Quantification of Design-Build Change Order Impacts

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In recent years, Design-Build (DB) has gained more popularity on infrastructure rehabilitation projects due to its defining advantage that is known to improve communication and to fast track the delivery of projects. However, very little is known about the impact of change order frequency and its occurrence timing that specifically pertain to DB projects. For the first time of its kind research, this study analyzes the impacts of change order occurrence frequency and timing on aspects of project performance in terms of schedule and cost. This study tests and validates the validity of the following research hypotheses that: 1) DB projects were more effective in shortening the durations of projects; 2) DB projects had better cost performance resulting in less total project cost; 3) DB projects had less frequency of change orders; and 4) The occurrence timing of DB change orders affects the level of project disruption on the contractors' schedule and cost performance. The study objectives are achieved by conducting a rigorous numerical analysis drawing on 530 3R (i.e., rehabilitation, reconstruction, and resurfacing) projects completed between 2002 and 2011 in Florida. A two-stage methodology is applied to 1) investigating the impact of change order frequency and timing by employing statistical analyses and 2) quantitatively modeling its impact on the project time and cost performance by employing a regression analysis. The proposed regression models are unique as they study the impact of change orders and theirs timing impact on project schedule and cost from a quantitative perspective using a large quantity of real-world transportation project data, thus providing numeric measurements of such potential impacts to future projects. The results of this study reveal that DB projects demonstrate the power of fast-track construction operated and managed by a single entity; many of these DB projects outperformed conventional design-bid-build projects. The regression analysis also clearly indicates that DB projects had lower frequency of change orders, resulting in less unfavorable impacts on schedule delays and cost overruns. However, occurrence timing of change orders did not have significant impact on the project performance. The results of this study can assist state transportation agencies to make better-informed decisions and consequently help them better respond to changes on project schedule and cost when change orders are occurred in a design-build project delivery setting. Critically, the proposed analyses and models will lead to the improved ability of agency engineers to quickly and more reliably estimate the potential schedule and cost impacts of change orders by having advanced knowledge about their consequences that are analyzed through the proposed regression models.

Key Words: Design-Build, Change Order, Frequency, Occurrence Timing, Infrastructure