PROKON Support Portal

Unexpected moment forces from Frame Analysis

Andrew - 2019-05-31 - 0 Comments - in A03:Frame analysis
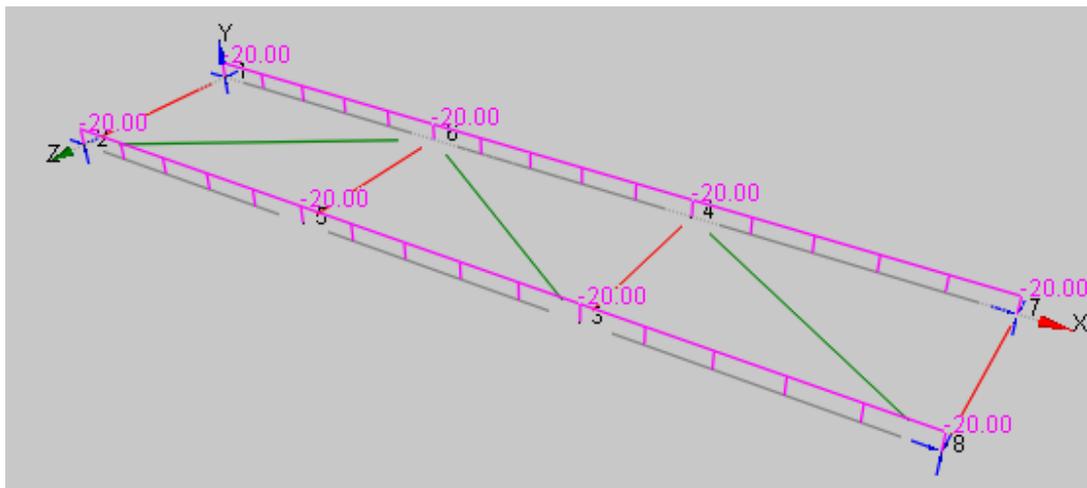
Consider the Frame example in Figure 1.

Figure 1: Frame model under consideration.

The following applies to the model in Figure 1:

- Full 3D Domain.
- Supports resisting translation only (i.e. simply supported beams).
- Equal loading of 20kN/m on the beams.
- Linear analysis type is used.
- Beam length = 4.5m.
- Own weight is excluded from analysis.

The analysis generates two different moments in the main beams, although the two beams have identical length and loading.
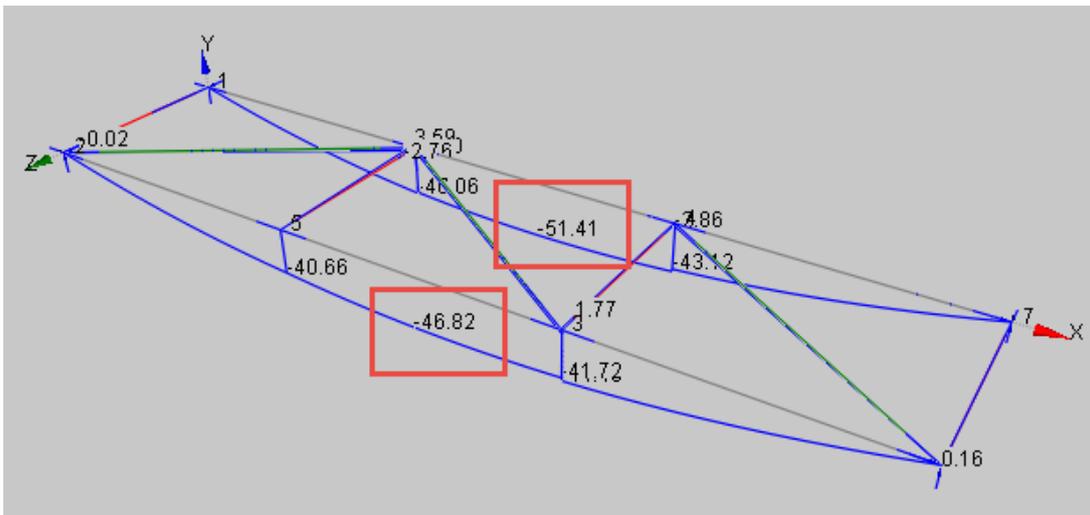
Figure 2: Moments in X-Direction.

