CORE-BASED STRENGTH LOGS

Core Lab
RESERVOIR OPTIMIZATION

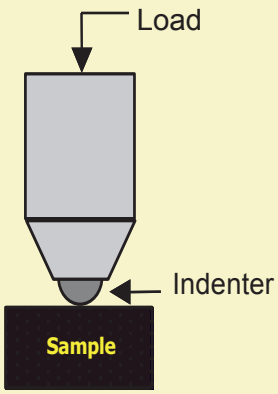
Core-based strength logs are a non-destructive solution to probe relative strength of cores over large depth intervals. Two primary methods used to measure core strength are Brinell hardness and ultrasonic velocity. Both are important in identifying the weakest interval within the formation.

Benefits of Core-Based Strength (CBS) Logs:

- Uses ASTM and industry-wide standard tests (Brinell hardness & acoustic velocity) to determine UCS data versus depth
- Ultrasonic bench top test probes the full diameter of core rather than just the top surface (greatly reduces data scattering)
- Provides high resolution logs with multiple rock mechanical parameters (V_p, V_s, E_d, UCS, BH)
- Non-destructive strength profile versus depth

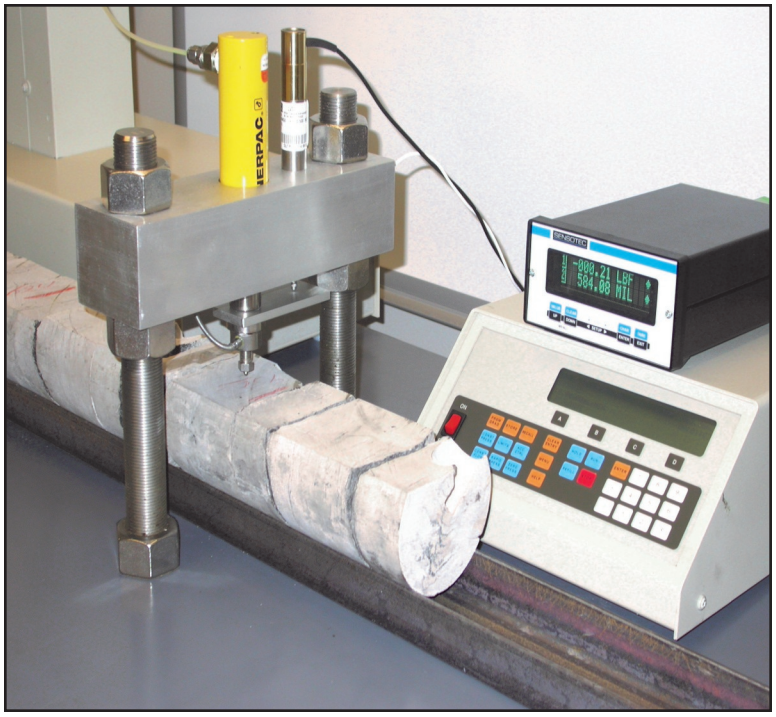
Brinell Hardness Test

The Brinell hardness test can be performed on samples with a variety of shapes and sizes. Brinell hardness is a measure of the resistance of the rock to indentation and has a direct correlation to rock strength.

