**Composite Steel Beam Design**

**Job:** 0

**Beam ID:** 0

**Time:** 3:14 PM 7/2/2008

**Designed By:**

**Checked By:** Composite Steel Beam 2.0

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### Composite Steel Beam Design

**Description:**

ⵏazzo (1990)  Design Method: ASD  Type: Composite Beam - Shored

- **Main Span Length:** 20.000 Ft
- **Beam Spacing:** 5.000 Ft
- **Slab Thickness:** 6.500 In
- **Fy:** 50 K /In^2
- **Max Stress Ratio:** 1.000
- **Rebar, Fy:** 60 K /In^2
- **Density:** 145.000 Lb/Ft^3
- **Modular Ratios**
  - **Short Term:** 7.118
  - **Long Term:** 14.236
- **Cover Plate**
  - **Thickness:** 0.750 In
  - **Width:** 6.000 In

### Echo of Load Input

<table>
<thead>
<tr>
<th></th>
<th>NON-COMPONENT</th>
<th>DEAD</th>
<th>LIVE</th>
<th>WIND</th>
<th>EARTHQUAKE</th>
<th>ROOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind/Earthquake Included:</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Check Deflection:</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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### Critical Shears & Moments

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

<table>
<thead>
<tr>
<th>Load Combination</th>
<th># 1</th>
<th>1.000 x Non-Comp + 1.000 x Dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Included:</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Shear Left End:</td>
<td>4.000 K</td>
<td>10.587 K</td>
</tr>
<tr>
<td>Moment Left End:</td>
<td>0.000 K -Ft</td>
<td>0.000 K -Ft</td>
</tr>
<tr>
<td>Shear Right End:</td>
<td>-5.000 K</td>
<td>-11.673 K</td>
</tr>
<tr>
<td>Moment Right End:</td>
<td>0.000 K -Ft</td>
<td>0.000 K -Ft</td>
</tr>
<tr>
<td>Maximum Moment:</td>
<td>33.600 K -Ft</td>
<td>69.648 K -Ft</td>
</tr>
<tr>
<td>Located at:</td>
<td>12.000 Ft</td>
<td>11.144 Ft</td>
</tr>
<tr>
<td>Max Deflection I=1000:</td>
<td>-0.072 In</td>
<td>-0.161 In</td>
</tr>
<tr>
<td>Located at:</td>
<td>10.396 Ft</td>
<td>10.215 Ft</td>
</tr>
<tr>
<td>Non-Composite Part:</td>
<td>-0.025 In</td>
<td>-0.025 In</td>
</tr>
<tr>
<td>Inflection Points:</td>
<td>0.000 Ft</td>
<td>0.000 Ft</td>
</tr>
<tr>
<td></td>
<td>20.000 Ft</td>
<td>20.000 Ft</td>
</tr>
</tbody>
</table>

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[22x24]Page 1/4
SECTION PROPERTIES

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

CRITICAL STRESSES

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

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

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 41.616 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

CRITICAL STRESSES SUMMARY

Main Span

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

With 26 Per Cent Partial Composite Action:

Required Shear Connectors

Mid Span: Vh (Full Composite) = 186.50 K 50 Studs Req'd
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 Req'd (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)
Between 12,000 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 Req'd For Uplift
In Regions Where No Studs are Theoretically Required, Place Additional Studs at the Maximum Spacing Allowed
Bottom Flange Cover Plate

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

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### DEFORMATIONS

<table>
<thead>
<tr>
<th>DEFORMATIONS</th>
<th>LOAD COMB 1</th>
<th>LOAD COMB 2</th>
<th>LOAD COMB 3</th>
<th>LOAD COMB 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Deflections Full Composite</td>
<td>-0.084 In</td>
<td>-0.189 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Long) :</td>
<td>-0.100 In</td>
<td>-0.224 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable :</td>
<td>1.000 In</td>
<td>1.000 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live Load Deflections Full Composite</td>
<td>-0.055 In</td>
<td>-0.160 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Long) :</td>
<td>-0.065 In</td>
<td>-0.190 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable :</td>
<td>0.667 In</td>
<td>0.667 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Deflections Partial Composite</td>
<td>-0.154 In</td>
<td>-0.346 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Long) :</td>
<td>-0.181 In</td>
<td>-0.496 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable :</td>
<td>1.000 In</td>
<td>1.000 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live Load Deflections Partial Composite</td>
<td>-0.101 In</td>
<td>-0.293 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Long) :</td>
<td>-0.119 In</td>
<td>-0.344 In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable :</td>
<td>0.667 In</td>
<td>0.667 In</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Deflections are calculated using constant value of I

### SECTION PROPERTIES

- **Non-Composite Section Properties for W10x12**
  - $I_x = 109.877 \text{ in}^4$
  - $S_{xt} = 13.896 \text{ in}^3$
  - $S_{xb} = 40.500 \text{ in}^3$

- **Composite Section Properties (Reff = 60.00 In)**
  - $I_x (\text{Short}) = 1154.325 \text{ in}^4$
  - $I_x (\text{Long}) = 1151.778 \text{ in}^4$
  - $S_{xt} = 547.440 \text{ in}^3$
  - $S_{xb} = 90.521 \text{ in}^3$
  - $S_{xslab} = 1885.137 \text{ in}^3$

