

Subsurface Mapping- A Trenchless Technology Perspective



Geospatial World Forum
19th January 2018
HICC, Hyderabad, India

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Prologue

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Road cave-in reports on record high in city

Old roads, new roads, it appears that all roads in the Capital are on the verge of collapse. Even the ones that have been laid ahead of the Commonwealth Games have begun giving trouble: Several roads near the Games venues have already started showing rot, raising serious questions about the quality of work being carried out. HT reports. Costly carelessness

DELHI Updated: Aug 23, 2010 01:58 IST

HT Correspondents
Hindustan Times

[f](#) Old roads, new roads, it appears that all roads in the Capital are on the verge of collapse. Even the ones that have been laid ahead of the Commonwealth Games have begun giving trouble: Several roads near the Games venues have already started showing rot, raising serious questions about the quality of work being carried out.

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Ringing the alarm bell, the Delhi Traffic Police have said this is the first time that so many

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Utility System Failure



Case 1 - Multiple Road Cave-ins Prior to 2010 Commonwealth Games in New Delhi



- New installation work on large scale was carried out without any prior buried utility mapping in Delhi.
- Following monsoon season saw several road cave-in incidents in Delhi NCR.
- PWD Delhi, engineers initially blamed use of Trenchless Technology for those collapses. While, inappropriate use of technology was the main reason behind those collapses.
- Under Delhi PWD assignment, INDSTT developed the Standard Operating Procedures for use of Trenchless Technology on PWD Delhi Roads.

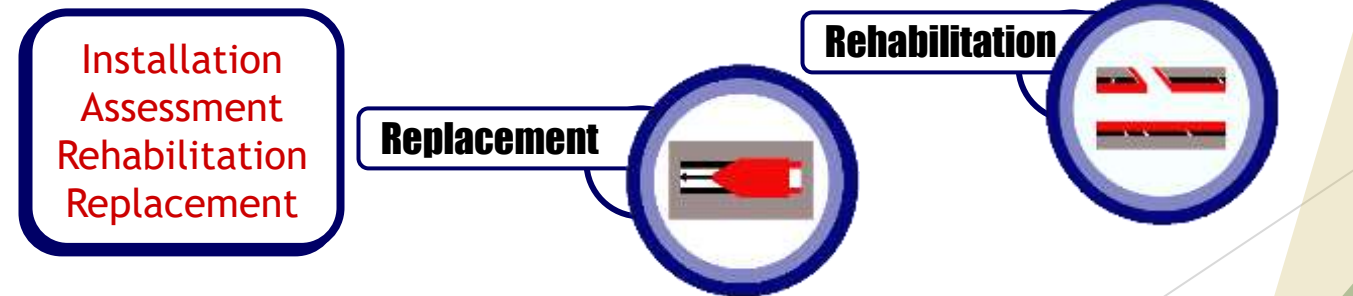
Case 2 - UFW & NRW, Kerala Water Authority (KWA)



- KWA in 2012-13, conduct a pilot survey of water mains in the city using a hi-tech pipeline inspection system.
- The insides of the pipes were found to be heavily tuberculated, which has reduced their internal diameter and consequently brought down their carrying capacity by 40%.
- An official statistics show that out of the 300 million litres a day (MLD) of drinking water sent to the pipelines in the city, only 150 MLD is accounted for.
- ALL national ULBs are facing the similar situation in their respective regions.

Trenchless Technology

A set of techniques for the remote installation, rehabilitation and repair of utilities, pipelines and small tunnels -- linked by their lack of need for digging a continuous trench for the installation of new pipes or the repair of old pipes.



What will serve our Purpose?



