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**Australasian Society for Trenchless
Technology
Specification for Horizontal Directional
Drilling**

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1.0 INTRODUCTION

The Australasian Society Trenchless Technology has developed this Specification to assist industry users in Australia and New Zealand in utilising Horizontal Directional Drilling.

General information on current methods of Horizontal Directional Drilling as a Trenchless Technology methodology for installing pipe is provided, as well as which method is most appropriate.

This document does not replace any existing relevant manuals or standards. It remains the users responsibility to ensure that all relevant laws, standards and specifications are adhered to during the course of a Works with use of Horizontal Directional Drilling.

Additional horizontal directional drilling information can be obtained from the Australasian Society Trenchless Technology website, they are:

- Guideline for (Horizontal Directional Drilling, Pipe Bursting, Microtunnelling and Pipe Jacking).
- Standard for Horizontal Directional Drilling.
- National Utility Contractors Association Trenchless Assessment Guide, a web-based tool that can be used for identifying trenchless construction methods suitable for a particular set of project attributes (i.e.: diameter, length, depth, geological conditions and so on).

2.0 DEFINITIONS

A number of abbreviations and technical terms have been used in this specification:

ASTT - Australasian Society for Trenchless Technology. (www.astt.com.au)

Client - Person or company requiring the Works to be undertaken.

CCTV - Closed Circuit Television - The use of video cameras to visually inspect the installation. Often used where manual entry is not feasible or possible.

Contingency Plan - A plan for backup procedures, emergency response, and post-disaster recovery.

Contractor - Person or company undertaking the Works required.

Guideline - General information about an item, process, method, material, system or service.

HDD - Horizontal Directional Drilling. A steerable trenchless method of installing underground pipes, along a prescribed path by using a surface launched drilling rig.

NUCA TAG - National Utility Contractors Association Trenchless Assessment Guide.

Operator - Suitably trained or qualified person who operates machinery, an instrument, or other equipment.

Specification - A document that specifies, in a complete, precise, verifiable manner, the requirements, design, behaviour, or other characteristics of a system, component, product, result, or service and, often, the procedures for determining whether these provisions have been satisfied.

Standard - A document that provides uniform technical criteria, methods and processes. Often establishes an engineering norm.

Work - The project or task to be completed by the Contractor on behalf of the Client.

3.0 SPECIFICATION FORMAT

From this point on in this specification, the format has deliberately been changed to a format that would typically be used in a works specific scope of works and/or specification. This has been done for the purpose of ease of use by industry users of this specification.

4.0 SUBMITTAL

The Contractor shall submit documentation and tenders in accordance with this specification's SUBMITTAL and GENERAL REQUIREMENTS.

- (i) Documentation detailing the training and relevant experience of the Contractor's personnel shall be submitted to the Client. All Contractor's personnel are required to be fully trained in their respective duties and in the safety of operating any equipment that will be utilised during the course of the Works. Please refer to DRT03 (Training Package for the Drilling Industry)¹ and or BCC03 Civil Construction Industry Training Package² for relevant competency standards and qualifications.

Prior to letting the Contract, the Client should ensure:

- (ii) Horizontal Directional Drilling is possible i.e. ensure the presence of and proposed proximity to existing services is clearly known and the risks understood.
- (iii) That a comprehensive geotechnical investigation is carried out and available at the time of tender.
- (iv) Liaison with relevant authorities e.g. railways, road authorities and local residents is completed and a system of liaison during the construction works is developed and detailed in the tender documents. Define any third party requirements which will impact the works e.g. extent of ground settlement monitoring if required during the works.

¹ Australian Drilling Industry Training Committee www.aditc.com.au.

