Composite Steel Beam Design

Job: 0
Beam ID: 0
Time: 2:22 PM 8/4/2026

Designed By:
Checked By:
Program: Composite Steel Beam 2.1

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

Main Span Length: 20.000 Ft

Beam Spacing	:	5.000	Ft				
Slab Thickness	:	4.000	In				
Fy	:	50	K /In ^2				
Max Stress Ratio	:	1.000					
Rebar, Fy	:	60	K /In ^2	Concrete, f'c	:	4	K /In ^2
Density	:	144.000	Lb/Ft ^3	Stud Capacity	:	8.000	K
Modular Ratios							
Short Term	:	8.041		Long Term	:	16.082	

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

NON-COMPOSITE DEAD LIVE WIND EARTHQUAKE ROOF

Main Span
=========

1 Uniform Load: -5.000 K /Ft
Distance to Begin: 0.000 Ft
End: 10.000 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)

NON-COMPOSITE LOAD COMB 1 LOAD COMB 2 LOAD COMB 3 LOAD COMB 4

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

Shear	Left End:	37.500	K	37.500	K	
Moment	Left End:	0.000	K -Ft	0.000	K -Ft	
Shear	Right End:	-12.500	K	-12.500	K	
Moment	Right End:	0.000	K -Ft	0.000	K -Ft	
	Maximum Moment:	140.625	K -Ft	140.625	K -Ft	
	Located at:	7.500	Ft	7.500	Ft	
Max Deflection	I=1000:	-0.313	In	-0.313	In	
	Located at:	9.196	Ft	9.196	Ft	
	Non-Composite Part:			-0.313	In	
	Inflection Points:	0.000	Ft	0.000	Ft	
		20.000	Ft	20.000	Ft	
Reaction	Left End:	37.500	K	37.500	K	
Reaction	Right End:	12.500	K	12.500	K	

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

Non-Composite Section Properties for W10x60
Ix = 341.000 In^4 Sxt = 66.700 In^3 Sxb = 66.700 In^3

Composite Section Properties (Beff = 60.00 In)

Ix (Short) =	940.481	In^4	Ix (Long) =	769.147	In^4	Ix (Stress) =	940.377 In^4
Sxt =	1473.755	In^3	Sxb =	98.141	In^3	Sxslab =	1631.010 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 W10x60

Main Span

Actual/Allowable Non-Composite Top Flange Stresses
@Max Non-Comp Moment: -25.300 K /In ^2
33.000 K /In ^2

Actual/Allowable Non-Composite Bottom Flange Stresses
@Max Non-Comp Moment: 25.300 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Top Flange Stresses
@Max Non-Comp Moment: -25.300 K /In ^2
45.000 K /In ^2
@Max Composite Moment: -25.300 K /In ^2
45.000 K /In ^2

Actual/Allowable Composite Bottom Flange Stresses
@Max Non-Comp Moment: 25.300 K /In ^2
45.000 K /In ^2
@Max Composite Moment: 25.300 K /In ^2
45.000 K /In ^2

Partial Composite Bottom Flange Stresses
20.436 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Shear Stresses
8.736 K /In ^2
20.000 K /In ^2

Actual/Allowable Composite Concrete Stresses

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 25.300 K /In ^2
@Max Composite Moment: 25.300 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 25.300 K /In ^2
@Max Composite Moment: 25.300 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

W10x60 Loc: DEFL Stress Ratio: 0.77 Load Comb: 0 Defl. Ratio: L/ 261 Load Comb: 0

fb: -25.30 K /In ^2 fv: 8.74 K /In ^2 Weight: 1.20 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.918 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 26 Per Cent Partial Composite Action:

Seff = 82.574 In^3 Ieff = 643.665 In^4 (Short) 557.162 In^4 (Long)
fb: 20.44 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors

Mid Span: Vh (Full Composite) = 408.00 K 102 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 1.8 In (51)
Between 7.500 Ft and 20.000 Ft, Spacing is 2.9 In (51)

Vh' (Partial Composite) = 104.00 K 26 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 6.9 In (13)
Between 7.500 Ft and 20.000 Ft, Spacing is 11.5 In (13)

