Estimating Total Cost of Bridge Construction Using Accelerated Bridge Construction (ABC) and Conventional Methods of Construction

Mohammed Hadi, Ph.D., P.E.; Wallied Orabi, Ph.D.; Yan Xiao, Ph.D., P.E.; Jianmin Jia
Florida International University, Miami, Florida

ABSTRACT

Accelerated Bridge Construction (ABC) methods have been successfully used by many state Department of Transportations for both planned and emergency bridge projects. However, the total cost of ABC projects are not completely identified or included in the decision making process for such projects. To help fill this gap, a framework was developed in this project to estimate the total cost of bridge construction from already built ABC projects to support the use of ABC strategies for future projects. As an important component of the framework, a two-tier model was proposed for ABC construction cost analysis. At the higher level, a regression model was developed to estimate the range of construction costs per square foot using bridge characteristics such as construction location, type, number of spans, and AADT; while at the lower level, the key cost items for three ABC methods (SPMT, Lateral Slide, and prefabricated method) were identified and is used as historical references for construction cost estimating for future construction projects.

In addition to construction costs, road user costs are also considered in the developed framework and modeled using a multi-resolution approach. Depending on the level of details available at the current stage of bridge construction, the impacts of bridge construction on traffic mobility and reliability can be estimated utilizing different analysis methods and tools; for example, sketch planning level tools, highway capacity manual (HCM) procedures, simulation-based dynamic traffic assignment tool, and microscopic simulation modeling. The impacts of route diversion on construction zone mobility were also examined through three types of traffic diversion: 1) diversion during a short-term construction utilizing a logit model developed in a previous study; 2) diversion during a long-term construction where the network reaches user equilibrium (modeled using dynamic user equilibrium; 3) diversion through a day-to-day learning assignment in Dynamic Traffic Assignment (DTA) modeling that accounts for the number of days that the construction zone is active (modeled using day-to-day learning assignment). The procedures to estimate additional road user costs such as emissions, vehicle operating cost, and safety were also identified and included in the analysis.

Case studies were conducted for bridge construction projects in Florida. The construction costs and user costs of using ABC were compared to those of convention methods. The results demonstrate the benefits of using total costs that incorporates both construction and user cost in the decision making process.