# FOUNDATION REPORTS
# For
# EARTH RETAINING SYSTEMS
# (ERS)

**January 2026**


**DIVISION OF ENGINEERING SERVICES**
**GEOTECHNICAL SERVICES**

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# 1. INTRODUCTION

The intent of this document is to define the Department's standard of practice for preparation of the Structure Preliminary Geotechnical Report (SPGR), the Preliminary Foundation Report (PFR), and the Foundation Report (FR) for the following Earth Retaining Systems (ERS).

- Conventional Retaining Walls
- Mechanically Stabilized Embankments
- Soil Nail Walls
- Non-Gravity Cantilever Retaining Walls
- Ground Anchor Earth Retaining Systems

## 1.1 Reporting for Project Delivery

Geotechnical investigation and reporting generally occurs at three stages of the project development process:

- A Structure Preliminary Geotechnical Report (SPGR) to support Advanced Planning Studies, performed during the Work Breakdown Structure 150.15 (K Phase).
- A Preliminary Foundation Report (PFR) to support Type Selection, performed during the Work Breakdown Structure 160.10 (0 Phase) or 240.70 (1 Phase).
- A Foundation Report (FR) to support the design and construction of the ERS, performed during the Work Breakdown Structure 240.80 (1 Phase).

Prepare a separate foundation report for each ERS. If requested by the client, multiple ERS may be included in one report, provided that the report is archived separately at each location along with the applicable Log of Test Borings (LOTB).

Prepare reports to succinctly communicate information pertinent to the recommendations in accordance with the report preparation requirements. The following rules must be followed:

- Present specific information that is relevant to the recommendations.
- Reference or cite existing standards, specifications, or policies only when clarifying, modifying, or disallowing the standard, specification, or policy.
- Do not include unsubstantiated disclaimers.
- Provide titles for all figures and tables.
- Tables and figures must be included within the body of the report and located as near as possible to the place where they are first referenced.
- All depth references must have a corresponding elevation in parenthesis.
- Elevations in the SPGR may be referenced to the current or former datum.
- Elevations in the PFR/FR must be presented using the current datum.

### 1.1.1 Reports Prepared by Caltrans Staff

Foundation Reports are written to the Structure Designer, Specification Engineer, and Structure Construction, and are part of the contract.

For reports prepared by Geotechnical Services staff, Foundation Reports must be prepared using the reporting (MS Word) templates with the subject line of “Foundation Report for ERS Name”, “Preliminary Foundation Report for ERS Name”, or “Structure Preliminary Geotechnical Report for ERS Name”. Do not include section numbers in the report. First-level section titles presented in this document (e.g., Geotechnical Conditions) must be included in the report. Second-level section titles (e.g., Geology, Surface Conditions) are optional.

Do not include the Log of Test Borings (LOTB) and/or As-Built LOTB as part of the FR. The Engineering Graphics Unit will send MicroStation LOTB files and scanned copies of the As-Built LOTB sheets to the Structure Designer for inclusion within the Contract Plans.

Sign, stamp, and distribute reports in accordance with the *Communications and Reporting* section of the *Offices of Geotechnical Design – Quality Management Plan*.

### 1.1.2 Reports Prepared by Consultants

Foundation Reports must include the following: cover sheet, table of contents, main contents per this document, and appendices. The cover sheet of the report and any addenda/amendments to the report must include the following information: Caltrans District, County, Route, Post Mile, Structure Number, Structure Name, and Expenditure Authorization (EA) Number.

The LOTB and/or As-Built LOTB must be submitted as part of the FR. Refer to the *Soil and Rock Logging, Classification, and Presentation Manual* for direction on the preparation of the LOTB and As-Built LOTB.

## 2. STRUCTURE PRELIMINARY GEOTECHNICAL REPORT (SPGR)

The SPGR is required during the project's early stages to assist Bridge Design in the preparation of an Advanced Planning Study and cost estimate for the District. Often the number, location, and type of ERS are not completely known. As a result, recommendations may be general, and detailed field investigations are usually not warranted. Typical fieldwork consists of a site visit only. The SPGR provides an overview of the existing foundations, site geology, seismic information, and recommendations regarding suitable and unsuitable wall types. If appropriate, the SPGR should also discuss the anticipated field and laboratory work required to support the PFR and FR.