² Construction Industry Training Board www.constructionskills.com.au

5.0 HORIZONTAL DIRECTIONAL DRILLING METHODOLOGY

Prior to commencing any work, the Contractor shall submit a clear and detailed statement for the execution of the trenchless pipe installation to the Client which shall include but is not limited to the following:

- Safety management plan,
- Risks Management plan,
- Environmental management plan and noise pollution problems,
- Quality management plan,
- Traffic and public relationship management plan
- General description of the construction method, sequence of operations and possible type of trench support,
- Manufacturer and type of HDD equipment and related operating system proposed and capability of equipment chosen,
- Bore plan, reaming and pull back,
- Bore tracking and related equipment use,
- Existing underground utility services location and proposed special precautions,
- Ground monitoring equipment and methods, for example heaving, fluid loss or frac-out,
- Type of existing pipe and services reconnection joints used and their relevant specification,
- Calculation of size, depth and location of launching pits required and hydraulic for bypass pumping (if applicable),
- Dewatering, flow bypass pumping, field final product testing,
- CCTV inspection frequency (to be agreed on with the Client), and or supply of temporary services (if applicable),
- Type of slurry or drilling fluid used, fluid design plan, and mud handling system specification,
- Location of exit pits, trench support and work sites layout,
- Method of temporary spoil storage and disposal,
- New pipe product (pipe specifications) and or replacement piping type, butt-fusion methods and equipment used,
- Programmed daily work hours and duration for the operation,
- Specialist subcontractors utilised applicable competency training records of personnel.

5.1 Horizontal Directional Drilling Installation of Pipe

The Contractor shall furnish all labours, plant, materials, tools, equipment required to complete the work.

The Contractor shall establish, file and maintained up to date records that demonstrate that the contractor's quality management system is being effectively maintained.

The Contractor shall follow the recommended pipe installation procedure illustrated but is not limited to the following:

(a) Pipe Installation

- (i) The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign deleterious faults.
- (ii) The pipe manufacturer shall be designated at the time of the tender. The Client, in writing, must approve any subsequent change of pipe manufacturer. The Contractor shall provide a record of experience and product type information at the time of tending.
- (iii) The Contractor shall transport, handle and store the pipes and fittings in accordance with the manufacturers' recommendations at all times. Materials that are damaged or lost shall be repaired or replaced by the Contractor at no additional cost to the Client.
- (iv) A drilling fluid design plan, including recycle-handling system shall be established and agreed with the Client prior to commencing the Works. This plan shall also be modified, when warranted, throughout the project to ensure the drilling fluid is fulfilling its function.
- (v) The Contractor's drilling execution plan shall identify the equipment to be maintained onsite to check drilling fluid properties. Alternations to the mix shall be made, when warranted, to stay within the proposed boundaries of the drilling fluid plan.
- (vi) In the event that the pilot bore deviates from the planned bore path, the Contractor shall notify the Client. The Contractor may be required to pull back and re-drill from the location along the bore path prior to the deviation occurring, if deemed necessary by the Client. (refer to 4.6(iii))
- (vii) In the event of a boring fluid fracture or return loss occurring during pilot hole boring operations, the Contractor shall ensure that the contingency plan for frac-out or fluid lost is implemented. The Client and the Contractor will discuss additional options, and implement as required.
- (viii) Upon successful completion of the pilot hole, the Contractor shall ream the bore hole using the appropriate tools to a minimum of 25% greater than outside diameter of pipe.
- (ix) The Contractor shall not attempt to ream at one time more than the boring equipment and recycle system are designed to handle.
- (x) The Contractor shall pull the pipe through the borehole after successfully reaming the borehole. In front of the pipe will be a swivel. Once pull back operations have commenced, the operation must continue without interruption until the pipe is completely pulled through the reamed hole.

During the pull back operation the Contractor will not apply more than the maximum safe pipe pull force at any time.