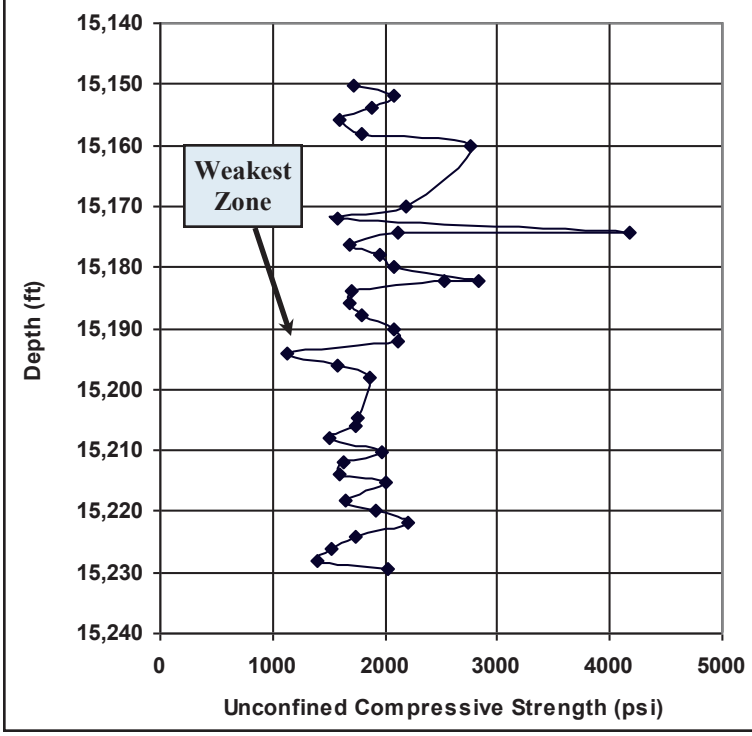


The Brinell hardness test is performed by applying measured load to a spherical steel-ball (indenter) that is in contact with the sample. The depth of ball penetration is recorded along with the applied load. The hardness value is determined from the ratio of applied load to the indentation area and is expressed as kg/mm^2.

Brinell Hardness Test Apparatus



UCS as Determined from Brinell Hardness Using Slabbed Core Sections



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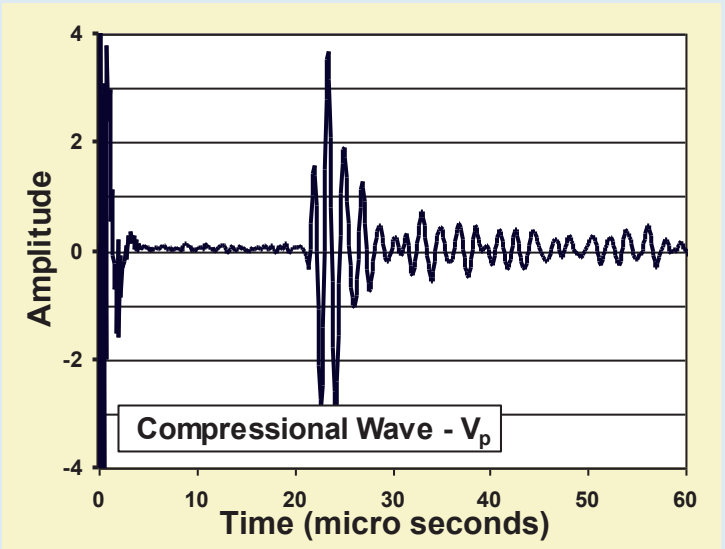
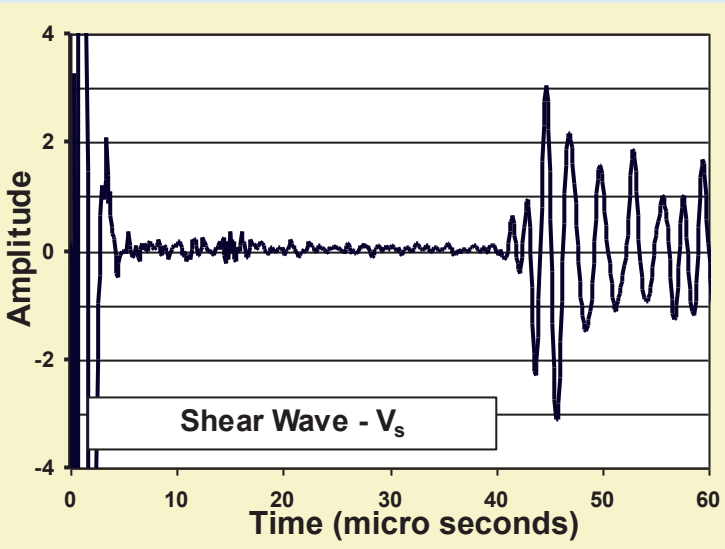
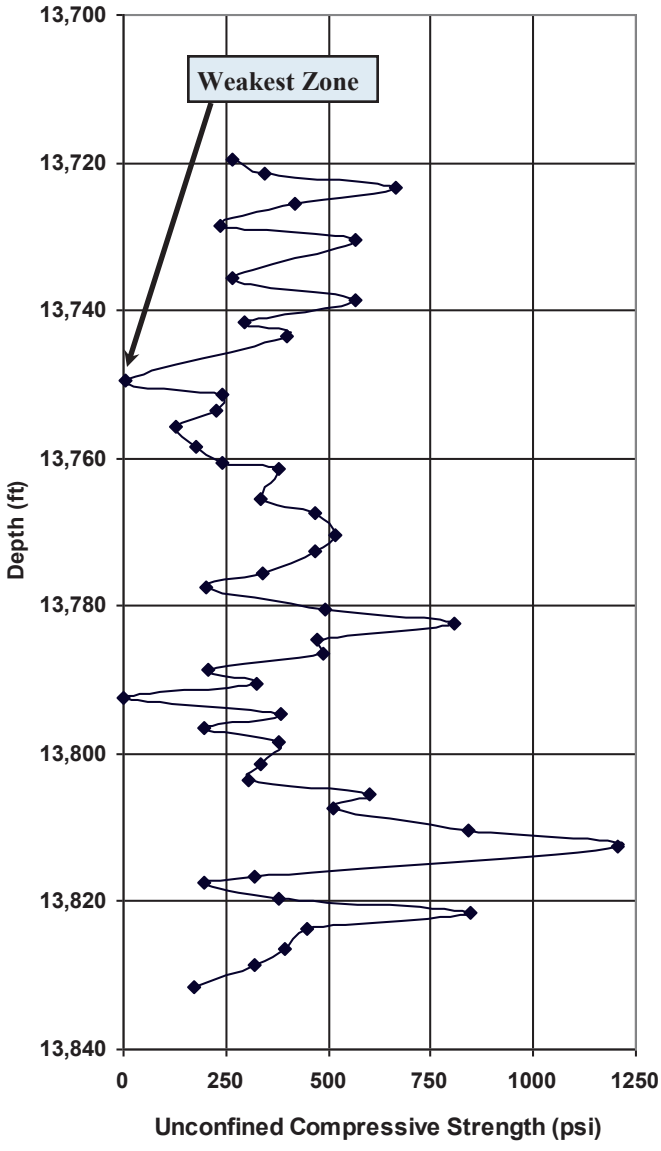
Sonic Velocity is a direct indication of the degree of cementation for the rock, which, in turn, controls the rock strength. Sonic velocities are an industry standard for indirect determination of strength.