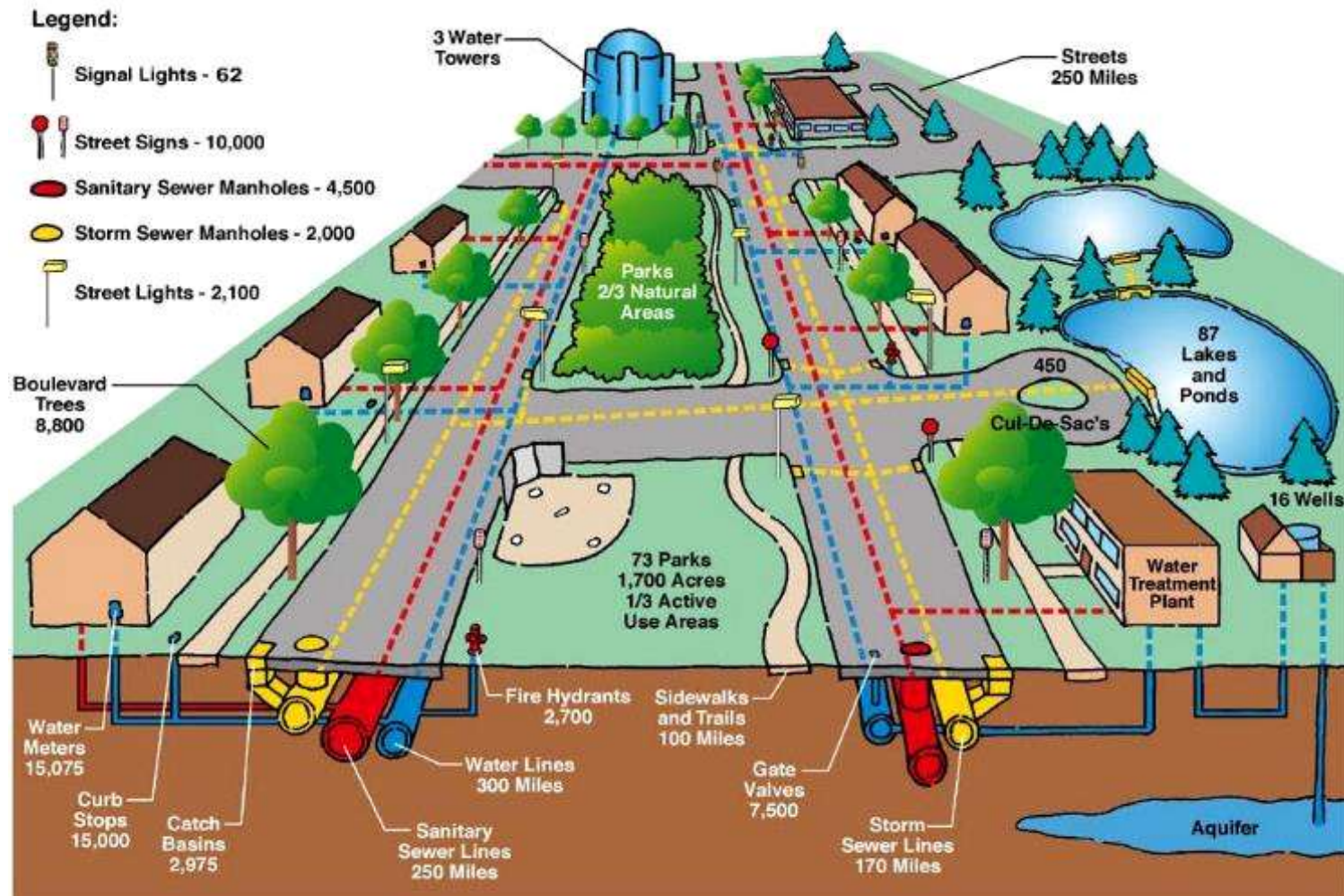
Just A MAP?

OR



MAP With Attributes?

Public Infrastructure



TYPES OF UTILITY

In locations where crossings may be required beneath roads the following utilities may be found:

- ▶ Sanitary sewers
- ▶ Surface water/storm drains
- ▶ Combined sewers
- ▶ Water mains
- ▶ Gas mains
- ▶ Gas Distribution pipelines
- ▶ Industrial pipelines
- ▶ Oil transmission pipelines
- ▶ Electricity cables
- ▶ Telephone cables
- ▶ Cable TV cables
- ▶ Street lighting cables
- ▶ Traffic light cables
- ▶ Other data / information technology cables
- ▶ Other unexpected utilities or historic structures.

