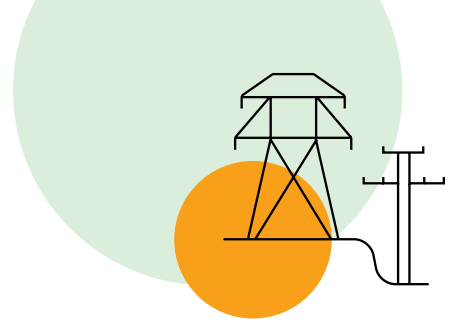


Underground Distribution Services



BLACK & VEATCH



Black & Veatch delivers optimized, customized, and practical underground solutions to meet client needs while minimizing costs, schedule, and impact to the environment. Our project experience encompasses the full spectrum of technology and methodology with cable systems in both urban, rural and marine environments. Whether for new or operating assets, typical underground distribution services focus on:

- New Businesses
- OH to UG Conversions
- Reliability
- New Substation Feeders
- PILC Replacements
- System Upgrades
- Aging Infrastructure Replacement
- Aesthetic Improvement

Custom Solutions For Every Project

There is no “one size fits all” approach to planning, designing, and installing an underground distribution system. So employing a flexible approach to planning, design and installation is necessary for a successful project. Whether the distribution line is needed in an urban area, across farmland, or a bridge, our solutions are tailored specifically to the challenges and requirements of the project.

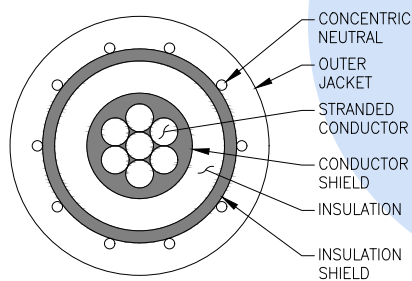
Regardless of the conditions, our experience provides a real-world perspective on available options for completing the underground installation, which means we get to the best option as quickly as possible, so the project stays on schedule and budget while maximizing constructability, safety, and minimizing environmental and community impact.

Engineering Design

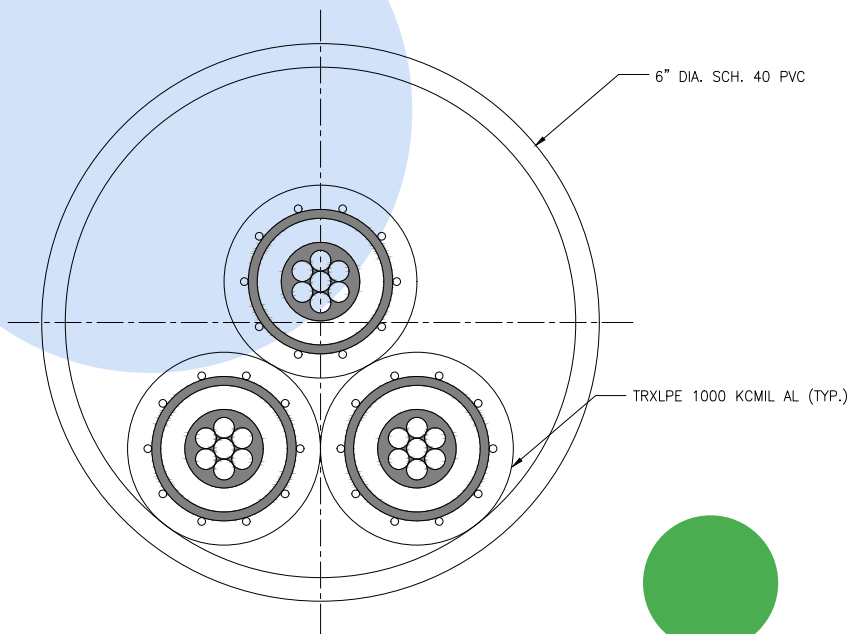
- Field Review/Verification
- Field Surveying/Geotechnical Investigation
- Underground Utility Exploration
- Plan and Profile Drawings
- Civil Duct Bank Design
- Manhole/Vault Design
- Trenchless Design (Jack & Bore and Horizontal Directional Drill)
- Detail Design For Construction Packages
- Cable System Design
- Magnetic Field Calculations
- Seismic Design
- Technical Specification Development
- Technical Support During Procurement and Construction
- Construction Inspection/Management

EPC

We can handle every aspect of an underground distribution project from planning through construction. With decades of experience in a variety of domestic and international projects, we are experienced with all major vendors of cable and the specialty contractors who install these systems. These relationships mean we can procure quality material at a low cost and manage all phases of construction execution successfully.



TRXLPE 1000 KCMIL AL
 SCALE = N.T.S.



