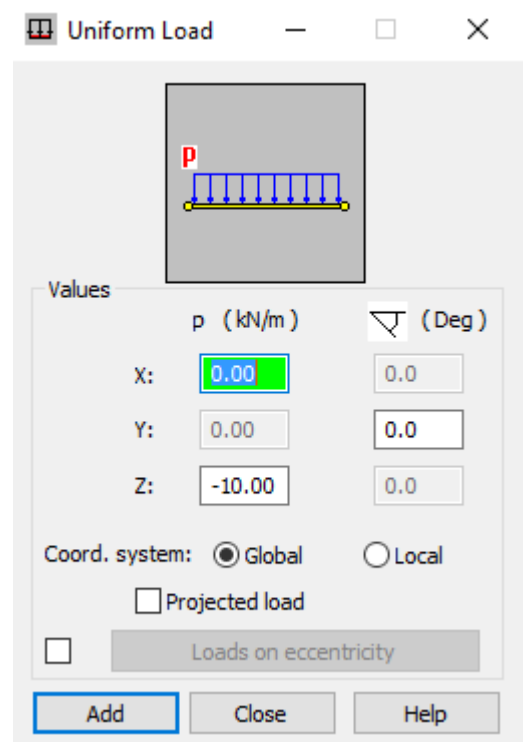
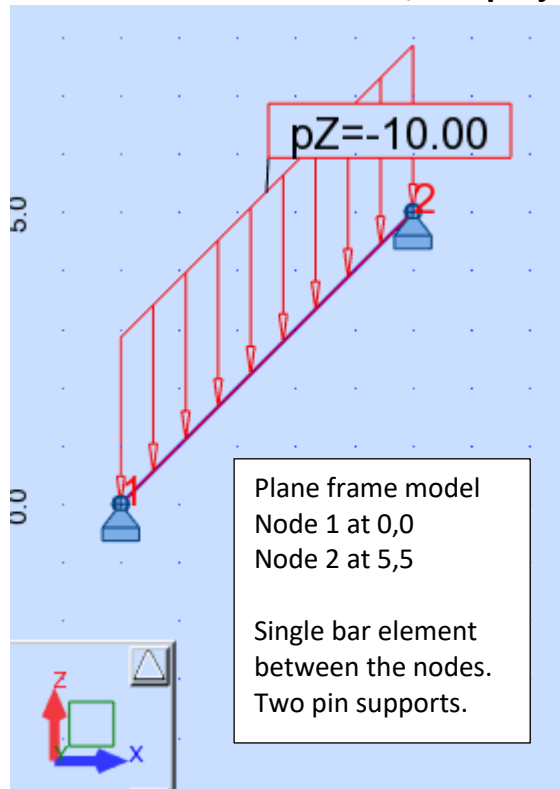


# Guidance for Robot

## Loads on sloping members

### 1. Global Z direction load, not projected

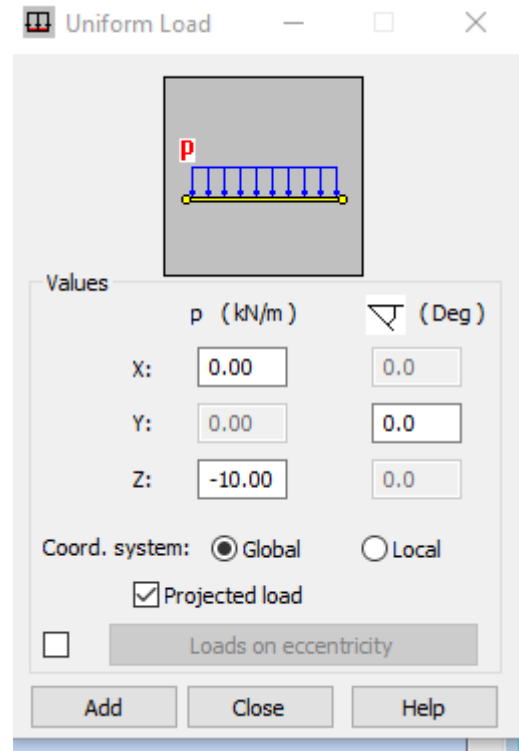
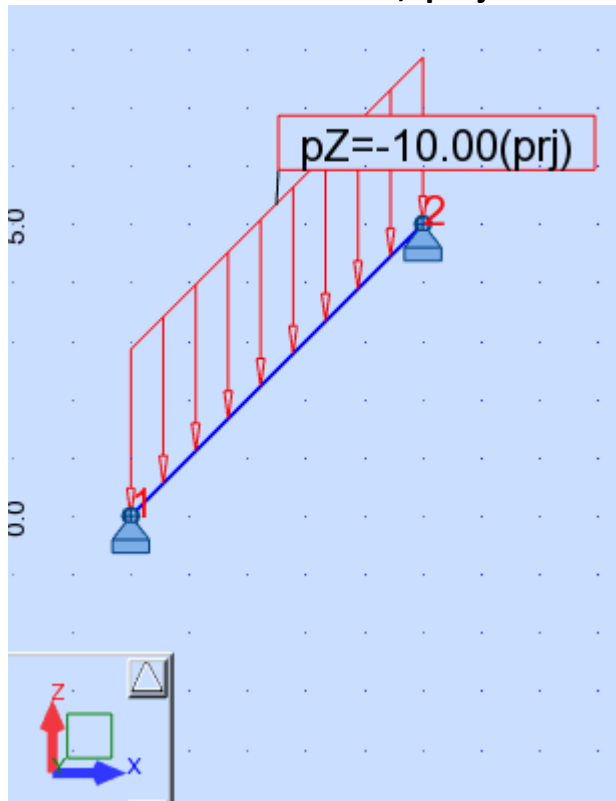


