.:



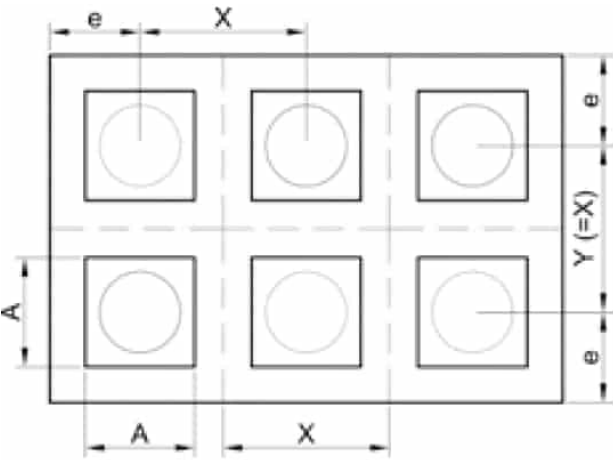
A = 70 mm

B = 1200 mm

C = 1700 mm

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:70
	Pretensioned double girder bridge	Date :	Created :

Measurements of cables VSL 12-15 :

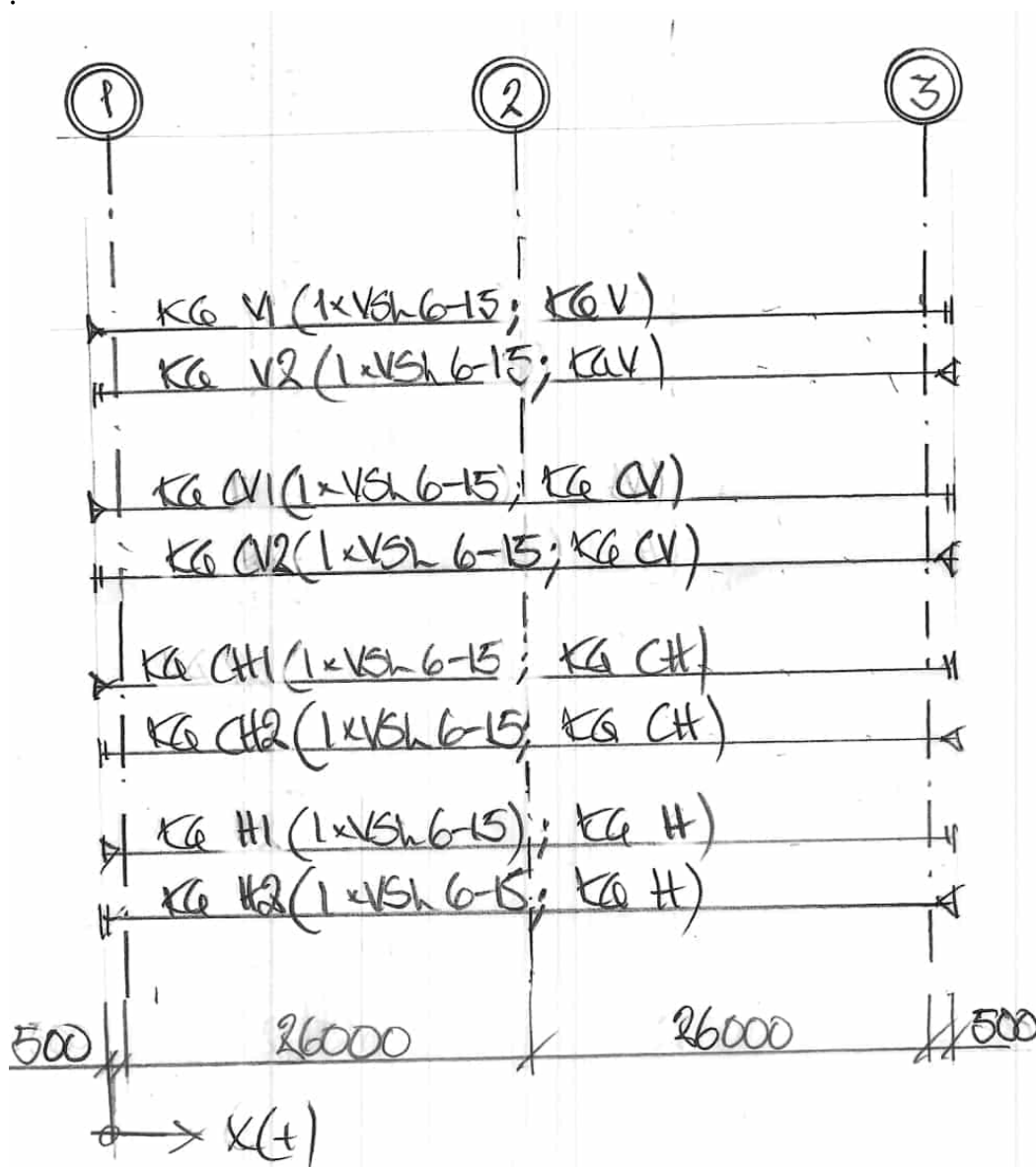


$A = 290\text{ mm}$

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

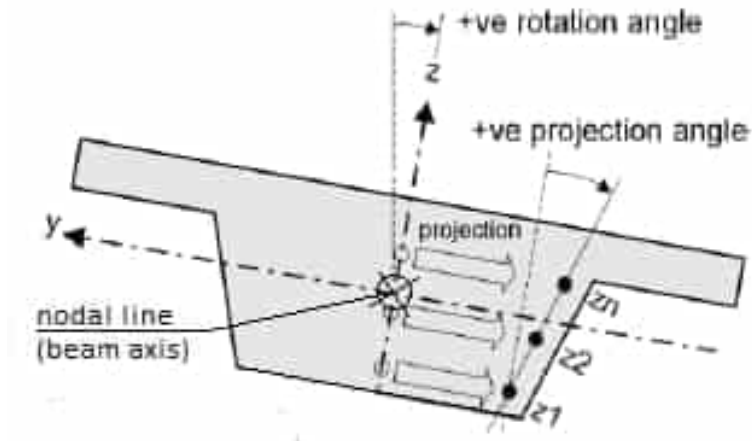
$X \geq 400\text{ mm}$

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:72
		Date :	Created :



	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:73
		Date :	Created :

Principle sketch:



Summary input - pretensioned cables:

Tendon load	Area	Slip	Left side	Right side	Max. prestress before	Min. prestress after	Pretension force	Location y(+)
KG V1	2250	3	Active	Passive	1476	1394	3320*	+0.72
KG V2	2250	3	Passive	Active	1476	1394	3320*	+0.72
KG CV1	2250	3	Active	Passive	1476	1394	3320*	+0.24
KG CV2	2250	3	Passive	Active	1476	1394	3320*	+0.24
KG CH1	2250	3	Active	Passive	1476	1394	3320*	-0.24
KG CH2	2250	3	Passive	Active	1476	1394	3320*	-0.24
KG H1	2250	3	Active	Passive	1476	1394	3320*	-0.72
KG H2	2250	3	Passive	Active	1476	1394	3320*	-0.72
-	mm ²	mm	-	-	MPa	MPa	kN	m

* = chosen prestress 1476 MPa

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:74
		Date :	Created :

Beam	Location	Cables	Fictive load
LB 1	Left side	1	KG V1 (= 1 x VSL 6-15)
-“-	Left side	1	KG V2 (= 1 x VSL 6-15)
-“-	Left side	1	KG CV1 (= 1 x VSL 6-15)
-“-	Left side	1	KG CV2 (= 1 x VSL 6-15)
-“-	Right side	1	KG CH1 (= 1 x VSL 6-15)
-“-	Right side	1	KG CH2 (= 1 x VSL 6-15)
-“-	Right side	1	KG H1 (= 1 x VSL 6-15)
-“-	Right side	1	KG H2 (= 1 x VSL 6-15)
LB 2	Left side	1	KG V1 (= 1 x VSL 6-15)
-“-	Left side	1	KG V2 (= 1 x VSL 6-15)
-“-	Left side	1	KG CV1 (= 1 x VSL 6-15)
-“-	Left side	1	KG CV2 (= 1 x VSL 6-15)
-“-	Right side	1	KG CH1 (= 1 x VSL 6-15)
-“-	Right side	1	KG CH2 (= 1 x VSL 6-15)
-“-	Right side	1	KG H1 (= 1 x VSL 6-15)
-“-	Right side	1	KG H2 (= 1 x VSL 6-15)

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:75
	Pretensioned double girder bridge	Date :	Created :

3.13.4 Load definition

Profile is retrieved from page A3:83.

3.13.4.1 Tendon profile

Spread sheet input for KG V1 & KG V2:

$x(+)$: $x'(+)$

$y(+)$: -0.72 m

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

$x(+)$	$z(+)$
0	+0.45
0.50	+0.45
3.80	+0.18
8.50	-0.45
12.50	-0.60
18.50	-0.15
22.50	+0.35
26.50	+0.60
30.50	+0.35
34.50	-0.15
40.50	-0.60
44.50	-0.45
49.20	+0.18
52.50	+0.45
53.00	+0.45
m	m

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:76
		Date :	Created :

Spread sheet input for KG CV1 & KG CV2:

$x(+)$: $x'(+)$

$y(+)$: -0.48 m

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

$x(+)$	$z(+)$
0	+0.45
0.50	+0.45
3.80	+0.18
8.50	-0.45
12.50	-0.60
18.50	-0.15
22.50	+0.35
26.50	+0.60
30.50	+0.35
34.50	-0.15
40.50	-0.60
44.50	-0.45
49.20	+0.18
52.50	+0.45
53.00	+0.45
m	m

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:77
	Pretensioned double girder bridge	Date :	Created :

Spread sheet input for KG.CH1 & KG.CH2:

$x(+)$: $x'(+)$

$y(+)$: +0.48 m

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

$x(+)$	$z(+)$
0	+0.45
0.50	+0.45
3.80	+0.18
8.50	-0.45
12.50	-0.60
18.50	-0.15
22.50	+0.35
26.50	+0.60
30.50	+0.35
34.50	-0.15
40.50	-0.60
44.50	-0.45
49.20	+0.18
52.50	+0.45
53.00	+0.45
m	m

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:78
		Date :	Created :

Spread sheet input for KG H1 & KG H2:

$x(+)$: $x'(+)$

$y(+)$: -0.48 m

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

$x(+)$	$z(+)$
0	+0.45
0.50	+0.45
3.80	+0.18
8.50	-0.45
12.50	-0.60
18.50	-0.15
22.50	+0.35
26.50	+0.60
30.50	+0.35
34.50	-0.15
40.50	-0.60
44.50	-0.45
49.20	+0.18
52.50	+0.45
53.00	+0.45
m	m

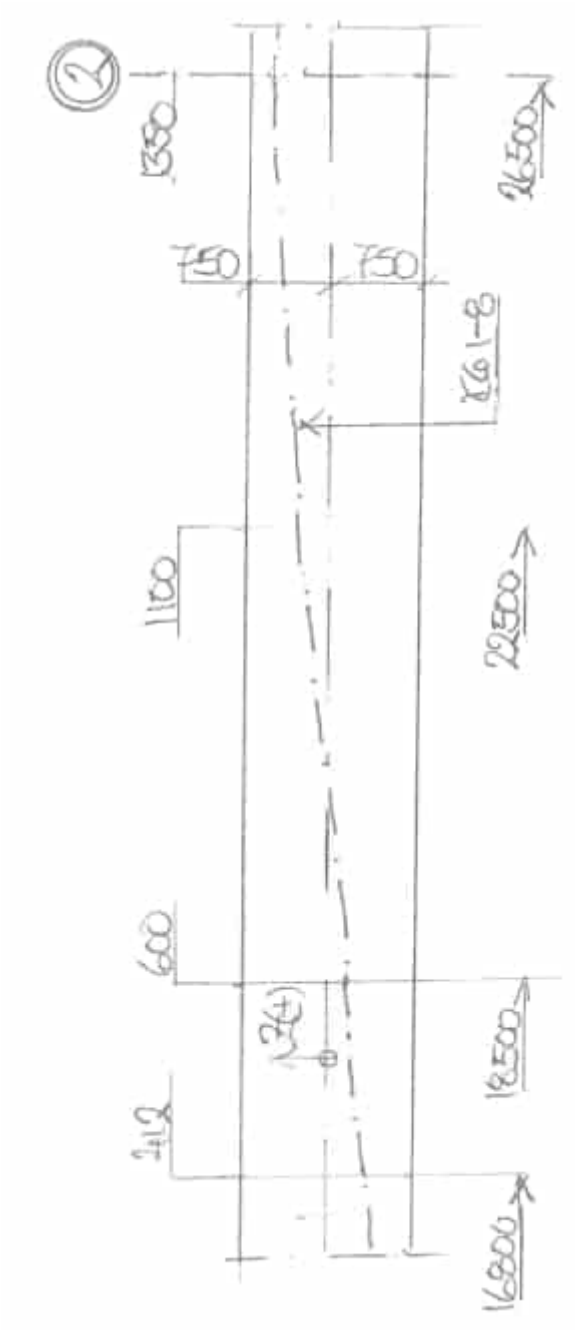
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:79
		Date :	Created :

A determination of the cable profile and verification of short-term losses is carried out using the calculation program B2.001, where all forms and partial results are reported.

To meet the requirement for permissible stress, 3 mm theoretical locking slip is needed, see page A3:91.

Various manufacturers have requirements for the minimum possible locking slip in active anchorage corresponding to 6 mm. In system calculations, 6 mm is applied in all active anchorages on the safe side.

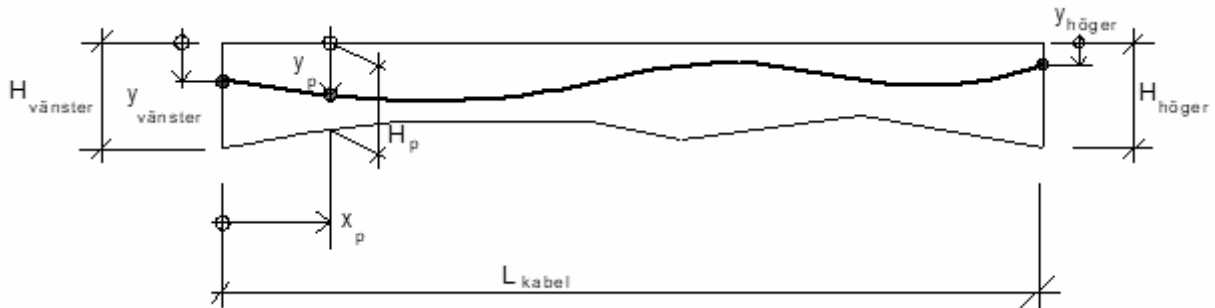
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:81
		Date :	Created :



ELEVATION
Part II

Object: Tendon profile (1 cable VSL 6-15)

PRINCIPLE SKETCH



INPUT

Total cable length: $L_{kabel} := 0.50 \text{ m} + 26 \cdot \text{m} + 26 \cdot \text{m} + 0.5 \text{ m} = 53 \text{ m}$

Number of definition points: $N := 15 \cdot pcs$

Friction coefficients: $\mu := 0.18$ $k := 0.005 \cdot \frac{rad}{m}$

Resistance cable: $f_{p0.1k} := 1640 \cdot MPa$

$f_{pk} := 1860 \cdot MPa$

E-modulus cable: $E_s := 195 \cdot GPa$

Tendon area: $A_s := 2250 \cdot mm^2$

PROG B2.001 / 2001-12-01 (T022)

Maximum permissible tensile force before locking according to SS-EN 1992-1-1 section 5.10.2.1:

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

Selected prestressing force:

$$V_o := 3320 \cdot \text{kN}$$

Maximum permissible tensile force after locking according to SS-EN 1992-1-1 section 5.10.3:

$$\min(0.75 \cdot f_{pk}, 0.85 \cdot f_{p0.1k}) \cdot A_s = 3137 \text{ kN}$$

Type of anchorage ("Passiv" or "Aktiv") / chosen maximum tendon force after locking:

Section	Type	$V_{\text{max}} [\text{kN}]$
Left	Aktiv	3137
Right	Passiv	3137

Defined points along cable:

Section	$x_p \text{ (m)}$	$y_p \text{ (mm)}$	$H_p \text{ (mm)}$
Left	0	300	1500
1	0,500	300	1500
2	3,800	571	1500
3	8,500	1200	1500
4	12,500	1350	1500
5	18,500	900	1500
6	22,500	400	1500
7	26,500	150	1500
8	30,500	400	1500
9	34,400	900	1500
10	40,500	1350	1500
11	44,500	1200	1500
12	49,200	571	1500
13	52,500	300	1500
Right	53,000	300	1500

LUSAS
⇒

$x(+)$	$z(+)$
0	0,45
0,00	0,45
1,00	0,18
1,00	-0,45
1,65	-0,60
7,05	-0,15
13,05	0,35
18,05	0,60
23,05	0,35
29,05	-0,15
34,45	-0,60
35,10	-0,45
35,10	0,18
35,10	0,45
36,10	0,45
m	m

CALCULATION**Create mathematical functions for a beam and a cable**

$C := \text{pspline} (x_p, y_p)$: determination of coefficients for parabolic spline functions

$y(x) := \text{interp} (C, x_p, y_p, x)$: cable routing (= spline functions)

$y'(x) := \frac{d}{dx} y(x)$: slope of cable routing

$y''(x) := \frac{d^2}{dx^2} y(x)$: curvature change of cable routing

$R_{min} := \frac{1}{\max(y''(x))}$: lowest curvature radius of cable routing

Friction loss function measured from the "left" side

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

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

$\eta_{vf} := e^{-\beta_v}$: friction loss before locking

$\eta_{ve} := e^{\beta_v}$: friction loss after locking

Location of maximal cable force on "left" side after locking of cable

$X_{mv} = \begin{cases} x_{skär} \leftarrow 0\text{m} & \text{if Typ} = \text{"Passiv"} \\ \text{if Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{start} \leftarrow 2\text{m} \\ x_{skär} \leftarrow \text{root}(V_{max} - V_0 \cdot \text{interp}(X, \eta_{vf}, x_{start}), x_{start}) \end{cases} \end{cases}$

Friction loss function measured from the "right" side

$$\alpha_h := \text{if} \left(i > 1, \sum_{j=i+1}^n |y'(x_j) - y'(x_{j-1})|, 0 \right) \quad : \text{accumulated change in angle}$$

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

$$\eta_{hf} := e^{-\beta_h} \quad : \text{friction loss before locking}$$

$$\eta_{he} := e^{\beta_h} \quad : \text{friction loss after locking}$$

Location of maximal cable force on "right" side after locking of cable

$$X_{mh} = \begin{cases} x_{skär} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Passiv"} \\ \text{if Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{start} \leftarrow L_{\text{kabel}} - 2m \\ x_{skär} \leftarrow \text{root}(V_{\text{max}} - V_0 \cdot \text{interp}(X, \eta_{hf}, x_{start}), x_{start}) \end{cases} \end{cases}$$

Location where curve of cable force "right" side intersects curve of cable force "left"

$$X_m = \begin{cases} x_{skär} \leftarrow L_{\text{kabel}} & \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Passiv"} \\ x_{skär} \leftarrow 0m & \text{if Typ} = \text{"Passiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \text{if Typ} = \text{"Aktiv"} \wedge \text{Typ} = \text{"Aktiv"} \\ \quad \begin{cases} x_{start} \leftarrow 0.5 \cdot L_{\text{kabel}} \\ x_{skär} \leftarrow \text{root}(V_0 \cdot \text{interp}(X, \eta_{vf}, x_{start}) - V_0 \cdot \text{interp}(X, \eta_{hf}, x_{start}), x_{start}) \end{cases} \end{cases}$$

Determine cable force at each end of cable after locking

Cable force at "left" side :

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

Cable force at "right" side :

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

Determine post slip / "lock sliding" at each end of cableLeft side :

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

Right side :

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

Determine cable elongation before locking of cableLeft side:

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

Right side :

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

Function - determine cable force at arbitrary location along cable before locking

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

Function - determine cable force at arbitrary location along cable after locking

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

Staking-out data for cable location in table formArbitrary sections :

Sections	$x' \text{ (m)}$	Remark
1	0	-
2	0,50	-
3	2,00	-
4	3,00	-
5	3,80	-
6	7,00	-
6	10,30	-
8	13,50	-
9	16,80	-
10	20,00	-
11	23,30	-
12	26,50	-