The following topics should be addressed in all Structure Preliminary Geotechnical Reports (SPGR).

### 2.1 Introduction

Reference the request date, wall type, and supplemental information provided in the request.

### 2.2 Project Description

Describe the proposed ERS and pertinent project information, such as the reason for constructing the ERS. A table such as the one below must be used to present the pertinent ERS information. Provide the project vertical datum.

<edit column heading to properly identify the location information presented>

Table X: ERS Information Table

| ERS ID No. | ERS Type | Begin Station & Offset PM | End Station & Offset PM | Length, (feet) | Maximum Design Height (feet) |
|---|---|---|---|---|---|
| | | | | | |

### 2.3 Exceptions to Policies and Procedures

List exceptions to Departmental policies and procedures relating to the SPGR. Approved *Request for Exception* forms must be included in the Appendix. Omit this section if there are no exceptions.

### 2.4 Geotechnical Investigation

Provide an overview of the geotechnical investigation(s) to support the preliminary ERS recommendations.

## 2.5 Geotechnical Conditions

Present only factual information in this section, not how it relates to design and construction. Discussion of site geology, geological features, and subsurface conditions as they relate to the ERS design and construction must be placed in the *Foundation Recommendations* section.

### 2.5.1 Geology

Identify the pertinent geologic map and the prominent geologic unit(s) at the ERS site.

### 2.5.2 Surface Conditions

Describe site topography, surface water and drainage conditions, cuts and fills, rock exposures, geologic hazards such as landslides and rockfall, structures, and pertinent land use history that may affect the proposed ERS.

### 2.5.3 Subsurface Conditions

Provide a generalized description of the known subsurface conditions. The information included within this section may include:

- Types of soil/rock, depths to generalized layer breaks, and corresponding elevations.
- Pertinent soil/rock conditions such as unsuitable materials (e.g., collapsible or expansive foundation materials).

Do not re-create an As-Built LOTB in detail in this section. A generalized discussion or summary table is sufficient.

## 2.6 Groundwater

Report groundwater elevation(s) and corresponding dates of measurements. Use of a table is recommended if there are numerous borings and/or measurements.

Table X: Summary of Groundwater Data

| Well ID or Hole ID | Distance to ERS (feet) | Ground Surface Elevation (feet) | Depth to Groundwater (feet) | Groundwater Elevation (feet) | Date Measured |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

## 2.7 As-Built Foundation Data

Include brief discussion of relevant As-Built foundation data, such as:

- Existing ERS and foundation types
- Construction records such as pile driving logs or settlement monitoring data

Omit this section if no As-Built foundation data is available.

## 2.8 Scour Data

If the ERS is adjacent to a watercourse, report pertinent scour information, including the potential for scour and the predicted magnitude of scour.

Omit this section if the ERS is not adjacent to a watercourse.

## 2.9 Corrosion Evaluation

Report and discuss pertinent site corrosion data. Use the following table to report archive data.

Table X: Soil Corrosion Test Summary

| Hole ID | Elevation (feet) | Minimum Resistivity (Ohm-Cm) | pH | Chloride Content (ppm) | Sulfate Content (ppm) | Corrosive? |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Caltrans currently defines a corrosive environment as an area where the soil has either a chloride concentration of 500 ppm or greater, a sulfate concentration of 1500 ppm or greater, or has a pH of 5.5 or less. With the exception of MSE, soil and water are not tested for chlorides and sulfates if the minimum resistivity is greater than 1,500 ohm-cm.

## 2.10 Seismic Information

Report all information required in Section 2.10.1 of the SPGR. Referencing a Seismic Report that was delivered separately is not acceptable. Information required in Section 2.10.2 should be summarized while referencing the reader to the applicable report (e.g., Fault Rupture Report).

