

TECHNICAL GUIDELINES
FOR
GEOTECHNICAL REPORTS



City of Carlsbad

January, 1993

TECHNICAL GUIDELINES FOR GEOTECHNICAL REPORTS

CITY OF CARLSBAD, DECEMBER 1992

The safe design, construction and maintenance of any project, whether it be a building or grading project, involves the cooperative involvement and effort of the consulting engineers, contractors, owners and public agencies. Because site conditions and development plans vary with each specific project, City of Carlsbad Planning, Engineering and Building Inspection Departments recognize that consulting professionals from different practices must use discretion and judgement.

These guidelines are intended for use by City staff, applicants and professional consultants, and outline the minimum standards and basic information that are required to help ensure the safe development and completion of a project.

For all land development projects and some building permits, two bound copies of the required report are to be included with the first submittal of project plans for review by City staff or their consultant. All reports shall be signed by the appropriate registered professionals and the registration numbers provided.

It should be understood that if the review process identifies potential problems that have not been adequately addressed or areas which require additional information, some delays in the approval process may occur.

I. GENERAL GUIDELINES FOR GEOTECHNICAL REPORTS

All geotechnical reports should contain the following:

- 1) Job address, tract name or number, tentative map and/or lot number, street address, and/or any other available information to help in locating the project. Except for very basic reports of ongoing projects, all reports should also contain a Site Location Map (at an appropriate scale).
- 2) Signature and State of California professional registration number of Certified Engineering Geologist (CEG) and/or Registered Civil Engineer (RCE) or Registered Geotechnical Engineer (GE) experienced in the practice of soil engineering.
- 3) Purpose of report, a description of the scope of work performed during the investigation and the description of the proposed development (if known).
- 4) Description of general site conditions including past, present, and proposed site usage (if known), topography, vegetation, drainage, existing structures, buried structures, and site improvements.
- 5) List of references utilized during preparation of the report including all previous reports for the site.

- 6) Conclusions as to the adequacy of the site for the proposed development and recommendations concerning geotechnical conditions that will affect site development.

II. GUIDELINES FOR SPECIFIC GEOTECHNICAL REPORTS

A. GEOTECHNICAL RECONNAISSANCE STUDY

A geotechnical reconnaissance study is a basic study which may or may not involve a field investigation. This type of study is intended to provide preliminary geologic and/or geotechnical information on a project site. A reconnaissance-level study is generally not considered to have an adequate scope for final design of grading and structural improvements. The report should include an overview of the geologic and geotechnical characteristics of the site based on available referenced materials, visual observation of the site, and possibly limited subsurface exploration.

In addition to the items listed in the General Guidelines for Geotechnical Reports (see Section I), the following should be incorporated into a geotechnical reconnaissance study:

- (1) Review of pertinent site-specific and general geotechnical literature maps and aerial photographs available and a summary of findings.
- (2) A geologic map (when applicable) showing geologic units and structure on a topographic base map.
- (3) Detailed description of the geotechnical (geologic, hydrogeologic and engineering) conditions of the site.
- (4) A field investigation (if pertinent) should be conducted to evaluate and document the geologic and geotechnical conditions anticipated from the literature review. The field investigation may include a limited subsurface exploration program or simply include geologic field mapping of the site.
- (5) A summary of conclusions should be prepared addressing the proposed development in relation to the known geotechnical conditions of the site. The summary of conclusions need not be long and detailed. Rather, a general overview of the site geotechnical conditions and an assessment of the degree of geotechnical hazards/constraints (based on existing information) should be given. If there are potential geotechnical problems that were not evaluated during the study, they should be clearly stated.
- (6) Geotechnical design recommendations should be limited to preliminary recommendations for project planning or feasibility purposes.

B. PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

The Preliminary Geotechnical Investigation Report is an in-depth evaluation which entails review of pertinent literature, a field subsurface investigation, geologic mapping, laboratory testing, geologic and engineering analysis of the data obtained, and a summary of conclusions and recommendations concerning site development. The investigation should include a sufficient subsurface investigation, appropriate laboratory testing and adequate analyses to provide enough information to assess the existing site conditions in relation to the proposed development. A number of items (such as site geology, boring, and trench locations, etc.) which should be presented on a map, need not be presented on separate maps, if all the items are clearly legible on one figure.

The Preliminary Geotechnical Investigation Report is required when additional or more precise data than is generally presented in a geotechnical reconnaissance study is needed. This type of report is generally needed for all planning approvals of projects with proposed cuts or fills exceeding five (5) feet in height. If a previous reconnaissance level geotechnical study has been performed, the previous report should be referenced and the results of that study should be imported into the preliminary geotechnical study. If a reconnaissance-level study has not been performed, the preliminary geotechnical investigation should include those items previously described for reconnaissance-level studies (see Section II.A) in addition to the items delineated below.