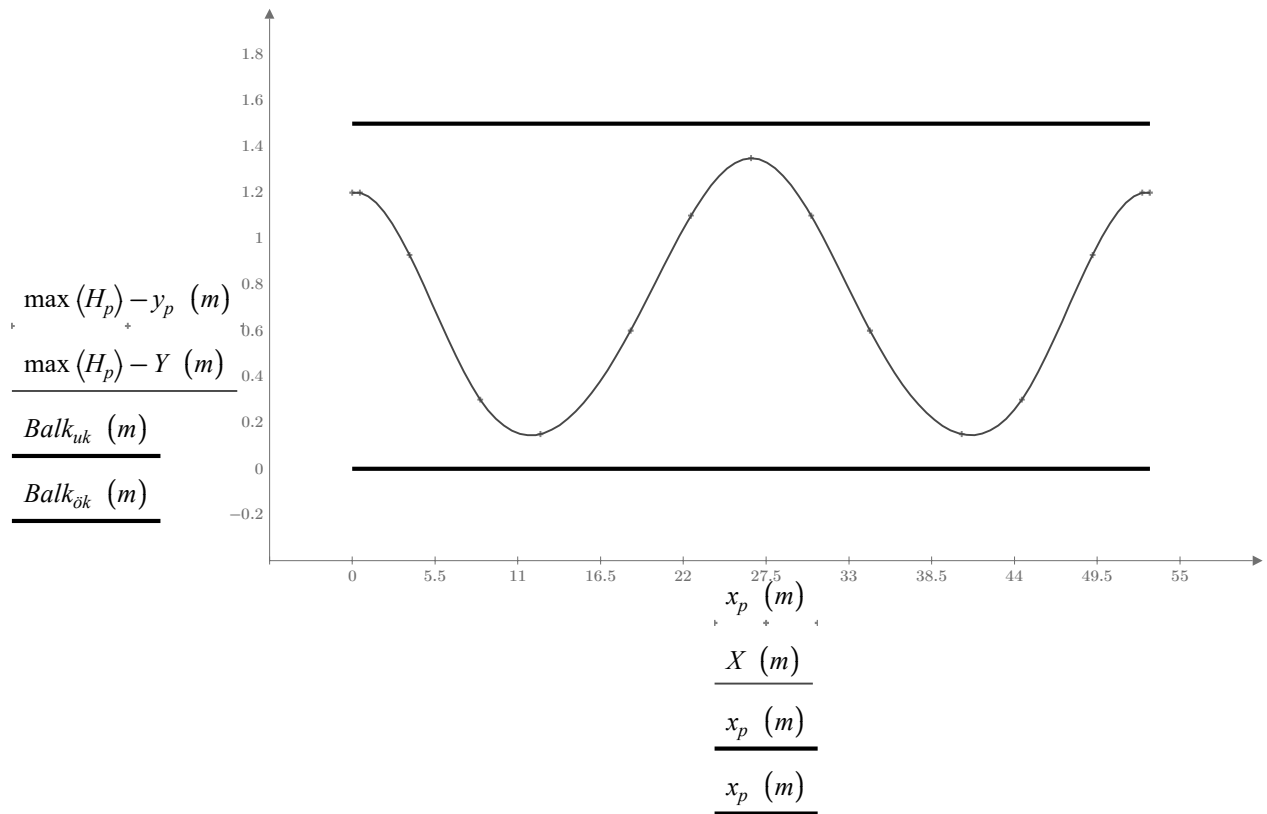
Cable locations :

Sections	$y' \text{ (m)}$	Remark.
1	0,300	Anchors
2	0,300	-
3	0,374	-
4	0,473	-
5	0,571	-
6	1,024	-
7	1,324	-
8	1,322	-
9	1,088	-
10	0,709	-
11	0,318	-
12	0,150	-

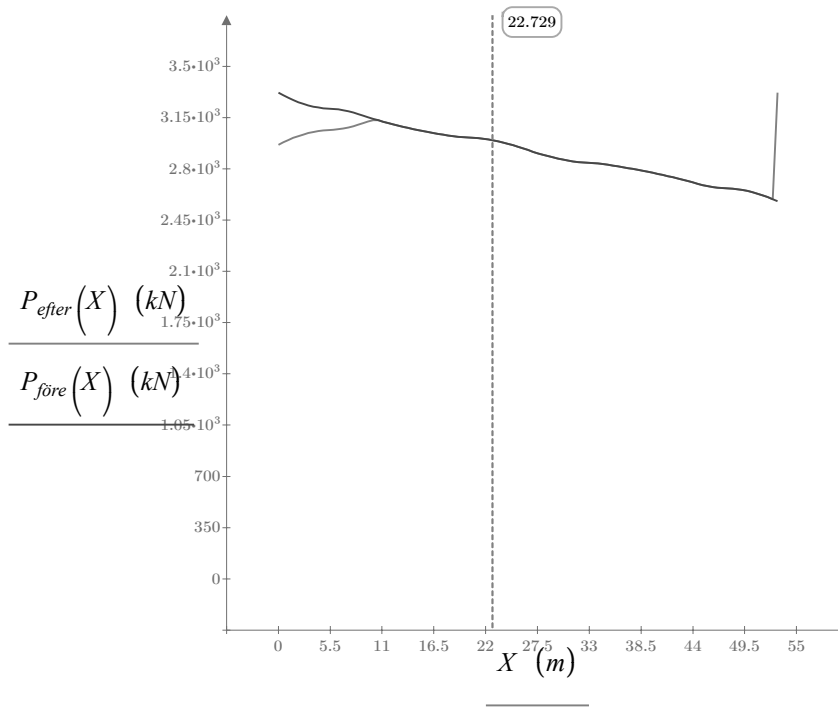
 $\Rightarrow$

$q_{sp} \text{ (m)}$
1,200
1,200
1,126
1,027
0,929
0,476
0,176
0,178
0,412
0,791
1,182
1,350

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

RESULTS**Beam and Cable routing — graphic presentation**

PROG B2.001 / 2001-12-01 (T022)

Graphical plotting of cable forces**Minimum curvature radius**

$$R_{min} = 18.7 \text{ m}$$

Cable elongation before locking

$$L_v = 354 \text{ mm}$$

: left side

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

: right side

Post slip / "lock sliding" at each end of cable

$$\Delta L_v = 4 \text{ mm}$$

: left side

$$\Delta L_h = 0$$

: right side

Cable force at each end after locking

$$P_{ve} = 2964 \text{ kN}$$

: left side

$$P_{he} = 2436 \text{ kN}$$

: right side

Location of maximum cable force after locking

$$X_{mv} = 10.294 \text{ m}$$

: left side

$$X_{mh} = 53 \text{ m}$$

: right side

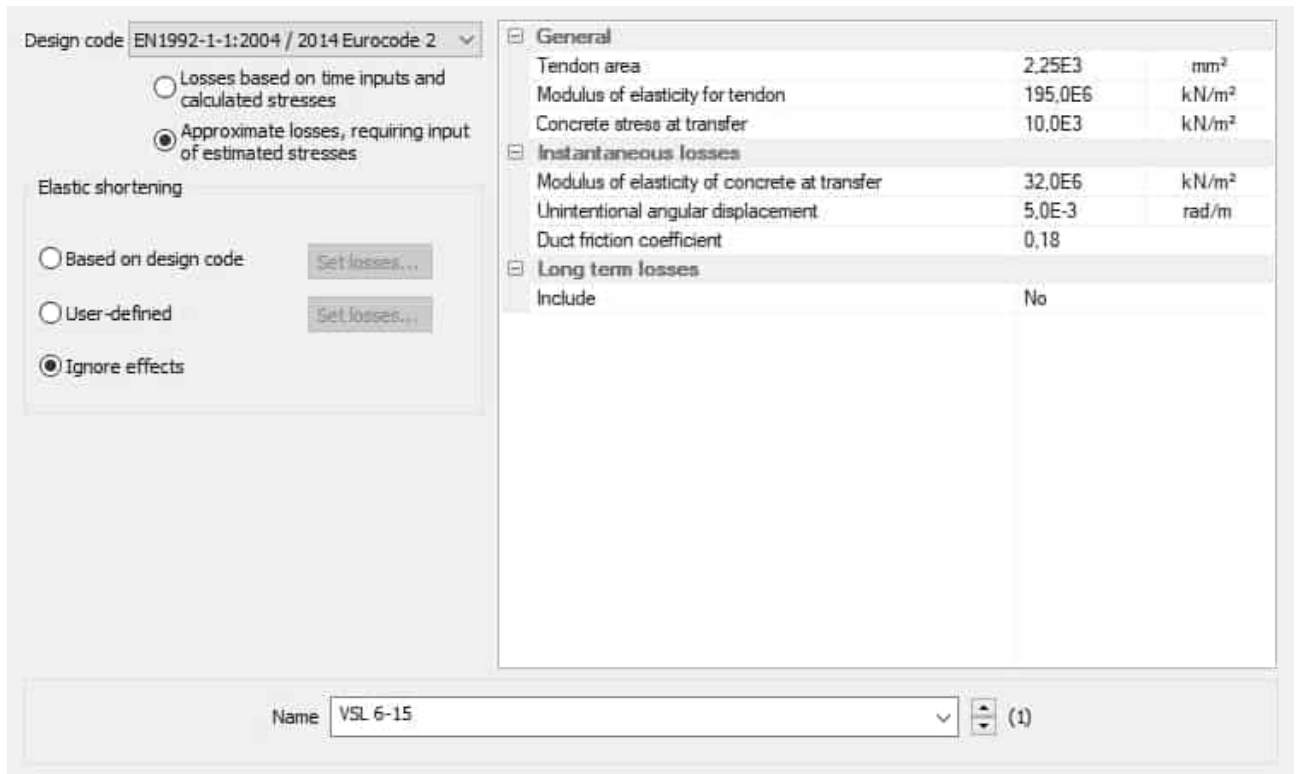
Location of minimum cable force after locking

$$X_m = 53 \text{ m}$$

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:90
	Pretensioned double girder bridge	Date :	Created :

3.13.4.2 Tendon properties

Calculation of "long term losses" is not done with FEM-program but separately. Hence "Include: No" in the table below.



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
☐ User-defined
☒ Ignore effects

Tendon area: 2.25E3 mm²
 Modulus of elasticity for tendon: 195.0E6 kN/m²
 Concrete stress at transfer: 10.0E3 kN/m²
 Modulus of elasticity of concrete at transfer: 32.0E6 kN/m²
 Unintentional angular displacement: 5.0E-3 rad/m
 Duct friction coefficient: 0.18

Long term losses

Include: No

Name: VSL 6-15 (1)

- The relaxation at times $t_1 = 30$ days and $t_2 = 120$ years is stated on page E5:41.
- Creep at times $t_1 = 30$ days and $t_2 = 120$ years is stated on page E5:41.
- Shrinkage at times $t_1 = 30$ days and $t_2 = 120$ years is stated on page E5:41.

Friction coefficients VSL:

Calculation is performed as below.

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

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

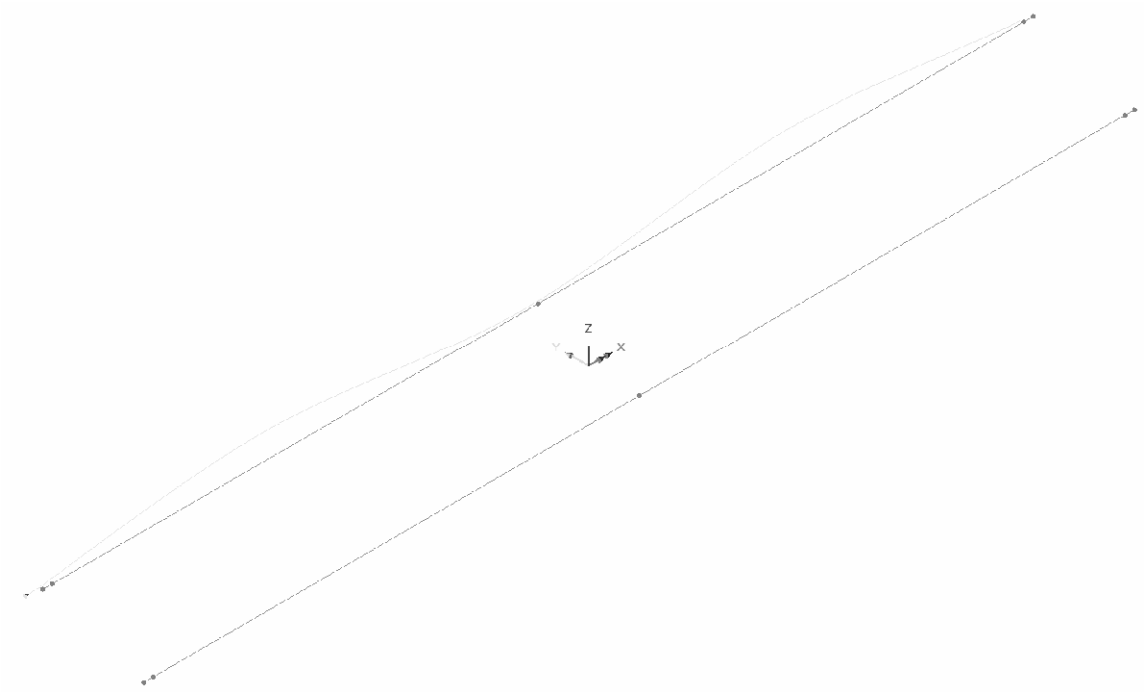
$$\mu = 0.18$$

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

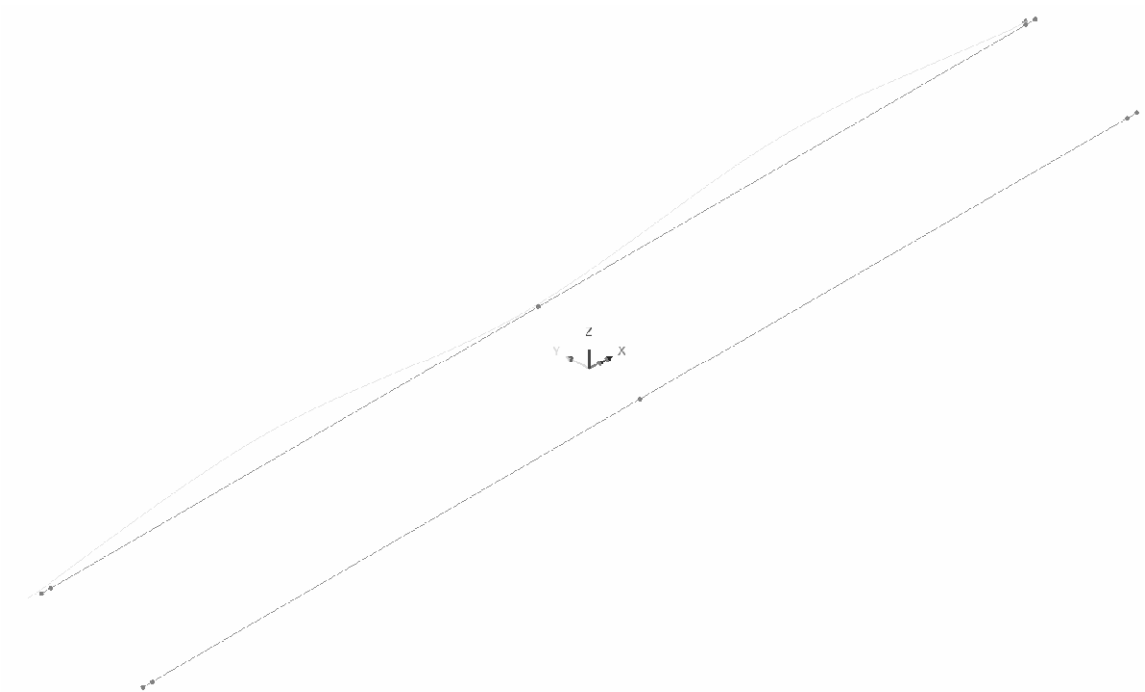
	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:91
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3.13.4.3 Tendon load case

Load case LB1 – KG V1:

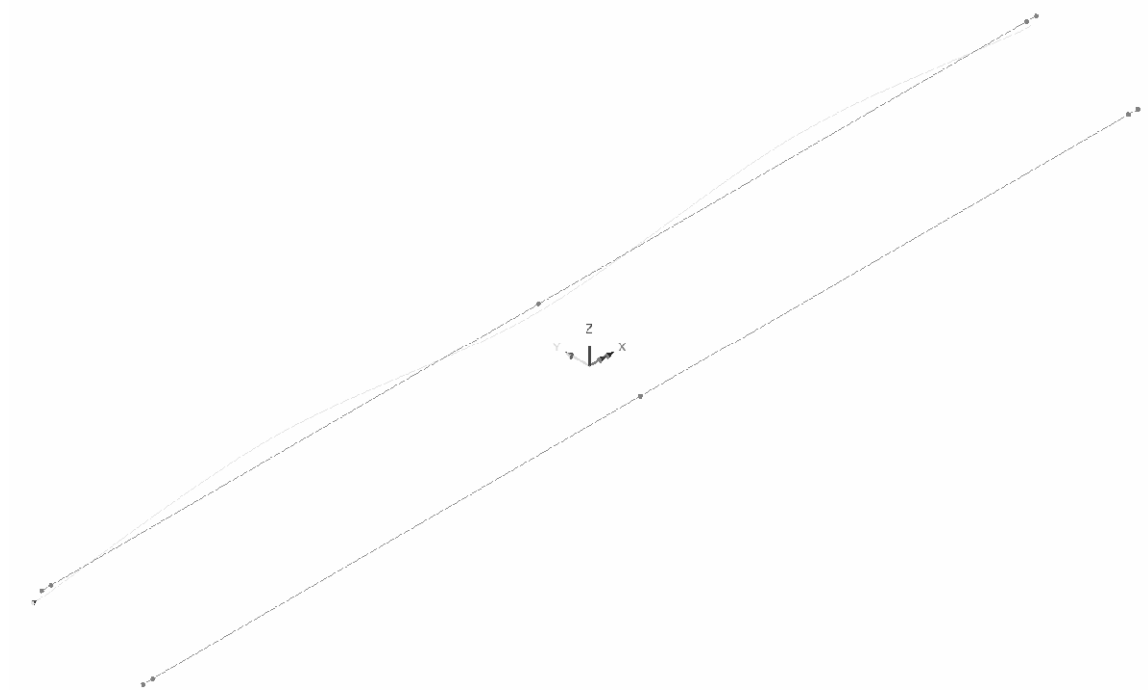


Loadcase LB1 – KG V2:

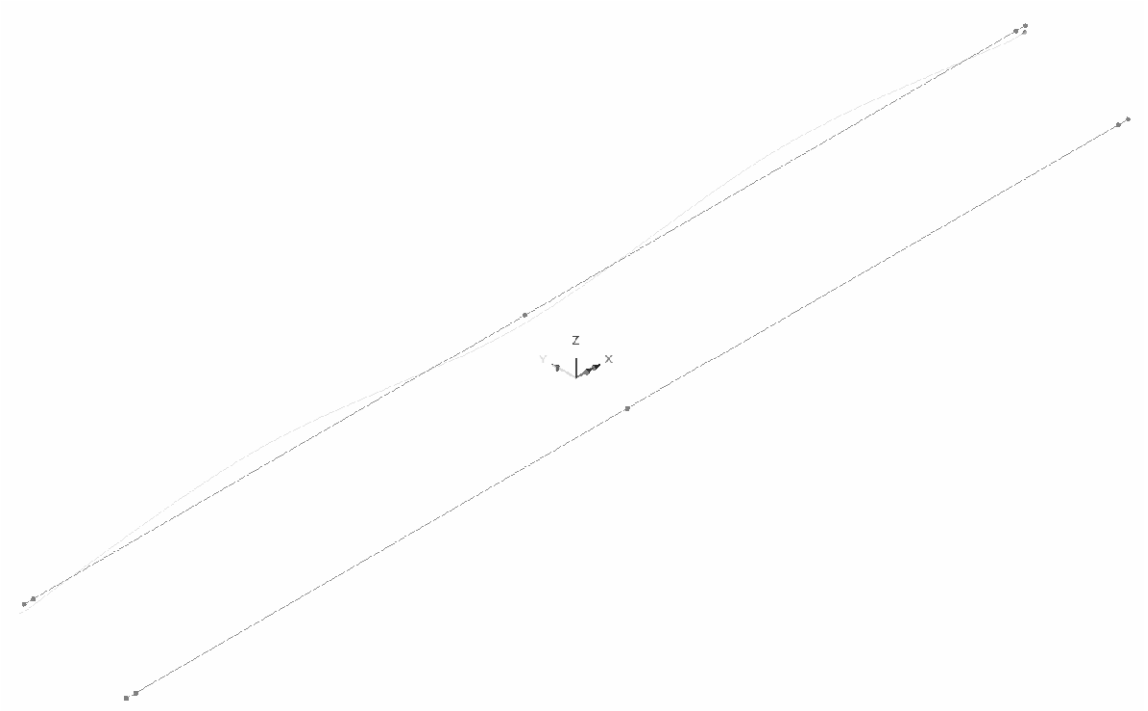


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:92
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Load case LB1 – KG CV1:

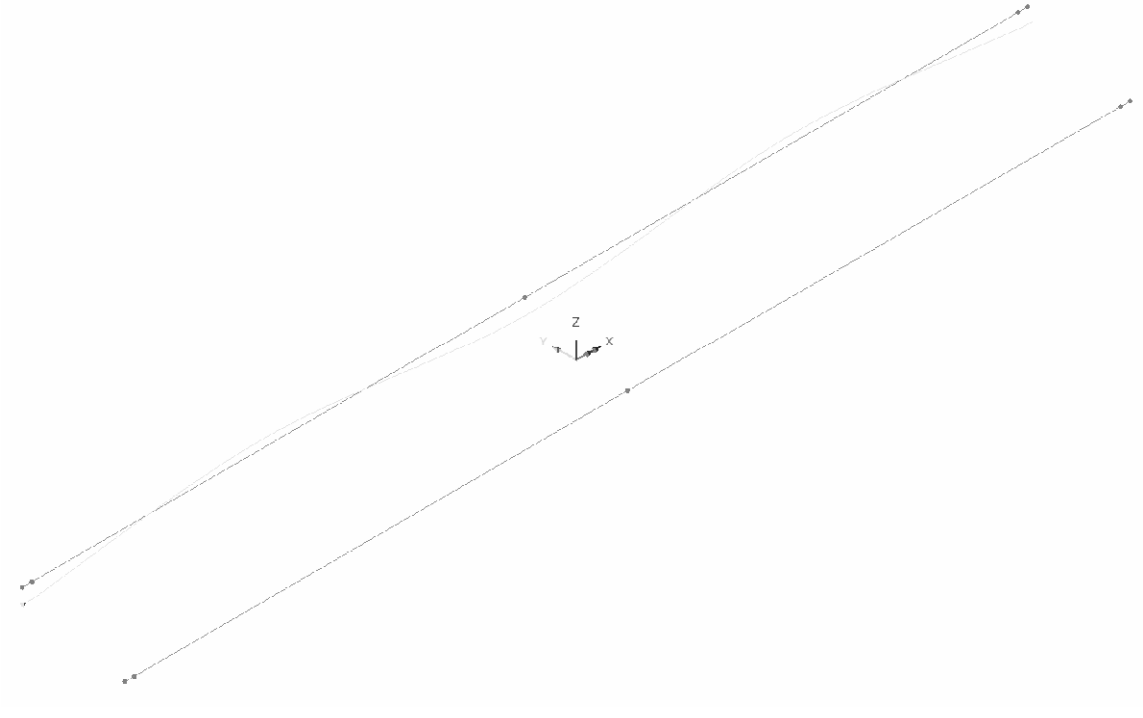


Load case LB1 – KG CV2:

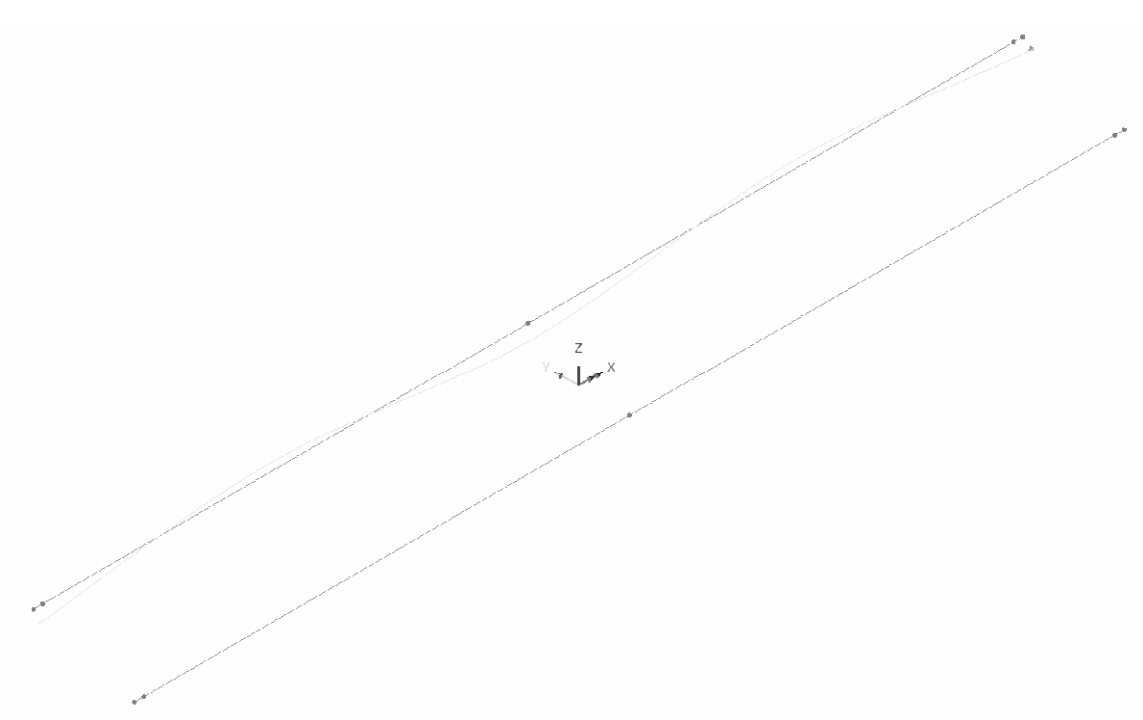


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:93
		Date :	Created :

Load case LB1 – KG CH1:

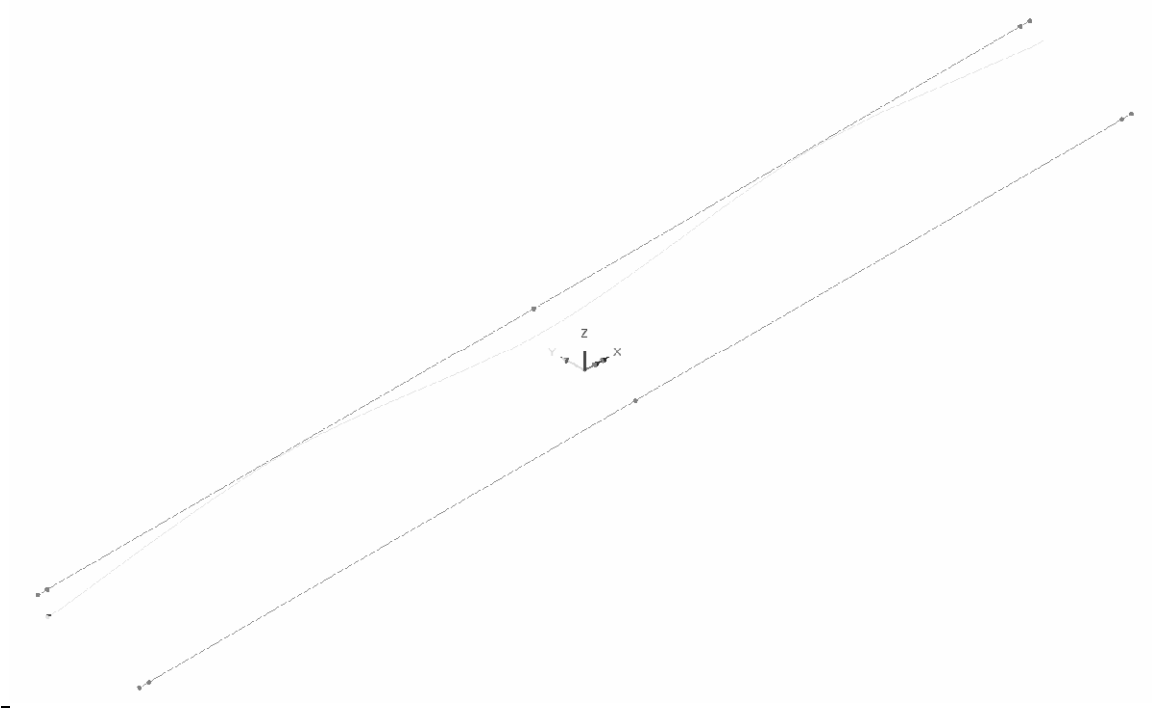


Load case LB1 – KG CH2:

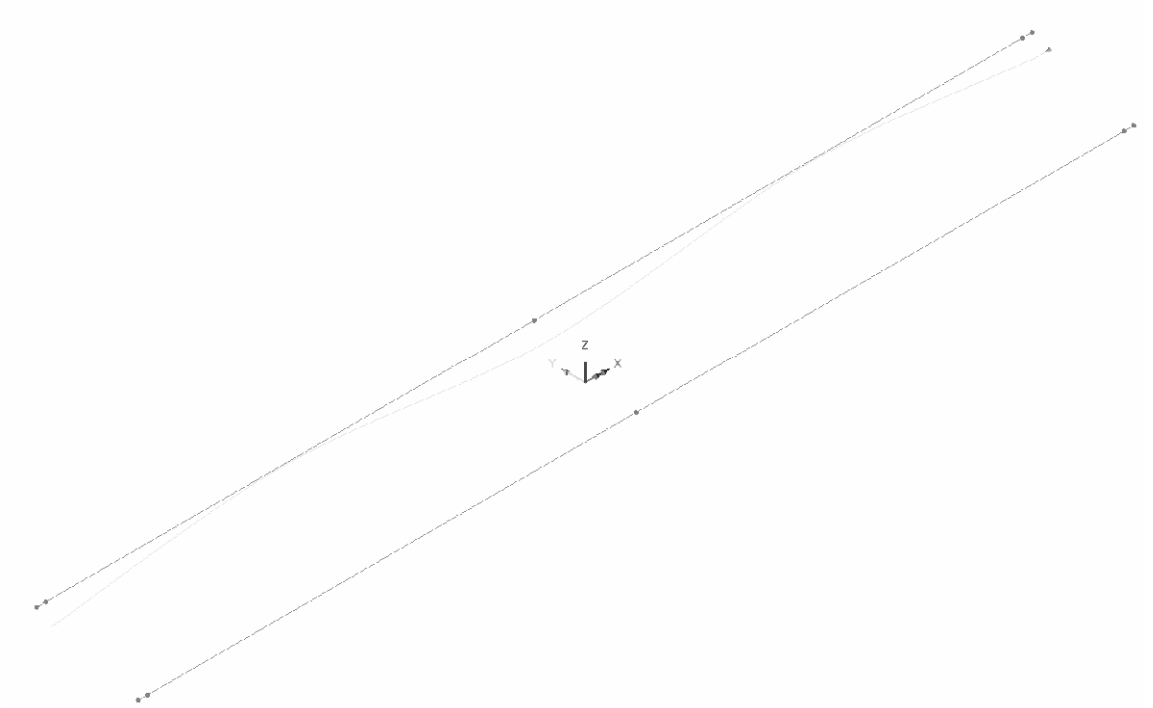


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:94
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Load case LB1 – KG H1:

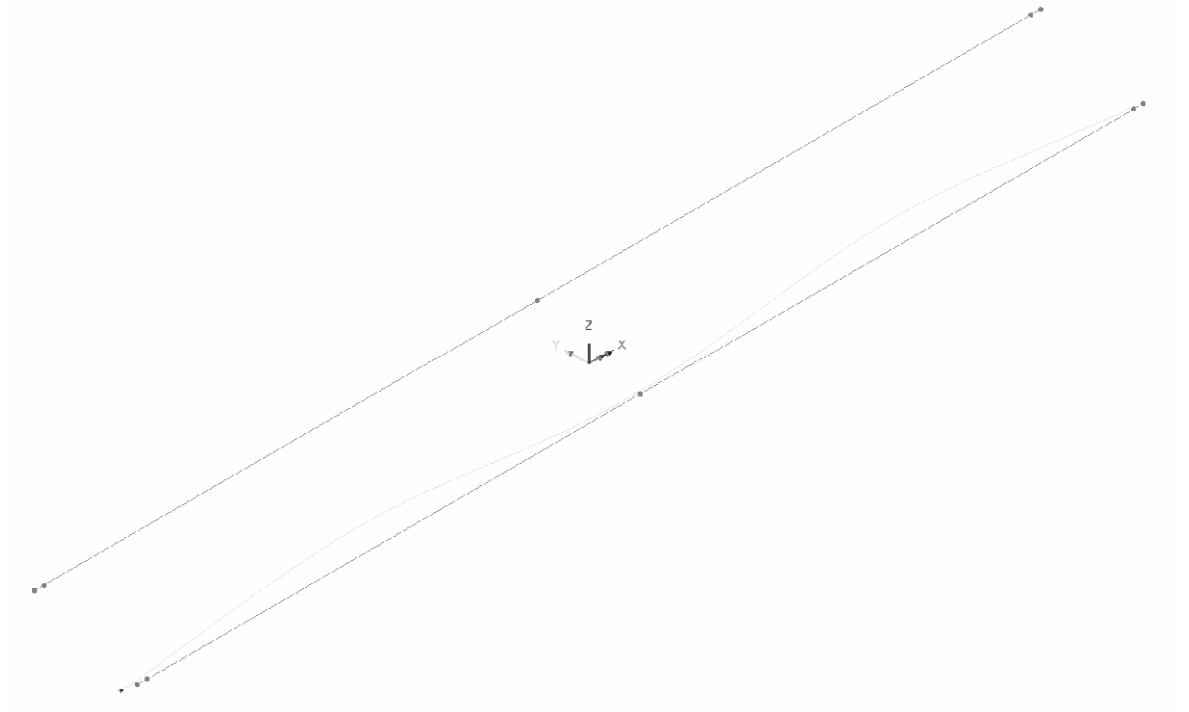


Load case LB1 – KG H2:

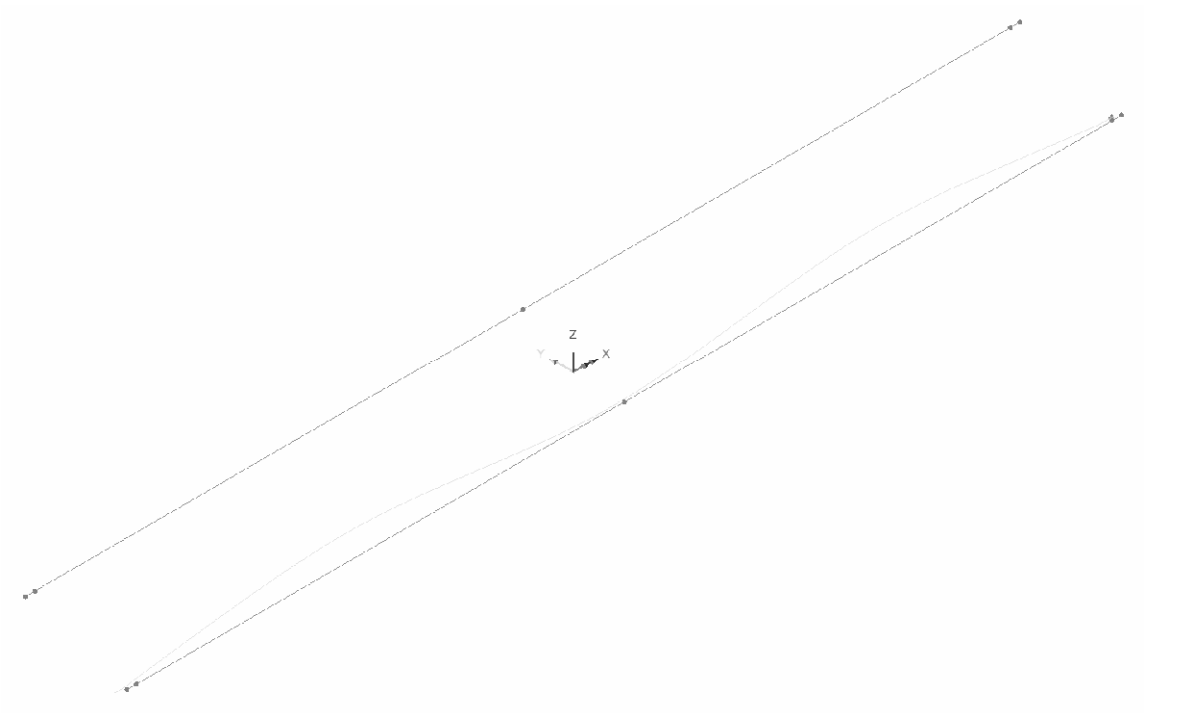


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:95
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Load case LB2 – KG V1:

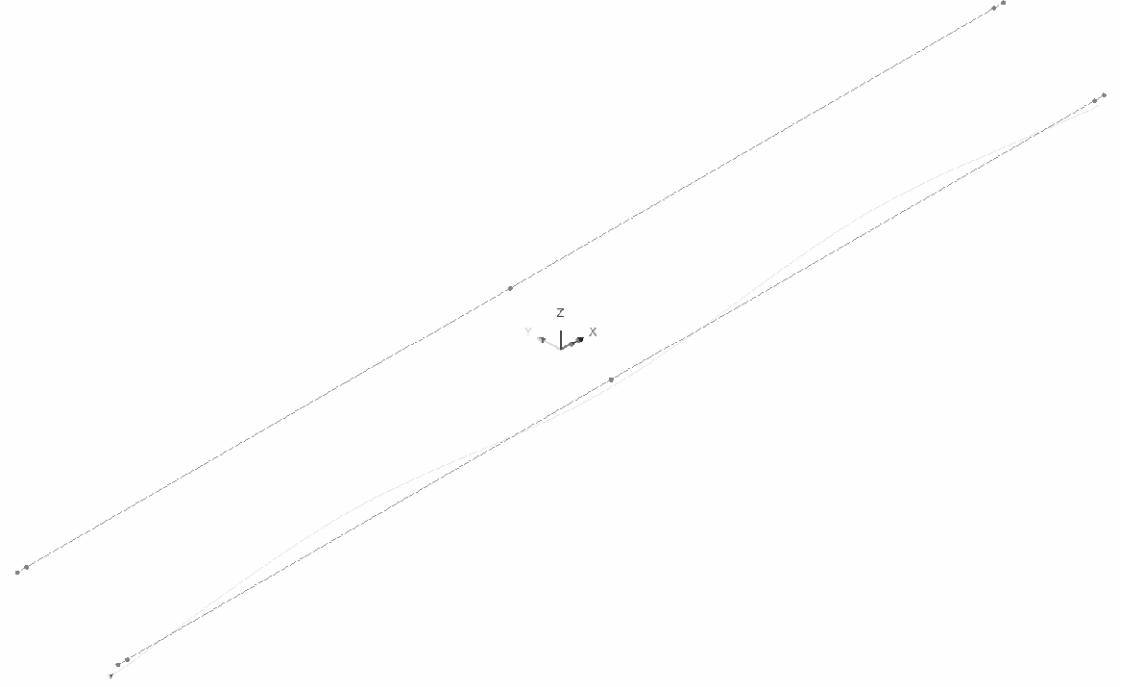


Load case LB2 – KG V2:

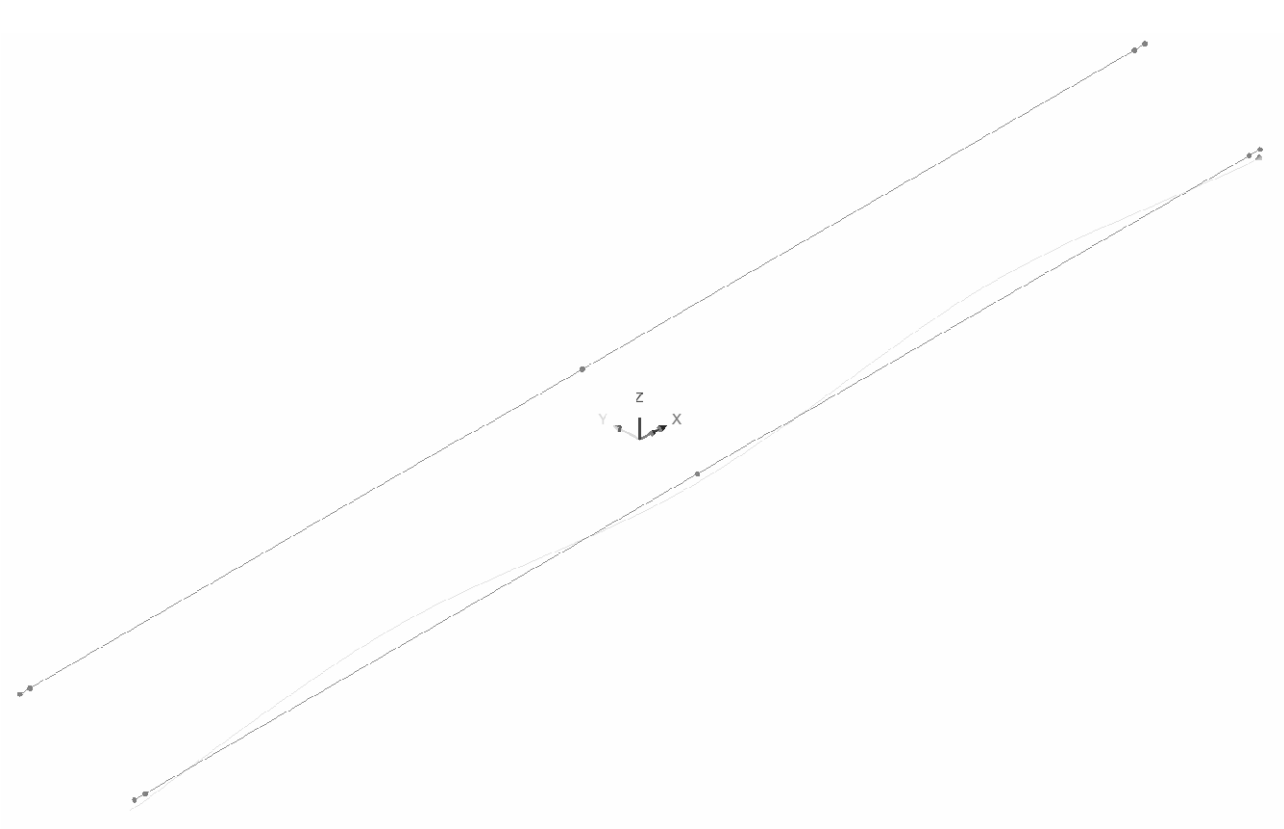


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:96
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Load case LB2 – KG CV1:

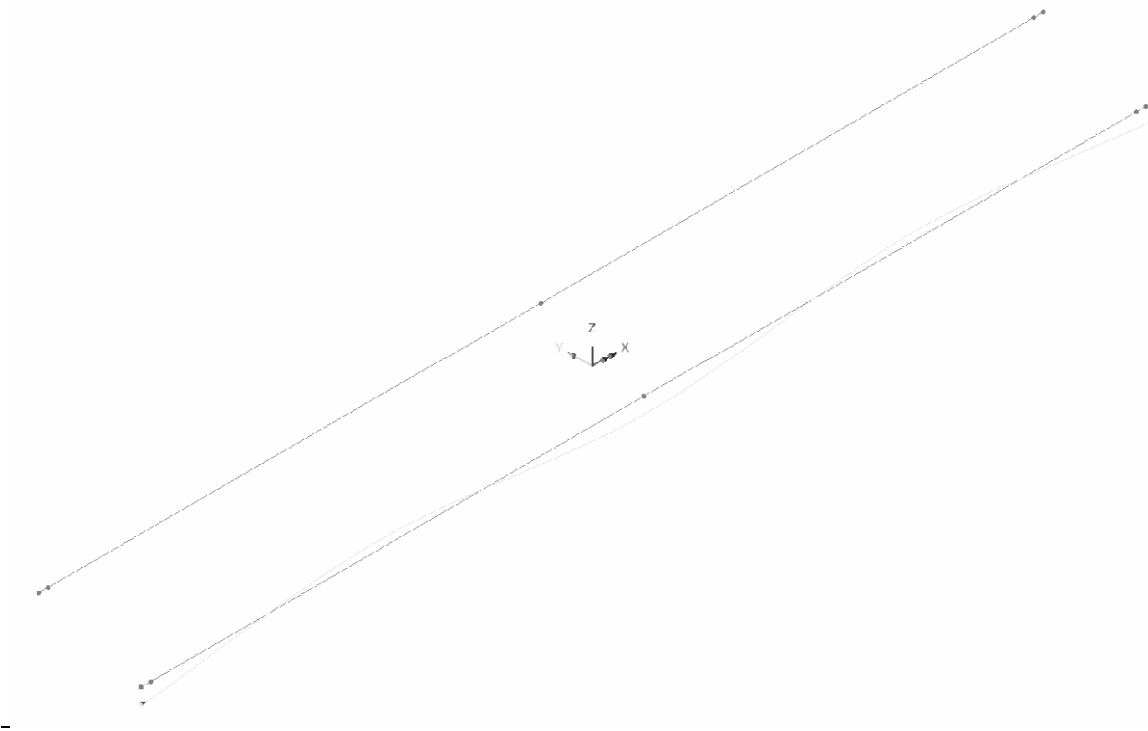


Load case LB2 – KG CV2:

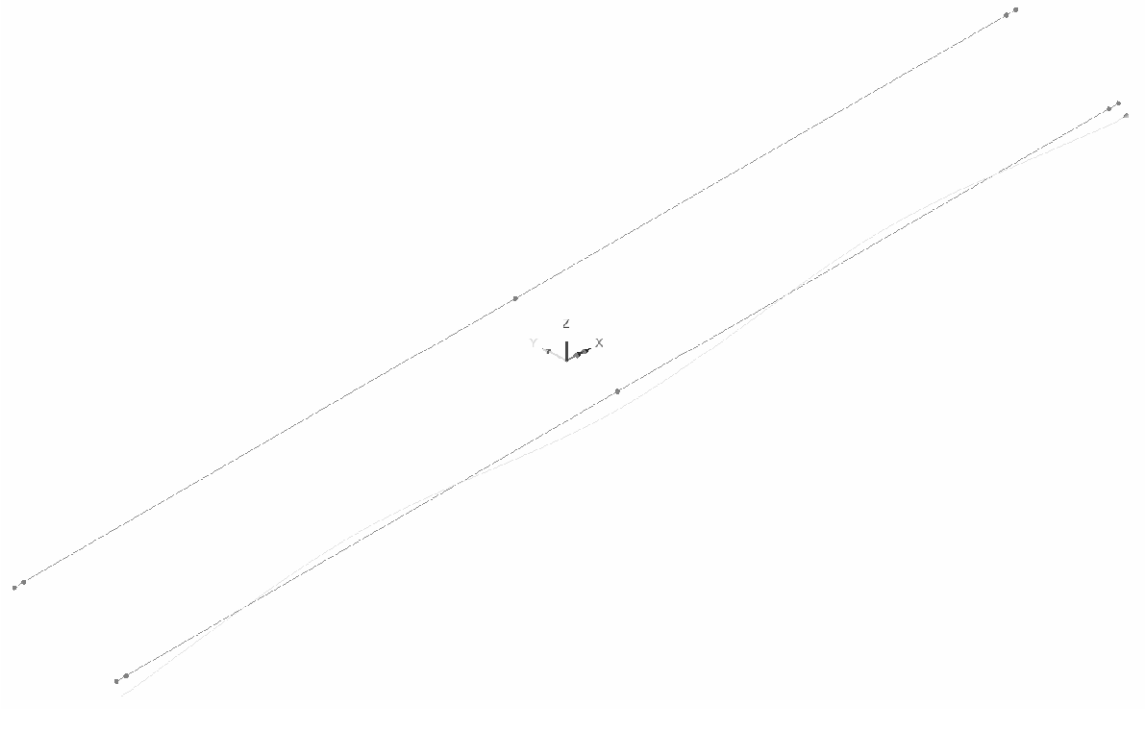


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:97
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Load case LB2 – KG CH1:

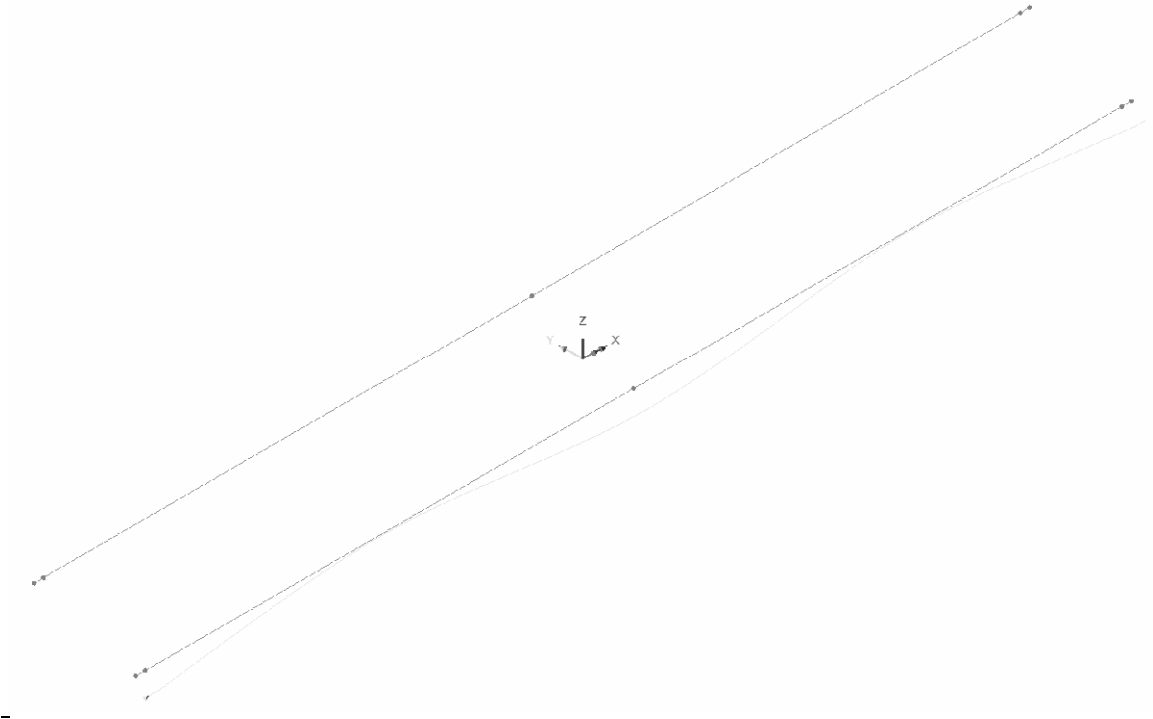


Load case LB2 – KG CH2:

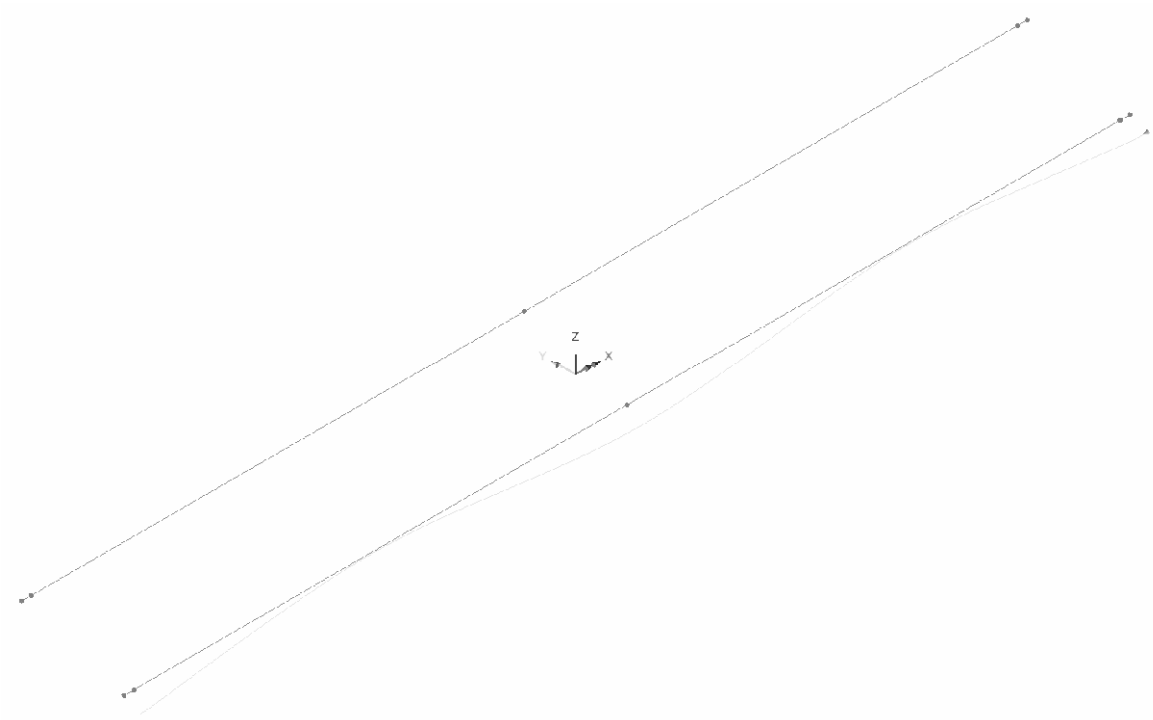


	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:98
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Load case LB2 – KG H1:



Loadc case LB2 – KG H2:



	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:99
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3.13.4 Load combination

Load combination basis PT-t0:

Load case	Factor
LB1 – KG V1	1.00
LB1 – KG V2	1.00
LB1 – KG CV1	1.00
LB1 – KG CV2	1.00
LB1 – KG CH1	1.00
LB1 – KG CH2	1.00
LB1 – KG H1	1.00
LB1 – KG H2	1.00
LB2 – KG V1	1.00
LB2 – KG V2	1.00
LB2 – KG CV1	1.00
LB2 – KG CV2	1.00
LB2 – KG CH1	1.00
LB2 – KG CH2	1.00
LB2 – KG H1	1.00
LB2 – KG H2	1.00

Load combination basis PT-t1:

Load case	Factor
PT – t0	0.95

Load combination basis PT-t2:

Load case	Factor
PT – t0	0.84

Envelope PT:

Load case
PT-t0
PT-t1
PT-t2

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:100
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3.14 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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:101
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3.14.1 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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:102
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3.14.1 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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:103
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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-A) case where the permanent loads are dominant, usually during the construction phase.

Equation 6.10b (ULS-B) 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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:104
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Load combination smart ULS-PERM:

Load case	Permanent factor	Variable factor
EGEN	1.00	1.20
BELÄGG	1.00	1.20
JORD	1.00	1.20
STOD	0	$1.2 \cdot f_{STOD} = 0.40$
KRYMP	0	$1.2 \cdot s_{KRYMP} = 0.40$

Load combination smart ULS-VAR:

(Load cases to consider : 5 / Variable loadcases : 1)

Load case	Permanent factor	Variable factor
TRAFIK	1.13	1.50
BROMS	1.13	1.50
SIDO	1.13	1.50
TEMP	$0.90 f_{TEMP} = 0.70$	$1.5 \cdot f_{TEMP} = 1.2$
VIND	0.45	1.50

For STR load case TEMP may be neglected, see SS-EN 1992-1-1 section 2.3.1.2(2).

Load combination smart ULS-0:

Load case	Permanent factor	Variable factor
ULS-PERM	1.00	1.00
ULS-VAR	0	1.00

Load combination smart ULS:

Load case	Permanent factor	Variable factor
ULS-PERM	1	0
PT	1	1.35
ULS-VAR	0	1

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:105
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3.14.2 Bruksgränstillstånd (SLS)

Bruksgränstillståndet är uppdelat i 3 st lastkombinationer beroende på dess varaktighet. Lastkombinationerna redovisas nedan.

Lastkombination	Varaktighet
SLS:K	Karakteristisk
SLS:F	Frekvent
SLS:Q	Kvasipermanent

Lastkombination SLS:K enligt EN 1990 ekv. 6.14b redovisas nedan.

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

Lastkombination SLS:F enligt EN 1990 ekv. 6.15b redovisas nedan.

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

Lastkombination SLS:Q enligt EN 1990 ekv. 6.16b redovisas nedan.

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

Vid dimensionering tillämpas lastkoefficienter tillhörande ekvationer 6.14a, 6.15b och 6.16b, se härledning se sida A3:137.

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:106
		Date :	Created :

Nr	Last		$\Psi\gamma_{SLS-K}$	$\Psi\gamma_{SLS-F}$	$\Psi\gamma_{SLS-Q}$
	<u>Permanent loads</u>				
1	Egentyngd	max	1,00	1,00	1,00
		min	1,00	1,00	1,00
2	Beläggning	max	1,10	1,10	1,10
		min	0,90	0,90	0,90
3	Överfyllnad	max	1,10	1,10	1,10
		min	0,90	0,90	0,90
4	Jordtryck	max	1,10	1,10	1,10
		min	0,90	0,90	0,90
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
	<u>Variable loads</u>				
	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
20	Bromskraft		0.56/0.75	0/0.56	0
22	Sidokraft		0.56/0.75	0/0.56	0
22	Centrifugalkraft		0.56/0.75	0/0.56	0
16	Temperatur		0.60/1.00	0.50/0.60	0.50
	Vindlaster:				
17	Vindlast mot bro		0.30/1.00	0/0.30	0
18	Vindlast mot trafik		0.30/1.00	0/0.30	0
19	Överlast		0.75/1.00	0/0.75	0

	Part A – CALCULATION ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:107
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Load combination smart SLS-PERM :

Loadcase	Permanentfactor	Variable factor
EGEN	1.00	1.00
BELÄGG	0.90	1.20
JORD	0.90	1.20
STOD	0	$1.0 \cdot f_{STOD} = 0.33$
KRYMP	0	$1.0 \cdot f_{KRYMP} = 0.33$

Load combination smart SLS-K-VAR :

(Load cases to consider : 5 / Variable loadcases : 1)

Loadcase	Permanent factor	Variable factor
TRAFIK	0.75	1.00
BROMS	0.56	0.75
SIDO	0.56	0.75
TEMP	$0.60 f_{TEMP} = 0.50$	$1.0 \cdot f_{TEMP} = 0.80$
VIND	0.60	1.00

Load combination smart SLS-F-VAR :

Load case	Permanent factor	Variable factor
TRAFIK	0	0.75
BROMS	0	0.56
SIDO	0	0.56
TEMP	0	$0.60 f_{TEMP} = 0.50$
VIND	0	0.30

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:108
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Load combination smart *SLS-K0* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
SLS-K-VAR	0	1

Load combination smart *SLS-K* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
PT	1	1
SLS-K-VAR	0	1

Load combination smart *SLS-F0* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
SLS-F-VAR	0	1

Load combination smart *SLS-F* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
PT	1	1
SLS-F-VAR	0	1

Load combination smart *SLS-Q0* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
TEMP	0	$0.50f_{TEMP} = 0.40$

Load combination smart *SLS-Q* :

Load case	Permanent factor	Variable factor
SLS-PERM	1	1
PT	1	1
TEMP	0	$0.50f_{TEMP} = 0.40$

	Part A – CALCULATION ASSUMPTION	Status :	Page: A3:109
	Pretensioned double girder bridge	Date :	Created :

3.14.3 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.

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

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.

Permanent loads:

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 ASSUMPTION	Status :	Page: A3:110
	Pretensioned double girder bridge	Date :	Created :

Variable loads:

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 ASSUMPTION Pretensioned double girder bridge	Status :	Page: A3:111
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Load combination smart FAT :

(FAT-0 is identical but does not contain load case PT-t0)

Load case	Permanent factor	Variable factor
EGEN	1.00	0
BELÄGG	1.00	0
JORD	-	-
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).

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Title: Input receipt

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 $S19 \rightarrow S24$.

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1. Points

Point	X coordinate	Y coordinate	Z coordinate
48	1.6	7.0	1.4
49	-1.6	-7.0	1.4
50	-24.4	7.0	1.4
51	-27.6	-7.0	1.4
52	-24.9	7.0	1.4
53	-28.1	-7.0	1.4
54	27.6	7.0	1.4
55	24.4	-7.0	1.4
56	28.1	7.0	1.4
57	24.9	-7.0	1.4
69	-0.8	-3.5	1.4
89	25.2	-3.5	1.4
95	25.7	-3.5	1.4
103	0.8	3.5	1.4
123	26.8	3.5	1.4
129	27.3	3.5	1.4
130	-26.8	-3.5	0.8
131	-27.3	-3.5	0.8
132	-0.8	-3.5	0.8
133	25.2	-3.5	0.8
134	25.7	-3.5	0.8
135	-25.2	3.5	0.8
136	-25.7	3.5	0.8
137	0.8	3.5	0.8
138	26.8	3.5	0.8
139	27.3	3.5	0.8
143	-26.8	-3.5	-0.1
145	-0.8	-3.5	-0.1
147	25.2	-3.5	-0.1
149	-25.2	3.5	-0.1
151	0.8	3.5	-0.1
153	26.8	3.5	-0.1
154	-26.0	0.0	-0.1
155	0.0	0.0	-0.1
156	26.0	0.0	-0.1
179	1.1	5.0	1.4
185	-25.4	5.0	1.4
188	27.6	5.0	1.4
202	0.5	2.0	1.4
208	-26.0	2.0	1.4
211	27.0	2.0	1.4
222	-24.9	5.0	1.4
224	-25.5	2.0	1.4
230	-26.5	-2.0	1.4
234	-27.0	-2.0	1.4
245	-27.1	-5.0	1.4
248	-27.6	-5.0	1.4
257	26.0	-2.0	1.4
259	25.5	-2.0	1.4
261	24.9	-5.0	1.4
262	25.4	-5.0	1.4
263	-25.2	3.5	1.4
264	-25.7	3.5	1.4
265	-27.3	-3.5	1.4
266	-26.8	-3.5	1.4
268	27.1	5.0	1.4
269	26.5	2.0	1.4
274	-1.1	-5.0	1.4
281	-0.5	-2.0	1.4
296	0.0	0.0	1.4
297	-26.0	0.0	1.4
312	26.0	0.0	1.4
330	-26.5	0.0	1.4
347	26.5	0.0	1.4
348	-30.0	0.0	10.0
352	30.0	0.0	10.0

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353	-30.0	7.0	10.0
354	30.0	7.0	10.0
355	-30.0	-7.0	10.0
356	30.0	-7.0	10.0
VLO load anchor	0.0	0.0	0.0
374	-25.7	3.5	10.0
378	27.3	3.5	10.0
379	-27.3	-3.5	10.0
383	25.7	-3.5	10.0
378	27.3	3.5	10.0
379	-27.3	-3.5	10.0
383	25.7	-3.5	10.0
384	-30.0	1.3	10.0
385	30.0	-1.3	10.0
386	-30.0	6.4	10.0
387	30.0	6.4	10.0
388	-30.0	1.9	10.0
389	30.0	1.9	10.0
390	-30.0	-5.3	10.0
391	30.0	-5.3	10.0
392	-30.0	-0.3	10.0
393	30.0	-0.3	10.0

