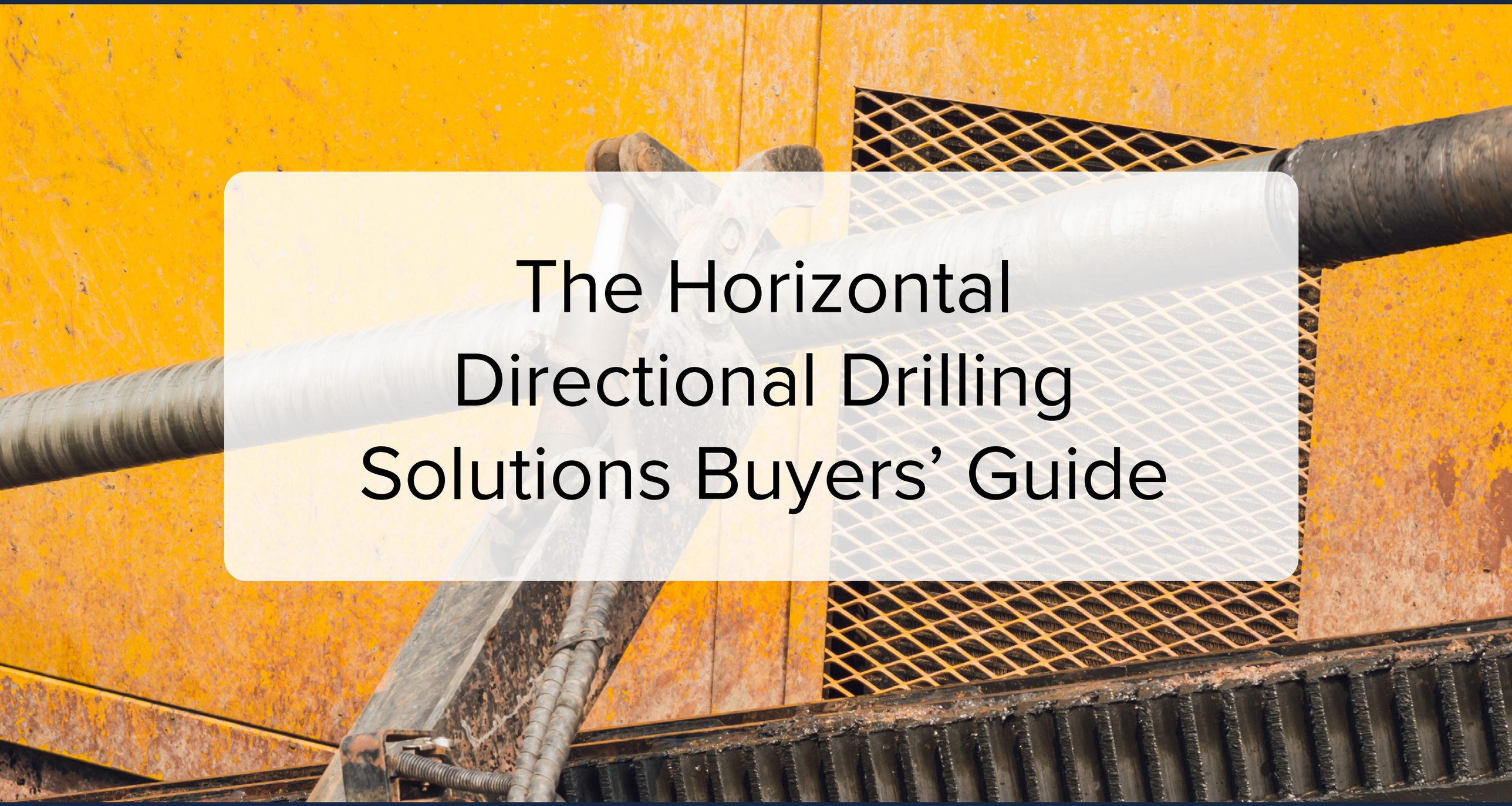
TECHNICAL TOOLBOXES



The Horizontal Directional Drilling Solutions Buyers' Guide

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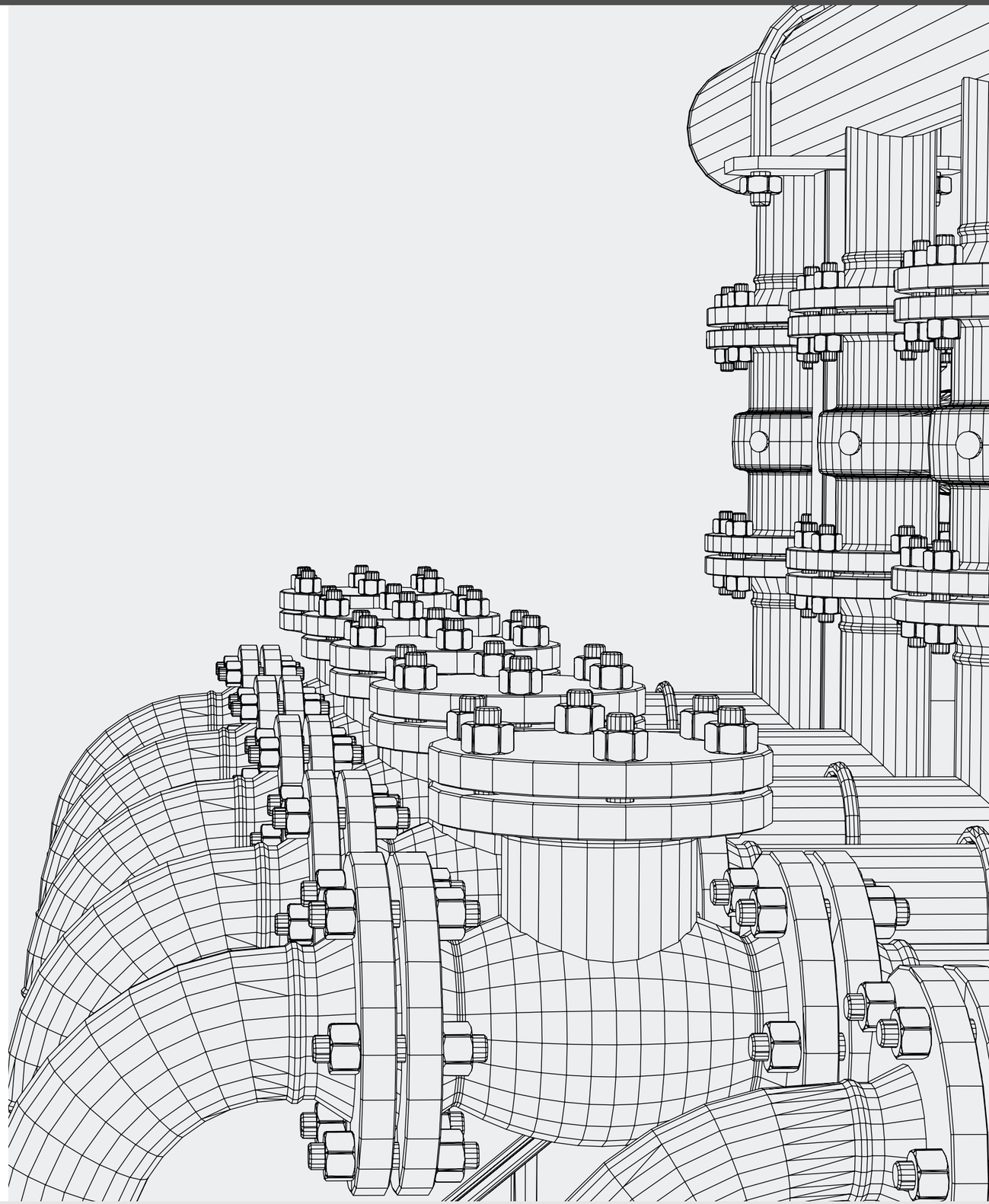
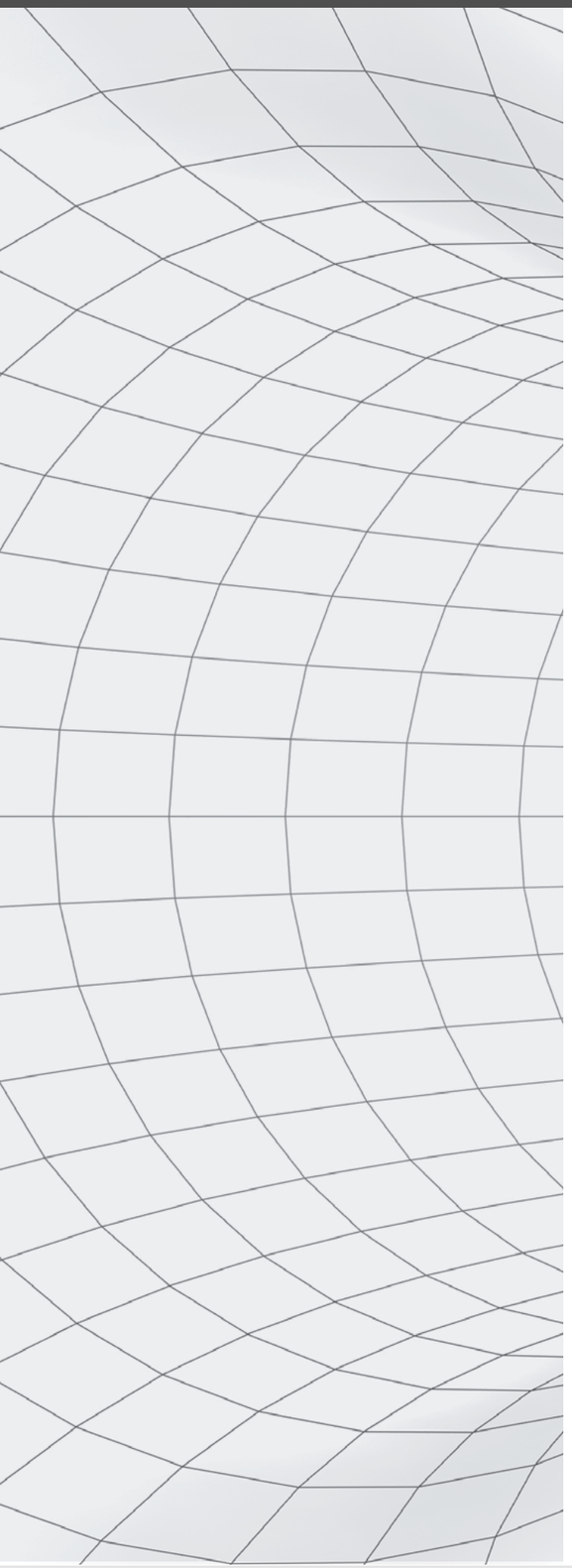




