CORRELATION OF KENTUCKY CBR'S AND SOIL SUPPORT VALUES

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Several ASTM and Kentucky CBR tests were performed at different molding moisture contents and compactive energies on the AASHO embankment soil, four representative Kentucky soils, and one soil from Ohio. These data were compared to CBR data previously reported. For CBR's ranging from about 4 to 12, a relation was developed between Kentucky and ASTM CBR's. Within this range, Kentucky and ASTM CBR's are approximately equal. Molding specimens under the static pressure of 2,000 psi (as used in the Kentucky CBR procedure) produced specimens with initial dry densities that averaged about 6 percent higher than those obtained by AASHO T 99-57. CBR's and axial swell values were also higher. For soil specimens molded at the same initial dry density, CBR's of statically compacted specimens are distinctively lower than those observed for dynamically compacted specimens. For relatively small decreases in initial dry densities, there were very large decreases in CBR's. Three different correlations between Kentucky CBR's and the AASHO Road Test soil support values were developed. The first relation was made by assuming a logarithmic scale between Kentucky CBR's of 5.2 and 100, which corresponded to values on the soil support scale of 3 and 10 respectively. The Kentucky CBR of 5.2 was determined by performing tests on the AASHO road subgrade soils. For practical purposes, the AASHO Road Test crushed-stone base material was assumed to be a "100 percent CBR material" (this assumption was based on CBR data previously reported). The second correlation was obtained by assuming a logarithmic scale between Kentucky CBR's of 5.2 and 90, corresponding to values on the soil support scale of 3 and 10 respectively. The third relation was constructed through computations using the Kentucky flexible pavement design curves and the AASHO design chart ($P_t = 2.5$).

•SUBGRADE strengths of the upper 3 ft of the embankment soils at the AASHO Road Test were expressed in terms of a dimensionless, hypothetical soil support parameter (1). The AASHO Road Test sections were constructed on only one soil, giving one point on the soil support scale. This point was assigned a value of 3. A second point was established on the soil support scale from observations and analysis of the performance of various sections having crushed-stone bases sufficiently thick to make the effect of the subgrade insignificant. This second point on the soil support scale was established and arbitrarily assigned a value of 10. A linear scale was assumed between the soil support values of 3 and 10 and extended to 1.

The AASHO Road Test scheme did not specify a test method for determining soil support capacity of a given soil. However, some means to correlate the hypothetical soil support values (S) and strength values resulting from a selected test method would be desirable. Correlation of Kentucky CBR's and soil support values was the main con-

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cern of this study. Such correlation would provide a basis for comparing flexible pavement designs from the AASHO Road Test with those based on Kentucky design criteria. Another intent was to compare CBR data reported by Shook and Fang (2) with Kentucky CBR data and CBR data obtained using other test methods so as to provide a means for making closer comparisons among various design criteria employing the CBR parameter.

Correlation curves C and D in Appendix A of the AASHO guide (1), which relate Kentucky CBR values and soil support values, are misleading because the conditions outlined for molding the CBR specimens are not the same as specified in the Kentucky CBR test procedure. The Kentucky CBR specimen is molded using static rather than dynamic compaction, and the CBR specimen is soaked until swell virtually ceases. Seed and Chan (3) presented data that indicated that the method—static, dynamic, or kneading—of compaction yields soil specimens with differing soil structures. When comparing samples prepared by static compaction and kneading compaction, there was a marked difference in the stress-strain relations for samples compacted "wet of optimum." Data showing the effect, if any, of different soil structures on CBR strengths were not available.

KENTUCKY CBR TEST PROCEDURE

Currently, there is not an AASHO or ASTM standard CBR test procedure involving static compaction. Static compaction, however, is suggested as an alternate compaction method for preparing test specimens for permeability, consolidation, volume-change expansion pressure, and triaxial compression tests. Static compaction does influence the structure of soils; i.e., the physical properties of specimens prepared with static compaction differ from those of specimens compacted dynamically or by types of kneading methods (4).

The CBR test procedure used in Kentucky was modeled by Baker and Drake (5) after a procedure suggested by Stanton (6). Significant changes made by Baker and Drake consisted of soaking the specimen until axial swell virtually ceases, molding the specimen to "Proctor conditions" using a 2,000-psi pressure, correcting the CBR load-deflection curve, and loading a 5-lb surcharge weight on the specimen at the start of penetration.

Most agencies specify a 4-day soaking period (2). Chamblin (7) noted in a study of the effect of soaking period on CBR strengths that, for a 4-day soaking period, there was a large decrease in CBR; for longer soaking periods, there was only a slight further decrease in CBR. Nevertheless, permitting swell to virtually cease does ensure an "extremely critical condition," comparable probably to the worst situation in the field.

In the Kentucky CBR procedure, the specimens are intended to conform to conditions of AASHO T 99-57, method A (compactive energy of 12,375 ft-lb/ft^3). However, observations (8) and data presented in this report suggest that the compactive effort of 2,000 psi is apparently greater than the compactive effort of AASHO T 99-57, method A. Consequently, the molded specimen has a higher density and a moisture content that is at or near optimum moisture content of AASHO T 99-57, method A.