Load definition for a bar element . **Global** selected means that the load will be applied in the global direction (Z in this case). With the **Projected Load** box not ticked, the load will be per unit along the length of the member which in this case is 7.74m Therefore the total load is  $10 \times 7.74 = 77.4$  kN

Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1	0.0	38.70	0.0
2/ 1	0.0	38.70	0.0
<b>Case 1</b>			
Sum of val.	0.0	77.41	0.0
Sum of reac.	0.0	77.41	-193.52
Sum of forc.	0.0	-77.41	193.52
Check val.	0.0	0.0	0.0
Precision	0.0	0.0	

Results for reactions

## 2. Global Z direction load, projected

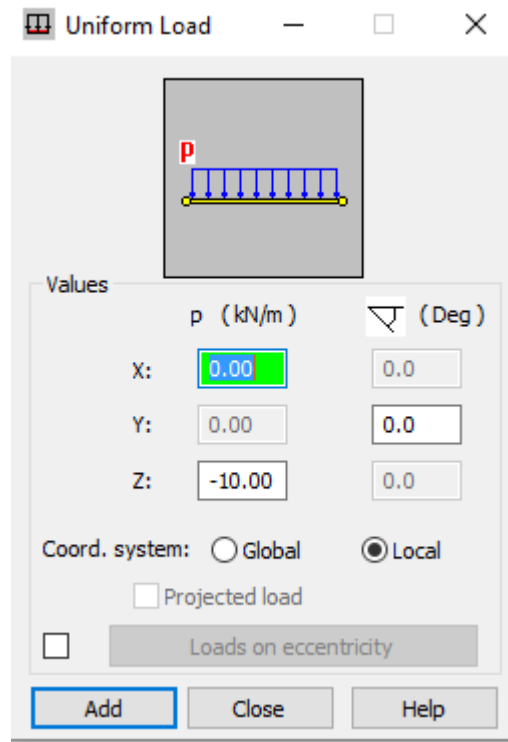
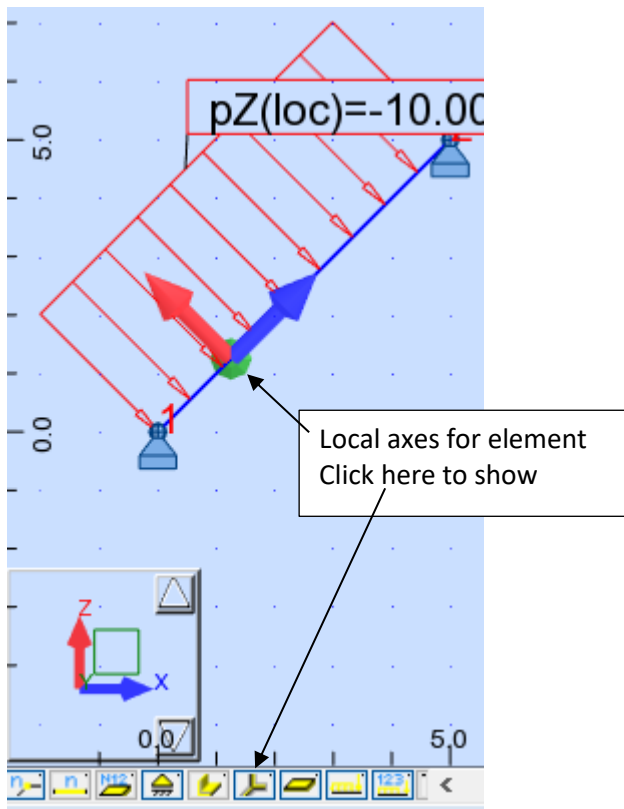


With the **Projected Load** box ticked, the load will be per unit along the length of the Z projection of the member i.e. along a length of 5m. Therefore the total load is  $10 \times 5 = 50$  kN

Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1	-0.00	25.00	0.0
2/ 1	0.00	25.00	-0.00
<b>Case 1</b>			
Sum of val.	0.0	50.00	-0.00
Sum of reac.	0.0	50.00	-125.00
Sum of forc.	0.0	-50.00	125.00
Check val.	0.0	0.0	0.0
Precision	6.98492e-16	0.0	

Results for reactions

### 3. Local Z direction load



With the **Local Load** box ticked, the load will be in the local Z direction as shown. The reactions are shown in the table.

Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1	-25.00	25.00	0.00
2/ 1	-25.00	25.00	-0.00
<b>Case 1</b>	<b>LL1</b>		
Sum of val.	-50.00	50.00	0.0
Sum of reac.	-50.00	50.00	-250.00
Sum of forc.	50.00	-50.00	250.00
Check val.	0.0	0.0	0.0
Precision	1.74623e-16	0.0	

Results for reactions in global coordinates

## Setting the number of significant digits for numbers in a table

Right click on a table and select 'Units and Formats' from the menu. This brings up the dialog box as shown below. The number of significant digits can be increased up to 9 in Robot. In the example below the number of significant digits is set at the maximum of 9 for forces and for moments.

In structural engineering calculations output values seldom are to better than 2 or 3 digit accuracy and should not be quoted to a greater number of digits than is appropriate.

It is only when considering the *numerical* significance of numbers that more digits should be used. This occurs when doing equilibrium and symmetry checks.

The screenshot shows the Robot software interface. At the top, a table displays force data for two cases. Below the table, the 'Job Preferences' dialog box is open, showing settings for 'Forces' and 'Moment'.

Bar/Node/Case	FX (kN)	FZ (kN)	MY (kNm)
1/ 1/ 1	0.0	35.355339059	0.000000000
1/ 2/ 1	0.0	-35.355339059	0.000000000

**Job Preferences** (DEFAULTS)

- Units and Formats
  - Dimensions
  - Forces**
  - Other
  - Unit Edition
- Materials
- Databases
- Design codes
- Structure Analysis
- Work Parameters
- Meshing

Force: kN 0.987654321 E

Moment: kN\*m 0.987654321 E

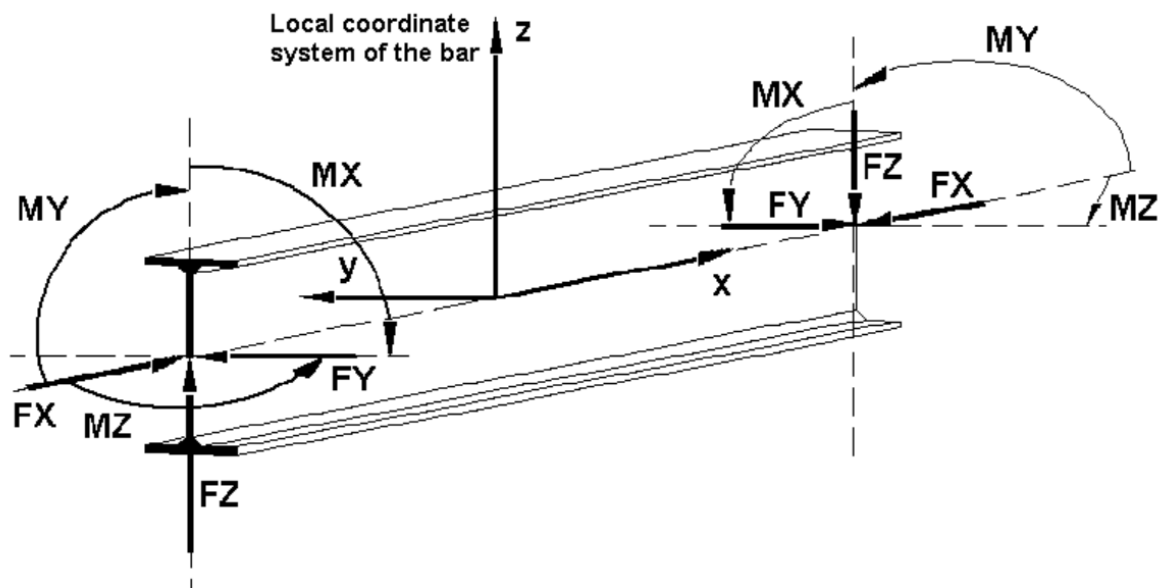
Stresses: MN/m2 0.21 E

Buttons: Open default parameters, Save current parameters as default, OK, Cancel, Help

Bottom navigation: Values, Envelope, Global extremes, Info

## Sign convention for internal force actions in beam elements

Positive directions of forces and moments:



Notes:

1. Compression is positive
2. The positive directions of the  $M_y$  moments gives tension on the underside of a horizontal beam . Therefore when a bending moment diagram is drawn for  $M_y$  moments, they are on the side of the beam that is in tension. This is the normal convention in structural engineering because it shows the side of the beam for tension reinforcement in reinforced concrete.

