Composite Steel Beam Design

Job: 0
Beam ID: 0
Time: 3:14 PM 7/2/2008

Designed By:
Checked By:
Program: Composite Steel Beam 2.0

C O M P O S I T E S T E E L B E A M D E S I G N

Description:
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Code: AISC (1990) Design Method: ASD Type: Composite Beam - Shored

Main Span Length:	20.000	Ft				
Beam Spacing	: 5.000	Ft				
Slab Thickness	: 6.500	In	Deck Thickness	: 2.250	In	
Fy	: 50	K /In ^2	Total Load Deflection Limit	: L/240.00		
Max Stress Ratio	: 1.000		Live Load Deflection Limit	: L/360.00		
Rebar, Fy	: 60	K /In ^2	Concrete, f'c	: 5	K /In ^2	
Density	: 145.000	Lb/Ft ^3	Stud Capacity	: 8.000	K	
Modular Ratios						
Short Term	: 7.118		Long Term	: 14.236		
Cover Plate						
Thickness	: 0.750	In	Width	: 6.000	In	

E C H O O F L O A D I N P U T

	NON-COMPOSITE	DEAD	LIVE	WIND	EARTHQUAKE	ROOF
Wind/Earthquake Included:		No	No	Yes		
Check Deflection:		Yes	Yes	Yes		
Main Span						
# 1 Concentrated Load:	0.000 K	-5.000 K	-2.000 K	0.000 K		
Distance:	0.000 Ft	12.000 Ft	11.000 Ft	0.000 Ft		
# 1 Uniform Load:	-0.200 K /Ft	0.000 K /Ft	-0.500 K /Ft	0.000 K /Ft		
Distance to Begin:	0.000 Ft	0.000 Ft	0.000 Ft	0.000 Ft		
End:	20.000 Ft	0.000 Ft	20.000 Ft	0.000 Ft		
# 1 Linear Load Begin:	0.000 K /Ft	0.000 K /Ft	0.000 K /Ft	-0.080 K /Ft		
End:	0.000 K /Ft	0.000 K /Ft	0.000 K /Ft	-0.046 K /Ft		
Distance to Begin:	0.000 Ft	0.000 Ft	0.000 Ft	0.000 Ft		
End:	0.000 Ft	0.000 Ft	0.000 Ft	20.000 Ft		

C R I T I C A L S H E A R S & M O M E N T S

(+Moment Produces Compression in Top Flange) (NON-COMPOSITE + COMPOSITE)

Load Combination # 1: 1.000 x Non-Comp + 1.000 x Dead
Load Combination # 2: 1.000 x Non-Comp + 1.000 x Dead + 1.000 x Live + 1.000 x Wind

	NON-COMPOSITE	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
Wind Included:		No	Yes		
Shear Left End:		4.000 K	10.587 K		
Moment Left End:		0.000 K -Ft	0.000 K -Ft		
Shear Right End:		-5.000 K	-11.673 K		
Moment Right End:		0.000 K -Ft	0.000 K -Ft		
Maximum Moment:		33.600 K -Ft	69.648 K -Ft		
Located at:		12.000 Ft	11.144 Ft		
Max Deflection I=1000:		-0.072 In	-0.161 In		
Located at:		10.395 Ft	10.215 Ft		
Non-Composite Part:		-0.025 In	-0.025 In		
Inflection Points:		0.000 Ft	0.000 Ft		
		20.000 Ft	20.000 Ft		

Reaction	Left End:	4.000 K	10.587 K
Reaction	Right End:	5.000 K	11.673 K

S E C T I O N P R O P E R T I E S

Non-Composite Section Properties for W8x10

Ix = 64.333 In^4 Sxt = 9.820 In^3 Sxb = 30.795 In^3

Composite Section Properties (Beff = 60.00 In)

Ix (Short) = 855.277 In^4 Ix (Long) = 720.002 In^4 Ix (Stress) = 853.329 In^4

Sxt = 344.050 In^3 Sxb = 76.737 In^3 Sxslab = 1527.410 In^3

C R I T I C A L S T R E S S E S

(Sign Convention: += Tension, -= Compression)

	NON-COMPOSITE	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
		(NON-COMPOSITE + COMPOSITE)			