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

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) :	-0.918 In	-0.918 In			
(Long) :		-0.918 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.918 In	-0.918 In			
(Long) :		-0.918 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		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 W12x45
Ix = 350.000 In^4 Sxt = 58.100 In^3 Sxb = 58.100 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 979.947 In^4 Ix (Long) = 821.553 In^4 Ix (Stress) = 979.854 In^4
Sxt = 2116.088 In^3 Sxb = 84.492 In^3 Sxslab = 1766.130 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 W12x45
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Main Span
==========

Actual/Allowable Non-Composite Top Flange Stresses
@Max Non-Comp Moment: -29.045 K /In ^2
33.000 K /In ^2

Actual/Allowable Non-Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.045 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Top Flange Stresses
@Max Non-Comp Moment: -29.045 K /In ^2
45.000 K /In ^2
@Max Composite Moment: -29.045 K /In ^2
45.000 K /In ^2

Actual/Allowable Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.045 K /In ^2
45.000 K /In ^2
@Max Composite Moment: 29.045 K /In ^2
45.000 K /In ^2

Partial Composite Bottom Flange Stresses
23.526 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Shear Stresses
9.282 K /In ^2
20.000 K /In ^2

Actual/Allowable Composite Concrete Stresses

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.045 K /In ^2
@Max Composite Moment: 29.045 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.045 K /In ^2
@Max Composite Moment: 29.045 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
=========

W12x45 Loc: DEFL Stress Ratio: 0.88 Load Comb: 0 Defl. Ratio: L/ 268 Load Comb: 0

fb: -29.04 K /In ^2 fv: 9.28 K /In ^2 Weight: 0.90 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.894 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 27 Per Cent Partial Composite Action:

Seff = 71.729 In^3 Ieff = 675.303 In^4 (Short) 593.509 In^4 (Long)
fb: 23.53 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors
=========================

Mid Span: Vh (Full Composite) = 330.00 K 84 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 2.1 In (42)
Between 7.500 Ft and 20.000 Ft, Spacing is 3.6 In (42)

Vh' (Partial Composite) = 88.00 K 22 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 8.2 In (11)
Between 7.500 Ft and 20.000 Ft, Spacing is 13.6 In (11)

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

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) :	-0.894 In	-0.894 In			
(Long) :		-0.894 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.894 In	-0.894 In			
(Long) :		-0.894 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		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 W14x38
Ix = 385.000 In^4 Sxt = 54.600 In^3 Sxb = 54.600 In^3

Composite Section Properties (Beff = 60.00 In)

```
     Ix (Short) =     1091.809  In^4  Ix (Long) =      928.926  In^4  Ix (Stress) =     1091.716  In^4
            Sxt =     2322.210  In^3        Sxb =       80.097  In^3       Sxslab =     1964.643  In^3
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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

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Design of W14x38
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Main Span
=========

   Actual/Allowable Non-Composite Top Flange Stresses
   @Max  Non-Comp Moment:     -30.907  K /In ^2
                               33.000  K /In ^2

   Actual/Allowable Non-Composite Bottom Flange Stresses
   @Max  Non-Comp Moment:      30.907  K /In ^2
                               33.000  K /In ^2

   Actual/Allowable Composite Top Flange Stresses
   @Max  Non-Comp Moment:                          -30.907  K /In ^2
                                                    45.000  K /In ^2
   @Max Composite Moment:                          -30.907  K /In ^2
                                                    45.000  K /In ^2

   Actual/Allowable Composite Bottom Flange Stresses
   @Max  Non-Comp Moment:                           30.907  K /In ^2
                                                    45.000  K /In ^2
   @Max Composite Moment:                           30.907  K /In ^2
                                                    45.000  K /In ^2

   Partial Composite Bottom Flange Stresses
                                                    24.989  K /In ^2
                                                    33.000  K /In ^2

   Actual/Allowable Composite Shear Stresses
                                                     8.579  K /In ^2
                                                    20.000  K /In ^2

   Actual/Allowable Composite Concrete Stresses

   Unshored Bottom Flange Elastic Stresses
   @Max  Non-Comp Moment:                           30.907  K /In ^2
   @Max Composite Moment:                           30.907  K /In ^2

   Partial Composite Bottom Flange Elastic Stresses
   @Max  Non-Comp Moment:                           30.907  K /In ^2
   @Max Composite Moment:                           30.907  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

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Main Span
=========

W14x38    Loc: NCOMP/TF     Stress Ratio:    0.94   Load Comb:   0  Defl. Ratio: L/  295   Load Comb: 0
================================================================================================================================
fb:     -30.91  K /In ^2  fv:       8.58  K /In ^2                    Weight:       0.76 K
Fb:      33.00  K /In ^2  Fv:      20.00  K /In ^2  Defl: -0.813  In (NC)   0.000  In (Short)   0.000  In (Long 100.00% Sustained)

With 26 Per Cent Partial Composite Action:

   Seff =       67.529  In^3  Ieff =      743.418  In^4  (Short)       660.821  In^4 (Long)
fb:      24.99  K /In ^2                          Defl:                 0.000  In (Short)   0.000  In (Long 100.00% Sustained)
Fb:      33.00  K /In ^2


Required Shear Connectors
=========================

  Mid Span: Vh  (Full Composite)    =   280.00  K  70 Studs Reqd
    Between 0.000 Ft and  7.500 Ft, Spacing is    2.6 In (35)
    Between 7.500 Ft and 20.000 Ft, Spacing is    4.3 In (35)

            Vh' (Partial Composite) =    72.00  K  18 Studs Reqd
    Between 0.000 Ft and  7.500 Ft, Spacing is   10.0 In (9)
    Between 7.500 Ft and 20.000 Ft, Spacing is   16.7 In (9)
```

