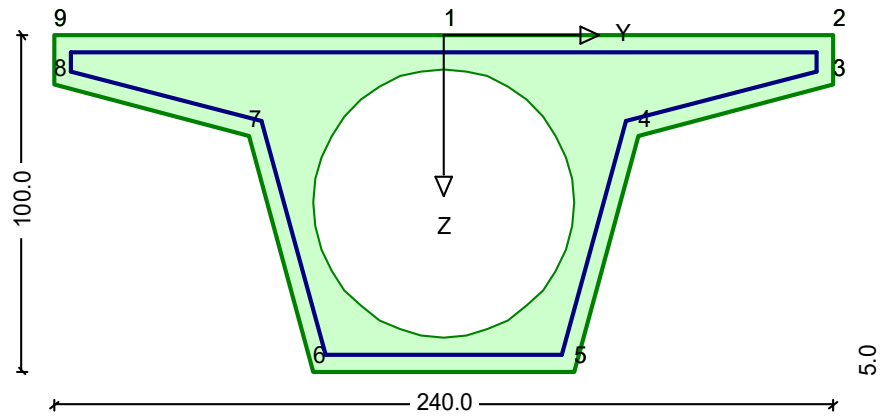
Footbridge

File: Fußgängersteg.zwv



Bereich: Footbridge Design w ith As'< As, Querschnitt: Web Cross-Section

RIB ZWAX 18.0 Biaxial bending with normal force

Footbridge Design with As'< As

File: ZWAX.ZWA

Record of the input

```
* Ultimate limit state for bending and longitudinal force EN 1992-1-1

* The   Net - section of compression zone will be used
```

Material - No.		Strength(N/mm2)	E-Modulus(N/mm2) Service	Strain Limits(o/oo)	Edge	Center
Concrete	1	fc.d = 23.3	E.c = 34100.	Compres	-3.50	-2.00
Reinf.Steel	2	fy.d = 434.8	E.s = 200000.	Tension	10.00	2.17
Prest.Steel	3	fp.d = 1304.3	E.p = 195000.			

Cross-section: Web Cross-Sectio

```
Calculation for non-compressive section
Distance between edge and outest tension reinforcement will be calculated

Polygonal Cross-Section   1
   Concrete  (=Material 1)

Coordinates
```

y (m)	z (m)	Point
0.000	0.000	1
1.200	0.000	2
1.200	0.150	3
0.600	0.300	4
0.400	1.000	5
-0.400	1.000	6
-0.600	0.300	7
-1.200	0.150	8
-1.200	0.000	9

Cross-Section No	Slap	Concrete Mat-No	Point 1 y1(m)	z1(m)	Dimension (m)	Alfa (Degree)
2	Circ.Recess	1	Middle= 0.000	0.500	Ra= 0.000 Ri= 0.400	

Point-, Line- and Ring-Reinforcement

No	Slap	Prio	Mat-No.	Cross-Sect. As min	max		Point 1 y1(m)	z1(m)	Point 2 y2(m)	z2(m)	reflected
1	Line	-1	2	0.0	100.0	cm2/m	0.000	0.050	1.150	0.050	
2	Line	-1	2	0.0	100.0	cm2/m	-1.150	0.050	0.000	0.050	
3	Line	1	2	0.0	100.0	cm2/m	1.150	0.050	1.150	0.111	
4	Line	1	2	0.0	100.0	cm2/m	1.150	0.111	0.560	0.258	
5	Line	1	2	0.0	100.0	cm2/m	0.560	0.258	0.362	0.950	
6	Line	1	2	0.0	100.0	cm2/m	0.362	0.950	-0.362	0.950	
7	Line	1	2	0.0	100.0	cm2/m	-0.362	0.950	-0.560	0.258	
8	Line	1	2	0.0	100.0	cm2/m	-0.560	0.258	-1.150	0.111	
9	Line	1	2	0.0	100.0	cm2/m	-1.150	0.111	-1.150	0.050	

```
RIB ZWAX 18.0  Biaxial bending with normal force

Footbridge  Design with As'< As


Loc: Midspan
------------
Lc    NEx(kN)    MEy(kNm)    MEz(kNm)
 1        0.0      1200.0       400.0
```

