

Geotechnical Drilling

The Office of Drilling Services (ODS) provides soil and rock exploratory drilling. A successful drilling program requires collaboration between the geoprofessional and ODS staff such that the expertise of both parties is utilized to the benefit of the Department.

Drilling Services employs foundation drillers, lead foundation drillers, senior foundation drillers and Branch Chiefs who are experienced in the various aspects of planning and executing geotechnical drilling operations. There is an [ODS Liaison](#) assigned to each Geotechnical Design Office and the geoprofessional is encouraged to contact their liaison for assistance in planning the site investigation and completing the work request.

Drilling priorities will be set by project schedule needs and job readiness.

ODS normal work schedule is 0700 hrs – 1730 hrs, Monday through Thursday (4/10 schedule). An alternate work schedule may be requested when drilling hours are subject to external constraints (e.g. to accommodate a traffic management plan or permit constraints). In consultation with the geoprofessional ODS management will determine the most appropriate schedule based on safety, efficiency, maximizing drilling time, bargaining Unit 12 contract rules, commercial drivers regulations, and minimizing overtime.

This module addresses the process for the geoprofessional to obtain drilling services for his/her project. The geoprofessional must also follow the procedures in:

- [Geotechnical Services – Supplement A](#): Specifies the requirements/procedures to comply with the California Water Code and Local Enforcement Agency (LEA) permit/conditions.
- [Geotechnical Investigations Module](#): Provides direction to the geoprofessional for planning the field investigation, obtaining utility clearance, and permitting.

Requesting Drilling

All Geotechnical Services employees are responsible to comply with the following drilling request process successfully obtain drilling services and to ensure compliance with Geotechnical Services Directive GS-01 – *Policy for Borings, Backfilling and Local Enforcement Agency Engagement*, California State Law (including the California Water Code), and applicable Local Enforcement Agency (LEA) requirements. More specifically, GS Managers and Supervisors are responsible to consistently monitor and actively manage this Drilling Request Process.

The process for requesting drilling includes the following steps:

1. The geoprofessional must complete and submit a preliminary work request, which includes:
 - a. Drilling Request (Preliminary),

- b. Layout Plan Sheet,
 - c. Site Assessment Questionnaire,
 - d. Allowable Lane Closure Times (if applicable)
2. The geoprofessional and a senior foundation driller must complete a site preview meeting.
3. The geoprofessional must complete and submit a final work request, which includes:
 - a. Drilling Request (Final),
 - b. Layout Plan Sheet,
 - c. Site Assessment Questionnaire,
 - d. Allowable Lane Closure Times (if applicable),
 - e. LEA C-57 determination document (Geotechnical Manual – Supplement A, LEA process),
 - f. LEA requirements including but not limited to special conditions, required grout mixes, and standpipe piezometer details (Geotechnical Manual – Supplement A, LEA process),
 - g. Site Safety Plan,
 - h. All applicable permits (encroachment, environmental, R/W, etc.) (See Geotechnical Investigations).
4. The geoprofessional provides the final work request to the design branch chief.
5. The design branch chief performs a quality check on the final work request to ensure it contains all of the required documents, is legible and completed in a quality manner.
6. If the design branch chief identifies any errors or problems, the geoprofessional will be instructed and notified in writing to ensure all corrections are resolved.
7. The geoprofessional submits the final work request to the Chief-Drilling Services-Branch C (drill.requests@dot.ca.gov)

Documents must be submitted to the Chief-Drilling Services-Branch C by email at drill.requests@dot.ca.gov (hard copies will not be accepted).

Upon Drilling Services receipt of the final work request:

1. The Chief-Drilling Services-Branch C will notify (emails) the geoprofessional and design branch chief if the final work request is incomplete identifying item(s) requiring correction. The geoprofessional and design branch chief must correct and re-submit the final work request to drill.requests@dot.ca.gov.
2. The Chief-Drilling Services-Branch C will distribute the final work request to the Drilling Services Branch Chief responsible for the drilling activities and staff assigned to the project.
3. The Drilling Services Branch Chief will review the final work request and instruct the Lead Driller to ensure a complete understanding of the requested work.

4. The Drilling Services Branch Chief and Lead Driller will initial the final work request confirming the review and acceptance of the planned work and any LEA permit/conditions by the Lead Driller.
5. The DSBC retains the documents in the Drilling Services File Retention Center.