### 2.10.1 Ground Motion Hazard

Include the following information:

a. Ground Motion Parameters table.
b. A statement of whether the $K_h$ used in the standardized ERS designs is applicable to the site.

Table X: Ground Motion Parameters

| Site Parameters | | | Design Ground Motion Parameters[1] (Return Period = 975 years) | |
|---|---|---|---|---|
| Latitude (degrees) | Longitude (degrees) | Shear-Wave Velocity[2] $V_{S30}$, (m/sec) | Horizontal Peak Ground Acceleration (g) | Deaggregated Mean Earthquake Moment Magnitude for PGA |
| XXX.XXXX | XXX.XXXX | XXX.X | X.XX | X.XX |

1. Based on Caltrans web tool ARS Online (Version 3.xx)
2. Shear wave velocity determined by <edit as appropriate, e.g., CPT, SPT correlations, geophysics>

### 2.10.2 Other Seismic Hazards

Discuss the potential for the following seismic hazards:

- Surface fault rupture (see *Fault Rupture* module)
- Liquefaction (see *Liquefaction Evaluation* module)
- Liquefaction-induced total ground settlements (see *Liquefaction Evaluation* module)
- Downdrag (see *Downdrag* module)
- Lateral spreading (see *Lateral Spreading* module)
- Seismic global stability (see *Embankments* module)

## 2.11 Geotechnical Recommendations

Provide preliminary recommendations for the ERS, including:

- ERS types considered, in the order of preference, and advantages and disadvantages of each
- ERS location (begin and end station, if available) and geometry (length, height)
- Description of external loadings used in analysis (surcharge, landslide, groundwater)
- Description of site constraints (environmental, right-of-way, utilities, traffic, construction, etc.)

## 2.12 Additional Field Work and Laboratory Testing

Describe the anticipated scope of fieldwork and types of testing that may be required to complete the geotechnical investigation. Discuss the potential need for entry permits, task orders, groundwater monitoring, access road construction, lane closures, etc.

## 2.13 Report Distribution

The SPGR must be addressed to the Bridge Designer and copies provided to:

- District Project Manager
- Project Liaison Engineer
- District Materials Engineer
- District Environmental Planning (optional)

## 2.14 Appendix

Reports prepared by consultants must include the following:

- Appendix I: Site Map showing project location
- Appendix II: As-Built Log of Test Borings (if available)

# 3. PRELIMINARY FOUNDATION REPORT (PFR) and FOUNDATION REPORT (FR)

The PFR is prepared after completion of the SPGR and Advanced Planning Study, and prior to Structure Type Selection. The ERS location, type, height, and length will be better defined, and the site investigation must be complete.

The FR expands on data provided in the PFR and updates the foundation recommendations based on final design details provided by Bridge Design. The FR becomes part of the contract documents via its inclusion in the Information Handout per Standard Special Provision 2-1.06B, "Supplemental Project Information."

The following topics must be addressed in the Preliminary Foundation Report and Foundation Report.

## 3.1 Introduction

Reference the request date, wall type, and supplemental information provided in the request.

Foundation Report only: Include a statement that the current report supersedes all previous reports (referenced by title and date).

## 3.2 Project Description

Describe the proposed ERS and pertinent project information, such as the reason for constructing the ERS. A table such as the one below may be used to present the information. Provide project vertical datum. When reporting older As-Built elevations, state conversion used (e.g., add 2.3 feet).

<edit column heading to properly identify the location information presented>

Table X: ERS Information Table

| ERS ID No. | ERS Type | Begin Station & Offset Northing/Easting | End Station & Offset Northing/Easting | Length, (feet) | Maximum Design Height (feet) |
|---|---|---|---|---|---|
| | | | | | |

## 3.3 Exceptions to Policies and Procedures

Discuss exceptions to Departmental policies and procedures relating to the PFR/FR. Approved Request for Exception forms must be included in the Appendix. Omit this section if there are no exceptions.

