

Geophysical Services

The Geophysics and Geology Branch provides non-destructive geophysical services for geotechnical investigations, pavement surveys, environmental studies and subsurface utility mapping. Geophysics and Geology employs engineering geologists, transportation engineers and transportation engineering technicians who are experienced in planning and executing geophysical surveys. This chapter provides information to help qualified geoprofessionals collaborate with Geophysics and Geology staff such that the expertise of both parties is utilized to the benefit of the Department.

Available Services

In House Services

The table below lists the geophysical services available through the Geophysics and Geology Branch. Additional information on these services is available on the [Geophysics webpage](#).

Seismic	Ground Penetrating Radar	Electromagnetic Conductivity	Electrical	Magnetics	Borehole Geophysics*
Refraction			Resistivity		
Tomography			Induced Polarization		
			Self Potential		

Table of in-house geophysical services. *See website for more information and availability of specific borehole geophysical tools.

Contract Services

Although most typical geophysical services are available in-house, geophysical services not listed above or on the website may require outside contract. (For example, reflection seismic is not available as an in-house service. Other methods not available in-house may be found online at the [Federal Highway Administration's geophysics website](#).) Rarely, personnel availability or the demands of the project schedule may also require outsourcing for services normally available in-house. Geophysics and Geology Branch personnel will assist with determining the need for outside services. The geoprofessional is responsible for completing any required Task Order or contract for outside services, as outlined in the next section.

Requesting Geophysical Services

Where required, the geoprofessional is responsible for obtaining access to their project site. Traffic control activities are included in that responsibility, whether performed by

the Department or consultants. If lane or shoulder closures are anticipated, the geoprofessional should contact the appropriate District Traffic Operations Branch and request that they provide allowable closure times for the project. The geoprofessional should contact the District Maintenance office to determine if they will be able to provide traffic control during the allowable times. It is not necessary that the geoprofessional agree on specific dates with District Maintenance, rather the geoprofessional should verify that District Maintenance has the capability to provide the support once the schedule is fixed. Occasionally, mowing and brush cutting may also be requested for site access, and the geoprofessional may be required to coordinate this activity with District Maintenance or other appropriate contractor.

The geoprofessional is responsible for contacting the District to acquire all permits required for the geophysical survey, which may include permits to enter non-State property and/or environmental permits. The District Project Engineer should help obtain the necessary documents, or alternatively refer the geoprofessional to the appropriate District Environmental personnel for permitting activities. The permit may require additional work constraints for the investigation including time restrictions, noise monitoring, or special protective measures.

The geoprofessional shall support the geophysical survey by acting as a coordinator between the Geophysics and Geology Branch and District Right-of-Way, District Maintenance, District Environmental or contractors.

In House Services

Scheduling geophysical services with the Geophysics and Geology Branch requires completing and submitting a Geophysics and Geology Branch [Project Request](#). Preliminary identification of the desired geophysical services is included on the request form, but is not required if the geoprofessional is unsure of the specific techniques that are best suited to his or her project. If desired, any member of the Geophysics and Geology Branch can assist with completing the request and with selection of preliminary methods. The Geophysics and Geology Branch Chief is responsible for final approval of the appropriate geophysical methods for any project.

Submit the completed request form to the Geophysics and Geology [Branch Chief](#). For requests not originating from a Branch Chief (i.e., prepared by a subordinate), the Branch Chief must initial the request to assure that the planned work is resourced and approved. Work cannot proceed until appropriate staff resources are allocated in the project budget.

Priority for scheduling geophysical services is set by schedule needs for projects and project readiness (primarily consisting of permit completions and lane closure availability). The geoprofessional is responsible for ensuring readiness for their project.

Geophysics and Geology work schedules will accommodate project constraints when needed (e.g., to accommodate traffic management plans and other permits). In consultation with the geoprofessional, the Geophysics and Geology chief will determine the most appropriate schedule based on safety, efficiency, state laws and Caltrans policies. Depending on personnel availability and the demands of the project schedule, the geoprofessional may be required to assist with fieldwork during the survey.

In all cases, the geoprofessional shall attend a project site visit with Geophysics and Geology staff to ensure that planned locations of geophysical measurements are acceptable and appropriate to the needs of the project. Other topics for the site visit may be included based on project-specific needs.

Communication Requirements for Borehole Geophysical Services

Specific provisions are required for borehole geophysical services performed in uncased (open) boreholes. Open-hole logging with geophysical tools requires coordination with Drilling Services personnel or contract drillers. Those crews typically remain on site during borehole geophysical logging to assist with borehole maintenance and, if necessary, tool retrieval operations. To avoid standby time due to logging crew schedule or mobilization conflicts, the geoprofessional shall notify the Geophysics and Geology Branch of commencement of drilling and shall provide an estimated date for geophysical logging. Periodic status updates during drilling operations are recommended. In addition, the geoprofessional shall provide the Geophysics and Geology Branch with a notice of intent to log no later than 24 hours before the desired start of logging. Those requirements may be waived on an individual basis, upon approval by the Geophysics and Geology Branch Chief.

Contract Services

Geophysical services that cannot be provided in-house will require outside contract. Acquiring contracted geophysical services may be achieved through a Task Order via an existing Architectural and Engineering (A&E) contract for geotechnical investigation services. Otherwise, a separate A&E contract will be required for services exceeding \$5,000. For services costing less than \$5,000, a Service Agreement may be employed.

