Appendix 1

Examples

Table of Contents

Appendix 1 - Miscellaneous Examples

This appendix includes a set of examples, which demonstrates some of the facilities in NovaFrame. The input files for each example is found in the “NF_Examples”-folder.

1 Traffic loads: Highway-1

This example shows the use of highway traffic loads on a small bridge.

Example folder: *Highway-1*
Example files: *Highway-1.inp*
Highway-1.lod

The traffic load consists of two tracks. The traffic line consists of element 1, 2 and 3. There are 16 positions on each element.

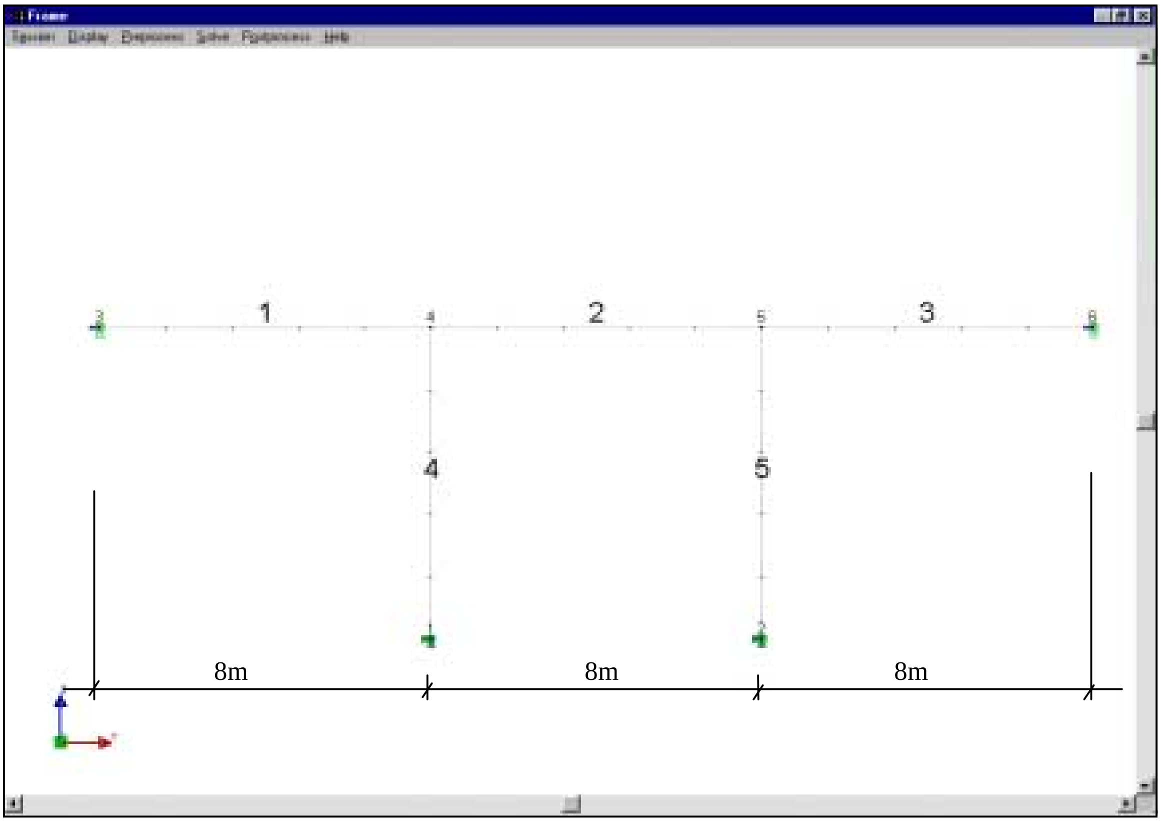


Figure 1.1 Simple Bridge

```
Project name: Highway-1


 *** NODE INPUT ***
NODEINS  3  6  1  0.000  0.000  8.000  0.000  8.000  0.000
NODEINS  1  2  1  0.000  8.000  0.000  0.000  8.000  0.000

 *** ELEMENT INPUT ***
ELEMINS     1    3   1    3    4   1
```

```
ELEMINS     4    4   1    1    4   1
ELEMINS     5    5   1    2    5   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  1  30000  0.0  1.000e+000  1.000e+000  1.000e+000  1.000e+000

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  5  1  1  0  4


 *** BOUNDARY CONDITION INPUT ***
BOUNDINS     1     2     1    1    1    1    1    1    1
BOUNDINS     3     6     3    1    0    1    0    1    0

 *** DESIGN SECTION INPUT ***
DESGINS     1     5     1  0.000  1.000  0.200



 *** LOAD INPUT ***

 *** TRAFFIC LINE INPUT ***
TRAFLINE  1  1  3  1  16  0.000

 *** TRAFFIC LOAD INPUT ***
TRAFLOAD 1  1  1  1    1.000   3.000  9.0  210.0 210.0  210.0  2.500  6.000 Traffic V1
TRAFLOAD 1  2  1  1   -3.000  -1.000  9.0  210.0 210.0  210.0  2.500  6.000 Traffic V1
```

Figure 1.2 ASCII input (both files).

```
Element No:     1, Traffic load No:      1, X/L:  0.00
------------------------------------------------------
Lc      Comp             Axial    Shear L    Shear N  Bending L  Bending N    Torsion
    1   Max Shear-L       0.00      56.91     -78.44       0.00      -0.00     621.96
    3   Max Shear-N       0.00      12.69      25.82       0.00      -0.00     109.05
    5   Max Torsion       0.00      39.96    -358.76      -0.00       0.00    1354.76
    7   Min Shear-L       0.00     -56.91     -78.44       0.00       0.00    -621.96
    9   Min Shear-N       0.00      24.20    -721.99      -0.00       0.00     882.45
   11   Min Torsion       0.00     -39.96    -358.76      -0.00      -0.00   -1354.76

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-L    111111111113111121111111111141111111111111111111
  2    Max Shear-L    000000000000000000000000000000000000000000000000
  1    Max Shear-N    000000000000000000011111211111111131111111111141
  2    Max Shear-N    000000000000000000011111211111111131111111111141
  1    Max Torsion    211113111111111114111111111111111111111111111111
  2    Max Torsion    000000000000000000000000000000000000000000000000
  1    Min Shear-L    000000000000000000000000000000000000000000000000
  2    Min Shear-L    666666666668666676666666666696666666666666666666
  1    Min Shear-N    211113111111111114100000000000000000000000000000
  2    Min Shear-N    211113111111111114100000000000000000000000000000
  1    Min Torsion    000000000000000000000000000000000000000000000000
  2    Min Torsion    766668666666666669666666666666666666666666666666




Element No:     1, Traffic load No:      1, X/L:  1.00
------------------------------------------------------
Lc      Comp             Axial    Shear L    Shear N  Bending L  Bending N    Torsion
    1   Max Shear-L       0.00      56.91     203.56    -132.97     455.29    -224.04
    3   Max Shear-N       0.00      36.83     797.53    -344.34     294.60    -538.17
    4   Max Bend-L        0.00      16.72      -8.50     137.77     133.76      78.93
    6   Max Bend-N        0.00      56.91     203.56    -132.97     455.29    -224.04
    5   Max Torsion       0.00       4.65     393.71    -131.77      37.16    1214.15
    7   Min Shear-L       0.00     -56.91     203.56    -132.97    -455.29     224.04
    9   Min Shear-N       0.00      16.39     -16.95     135.63     131.12      85.94
   10   Min Bend-L        0.00      25.21     460.81    -660.32     201.71    -226.68
   12   Min Bend-N        0.00     -56.91     203.56    -132.97    -455.29     224.04
```

```
   11   Min Torsion        0.00      -4.65     393.71    -131.77     -37.16   -1214.15

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-L    111111111113111121111111111141111111111111111111
  2    Max Shear-L    000000000000000000000000000000000000000000000000
  1    Max Shear-N    111111111131111200011111114111111111111111111111
  2    Max Shear-N    111111111131111200011111114111111111111111111111
  1    Max Bend.-L    000000000000000121100000000000000000000000000000
  2    Max Bend.-L    000000000000000121100000000000000000000000000000
  1    Max Torsion    000000000000000021111311111111111411111111111111
  2    Max Torsion    666666666668666670000000000000000000000000000000
  1    Max Bend.-N    111111111113111121111111111141111111111111111111
  2    Max Bend.-N    000000000000000000000000000000000000000000000000
  1    Min Shear-L    000000000000000000000000000000000000000000000000
  2    Min Shear-L    666666666668666676666666666696666666666666666666
  1    Min Shear-N    000000000000000021100000000000000000000000000000
  2    Min Shear-N    000000000000000021100000000000000000000000000000
  1    Min Bend.-L    111311112111111000011111411111111111111111111111
  2    Min Bend.-L    111311112111111000011111411111111111111111111111
  1    Min Torsion    111111111131111200000000000000000000000000000000
  2    Min Torsion    000000000000000076666866666666666966666666666666
  1    Min Bend.-N    000000000000000000000000000000000000000000000000
  2    Min Bend.-N    666666666668666676666666666696666666666666666666
```

Figure 1.3 Results, see the manual for the description of position codes.

The data for the traffic position can be visualized by selecting the ***Plot traffic position..*** in the ***Postprocess*** menu. See Figure 1.4 and 1.5.

The position codes consists of 48 position along the traffic line. The 16 first apply for element 1, next 16 for element 2 and the last 16 for element 3.

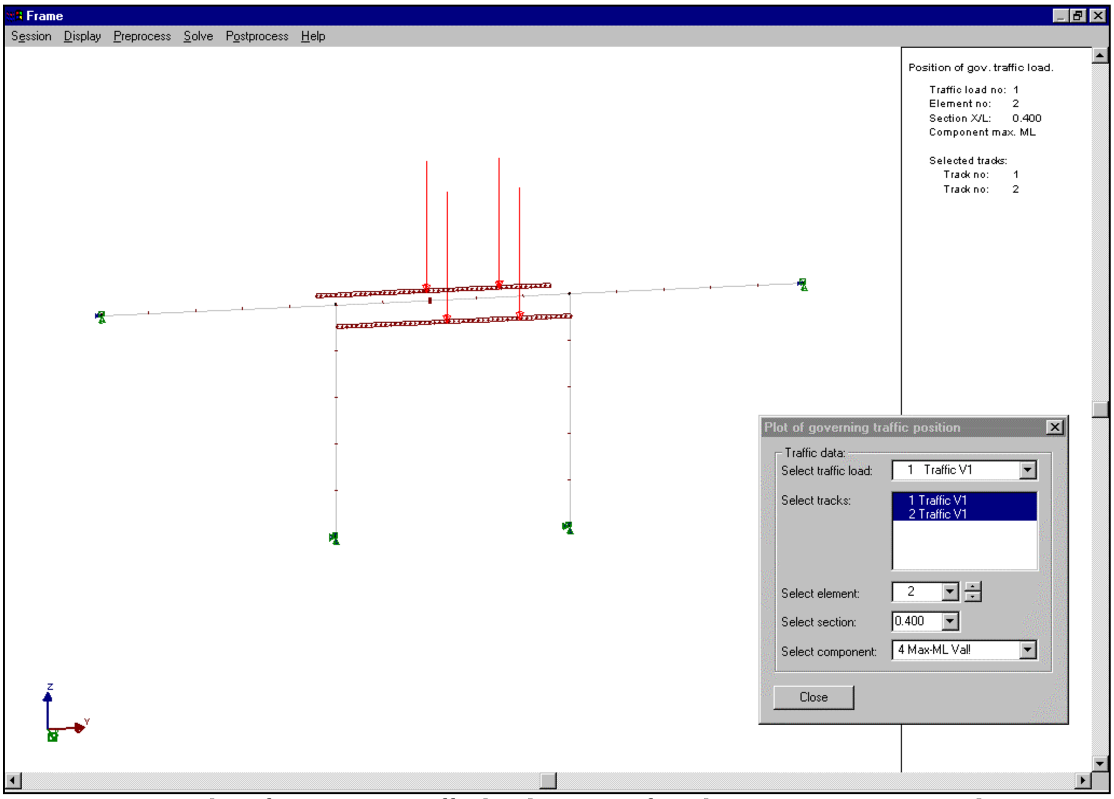


Figure 1.4 Plot of governing traffic load position for Element, 2 X/L = 0.4 and Max ML.