Cross-section: Web Cross-Sectio

```
Calculation for non-compressive section
Distance between edge and outest tension reinforcement will be calculated

Polygonal Cross-Section   1
   Concrete  (=Material 1)

Coordinates
   y (m)    z (m)  Point
   0.000    0.000    1
   1.200    0.000    2
   1.200    0.150    3
   0.600    0.300    4
   0.400    1.000    5
  -0.400    1.000    6
  -0.600    0.300    7
  -1.200    0.150    8
  -1.200    0.000    9

Cross-Section  Concrete           Point 1      Dimension    (m)     Alfa
No  Slap        Mat-No         y1(m)   z1(m)                      (Degree)

 2 Circ.Recess     1  Middle=  0.000  0.500 Ra= 0.000 Ri= 0.400

Point-, Line- and Ring-Reinforcement

No Slap  Prio Mat-No. Cross-Sect. As       Point 1       Point 2   refle
                       min   max        y1(m)  z1(m)  y2(m)  z2(m)  cted

 1  Line  -1     2     0.0 100.0 cm2/m  0.000  0.050  1.150  0.050
 2  Line  -1     2     0.0 100.0 cm2/m -1.150  0.050  0.000  0.050
 3  Line   1     2     0.0 100.0 cm2/m  1.150  0.050  1.150  0.111
 4  Line   1     2     0.0 100.0 cm2/m  1.150  0.111  0.560  0.258
 5  Line   1     2     0.0 100.0 cm2/m  0.560  0.258  0.362  0.950
 6  Line   1     2     0.0 100.0 cm2/m  0.362  0.950 -0.362  0.950
 7  Line   1     2     0.0 100.0 cm2/m -0.362  0.950 -0.560  0.258
 8  Line   1     2     0.0 100.0 cm2/m -0.560  0.258 -1.150  0.111
 9  Line   1     2     0.0 100.0 cm2/m -1.150  0.111 -1.150  0.050

Loc: Stütze
-----------
Lc    NEx(kN)    MEy(kNm)    MEz(kNm)
 1        0.0     -2000.0      -600.0
```

```
RIB ZWAX 18.0  Biaxial bending with normal force

Footbridge  Design with As'< As
```

Result

```
Cross-Section: Web Cross-Sectio Location: Midspan
-------------------------------------------------

Gross  Cross-Section             I1 =   0.083217 m4   ys = -0.0000 m
A =  0.8273 m2   Alfa =   0.00   I2 =   0.294361 m4   zs =  0.3298 m

Reinforcement  (R=Priority   M=Material)

As      min.As  max.As   required.As      Coordinates (m)        Eps.0
No  R M  (cm2)   (cm2)   (cm2) cm2/m    y1     z1     y2     z2   o/oo

 3  1 2    0.0     6.1     1.1  17.3  1.150  0.050  1.150  0.111
 4  1 2    0.0    60.8    10.5  17.3  1.150  0.111  0.560  0.258
 5  1 2    0.0    71.9    12.4  17.3  0.560  0.258  0.362  0.950
 6  1 2    0.0    72.5    12.5  17.3  0.362  0.950 -0.362  0.950
 7  1 2    0.0    71.9    12.4  17.3 -0.362  0.950 -0.560  0.258
 8  1 2    0.0    60.8    10.5  17.3 -0.560  0.258 -1.150  0.111
 9  1 2    0.0     6.1     1.1  17.3 -1.150  0.111 -1.150  0.050
Total      0.0   580.1    60.6       required    .As/A_gross = 0.732 %


Design for Ultimate LS  As =   60.6 cm2
-----------------------

Lc        Bearing capacity        Strain (o/oo)      Beta Gamma  Uti-
    NRx(kN)  MRy(kNm)  MRz(kNm)  Eps.1  Eps.2 Eps.s  Degree     lization

 1       0.     1200.      400. -1.238 10.583 10.00   0.9 1.000 1.000


Cross-Section: Web Cross-Sectio Location: Stütze
-------------------------------------------------

Gross  Cross-Section             I1 =   0.083217 m4   ys = -0.0000 m
A =  0.8273 m2   Alfa =   0.00   I2 =   0.294361 m4   zs =  0.3298 m

Reinforcement  (R=Priority   M=Material)

As      min.As  max.As   required.As      Coordinates (m)        Eps.0
No  R M  (cm2)   (cm2)   (cm2) cm2/m    y1     z1     y2     z2   o/oo

 1 -1 2    0.0   115.0    28.4  24.7  0.000  0.050  1.150  0.050
 2 -1 2    0.0   115.0    28.4  24.7 -1.150  0.050  0.000  0.050
Total      0.0   580.1    56.8       required    .As/A_gross = 0.687 %
```

