

FOUNDATION INVESTIGATION AND REPORTS

Foundation Investigation

A foundation investigation and report will be required for all proposed structures. The study and report shall be made by a California licensed Engineering Geologist or Civil Engineer, who specializes in foundations (including deep foundations for large structures).

A Log of Test Borings sheet shall be drafted and included as part of the foundation report, and as part of the structure plans.

All driven pile support recommendations shall consider the use of Caltrans standard Class 45 or Class 70 piles using design loads of 45 and 70 tons respectively.

CHECKLIST FOR STRUCTURE FOUNDATION STUDIES AND REPORTS

Log of Test Borings

A Log of Test Borings sheet shall be included as part of the Foundation Report. Show the location of each boring or test pile in plan view. Logs of all borings shall be shown in an elevation or profile view on the sheet. Information which should be shown on plots of test borings is as follows:

1. Diameter, type, and date of boring.
2. Location of borings with respect to stationing along survey lines for the proposed project.
 - a. Profile of existing ground.
3. Elevation of the top of each boring, etc.
4. Description of samplers, sampling methods, and in-situ tests.
5. Test results including Standard Penetration Test. Results of the Standard Penetration Test (ASTM D-1586-84) shall be presented so that quick correlation with similar data base may be made.
6. Soil or rock descriptions and elevations of strata.
7. Groundwater elevation and date of measurement should be shown adjacent to the boring or test pit where taken.
8. Location, description, and elevation of the benchmark used for determining the top-of-hole elevations shown on the Log of Test Borings.
9. Name of position or title of person conducting the field study.
10. Name and position or title of the registered Engineering Geologist or Civil Engineer approving the "Log of Test Borings Sheet".

Written Report

A written report shall be prepared which will contain an interpretation and analysis of the foundation conditions based upon all available sources of data. Data may come from new or previous exploration programs, laboratory testing, nearby construction experience, performance of nearby existing structures, etc. A short description of site topography and local geology should be included. Emphasis should be placed on slope stability of cuts and excavations, unusual groundwater conditions, springs, etc. All sources of information should be cited. The materials and conditions, which may be encountered during construction, shall also be discussed. Problems involving design and construction

should also be anticipated, and recommendations made for their solution. The recommendations shall be brief, concise and definite. Reasons for recommendations and their supporting data shall always be included. Methods used for calculating pile capacities and soil bearing capacities should be mentioned for ease of review. Extraneous data, which are of no use to the designer or Resident Engineer, should be omitted. The written report shall include, but not be limited to, information and recommendations regarding applicable items in the following list.

I. TYPE OF FOUNDATION

A. Pile Support (Driven or Cast-In-Drilled-Hole)

1. Method of support (skin friction and/or end bearing) in rock or soil or both.
2. Suitable pile type(s) — reasons for choice and/or exclusion of types. When appropriate, Caltrans' standard pile should be used.
3. Pile tip elevations.
 - a. Specified (use of "indicator piles" is not acceptable).
 - b. Probable
 - c. Need for pre-drilling or jetting.
4. Pile Design Load and Ultimate Capacity in compression and tension. Specify the Safety Factor.
5. Reduction of pile capacity due to negative skin friction.
6. Requirement for load test. Specify which portion of the Structures' foundation will be controlled by the test.
7. Effects on adjacent existing structures.
8. Corrosion effects of various soils and waters, and possibility of galvanic reaction from stray currents.
9. Scour depth (elevation) and method of determination.

B. Footing Support

1. Elevation of bottom footing.
2. Allowable and ultimate footing pressure (include Safety Factor). Approximate settlement at uniformly distributed allowable load.

3. Brief description of material on which the footing is to be placed.
4. Scour depth (elevation).

C. Drilled Shafts/Pier Columns (Mined Shafts)

1. Geologic description of foundation materials.
2. Diameter (or dimensions).
3. Design load, ultimate load, and Safety Factor.
4.
 - a. Top of shaft elevation.
 - b. Bottom of shaft elevation.
 - c. Minimum shaft length into load carrying stratum.
 - d. Estimate of shaft wall stability and possible shoring requirements.
5. Soil or rock weight and strength parameters for determining end bearing capacity, lateral load capacity and point of shaft/column fixity.

II. APPROACH FILL REQUIREMENTS

1. Predicted amount of settlement and time delay required prior to beginning foundation construction. Predicted post-construction settlement. Possibility of negative friction on pile foundations.

Area of control.

2. Special Requirements:
 - a. Controlled rates of embankment placement.
 - b. Fill height limit on untreated foundation.
 - c. Stripping of unsuitable foundation material.
 - d. Use of lightweight fills to reduce amount of settlement.
 - e. Use of surcharge, wick drains, or other methods to shorten the required time delay period.
 - f. Slope protection.
 - g. Recommendation for settlement platform.
 - h. Specify embankment side slopes.
 - i. Unusual compaction requirements (i.e. 95% R.C.) where abutments on spread footings are used.

III. CONSTRUCTION CONSIDERATIONS

1. Water table — seasonal or long term fluctuations, data for possible control in excavations (i.e. pumping, well points, tremie seals, amounts of groundwater, etc.).
2. Adjacent structures — protection against damage from excavations, pile driving, etc.
3. Pile driving — difficulties, clearance, overhead or underground utilities, other unusual conditions, etc.
4. Excavation — control of earth slopes including shoring, sheet piles, bracing, and safety requirements.

IV. SEISMIC DATA

The foundation report should contain the following information, so that an evaluation of seismicity can be made.

1. Maximum credible rock acceleration (from GDMG MS-45*).
2. Magnitude of the maximum credible event.
3. Name of the causative fault and distance from the site.
4. Depth to rock or rock-like material ($VS \geq 2500$ ft/sec). Provide supporting evidence for depth (i.e. boring log or geologic reference).
5. Liquefaction potential.
6. Need for “seismic approach slab”.

V. REVIEW OF FINAL STRUCTURE PLANS

The structure plans shall be reviewed to ensure that the foundation recommendations have been followed, and provide revised recommendations, if required by design changes, etc.

* Mualchin, Lalliana (1987) California Division of Mines and Geology Map Sheet 45, Rock Acceleration from Maximum Credible Earthquakes in California.

AS-BUILT PLANS

The maintenance of the Division of Structures (DOS) permanent microfilm file for As-Built plans of bridges and other transportation-related structures constructed within the state right-of-way, is essential to the long-term operation of the transportation system in California. For projects developed and constructed by Caltrans' employees there is a long-standing procedure (DOS Memo to Designers 1-20) which provides the necessary direction. However, when structure PS&E is prepared by others, the following will apply:

1. All contracts, cooperative agreements, encroachment permits, etc., with external entities, must clearly state that such entity will provide:
 - a. One complete set of As-Advertised plans to DOS immediately following the award of the contract. These will be kept in the appropriate unit, Externally Financed Branch, Architectural Consultant Services Section, or the Local Assistance Section, as a reference copy for any future discussions until receipt of the As-Built plans.
 - b. One complete set of full-size film positive reproducibles of the As-Built plans shall be provided to the State (District) within 60 days of the completion and acceptance of the project.
2. The "Structures" As-Built plans shall be forwarded to the DOS Externally Financed Projects Branch or Architectural Consultant Services Section for a review for completeness and quality. If acceptable, they will be forwarded to the Documents Unit for microfilming and filing in compliance with Memo to Designers 1-20. If not acceptable, they will be recycled through the District.
3. The Documents Unit will maintain a record of bridges and other transportation-related structures handled through this process.