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# ENVIRONMENTAL FACTORS RELEVANT TO PAVEMENT CRACKING IN WEST TEXAS

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# Environmental Factors Relevant to Pavement Cracking in West Texas

by

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This study provides a compilation of environmental data for the west Texas area. West Texas is important because, in that area, pavement deterioration due to environmental factors is more severe than in the remainder of the state. This report gives data which will be necessary to predict thermal and shrinkage cracking. Climatic factors have been used to predict moisture suction beneath pavements, a controlling factor in shrinkage cracking. These climatic factors must be validated by field measurements in the west Texas area.

## Compiled Data

Previous studies have shown the following factors to be important in the prediction of pavement cracking: annual solar radiation, annual average temperature, July average solar radiation, daily temperature, annual temperature range, and annual average wind velocity.

These studies dealt with thermal cracking of the asphalt surface course and frost susceptibility and fines content of the base course. Field visits and subsequent laboratory studies indicated that the pavement cracking mechanism involves more mechanisms than these including freeze-contraction of the base course at constant moisture, drying shrinkage of the base course, and selective absorption of the asphalt volatiles by porous aggregates. Additional climatic data to aid in the prediction of these mechanisms include: freeze-thaw cycles of air temperature, plunge rates of air temperature, average depth of freezing penetration, precipitation evaporation, and potential evapo-transpiration.

These data have been tabulated in the form of contour maps for the entire west Texas area providing an easy means of obtaining information for a particular area.

## Moisture Indices

Moisture changes beneath a pavement can cause severe pavement deterioration. Excluding construction faults the long term moisture balance beneath a pavement may be predicted from the Thornthwaite moisture index which is strictly a climatic indicator. This index was regressed against similar data actually observed for each Texas Highway Department District in west Texas. The squared correlation coefficient, $R^2$, was above 0.98

for all data. These data, validated for west Texas, will allow laboratory values of moisture suction to be compared with in-situ measurements to show the effects on pavement performance of moisture changes in the subgrade and base course.

## Conclusions and Recommendations

The study undertaken shows west Texas to have the most severe environment of the state. Low-temperature cracking should be considered a problem in the extreme northern portion of the panhandle region. However, thermal fatigue cracking would appear to be much more likely throughout the west Texas area. It is evident from the work done in previous studies that the base course and subgrade materials have not been considered adequately in the analysis of pavement cracking. The data collected will provide a common base for discussion and explanation of observed pavement cracking. It is recommended that this study be extended to cover the entire state.

## Implementation Statement

The data reported herein will aid design engineers as well as field engineers in considering all probable causes of pavement deterioration. The data point out areas of inadequacies in previous studies and suggest new areas of investigation in addition to serving as a base for investigating pavement cracking in Texas.

The published version of this report may be obtained by addressing your request as follows:

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