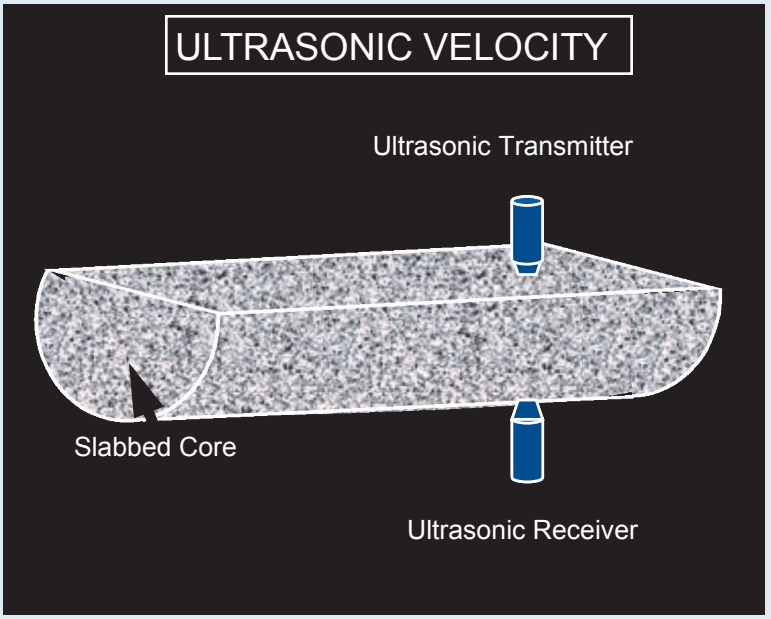




Calculated UCS Versus Depth from Acoustic Velocities



ULTRASONIC VELOCITY



Unconfined compressive strength can be indirectly determined from the acoustic velocities that are measured across the diameter of whole cores or slabbed cores (i.e., butt sections) as well as routine core plugs.

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