Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Improving Cost Estimation and Budget Planning with New Michigan Highway Construction Cost Index

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New cost index enhances construction estimates and budgeting

Sound budget planning for transportation projects depends on accurate construction cost estimations. A range of factors impacts construction costs, including project characteristics, materials and labor markets, inflation, economic shifts, and unexpected events. The new Michigan Highway Construction Cost Index (MHCCI) incorporates project-level cost factors, broad economic factors and regional variations to track price trends over time and predict future construction costs. Transportation planners and taxpayers will benefit from the improved tool with more accurate cost estimations, decreased risk of cost overruns and more efficient allocation of funds.

PROBLEM

Transportation construction costs are impacted by an array of highly variable factors, from specific project elements to broader economic conditions. The number and type of construction items, geographic factors, inflation, supply chain disruptions, and national and global trends can all significantly affect construction costs.

MDOT's updated construction cost index will support accurate cost estimations, improved project budgeting and reduced risk of cost overruns.

In a previous research project, the Michigan Department of Transportation (MDOT) developed the MHCCI, which incorporates historical categorical, regional and statewide indices from 2010 to 2019. This MHCCI effectively tracks overall price changes across Michigan but does not capture price variations for specific construction projects or services. Using historical index data to forecast construction prices, however, doesn't account for current price fluctuations, materials and labor cost trends, or other dynamic market conditions.

A more detailed cost index was needed to better track price changes for individual contracts and specific services. Incorporating data reflecting regional, national or global economic factors that contribute to the

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"This project improves MDOT's capacity to more accurately predict highway construction cost indices, allowing us to consider economic data that supports realistic budgets and ensures our estimating goals and targets are achieved."

Kristi Kirkpatrick
Project Manager

fluctuating nature of construction pricing in MHCCI future value forecasts could help avoid inaccurate budgeting and cost overruns.

RESEARCH

To refine the existing MHCCI and its forecasts, researchers gathered data from past projects, including detailed bid information, contractor details and key pricing factors. To explore external factors impacting construction costs, they collected broader economic data, including economic indicators, such as the Consumer Price Index, crude oil prices and interest rates; construction spending and building permit information; labor market statistics, including average hourly earnings and unemployment rates; manufacturing profits and materials, such as iron ore and industrial gas; housing starts and real estate trends; and seasonal and temporal factors.

An extensive statistical analysis identified factors most likely to impact construction costs. Then item- and contract-level indices illustrated how costs fluctuate for specific contracts or services. Additional analyses and machine learning techniques helped researchers explore models to predict future cost index trends to further inform construction cost estimations.

The creation and comparison of regional profiles illustrated how cost indices vary across Michigan to enable tailored construction budgeting and cost planning. Regional profiles included local economic conditions and underlying contributing factors, such as transportation logistics, labor and materials costs, and market demand.

RESULTS

New item- and contract-level cost indices along with predictive models based on broad economic factors improved the original MHCCI, providing more accurate construction cost estimations. The new cost indices better accommodate the fluctuating costs of construction items and unique project characteristics, supporting more precise cost estimations and forecasts.

Integrating the index predictive models in construction cost estimations improves accuracy by considering indicators such as inflation and market trends for labor and materials, allowing MDOT to account for unexpected events, market shifts and future price changes.

Another significant improvement in project cost estimation accuracy resulted from the comparison of regional cost indices across Michigan. Several factors affect regional construction costs and cost indices, including:

- **Local economic conditions** (economic bases, such as major employers, income levels and costs of living).
- **Construction market dynamics** (labor markets, material availability and changing development patterns).
- **Regulatory and policy requirements** (local building codes, environmental or other requirements, and local government investment trends).
- **Competitive building environment** (levels of bidding competition and contractor availability).

An analysis of these factors indicated that urban areas such as the Metro Region have higher cost indices than rural areas such as the North Region. MDOT planners now understand regional differences and can monitor and adjust construction cost estimates accordingly.

IMPLEMENTATION

MDOT will pilot the tool on transportation construction projects costing more than $50 million. Lump sum items and unique item costs are not currently incorporated into the updated tool. Lump sum costs, where a specific project part is bid at one cost without specifying the materials, labor or processes, are typical in bridge projects. Further research exploring the inclusion of these costs would broaden the tool's applicability and benefits.

Research Administration

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The final report is available online at MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1743.

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