The use of PE100+ Materials in Trenchless Technology Applications

Speaker: Andrew Wedgner, PE100+ Association

2023 TRENCHLESS ASIA

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PE100+ Association: The production, testing and listing of consistently high quality PE100 materials

- Introduction to the PE100+ Association
- Trenchless installation and rehabilitation techniques using PE pipes and liners
- An introduction to the EN ISO 11295 family of standards
- The PE100+ Association online No-Dig Technical Guide
- Conclusions

Introduction to the PE100+ Association

PE100+ Association: The production, testing and listing of consistently high quality PE100 materials

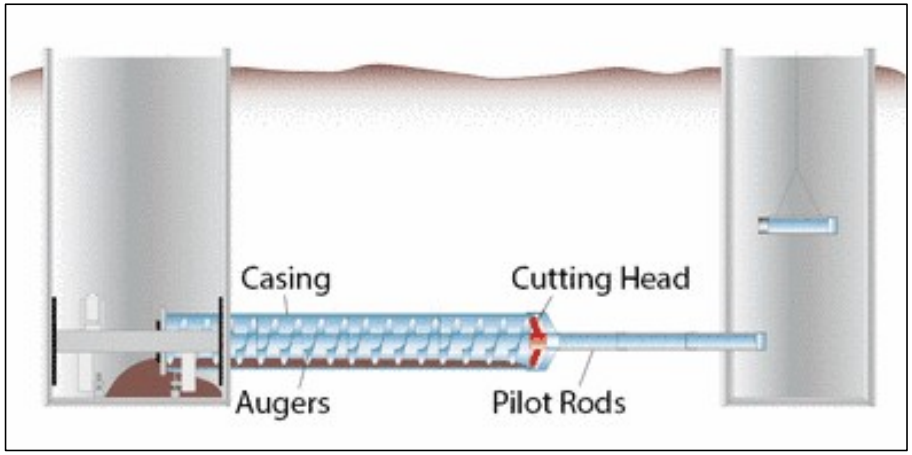
- PE100+ Association is an industry organisation of 14 polyethylene (PE) manufacturers whose objective is to promote consistent high quality in the production and the use of polyethylene for PE100 pipes.
- The association funds the KIWA managed 3rd party laboratory testing of PE100 pipes samples produced by member companies on a regular basis.
- Supported by an advisory committee and working closely with other plastic pipe, standards and utility bodies, the association promotes the proper specification, design and use of high quality PE100 pipe systems

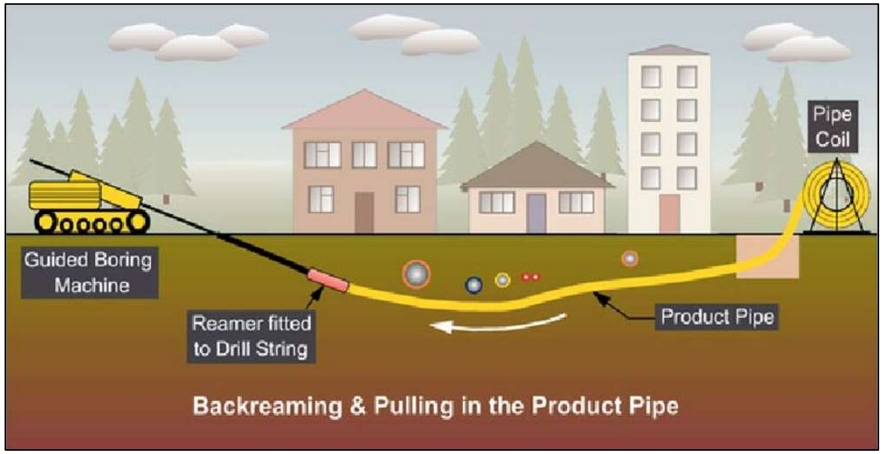
Trenchless installation and rehabilitation techniques using PE pipes and liners

