

# *Design and Construction of Microtunneling Projects*

## **Purpose and Background**

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Significant technical advances and increases in the utilization of microtunneling have occurred in North America in the past decade permitting the installation underground of small/medium diameter pipes in virtually all ground conditions with the minimum of surface disturbance.

Microtunneling techniques, while becoming increasingly wider in their range of application and diameter range, do incorporate many of the complexities of modern large diameter tunnels including the challenges of technically demanding tunneling.

This course is specifically tailored for those interested in microtunneling and describes the technique in depth together with comparisons with other trenchless techniques such as horizontal directional drilling etc. The course provides an in-depth review of microtunneling including all its aspects. Techniques for subsurface investigation and characterization and how these are best applied to microtunneling will be discussed.

The course reviews how this sub-surface information is then used in designing, specifying, planning, and costing for microtunneling projects.

The selection of an appropriate microtunneling technique (auger, slurry or EPB) and tunneling systems (such as various pipe materials or segments in various ground conditions), will be discussed, as well as the set-up and configuration of the tunneling equipment for each project.

The seminar examines the selection, sizing, and construction of various shafts for tunneling, and key aspects of microtunnel design, specification, planning, monitoring and management, including risk assessment and management. New trends and the state of the art in microtunneling will also be discussed.

Case Histories and Group Discussion: The seminar includes a number of relevant short videos and several microtunneling case histories. It provides practical applications and group involvement and discussion of the various techniques discussed together with relevant course materials to be retained by the attendees. A list of suggested reading will also be provided.

• For group training, contact John Wyrick ([JWyrick@asce.org](mailto:JWyrick@asce.org)) or Stephanie Tomlinson ([STomlinson@asce.org](mailto:STomlinson@asce.org))

# Summary Outline

## DAY ONE

### Introduction to Microtunneling and its Role in Underground Construction

- Seminar Overview
- Participants background
- A brief historical overview
- A brief review of all trenchless techniques, HDD, pipe ramming etc. in comparison to microtunneling
- Review of microtunneling and principal uses

### Sub-Surface Characterization in Soil and Rock for Microtunneling

- Geotechnical site investigation for microtunneling
- Characterization of soils for microtunneling
- Characterization rock mass for microtunneling
- Soil and rock permeability
- Interpretation of site investigation data for microtunneling

### Microtunneling Methods

- Definition of microtunneling
- Face support, settlement & minimum cover
- Equipment selection criteria auger/slurry/EPB
- Auger microtunneling
- Slurry microtunneling
- EPB microtunneling
- Use of bentonite in microtunneling
- Ground excavation capabilities
- Rock excavation in microtunneling
- Rational for cutter head configurations and overcut
- Case histories

### Microtunneling Techniques

- Microtunneling system manufacturers and selection
- Site layouts and size requirements
- Launching and recovery of microtunnel systems
- Jacking systems
- Jacking force prediction and monitoring
- Lubrication for microtunneling
- Planning for and use of interjacks
- Alignment control
- House connection/pilot pipe systems
- Special features
- Case histories

## DAY TWO

### Jacking Pipe and Segmental Linings for Microtunneling

- Jacking pipe types
- Key factors in selecting jacking pipes
- Jacking pipe & lining capabilities & performance
- Jacking pipe specification
- Special jacking pipes
- Use of segmental linings in microtunneling
- Segment specification

### Shaft Construction for Microtunneling

- Review of available techniques and their suitability
- Shaft sizing for microtunneling
- Rib & lag and steel supports
- Sheet piles
- Jet grouting
- Caissons
- Slurry walls
- Ground freezing
- Case histories

### Planning, Productivity and Costing for Microtunneling

- Development of projects
- Key aspects of planning for microtunneling
- Planning and equipment selection
- Drive lengths and depth capabilities
- Productivities
- Cost and costing for microtunneling
- Case study

### Microtunneling Prequalification, Specifications, Submittals and Monitoring

- Contract documents for successful microtunneling
- Dispute mitigation and resolution measures
- Prequalification for microtunneling
- Specification for microtunneling
- Submittals for microtunneling
- Operational monitoring data acquisition and reporting
- Site staff training

## DAY THREE

### Microtunnel Planning, Management Risk and Safety

- Site investigation
- Conceptual planning
- Key planning issues
- Risk identification mitigation and management
- Environmental concerns
- Operation safety

### Potential Problems in Microtunneling and Shaft Construction

- Groundwater control
- Excavating and dealing with obstructions
- Cobbles boulders and hard rock
- Microtunneling in very soft ground and wood
- Mixed face microtunneling
- Operational concerns
- Ground improvement methods and ground freezing
- Issues concerning long drives
- Case histories

### New Developments, Trends and Techniques in Microtunneling

- New trends in site investigation techniques
- Excavation techniques and capabilities
- Modern high capability microtunneling systems
- Soil removal and separation
- Curved microtunneling
- Long drive capability
- New technical developments
- Retractable machines and other special techniques
- Pipe arch microtunneling
- Lake taps

### Plus specifically relevant case studies and videos

### Group participation in discussion of case histories and attendees' particular concerns or projects

### Bibliography of suggested reading

## Seminar Benefits

- Select suitable investigation techniques, investigate and analyze ground conditions for microtunneling
- Provide firm data to assist in making informed decisions regarding microtunnel equipment selection, microtunnel lining selection and shaft construction methods
- Develop techniques to mitigate anticipated and unanticipated microtunneling problems
- Develop microtunnel prequalification, specifications and construction schedules more accurately
- Understand the microtunneling process better and how to monitor microtunneling projects and interpret the data
- Manage and risk mitigate microtunnel construction projects more successfully and safely
- You will have the opportunity to discuss case histories and to discuss particular concerns or projects

## Who Should Attend?

- Sewer, storm water and utility managers
- Construction and project managers
- Engineers (both field and design office)
- Construction supervisory personnel
- Construction cost estimators
- Graduate civil or geotechnical engineers
- Individuals in the construction industry including contractor's personnel wanting a firm grounding in modern microtunneling techniques and practices

## Seminar Instructor

**Andy Robinson** has a B.Sc Civil Engineering degree from Aston University in Birmingham, UK and has over 30 years experience in the underground utility installation sector. His primary experience is in the fields of tunneling, underground space and trenchless technologies including tunneling, pipe jacking & microtunneling, Horizontal Directional Drilling, shaft works and jacked underground structures.

Andy specialises in underground design, construction management and Expert analysis and prior to entering the engineering services field had roles with both a tunneling contractor a tunneling plant manufacturer. His expertise covers all aspects of project development and support, from project evaluation and feasibility study through conceptual and detailed engineering design to equipment and materials selection, project construction and operations management, and dispute resolution. He has a strong practical understanding of geotechnical and geological conditions and their impact on the underground works and how they are constructed.

His international experience is extensive having worked on projects in Europe, SE and Far East Asia, North, South and Latin America, The Caribbean, the Middle East and Australasia. He has been at the forefront of developments and innovations in the trenchless technology, microtunneling and tunneling field and has been a team member on two projects that have previously been recipients of the Trenchless Technology "Project of the Year" award.

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