Joint Transportation Research Program

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Capital Program Cost Optimization through Contract Aggregation Process

Introduction

An earlier study (SPR-3702) indicated that INDOT's practice of grouping (or bundling) projects into multiple-project contracts (MPCs) usually resulted in lower unit costs. Because the practice had not yet become common within INDOT, the data on such contracts were limited. Nevertheless, it was possible to confirm that economies of scale exist—that is, unit costs decline as project size increases. However, the declining trend in unit costs appeared to level off when bridge projects reached 20,000 square feet of deck area and road projects exceeded 10–20 lane miles. Other possible influences on unit costs (e.g., number of bidders and time of year for bid letting) were examined, without conclusive results. Because of limited data, only a few work types within the bridge and road work categories yielded statistically significant results in the earlier study. This follow-up study (SPR-4156) takes advantage of INDOT's increased use of project bundling and the data that have been assembled since the conduction of SPR-3702.

Findings

1. *Economies of scale.* Economies of scale—the decline in unit cost as the project size increases—have been documented for all project types analyzed in this study. This is true for both single-project contracts and multiple-project contracts.
2. *Economies of bundling.* Economies of bundling—the reduction in project cost as projects are bundled into a contract—have been found for all bridge work types, and most traffic, small structure and miscellaneous work types. For road work types, however, the reduction in project cost due to project bundling was only found for certain road project types. Having road work with one big project in a contract is more cost-effective than bundling several small projects into one contract.
3. *Economies of competition.* Increased market competition (more bidders) lowers costs for most bridge projects, but larger contracts can discourage all but the largest firms from bidding, which can lead to less competition and therefore higher unit costs. This was investigated and modeled using both deterministic and probabilistic methods. According to the probabilistic model, the average number of bidders tends to be the highest when the number of projects is 2 to 4.
4. *Project similarity (compatibility).* Using a measure of similarity between different project types based on their constituent pay items, it was verified that project types in the same work category have a better (smaller) similarity distance compared to those in different work categories. The "similarity distance" measure can help identify candidate projects for bundling.
5. *Maintenance of traffic (MOT).* MOT can be a major component of project cost. The study found that the MOT cost could be slightly reduced by bundling some bridge work types, while the MOT cost for other bridge project types might increase due to project bundling. The MOT cost for most road, traffic, and small structure work types was found to be generally reduced by project bundling. Of all work categories, road work was found to benefit the most from project bundling in terms of MOT cost savings.
6. *Past bundling strategy.* The most frequent combinations of work categories in the past bundled contracts include bridge with road work, traffic with road work, bridge with traffic and road work, and bridge with

small structures work. The most common combinations of different project types include Intersection Improvement with Traffic Signals, New Bridge with New Road Construction, Bridge Replacement with Bridge Deck Overlay, and New Bridge with Signing and New Road Construction.

7. *Future bundling strategies.* Use the "similarity distance" measure to identify projects suitable for combining into multiple-project contracts (MPCs). Use patterns found in this study to guide the number of projects to combine into MPCs.

Implementation

The findings from this study are compatible with results of studies being done for INDOT by other researchers on related activities. The results of this study are based on the data available through INDOT's SPMS and other agency sources. The Business Owner and his staff are aware of the shortcomings of those data, but they are satisfied with the patterns that have been identified by this study. The study findings can be used as a guide to support project scheduling decisions. For example, a certain collection of individual projects may yield significant cost savings for INDOT, but the locations of the projects may create unacceptable disruption in traffic. As more projects are bundled, the related databases will continue to grow, as will evidence about which bundles saved money and which ones did not.

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