

Fulcrum Technology Improves Cement Bond Index by 55% in Horizontal Wells, Permian Basin

Cement-conveyed frac performance technology efficiently mitigates hole-cleaning challenges by altering mud mobility—without special equipment or cement designs

CHALLENGE

Improve cement quality around 5½-in production casing in horizontal environment with mud removal challenges—without increasing job complications.

SOLUTION

Cement the wells using Fulcrum* cement-conveyed frac performance technology.

RESULTS

Improved average cement bond index (BI) to 0.87 as compared with 0.56 in conventionally cemented wells, with no change in operational complexity.



Oil-based mud and centralization limitations result in mud channeling

A Permian Basin operator drills long horizontal wells with 10,000-ft laterals to accommodate multistage plug-and-perf completions with hydraulic fracturing. The operator is concerned about the possibility of zone-to-zone fracture communication behind the casing if cement bond quality is inadequate.

Moreover, diesel-based muds that are commonly used in the Permian Basin for horizontal sections complicate the ability of conventional cements to achieve optimal zonal isolation. To mitigate the mud challenge, the operator uses industry-recognized cementing best practices: running casing with at least one centralizer per joint for good standoff, pumping spacers with surfactants ahead of cement, and optimizing cement placement using CEMENTICS* zonal isolation software models to ensure that the rheological parameters optimize mud removal.

Still, the cement BI for the operator's wells is lower than ideal, often falling in the range of 0.5 to 0.6. The operator tried rotating and reciprocating the casing to improve mud removal, but this operation is limited in use due to safety and logistics concerns.

To optimize zonal isolation and cement bonding without adding operational complications and costs, the operator asked Schlumberger for a new solution.

Cement system alters fluid mobility in mud channels

Schlumberger recommended the Fulcrum technology, a cost-effective mud-sealing solution that enhances zonal isolation in well sections where nonaqueous fluid remains after cementing. The system can be blended with any cement across a wide density range and is compatible with most cementing additives.

While the cement cures, it interacts with nonaqueous drilling fluids, reducing fluid mobility in any channels that may have formed. The system uses conventional equipment, blending, and cement design considerations, making it easy to use in the field.

Logs indicate bond index improvement and minimized channeling

The new system was used in four new horizontal wells, and the results were compared with two nearby wells cemented using conventional 13.2-lbm/galUS lightweight slurry.

All six wells had similar designs and execution. The open hole was drilled with a 6¼-in diameter for 5½-in production casing. Wells were circulated before cementing with 9.3-lbm/galUS oil-based mud. Casing in all wells was run with one centralizer per joint.

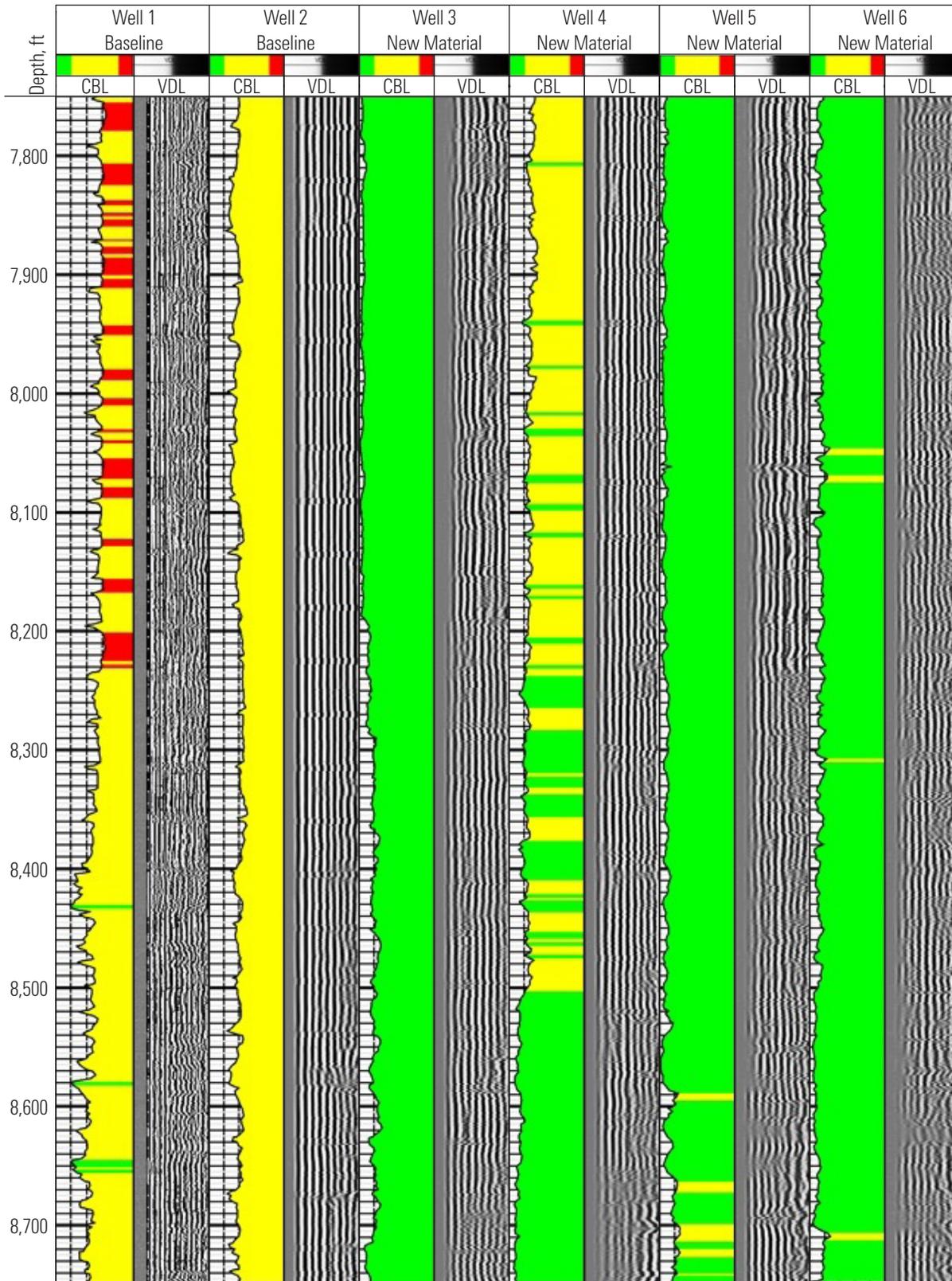
For each well, the pumping schedule included 110 bbl of 9.5-lbm/galUS MUDPUSH Express* stable, continuously mixed mud removal system ahead of the cement. No lead slurry was used. Cement was mixed, pumped, and displaced without any issues.

Cement bond logs were run to evaluate cement quality above the curve. The logs for the reference wells gave a calculated BI of 0.56, and logs for the wells cemented with Fulcrum technology had an average BI of 0.87, which indicated excellent improvement in cement.

The Fulcrum technology required no special equipment, personnel, or operational changes, making the operations as efficient and cost effective as any standard operation.

Additional details of the work are described in SPE-191561.

CASE STUDY: Fulcrum technology improves cement bonds in horizontal wells by 55%, Permian Basin



The Fulcrum technology significantly improved cement bonding in Wells 3 through 6 as compared with the baseline Wells 1 and 2 that used conventional cement. Green indicates good bonding, yellow is partial bonding, and red is poor bonding.

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