How to Use This Guide

Technical Toolboxes created the HDD Solutions Buyers' Guide for pipeline engineers, company managers, executive vice presidents of pipeline construction responsible for selecting software solutions. Pipeline, utility, civil, and mechanical engineers use Horizontal Directional Drilling to pass under obstacles and barriers that obstruct the paths of pipelines and cable conduits. Compared to trenching and suspended pipelines, HDD can be a cost-efficient and environmentally friendly alternative if well-designed.

The HDD Solutions Buyers Guide assumes that the reader has a solid understanding of the principles and practices involved in pipeline engineering. You have to consider five areas in designing and planning your HDD operation. The Guide analyzes these areas as dimensions to give you a clear understanding of how they relate to HDD engineering software.

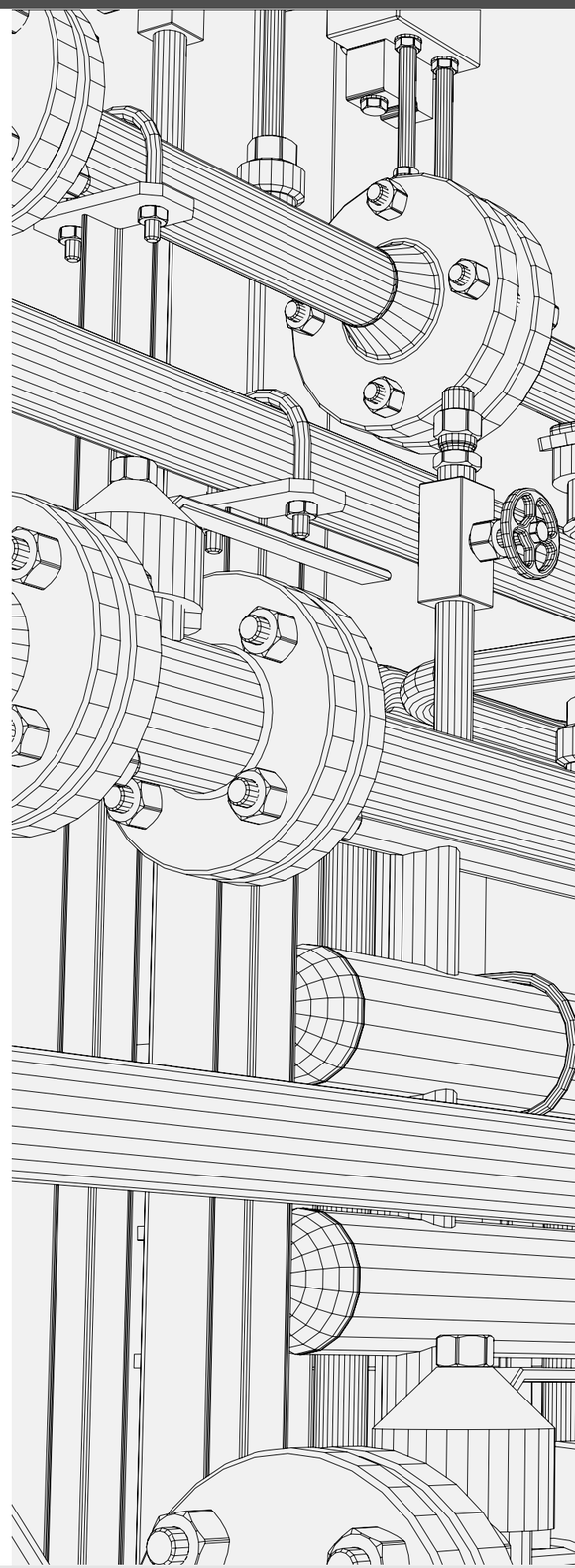
Very few commercial applications generate project plans and reports for action in the field. The Guide's final section describes how these dimensional factors relate to the benefits of the HDD PowerTool from Technical Toolboxes and how it provides the best-in-class solution.

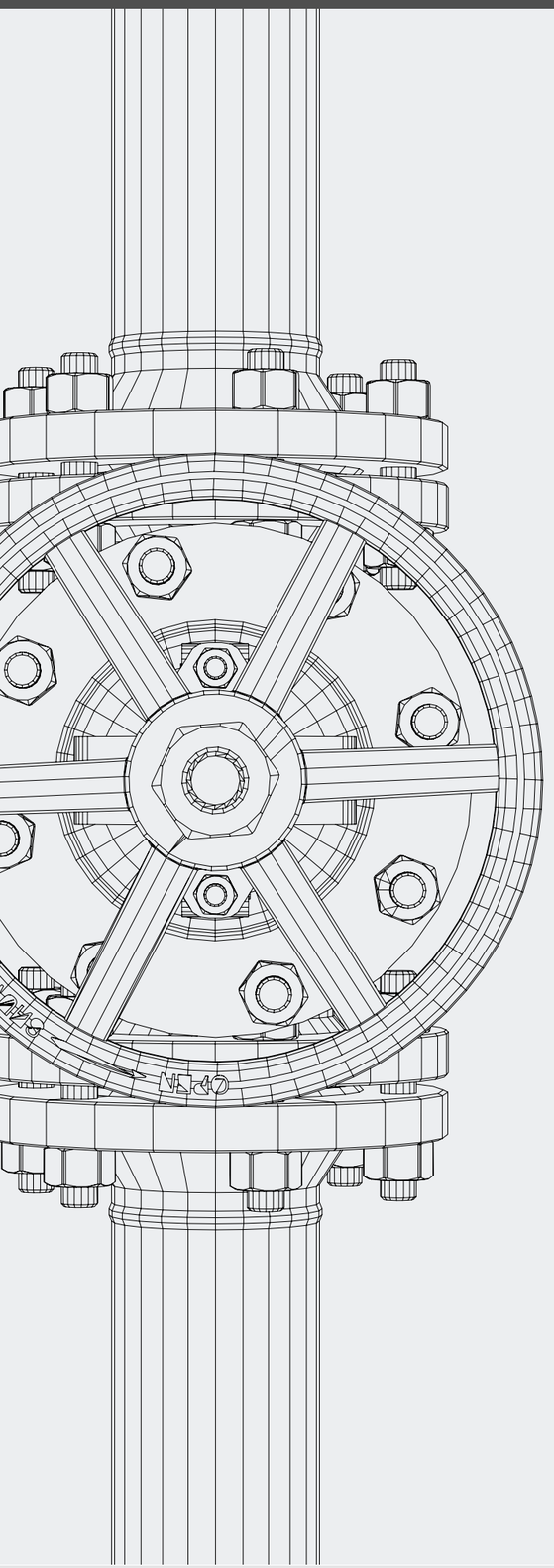
"You have to consider five areas in designing and planning your HDD operation."

