INTRODUCTION

Our highways are being subjected to increasing higher traffic volumes and weights which are causing a more rapid deterioration of the pavement structure than we have previously experienced. This development coupled with the accelerating rate of reduction in financial capability to rebuild, rehabilitate, or even adequately maintain the present systems has created programming needs which the present descriptive data based sufficiency rating system cannot meet. The Federal 3-R programs have focused considerable attention on this aspect of pavement management.

These programming needs are somewhat compounded by an apparent growing change in the User's attitude. As interstate driving experience accumulates the User's level of expectation in rideability and safety seems to raise, and a lower tolerance of interference with movements by internal or contract maintenance develops. This changing attitude may require future benefit-cost studies of zero-maintenance rehabilitation concepts particularly for high traffic volume sections or special designs. Zero-maintenance rehabilitation being defined as a planned surface improvement that is accomplished prior to the incipient failure of the pavement surface. Evaluation of this concept for continuously reinforced pavement with Class I aggregate seems appropriate at this time from the standpoint of possibly reducing life cycle costs.

This situation and current problems predicates the necessity to examine the possibilities of developing a more engineering oriented system for measuring and quantifying pavement condition and for quantifying pavement performance.

In recognition of these problems, Chief Engineer R. H. Given directed that an elemental prccedure be initiated through the Office of Materials to outline methods by which we can measure pavement condition. The basic objective to enhance our engineering capability for a more effective pavement management system.

Initially a brief search of the literature in the pavement management area was conducted. A number of systems for identifying pavement conditions have been developed. The most exotic system was that being used by the New York Department of Transportation. It was based on psychophysical analysis to quantify ratings on standard test sections by panels composed of sixty to eighty people. These ratings were then correlated with vehicle-mounted profile measuring systems.

Sufficient evidence was not discovered in this brief search to alter the general opinion that the Serviceability (Present Serviceability Index-PSI) - Performance Concepts developed by the AASHO Road Test provides the optimum engineering basis for pavement management. Use of these concepts in Iowa has the additional advantage in that we have a reasonable quantity of historical data over a period of time on the change in pavement condition as measured by PSI's. Some additional benefits would be the ability to better assess our needs with respect to those being recommended to Congress by AASHTO Committees. These concepts have been the basis used for developing policies on dimensions and weight of vehicles and highway needs which the AASHTO Transport Committees have recommended to the United States House Committee on Ways and Means. The first recommendation based on these concepts was made in the mid 1960's. Iowa's participation in the evaluation for this recom-

mendation was under the direction of our present Director of Transportation, Mr. Raymond Kassel. PSI Indexes had to be derived from subjective surface ratings at that time. The most recent recommendation to Congress was made in November of 1977.

Based on the rationale expressed above, a pilot study of the major part of the rural interstate system was conducted. The Objective of the study was to measure pavement performance through the use of the Present Serviceability Index (PSI) - Pavement Performance concepts as developed by the AASHO Road Test and to explore the usefulness of this type of data as a pavement management tool.

Projects in the vicinity of the major urban centers were not included in this study due to the extra time that would be required to isolate accurate traffic data in these areas. Projects consisting of asphalt surface courses on crushed stone base sections were not included.

FINDINGS

1. The Present Serviceability Index survey procedures should be modified as noted to reduce sampling variability in the ratings.
2. The performance curves derived substantiate that the Serviceability Indexes have adequate potential to justify their use for determining the rate of change in serviceability of an individual pavement section.
3. The capability of performance curves - present serviceability indexes versus accumulated equivalent axle loads - to quantify pavement needs and project the time of these needs was demonstrated. Their usefulness in assessing the effect of design features, variations in materials, construction and maintenance and in quantifying the effect of changes in axle loadings are obvious. The effect of aggregate characteristics was illustrated.
4. The limited rehabilitation construction on the rural sections of 10 inch standard p.c. pavement have occurred at about the 3 PSI level of serviceability.
5. Based on the overall performance curves, the PSI depreciates at the rate of 0.1 of a point for every 1.1 million repetitions of equivalent 18-kip axle loads for p.c. standard 10 inch pavement with Class II aggregate and 0.6 million for 8 inch standard continuously reinforced pavement. The level of serviceability of the continuously reinforced drops below that of the standard at approximately 4 million repetitions and a PSI of just over 3.6.
6. Due to the observed rapid rate that D-cracking deterioration develops after it becomes noticeably visible and the possible effect of the deterioration in the performance of continuous reinforcement or structural adequacy, zero-maintenance reha-

bilitation should be evaluated for cost effectiveness and as an alternate strategy for these pavements.

7. The full depth asphalt sections are showing superior performance to the overall trend performance of the 10 inch portland cement concrete sections up through 8 million accumulated axle loads.

8. In summary, this pilot study has demonstrated the capability of the Present Serviceability Index - Pavement Performance concepts as outlined for measuring and quantifying pavement condition and performance. It demonstrated the usefulness of this type of data as a basis for a user-engineering oriented pavement management system. This type of system could be implemented as a satellite pavement management program to augment the present systems with minimum programming requirements. Any programming should also include ADT and SN skid index data.