CRD-C 656-95

Standard Test Method for Determining the California Bearing Ratio and for Sampling Pavement by the Small-Aperture Procedure*

1. Scope.

This test method is used to determine layer thicknesses and in-place California Bearing Ratio (CBR) and to obtain samples of the pavement layer, base, subbase, and subgrade for laboratory testing. The test method is applicable to both asphalt concrete (AC) and portland-cement concrete (PCC) pavements.

2. Apparatus.

2.1 *Drilling.* Drill rig suitable for coring AC and PCC pavements using 6.in.-diameter thin-walled diamond core barrels and augering 6-in.-diameter holes through base, subbase, and subgrade to depths up to 10 ft; hydraulic lifting jacks to provide a stable work platform; and a sliding-base that allows coring of pavements, removal of the drill assembly from the hole to perform tests, and automatic realinement of the drill assembly for further advancement of the hole (see Figure 1).

2.2 *Core barrels.* Thin-wall diamond core barrels with barrel lengths suitable for the pavement thickness being encountered (see Figure 2).

2.3 *Core catcher.* Core-catcher device for removal of the core once coring is complete (see Figures 3 and 4).

2.4 *Suction device.* Suction device for removal of drill water for the core hole.

2.5 *Auger.* Modified earth auger for coring through granular base and sub-base layers. Auger should be 5.5 in. in diameter, and the cutting edge should have a flat end with a squared-off cutting edge (see Figure 5). The cutting edge should be face-hardened to minimize wear when augering hard aggregates.

2.6 *Cleanout device.* Cleanout device (see Figure 6) for shallow cutting into the subgrade soil to provide an undisturbed surface and for removal of loose material. A handle is turned to close the opening in the cleanout tool so that all loose material can be removed. This device is used primarily in fine-grained materials.

2.7 *CBR equipment.* CBR equipment for field in-place tests (see CRD-C 654-95) to be used for obtaining CBR through the 6-in.-diameter core hole. The aluminum I-beam to which the CBR loading jack is attached must be modified so that it can be quickly attached to the frame of the drill rig. In order to attach the CBR beam, the drill rig is moved back on its sliding base. The CBR setup is shown in Figure 7. Additional weight may be required on the drill rig frame to perform CBR tests on high-strength soils.