- General

In addition to the General Guidelines for Geotechnical Reports (see Section I), the following should be included in a Preliminary Geotechnical Investigation Report:

- (1) Description of proposed grading (if known) including slope ratios, earthwork quantities, and methods.
- (2) Description of planned development (i.e., types of structures, foundation systems, etc.).
- (3) Grading plan or tentative map (which can be used as a base map to present the geology, location of subsurface exploration excavations, and other conditions) showing pad or structure locations and planned grading.
- (4) Discussion of the location and types of manufactured slopes and effects the existing geotechnical conditions will have on the slopes.

- Field Investigation

- (5) A description of the field investigation should be provided describing the number and depth of exploration excavations, sampling methods, and other pertinent information.
- (6) Description and results of laboratory testing.

- (7) Graphic presentation of the subsurface exploration excavations including elevation (e.g., boring and trench logs) and, where, pertinent the laboratory test results (e.g., moisture/density, expansion index, grain size, Atterberg Limits, direct shear, consolidation data, etc.).

- Summary of Geologic Conditions

- (8) A detailed description of the geologic conditions present on the site should be presented in the report. The description should include the geologic setting, units, surficial deposits, faults, structural features, etc. Surface and ground water conditions should also be discussed.
- (9) Geologic references (including aerial photographs) utilized during the investigation.
- (10) A geologic map (when applicable) showing geologic units and structure, location of exploration excavations, geologic cross-sections, recommended remedial grading measures and subdrain locations, and a legend explaining the symbols, etc. should be provided. The map should be suitable for the purpose of the report and have sufficient data to give a representative overview of the geotechnical conditions of the site.
- (11) Cross-sections or structural-sections of suitable scale (appropriately placed through geotechnically critical areas and shown on the map) showing the existing geologic conditions and proposed development in cross-sectional view should be prepared.

- Summary of Engineering Conditions

- (12) A description of the engineering characteristics and properties of the bedrock and surficial units should be provided. The soil classification, density, expansion potential, compressibility, erodibility, suitability as use as fill, settlement, effects of weathering, along with other important characteristics should be addressed.
- (13) Analysis and discussion of surficial and gross stability of natural and manufactured fill and cut slopes should be presented. The analysis should be supported with calculations and the parameters used. Proposed slopes should have a minimum static factor-of-safety of 1.50 (rounding up is not acceptable). In addition, the description of the analytical methods and how the parameters were obtained should be presented.

- Seismic Considerations

- (14) Fault parameters including distance from the site to regionally active faults and probable earthquake ground accelerations should be provided.

- (15) Seismic considerations such as regional seismicity, potential ground shaking, ground rupture, potential liquefaction, tsunami occurrence, and other secondary seismic effects should be discussed.

● Conclusions and Recommendations

- (16) Conclusions of the investigation should be presented in significant detail to provide substantiation of opinions if they differ from available geotechnical literature and provide a basis for determining the adequacy of the site for the planned development. The conclusions should include a summary of potential geologic, soils engineering and/or seismic hazards and an assessment of the degree of the geotechnical hazards present at the site.
- (17) Detailed recommendations concerning geotechnical factors affecting the site development should be discussed. Recommendation should include but not be limited to:
- a) recommendations to effectively mitigate or reduce the geotechnical hazards identified on the site (i.e. potential expansive or compressive soils, landslides, soil creep, etc.)
 - b) earthwork recommendations such as site preparation, overexcavation of cut/fill transitions, removals of compressible material and slope keys
 - c) fill placement, compaction methods and degree of compaction specifications
 - d) treatment of material generated during grading (including dry or overly wet soil, oversized rock, asphalt, concrete and other types of debris)
 - e) trench excavation recommendations
 - f) trench backfill soil specifications
 - g) fill observation and testing services
 - h) distance of proposed structures to drainage swales
 - i) special erosion control measures
 - j) subdrain type and installation
 - k) slope compaction
 - l) remedial grading measures

- m) foundation and slab design recommendations including deep-foundation or post-tensioned systems, if applicable, and foundation setbacks from slopes and retaining wall
- n) slope stability recommendations (i.e., mitigation of unstable slopes)
- o) retaining wall design parameters
- p) exterior concrete flatwork thickness and reinforcement
- q) mitigation of ground water seepage and the control of surface water
- r) protection of existing structures and improvements during grading
- s) the potential effects of the proposed development on offsite areas (if applicable)

C. AS-GRADED GEOTECHNICAL REPORT

As-Graded Geotechnical Reports provide a summary of the geotechnical conditions encountered during grading and any changes made during site grading or construction. The report should present the findings and conclusions of site development from a geotechnical standpoint and provide final design recommendations based on actual constructed site conditions. The report should also contain field density and laboratory test results. The report should be detailed enough so that it accurately summarizes the as-graded conditions and provides meaningful design recommendations for post-grading construction and long-term maintenance. An approved As-Graded Geotechnical Report is generally required prior to issuance of a building permit.