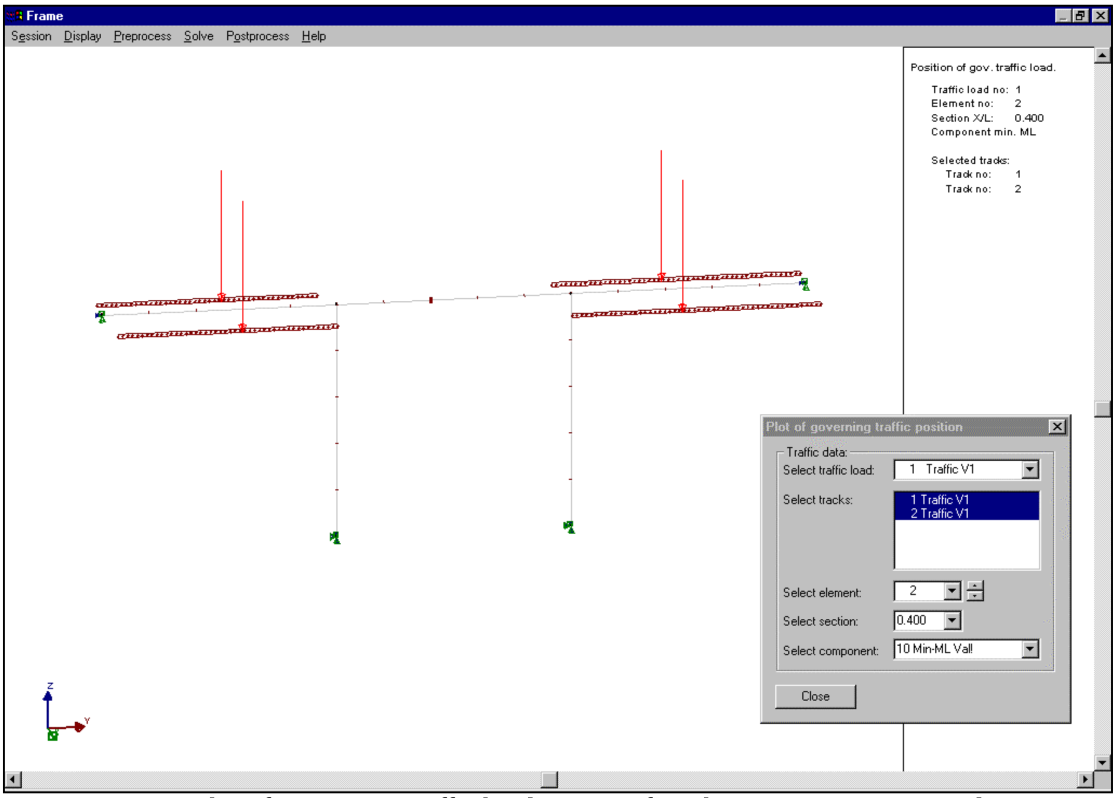


Figure 1.5 Plot of governing traffic load position for Element, 2 X/L = 0.4 and Min ML.

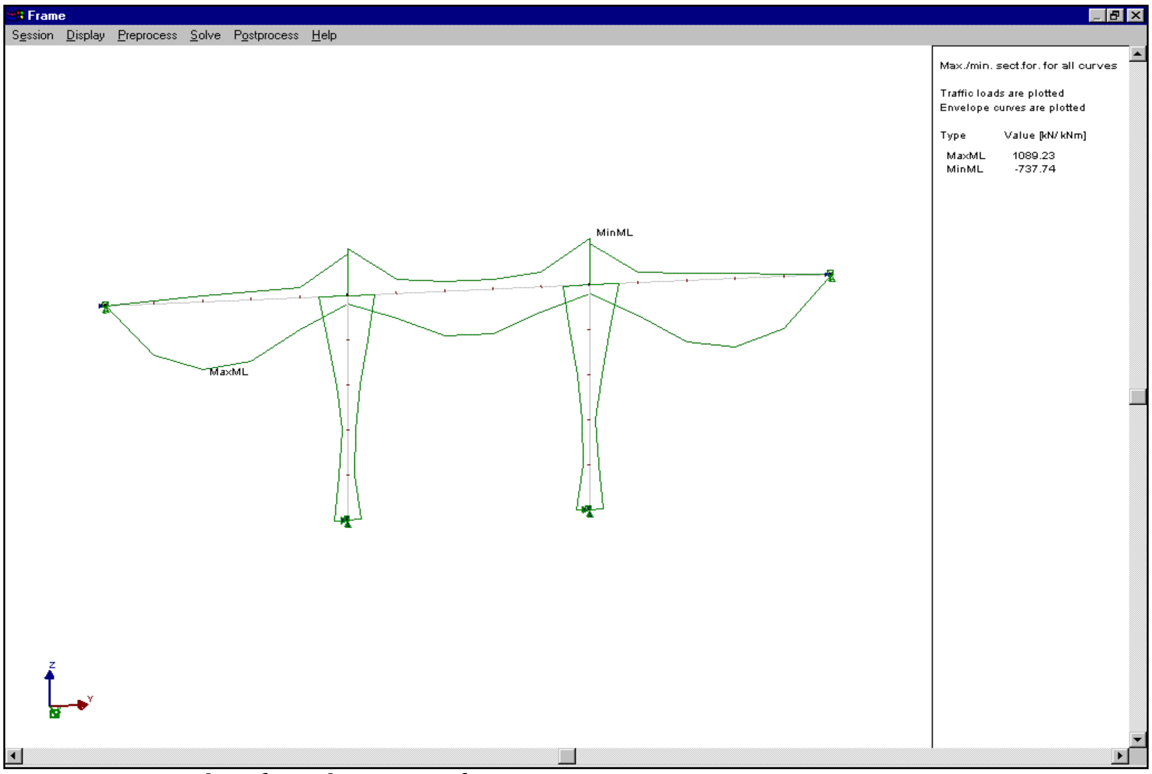


Figure 1.6 Plot of envelope curve for moment ML.

2 Traffic loads: Railway-1

This example shows the use of railway traffic loads, and how the accuracy of the method can be investigated.

Example folder: *Railway-1*
Example files: *Railway-1.inp*
Railway-1.lod

The three types of railway loads are calculated for a bridge with two spans. Each span is one element. Three different traffic lines are defined so that accuracy of the traffic load can be evaluated. All the traffic loads consists of one single track. The input and results are presented below. Comparisons of the results are shown in figure 2.5. One should try the ***Plot traffic position..,*** from the **Postprocess** menu in order to view the position of the traffic loads.

```
Project name: Railway-1


 *** NODE INPUT ***
NODEINS  1  2  1  0.000    0.000  0.000  0.000  40.000  0.000
NODEINS  3  3  1  0.000  100.000  0.000  0.000   0.000  0.000

 *** ELEMENT INPUT ***
ELEMINS     1    2   1    1    2   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  1  27174  0.0  1.000e+000  1.000e+000  1.000e+000  1.000e+000

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  2  1  1  0  4

 *** BOUNDARY CONDITION INPUT ***
BOUNDINS     1   1     1    1    1    1    0    1    1
BOUNDINS     2   2     1    1    0    1    0    1    1
BOUNDINS     3   3     1    1    0    1    0    1    1

 *** DESIGN SECTION INPUT ***
DESGINS     1     2     1  0.000  1.000  0.500



*** LOAD INPUT ***

*** TRAFFIC LINE INPUT ***
        LineNo  E1  E2  dE  PosNo  Name
TRAFLINE  1  1  1  0  4  0.000  PosDist =10m
TRAFLINE  1  2  2  0  6  0.000  PosDist =10m
TRAFLINE  2  1  1  0  10 0.000  PosDist =4m
TRAFLINE  2  2  2  0  15 0.000  PosDist =4m
TRAFLINE  3  1  1  0  20 0.000  PosDist =2m
TRAFLINE  3  2  2  0  30 0.000  PosDist =2m

*** TRAFFIC LOAD INPUT ***
      LoadNo Tr Li Dir  E-min  E-max     Q      P1   P2   P3     distA  distB Name
TRAFLOAD 100  1  1   2  0.000  0.000   80.000  250.0  0.0  0.0   1.600  0.000 UIC71-Line1
TRAFLOAD 120  1  2   2  0.000  0.000   80.000  250.0  0.0  0.0   1.600  0.000 UIC71-Line2
TRAFLOAD 140  1  3   2  0.000  0.000   80.000  250.0  0.0  0.0   1.600  0.000 UIC71-Line3
TRAFLOAD 200  1  1   3  0.000  0.000  133.000    0.0  0.0  0.0  15.000  5.300 SW/0-Line1
TRAFLOAD 220  1  2   3  0.000  0.000  133.000    0.0  0.0  0.0  15.000  5.300 SW/0-Line2
TRAFLOAD 240  1  3   3  0.000  0.000  133.000    0.0  0.0  0.0  15.000  5.300 SW/0-Line3
TRAFLOAD 300  1  1   3  0.000  0.000  150.000    0.0  0.0  0.0  25.000  7.000 SW/2-Line1
TRAFLOAD 320  1  2   3  0.000  0.000  150.000    0.0  0.0  0.0  25.000  7.000 SW/2-Line2
TRAFLOAD 340  1  3   3  0.000  0.000  150.000    0.0  0.0  0.0  25.000  7.000 SW/2-Line3
```

Figure 2.1 ASCII input, (both files).

Traffic load No: 100, Element No: 2, X/L: 0.00

Lc	Comp	Axial	Shear L	Shear N	Bending L	Bending N	Torsion
108	Min Shear-N	0.00	0.00	-3067.12	-29027.08	0.00	0.00
109	Min Bend-L	0.00	0.00	-3014.76	-29885.42	0.00	0.00

Traffic load position details:

Track:	Comp.:	Positions:
1	Min Shear-N	1111511111
1	Min Bend.-L	1111115111

Traffic load No: 100, Element No: 2, X/L: 0.50

Lc	Comp	Axial	Shear L	Shear N	Bending L	Bending N	Torsion
102	Max Shear-N	0.00	0.00	453.99	13619.53	0.00	0.00
103	Max Bend-L	0.00	0.00	-468.99	26929.97	0.00	0.00
108	Min Shear-N	0.00	0.00	-972.74	11817.71	0.00	0.00
109	Min Bend-L	0.00	0.00	-120.16	-3604.69	0.00	0.00

Traffic load position details:

Track:	Comp.:	Positions:
1	Max Shear-N	0000115000
1	Max Bend.-L	0000111511
1	Min Shear-N	1111000511
1	Min Bend.-L	1151000000

Traffic load No: 100, Element No: 2, X/L: 1.00

Lc	Comp	Axial	Shear L	Shear N	Bending L	Bending N	Torsion
102	Max Shear-N	0.00	0.00	2213.37	-0.50	0.00	0.00
108	Min Shear-N	0.00	0.00	-120.16	-0.00	0.00	0.00
109	Min Bend-L	0.00	0.00	2030.94	-0.50	0.00	0.00

Traffic load position details:

Track:	Comp.:	Positions:
1	Max Shear-N	0000111115
1	Min Shear-N	1151000000
1	Min Bend.-L	0100151111

Traffic load No: 120, Element No: 2, X/L: 0.00

Lc	Comp	Axial	Shear L	Shear N	Bending L	Bending N	Torsion
128	Min Shear-N	0.00	0.00	-3216.66	-28839.36	0.00	0.00
129	Min Bend-L	0.00	0.00	-3125.26	-30555.36	0.00	0.00

Traffic load position details:

Track:	Comp.:	Positions:
1	Min Shear-N	1111111111331111111111111
1	Min Bend.-L	1111111111111113311111111

Traffic load No: 120, Element No: 2, X/L: 0.50

Lc	Comp	Axial	Shear L	Shear N	Bending L	Bending N	Torsion
122	Max Shear-N	0.00	0.00	588.74	17662.00	0.00	0.00
123	Max Bend-L	0.00	0.00	-228.06	29198.05	0.00	0.00
128	Min Shear-N	0.00	0.00	-949.91	11502.67	0.00	0.00
129	Min Bend-L	0.00	0.00	-125.42	-3762.48	0.00	0.00

Traffic load position details:

Track:	Comp.:	Positions:
1	Max Shear-N	0000000000111111330000000
1	Max Bend.-L	0000000000111111133111111
1	Min Shear-N	1111111111000000033111111
1	Min Bend.-L	1111133111000000000000000

Traffic load No: 120, Element No: 2, X/L: 1.00

```
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  122   Max Shear-N        0.00       0.00    2368.06      -0.52       0.00       0.00
  128   Min Shear-N        0.00       0.00    -125.42      -0.00       0.00       0.00
  129   Min Bend-L         0.00       0.00    2113.16      -0.52       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0000000000111111111111133
  1    Min Shear-N    1111133111000000000000000
  1    Min Bend.-L    1110011111111111133111111


Traffic load No:      140, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  148   Min Shear-N        0.00       0.00   -3379.10  -28606.17       0.00       0.00
  149   Min Bend-L         0.00       0.00   -3221.17  -31610.25       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    11111111111111111111132211111111111111111111111111
  1    Min Bend.-L    11111111111111111111111111111111322111111111111111


Traffic load No:      140, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  142   Max Shear-N        0.00       0.00     563.18   16895.08       0.00       0.00
  143   Max Bend-L         0.00       0.00    -338.19   30894.04       0.00       0.00
  148   Min Shear-N        0.00       0.00   -1163.45   15636.42       0.00       0.00
  149   Min Bend-L         0.00       0.00    -133.23   -3996.87       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    00000000000000000000111111111111322000000000000000
  1    Max Bend.-L    00000000000000000000111111111111322111111111111111
  1    Min Shear-N    11111111111111111111000000000000322111111111111111
  1    Min Bend.-L    11111111113221111111000000000000000000000000000000


Traffic load No:      140, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  142   Max Shear-N        0.00       0.00    2515.23      -0.53       0.00       0.00
  148   Min Shear-N        0.00       0.00    -133.23      -0.00       0.00       0.00
  149   Min Bend-L         0.00       0.00    2096.96      -0.53       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    00000000000000000000111111111111111111111111111322
  1    Min Shear-N    11111111113221111111000000000000000000000000000000
  1    Min Bend.-L    10011001101100111000111111111111322111111111111111
```