During soaking, Stanton's method (6) specified a 10-lb surcharge weight; in the Kentucky procedure, a 17.5-lb surcharge weight is used. In the Kentucky method, a 5-lb annular weight is used during penetration to center the piston; in Stanton's method, such weight was used only for the case of granular materials.

Another feature added to the Kentucky method was the correction of the load-penetration curve. Because of irregularities in the surface or in distribution of moisture near the surface, it is usually necessary to plot load versus depth of penetration (ordinate and abscissa respectively). If necessary, the abscissa zero point is corrected for any concave-upward tendency in the curve near the origin.

It is customary in most CBR test procedures to select the CBR value at either 0.1- or 0.2-in. deflection. In the Kentucky method, the minimum CBR value is chosen from

CBR's occurring at 0.1-, 0.2-, 0.3-, 0.4-, and 0.5-in. penetration. Baker and Drake (5) noted in developing pavement thickness design curves that the minimum field and laboratory CBR's afforded the best correlation with pavement performance.

PREPARATION OF CBR SPECIMENS

Characteristics of the different methods used in molding CBR specimens for the study reported here are given in Table 1. Method 1 (AASHO T 99-61, method A) was used to determine the moisture-density relations of each of the soils investigated. These relations were used in preparing the Kentucky CBR specimens, method 5. Basically, method 1 consisted of compacting three equal layers of soil in a 4-in. mold, each layer receiving 25 blows from a 5.5-lb hammer dropped 12 in.

CBR specimens for testing under ASTM D1883-61T were prepared in three different ways. Method 2 (AASHO T 99-61, method B) involved compacting three equal layers of soil in a 6-in. mold with each layer receiving 56 blows from a 5.5-lb hammer dropped 12 in. Method 3 was the same as method 2, except that the height of the sample was 5 in. instead of 4.59 in. Method 4 (AASHO T180-57, method B) consisted of compacting five equal layers of soil in a 6-in. mold with each layer receiving 56 blows from a 10-lb hammer dropped 18 in.

CBR specimens for testing under the Kentucky CBR procedure were prepared in two different ways. Method 5 involved compressing the total sample under a static pressure of 2,000 psi. Method 5 differed slightly from the Kentucky CBR testing routine. Normally, values of optimum moisture content and maximum dry density of method 1 are used to calculate the amount of material for specimen preparation. In this study, however, the moisture content was varied over a wide range of values. Method 6 was basically the same as method 5; however, the specimens were not molded under a static load of 2,000 psi but were molded to a predetermined height (volume).

LABORATORY RESULTS

Soil samples were secured from stockpiled embankment material located at the AASHO Road Test site, four different locations in Kentucky, and one location in Ohio. The Kentucky samples were representative of a range of Kentucky soils. A portion of each sample was submitted to a routine laboratory testing program consisting of specific gravity, Atterberg limits, grain size analysis, and standard compaction (method 1). All tests were performed in accordance with AASHO standard test methods. A summary of classification data for the six soils is given in Table 2. Included in the table are mean values reported by Shook and Fang (2) for the AASHO Road Test subgrade soil.

From 8 to 14 Kentucky CBR tests were performed on each of the soil samples from the six locations in accordance with method 5. However, moisture contents of the samples were varied in order to obtain a moisture content-dry density curve. A total of 67 Kentucky CBR tests were performed. A total of 56 CBR tests were performed on each of the six soil samples in accordance with ASTM D1883-61T. The number of tests performed on each of the six soils ranged from 8 to 29. The specimens were molded according to method 2. An additional 20 CBR tests were performed on specimens compacted according to method 3. Dry density-, CBR-, and axial swell-molding moisture content curves for the samples from the six locations are shown in Figures 1 through 6.

Five ASTM CBR tests were performed on the AASHO Road Test sample compacted in accordance with method 4 (Figs. 1 and 10). Four Kentucky CBR tests were performed on the Fayette County soil using a static compactive effort other than 2,000 psi (method 6). The intent of these tests was to duplicate the moisture content-dry density curve obtained using method 2 and to observe the resulting effects on CBR's. These data are shown in Figure 3. Also shown in Figure 1 are the results of two ASTM CBR tests performed on specimens compacted by method 4, with the exception that the compactive energies were 11,992 and 24,992 ft-lb/ft^3.

General relations between ASTM CBR's and Kentucky CBR's determined for various molding conditions are shown in Figure 7.

Table 1. Compaction methods used to prepare CBR specimens.

Item	AASHO T 99-61, ASTM D 698-66T Method A Method 1	AASHO T 99-61, ASTM D 698-66T Method B Method 2	AASHO T 99-61, ASTM D 698-66T Method B Method 3	AASHO T 180-51, ASTM D 1557-66T Method B Method 4	Standard Kentucky CBR Method 5	Altered Kentucky CBR Method 6
Mold						
Diameter, in.	4	6	6	6	6	6
Height, in.	4.59	4.59	5.00	4.59	Variable	Predetermined
Volume, ft^3	1/30	1/13.33	1/12.23	1/13.33	Variable	Predetermined
Rammer						
Weight, lb	5.5	5.5	5.5	10.0		
Free drop, in.	12.0	12.0	12.0	18.0		
Face diameter, in.	2.0	2.0	2.0	2.0		
Layer						
Total number	3	3	3	5	1	1
Surface area, $in.^2$	12.57	28.27	28.27	28.27	28.27	28.27
Compacted thickness, in.	1.7	1.7	1.7	1.0	Variable	Predetermined
Compaction effort						
Blows per layer	25	56	56	56	2,000 psi	Variable
Energy, ft-lb/ft^3	12,375	12,317	11,301	55,986	Static compression	Static compression
Material						
Maximum size	No. 4	No. 4	No. 4	No. 4	¾ in.	¾ in.
Correction for oversize	No	No	No	No	Yes	Yes

Table 2. Summary of classification data.