RIB ZWAX 18.0 Biaxial bending with normal force

Footbridge Design with As'< As

Design for Ultimate LS As = 56.8 cm2

Lc	Bearing capacity			Strain (o/oo)			Beta	Gamma	Uti-
	NRx(kN)	MRy(kNm)	MRz(kNm)	Eps.1	Eps.2	Eps.s	Degree		lization
1	0.	-2000.	-600.	-3.152	10.571	10.00	206.7	1.000	1.000

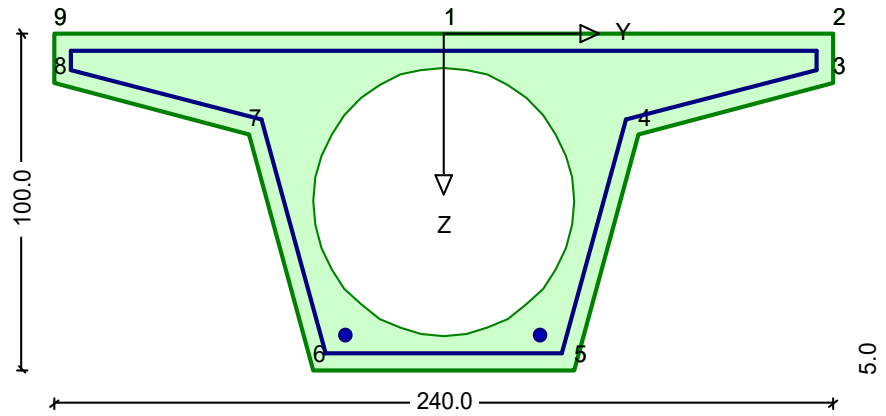
```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Tragfähigkeit

                                                    File: ZWAX.ZWA
```

Echoprint of input data

```
KOPF Fußgängersteg  vorgespannt - Tragfähigkeit
SEIT 1 1 1 69 1 3
MATE 19.8333 34100 434.783 1 2 1 1304.35 195000 *
     -3.5 10 -2 2.381 200000 35
QUER 'Stegquerschnitt' 0 1
TQP 1 1 2 0 0 2
PU 0 0 1
PU 1.2 0 2
PU 1.2 0.15 3
PU 0.6 0.3 4
PU 0.4 1 5
PU -0.4 1 6
PU -0.6 0.3 7
PU -1.2 0.15 8
PU -1.2 0 9
TQR 2 1 2 0 0 0 0.5 0 0.4 0 2
AS 1 -1 2 0. 0 100 0 0.05 1.15 0.05 0
AS 2 -1 2 0. 0 100 -1.15 0.05 0 0.05 0
AS 3 1 2 0. 0 100 1.15 0.05 1.15 0.110961 0
AS 4 1 2 0. 0 100 1.15 0.110961 0.559857 0.258497 0
AS 5 1 2 0. 0 100 0.559857 0.258497 0.362285 0.95 0
AS 6 1 2 0. 0 100 0.362285 0.95 -0.362285 0.95 0
AS 7 1 2 0. 0 100 -0.362285 0.95 -0.559857 0.258497 0
AS 8 1 2 0. 0 100 -0.559857 0.258497 -1.15 0.110961 0
AS 9 1 2 0. 0 100 -1.15 0.110961 -1.15 0.05 0
AS 10 1 3 3.6 12 12.001 0.3 0.9 - - 2
ORT 'Feldmitte' 0
LF 1 0. 2720. 290.
WAHL 1/8/9
ENDE
```

```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Tragfähigkeit
```

