Spatiotemporal Visualization of Major Cost Items in Highway Construction in Iowa

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Spatiotemporal Visualization of a Major Cost Item in Iowa DOT Bids
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Abstract

Design, bid, build is the most popular type of construction procurement in heavy civil construction in the U.S. As a result, state DOTs have a large amount of historical bid data that can be used for cost estimation of future construction projects. However, the state DOTs generally use the statewide average unit costs of bid items from several years. This essentially neglects the spatiotemporal variation of the unit prices and hence the estimates based on that is usually unreliable and far off from actual low bid. The inaccurate cost estimates can result in loss of the available budget (when estimates are high) or deferral and delay of projects (when estimates are low). Thus, spatiotemporal variations should be considered during project cost estimates. In this study, major cost items were identified in terms of the total cost and frequency. For this study, only one major pay item Asphalt Binder PG 58-28 was used. The data from year 2005, 2006, and 2007 for the item were plotted in Iowa map and heat map was developed using Inverse Distance Weighted (IDW) tool. The study identified that some locations consistently had higher unit costs for that item while it varied in other locations. Also, based on the interpolated data, it can be seen that the unit costs have varied even across single county for a given year. As such, it can be concluded that the current practice of using the statewide average is not a reliable method for cost estimation.

Objectives

- To identify the spatiotemporal variation of the unit costs of one of the major cost items (Asphalt Binder PG 58-28) in the Iowa DOT bids
- Developing a framework for more accurate cost estimation system
- Developing a framework visual monitoring of cost trends across the state over time

Methodology

1. Obtain Bid Data from Iowa DOT.
2. Categorize the data year wise.
3. Calculate frequency of occurrence of each bid item.
4. Map identified items in ArcGIS and generate heat map.
5. Discard the data.
6. Top item with respect to frequency of occurrence.
7. Top item with respect to cost of the item.
8. Identify repetitive top items from the top item lists.
9. Identify the trend.

Results

- Unit price (most popular)
- Spatially referenced unit price data
- Possibility of spatial data analysis
- Geographic Information System (GIS) as an emerging technology
- Ability to handle complicated data structures and provide comprehensive information (Clementini and Felice, 1994)

Further Research

- Automate the batch heat map generation
- Generate HCCI that takes account of spatial variation
- Generate the cost zones based on the HCCI heat map

Recommendations

- Identify the causes of the high costs in those area
- Take steps towards making bid more competitive in areas with higher cost
- Monitor the trend over time and identify the pattern

Conclusions

- High fluctuation of unit costs across the state and even counties
- Consistently high unit costs in some areas over time
- Current methodology used by state DOTs are unreliable

Reference