Soil Sample	Classification AASHO	Unified	Textural	Atterberg Limits Liquid Limit (percent)	Plasticity Index (percent)	Moisture-Density Relation (AASHO T 99-61) Optimum Moisture Content (percent)	Maximum Dry Density (lb/ft^3)	Grain Size Distribution (percent finer) No. 4	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm	Specific Gravity
AASHO Road Test[a]	A-6(9)	CL	Clay	27.7	12.6	13.5	119.2	96.6	88.6	75.5	72.3	61.9	40.3	27.6	2.72
AASHO Road Test (Kentucky)	A-6(11)	CL	Clay	32.5	15.7	14.0	117.0	97.0	90.0	79.5	76.5	65.5	45.0	32.0	2.68
Ohio	A-6(8)	CL	Clay loam	30.0	12.0	16.8	111.7	95.0	86.0	71.0	58.0	45.0	30.0	21.0	2.71
Fayette County (Maury series)	A-6(12)	CL	Clay loam	34.5	13.5	19.8	100.5	100.0	94.0	79.0	76.0	61.0	30.0	20.0	2.69
Clark County (Eden series)	A-6(13)	CL	Silty clay	36.5	12.0	21.5	98.6	100.0	98.0	91.0	88.0	75.0	44.0	31.0	2.71
Fulton County (Calloway series)	A-4(8)	ML	Silt loam	26.1	1.0	16.6	107.3	100.0	98.0	78.0	70.0	40.0	17.0	13.0	2.66
Adair County (Baxter series)	A-7-5(19)	CH	Clay	61.0	34.0	24.0	96.2	92.3	89.3	87.6	82.0	74.0	58.0	50.0	2.77

[a]Mean values (2).

Figure 1. CBR data, AASHO Road Test soil sample.

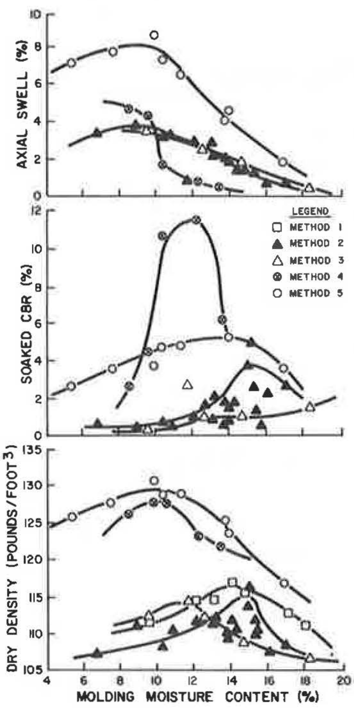


Figure 2. CBR data, Ohio soil sample.

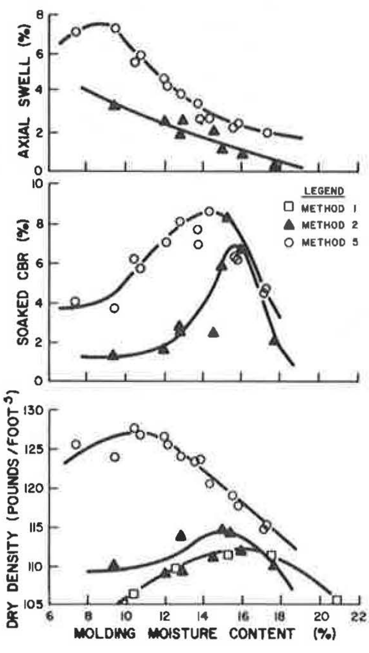


Figure 3. CBR data, Fayette County soil sample.

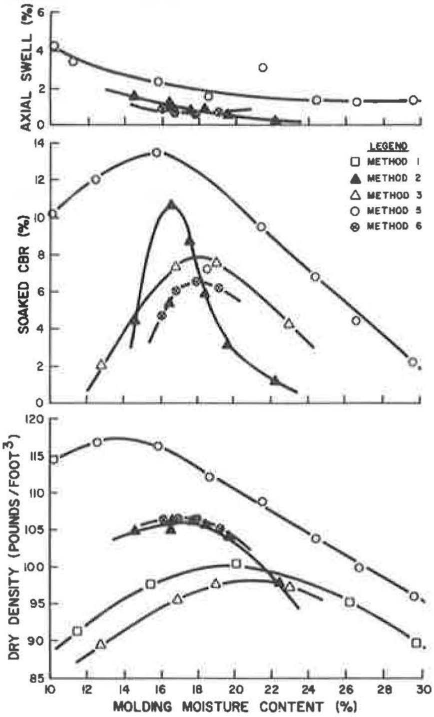


Figure 4. CBR data, Clark County soil sample.