Installation techniques that can use PE100 pipes and liners

Impact Moling

Pilot tube micro-tunneling





Horizontal directional drilling

Pipe (mole) ploughing

Rehabilitation techniques that can use PE100 pipes and liners

Loose (slip) lining

Close fit - reduced diameter

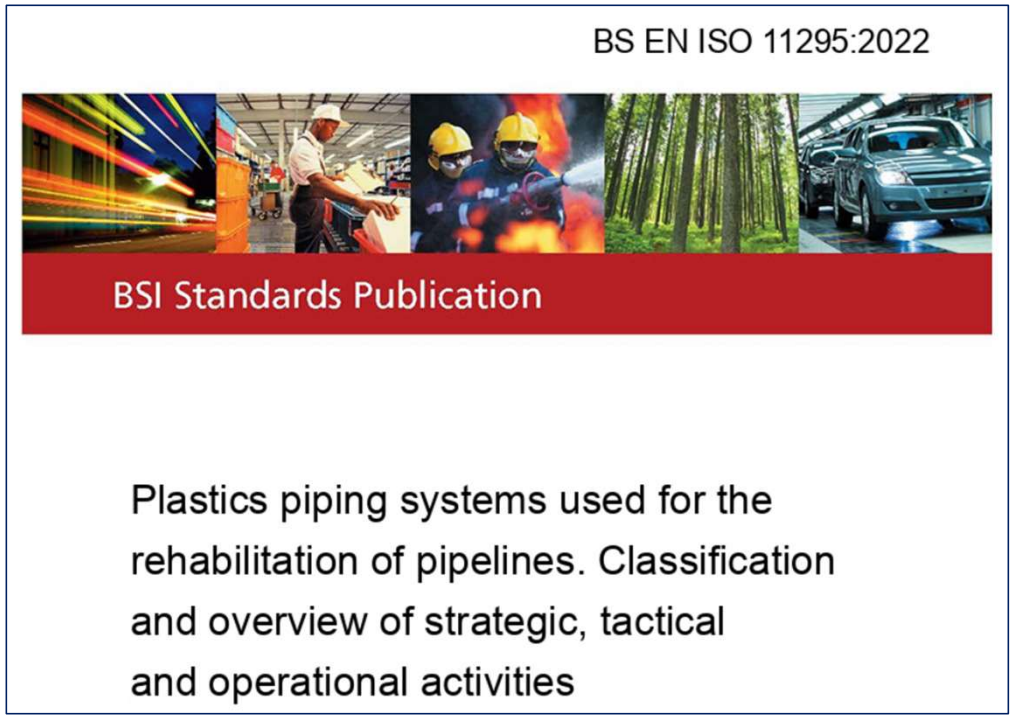
Pipe bursting

Close fit - folded liner

An introduction to the EN ISO 11295 family of standards

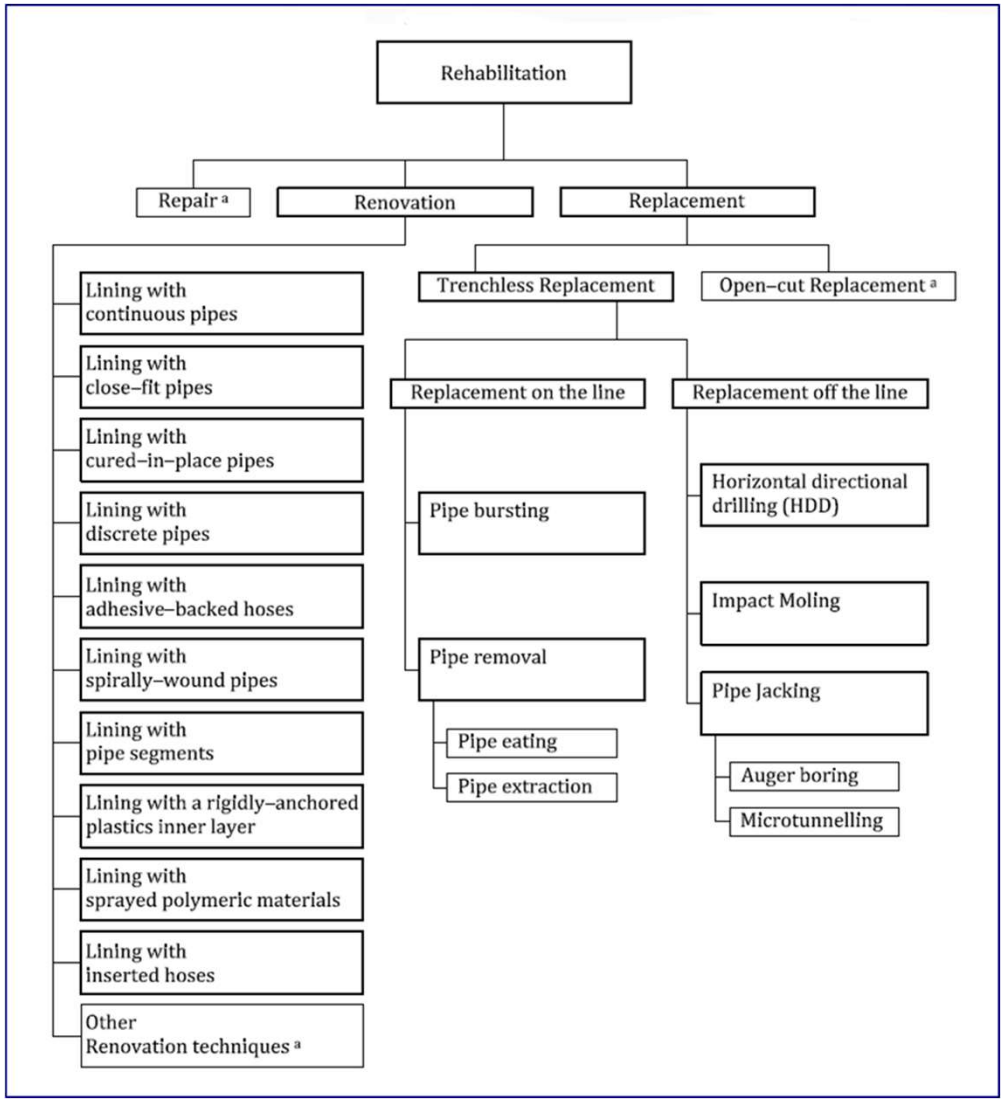
EN ISO 11295 provides an introduction and the framework in which a family of system specific product standards fit

- Many of the systems use methods that were developed by specialist companies in different countries
- Historically companies frequently used different descriptions and buzz words to describe their systems and differentiate themselves from competitors
- Using the classifications given in ISO 11295 helps End Users to clearly specify systems
- The PE100+ on-line guide draws on the contents of the standard



The 2022 revision includes more on the planning and operational use of the systems

The technique families covered by ENO ISO 11295 and related trenchless renovation and replacement standards



Status of the EN ISO 11295 family of rehabilitation standards

Parts Description	Sewer EN ISO 11296	Pressure Sewer EN ISO 11297	Water Main EN ISO 11298	Gas Main EN ISO 11299
1: General	Published	Published	Published	Published
2: Continuous Pipes	Published	Published	Published	Published
3: Close Fit Pipes	Published	Published	Published	Published
4: Cured In-place Pipes	Published	Published	Published	
5: Discrete Pipes				
6: Adhesive Backed Hoses				
7: Spirally-Wound Pipes	Published			
8: Pipe Segments				
9: Anchored Inner Layer	Published			
10: Sprayed Polymeric Mats.				
11: Inserted Hoses				

EN ISO 11298 and 11299 parts 2 and 3 cover the renovation of water and gas pipelines using PE

BS EN ISO 11298-2:2018
Incorporating corrigendum August 2018

BSI Standards Publication

Plastics piping systems for renovation of underground water supply networks

Part 2: Lining with continuous pipes (ISO 11298-2:2018)

BS EN ISO 11299-3:2018

BSI Standards Publication

Plastics piping systems for renovation of underground gas supply networks

Part 3: Lining with close-fit pipes

EN ISO 21225 parts 1 and 2 cover pipe bursting, horizontal directional drilling and impact moling

BS EN ISO 21225-1:2018

BSI Standards Publication

Plastics piping systems for the trenchless replacement of underground pipeline networks

Part 1: Replacement on the line by pipe bursting and pipe extraction (ISO 21225-1:2018)