One would expect a moment in the beams to be similar to the equation:

$$M_x = \frac{w \cdot l^2}{8}$$

When the diagonal members are removed and the analysis is done, the moments in the beams are equal to the result in the above equation (50.6 kNm).
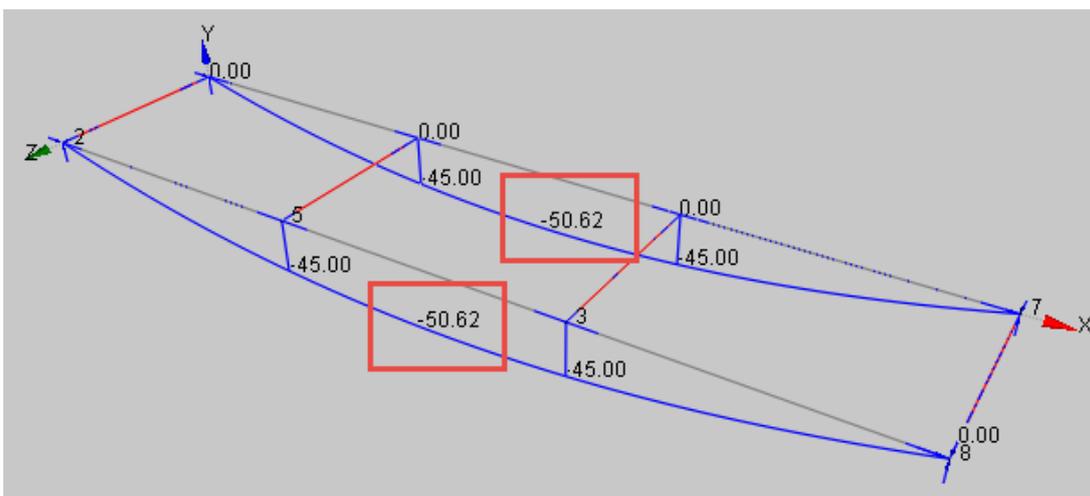

Figure 3: Moments in X-direction (no diagonal members).

When the diagonal members are added, a transfer of moments occurs between the beams

and the diagonal members. The transfer occurs for the following reasons:

1. The diagonal members have fixed end connections.
2. There is a difference in the moments at each of the two nodes of the diagonal members. For equilibrium to be reached, a moment transfer occurs between the two nodes. (The amount of moment that is transferred depends on the stiffness of the elements.)

Note the results for the analysis without the diagonal members (see figure 3). The moments are equal, even though there are struts in between the two beams. The reason for this is that the moment at each of the two nodes of each strut is equal. Therefore, no transfer is required for equilibrium.

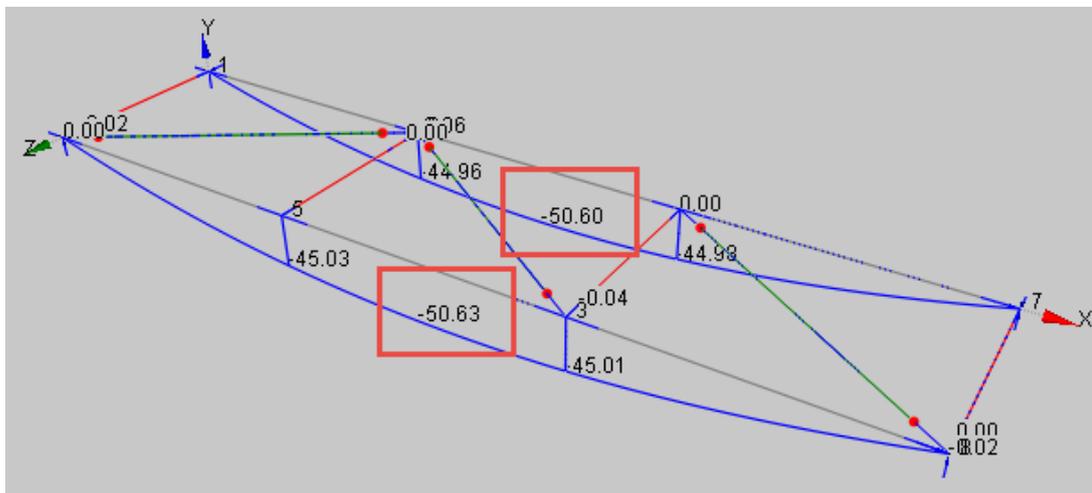To minimise the transfer of moments, the diagonal members should be pinned.

Figure 4: Moments in X-direction (Pinned diagonal members).