



PDHonline Course C264 (4 PDH)

Laboratory Testing and Interpretation of Rock Properties

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2020

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A color bar chart is often desirable in the photograph to provide indications of the effects of variation in film age, film processing, and the ambient light source. The photographer should strive to maintain uniform light conditions from day to day, and those lighting conditions should be compatible with the type of film selected for the project.

Rock Classification

The rock type and its inherent discontinuities, joints, seams, and other facets should be documented. See Section 4.7 for a discussion of rock classification and other information to be recorded for rock core.

Recovery

The core recovery is the length of rock core recovered from a core run, and the recovery ratio is the ratio of the length of core recovered to the total length of the core drilled on a given run, expressed as either a fraction or a percentage. Core length should be measured along the core centerline. When the recovery is less than the length of the core run, the non-recovered section should be assumed to be at the end of the run unless there is reason to suspect otherwise (e.g., weathered zone, drop of rods, plugging during drilling, loss of fluid, and rolled or recut pieces of core). Non-recovery should be marked as NCR (no core recovery) on the boring log, and entries should not be made for bedding, fracturing, or weathering in that interval.

Recoveries greater than 100 percent may occur if core that was not recovered during a run is subsequently recovered in a later run. These should be recorded and adjustments to data should not be made in the field.

Rock Quality Designation (RQD)

The RQD is a modified core recovery percentage in which the lengths of all pieces of sound core over 100 mm (4 in) long are summed and divided by the length of the core run. The correct procedure for measuring RQD is illustrated in Figure 3-20. The RQD is an index of rock quality in that problematic rock that is highly weathered, soft, fractured, sheared, and jointed typically yields lower RQD values. Thus, RQD is simply a measurement of the percentage of "good" rock recovered from an interval of a borehole. It should be noted that the original correlation for RQD (Rock Quality Designation) reported by Deere (1963) was based on measurements made on NX-size core. Experience in recent years reported by Deere and Deere (1989) indicates that cores with diameters both slightly larger and smaller than NX may be used for computing RQD. The wire line cores using NQ, HQ, and PQ are also considered acceptable. The smaller BQ and BX sizes are discouraged because of a higher potential for core breakage and loss.

Length Measurements of Core Pieces

The same piece of core could be measured three ways: along the centerline, from tip to tip, or along the fully circular barrel section (Figure 3-21). The recommended procedure is to measure the core length along the centerline. This method is advocated by the International Society for Rock Mechanics (ISRM), Commission on Standardization of Laboratory and Field Tests (1978, 1981). The centerline measurement is preferred because: (1) it results in a standardized RQD not dependent on the core diameter, and (2) it avoids unduly penalizing of the rock quality for cases where the fractures parallel the borehole and are cut by a second set.

Core breaks caused by the drilling process should be fitted together and counted as one piece. Drilling breaks are usually evidenced by rough fresh surfaces. For schistose and laminated rocks, it is often difficult to discern the difference between natural breaks and drilling breaks. When in doubt about a break, it should be considered as natural in order to be conservative in the calculation of RQD for most uses. It is noted that this practice would not be conservative when the RQD is used as part of a ripping or dredging estimate.

