Retrospective Analysis

Challenge

- Historical drilling data analysis
- NPTs root cause analysis
- Continues improvement of best practices and mitigation recommendations to excel well construction

Solution

- Retrospective analysis tools
- Live digital twin
- Evaluation of effective loads at a drill bit and associated MSE

Results

- Underlying root causes of Non-Productive Time are identified and eliminated
- Reduced number of unplanned BHA runs
- Automated data replay and dysfunctions /NPT root cause analysis

CASE OVERVIEW

A world-class drilling engineering advisor company, providing consultancy in ERD wells drilling, and well construction services on turnkey well construction projects, faced a problem in identifying the root cause of extensive time spent while drilling out casing shoes at multiple wells of a national oil and gas company. Since the company didn't have the authorization to gain real-time data feeds, the analysis had to be done after the fact with a limitation to drilling contractor EDR data. In order to optimize the SME resources utilization to perform the analysis of Terabytes of drilling data, the company decided to leveraged the ECO System automated retrospective analysis functionality, allowing to perform analysis of the entire well construction cycle in accelerated simulation mode. Replay analysis of a month of drilling data is performed within 24 hours, with the possibility of generating reports during the analysis.

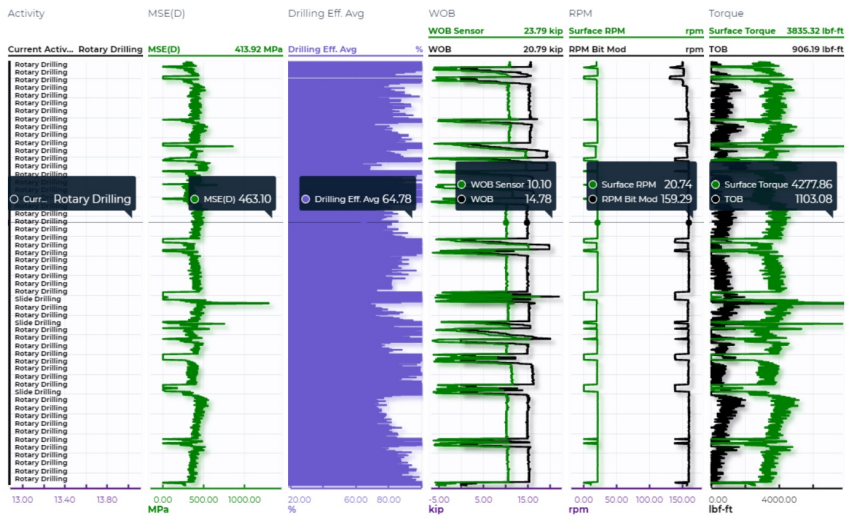
- At the client's request, within an hour, the ECO platform has been deployed on a regional commercially available cloud.
- Within a single day, all data required to generate a digital twin of a well and the EDR LAS time series data were uploaded to the system

AUTOMATED ANALYSIS CONCLUSIONS

Automatic daily reports with engineering analysis results and respective data charts were generated along the replay analysis. Based on the results obtained, in particular, during casing shoe drill out, the following insight has been identified:

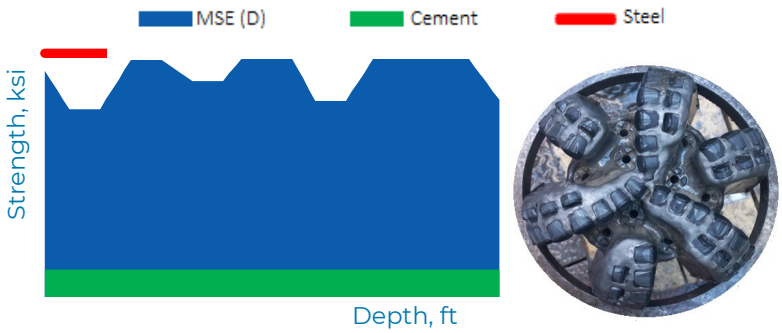
- Excessive Weights On Bit,
- discrepancy between the Surface EDR WOB, "latched" hook load values based WOB and the effective weight transferred to the drillbit.
- no evidence of drilling dysfunction, associated with BHA whirl or excessive stick-slip events downhole.
- Extraordinary high hardness of the casing shoe, strengths equivalent to a steel-reinforced material.

The digital twin analysis made it possible to determine the effective loads at the bit and evaluate downhole MSE and associated drilling efficiency.



In the absence of complications - observations of drilling dysfunctions and increased wear of the bit, the MSE values calculated from bottom hole loads are corresponding to the strength of the material/formation being drilled. The resulting drilling efficiency compared to the expected strength values of cement and tooling revealed 65% drilling efficiency, and strength values corresponding to the steel reinforced structure.

According to the available field daily reports, the revision of the BHA after the unplanned trips reported that the bit and PDM were in satisfactory condition, and there was no metal debris evidence on the surface flow out.



Depth Based Downhole MSE log versus cement and steel strength

The result of a retrospective analysis trigged an investigation of the casing shoe tools design. The conducted study confirmed that high-strength steel was used in one of the vendor's components, which indeed was the underlying cause of the mysterious and randomly appearing NPT on the wells where the tool has been deployed.

Well construction time has improved by 80 days per year as a result of switching to a new vendor casing shoe tools.

18 hours

Time improvement in an intermediate well section

1 day/hour

rate of historical data analysis

80 days

Of NPT prevented based on insights gathered through retrospective analysis

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