## 3.4 Geotechnical Investigation

Provide an overview of the geotechnical investigation(s) performed to support the ERS recommendations including the number of boreholes/CPT soundings, with maximum depth(s), corresponding elevation(s), and the types of field and/or downhole testing (e.g., in-situ, geophysical).

## 3.5 Laboratory Testing Program

Provide an overview of the laboratory testing program, if performed, to support the ERS recommendations. Briefly explain what the tests were used for (e.g., soil classification, settlement analysis, strength parameters).

## 3.6 Geotechnical Conditions

Present only factual information in this section, not how it relates to design and construction. Discussion of the site geology, geological features, and subsurface conditions as they relate to the foundation design and construction must be placed in the *Foundation Recommendations*, *Notes for Specifications*, and/or *Notes for Construction* sections.

### 3.6.1 Geology

Identify the pertinent geologic map and the prominent geologic unit(s) at the ERS site.

### 3.6.2 Surface Conditions

Describe site topography, surface water and drainage conditions, cuts and fills, erosion, pavement distress, geologic hazards such as landslides and rockfall, existing structures, and pertinent land use history that may affect the proposed ERS.

### 3.6.3 Subsurface Conditions

Provide a generalized description of the known subsurface conditions. The information included within this section may include:

- Types of soil/rock, depths to generalized layer breaks, and corresponding elevations.
- Pertinent soil/rock conditions such as unsuitable materials (e.g., collapsible or expansive foundation materials).

Do not re-create the LOTB(s) in detail in this section. A generalized discussion or summary table is sufficient.

## 3.7 Groundwater

Report groundwater elevation(s) and dates of measurements. Use of the following table is recommended if there are numerous borings and/or measurements.

Table X: Summary of Groundwater Data

| Well ID or Hole ID | Distance to ERS (feet) | Ground Surface Elevation (feet) | Depth to Groundwater (feet) | Groundwater Elevation (feet) | Date Measured |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

## 3.8 As-Built Foundation Data

Include a brief discussion of relevant As-Built foundation data, such as:

- Existing ERS and foundation types
- Construction records such as pile driving logs or settlement monitoring data

Omit this section if no As-Built foundation data is available.

## 3.9 Scour Data

If the ERS is adjacent to a watercourse, report the pertinent scour information, including the potential for scour and the predicted magnitude of scour. This information may come from hydraulics reports, geotechnical investigations, BIRIS records, etc.

If the field investigation reveals geologic information that contradicts the hydraulics report, discuss the findings and provide pertinent information to the author of the hydraulics report so that the scour recommendations can be re-evaluated.

Omit this section if the ERS is not adjacent to a watercourse.

## 3.10 Corrosion Evaluation

Include and update the corrosion data from the SPGR based on new findings and field investigations.

## 3.11 Seismic Information

Update the seismic information required for the SPGR based on new findings and/or investigations.

### 3.11.1 Ground Motion Hazard

Include the following information:

a. Ground Motion Parameters table
b. A statement of whether the $K_h$ used in the standardized ERS designs is applicable to the site.

Table X: Ground Motion Parameters

| Site Parameters | | | Design Ground Motion Parameters[1] (Return Period = 975 years) | |
|---|---|---|---|---|
| Latitude (degrees) | Longitude (degrees) | Shear-Wave Velocity[2] $V_{S30}$, (m/sec) | Horizontal Peak Ground Acceleration (g) | Deaggregated Mean Earthquake Moment Magnitude for PGA |
| XXX.XXXX | XXX.XXXX | XXX.X | X.XX | X.XX |

1. Based on Caltrans web tool ARS Online (Version 3.xx)
2. Shear wave velocity determined by *<edit as appropriate e.g., CPT, SPT correlations, geophysics>*

### 3.11.2 Other Seismic Hazards

State whether the following seismic hazards exist:

- Surface fault rupture (see *Fault Rupture* module)
- Liquefaction (see *Liquefaction Evaluation* module)
- Liquefaction-induced total ground settlements
- Downdrag (see *Downdrag* module)
- Lateral spreading (see *Lateral Spreading* module)
- Seismic global instability (see *Embankments* module)

For seismic hazards that do exist, refer to the Reporting section of the applicable module to determine what information to present in the *Analysis and Design* section, if any, and *Recommendations* section of the report.