The geoprofessional is responsible for completing any required Task Order or contract. Geophysics and Geology Branch personnel will assist in developing the scope of work and providing oversight and review of the work and subsequent report. That assistance is obtained by submitting a Geophysics and Geology Branch [Project Request](#), as described in *In House Services*.

Field Operations

Prior to performing the field investigation work, the geoprofessional is responsible for procuring all required permits and arranging for traffic control if needed. The geoprofessional must meet with the Geophysics and Geology staff to confirm locations of geophysical measurements are acceptable and appropriate to the needs of the project.

During geophysical field operations the geoprofessional serves as the central point of contact between Geophysics and Geology staff and any other internal and external groups associated with the project (such as Caltrans district offices, permitting agencies and contractors). The geoprofessional is responsible for keeping Geophysics and Geology staff informed of activities that may affect geophysical field operations.

During geophysical field operations, Geophysics and Geology staff are responsible for the following:

- Conducting the tailgate safety meeting at the start of the project and maintaining safe operating practices during the field work,
- Setup of equipment and functional checks,
- Calibration of equipment as needed,
- Data acquisition,
- Adjusting measurement parameters and procedures to adapt to changed site conditions,
- Equipment tear down and clean up,
- Minor site restoration as needed.

Standards of Practice for Geophysical Investigations

In California, the practice of geophysics is governed by California law (Business and Professions Code §§ 7800-7887 and 16 CCR §§3000-3067) and enforced by the state Board for Professional Engineers, Land Surveyors and Geologists. The practice of geophysics in the state is delegated to professionals who are appropriately licensed by that board, which also enforces general standards of practice.

For specific geophysical services, offered either in-house or through contracted services, standards of practice are not promulgated. However, a number of guidelines are available and, where appropriate, may help describe adequate practice.

The following guidelines are included herein by reference:

American Society for Testing and Materials (ASTM), *Standard Guide to Site Characterization for Engineering Design and Construction Purposes*, ASTM D 420.

ASTM, *Standard Test Method for Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar*, ASTM D 4748

ASTM, *Standard Guide for Planning and Conducting Borehole Geophysical Logging*, ASTM D 5753

ASTM, *Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation*, ASTM D 5777

ASTM, *Standard Guide for Conducting Borehole Geophysical Logging: Mechanical Caliper*, ASTM D 6167

ASTM, *Standard Guide for Conducting Borehole Geophysical Logging: Gamma*, ASTM D 6274

ASTM, *Standard Guide for Selecting Surface Geophysical Methods*, ASTM D 6429

ASTM, *Standard Guide for Using the Direct Current Resistivity Method for Subsurface Investigation*, ASTM D 6431

ASTM, *Standard Guide for Using the Ground Penetrating Radar Method for Subsurface Investigation*, ASTM D 6432

ASTM, *Standard Guide for Using the Frequency Domain Electromagnetic Method for Subsurface Investigation*, ASTM D 6639

ASTM, *Standard Guide for Conducting Borehole Geophysical Logging: Electromagnetic Induction*, ASTM D 6726

ASTM, *Standard Guide for Conducting Borehole Geophysical Logging: Neutron*, ASTM D 6727

ASTM, *Standard Test Methods for Downhole Seismic Testing*, ASTM D 7400

Transportation Research Board, 2008, *Geophysical Methods Commonly Employed for Geotechnical Site Characterization*, Transportation Research Circular E-C130, <http://pubsindex.trb.org/view.aspx?id=873642>

US Department of Transportation, Federal Highway Administration, 2003, *Guidelines for Geophysical Investigations of Mines under Highways*, Report No. FHWA/OH-2003/007-1, Ohio Department of Transportation Mine Research Project GUE 70-14.10

The Advisory Committee on Standardization, 2004, *Application of Geophysical Methods to Engineering and Environmental Problems*, Society of Exploration Geophysicists of Japan.

Standards for Geophysical Investigation Reports

Geophysical interpretations and models shall be adequately documented. Geophysical investigation reports shall discuss the purpose for the work, field methods used to conduct the surveys, and techniques used for data processing and interpretation. Names and descriptions of any software applications used for data reduction and interpretation shall be presented. Maps and cross-sections of the geophysical models shall be provided. Features in the geophysical models that may affect a project shall be noted and discussed in the report.

In-House Reports

In-house reports should use the standard Caltrans memorandum format. In-house reports may not include all supporting data used for geophysical interpretations, since such reports are typically incorporated as appendices to other Caltrans geotechnical reports. However, supporting data are archived and can be provided to the geoprofessional upon request.

Consultant Reports

Geophysical investigation reports prepared by a contractor shall meet the same substantive criteria as Caltrans in-house reports and shall include one additional provision: for contractor reports, all supporting data used for geophysical interpretation shall be presented, including graphs and tables of the geophysical data. Required information may be provided in appropriate electronic formats when approved by Caltrans. Unless Caltrans specifies a format, in either a Task Order or contract scope of work, final reports prepared by a contractor shall follow a format of their choice. Raw data and data created from intermediate processing steps, if used to produce final geophysical interpretations, are not required in the final report, unless specified by Caltrans in a Task Order or contract scope of work. However, such data must be retained and made available to Caltrans upon request.

Revisions

- Supersedes “Geophysical Services”, Caltrans Geotechnical Manual, December 2012