Figure 2.2 Results for element 2, UIC-71 traffic loads.

```
Traffic load No:      200, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  208   Min Shear-N        0.00       0.00   -4026.94  -28816.67       0.00       0.00
  209   Min Bend-L         0.00       0.00   -3175.38  -30922.50       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    0000111100
  1    Min Bend.-L    0000011110


Traffic load No:      200, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  202   Max Shear-N        0.00       0.00     618.24   18546.87       0.00       0.00
  203   Max Bend-L         0.00       0.00    -515.38   37738.48       0.00       0.00
  208   Min Shear-N        0.00       0.00   -1261.42   22007.34       0.00       0.00
```

```
  209   Min Bend-L         0.00       0.00    -182.87   -5486.25       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0001111000
  1    Max Bend.-L    0000011110
  1    Min Shear-N    0000000111
  1    Min Bend.-L    1111000000


Traffic load No:      200, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  202   Max Shear-N        0.00       0.00    3129.19      -0.53       0.00       0.00
  208   Min Shear-N        0.00       0.00    -182.87      -0.00       0.00       0.00
  209   Min Bend-L         0.00       0.00    2144.63      -0.53       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0000001111
  1    Min Shear-N    1111000000
  1    Min Bend.-L    0000011110


Traffic load No:      220, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  228   Min Shear-N        0.00       0.00   -3345.64  -21986.50       0.00       0.00
  229   Min Bend-L         0.00       0.00   -2830.57  -25130.26       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    0000000000111101111000000
  1    Min Bend.-L    0000000000001111011110000


Traffic load No:      220, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  222   Max Shear-N        0.00       0.00     687.42   20622.34       0.00       0.00
  223   Max Bend-L         0.00       0.00    -110.32   30738.04       0.00       0.00
  228   Min Shear-N        0.00       0.00   -1101.52   19090.47       0.00       0.00
  229   Min Bend-L         0.00       0.00    -147.47   -4424.11       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0000000001111011110000000
  1    Max Bend.-L    0000000000000011110111100
  1    Min Shear-N    0000000000000000001111111
  1    Min Bend.-L    0111101111000000000000000


Traffic load No:      220, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  222   Max Shear-N        0.00       0.00    2997.77      -0.48       0.00       0.00
  228   Min Shear-N        0.00       0.00    -147.47      -0.00       0.00       0.00
  229   Min Bend-L         0.00       0.00    2997.77      -0.48       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0000000000000000111111111
  1    Min Shear-N    0111101111000000000000000
  1    Min Bend.-L    0000000000000000111111111


Traffic load No:      240, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  248   Min Shear-N        0.00       0.00   -3344.90  -21941.81       0.00       0.00
  249   Min Bend-L         0.00       0.00   -2688.47  -25116.07       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    00000000000000000000111111110011111111000000000000
  1    Min Bend.-L    00000000000000000000000001111111100111111110000000
```

```
Traffic load No:      240, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  242   Max Shear-N        0.00       0.00     586.34   17589.72       0.00       0.00
  243   Max Bend-L         0.00       0.00    -375.86   30485.90       0.00       0.00
  248   Min Shear-N        0.00       0.00   -1144.92   20182.36       0.00       0.00
  249   Min Bend-L         0.00       0.00    -148.43   -4452.84       0.00       0.00

Traffic load position details:
Track: Comp.:          Positions:
  1    Max Shear-N    00000000000000000111111110011111111000000000000000
  1    Max Bend.-L    00000000000000000000000000001111111100111111110000
  1    Min Shear-N    00000000000000000000000000000000000111111111001111
  1    Min Bend.-L    01111111100111111110000000000000000000000000000000


Traffic load No:      240, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  242   Max Shear-N        0.00       0.00    2669.26      -0.43       0.00       0.00
  248   Min Shear-N        0.00       0.00    -148.43      -0.00       0.00       0.00
  249   Min Bend-L         0.00       0.00    1863.87      -0.43       0.00       0.00

Traffic load position details:
Track: Comp.:          Positions:
  1    Max Shear-N    00000000000000000000000000000000111111110011111111
  1    Min Shear-N    01111111100111111110000000000000000000000000000000
  1    Min Bend.-L    00000000000000000000000000011111111001111111100000
```

Figure.2.3 Results for element 2, SW/0 traffic loads.

```
Traffic load No:      300, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  308   Min Shear-N        0.00       0.00   -5184.38  -41062.50       0.00       0.00
  309   Min Bend-L         0.00       0.00   -5063.15  -41289.06       0.00       0.00

Traffic load position details:
Track: Comp.:          Positions:
  1    Min Shear-N    0000111111
  1    Min Bend.-L    0001111110


Traffic load No:      300, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  302   Max Shear-N        0.00       0.00     556.64   16698.77       0.00       0.00
  303   Max Bend-L         0.00       0.00    -684.38   46968.30       0.00       0.00
  308   Min Shear-N        0.00       0.00   -1422.66   24820.31       0.00       0.00
  309   Min Bend-L         0.00       0.00    -206.25   -6187.50       0.00       0.00

Traffic load position details:
Track: Comp.:          Positions:
  1    Max Shear-N    0111111000
  1    Max Bend.-L    0000111111
  1    Min Shear-N    0000000111
  1    Min Bend.-L    1111000000


Traffic load No:      300, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  302   Max Shear-N        0.00       0.00    3815.62      -0.90       0.00       0.00
  308   Min Shear-N        0.00       0.00    -206.25      -0.00       0.00       0.00
  309   Min Bend-L         0.00       0.00    3815.62      -0.90       0.00       0.00

Traffic load position details:
Track: Comp.:          Positions:
  1    Max Shear-N    0000111111
```

```
  1    Min Shear-N    1111000000
  1    Min Bend.-L    0000111111


Traffic load No:      320, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  328   Min Shear-N        0.00       0.00   -4809.00  -36540.00       0.00       0.00
  329   Min Bend-L         0.00       0.00   -4511.79  -36707.40       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    0000000000111111101111111
  1    Min Bend.-L    0000000111111101111111000


Traffic load No:      320, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  322   Max Shear-N        0.00       0.00     690.69   20720.28       0.00       0.00
  323   Max Bend-L         0.00       0.00    -137.19   41484.04       0.00       0.00
  328   Min Shear-N        0.00       0.00   -1242.31   21530.60       0.00       0.00
  329   Min Bend-L         0.00       0.00    -182.25   -5467.50       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0001111111011111110000000
  1    Max Bend.-L    0000000000001111111011111
  1    Min Shear-N    0000000000000000001111111
  1    Min Bend.-L    1101111111000000000000000


Traffic load No:      320, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  322   Max Shear-N        0.00       0.00    3591.00      -0.84       0.00       0.00
  328   Min Shear-N        0.00       0.00    -182.25      -0.00       0.00       0.00
  329   Min Bend-L         0.00       0.00    3591.00      -0.84       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    0000000000111111101111111
  1    Min Shear-N    1101111111000000000000000
  1    Min Bend.-L    0000000000111111101111111


Traffic load No:      340, Element No:     2, X/L:  0.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  348   Min Shear-N        0.00       0.00   -4601.92  -34315.45       0.00       0.00
  349   Min Bend-L         0.00       0.00   -4342.73  -34363.55       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Min Shear-N    00000000000000000000011111111111100011111111111110
  1    Min Bend.-L    00000000000000000000011111111111100011111111111111


Traffic load No:      340, Element No:     2, X/L:  0.50
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  342   Max Shear-N        0.00       0.00     572.37   17170.74       0.00       0.00
  343   Max Bend-L         0.00       0.00    -339.53   38413.93       0.00       0.00
  348   Min Shear-N        0.00       0.00   -1394.42   24467.46       0.00       0.00
  349   Min Bend-L         0.00       0.00    -172.83   -5184.79       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    00000011111111111110001111111111110000000000000000
  1    Max Bend.-L    00000000000000000000000001111111111110001111111111
  1    Min Shear-N    00000000000000000000000000000000000111111111111100
  1    Min Bend.-L    11100011111111111100000000000000000000000000000000


Traffic load No:      340, Element No:     2, X/L:  1.00
---------------------------------------------------------
Lc      Comp              Axial    Shear L    Shear N  Bending L  Bending N    Torsion
```

```
  342   Max Shear-N        0.00       0.00    3457.27      -0.78       0.00       0.00
  348   Min Shear-N        0.00       0.00    -172.83      -0.00       0.00       0.00
  349   Min Bend-L         0.00       0.00    3457.27      -0.78       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    00000000000000000000011111111111110001111111111111
  1    Min Shear-N    11100011111111111100000000000000000000000000000000
  1    Min Bend.-L    00000000000000000000011111111111110001111111111111


Element No:     2, Traffic load No:    340, X/L:  1.00
------------------------------------------------------
Lc      Comp                Axial    Shear L    Shear N  Bending L  Bending N    Torsion
  341   Max Axial          0.00       0.00       0.00       0.00       0.00       0.00
  340   Max Shear-L        0.00       0.00       0.00       0.00       0.00       0.00
  342   Max Shear-N        0.00       0.00    3457.27      -0.78       0.00       0.00
  343   Max Bend-L         0.00       0.00       0.00       0.00       0.00       0.00
  345   Max Bend-N         0.00       0.00       0.00       0.00       0.00       0.00
  344   Max Torsion        0.00       0.00       0.00       0.00       0.00       0.00
  347   Min Axial          0.00       0.00       0.00       0.00       0.00       0.00
  346   Min Shear-L        0.00       0.00       0.00       0.00       0.00       0.00
  348   Min Shear-N        0.00       0.00    -172.83      -0.00       0.00       0.00
  349   Min Bend-L         0.00       0.00    3457.27      -0.78       0.00       0.00
  351   Min Bend-N         0.00       0.00       0.00       0.00       0.00       0.00
  350   Min Torsion        0.00       0.00       0.00       0.00       0.00       0.00

Traffic load position details:
Track: Comp.:         Positions:
  1    Max Shear-N    00000000000000000000011111111111110001111111111111
  1    Max Bend.-L    00000000000000000000000001111111111111000111111111
  1    Min Shear-N    11100011111111111100000000000000000000000000000000
  1    Min Bend.-L    00000000000000000000011111111111110001111111111111
```

Figure 2.4 Results for element 2, SW/2 traffic loads.

Selected points for results:
A = Element 2, X/L = 0.0
B = Element 2, X/L = 0.5
C = Element 2, X/L = 1.0

Load type	Load No	Pos.	A (PN-Min)	B (ML-Max)	C (PN-Max)
UIC 71	100	10	-3067.1	26930.0	2213.4
UIC 71	120	25	-3216.7	29198.0	2368.1
UIC 71	140	50	-3379.1	30894.0	2515.2
SW/0	200	10	-4026.9	37738.5	3129.2
SW/0	220	25	-3345.6	30738.0	2997.8
SW/0	240	50	-3344.9	30485.9	2669.3
SW/2	300	10	-5184.4	46968.3	3815.6
SW/2	320	25	-4809.0	41484.0	3591.0
SW/2	340	50	-4601.9	38143.9	3457.3

Figure 2.5 Comparing results for the different traffic loads

It can be concluded that the accuracy of the results will depend on the selected number of position.

3 Dynamic loads: Earthquake-1

This is an example, which demonstrates the use of earthquake analyses in NovaFrame.

Example folder: *Earthquake-1*
Example files: *Earthquake-1.inp*
Earthquake-1.lod

Earthquake response is calculated for 30 modes. Results for the main ground acceleration in global Y- and X-direction is calculated.

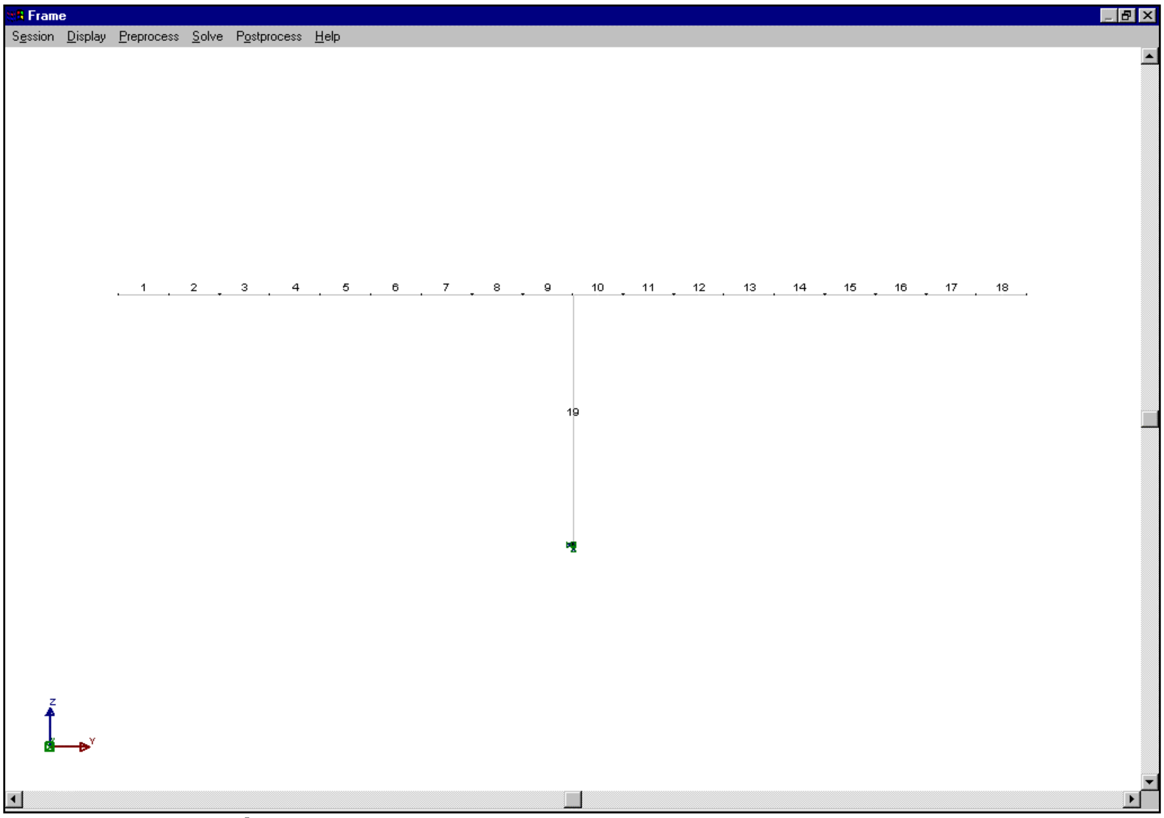


Figure 3.1 Cantilever -T.

