World Pipelines reached out to three experts in the pipeline installation sector to discuss the latest developments in horizontal directional drilling (HDD).

With contributions from:

Simon Herrenknecht, Head of Business Division Pipeline, Business Unit Utility Tunnelling, Herrenknecht;

Jason LaValley, Founder and Chief Executive Officer, LaValley Industries;

Boris Böhm, MAX STREICHER GmbH & Co. KG aA, BD Project Division/Business Development and Equipment.

Where do HDD projects carry the highest risk today, and what has changed in how those risks are managed?

Simon Herrenknecht, Herrenknecht

The highest risks in HDD projects today remain closely linked to subsurface uncertainty. Despite modern ground investigation, complex ground conditions continue to represent the most significant challenge and potential risk factor for borehole instability, tool damage or loss of returns. Fluid losses or inadvertent returns can cause immediate work stoppages and are considered as increasingly critical for environmental and regulatory aspects. From a manufacturer's perspective, downhole tools such as the downhole jet pump or weeper subs were developed to technologically mitigate these risks, but their use in the market unfortunately still remains cautious and selective. In parallel, HDD is increasingly executed in dense urban and congested surroundings, where tolerance for deviation is extremely low and the consequences of even minor alignment errors can be severe. Therefore, the industry has largely moved away from a reactive, trial-and-error mindset toward predictive risk control supported by detailed FEED studies, more integrated geotechnical investigations, and the use of digital tools like 3D mapping and real-time data analysis.

Jason LaValley, LaValley Industries

The exit side remains in the highest-risk area in many HDD operations. This is where pipe, tooling, and stored energy must be managed simultaneously under variable field conditions – alignment, make-up/break-out, and load behaviour all need to stay predictable.

Traditionally, crews relied on manual handling, hand signals, radio contact, and operator feel – often described as a 'rope-and-hope' approach. Today, the shift is from assumption to verified control. Mechanised exit-side systems provide positive

grip, torque control, alignment, and real-time feedback. This removes personnel from high-energy zones and turns critical transitions into repeatable, predictable operations.

Boris Böhm, MAX STREICHER GmbH & Co. KG aA

HDD projects currently carry the highest risk on construction sites themselves, where real-time conditions directly impact execution quality and safety. Additional risk arises from the increasing consolidation of construction sites, which leads to higher complexity, tighter schedules, and overlapping activities. Significant risks also occur when positioning or control tolerances are neglected, as even minor deviations can have major technical and financial consequences.

HDD projects and their regulatory, environmental, precision, and documentation requirements have become significantly more complex and stringent. However, these risks can be effectively managed through thorough professional preparation, proactive site management, and the use of advanced, fully electric drilling rigs equipped with integrated drilling assistance and anti-collision systems.

How far can HDD realistically be pushed in terms of length, diameter, and geology; and what has improved most in recent years?

Boris Böhm, MAX STREICHER GmbH & Co. KG aA

In terms of length, HDD installations can realistically exceed 3000 m depending on soil conditions, and this distance can be effectively doubled using intersect (meet-in-the-middle) methods. Regarding diameter, typical achievable ranges are between 30 in. and 32 in., with a technical maximum of approximately 36 in. under optimal conditions.

One of the most significant improvements is the use of double-column drilling rigs for surveying, combined with telescopic pipes and magnetic guidance systems, which have greatly enhanced precision and control over long distances.

Herrenknecht: HDD Rigs HK500CM, Balranald mineral sands mine project for Iluka Resources, New South Wales, Australia.

Herrenknecht: HDD Rig HK250C, on-grade pressure sewer pipeline for Refresh Vaucluse and Diamond Bay project for UEA Pty Ltd, Australia.

Simon Herrenknecht, Herrenknecht

Our focus is on the rig itself – ensuring that it operates reliably and is properly designed for its intended application, as far as we are involved in the planning process. Over recent years, the key improvements have been driven by higher torque, enhanced operational safety and increased efficiency. Furthermore, steering with gyro systems is common nowadays. This provides higher accuracy, which is particularly relevant in surroundings with existing subsurface infrastructure.

Fluid control and quality finally receives the long-overdue attention in HDD operations, since correct mud handling often the key factor for a successful project.

Limits in length and diameter are not strictly defined by the technology, but rather depend on risk management, project conditions and above all – the experience of the drilling teams. Speaking of Europe, we are observing a clear trend toward drilling contractors becoming more internationally oriented, operating across national borders and deliberately contributing their specific expertise where it adds the most value. This is particularly evident in Germany, where a substantial volume of work has to be done and foreign companies are strongly involved.

Which digital or monitoring tools have changed onsite reporting and decision-making?

Simon Herrenknecht, Herrenknecht

As a technology supplier, we are driving the development of digitalisation and automation at full speed for improved occupational safety and efficiency in HDD operations. In times of skilled labour shortages, new tools can assist drillers

and provide ongoing training. This includes the integration of smart surveying and the continuous advancement of digital tools that support planning, execution, monitoring, and documentation throughout the entire drilling process.