- (xi) In the event that the pipe becomes stuck, the Contractor shall immediately cease the pulling operations to allow any potential hydro-lock to subside. Then if on re-commencement of the pulling operations the pipe remains stuck the Contractor shall immediately notify the Client. The Contractor in consultation with the Client will discuss the appropriate recovery plan to be implemented to allow the work to continue.
 - (xii) Prior to sealing the annulus space, restoring the access chambers, and backfilling the insertion pit, the installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than four hours, for cooling and relaxation. Sufficient excess length of new pipe shall be allowed to protrude into the access chamber to allow for cooling and relaxation and the consequential contraction.
 - (xiii) Restraint of the pipe ends shall be achieved by means of Central Plastics Electro Fusion couplings or other methods approved by the Client. The electro-fusion couplings shall be slipped over the pipe ends against the access chamber wall and fused in place. Installation of electro fusion couplings shall be done in accordance with the manufacturer's recommended procedures.
 - (xiv) Prior to backfilling launching and exit pits, the Contractor shall ensure that new pipe is properly supported and on the required grade. Suitable material approved by the Client shall be used immediately under the new pipe as support in order to avoid sagging after backfill and compaction.
- (b) Drawing and Calculations
- (i) All construction drawings and design calculations used during the construction shall return to the client with marks up to serve as "As-Built" record. Marks up shall include the following but not limited to the new pipe alignment, access chamber, pipe joints, and lateral service connections.

5.2 Settlement and Surface Heave Monitoring and Collapse of Bore Hole

- (i) The Contractor shall take all care and necessary precautions to protect existing structures, utilities and services in planning and execution of the Works. Any damage to adjacent properties that are not part of this work shall be repaired and restored to its original condition at the Contractor's expense.
- (ii) The Contractor shall be responsible for the identification and protection of services where these are crossed by construction activities.
- (iii) The Client shall be notified immediately of all services encountered during the progress of the Works. The services shall be marked on the "As-Built" drawings by the Contractor.
- (iv) Where crossing of roadways and railways are involved, the Contractor shall be required to record and report any ground settlement to the satisfaction of the controlling agencies.

- (v) Where utilities and pipelines are involved the Contractor shall monitor ground settlement or heave directly above and 3m before and after the utility or pipeline intersection.
- (vi) The Contractor shall cease operations when monitoring points indicate any surface disruption. The Contractor shall propose immediate action for review and approval by the Client to remedy the problem.

5.3 Performance Requirements

- (i) The Contractor shall provide proof of certification by the HDD equipment manufacturers of the energy, condition, and operational characteristics of all equipment to be used for installing the specified pipe.
- (ii) Dewatering shall not be permitted for HDD, but, if required may be permitted for construction of receiving pits and utilities cross over access pits.
- (iii) The Contractor shall ensure the pipes are assembled on site using butt-fusion method to provide a leak proof joint. Threaded or solvent cement joints and connections are not permitted. Fusing shall be accomplished by personnel certified as a fusion technician to the satisfaction of the client.
- (iv) The Contractor shall in accordance with the manufacturer specification ensure that a butt-fused joint is constructed in true alignment with a result an uniform roll-back beads. The joint shall be allowed adequate cooling time before removal of pressure. All identified defective areas of the pipe shall be cut out and the joint fused in accordance with the procedures stated by the manufacturer and replaced at no additional cost to the Client.
- (v) The Contractor shall ensure that the terminal sections of pipe that are joined are connected with Central Plastics Electrofusion Couplings, or connectors with tensile strength equivalent to that of the pipe being joined.
- (vi) The Contractor shall ensure that the operator monitors the system at all times. All functions of the system shall be monitored and relayed to the operator. The minimum information available to the operator shall include thrust or pull force, roll, depth, temperature and fluid pressure.
- (vii) The Contractor shall include in his drilling plan the process to relieve pressure that may occur during the drilling operation for all utilities crossing identify within 600mm of the proposed pipe alignment.
- (viii) The Contractor is to ensure that the equipment has the capability of limiting the drilling and pulling force applied to the pipe so as not to exceed the manufactures recommended tension loads for the pipe.

