ABSTRACT

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Degree Received: August, 2019
Title: Bundling Effects on Contract Performance of Highway Projects: Quantitative Analysis and Optimization Framework
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The practice of project bundling, which involves combining multiple projects into a single multi-project contract, is in increased use at infrastructure agencies. Researchers have shown that this practice potentially reduces project cost but could cause undesirable consequences such as reduced market competition. For this reason, bundling policy needs to be guided by a determination of whether specific projects should be bundled, the bundling strategy in terms of bundle size, bundling combinations, geographical locations, and project scheduling, and the resulting outcome of each strategy in the terms of contract performance (overall cost and time duration, and cost and time overrun). Practitioners seeking answers to these questions continue to be stymied by the lack of quantified relationships between bundling alternatives and the resulting contract performance.

This dissertation addresses these questions by analyzing empirical data including the costs and durations of highway contracts and projects over a ten-year period. Using a variety of modeling approaches, the dissertation developed models to quantify the effects of bundling-related factors on the key contract performance measures (CPMs). The bundling related factors are contract size, bundle size, project combinations, project similarity and spatial proximity between bundled projects, and the CPMs are project cost and time performance, market competition, and the risks of cost overrun and project delay. Through the modeling process, the dissertation measured the effects of project similarity, economies of scale, economies of bundling, and economies of competition on bundling, and developed a novel technique to measure similarities between projects. Using the developed models, the dissertation then established an optimization framework to identify cost-effective bundling strategies. A greedy approach that minimizes the overall cost in a polynomial time was proposed to obtain heuristic solutions. The outcomes of this dissertation are twofold: first, it provides highway agencies with a quick, convenient and robust tool to design long-term cost-effective bundling strategies for any given pool of candidate projects; secondly, it provides guidelines and directions for future bundling policy formulation or evaluation.