Report

Rectangular HSS tension member

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| Prepared by: | Prepared for: |
| SDC Verifier |  |
|  |  |

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| --- | --- |
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| Customer: |  |
| Project Number: |  |
| Version: | 1 |
| Date: | 20 Jun 2014 |

# Preface

In this document we’ve compared results of calculation of tensile yielding and recommended slenderness limit according to SDC Verifier and Design Examples of AISC (official version 14.1). Our goal was a testing of SDC Verifier and reaching correct results according to Specification for Structural Steel Buildings (ANSI/AISC 360-10 chapter D).

This document is generated with SDC Verifier 3.6 and calculated with FEMAP v11.0.0

Model File: D:\Bezushko\Checks AISC 360-10\Example D.4.modfem

Report Profile: 1..Report Designer (Full) 1

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Femap and SDC Verifier models coincide. Checked information is presented below:

|  |  |  |
| --- | --- | --- |
| Entity | Femap Model Entities Count | SDC Verifier Model Entities Count |
| Elements | 11 | 11 |
| Elements | 10 | 10 |
| Materials | 1 | 1 |
| Property | 1 | 1 |

# Design Examples AISC, version 14.1





# Model Entities

This paragraph shows detailed or brief model overview.

## Materials

This paragraph contains materials information.

### Materials Summary

|  |  |  |  |
| --- | --- | --- | --- |
| Title | Element(s) | Mass | Gravity Center |
| 1..A500 Grade B | 10 | 631.84 | [180.00; 0.00; 0.00] |

### 1..A500 Grade B

|  |  |
| --- | --- |
| Property | Value |
| Elements | 10 |
| Mass | 631.84 |
| Gravity Center | [180.00; 0.00; 0.00] |
| X [Min;Max] | [0.00; 360.00] |
| Y [Min;Max] | [0.00; 0.00] |
| Z [Min;Max] | [0.00; 0.00] |

|  |  |  |
| --- | --- | --- |
|  | Property | Value |
| FEM Relevant | Young Modulus | 2.96e+07 |
|  | Shear Modulus | 0.00 |
|  | Poisson Ratio | 0.30 |
|  | Shear | 0.00 |
|  | Mass Density | 0.28 |
| SDC Verifier Relevant | Tensile Strength | 0.06e+6 |
|  | Yield Stress | 0.05e+6 |
|  | | | |

## Properties

This paragraph contains properties information.

### Properties Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Title | Element(s) | Material | Mass | Gravity Center |
| 1..HSS 6x4x3/8 | 10 | 1..A500 Grade B | 631.84 | [180.00; 0.00; 0.00] |

### 1..HSS 6x4x3/8

|  |  |
| --- | --- |
| Property | Value |
| Elements | 10 |
| Type | Beam |
| Material | 1..A500 Grade B |
| Mass | 631.84 |
| Gravity Center | [180.00; 0.00; 0.00] |
| X [Min;Max] | [0.00; 360.00] |
| Y [Min;Max] | [0.00; 0.00] |
| Z [Min;Max] | [0.00; 0.00] |
| Moment I1 or Izz | 28.30 |
| Moment I2 or Iyy | 14.90 |
| Moment I3 or Izy | 0.00 |
| Area A | 6.18 |
| Z Shear Area | 2.12 |
| Y Shear Area | 3.75 |
| Torsional Constant J | 33.20 |
| Nonstructural Mass Length | 0.00 |
| Warping Constant | 0.00 |
| Perimeter | 20.00 |
| Y Neutral Axis Offset | 0.00 |
| Z Neutral Axis Offset | 0.00 |

|  |  |
| --- | --- |
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|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Geometry Property | Value | Points Of Interest | Value |
| Height | 4.00 | Point 1 | [-3.00 ; -2.00] |
| Width | 6.00 | Point 2 | [3.00 ; -2.00] |
| h | 4.00 | Point 3 | [3.00 ; 2.00] |
| b | 6.00 | Point 4 | [-3.00 ; 2.00] |
| d | 0.35 |  |  |
|  | | | | |

**Example from AISC Design Examples**

## 



**Note**: *HSS-beam was created in Femap (built-up section) with moment of inertia Iyy =15.3 in^4 (fillets of rolled section weren’t taken into account), but in SDC Verifier moment of inertia was changed to Iyy = 14.4 in^4 according to the input data of the example.*

## FEM Loads

This paragraph contains information about applied loads to model.

