

Minimize disruption and maximize results with trenchless technology



Reach your destination with confidence

Wherever you are on your project journey, Terracon's employee-owners are ready to meet you and help you reach your goal. Since our founding in 1965, Terracon has grown and evolved to become a thriving, employee-owned, multidiscipline engineering consulting firm. Our more than 7,000 curious minds include engineers, scientists, architects, facilities experts, and field professionals focused on solving engineering and technical challenges from more than 180 locations nationwide. On-time and real-time data driven insights, provided by our talented employee-owners, create an unmatched client experience that spans the lifecycle of any project from earth-to-sky. Terracon ranks as a top 20 design firm by *Engineering News-Record* (ENR). Our successful growth has included organic expansion and innovation as well as the acquisition of more than 60 firms with specialized capabilities. A focused and uncompromising dedication to safety has been integral to how we support our employees, clients, and communities.

Throughout the life of your project, we won't just point the way – we'll go with you. From site selection, to design and construction, to maintaining the life of the structure, we'll help you achieve success through engineering and scientific expertise, a passion for problem-solving, an uncompromising commitment to safety, and a drive to explore.

Minimize disruption and maximize results with trenchless technology.

Say goodbye to disruptive excavations and hello to efficient, cost-effective solutions. With Terracon's trenchless engineering services infused into the design process, we mitigate risks and deliver value.

We have the tools to help you mitigate your trenchless risk:

- Geotechnical investigations, in-house laboratory testing, and reports from 180 different locations
- Geohazard studies
- Report of Expected Geotechnical Conditions (REGC) – Stage 1
- Trenchless Engineering Studies, including inadvertent return analysis, borepath planning, and detailed design
- Geotechnical/structural design for support of excavation, launch portals, and thrust blocks
- Automated geotechnical instrumentation
- Ground modification to stabilize weak ground

Visit terracon.com/Services/Geotechnical to learn more.

Contact us today for a smoother, cleaner, and faster construction experience.

ENR Rankings 2024

#2	Asbestos and Lead Abatement
#10	Top 100 Pure Designers
#18	Top 500 Design Firms
#44	Top 150 Global Design Firms
#71	Top 200 Environmental Firms



We have the tools to help you mitigate your trenchless risk.

Trenchless Design

- Trenchless evaluations and detailed designs, including:
 - Horizontal Direction Drilling (HDD)
 - Pipe jacking
 - Auger boring
 - Microtunneling
 - Pipe ramming
 - Rehabilitation methods
- Feasibility studies
- Alternative project delivery methods
- Hydraulic Fracture and Inadvertent Return (HFIR) analysis
- Preparation of plan and specs
- Risk mitigation evaluations
- Permitting and coordination

Geohazard Studies

- Identification of geohazards along your existing alignment, including:
 - Karst
 - Mining activities
 - Landslides
 - Faulting
- GIS-based assessment programs to prioritize known geohazards
- Field reconnaissance to confirm geohazards and collect site specific data
- Development of mitigation plans for geohazards
- Landslide and deformation assessments
- Design of erosion control measures
- Instrumentation and monitoring programs
- Scour protection and design

Geotechnical Investigations

- Stage1 Predictive Analysis allows quick, site-specific research so project planning and feasibility-level design can move forward
- Mobilize rapidly – Terracon has a fleet of more than 140 exploration rigs to efficiently meet your workload demands
- Explore field conditions using conventional soil borings, cone penetration testing, geophysical methods, in-situ testing, etc.
- Modify exploration program as needed based on the conditions encountered and in collaboration with client
- Geophysical methods can be used independently or integrated with other investigative methods
- Geophysical characterization of sites with complex geological conditions (buried stream channels, faults, landslides, sinkholes, voids, rock conditions, and groundwater seepage)

Geotechnical Instrumentation

- Automated Data Acquisition Systems (ADAS)
- Real-time cloud-based monitoring
- Inclinometers, extensometers, piezometers, and tilt meters
- Noise and vibration monitoring
- Structural health monitoring
- Foundation testing





Nationwide | [Terracon.com](https://terracon.com)

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More than 50 Years of Service
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Assessment of Land

- Data consulting and analytics for siting and suitability studies
- Preliminary Specialized Environmental and Geotechnical Desktop Studies Based on Existing Proprietary and Public Data
- Environmental Contamination Concerns (Phase I, Phase II)
- Wetlands and other environmental features
- Subsurface Conditions (Geotechnical/Geophysical)
- Natural/Cultural Resource Studies
- Topography and Utilities

Existing Structures

- Environmental Due Diligence
- Underground Utilities
- Land use
- Traffic Management
- Off street access
- Nearby structurally sensitive Buildings and utilities

Why Use a Trenchless Design Method?