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

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) :	-0.813 In	-0.813 In			
(Long) :		-0.813 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.813 In	-0.813 In			
(Long) :		-0.813 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		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 W16x36
Ix = 448.000 In^4 Sxt = 56.500 In^3 Sxb = 56.500 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 1259.088 In^4 Ix (Long) = 1079.030 In^4 Ix (Stress) = 1258.986 In^4
Sxt = 2087.262 In^3 Sxb = 82.520 In^3 Sxslab = 2200.171 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 W16x36
==========

Main Span
==========

Actual/Allowable Non-Composite Top Flange Stresses
@Max Non-Comp Moment: -29.867 K /In ^2
33.000 K /In ^2

Actual/Allowable Non-Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.867 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Top Flange Stresses
@Max Non-Comp Moment: -29.867 K /In ^2
45.000 K /In ^2
@Max Composite Moment: -29.867 K /In ^2
45.000 K /In ^2

Actual/Allowable Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.867 K /In ^2
45.000 K /In ^2
@Max Composite Moment: 29.867 K /In ^2
45.000 K /In ^2

Partial Composite Bottom Flange Stresses
24.086 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Shear Stresses
8.015 K /In ^2
20.000 K /In ^2

Actual/Allowable Composite Concrete Stresses

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.867 K /In ^2
@Max Composite Moment: 29.867 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.867 K /In ^2
@Max Composite Moment: 29.867 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
=========

W16x36 Loc: NCOMP/TF Stress Ratio: 0.91 Load Comb: 0 Defl. Ratio: L/ 343 Load Comb: 0
fb: -29.87 K /In ^2 fv: 8.02 K /In ^2 Weight: 0.72 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.698 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 28 Per Cent Partial Composite Action:

Seff = 70.063 In^3 Ieff = 870.777 In^4 (Short) 776.922 In^4 (Long)
fb: 24.09 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors
=========================

Mid Span: Vh (Full Composite) = 265.00 K 68 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 2.6 In (34)
Between 7.500 Ft and 20.000 Ft, Spacing is 4.4 In (34)

Vh' (Partial Composite) = 72.00 K 18 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 10.0 In (9)
Between 7.500 Ft and 20.000 Ft, Spacing is 16.7 In (9)

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

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) :	-0.698 In	-0.698 In			
(Long) :		-0.698 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.698 In	-0.698 In			
(Long) :		-0.698 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		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 W18x35
Ix = 510.000 In^4 Sxt = 57.600 In^3 Sxb = 57.600 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 1451.252 In^4 Ix (Long) = 1247.299 In^4 Ix (Stress) = 1451.138 In^4

Sxt = 1849.725 In^3 Sxb = 85.788 In^3 Sxslab = 2439.854 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 W18x35
==========

Main Span
==========

Actual/Allowable Non-Composite Top Flange Stresses
@Max Non-Comp Moment: -29.297 K /In ^2
33.000 K /In ^2