Design of W8x10

Main Span

Actual/Allowable Composite Top Flange Stresses			
@Max Composite Moment:	-1.172 K /In ^2	-2.429 K /In ^2	
	32.712 K /In ^2	43.616 K /In ^2	
Actual/Allowable Composite Bottom Flange Stresses			
@Max Composite Moment:	5.254 K /In ^2	10.892 K /In ^2	
	33.000 K /In ^2	44.000 K /In ^2	
Partial Composite Bottom Flange Stresses			
	7.453 K /In ^2	15.448 K /In ^2	
	33.000 K /In ^2	44.000 K /In ^2	
Actual/Allowable Composite Shear Stresses			
	3.728 K /In ^2	8.703 K /In ^2	
	20.000 K /In ^2	26.667 K /In ^2	
Actual/Allowable Composite Concrete Stresses			
@Max Non-Comp Moment:	-0.236 K /In ^2	-0.528 K /In ^2	
	2.250 K /In ^2	3.000 K /In ^2	
@Max Composite Moment:	-0.264 K /In ^2	-0.547 K /In ^2	
	2.250 K /In ^2	3.000 K /In ^2	

C R I T I C A L S T R E S S E S
S U M M A R Y

Main Span

W8x10 Loc: fv/Fv Stress Ratio: 0.33 Load Comb: 2 Defl. Ratio: L/ 1071 Load Comb: 2

fb: 10.89 K /In ^2 fv: 8.70 K /In ^2 Weight: 0.51 K

Fb: 44.00 K /In ^2 Fv: 26.67 K /In ^2 Defl: 0.000 In (NC) -0.189 In (Short) -0.224 In (Long 100.00% Sustained)

With 26 Per Cent Partial Composite Action:

Seff = 54.102 In^3 Ieff = 465.594 In^4 (Short) 396.967 In^4 (Long)

fb: 15.45 K /In ^2 Defl: -0.346 In (Short) -0.406 In (Long 100.00% Sustained)

Fb: 44.00 K /In ^2

Required Shear Connectors

Mid Span: Vh (Full Composite) = 186.50 K 50 Studs Reqd

Between 0.000 Ft and 11.000 Ft, Spacing is 5.5 In (24)

Between11.000 Ft and 12.000 Ft, Spacing is 6.0 In (2)

Between12.000 Ft and 20.000 Ft, Spacing is 4.0 In (24)

Vh' (Partial Composite) = 48.00 K 13 Studs Reqd (Increased to 28 Per Cent Due to Spacing Constraints)

Between 0.000 Ft and 11.000 Ft, Spacing is 22.0 In (6)

Between11.000 Ft and 12.000 Ft, Spacing is 24.0 In (1)

Between12.000 Ft and 20.000 Ft, Spacing is 16.0 In (6)

NOTE: Program Does Not Check Minimum Spacing Based on Stud Diameter or Minimum Resistance Reqd For Uplift
In Regions Where No Studs are Theorectically Required, Place Additional Studs at the Maximum Spacing Allowed

Bottom Flange Cover Plate
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Theoretical Cutoffs at 7.976 Ft From Left Support and 6.461 Ft From Right Support
Plate Must Be Extended Beyond These Points to Develop Plate Flange Force = 42.06 K

Partial Composite

Theoretical Cutoffs at 4.662 Ft From Left Support and 4.023 Ft From Right Support
Plate Must Be Extended Beyond These Points to Develop Plate Flange Force = 33.59 K

D E F L E C T I O N S

	NON-COMPOSITE	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
Total Deflections Full Composite					
Main Span (Short) :		-0.084 In	-0.189 In		
(Long) :		-0.100 In	-0.224 In		
Allowable :		1.000 In	1.000 In		
Live Load Deflections Full Composite					
Main Span (Short) :		-0.055 In	-0.160 In		
(Long) :		-0.065 In	-0.190 In		
Allowable :		0.667 In	0.667 In		
Total Deflections Partial Composite					
Main Span (Short) :		-0.154 In	-0.346 In		
(Long) :		-0.181 In	-0.406 In		
Allowable :		1.000 In	1.000 In		
Live Load Deflections Partial Composite					
Main Span (Short) :		-0.101 In	-0.293 In		
(Long) :		-0.119 In	-0.344 In		
Allowable :		0.667 In	0.667 In		

NOTE: Deflections are calculated using constant value of I

S E C T I O N P R O P E R T I E S

Non-Composite Section Properties for W10x12
Ix = 109.877 In^4 Sxt = 13.896 In^3 Sxb = 40.500 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 1154.325 In^4 Ix (Long) = 973.934 In^4 Ix (Stress) = 1151.778 In^4
Sxt = 547.440 In^3 Sxb = 90.521 In^3 Sxslab = 1885.137 In^3

