

**Trenchless Technology Operator Qualification Programme**

Trade Skill Evaluation at Competency level – 2

**COMPETENCE:  
BASIC COMPETENCE**TTOQP 1  
GDI 1.2SUBSURFACE SURVEY  
GEOPHYSICAL DATA INTERPRETER**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**

- 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;

**2. Read working drawings / Sketches and proceed with work**

- i. Given a set of drawings / sketch requirement of the equipment and related tooling worked out and the scope of work understood;
- ii. The work is executed as per drawings / sketches;

**3. Knowledge and use of equipment and tooling**

- i. Proper identification of equipment/tools.
- ii. Proper storage of equipment and tooling;
- iii. Proper use of tools.

**4. Knowledge of machine operating procedure and sequence**

- i. Equipment is properly connected to desired power points and all related accessories are connected properly.
- ii. Voltage, frequency, current potential, and polarity are checked.
- iii. Instrument is properly calibrated to get accurate reading.

**5. Knowledge about defects, their remedy and acceptance limit**

- i. Identified the defects of equipment.
- ii. Remedy to the defects is known.
- iii. Acceptance limit as per standard code is known.

**PERFORMANCE EVIDENCE**

1. Helmet, Hand Shields, Safety Goggles, Gloves etc. are used.
2. Operator's health is fit before he goes to job.
3. The geophysical operator identified the proper tools for work.
4. The geophysical operator knows the use of specific tool.
5. The work is done as per demand of drawings.
6. Operator knows how to make equipment/ instrument ready for use.
7. Proper earthing is provided.
8. Proper polarity is confirmed.
9. Loose connections are checked.
10. All the defects in different type of equipment/ instrument are clearly identified.
11. Possible remedy to the defects identified is given.
12. Variation allowed as per codes are very well known.

**SUPPLEMENTARY (KNOWLEDGE) EVIDENCE**

In addition to the prior achievement evidence a trainee needs to display the following supplementary knowledge evidence for the course completion and being permitted to do the geophysical investigations independently:

1. Reading and writing in vernacular language.
2. Ability to conduct area and volume calculations.
3. Understanding about subsurface investigation requirements.
4. Understanding about different types subsurface investigation techniques
5. Possession of knowledge of various basic construction norms;
6. Possession of knowledge of basic electrical hazard prevention methods;
7. Awareness about basic operator's manual for geophysical investigation equipment required for the job.

## TEST COVERAGE

In order to verify the above competencies, the test is aimed to evaluate the workers' knowledge in the following fields:

### A. Basics of Mathematics / Natural Sciences

- Units and their conversion
- Calculation of cross-section and volumes (i.e. annuli, pits)
- Basic of technical mechanics (power, torque, tension)
- Work, energy, capacity
- Basics of fluid mechanics (hydrostatic pressure, flow-rate, viscosity, pressure loss in fluids)

### B. Basics of Geology

- Geological cycle of formation of soil;
- Nature of soil and its stratification;
- Soil characteristics and classification;
- Common clay minerals;
- Properties of coarse and fine soils;
- Rock Properties, Classification and mode of formation;
- Physical and engineering properties of the soil and rock formations;
- Differences in behaviour of rock, soil and other engineering materials.

### C. Geophysical Investigation Techniques

- Application Area of Geophysics;
- Geophysical investigation techniques and basic selection criteria;
- Principle of Geophysical investigation methods;
- Objectives of Geophysical investigation;
- Stages of Geophysical investigation;
- Demonstrations of Geophysical Techniques.

### D. Project Realization

- Location plans and terrain profiles;
- Job site set-up;
- Documentation of system basics;
- Daily job reports;

### E. Planning for Subsurface Investigation

- Preliminary Designs and Cost Estimation;
- Evaluation of Available surface and subsurface information;
  - ⇒ geological maps and memoirs;
  - ⇒ topographic map for studying terrain, access and site conditions
  - ⇒ Aerial photographs for the indication of geomorphology features, land use, problem areas and layout arrangements;
  - ⇒ Site Histories and Details of Adjacent Development.
- Site Reconnaissance to confirm the available information;
- Assessing the extent of subsurface investigation required for the Proposed Structures;
- Obtaining essential information for a trenchless technology project;
  - ⇒ Standard penetration values;
  - ⇒ Particle size distribution including presence of cobbles and boulders;

- ⇒ Shear strength;
- ⇒ Atterberg limits (liquid, plastic and shrinkage limits);
- ⇒ Moisture content;
- ⇒ Height and movement of water-table;
- ⇒ Permeability;
- ⇒ Presence of contaminated soils (hydrocarbons, etc).
- Selection of appropriate Geophysical investigation method.

#### F. Geophysical Investigation Requirements

- Determination of depth and thickness of geologic strata;
- Determination of perched water zones and depth of groundwater;
- Estimation of soil and rock composition;
- Location of fracture zones, faults, karst, and other hazards;
- Location of clay lenses and sand channels;
- Location of buried objects (metal and non-metal);
- Location of utilities, and backfilled areas;
- Assessment of ground response to changing natural conditions brought about by subsurface excavations;
- Assessment of any special construction problems with respect to the existing structures nearby;
- Presence of contaminated soils (hydrocarbons, etc).

#### G. Hazards Identification

- Unstable slopes
- Active or potentially active faults
- Regional seismicity
- Floodplains
- Ground subsidence
- Collapse
- Heave potential

#### H. Geophysical Tools for Sub Surface Investigations;

- Electrical Tomography:
  - ⇒ Equipments and mode of operation;
  - ⇒ Field of application.
- Seismic Techniques:
  - ⇒ Equipments and mode of operation;
  - ⇒ Field of application.
- Electromagnetic Methods:
  - ⇒ Equipments and mode of operation;
  - ⇒ Field of application.
- Ground Penetrating Radar:
  - ⇒ Components and mode of operation;
  - ⇒ Field of application.

#### I. Field Data Acquisition and Interpretations

- Instrument Precision Requirement;
- Instrument Calibration;
- Data Collection and Recording;
- Frequency of Observations;
- Field Data Acquisition;

- Field Data Processing & Interpretation;
- Use of Computer software in Geophysical Data Interpretations;
- Maps Creation and Report Writing.

**J. Authority regulations / safety at work / environmental protection / work sheets**

- Responsible persons;
- Work safety;
- Water protection;
- Pollutant and noise emission;
- Regulations for handling dangerous materials and agents;
- Basics of working and civil laws for drilling operations (liability, negligence etc.);
- Regulatory guidelines;
- Relevant laws, rules and regulations;
- Work sheet standards.