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SPECIAL FOCUS: ADVANCES IN DRILLING

Rethinking WOB in extended laterals

What if your WOB looks right, but the weight reaching the bit isn't?

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As a lateral extends, changing frictional forces can alter how effectively applied surface weight is transferred through the drillstring. The result can be difficult to recognize in real time: surface-indicated WOB remains within the expected range while hookload inadvertently rises, and ROP begins to decline farther into the lateral.

Ascent Resources – Utica, LLC developed and implemented a drilling process guided by forecasted hookload across its Appalachian fleet. The approach helped sustain high ROP farther into the lateral, improved footage per day, and delivered longer wells in less time. Building on this work, Ascent and AKM collaborated to develop Lateral-IQ, a patent pending app within AKM-AI's drilling analytics platform that provides crews with a depth-based hookload reference. The tool helps Ascent's team evaluate how drilling parameters affect performance while accounting for the limitations of surface-indicated WOB.

The issue is not the absence of a torque-and-drag model. Those models remain the right tool for well design. The issue is the reference used while drilling. In a long lateral, a weight indication that was reasonable near landing point can become a poor indication of the load being transferred to the bit. The work below describes how that change appears in drilling data, how a depth-based hookload reference is established for the rig, and what Ascent observed after applying the process across its fleet.

RECOGNIZING THE LOSS OF WEIGHT TRANSFER

Surface-indicated WOB is a derived measurement, based on the difference between a reference hookload and the hookload observed while drilling. In a vertical or relatively low-drag environment, that relationship can provide a useful indication of applied weight. In an extended lateral, however,

number. The bit may be receiving less of the weight than the setpoint implies.

The loss is easy to miss in a daily report. When WOB remains within the planned range, a decline in ROP may be attributed to changes in formation or bit condition rather than reduced weight transfer. However, comparing surface-indicated WOB with the hookload trend can reveal signs of deteriorating weight transfer.

The wells that prompted this work for Ascent showed a consistent pattern: surface WOB appeared normal, while hookload increased and ROP declined, as you got farther into the lateral, Fig. 1. As the lateral extends, frictional forces acting on the drillstring can change the relationship between surface hookload and the load transferred through the string. A WOB reference established at a connection represents conditions at that point in time; as those conditions evolve with depth, the same surface-indicated WOB may no longer represent the same weight-transfer condition at the bit.

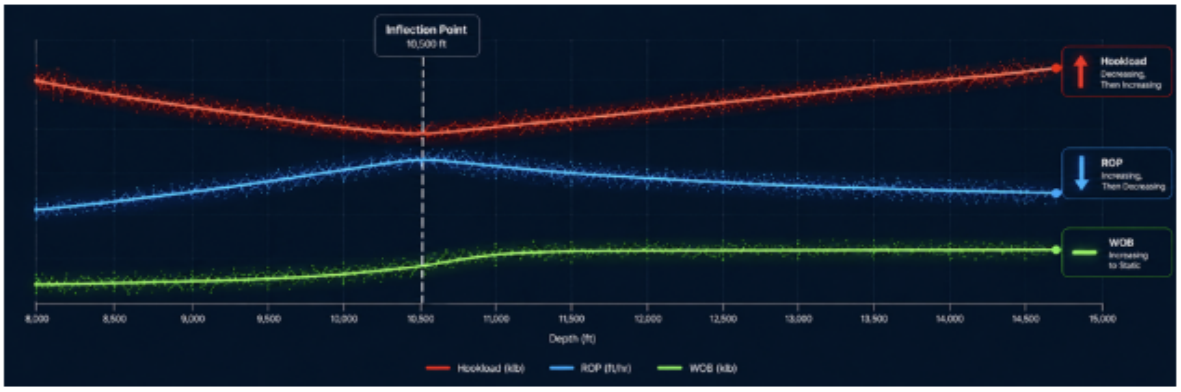


Fig. 1. Hookload increasing, as ROP declines farther into the lateral.

