



Composite Design

Robot Extensions for Autodesk Revit Structure - Composite Design 3.3



Ratio = 1.00



DATA

Revit Id: 1383965

L = 26' - 0" Length

MATERIAL

Metal - Steel - ASTM A992

E = 29000.00 [kip/in²] Young's modulus

f = 50.00 [kip/in²] Strength

DESIGNED SECTION

W14X22

A = 6.490 [in²] Cross-sectional area

I = 199.000 [in⁴] Moment of inertia

Wpl = 33.000 [in³] Plastic Section Module

RESULTS

Detailed results

NODAL DISPLACEMENTS

| Node | U | Ufi | Case |
|------|---------|----------|-------------------|
| 1 | 0' - 0" | 0.000 ° | Accidental |
| 1 | 0' - 0" | 0.000 ° | Construction Dead |
| 1 | 0' - 0" | 0.000 ° | Construction Live |
| 1 | 0' - 0" | -0.015 ° | Dead |
| 1 | 0' - 0" | -0.294 ° | Live |
| 1 | 0' - 0" | -0.628 ° | Material |
| 1 | 0' - 0" | 0.000 ° | Roof |
| 1 | 0' - 0" | 0.000 ° | Seismic |

| | | | |
|---|---------|----------|------------------------------------|
| 1 | 0' - 0" | 0.000 ° | Snow |
| 1 | 0' - 0" | 0.000 ° | Temperature |
| 1 | 0' - 0" | 0.000 ° | Unknown |
| 1 | 0' - 0" | 0.000 ° | Wind |
| 1 | 0' - 0" | -0.936 ° | Unfactored |
| 1 | 0' - 0" | -0.936 ° | Custom |
| 1 | 0' - 0" | -0.967 ° | Precomposite + 1.4 Dead |
| 1 | 0' - 0" | -0.829 ° | Precomposite + 1.2 Dead + 1.6 Live |
| 1 | 0' - 0" | -0.899 ° | 1.4 Dead |
| 1 | 0' - 0" | -1.241 ° | 1.2 Dead + 1.6 Live |
| 1 | 0' - 0" | -0.879 ° | Self-weight |
| 1 | 0' - 0" | -0.690 ° | Precomposite |
| 1 | 0' - 0" | -0.999 ° | NetTotal |
| 1 | 0' - 0" | -0.690 ° | Precomposite Unfactored |
| 2 | 0' - 0" | 0.000 ° | Accidental |
| 2 | 0' - 0" | 0.000 ° | Construction Dead |
| 2 | 0' - 0" | 0.000 ° | Construction Live |
| 2 | 0' - 0" | 0.015 ° | Dead |
| 2 | 0' - 0" | 0.294 ° | Live |
| 2 | 0' - 0" | 0.627 ° | Material |
| 2 | 0' - 0" | 0.000 ° | Roof |
| 2 | 0' - 0" | 0.000 ° | Seismic |
| 2 | 0' - 0" | 0.000 ° | Snow |
| 2 | 0' - 0" | 0.000 ° | Temperature |
| 2 | 0' - 0" | 0.000 ° | Unknown |
| 2 | 0' - 0" | 0.000 ° | Wind |
| 2 | 0' - 0" | 0.935 ° | Unfactored |
| 2 | 0' - 0" | 0.935 ° | Custom |
| 2 | 0' - 0" | 0.965 ° | Precomposite + 1.4 Dead |
| 2 | 0' - 0" | 0.827 ° | Precomposite + 1.2 Dead + 1.6 Live |
| 2 | 0' - 0" | 0.898 ° | 1.4 Dead |
| 2 | 0' - 0" | 1.239 ° | 1.2 Dead + 1.6 Live |
| 2 | 0' - 0" | 0.877 ° | Self-weight |
| 2 | 0' - 0" | 0.689 ° | Precomposite |
| 2 | 0' - 0" | 0.997 ° | NetTotal |
| 2 | 0' - 0" | 0.689 ° | Precomposite Unfactored |