*Standard Operating Procedures
for
Application of Trenchless Techn
in
Developing and Maintaining
Subsurface Utility Networks
Under PWD Roads
in
New Delhi*



*Indian Society For Trenchless Techn
908, Hemkunt Chamber
89, Nehru Place
New Delhi - 110019*



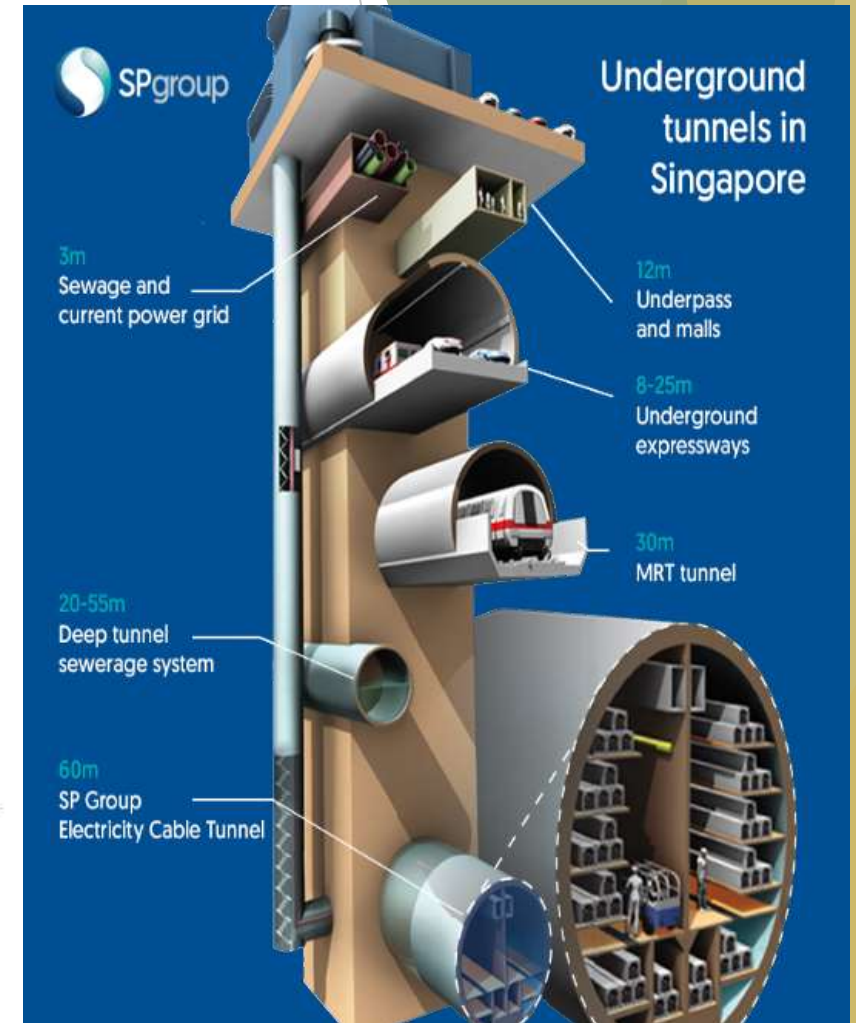
Standard Operating Procedure Stipulations Linked with Mapping

1. Introduction
2. Importance
3. Utility Classification
4. Location Timing
5. Scope of Coverage
6. Responsibility of Location
7. Sharing of Background Information
8. Liaising Assistance
9. Investigation Procedure
10. Data Management