In addition to the General Guidelines for Geotechnical Reports (Section I), the following should be included in an As-Graded Geotechnical Report:

- General

- (1) Plan file number and/or grading permit number.
- (2) Tract name and/or number.

- Grading Operations

- (3) A detailed description of the general grading operations including site preparation, fill placement and compaction methods, natural and manufactured slope construction methods, etc.

- (4) A description of slope stability measures performed during grading such as buttress or replacement fill construction methods, geotechnical conditions of the buttress or replacement fill excavation, a discussion of actual versus anticipated conditions and their effect on slope stability, and a summary of the results of stability calculations made during grading.
 - (5) The as-built stability measures presented on a map with appropriate cross-sections.
 - (6) Description of canyon and buttress subdrains placed during grading and the locations presented on a map.
 - (7) Description of the type of field compaction tests performed, a map showing locations, and a summary of field compaction test results (including trench backfill, if applicable).
 - (8) Summary of laboratory testing performed during grading including test locations.
 - (9) Summary of the types and purpose of geotextile materials and/or any other additives used to complete the project. The location of these items should be presented on a map.
- As-Graded Conditions
- (10) Summary of geotechnical conditions encountered during grading such as geologic units, structure, engineering characteristics, treatment of adverse geologic or engineering conditions, expansive or compressive soils, landslides, areas of soil creep, etc.
 - (11) Summary of measures to control existing and anticipated ground water, surface water and seepage. Identify the locations of subsurface drains, monitoring wells or any other related items and provide a description of any monitoring programs.
 - (12) Location of faults or evidence of faulting and a discussion of recency of activity if encountered.
 - (13) Map showing the as-graded geotechnical conditions, such as geology, faults, fill areas, limits of overexcavation, removal areas, etc.
 - (14) Comments on changes made during grading (including field recommendations) and their effects on recommendations of the Preliminary Geotechnical Investigation Report.
 - (15) Exploratory subsurface excavations made during grading should be discussed, placed on the as-graded plan and the logs included in the report.

● Conclusions and Recommendations

- (16) The report should contain a general conclusion or opinion as to the adequacy of the site for its intended use, conclusions as to the site's overall stability, and ability of the onsite materials to support the proposed structures. It should also discuss whether or not grading was performed in accordance with the geotechnical recommendations of the geotechnical consultant, applicable conditions of the grading permit and appropriate sections of the City of Carlsbad Grading Code and Ordinances.
- (17) Final recommendations based on as-graded or as-built conditions should be provided and should include:
- a) Foundation and slab design recommendations based on the as-graded conditions
 - b) Trench backfill excavation and backfill recommendations
 - c) Retaining wall design, backfill and subdrainage recommendations
 - d) Exterior flatwork concrete thickness and reinforcement
 - e) Slope maintenance guidelines
 - f) Observation and testing services recommendations during fine- or post-grading and construction phases
 - g) Pavement section design based on R-value testing of the street subgrade soils or subgrade treatment
 - h) Concrete recommendations (sulfate resistant cement, sidewalk, curb or gutter design recommendations, etc.)
 - i) Other geotechnical recommendations concerning post-grading, construction or long-term maintenance
- (18) The As-graded Maps in addition to being presented in the As-graded Report should also be presented in mylar form. As-graded Maps should specifically identify the locations of items I.L.C.(6), (9), (11), and (13) listed above.

III. SPECIAL CONCERNS WITHIN GEOTECHNICAL REPORTS

In addition to the guidelines presented above, unique geotechnical conditions or conditions of particular concern may be encountered during geotechnical evaluations and grading operations. As a result, the following guidelines concerning these conditions should be addressed in the appropriate geotechnical report.

A. Nonrippable/Marginally Rippable Rock

- (1) A field investigation using excavations or geophysical means to determine the depth to nonrippable/marginally rippable rock should be performed.
- (2) Recommendations for excavations when blasting is required should include procedures to protect adjacent properties and/or structures. In addition, a preliminary discussion on the type of monitoring equipment and locations where equipment should be positioned during blasting procedures should be included if appropriate. A more detailed blasting program may be required from the blasting contractor during grading operations.