INTERNAL FORCES IN THE BEAM

| Q min | Q max | M min | M max | Case |
|---------|--------|-------------|---------------|------------------------------------|
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Accidental |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Construction Dead |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Construction Live |
| -1 kip | 1 kip | 0.00 kip*ft | 3.56 kip*ft | Dead |
| -11 kip | 11 kip | 0.00 kip*ft | 71.12 kip*ft | Live |
| -8 kip | 8 kip | 0.00 kip*ft | 50.66 kip*ft | Material |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Roof |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Seismic |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Snow |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Temperature |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Unknown |
| 0 kip | 0 kip | 0.00 kip*ft | 0.00 kip*ft | Wind |
| -19 kip | 19 kip | 0.00 kip*ft | 125.34 kip*ft | Unfactored |
| -19 kip | 19 kip | 0.00 kip*ft | 125.34 kip*ft | Custom |
| -12 kip | 12 kip | 0.00 kip*ft | 78.01 kip*ft | Precomposite + 1.4 Dead |
| -10 kip | 10 kip | 0.00 kip*ft | 66.87 kip*ft | Precomposite + 1.2 Dead + 1.6 Live |
| -11 kip | 12 kip | 0.00 kip*ft | 75.90 kip*ft | 1.4 Dead |
| -27 kip | 28 kip | 0.00 kip*ft | 178.86 kip*ft | 1.2 Dead + 1.6 Live |

| | | | | |
|---------|--------|-------------|---------------|-------------------------|
| -11 kip | 11 kip | 0.00 kip*ft | 70.92 kip*ft | Self-weight |
| -8 kip | 9 kip | 0.00 kip*ft | 55.72 kip*ft | Precomposite |
| -20 kip | 20 kip | 0.00 kip*ft | 130.40 kip*ft | NetTotal |
| -8 kip | 9 kip | 0.00 kip*ft | 55.72 kip*ft | Precomposite Unfactored |

DISPLACEMENTS IN THE BEAM

| U min | U max | U Camber min | U Camber max | Case |
|------------------|---------|------------------|-----------------|------------------------------------|
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Accidental |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Construction Dead |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Construction Live |
| -0' - 0 6/256" | 0' - 0" | 0' - 0" | 0' - 0 186/256" | Dead |
| -0' - 0 128/256" | 0' - 0" | 0' - 0" | 0' - 0 64/256" | Live |
| -0' - 1 17/256" | 0' - 0" | -0' - 0 81/256" | 0' - 0" | Material |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Roof |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Seismic |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Snow |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Temperature |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Unknown |
| 0' - 0" | 0' - 0" | 0' - 0" | 0' - 0 192/256" | Wind |
| -0' - 1 152/256" | 0' - 0" | -0' - 0 216/256" | 0' - 0" | Unfactored |
| -0' - 1 152/256" | 0' - 0" | -0' - 0 216/256" | 0' - 0" | Custom |
| -0' - 1 165/256" | 0' - 0" | -0' - 0 229/256" | 0' - 0" | Precomposite + 1.4 Dead |
| -0' - 1 105/256" | 0' - 0" | -0' - 0 169/256" | 0' - 0" | Precomposite + 1.2 Dead + 1.6 Live |
| -0' - 1 136/256" | 0' - 0" | -0' - 0 200/256" | 0' - 0" | 1.4 Dead |
| -0' - 2 28/256" | 0' - 0" | -0' - 1 92/256" | 0' - 0" | 1.2 Dead + 1.6 Live |
| -0' - 1 127/256" | 0' - 0" | -0' - 0 191/256" | 0' - 0" | Self-weight |
| -0' - 1 45/256" | 0' - 0" | -0' - 0 109/256" | 0' - 0" | Precomposite |
| -0' - 1 179/256" | 0' - 0" | -0' - 0 243/256" | 0' - 0" | NetTotal |
| -0' - 1 45/256" | 0' - 0" | -0' - 0 109/256" | 0' - 0" | Precomposite Unfactored |

