

Implementation Report FHWA/MT-23-001/9929-819

More Info:

The research is documented in Report FHWA/MT-23-001/9929-819

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ARTIFICIAL INTELLIGENCE (AI) BASED TOOL TO ESTIMATE CONTRACT TIME

https://www.mdt.mt.gov/research/projects/const/ai_based_contracting_tool.aspx

Introduction and Purpose

MDT is in the process of modernizing their contract time determination processes by developing user-friendly tools to facilitate the estimate process of project duration and contract time. As part of this modernization effort, a top-down project duration estimation tool was developed in this research project.

This tool is particularly useful when there is limited information available during the early preconstruction stages. This research project involved the development of an Artificial Intelligence (AI) based model that can predict the most probable duration of a construction project using an early cost estimate, major controlling work items, and their estimated quantities as input values. Additionally, a regression model with the same set of input variables was developed as a companion to the AI model. The models were trained and tested using the historical project data of more than 1,000 highway projects from 2008 to 2019.

In order to operationalize the models, a user-friendly Microsoft Excel tool named AI-PDET (Artificial Intelligence based Project Duration Estimation Model) was created. AI-PDET can be used throughout the preconstruction phases to quickly determine a reasonable project duration for proper project planning and delivery. Furthermore, it can serve as a reality check tool alongside bottom-up tools during the procurement stages.

The final report provides a chapter that explains how to update the AI-PDET when new project data is available. The coding was fully explained to make users understand how the code works and how to use it to take new data and update the database and key attributes of the prediction models. To simplify the process, the code generates model attributes in Microsoft Excel format. The updated AI-PDET would help users to predict project durations that are more relevant to recent projects.

Implementation Summary

MDT plans to work with relevant offices to let them start to use the AI-PDET as a tool for early project duration estimation and obtain their feedback for further enhancement in the future. Even though the AI-PDET is intended to be used in the early project development stages, MDT believes that it can also be used as a reality check tool at the end of the final design phase. MDT plans to work with contract time developers in the final design phase and have them use the AI-PDET tool and document the reliability of the tool and identify areas for further improvement.

Implementation Recommendations

RECOMMENDATION 1:

Use the AI-PDET as an early project duration estimation tool in the programming and the preliminary design stages. The level of accuracy of AI-PDET will be acceptable in these project delivery stages. However, when the project size gets larger with the estimated construction cost greater than \$8M, a caution must be exercised as the predicted project duration may not be reliable. It is because the majority of the historical projects cost less than \$8M and the models were trained with the available historical data set. The prediction accuracy of a project that is not common or rare in the training dataset tends to be unreliable.

MDT RESPONSE:

MDT agrees. AI-PDET will serve as an excellent tool to quickly estimate the project duration during the early preconstruction stages. MDT will work with relevant offices to let them start to use the AI-PDET. Since the accuracy of estimations may decrease as project size in dollar value increases primarily due to limited data points in the training dataset, a disclaimer may need to be provided within the tool.

RECOMMENDATION 2:

Use the AI-PDET tool as a back-check tool at the end of the final design stage to ensure that the contract time in working days estimated by the scheduler is within the reasonable range of similar historical projects.

MDT RESPONSE:

MDT agrees. We utilize some existing tools, and we may use this new tool and do some comparisons with the results from our existing tools and see how MDT can use the tool in the final design stage. We may also need to document what tools are used by designers in estimating the contract time of a project and track the performance of each tool's estimation accuracy by comparing the actual working days with the original estimate.

RECOMMENDATION 3:

Regularly update the AI-PDET over time with new project data to enable the models to learn from new projects, improve the prediction performance and make AI-PDET relevant to recent projects.

MDT RESPONSE:

MDT agrees that updating the tool with new datasets is crucial to ensure that AI-PDET remains up-to-date with current trends. The detailed updating process described in the final report will be helpful for this purpose.

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