PIPE CROSS SECTION
 SCALE = N.T.S.

Owner's Engineer

As a global leader in transmission and distribution engineering, we have proven experience as owner's engineer for utilities around the world. These services include:

- Conceptual Design
- Feasibility Analysis
- Technology Evaluation
- Permitting Support
- Engineering Design Review
- Procurement Support
- Manufacturing Inspection
- Factory Acceptance Test Witness Support
- Construction Office and Field Support
- Field and Commissioning Test Witness Support

Studies

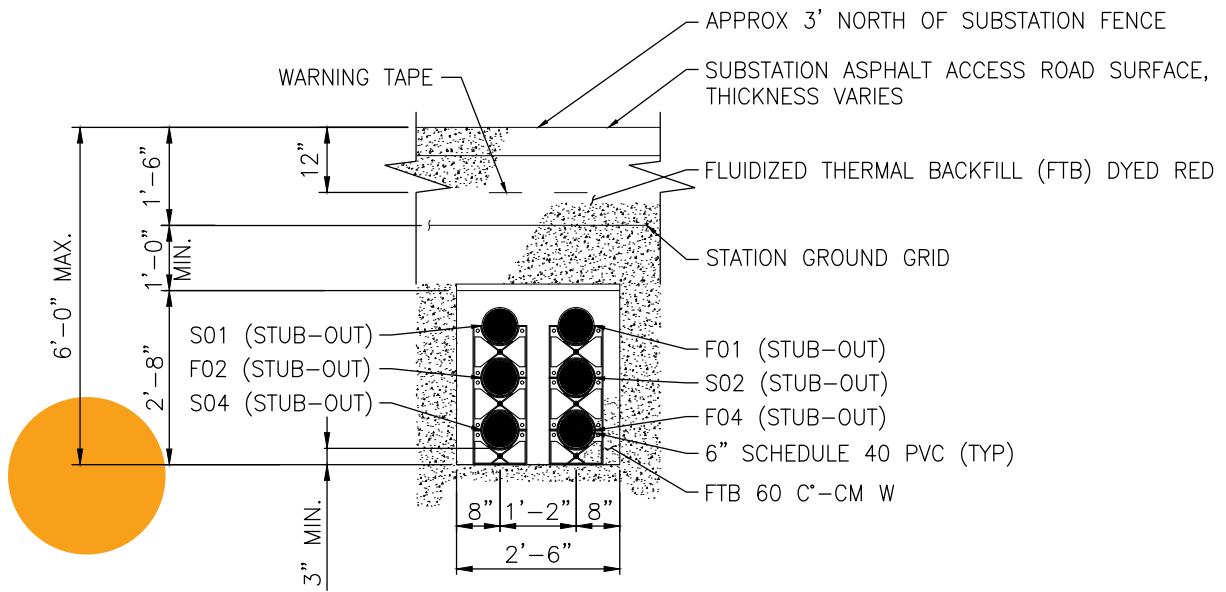
Grappling with an increasingly complicated list of competing priorities means choosing when and how to invest valuable resources isn't always a clear choice. We understand this difficulty because our team has been in those positions as operators and consulting engineers. It's this unique blend of perspectives that informs our approach to studies and offers the perspective you need to make the best possible choice for your distribution network. These services include:

Route Selection Study

- Community Impact Analysis
- Historical Landmark Analysis
- Utility Impact Search
- Environmental Impact Analysis
- Geographical Analysis
- Real Estate Easement and Condemnation Analysis
- Risk Analysis
- Construction Feasibility Analysis
- Cost Comparison Estimates

Cable System and Constructability Study

- Technology Review
- System Requirements
- Constructability
- Cost Estimates
- Suppliers
- Open Trenching
- Horizontal Directional Drill
- Jack & Bore
- Bridge Attachment
- Water Crossing
- Difficult Terrain
- Tunnel



Resources

Our underground transmission and distribution team is led by industry-recognized underground cable experts, and has comprehensive experience in: theoretical analysis, practical cable manufacturing, testing and application, engineering design consulting, and project management. Beyond technical knowledge, the underground team members have decades of hands-on experience working with clients across the globe on various AC and DC cable systems through 500kV.

Tools

Our cutting-edge tools and processes integrate data and incorporate analytics for comprehensive, innovative, and intelligent designs. We use a suite of interconnected tools that can work in tandem to cross-analyze data to produce advanced calculations. For example, our internal design tool allows us to analyze cable installation data, calculate pulling tensions and sidewall pressures in real time, and incorporate changes quickly. These tools paired with our underground expertise result in optimized designs for each project that save our clients time and money.