REACTIONS

| Support | Rz | Rm | Case |
|---------|--------|-------------|------------------------------------|
| 1 | 0 kip | 0.00 kip*ft | Accidental |
| 1 | 0 kip | 0.00 kip*ft | Construction Dead |
| 1 | 0 kip | 0.00 kip*ft | Construction Live |
| 1 | 1 kip | 0.00 kip*ft | Dead |
| 1 | 11 kip | 0.00 kip*ft | Live |
| 1 | 8 kip | 0.00 kip*ft | Material |
| 1 | 0 kip | 0.00 kip*ft | Roof |
| 1 | 0 kip | 0.00 kip*ft | Seismic |
| 1 | 0 kip | 0.00 kip*ft | Snow |
| 1 | 0 kip | 0.00 kip*ft | Temperature |
| 1 | 0 kip | 0.00 kip*ft | Unknown |
| 1 | 0 kip | 0.00 kip*ft | Wind |
| 1 | 19 kip | 0.00 kip*ft | Unfactored |
| 1 | 19 kip | 0.00 kip*ft | Custom |
| 1 | 12 kip | 0.00 kip*ft | Precomposite + 1.4 Dead |
| 1 | 10 kip | 0.00 kip*ft | Precomposite + 1.2 Dead + 1.6 Live |
| 1 | 12 kip | 0.00 kip*ft | 1.4 Dead |
| 1 | 28 kip | 0.00 kip*ft | 1.2 Dead + 1.6 Live |
| 1 | 11 kip | 0.00 kip*ft | Self-weight |
| 1 | 9 kip | 0.00 kip*ft | Precomposite |
| 1 | 20 kip | 0.00 kip*ft | NetTotal |
| 1 | 9 kip | 0.00 kip*ft | Precomposite Unfactored |
| 2 | 0 kip | 0.00 kip*ft | Accidental |
| 2 | 0 kip | 0.00 kip*ft | Construction Dead |

| | | | |
|---|--------|-------------|------------------------------------|
| 2 | 0 kip | 0.00 kip*ft | Construction Live |
| 2 | 1 kip | 0.00 kip*ft | Dead |
| 2 | 11 kip | 0.00 kip*ft | Live |
| 2 | 8 kip | 0.00 kip*ft | Material |
| 2 | 0 kip | 0.00 kip*ft | Roof |
| 2 | 0 kip | 0.00 kip*ft | Seismic |
| 2 | 0 kip | 0.00 kip*ft | Snow |
| 2 | 0 kip | 0.00 kip*ft | Temperature |
| 2 | 0 kip | 0.00 kip*ft | Unknown |
| 2 | 0 kip | 0.00 kip*ft | Wind |
| 2 | 19 kip | 0.00 kip*ft | Unfactored |
| 2 | 19 kip | 0.00 kip*ft | Custom |
| 2 | 12 kip | 0.00 kip*ft | Precomposite + 1.4 Dead |
| 2 | 10 kip | 0.00 kip*ft | Precomposite + 1.2 Dead + 1.6 Live |
| 2 | 11 kip | 0.00 kip*ft | 1.4 Dead |
| 2 | 27 kip | 0.00 kip*ft | 1.2 Dead + 1.6 Live |
| 2 | 11 kip | 0.00 kip*ft | Self-weight |
| 2 | 8 kip | 0.00 kip*ft | Precomposite |
| 2 | 20 kip | 0.00 kip*ft | NetTotal |
| 2 | 8 kip | 0.00 kip*ft | Precomposite Unfactored |