Figure 1. Trailer mounted drill rig

Figure 2. Close-up of pavement drill

*Formerly MIL-STD-621A, Method 107, 22 December 1964

Figure 3. Removing a pavement core

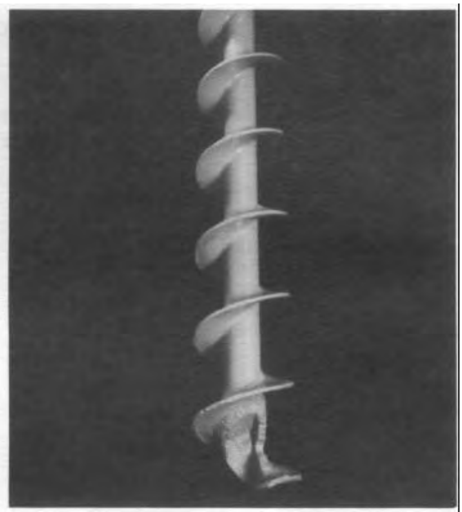

Figure 5. Modified earth auger

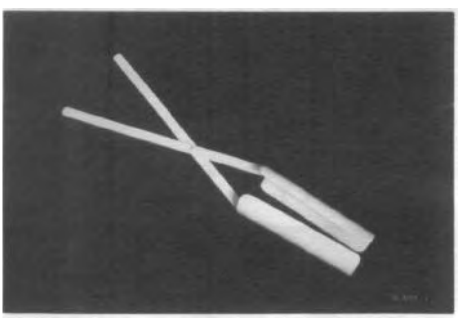

Figure 4. Core catcher tool

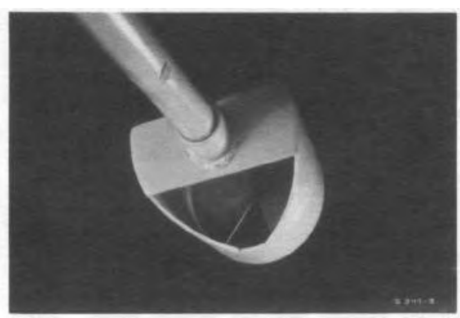

Figure 6. Cleanout device

3. Test Procedure.

3.1 *Coring and cutting technique.* A 6-in.-diameter core hole has been found to be the optimum size to provide adequate space to perform the tests on underlying pavement layers and yet result in minimum disturbance to the pavement. The pavement layer is cored using a thin-walled diamond-core barrel with water pumped into the core barrel to flush out the cuttings. Attempts to use compressed air to flush out the cuttings have not been successful. The corecatcher tool shown is used to remove the pavement core. The excess drill water is immediately removed from the hole using the suction device. Generally, the drill water only penetrates a fraction of an inch into the underlying layer; removal of this material is discussed below. In areas where the underlying layer is known or suspected to be highly susceptible to small amounts of moisture, the water supply can be turned off just before cutting completely through the pavement. This, however, may require cutting one core to determine the pavement thickness, then a second one for testing purposes. Further advancement of the test hole is made with the modified earth auger. Caution must be used in the auger operation to preclude excessive cutting into the next layer of the pavement structure. The base and subbase layers are removed a few inches at a time, and the material removed is examined to determine when the next layer is encountered. Generally, there is a distinct change in color or aggregate gradation between layers. Figure 8 shows the technique used to clean material from the auger without permitting material to fall back into the hole. The cleanout device was developed for cutting slightly into the soil to provide an undisturbed surface and for removal of loose material. A handle is turned to close the opening in the cleanout tool so that all loose material can be removed. This device is applicable primarily to fine-grained materials.

3.2 *Small-aperture tests.* The strength of various pavement components is determined with the CBR test. The small-aperture procedure uses the CBR test on both flexible and rigid pavements. Once the pavement core and drill water have been removed, the CBR test is performed on the underlying layer. When a thin layer of the material becomes wet due to the drill water, the wet material is removed either with the cleanout tool or with a small trowel. When a granular material is encountered, such as crushed-stone base course, a thin layer of fine sand is used as a leveling course to provide uniform loading beneath the CBR piston. The drill rig piston is not to be used to perform the CBR test. A conventional CBR loading jack adapted to be quickly attached to the drill rig frame is used. The CBR jack is mounted to the beam, which in turn is mounted on the drill rig which provides counterweight. During CBR testing the sliding base of the rig is moved away from the test hole. Additional weight may be added to the drill rig frame as needed to provide counterweight for testing high-strength materials. Adjustments may be required to allow centering of the CBR piston in the hole. After completion of the CBR test on the first layer, the hole is advanced to the surface of the next layer, and the cleanout tool is used to clean loose material and to obtain an undisturbed area for the next CBR test. The standard CBR test performed in a test pit requires the use of surcharge weights placed around the CBR piston to replace the overburden material that is removed when excavating the test pit; however, the surcharge weight is not necessary in the small aperture tests. At each CBR test location, determination of water content and density of the material is also desirable for evaluation purposes. A sample of the material taken during the augering operation is placed in a contamer for water content determination. Also, samples are obtained in the same manner for identification and classification tests to be made in the laboratory. Conventional methods of density determination with the sand cone or water balloon equipment are not adaptable to small-aperture testing. Therefore, nuclear density devices specially adapted for measurement in core holes may be used, or density determinations can be made from undisturbed samples of fine-grained soils obtained with a Shelby tube sampler.

Figure 7. CBR test setup in small aperture

Figure 8. Shovel under auger to prevent fallback

3.3 *Number of tests.* Three core holes should be made in the same area. Within each core hole CBR tests should be made at the top of each granular layer (base and subbase) and the subgrade, and at increments of 6 in. within a layer when the thickness of the layer exceeds multiples of 6 in. CBR tests should be made in the subgrade at increments of 12 in. to a depth of at least 24 in. below the top of the subgrade.

4. Calculations.

4.1 *Test calculations.* The CBR from each test shall be calculated as prescribed in CRD-C 654-95.

4.2 *Corrections for core hole measurements. The* CBR calculated for the small aperture core hole measurements is corrected to standard CBR values by use of Figure 9.

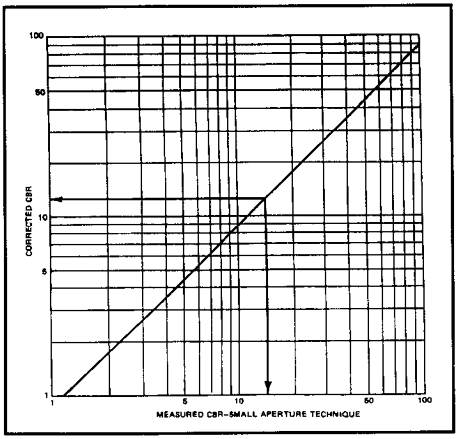

Figure 9. CBR adjustment curve