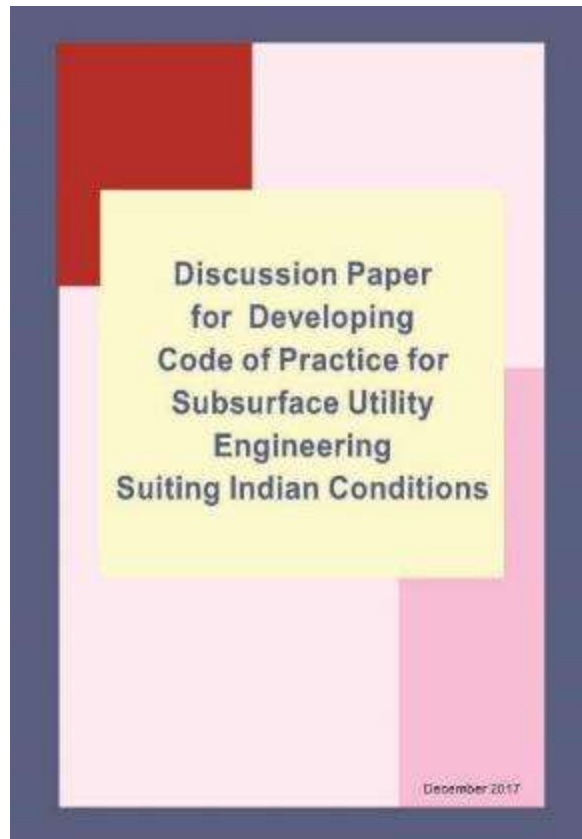
Data Management

- ▶ Right-of-way owner needs to assume the responsibility of developing, managing and owning the subsurface utility data base.
- ▶ For new structures, as-built drawings and data must be collected from the implementing agencies after proper verification.
- ▶ For existing structures, the use of correct mapping techniques and methods is essential to generate reasonable and correct subsurface interpretations.
- ▶ Professionals engaged in this data generation and interpretation must be adequately skilled in Subsurface Utility Engineering.

Future of Subsurface Structures



Discussion Paper for Developing Code of Practice for Subsurface Utility Engineering Suiting Indian Conditions

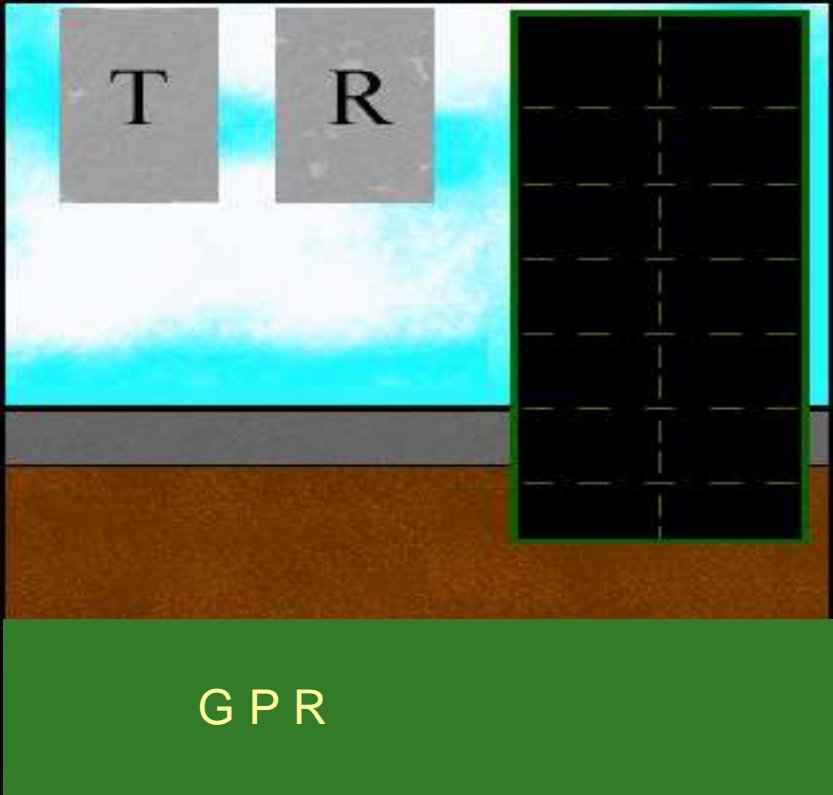
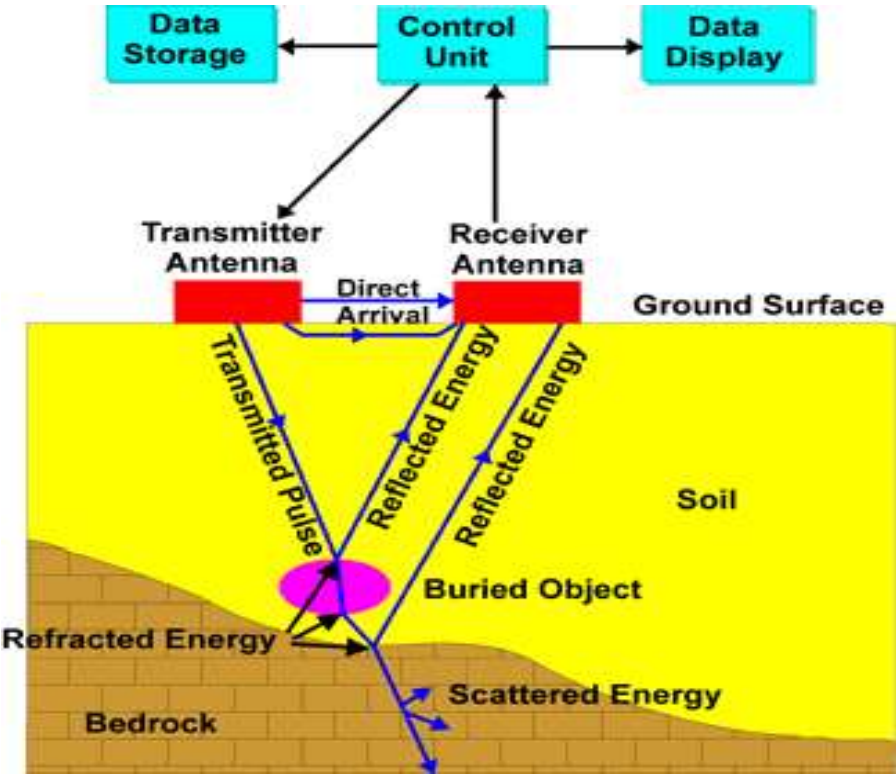


