Report

Example F.7

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| --- | --- |
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| Customer: |  |
| Project Number: |  |
| Version: | 1 |
| Date: | 15 Jan 2015 |

# Preface

In this document we’ve compared results of calculation of available flexural strength according to SDC Verifier internal check 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 F** - ASD-method).

This document is generated with SDC Verifier 3.7.1 and calculated with FEMAP v11.0.0

Model File: D:\Bezushko\Calculation in Excel\Example F.7\F.7.modfem

Project File: D:\Bezushko\Calculation in Excel\Example F.7\F.7.sdcv

Report Profile: 1..Example F.7

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Femap and SDC Verifier models coincide. Details below:

|  |  |  |
| --- | --- | --- |
| Entity | Femap Model Entities Count | SDC Verifier Model Entities Count |
| Nodes | 22 | 22 |
| Elements | 10 | 10 |
| Materials | 1 | 1 |
| Property | 1 | 1 |

# Design Examples, AISC (version 14.1)









**Units which were used in calculation:**

1 kip = 1000lb

1 ft = 12 in

1 ksi = 1000 psi (lb/in^2)

# Model Entities

This paragraph shows detailed or brief model overview.

## Materials

This paragraph contains materials information.

### 1..A500 Grade B

|  |  |
| --- | --- |
| Property | Value |
| Elements | 10 |
| Mass | 389.82 |
| Gravity Center | [126.00; 0.00; 0.00] |
| X [Min;Max] | [0.00; 252.00] |
| Y [Min;Max] | [0.00; 0.00] |
| Z [Min;Max] | [0.00; 0.00] |

|  |  |  |
| --- | --- | --- |
|  | Property | Value |
| FEM Relevant | Young Modulus | 2.90e+7 psi = 2.90e+4 ksi |
|  | Shear Modulus | 0.00 |
|  | Poisson Ratio | 0.30 |
|  | Shear | 0.00 |
|  | Mass Density | 0.28 |
| SDC Verifier Relevant | Tensile Strength | 58.00e+03 psi = 58ksi |
|  | Yield Stress | 46.00e+03 psi = 46ksi |
|  | | | |

## Properties

This paragraph contains properties information.

### 1..HSS 10x6x3/16

|  |  |
| --- | --- |
| Property | Value |
| Elements | 10 |
| Type | Beam |
| Material | 1..A500 Grade B |
| Mass | 389.82 |
| Gravity Center | [126.00; 0.00; 0.00] |
| X [Min;Max] | [0.00; 252.00] |
| Y [Min;Max] | [0.00; 0.00] |
| Z [Min;Max] | [0.00; 0.00] |
| Moment I1 or Izz | 34.77 |
| Moment I2 or Iyy | 76.48 |
| Moment I3 or Izy | 0.00 |
| Area | 5.45 |
| Y Shear Area | 3.21 |
| Z Shear Area | 1.58 |
| Torsion Constant | 73.69 |
| Nonstructural Mass | 0.00 |
| Warping Constant | 25.51 |
| Perimeter | 32.00 |
| Y Neutral Axis Offset | 0.00 |
| Z Neutral Axis Offset | 0.00 |

|  |  |
| --- | --- |
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|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Geometry Property | Value | Points Of Interest | Value |
| Height | 10.00 | Point 1 | [-3.00 ; -5.00] |
| Width | 6.00 | Point 2 | [3.00 ; -5.00] |
| h | 10.00 | Point 3 | [3.00 ; 5.00] |
| b | 6.00 | Point 4 | [-3.00 ; 5.00] |
| d | 0.174 |  |  |
|  | | | | |

## FEM Loads

This paragraph contains information about applied loads to model.

### 1..Loads

|  |  |  |  |
| --- | --- | --- | --- |
| Definition | Load Type | Applied On | Values |
| 1..Dead load | Lineload | 10 element(s) | End I = -12.5 lb/in =  -0.15 kip/ft |
|  |  |  | End J = -12.5 |
| 2..Live load | Lineload | 10 element(s) | End I = -33.33 lb/ft =  -0.4 kip/ft |
|  |  |  | End J = -33.33 |

|  |
| --- |
|  |

## Constraints

This paragraph contains information about constrained parts of the model.

### 1..Constraint

|  |  |  |
| --- | --- | --- |
| Definition | Count | DOF |
| 1..Left | 1 node(s) | Tx Ty Tz Rx |
| 2..Right | 1 node(s) | Ty Tz Ry |
|  | | | |

# Jobs

This paragraph consists of a list of existing jobs, related to them loads and result tables and plots.

