Kansas Department of Transportation

TECHNICAL SUMMARY

Development of a Risk-Based Approach for KDOT Construction Inspection: Implementation Guidelines

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Dan Tran, Ph.D., P.E.
Mamdouh Mohamed, Ph.D.

The University of Kansas

Introduction

State departments of transportation (DOTs) routinely face the challenges of shrinking budgets and substantial reductions in the numbers and experience levels of inspectors. Many experienced construction inspection staff have left state DOTs, including the Kansas DOT (KDOT), while the number of projects and the levels of required inspections have increased. Consequently, DOTs often rely on costly strategies such as the utilization of contractor's quality control and outsourcing for third-party testing and inspection. K-TRAN: KU-19-3, Development of Risk-Based Approach for KDOT Construction Inspection: An Assessment, successfully identified and evaluated the level of risk of KDOT construction activities associated with section numbers from the KDOT Standard Specifications and the KDOT Construction Manual.

The overarching goal of this research project was to develop implementation guidelines to incorporate risk-based approaches into current KDOT construction inspection practices. An empirical dataset of 169 KDOT construction projects completed between 2017 and 2021 was used to analyze inspection risk activities and develop an inspection checklist. The inspection checklist includes 35 primary activities associated with six common construction operations from the KDOT quality assurance (QA) documents, including (1) earthwork and embankment; (2) subgrade, base, and shoulders; (3) Portland cement concrete pavement (PCCP) and hot-mix asphalt (HMA) pavement; (4) structures; (5) incidental construction; and (6) roadside improvement. Eighteen KDOT experts provided input to create heat maps of risk levels, inspection frequency, and required inspection staff associated with each inspection activity in the checklist. Results from this study will help KDOT managers effectively and efficiently allocate inspection resources for highway construction projects.

Project Description

The primary objective of this research was to develop implementation guidelines for KDOT risk-based construction inspection. The proposed guideline provides KDOT with inspection forms and checklists, including critical construction inspection items associated with risk impact, inspection priorities, inspection tasks, and appropriate inspector staffing. The inspection checklist is expected to help KDOT project and program managers effectively and efficiently allocate their limited resources while mitigating risk impact. The secondary objectives include the following: (1) Conduct a quantitative review of existing material QA practices via empirical data collection and analysis; (2) Identify and assess tasks of each risk-based inspection activity, including inspection stages (e.g., pre-construction, during construction, and post-construction) and levels of inspection (e.g., continuous, intermittent, or end product inspection); (3) Develop a risk-based inspection checklist for different construction processes and related material testing; (4) Create inspection staff guidance that allows KDOT project managers to estimate the project needs of inspection staff given project types and budget; and (5) Document the results of this research in a concise and comprehensive research report.

Project Results

The Building upon the previous K-TRAN: KU-19-3, Development of Risk-Based Approach for KDOT Construction Inspection: An Assessment, the main objective of this research was to develop implementation guidelines for KDOT risk-based construction inspection. The research approach included three phases: (1) empirical data collection on highway construction inspection staffing from the KDOT database and construction QA documents, (2) assessment and evaluation of KDOT inspection items/checklists, and (3) the development of final risk-based checklists and guidance that consider staff size, staff experience, frequency of inspection, and item risk level. A mix of qualitative and quantitative research approaches was applied during these phases. Due to the shortage of data regarding risk levels of various construction operations, the qualitative risk evaluation approach was used to screen and prioritize inspection items and develop inspection checklists. A total of 18 KDOT experts evaluated the 35 checklists in terms of risk level and priority for inspection, inspection frequency, number of inspectors, and inspector experience. Based on the data extracted from 169 KDOT highway construction projects between 2017 and 2021, the quantitative approach was used to evaluate inspection staffing needs. Both the qualitative and quantitative evaluations provided appropriate risk mitigation and staff allocation strategies for highway construction projects with minimal inspection risks.

Each checklist includes inspection tasks that cover core inspection items before, during, and after construction operations. Critical QA tests of each construction operation were also added from a previous research project (K-TRAN: KU-19-3) to consider field inspections and material testing of each construction operation. Priority for inspection, expressed as the risk level of each checklist, was evaluated based on input from the 18 KDOT experts. In addition, the evaluation process for each checklist included frequency of inspection, number of inspectors, and inspector experience. Furthermore, KDOT inspection staffing needs for four types of construction projects (grading and surfacing, sealing, surface recycling and overlay, and bridge repair) were determined using historical data from KDOT construction projects.

Project Information

For information on this report, please contact Dan Tran, Ph.D., P.E., University of Kansas, 1530 W 15th St, Lawrence, KS 66045; 785-864-6851; daniel.tran@ku.edu.

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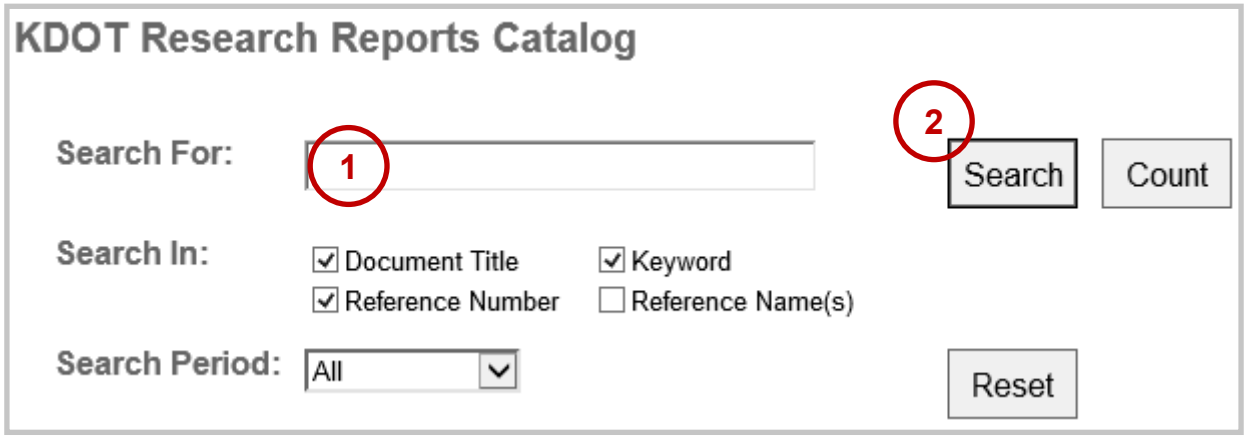

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