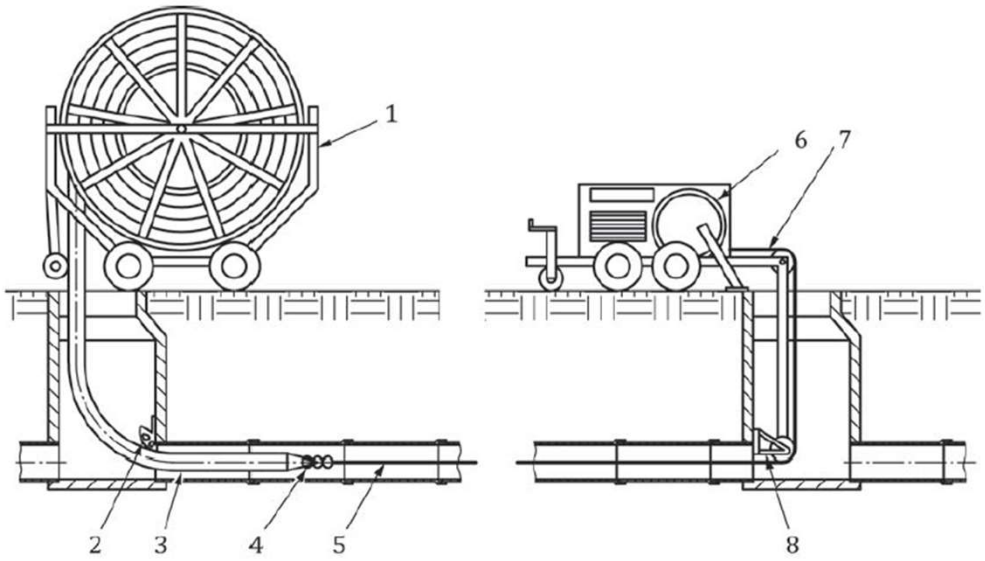
BS EN ISO 21225-2:2018

BSI Standards Publication

Plastics piping systems for the trenchless replacement of underground pipeline networks

Part 2: Replacement off the line by horizontal directional drilling and impact moling

The standards give descriptions of the different systems including helpful diagrams



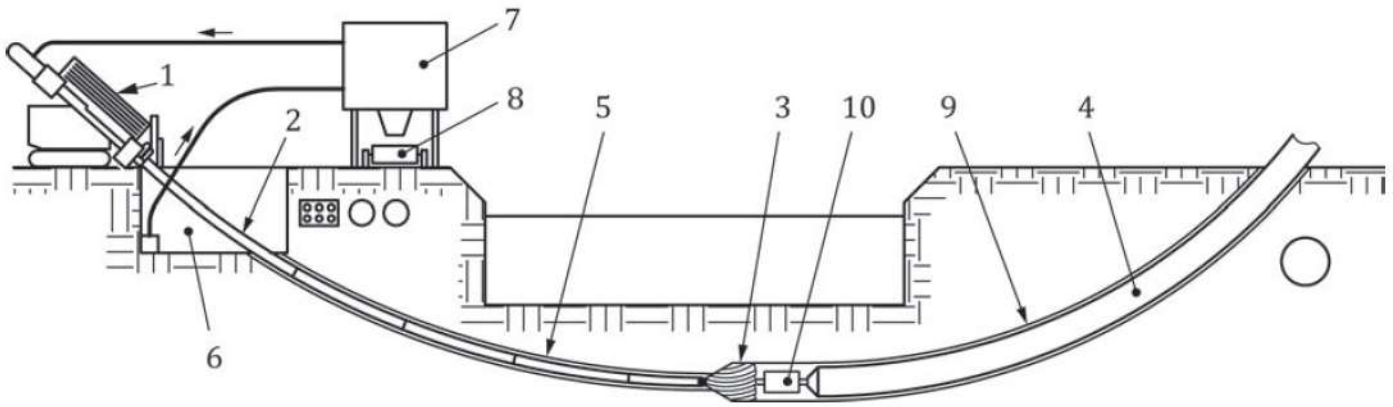
Key

1	drum trailer	4	pulling head	7	guide pulley
2	pipe guide	5	winch cable	8	bracing
3	lining pipe (folded)	6	winch		

NOTE Pipe reverted (unfolded) after insertion by application of heat and/or pressure.

Figure 3 — Lining with close-fit pipes — Schematic representation of installation of a pipe reduced in external dimension in the pipe manufacturing plant (Method A)

and give guidance on their planning and organisation, materials, applications, performance and installation



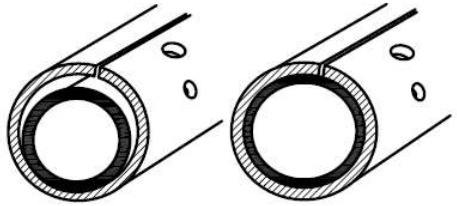
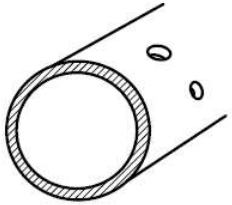
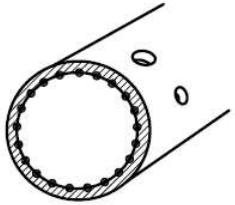
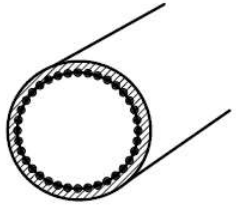
Key

1	drill rig	6	mud sump
2	drill string	7	mud recycling and spoil separation unit
3	back reamer	8	spoil skip
4	new pipe	9	final bore
5	pilot bore	10	spinner

Figure 23 — Schematic representation of replacement by horizontal directional drilling — Pipe installation

They also provide a system for classifying the pipe or liner structural performance