Record of the input



Bereich: Fußgängersteg vorgespannt - Tragfähigkeit, Querschnitt: Stegquerschnitt

```
* Ultimate limit state for bending and longitudinal force EN 1992-1-1

uniaxial bending (neutral axis parallel to y-axis)

* The   Net - section of compression zone will be used

Material - No.    Strength(N/mm2)    E-Modulus(N/mm2) Strain Limits(o/oo)
                                        Service              Edge Center
Concrete    1      fc.d =   19.8     E.c =  34100. Compres  -3.50  -2.00
Reinf.Steel 2      fy.d =  434.8     E.s = 200000. Tension  10.00   2.38
Prest.Steel 3      fp.d = 1304.3     E.p = 195000.
```

Cross-section: Stegquerschnitt

```
Calculation for non-compressive section
Distance between edge and outest tension reinforcement will be calculated

Polygonal Cross-Section   1
   Concrete  (=Material 1)

Coordinates
   y (m)    z (m)  Point
   0.000    0.000     1
   1.200    0.000     2
   1.200    0.150     3
   0.600    0.300     4
   0.400    1.000     5
  -0.400    1.000     6
  -0.600    0.300     7
  -1.200    0.150     8
  -1.200    0.000     9

Cross-Section  Concrete          Point 1      Dimension    (m)     Alfa
No   Slap        Mat-No        y1(m)   z1(m)                     (Degree)
```

2 Circ.Recess 1 Middle= 0.000 0.500 Ra= 0.000 Ri= 0.400

Point-, Line- and Ring-Reinforcement

(Pri=Prio. M=Material Eps.0=initial strain in prestressing tendon)

No	Slap	Pri	M	Eps.0 (o/oo)	Cross-Sect. As min	max		Point 1 y1(m)	z1(m)	Point 2 y2(m)	z2(m)	refle cted
1	Line	-1	2	0.000	0.0	100.0	cm2/m	0.000	0.050	1.150	0.050	
2	Line	-1	2	0.000	0.0	100.0	cm2/m	-1.150	0.050	0.000	0.050	
3	Line	1	2	0.000	0.0	100.0	cm2/m	1.150	0.050	1.150	0.111	
4	Line	1	2	0.000	0.0	100.0	cm2/m	1.150	0.111	0.560	0.258	
5	Line	1	2	0.000	0.0	100.0	cm2/m	0.560	0.258	0.362	0.950	
6	Line	1	2	0.000	0.0	100.0	cm2/m	0.362	0.950	-0.362	0.950	

