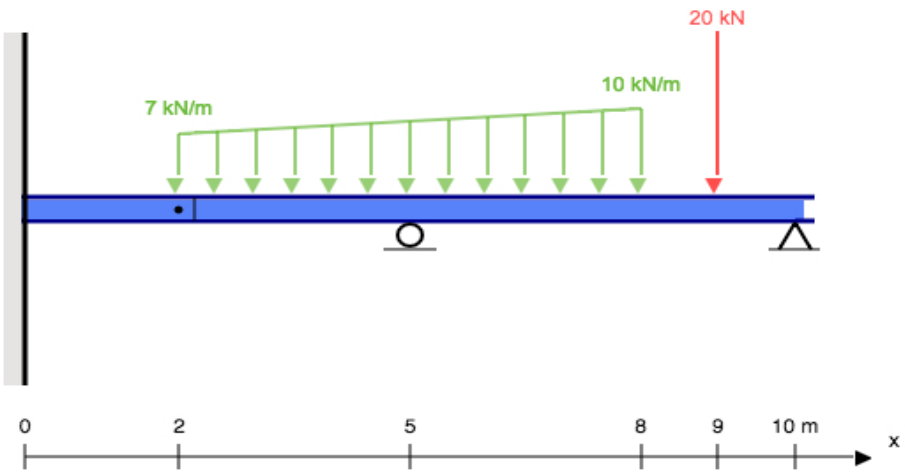
BEAM ANALYSIS REPORT

Thu Aug 11 2016 11:58:44 GMT+1000 (AEST)



File Name: Beam Example
Software: SkyCiv Beam v1.3.3

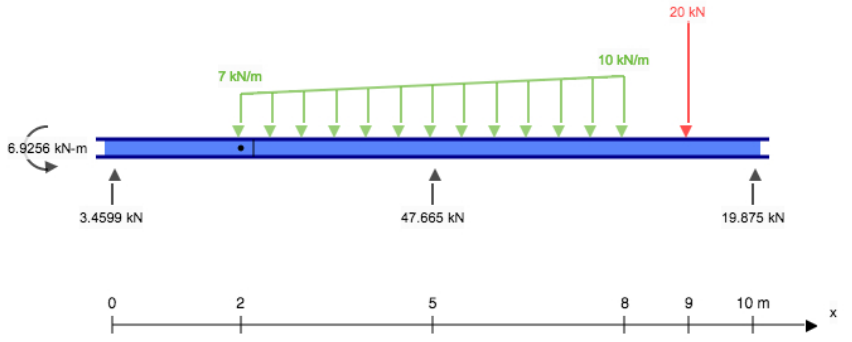
Job Name: Project Beam
Designer: Sam Carigliano

Included in this Report:

Free Body Diagram (FBD)
Section Properties
Shear Force Diagram (SFD)
Bending Moment Diagram (BMD)
Vertical Deflection and Elastic Curve
Rotational Displacement
3D Renderer and Color Contour Results
Stress Results

Free Body Diagram (FBD)

Show Equivalent Loads



Full Working Solution for Reaction Forces

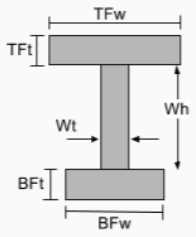
Start by finding the equivalent loads caused by the distributed load(s). Remember that the equivalent load of a DL has a magnitude equal to its area, acting through the area's centroid.

Equivalent load(s) of the DL from $x = 2\ m$ to $x = 8\ m$:
Rectangular Load Magnitude: $(8\ m - 2\ m) \times (-7\ kN/m) = -42\ kN$
Rectangular Load Position: $2\ m + (8\ m - 2\ m)/2 = 5\ m$
Triangular Load Magnitude: $(1/2) \times (8\ m - 2\ m) \times (-10\ kN/m - -7\ kN/m) = -9\ kN$
Triangular Load Position: $2\ m + 2 \times (8\ m - 2\ m)/3 = 6\ m$

Sorry but the full working solution of the reaction forces cannot be generated when there are hinges involved. The solution shown on this page is correct though.

