

Abridgment

Correlation of Subjective Panel Ratings of Pavement Ride Quality with Profilometer-Derived Measures of Pavement Roughness

M. S. JANOFF, P. S. DAVIT, and J. B. NICK

ABSTRACT

Results of a series of comparative, statistical analyses that were accomplished to relate subjective ratings of pavement ride quality to profilometer-derived measures of pavement roughness are reported. The goal was to develop preferred methods of analysis that can be used to develop transforms that will allow subjective ratings to be predicted from objective measures. The major conclusions are that: (a) it is possible to determine those specific frequency bands that are most related to subjective ride quality and (b) the correlations between the profile power levels in these frequency bands and the mean panel ratings are very high, indicating excellent agreement.

Some of the results of a series of comparative, statistical analyses that related subjective ratings of pavement ride quality to profilometer-derived measures of pavement roughness are briefly summarized. The intent of these analyses was to develop preferred methods of analyses that combine subjective ratings and physical profiles, and that can be used to develop transforms that will allow subjective ratings to be predicted from objective measures.

EXPERIMENTAL DESIGN

Twenty-one panel members were used to subjectively rate the ride quality of 18 bituminous pavement sections of uniform length and spanning a wide range of roughness. The Weaver/AASHO scale shown in Figure 1 was employed for all subjective ratings. Roughness was measured, with a GM profilometer and Mays Ride Meter, concurrent with the panel ratings. The test sections spanned a range of roughness of 25 to 327 in. per mile and the mean panel ratings spanned a range of 1.20 to 4.26 on the 0 to 5 scale.

DATA COLLECTION

The panel members were divided into groups of three, given detailed rating instructions, and then driven over the 18 test sections; each test section was individually rated by each panel member and mean panel ratings were computed for each test section. Profiles and response type roughness was collected concurrent with the panel ratings.

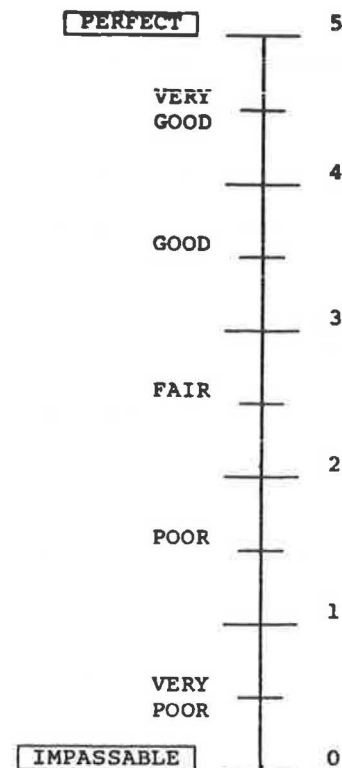


FIGURE 1 Weaver/AASHO scale.

DATA ANALYSIS

The profiles were digitized and a fast Fourier transform (FFT) was applied to compute profile power. The power was then graphed to visually compare the 18 test sections. In general, as power rose--indicating a rougher pavement--the mean panel ratings decreased, indicating a loss of ride qual-

TABLE 1 Regression Analyses

Objective Measure of Roughness	Correlation Coefficient ^a
Mays Ride Meter	-0.76
1/4 car index	-0.69
Profile power	
(0.0029 to 3.0 cy/f)	-0.33
(0.09 to 1.5 cy/f)	-0.92
(0.2 to 0.4 cy/f)	-0.92
(0.09 to 3.0 cy/f)	-0.92
(0.02 to 3.0 cy/f)	-0.90
(0.4 to 3.0 cy/f)	-0.87

^aWhen correlating mean panel rating (subjective measure of ride quality) with each objective measure of road roughness in column 1.

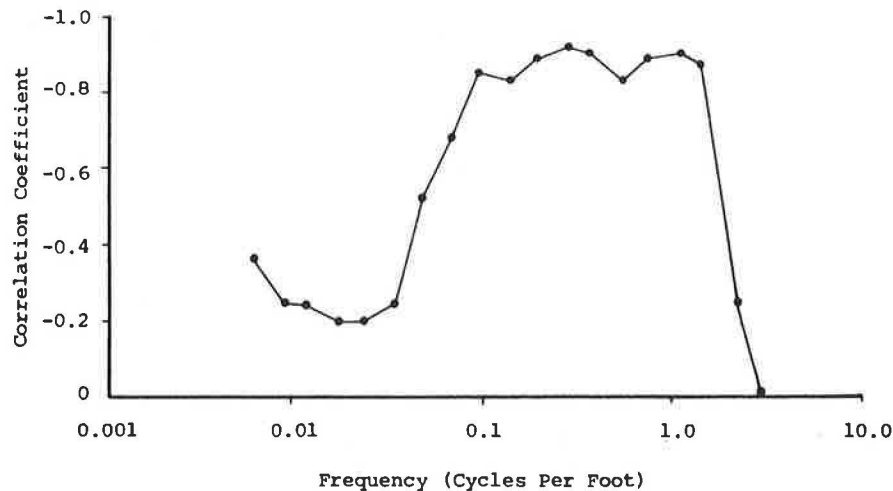


FIGURE 2 Results of correlating power with mean panel ratings for individual one-half octave bands.

ity. However, the correlation coefficient was quite low (-0.33). Simple roughness measures such as the Mays Ride Meter provide somewhat better correlations (-0.76).

In restricted bands of frequencies, however, the correlation of mean panel rating and profile power was quite high, as indicated in Table 1, often exceeding -0.90.

The power was computed in each of 18 one-half octave bands from 0.0029 to 3.0 cycles per foot and correlated with mean panel ratings as illustrated in Figure 2.

The correlations are extremely high between 0.09 and 1.48 cycles per foot and fall off outside this range. The total power in this band when correlated with mean panel rating yields a correlation coefficient of -0.92.

CONCLUSIONS

The one-half octave analysis indicates that it is possible to identify a specific frequency band (or

bands) where profile power is highly correlated with subjective ratings of ride quality. A transform can thus be developed that allows the user to accurately predict subjective appraisals of ride quality (i.e., mean panel ratings) from physical measures of the pavement profile.

ACKNOWLEDGMENT

This work is extracted from the results obtained under NCHRP Project 1-23, Pavement Roughness and Rideability. A complete coverage of the preceding material will be contained in the final report for this project (1).

REFERENCE

1. M.S. Janoff et al. Pavement Roughness and Rideability. Final Report. NCHRP Project 1-23, TRB, National Research Council, Washington, D.C., in preparation.