The Principles of HDD

Horizontal Directional Drilling is a trenchless digging method for tunneling under otherwise-impassable obstacles. It is a mature technology honed by engineers and contractors to provide safe and efficient crossings. It is an effective method to extend pipelines and utility conduits under long barriers such as roads, railway tracks, other pipelines, and rivers.

Geography is a given in planning and constructing pipeline networks. For pipelines of any considerable length, you are likely to encounter a barrier that you cannot go around at ground-level at some point. It may be unreasonably expensive or not even physically possible to go over it either. The only practical option is to go under it in such cases.





In an HDD operation, engineers employ a large drilling rig to bore a path between the two accessible pipeline end-points, which may be several thousand feet apart. The rig drills a pilot hole, guiding down to a predetermined depth beneath the obstacle at a relatively shallow angle and back up to the surface at the far end.

Throughout the process, rig operators monitor mud pressure levels in a delicate balancing act, as they work to keep drilling fluids within the minimum and maximum limits along the borehole profile. A reamer attachment widens the hole in a second pass through and pulls the complete length of steel or plastic piping back from the far end. It requires a clear understanding of stresses on the pipe, the geology of the rock and soil, and the optimum “mud” or drilling fluid composition.

> “The rig drills a pilot hole, guiding down to a predetermined depth beneath the obstacle at a relatively shallow angle… ”

The Factors of a Complete HDD Solution

Given the necessity of addressing an HDD project of some type, there are five areas you have to consider in selecting your engineering software solution. Ideally, your HDD solution addresses these multi-dimensional concerns in one suite of tools.

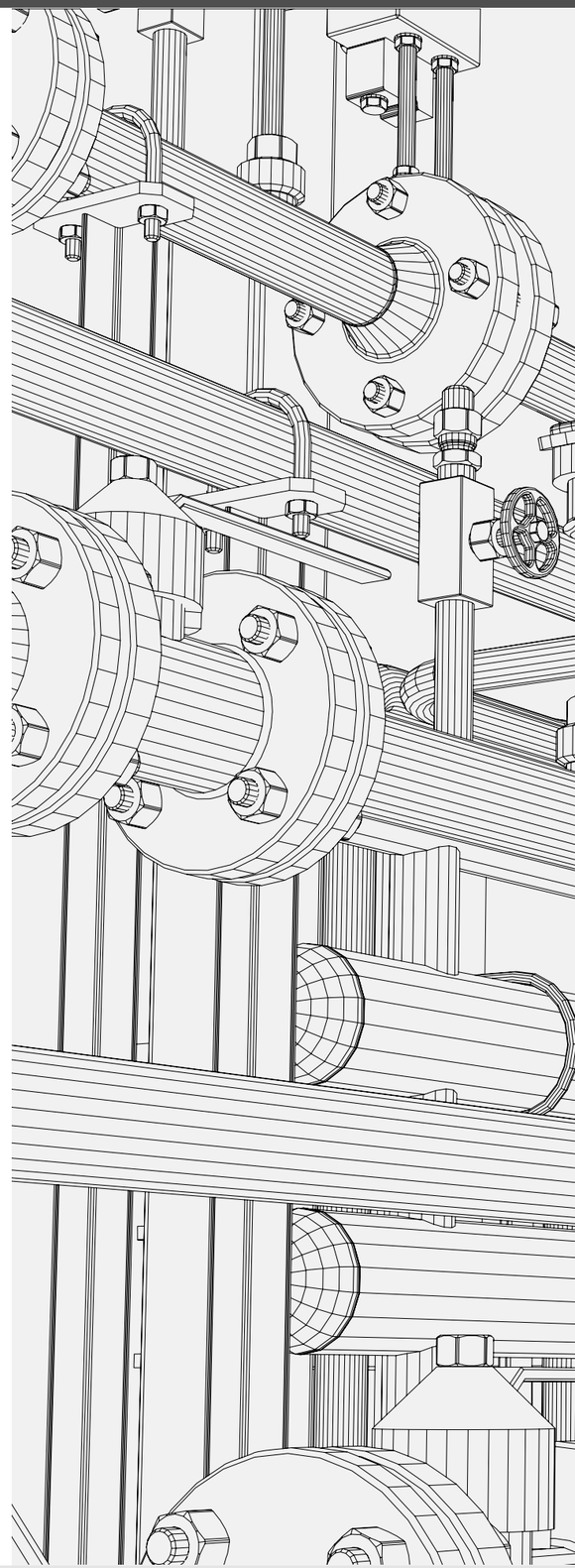
The Dimensions of HDD:

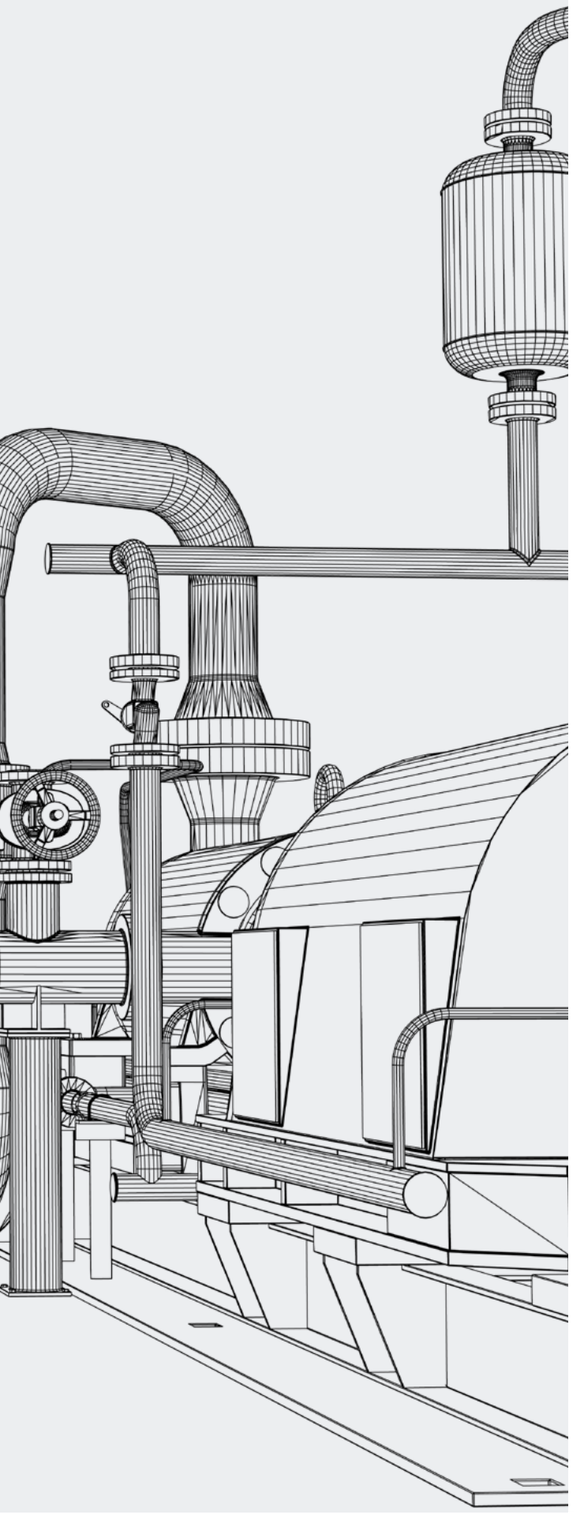
- Designers Tool Kit
- Operational Productivity
- Use-Case Coverage
- Data Management Capabilities
- Health Safety and Environmental Risk Mitigation

Designers Tool Kit

A complete HDD solution means a comprehensive designer's tool kit. Engineering calculations and analyses provide the bedrock foundation of all HDD solutions. As such, they are the design tools to plan your HDD projects before you head out to the field.