The ASCII input is:

```
Project name: Earthquake 1

 *** NODE INPUT ***
NODEINS  1   19  1  0.000   0.000 50.000  0.000  10.000  0.000
NODEINS  20  20  1  0.000  90.000  0.000  0.000   0.000  0.000

 *** ELEMENT INPUT ***
ELEMINS     1   18   1    1    2   1
ELEMINS    19   19   1   20   10   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  1  30000  0.0  10  100  200  100

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  19  1  1  0  4
```

```
 *** BOUNDARY CONDITION INPUT ***
BOUNDINS    20    20     1    1    1    1    1    1    1

 *** ELEMENTMASS INPUT ***
ELEMMASS    1   19   1   3    0    75.000000  0.000000




 *** LOAD INPUT ***

 *** TRAFFIC LOAD INPUT ***
EARTHQUA  100     1    30     0    2.500    1.000    0.670    0.500    0.050 Maindir X
EARTHQUA  101     1    30     0    2.500    0.670    1.000    0.500    0.050 Maindir Y
```

Figure 3.2 ASCII input, (both files).

```
Loadcase no.:                  100
Ground Accelration Ga:       2.500
Scale of Ga in X-dir:        1.000
Scale of Ga in X-dir:        0.670
Scale of Ga in X-dir:        0.500

 Mode:     Freq:      SVx:      SVy:      SVz:    W-Max:      MRx:      MRy:      MRz:
    1      0.169     0.047     0.032     0.024     0.021     0.000     0.177     0.000
    2      0.185     0.052     0.035     0.026     0.000     0.000     0.000     0.000
    3      0.289     0.081     0.054     0.040     0.064     0.930     0.000     0.000
    4      0.432     0.121     0.081     0.060     0.035     0.000     0.000     0.545
    5      0.601     0.168     0.113     0.084     0.028     0.000     0.807     0.000
    6      0.752     0.181     0.121     0.090     0.018     0.070     0.000     0.000
    7      1.978     0.181     0.121     0.090     0.000     0.000     0.000     0.000
    8      2.175     0.181     0.121     0.090     0.002     0.000     0.014     0.000
    9      2.506     0.181     0.121     0.090     0.005     0.000     0.000     0.241
   10      3.354     0.181     0.121     0.090     0.000     0.000     0.000     0.000
   11      5.539     0.181     0.121     0.090     0.002     0.000     0.000     0.185
   12      5.549     0.181     0.121     0.090     0.000     0.000     0.000     0.000
   13      6.136     0.181     0.121     0.090     0.000     0.000     0.000     0.000
   14      6.371     0.181     0.121     0.090     0.000     0.000     0.001     0.000
   15      8.269     0.145     0.097     0.073     0.000     0.000     0.000     0.000
   16      8.967     0.134     0.090     0.067     0.000     0.000     0.000     0.026
   17      9.799     0.123     0.082     0.061     0.000     0.000     0.000     0.000
   18     12.533     0.096     0.064     0.048     0.000     0.000     0.000     0.000
   19     12.789     0.094     0.063     0.047     0.000     0.000     0.000     0.000
   20     15.342     0.078     0.052     0.039     0.000     0.000     0.000     0.000
   21     15.559     0.077     0.052     0.039     0.000     0.000     0.000     0.001
   22     16.477     0.073     0.049     0.036     0.000     0.000     0.000     0.000
   23     19.519     0.062     0.041     0.031     0.000     0.000     0.000     0.000
   24     21.082     0.052     0.035     0.026     0.000     0.000     0.000     0.000
   25     21.340     0.051     0.034     0.025     0.000     0.000     0.000     0.000
   26     24.478     0.035     0.024     0.018     0.000     0.000     0.000     0.000
   27     24.572     0.035     0.023     0.018     0.000     0.000     0.000     0.000
   28     26.905     0.028     0.019     0.014     0.000     0.000     0.000     0.000
   29     29.018     0.023     0.015     0.011     0.000     0.000     0.000     0.000
   30     31.611     0.018     0.012     0.009     0.000     0.000     0.000     0.000

                                                    SUM:      1.000     1.000     1.000

  Lc  Node        Ux        Uy        Uz             Rx          Ry          Rz
                 [mm]      [mm]      [mm]         [rad]       [rad]       [rad]
  100    1       66.9      24.8      49.6     0.00085025  0.00095188  0.00073301
  100    2       60.5      24.8      41.7     0.00084247  0.00095188  0.00073032
  100    3       54.4      24.8      34.0     0.00081319  0.00095188  0.00071804
  100    4       48.7      24.8      26.8     0.00075979  0.00095188  0.00068889
  100    5       43.7      24.7      20.3     0.00068894  0.00095188  0.00063783
  100    6       39.4      24.7      14.6     0.00060355  0.00095188  0.00056191
  100    7       36.1      24.6       9.8     0.00050177  0.00095188  0.00045989
  100    8       33.7      24.6       6.1     0.00038577  0.00095188  0.00033176
  100    9       32.3      24.5       3.4     0.00028148  0.00095188  0.00017822
  100   10       31.7      24.4       1.8     0.00030073  0.00095188  0.00000000
  100   11       32.3      24.5       3.4     0.00028148  0.00095188  0.00017822
```

100	12	33.7	24.6	6.1	0.00038577	0.00095188	0.00033176
100	13	36.1	24.6	9.8	0.00050177	0.00095188	0.00045989
100	14	39.4	24.7	14.6	0.00060355	0.00095188	0.00056191
100	15	43.7	24.7	20.3	0.00068894	0.00095188	0.00063783
100	16	48.7	24.8	26.8	0.00075979	0.00095188	0.00068889
100	17	54.4	24.8	34.0	0.00081319	0.00095188	0.00071804
100	18	60.5	24.8	41.7	0.00084247	0.00095188	0.00073032
100	19	66.9	24.8	49.6	0.00085025	0.00095188	0.00073301
100	20	0.0	0.0	0.0	0.00000000	0.00000000	0.00000000

Loadcase no.:	101
Ground Accelration Ga:	2.500
Scale of Ga in X-dir:	0.670
Scale of Ga in X-dir:	1.000
Scale of Ga in X-dir:	0.500

Mode:	Freq:	SVx:	SVy:	SVz:	W-Max:	MRx:	MRy:	MRz:
1	0.169	0.032	0.047	0.024	0.032	0.000	0.177	0.000
2	0.185	0.035	0.052	0.026	0.000	0.000	0.000	0.000
3	0.289	0.054	0.081	0.040	0.043	0.930	0.000	0.000
4	0.432	0.081	0.121	0.060	0.035	0.000	0.000	0.545
5	0.601	0.113	0.168	0.084	0.041	0.000	0.807	0.000
6	0.752	0.121	0.181	0.090	0.012	0.070	0.000	0.000
7	1.978	0.121	0.181	0.090	0.000	0.000	0.000	0.000
8	2.175	0.121	0.181	0.090	0.003	0.000	0.014	0.000
9	2.506	0.121	0.181	0.090	0.005	0.000	0.000	0.241
10	3.354	0.121	0.181	0.090	0.000	0.000	0.000	0.000
11	5.539	0.121	0.181	0.090	0.002	0.000	0.000	0.185
12	5.549	0.121	0.181	0.090	0.000	0.000	0.000	0.000
13	6.136	0.121	0.181	0.090	0.000	0.000	0.000	0.000
14	6.371	0.121	0.181	0.090	0.000	0.000	0.001	0.000
15	8.269	0.097	0.145	0.073	0.000	0.000	0.000	0.000
16	8.967	0.090	0.134	0.067	0.000	0.000	0.000	0.026
17	9.799	0.082	0.123	0.061	0.000	0.000	0.000	0.000
18	12.533	0.064	0.096	0.048	0.000	0.000	0.000	0.000
19	12.789	0.063	0.094	0.047	0.000	0.000	0.000	0.000
20	15.342	0.052	0.078	0.039	0.000	0.000	0.000	0.000
21	15.559	0.052	0.077	0.039	0.000	0.000	0.000	0.001
22	16.477	0.049	0.073	0.036	0.000	0.000	0.000	0.000
23	19.519	0.041	0.062	0.031	0.000	0.000	0.000	0.000
24	21.082	0.035	0.052	0.026	0.000	0.000	0.000	0.000
25	21.340	0.034	0.051	0.025	0.000	0.000	0.000	0.000
26	24.478	0.024	0.035	0.018	0.000	0.000	0.000	0.000
27	24.572	0.023	0.035	0.018	0.000	0.000	0.000	0.000
28	26.905	0.019	0.028	0.014	0.000	0.000	0.000	0.000
29	29.018	0.015	0.023	0.011	0.000	0.000	0.000	0.000
30	31.611	0.012	0.018	0.009	0.000	0.000	0.000	0.000
					SUM:	1.000	1.000	1.000

Lc	Node	Ux [mm]	Uy [mm]	Uz [mm]	Rx [rad]	Ry [rad]	Rz [rad]
101	1	44.8	37.0	63.0	0.00106708	0.00063776	0.00049112
101	2	40.5	37.0	52.9	0.00105907	0.00063776	0.00048932
101	3	36.4	37.0	43.1	0.00102767	0.00063776	0.00048109
101	4	32.6	36.9	33.9	0.00096656	0.00063776	0.00046155
101	5	29.3	36.9	25.5	0.00087869	0.00063776	0.00042734
101	6	26.4	36.8	18.3	0.00076602	0.00063776	0.00037648
101	7	24.2	36.8	12.4	0.00062979	0.00063776	0.00030812
101	8	22.6	36.7	7.9	0.00048156	0.00063776	0.00022228
101	9	21.6	36.6	4.4	0.00037517	0.00063776	0.00011941
101	10	21.3	36.5	1.8	0.00044885	0.00063776	0.00000000
101	11	21.6	36.6	4.4	0.00037517	0.00063776	0.00011941
101	12	22.6	36.7	7.9	0.00048156	0.00063776	0.00022228
101	13	24.2	36.8	12.4	0.00062979	0.00063776	0.00030812
101	14	26.4	36.8	18.3	0.00076602	0.00063776	0.00037648
101	15	29.3	36.9	25.5	0.00087869	0.00063776	0.00042734
101	16	32.6	36.9	33.9	0.00096656	0.00063776	0.00046155
101	17	36.4	37.0	43.1	0.00102767	0.00063776	0.00048109
101	18	40.5	37.0	52.9	0.00105907	0.00063776	0.00048932
101	19	44.8	37.0	63.0	0.00106708	0.00063776	0.00049112
101	20	0.0	0.0	0.0	0.00000000	0.00000000	0.00000000

Figure 3.3 Results for earthquake analysis.

The results above give detailed descriptions of the response for each mode. The results are obtained by selecting listing of displacements in the **List results** dialog. Select sort order by loadcase in order to get the details for each loadcase.

Note the sum of MRX, MRY and MRZ. This sum gives a check on whether or not the number of modes included in the calculations is sufficient. When the sum is 1.00, then all significant modes are included. According to NPD this sum must at least be 0.9.

4 Axial force: Axial-1

This is an example, which demonstrates the methods for specifying the axial force magnitude.

Example folder: *Axial-1*
Example files: *Axial-1.inp*
Axial-1.lod
Axial-1.mod

The column consists of one element. There are five identical (sub-) models defined each consisting of one single element.