### 1..Dead load 35 kips

|  |  |  |  |
| --- | --- | --- | --- |
| Definition Title | Load Type | Applied on | Value(s) |
| 1..Force on Node | Force | Node: 11 | (35000;0;0) |

### 2..Live load 105 kips

|  |  |  |  |
| --- | --- | --- | --- |
| Definition Title | Load Type | Applied on | Value(s) |
| 1..Force on Node | Force | Node: 11 | (105000;0;0) |

## Constraints

This paragraph contains information about constrainted parts of the model.

### 1..Constraint

|  |  |  |
| --- | --- | --- |
| Definition | Count | Type (DOF) |
| 1..Fixed | 1 node(s) | Tx Ty Tz Rx Ry Rz |
| 2..Pinned | 1 node(s) | Ty Tz Rx Ry Rz |
|  | | | |

# Standards

This paragraph shows detailed information about applied standards.

## 1..ANSI / AISC LRFD 360-10

### Checks

This paragraph contains checks descriptions with their results.

#### 1..Beam Characteristics

|  |  |
| --- | --- |
| Property | Value |
| Category | Elemental Custom Check |
| Selection | 18 PropertyShape(s) |
| Parameters | 6 |
| Alias (Parameter) | Rg\_y (Radius of Gyration Y) |
| All | sqrt(Izz / Area) |
| Alias (Parameter) | Rg\_z (Radius of Gyration Z) |
| All | sqrt(Iyy / Area) |
| Alias (Parameter) | Slenderness\_Y (Slenderness Ratio Y) |
| All | (Ky \* Ly) / Rg\_y |
| Alias (Parameter) | Slenderness\_Z (Slenderness Ratio Z) |
| All | (Kz \* Lz) / Rg\_z |
| Alias (Parameter) | Fe\_y (Elastic Buckling Stress Y) |
| Description | Formula (E3-4) |
| All | pow(PI, 2) \* Young / pow(Slenderness\_Y, 2) |
| Alias (Parameter) | Fe\_z (Elastic Buckling Stress Z) |
| Description | Formula (E3-4) |
| All | pow(PI, 2) \* Young / pow(Slenderness\_Z, 2) |

All (LS1, All Entities)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Check | 1..Beam Characteristics | | | Load Set | | 1..Load Set 1 | | |
| Direction | All | | | Selection | | All Entities | | |
| Extreme | Radius of Gyration Y | Radius of Gyration Z | Slenderness Ratio Y | | Slenderness Ratio Z | | Elastic Buckling Stress Y | Elastic Buckling Stress Z | |
| Minimum |  |  |  | |  | |  |  | |
| Value | 2.14 | 1.55 | 168.23 | | 231.85 | | 0.01e+6 | 0.01e+6 | |
| Element ID | 1 | 1 | 1 | | 1 | | 1 | 1 | |
| Maximum |  |  |  | |  | |  |  | |
| Value | 2.14 | 1.55 | 168.23 | | 231.85 | | 0.01e+6 | 0.01e+6 | |
| Element ID | 1 | 1 | 1 | | 1 | | 1 | 1 | |
| Absolute Maximum |  |  |  | |  | |  |  | |
| Value | 2.14 | 1.55 | 168.23 | | 231.85 | | 0.01e+6 | 0.01e+6 | |
| Element ID | 1 | 1 | 1 | | 1 | | 1 | 1 | |



#### 2..Axial

All (LS1, All Entities)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Check | 8..Axial | | | Load Set | | | 1..Load Set 1 | | |
| Direction | All | | | Selection | | | All Entities | | |
| Extreme | Net Reduction Factor | Critical Stress Y | Critical Stress Z | | Nominal Compressive Strength | Design Tensile Strength | | Axial Force | Utilization Factor | |
| Minimum |  |  |  | |  |  | |  |  | |
| Value | 1.00 | 9052.8 | 4766.3 | | 25037.52 | 255852.00 | | 210000.00 | 0.82 | |
| Element ID | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | |
| Maximum |  |  |  | |  |  | |  |  | |
| Value | 1.00 | 9052.8 | 4766.3 | | 25037.52 | 255852.00 | | 210000.00 | 0.82 | |
| Element ID | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | |
| Absolute Maximum |  |  |  | |  |  | |  |  | |
| Value | 1.00 | 9052.8 | 4766.3 | | 25037.52 | 255852.00 | | 210000.00 | 0.82 | |
| Element ID | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | |

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# Conclusion

Comparing results of calculation in SDC Verifier and in Example D.4 we can see that values completely match.

Tensile yielding stress is 256 kips > required tensile stress is 210 kips.

Slenderness ratio Z is 232 < maximum slenderness limit for members in tension is 300 (AISC 360-10 chapter D.1).