



Composite Design

Robot Extensions for Autodesk Revit Structure - Composite Design 3.3



Ratio = 0.95

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
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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	0.73 <= 1	Succeed	(0.73)
Composite Strength	0.91 <= 1	Succeed	(0.91)
Depth Restriction	0.95 <= 1	Succeed	(0.95)
Non Composite Deflection	0.68 <= 1	Succeed	(0.68)
Non Composite Strength	0.63 <= 1	Succeed	(0.63)
Shear Strength	0.32 <= 1	Succeed	(0.32)
Stud Rows	0.15 <= 1	Succeed	(0.15)
Ratio	0.95 <= 1	Succeed	(0.95)