5.4 Receiving Exit and Access Pits

The Contractor shall take all necessary action to ensure the safety of the work and shall ensure compliance with the pre-approved Safety Management Plan requirements at all times.

The sizes of all excavations shall conform with the following:

- (i) Pits shall be of the minimum possible size commensurate with safe working practices and located at the maintenance holes. The Contractor shall select the size and provide the details of all pits.
- (ii) Every face of any excavation that exceeds a depth of 1.5 m shall be supported or contained by shoring unless the face is cut back to a safe slope.
- (iii) The shoring of the excavation shall be braced as the excavation progresses and where a mechanical digger is used, the shoring shall be kept as close as practicable to the excavator.
- (iv) All necessary measures must be taken to ensure that excavations are left in a safe condition, including the erection of suitable hard barricades, warning signs and hazard lights.
- (v) The earthworks shall be set out in accordance with the design drawings.
- (vi) The Contractor shall inspect the site, and verify all existing levels, survey control points and set out points shown on the Drawings, before commencing the earthworks.
- (vii) All excavations shall be made to the depth and extent as shown on the Drawings with proper allowance for fill, additional cover (where required) and formwork. The excavations shall be kept free and clear of loose materials, water and rubbish. Should excavation to the nominated depth reveal unstable or unsuitable ground, the Contractor shall immediately notify the Client.

5.5 Grade and Alignment Tolerances

- (i) Tolerances in the gradient and alignment of the final installation shall comply with the Client's specifications.
- (ii) The contractor shall record the exact position of the drill, to ensure that heave or settlement along the alignment is within specified tolerances. The Contractor shall make immediate corrections to alignment before allowable tolerances are exceeded if a misalignment is recorded.
- (iii) All client shall agrees the allowable tolerance on the pilot bore path once it has been established if it fall outside the original proposed alignment indicated in the design drawing.

5.6 Obstructions and Loss of Ground

- (i) If a stoppage in the forward progress of the project is encountered, the cause of the stoppage shall be determined by the contractor. When the cause has been identified, the installation method shall be modified to the satisfaction of the client to best suit the actual conditions encountered. Should the stoppage be a result of the Contractor's equipment, materials or method, then all remedial costs will be at the Contractor's expense.

5.7 Pipe Testing, Disinfection and Inspection

After satisfactory completion of the installing the new pipe and removal of all equipments and excavated materials for the HDD operations, the Contractor shall conduct the inspection outlined as follows:

- (i) Air testing of individual pipe joints using low-pressure air methods (in compliance with ASTM C828) shall be used to complete the test requirements.
- (ii) Hydrostatic testing and CCTV inspection for pipe shall be used to complete the necessary test requirements.
- (iii) Further testing may be required to ensure the pipeline is leak proof, based on manufacturer provided material panel properties.
- (iv) All test sheets of inspection equipment shall be provided to the Client as part of the "As-Built" documentation.

5.8 Closing of Pits

- (i) After satisfactory completing all testing and all equipment and excavated materials for the HDD operations have been removed, the Contractor shall prepare the bottom of all pits to the same specification as required for the pipe foundation. The Contractor shall remove all loose and disturbed materials below pipe grade to the undisturbed earth level and shall recompact the materials to as close to the original condition as possible.

5.9 Quality Control and Assurance

- (i) The Contractor shall submit a description of the method and frequency of survey control that will be utilised (e.g. drilling daily log).
- (ii) The Contractor shall maintain a record of "As-Built" drawings and other data in accordance with the General Conditions of Contract, this Specification and the Scope of Works, throughout the duration of the contract.
- (iii) The Client reserves the right to reasonable access to the Contractor's facilities and Quality Assurance records for the purposes of Quality Assurance Audit and inspection throughout the contract period.
- (iv) The Contractor's Quality Management System shall be subject to formal audits as required by the Client.
- (v) The Contractor's Quality Management System shall define the method for performing its own internal audits.