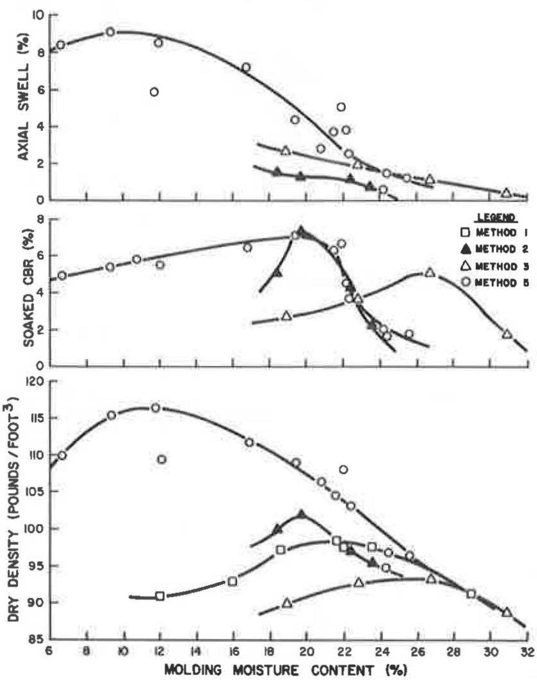


Figure 5. CBR data, Fulton County soil sample.

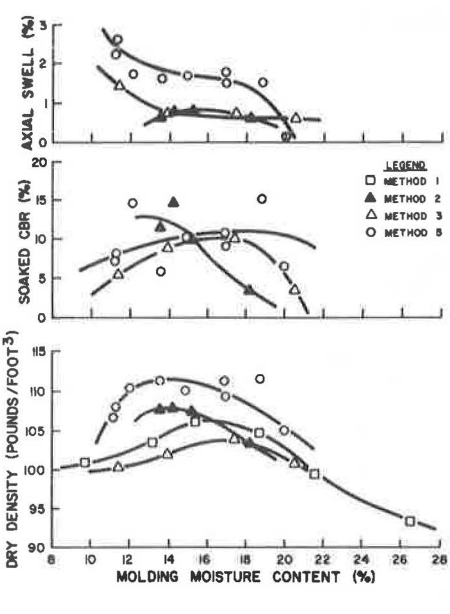
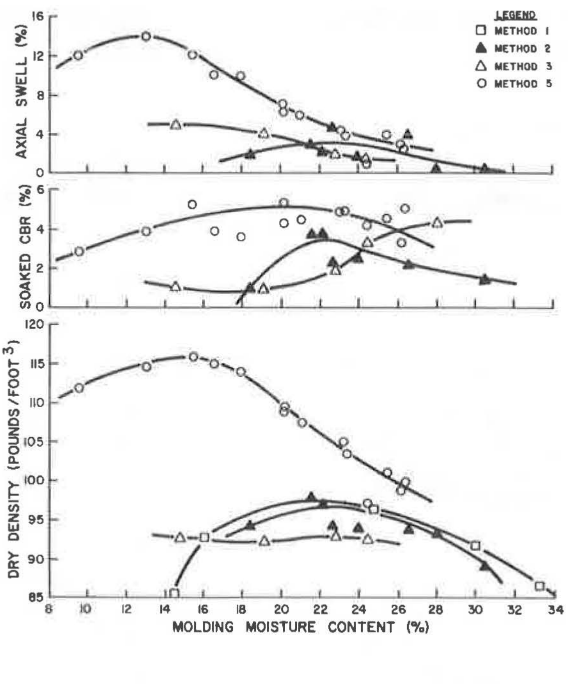


Figure 6. CBR data, Adair County soil sample.



AASHO ROAD TEST CBR DATA

Twenty-eight agencies reported (2) CBR data on the embankment soil at the AASHO Road Test. Most reported only one CBR value. Seven agencies reported more than one CBR value, usually for varying conditions of compactive effort, moisture content, and dry density.

For conditions of similar testing, various plots of the reported CBR data (2) and data reported here were made. These data are shown and compared in Figures 8 through 12.

Seven agencies reported (2) CBR values for specimens molded under static compaction in accordance with Stanton's suggested CBR test procedure, but the static pressure of 2,000 psi was not always used. These data and the dry density-, CBR-, and swell-moisture content curves from Figure 1 are compared in Figure 8. The CBR test procedures of the Utah (8), Oklahoma (9), and Missouri agencies are practically the same as Kentucky's method, although it is not exactly evident which method of compaction is used to determine optimum moisture and maximum dry density; presumably each method refers to methods 1 or 2 because "standard compaction" is commonly referred to in each of the procedures except Oklahoma's. Each of these agencies compact their CBR specimens under a static pressure of 2,000 psi. Note in Figure 8 that the reported Utah CBR value of 5.0 fits the Kentucky data; Oklahoma's CBR value is close, but Missouri's differs significantly, mainly because of the relatively low dry density. In a later report (8), Utah correlated a dynamic CBR of 2.8 with a soil support of 3. In the Illinois CBR procedure, the specimen is molded statically to a predetermined optimum moisture content, and maximum dry density is derived in accordance with methods 1 or 2. Illinois's reported CBR of 4 differs from the Kentucky value, although the dry density value falls near the Kentucky moisture content-dry density curve. This agency in a later report (10) showed a correlation between its CBR and soil support of 3. Alabama's CBR procedure specifies molding of at least three specimens at different moisture contents under a static load of 2,000 psi to determine three points on the moisture content-dry density curve. Optimum moisture content and maximum dry density are determined by using this curve. A CBR test is performed on a specimen molded at these conditions. As shown in Figure 8, the reported CBR of 4.5 is in fair agreement with the Kentucky value, although Alabama's dry density is higher. Information on New Jersey's CBR testing method was not available.