Drilling Requests (Preliminary) may be for individual structures/locations, or by project (multi-structure/locations). The *Drilling Request (Preliminary)* should be submitted to ODS as early as possible, but typically no later than one month prior to the requested start date for drilling. The purpose of providing an early submission is to put the project on the preliminary drilling schedule and to provide ample time to conduct the site preview, obtain site access and allow efficient allocation of resources. The *Drilling Request (Preliminary)* for multiple structures will be divided into individual Drill Requests as agreed to at the site preview meeting. The *Drilling Request (Preliminary-multi)* will have the *Project Information* section completed and include all planned structures/drill locations in the *Remarks* section. For a single-structure/location a *Drilling Request (Preliminary)* will have the *Project Information* section completed, and other sections completed as much as possible.

The complete final work request (3a-3h above) must be received by ODS at least 1 week prior to the requested start date in order for drilling to occur.

In general, final work requests are to include manageable quantities of work such that the information on the *Drilling Request*, *Site Safety Plan* and *Site Assessment Questionnaire* is useful. The *Drilling Request (Final)* should include only those borings for:

- one bridge, building or large earthwork location (e.g. landslide)
- multiple minor structures or earthwork locations in close proximity that are covered by one USA ticket (e.g. two or more retaining walls, sound walls or slip outs)

Site Preview Meeting

After the receipt of the preliminary work request ODS will schedule and conduct a site preview meeting with the geoprofessional. If Maintenance-assisted access or traffic control is anticipated the geoprofessional should invite a Maintenance representative to the site preview meeting. along with any other stakeholders such as Environmental personnel. At the site preview meeting a senior foundation driller and the geoprofessional will:

- Review/determine access to the planned borehole locations
- Discuss the type(s) of equipment best suited for the planned work
- Agree on the traffic control plan (no. of lanes closed, equipment, CHP support, etc)
- Look for utilities and mark for USA if not previously marked

- Discuss how the drilling work is to be separated into individual Drilling Requests (for multi-structure or lengthy projects)

Based on the site review the senior foundation driller may propose alternate borehole locations to reduce exposure of employees to traffic, avoid known utilities, or simplify access to the drill site, however, the final decision for borehole locations resides with the geoprofessional.

The senior foundation driller must document the meeting on a *Drilling Site Preview Report* and the Chief-Drilling Services-Branch C must forward a copy to the geoprofessional. The *Drilling Site Preview Report* must document any changes made to the preliminary work request, and those changes will be reflected in the final work request.

Site Investigation Peer Review

At any time, if ODS or the geoprofessional determines that the drilling plan, defined by either the preliminary or final work requests, might benefit from additional input, either can request a site investigation peer review meeting with the requesting design office. The site investigation peer review meeting must include the geoprofessional, the design branch chief, a geoprofessional from another design office and a representative from ODS who meet to discuss the site investigation plan. The Design Office that originated the drilling request will arrange the peer review meeting.

Drilling Request

The Drilling Request consists of eight sections to be completed by the geoprofessional; Project Information, Drilling and Sampling, Traffic Control, Maintenance Yard, Permits, Remarks, Installations, and Borehole Backfill.

The *Project Information* section includes the Branch Chief's name and initials indicating that the Drilling Request has been reviewed and approved, and that ODS staff can charge time to the project ID on the Drilling Request.

In the *Drilling and Sampling* section, indicate the type(s) of drilling and sampling requested. Identify all borehole locations on a layout plan sheet along with anticipated depths. If multiple drilling methods are anticipated, indicate which types and where on the layout plan.

The geoprofessional is responsible for managing all traffic control activities whether performed by the Department or consultants. If lane or shoulder closures are anticipated the geoprofessional must contact the appropriate District Traffic Operations Branch and request that they provide allowable closure times (traffic management chart) for the project. Provide specifics for traffic handling in the *Traffic Control* section including the number of lanes to be closed and the anticipated

hours of work within the closure, and attach the traffic management chart to the *Drilling Request*.

The geoprofessional should contact Maintenance to determine if and when they will be able to provide the traffic control during the allowable times. It is not necessary that the geoprofessional agree on specific dates with Maintenance, rather the geoprofessional should verify that Maintenance has the capability to provide the support once the schedule is fixed. Enter the contact information for traffic control in the *Maintenance Yard* section.