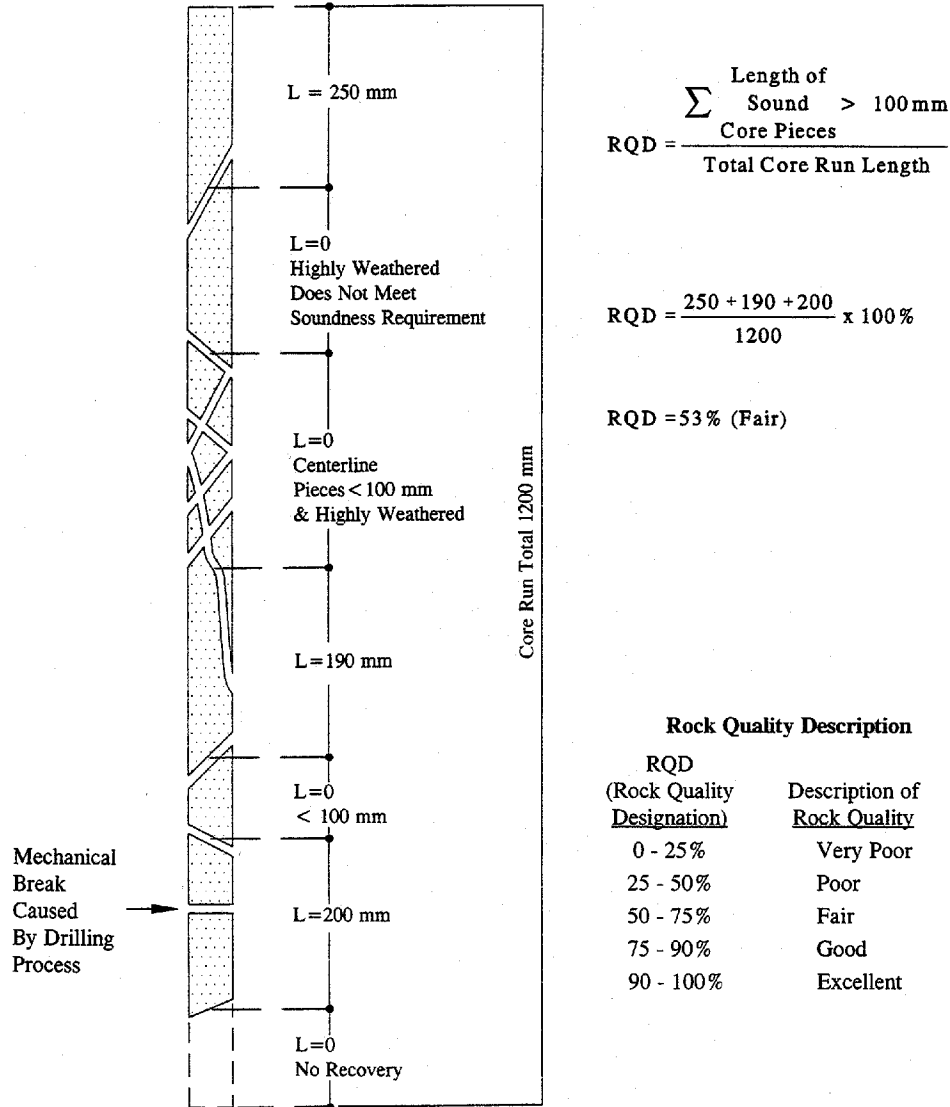


Figure 3-20. Modified Core Recovery as an Index of Rock Mass Quality.

Assessment of Soundness

Pieces of core which are not "hard and sound" should not be counted for the RQD even though they possess the requisite 100 mm (3.94 in) length. The purpose of the soundness requirement is to downgrade the rock quality where the rock has been altered and weakened either by agents of surface weathering or by hydrothermal activity. Obviously, in many instances, a judgment decision must be made as to whether or not the degree of chemical alteration is sufficient to reject the core piece.

One commonly used procedure is not to count a piece of core if there is any doubt about its meeting the soundness requirement (because of discolored or bleached grains, heavy staining, pitting, or weak grain boundaries). This procedure may unduly penalize the rock quality, but it errs on the side of conservatism. A second procedure which occasionally has been used is to include the altered rock within the RQD summed percentage, but to indicate by means of an asterisk (RQD*) that the soundness requirements have not been met. The advantage of the method is that the RQD* will provide some indication of the rock quality with respect to the degree of fracturing, while also noting its lack of soundness.