If a project goes to plan, HDD is cost-competitive compared to other methods, assuming there are any practical alternatives in a given situation. The critical factor is the need for a complete and competent drilling plan. The tool kit must provide all of the calculations and analytical tools for engineers in an HDD project's planning stage to be a complete solution.





Ideally, your HDD solution offers an alternative to AutoCAD, with all straight lines, curves, or compound angles that define the drill path between the entry and exit points, guiding around obstacles and providing simplified 2-D modeling.

As a designer, you need to communicate plans to third-party subcontractors and validate their proposals. Your analysis should give go/no-go decision-points so you can address any unexpected issues before you have a drilling team on the clock waiting in the field. If the drill path crosses a public highway or waterway, public authorities are much more likely to approve a plan that includes a profile schematic of the drill path. It serves as proof that they have done the necessary engineering calculations.

Operational Productivity

In an HDD project's operational environment, your solution's design output directly influences your productivity and potential success. With a complete solution, you can minimize the costs and maximize productivity. When field operations experience unexpected challenges, it gives you pull-load analyses that reduce risks caused by design errors and keeps the pipe stresses within tolerable limits. It provides all of the calculations for pilot hole frac-out analysis, bore stability, pull-force, and installation stress.

"Your analysis should give go/no-go decision-points ... before you have a drilling team on the clock waiting in the field."

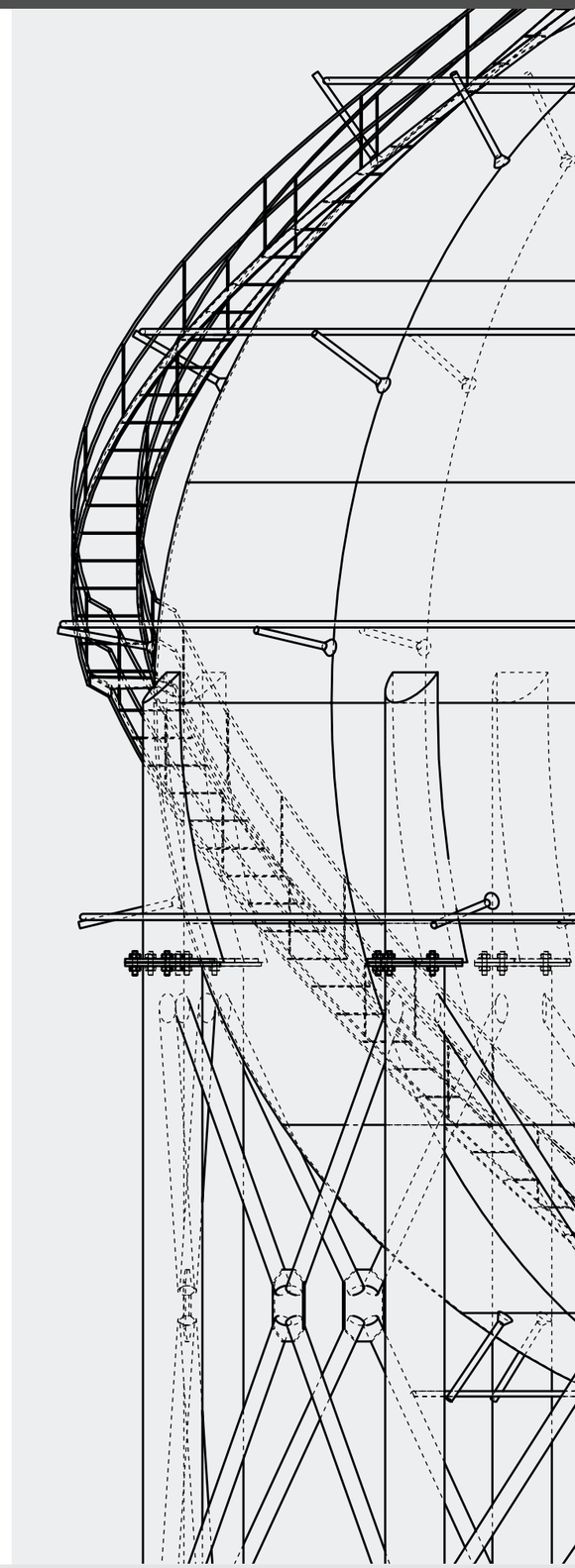
“A complete solution provides the different calculations for steel or plastic piping or conduits. ”

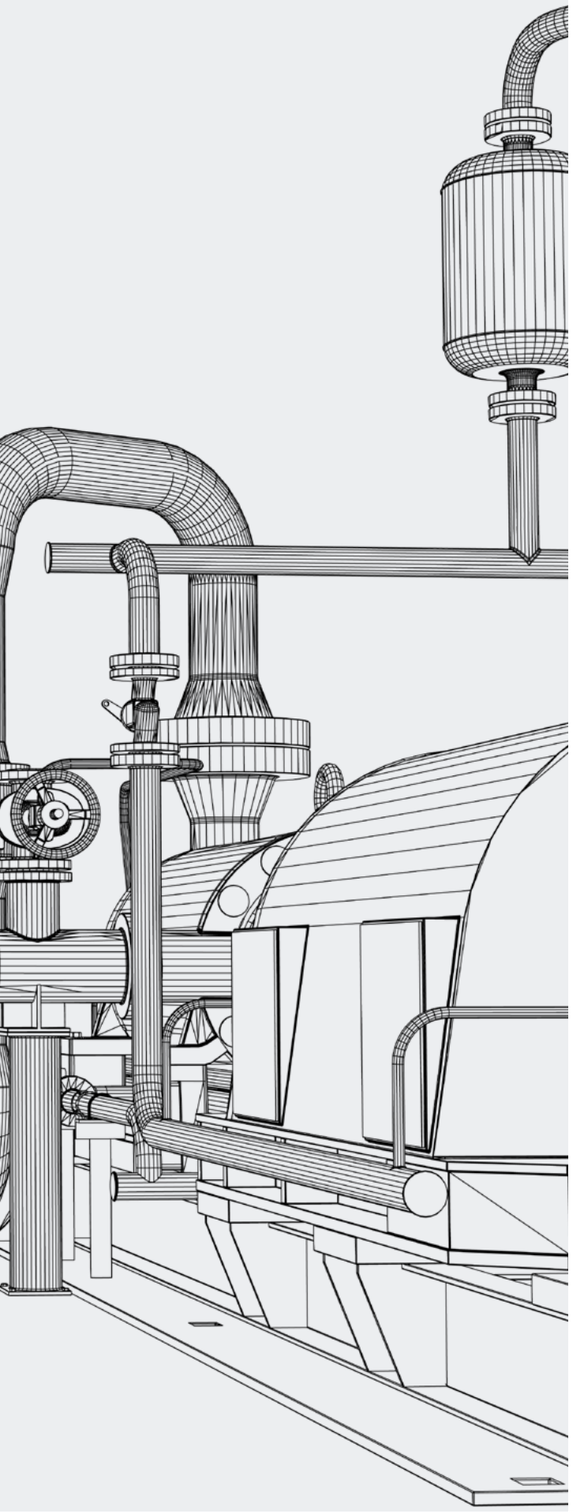
A solution that includes mud management tools gives you better control over the large quantities of drilling fluid required for boreholes thousands of feet long. Careful composition control, frictional pressure loss verifications, and pressure calculations for Duplex and Triplex pumps ensure successful projects without excessive wear, which extends the life of your equipment.

