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Abstract:

The conventional Federal Aviation Administration's (AC 150/5320-6D) thickness design methodology for rigid airfield pavements was based on "the plate theory". Recently, FAA has issued a new Advisory Circular which entirely utilized "the multi-layered linear elastic theory" for the design of both flexible and rigid airfield pavements to accommodate the new-coming Boeing 777 airplanes (AC 150/5320-16). Computerized design procedures are coded in the LEDFAA program. Nevertheless, the applicability of layered elastic theory in concrete pavement design has always been questioned and debated over the decades, which also warrants a need for further investigations.

The main objective of this study is to develop new thickness design procedures for rigid airfield pavements in attempts to accommodate the Boeing 777 airplanes based on the plate theory approach. The original concept of pass to coverages ratio is reevaluated. The prediction models developed by Lee, et al. (1997) are utilized for the estimation of critical edge stress. The problems and difficulties of the conventional method especially in the conversions of different aircraft types are identified. The concept of cumulative fatigue damage factor is used to account for the combined damages of different aircraft types and departures. Structure deterioration relationships are compared and tentative modification alternatives are investigated. Consequently, an equivalent stress factor is introduced and an alternative structural deterioration model is proposed. The proposed approach is implemented in a user-friendly computer program (TKUAPAV) for practical trial applications.

Keywords: Plate Theory, Multi-layered Linear Elastic Theory, Rigid Airfield Pavements, Thickness Design, Pass to Coverages Ratio, Prediction Models, Fatigue Damage