Figure 1 is that pattern on a depth scale. Hookload rises, as measured depth increases, and ROP falls over the same interval. The surface WOB indication did not have to leave a normal range for the loss of transfer to be visible. Hookload is the channel that moves as drag builds. A declining hookload trend accompanied by sustained ROP represents the desired response: the surface behavior is consistent with maintaining weight transfer, as the lateral extends. The rising hookload case is what indicated that the displayed weight and the weight at the bit had separated.

A HOOKLOAD REFERENCE THE RIG CAN USE

Lateral-IQ (Patent Pending U.S. 64,231,161) provides a depth-based hookload trend, designed to account for the changing frictional effects observed, as the lateral extends. Presented in an easy-to-follow chart, it suggests the on-bottom hookload that the crew should see while drilling ahead at a given depth. This baseline gives the crew a reference for adjusting drilling parameters and evaluating their effect on performance.

During development of this process, considerable effort was devoted to validating hookload as the primary reference for evaluating weight transfer to the bit. Using established torque-and-drag modeling principles, the team confirmed that, under consistent drilling and wellbore conditions, on-bottom hookload should exhibit a predictable, approximately linear decline as lateral length increases. As additional drillpipe is introduced into the lateral, each incremental foot contributes a

relatively consistent amount of frictional drag, resulting in a cumulative increase in resistance along the drillstring. This relationship is expected to remain consistent through total depth (TD), barring significant changes in wellbore geometry or conditions, such as excessive doglegs, washouts, or other anomalies. This independent engineering validation reinforced the trends observed in actual drilling data and provided confidence that a linear, depth-based hookload reference could be established. More importantly, it provided a basis for quantifying the expected reduction in hookload per foot of lateral drilled to maintain consistent weight transfer to the bit face.

Torque is carried as a companion trend, so a change in hookload can be read against torque, rather than against ROP alone. Additionally, any other parameter can be brought in for evaluation. If a team has a history of manipulating differential pressure, flowrate, rpms, etc., they can evaluate these alongside the hookload reference, to ensure they are operating at optimal conditions. Ascent pulls in gamma-ray data to distinguish ROP changes caused by formation changes from those associated with drilling-parameter adjustments.

HOW AI SUPPORTS THE DRILLING ENGINEER

Lateral-IQ's Artificial Intelligence (AI) uses the well's electronic drilling recorder (EDR) data to project a starting value and depth trend for hookload, along with a corresponding torque trend. A drilling engineer reviews the projection (Fig. 2), locks the reference, and provides it to the rig. Lateral-IQ supports that decision; it does not independently set WOB or operate the driller's controls.



Fig. 2. Lateral-IQ (Patent Pending U.S. 64,231,161) display, showing the depth-based hookload reference and operating targets.

Selecting suitable data is an important part of the process. The model uses the current well's on-bottom response to develop its proposal. In this workflow, an interval with rising hookload and falling ROP is treated as evidence of deteriorating weight transfer, rather than as a trend to reproduce.

The projection is an input to the engineer's decision, not an automated drilling command. Because EDR records include connections, off-bottom periods, and intervals, where weight transfer may already have deteriorated, the model excludes data that do not provide an appropriate basis for calibration. Comparable offsets with favorable weight transfer and sustained drilling performance can inform the initial estimate. The engineer can then accept, adjust, or reject the projection before locking the reference for the rig.

After a trip, circulation or geometry change, a new reference is required to reflect the changed conditions. The previous line remains visible as history, but it is not automatically extended into the next drilling interval. This review allows the reference to change when warranted without asking the crew to follow every new model proposal. Figure 2 is the review screen for that proposal. The depth tracks show hookload and torque against the projected trends, with ROP and the related drilling channels available for context. The depth-indexed targets on the right are the values the rig would be asked to follow, if the engineer locks the reference. The projection can be accepted, adjusted, or rejected before it is sent.

