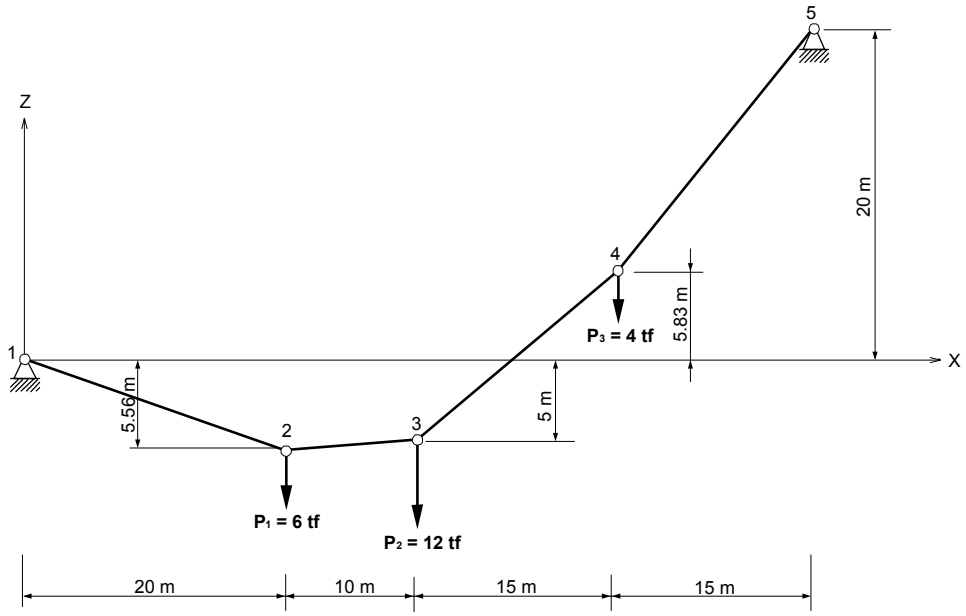
GNL-8

Title

Static large displacement analysis of a cable supporting hanging loads

Description

A nonsymmetrical cable shown below supports three loads $P_1 = 6$ tf, $P_2 = 12$ tf and $P_3 = 4$ tf.
Determine the horizontal and vertical reactions at the left end and the maximum tension in the cable.



Structural geometry and analysis model

MODEL

Analysis Type

2-D static large displacement analysis (X-Z plan)

Unit System

m, tf

Dimension

Length 60 m (Projected)