If requested by Bridge Design, provide mitigation recommendations for specific seismic hazards in the *Recommendations* section.

### 3.12 Analyses and Design

Include a statement that summarizes, at a high level, the analyses and design work performed.

Refer to the *Reporting* section in the applicable module to determine required content, if any, to include in this section.

### 3.13 Geotechnical Recommendations

Refer to the *Reporting* section in the applicable module to determine required content to include in this section.

### 3.14 Notes for Specifications

Omit this section for the Preliminary Foundation Report.

This section provides recommendations to the Specifications Engineer for inclusion and editing of Standard Special Provisions and NSSPs. Refer to the *Geotechnical Notes for Specifications* module for guidance on preparing this section.

### 3.15 Notes for Construction

Omit this section for the Preliminary Foundation Report.

Notes for Construction are written to State construction personnel and contractors. Specific geologic conditions that are relevant to construction inspection should be cited in this section to ensure that the intent of the geotechnical design is met and construction is successful.

Address topics when applicable, such as:

1) Include the following instructions to request footing inspections by the Geoprofessional.

### 3.16 Report Distribution

Reports must be addressed to the Structure Designer, with copies provided to:

- District Project Manager
- Project Liaison Engineer (PFR only)
- District Environmental Planning (optional, PFR only)
- Structures Office Engineer (FR only)
- District Materials Engineer

## 3.17 Appendices

Report appendices provide detailed information supporting foundation type selection, analyses, and recommendations. Reports prepared by Geotechnical Services staff must include the following if produced during the investigation (in the order presented, numerated as Appendix I, Appendix II, …):

- Laboratory Test Data (including Corrosion Test Report) – Organized by test type. In addition to raw laboratory test results, provide summary tables and graphs developed for the interpretation of laboratory test results.
- Field-generated Geologic Map and Cross-Sections: Do not include published maps.
- Geophysical Test Reports
- Fault Rupture Report
- Pile Drivability Study
- Soil parameters for lateral analysis and/or P-Y Curves
- Approved "Request for Exception" forms

Optional

- Photos relevant to the investigation findings, design recommendations, and construction. Photos that illustrate content presented in the text should be embedded in the report if feasible.

Reports prepared by consultants must include the following if produced during the investigation (in the order presented, numerated as Appendix I, Appendix II, …):

- Laboratory Test Data (including Corrosion Test Report) – Organized by test type. Summarize and provide summary tables and graphs developed for the interpretation of laboratory test results.
- Field-generated Geologic Map and Cross-Sections: Do not include published maps.
- Geophysical Test Reports
- Fault Rupture Report
- Pile Drivability Study
- Soil parameters for lateral analysis and/or P-Y Curves
- Data acquired from field testing such as in-situ Vane Shear Tests, slope inclinometer readings.
- Approved "Request for Exception" forms
- Optional: Photos relevant to the investigation findings, design recommendations, and construction. Photos that illustrate content presented in the text should be embedded in the report if feasible.

Additionally, the following must be submitted individually (i.e., not attached to the report) for all Preliminary Foundation Reports and Foundation Reports:

1. Log of Test Borings (including As-Built LOTB) and Test Boring Layout sheet
2. Calculation Package:
    - The objectives of each calculation, such as bearing resistance or time rate of settlement.
    - Calculation and design assumptions.
    - Design cross sections and/or profiles (Geotechnical model) used for each calculation.
    - Equations used and definitions of the terms used in the equations.
    - Copies of the curves or tables used in the calculations and their source(s).
    - Load and resistance factors or factors of safety used in design.
    - If calculations are performed using computer spreadsheets, provide step-by-step calculations for one example to demonstrate the basis of the spreadsheet. A computer spreadsheet is not a substitute for the step-by-step calculations.
    - Summary of the calculation results that form the basis of geotechnical recommendations, including a sketch of the design, if appropriate.
3. Comment Matrix with consultant responses