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2. Lines

Line	Points	Line	Points
54	50,52	55	48,50
56	48,54	57	54,56
58	51,53	59	49,51
60	49,55	61	55,57
96	131,130	97	130,132
98	132,133	99	133,134
100	136,135	101	135,137
102	137,138	103	138,139
105	143,130	106	145,132
107	147,133	108	149,135
109	151,137	110	153,138
114	149,154	115	154,143
116	151,155	117	155,145
118	153,156	119	156,147
128	48,179	129	179,103
130	52,185	132	56,188
133	188,129	138	103,202
142	129,211	148	50,222
150	185,222	151	222,179
154	208,224	155	224,202
164	234,230	167	245,51
169	53,248	173	248,245
177	263,224	178	222,263
179	208,264	180	264,185
181	248,265	182	265,234
183	266,245	184	230,266
185	263,264	186	103,263
187	103,123	188	123,129
189	54,268	190	268,123
191	179,268	192	268,188
193	202,269	194	211,269
195	265,266	196	69,266
197	69,89	198	89,95
203	69,274	206	49,274
207	261,274	208	261,262
209	281,69	211	230,281
212	259,281	213	257,259
214	259,89	216	123,269
217	95,257	220	245,274
221	261,55	222	89,261
224	57,262	225	262,95
238	296,297	240	296,281
241	202,296	242	297,230
243	224,297	255	312,296
257	312,259	258	269,312
270	297,330	274	234,330
275	330,208	287	347,312
289	257,347	290	347,211
293	353,354	294	355,356
307	384,385	308	386,387
309	388,389	310	390,391
311	392,393		

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3. Surfaces

Surface	Lines	Surface	Lines
3	155,138,186,177	4	193,216,187,138
5	186,129,151,178	6	187,190,191,129
7	151,128,55,148	8	191,189,56,128
9	196,209,211,184	10	197,214,212,209
11	220,203,196,183	12	207,222,197,203
13	59,206,220,167	14	60,221,207,206
15	150,148,54,130	16	185,178,150,180
17	154,177,185,179	19	195,184,164,182
20	173,183,195,181	21	58,167,173,169
22	192,132,57,189	23	188,133,192,190
24	194,142,188,216	26	61,224,208,221
27	208,225,198,222	29	198,217,213,214
32	211,240,238,242	33	238,241,155,243
36	212,257,255,240	37	255,258,193,241
40	164,242,270,274	41	270,243,154,275
44	213,289,287,257	45	287,290,194,258

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4. 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
96;99;100;103

Attribute: 3 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
148;167;189;221;240T243;257;258

Attribute: 4 Title: Element 52
Sub Type = Line Mesh **Element Type = BMI21**
Mesh spacing **Nr. of elements** **Start node end releases:** **End node end releases:**
Uniform 52 None None

Assignment to Lines: Beta angle = 0,0
97;98;101;102

Attribute: 8 Title: Element support
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
114T119

Attribute: 13 Title: Element 3
Sub Type = Line Mesh **Element Type = BMI21**
Mesh spacing **Nr. of elements** **Start node end releases:** **End node end releases:**
Uniform 3 None None

Assignment to Lines: Beta angle = 0,0
138;177;178;183;184;190;209;214;216;222

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5. MESH:Surface

Attribute: 9 Title: Element 52 x 3

Sub Type = Surface Mesh Element Type = QTS4

Property	Symbol	Value
Element size	size	0.0
Number of divisions in x	xDivisions	52
Number of divisions in y	yDivisions	3
Transition mesh	transition	true
Allow irregular mesh	allowIrregular	true
Element defined by name	DefinedByName	false
Single feature joint	isSingleFtrJnt	false

Assignment to Surfaces:

3T6;9T12

Attribute: 10 Title: Element 52 x 4

Sub Type = Surface Mesh Element Type = QTS4

Property	Symbol	Value
Element size	size	0.0
Number of divisions in x	xDivisions	52
Number of divisions in y	yDivisions	4
Transition mesh	transition	true
Allow irregular mesh	allowIrregular	true
Element defined by name	DefinedByName	false
Single feature joint	isSingleFtrJnt	false

Assignment to Surfaces:

7;8;13;14;32;33;36;37

Attribute: 11 Title: Element 1 x 4

Sub Type = Surface Mesh Element Type = QTS4

Property	Symbol	Value
Element size	size	0.0
Number of divisions in x	xDivisions	1
Number of divisions in y	yDivisions	4
Transition mesh	transition	true
Allow irregular mesh	allowIrregular	true
Element defined by name	DefinedByName	false
Single feature joint	isSingleFtrJnt	false

Assignment to Surfaces:

15;21;22;26;40;41;44;45

Attribute: 12 Title: Element 1 x 3

Sub Type = Surface Mesh Element Type = QTS4

Property	Symbol	Value
Element size	size	0.0
Number of divisions in x	xDivisions	1
Number of divisions in y	yDivisions	3
Transition mesh	transition	true
Allow irregular mesh	allowIrregular	true
Element defined by name	DefinedByName	false
Single feature joint	isSingleFtrJnt	false

Assignment to Surfaces:

16;17;19;20;23;24;27;29

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6. MESH:Joint elements

Attribute: 2 Title: JSO2 – TA

Assigned in: Analysis 1

Sub Type = Joint Material, Spring Stiffness Only

	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:			
135;138;149;153			

Attribute: 3 Title: JSO2 - TE:X

Assigned in: Analysis 1

Sub Type = Joint Material, Spring Stiffness Only

	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]	1000,0	1000,0
Elastic spring stiffness	K[2]	0,0	0,0
Assignment to Points:			
130;133;143;147			

Attribute: 4 Title: JSO2 - TE:Y

Assigned in: Analysis 1

Sub Type = Joint Material, Spring Stiffness Only

	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]	1000,0	1000,0
Assignment to Points:			
137;151			

Attribute: 5 Title: JSO2 – TF

Assigned in: Analysis 1

Sub Type = Joint Material, Spring Stiffness Only

	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]	1000,0	1000,0
Elastic spring stiffness	K[2]	1000,0	1000,0
Assignment to Points:			
132;145			

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7. Geometric : Line

Attribute: 4 Title: Trapets

Sub Type = Line Geometric

Property

Cross sectional area
 Second moment of area about y axis
 Second moment of area about z axis
 Product moment of area
 Torsional constant
 Eccentricity in local z direction, relative to specified origin
 Eccentricity in local y direction, relative to specified origin
 Eccentricity in local z direction, relative to beam centroid
 Eccentricity in local y direction, relative to beam centroid
 Wagner constant 1st moment of square radius about y (Iyr)
 Wagner constant 1st moment of square radius about z (Izr)
 Wagner constant 4th moment of area about origin (Irr)
 Wagner constant 2nd moment of warping about origin (Iwr)
 Effective shear area in local z direction
 Effective shear area in local y direction
 Plastic area
 Plastic modulus for bending about y
 Plastic modulus for bending about z
 Plastic neutral axis, distance from centroid along y axis
 Plastic neutral axis, distance from centroid along z axis
 Plastic torsional section modulus
 Warping torsional constant about shear centre
 Shear centre about y axis
 Shear centre about z axis
 Monosymmetry constant about y
 Monosymmetry constant about z
 Radius of gyration about y axis
 Radius of gyration about z axis
 y axis extreme fibre, top
 y axis extreme fibre, bottom
 z axis extreme fibre, top
 z axis extreme fibre, bottom
 Shape code identifier
 Element type
 Reinforcement

Symbol

A
 Iyy
 Izz
 Iyz
 J
 ez0
 ey0
 ez
 ey
 Iyr
 Izr
 Irr
 Iwr
 Asz
 Asy
 Ap
 Zpy
 Zpz
 yp
 zp
 Zpt
 Cw
 yo
 zo
 betay
 betaz
 ky
 kz
 yt
 yb
 zt
 zb
 Type
 elementType
 reinforcement

Value

3,0
 0,4
 1,6
 0,0
 1,0
 0,1
 0,0
 0,1
 0,0
 0,1
 0,0
 2,1
 0,0
 2,4
 2,5
 3,0
 0,9
 1,9
 0,0
 0,0
 1,8
 0,1
 0,0
 -0,1
 0,5
 0,0
 0,3
 0,7
 1,5
 -1,5
 0,6
 -0,6
 0
 "3D Thick Beam"
 None

Assignment to Lines:

96T103

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Attribute: 5 Title: TVB (Tvarbalk (RSS D=1,1 B=1))

Sub Type = Line Geometric

Property	Symbol	Value
Cross sectional area	A	1,1
Second moment of area about y axis	Iyy	0,1
Second moment of area about z axis	Izz	0,1
Product moment of area	Iyz	0,0
Torsional constant	J	0,2
Eccentricity in local z direction, relative to specified origin	ez0	0,7
Eccentricity in local y direction, relative to specified origin	ey0	0,0
Eccentricity in local z direction, relative to beam centroid	ez	0,7
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	0,1
Wagner constant 2nd moment of warping about origin (Iwr)	Iwr	0,0
Effective shear area in local z direction	Asz	0,9
Effective shear area in local y direction	Asy	0,9
Plastic area	Ap	1,1
Plastic modulus for bending about y	Zpy	0,3
Plastic modulus for bending about z	Zpz	0,3
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	0,4
Warping torsional constant about shear centre	Cw	0,0
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	0,3
Radius of gyration about z axis	kz	0,3
y axis extreme fibre, top	yt	0,5
y axis extreme fibre, bottom	yb	-0,5
z axis extreme fibre, top	zt	0,6
z axis extreme fibre, bottom	zb	-0,6
Shape code identifier	Type	1
Breadth of this section	B	1,0
Depth of this section	D	1,1
Element type	elementType	"3D Thick Beam"
Reinforcement	reinforcement	None

Assignment to Lines:

138;148;167;177;178;183;184;189;190;209;214;216;221;222;240T243;257;258

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Attribute: 6 Title: Rigid beam - supports

Sub Type = Line Geometric

Property

Cross sectional area
 Second moment of area about y axis
 Second moment of area about z axis
 Product moment of area
 Torsional constant
 Eccentricity in local z direction, relative to specified origin
 Eccentricity in local y direction, relative to specified origin
 Eccentricity in local z direction, relative to beam centroid
 Eccentricity in local y direction, relative to beam centroid
 Wagner constant 1st moment of square radius about y (Iyr)
 Wagner constant 1st moment of square radius about z (Izr)
 Wagner constant 4th moment of area about origin (Irr)
 Wagner constant 2nd moment of warping about origin (Iwr)
 Effective shear area in local z direction
 Effective shear area in local y direction
 Radius of gyration about y axis
 Radius of gyration about z axis
 y axis extreme fibre, top
 y axis extreme fibre, bottom
 z axis extreme fibre, top
 z axis extreme fibre, bottom
 Shape code identifier
 Element type
 Reinforcement

Symbol

A
 Iyy
 Izz
 Iyz
 J
 ez0
 ey0
 ez
 ey
 Iyr
 Izr
 Irr
 Iwr
 Asz
 Asy
 ky
 kz
 yt
 yb
 zt
 zb
 Type
 elementType
 reinforcement

Value

1,0
 1000,0
 1000,0
 0,0
 1000,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 0,0
 -1
 "3D Thick Beam"
 None

Assignment to Lines:

114T119

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8. Geometric: Surface

Attribute: 1 Title: t1

Sub Type = Surface Geometric

Property

Thickness

Eccentricity in local z direction, relative to beam centroid

Symbol

t

ez

Value

t1

e1

Assignment to Surfaces:

7;8;15;22

Attribute: 2 Title: t2

Sub Type = Surface Geometric

Property

Thickness

Eccentricity in local z direction, relative to beam centroid

Symbol

t

ez

Value

0.3

0.0

Assignment to Surfaces:

3T6;9T12;16;17;19;20;23;24;27;29;32;33;36;37;40;41;44;45

Attribute: 3 Title: t3

Sub Type = Surface Geometric

Property

Thickness

Eccentricity in local z direction, relative to beam centroid

Symbol

t

ez

Value

t3

e3

Assignment to Surfaces:

13;14;21;26

Attribute: 1 Title: t1

Sub Type = Surface Function Variation

Property

Function

Symbol

function

Value

"0.3 - 0.1 * v"

Attribute: 2 Title: t3

Sub Type = Surface Function Variation

Property

Function

Symbol

function

Value

"0.2 + 0.1 * v"

Attribute: 3 Title: e1

Sub Type = Surface Function Variation

Property

Function

Symbol

function

Value

"-0.05 * v"

Attribute: 4 Title: e3

Sub Type = Surface Function Variation

Property

Function

Symbol

function

Value

"-0.05 + 0.05 * v"

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9. Isotropic material

Attribute: 1 Title: 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:

54T61;96T103;105T110;114T119;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216 ;217;220T222;224;225;240T243;257;258;274;275;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

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10. Support

Attribute: 1 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	"R"
Rotation about Y	THY	"R"
Rotation about Z	THZ	"R"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Pore pressure	pore	"F"

Assignment to Points:
154

Attribute: 2 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	"R"
Rotation about Y	THY	"R"
Rotation about Z	THZ	"R"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Pore pressure	pore	"F"

Assignment to Points:
155

Attribute: 3 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	"R"
Rotation about Y	THY	"R"
Rotation about Z	THZ	"R"
Torsional warping	Torsion	"F"
Moment about hinge	L1	"F"
Pore pressure	pore	"F"

Assignment to Points:
156

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11. Tied mesh

Attribute: 3 Title: LB1-1
Sub Type = Normal Tied Mesh Constraint
Assigned in: Analysis 1

Property	Symbol	Value
Rigid	doRigid	true

Primary
Assignment to Lines:
100T103

Secondary
Assignment to Lines:
150;151;191;192

Attribute: 5 Title: LB1-2
Sub Type = Normal Tied Mesh Constraint
Assigned in: Analysis 1

Property	Symbol	Value
Rigid	doRigid	true

Primary
Assignment to Lines:
100T103
Loadcase ID: 33 Title: LB2 - KG H2

Secondary
Assignment to Lines:
154;155;193;194

Attribute: 6 Title: LB2-1
Sub Type = Normal Tied Mesh Constraint
Assigned in: Analysis 1

Property	Symbol	Value
Rigid	doRigid	true

Primary
Assignment to Lines:
96T99

Secondary
Assignment to Lines:
164;211;212;213

Attribute: 8 Title: LB2-2
Sub Type = Normal Tied Mesh Constraint
Assigned in: Analysis 1

Property	Symbol	Value
Rigid	doRigid	true

Primary
Assignment to Lines:
96T99

Secondary
Assignment to Lines:
173;207;208;220

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12. Search Area

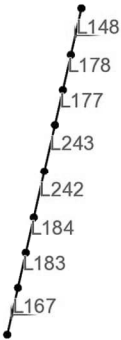
Attribute: 1 Title: Brobana
Sub Type = Search Area

Assignment to Surfaces:
3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

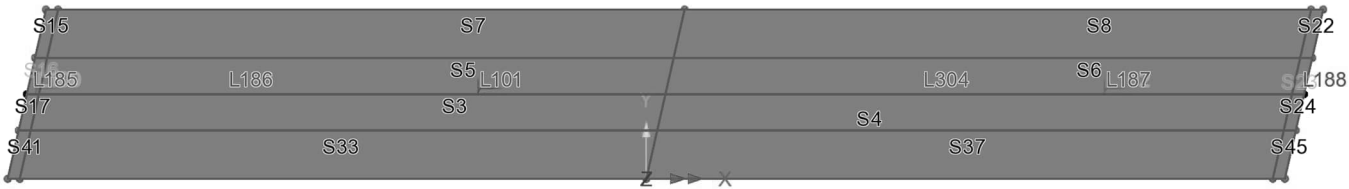
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13. Groups

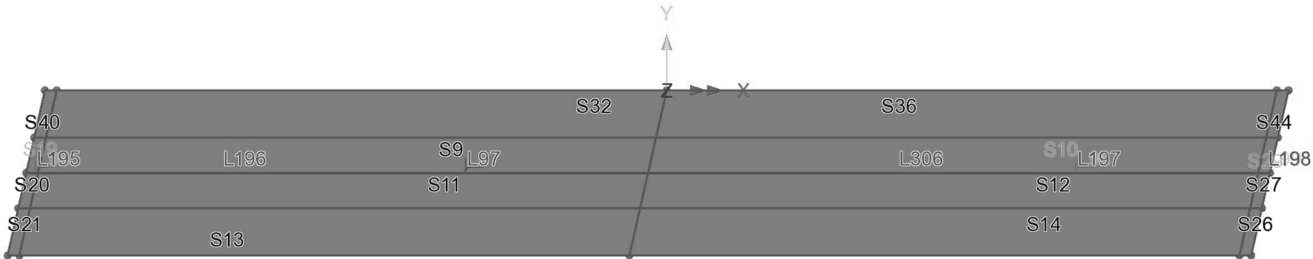
13.1 Group: Girder TVB 1-3



13.2 Group: Girder LB1



13.3 Group: Girder LB2



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14. Slice Resultants Beams/Shells

Attribute: 1 Title: TVB1

Slice path: L307

Slice locations along path: 0,1;3,5;3,7;7,2;10,7;10,9;14,3

Slice width: 1.0

Extent: Girder TVB 1-3

Moment about (Neutral Axis or Slice Path): Neutral axis

Attribute: 2 Title: TVB2

Slice path: L309

Slice locations along path: 0,1;3,6;7,1

Slice width: 1.0

Extent: Girder TVB 1-3

Moment about (Neutral Axis or Slice Path): Neutral axis

Attribute: 3 Title: LB1

Slice path: L304

Slice locations along path: 0,5;3,75;7,0;10,25;13,5;16,75;20,0;23,25;26,5

Slice width: 7.0

Extent: Girder LB1

Moment about (Neutral Axis or Slice Path): Neutral axis

Attribute: 4 Title: TVB3

Slice path: L308

Slice locations along path: 0,1;3,5;3,7;7,2;10,7;10,9;14,3

Slice width: 1.0

Extent: Girder TVB 1-3

Moment about (Neutral Axis or Slice Path): Neutral axis

Attribute: 5 Title: LB2

Slice path: L306

Slice locations along path: 0,5;3,75;7,0;10,25;13,5;16,75;20,0;23,25;26,5

Slice width: 7.0

Extent: Girder LB2

Moment about (Neutral Axis or Slice Path): Neutral axis

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15. Local coordinate system

Attribute: 1 Title: Local system

Sub Type = Local Coordinates

Property

Attribute type
Rotation angle
Origin
Origin
Origin
Type

Symbol

type
angle
originPos0
originPos1
originPos2
plane

Value

"Cartesian"
-13.0
0.0
0.0
0.0
"XY_Angle"

Assignment to Points:

154T156

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16. Global distributed

Attribute: 3 Title: BELAGG

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Area"
X Direction	WX	0.0
Y Direction	WY	0.0
Z Direction	WZ	-2.1
Keep global	keepGlobal	false

Loadcase ID: 1530 Title: BELAGG Factor = 1

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

Attribute: 5 Title: BROMS 1+

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	73.0
Y Direction	WY	0.0
Z Direction	WZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	18.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Keep global	keepGlobal	false

Loadcase ID: 1538 Title: BROMS 1+ Factor = 1

Assignment to Lines:

128;129;138;241

Attribute: 6 Title: BROMS 2+

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	73.0
Y Direction	WY	0.0
Z Direction	WZ	0.0
Moment about X axis	MX	0.0
Moment about Y axis	MY	18.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Keep global	keepGlobal	false

Loadcase ID: 1539 Title: BROMS 2+ Factor = 1

Assignment to Lines:

203T209I3;240

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Attribute: 7 Title: SIDO+

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	9.0
Z Direction	WZ	0.0
Moment about X axis	MX	-2.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Keep global	keepGlobal	false

Loadcase ID: 1540 Title: SIDO+ Factor = 1

Assignment to Lines:

238;255;270;287

Attribute: 8 Title: VIND+

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	4.0
Z Direction	WZ	0.0
Moment about X axis	MX	-2.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Keep global	keepGlobal	false

Loadcase ID: 1541 Title: VIND+ Factor = 1

Assignment to Lines:

58T61

Attribute: 9 Title: EGEN 3

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	0.0
Z Direction	WZ	-5.0
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
Keep global	keepGlobal	false

Loadcase ID: 1542 Title: EGEN 3 Factor = 1

Assignment to Lines:

54T61

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Attribute: 10 Title: VIND-

Assigned in: Analysis 1

Sub Type = Global Distributed Load

Property	Symbol	Value
Attribute type	type	"Length"
X Direction	WX	0.0
Y Direction	WY	-4.0
Z Direction	WZ	0.0
Moment about X axis	MX	2.0
Moment about Y axis	MY	0.0
Moment about Z axis	MZ	0.0
Moment about hinge nodes	Hinge	0.0
Keep global	keepGlobal	false

Loadcase ID: 1543 Title: VIND- Factor = 1

Assignment to Lines:

54T57

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17. Body load

Attribute: 1 Title: EGEN 1

Assigned in: Analysis 1

Sub Type = Body Force Load

Property

	Symbol	Value
Linear acceleration in X	AccX	0.0
Linear acceleration in Y	AccY	0.0
Linear acceleration in Z	AccZ	-10.0
Angular velocity about X axis	AngVelX	0.0
Angular velocity about Y axis	AngVelY	0.0
Angular velocity about Z axis	AngVelZ	0.0
Angular acceleration about X axis	AngAccX	0.0
Angular acceleration about Y axis	AngAccY	0.0
Angular acceleration about Z axis	AngAccZ	0.0
Linear acceleration In X fluid phase	lnFlAccX	0.0
Linear acceleration In Y fluid phase	lnFlAccY	0.0
Linear acceleration In Z fluid phase	lnFlAccZ	-10.0

Loadcase ID: 1 Title: EGEN 1 Factor = 1

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

Attribute: 2 Title: EGEN 2

Assigned in: Analysis 1

Sub Type = Body Force Load

Property

	Symbol	Value
Linear acceleration in X	AccX	0.0
Linear acceleration in Y	AccY	0.0
Linear acceleration in Z	AccZ	-10.0
Angular velocity about X axis	AngVelX	0.0
Angular velocity about Y axis	AngVelY	0.0
Angular velocity about Z axis	AngVelZ	0.0
Angular acceleration about X axis	AngAccX	0.0
Angular acceleration about Y axis	AngAccY	0.0
Angular acceleration about Z axis	AngAccZ	0.0
Linear acceleration In X fluid phase	lnFlAccX	0.0
Linear acceleration In Y fluid phase	lnFlAccY	0.0
Linear acceleration In Z fluid phase	lnFlAccZ	-10.0

Loadcase ID: 1529 Title: EGEN 2 Factor = 1

Assignment to Lines:

96T103;138;148;167;177;178;183;184;189;190;203;209;214;216;221;222;240;241T243;257;258

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18. Prescribed load

Attribute: 190 Title: STOD 1Z

Assigned in: Analysis 1

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	-0.010
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: 1531 Title: STOD 1Z Factor = 1

Assignment to Points:

154

Attribute: 191 Title: STOD 2Z

Assigned in: Analysis 1

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	-0.010
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: 1532 Title: STOD 2Z Factor = 1

Assignment to Points:

155

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Attribute: 192 Title: STOD 3Z

Assigned in: Analysis 1

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	-0.010
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: 1533 Title: STOD 3Z Factor = 1

Assignment to Points:

156

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19. Temperature and shrinkage load

Attribute: 11 Title: JTEMP+

Assigned in: Analysis 1

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: 1544 Title: JTEMP+ Factor = 1

Assignment to Lines:

54T61;96T103;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216;217;220T222;224;
225;238;240;241T243;255;257;258;270;274;275;287;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

Attribute: 12 Title: JTEMP-

Assigned in: Analysis 1

Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"element"
Final temperature	T	-42.0
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: 1545 Title: JTEMP- (Factor = 1

Assignment to Lines:

54T61;96T103;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216;217;220T222;224;
225;238;240;241T243;255;257;258;270;274;275;287;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

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Attribute: 13 Title: OJTEMP+

Assigned in: Analysis 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	8.0
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: 1546 Title: OTEMP+ Factor = 1

Assignment to Lines:

54T61;96T103;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216;217;220T222;224;
225;238;240;241T243;255;257;258;270;274;275;287;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

Attribute: 14 Title: OJTEMP-

Assigned in: Analysis 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	-6.0
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: 1547 Title: OTEMP- Factor = 1

Assignment to Lines:

54T61;96T103;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216;217;220T222;224;
225;238;240;241T243;255;257;258;270;274;275;287;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

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Attribute: 4 Title: KRYMP

Assigned in: Analysis 1

Sub Type = Temperature Load

Property	Symbol	Value
Attribute type	type	"nodal"
Final temperature	T	-23.0
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: 1537 Title: KRYMP Factor = 1

Assignment to Lines:

54T61;96T103;128T130;132;133;138;142;148;150;151;154;155;164;167;169;173;177;178T198;203;206;207T209;211T214;216;217;220T222;224;
225;238;240;241T243;255;257;258;270;274;275;287;289;290

Assignment to Surfaces:

3T17;19T24;26;27;29;32;33;36;37;40;41;44;45

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20. Prestress

20.1 Tendon properties

Attribute: 1 Title:VSL 6-15

General

	Value	Units
Design code	EN1992-1-1:2004 Eurocode 2	-
Initial tendon force	3150,0	kN
Tendon area	2250,0	mm ²
Modulus of elasticity for tendon	195000000,0	kN/m ²
Concrete stress at transfer	10000,0	kN/m ²

Instantaneous losses

	Value	Units
Modulus of elasticity of concrete at transfer	32000000,0	kN/m ²
Unintentional angular displacement	0.005	rad/m
Duct friction coefficient	0.180	-

Long term losses

	Value	Units
Include	No	

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20.2 Tendon profile

Attribute: 1 Title: KG-H

Tendon profile

Coordinates (Local mapped to lines or Global):

Minumum radius:

Smoothing (yes or no):

Value

Local mapped to lines

40

Yes

Units

-

m

-

Point	Type	x(m)	y (m)	z (m)
1	Start	0	-0,720	0,55
2	Straight	0,50	-0,720	0,55
3	Spline	8,50	-0,720	-0,45
4	Spline continued	12,5	-0,720	-0,65
5	Spline continued	18,5	-0,720	-0,15
6	Spline continued	22,5	-0,720	0,350
7	Spline continued	26,5	-0,720	0,60
8	Spline continued	30,5	-0,720	0,35
9	Spline continued	34,5	-0,720	-0,15
10	Spline continued	40,5	-0,720	-0,65
11	Spline continued	44,5	-0,720	-0,45
12	Straight	52,5	-0,720	0,55
13	Straight	53,0	-0,720	0,55

Attribute: 2 Title: KG-V

Tendon profile

Coordinates (Local mapped to lines or Global):

Minumum radius:

Smoothing (yes or no):

Value

Local mapped to lines

40

Yes

Units

-

m

-

Point	Type	x(m)	y (m)	z (m)
1	Start	0	0,720	0,55
2	Straight	0,50	0,720	0,55
3	Spline	8,50	0,720	-0,45
4	Spline continued	12,5	0,720	-0,65
5	Spline continued	18,5	0,720	-0,15
6	Spline continued	22,5	0,720	0,350
7	Spline continued	26,5	0,720	0,60
8	Spline continued	30,5	0,720	0,35
9	Spline continued	34,5	0,720	-0,15
10	Spline continued	40,5	0,720	-0,65
11	Spline continued	44,5	0,720	-0,45
12	Straight	52,5	0,720	0,55
13	Straight	53,0	0,720	0,55

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Attribute: 3 Title: KG-CV

Tendon profile

Coordinates (Local mapped to lines or Global):

Minumum radius:

Smothing (yes or no):

Value

Local mapped to lines

40

Yes

Units

-

m

-

Point	Type	x(m)	y (m)	z (m)
1	Start	0	0,240	0,55
2	Straight	0,50	0,240	0,55
3	Spline	8,50	0,240	-0,45
4	Spline continued	12,5	0,240	-0,65
5	Spline continued	18,5	0,240	-0,15
6	Spline continued	22,5	0,240	0,350
7	Spline continued	26,5	0,240	0,60
8	Spline continued	30,5	0,240	0,35
9	Spline continued	34,5	0,240	-0,15
10	Spline continued	40,5	0,240	-0,65
11	Spline continued	44,5	0,240	-0,45
12	Straight	52,5	0,240	0,55
13	Straight	53,0	0,240	0,55

Attribute: 4 Title: KG-CH

Tendon profile

Coordinates (Local mapped to lines or Global):

Minumum radius:

Smothing (yes or no):

Value

Local mapped to lines

40

Yes

Units

-

m

-

Point	Type	x(m)	y (m)	z (m)
1	Start	0	-0,240	0,55
2	Straight	0,50	-0,240	0,55
3	Spline	8,50	-0,240	-0,45
4	Spline continued	12,5	-0,240	-0,65
5	Spline continued	18,5	-0,240	-0,15
6	Spline continued	22,5	-0,240	0,350
7	Spline continued	26,5	-0,240	0,60
8	Spline continued	30,5	-0,240	0,35
9	Spline continued	34,5	-0,240	-0,15
10	Spline continued	40,5	-0,240	-0,65
11	Spline continued	44,5	-0,240	-0,45
12	Straight	52,5	-0,240	0,55
13	Straight	53,0	-0,240	0,55

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20.3 LB1 – KG V1

Attribute: 1 Title: LB1 KG V1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-V

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG V1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	4,2	1,3	0	0	0,7	0,6
-25,2	4,2	1,3	0,5	8	0,7	0,6
-22,8	4,2	1	3	0,5	0,7	0,2
-20,3	4,2	0,6	5,4	1,1	0,7	-0,1
-17,9	4,2	0,4	7,9	1,7	0,7	-0,4
-15,4	4,2	0,2	10,4	2,2	0,7	-0,6
-14,2	4,2	0,1	11,6	2,2	0,7	-0,6
-12,9	4,2	0,1	12,9	2,4	0,7	-0,6
-11,7	4,2	0,1	14,1	2	0,7	-0,6
-10,5	4,2	0,2	15,3	2,1	0,7	-0,5
-8,0	4,2	0,5	17,8	1,2	0,7	-0,3
-5,5	4,2	0,8	20,3	0,5	0,7	0,1
-3,1	4,2	1,1	22,7	2,2	0,7	0,4
-0,6	4,2	1,3	25,2	3	0,7	0,6
0,6	4,2	1,3	26,4	2,6	0,7	0,6
1,8	4,2	1,3	27,7	2,3	0,7	0,6
3,1	4,2	1,3	28,9	1,8	0,7	0,5
4,3	4,2	1,2	30,1	1,6	0,7	0,4
6,8	4,2	0,9	32,6	0,8	0,7	0,1
9,2	4,2	0,5	35,1	0,9	0,7	-0,2
11,7	4,2	0,3	37,6	1,9	0,7	-0,5
12,9	4,2	0,2	38,8	2	0,7	-0,6
14,1	4,2	0,1	40	2,4	0,7	-0,6
15,4	4,2	0,1	41,3	2,3	0,7	-0,6
16,6	4,2	0,1	42,5	1,8	0,7	-0,6
18,8	4,2	0,3	44,7	3,2	0,7	-0,5
20,8	4,2	0,6	46,7	0	0,7	-0,2
22,8	4,2	0,8	48,7	0	0,7	0,1
24,8	4,2	1,1	50,8	0	0,7	0,3
26,8	4,2	1,3	52,8	7,1	0,7	0,6

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Prestress Losses - LB 1 KG V1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

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20.4 LB1 – KG V2

Attribute: 2 Title: LB1 KG V2

Assigned in: Analysis 1

Genera	Value	Units
Tendon property	VSL 6-15	-
Tendon profile:	KG-V	-
Prestress force:	3320	kN
Jacking slip at end 1	No	-
Jacking slip at end 2	Yes	-
Slip at end 2	0,006	m
Jack angle at end 1	0,0	deg
Offset from start	0	m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG V2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	4,2	1,3	0	0	0,7	0,6
-25,2	4,2	1,3	0,5	8	0,7	0,6
-22,8	4,2	1,0	3	0,5	0,7	0,2
-20,3	4,2	0,6	5,4	1,1	0,7	-0,1
-17,9	4,2	0,4	7,9	1,7	0,7	-0,4
-15,4	4,2	0,2	10,4	2,2	0,7	-0,6
-14,2	4,2	0,1	11,6	2,2	0,7	-0,6
-12,9	4,2	0,1	12,9	2,4	0,7	-0,6
-11,7	4,2	0,1	14,1	2	0,7	-0,6
-10,5	4,2	0,2	15,3	2,1	0,7	-0,5
-8,0	4,2	0,5	17,8	1,2	0,7	-0,3
-5,5	4,2	0,8	20,3	0,5	0,7	0,1
-3,1	4,2	1,1	22,7	2,2	0,7	0,4
-0,6	4,2	1,3	25,2	3	0,7	0,6
0,6	4,2	1,3	26,4	2,6	0,7	0,6
1,8	4,2	1,3	27,7	2,3	0,7	0,6
3,1	4,2	1,3	28,9	1,8	0,7	0,5
4,3	4,2	1,2	30,1	1,6	0,7	0,4
6,8	4,2	0,9	32,6	0,8	0,7	0,1
9,2	4,2	0,5	35,1	0,9	0,7	-0,2
11,7	4,2	0,3	37,6	1,9	0,7	-0,5
12,9	4,2	0,2	38,8	2	0,7	-0,6
14,1	4,2	0,1	40	2,4	0,7	-0,6
15,4	4,2	0,1	41,3	2,3	0,7	-0,6
16,6	4,2	0,1	42,5	1,8	0,7	-0,6
18,8	4,2	0,3	44,7	3,2	0,7	-0,5
20,8	4,2	0,6	46,7	0	0,7	-0,2
22,8	4,2	0,8	48,7	0	0,7	0,1
24,8	4,2	1,1	50,8	0	0,7	0,3
26,8	4,2	1,3	52,8	7,1	0,7	0,6

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Prestress Losses - LB 1 KG V2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

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20.5 LB1 – KG CV1

Attribute: 3 Title: LB1 KG CV1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-CV

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG CV1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	3,7	1,3	0,0	0	0,2	0,6
-25,2	3,7	1,3	0,5	8	0,2	0,6
-22,8	3,7	1,0	3,0	0,5	0,2	0,2
-20,3	3,7	0,6	5,4	1,1	0,2	-0,1
-17,9	3,7	0,4	7,9	1,7	0,2	-0,4
-15,4	3,7	0,2	10,4	2,2	0,2	-0,6
-14,2	3,7	0,1	11,6	2,2	0,2	-0,6
-12,9	3,7	0,1	12,9	2,4	0,2	-0,6
-11,7	3,7	0,1	14,1	2	0,2	-0,6
-10,5	3,7	0,2	15,3	2,1	0,2	-0,5
-8,0	3,7	0,5	17,8	1,2	0,2	-0,3
-5,5	3,7	0,8	20,3	0,5	0,2	0,1
-3,1	3,7	1,1	22,7	2,2	0,2	0,4
-0,6	3,7	1,3	25,2	3	0,2	0,6
0,6	3,7	1,3	26,4	2,6	0,2	0,6
1,8	3,7	1,3	27,7	2,3	0,2	0,6
3,1	3,7	1,3	28,9	1,8	0,2	0,5
4,3	3,7	1,2	30,1	1,6	0,2	0,4
6,8	3,7	0,9	32,6	0,8	0,2	0,1
9,2	3,7	0,5	35,1	0,9	0,2	-0,2
11,7	3,7	0,3	37,6	1,9	0,2	-0,5
12,9	3,7	0,2	38,8	2	0,2	-0,6
14,1	3,7	0,1	40,0	2,4	0,2	-0,6
15,4	3,7	0,1	41,3	2,3	0,2	-0,6
16,6	3,7	0,1	42,5	1,8	0,2	-0,6
18,8	3,7	0,3	44,7	3,2	0,2	-0,5
20,8	3,7	0,6	46,7	0	0,2	-0,2
22,8	3,7	0,8	48,7	0	0,2	0,1
24,8	3,7	1,1	50,8	0	0,2	0,3
26,8	3,7	1,3	52,8	7,1	0,2	0,6

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Prestress Losses - LB 1 KG CV1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

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20.6 LB1 – KG CV2

Attribute: 4 Title: LB1 KG CV2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-CV

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG CV2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	3,7	1,3	0,0	0	0,2	0,6
-25,2	3,7	1,3	0,5	8	0,2	0,6
-22,8	3,7	1,0	3,0	0,5	0,2	0,2
-20,3	3,7	0,6	5,4	1,1	0,2	-0,1
-17,9	3,7	0,4	7,9	1,7	0,2	-0,4
-15,4	3,7	0,2	10,4	2,2	0,2	-0,6
-14,2	3,7	0,1	11,6	2,2	0,2	-0,6
-12,9	3,7	0,1	12,9	2,4	0,2	-0,6
-11,7	3,7	0,1	14,1	2	0,2	-0,6
-10,5	3,7	0,2	15,3	2,1	0,2	-0,5
-8,0	3,7	0,5	17,8	1,2	0,2	-0,3
-5,5	3,7	0,8	20,3	0,5	0,2	0,1
-3,1	3,7	1,1	22,7	2,2	0,2	0,4
-0,6	3,7	1,3	25,2	3	0,2	0,6
0,6	3,7	1,3	26,4	2,6	0,2	0,6
1,8	3,7	1,3	27,7	2,3	0,2	0,6
3,1	3,7	1,3	28,9	1,8	0,2	0,5
4,3	3,7	1,2	30,1	1,6	0,2	0,4
6,8	3,7	0,9	32,6	0,8	0,2	0,1
9,2	3,7	0,5	35,1	0,9	0,2	-0,2
11,7	3,7	0,3	37,6	1,9	0,2	-0,5
12,9	3,7	0,2	38,8	2	0,2	-0,6
14,1	3,7	0,1	40,0	2,4	0,2	-0,6
15,4	3,7	0,1	41,3	2,3	0,2	-0,6
16,6	3,7	0,1	42,5	1,8	0,2	-0,6
18,8	3,7	0,3	44,7	3,2	0,2	-0,5
20,8	3,7	0,6	46,7	0	0,2	-0,2
22,8	3,7	0,8	48,7	0	0,2	0,1
24,8	3,7	1,1	50,8	0	0,2	0,3
26,8	3,7	1,3	52,8	7,1	0,2	0,6

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Prestress Losses - LB 1 KG CV2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

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20.7

LB1 – KG CH1

Attribute: 5 Title: LB1 KG-CH1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-CH

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG CH1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	3,3	1,3	0,0	0	-0,2	0,6
-25,2	3,3	1,3	0,5	8	-0,2	0,6
-22,8	3,3	1,0	3,0	0,5	-0,2	0,2
-20,3	3,3	0,6	5,4	1,1	-0,2	-0,1
-17,9	3,3	0,4	7,9	1,7	-0,2	-0,4
-15,4	3,3	0,2	10,4	2,2	-0,2	-0,6
-14,2	3,3	0,1	11,6	2,2	-0,2	-0,6
-12,9	3,3	0,1	12,9	2,4	-0,2	-0,6
-11,7	3,3	0,1	14,1	2	-0,2	-0,6
-10,5	3,3	0,2	15,3	2,1	-0,2	-0,5
-8,0	3,3	0,5	17,8	1,2	-0,2	-0,3
-5,5	3,3	0,8	20,3	0,5	-0,2	0,1
-3,1	3,3	1,1	22,7	2,2	-0,2	0,4
-0,6	3,3	1,3	25,2	3	-0,2	0,6
0,6	3,3	1,3	26,4	2,6	-0,2	0,6
1,8	3,3	1,3	27,7	2,3	-0,2	0,6
3,1	3,3	1,3	28,9	1,8	-0,2	0,5
4,3	3,3	1,2	30,1	1,6	-0,2	0,4
6,8	3,3	0,9	32,6	0,8	-0,2	0,1
9,2	3,3	0,5	35,1	0,9	-0,2	-0,2
11,7	3,3	0,3	37,6	1,9	-0,2	-0,5
12,9	3,3	0,2	38,8	2	-0,2	-0,6
14,1	3,3	0,1	40,0	2,4	-0,2	-0,6
15,4	3,3	0,1	41,3	2,3	-0,2	-0,6
16,6	3,3	0,1	42,5	1,8	-0,2	-0,6
18,8	3,3	0,3	44,7	3,2	-0,2	-0,5
20,8	3,3	0,6	46,7	0	-0,2	-0,2
22,8	3,3	0,8	48,7	0	-0,2	0,1
24,8	3,3	1,1	50,8	0	-0,2	0,3
26,8	3,3	1,3	52,8	7,1	-0,2	0,6
27,3	3,3	1,3	53,3	0	-0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 42
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Prestress Losses - LB 1 KG CH1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 43
	Pretensioned double girder bridge	Date :	Created :

20.8

LB1 – KG CH2

Attribute: 6 Title: LB1 KG-CH2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-CH

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG CH2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	3,3	1,3	0	0	-0,2	0,6
-25,2	3,3	1,3	0,5	8	-0,2	0,6
-22,8	3,3	1	3	0,5	-0,2	0,2
-20,3	3,3	0,6	5,4	1,1	-0,2	-0,1
-17,9	3,3	0,4	7,9	1,7	-0,2	-0,4
-15,4	3,3	0,2	10,4	2,2	-0,2	-0,6
-14,2	3,3	0,1	11,6	2,2	-0,2	-0,6
-12,9	3,3	0,1	12,9	2,4	-0,2	-0,6
-11,7	3,3	0,1	14,1	2	-0,2	-0,6
-10,5	3,3	0,2	15,3	2,1	-0,2	-0,5
-8,0	3,3	0,5	17,8	1,2	-0,2	-0,3
-5,5	3,3	0,8	20,3	0,5	-0,2	0,1
-3,1	3,3	1,1	22,7	2,2	-0,2	0,4
-0,6	3,3	1,3	25,2	3	-0,2	0,6
0,6	3,3	1,3	26,4	2,6	-0,2	0,6
1,8	3,3	1,3	27,7	2,3	-0,2	0,6
3,1	3,3	1,3	28,9	1,8	-0,2	0,5
4,3	3,3	1,2	30,1	1,6	-0,2	0,4
6,8	3,3	0,9	32,6	0,8	-0,2	0,1
9,2	3,3	0,5	35,1	0,9	-0,2	-0,2
11,7	3,3	0,3	37,6	1,9	-0,2	-0,5
12,9	3,3	0,2	38,8	2	-0,2	-0,6
14,1	3,3	0,1	40	2,4	-0,2	-0,6
15,4	3,3	0,1	41,3	2,3	-0,2	-0,6
16,6	3,3	0,1	42,5	1,8	-0,2	-0,6
18,8	3,3	0,3	44,7	3,2	-0,2	-0,5
20,8	3,3	0,6	46,7	0	-0,2	-0,2
22,8	3,3	0,8	48,7	0	-0,2	0,1
24,8	3,3	1,1	50,8	0	-0,2	0,3
26,8	3,3	1,3	52,8	7,1	-0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 44
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Prestress Losses - LB 1 KG CH2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 45
	Pretensioned double girder bridge	Date :	Created :

