

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 217

**Near-surface 2D high-resolution seismic reflection
survey onshore**

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1. Scope

This General Specification details the minimum standards required by Company for onshore Near-Surface 2D High-Resolution Seismic Reflection surveys. The term “near-surface” relates to the depth of investigation, which varies according to the objectives of the survey. The objectives and the corresponding depths of investigation are detailed in the Particular Technical Specifications which are an exhibit of the contract for the onshore geophysical survey. In most cases, the required depth of investigation will be 50 m for the shallowest investigations and up to 500 m for the deepest investigations. All equipment and materials, including spare parts, necessary to carry out the survey in accordance with the requirements of this General Specification and the contract shall be provided by the Contractor.

Equipment and materials shall be in nominal operating conditions and in adequate quantities for the performance of optimal operations.

The equipment shall be calibrated, tested, checked, and maintained on a routine basis during the operations in order to ensure that the equipment is functioning at all times within the tolerances set by the manufacturer.

Contractor undertakes to provide Company with the calibration certificates of the equipment prior to the start of the acquisition. Company will accept proof of Contractor's testing of equipment.

The work defined in this General Specification shall be performed in accordance with the contract.

The work includes the following stages:

- Preparation of the mobilization and of the field operations including the preparation and finalization of the project execution plan
- Mobilization
- Field operations including but not limited to, data acquisition
- Data processing including in-field QC, in-field processing, and final processing
- Demobilization
- Reporting and Interpretation.

The Project Execution Plan will include a detailed description of each stage together with a detailed planning.

Mobilization may not start if Company has not accepted the Project Execution Plan.

Reports and other deliverables shall include raw data, processed data, and interpreted seismic sections as per the objectives and the requirements detailed in the Particular Technical Specifications.

The final product shall be an Expert Report.

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2. Reference documents

The reference documents listed below form an integral part of this General Specification.

The order of precedence of those documents is:

- The General Specifications
- The Codes and Standards.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
ASTM D7128	Standard Guide for Using the Seismic Reflection Method for Shallow Subsurface Investigation
ISO 80000-1	Quantities and units - Part 1: General

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP GEO 210	Onshore Geophysical Site Survey - Cross hole geophysical survey
GS EP GEO 211	Onshore Geophysical Site Survey - Seismic refraction geophysical survey
GS EP GEO 212	Onshore Geophysical Site Survey - Multichannel surface waves geophysical survey
GS EP GEO 213	Onshore Geophysical Site Survey - Micro-Gravity Geophysical Survey
GS EP GEO 214	Onshore Geophysical Site Survey - Electric Geophysical Survey
GS EP GEO 215	Onshore Geophysical Site Survey - Radar Geophysical Survey
GS EP GEO 216	Onshore Geophysical Site Survey - Electro-Magnetic Geophysical Survey
GS EP GEO 401	GIS requirements for engineering site surveys and studies
GS EP GIN 122	Deliverables and Delivery Procedure for Surface Seismic Acquisition and Processing Data
GS EP GPA 202	Seismic HSE for Land Activities
GS EP GPA 203	Seismic HSE for Shallow Water and Transition Zone Activities

Reference	Title
GS EP POS 003	Land surveying and positioning works
GS EP POS 004	The use of Differential Global Navigation Satellite System

3. 2D High-Resolution seismic reflection survey objectives and general methodology

3.1 Seismic reflection survey objectives

The general objective is to provide key geological, environmental, or hydrological information to engineering design and construction studies.

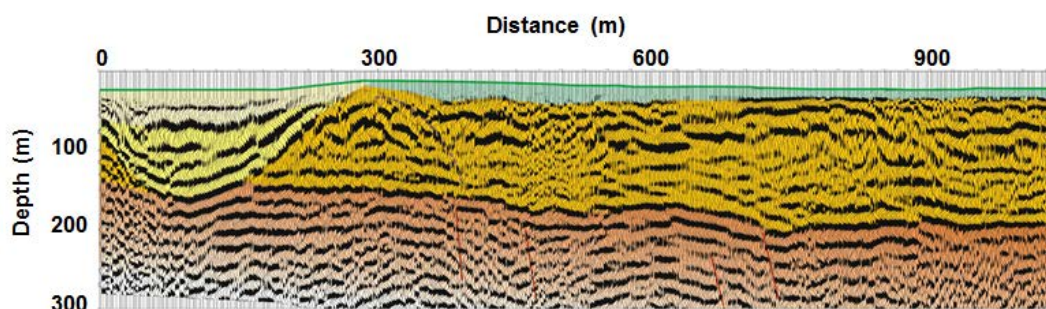
In most cases, this method will be applied in combination with other methods of engineering geophysics, such as seismic refraction, multichannel analysis of surface waves, resistivity, micro-gravity, electro-magnetism.