The axial force magnitude for model 2, 3, 4 and 5 is specified by using the available model modification commands. The initial axial force definition is given in the AXIAL card in the ***Preprocess.. Loads..*** menu.

```
Project name: Axial-1

 *** NODE INPUT ***
NODEINS  1  2  1  0.000  0.000  0.000  0.000  0.000  10.000

 *** ELEMENT INPUT ***
ELEMINS     1    1   1    1    2   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  1  30000  0.2  1.000e+000  1.000e+000  1.000e+000  1.000e+000

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  1  1  1  0  4

 *** BOUNDARY CONDITION INPUT ***
BOUNDINS     1     1     1    1    1    1    1    1    1

 *** DESIGN SECTION INPUT ***
DESGINS     1     1     1  0.000  1.000  0.500



*** LOAD INPUT ***
LOADINS     1     1     1     1   4   3  -370000.0  10.000  0.000  0.000
LOADINS    11     1     1     1   4   2      100.0  10.000  0.000  0.000
LOADINS    12     1     1     1   4   2      100.0  10.000  0.000  0.000
LOADINS    13     1     1     1   4   2      100.0  10.000  0.000  0.000
LOADINS    14     1     1     1   4   2      100.0  10.000  0.000  0.000
LOADINS    15     1     1     1   4   2      100.0  10.000  0.000  0.000

 *** AXIALFORCE LOAD INPUT ***
AXIAL 1  1  1   2   1   0.5



 *** SUBMODELS  INPUT ***
MODEL  1  0  3    0  0  0   Model 1
MODEL  2  0  3    0  0  0   Model 2
MODEL  3  0  3    0  0  0   Model 3
MODEL  4  0  3    0  0  0   Model 4
MODEL  5  0  3    0  0  0   Model 5

 *** SUBMODEL MODIFICATION INPUT ***
MODMODIF  2  30  1  0  0       1  0.700   0  0.000   0  0.000
MODMODIF  3  31  1  0  0       1  0.900   0  0.000   0  0.000
MODMODIF  4  32  1  1  0     -400000.0
MODMODIF  5  33

 *** CALCULATION GROUP INPUT ***
```

```
  CALCGRP  1  1  11  11  1
  CALCGRP  2  1  12  12  1
  CALCGRP  3  1  13  13  1
  CALCGRP  4  1  14  14  1
  CALCGRP  5  1  15  15  1
  CALCGRP 10  1   1   1  1

   *** ANALYSES INPUT ***
  ANALYSIS  1  1   1    0 0.000
  ANALYSIS  2  2   2    0 0.000
  ANALYSIS  3  3   3    0 0.000
  ANALYSIS  4  4   4    0 0.000
  ANALYSIS  5  5   5    0 0.000
  ANALYSIS 10  5  10    0 0.000
  ANALYSIS 11  5   5    0 0.000
```

Figure 4.1 ASCII input files (all files).

```
  Node   Lc       Ux        Uy        Uz            Rx          Ry          Rz
                 [mm]      [mm]      [mm]          [rad]       [rad]       [rad]

      2    1       0.0       0.0    -123.3     0.00000000  0.00000000  0.00000000
      2   11       0.0       1.5       0.0    -0.00022366  0.00000000  0.00000000
      2   12       0.0       2.7       0.0    -0.00042108  0.00000000  0.00000000
      2   13       0.0       2.0       0.0    -0.00030611  0.00000000  0.00000000
      2   14       0.0       2.4       0.0    -0.00036667  0.00000000  0.00000000
      2   15       0.0       1.5       0.0    -0.00022366  0.00000000  0.00000000
```

Figure 4.2 Results, displacement top of column.

```
Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                     [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
   1    1   0.00 -370000.00        0.00        0.00        0.00        0.00        0.00
   1    1   0.50 -370000.00        0.00        0.00        0.00        0.00        0.00
   1    1   1.00       0.00        0.00        0.00        0.00        0.00        0.00

  Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                       [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
  11    1   0.00       0.00        0.00     -100.00    -1272.98        0.00        0.00
  11    1   0.50       0.00        0.00     -100.00     -772.98        0.00        0.00
  11    1   1.00       0.00        0.00        0.00     -272.99        0.00        0.00

  Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                       [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
  12    1   0.00       0.00        0.00     -100.00    -2214.87        0.00        0.00
  12    1   0.50       0.00        0.00     -100.00    -1714.87        0.00        0.00
  12    1   1.00       0.00        0.00        0.00    -1214.88        0.00        0.00

  Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                       [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
  13    1   0.00       0.00        0.00     -100.00    -1666.75        0.00        0.00
  13    1   0.50       0.00        0.00     -100.00    -1166.75        0.00        0.00
  13    1   1.00       0.00        0.00        0.00     -666.76        0.00        0.00

  Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                       [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
  14    1   0.00       0.00        0.00     -100.00    -1955.56        0.00        0.00
  14    1   0.50       0.00        0.00     -100.00    -1455.56        0.00        0.00
  14    1   1.00       0.00        0.00       -0.00     -955.57        0.00        0.00

  Lc Elem    X/L      Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                       [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
  15    1   0.00       0.00        0.00     -100.00    -1272.98        0.00        0.00
  15    1   0.50       0.00        0.00     -100.00     -772.98        0.00        0.00
  15    1   1.00       0.00        0.00        0.00     -272.99        0.00        0.00
```

Figure 4.3 Results, section forces.

Magnitude of axial forces in the different analyses/models and how the values are obtained:

Analysis	**Axial force:**	**Obtained by:**
1	-185000 kN	From AXIAL-definition, found by pre-analysis.
2	-444000 kN	From AXIAL-definition, + addition by using model modification cards; (0.5 +0.7)* -370000. Value of –370000 is found by pre-analysis.
3	-330000 kN	Axial force is defined by model modification only: 0.9*-370000. Value of –370000 is found by pre-analysis.
4	-400000 kN	Axial force is defined by model modification, value directly
5	0	From AXIAL-definition. Axial force is to be loaded from database according to model modification card. Load of axial forces from database fails. This can be viewed by pressing the "View errors and warnings"-button in the **Solve Analyses** dialog. (No results for loadcase 1)
10	0	Loadcase 1 is analyzed.
11	-185000 kN	From AXIAL-definition. Axial force is to be loaded from database according to model modification card. Load of axial forces from database gives: –370000*0.5.

Figure 4.4 Analyses and axial force levels.

The axial force magnitude, which is defined for each model can, when the analyses are performed and saved to the database, be viewed in the Novaframe document. The calculated axial force magnitudes are presented for each model.

Note that the moments in the column includes the second order moment generated by the axial force and the deformation.

5 Creep loads: Creep-1

This example gives a short description of the use of creep capabilities in NovaFrame.

Example folder: *Creep-1*
Example files: *Creep-1.inp*
Creep-1.lod
Creep-1.mod

The structure consists of two cantilevers, which are built simultaneously on a fixed framework. After 30 days the framework is removed and the self-weight is activated on the cantilevers. The cantilever remains like this for 60 days until they, at the age of 90 days, are connected. At the age of 9999 days the cantilevers are again evaluated after being connected for 9909 days. This approach is somewhat theoretic but it simulates a simplified approach relevant for cantilever bridges.

The “Bridge” is symmetric, hence only the left cantilever is evaluated in the calculations. The ASCII Input is shown in figure 5.2. It is required to define two static models in order to perform the calculations at the different construction stages.

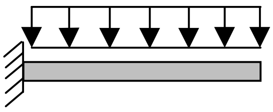
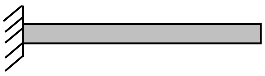
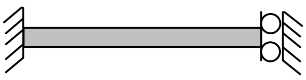
Loadcase	Model	Analysis/phase
1		Self weight applied, Model 1 Analysis 1 T = 30 [days]
2		Creep deformation, Model 1 Analysis 2 T = 30 – 90 [days]
3		Connected Creep redistribution, Model 2 Analysis 3 T = 90 – 9999 [days]

Figure 5.1 Model and analyses.

```
Project name: Creep-1


 *** NODE INPUT ***
NODEINS  1  2  1  0.000  0.000  0.000  0.000  100.000  0.000

 *** ELEMENT INPUT ***
ELEMINS     1    1   1    1    2   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  4  30000  0.2  10.000  10.000  1.000  1.000

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  1  1  1  0  4

 *** BOUNDARY CONDITION INPUT ***
BOUNDINS     1     1     1    1    1    1    1    1    1

 *** DESIGN SECTION INPUT ***
DESGINS     1     1     1  0.000  1.000  0.200
```

```
 *** LOAD INPUT ***
LOADINS     1     1     1     1     3     3  -24.000 0.0  0.0  0.0 Self weight

 *** CREEP COMBINATION INPUT ***
CREEPCMB   10   1   1.000

 *** CREEP LOAD INPUT ***
CREEPLC   2   1  1   1   10   2   0.538  0.000  0.000  Creep Cant
CREEPLC   3   1  1   1   10   2   0.833  0.000  0.000  Creep Conn.



 *** SUBMODELS  INPUT ***
MODEL  1  0  3    0  0  0 Free  End 2
MODEL  2  0  3    0  0  0 Fixed End 2

 *** SUBMODEL MODIFICATION INPUT ***
MODMODIF  2   1  2  2  1    100111

 *** CALCULATION GROUP INPUT ***
CALCGRP  1  1  1  1  1  Self weight canteliver
CALCGRP  2  3  2  2  1  Creep canteliver
CALCGRP  3  3  3  3  1  Creep connected

 *** ANALYSES INPUT ***
ANALYSIS 1   1   1  0 0.000   Self weight
ANALYSIS 2   1   2  0 0.000   Creep canteliver
ANALYSIS 3   2   3  0 0.000   Creep connected
```

Figure 5.2 ASCII input (All files).

```
Node   Lc       Ux        Uy        Uz            Rx          Ry          Rz
               [mm]      [mm]      [mm]          [rad]       [rad]       [rad]

    2    1       0.0       0.0     -20.3    -0.00027100  0.00000000  0.00000000
    2    2       0.0       0.0     -11.1    -0.00014872  0.00000000  0.00000000
    2    3       0.0       0.0      -5.6    -0.00000000  0.00000000  0.00000000


   Lc Elem    X/L       Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                         [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
    1    1   0.00        0.00        0.00    -2400.00  -120000.00        0.00        0.00
    1    1   0.20        0.00        0.00    -1920.00   -76800.05        0.00        0.00
    1    1   0.40        0.00        0.00    -1440.00   -43200.10        0.00        0.00
    1    1   0.60        0.00        0.00     -960.00   -19200.14        0.00        0.00
    1    1   0.80        0.00        0.00     -480.00    -4800.19        0.00        0.00
    1    1   1.00        0.00        0.00        0.00       -0.24        0.00        0.00

   Lc Elem    X/L       Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                         [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
    2    1   0.00        0.00        0.00        0.00       -0.00        0.00        0.00
    2    1   0.20        0.00        0.00        0.00       -0.00        0.00        0.00
    2    1   0.40        0.00        0.00        0.00       -0.00        0.00        0.00
    2    1   0.60        0.00        0.00        0.00       -0.00        0.00        0.00
    2    1   0.80        0.00        0.00        0.00       -0.00        0.00        0.00
    2    1   1.00        0.00        0.00        0.00       -0.00        0.00        0.00

   Lc Elem    X/L       Axial     Shear L     Shear N   Bending L   Bending N     Torsion
                         [kN]        [kN]        [kN]       [kNm]       [kNm]       [kNm]
    3    1   0.00        0.00        0.00        0.00    19897.84        0.00        0.00
    3    1   0.20        0.00        0.00        0.00    19897.84        0.00        0.00
    3    1   0.40        0.00        0.00        0.00    19897.84        0.00        0.00
    3    1   0.60        0.00        0.00        0.00    19897.84        0.00        0.00
    3    1   0.80        0.00        0.00        0.00    19897.84        0.00        0.00
    3    1   1.00        0.00        0.00        0.00    19897.84        0.00        0.00
```

Figure 5.3 Listing of results

Results:

Displacement at node 2 (tip of cantilever):

Loadcase 1: Immediate displacement when framework is removed:	20.3 mm.
Loadcase 2: Creep before tip is connected:	11.1 mm.
Loadcase 3: Creep after tip is connected:	5.6 mm.
Total displacement after 9999 days:	36.9 mm.

Redistribution of forces starting when cantilever is connected, is found from analysis 3 and loadcase 3
At support the moment is -120000 + 19898 = -100102 kNm.
At field/tip the moment is 19898 kNm.

Using the simplified 22/78 method gives:

$$M = 0.22*M_0 + 0.78*M_\infty$$

Support;	0.22*120000 + 0.78*80000	= 88800 kNm
Field;	0.22*0.0 + 0.78*40000	= 31200 kNm

6 Creep loads: Creep-2

This example shows the use of multiple analyses and calculation of creep.

Example folder: *Creep-2*
Example files: *Creep-2.inp*
Creep-2.lod
Creep-2.mod
Creep-2.cmb

The example is obtained from: “Trost et al., Der Bauingenieur, 1970, Heft 5”.

The system and its different construction stages is shown in figure 6.1
A continuos beam with three spans is cast in three steps. Each stage in the process has its own model.

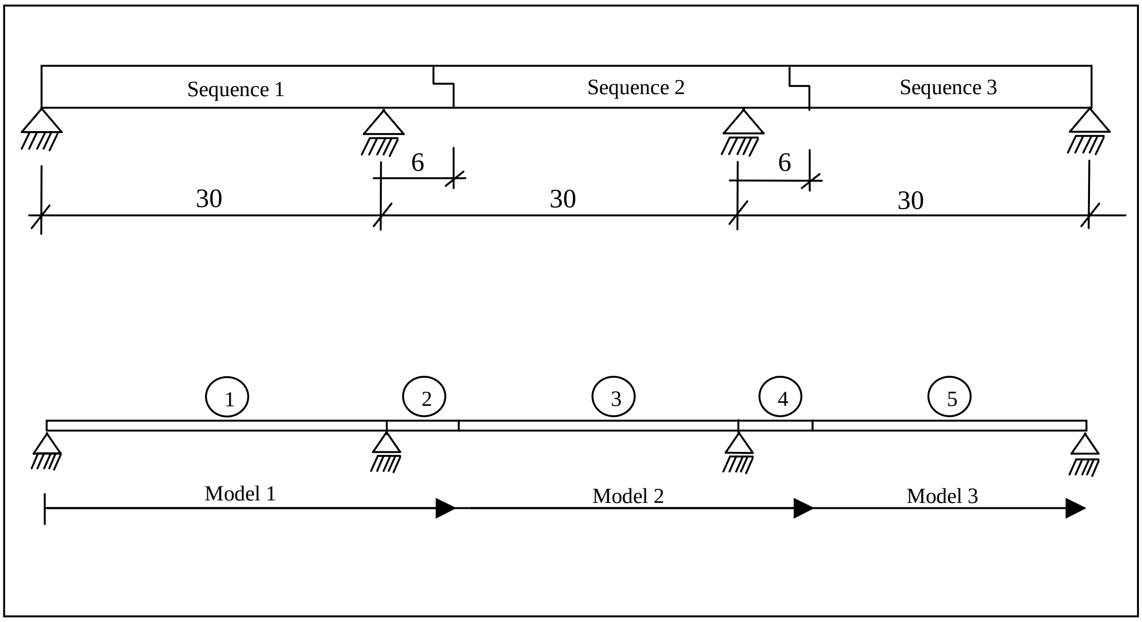


Figure 6.1 Construction stages, system and sub models

Each sequence is an addition to the existing model resulting in a new model.
The building process can be represented with 5 different stages to be analysed see fig 1.6.2.