Use Case Coverage

Horizontal Directional Drilling has found enthusiastic advocates for a variety of applications. It connects pipelines for oil and gas transport, routes water and sewerage pipework beneath crowded communities, and provides conduits for communications or power cables, all via a well-designed trenchless technology. A complete solution provides the different calculations for steel or plastic piping or conduits.

HDD tools can also provide oversight for third-party and subcontractors that drill on your behalf. Plans and reports as validation tools minimize the risk of costly liabilities incurred by careless contractor work or incomplete borehole designs. The capability of producing the documentation to communicate designs to an authorizing body is vital to winning approvals. It may be the difference between using HDD, being directed to proceed with more costly methods, or abandoning your plans altogether.





Data Management Capabilities

Outdated data management methodologies inflict unnecessary limitations on pipeline engineers. Many organizations, particularly in the midstream oil and gas sector, still depend on spreadsheets, PDF reports, and printed reference publications. Unfortunately, as a side effect of this conservative mindset, highly-paid engineers too often spend time hunting for documents, entering data, and second-guessing the validity of past work. The cost of time spent on manual labor undermines any savings gained by sticking with obsolete technology.

Today, the tremendous potential unleashed by digital technology means data systems give you unlimited scope to retain and share asset records and case histories. A solution that supports digital integration with other information systems means engineers can access data directly from all relevant asset databases. Users have access to information without delays, duplications, or conflicts. Instead of chasing data and duplicating calculations, your engineers spend more time focused on where they provide the most value, positively affecting your company's bottom line.

"Outdated data management methodologies inflict unnecessary limitations on pipeline engineers."

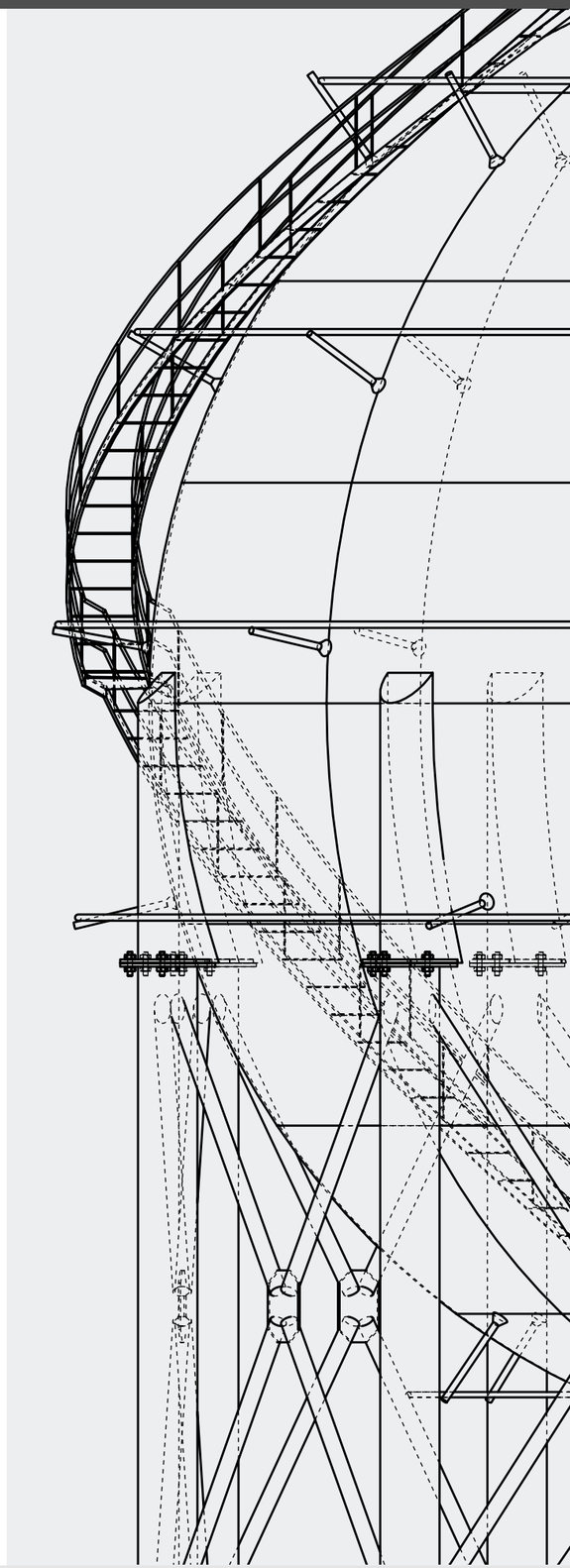
> “Digital integration facilitates alignment for Standard Operating Procedures across your whole company.”

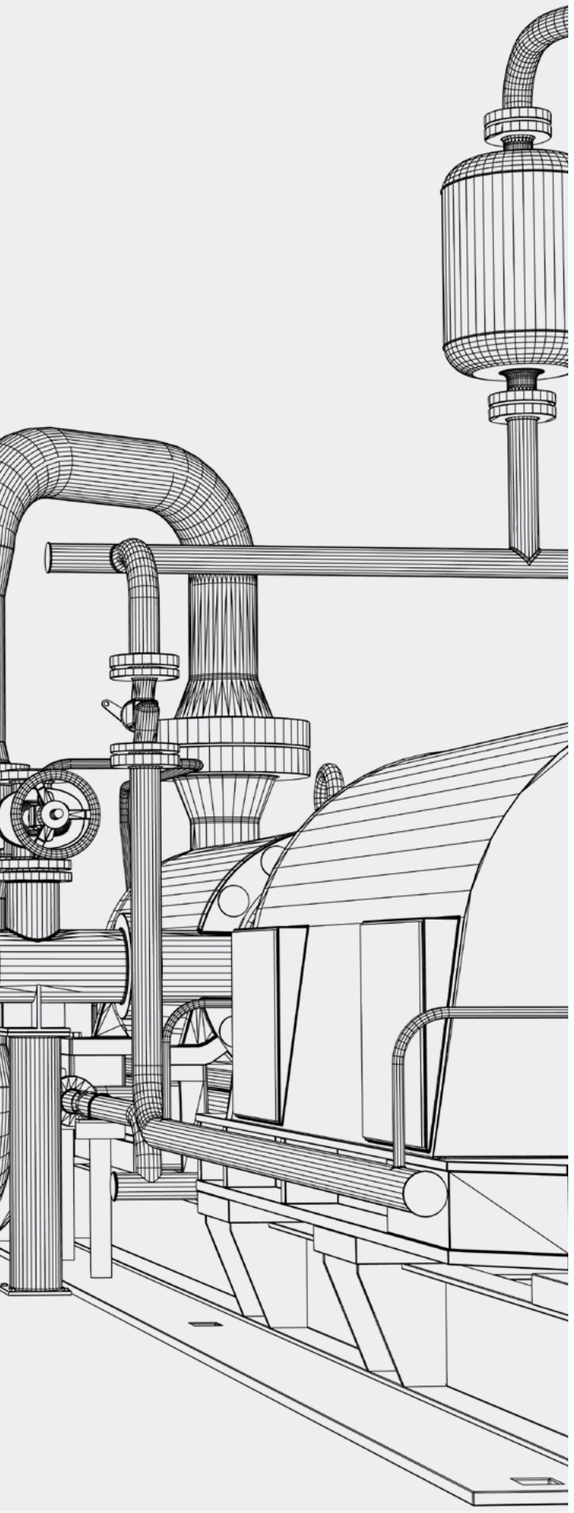
The advantages of a modern digital solution multiply with scale. Digital integration facilitates alignment for Standard Operating Procedures across your whole company. When all your teams work to one SOP, it prevents errors due to miscommunication and eliminates the need for users to learn new systems when you reshuffle your staff. Additionally, you can control data sharing and manage authorized users so that all teams across your organization have access.