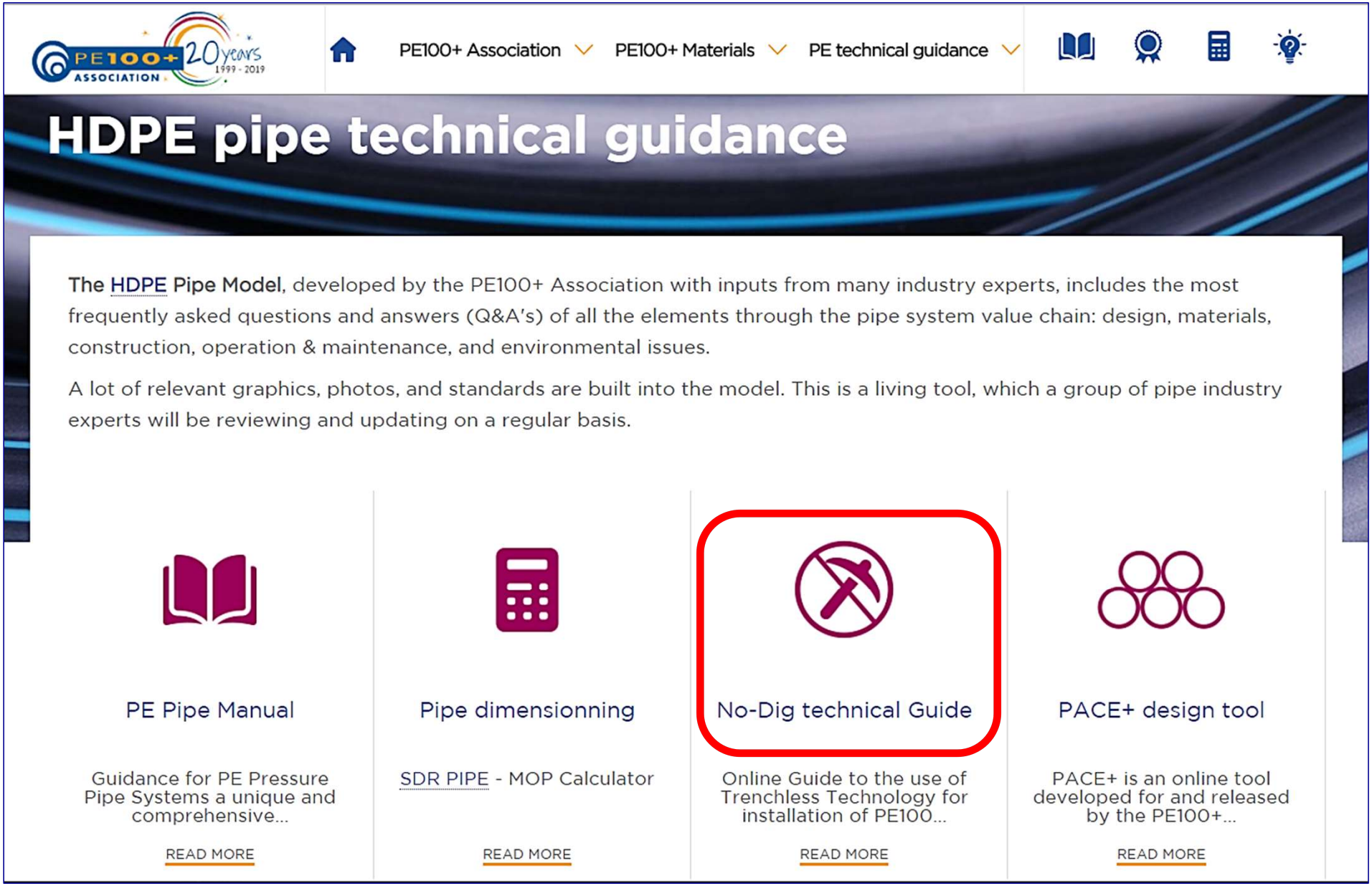
Table 17
Structural classification of pressure pipe liners and correspondence to technique families within the scape of the document (standard)

<table>
<tr><th colspan="2">Class A</th><th>Class B</th><th>Class C</th><th>Class D</th></tr>
<tr><td colspan="2">  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Independent</td><td colspan="3">Interactive</td></tr>
<tr><td colspan="2">Fully structural</td><td colspan="2">Semi-structural</td><td>Non-structural</td></tr>
<tr><td colspan="2">Lining with continuous pipes</td><td colspan="3">—</td><td rowspan="6">This document is not applicable</td></tr>
<tr><td colspan="2">Lining with discrete pipes</td><td colspan="3">—</td></tr>
<tr><td rowspan="3">—</td><td colspan="2">Lining with close-fit pipes</td><td>—</td></tr>
<tr><td colspan="3">Lining with cured-in-place pipes</td></tr>
<tr><td colspan="2">—</td><td>Lining with adhesive-backed hoses</td></tr>
<tr><td>—</td><td>—</td><td colspan="2">Lining with sprayed polymeric materials</td><td>—</td></tr>
<tr><td colspan="5">NOTE 1 Classification of lining with inserted hoses is yet to be determined, pending development of product standards for this technique family.
NOTE 2 Dots in illustrations for Classes C and D depict adhesion.</td></tr>
</table>

The PE100+ Association online No-Dig Technical Guide

The installation methods covered by the PE100+ No-Dig Guide

11 Installation Methods	Water Mains	Gas Mains	Sewage		Cable Ducts
			Gravity	Pressure (Rising Mains)	
New installation with PE pipe	HDD Impact moling Mole ploughing	HDD Impact moling Mole ploughing	Pilot tube microtunnelling	HDD Impact moling Mole ploughing	HDD Impact moling Mole ploughing
Rehabilitation with PE pipe	Slip lining Close-fit lining Pipe bursting Pipe splitting Pipe extraction	Slip lining Close-fit lining Pipe bursting Pipe splitting Pipe extraction	Pipe bursting Pipe splitting Pipe reaming	Slip lining Close-fit lining Pipe bursting Pipe splitting Pipe extraction	


PE100+ ASSOCIATION 20 years 1999 - 2019
PE100+ Association
PE100+ Materials
PE technical guidance
HDPE pipe technical guidance
The HDPE Pipe Model, developed by the PE100+ Association with inputs from many industry experts, includes the most frequently asked questions and answers (Q&A's) of all the elements through the pipe system value chain: design, materials, construction, operation & maintenance, and environmental issues.
A lot of relevant graphics, photos, and standards are built into the model. This is a living tool, which a group of pipe industry experts will be reviewing and updating on a regular basis.
PE Pipe Manual
Guidance for PE Pressure Pipe Systems a unique and comprehensive...
READ MORE
Pipe dimensionning
SDR PIPE - MOP Calculator
READ MORE
No-Dig technical Guide
Online Guide to the use of Trenchless Technology for installation of PE100...
READ MORE
PACE+ design tool
PACE+ is an online tool developed for and released by the PE100+...
READ MORE

