Abstract

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The time-to-event analysis is routinely utilized in pavement deterioration modeling to estimate time (or cumulative traffic loading) taken for discrete state transitions (e.g., from no cracks to cracks). Such models are typically estimated in the literature through survival analysis and classification techniques using data compiled from periodic inspections as a function of different covariates (e.g., traffic, pavement design, and environment variables). The estimated model helps capture the evolution of the pavement condition over a planning horizon when optimizing for maintenance, rehabilitation, and reconstruction decisions.

Prior studies on pavement management systems argue that survival analysis is better equipped to handle the sequential nature of outcomes and their censoring (whereby some sections do not fail by the end of the inspection period) when compared to discrete choice frameworks. However, some comparative studies in the statistics and biostatistics literature establish conditions under which the two methodologies can be observed to have similar likelihood functions and parameter estimates. Through this work, this equivalence in performance between a popular survival analysis technique (Cox proportional hazards model) and binary logit models is explored in the context of crack initiation modelling. Furthermore, possibilities of model mis specification errors in Cox and binary logit models are investigated using random forest- and gradient boosting-based feature engineering techniques in both classification and survival analyses. A comparative analysis of these methods is demonstrated using both simulated and empirical datasets.