## 1..Test example F.7

### Individual Load '1..Loads.Constraint'

Loads; Constraint

|  |
| --- |
|  |

|  |  |
| --- | --- |
| Title | Value |
| Individual Load | 1..Loads.Constraint |
| FemLoad | 1..Loads |
| Constraint | 1..Constraint |
| Output Set | 2..Loads.Constraint |

1..Line Element Force (IL1, All Entities)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Individual Load | 1..Loads.Constraint | | | | Selection | | All Entities | | | |
| Type | Extreme | | | | Parameter | | Line Element Force | | | |
| Extreme | | Bending Plane Moment 1 | Bending Plane Moment 2 | Shear Plane 1 | | Shear Plane 2 | | Axial Force | Total Torque | Warping Torque | |
| Minimum | | 0.00e+3 | **-363.80e+3** | 0.00e+3 | | -5.77e+3 | | 0.00e+3 | 0.00e+3 | 0.00e+3 | |
| Maximum | | 0.00e+3 | 0.00e+3 | 0.00e+3 | | 5.77e+3 | | 0.00e+3 | 0.00e+3 | 0.00e+3 | |
| Absolute | | 0.00e+3 | **-363.80e+3** | 0.00e+3 | | 5.77e+3 | | 0.00e+3 | 0.00e+3 | 0.00e+3 | |



**Convert values:** 363.80e+03 lb-in = 30.31 kip-ft

# Standards

This paragraph shows detailed information about applied standards.



## 1..ANSI / AISC 360-10

### Checks

This paragraph contains checks descriptions with their results.

#### 1..HSS (square and rectangular)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Check | 3..Rectangular Tube | | | Individual Load | 1..Loads.Constraint | | |
| Direction | All | | | Selection | 3 Shapes | | |
| Extreme | Zx | Sx | Mp X | | | Mn Minor | Mn Major | |
| Minimum |  |  |  | | |  |  | |
| Value | **18.36** | **15.30** | **844.71e+3** | | | 594.16e+3 | **777.51e+3** | |
| Element ID | 11 | 11 | 11 | | | 11 | 11 | |
| Maximum |  |  |  | | |  |  | |
| Value | **18.36** | **15.30** | **844.71e+3** | | | 594.16e+3 | **777.51e+3** | |
| Element ID | 11 | 11 | 11 | | | 11 | 11 | |
| Absolute |  |  |  | | |  |  | |
| Value | **18.36** | **15.30** | **844.71e+3** | | | 594.16e+3 | **777.51e+3** | |
| Element ID | 11 | 11 | 11 | | | 11 | 11 | |

 

#### 2..Bending

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Check | 14..Bending | | | Individual Load | | 1..Loads.Constraint | | |
| Direction | All | | | Selection | | 17 Shapes | | |
| Extreme | Mn Major | Mn Minor | Bending Major | | Bending Minor | | Uf Major | Uf Minor | |
| Minimum |  |  |  | |  | |  |  | |
| Value | **777.51e+3** | 594.16e+3 | **-363.80e+3** | | 0.00e+3 | | 0.28 | 0.00 | |
| Element ID | 11 | 11 | 15 | | 11 | | 20 | 11 | |
| Maximum |  |  |  | |  | |  |  | |
| Value | **777.51e+3** | 594.16e+3 | -130.97e+3 | | 0.00e+3 | | **0.78** | 0.00 | |
| Element ID | 11 | 11 | 20 | | 11 | | 15 | 11 | |
| Absolute |  |  |  | |  | |  |  | |
| Value | **777.51e+3** | 594.16e+3 | **-363.80e+3** | | 0.00e+3 | | **0.78** | 0.00 | |
| Element ID | 11 | 11 | 15 | | 11 | | 15 | 11 | |



**Utilization factor**

777.51 kip-in = 64.79 kip-ft;

363.8 kip-in = 30.31 kip-ft;

64.79 kip-ft/1.67 =38.79 kip-ft

30.31/38.79 = **0.78**

# Conclusion

Comparing results of calculation with SDC Verifier and Example F.7 can be seen that values coincide. Slight difference is explained by converting units from one to another and using conservative shape of the beam in Femap.

The required flexural strength is 30.31 kip-ft.

The available flexural strength is 38.79 kip-ft.