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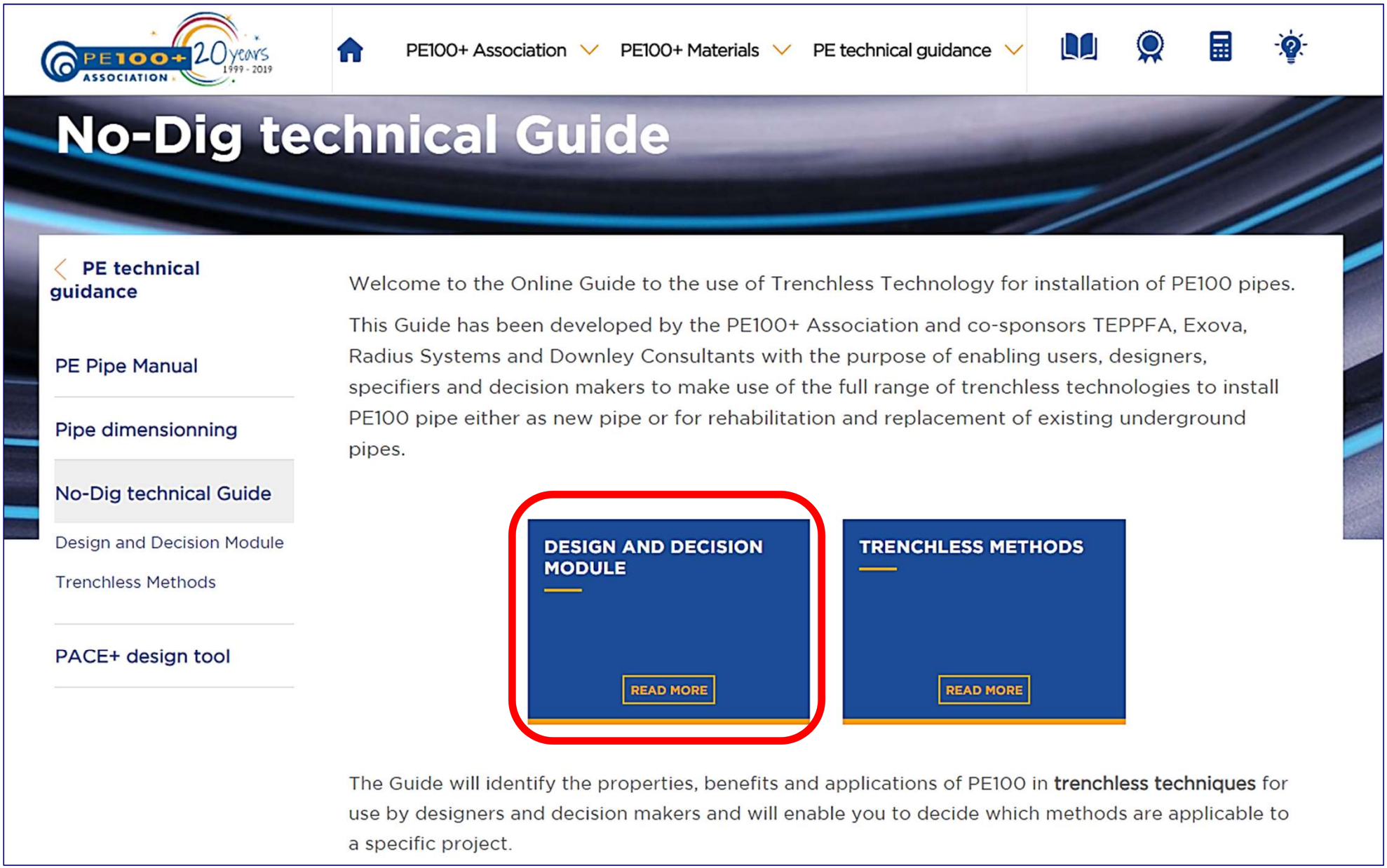
PE100+ ASSOCIATION 20 years 1999 - 2019
PE100+ Association
PE100+ Materials
PE technical guidance
No-Dig technical Guide
PE technical guidance
PE Pipe Manual
Pipe dimensionning
No-Dig technical Guide
Design and Decision Module
Trenchless Methods
PACE+ design tool
Welcome to the Online Guide to the use of Trenchless Technology for installation of PE100 pipes.
This Guide has been developed by the PE100+ Association and co-sponsors TEPPFA, Exova, Radius Systems and Downley Consultants with the purpose of enabling users, designers, specifiers and decision makers to make use of the full range of trenchless technologies to install PE100 pipe either as new pipe or for rehabilitation and replacement of existing underground pipes.
DESIGN AND DECISION MODULE
READ MORE
TRENCHLESS METHODS
READ MORE
The Guide will identify the properties, benefits and applications of PE100 in trenchless techniques for use by designers and decision makers and will enable you to decide which methods are applicable to a specific project.

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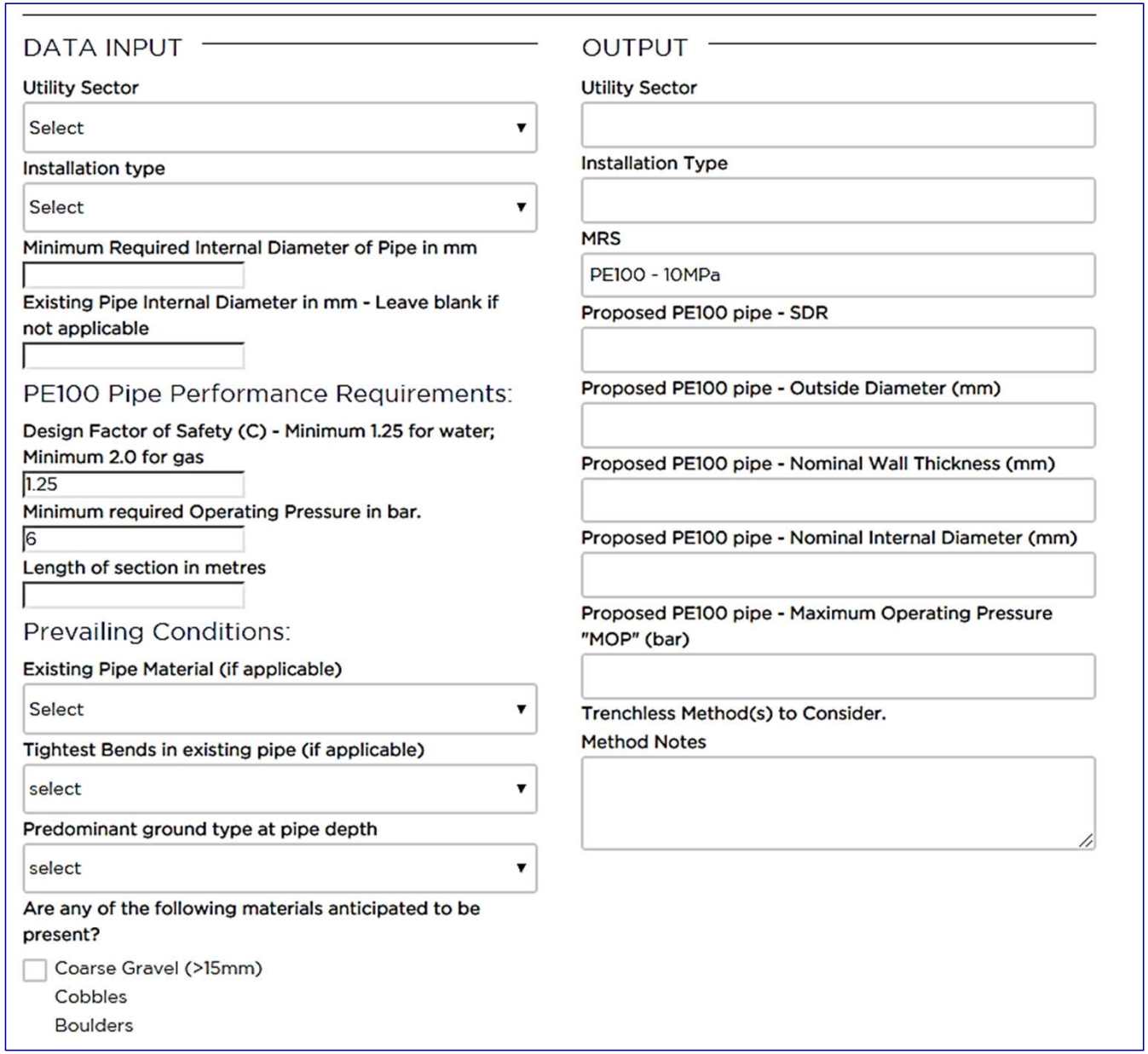
Design and Decision Model – enter parameters of a specific project