Cloud-based tools enable jobsite and project managers to monitor all relevant data anytime and from anywhere. This includes a wide range of automated analysis features, comprehensive dashboards, and detailed evaluations of sensor data. For example, real-time 3D mapping on site allows to continuously track how the surface is affected. Predictive maintenance helps to stay ahead of maintenance schedules by identifying worn out tools early, ensuring that necessary parts are available, and minimising downtime. In addition, data on power consumption and CO_2 output, as well as online inventory and spare parts management, are all accessible through the cloud at any time. Together, these capabilities enhance efficiency, improve reliability, and provide the level of transparency required on modern jobsites.

Jason LaValley, LaValley Industries

A large portion of exit-side reporting still happens after the fact via radio, with contractors relying on three-way communication protocols to reduce misunderstandings. While these techniques help manage risk, they do not remove the underlying hazard.

Real-time monitoring tools now deliver verified feedback on load behaviour, grip, torque, alignment, and response during key operations. This replaces radio relays and inference with direct data, enabling faster decisions and moving from communication to verified control across the jobsite.

Boris Böhm, MAX STREICHER GmbH & Co. KG aA

Digital monitoring tools such as Pressure While Drilling (PWD) during both pilot drilling and reaming, as well as continuous monitoring of mud flow rates (Mud In vs Mud Out), have significantly improved onsite reporting accuracy and enabled faster, data-driven decision-making.

How is environmental and regulatory scrutiny reshaping HDD design, execution, and accountability?

Boris Böhm, MAX STREICHER GmbH & Co. KG aA

Increasing environmental and regulatory requirements have led to the adoption of multiple piping systems, more frequent use of lost circulation materials (LCM), and the cementing of casings to ensure greater operational safety.

LaValley Industries: LaValley Industries' TONGHAND® mechanised torque management system controlling torque, alignment, and load position during HDD exit-side operations, with the operator positioned in the cab and separated from the immediate risk zone during high-energy transitions.

LaValley Industries: Mechanised system maintaining positive grip, alignment, and controlled torque to support predictable and repeatable handling of pipe and tooling during HDD exit-side operations.

At the same time, fully electric and intelligent drilling rigs help reduce environmental risks and enable HDD operations even in highly sensitive or protected areas.

Jason LaValley, LaValley Industries

Increased scrutiny requires demonstrable control at high-risk steps rather than reactive crew management. Mechanised systems convert variable tasks into repeatable, verifiable processes with controlled parameters and real-time feedback. This strengthens execution, reduces variability, and supports engineering risk out of operations.

Mechanised systems support this by converting critical tasks into repeatable, verifiable processes with controlled torque, alignment, and real-time feedback. This doesn't replace planning or engineering judgment – it strengthens execution where variability is greatest and accountability is most visible. The result is a broader industry shift: engineering risk out of the operation instead of managing it on the fly.

Simon Herrenknecht, Herrenknecht

Particularly in Europe, environmental and regulatory requirements increasingly shape HDD design, execution and accountability. There is close to zero tolerance for fluid losses, groundwater contamination, or surface disturbances, which has led to more detailed design phases that often include formal environmental impact assessments. Contingency planning is frequently mandatory, supported by measures such as real-time frac-out monitoring systems. In addition, full traceability of drilling parameters, along with digital reporting and documentation, is now often required by the clients – in and outside Europe. From a technology perspective, environmental regulation is not slowing HDD down; on the contrary, it is accelerating its adoption, as HDD is increasingly recognised as a method that significantly reduces surface disruption compared to open-cut construction.

5. Discuss a recent HDD project that highlights your strengths and expertise.

Simon Herrenknecht, Herrenknecht

In addition to the core business in pipeline construction, our rigs are increasingly being deployed across other construction sectors. In particular, the cable installation market shows strong overlap with pipeline projects regarding route requirements and environmental constraints.

A key highlight for us is the growing use of hybrid and all-electric rigs in Europe, where sustainability targets and regulatory demands are accelerating their adoption.

Beyond infrastructure, we have also technologically adapted our rigs for the mining sector. In Australia, Iluka Resources is pioneering a more sustainable approach at the West Balranald mineral sands mine in New South Wales, where four customised HK500CM drilling rigs are used to extract minerals. This method avoids open-pit mining and significantly reduces surface disturbance and environmental impact.

Our contribution focused on comprehensive engineering and intensive training of the jobsite crews to ensure safe, efficient, and reliable operations.

MAX STREICHER: HDD45-E on site.

MAX STREICHER: HDD80-E on site.

Boris Böhm, MAX STREICHER GmbH & Co. KG aA

A recent project's key challenges included the presence of highly fractured ground conditions, combined with significant elevation differences between entry point, drilling depth, and exit point. A complex scope of work involved an intersect (meet-in-the-middle) execution, the secure backfilling of the annulus after pipe installation, and real-time pressure monitoring during the curing phase of the annulus cement, including the option to install a permanent pressure sensor within the annulus.