EVALUATION OF PAVEMENT SERVICEABILITY ON UTAH HIGHWAYS

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Abridgment

Pavement condition is an area of mutual concern to the travelers and to the highway engineers. To explore this field of common interest in Utah, a comprehensive evaluation of pavement serviceability was instituted in 1964. Included in the research are 109 highway projects completed since 1959 and equalling more than 1,300 miles of pavement length. Both flexible and rigid pavements are evaluated.

The primary objectives for conducting this research are (a) utilization of pavement evaluation data to rate the performance of a specific pavement and (b) determination of the adequacies for current AASHO design procedures.

The basic element required to evaluate pavement serviceability is the present serviceability index (PSI), which is derived for each pavement project included in the evaluation determination. The PSI is a numerical rating representing the momentary ability of a pavement to serve traffic. It is considered that the PSI is a valid indicator of the relationship between the known number of specific axle loads and the actual performance for various pavement designs.

The prime emphasis for this research is the performance history for a pavement from original construction throughout its useful life as revealed by the serviceability trend in conjunction with the cumulative load application. The 18-kip equivalent load applications are calculated from traffic data that are collected from permanently installed counting stations, portable counters, and manual counts at selected sites throughout Utah.

The pavement characteristics analyzed to derive the PSI are pavement roughness count, surface defects such as cracking, patching, and spalling, and wheelpath rut depths. Roughness was initially measured for 2 years with the BPR roughometer. Since then, the California type of profilograph has been used. The profilograph was preferred because it traces a profile line of the pavement surface and is considered to be more precise. An integrator has been implemented that accumulates and counts the most minute surface deviations.

To establish the individual project serviceability trend, each PSI is plotted graphically as a function of cumulative 18-kip equivalent loads along the horizontal axis. The PSI rating scale from 0 to 5 is the vertical axis. Each succeeding evaluation produces a PSI that is plotted to further define a curve representing the serviceability trend of a particular project as related to the cumulative loading. The pavement is considered to have failed and to be no longer serviceable when this curve descends to the terminal index line. Utah highways are designed from a 2.5 terminal index except that certain highways with lower volumes may have a 2.0 terminal index.

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It is expected that the serviceability trend for an adequately designed pavement would be similar to example I shown in Figure 1. Example II shows an overdesigned pavement, and example III shows an inadequate design as indicated by the curve intersection that is far short of the terminal design line.

Because the 20-year terminal design load is a predetermined design factor, actual traffic accumulation may occur in a time period of less, or more, than the prescribed 20 years. The curvilinear serviceability relationship between PSI and loading is, of course, still valid irrespective of time.

It must be realized that construction methods and materials will also have a significant effect on how a pavement performs. Therefore, the construction quality must be considered as an integral part of this evaluation. To rate this quality, a construction index is derived for each project from actual construction control test records.

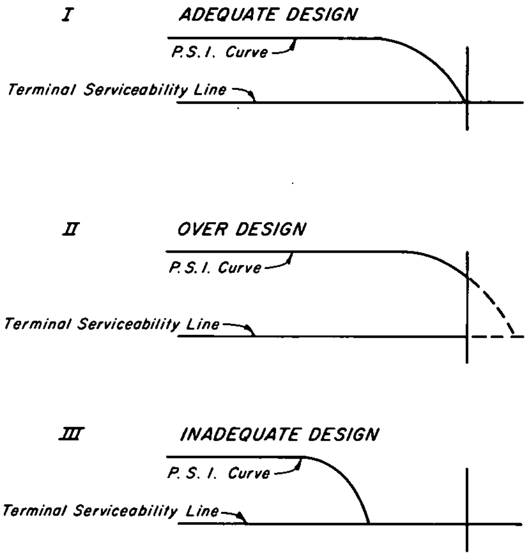
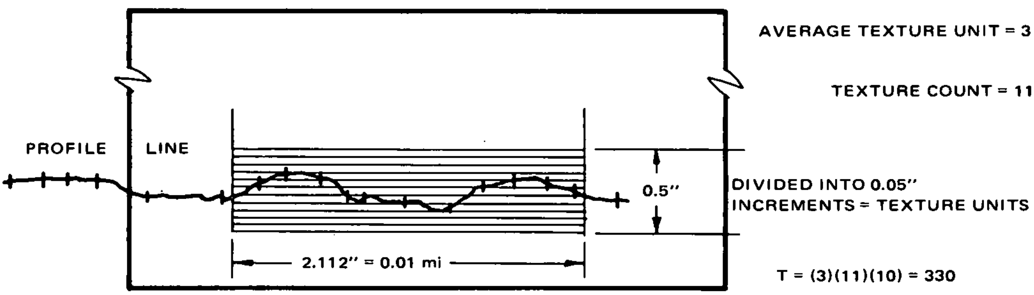


Figure 1. Examples of various pavement performance conditions.

The results of the 6 evaluations completed to date have separated the project serviceability trends into 4 major classifications: those with decreasing index trends, those with increasing index trends, those remaining virtually constant, and those that have developed fluctuating PSI behavior with no discernible trend. Subsequent evaluations are expected to produce definable trends for these projects also. The percentages for the 4 classes respectively are 45, 13, 17, and 25. The fluctuation is attributed to diverse test methods and to anomalies caused by pavement maintenance procedures and resurfacing. It has been observed that pavement repair or resurfacing can raise or lower the PSI according to the influence of chipping and sealing, resurfacing, or maintenance procedures on the pavement roughness.



T = average texture unit x texture count x 10 = textural roughness in in./mile

where

average texture unit = average height of texture in 0.05 in. obtained over length of template (texture appears as single vertical line for the vertical deviation of the profile line at any point on the profilogram, and

texture count = number of vertical texture lines over length of template.

Figure 2. Clear plastic texture template.

A project may have a low PSI not actually representative of the true performance of the pavement. This may be caused by an exceedingly high roughness count directly attributable to surface texture and not to any real loss of serviceability. Textural roughness usually occurs on road-mixed pavements, after recent chipping and sealing, or during resurfacing operations. The textural influence on PSI is accounted for by a texture template (Fig. 2) used to isolate the roughness count from the profile line so that it can be deducted from the total count.

To further refine roughness measurements, a road meter has been introduced into the pavement testing program to be utilized for future evaluations. This device will measure roughness count at speeds up to 50 mph. This permits total length testing instead of the 20 percent random sampling testing conducted with the profilograph.

In conclusion, the results of the evaluation to date appear to justify the continued use of the AASHO design formula and the perpetuation of pavement research studies to evaluate pavement performance.