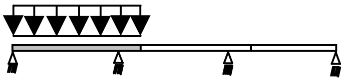
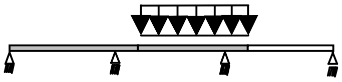
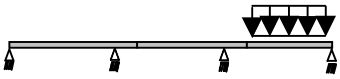
Loadcase	Model	Analysis/phase
1		Sequence 1, Model 1 Analysis 1 T = 0 – 7 [days]
2		Sequence 2, Model 2 Analysis 2 T = 14 – 21 [days]
3		Creep redistribution, Model 2 Analysis 10 T = 21 – 35 [days]
4		Sequence 3, Model 3 Analysis 3 T = 28 – 35 [days]
5		Creep redistribution, Model 3 Analysis 11 T = 35 – ∞ [days]

Figure 6.2 Analyses

The input is listed below:

```
Project name: Creep 2

 *** NODE INPUT ***
NODEINS  1  1  1  0.000  0.000  0.000  0.000  0.000  0.000
NODEINS  2  2  1  0.000  30.000  0.000  0.000  0.000  0.000
NODEINS  3  3  1  0.000  36.000  0.000  0.000  0.000  0.000
NODEINS  4  4  1  0.000  60.000  0.000  0.000  0.000  0.000
NODEINS  5  5  1  0.000  66.000  0.000  0.000  0.000  0.000
NODEINS  6  6  1  0.000  90.000  0.000  0.000  0.000  0.000

 *** ELEMENT INPUT ***
ELEMINS     1    5   1    1    2   1

 *** GEOMETRY SECTION INPUT ***
SECTINS  1  1  30000  0.2  1.000e+001  1.000e+001  1.000e+001  1.000e+001

 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS  1  5  1  1  0  4

 *** BOUNDARY CONDITION INPUT ***
BOUNDINS     1     1     1    1    1    1    0    1    1
BOUNDINS     2     2     1    1    0    1    0    1    1
BOUNDINS     4     4     1    1    0    1    0    1    1
BOUNDINS     6     6     1    1    0    1    0    1    1

 *** JOINT INPUT ***

 *** DESIGN SECTION INPUT ***
DESGINS     1     1     1  0.000  1.000  0.200
DESGINS     2     2     1  0.000  1.000  1.000
DESGINS     3     3     1  0.000  1.000  0.250
DESGINS     4     4     1  0.000  1.000  1.000
DESGINS     5     5     1  0.000  1.000  0.250




 *** LOAD INPUT ***
LOADINS     1     1     2     1     3     3  -100.000    0.000    0.000    0.000
LOADINS     2     3     4     1     3     3  -100.000    0.000    0.000    0.000
LOADINS     4     5     5     1     3     3  -100.000    0.000    0.000    0.000
LOADINS    10     1     5     1     3     3  -100.000    0.000    0.000    0.000

 *** CREEP COMBINATIONS ***
CREEPCMB    1     1   1.000  2  1.000
```

```
CREEPCMB    2     1   1.000  2  1.000  3  1.000
CREEPCMB    2     4   1.000

 *** CREEP LOADCASES ***
CREEPLC    3     1     2     1     1     2     0.170    0.000    0.000  Kryp
CREEPLC    3     3     4     1     1     2     0.480    0.000    0.000  Kryp
CREEPLC    5     1     2     1     2     2     1.030    0.000    0.000  Kryp
CREEPLC    5     3     4     1     2     2     1.340    0.000    0.000  Kryp
CREEPLC    5     5     5     1     2     2     2.210    0.000    0.000  Kryp




 *** SUBMODELS  INPUT ***
MODEL  1  -1  3    1  2  0
MODEL  2   1  3    3  4  0
MODEL  3   2  3    5  5  0

 *** SUBMODEL MODIFICATION INPUT ***

 *** CALCULATION GROUP INPUT ***
CALCGRP   1  1   1   1  1
CALCGRP   2  1   2   2  1
CALCGRP   3  1   4   4  1
CALCGRP   4  1  10  10  1
CALCGRP  10  3   3   3  1
CALCGRP  11  3   5   5  1

 *** ANALYSES INPUT ***
ANALYSIS 1  1  1    0   0.000   Self weight cast 1
ANALYSIS 2  2  2    0   0.000   Self weight cast 2
ANALYSIS 3  3  3    0   0.000   Self weight cast 3
ANALYSIS 4  3  4    0   0.000   Self weight cast entire model
ANALYSIS 10  2  10  0   0.000   Creep part 1
ANALYSIS 11  3  11  0   0.000   Creep part 2



 *** ORDINARY COMBINATION INPUT ***
ORDCOMB   6  1  1   1  1.000  2  1.000  4  1.000
ORDCOMB  10  1  1   1  1.000  2  1.000  3  1.000
ORDCOMB  10  1  1   4  1.000  5  1.000
ORDCOMB  11  1  1  10  0.780
ORDCOMB  11  1  2   6  0.220
```

Figure 6.3 ASCII input (all files).

Combined results are shown in figure 1.6.4. Combination 10 is the sum of loadcase 1-5, which gives the force at infinite time. Combination 11 is calculated by the 22/78 method.
The results are compared with moments at support calculated by “Trost et al.” in figure 1.6.5. The difference between Combination 10 and the result from “Trost” is mainly the difference in partial creep factors.

Comb	Elem	X/L	Axial [kN]	Shear L [kN]	Shear N [kN]	Bending L [kNm]	Bending N [kNm]	Torsion [kNm]
10	1	0.00	0.00	0.00	-1255.21	-0.00	0.00	0.00
10	1	0.20	0.00	0.00	-655.21	5731.27	0.00	0.00
10	1	0.40	0.00	0.00	-55.21	7862.55	0.00	0.00
10	1	0.60	0.00	0.00	544.79	6393.82	0.00	0.00
10	1	0.80	0.00	0.00	1144.79	1325.10	0.00	0.00
10	1	1.00	0.00	0.00	1744.79	-7343.63	0.00	0.00
10	2	0.00	0.00	0.00	-1443.31	-7343.33	0.00	0.00
10	2	1.00	0.00	0.00	-843.31	-483.45	0.00	0.00
10	3	0.00	0.00	0.00	-843.31	-483.39	0.00	0.00
10	3	0.25	0.00	0.00	-243.31	2776.48	0.00	0.00
10	3	0.50	0.00	0.00	356.69	2436.36	0.00	0.00
10	3	0.75	0.00	0.00	956.69	-1503.76	0.00	0.00
10	3	1.00	0.00	0.00	1556.69	-9043.89	0.00	0.00
10	4	0.00	0.00	0.00	-1801.44	-9043.65	0.00	0.00
10	4	1.00	0.00	0.00	-1201.44	-34.98	0.00	0.00
10	5	0.00	0.00	0.00	-1201.44	-34.92	0.00	0.00

10	5	0.25	0.00	0.00	-601.44	5373.75	0.00	0.00
10	5	0.50	0.00	0.00	-1.44	7182.42	0.00	0.00
10	5	0.75	0.00	0.00	598.56	5391.09	0.00	0.00
10	5	1.00	0.00	0.00	1198.56	-0.24	0.00	0.00

Comb	Elem	X/L	Axial [kN]	Shear L [kN]	Shear N [kN]	Bending L [kNm]	Bending N [kNm]	Torsion [kNm]
11	1	0.00	0.00	0.00	-1229.76	-0.00	0.00	0.00
11	1	0.20	0.00	0.00	-629.76	5578.56	0.00	0.00
11	1	0.40	0.00	0.00	-29.76	7557.12	0.00	0.00
11	1	0.60	0.00	0.00	570.24	5935.69	0.00	0.00
11	1	0.80	0.00	0.00	1170.24	714.25	0.00	0.00
11	1	1.00	0.00	0.00	1770.24	-8107.19	0.00	0.00
11	2	0.00	0.00	0.00	-1484.72	-8106.89	0.00	0.00
11	2	1.00	0.00	0.00	-884.72	-998.56	0.00	0.00
11	3	0.00	0.00	0.00	-884.72	-998.50	0.00	0.00
11	3	0.25	0.00	0.00	-284.72	2509.84	0.00	0.00
11	3	0.50	0.00	0.00	315.28	2418.17	0.00	0.00
11	3	0.75	0.00	0.00	915.28	-1273.50	0.00	0.00
11	3	1.00	0.00	0.00	1515.28	-8565.17	0.00	0.00
11	4	0.00	0.00	0.00	-1785.49	-8564.93	0.00	0.00
11	4	1.00	0.00	0.00	-1185.49	348.00	0.00	0.00
11	5	0.00	0.00	0.00	-1185.49	348.06	0.00	0.00
11	5	0.25	0.00	0.00	-585.49	5660.98	0.00	0.00
11	5	0.50	0.00	0.00	14.51	7373.91	0.00	0.00
11	5	0.75	0.00	0.00	614.51	5486.83	0.00	0.00
11	5	1.00	0.00	0.00	1214.51	-0.24	0.00	0.00

Figure 6.4 Results of combinations.

Section	**Comb 10**	**Comb 11** ($0.22*M_0 + 0.78*M_\infty$)	**Trost**
El 1 – 1.00	-7344	-8107	-7891
El 3 – 1.00	-9044	-8565	-8911

Figure 6.5 Comparison of results, Moment ML [kNm].

7 Creep loads: Creep-3

This example shows how a creep calculation for a cantilever with stressed tendons is handled.

Example folder: *Creep-3*
Example files: *Creep-3.inp*
Creep-3.lod
Creep-3.mod
Creep-3.cmb

The model and the amount of tendons are shown on figure 7.1.

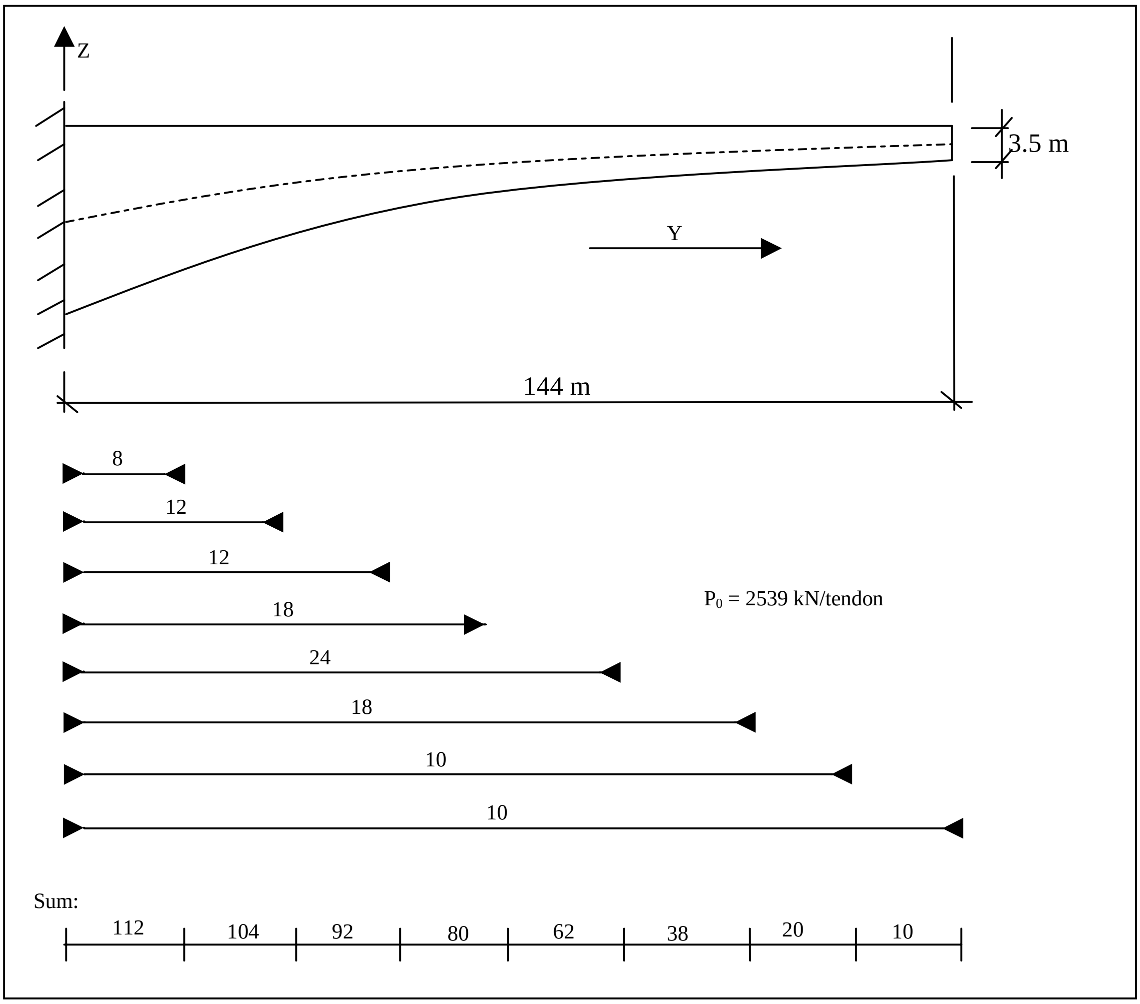
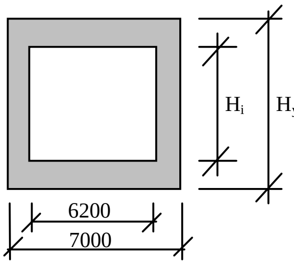


