

Case study: Northwest China

MAX-BRIDGE bridging solution stabilized wellbore while drilling two complex deep wells, saving \$1.13 million USD in rig costs

The customer faced significant wellbore instability issues due to a narrow operating window, increasing the risk of massive losses and formation collapse. In some wells, the client countered these problems by implementing a two-casing structure at the 1200–1400 m (3,940–4,600 ft) drilling interval. However, this solution did not completely address the issue.

Due to the risk of faults in the formation, a customized solution was required to work in both micro fractures and mini faults. The solution would also have to be compatible with the current water-based mud (WBM) system and minimize any rheology changes.

Baker Hughes worked with the client to collect information on previous product solution attempts. The client also provided formation data for lab testing and modeling purposes.

After conducting simulations to accurately predict and manage circulating pressure windows with **BOREWISE™ engineering software** and determine product formulations to strengthen the wellbore using **BRIDGEWISE™ engineering software**, Baker Hughes proposed its **MAX-BRIDGE™ advanced bridging solution**. MAX-BRIDGE combines the **MAX-SHIELD™/NANOSHIELD™ deformable sealing polymer**, **BRIDGEFORM™ wellbore strengthening system**, **SOLUFLAKE™ D series of flaked calcium carbonate**, and **LC-LUBE™ series of sized synthetic graphite additives**. Customized to any drilling mud, the field-proven solution reduces pore pressure transmission and seals

and plugs microfractures in shale and low porosity sands.

The product mix were tested with the current WBM to verify the impact on rheology and its effectiveness at reducing fluid loss. As a result, MAX-BRIDGE solutions added at 1.8% and 3% dosages to the mud system maintained the fluid's density and rheological properties within acceptable application limits. Laboratory test results also showed that the addition of MAX-BRIDGE reduced fluid loss by 43% while maintaining rheology.

A MAX-BRIDGE solution containing the various additives was mixed and applied to the WBM throughout the drilling operation. A concentrated MAX-BRIDGE pill was also mixed and pumped before each trip to boost wellbore stability. The solution increased mud weight from 11.6 to 11.9 ppg (1.39 to 1.43 sg), thus minimizing the risk of saltwater kicks to the hole.

The client drilled through the entire interval with a consistent mud weight and maintained good wellbore stability without any losses. In offset wells drilled in the same interval, induced losses of 150 cu m (5,300 cu ft) were common.

The improved well stability allowed the client to combine two casing sections, thus eliminating one casing size per well. The ability to maintain wellbore stability while drilling gave the client confidence to drill an additional 50 m (164 ft) and 160 m (525 ft) of lateral length in each well, with no fluid losses.

The MAX-BRIDGE solution saved more than 38 days of drilling time in two

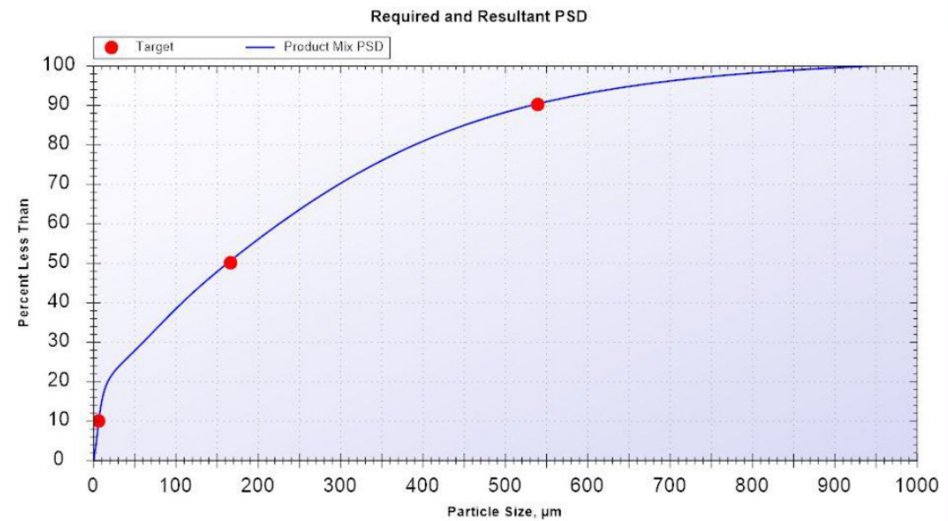
Challenges

- Avoid borehole instability while drilling through fracture/fault zone
- Minimize risks of differential sticking, downhole losses, and well control issues
- Lower nonproductive time and operational costs due to wellbore instability risks

Results

- Eliminated one casing section vs. plan for each well
- Extended mud weight window by 0.04 sg (0.33 ppg), overcoming the risk of saltwater kick
- Added 50 m (164 ft) for well 1 and 160 m (525 ft) for well 2 to planned TD
- Eliminated 38+ rig days vs. plan in two wells
- Saved operator an estimated \$1.13 million USD
- Observed no losses, differential sticking, or well control issues

wells, permitted effective well logging without restriction due to tight spots, and allowed casing to be run to bottom in 1.5 and 1.8 days for wells 1 and 2, respectively. The efficiency and time savings afforded by the solution saved the operator an estimated \$1.13 million USD in well construction costs for the two wells.



The Baker Hughes fluids’ team performed a BRIDGEWISE simulation to customize the wellbore strengthening solution and confirm its compatibility with the WBM system and its ability to address both microfractures and mini faults.