High-resolution - seismic reflection is a widely used robust method for mapping or delineating geological layers or other shallow sub-surface features from the very near-surface to the required depth of investigation (refer to [ASTM D7128](#)), while ensuring a high lateral resolution.

Applications are numerous and concern either geological, civil engineering, environmental or hydrological purposes. Examples are given below:

- Determination of the thicknesses of the geological units and mapping of the variation of depth to bedrock
- Search for paleo-channels beneath alluvium or other consolidated sediments (Figure 1)
- Detection of faults which is of primary importance when assessing seismic hazards, or when searching for high-permeability pathways
- Detection of shallow water table
- Characterization of lateral variations of the properties of the lithological units related to the modification of the elastic properties or density of the materials (variation of reflection coefficient)
- Detection of gas accumulations to select appropriate location for drilling (indicators such as bright spots related to higher acoustic impedance contrasts caused by gas accumulation).

Figure 1 - Example of seismic reflection section showing a paleo-channel



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3.2 Methodology

The acquisition of 2D seismic reflection data calls for:

- A controlled source to generate seismic waves
- An array of receivers laid on the ground
- A recording system.

The compressional waves generated by the source are reflected as PP-waves and PS-waves and transmitted as P-waves and S-waves at the interface of two units presenting a contrast of acoustic impedance.

The reflected P-waves are recorded by the receiver array laid on the ground. In some cases, Company may also require the acquisition of the converted S-waves.

The records of the PP component are then processed to produce seismic time sections and depth-converted sections. When the acquisition of the converted S-waves is required by the Company, then the records of the PS component are also processed to produce seismic time and depth-converted sections.

4. Units and abbreviations

4.1 Units

Only the ISO **International System** of units ([ISO 80000-1](#)) shall be used in all relevant measurements, processing and reporting.

4.2 Abbreviations

AGC	Automatic Gain Control
CDP	Common Depth Point
CMP	Common Mid-Point
DGPS	Differential Global Positioning System
ERP	Emergency Response Plan
GIS	Geographical Information System (chart database)
H3SE	Health, Safety, Social, Security and Environment
HDD	Hard Disk Drive
HAZID	Hazard Identification
INS	Inertial Navigation System
IP	Injured Person
JRA	Job Risk Assessment
NMO	Normal Move-Out
PEP	Project Execution Plan
POB	Personnel on board

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QA/QC	Quality Assurance / Quality Control
RTK	Real-Time Kinematics
SEG2	Society Exploration Geophysicist recording format 2
SEG-D	Society of Exploration Geophysicist recording format D
SEG-Y	Society of Exploration Geophysicist recording format
YTB	Time break
Vp	Velocity of compressional wave
Vs	Velocity of shear wave
VSP	Vertical Seismic Profile
VT	Vertical Time

5. Field work

Contractor shall detail in his proposal and in the Project Execution Plan the operational keystones of the survey:

- Organisation and timing of the mobilisation and of the demobilisation
- Logistics
- Advanced party - composition and schedule
- Composition of the seismic crew and associated equipment
 - Line clearing / bridging (when applicable)
 - Surveying
 - Drilling (when applicable)
 - Loading (when applicable)
 - Recording, back crew, front crew.
- Organisation and timing of the work for each crew engaged in the survey
- In-field organisation of the management of the field operations
- In-office organisation of the management of the field operations and interface with in-field management team
- Anticipated POB vs. time from start of field operations to end of field operations
- In-field QC and in-field processing
- Communications
- In-field and in-office HSE management
- Emergency response
- Community affairs

- Permitting
- Security
- Management of interfaces with parties other than the seismic crew.

These operational aspects must be fully suitable for the site conditions of the survey area at all time during the fieldwork. In some cases, a field trip can be organised in order to appreciate and fully understand the site conditions during the early stage of the tendering phase.

The operational interfaces with the Company must be clearly identified in the proposal and in the PEP. Contractor will detail in his proposal and in the PEP any item that may be required from the Company.

Standard operating procedures and job safety analysis must be submitted in the technical proposal and appended to the PEP.

6. Seismic acquisition parameters and pre-plot

6.1 Determination of the acquisition parameters

The acquisition parameters include:

- Array parameters
- Recording parameters
- Source type
- Source depth
- Receiver type.

The array parameters depend on the range of the depth of investigation, and on the required resolution and the dip of the formations within that range.

The array parameters include:

- Source interval
- Receiver interval
- Source-receiver inline and crossline offsets
- Minimum offset
- Maximum offset
- Full fold value
- Geometry type
- Location of the first and last shot points
- Number of active channels per shot point.

Contractor shall request all relevant available information from Company, to finalize his technical proposal, such as geological context, results of previous geophysical investigations, access to the site and type of the ground surface.