In Figure 9, CBR data for specimens compacted in accordance with method 2, reported by Shook and Fang (2), and data shown in Figure 1 are compared. Although there is some scatter of the data, notable trends are evident.

Other CBR data reported by Shook and Fang (2) and data given here for specimens compacted in accordance with method 4 are shown in Figures 10 through 12. In Figures 11 and 12, the CBR data are for specimens molded with compactive energies of 24,992 and 11,992 ft-lb/ft^3. In Figure 10, the data are for specimens molded with 55,986 ft-lb/ft^3 of energy. Again, notable trends are apparent.

In Figure 13, relations between soaked CBR's and different compactive energies are presented for the AASHO embankment soil. Note that a 5 percent decrease in dry density produces a relatively large decrease in CBR's. Even a 2 percent decrease in dry density decreases the CBR's from 20 to 50 percent. The CBR values for the 98 and 95 percent compaction curves were on the "wet side of optimum moisture content." Generally, the "dry-side" CBR values could not be read from Figures 10 through 12.

KENTUCKY CBR-SOIL SUPPORT CORRELATION CURVES

From the Kentucky CBR tests performed on soil samples obtained from a stockpile at the AASHO Road Test, a Kentucky CBR of 5.2 was found to correspond to a soil support value of 3.0. Crushed-stone base material at the AASHO Road Test site having a soil support value of 10.0 was not available for determining a Kentucky CBR; consequently, a value had to be established by other means. In reviewing CBR data reported by Shook and Fang (2), indications were that the crushed-stone base material could be considered a "100 percent CBR material" for practical purposes. States such as Alabama, Illinois, Oklahoma, and Utah, which used static compaction in preparing test

Figure 7. Kentucky-ASTM CBR curves.

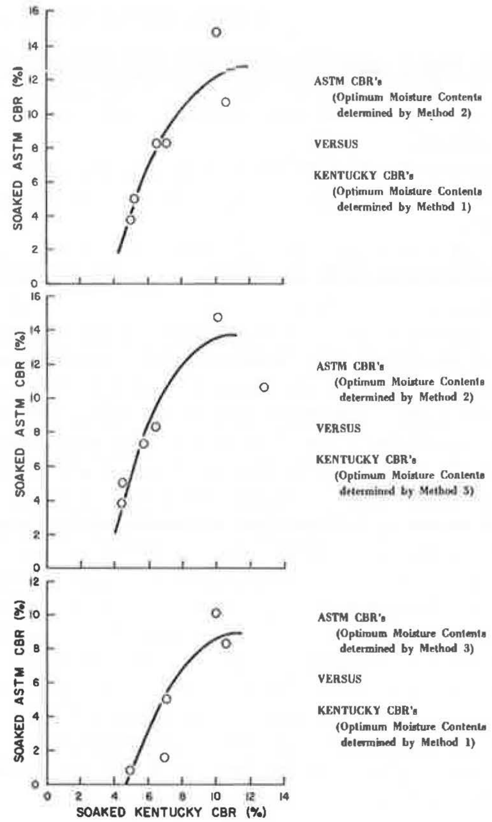


Figure 8. CBR data, AASHO soil sample (static compaction).

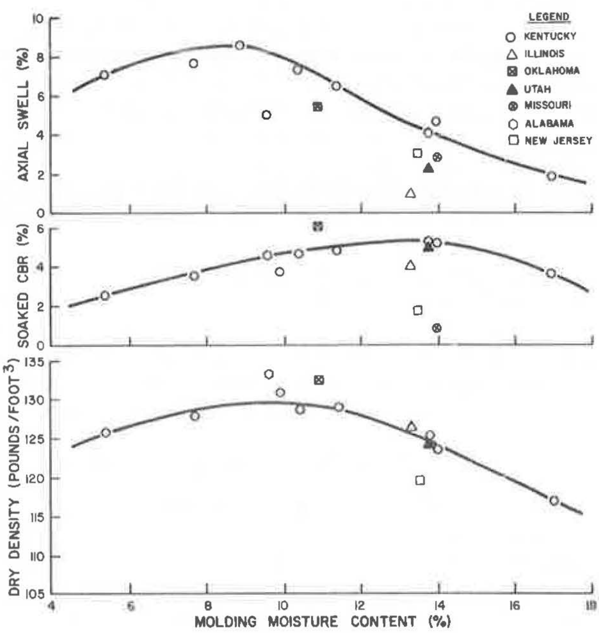


Figure 9. CBR data, AASHO soil sample (method 2).

