

Advanced Forepoling Systems

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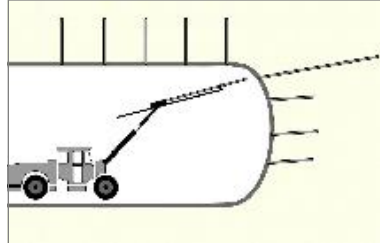
- Introduction
- Spiles / Short Forepoling
- Pipe Umbrella System



Definition Pre-Support

■ Pre-Support

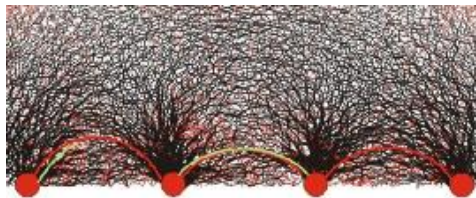
- All support measures installed into the ground prior to the excavation
- Face dowels / short forepoling / pipe umbrella systems



Support Effects – Stabilization of Open Span

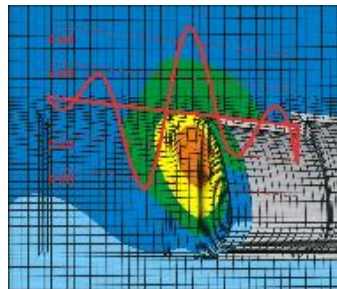
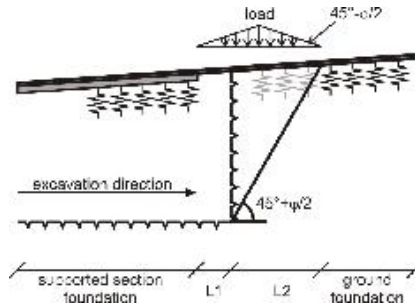
■ Local arching effects in the open span

- Subdivision of open areas
- Reduction of overbreak volume
- Increase of safety
- Reduction of costs



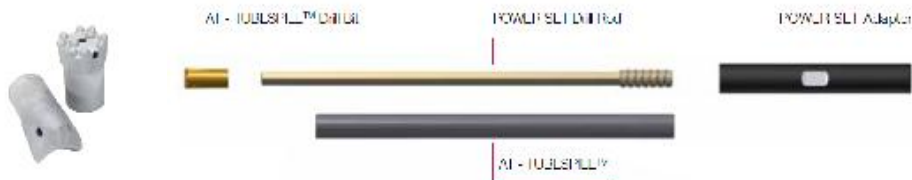
Support Effects – Load Transfer

- Longitudinal load transfer from critical sections to less loaded ones
- Abutments are:
 - Already supported sections
 - Ground ahead of the face



AT - TUBESPILE™

- Field of Application
 - Tunneling in soft homogenous or inhomogeneous ground
 - Unstable conditions in the unsupported span
 - Short pre-support (3-4m)



AT - TUBESPILE™ – Installation Procedure

Installation Procedure

- Attachment of ready-for-use AT - TUBESPILE™
- Rotary-percussive self-drilling installation with a single-use drill bit
- Completion of installation after the final drilling depth has been reached
- Retraction of the POWER SET drill rod from the installed AT - TUBESPILE™



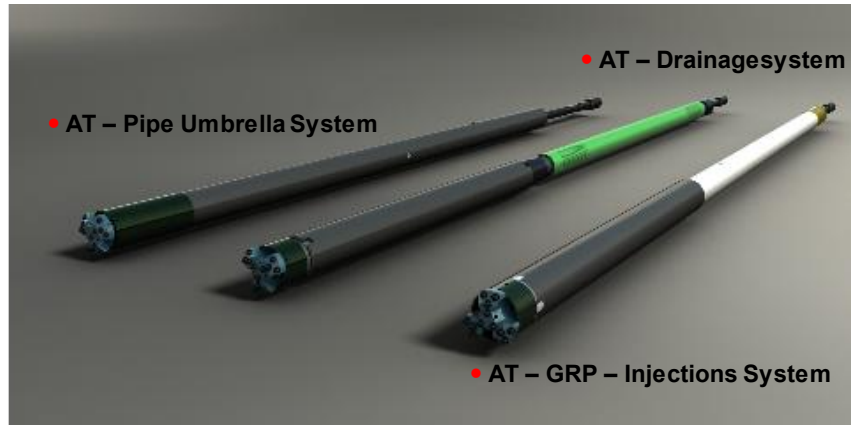
AT - TUBESPILE™

Main Advantages

- Installation using conventional drill jumbos
- Fast, secure and easy installation procedure
- Spile drilling and installation in one step
- Ground preserving, self-drilling installation
- Higher section modulus than comparable ram spiles, rebar spiles, or IBO - Self-Drilling Spiles



