Florida Department of Transportation
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FLEXIBLE PAVEMENT PERFORMANCE PREDICTION MODEL ON THE BASIS OF PAVEMENT CONDITION DATA

PROBLEM STATEMENT

Maintenance and repair of the highway network system are major expenses in the state budget. Justification for pavement rehabilitation and distribution of funds to Districts is based on the rating scores of pavement condition. The Florida Department of Transportation (FDOT) State Materials Office annually conducts a Pavement Condition Survey (PCS) on the State Highway System. Pavement segments are rated in three categories: crack, ride, and rut. A scale of zero to ten is used for the rating. A rating of ten indicates an excellent pavement condition, while a rating of zero indicates a totally failed pavement.

The FDOT Pavement Resurfacing Program is intended to improve the structural integrity and extend the service life of the existing pavement on the State Highway System, including the Interstate and Turnpike. Pavement segments with a rating of six or below in any distressed category are classified as deficient. Rehabilitation is then to be scheduled to correct deficient segments. According to the Work Program instructions, Districts are to plan fully the first three years of the Tentative Work Program. Once the pavement segment is in the Work Program, it will normally take a minimum of three years before a pavement segment is to be rehabilitated.

Problems occur when the PCS identifies a pavement segment that rates 7 or higher in one year, then drops to 6 or below within the next three years. By the time the project is scheduled for resurfacing, three or more years following the PCS, the pavement may require reconstruction rather than resurfacing as a result of continuous deterioration without treatment. Consequently, maintenance costs will increase for a reconstruction project, and public activities will be affected by traffic delays created by reconstruction.

The initiation of surface distress such as cracking or raveling marks a significant stage in the deterioration of a pavement. The distress does not occur instantaneously over the entire length of the road under the same conditions. The rate of deterioration usually accelerates with an abrupt increase in traffic volume or extreme environmental changes. The timing for scheduling maintenance to control the deterioration is usually based on when the initiation of the distress is observed. Emergency maintenance expenditures for a suddenly deteriorated segment pavement become a hardship for the District.

OBJECTIVES

The objectives of this research are: (1) To determine at what PCS rating pavement segments should be identified for a more comprehensive pavement condition survey, (2) To determine what

parameters should be used to predict the rate of deterioration [i.e., from a subset of annual average daily traffic (AADT), percent of truck traffic, urban vs. rural, drainage, asphalt concrete thickness, mix design, etc.], and (3) To determine the projected rate of deterioration of these identified segments so that the Department can schedule for rehabilitation.

FINDINGS AND CONCLUSIONS

Crack ratings have been shown to be lower than ride or rutting ratings in any given year; therefore, the proposed models are just for predicting future crack ratings. Data for the period from 1992 to 1996 were employed to predict 1997, 1998, and 1999 crack ratings. Predicted ratings were then compared with actual ratings. Eighty-five percent of the predictions were within .4 of the actual ratings one-year ahead, 80% within .6 two years ahead, and 80% within .8 three years ahead.

Two issues were raised with respect to the proposed models, both of which may be treated as cautionary. First, models of this sort performed poorly when attempting to predict outlier points, such as when, for example, a leanly traveled segment of historically stable ratings drop from 10.0 to 6.0 in a year. The models flag these anomalies as "at-risk" segments, and logic dictates that an "unusual event" must have occurred to make this segment appear so untypical. Two analyses need to be done in order to foresee these types of events:

(1) A designed study of cause-and-effect models must be conducted to reveal the types of major adverse conditions that cause terrific pavement deterioration.

(2) FDOT engineers would need to be constantly observant of each segment, so that when and if these conditions present themselves, they can be immediately noted and remedied.

The second issue is related to measurement error. Although this project was approached as if the ratings, the annual average daily traffic, and all other variables were exact measurements, such exactitude could not be guaranteed. Consequently, incorporating the actual effect of measurement error is beyond the scope of this study. Nonetheless, a brief note is appropriate. Consider, for example, that the crack rating values as recorded on the website are often given in units and tenths. A gross test of the importance of that decimal place would be to ask the following: Would the same crew, with the same instructions, under the same type of weather conditions give the same rating to a job done today that it would give to it a week later? Should the answer to a repeat performance be “plus or minus .5”, it would strengthen the innate accuracy of the ultimate prediction formula discussed in the pilot case. Since *85%* were predicted to be within .4 of the actual ratings, the results are within the measurement error and can be assumed to be exact.

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