20.9

LB1 – KG H1

Attribute: 7 Title: LB1 KG-H1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-H

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG H1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	2,8	1,3	0	0	-0,7	0,6
-25,2	2,8	1,3	0,5	8	-0,7	0,6
-22,8	2,8	1	3	0,5	-0,7	0,2
-20,3	2,8	0,6	5,4	1,1	-0,7	-0,1
-17,9	2,8	0,4	7,9	1,7	-0,7	-0,4
-15,4	2,8	0,2	10,4	2,2	-0,7	-0,6
-14,2	2,8	0,1	11,6	2,2	-0,7	-0,6
-12,9	2,8	0,1	12,9	2,4	-0,7	-0,6
-11,7	2,8	0,1	14,1	2	-0,7	-0,6
-10,5	2,8	0,2	15,3	2,1	-0,7	-0,5
-8,0	2,8	0,5	17,8	1,2	-0,7	-0,3
-5,5	2,8	0,8	20,3	0,5	-0,7	0,1
-3,1	2,8	1,1	22,7	2,2	-0,7	0,4
-0,6	2,8	1,3	25,2	3	-0,7	0,6
0,6	2,8	1,3	26,4	2,6	-0,7	0,6
1,8	2,8	1,3	27,7	2,3	-0,7	0,6
3,1	2,8	1,3	28,9	1,8	-0,7	0,5
4,3	2,8	1,2	30,1	1,6	-0,7	0,4
6,8	2,8	0,9	32,6	0,8	-0,7	0,1
9,2	2,8	0,5	35,1	0,9	-0,7	-0,2
11,7	2,8	0,3	37,6	1,9	-0,7	-0,5
12,9	2,8	0,2	38,8	2	-0,7	-0,6
14,1	2,8	0,1	40	2,4	-0,7	-0,6
15,4	2,8	0,1	41,3	2,3	-0,7	-0,6
16,6	2,8	0,1	42,5	1,8	-0,7	-0,6
18,8	2,8	0,3	44,7	3,2	-0,7	-0,5
20,8	2,8	0,6	46,7	0	-0,7	-0,2
22,8	2,8	0,8	48,7	0	-0,7	0,1
24,8	2,8	1,1	50,8	0	-0,7	0,3
26,8	2,8	1,3	52,8	7,1	-0,7	0,6
27,3	2,8	1,3	53,3	0	-0,7	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 46
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Prestress Losses - LB 1 KG H1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 47
	Pretensioned double girder bridge	Date :	Created :

20.10 LB1 – KG H2

Attribute: 8 Title: LB1 KG H2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-H

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

100, 101,102,103

Tendon profile (sampling points) – LB1 KG H2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-25,7	2,8	1,3	0,0	0	-0,7	0,6
-25,2	2,8	1,3	0,5	8	-0,7	0,6
-22,8	2,8	1,0	3,0	0,5	-0,7	0,2
-20,3	2,8	0,6	5,4	1,1	-0,7	-0,1
-17,9	2,8	0,4	7,9	1,7	-0,7	-0,4
-15,4	2,8	0,2	10,4	2,2	-0,7	-0,6
-14,2	2,8	0,1	11,6	2,2	-0,7	-0,6
-12,9	2,8	0,1	12,9	2,4	-0,7	-0,6
-11,7	2,8	0,1	14,1	2	-0,7	-0,6
-10,5	2,8	0,2	15,3	2,1	-0,7	-0,5
-8,0	2,8	0,5	17,8	1,2	-0,7	-0,3
-5,5	2,8	0,8	20,3	0,5	-0,7	0,1
-3,1	2,8	1,1	22,7	2,2	-0,7	0,4
-0,6	2,8	1,3	25,2	3	-0,7	0,6
0,6	2,8	1,3	26,4	2,6	-0,7	0,6
1,8	2,8	1,3	27,7	2,3	-0,7	0,6
3,1	2,8	1,3	28,9	1,8	-0,7	0,5
4,3	2,8	1,2	30,1	1,6	-0,7	0,4
6,8	2,8	0,9	32,6	0,8	-0,7	0,1
9,2	2,8	0,5	35,1	0,9	-0,7	-0,2
11,7	2,8	0,3	37,6	1,9	-0,7	-0,5
12,9	2,8	0,2	38,8	2	-0,7	-0,6
14,1	2,8	0,1	40,0	2,4	-0,7	-0,6
15,4	2,8	0,1	41,3	2,3	-0,7	-0,6
16,6	2,8	0,1	42,5	1,8	-0,7	-0,6
18,8	2,8	0,3	44,7	3,2	-0,7	-0,5
20,8	2,8	0,6	46,7	0	-0,7	-0,2
22,8	2,8	0,8	48,7	0	-0,7	0,1
24,8	2,8	1,1	50,8	0	-0,7	0,3
26,8	2,8	1,3	52,8	7,1	-0,7	0,6
27,3	2,8	1,3	53,3	0	-0,7	0,6

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 48
	Pretensioned double girder bridge	Date :	Created :

Prestress Losses - LB 1 KG H2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697,3	0	0	2622,7
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 49
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20.11 LB2 – KG V1

Attribute: 9 Title: LB2 KG V1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-V

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG V1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-2,8	1,3	0,0	0	0,7	0,6
-26,8	-2,8	1,3	0,5	8	0,7	0,6
-24,3	-2,8	1,0	3,0	0,5	0,7	0,2
-21,9	-2,8	0,6	5,4	1,1	0,7	-0,1
-19,4	-2,8	0,4	7,9	1,7	0,7	-0,4
-17,0	-2,8	0,2	10,4	2,2	0,7	-0,6
-15,7	-2,8	0,1	11,6	2,2	0,7	-0,6
-14,5	-2,8	0,1	12,9	2,4	0,7	-0,6
-13,3	-2,8	0,1	14,1	2	0,7	-0,6
-12,0	-2,8	0,2	15,3	2,1	0,7	-0,5
-9,6	-2,8	0,5	17,8	1,2	0,7	-0,3
-7,1	-2,8	0,8	20,3	0,5	0,7	0,1
-4,7	-2,8	1,1	22,7	2,2	0,7	0,4
-2,2	-2,8	1,3	25,2	3	0,7	0,6
-1,0	-2,8	1,3	26,4	2,6	0,7	0,6
0,2	-2,8	1,3	27,7	2,3	0,7	0,6
1,5	-2,8	1,3	28,9	1,8	0,7	0,5
2,7	-2,8	1,2	30,1	1,6	0,7	0,4
5,2	-2,8	0,9	32,6	0,8	0,7	0,1
7,6	-2,8	0,5	35,1	0,9	0,7	-0,2
10,1	-2,8	0,3	37,6	1,9	0,7	-0,5
11,3	-2,8	0,2	38,8	2	0,7	-0,6
12,5	-2,8	0,1	40,0	2,4	0,7	-0,6
13,8	-2,8	0,1	41,3	2,3	0,7	-0,6
15,0	-2,8	0,1	42,5	1,8	0,7	-0,6
17,2	-2,8	0,3	44,7	3,2	0,7	-0,5
19,2	-2,8	0,6	46,7	0	0,7	-0,2
21,2	-2,8	0,8	48,7	0	0,7	0,1
23,2	-2,8	1,1	50,8	0	0,7	0,3
25,2	-2,8	1,3	52,8	7,1	0,7	0,6
25,7	-2,8	1,3	53,3	0	0,7	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 50
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Prestress Losses - LB 2 KG V1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 51
	Pretensioned double girder bridge	Date :	Created :

20.12 LB2 – KG V2

Attribute: 10 Title: LB2 KG V2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-V

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG V2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-2,8	1,3	0,0	0	0,7	0,6
-26,8	-2,8	1,3	0,5	8	0,7	0,6
-24,3	-2,8	1,0	3,0	0,5	0,7	0,2
-21,9	-2,8	0,6	5,4	1,1	0,7	-0,1
-19,4	-2,8	0,4	7,9	1,7	0,7	-0,4
-17,0	-2,8	0,2	10,4	2,2	0,7	-0,6
-15,7	-2,8	0,1	11,6	2,2	0,7	-0,6
-14,5	-2,8	0,1	12,9	2,4	0,7	-0,6
-13,3	-2,8	0,1	14,1	2	0,7	-0,6
-12,0	-2,8	0,2	15,3	2,1	0,7	-0,5
-9,6	-2,8	0,5	17,8	1,2	0,7	-0,3
-7,1	-2,8	0,8	20,3	0,5	0,7	0,1
-4,7	-2,8	1,1	22,7	2,2	0,7	0,4
-2,2	-2,8	1,3	25,2	3	0,7	0,6
-1,0	-2,8	1,3	26,4	2,6	0,7	0,6
0,2	-2,8	1,3	27,7	2,3	0,7	0,6
1,5	-2,8	1,3	28,9	1,8	0,7	0,5
2,7	-2,8	1,2	30,1	1,6	0,7	0,4
5,2	-2,8	0,9	32,6	0,8	0,7	0,1
7,6	-2,8	0,5	35,1	0,9	0,7	-0,2
10,1	-2,8	0,3	37,6	1,9	0,7	-0,5
11,3	-2,8	0,2	38,8	2	0,7	-0,6
12,5	-2,8	0,1	40,0	2,4	0,7	-0,6
13,8	-2,8	0,1	41,3	2,3	0,7	-0,6
15,0	-2,8	0,1	42,5	1,8	0,7	-0,6
17,2	-2,8	0,3	44,7	3,2	0,7	-0,5
19,2	-2,8	0,6	46,7	0	0,7	-0,2
21,2	-2,8	0,8	48,7	0	0,7	0,1
23,2	-2,8	1,1	50,8	0	0,7	0,3
25,2	-2,8	1,3	52,8	7,1	0,7	0,6
25,7	-2,8	1,3	53,3	0	0,7	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 52
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Prestress Losses – LB2 KG V2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 53
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20.13

LB2 – KG CV1

Attribute: 11 Title: LB2 KG CV1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-CV

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG CV1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-3,3	1,3	0	0	0,2	0,6
-26,8	-3,3	1,3	0,5	8	0,2	0,6
-24,3	-3,3	1	3	0,5	0,2	0,2
-21,9	-3,3	0,6	5,4	1,1	0,2	-0,1
-19,4	-3,3	0,4	7,9	1,7	0,2	-0,4
-17,0	-3,3	0,2	10,4	2,2	0,2	-0,6
-15,7	-3,3	0,1	11,6	2,2	0,2	-0,6
-14,5	-3,3	0,1	12,9	2,4	0,2	-0,6
-13,3	-3,3	0,1	14,1	2	0,2	-0,6
-12,0	-3,3	0,2	15,3	2,1	0,2	-0,5
-9,6	-3,3	0,5	17,8	1,2	0,2	-0,3
-7,1	-3,3	0,8	20,3	0,5	0,2	0,1
-4,7	-3,3	1,1	22,7	2,2	0,2	0,4
-2,2	-3,3	1,3	25,2	3	0,2	0,6
-1,0	-3,3	1,3	26,4	2,6	0,2	0,6
0,2	-3,3	1,3	27,7	2,3	0,2	0,6
1,5	-3,3	1,3	28,9	1,8	0,2	0,5
2,7	-3,3	1,2	30,1	1,6	0,2	0,4
5,2	-3,3	0,9	32,6	0,8	0,2	0,1
7,6	-3,3	0,5	35,1	0,9	0,2	-0,2
10,1	-3,3	0,3	37,6	1,9	0,2	-0,5
11,3	-3,3	0,2	38,8	2	0,2	-0,6
12,5	-3,3	0,1	40	2,4	0,2	-0,6
13,8	-3,3	0,1	41,3	2,3	0,2	-0,6
15	-3,3	0,1	42,5	1,8	0,2	-0,6
17,2	-3,3	0,3	44,7	3,2	0,2	-0,5
19,2	-3,3	0,6	46,7	0	0,2	-0,2
21,2	-3,3	0,8	48,7	0	0,2	0,1
23,2	-3,3	1,1	50,8	0	0,2	0,3
25,2	-3,3	1,3	52,8	7,1	0,2	0,6
25,7	-3,3	1,3	53,3	0	0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 54
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Prestress Losses – LB2 KG CV1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 55
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20.14 LB2 – KG CV2

Attribute: 12 Title: LB2 KG CV2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-CV

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG CV2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-3,3	1,3	0	0	0,2	0,6
-26,8	-3,3	1,3	0,5	8	0,2	0,6
-24,3	-3,3	1	3	0,5	0,2	0,2
-21,9	-3,3	0,6	5,4	1,1	0,2	-0,1
-19,4	-3,3	0,4	7,9	1,7	0,2	-0,4
-17,0	-3,3	0,2	10,4	2,2	0,2	-0,6
-15,7	-3,3	0,1	11,6	2,2	0,2	-0,6
-14,5	-3,3	0,1	12,9	2,4	0,2	-0,6
-13,3	-3,3	0,1	14,1	2	0,2	-0,6
-12,0	-3,3	0,2	15,3	2,1	0,2	-0,5
-9,6	-3,3	0,5	17,8	1,2	0,2	-0,3
-7,1	-3,3	0,8	20,3	0,5	0,2	0,1
-4,7	-3,3	1,1	22,7	2,2	0,2	0,4
-2,2	-3,3	1,3	25,2	3	0,2	0,6
-1,0	-3,3	1,3	26,4	2,6	0,2	0,6
0,2	-3,3	1,3	27,7	2,3	0,2	0,6
1,5	-3,3	1,3	28,9	1,8	0,2	0,5
2,7	-3,3	1,2	30,1	1,6	0,2	0,4
5,2	-3,3	0,9	32,6	0,8	0,2	0,1
7,6	-3,3	0,5	35,1	0,9	0,2	-0,2
10,1	-3,3	0,3	37,6	1,9	0,2	-0,5
11,3	-3,3	0,2	38,8	2	0,2	-0,6
12,5	-3,3	0,1	40	2,4	0,2	-0,6
13,8	-3,3	0,1	41,3	2,3	0,2	-0,6
15	-3,3	0,1	42,5	1,8	0,2	-0,6
17,2	-3,3	0,3	44,7	3,2	0,2	-0,5
19,2	-3,3	0,6	46,7	0	0,2	-0,2
21,2	-3,3	0,8	48,7	0	0,2	0,1
23,2	-3,3	1,1	50,8	0	0,2	0,3
25,2	-3,3	1,3	52,8	7,1	0,2	0,6
25,7	-3,3	1,3	53,3	0	0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 56
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Prestress Losses – LB2 KG CV2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

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20.1 LB2 – KG CH1

Attribute: 13 Title: LB2 KG-CH1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-CH

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG CH1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-3,7	1,3	0	0	-0,2	0,6
-26,8	-3,7	1,3	0,5	8	-0,2	0,6
-24,3	-3,7	1	3	0,5	-0,2	0,2
-21,9	-3,7	0,6	5,4	1,1	-0,2	-0,1
-19,4	-3,7	0,4	7,9	1,7	-0,2	-0,4
-17,0	-3,7	0,2	10,4	2,2	-0,2	-0,6
-15,7	-3,7	0,1	11,6	2,2	-0,2	-0,6
-14,5	-3,7	0,1	12,9	2,4	-0,2	-0,6
-13,3	-3,7	0,1	14,1	2	-0,2	-0,6
-12,0	-3,7	0,2	15,3	2,1	-0,2	-0,5
-9,6	-3,7	0,5	17,8	1,2	-0,2	-0,3
-7,1	-3,7	0,8	20,3	0,5	-0,2	0,1
-4,7	-3,7	1,1	22,7	2,2	-0,2	0,4
-2,2	-3,7	1,3	25,2	3	-0,2	0,6
-1,0	-3,7	1,3	26,4	2,6	-0,2	0,6
0,2	-3,7	1,3	27,7	2,3	-0,2	0,6
1,5	-3,7	1,3	28,9	1,8	-0,2	0,5
2,7	-3,7	1,2	30,1	1,6	-0,2	0,4
5,2	-3,7	0,9	32,6	0,8	-0,2	0,1
7,6	-3,7	0,5	35,1	0,9	-0,2	-0,2
10,1	-3,7	0,3	37,6	1,9	-0,2	-0,5
11,3	-3,7	0,2	38,8	2	-0,2	-0,6
12,5	-3,7	0,1	40	2,4	-0,2	-0,6
13,8	-3,7	0,1	41,3	2,3	-0,2	-0,6
15	-3,7	0,1	42,5	1,8	-0,2	-0,6
17,2	-3,7	0,3	44,7	3,2	-0,2	-0,5
19,2	-3,7	0,6	46,7	0	-0,2	-0,2
21,2	-3,7	0,8	48,7	0	-0,2	0,1
23,2	-3,7	1,1	50,8	0	-0,2	0,3
25,2	-3,7	1,3	52,8	7,1	-0,2	0,6
25,7	-3,7	1,3	53,3	0	-0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 58
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Prestress Losses – LB2 KG CH1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

	Appendix 1: Input receipt SYSTEM 001	Status :	Page: 59
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20.16 LB2 – KG CH2

Attribute: 14 Title: LB2 KG-CH2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-CH

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG CH2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-3,7	1,3	0	0	-0,2	0,6
-26,8	-3,7	1,3	0,5	8	-0,2	0,6
-24,3	-3,7	1	3	0,5	-0,2	0,2
-21,9	-3,7	0,6	5,4	1,1	-0,2	-0,1
-19,4	-3,7	0,4	7,9	1,7	-0,2	-0,4
-17,0	-3,7	0,2	10,4	2,2	-0,2	-0,6
-15,7	-3,7	0,1	11,6	2,2	-0,2	-0,6
-14,5	-3,7	0,1	12,9	2,4	-0,2	-0,6
-13,3	-3,7	0,1	14,1	2	-0,2	-0,6
-12,0	-3,7	0,2	15,3	2,1	-0,2	-0,5
-9,6	-3,7	0,5	17,8	1,2	-0,2	-0,3
-7,1	-3,7	0,8	20,3	0,5	-0,2	0,1
-4,7	-3,7	1,1	22,7	2,2	-0,2	0,4
-2,2	-3,7	1,3	25,2	3	-0,2	0,6
-1,0	-3,7	1,3	26,4	2,6	-0,2	0,6
0,2	-3,7	1,3	27,7	2,3	-0,2	0,6
1,5	-3,7	1,3	28,9	1,8	-0,2	0,5
2,7	-3,7	1,2	30,1	1,6	-0,2	0,4
5,2	-3,7	0,9	32,6	0,8	-0,2	0,1
7,6	-3,7	0,5	35,1	0,9	-0,2	-0,2
10,1	-3,7	0,3	37,6	1,9	-0,2	-0,5
11,3	-3,7	0,2	38,8	2	-0,2	-0,6
12,5	-3,7	0,1	40	2,4	-0,2	-0,6
13,8	-3,7	0,1	41,3	2,3	-0,2	-0,6
15	-3,7	0,1	42,5	1,8	-0,2	-0,6
17,2	-3,7	0,3	44,7	3,2	-0,2	-0,5
19,2	-3,7	0,6	46,7	0	-0,2	-0,2
21,2	-3,7	0,8	48,7	0	-0,2	0,1
23,2	-3,7	1,1	50,8	0	-0,2	0,3
25,2	-3,7	1,3	52,8	7,1	-0,2	0,6
25,7	-3,7	1,3	53,3	0	-0,2	0,6

	Appendix 1: Input receipt SYSTEM 001 Pretensioned double girder bridge	Status :	Page: 60
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Prestress Losses – LB2 KG CH2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697	0	0	2623
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