In terms of an HDD solution, data integration means your engineers have easy access to the calculations and data they need. It simplifies design modeling from complex AutoCAD files and integrates ground elevation profiles with plan and profile views of the borehole, plus ArcGIS mapping. So you can design drill paths that stay within desirable geological layers consistently and navigate around other pipes and conduits safely and efficiently.

Health Safety and Environmental Risk Mitigation

Safety is the final and most vital factor. Risk mitigation is paramount in any professional setting. In engineering environments with heavy equipment and hazardous environments, the risk of safety failures weighs heavily on both





decision-makers and installation crews.

Drilling errors can result in physical injuries or loss of life, high clean-up costs, fines, and lawsuits. If investigators find a third-party contractor responsible for an accident, the company or utility that hired them is likely to face liability too. Less dramatically, minimizing the risk of HDD design errors might spare you the cost of drilling inaccuracies.

Frac-outs, costly regulatory fines or environmental damage, and having to re-do expensive work in the field. The hazard posed by Frac-outs raises the specter of multi-million-dollar costs. Damage, contamination, and clean-up that follow from a failed bore path design can tie up companies in legal actions for many years. The costs can bankrupt corporations and ruin promising careers.

A comprehensive solution that ensures safety and minimizes risk maximizes both analytical and operational productivity. It helps you sleep at night with the confidence that you can avoid devastating outcomes.

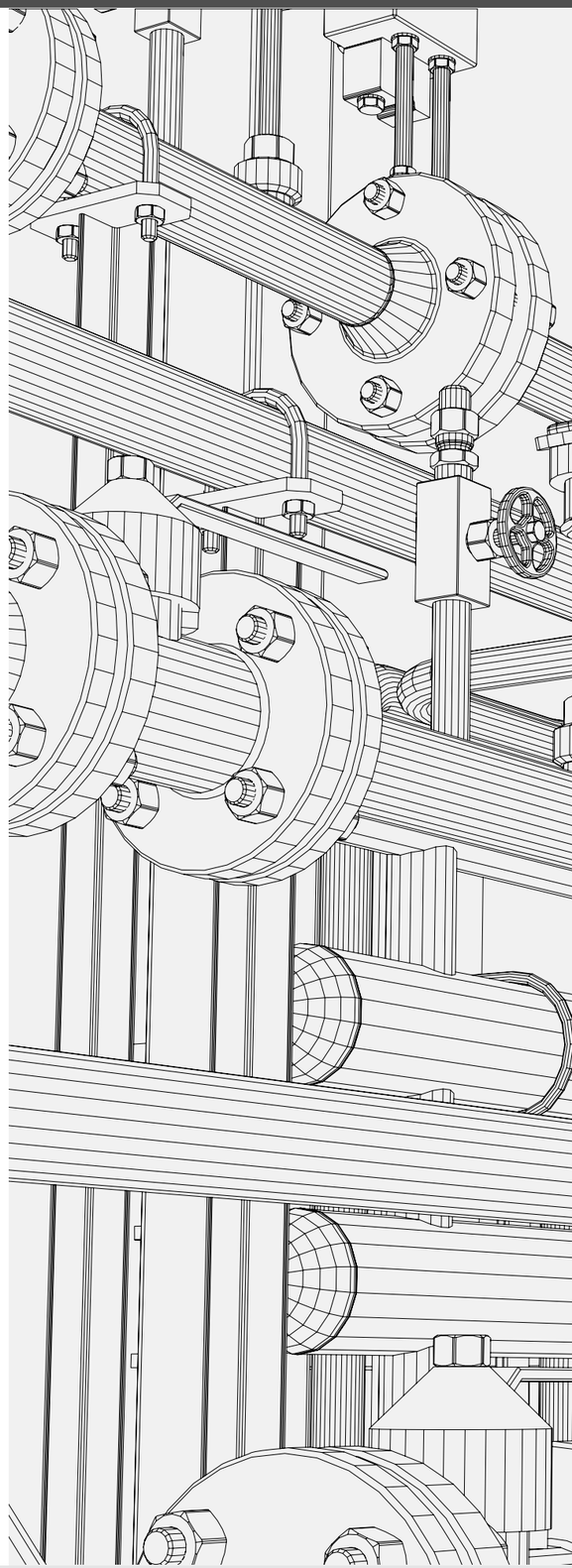
“A comprehensive solution that ensures safety and minimizes risk maximizes both analytical and operational productivity.”

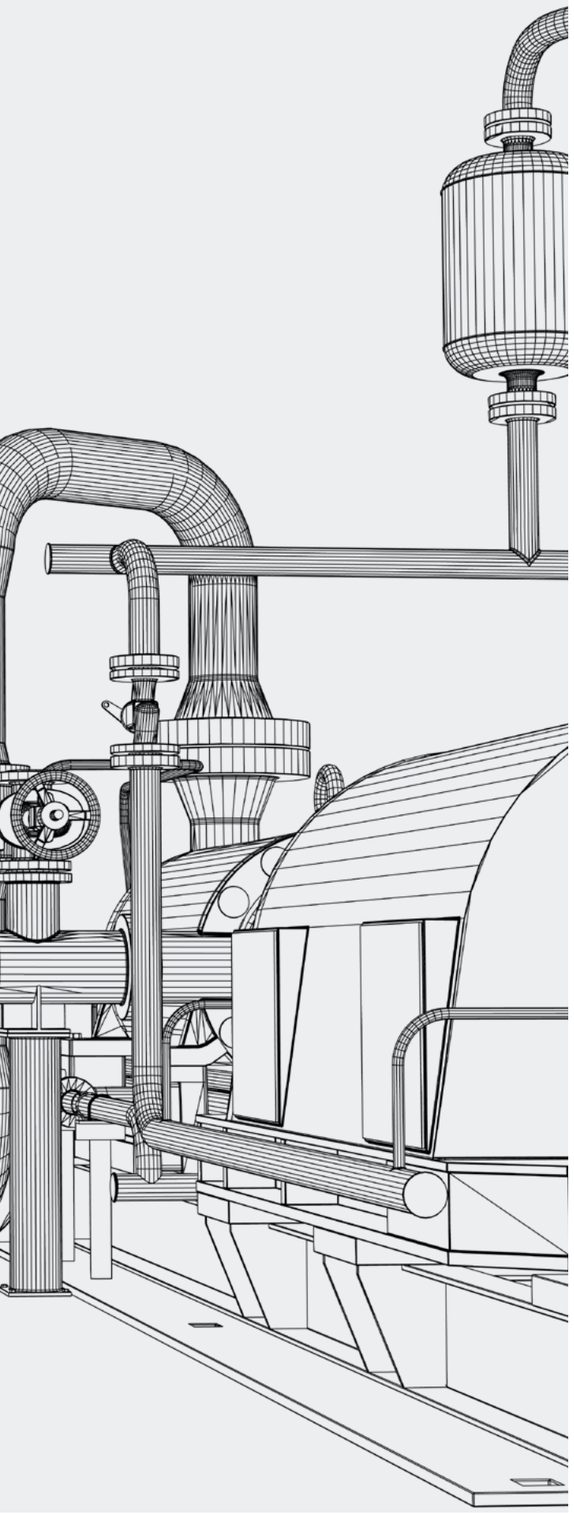
The HDD PowerTool from Technical Toolboxes

The Horizontal Directional Drilling PowerTool (HDDPT) is part of a comprehensive solution for HDD. It is a suite of six modules that provide HDD design validation solutions. HDDPT includes tools for the design and construction phase of HDD, whether the project is for liquid or gas pipelines or cable conduits. It gives you calculations for drill path design and planning. Moreover, the HDDPT minimizes excavation complexity to lower project costs while producing the analyses to monitor drilling or pulling operations and prevent borehole collapse. Technical Toolboxes provides the software, training, and user-onboarding/support for successful implementation and greater productivity in one comprehensive package.

The HDDPT reduces construction costs by validating your drilling designs. It provides excellent go/no-go checks for drilling plans and requests to authorizing bodies because it proves quality-assurance/quality-checks on all of the factors they consider in decision-making.