6.0 GENERAL REQUIREMENTS

6.1 Environmental Impact Assessment

- (i) The Contractor shall undertake all Works in accordance with appropriate environmental requirements.
- (ii) Prior to commencing any earthworks or excavation operations, the Contractor is obtain an "Excavation Permit" from the Client and to identify the location of underground installations (i.e. gas, sewer, water, fuel, electrical and communications cabling) in the area. If required, the Contractor shall obtain any or all approvals required from external agencies e.g. local councils, State Road Authorities. The Contractor shall take all measures necessary to ensure that all such installations are protected from damage or displacement during the course of the work.
- (iii) The Contractor shall obtain a "Gain Access approval", and be responsible for clearing any construction spillage, waste and debris from local Regulator.

6.2 Geotechnical Baseline Report

- (i) It is the Contractor responsibility to ensure that the geotechnical assessment of the grounds provided by the client is sufficient to complete the work.

6.3 Traffic and Public Relationship Management Plan

- (i) The Contractor shall undertake works in accordance with requirements of an approved Traffic Management Plan, (per the provisions of AS 1742 - Manual of Uniform Traffic Control Devices) and any additional requirements of the local and state authority.
- (ii) The Contractor shall ensure that access is maintained for public and construction traffic. Traffic shall be isolated from construction traffic wherever practicable. In areas where access for public traffic cannot be separated from construction traffic, appropriate traffic measures shall be cleared identify in the Traffic Management Plan.
- (iii) The Traffic Management Plan shall clearly identify what traffic control devices shall be implemented for the work. All traffic control devices shall be kept clean to ensure visibility and reflectivity is maximised for both day and night traffic.
- (iv) Any by-pass roads, detours and other temporary works as proposed should be clearly identify in the Traffic Management Plan. Details of the proposed temporary works shall be provided to the Client for approval prior to the start of these works.
- (v) Pursuant to these requirements, a traffic management diagram shall be provided to parties nominated by the Client for distribution and display on all safety notice boards. This diagram shall be updated to display the current conditions at all times.

- (vi) Traffic management plans implemented on site shall be inspected daily or at greater frequency as required to ensure they are maintained in accordance with the plans. A register of traffic management plans shall be maintained to reflect inspections and maintenance undertaken.
- (vii) The Contractor shall provide a public relationship management Plan.

6.4 Safe Work Practices

- (i) Toolbox meetings shall be conducted before the commencement of daily works and a written record of attendance (and safety topic) will be submitted to the Client's Representative.
- (ii) The Contractor shall undertake works in accordance with appropriate safety requirements by local, state and federal regulations. Safety measures shall include, but not be limited to, personal protective equipments, operating of machinery within job site, and storage and transportation of materials and equipments.

6.5 By-pass Pumping

- (i) The Contractor shall outline temporary services plans for the duration of this project. Each plan, and details of how it shall affect the Client and the Works, shall be submitted to the Client for his approval.
- (ii) The Contractor shall outline all hydraulic calculations of by-pass flow pumping during the project. The Contractor will also submit pump specifications, the number of stand-by, duty and operating procedures to the Client for approval.

7.0 CONTINGENCY PLANNING

The Contractor shall prepare a contingency plan specific to the site of operation.

The plan should address but not be limited to the following:

- (i) General procedures
- (ii) Labour issues
- (iii) Equipment needs and spares
- (iv) Boring fluid fracture and spillage
- (v) Time considerations
- (vi) Clean up and monitoring methods
- (vii) Client and regulatory contact
- (viii) Disposal plans
- (ix) Public Relations

8.0 MEASUREMENT AND PAYMENTS

- (i) Payment shall be based on the Contract Schedule and paid in accordance with the contracted terms and conditions.
- (ii) All work necessary to complete the Works, including but not limited to shafts, access chambers, dewatering, connections, and similar items are considered subsidiary to the bid items. Payment will be made based on the bid items complete and in place.

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