Introduction to CSiBridge

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Outline

Official tutorials
Installation
Example

Official tutorials

- CSi Knowledge base: https://wiki.csiamerica.com/display/csibridge/Home
- CSiBridge Tutorials: https://wiki.csiamerica.com/display/tutorials/CSiBridge
https://www.csiamerica.com/products/csibridge/watch-and-learn
- Manuals:
  ...\Computers and Structures\CSiBridge 2017\Manuals\...
- Resources
  ...
Official tutorials - CSiBridge Tutorials

Installation and licenses

Follow the instructions to install the software (email from Dr. Ye)

When using the software:
• Connect to the Internet
• No more than 10 users at the same time
Example

- Concrete deck on 5 steel girders composite bridge
- Girder spacing = 6 ft and edge distances = 3 ft

- Concrete Floor:
  - Density 2400 kg/m³ (150 lb/ft³),
  - Modulus of Elasticity=2.4x10¹⁰ N/m² (3480 ksi).
  - Width= 30 ft, Depth=8 in, Length=60 ft, Poison Ratio=0.2.
- Steel Girders:
  - W21X166
  - Modulus of Elasticity 200x10⁹ N/m² (29,000 ksi),
  - Poison Ratio=0.3,
  - Density=7850 kg/m³(490 lb/ft³).

Example – Demo (Screen Recording)

Example – New case

Create a new blank case

Example – Layout

Units

Layout line should equal or longer than your bridge length
Example – 3D Shell-Beam elements

Bridge Deck (Shell Element)
Rigid Link
Girder (Beam Element)
Support (Zero Displacement Element)

Example – 3D mixed elements

Deck Slab (Shell Element)
Flange (Beam Element)
Rigid Beam Element
Web (Shell Element)

Example – 3D Shell elements

Deck (Shell Element with Stressed Layer of reinforcement)
Flange (Beam Element)
Web (Beam Element)

Example – Boundary Conditions
Example – Analysis options

The fundamental frequency should be vertical bending.

Example – Run analysis

Example – Frequencies verification

Example – Frequencies verification

Spine Model / Beam element

Area Model / Shell-Frame elements
Example – Frequencies verification

Area Model / Shell-Mixed elements

Example – Frequencies verification

Area Model / Shell-Shell elements

Example – Hand calculations

<table>
<thead>
<tr>
<th>Section</th>
<th>A</th>
<th>d</th>
<th>Ad</th>
<th>dF</th>
<th>I0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slab</td>
<td>69.15</td>
<td>26.52</td>
<td>1833.45</td>
<td>6.30</td>
<td>2742.03</td>
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<tr>
<td>Haunch</td>
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<td>21.59</td>
<td>0.52</td>
<td>2.87</td>
<td>0.81</td>
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<tr>
<td>Web</td>
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<td>21.52</td>
<td>377.47</td>
<td>1.02</td>
<td>42.29</td>
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<tr>
<td>Top</td>
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<td>23.19</td>
<td>0.52</td>
<td>2.97</td>
<td>0.19</td>
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<tr>
<td>Flange</td>
<td>16.86</td>
<td>11.68</td>
<td>1833.45</td>
<td>1.60</td>
<td>43.29</td>
</tr>
</tbody>
</table>

\[ I_x = I_{0} + A_d d^2 = 11260.40 \text{ in}^4 \]

\[ S_{topc} = 967.10 \text{ in}^3 \]

\[ S_{bot} = 557.61 \text{ in}^3 \]

\[ S_{top} = 4939.81 \text{ in}^3 \]

\[ Q_{slab} = 433.36 \text{ in}^3 \]

Material Density Area Unit weight (lb/ft)

<table>
<thead>
<tr>
<th>Material</th>
<th>Density (lb/ft³)</th>
<th>Area (ft²)</th>
<th>Weight (lb)</th>
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<tbody>
<tr>
<td>Concrete</td>
<td>150</td>
<td>20</td>
<td>3000</td>
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<tr>
<td>Steel</td>
<td>490</td>
<td>1.6945</td>
<td>830.305</td>
</tr>
</tbody>
</table>

\[ W = (3000 + 830.305)/12 = 319.192 \text{ lb/in} \]

\[ \Delta = 0.18 \text{ in} \]

\[ f_1 = \frac{\pi \sqrt{EI}}{2 \sqrt{W/L}} = 4.28 \text{ Hz} \]