Element

Cable element

Material

Modulus of elasticity $E = 2.0 \times 10^7$ tf/m^2

Sectional Property

Area = 0.1 m^2

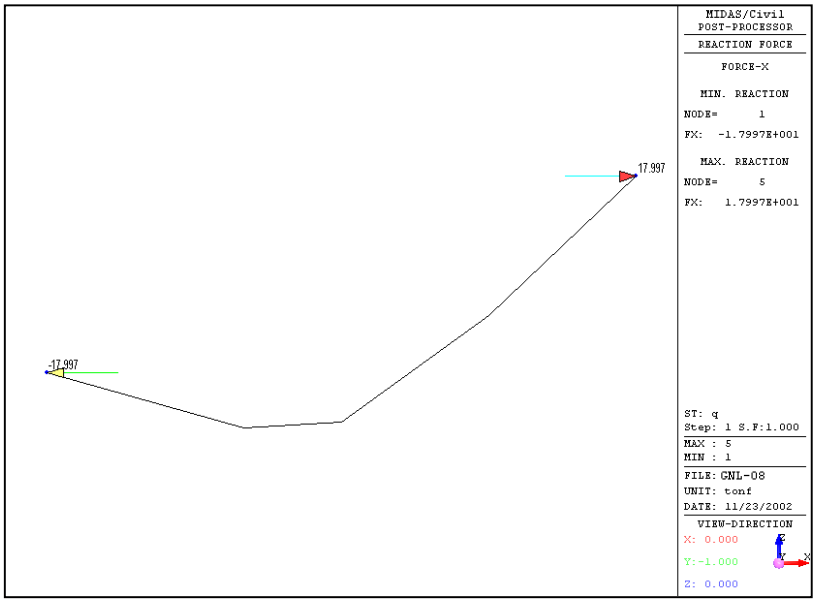
Boundary Condition

Node 1, 5: Constrain D_X and D_Z

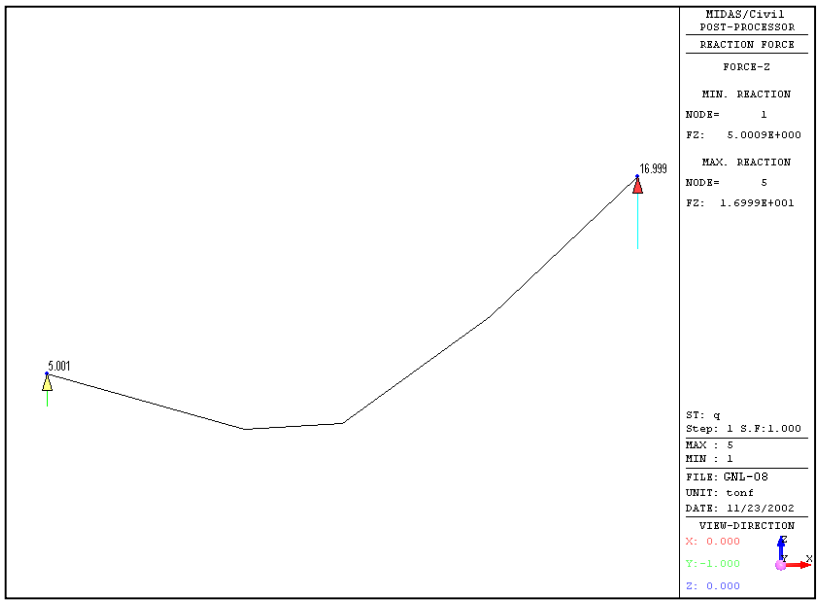
Load Case

Concentrated loads $P_1 = 6.0$ tf, $P_2 = 12.0$ tf and $P_3 = 4.0$ tf each are applied to the nodes 2, 3 and 4 respectively in the –Z direction.

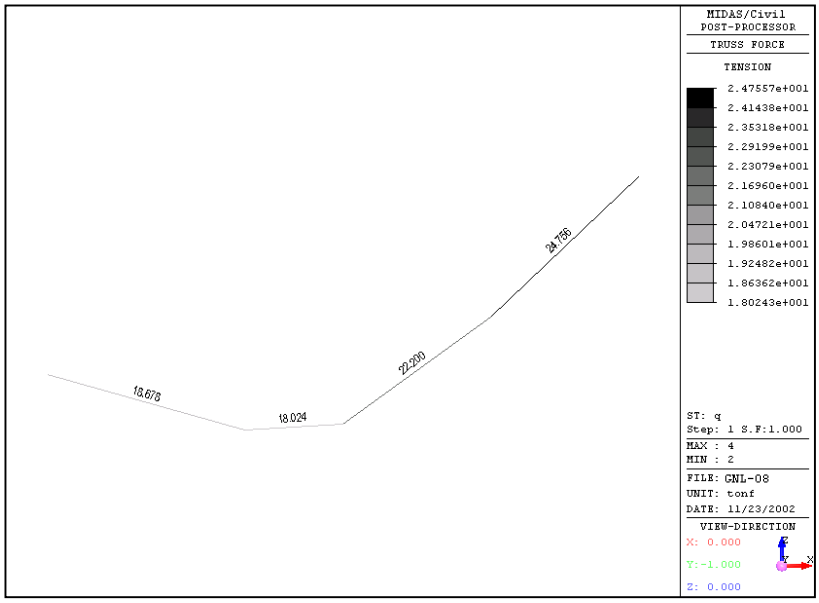
Results



X-dir. reaction (R_x)



Z-dir. reaction (R_z)



The maximum tension (T)

Comparison of Results

Unit: tf

Results	Theoretical	MIDAS/Civil
X-dir. reaction (R_x)	-18.000	-17.997
Z-dir. reaction (R_z)	5.000	5.001
Tension (T)	24.762	24.756

Reference

Beer, F. P., and Johnston, Jr., E. R. "*Vector Mechanics for Engineers, Statics and Dynamics*" McGraw-Hill, New-York, NY, 1962.