Trenchless methods can reduce disruption and damage while minimizing the project's carbon footprint during pipe installation in developed urban areas, environmentally sensitive areas, and when crossing waterways or surface transportation corridors. The design of a successful trenchless project requires an understanding of surface topography, subsurface geologic conditions along the proposed alignment, and geometric constraints.

Why Terracon?

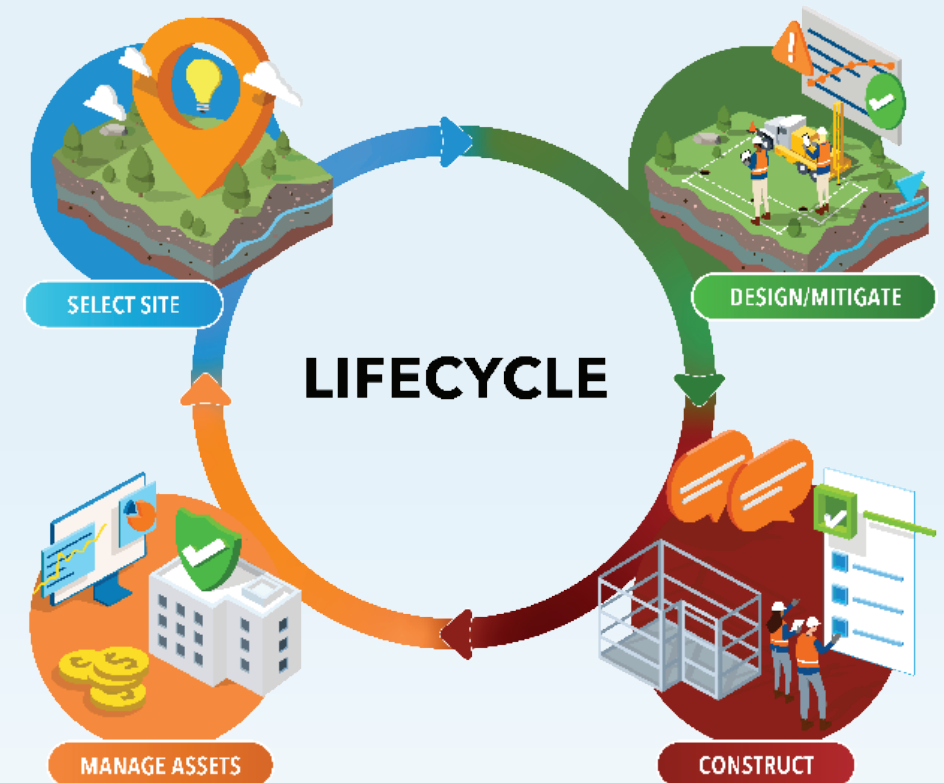
Terracon is experienced with the full range of small-diameter tunneling and trenchless technology methods currently available in the market today. Our bench strength of trenchless design professionals provides comprehensive services for the simple to the most complex projects, including:

- Feasibility studies
- Subsurface, investigations
- Preliminary and final trenchless design
- Alternative Delivery Methods
- Construction support
- Geohazard studies
- Shoring design

Let Terracon put our local and national expertise to work for you!



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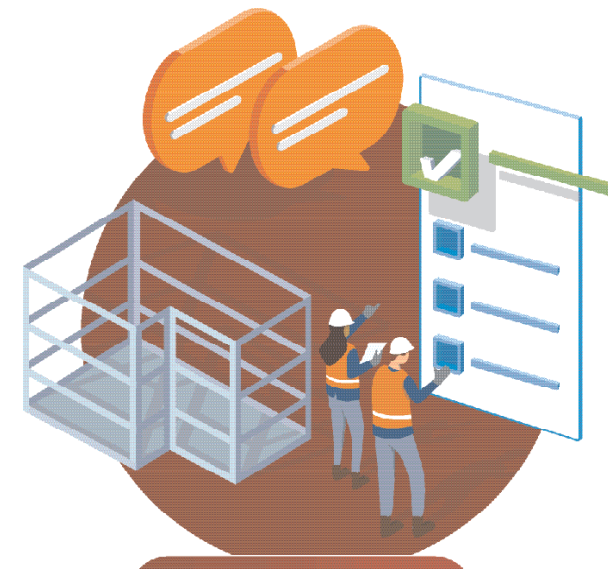


