

ABSTRACT

An Optimal Dynamic Policy for the Design and
Maintenance of Flexible Pavements. (May 1969)

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The primary objective of this research is to provide an analytical solution to the optimal flexible pavement design problem. The procedure is based upon empirical equations for deflection, performance, and traffic. These physical relationships are described in detail, both quantitatively and qualitatively. Along with other physically constraining factors, these equations provide a framework for the optimization techniques that are presented.

Optimization is with respect to providing, at minimum cost, a pavement structure that is acceptable for normal travel. Models are developed for predicting the relevant cost components of a pavement structure. These include initial construction, maintenance, and salvage value at the end of the analysis period. Maintenance is further divided into the categories of overlay construction, routine maintenance, seal coating, and the motorist's inconvenience costs during these operations.

The initial design problem is formulated as an integer programming problem and is solved by a specialized branch and

bound algorithm. Many initial designs are obtained, each the longest lived for a specific investment in initial construction. On the assumption that overlays are applied only when required, overlay policies are examined to determine the optimal maintenance policy for each of the initial designs. This will allow optimal design decisions to be made on the basis of cumulative cost rather than initial construction alone. An example problem is given in the appendix.

Finally, the flexible pavement problem is generalized in a specialized dynamic programming formulation. The first stage of the formulation is associated with initial construction, and the remaining stages are associated with future performance periods. Because of the complexity of the algorithm, iteration is required in order to evaluate the recursive relationship at each stage. For this reason, a special set of steps are given for stepping through the algorithm. A discussion is also contained concerning the applicability of the algorithm with respect to stage dependency under certain traffic conditions.