Specialized Services in Geophysics, Rock and Soil Mechanics, Topography and, Field Laboratory

Solum Consulting Group

Geophysics Studies

Geophysics studies contribute to determining the adequate location of civil works and preventing structural disasters, as well as optimizing the exploration and extraction processes of minerals, water, and energy. Solum's geology and geotechnical engineering team, specialized in internal geophysics, use quantitative methods of prospection to determine the location of mineral deposits and in construction works in general.

The development and growth of mining units in areas of greater geological complexity or located in zones vulnerable to seismic activity have led to the development of advanced designs in the construction of facilities and therefore, it is imperative to have a clear knowledge of the conditions of the area in where the construction works will take place. For this, it is necessary to know the type of geological material existing in the area and its physical properties.

Solum has conducted geophysics studies that have been beneficial for our clients throughout the life cycle of their projects.

PLANNING PHASE

Contributes to valuable data that engineers can use for conceptual and initial designs.

CONSTRUCTION PHASE

Services such as vibration control and exploration with penetration radards can help identify project risks.

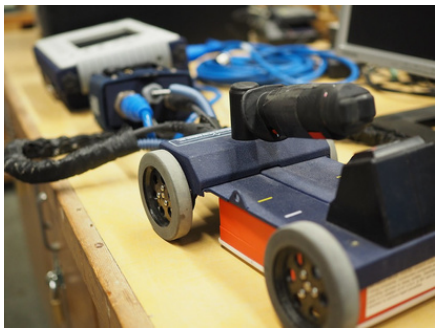
Bacanora Minerals | Sonora Lithium Project Geophysics Study (2020)

Geophysical Study with Electrical Resistivity Tomography

The geophysics study field program was designed based on the results of the drilling campaign of radial wells and the laboratory field testing program previously conducted by Solum for the site that was the most adequate for its characteristics for safe location of a new extraction pilot well; PW-1 which will be constructed and installed with a submersible pump, rail system discharge, piezometers, and instrumentation. The geophysics method selected was Electrical Resistivity Tomography (ERT) through the dipole-dipole array and it was centered in the potential area for construction and testing of the pilot well PW-1.

GeoRadar (Ground Penetrating Radar | GPR)

Solum offers one of the most used geophysical technics for location of objects and underground structures: GeoRadar or GPR (Ground Penetrating Radar) with field specialists who have the necessary experience in the mining and construction industries and with a state-of-the-art GeoRadar with double channel and GPS support.



The GeoRadar services are executed by our sister company RA Solutions ,and we also offer training and operator certification services.

Objectives

- DEFINITION OF SOIL/ROCK CONTACT AND CAVITY DETECTION
- FAULT AND FRACTURE MAPPING
- DETECTION OF DABLES, TUNNELS AND PIPING
- PAVEMENT THICKNESS AND ROAD INTEGRITY
- EMBANKMENT, SUBSIDENCE, AND BODIES OF WATER PROFILING

The service is conducted in two modalities:

1. Real Time Study: The detection is performed, and the trace of the detected objects is marked on the surface.
2. Real Time Study with Post-Processing: Geo-reference of the underground installation and an as-built drawing is provided.

We use a drone flight to obtain the aerial images through the subsoil mapping, obtaining a level of detail that allows to:

- Obtain an as-built drawing
- Prevent third party damages
- Perform the activities meeting all the industry standards.

Topographic Survey and Drone Flights

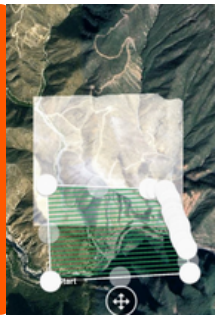
We have state-of-the-art equipment and software necessary to obtain the highest quality data in the industry.

The main objective of the surveys made with a drone flight is obtaining the topography and high-resolution images that are geo-referenced through the photogrammetric process that is carried out thanks to the information obtained by the drone and the GPS RTK of the required areas.

With the photogrammetric study, a cloud of points, contour lines, digital elevation model, digital terrain model, and a duly georeferenced orthomosaic can be obtained because the process is linked to the INEGI level banks through control points. Another purpose is the updating of the existing data in order to obtain a more accurate topography with high-resolution images. The site photogrammetric study is usually carried out before initiating field activities and at the end of all field activities.