Click 'Support' in the top menu to let us know that you'd like to see this feature added in future!

Beam Section



I-Beam | mm

TFw:	13.7
TFt:	2.72
BFw:	13.7
BFt:	2.72
Wh:	22.56
Wt:	1.52
r:	Fillet Radius

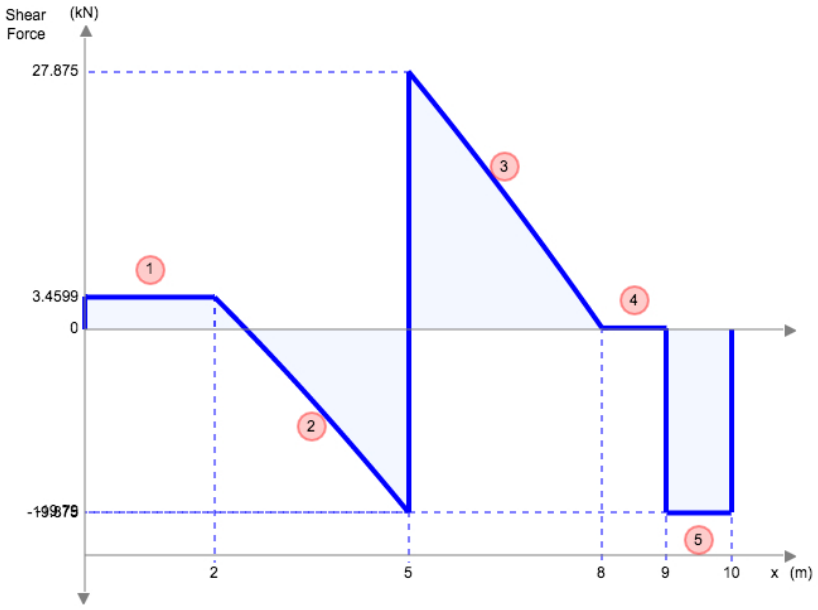
Material Properties

Common Materials | GPa | E: 29000

Notation	Value	Unit
A	108.819	in^2
I_z	13407.644	in^4
I_y	1172.282	in^4
C_z	6.85	in
C_y	14	in
Q_z	567.718	in^3
Q_y	134.145	in^3
Z_z	957.689	in^3
Z_y	171.136	in^3
J	210.205	in^4

SkyCiv
CLOUD ENGINEERING SOFTWARE

Shear Force Diagram (SFD)



Full Working Solution for the Shear Force Diagram +

Take a cut for $0 \leq x \leq 2$:

$\Sigma F = 3.4599$

$\therefore V_1(x) = 3.4599 \quad for\ 0 \leq x \leq 2$

Take a cut for $2 \leq x \leq 5$:

$\Sigma F = 3.4599 + 13 - 6x - 0.25x^2$

$= 16.46 - 6x - 0.25x^2$

$\therefore V_2(x) = 16.46 - 6x - 0.25x^2 \quad for\ 2 \leq x \leq 5$

Take a cut for $5 \leq x \leq 8$:

$\Sigma F = 3.4599 + 47.665 + 13 - 6x - 0.25x^2$

$= 64.125 - 6x - 0.25x^2$

$\therefore V_3(x) = 64.125 - 6x - 0.25x^2 \quad for\ 5 \leq x \leq 8$

Take a cut for $8 \leq x \leq 9$:

$\Sigma F = 3.4599 + 47.665 - 51$

$= 0.1249$

$\therefore V_4(x) = 0.1249 \quad for\ 8 \leq x \leq 9$

Take a cut for $9 \leq x \leq 10$:

$\Sigma F = 3.4599 + 47.665 - 20 - 51$

$= -19.875$

$\therefore V_5(x) = -19.875 \quad for\ 9 \leq x \leq 10$

Shear Force Equations

$V_1(x) = 3.4599$

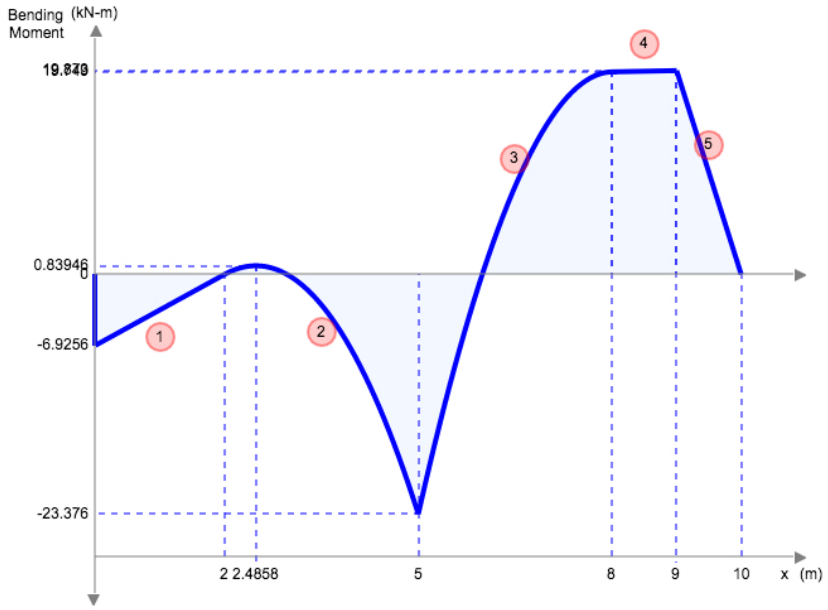
$V_2(x) = -0.25x^2 - 6x + 16.46$

$V_3(x) = -0.25x^2 - 6x + 64.125$

$V_4(x) = 0.1249$

$V_5(x) = -19.875$

Bending Moment Diagram (BMD)



Full Working Solution for the Bending Moment Diagram +

Take a cut at $0 \le x \le 2$:

$\Sigma M = (3.4599)(x - 0) - 6.9256$

$= -6.9256 + 3.4599x$

$\therefore M_1(x) = -6.9256 + 3.4599x \quad for\ 0 \le x \le 2$

Take a cut at $2 \le x \le 5$:

$\Sigma M = (3.4599)(x - 0) - 6.9256 + 13x - 3x^2 - 0.083333x^3 - 13.333$

$= -20.259 + 16.46x - 3x^2 - 0.083333x^3$

$\therefore M_2(x) = -20.259 + 16.46x - 3x^2 - 0.083333x^3 \quad for\ 2 \le x \le 5$

Take a cut at $5 \le x \le 8$:

$\Sigma M = (3.4599)(x - 0) + (47.665)(x - 5) - 6.9256 + 13x - 3x^2 - 0.083333x^3 - 13.333$

$= -258.584 + 64.125x - 3x^2 - 0.083333x^3$

$\therefore M_3(x) = -258.584 + 64.125x - 3x^2 - 0.083333x^3 \quad for\ 5 \le x \le 8$

Take a cut at $8 \le x \le 9$:

$\Sigma M = (3.4599)(x - 0) + (47.665)(x - 5) - 6.9256 - 51x + 264$

$= 18.749 + 0.1249x$

$\therefore M_4(x) = 18.749 + 0.1249x \quad for\ 8 \le x \le 9$

Take a cut at $9 \le x \le 10$:

$\Sigma M = (3.4599)(x - 0) + (47.665)(x - 5) - 6.9256 + (-20)(x - 9) - 51x + 264$

$= 198.749 - 19.875x$

$\therefore M_5(x) = 198.749 - 19.875x \quad for\ 9 \le x \le 10$

Bending Moment Equations

$M_1(x) = 3.4599x - 6.9256$

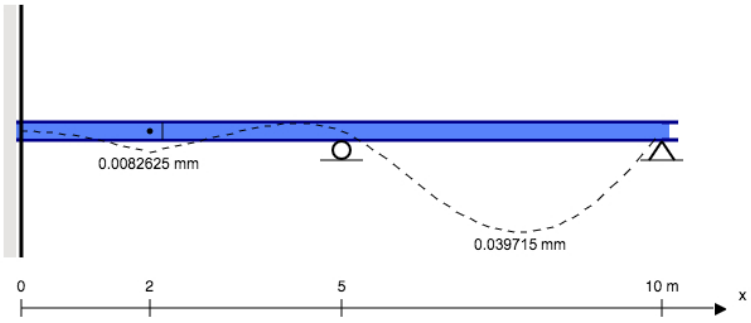
$M_2(x) = -0.083333x^3 - 3x^2 + 16.46x - 20.259$