With the HDDPT, you only have to do the design-work once because it gives you the confidence you did it right the first time. It flags issues for review before you have expensive teams and equipment on the clock. In the petroleum industry, midstream companies frequently rely on it for third-party oversight, and drilling contractors use it to validate the plans they have received.





- A shared platform that aligns your team for better performance
- Pull force and installation calculations for steel and plastic pipe
- Drill path mapping with simplified 2-D profile designs and ArcGIS integration
- Hydraulic fracture calculations for pilot hole stability analysis
- Drilling fluid quantity tool for mud management in the borehole
- Model Duplex and Triplex pump pressure calculations
- Transparency to win approvals for public highway or waterway crossings

Why Technical Toolboxes?

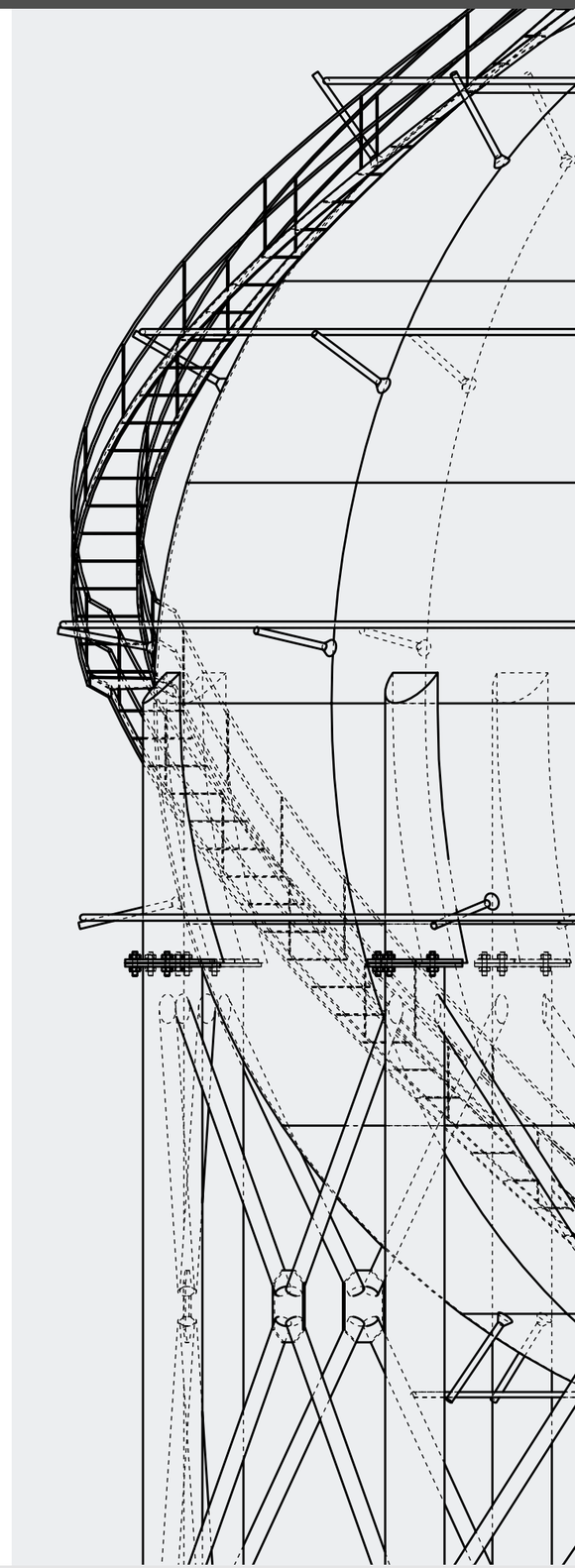
The HDDPT's credibility comes from Technical Toolboxes' position within the industry. The company built the solution with the help of many respected sources. Technical Toolboxes is a leading provider of integrated desktop and cloud-based pipeline software, online resources, and specialized training for pipeline engineering professionals worldwide.

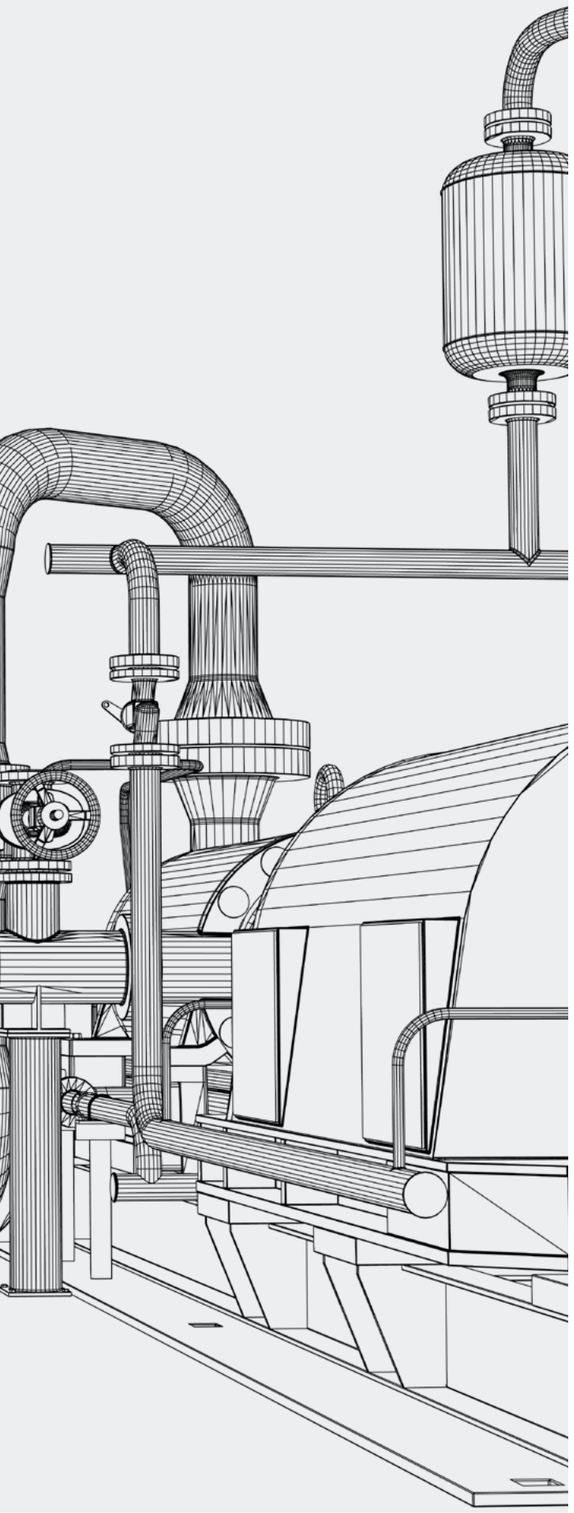
"Technical Toolboxes is a leading provider of integrated desktop and cloud-based pipeline software, online resources, and specialized training..."

"Technical Toolboxes worked extensively with world-renowned expert David Willoughby to develop and refine the PowerTool..."

The HDDPT builds calculations based on the Technical University of Delft's model and the US Army Corps of Engineers® Engineer Research and Development Center. Moreover, the hydraulic fracture calculations are derived from the databases mentioned above, along with other publications such as guidelines from Latorre, C. A., Wakely, L. D., and Conroy. Furthermore, Technical Toolboxes worked extensively with world-renowned expert David Willoughby to develop and refine the PowerTool as the ultimate HDD solution suite.

Mr. Willoughby has 40 years of experience in the industry. He is the author of highly regarded HDD textbooks and provided practical expertise for the HDDPT. Mr. Willoughby also works with the Technical Toolboxes training department as an instructor for our professional development courses for HDD.





Conclusions

The Dimensions of the HDDPT:

- A complete designers tool kit to mitigate risk and optimize drill path design
- Operational tools to minimize operating costs and maximize productivity
- Complete use case coverage for steel and plastic pipelines and conduit drill profiles
- Complete Data integration capabilities as part of the Pipeline HUB (HUB^{PL})
- Tools to maximize safety for the project, environment, and the community while minimizing risks and liability concerns

There are many potential gains to be had from a modern Integrated Data Environment. The latest technologies have revolutionized quality and productivity, so engineers achieve more consistent results while saving time and reducing cost. Data management, quality, and productivity contribute to risk mitigation and general safety.