B. Bluff Stability

- (1) A historical review of bluff retreat utilizing geologic publications and maps, photographs, public records, topographic maps or existing studies should be performed to determine amount of past bluff retreat and its causes.
- (2) A geologic investigation should be performed to determine and aid in the discussion of bluff face composition (rock or soil type), bedding, orientations and degree of jointing or fracturing, erodibility, drainage patterns above bluff, degree of wave attack, etc.
- (3) Analysis to estimate future bluff retreat (including an estimated yearly retreat rate) and its effect on the proposed development.
- (4) Analysis of gross and surficial bluff stability with and without bluff retreat.
- (5) Conclusion as to the adequacy of the site for its intended use as affected by existing geotechnical aspects of the bluff and potential retreat of the bluff.
- (6) Recommendations should be presented concerning foundation setbacks from top of bluff, measures to reduce bluff retreat, measures to reduce erosion of the bluff face and undercutting of the bluff toe, etc.

C. Cut Slopes Containing Clayey (i.e. Expansive) Soils

- (1) When cut slopes are proposed in geologic units containing clayey (i.e. expansive) soils (mainly the Del Mar Formation and portions of the Santiago Formation), a detailed discussion concerning the effects of these clayey soils (such as surficial and deep-seated stability, presence of out-of-slope bedding, expansive characteristics, etc.) should be prepared.
- (2) Additional guidelines and regulations concerning cut slopes may be found in the current editions of the City of Carlsbad/Hillside Development Guidelines and Hillside Development Regulations.

D. Slopes Exceeding Thirty (30) Feet in Height

Current City regulations dictate that cut or fill slopes shall not be greater than thirty (30) feet in height unless a modification to the standards can be justified per the requirements of Section 21.95.070 of the Hillside Development Regulations.

- (1) A detailed discussion of the justification for any slope height modification should be prepared. The identification of alternatives to the proposed modification and the reasons why the alternatives were not chosen should also be provided.
- (2) Additional guidelines and regulations may be found in the current editions of the City of Carlsbad Hillside Development Guidelines and Hillside Development Regulations.

IV. GEOTECHNICAL PEER REVIEW

As part of the City's review process of geotechnical reports, some geotechnical conditions of a site may require (in addition to normal City reviews), a third-party or peer review. Some of the conditions which may warrant a peer review include:

1. Manufactured slopes higher than thirty (30) feet.
2. Slopes steeper than 2:1 (horizontal to vertical) containing clayey (i.e. expansive) soils.
3. Sites containing significant landslide(s)
4. Significant grading or development of coastal bluff.
5. Unique/significant geologic conditions present on site or unique mitigation procedures.
6. Coastal sea walls.

The peer review will examine the geotechnical report and substantiating data accompanying it to assure that the report addresses the appropriate concerns relative to the conditions warranting the review and that the current geotechnical standard of practice is being followed. The peer review will also take into account pertinent site-specific items the reviewer considers important. The peer reviewer (who will be a registered professional Certified Engineering Geologist (CEG), Geotechnical Engineer (GE) and/or Registered Civil Engineer (RCE) experienced in the practice of soil engineering) is required to make one visit to the site, in addition to performing the peer review.

Presented below are the general items that will be examined during the peer review. The report under peer review should also contain or address the appropriate items listed in Sections I, II, and III of the technical guidelines (presented above). After the peer review is completed, a report shall be prepared by the reviewer specifying additional data necessary to "conclusively assure safe foundation and soil conditions for the project soils report being reviewed" and to address the conditions warranting the peer review.

A. Peer Review Tasks

The following items will be examined during the Peer Review:

- (1) site history
- (2) existing soil conditions
- (3) number, depth, and locations of subsurface explorations (i.e. borings, trenches, pits, etc.)
- (4) number, type, and applicability of laboratory tests
- (5) types and completeness of slope stability or other calculations
- (6) Suitability of design parameters for soil stability (e.g. soil strength, saturation depth, etc.)
- (7) Suitability of construction design parameters (e.g. allowable bearing pressures, active and passive lateral bearing pressures, coefficients of sliding, etc.)
- (8) Construction methods and specification
- (9) Slope maintenance methods, including specific recommendations for suitable vegetation
- (10) Applicable remedial soil construction (e.g. buttress, soil additives, use of geotextile, subdrains, benching, removals, etc.)
- (11) Applicable soil construction parameters (e.g. relative compaction, unsuitable materials removal, moisture adjustment, etc.)

B. Peer Review Tasks for Coastal Bluff Development and Seawall Design Criteria

In addition to items 1 through 11 listed above in Section IV.A, these additional items will be examined for the peer review of a report dealing with projects along the coastline:

- (1) Existing site conditions (soil, topography, bathymetry, wave action, etc.)
- (2) Site and geotechnical constraints
- (3) Suitability of seawall or bluff stability design parameters