$M_3(x) = -0.083333x^3 - 3x^2 + 64.125x - 258.584$

$M_4(x) = 0.1249x + 18.749$

$M_5(x) = -19.875x + 198.749$

Vertical Deflection and Elastic Curve

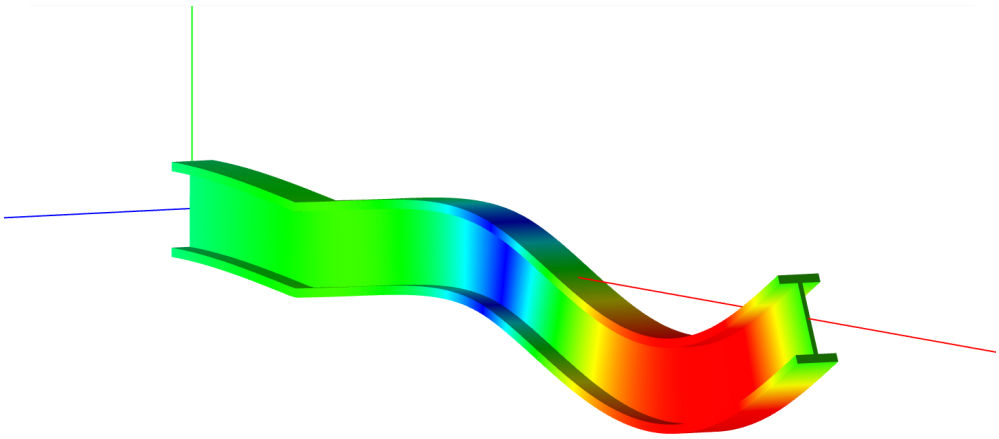


Deflection Value (mm)	Locations along Beam (m)
-0.039715	7.8044
-0.0082652	2
0	0, 5, 10
0	3.4404
0.0030379	4.3397

Rotational Displacement

Rotation Value (rad)	Locations along Beam (m)
-0.000020036	5.9914
-0.0000061995	2
0	4.3397
0	0
0	7.8044
0.0000054655	2
0.0000059474	2.9647
0.000030049	10

3D Renderer and Color Contour Results



3D Renderer Options

Show Tips | Orthographic View

Bending Moment | Show

Deflection: x663

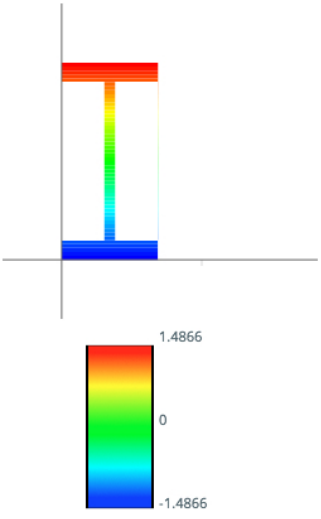
Bending Moment (kN-m)

Stress Results

Stress Units: MPa	Type	Stress Value (MPa)	Locations along Beam (m)	Y location on Beam Section (in)
Overall Maximum Transverse Shear Stress	Positive (Upward)	1.2037	5	14 (Neutral Axis)
	Negative (Downward)	0.85828	9	
Overall Maximum Normal Bending Stress	Tension	1.4866	5	28 (Top of Section)
	Compression	1.4866	5	0 (Bottom of Section)

Stress Profile

Bending Stress (MPa) at x=5.000



Custom Stress Results

The stresses at 5.000 m along the beam are:

	Type	Stress Value (MPa)	Y location on Beam Section (in)
Maximum Transverse Shear Stress	Positive (Upward)	1.2037	14 (Neutral Axis)
Maximum Normal Bending Stress	Tension	1.4866	28 (Top of Section)
	Compression	1.4866	0 (Bottom of Section)