### CRITICAL STRESSES

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

<table>
<thead>
<tr>
<th>CRITICAL STRESSES</th>
<th>LOAD COMB 1</th>
<th>LOAD COMB 2</th>
<th>LOAD COMB 3</th>
<th>LOAD COMB 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(NON-COMPONENT + COMPOSITE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NON-COMPONENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@Max Composite Moment:</td>
<td>-0.737 K /In ^2</td>
<td>-1.527 K /In ^2</td>
<td>32.853 K /In ^2</td>
<td>43.804 K /In ^2</td>
</tr>
<tr>
<td>Actual/Allowable Composite Top Flange Stresses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@Max Composite Moment:</td>
<td>4.454 K /In ^2</td>
<td>9.233 K /In ^2</td>
<td>33.000 K /In ^2</td>
<td>44.000 K /In ^2</td>
</tr>
<tr>
<td>Partial Composite Bottom Flange Stresses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@Max Composite Moment:</td>
<td>6.027 K /In ^2</td>
<td>12.492 K /In ^2</td>
<td>33.000 K /In ^2</td>
<td>44.000 K /In ^2</td>
</tr>
<tr>
<td>Actual/Allowable Composite Shear Stresses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Design of W10x12

Main Span

Actual/Allowable Composite Top Flange Stresses

@Max Composite Moment: $-0.737 \text{ K /In}^2$, $-1.527 \text{ K /In}^2$; $32.853 \text{ K /In}^2$, $43.804 \text{ K /In}^2$

Actual/Allowable Composite Bottom Flange Stresses

@Max Composite Moment: $4.454 \text{ K /In}^2$, $9.233 \text{ K /In}^2$; $33.000 \text{ K /In}^2$, $44.000 \text{ K /In}^2$

Partial Composite Bottom Flange Stresses

$6.027 \text{ K /In}^2$, $12.492 \text{ K /In}^2$; $33.000 \text{ K /In}^2$, $44.000 \text{ K /In}^2$

Actual/Allowable Composite Shear Stresses

tester2  7/2/2008
Actual/Allowable Composite Concrete Stresses

\( \begin{align*}
&2.666 \text{ K/In}^2, 6.225 \text{ K/In}^2 \\
&20.000 \text{ K/In}^2, 26.667 \text{ K/In}^2
\end{align*} \)

@Max Non-Comp Moment:

\( \begin{align*}
&-0.191 \text{ K/In}^2, -0.427 \text{ K/In}^2 \\
&2.250 \text{ K/In}^2, 3.000 \text{ K/In}^2
\end{align*} \)

@Max Composite Moment:

\( \begin{align*}
&-0.214 \text{ K/In}^2, -0.443 \text{ K/In}^2 \\
&2.250 \text{ K/In}^2, 3.000 \text{ K/In}^2
\end{align*} \)

### Critical Stresses Summary

**Main Span**

\[ W10x12 \]

<table>
<thead>
<tr>
<th>Loc: fv/Fv</th>
<th>Stress Ratio:</th>
<th>0.23</th>
<th>Load Comb: 2</th>
<th>Defl. Ratio: L/1449</th>
<th>Load Comb: 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>fb:</td>
<td>9.23 K/In^2</td>
<td>6.22 K/In^2</td>
<td>Weight:</td>
<td>0.55 K</td>
<td></td>
</tr>
<tr>
<td>Fb:</td>
<td>44.00 K/In^2</td>
<td>26.67 K/In^2</td>
<td>Defl: 0.000 In (NC)</td>
<td>-0.140 In (Short)</td>
<td>-0.166 In (Long 100.00% Sustained)</td>
</tr>
</tbody>
</table>

With 28 Per Cent Partial Composite Action:

\[ Seff = 66.903 \text{ In}^3 \quad Ieff = 661.171 \text{ In}^4 \quad 565.954 \text{ In}^4 \]

| 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

**Mid Span**

\[ Vh (Full Composite) = 201.00 \text{ K} \quad 55 \text{ Studs Reqd} \]

Between 0.000 Ft and 11.000 Ft, Spacing is 5.1 In (26)

Between 11.000 Ft and 12.000 Ft, Spacing is 5.5 In (3)

Between 12.000 Ft and 20.000 Ft, Spacing is 3.7 In (26)

\[ Vh' (Partial Composite) = 56.00 \text{ K} \quad 15 \text{ Studs Reqd (Increased to 30 Per Cent Due to Spacing Constraints)} \]

Between 0.000 Ft and 11.000 Ft, Spacing is 18.9 In (7)

Between 11.000 Ft and 12.000 Ft, Spacing is 20.6 In (1)

Between 12.000 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 Theoretically Required, Place Additional Studs at the Maximum Spacing Allowed

**Bottom Flange Cover Plate**

**Deflections**

**NON-COMPONET LOAD COMB 1 LOAD COMB 2 LOAD COMB 3 LOAD COMB 4**

Total Deflections Full Composite

Main Span (Short) :  
\(-0.062 \text{ In}, -0.140 \text{ In}\)

Main Span (Long) :  
\(-0.074 \text{ In}, -0.166 \text{ In}\)

Allowable :  
\(1.000 \text{ In}, 1.000 \text{ In}\)

Live Load Deflections Full Composite

Main Span (Short) :  
\(-0.041 \text{ In}, -0.118 \text{ In}\)

Main Span (Long) :  
\(-0.048 \text{ In}, -0.140 \text{ In}\)

Allowable :  
\(0.667 \text{ In}, 0.667 \text{ In}\)

Total Deflections Partial Composite

Main Span (Short) :  
\(-0.109 \text{ In}, -0.244 \text{ In}\)

Main Span (Long) :  
\(-0.127 \text{ In}, -0.285 \text{ In}\)

Allowable :  
\(1.000 \text{ In}, 1.000 \text{ In}\)

Live Load Deflections Partial Composite

Main Span (Short) :  
\(-0.071 \text{ In}, -0.206 \text{ In}\)

Main Span (Long) :  
\(-0.083 \text{ In}, -0.241 \text{ In}\)

Allowable :  
\(0.667 \text{ In}, 0.667 \text{ In}\)

**NOTE:** Deflections are calculated using constant value of I