Closing the Gap between Bridge Analysis and Detailing

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Summary

The overall process for bridge construction comprises such different tasks as general layout and tender specification, preliminary design, detailed design, proof checks and finally actual construction works. These tasks are typically performed by different parties, where the subsequently involved engineers base their work on the published documents (specifications, drawings) of the previous party.

Detailed design is an important step in this process, however, it resolves into two different topics:

a) Analysis and proof checks ensuring stability and serviceability of the structure during construction and over its lifetime, and
b) Reinforcement detailing and production of respective construction drawings.

Many software products have been developed in the past decades to support these tasks. However, although these tasks are linked together we have mostly two separate software tools, an analysis package and a CAD package for reinforcement detailing and drawing production. This means that the engineer has to assess the analysis results, defining the detailing requirements based on these results, and re-entering a lot of data in the CAD system to create the required drawings.

An initiative to close this gap has recently been started as a joint venture between Tennessee DOT and Bentley Systems. It aims especially at precast girder bridges and intends to allow for a straightforward progress from analysis to detailing and drawing production with using the same database. The paper explains the basics the software solution, describes the dataflow and outlines the applied procedure.

Keywords: detailed design, structural analysis, reinforcement detailing, data sharing, drawing production

1. Needs for an Integrated Solution

The bridge engineering and design process is a fragmented operation where data is repeatedly re-entered between each step in the process. Preliminary design information is re-entered into detail design software. Detailed design data is re-entered into estimating and fabrication systems. Beyond the design process, data for the same bridge may have to be re-entered into a bridge management system or a load rating system, and the list goes on.

Additionally, if a change occurs at any point in the existing process there can be a ripple effect in all processes downstream from where the change occurred. Appropriate software solutions exist for any of the individual steps in the process. The focus now is to achieve even greater levels of productivity by adjusting the paradigm of bridge design and management of the bridge asset over the entire life cycle. The labour and cost savings can easily be extrapolated from the NIST study [1]. This study performed by the National Institute of Standards and Technology on cost analysis of inadequate interoperability in the U.S. capital services industry illustrates dollars wasted due to lack of interoperability of systems utilized in the engineering lifecycle.