Actual/Allowable Non-Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.297 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Top Flange Stresses
@Max Non-Comp Moment: -29.297 K /In ^2
45.000 K /In ^2
@Max Composite Moment: -29.297 K /In ^2
45.000 K /In ^2

Actual/Allowable Composite Bottom Flange Stresses
@Max Non-Comp Moment: 29.297 K /In ^2
45.000 K /In ^2
@Max Composite Moment: 29.297 K /In ^2
45.000 K /In ^2

Partial Composite Bottom Flange Stresses
23.551 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Shear Stresses
7.062 K /In ^2
20.000 K /In ^2

Actual/Allowable Composite Concrete Stresses

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.297 K /In ^2
@Max Composite Moment: 29.297 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 29.297 K /In ^2
@Max Composite Moment: 29.297 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
==========

W18x35 Loc: NCOMP/TF Stress Ratio: 0.89 Load Comb: 0 Defl. Ratio: L/ 391 Load Comb: 0
fb: -29.30 K /In ^2 fv: 7.06 K /In ^2 Weight: 0.70 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.613 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 25 Per Cent Partial Composite Action:

Seff = 71.653 In^3 Ieff = 979.253 In^4 (Short) 877.574 In^4 (Long)
fb: 23.55 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors
==========

Mid Span: Vh (Full Composite) = 257.50 K 66 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 2.7 In (33)
Between 7.500 Ft and 20.000 Ft, Spacing is 4.5 In (33)

Vh' (Partial Composite) = 64.00 K 16 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 11.3 In (8)
Between 7.500 Ft and 20.000 Ft, Spacing is 18.8 In (8)

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

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) :	-0.613 In	-0.613 In		
(Long) :		-0.613 In		
Allowable :	1.000 In	1.000 In		
Live Load Deflections Full Composite				
Main Span (Short) :		0.000 In		
(Long) :		0.000 In		
Allowable :		0.667 In		
Total Deflections Partial Composite				
Main Span (Short) :	-0.613 In	-0.613 In		
(Long) :		-0.613 In		
Allowable :	1.000 In	1.000 In		
Live Load Deflections Partial Composite				
Main Span (Short) :		0.000 In		
(Long) :		0.000 In		
Allowable :		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 W21x44
Ix = 843.000 In^4 Sxt = 81.600 In^3 Sxb = 81.600 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 2259.529 In^4 Ix (Long) = 1919.157 In^4 Ix (Stress) = 2259.337 In^4
Sxt = 1296.918 In^3 Sxb = 119.428 In^3 Sxslab = 3165.227 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 W21x44
==========

Main Span
==========

Actual/Allowable Non-Composite Top Flange Stresses				
@Max Non-Comp Moment:	-20.680 K /In ^2			
	33.000 K /In ^2			
Actual/Allowable Non-Composite Bottom Flange Stresses				
@Max Non-Comp Moment:	20.680 K /In ^2			
	33.000 K /In ^2			
Actual/Allowable Composite Top Flange Stresses				
@Max Non-Comp Moment:		-20.680 K /In ^2		
		45.000 K /In ^2		
@Max Composite Moment:		-20.680 K /In ^2		
		45.000 K /In ^2		
Actual/Allowable Composite Bottom Flange Stresses				
@Max Non-Comp Moment:		20.680 K /In ^2		
		45.000 K /In ^2		
@Max Composite Moment:		20.680 K /In ^2		
		45.000 K /In ^2		
Partial Composite Bottom Flange Stresses				
		16.661 K /In ^2		
		33.000 K /In ^2		
Actual/Allowable Composite Shear Stresses				
		5.186 K /In ^2		
		20.000 K /In ^2		
Actual/Allowable Composite Concrete Stresses				

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 20.680 K /In ^2
@Max Composite Moment: 20.680 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 20.680 K /In ^2
@Max Composite Moment: 20.680 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
=========

W21x44 Loc: NCOMP/TF Stress Ratio: 0.63 Load Comb: 0 Defl. Ratio: L/ 646 Load Comb: 0

fb: -20.68 K /In ^2 fv: 5.19 K /In ^2 Weight: 0.88 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.371 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 28 Per Cent Partial Composite Action:

Seff = 101.284 In^3 Ieff = 1580.098 In^4 (Short) 1402.984 In^4 (Long)
fb: 16.66 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors
=========================

Mid Span: Vh (Full Composite) = 325.00 K 82 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 2.2 In (41)
Between 7.500 Ft and 20.000 Ft, Spacing is 3.7 In (41)

Vh' (Partial Composite) = 88.00 K 22 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 8.2 In (11)
Between 7.500 Ft and 20.000 Ft, Spacing is 13.6 In (11)

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

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) :	-0.371 In	-0.371 In			
(Long) :		-0.371 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.371 In	-0.371 In			
(Long) :		-0.371 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		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 W24x55
Ix = 1350.000 In^4 Sxt = 114.000 In^3 Sxb = 114.000 In^3

Composite Section Properties (Beff = 60.00 In)
Ix (Short) = 3385.187 In^4 Ix (Long) = 2845.982 In^4 Ix (Stress) = 3384.875 In^4
Sxt = 1187.224 In^3 Sxb = 163.371 In^3 Sxslab = 3974.445 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 W24x55
==========

Main Span
=========

Actual/Allowable Non-Composite Top Flange Stresses
@Max Non-Comp Moment: -14.803 K /In ^2
33.000 K /In ^2

Actual/Allowable Non-Composite Bottom Flange Stresses
@Max Non-Comp Moment: 14.803 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Top Flange Stresses
@Max Non-Comp Moment: -14.803 K /In ^2
45.000 K /In ^2
@Max Composite Moment: -14.803 K /In ^2
45.000 K /In ^2

Actual/Allowable Composite Bottom Flange Stresses
@Max Non-Comp Moment: 14.803 K /In ^2
45.000 K /In ^2
@Max Composite Moment: 14.803 K /In ^2
45.000 K /In ^2

Partial Composite Bottom Flange Stresses
12.139 K /In ^2
33.000 K /In ^2

Actual/Allowable Composite Shear Stresses
4.028 K /In ^2
20.000 K /In ^2

Actual/Allowable Composite Concrete Stresses

Unshored Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 14.803 K /In ^2
@Max Composite Moment: 14.803 K /In ^2

Partial Composite Bottom Flange Elastic Stresses
@Max Non-Comp Moment: 14.803 K /In ^2
@Max Composite Moment: 14.803 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
=========

W24x55 Loc: NCOMP/TF Stress Ratio: 0.45 Load Comb: 0 Defl. Ratio: L/ 1035 Load Comb: 0
fb: -14.80 K /In ^2 fv: 4.03 K /In ^2 Weight: 1.10 K
Fb: 33.00 K /In ^2 Fv: 20.00 K /In ^2 Defl: -0.232 In (NC) 0.000 In (Short) 0.000 In (Long 100.00% Sustained)

With 26 Per Cent Partial Composite Action:

Seff = 139.019 In^3 Ieff = 2381.320 In^4 (Short) 2108.081 In^4 (Long)
fb: 12.14 K /In ^2 Defl: 0.000 In (Short) 0.000 In (Long 100.00% Sustained)
Fb: 33.00 K /In ^2

Required Shear Connectors
=========

Mid Span: Vh (Full Composite) = 405.00 K 102 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 1.8 In (51)
Between 7.500 Ft and 20.000 Ft, Spacing is 2.9 In (51)

Vh' (Partial Composite) = 104.00 K 26 Studs Reqd
Between 0.000 Ft and 7.500 Ft, Spacing is 6.9 In (13)
Between 7.500 Ft and 20.000 Ft, Spacing is 11.5 In (13)

NOTE: Program Does Not Check Minimum Spacing Based on Stud Diameter or Minimum Resistance Reqd For Uplift

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In Regions Where No Studs are Theorectically Required, Place Additional Studs at the Maximum Spacing Allowed

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) :	-0.232 In	-0.232 In			
(Long) :		-0.232 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Full Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			
Total Deflections Partial Composite					
Main Span (Short) :	-0.232 In	-0.232 In			
(Long) :		-0.232 In			
Allowable :	1.000 In	1.000 In			
Live Load Deflections Partial Composite					
Main Span (Short) :		0.000 In			
(Long) :		0.000 In			
Allowable :		0.667 In			

NOTE: Deflections are calculated using constant value of I