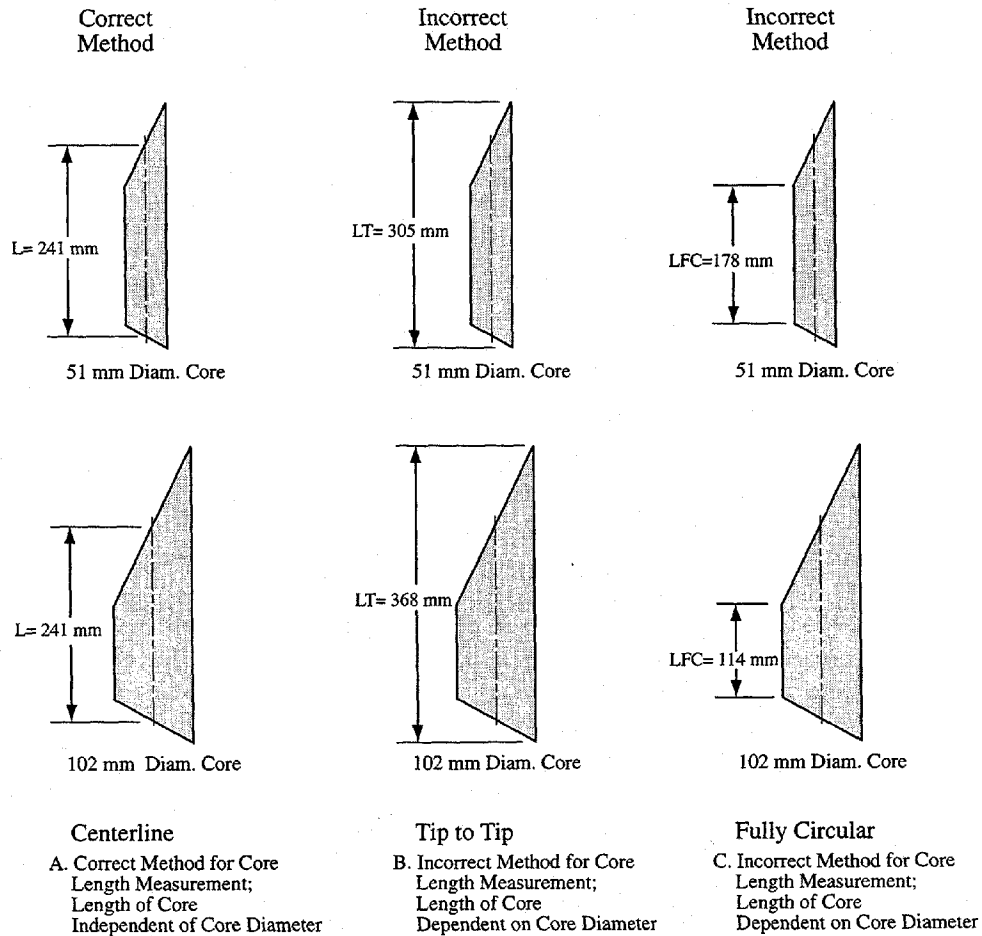


Figure 3-21. Length Measurement of Core RQD Determination.

Drilling Fluid Recovery

The loss of drilling fluid during the advancement of a boring can be indicative of the presence of open joints, fracture zones or voids in the rock mass being drilled. Therefore, the volumes of fluid losses and the intervals over which they occur should be recorded. For example, "no fluid loss" means that no fluid was lost except through spillage and filling the hole. "Partial fluid loss" means that a return was achieved, but the amount of return was significantly less than the amount being pumped in. "Complete water loss" means that no fluid returned to the surface during the pumping operation. A combination of opinions from the field personnel and the driller on this matter will result in the best estimate.

Core Handling and Labeling

Rock cores from geotechnical explorations should be stored in structurally sound core boxes made of wood or corrugated waxed cardboard (Figure 3-22). Wooden boxes should be provided with hinged lids, with the hinges on the upper side of the box and a latch to secure the lid in a closed position.

Cores should be handled carefully during transfer from barrel to box to preserve mating across fractures and fracture-filling materials. Breaks in core that occur during or after the core is transferred to the core box