- Indian Society for Trenchless Technology (INDSTT) in its recently concluded No Dig India Show 2017 has released a discussion paper for developing Code of Practice for Subsurface Utility Engineering Suiting Indian Conditions.
- Discussion paper is open for the expert comments and interested contributor may contact for the copy of the paper.
- Final COP for SUE is schedule to be released in forthcoming No Dig India Show 2018 at Mumbai.


METHODS

- ▶ Pipe and Cable Location
- ▶ Ground penetrating radar (GPR)
- ▶ Terrain Conductivity
- ▶ Resistivity
- ▶ Metal Detection
- ▶ Magnetic
- ▶ Acoustic
- ▶ Thermal/Infrared
- ▶ Gravity
- ▶ Seismic

Principle of GPR



Operator Skills


Indian Society for Trenchless Technology
TTOQP 1 Data Interpreter Level Structure Subsurface Survey

Trenchless Technology Operator Qualification Programme

Trade Skill Evaluation at Competency level – 2

COMPETENCE: BASIC COMPETENCE	TTOQP 1 GOI 1.2	SUBSURFACE SURVEY GEOPHYSICAL DATA INTERPRETER
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Background

Geophysical investigation deals with the techniques that are relevant to ground investigations to determine structural nature of the subsurface for engineering projects. It involves techniques for the measurements of various physical properties of subsurface like conductivity, hardness, presence of anomalies, dielectric properties, moisture content, density, interfaces etc to determine the properties of the earth and subsurface structures.

Geophysical data processing and interpretation is a specialized subject and must be carried out by a geophysicist or a professional having acquired requisite qualification in geophysics. Present document, the Geophysical Data Interpreter Qualification Criteria (GDIQC), identifies a set of standards for a qualified professional performing the geophysical data interpretation for subsurface work. These sets of vocational qualification standards define the minimum technical qualifications one needs to possess for doing geophysical investigations successfully.

PRIOR ACHIEVEMENT EVIDENCE

Persons undergoing this certification should have a Degree in Science/ Engineering having Geology or Physics as one of the subjects or graduate having other specialized qualifications related to geology/ geophysics. In addition to the above qualification the Geophysical Data Interpreter should have Diploma/ PG Diploma in geophysics.