Figure 7.1 Geometry and prestressing cables

In this calculation the redistribution of forces due to creep is calculated. Effects of creep before the connection has no influence on the force distribution. Partial creep factors are calculated according to:

Elements:	**1-4**	**5-8**	**9-12**	**13-16**	**17-20**	**21-24**	**25-28**	**29-32**
H_y[mm]	13000	10000	8200	6600	5100	4200	3700	3500
H_i[mm]	11500	8500	6700	5100	3600	2700	2200	2000
Age: t_1	250	200	160	125	100	70	40	14
$\Delta\varphi$	0.79	0.85	0.91	0.98	1.03	1.11	1.23	1.41

t_0 = 3 days
t_∞ = 9999 days
RH = 70%
f_{cck} = 54 Mpa (C65)



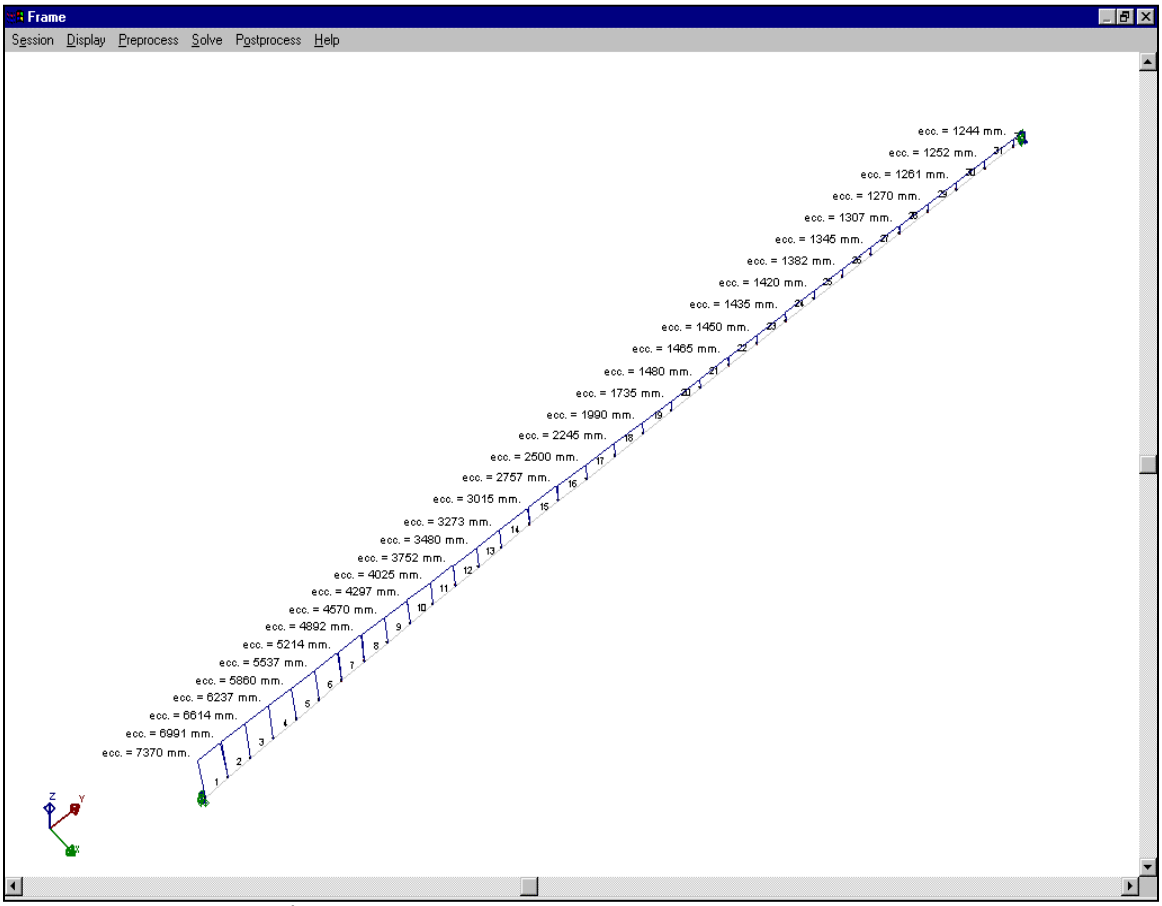


Figure 7.2 Eccentricites for tendons, element numbers are also shown.

Two static models are used:

- Model 1 is a cantilever used for calculating section forces for self-weight and prestressing prior to connection. This model consists of element 1 to 31.
- Model 2 also includes element 32 and constraints applicable for the mid-field.

Pleas note that both the left and the right end of model 2 is restrained in global Y-direction. Due to creep effects following connection one can expect contribution from tension in the cantilever from the creep phase.

The analyses are performed in three steps:

Analysis 1; Before the cantilever is connected. Ordinary static loads are:
Self weight loadcase 11.
Prestress (parasite) loadcase 12. (Used for design).
Total section forces due to prestress loadcase 13. (For the creep analysis).

Analysis 2; Cantilever is connected. A creep analysis is performed for:
Creep loadcase 14.

Analysis 3; Cantilever is connected. Ordinary static loads are:
Self weight loadcase 21.
Prestress (parasite) loadcase 22.

The loadcases 21 and 22 are used to estimate the effect of creep based on a simplified method where 22% of the initial state is added to 78% of the final state.

The input required to establish geometry, loads, models and analyses are shown below. In addition the definition of a few load combinations are included. See figure 7.3 - 7.6.

The combined results of the analyses are shown in figure 7.7. The results at support (Element 1 X/L = 0.0) and at mid-field (Element 32 X/L = 1.0) is presented. Combination 1- 7 are the result of each loadcase. Note that prestress loadcase 12 (comb.2) does not give any section forces while prestress loadcase 13 (comb.3) gives the total forces.
The redistribution of creep is stored to loadcase 14 (comb.4). Note that there is a considerable tension in the cantilever due to the constraints in both ends.

Combination 7 gives the total section forces after creep. These forces can be compared with section forces for self-weight Lc 11 before connection. Note that the parasite forces due to prestressing is zero. Normally one would expect that the section forces at support should decrease and that the section forces in the mid-field should increase. The situation for this example is that the section force at support also increases relative to the moment obtained from a free cantilever. The reason for this is the curvature of the cantilever COG, see fig 1.7.1, and the axial tension due to creep redistribution.

Combination 8 presents the total section forces by using the simplified 22/78 method. The results compare reasonably well. This method also provides axial tension and eccentricity moments.

```
Project name: Creep-3


 *** NODE INPUT ***
NODEINS       101      0       0     0         0     44.36         0         0         0
NODEINS       102      0       0     0         4     44.97         0         0         0
NODEINS       103      0       0     0         8     45.46         0         0         0
NODEINS       104      0       0     0        12     45.93         0         0         0
NODEINS       105      0       0     0        16     46.41         0         0         0
NODEINS       106      0       0     0        20     46.88         0         0         0
NODEINS       107      0       0     0        24     47.32         0         0         0
NODEINS       108      0       0     0        28     47.71         0         0         0
NODEINS       109      0       0     0        32     48.06         0         0         0
NODEINS       110      0       0     0        36     48.45         0         0         0
NODEINS       111      0       0     0        40     48.82         0         0         0
NODEINS       112      0       0     0        44     49.17         0         0         0
NODEINS       113      0       0     0        48     49.53         0         0         0
NODEINS       114      0       0     0        52     49.86         0         0         0
NODEINS       115      0       0     0        57     50.31         0         0         0
NODEINS       116      0       0     0        62     50.62         0         0         0
NODEINS       117      0       0     0        67     50.73         0         0         0
NODEINS       118      0       0     0        72     51.02         0         0         0
NODEINS       119      0       0     0        77     51.29         0         0         0
NODEINS       120      0       0     0        82     51.54         0         0         0
NODEINS       121      0       0     0        87     51.77         0         0         0
NODEINS       122      0       0     0        92     51.98         0         0         0
NODEINS       123      0       0     0        97     52.06         0         0         0
NODEINS       124      0       0     0       102     52.24         0         0         0
NODEINS       125      0       0     0       107     52.35         0         0         0
NODEINS       126      0       0     0       112     52.45         0         0         0
NODEINS       127      0       0     0       117     52.49         0         0         0
NODEINS       128      0       0     0       122     52.56         0         0         0
NODEINS       129      0       0     0       127      52.6         0         0         0
NODEINS       130      0       0     0       132     52.64         0         0         0
NODEINS       131      0       0     0       137     52.65         0         0         0
NODEINS       132      0       0     0       142     52.66         0         0         0
NODEINS       133      0       0     0       144     52.66         0         0         0


 *** ELEMENT INPUT ***
ELEMINS         1     32       1   101       102         1


 *** GEOMETRY SECTION INPUT ***
SECTINS         1      1 29500.0   0.0     22.20    652.40    355.70    176.80
SECTINS         2      1 29500.0   0.0     21.60    572.80    331.10    170.30
SECTINS         3      1 29500.0   0.0     21.00    502.50    307.70    164.10
SECTINS         4      1 29500.0   0.0     20.50    440.30    285.50    158.20
SECTINS         5      1 29500.0   0.0     19.80    383.20    264.30    152.10
SECTINS         6      1 29500.0   0.0     19.20    332.60    244.30    146.20
SECTINS         7      1 29500.0   0.0     18.60    289.00    225.40    140.70
SECTINS         8      1 29500.0   0.0     18.10    252.70    208.00    135.90
SECTINS         9      1 29500.0   0.0     17.00    217.40    176.20    124.10
SECTINS        10      1 29500.0   0.0     16.50    188.90    162.90    119.90
SECTINS        11      1 29500.0   0.0     16.00    163.70    149.80    115.60
SECTINS        12      1 29500.0   0.0     15.50    141.80    137.50    111.50
SECTINS        13      1 29500.0   0.0     14.80    121.80    126.00    107.20
SECTINS        14      1 29500.0   0.0     14.30    103.80    114.20    103.20
SECTINS        15      1 29500.0   0.0     13.30     84.10    101.30     97.40
SECTINS        16      1 29500.0   0.0     12.80     71.20     90.80     93.80
SECTINS        17      1 29500.0   0.0     11.80     57.60     78.00     88.70
SECTINS        18      1 29500.0   0.0     11.30     48.90     70.00     85.30
SECTINS        19      1 29500.0   0.0     10.80     41.60     62.80     82.20
SECTINS        20      1 29500.0   0.0     10.40     35.70     56.50     79.40
SECTINS        21      1 29500.0   0.0      9.90     30.60     50.80     76.60
SECTINS        22      1 29500.0   0.0      9.50     26.60     46.00     74.20
SECTINS        23      1 29500.0   0.0      8.10     21.60     36.00     67.50
SECTINS        24      1 29500.0   0.0      7.70     19.00     32.90     65.70
SECTINS        25      1 29500.0   0.0      7.60     17.50     30.90     64.60
SECTINS        26      1 29500.0   0.0      7.50     16.30     29.30     63.80
SECTINS        27      1 29500.0   0.0      7.20     15.30     28.00     59.30
SECTINS        28      1 29500.0   0.0      7.10     14.50     26.90     58.60
SECTINS        29      1 29500.0   0.0      7.00     14.10     26.30     58.30
SECTINS        30      1 29500.0   0.0      7.00     13.80     25.90     58.10
```

```
SECTINS        31      1 29500.0   0.0      7.00     13.80     25.80     58.00
SECTINS        32      1 29500.0   0.0      7.00     13.70     25.80     58.00


 *** ELEMENT SPECIFICATION INPUT ***
ELSPINS     1   32   1    1   1   4

 *** BOUNDARY CONDITION INPUT ***
BOUNDINS      101      0       0     1         1         1         1         1         1
BOUNDINS      133      0       0     1         1         0         1         1         1


 *** DESIGN SECTION INPUT ***
DESGINS        1     31       1     0         1         2
DESGINS       32     32       1     0         1         1
```

