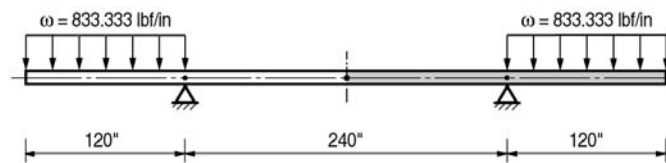# Static-3

Title

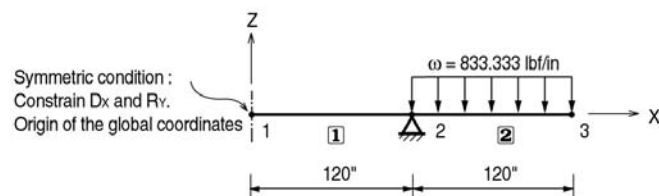Overhanging beam analysis

Description

An H(I)-section beam is supported as shown below and loaded on the overhangs with uniformly distributed loads.
Determine the maximum displacements and the stresses of the beam.
Only a half model may be analyzed due to symmetry.

(a) Cantilever beam under uniformly distributed loads

(b) Half model

Structural geometry and analysis model

Model

Analysis Type
2-D static analysis (X-Z plane)

Unit System
in, lbf

Dimension
Length 240.0 in

Element
Beam element

Material
Modulus of elasticity $E = 30.0 \times 10^6$ psi

Section Property
Area $A = 7.0$ in^2

Moment of inertia $I_{yy} = 7892.0$ in^4 (Strong axis)

Boundary Condition
Node 1 ; Constrain Dx and Ry. (Symmetry)

Node 2 ; Constrain Dx and Dz. (Hinged node)

Load Case
A uniformly distributed load, 833.333 lbf/in is applied to the element **2** in the –Z direction.
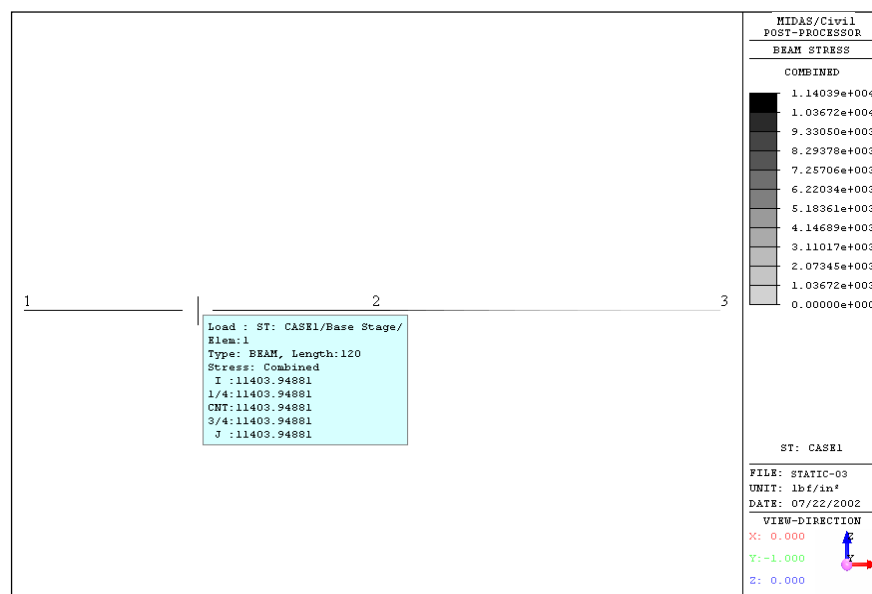
Results

Displacements

	Node	Load	DX (in)	DY (in)	DZ (in)	RX ([rad])	RY ([rad])	RZ ([rad])
▶	1	CASE1	0,000000	0,000000	0,182463	0,000000	0,000000	0,000000
	2	CASE1	0,000000	0,000000	0,000000	0,000000	0,003041	0,000000
	3	CASE1	0,000000	0,000000	−0,456158	0,000000	0,004055	0,000000

Stresses

	Elem	Load	Part	Axial (lbf/in²)	Shear-Y (lbf/in²)	Shear-Z (lbf/in²)	Bend(+Y) (lbf/in²)	Bend(−Y) (lbf/in²)	Bend(+Z) (lbf/in²)	Bend(−Z) (lbf/in²)
▶	1	CASE1	i	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	1	CASE1	1/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	1	CASE1	2/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	1	CASE1	3/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	1	CASE1	j	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	2	CASE1	i	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	1,14e+004	−1,14e+004
	2	CASE1	1/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	6,41e+003	−6,41e+003
	2	CASE1	2/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	2,85e+003	−2,85e+003
	2	CASE1	3/4	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	7,13e+002	−7,13e+002
	2	CASE1	j	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000	0,00e+000

Stress of the structure (Element **1** *)*

Comparison of Results

Unit : in, psi

Result	Theoretical	MIDAS/Civil
Maximum deflection(δ_{max})	0.182	0.182
Maximum stress(σ_{max})	11404.0	11404.0

Reference

Timoshenko, S., *"Strength of Materials, Part I, Elementary Theory and Problems"*, 3rd Ed., D. Van Nostrand Co., Inc., New York, 1956, p. 98.