Offsets, when used, are held to the same standard. A comparable interval with favorable weight transfer and sustained performance can inform the first estimate. An offset that reflects poor weight transfer is not given equal weight simply because it is nearby. Carrying the dominant historical trend forward would repeat that pattern on the next well. After the reference is approved, it stays under the engineer's control. A trip, a circulation, or a geometry change requires a new reference. The prior line remains visible as history and is not extended on its own. The review exists, so the reference can be updated when conditions warrant it, without asking the crew to follow each new proposal.

RESULTS FROM THE ASCENT FLEET

Ascent's rollout focused on whether the process could sustain drilling performance farther into the lateral and improve the pace of the overall program. Following implementation, the team reported stronger ROP performance, deeper into its extended laterals. Comparing the most recent year with Lateral-IQ in use against the preceding year before implementation, average lateral ROP improved approximately 20%. Over the same period, Ascent continued drilling increasingly long laterals while improving overall drilling pace.

The 20% figure is a year-over-year program comparison, not a single-well result. Average lateral ROP during the year with Lateral-IQ in use was compared with that of the preceding year, before implementation. The reported improvement was in the deeper portion of the lateral, where a connection-based WOB reference is most likely to have drifted. Over the same period, lateral length increased, and overall drilling pace improved. Footage per day captures both: more hole, drilled in less time. A faster ROP confined to the first day after landing would not have answered the question that the rollout was built to ask, because a connection zero is still close to acceptable accuracy there.

Figure 3 compares the ROP of the fleet, utilizing the hookload reference against the years prior to rollout. By year, the table reports average lateral and section footage, average ROP, average lateral days, average on-bottom hours, average total time, and average measured depth. The ROP row is the basis for the approximate 20% statement. It is an average for the period, not a claim that every lateral moved by the same amount. The other rows keep that average in context. Average measured depth and lateral footage increased over the same years, while average lateral days and average total time declined. On-bottom hours are included, so the ROP change can be read against time spent drilling,

declined. On-bottom hours are included, so the ROP change can be read against time spent drilling, rather than against calendar time alone.



Fig. 3. Reported performance during the Ascent rollout. Average lateral ROP in the most recent year with Lateral-IQ in use was approximately 20% higher than in the preceding year before implementation.

The process was expanded after positive results had been observed on multiple wells. Stronger ROP deeper in the lateral, and the pace improvement (shown in Fig. 3), were what supported wider use. Crews accustomed to a WOB setpoint adopted the hookload reference, as the new workflow undeniably improved drilling performance. The fleet comparison is the result of that sequence, rather than of a single demonstration well.

PUTTING THE METHOD INTO PRACTICE

Successful adoption begins with a shared understanding of what the hookload reference is intended to accomplish. Crews accustomed to controlling a WOB number need a clear explanation of how drag affects the relationship between displayed WOB and weight transfer. The engineer must establish that understanding before asking the driller to follow a different reference. Adoption improved, as crews gained experience with the reference and observed its relationship to drilling performance. Over time, the hookload trend became less of an additional instruction and more of an operational roadmap: a depth-based reference that the engineer and driller could use to evaluate whether weight was being transferred effectively, as the lateral extended.

The explanation is that the hookload trend accounts for drag. It is not a way to conceal weight. Displayed WOB can remain steady while the load transferred to the bit declines. The reference gives the engineer and the driller a common basis for seeing that difference. The engineer reviews the projection, locks it, and provides it to the rig. The driller then has a depth-based, on-bottom hookload to follow, rather than a zero established at an earlier connection. After a crew change, both parties are working from that locked reference.

With practice, the hookload trend became a roadmap for evaluating weight transfer as the lateral extended. The engineer reviews the trend alongside drilling results to identify opportunities for improvement. The workflow is straightforward with Lateral-IQ: land the curve, set the trend, lock it in, and optimize drilling performance. The engineer remains in control, with Lateral-IQ providing an enhanced view of how the well responds to parameter adjustments, Fig. 3. WO

ACKNOWLEDGMENT
The process described here builds on hookload roadmaps developed by Ascent, and its experience applying the live workflow across its Appalachian fleet.

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