Figure 7.3 Geometry input

```
Project name: Creep-3

 *** LOAD INPUT ***
LOADINS  11   1   31  1    1  3     -26.0     0.000     0.000       0.0 SelfWeight 1-31
LOADINS  21   1   32  1    1  3     -26.0     0.000     0.000       0.0 SelfWight 32
LOADINS  12   1    1  1    7  5    2539.0     7.370    -0.379     112.0 Prest. parasite1
LOADINS  12   2    2  1    7  5    2538.0     6.991    -0.377     112.0 Prest. parasite1
LOADINS  12   3    3  1    7  5    2538.0     6.614    -0.377     112.0 Prest. parasite1
LOADINS  12   4    4  1    7  5    2539.0     6.237    -0.377     112.0 Prest. parasite1
LOADINS  12   5    5  1    7  5    2539.0     5.860    -0.323     104.0 Prest. parasite1
LOADINS  12   6    6  1    7  5    2538.0     5.537    -0.323     104.0 Prest. parasite1
LOADINS  12   7    7  1    7  5    2538.0     5.214    -0.322     104.0 Prest. parasite1
LOADINS  12   8    8  1    7  5    2539.0     4.892    -0.322     104.0 Prest. parasite1
LOADINS  12   9    9  1    7  5    2539.0     4.570    -0.273      92.0 Prest. parasite1
LOADINS  12  10   10  1    7  5    2538.0     4.297    -0.273      92.0 Prest. parasite1
LOADINS  12  11   11  1    7  5    2538.0     4.025    -0.272      92.0 Prest. parasite1
LOADINS  12  12   12  1    7  5    2539.0     3.752    -0.272      92.0 Prest. parasite1
LOADINS  12  13   13  1    7  5    2539.0     3.480    -0.207      80.0 Prest. parasite1
LOADINS  12  14   14  1    7  5    2538.0     3.273    -0.258      80.0 Prest. parasite1
LOADINS  12  15   15  1    7  5    2538.0     3.015    -0.258      80.0 Prest. parasite1
LOADINS  12  16   16  1    7  5    2539.0     2.757    -0.257      80.0 Prest. parasite1
LOADINS  12  17   17  1    7  5    2539.0     2.500    -0.255      62.0 Prest. parasite1
LOADINS  12  18   18  1    7  5    2538.0     2.245    -0.255      62.0 Prest. parasite1
LOADINS  12  19   19  1    7  5    2538.0     1.990    -0.255      62.0 Prest. parasite1
LOADINS  12  20   20  1    7  5    2539.0     1.735    -0.255      62.0 Prest. parasite1
LOADINS  12  21   21  1    7  5    2539.0     1.480    -0.015      38.0 Prest. parasite1
LOADINS  12  22   22  1    7  5    2538.0     1.465    -0.015      38.0 Prest. parasite1
LOADINS  12  23   23  1    7  5    2538.0     1.450    -0.015      38.0 Prest. parasite1
LOADINS  12  24   24  1    7  5    2539.0     1.435    -0.015      38.0 Prest. parasite1
LOADINS  12  25   25  1    7  5    2539.0     1.420    -0.038      20.0 Prest. parasite1
LOADINS  12  26   26  1    7  5    2538.0     1.382    -0.037      20.0 Prest. parasite1
LOADINS  12  27   27  1    7  5    2538.0     1.345    -0.038      20.0 Prest. parasite1
LOADINS  12  28   28  1    7  5    2539.0     1.307    -0.037      20.0 Prest. parasite1
LOADINS  12  29   29  1    7  5    2539.0     1.270    -0.009      10.0 Prest. parasite1
LOADINS  12  30   30  1    7  5    2538.0     1.261    -0.009      10.0 Prest. parasite1
LOADINS  12  31   31  1    7  5    2539.0     1.252    -0.009      10.0 Prest. parasite1
LOADINS  12  32   32  1    7  5    2540.0     1.244    -0.004      10.0 Prest. parasite1
LOADINS  13   1    1  1   11  5    2539.0     7.370    -0.379     112.0   Prest. creep
LOADINS  13   2    2  1   11  5    2538.0     6.991    -0.377     112.0   Prest. creep
LOADINS  13   3    3  1   11  5    2538.0     6.614    -0.377     112.0   Prest. creep
LOADINS  13   4    4  1   11  5    2539.0     6.237    -0.377     112.0   Prest. creep
LOADINS  13   5    5  1   11  5    2539.0     5.860    -0.323     104.0   Prest. creep
LOADINS  13   6    6  1   11  5    2538.0     5.537    -0.323     104.0   Prest. creep
LOADINS  13   7    7  1   11  5    2538.0     5.214    -0.322     104.0   Prest. creep
LOADINS  13   8    8  1   11  5    2539.0     4.892    -0.322     104.0   Prest. creep
LOADINS  13   9    9  1   11  5    2539.0     4.570    -0.273      92.0   Prest. creep
LOADINS  13  10   10  1   11  5    2538.0     4.297    -0.273      92.0   Prest. creep
LOADINS  13  11   11  1   11  5    2538.0     4.025    -0.272      92.0   Prest. creep
LOADINS  13  12   12  1   11  5    2539.0     3.752    -0.272      92.0   Prest. creep
LOADINS  13  13   13  1   11  5    2539.0     3.480    -0.207      80.0   Prest. creep
LOADINS  13  14   14  1   11  5    2538.0     3.273    -0.258      80.0   Prest. creep
LOADINS  13  15   15  1   11  5    2538.0     3.015    -0.258      80.0   Prest. creep
LOADINS  13  16   16  1   11  5    2539.0     2.757    -0.257      80.0   Prest. creep
LOADINS  13  17   17  1   11  5    2539.0     2.500    -0.255      62.0   Prest. creep
```

```
LOADINS  13  18   18  1   11  5    2538.0     2.245    -0.255      62.0   Prest. creep
LOADINS  13  19   19  1   11  5    2538.0     1.990    -0.255      62.0   Prest. creep
LOADINS  13  20   20  1   11  5    2539.0     1.735    -0.255      62.0   Prest. creep
LOADINS  13  21   21  1   11  5    2539.0     1.480    -0.015      38.0   Prest. creep
LOADINS  13  22   22  1   11  5    2538.0     1.465    -0.015      38.0   Prest. creep
LOADINS  13  23   23  1   11  5    2538.0     1.450    -0.015      38.0   Prest. creep
LOADINS  13  24   24  1   11  5    2539.0     1.435    -0.015      38.0   Prest. creep
LOADINS  13  25   25  1   11  5    2539.0     1.420    -0.038      20.0   Prest. creep
LOADINS  13  26   26  1   11  5    2538.0     1.382    -0.037      20.0   Prest. creep
LOADINS  13  27   27  1   11  5    2538.0     1.345    -0.038      20.0   Prest. creep
LOADINS  13  28   28  1   11  5    2539.0     1.307    -0.037      20.0   Prest. creep
LOADINS  13  29   29  1   11  5    2539.0     1.270    -0.009      10.0   Prest. creep
LOADINS  13  30   30  1   11  5    2538.0     1.261    -0.009      10.0   Prest. creep
LOADINS  13  31   31  1   11  5    2539.0     1.252    -0.009      10.0   Prest. creep
LOADINS  13  32   32  1   11  5    2540.0     1.244    -0.004      10.0   Prest. creep
LOADINS  22   1    1  1    7  5    2539.0     7.370    -0.379     112.0  Prest. parasite2
LOADINS  22   2    2  1    7  5    2538.0     6.991    -0.377     112.0  Prest. parasite2
LOADINS  22   3    3  1    7  5    2538.0     6.614    -0.377     112.0  Prest. parasite2
LOADINS  22   4    4  1    7  5    2539.0     6.237    -0.377     112.0  Prest. parasite2
LOADINS  22   5    5  1    7  5    2539.0     5.860    -0.323     104.0  Prest. parasite2
LOADINS  22   6    6  1    7  5    2538.0     5.537    -0.323     104.0  Prest. parasite2
LOADINS  22   7    7  1    7  5    2538.0     5.214    -0.322     104.0  Prest. parasite2
LOADINS  22   8    8  1    7  5    2539.0     4.892    -0.322     104.0  Prest. parasite2
LOADINS  22   9    9  1    7  5    2539.0     4.570    -0.273      92.0  Prest. parasite2
LOADINS  22  10   10  1    7  5    2538.0     4.297    -0.273      92.0  Prest. parasite2
LOADINS  22  11   11  1    7  5    2538.0     4.025    -0.272      92.0  Prest. parasite2
LOADINS  22  12   12  1    7  5    2539.0     3.752    -0.272      92.0  Prest. parasite2
LOADINS  22  13   13  1    7  5    2539.0     3.480    -0.207      80.0  Prest. parasite2
LOADINS  22  14   14  1    7  5    2538.0     3.273    -0.258      80.0  Prest. parasite2
LOADINS  22  15   15  1    7  5    2538.0     3.015    -0.258      80.0  Prest. parasite2
LOADINS  22  16   16  1    7  5    2539.0     2.757    -0.257      80.0  Prest. parasite2
LOADINS  22  17   17  1    7  5    2539.0     2.500    -0.255      62.0  Prest. parasite2
LOADINS  22  18   18  1    7  5    2538.0     2.245    -0.255      62.0  Prest. parasite2
LOADINS  22  19   19  1    7  5    2538.0     1.990    -0.255      62.0  Prest. parasite2
LOADINS  22  20   20  1    7  5    2539.0     1.735    -0.255      62.0  Prest. parasite2
LOADINS  22  21   21  1    7  5    2539.0     1.480    -0.015      38.0  Prest. parasite2
LOADINS  22  22   22  1    7  5    2538.0     1.465    -0.015      38.0  Prest. parasite2
LOADINS  22  23   23  1    7  5    2538.0     1.450    -0.015      38.0  Prest. parasite2
LOADINS  22  24   24  1    7  5    2539.0     1.435    -0.015      38.0  Prest. parasite2
LOADINS  22  25   25  1    7  5    2539.0     1.420    -0.038      20.0  Prest. parasite2
LOADINS  22  26   26  1    7  5    2538.0     1.382    -0.037      20.0  Prest. parasite2
LOADINS  22  27   27  1    7  5    2538.0     1.345    -0.038      20.0  Prest. parasite2
LOADINS  22  28   28  1    7  5    2539.0     1.307    -0.037      20.0  Prest. parasite2
LOADINS  22  29   29  1    7  5    2539.0     1.270    -0.009      10.0  Prest. parasite2
LOADINS  22  30   30  1    7  5    2538.0     1.261    -0.009      10.0  Prest. parasite2
LOADINS  22  31   31  1    7  5    2539.0     1.252    -0.009      10.0  Prest. parasite2
LOADINS  22  32   32  1    7  5    2540.0     1.244    -0.004      10.0  Prest. parasite2


 *** CREEP LOAD INPUT ***
CREEPCMB       1      11  1.00       13   1.00      0    0.000   Creep combination 1


 *** CREEP COMBINATION INPUT ***
CREEPLC  14    1   4   1     1   2    0.79     0.000    0.000 Creep Lc14
CREEPLC  14    5   8   1     1   2    0.85     0.000    0.000 Creep Lc14
CREEPLC  14    9  12   1     1   2    0.91     0.000    0.000 Creep Lc14
CREEPLC  14   13  16   1     1   2    0.98     0.000    0.000 Creep Lc14
CREEPLC  14   17  20   1     1   2    1.03     0.000    0.000 Creep Lc14
CREEPLC  14   21  24   1     1   2    1.11     0.000    0.000 Creep Lc14
CREEPLC  14   25  28   1     1   2    1.23     0.000    0.000 Creep Lc14
CREEPLC  14   29  32   1     1   2    1.41     0.000    0.000 Creep Lc14
```

Figure 7.4 Load input

```
Project name: Creep-3

*** SUBMODELS  INPUT ***
MODEL       1    -1     3     1      31     1  Canteliver
MODEL       2    -1     3     1      32     1  Connected

*** SUBMODEL MODIFICATION INPUT ***    *** CALCULATION GROUP INPUT ***
CALCGRP         1      1      11    13         1   Static build
CALCGRP         2      3      14    14         1   Creep load
CALCGRP         3      1      21    22         1   Static finished


*** ANALYSES INPUT ***
ANALYSIS        1      1       1     0      0.00  Canteliver static
ANALYSIS        2      2       2     0      0.00  Connected creep
ANALYSIS        3      2       3     0      0.00  Connected static
```

Figure 7.5 Models and analysis input

```
Project name: Creep-3



ORDCOMB  1  1 1  11      1    0       0    0       0  Loadcase 11
ORDCOMB  2  1 1  12      1    0       0    0       0  Loadcase 12
ORDCOMB  3  1 1  13      1    0       0    0       0  Loadcase 13
ORDCOMB  4  1 1  14      1    0       0    0       0  Loadcase 14
ORDCOMB  5  1 1  21      1    0       0    0       0  Loadcase 21
ORDCOMB  6  1 1  22      1    0       0    0       0  Loadcase 22
ORDCOMB  7  1 1  11      1   12       1   14       1  Total w/creep
ORDCOMB  8  1 1  11   0.22   12    0.22   21    0.78  Total Simplified
ORDCOMB  8  1 1  22   0.78                            Total Simplified
```

Figure 7.6 Load combination input

Elem	X/L	Comb	[kN] Axial	[kN] Shear L	[kN] Shear N	[kNm] Bending L	[kNm] Bending N	[kNm] Torsion
1	0.00	1	-7138.96	0.00	-46812.86	-2616716.12	0.00	0.00
1	0.00	2	-0.00	0.00	-0.00	-0.00	0.00	0.00
1	0.00	3	-283128.69	0.00	26519.84	2086655.82	0.00	0.00
1	0.00	4	37353.38	0.00	-5696.39	-273433.63	0.00	0.00
1	0.00	5	-92528.05	0.00	-34159.23	-1795108.42	0.00	0.00
1	0.00	6	155676.50	0.00	-23740.67	-1380359.11	0.00	0.00
1	*0.00*	*7*	*30214.42*	*0.00*	*-52509.25*	*-2890149.75*	*0.00*	*0.00*
1	*0.00*	*8*	*47685.22*	*0.00*	*-55460.75*	*-3052542.22*	*0.00*	*0.00*
32	1.00	4	37785.23	0.00	-0.00	40183.77	0.00	0.00
32	1.00	5	-86320.78	0.00	-0.00	157197.16	0.00	0.00
32	1.00	6	157476.32	0.00	-0.00	-73305.65	0.00	0.00
32	*1.00*	*7*	*37785.23*	*0.00*	*-0.00*	*40183.77*	*0.00*	*0.00*
32	*1.00*	*8*	*55501.32*	*0.00*	*-0.00*	*65435.38*	*0.00*	*0.00*

Figure 7.7 Results