Managing Risk on Trenchless Design Projects

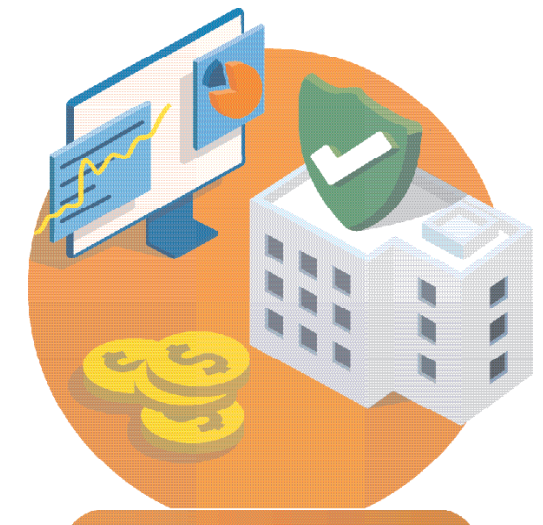
Managing the risk associated with your trenchless design projects is challenging. Terracon's trenchless technology experts understand the issues you are facing and are recognized as one of the Top 50 Trenchless Engineering firms in North America by Trenchless Technology Magazine.



DESIGN/MITIGATE



CONSTRUCT



MANAGE ASSETS

TRENCHLESS DESIGN ASSISTANCE

- Geotechnical Engineering and Trenchless Design
- Feasibility Study / Alternatives
- Detailed Design Reviews, Plans and Specs
- Project Delivery Method
- Permitting & coordination with others
- Risk Mitigation

MITIGATION OF SITE ISSUES PRIOR TO STARTING TRENCHLESS CONSTRUCTION

- Risk Register
- Design to manage risk
- Ground modification
- Preconstruction survey
- Prequalification
- Geotechnical Instrumentation
- Independent constructability review
- Forensic and Litigation support

CONSTRUCTION QA/QC

- Testing and Inspection of Construction Materials
- Observation and recording of Trenchless construction activities
- Daily field reports
- Construction photos
- Detection of Changed Conditions
- Construction Administration Support
- Construction Consulting/Owner's Rep Services
- Vibration Monitoring
- Settlement/heave monitoring Observations, and Consulting

ENVIRONMENTAL COMPLIANCE

- Monitor project alignment daily for inadvertent returns
- Construction Monitoring for Environmental Compliance
- Monitoring of drill mud returns
- Monitoring of downhole pressure sensors
- Storm Water Monitoring

BUILDING AND OCCUPANT HEALTH

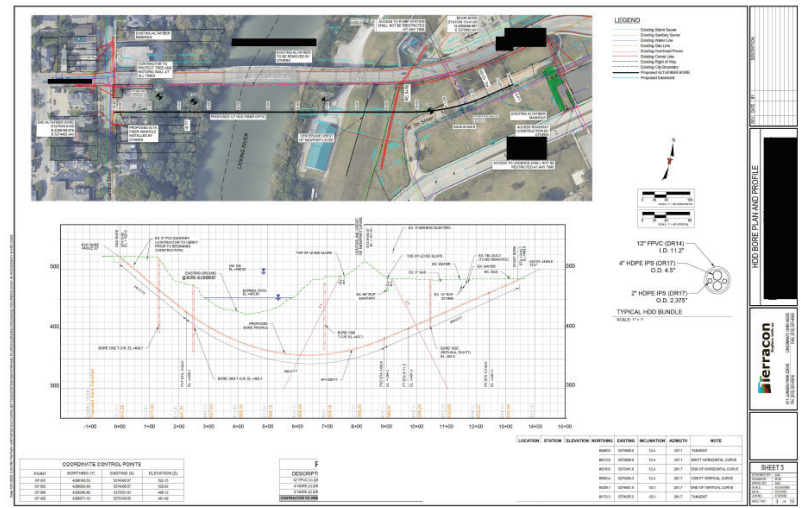
- Building Enclosure Air/Water Infiltration Investigations
- Industrial Hygiene/Indoor Air Quality
- Hazardous Materials O & M Plans and Management
- ADA Compliance
- Energy Management and Usage Studies
- Structural & Materials Assessment/Monitoring

UNANTICIPATED ISSUES

- Rapid Response – Spills
- Natural and Manmade Disaster Response
- Property Transaction Support
- Repair/Maintenance Design and Construction Management
- Cause and Origin Diagnostic Investigations

ASSET MANAGEMENT

- Facility Asset Management Programs
- Pavement and Roof Evaluation/Management
- MEP Studies
- Immediate and Long Term Capital Expenditures
- UST Management
- Re/Retro Commissioning
- System Replacement/Rehabilitation Design and Construction Administration
- Facility Condition Assessments
- Repurposing Evaluation



Trenchless Technology

Experience and Expertise

The potential of encountering unknown subsurface and geological conditions at a planned pipeline crossing when conducting horizontal direction drilling (HDD) often exists. Not knowing this information can severely impact your project's cost and schedule. It is important to research the lay of the land for area:

- Railways
- Wetlands
- Local roadways and drainages,
- Major river systems, and
- Areas within the jurisdiction of U.S. Army Corps of Engineers (USACE) levee systems.