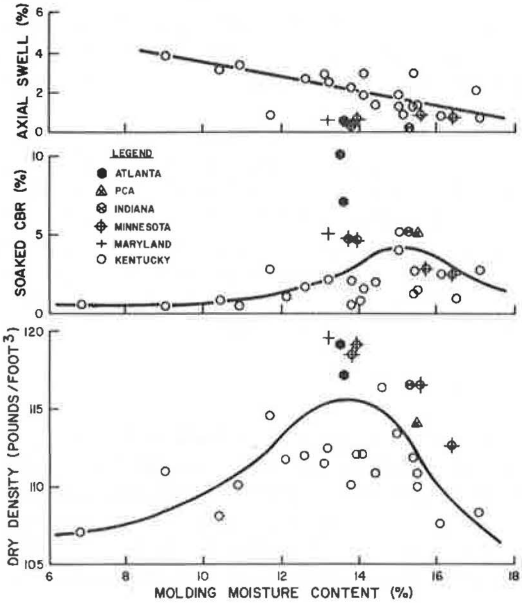


Figure 10. CBR data, AASHO soil sample (method 4).

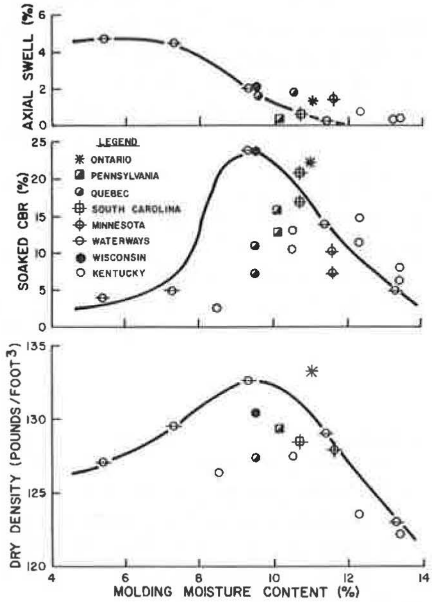


Figure 11. CBR data, AASHO soil sample (method 4, 25 blows per layer).

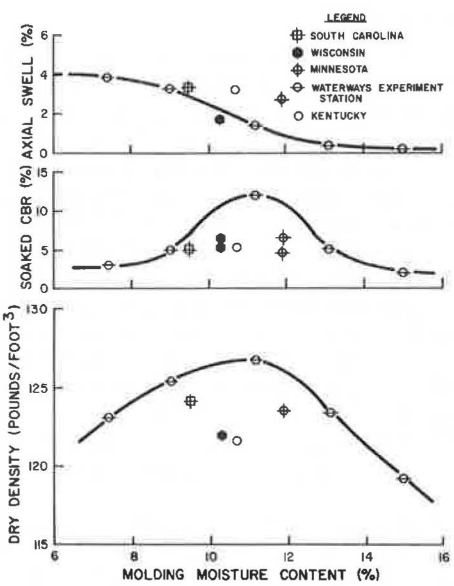
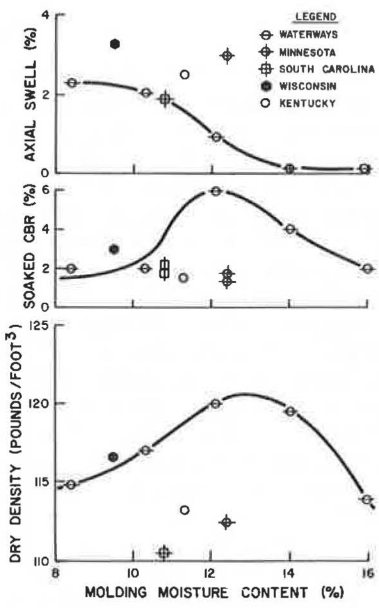


Figure 12. CBR data, AASHO soil sample (method 4, 12 blows per layer).



specimens, reported CBR values of 145, 202, 200, and 180 respectively although these states did not necessarily use these CBR's in their CBR-soil support correlation curves.

The Kentucky CBR-soil support correlation curve A (Fig. 14) was drawn by assuming a logarithmic scale between Kentucky CBR's of 5.2 and 100, corresponding to values on the soil support scale of 3 and 10 respectively. Correlation curve B was constructed by assuming a logarithmic scale between Kentucky CBR's of 5.2 and 90 and soil support values of 3 and 10 respectively.

Kentucky CBR-soil support correlation curve C (Fig. 14) was constructed in the following manner. A number of Kentucky CBR's covering the range from 3 to 90 were assumed. Equivalent axle loads (EAL's) were also assumed for a broad range of traffic conditions representing Kentucky design cruves IA through XII. The assumed EAL's were converted to AASHO-equivalent daily 18-kip axle load applications. The assumed Kentucky CBR's and EAL's and Kentucky flexible pavement design curves (11, 12) were used to obtain several combined pavement thicknesses. The structural numbers (SN) for the pavement systems obtained were calculated from the formula (1)

$$SN = a_1 d_1 + a_2 d_2$$

where a_1 and a_2 = coefficients of pavement components (equivalency factors), and d_1 and d_2 = thicknesses of bituminous surface course and base course. Values for a_1 of 0.36 and a_2 of 0.18 were used to compute the structural numbers. These values of a_1 and a_2 are currently used in pavement analyses in Kentucky. With these values of structural numbers and assumed EAL's, the AASHO design chart (serviceability index, P = 2.5) was used to determine values for the soil support corresponding to each assumed Kentucky CBR.

