Modeling Spatial Heterogeneity to Establish Local Construction Cost Models for Highway Projects

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Transportation agencies experience significant cost variation because of variability in construction market and economic conditions. Variability in construction market and economic conditions impose significant uncertainty in developing construction costs. In addition, spatial variability of construction market and economic conditions increases the degree of uncertainty for highway construction projects. The high degree of uncertainty leads to significant variations in highway construction costs. Thus, the main objective of this study was to explain variations in the submitted unit price bids for asphalt line items used in highway construction projects by incorporating external factors, construction market- and economic condition-related factors. To achieve this main objective, the sub-objectives of this research were to: 1) identify potential factors that affect the submitted unit price bids; and 2) develop explanatory models for describing variations in the submitted unit price bids considering the spatial correlation.

It is shown that there is a significant spatial correlation between construction project cost and geographical location of the project that a generalized linear modeling (GLM) approach may overlook. Thus, this study utilizes geographically weighted regression (GWR) analysis to develop explanatory models for describing variations in the submitted unit price bids considering the spatial correlation. Key factors including quantity of bid items, total contract price, number of bides, total dollar value of projects, and asphalt cement price index were selected for conducting regression analysis. The results indicated that significant spatial variation shows as far as the relationship between submitted unit price bid and the identified explanatory variables. The use of GWR analysis can provide greater capability in describing the variation in submitted unit price bids. Moreover, the proposed approach provides insight on exploring the geographical variation in a graphical manner. The finding of this study help transportation agencies develop more accurate construction costs with consideration of geographical locations of the projects.

Keywords: Spatial Heterogeneity, Construction Cost, Uncertainty, Highway Construction