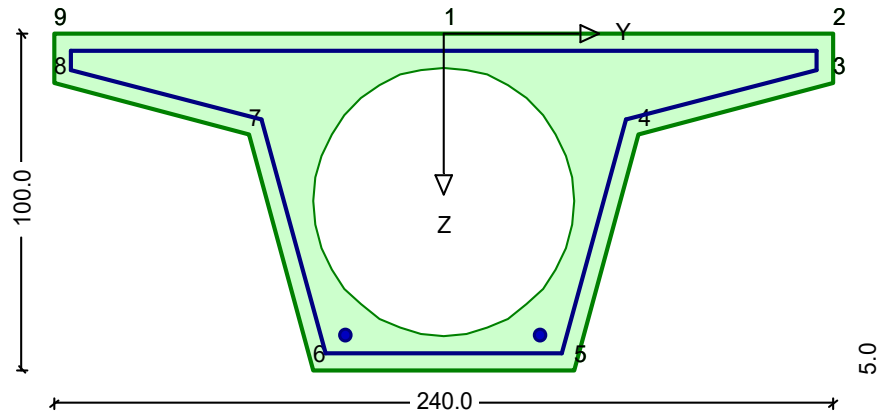
```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Tragfähigkeit


No Slap Pri M  Eps.0  Cross-Sect. As       Point 1       Point 2   refle
               (o/oo)  min   max        y1(m)  z1(m)  y2(m)  z2(m)  cted

 7  Line  1 2  0.000   0.0 100.0 cm2/m -0.362  0.950 -0.560  0.258
 8  Line  1 2  0.000   0.0 100.0 cm2/m -0.560  0.258 -1.150  0.111
 9  Line  1 2  0.000   0.0 100.0 cm2/m -1.150  0.111 -1.150  0.050
10 Point  1 3  3.600  12.0  12.0 cm2    0.300  0.900                at z

Loc: Feldmitte
--------------
Lc    NEx(kN)    MEy(kNm)    MEz(kNm)
 1        0.0      2720.0       290.0
```

Result

```
Cross-Section: Stegquerschnitt  Location: Feldmitte
---------------------------------------------------

Gross  Cross-Section             I1 =   0.083217 m4   ys = -0.0000 m
A =  0.8273 m2   Alfa =   0.00   I2 =   0.294361 m4   zs =  0.3298 m

Reinforcement  (R=Priority   M=Material)

As       min.As  max.As   required.As      Coordinates (m)         Eps.0
No  R M  (cm2)   (cm2)    (cm2) cm2/m    y1     z1     y2     z2    o/oo

 3  1 2    0.0     6.1      0.0   0.6  1.150  0.050  1.150  0.111
 4  1 2    0.0    60.8      0.4   0.6  1.150  0.111  0.560  0.258
 5  1 2    0.0    71.9      0.4   0.6  0.560  0.258  0.362  0.950
 6  1 2    0.0    72.5      0.4   0.6  0.362  0.950 -0.362  0.950
 7  1 2    0.0    71.9      0.4   0.6 -0.362  0.950 -0.560  0.258
 8  1 2    0.0    60.8      0.4   0.6 -0.560  0.258 -1.150  0.111
 9  1 2    0.0     6.1      0.0   0.6 -1.150  0.111 -1.150  0.050
10  1 3   12.0    12.0     12.0         0.300  0.900                3.600
11  1 3   12.0    12.0     12.0        -0.300  0.900                3.600
Total     24.0   604.1     26.1       required    .As/A_gross = 0.315 %


Design for Ultimate LS  As =   26.1 cm2
-----------------------

Lc        Bearing capacity         Strain (o/oo)      Beta Gamma  Uti-
    NRx(kN)  MRy(kNm)  MRz(kNm)  Eps.1  Eps.2 Eps.s  Degree     lization

 1       0.     2720.        0. -1.466 10.603 10.00   0.0 1.000 1.000

Lc   ----Compressive Resultant---- -------Tensile Resultant-----  Lever
       (kN)   y(m)   z(m)   A(m2)     (kN)   y(m)   z(m)     A(m2) arm(m)

 1   -3196. -0.000  0.044  0.2878   3196.  0.000  0.895  0.00259 0.8510
```

```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Dehnung

                                                    File: ZWAX.ZWA
```