Our professionals have completed site investigations and provided consulting support for hydraulic fracture/pullback pipe stress analyses on hundreds of projects throughout the country. We work with you to provide our knowledge on local geology and expected conditions to develop a cost-effective, subsurface exploration plan. This provides information for both design as well as installation impacts that the trenchless contractor uses in establishing a schedule and budget.

Then based on the information obtained in the field exploration, an analysis of the potential for an inadvertent release of drilling mud during the HDD process (hydraulic fracturing or frac-out) can be performed for the preliminary HDD alignment provided.

Limiting mud pressure calculations are typically based on the formulas developed by Delft Geotechnics. The equations are based on cavity expansion theory and used to calculate the maximum allowable drilling pressures during an HDD to preclude localized hydraulic fracturing. The factor of safety against hydraulic fracture is the ratio of allowable pressure in the drill hole based upon the soil strength properties and overburden to the actual anticipated downhole mud pressure in the pipeline excavation at the same elevation/location.

If a proposed trenchless profile has not been provided by a third party, we can provide ground surface mapping along the proposed trenchless alignment using survey-grade global positioning system (GPS) with real-time kinetic correction. The data collected is corrected to the appropriate State Plane Coordinate System using On-line Positioning User Service (OPUS) and used to develop a ground

surface profile. We then compile this information into a preliminary trenchless profile based on ground surface data collected, extents of easements, preferred entry and exit locations, and other project-specific requirements.

We estimate installation loads and analyze resulting stresses on the pipe using calculations presented in a number of industry standards acceptable methods. This information also considers the geometry of the proposed trenchless profile, including the angle of entry and exit, points of tangency and curvature of the trenchless, and the amount and type of soil cover over the pipeline at these critical points.

Additional Services Offered:

- Geohazard and Scour Surveys Permitting
- Environmental Planning (National Environmental Protection Agency, (NEPA), Field services)
- Stormwater Pollution Prevention Plan (SWPPP)
- Construction Observation
- Geo Instrumentation
- Ground Improvements
- Support of Excavation
- Jacking and REceiving Shaft Design



PIPE STRING



PIPE PULLBACK

Why Terracon?

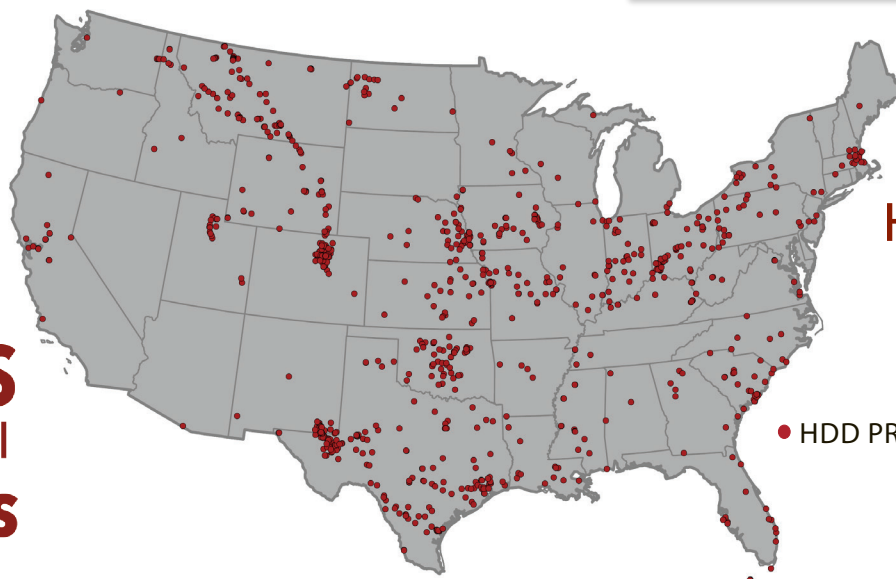
Resourceful. Terracon applies new processes, methodologies, and techniques to provide a proactive approach to solve your project challenges.

Responsive. Through our national network of offices, accredited laboratories, exploration fleet, and geophysical engineering professionals, Terracon can act quickly to develop a customized approach to provide you the most cost-effective program to develop the best data for you.

Reliable. As a trusted partner, we help you succeed in your business ventures by effectively executing projects, controlling costs, and managing risk. Terracon provides services on thousands of projects each year in both public and private sectors.

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750+
HDD Projects

● HDD PROJECTS

SERVICES
available in all
50 states

Locations Nationwide

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