Putting Research Into Practice: New Tool Estimates Bridge Construction Time

What Was the Need?
Planning complex projects like bridges requires careful assessment of construction activities, including staging, material needs, traffic control and budgets. Due to project complexity, project size, construction time and cost, engineers plan bridge building years in advance.

Accurately estimating construction time for bridge projects can reduce cost overruns and efficiently manage traffic control needs and budgetary limits. These estimations are incorporated in construction contracts to guide contractors and minimize costs and inconvenience to the public.

Traffic and environmental requirements may suggest the need for accelerated construction, a method that uses preconstructed bridge components and special contracting and scheduling approaches to shorten bridge-building timelines. Accelerated construction can add up to 20% in costs to multimillion-dollar projects that already challenge agency resources, requiring even more advance time for budgeting and more accurate construction time estimations.

Ideally, project engineers can draw upon data and experience to determine how much time will be required to build a structure. But as MnDOT engineers, program staff and project managers retire, the workforce must draw on new tools for determining construction schedules and estimating timetables for bridge building.

What Was Our Goal?
MnDOT sought to develop a spreadsheet tool to use for estimating bridge construction time when developing contracts. Project engineers could use the tool to explore construction time and to estimate contract scheduling needs based on design information and data from previous bridge projects.

What Did We Implement?
Investigators created a database of bridge construction information based on previous bridge projects in Minnesota. These bridges varied in location, size and complexity. The project team then developed the estimating tool that allows users to enter design elements, bridge type, work schedule considerations and other factors to estimate construction time based on similar bridges in the tool’s expandable database.

How Did We Do It?
The project began with a review of the literature on bridge contract time estimation, focusing on Federal Highway Administration recommendations and the practices of 12 states. Investigators then surveyed 15 state transportation agencies to determine the state of the practice. Follow-up interviews with five agencies provided more information about the tools used for contract time estimation.

Investigators also interviewed MnDOT project engineers about bridge construction and contract time estimation experiences, and gathered data to evaluate design character-
The project team then selected 60 bridges that were built in Minnesota in the last 10 years. These bridges represented various types and span numbers, most with one or two spans covering distances up to 100 feet. Data from these bridges was used to develop a database for estimating bridge construction time.

Drawing on information from the 60-bridge database, the research team created a bridge construction time estimating tool based on bridge design features and characteristics. To supplement the information provided in the tool, the project team also developed a guidebook and instructional videos for users.

Accurately estimating bridge construction timelines reduces overruns and traffic closures.

What Was the Result?

Review of the practice throughout the country determined that existing tools for estimating bridge construction time are limited. The tool developed in this project allows users to input details about the bridge they are designing and planning to generate construction time estimates. If necessary, users may select one of the comparable bridges to use for starting inputs and then change inputs such as the number of spans (up to five) or extended workweek schedules to generate alternative estimations.

Users can also add data about similar bridges to the database. As more information is entered into the database over time, the tool is expected to become more robust and accurate in estimating construction time expectations.

What’s Next?

To attain 95% confidence in schedule estimations, specific bridges require data on 27 comparable structures in the database. The current database of 60 bridges is not sufficient to yield 27 comparable structures to most users once design characteristics have been selected. The database also does not feature comparable large structures for environments such as river crossings.

As MnDOT project engineers continue to use the spreadsheet and add to the database of constructed bridges, the tool is expected to become increasingly accurate and valuable to project managers and planners. Future modifications to the tool could include adding a cost estimation dimension to assist planners in projecting costs and evaluating accelerated construction and innovative contracting options for bridges.