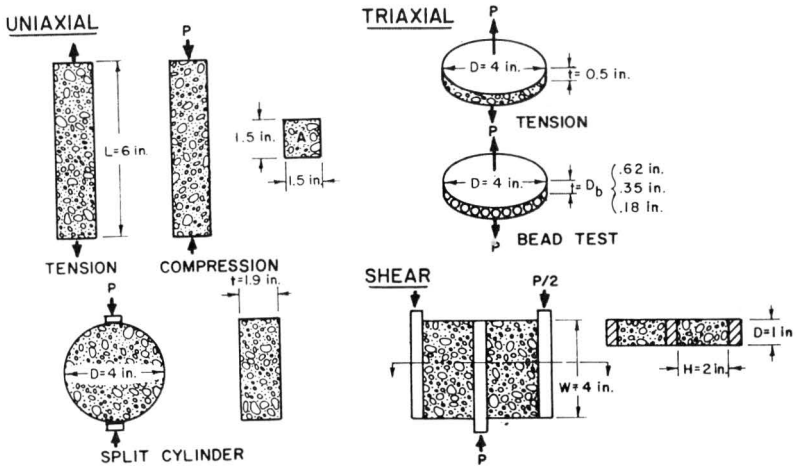
SUMMARY REPORT 127-4F(S)

EVALUATION OF ASPHALT STRUCTURAL PERFORMANCE

SUMMARY REPORT
of
Research Report 127-4F
Study 2-8-69-127



Summary of Test Procedures.

Cooperative Research Program of the
Texas Transportation Institute and the Texas Highway Department
In Cooperation with the
U. S. Department of Transportation, Federal Highway Administration

May, 1971

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Evaluation of Asphalt Structural Performance

by

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Purpose

The purpose of this phase of the study was to determine the feasibility of a fundamental approach to the evaluation of the structural performance requirements of asphalt cements employed as cohesive-adhesive waterproof binders in first-class, long-life flexible pavement courses, and to develop improved control tests for use in specifications for such materials.

Scope

This part of the research comprised measurement of the basic mechanical behavior (load response and failure criteria) of representative asphaltic concrete mixtures by application of available direct uniaxial tension and compression, splitting tension, hydrostatic tension, and double lap shear test procedures. The mixtures were made using asphalt cements from two different manufacturing processes, and mixtures of these cements with a synthetic elastomeric polymer, in order to determine how possible variations in the asphalt cement structural performance would influence pavement performance. The results obtained were expected to indicate, in a fundamental way, how the structural performance requirements of a bituminous pavement material might be determined, specified, and controlled.

Conclusions

The experimental data and resulting analysis in this study indicate that:

1. Test methods are available which can be applied to reliably evaluate asphalt structural performance in a fundamental way. The test methods examined in this study are sensitive to significant differences in asphalt content and asphalt structural performance. Thus these methods can be applied to obtain basic pavement design data, to select asphaltic materials, and for asphalt quality control. However, additional research related to details of sample preparation, test procedures, and analysis of results should be completed before this approach can be put to practical use. Additionally, a cyclic loading (fatigue) method should be included in any complete asphalt structural performance evaluation scheme.

2. All of the test methods applied in this study give more reliable ultimate stress than ultimate strain data, and more reliable secant modulus than tangent modulus values. Improved methods of measuring sample deformation during test should improve the precision of the ultimate strain data.

3. Relative structural performance of asphaltic concrete will vary with stress axiality. Also, it appears that there is no consistent relation between uniaxial and multiaxial mechanical behavior. Accordingly, asphalt structural performance cannot be judged solely on the basis of uniaxial test results; a combination of several test modes is necessary for adequate performance evaluation.

4. Asphaltic concrete modulus and failure data demonstrate a simple power law dependence on strain rate. Such dependence implies that linear viscoelastic behavior for this material is a reasonable engineering assumption. It also suggests that the test procedures might be simplified by substitution of a constant load (creep) schedule for the more commonly applied constant strain rate schedule.

5. Additions of elastomeric polymers (synthetic and natural rubber and the like) have a significant effect on asphalt cement structural performance. Failure behavior is improved but such additions may either increase or decrease the elastic modulus, depending on the base asphalt source.

6. Based on the limited experiments performed in this study, substitution of ground reclaimed rubber for part of the aggregate has little effect on the mechanical behavior of asphaltic concrete.

Recommendations

1. Serious consideration should be given to the application of a fundamental approach to the measurement of asphalt structural performance, as proposed in this study, for the acquisition of basic design data, selection of asphalt cements, and for asphalt quality control. However, the required additional research to further develop and improve the test methods should be supported to completion so that this scheme can be applied in a practical way and with confidence.

2. Methods of sample preparation should be studied carefully, with respect to how well the samples represent asphaltic concrete produced in highway construction as well as to improvement of the accuracy and precision of the test methods themselves.

3. Further research on test methods to be used in the fundamental evaluation of asphalt structural performance should include a study of creep test and fatigue test methods.

4. The application of structural performance evaluation methods should be extended to include the study of the effects of asphalt aging on both field and laboratory samples.

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