- Project type (new, rehabilitation, gas, water)
- Hydraulic needs (diameter and pressure)
- Soil types
- Alignment and length
- For rehabilitation only – existing pipe material and diameter
- The model will calculate standard PE diameter and SDR to meet the needs of the application eg. Internal Diameter and Operating Pressure
- It will list the trenchless methods that are feasible to achieve the installation required by the designer
- The user can click on the methods listed for a full description

Screen Shot from the Decision Module Page



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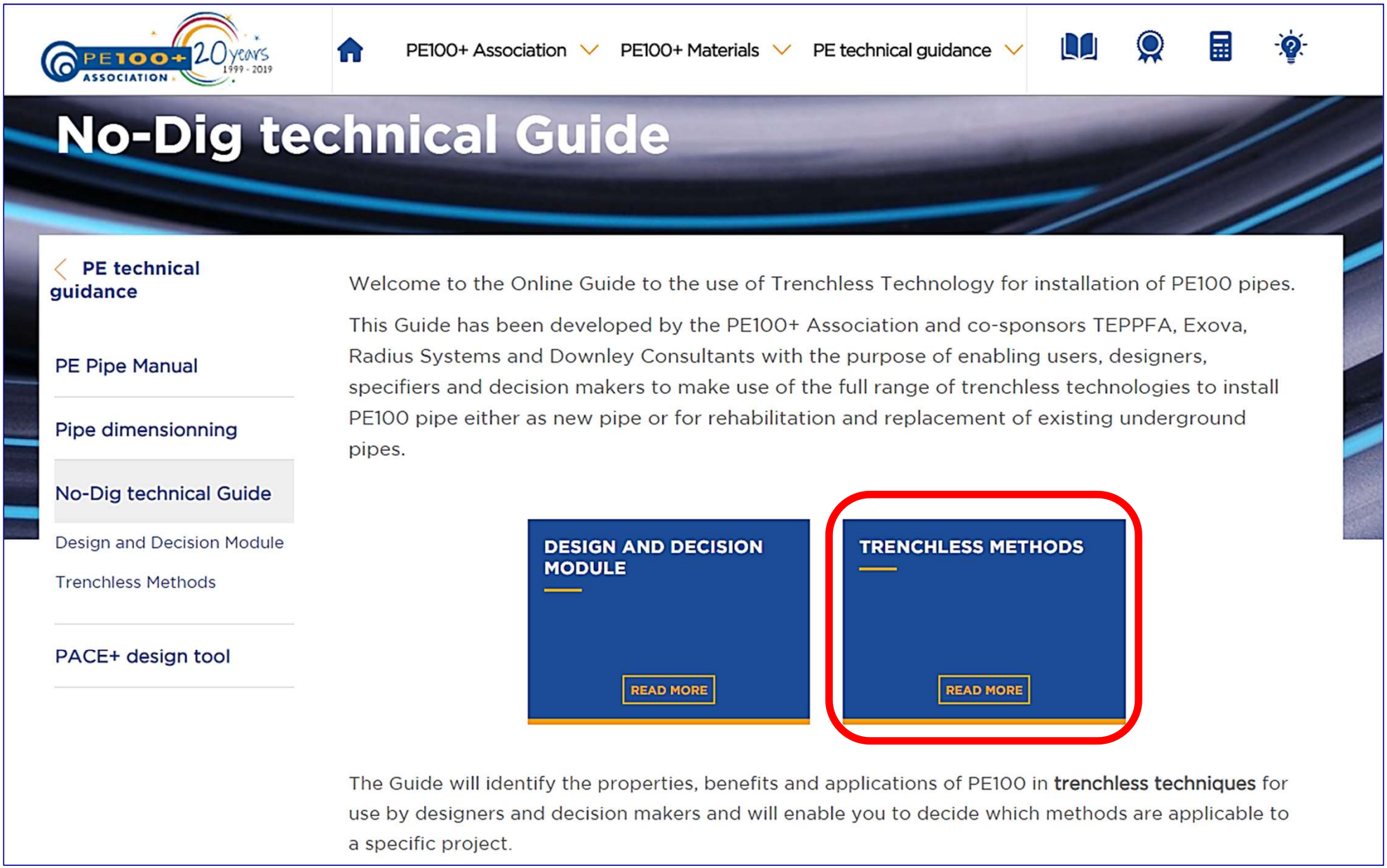
PE100+ ASSOCIATION 20 years 1999 - 2019
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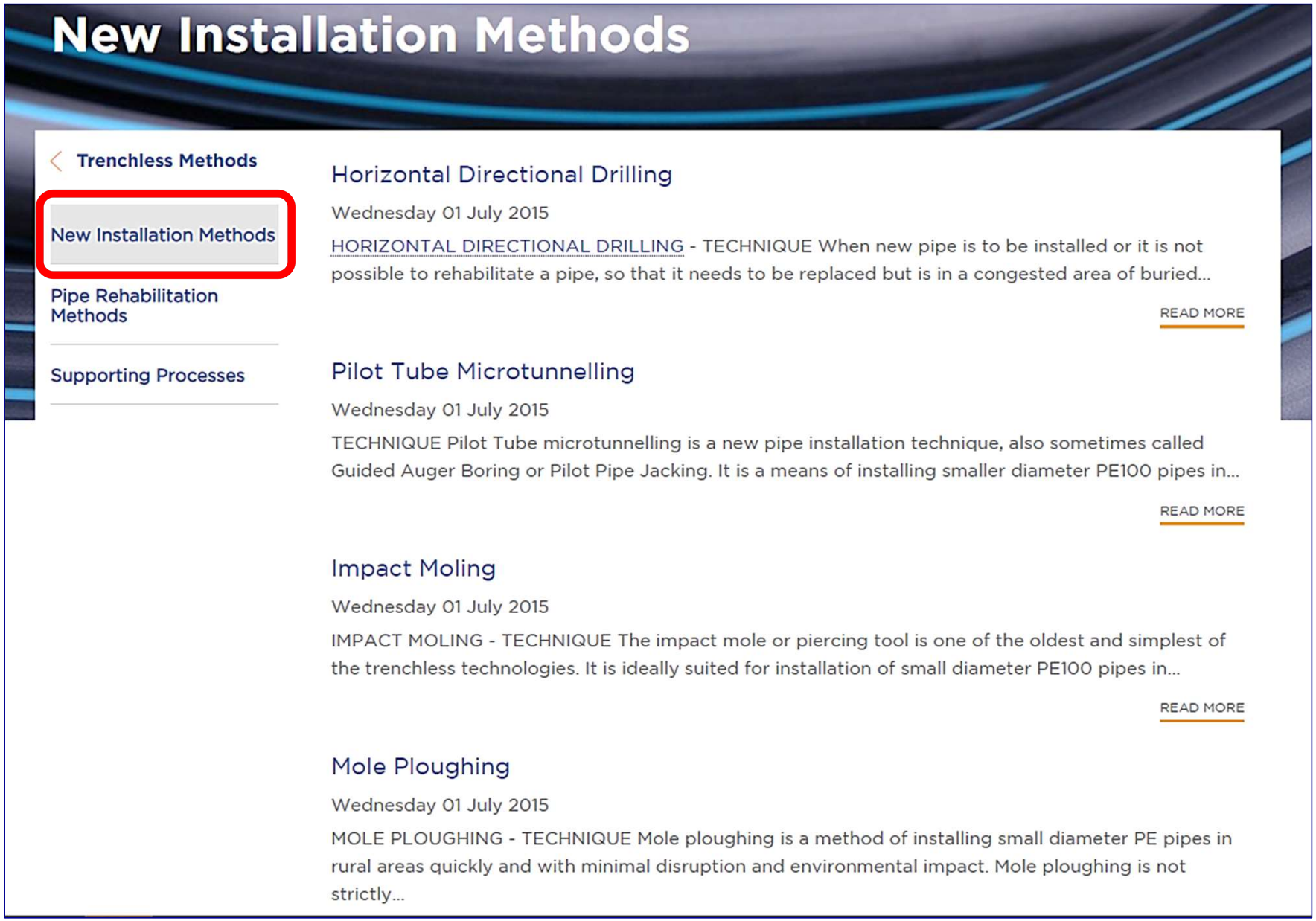
New Installation Methods
Trenchless Methods
New Installation Methods
Pipe Rehabilitation Methods
Supporting Processes
Horizontal Directional Drilling
Wednesday 01 July 2015
HORIZONTAL DIRECTIONAL DRILLING - TECHNIQUE When new pipe is to be installed or it is not possible to rehabilitate a pipe, so that it needs to be replaced but is in a congested area of buried...
READ MORE
Pilot Tube Microtunnelling
Wednesday 01 July 2015
TECHNIQUE Pilot Tube microtunnelling is a new pipe installation technique, also sometimes called Guided Auger Boring or Pilot Pipe Jacking. It is a means of installing smaller diameter PE100 pipes in...
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Impact Moling
Wednesday 01 July 2015
IMPACT MOLING - TECHNIQUE The impact mole or piercing tool is one of the oldest and simplest of the trenchless technologies. It is ideally suited for installation of small diameter PE100 pipes in...
READ MORE
Mole Ploughing
Wednesday 01 July 2015
MOLE PLOUGHING - TECHNIQUE Mole ploughing is a method of installing small diameter PE pipes in rural areas quickly and with minimal disruption and environmental impact. Mole ploughing is not strictly...