The geoprofessional is responsible for contacting the District to obtain permits required for the planned drilling, which may include permits to enter non-State property and/or environmental permits (See Geotechnical Investigations). Exception: For C-57 work the geoprofessional must obtain all LEA Drilling Permits per Geotechnical Manual – Supplement A. List the required permits in the *Permits* section and attach copies to the Drilling Request. Describe and/or attach all special work required by the permit(s) in the *Remarks* section.

If the planned boreholes are located off of the highway, describe the access constraints in the *Remarks* section. ODS will make the final determination on how to best access the borehole locations during the site preview meeting and will work with Maintenance or others to oversee and complete the access work. The geoprofessional is expected to support access work by acting as a coordinator between ODS and District Right-of-Way, Maintenance, Environmental or consultant.

Indicate the planned instrumentation, monuments and borehole backfill in the *Installations* and *Borehole Backfill* sections and for each planned borehole on the attached layout plan sheet.

Layout Plan Sheet

The layout plan sheet presents the requested boreholes on a plan sheet (aerial photo, general plan, etc.) so that a reviewer can understand where the boreholes will be located relative to pertinent existing site features, such as a bridge, building, or stream. The layout plan sheet must include:

- Planned boreholes, including for each hole:
 - Type(s) of drilling (rotary, coring, etc.)
 - Depth
 - Instrumentation (piezometer, SI)
 - Estimated depth to groundwater
- Pertinent existing features (bridge, stream, highway, etc.)
- Access routes

Site Safety Plan

The Site Safety Plan consists of five sections to be completed by the geoprofessional; Project Information, Local Hospital, Physical Hazards, and Utility Clearance Data and Remarks.

The *Project Information* section includes the Branch Chief's signature. Unsigned submittals must be by the Branch Chief, indicating that the *Site Safety Plan* has been reviewed and approved.

Determine the closest emergency medical facility to the job site and enter its information in the *Local Hospital* section. Contact the emergency medical facility directly to verify its location. A map showing the project site and verified directions to the nearest emergency medical facility is part of the *Site Safety Plan*.

Note potential or confirmed hazards such as poison oak, snakes, ticks, steep slopes, proximity to water courses, hypodermic needles, or potential violence toward Caltrans staff from local residents in the *Physical Hazards* section.

Clearance information for all utilities is documented in the *Utility Clearance Data* section. A Site Safety Plan has only one USA number.

The geoprofessional is responsible for obtaining all utility clearances as required by law, including [USA North](#) or [USA South/Dig Alert](#) and non-subscriber utilities such as Caltrans or local municipalities (see Geotechnical Investigations). In order to submit a complete work request to ODS one week prior to the drilling start date it is recommended that USA/Dig Alert be contacted two weeks prior to the drilling start date.

Site Assessment Questionnaire

The *Site Assessment Questionnaire* provides information on soil or groundwater contamination at the site. In most cases, if soil or groundwater contamination is expected or known to exist at the site, a consultant drilling company will perform the work. Information on procuring contract drilling services is available from the ODS liaison.

The geoprofessional completes the top portion of the *Site Assessment Questionnaire*, attaches a site plan showing the locations of planned boreholes, and submits it to the District Environmental Branch as early as possible. The environmental coordinator will complete the bottom portion of the form and return the Questionnaire to the geoprofessional. The *Site Assessment Questionnaire* is valid for one year only.

Drilling Schedule

The drilling schedule shows which jobs will be drilled on what weeks. The drilling schedule is emailed to all office chiefs and branch chiefs each week and the geoprofessional is encouraged to monitor the status of his/her projects each week. Drill projects are assigned one of three statuses:

- Red: *Drilling Request (Preliminary)* received. Project not ready to drill.
- Yellow: Site preview meeting completed. ODS committed to the drill start date subject to approval of the final work request.
- Green: Final work request approved. Drilling is scheduled.

There are many variables that control the status of a drill project, some of which are out of the geoprofessional's control. It is common for a drilling project to be delayed at the last moment due to employee illness, equipment malfunctions, weather, etc. Hence ODS prefers that projects be ready to drill at least one week in advance so drill crews can be re-assigned to new projects at the last minute. Typically it is easiest to reassign drilling to those jobs that do not depend on external assistance, such as traffic control services.

The Week Prior to Drilling

Each Monday, ODS conducts a schedule meeting and reviews all work for the current and following week(s). Projects on the schedule that are not ready (red and yellow) will be identified.