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20.17

LB2 – KG H1

Attribute: 15 Title: LB2 KG-H1

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Slip at end 1

Jack angle at end 1

Jacking slip at end 2

Value

VSL 6-15

KG-H

3320

Yes

0,006

0,0

No

Units

-

-

kN

-

m

deg

-

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG H1 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-4,2	1,3	0	0	-0,7	0,6
-26,8	-4,2	1,3	0,5	8	-0,7	0,6
-24,3	-4,2	1	3	0,5	-0,7	0,2
-21,9	-4,2	0,6	5,4	1,1	-0,7	-0,1
-19,4	-4,2	0,4	7,9	1,7	-0,7	-0,4
-17,0	-4,2	0,2	10,4	2,2	-0,7	-0,6
-15,7	-4,2	0,1	11,6	2,2	-0,7	-0,6
-14,5	-4,2	0,1	12,9	2,4	-0,7	-0,6
-13,3	-4,2	0,1	14,1	2	-0,7	-0,6
-12,0	-4,2	0,2	15,3	2,1	-0,7	-0,5
-9,6	-4,2	0,5	17,8	1,2	-0,7	-0,3
-7,1	-4,2	0,8	20,3	0,5	-0,7	0,1
-4,7	-4,2	1,1	22,7	2,2	-0,7	0,4
-2,2	-4,2	1,3	25,2	3	-0,7	0,6
-1,0	-4,2	1,3	26,4	2,6	-0,7	0,6
0,2	-4,2	1,3	27,7	2,3	-0,7	0,6
1,5	-4,2	1,3	28,9	1,8	-0,7	0,5
2,7	-4,2	1,2	30,1	1,6	-0,7	0,4
5,2	-4,2	0,9	32,6	0,8	-0,7	0,1
7,6	-4,2	0,5	35,1	0,9	-0,7	-0,2
10,1	-4,2	0,3	37,6	1,9	-0,7	-0,5
11,3	-4,2	0,2	38,8	2	-0,7	-0,6
12,5	-4,2	0,1	40	2,4	-0,7	-0,6
13,8	-4,2	0,1	41,3	2,3	-0,7	-0,6
15	-4,2	0,1	42,5	1,8	-0,7	-0,6
17,2	-4,2	0,3	44,7	3,2	-0,7	-0,5
19,2	-4,2	0,6	46,7	0	-0,7	-0,2
21,2	-4,2	0,8	48,7	0	-0,7	0,1
23,2	-4,2	1,1	50,8	0	-0,7	0,3
25,2	-4,2	1,3	52,8	7,1	-0,7	0,6
25,7	-4,2	1,3	53,3	0	-0,7	0,6

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Prestress Losses - LB2 KG H1 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	0	420	0	2900
0,5	2	417	0	2901
3,0	91	238	0	2991
5,4	104	213	0	3004
7,9	122	177	0	3022
10,4	146	128	0	3046
11,6	172	77	0	3071
12,9	196	28	0	3096
14,1	223	0	0	3097
15,3	246	0	0	3074
17,8	272	0	0	3048
20,3	291	0	0	3029
22,7	302	0	0	3018
25,2	329	0	0	2991
26,4	360	0	0	2960
27,7	388	0	0	2932
28,9	413	0	0	2908
30,1	432	0	0	2888
32,6	453	0	0	2867
35,1	466	0	0	2854
37,6	481	0	0	2840
38,8	501	0	0	2819
40,0	521	0	0	2799
41,3	545	0	0	2775
42,5	569	0	0	2751
44,7	590	0	0	2730
46,7	622	0	0	2698
48,7	627	0	0	2693
50,8	632	0	0	2688
52,8	637	0	0	2683
53,3	697	0	0	2623

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20.18 LB2 – KG H2

Attribute: 16 Title: LB2 KG H2

Assigned in: Analysis 1

General

Tendon property

Tendon profile:

Prestress force:

Jacking slip at end 1

Jacking slip at end 2

Slip at end 2

Jack angle at end 1

Value

VSL 6-15

KG-H

3320

No

Yes

0,006

0,0

Units

-

-

kN

-

-

m

deg

Offset from start

0

m

Assignment to Lines:

96, 97, 98, 99

Tendon profile (sampling points) – LB2 KG H2 assignment 1

X (m)	Y (m)	Z (m)	Distance along profile (m)	Angle change in profile Eccentricity (rad)	Eccentricity y from beam (m)	Eccentricity z from beam (m)
-27,3	-4,2	1,3	0	0	-0,7	0,6
-26,8	-4,2	1,3	0,5	8	-0,7	0,6
-24,3	-4,2	1	3	0,5	-0,7	0,2
-21,9	-4,2	0,6	5,4	1,1	-0,7	-0,1
-19,4	-4,2	0,4	7,9	1,7	-0,7	-0,4
-17,0	-4,2	0,2	10,4	2,2	-0,7	-0,6
-15,7	-4,2	0,1	11,6	2,2	-0,7	-0,6
-14,5	-4,2	0,1	12,9	2,4	-0,7	-0,6
-13,3	-4,2	0,1	14,1	2	-0,7	-0,6
-12,0	-4,2	0,2	15,3	2,1	-0,7	-0,5
-9,6	-4,2	0,5	17,8	1,2	-0,7	-0,3
-7,1	-4,2	0,8	20,3	0,5	-0,7	0,1
-4,7	-4,2	1,1	22,7	2,2	-0,7	0,4
-2,2	-4,2	1,3	25,2	3	-0,7	0,6
-1,0	-4,2	1,3	26,4	2,6	-0,7	0,6
0,2	-4,2	1,3	27,7	2,3	-0,7	0,6
1,5	-4,2	1,3	28,9	1,8	-0,7	0,5
2,7	-4,2	1,2	30,1	1,6	-0,7	0,4
5,2	-4,2	0,9	32,6	0,8	-0,7	0,1
7,6	-4,2	0,5	35,1	0,9	-0,7	-0,2
10,1	-4,2	0,3	37,6	1,9	-0,7	-0,5
11,3	-4,2	0,2	38,8	2	-0,7	-0,6
12,5	-4,2	0,1	40	2,4	-0,7	-0,6
13,8	-4,2	0,1	41,3	2,3	-0,7	-0,6
15	-4,2	0,1	42,5	1,8	-0,7	-0,6
17,2	-4,2	0,3	44,7	3,2	-0,7	-0,5
19,2	-4,2	0,6	46,7	0	-0,7	-0,2
21,2	-4,2	0,8	48,7	0	-0,7	0,1
23,2	-4,2	1,1	50,8	0	-0,7	0,3
25,2	-4,2	1,3	52,8	7,1	-0,7	0,6
25,7	-4,2	1,3	53,3	0	-0,7	0,6

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Prestress Losses – LB2 KG H2 assignment 1

Distance along profile (m)	Friction & Wobble (kN)	Anchorage (kN)	Long Term Losses (kN)	Force (kN)
0	697,3	0	0	2622,7
0,5	629	0	0	2691
3,0	619	0	0	2701
5,4	603	0	0	2717
7,9	583	0	0	2738
10,4	557	0	0	2763
11,6	536	0	0	2784
12,9	512	0	0	2808
14,1	491	0	0	2829
15,3	469	0	0	2851
17,8	452	0	0	2868
20,3	441	0	0	2879
22,7	415	0	0	2905
25,2	381	0	0	2939
26,4	354	0	0	2966
27,7	329	0	0	2992
28,9	308	0	0	3012
30,1	290	0	0	3030
32,6	276	0	0	3044
35,1	260	0	0	3060
37,6	235	0	0	3085
38,8	213	0	0	3107
40,0	185	21	0	3113
41,3	159	74	0	3087
42,5	137	117	0	3065
44,7	98	195	0	3027
46,7	93	207	0	3021
48,7	87	219	0	3015
50,8	81	230	0	3009
52,8	2	389	0	2930
53,3	0	392	0	2928

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21. Direct Method Influence Envelope

Attribute: 1 Title: Inf1 – Reactions
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: Reactions
Directions: FX, FY, FZ, MX, MY
Assignment to Points:
 504;513

Attribute: 2 Title: Inf2 – Bearings
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: Force/Moment – Thick Shell
Directions: Sx, Mx
Assignment to Points:
 128T134;228T234
Assignment to Lines:
 151;152;154;155;157;158;251;252;254;255;257;25

Attribute: 3 Title: Inf3 – Deck
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: Reactions
Directions: Sy, My
Assignment to Points:
 413T416;419T422;431T434;437T440
Assignment to Lines:
 1312T1316I2;1321;1323;1324T1328;1346T1350I2;1353;1356;1357T1361
Assignment to Surfaces:
 598T600;614;615;627

Attribute: 4 Title: Inf4 – LB1
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: ReactiBeam/shell
Directions: Fx, Fy, Fz, Mx, My
Assignment to Beam/Shell Slices: LB1

Attribute: 5 Title: Inf4 - LB 2
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: ReactiBeam/shell
Directions: Fx, Fy, Fz, Mx, My
Assignment to Beam/Shell Slices: LB2

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Attribute: 6 Title: Inf5 – TVB1
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: ReactiBeam/shell
Directions: Fx, Fy, Fz, Mx, My
Assignment to Beam/Shell Slices: TVB1

Attribute: 7 Title: Inf5 - TVB2
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: ReactiBeam/shell
Directions: Fx, Fy, Fz, Mx, My
Assignment to Beam/Shell Slices: TVB2

Attribute: 8 Title: Inf5 -TVB3
Assigned in: Analysis 1
Sub Type = Direct method influence
Entity: ReactiBeam/shell
Directions: Fx, Fy, Fz, Mx, My
Assignment to Beam/Shell Slices: TVB3

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22. 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: Singular axle
 Lane 1: 400 kN

Load groups : Fatigue modell 3 (UTM3)

Type: Quadruple axel
 Axle load: 120 kN

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23. VLO Analysis

Type: VLO – LM1 ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : LM1
Longitudinal increment : 0.50 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L293, L294
UDL alfa factor : 0.8, 1, 1 , 1, 1
TS alfa factor : 0.9, 0.9,0
Influence attributes :
 Inf 1: Reactions
 Inf 2: Abutments
 Inf 3: Deck
 Inf 4: LB1
 Inf 4: LB2
 Inf 5: TVB1
 Inf 5: TVB2
 Inf 5: TVB3

Type: VLO – LM2 ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : LM2
Longitudinal increment : 0.50 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L293, L294
TS alfa factor : 0.9
Influence attributes :
 Inf 1: Reactions
 Inf 2: Abutments
 Inf 3: Deck
 Inf 4: LB1
 Inf 4: LB2
 Inf 5: TVB1
 Inf 5: TVB2
 Inf 5: TVB3

Type: VLO – UTM3 ~ Characteristic
Representative values : Charateristic
Design code : EN 1991-2 Sweden 2011
Load groups : UTM3
Longitudinal increment : 0.50 m
Transverse increment : 0.50 m
Vehicule direction : Both
Kerbs : L293, L294
Influence attributes :
 Inf 1: Reactions
 Inf 2: Abutments
 Inf 3: Deck
 Inf 4: LB1
 Inf 4: LB2
 Inf 5: TVB1
 Inf 5: TVB2
 Inf 5: TVB3

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Type: VLO – EG A ~ Characteristic

Representative values : Characteristic

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 : 0.50 m

Transverse increment : 0.50 m

Vehicule direction : Both

Kerbs : L2935, L294

Minimum width vehicule : 2.0 m

Maximum width vehicle : 2.0 m

Influence attributes :

Inf 1: Reactions

Inf 2: Abutments

Inf 3: Deck

Inf 4: LB1

Inf 4: LB2

Inf 5: TVB1

Inf 5: TVB2

Inf 5: TVB3

Type: VLO – EG B ~ Characteristic

Representative values : Characteristic

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 : 0.50 m

Transverse increment : 0.50 m

Vehicule direction : Both

Kerbs : L293, L294

Minimum width vehicule : 2.0 m

Maximum width vehicle : 2.0 m

Influence attributes :

Inf 1: Reactions

Inf 2: Abutments

Inf 3: Deck

Inf 4: LB1

Inf 4: LB2

Inf 5: TVB1

Inf 5: TVB2

Inf 5: TVB3

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24. Basic combination

Loadcase ID: 100 Title: EGEN

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
1	0	1,0	EGEN 1
2	0	1,0	EGEN 2
3	0	1,0	EGEN 3

Loadcase ID: 105 Title: BROMS 1-

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
9	0	-1,0	BROMS 1+

Loadcase ID: 106 Title: BROMS 2-

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
10	0	-1,0	BROMS 2+

Loadcase ID: 109 Title: SIDO-

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
11	0	-1,0	SIDO+

Loadcase ID: 124 Title: PT-t0

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
18	0	1,0	LB1 - KG V1
19	0	1,0	LB1 - KG V2
20	0	1,0	LB1 - KG CV1
21	0	1,0	LB1 - KG CV2
22	0	1,0	LB1 - KG CH1
23	0	1,0	LB1 - KG CH2
24	0	1,0	LB1 - KG H1
25	0	1,0	LB1 - KG H2
26	0	1,0	LB2 - KG V1
27	0	1,0	LB2 - KG V2
28	0	1,0	LB2 - KG CV1
29	0	1,0	LB2 - KG CV2
30	0	1,0	LB2 - KG CH1
31	0	1,0	LB2 - KG CH2
32	0	1,0	LB2 - KG H1
33	0	1,0	LB2 - KG H2

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Loadcase ID: 125 Title: PT-t1

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
124	0	0,95	PT-t0

Loadcase ID: 126 Title: PT-t2

Sub Type: Basic Combination

Loadcase	Results		
File	Factor	Title	Type
124	0	0,84	PT-t0

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25. Smart combination

Loadcase ID: 118 Title: TEMP-1

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable	Factor
114	0	0,0	1,0	JTEMP (Max)
115	0	0,0	1,0	JTEMP (Min)
116	0	0,0	0,75	OJTEMP (Max)
117	0	0,0	0,75	OJTEMP (Min)

Loadcase ID: 120 Title: TEMP-2

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
114	0	0,0	0,35	JTEMP (Max)
115	0	0,0	0,35	JTEMP (Min)
116	0	0,0	1,0	OJTEMP (Max)
117	0	0,0	1,0	OJTEMP (Min)

Loadcase ID: 127 Title: ULS-PERM

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
100	0	1,0	0,2	EGEN
4	0	1,0	0,2	BELAGG
8	0	0,0	0,4	KRYMP
165	0	0,0	0,4	STOD (Max)
166	0	0,0	0,4	STOD (Min)

Loadcase ID: 129 Title: ULS-VAR

Sub Type: Smart Combination

Loadcases to consider: 5

Variable Loadcases: 1

Loadcase	Results File	Permanent Factor	Variable Factor	Title
103	0	1,13	0,37	TRAFIK (Max)
104	0	1,13	0,37	TRAFIK (Min)
107	0	1,13	0,37	BROMS (Max)
108	0	1,13	0,37	BROMS (Min)
110	0	1,13	0,37	SIDO (Max)
111	0	1,13	0,37	SIDO (Min)
122	0	0,7	0,5	TEMP (Max)
123	0	0,7	0,5	TEMP (Min)
112	0	0,45	1,05	VIND (Max)
113	0	0,45	1,05	VIND (Min)

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Loadcase ID: 131 Title: ULS-0

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
127	0	1,0	0,0	ULS-PERM (Max)
128	0	1,0	0,0	ULS-PERM (Min)
129	0	0,0	1,0	ULS-VAR (Max)
130	0	0,0	1,0	ULS-VAR (Min)

Loadcase ID: 133 Title: SLS-PERM

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
100	0	1,0	0,0	EGEN
165	0	0,0	0,33	STOD (Max)
166	0	0,0	0,33	STOD (Min)
4	0	0,9	0,3	BELAGG
8	0	0,0	0,33	KRYMP

Loadcase ID: 135 Title: SLS K-VAR

Sub Type: Smart Combination

Loadcases to consider: 5

Variable Loadcases: 1

Loadcase	Results File	Permanent Factor	Variable Factor	Title
103	0	0,75	0,25	TRAFIK (Max)
104	0	0,75	0,25	TRAFIK (Min)
107	0	0,56	0,19	BROMS (Max)
108	0	0,56	0,19	BROMS (Min)
110	0	0,56	0,19	SIDO (Max)
111	0	0,56	0,19	SIDO (Min)
122	0	0,5	0,3	TEMP (Max)
123	0	0,5	0,3	TEMP (Min)
112	0	0,6	0,4	VIND (Max)
113	0	0,6	0,4	VIND (Min)

Loadcase ID: 137 Title: SLS F-VAR

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
103	0	0,0	0,75	TRAFIK (Max)
104	0	0,0	0,75	TRAFIK (Min)
107	0	0,0	0,56	BROMS (Max)
108	0	0,0	0,56	BROMS (Min)
110	0	0,0	0,56	SIDO (Max)
111	0	0,0	0,56	SIDO (Min)
122	0	0,0	0,5	TEMP (Max)
123	0	0,0	0,5	TEMP (Min)
112	0	0,0	0,3	VIND (Max)
113	0	0,0	0,3	VIND (Min)

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Loadcase ID: 139 Title: SLS-K0

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
135	0	0,0	1,0	SLS K-VAR (Max)
136	0	0,0	1,0	SLS K-VAR (Min)

Loadcase ID: 141 Title: SLS-F0

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
137	0	0,0	1,0	SLS F-VAR (Max)
138	0	0,0	1,0	SLS F-VAR (Min)

Loadcase ID: 143 Title: SLS-Q

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
122	0	0,0	0,4	TEMP (Max)
123	0	0,0	0,4	TEMP (Min)
155	0	1,0	0,0	PT (Max)
156	0	1,0	0,0	PT (Min)

Loadcase ID: 145 Title: FAT

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
100	0	1,0	0,0	EGEN
153	0	0,0	1,0	UTM3 (Max)
154	0	0,0	1,0	UTM3 (Min)

Loadcase ID: 157 Title: SLS-Q0

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
122	0	0,0	0,4	TEMP (Max)
123	0	0,0	0,4	TEMP (Min)

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Loadcase ID: 159 Title: ULS

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
127	0	1,0	0,0	ULS-PERM (Max)
128	0	1,0	0,0	ULS-PERM (Min)
129	0	0,0	1,0	ULS-VAR (Max)
130	0	0,0	1,0	ULS-VAR (Min)
155	0	1,0	0,35	PT (Max)
156	0	1,0	0,35	PT (Min)

Loadcase ID: 161 Title: SLS-F

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable actor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
137	0	0,0	1,0	SLS F-VAR (Max)
138	0	0,0	1,0	SLS F-VAR (Min)
155	0	1,0	0,0	PT (Max)
156	0	1,0	0,0	PT (Min)

Loadcase ID: 163 Title: SLS-K

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
133	0	1,0	0,0	SLS-PERM (Max)
134	0	1,0	0,0	SLS-PERM (Min)
135	0	0,0	1,0	SLS K-VAR (Max)
136	0	0,0	1,0	SLS K-VAR (Min)
155	0	1,0	0,0	PT (Max)
156	0	1,0	0,0	PT (Min)

Loadcase ID: 165 Title: STOD

Sub Type: Smart Combination

Loadcases to consider: All

Variable Loadcases: All

Loadcase	Results File	Permanent Factor	Variable Factor	Title
5	0	0,0	1,0	STOD 1Z
6	0	0,0	1,0	STOD 2Z
7	0	0,0	1,0	STOD 3Z

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26. Envelopes

Loadcase ID: 4634 Title: LM1

Sub Type: Envelope

Loadcase	Results File	Title
3699	0	VLO – LM1 ~ Characteristic

Loadcase ID: 4680 Title: LM2

Sub Type: Envelope

Loadcase	Results File	Title
4101	0	VLO – LM2 ~ Characteristic

Loadcase ID: 4682 Title: EG A

Sub Type: Envelope

Loadcase	Results File	Title
2895	0	VLO – EG A ~ Characteristic

Loadcase ID: 4684 Title: EG B

Sub Type: Envelope

Loadcase	Results File	Title
3297	0	VLO – EG B ~ Characteristic

Loadcase ID: 4686 Title: UTM3

Sub Type: Envelope

Loadcase	Results File	Title
4503	0	VLO – UTM3 ~ Characteristic

Loadcase ID: 4636 Title: TRAFIK

Sub Type: Envelope

Loadcase	Results File	Title
4682	0	EG A (Max)
4683	0	EG A (Min)
4684	0	EG B (Max)
4685	0	EG B (Min)
4634	0	LM1 (Max)
4635	0	LM1 (Min)
4680	0	LM2 (Max)
4681	0	LM2 (Min)

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Loadcase ID: 107 Title: BROMS

Sub Type: Envelope

Loadcase	Results File	Title
9	0	BROMS 1+
10	0	BROMS 2+
105	0	BROMS 1-
106	0	BROMS 2-

Loadcase ID: 110 Title: SIDO

Sub Type: Envelope

Loadcase	Results File	Title
11	0	SIDO+
109	0	SIDO-

Loadcase ID: 112 Title: VIND

Sub Type: Envelope

Loadcase	Results File	Title
12	0	VIND+
13	0	VIND-

Loadcase ID: 114 Title: JTEMP

Sub Type: Envelope

Loadcase	Results File	Title
14	0	JTEMP+
15	0	JTEMP-

Loadcase ID: 116 Title: OJTEMP

Sub Type: Envelope

Loadcase	Results File	Title
16	0	OJTEMP+
17	0	OJTEMP-

Loadcase ID: 122 Title: TEMP

Sub Type: Envelope

Loadcase	Results File	Title
118	0	TEMP-1 (Max)
119	0	TEMP-1 (Min)
120	0	TEMP-2 (Max)
121	0	TEMP-2 (Min)