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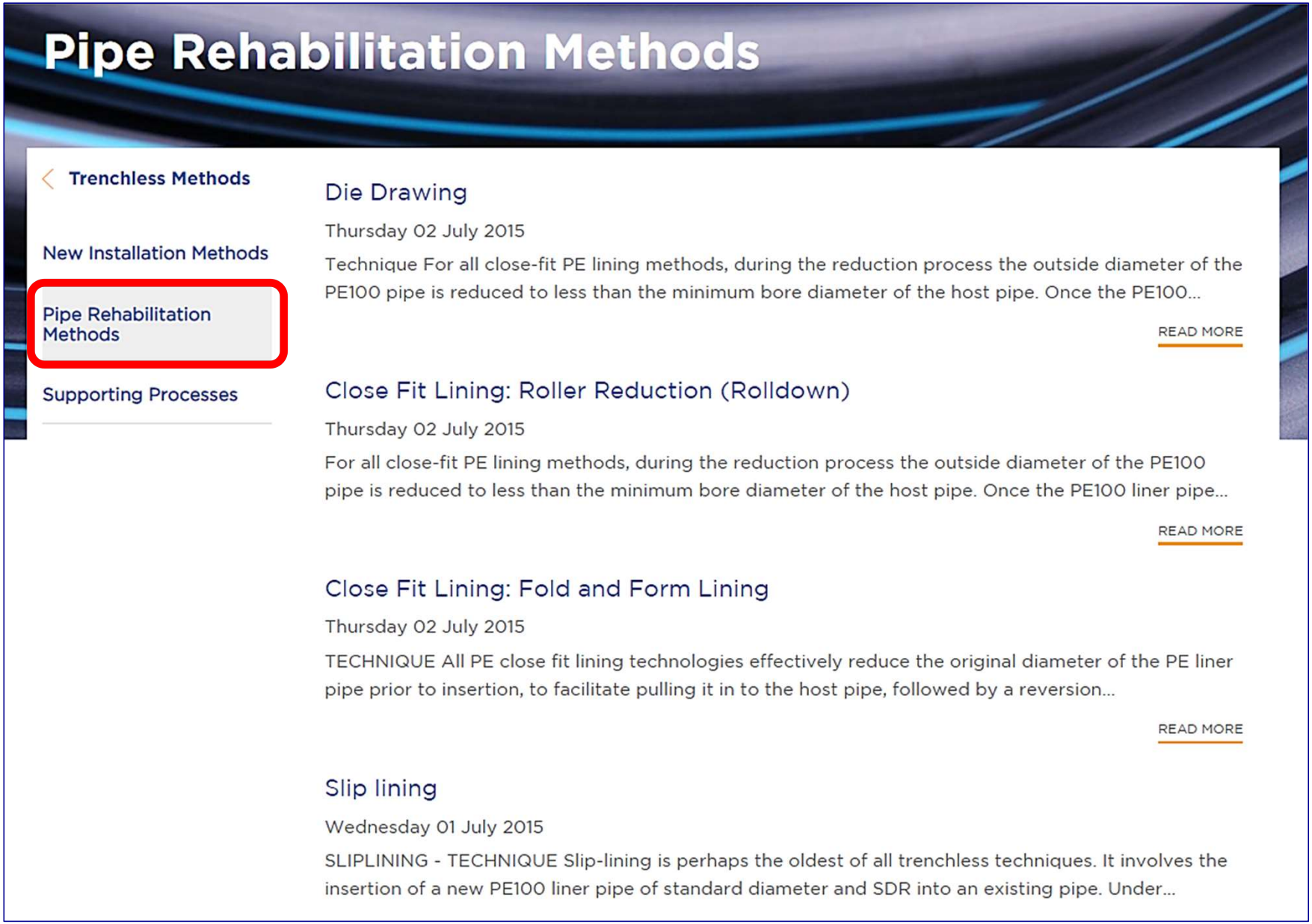
Pipe Rehabilitation Methods
Trenchless Methods
New Installation Methods
Pipe Rehabilitation Methods
Supporting Processes
Die Drawing
Thursday 02 July 2015
Technique For all close-fit PE lining methods, during the reduction process the outside diameter of the PE100 pipe is reduced to less than the minimum bore diameter of the host pipe. Once the PE100...
READ MORE
Close Fit Lining: Roller Reduction (Rolldown)
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Close Fit Lining: Fold and Form Lining
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TECHNIQUE All PE close fit lining technologies effectively reduce the original diameter of the PE liner pipe prior to insertion, to facilitate pulling it in to the host pipe, followed by a reversion...
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Slip lining
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SLIPLINING - TECHNIQUE Slip-lining is perhaps the oldest of all trenchless techniques. It involves the insertion of a new PE100 liner pipe of standard diameter and SDR into an existing pipe. Under...