Each geoprofessional on the drilling schedule for the following week will be contacted to confirm the drilling start date and to:

- Verify that all paperwork is complete
- Verify that utility conflicts do not exist
- Verify that the traffic control support is committed to the schedule
- Review particulars of the work as necessary

Projects that are not ready one week prior to the scheduled start date may be rescheduled.

On Thursday ODS will contact the geoprofessional to:

- Review the planned drilling work
- Verify the schedule for the beginning of drilling (time, meeting place, etc.)
- Confirm lead driller and his/her contact information

The Week of Drilling

- On Monday morning, the lead worker will contact the geoprofessional to confirm details and provide the estimated departure time and anticipated start of drilling time.

- The geoprofessional will be at the drill site ready to conduct the tailgate safety meeting and begin drilling at the agreed start of drilling time. The geoprofessional will submit a copy of the completed and signed tailgate [Safety Meeting Report \(PM-S-0110\)](#) to ODS within two weeks of drilling completion.
- Geoprofessional will keep the Foundation Driller Leadworker informed regarding the progress of the job so ODS can adjust the work schedule if necessary.

Field Operations

Prior to performing the field investigation work, the geoprofessional must preside over a tailgate safety meeting. Refer to the Code of Safe Drilling Practices for procedures.

During drilling operations the geoprofessional is responsible for:

- Showing the drillers all USA markings, overhead utilities, marked utilities close to proposed boring locations, and environmental constraints, and safely positioning the borehole.
- Maintaining communication with support personnel (e.g., Maintenance, Consultants, District or Structures P.E.).
- Being at the work site for the entire time the drill crew is performing work.
- Determining the sequence of work and exact location of the borehole. However, the geoprofessional must be aware that due to equipment and access limitations the drill crew may not be able to set up on the exact spot. If exact locations are required it should be noted on the drill request and discussed with the senior driller during the site preview.
 - Whenever practicable, the sequence of drilling should take into account the possibility of eliminating borings if the site conditions are predictable or uniform. Typically it is better to alternate drilling ends and sides at a site rather than starting at one end and drilling consecutive holes. Efficiency relating to access restrictions need also be considered. A drilling program should always be flexible and consider information as it is obtained.
- Directing the drill crew when and where to sample. The geoprofessional is advised to discuss the goals of the drilling program with the drill crew (e.g., geotechnical features being explored, foundation types, subsurface expectations). The drill crew will be more inclined to communicate back to the geoprofessional the subtle information that they note while drilling (e.g., change in drilling rate, down pressure, rattling due to gravel) if they know the goals of the investigation.
- Inspecting the sampler to assure it is in the required condition. Damaged drive shoes must be replaced, check valves operational, check catchers, inspect threads, etc.
- Informing the drill crew (and if necessary halting drilling operations) if standards are not being met. Examples include: not carefully marking the drill rods for SPT, hammer drop for SPT not being within tolerance, not lifting casing from the bottom of the hole prior to performing SPT, and not cleaning the hole adequately.

- Observing the sampler as it comes out of the hole in order to determine if the sample was retrieved properly, and if not to determine if another attempt should be made to sample before continuing to drill.
- Preparation, labeling, storage, and transportation of samples (refer to the [Soil and Rock Logging, Classification and Presentation Manual](#)).
- Communicating modifications to the exploration plan to the drill crew. Encountering unexpected conditions, either favorable or unfavorable, may necessitate modifications by the drill crew. For example, if the drill hole needs to be much deeper than originally planned, the drill crew may need more water or drilling mud, and schedules may need to be changed. Shorter holes may free the drill crew for other work or allow for rig maintenance to be performed.

During drilling operations the drill crew is responsible for the following:

- Performing operations according to the accepted standards (refer to Soil and Rock Logging, Classification and Presentation Manual and the Drilling Services web page).
- Handling the sampler while it is attached to the drill tools. Once a drive or push sampler is retrieved from the borehole and removed from the drill rods, it is the responsibility of the geoprofessional. The Driller should assist as requested by the geoprofessional.
- Grouting and sealing the borings according to the requirements established by the Local Enforcement Agencies.

Borehole Backfill and Well Completion

A Borehole Backfill Data Sheet is required for all boreholes except slope inclinometers that are drilled or slotted to measure groundwater and standpipe piezometers, which require a Well Completion Report (WCR). See Geotechnical Manual - Supplement A.

Revisions

- Supersedes “Geotechnical Drilling”, Caltrans Geotechnical Manual, June 2012