C R I T I C A L S T R E S S E S

(Sign Convention: += Tension, -= Compression) (NON-COMPOSITE + COMPOSITE)

	NON-COMPOSITE	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
Design of W10x12					
Main Span					
Actual/Allowable Composite Top Flange Stresses					
@Max Composite Moment:		-0.737 K /In ^2	-1.527 K /In ^2		
		32.853 K /In ^2	43.804 K /In ^2		
Actual/Allowable Composite Bottom Flange Stresses					
@Max Composite Moment:		4.454 K /In ^2	9.233 K /In ^2		
		33.000 K /In ^2	44.000 K /In ^2		
Partial Composite Bottom Flange Stresses					
		6.027 K /In ^2	12.492 K /In ^2		
		33.000 K /In ^2	44.000 K /In ^2		
Actual/Allowable Composite Shear Stresses					

	2.666 K /In ^2	6.225 K /In ^2
	20.000 K /In ^2	26.667 K /In ^2
Actual/Allowable Composite Concrete Stresses		
@Max Non-Comp Moment:	-0.191 K /In ^2	-0.427 K /In ^2
	2.250 K /In ^2	3.000 K /In ^2
@Max Composite Moment:	-0.214 K /In ^2	-0.443 K /In ^2
	2.250 K /In ^2	3.000 K /In ^2

C R I T I C A L S T R E S S E S
S U M M A R Y

Main Span
=========

W10x12 Loc: fv/Fv Stress Ratio: 0.23 Load Comb: 2 Defl. Ratio: L/ 1449 Load Comb: 2

fb: 9.23 K /In ^2 fv: 6.22 K /In ^2 Weight: 0.55 K
Fb: 44.00 K /In ^2 Fv: 26.67 K /In ^2 Defl: 0.000 In (NC) -0.140 In (Short) -0.166 In (Long 100.00% Sustained)

With 28 Per Cent Partial Composite Action:

Seff = 66.903 In^3 Ieff = 661.171 In^4 (Short) 565.954 In^4 (Long)
fb: 12.49 K /In ^2 Defl: -0.244 In (Short) -0.285 In (Long 100.00% Sustained)
Fb: 44.00 K /In ^2

Required Shear Connectors
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Mid Span: Vh (Full Composite) = 201.00 K 55 Studs Reqd
Between 0.000 Ft and 11.000 Ft, Spacing is 5.1 In (26)
Between11.000 Ft and 12.000 Ft, Spacing is 5.5 In (3)
Between12.000 Ft and 20.000 Ft, Spacing is 3.7 In (26)

Vh' (Partial Composite) = 56.00 K 15 Studs Reqd (Increased to 30 Per Cent Due to Spacing Constraints)
Between 0.000 Ft and 11.000 Ft, Spacing is 18.9 In (7)
Between11.000 Ft and 12.000 Ft, Spacing is 20.6 In (1)
Between12.000 Ft and 20.000 Ft, Spacing is 13.7 In (7)

NOTE: Program Does Not Check Minimum Spacing Based on Stud Diameter or Minimum Resistance Reqd For Uplift
In Regions Where No Studs are Theorectically Required, Place Additional Studs at the Maximum Spacing Allowed

Bottom Flange Cover Plate
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Partial Composite

Theoretical Cutoffs at 6.870 Ft From Left Support and 5.706 Ft From Right Support
Plate Must Be Extended Beyond These Points to Develop Plate Flange Force = 35.61 K

D E F L E C T I O N S

	NON-COMPOSITE	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
Total Deflections Full Composite					
Main Span (Short) :		-0.062 In	-0.140 In		
(Long) :		-0.074 In	-0.166 In		
Allowable :		1.000 In	1.000 In		
Live Load Deflections Full Composite					
Main Span (Short) :		-0.041 In	-0.118 In		
(Long) :		-0.048 In	-0.140 In		
Allowable :		0.667 In	0.667 In		
Total Deflections Partial Composite					
Main Span (Short) :		-0.109 In	-0.244 In		
(Long) :		-0.127 In	-0.285 In		
Allowable :		1.000 In	1.000 In		
Live Load Deflections Partial Composite					
Main Span (Short) :		-0.071 In	-0.206 In		
(Long) :		-0.083 In	-0.241 In		
Allowable :		0.667 In	0.667 In		

NOTE: Deflections are calculated using constant value of I