AT – Casing System



AT – Pipe Umbrella System

■ Fields of Application

- Weak ground conditions
- Frequently changing ground conditions
- Between spiles (normal forpiling) & special techniques (pipe jacking, grouted columns, ground freezing)

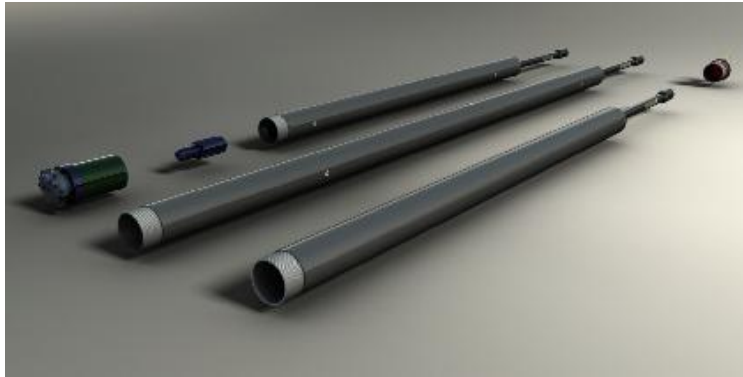
■ Pipes installed prior to excavation

- Diameter 70-200mm
- Pipe wall thickness 5-15mm



System Parts / Force Transmission

- AT - Starter Unit with Drill Bit
- AT - Extension Tube
- Valves in injection holes
- Various AT - Adapters
- Drill Rods
- AT - Grouting Plug (End Plug)



Main Advantages

- Installation with conventional drill jumbos
- Execution of pipe umbrella drilling with on-site personnel
- Simple and robust system components
- Fast self-drilling installation
- Length of pipe umbrella pipes can be adapted to constricted space
- Different pipe coupling types available to suit different project requirements



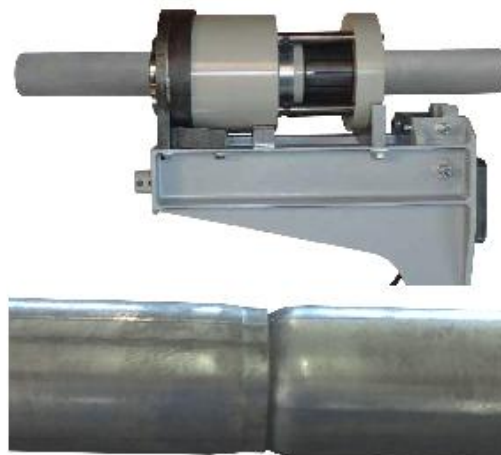
Pipe Couplings - Standard Thread Connection

- Simplest connection type
- Installed tubes show a constant inner diameter
- The stiffness of the connection is considerably lower than the stiffness of the standard pipes
- Recommended for the installation of measurement instrumentations and for ground-improving injection works



Pipe Couplings - Squeezed Connection

- The ultimate load of this connection is higher than the elastic design load of a normal pipe (> 1.5)
- Reduction of the inner diameter in the connection area
- Recommended for all advances where a pipe umbrella is installed because of its static load-bearing capacity

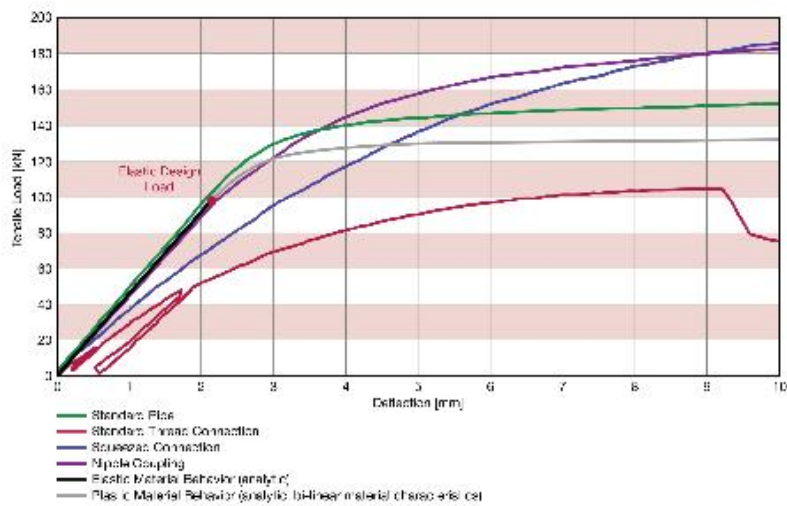


Pipe Couplings - Nipple Coupling

- The elastic design load is equal to the one of a standard pipe
- Stiffness in the elastic range is comparable to the one of a standard pipe
- Reduction of the inner cross-section
- Recommended for advances where the static load-bearing capacity is required to achieve stable conditions and settlement limitations are part of the design



Comparison of AT - Pipe Couplings





THANK YOU !