Comparisons of several trial pavement designs were made using the correlations shown in Figure 14, the AASHO design chart, and the Kentucky flexible pavement design charts. A range of traffic data and Kentucky CBR's were assumed for these designs. The results of these computations are given in Table 3.

SUMMARY OF FINDINGS

Classification data (Table 2) for the AASHO Road Test sample secured from a stockpile at the AASHO site were practically the same as mean classification data reported by Shook and Fang (2). Hence, the stockpile sample tested was essentially the same as that used in the embankment at the AASHO Road Test site. The two methods used to determine the Kentucky CBR of the AASHO Road Test soil, which has been assigned a soil support value of 3, produced similar results. From laboratory tests, a Kentucky CBR of 5.2 (Figs. 1 and 8) was obtained. Computations produced a value of 5.7 based on 1958 design curves (11) and 6.2 based on 1971 curves (12). For practical purposes, the AASHO Road Test crushed-stone base material, assigned a soil support value of 10, was assumed to be a 100 percent CBR material. Computed CBR values from the 1958 and 1971 curves for this material were 90 and about 80 respectively. Correlation curves were drawn using this CBR and soil support points of reference as shown in Figure 14. Based on CBR data reported by Shook and Fang and the data shown in Figures 10 through 12, CBR's of the AASHO soil for compactive energies of 55,986 (method 4), 24,992, and 11,992 (close to method 2 compactive energy) ft-lb/ft^3 appear to be 24, 12, and 6 respectively. For method 2, the CBR value (Fig. 9) of the AASHO soil appears to be about 5.

Pavement thicknesses determined from the AASHO design charts and the correlation curves (Fig. 14) relating Kentucky CBR's and soil support values and those determined from the 1958 and 1971 Kentucky design charts are reasonably similar (Table 3). Generally, the 1971 design curves yield slightly thicker pavements than those determined from either the 1958 Kentucky design curves or the AASHO charts and the correlation curves (A, B, and C).

Molding CBR specimens statically under a 2,000-psi pressure and in a manner specified in the Kentucky CBR procedure (method 5) produces CBR specimens with higher initial dry densities and higher CBR's and axial swell values than those specimens

Figure 13. CBR-compactive energy curves.

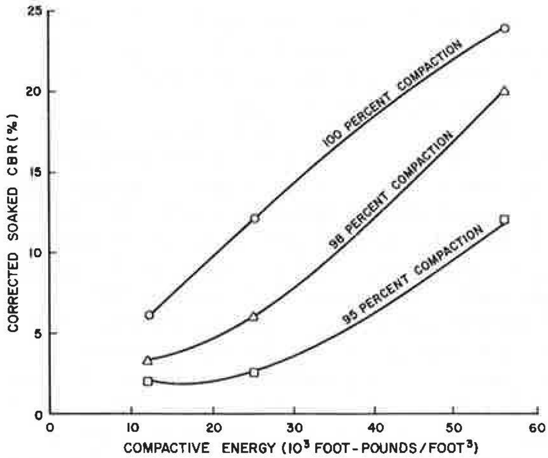


Figure 14. Soil support value-Kentucky CBR curves.

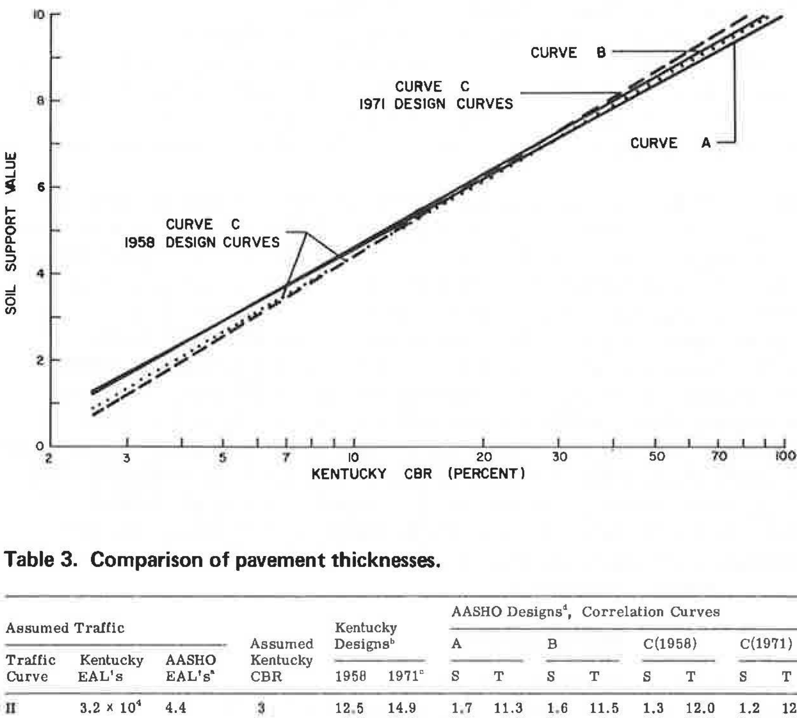


Table 3. Comparison of pavement thicknesses.