Echoprint of input data



Bereich: Fußgängersteg vorgespannt - Dehnung , Querschnitt: Stegquerschnitt

```
KOPF Fußgängersteg  vorgespannt - Dehnung
SEIT 1 1 1 69 1 3
MATE 23.3333 34100 434.783 1 2 1 1304.35 195000 *
     -3.5 10 -2 2.17391 200000 35
MATZ 4 1 -10 0 -370 -185 0
QUER 'Stegquerschnitt' 0 1
TQP 1 1 2 0 0 2
PU 0 0 1
PU 1.2 0 2
PU 1.2 0.15 3
PU 0.6 0.3 4
PU 0.4 1 5
PU -0.4 1 6
PU -0.6 0.3 7
PU -1.2 0.15 8
PU -1.2 0 9
TQR 2 1 2 0 0 0 0.5 0 0.4 0 2
AS 1 -1 2 0. 0 100 0 0.05 1.15 0.05 0
AS 2 -1 2 0. 0 100 -1.15 0.05 0 0.05 0
AS 3 1 2 0. 0 100 1.15 0.05 1.15 0.110961 0
AS 4 1 2 0. 0 100 1.15 0.110961 0.559857 0.258497 0
AS 5 1 2 0. 0 100 0.559857 0.258497 0.362285 0.95 0
AS 6 1 2 0. 0 100 0.362285 0.95 -0.362285 0.95 0
AS 7 1 2 0. 0 100 -0.362285 0.95 -0.559857 0.258497 0
AS 8 1 2 0. 0 100 -0.559857 0.258497 -1.15 0.110961 0
AS 9 1 2 0. 0 100 -1.15 0.110961 -1.15 0.05 0
AS 10 1 3 3.6 12 12.001 0.3 0.9 - - 2
ORT 'Feldmitte' 0
LF 1 0. 2720. 290.
WAHL 1/3/8
ENDE
```

```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Dehnung
```

Record of the input

```
* Ultimate limit state for bending and longitudinal force EN 1992-1-1

* Serviceability limit state for Strain Check under cracked conditions
  with  Ec  =  34100.  N/mm2.  Concrete  elastic  compression,  without  tensil
strength

* The   Net - section of compression zone will be used

Material - No.    Strength(N/mm2)    E-Modulus(N/mm2) Strain Limits(o/oo)
                                        Service               Edge Center
Concrete    1      fc.d =   23.3     E.c =  34100. Compres  -3.50  -2.00
Reinf.Steel 2      fy.d =  434.8     E.s = 200000. Tension  10.00   2.17
Prest.Steel 3      fp.d = 1304.3     E.p = 195000.

Additional stress-strain diagrams
Material     Part       Strain(o/oo)    ------Stresses(N/mm2)------
                      Eps.1   Eps.2   Sigma.1   Sigma.m   Sigma.2
    4          1     -10.000   0.000   -370.00   -185.00      0.00
```

Cross-section: Stegquerschnitt

```
Calculation for non-compressive section
Distance between edge and outest tension reinforcement will be calculated

Polygonal Cross-Section   1
   Concrete  (=Material 1)

Coordinates
   y (m)    z (m)  Point
   0.000    0.000    1
   1.200    0.000    2
   1.200    0.150    3
   0.600    0.300    4
   0.400    1.000    5
  -0.400    1.000    6
  -0.600    0.300    7
  -1.200    0.150    8
  -1.200    0.000    9

Cross-Section  Concrete          Point 1      Dimension    (m)     Alfa
No  Slap        Mat-No         y1(m)   z1(m)                     (Degree)

 2 Circ.Recess     1  Middle=  0.000   0.500 Ra= 0.000 Ri= 0.400
```

```
RIB ZWAX 18.0  Biaxial bending with normal force

Fußgängersteg  vorgespannt - Dehnung


Point-, Line- and Ring-Reinforcement

            (Pri=Prio.  M=Material      Eps.0=initial  strain  in  prestressing
tendon)
No Slap Pri M  Eps.0  Cross-Sect. As        Point 1        Point 2    refle
               (o/oo)  min    max         y1(m)   z1(m)   y2(m)   z2(m)  cted

 1  Line -1 2  0.000    0.0 100.0 cm2/m  0.000   0.050   1.150   0.050
 2  Line -1 2  0.000    0.0 100.0 cm2/m -1.150   0.050   0.000   0.050
 3  Line  1 2  0.000    0.0 100.0 cm2/m  1.150   0.050   1.150   0.111
 4  Line  1 2  0.000    0.0 100.0 cm2/m  1.150   0.111   0.560   0.258
 5  Line  1 2  0.000    0.0 100.0 cm2/m  0.560   0.258   0.362   0.950
 6  Line  1 2  0.000    0.0 100.0 cm2/m  0.362   0.950  -0.362   0.950
 7  Line  1 2  0.000    0.0 100.0 cm2/m -0.362   0.950  -0.560   0.258
 8  Line  1 2  0.000    0.0 100.0 cm2/m -0.560   0.258  -1.150   0.111
 9  Line  1 2  0.000    0.0 100.0 cm2/m -1.150   0.111  -1.150   0.050
10 Point  1 3  3.600   12.0  12.0 cm2     0.300   0.900                  at z

Loc: Feldmitte
--------------
Lc    NEx(kN)    MEy(kNm)    MEz(kNm)
 1        0.0      2720.0       290.0
```