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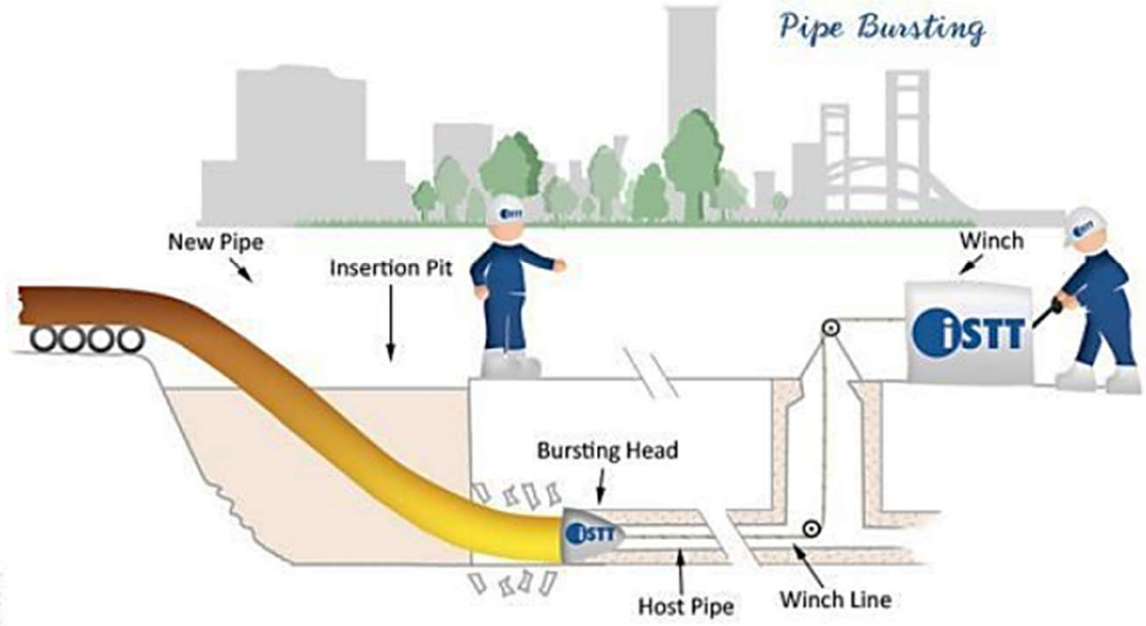
Trenchless Methods – typical information provided on each method

- General description of the method
- PE100 applications (gas/water mains, services, pumping mains)
- Installation procedures
- Equipment
- Practicalities – soil types, diameter, pressure and length ranges
- Excavations, space and access requirements
- Design, specification and planning
- Health, safety and environmental considerations
- Standards and Codes of Practice

There are **three methods of pipe bursting**: pneumatic, hydraulic, and static pull. The difference between them is in the source of energy and the method of breaking the old pipe. Pneumatic and hydraulic methods use dynamic force to break the old pipe whereas static pull uses a constant pull force. The selection of a specific method depends on soil conditions, groundwater conditions, degree of upsizing required, type of new pipe, construction of the existing pipeline, depth of the pipeline and availability of experienced contractors with suitable equipment. Static pipe bursting has replaced pneumatic bursting as the most commonly used variant primarily because of the absence of shock waves generated by a dynamic burster, which can cause damage to adjacent buried utilities.

Pipe splitting is necessarily a static pull method.

Screen shot from the pipe bursting page



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Conclusions

Conclusions – Takeaways from the presentation

- Trenchless technology provides a way of quickly installing a new pipeline or renovating an existing one whilst minimizing the environmental impact
- Many techniques employ PE pipes and liners due to the flexibility of the material, its visco-elastic properties and ability to be form long pipe strings
- End users, in particular, should make use of the EN ISO 11295 family of standards in order to make sure that all the parties in a project are referring to a common standard
- PE pipes and liners can be damaged during and after the installation process, which can initiate a Slow Crack Growth failure. Hence it is recommended to use PE100-RC materials that are resistant to this failure mode
- There are a variety of techniques that may be applicable to each situation therefore make use of the PE100+ No-Dig Technical Guide. It's on-line, free to use and contains lots of information especially for non-specialists

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Backup slide for questions on standards

Definitions of some terms given in EN ISO 11295 to avoid confusion

- **Rehabilitation**
  All measures for restoring or upgrading the performance of an existing pipeline system.
- **Renovation**
  Work incorporating all or part of the original fabric of the pipeline by means of which its current performance is improved.
- **Replacement**
  Rehabilitation of an existing pipeline system by the installation of a new pipeline system, without incorporating the original fabric.
- **Technique family**
  A group of renovation techniques which are considered to have common characteristics for standardisation purposes.

Revision of the EN and ISO PE pipe standards to incorporate PE100-RC materials