Assumed Traffic			Assumed Kentucky CBR	Kentucky Designs[b]		AASHO Designs[d], Correlation Curves							
						A		B		C(1958)		C(1971)	
Traffic Curve	Kentucky EAL's	AASHO EAL's[a]		1958	1971[c]	S	T	S	T	S	T	S	T
II	3.2×10^4	4.4	3	12.5	14.9	1.7	11.3	1.6	11.5	1.3	12.0	1.2	12.2
			5	9.8	12.6	2.9	9.6	2.9	9.6	2.6	10.0	2.5	10.1
			9	7.7	9.5	4.3	7.8	4.3	7.8	4.1	8.0	4.1	8.0
			15	6.5	6.6	5.5	6.4	5.6	6.3	5.4	6.5	5.5	6.4
VI	5.0×10^5	68	3	20.9	21.7	1.7	17.6	1.6	17.9	1.3	18.6	1.2	18.8
			5	17.3	19.0	2.9	15.1	2.9	15.1	2.6	15.7	2.5	15.8
			9	14.4	15.6	4.3	12.5	4.3	12.5	4.1	12.9	4.1	12.9
			15	12.4	12.7	5.5	10.6	5.6	10.5	5.4	10.8	5.5	10.6
X	8.0×10^6	1.1×10^3	3	27.2	29.2	1.7	26.9	1.6	27.1	1.3	28.1	1.2	28.2
			5	23.1	25.6	2.9	23.0	2.9	23.0	2.6	23.8	2.5	24.2
			9	19.5	22.0	4.3	19.5	4.3	19.5	4.1	19.9	4.1	19.9
			15	17.0	19.1	5.5	16.7	5.6	16.4	5.4	17.0	5.5	16.7
XII	3.2×10^7	4.4×10^3	3	29.8	36.1	1.7	32.7	1.6	33.1	1.3	34.4	1.2	34.6
			5	25.2	31.7	2.9	28.5	2.9	28.5	2.6	29.6	2.5	29.8
			9	21.5	27.0	4.3	24.0	4.3	24.0	4.1	24.6	4.1	24.6
			15	18.9	23.7	5.5	20.9	5.6	20.6	5.4	21.1	5.5	20.9

[a]Equivalent daily 18-kip axle loads.
[b]Total pavement thicknesses in inches.
[c]One-third of total thickness composed of asphaltic concrete.
[d]AASHO flexible pavement design chart for p = 2.0, one-third of total thickness composed of asphaltic concrete, and total pavement thickness in inches.

molded dynamically in accordance with methods 2 or 3 (Figs. 1 through 6). At method 2 optimum moisture contents, dry densities of specimens obtained by the Kentucky method (method 5) ranged from about 3 to 10 percent higher than the maximum dry densities obtained by method 1, and they averaged about 6 percent higher.

In the Kentucky CBR tests, the maximum CBR occurred slightly to the wet side of optimum moisture content. Maximum Kentucky CBR's generally occurred near the peak of the method 1 molding moisture content-dry density curve. For the dynamically compacted samples, the maximum CBR usually occurred at optimum conditions. Generally, for samples compacted at 2,000 psi and for method 1 optimum moisture contents, Kentucky CBR's in the range from 4 to 12 were approximately the same as or lower than CBR's of specimens molded by method 2, although in two cases they were slightly higher. Kentucky CBR's averaged about 15 percent lower than method 2 CBR's. The comparatively higher axial swells associated with the Kentucky CBR's are apparently a partial result of the elastic rebound of the specimens, the fact that the specimens are soaked until swell virtually ceases, and the absence of shear strains during compaction.

As shown in Figures 2 through 5, method 2 maximum dry densities were slightly higher and optimum moisture contents were lower than those obtained by method 1. In the case of the Adair County soil (Fig. 6), the maximum dry densities and optimum moisture contents for methods 1 and 2 were about the same. For samples molded in accordance with method 3, dry densities were slightly lower, optimum moisture contents higher, and CBR's lower than those obtained by method 2.

Influence of the method of compaction—static or dynamic—on CBR values is strongly indicated in Figure 3. In this series of tests, specimens were molded statically (method 6) to conform with the dry density-molding moisture content curve obtained by method 2. Static compaction pressures ranged from a high of 180 to a low of 99 psi. CBR's obtained in this manner were as much as 40 percent lower than those resulting from method 2.

As reported by Shook and Fang (2), average maximum densities and optimum moisture contents of the as-constructed embankment soil at the AASHO Road Test site were generally lower than those obtained from method 1, and field CBR's were also lower. For "optimum construction," the embankment had a dry density of 117 lb/ft^3. For method 1 compaction, the dry density was 119 lb/ft^3. Hence, the as-constructed dry density was about 2 percent lower than method 1 dry density. As shown in Figure 13, a 2 percent decrease in dry density resulted in a 20 to 50 percent decrease in CBR. For "P_{20} as constructed" (20th percentile, or density below which 20 percent of test values lie, or moisture content above which 20 percent lie), a density of 112 lb/ft^3 and a CBR of 2 were reported. The P_{20} field dry density was about 6 percent lower than method 2 dry density, and P_{20} field CBR of 2 was 60 percent lower than method 2 CBR of 5. In Figure 13, a 5 percent decrease in dry density results in roughly a 50 to 60 percent decrease in CBR. Consequently, the apparent discrepancies between field and laboratory CBR's (dynamic compaction) may be the result of differences in field and laboratory densities and moisture contents.

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