Design

DESIGN SETTINGS

| | | |
|-------------------------------|---------------------------------|--|
| Selection Order = | By Weight | Order of preference in member selection |
| Abs Combined Deflection = | 0' - 2" | Absolute combined deflection limit |
| Rel Combined Deflection = | 240.00 | Relative combined deflection limit |
| Abs Construction Deflection = | 0' - 2" | Absolute construction deflection limit |
| Rel Construction Deflection = | 500.00 | Relative construction deflection limit |
| Abs Live Deflection = | 0' - 2" | Absolute live load deflection limit |
| Rel Live Deflection = | 360.00 | Relative live deflection limit |
| Camber = | Include camber | |
| Camber Step = | 0' - 0 64/256" | Minimum increment of camber change |
| Min Length to Camber = | 20' - 0" | Minimum beam length to camber |
| Percent To Camber = | 2' - 7 127/256" | Percentage of self weight to use in camber |
| Min Camber = | 0' - 0 192/256" | Minimum allowable camber |
| Max Camber = | 0' - 4" | Maximum allowable beam camber |
| Construction Dead Load = | 0.00 [kip/in ²] | Superimposed uniform construction dead load |
| Construction Live Load = | 0.00 [kip/in ²] | Superimposed uniform construction live load |
| Ponding Load = | 0.00 [kip/in ²] | Superimposed concrete ponding load |
| Wet Concrete Factor = | 1.10 | Factor to use in determining the wet weight of concrete |
| Cost of Concrete = | 75.00 [\$] | Cost per cubic yard of concrete |
| Cost of Steel = | 4000.00 [\$] | Cost per ton of steel |
| Cost of Stud = | 10.00 [\$] | Cost per stud |
| Deck Area Factor = | 0.50 | Percent of concrete within deck flutes to include for design |
| Fu stud = | 50.00 [kip/in ²] | Ultimate strength of stud |
| Es = | 29000.00 [kip/in ²] | Stiffness of beam |
| Fy = | 50.00 [kip/in ²] | Yield strength of beam steel |
| Min Beam Depth = | 0' - 1" | Minimum allowable beam depth |
| Max Beam Depth = | 1' - 6" | Maximum allowable beam depth |
| Min Percent Composite = | 0.25 [%] | Minimum allowable percent composite action |
| Max Percent Composite = | 1.00 [%] | Max Percent Composite |
| Span to Depth Ratio = | 24.00 | Maximum allowable span-to-depth ration |
| Min Stud Spacing = | 0' - 6" | Minimum allowable stud spacing |
| Max Stud Spacing = | 2' - 0" | Maximum stud spacing |
| Min Stud Cover = | 0' - 1" | Minimum allowable stud cover |
| Stud Diameter = | 0' - 0 192/256" | Diameter of a single stud |
| Stud Height = | 0' - 0 192/256" | Height of a stud |

Stud Step = 0' - 5" Stud count step
 Lateral-torsional buckling verification = Not analysed

DESIGN RESULTS - ANSI/AISC 360-05 - LRFD METHOD

| | | | |
|------------------|-----------------------------|--|-------------|
| Mode = | Composite | Design mode | |
| Mn = | 218.87 [kip*ft] | Moment Capacity | [F2.1] |
| 0.9 Mn = | 196.99 [kip*ft] | Moment Capacity | [F1.(1)] |
| Mmax = | 178.86 [kip*ft] | Maximum moment | |
| Cc = | 86 [kip] | Compressive force in concrete | |
| Cost = | 898.21 [\$] | Estimated cost of beam | |
| Itr = | 972.171 [in ⁴] | Transformed section modulus | |
| Failure Mode = | Stud Failure | Ultimate failure mode | |
| PNA = | 0' - 3 32/256" | Plastic neutral axis location (measured down from top of beam) | |
| Ts = | 205 [kip] | Tensile force in steel | |
| Vn = | 95 [kip] | Shear capacity | [G2.1] |
| Studs = | 13 | Number of studs | |
| %Composite = | 25.93 [%] | composite action | |
| Full Composite = | 71 | Number of studs in full composite mode | |
| Stud Rows = | 0.52 | Number of stud rows | |
| Qn = | 13 [kip] | Average shear strength of stud | [I3.2d.(3)] |
| Rg = | 1.00 | Stud strength group factor | [I3.2d.(3)] |
| Rp = | 0.60 | Stud strength placement factor | [I3.2d.(3)] |
| Eeff = | 0.00 [kip/in ²] | Effective stiffness | |
| Ieff = | 597.375 [in ⁴] | Effective section modulus | |
| a = | 0' - 0 83/256" | Depth of concrete stress block measured down from top of concrete slab | |

| | | | |
|--------------------------|-----------|---------|---------|
| Composite Deflection | 0.77 <= 1 | Succeed | (0.77) |
| Composite Strength | 0.91 <= 1 | Succeed | (0.91) |
| Depth Restriction | 0.95 <= 1 | Succeed | (0.95) |
| Maximum Stud Spacing | 1.00 <= 1 | Succeed | (1.00) |
| Non Composite Deflection | 0.68 <= 1 | Succeed | (0.68) |
| Non Composite Strength | 0.63 <= 1 | Succeed | (0.63) |
| Percent Composite | 0.96 <= 1 | Succeed | (0.96) |
| Shear Strength | 0.32 <= 1 | Succeed | (0.32) |
| Stud Capacity | 1.00 <= 1 | Succeed | (1.00) |
| Stud Rows | 0.15 <= 1 | Succeed | (0.15) |
| Ratio | 1.00 <= 1 | Succeed | (1.00) |