Minnesota Bridge Software Usage for Programming, Design, Inspection, and Maintenance

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Design

1. Design Automation
2. Steel Rating Study
Design Automation

Bridge Design Automation Committee
BDAC - Purpose

- To promote consistent design practice through the development and validation of design tools.
**BDAC - Membership**

- All design engineers are welcome to participate in committee activities.
- Four to five person “core group” responsible for updating procedure documents and delegating tasks as needed.
BDAC - Services

- Design Sheets
  - Internally developed (MathCAD, Excel, etc.)
  - Determine internal needs
  - QA/QC process for approval
  - Review for specification updates
  - File maintenance, revision logs, and archiving
  - Training
BDAC - Services

- Software Validation
  - Commercial products
  - Documentation of validation process using published examples
  - Internal issues log
  - Internal guidance sheets
B DAC - Services

- File structure
  - Active projects
  - Post-construction
- Digital reference library
- Internal design examples
• TIME!
  – Internal design sheets updated
  – Validating software with new version release
  – Allocating time for designers to develop/maintain
  – Trying to schedule with normal production

• Documentation of modifications to “approved” design sheets
Steel Rating Study

An internal software validation for analysis and rating of steel bridge structures.
SRS - Purpose

- MnDOT LRFD BDM 4.6.2: Repair Projects
- Load Rating completed using LRFR procedures at scoping level AND when project includes:
  - Deck replacements
  - Widenings
  - Superstructure Replacements
  - Significant increases to dead load
    - i.e. deck thickness increases or barrier modifications
SRS - Purpose

List generated from Bridge Data Management Inventory output & plan review

\[ I_S = \frac{w_g \tan \theta}{L_S} \]

\[ I_C = \frac{15000}{R(n_f + 1)m} \]
### SRS - Purpose

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<th>Rehabilitation</th>
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- Project Schedule (FY2016 – FY2018)
- Most rated using line girder analysis
**SRS - Skewed**

\[ I_S = \frac{w_g \tan \theta}{L_s} \]

**NCHRP 725: Guidelines for Analysis Methods and Construction Engineering of Curved and Skewed Steel Girder Bridges Test Bridge ElCSS12**
SRS - Curved

\[ I_c = \frac{15000}{R(n_f + 1)m} \]

FHWA Steel Design Handbook: Design Example 3” Three-Span Continuous Horizontally Curved Composite Steel-I-Girder Bridge
NHI Course No. 130095: Analysis and Design of Skewed and Curved Steel Bridges with LRFD - Chapter 5 Design Example

Figure 5.1.1 Plan View of the Example I-Girder Bridge
SRS - Current & Upcoming Tasks

• Comparison of section properties, dead and live load forces, deflections
  1. Skewed
  2. Curved
  3. C&S

• Diaphragm forces

• Modelling time
? QUESTIONS ?

**BDAC**

- Purpose
- Membership
- Services
  - Design Sheets
  - Software Validation
  - Misc.
- Challenges

**SRS**

- Purpose
- Examples
- Tasks