PERFORMANCE STANDARD

Qualified candidate should be able to display competence in the following sections of geophysical investigation:

- Ability to consider the most important basics of jobsite preparation when planning the complete project.
- Awareness of general safety precautions.
- Awareness of electrical safety precautions and ability to use them at site.
- Ability to understand maps, plans and reports on existing networks.
- Ability to understand Regional geology and hydrogeology of the area
- Aware of the use of scientific/geophysical equipment.
- Ability to use of Computer software in geophysical data interpretations
- Ability for Field Data Acquisition and Basic Field Data Interpretations
- Ability for Maps Creation and Report Writing
- Ability to anticipate problems in equipment.
- Ability to carry out common maintenance and problem solving measurements independently.

MINIMUM PERFORMANCE STANDARDS


While performing the subsurface geophysical investigation the Geophysical Data Interpreter need to display the following minimum qualifications:

1. Safety during work

Trenchless Technology Operator Qualification Programme

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Indian Society for Trenchless Technology
TTOQP 1 Operator Level Structure Subsurface Survey

Trenchless Technology Operator Qualification Programme

Trade Skill Evaluation at Competency level – 1

COMPETENCE: BASIC COMPETENCE	TTOQP 1 GO 1.1	SUBSURFACE SURVEY GEOPHYSICAL OPERATORS
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Background

Sub-surface geophysical investigation to detect changes in soil and rock stratigraphy, locate buried utilities and map fracture zones is essential for below-ground activities where the risk of encountering something unforeseen is at its highest. The various investigation techniques, like Ground Penetrating Radar, Seismic Refraction, Electrical Tomography and Seismic Reflection, reduce the chances of encountering major surprises in the course of trenchless installation, renewal or repair.

Geophysical investigation demand highly precise and accurate survey, hence taking quality measurements and adhering to quality control standards are necessary. The geophysical operator, therefore, should be aware of various techniques of geophysics and methods of installation and calibration of equipment to get quick and accurate information on subsurface conditions. Present document identifies a set of standards for a qualified professional operating the scientific/geophysical equipment for subsurface survey. These sets of vocational qualification standards define the minimum technical qualifications one needs to possess for handling machines/equipments for geophysical investigations successfully.

PRIOR ACHIEVEMENT EVIDENCE

The geophysical operators should have minimum 10+2 qualifications with science discipline, and must possess valid training certificate on use of particular technique from a recognized institute.

PERFORMANCE STANDARD

Qualified candidate should be able to display competence in the following sections of geophysical investigation:

- Ability to consider the most important basics of jobsite preparation when planning the complete project.
- Awareness of general safety precautions.
- Awareness of electrical safety precautions and ability to use them at site.
- Ability to understand maps, plans and reports on existing networks.
- Aware of the use of scientific/geophysical equipment.
- Ability for Field Data Acquisition
- Ability to use Computer software in geophysical investigations
- Ability to anticipate problems in equipment.
- Ability to carry out common maintenance and problem solving measurements independently.

MINIMUM PERFORMANCE STANDARDS

While performing the subsurface geophysical investigation the operators need to display the following minimum qualifications:

1. Safety during work

- I. General precautions necessary for safety of the operators,
- II. General precautions necessary for safety of equipment,
- III. Necessary Aids for safety are used without fail.

Trenchless Technology Operator Qualification Programme

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Concluding Remarks

- ▶ Buried Utilities pose great challenges as these are out of sight so are out of mind and we see them only when a failure has occurred.
- ▶ With each new utility buried, rehabilitated or replaced, the complexity grows and we need to wake up to the requirement immediately.
- ▶ Trenchless is the solution of many of such challenges, provided all subsurface data is up to date & interpretations are geologically and valid in three dimensions.
- ▶ We are Vigorously Persuing standardization in subsurface mapping by laying specifications, competency standards, and operating procedures and invite stakeholders to join us in this important capacity building initiative.
- ▶ Associations with this initiative could be through society membership, participation in the task forces, contribution of technical inputs, vetting and commenting on the draft documents and proposals

Thanks for your attention



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