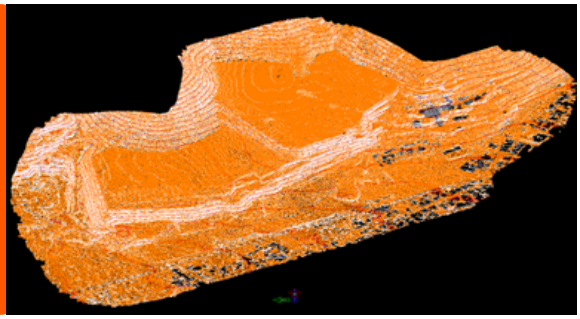
Topographic Survey for the Tahuehueto Project

Flight Plan in the DroneDeploy Platform



Topographic Survey for the San Guillermo Tailings Storage Facility

Point cloud filtered in TerraSolid©



Rock and Soil Mechanics

Our team of professionals has the necessary experience to perform Rock and Soil Mechanics Studies, geomechanics studies, slope design and underground mines. We have developed numeric models for the analysis as interpretation tools supported by the observations made onsite.

These services are important to be able to characterize the subsoil and they consist of the direct testing of soil layers; soil sampling is an indispensable process in studies previous to construction and/or facility design.

The rock and soil mechanics are performed through direct drillings (SPT, PCA, etc.), to extract samples at different depths. The samples are sent to a certified laboratory where they can be evaluated to calculate parameters to know the material's elasticity properties, dynamics and concentrations. The rock and soil mechanics studies are used to develop:

- Engineering analyses: Slope and pit stability, settlement, runoff, etc.
- Underground mine engineering
- Waste rock pile design
- Tailings storage facility design

Field Laboratory Services

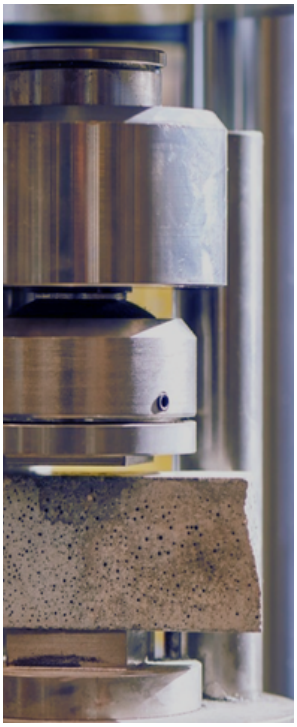
Soil Laboratory

Our field engineering and technical team have wide experience studying soil, therefore, they can provide high-quality geotechnical reports that identify the different types of soils and the constructive characteristics of them.

Tests

- Moisture content
- Sieve gradation test
- Sedimentation gradation test
- Liquid limit
- Plastic limit
- Modified Proctor
- Sand equivalent
- Volumetric unit weight
- Minimum density
- Maximum density (dry method)
- Total soluble salt
- Soluble chloride content
- Soluble sulfate content
- pH
- Contraction limit
- Cohesive soil volumetric weight
- Specific gravity of solids
- Direct shear
- Standard Proctor
- Standard Penetration Test (SPT)
- Lightweight Dynamic Penetration (LDP)
- Direct load test
- Triaxial compression
- Shallow and deep foundation studies
- Unidimensional consolidation
- Free expansion test

Concrete Laboratory



When carrying out the concrete laboratory tests, an efficient evaluation and categorization of materials is performed at a physical and mechanical level to obtain the necessary parameters for their respective use in engineering design. For the tests and quality control of all types of fresh and hardened concrete, Solum performs geotechnical explorations in accordance with ASTM regulations, as well as geotechnical mapping that allows us to obtain representative samples in the field.

Tests

- Concrete mix design
- Design verification
- Exudation
- Fresh concrete air content
- Granulometric analysis
- Fine and thick aggregate
- Global aggregate
- Organic debris
- Abrasion weathering
- Sand equivalent
- Organic matter content
- Specific weight and adsorption
- Unit weight
- Moisture content
- Mortar length change
- Cube compression
- Concrete cylinder compression
- Quality control of fresh concrete on site

Steel Field Tests

Steel tests are performed for the assembly of structures by performing the following:

- Destructive and non-destructive tests
- Liquid penetrating tests
- Ultrasound tests
- Torque tests on bolts
- Tests on steel welds, among other tests

Each test has a record with its due process of quality control to be part of a dossier or final field laboratory report.

Our services have:

THE REQUIRED EQUIPMENT TO PERFORM THE FIELD WORK

HIGHLY TRAINED STAFF WITH THE NECESSARY EXPERIENCE

STATE-OF-THE-ART SOFTWARE

Innovative Solutions | Environmentally Responsible | Cost-Effective

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