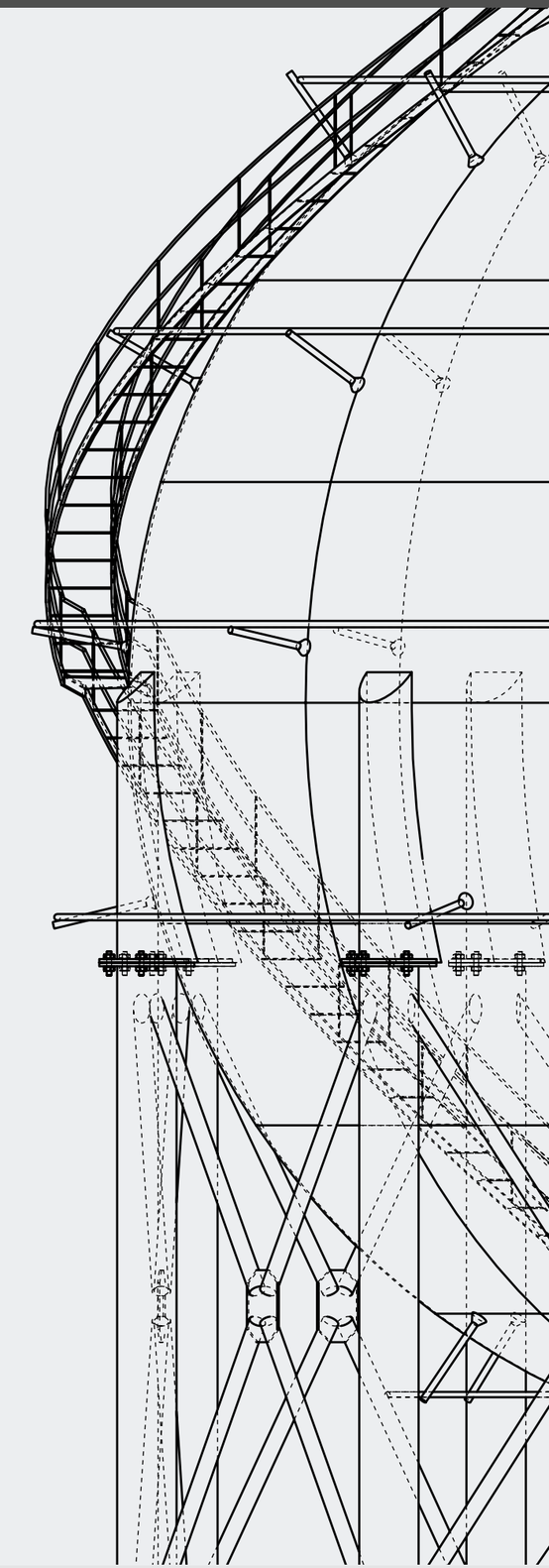
A complete solution for HDD today means pipeline and utility engineers can do data-gathering, analysis, and quality assurance one time. You keep knowledge resources within the company as personnel move on or retire. It contributes to data management automation for your processes, reducing the work you do to achieve the maximum result.

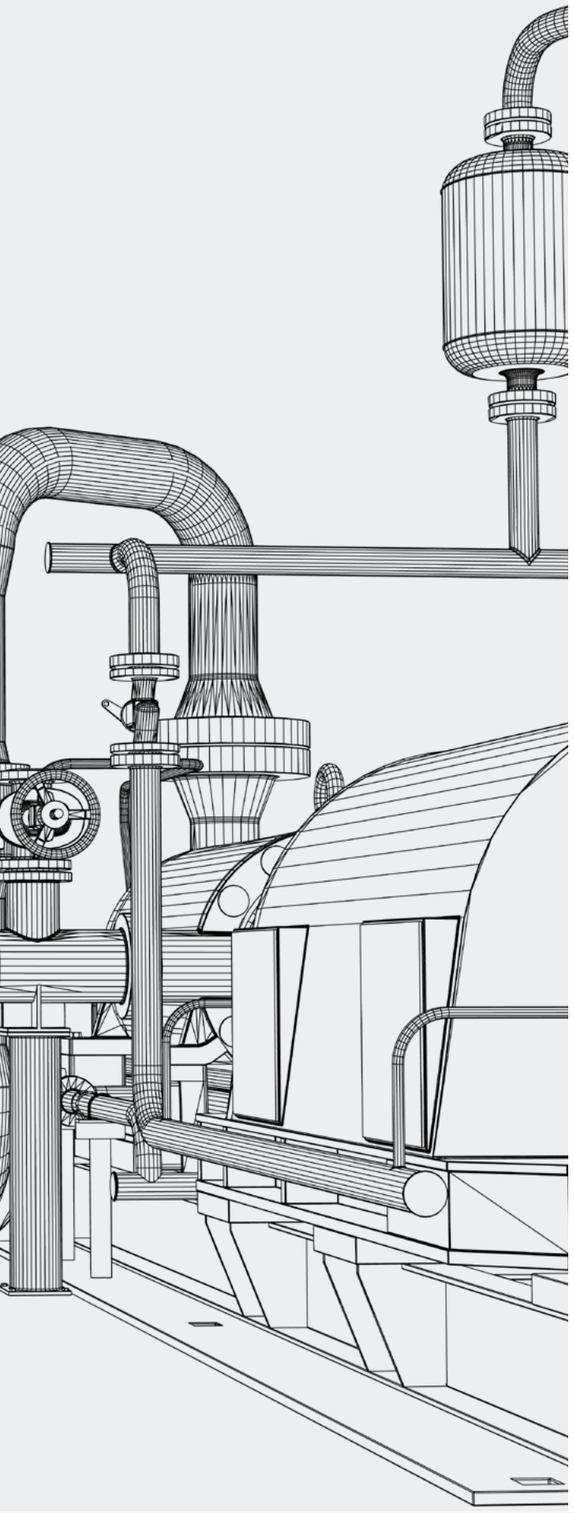
“The latest technologies have revolutionized quality and productivity, so engineers achieve more consistent results…”

“A complete solution for HDD today means pipeline and utility engineers can do data-gathering, analysis, and quality assurance one time. ”

The HDDPT addresses safety and risk and fosters productivity for drill path calculations and operation. It covers a broad range of use cases for steel and plastic pipes and conduits for utility cables. As a modular suite of digital tools, it shares data seamlessly with the integrated data environment of the Pipeline HUB[PL].

Recently, an executive from an engineering firm in Colorado explained to Technical Toolboxes why they use HDDPT. In many cases, trenchless technology is the only viable method to make critical connections in their operations. In one particular case, having HDDPT meant they could demonstrate that their plan met US Army Corps of Engineering standards. The regulators know Technical Toolboxes, so the company got that job and completed it successfully, with HDDPT playing a critical role.





Next Steps

- Ask us how the solution can help you
- Book a live demonstration to see HDDPT in action
- Check out the HDD training options available from Technical Toolboxes

Click here to learn more about Technical Toolboxes

Technical Toolboxes
3801 Kirby Drive, Suite 520
Houston, TX 77098

Toll Free: (866) 866-6766
Phone: (713) 630-0505
Fax: (713) 630-0560

info@technicaltoolboxes.com
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About Technical Toolboxes

Technical Toolboxes is a leading provider of integrated desktop and cloud-based pipeline software, online resources, and specialized training for pipeline engineering professionals worldwide. We deliver oil and gas industry training courses covering a breadth of topics with industry-recognized instructors. Compare the performance that Technical Toolboxes technology and training can make in pipeline engineering performance and you'll see a measurable difference. Our fit-for-purpose pipeline engineering software platform will help you reduce risk, lower the total cost of operations, and accelerate project schedules. Hundreds of companies rely on our certified, industry-standard technology to enhance their pipeline engineering performance.