Result

```
Cross-Section: Stegquerschnitt  Location: Feldmitte
--------------------------------------------------

Gross  Cross-Section              I1 =   0.083217 m4   ys = -0.0000 m
A =  0.8273 m2   Alfa =   0.00    I2 =   0.294361 m4   zs =  0.3298 m

Reinforcement  (R=Priority   M=Material)

As       min.As  max.As   required.As      Coordinates (m)         Eps.0
No  R M  (cm2)   (cm2)    (cm2) cm2/m    y1      z1      y2      z2   o/oo

 3  1 2    0.0     6.1      0.0   0.4  1.150   0.050   1.150   0.111
 4  1 2    0.0    60.8      0.2   0.4  1.150   0.111   0.560   0.258
 5  1 2    0.0    71.9      0.3   0.4  0.560   0.258   0.362   0.950
 6  1 2    0.0    72.5      0.3   0.4  0.362   0.950  -0.362   0.950
 7  1 2    0.0    71.9      0.3   0.4 -0.362   0.950  -0.560   0.258
 8  1 2    0.0    60.8      0.2   0.4 -0.560   0.258  -1.150   0.111
 9  1 2    0.0     6.1      0.0   0.4 -1.150   0.111  -1.150   0.050
10  1 3   12.0    12.0     12.0         0.300   0.900                3.600
11  1 3   12.0    12.0     12.0        -0.300   0.900                3.600
Total     24.0   604.1     25.4       required    .As/A_gross = 0.307 %
```

RIB ZWAX 18.0 Biaxial bending with normal force

Fußgängersteg vorgespannt - Dehnung

Design for Ultimate LS As = 25.4 cm2

Lc	Bearing capacity			Strain (o/oo)			Beta	Gamma	Uti-
	NRx(kN)	MRy(kNm)	MRz(kNm)	Eps.1	Eps.2	Eps.s	Degree		lization
1	-0.	2720.	290.	-1.484	10.598	10.00	0.7	1.000	1.000

Lc	----Compressive Resultant----				-------Tensile Resultant-----				Lever
	(kN)	y(m)	z(m)	A(m2)	(kN)	y(m)	z(m)	A(m2)	arm(m)
1	-3177.	0.091	0.040	0.2640	3177.	-0.000	0.896	0.00253	0.8610

Check for strain under Service LS As = 25.4 cm2 Ec =34100.0 N/mm2

Lc	Internal stresses SLS			Strain (o/oo)			Beta	Mue.z	A.ten/
	NR(kN)	MRy(kNm)	MRz(kNm)	Eps.1	Eps.2	Eps.s	Deg.	(%)	A.gross
1	0.	2720.	290.	-0.735	4.999	4.72	0.6	0.461	0.664

Lc	----Compressive Resultant----				-------Tensile Resultant-----				Lever
	(kN)	y(m)	z(m)	A(m2)	(kN)	y(m)	z(m)	A(m2)	arm(m)
1	-3169.	0.091	0.039	0.2783	3169.	-0.000	0.898	0.00253	0.8631