



## INFORMATION BULLETIN / PUBLIC - BUILDING CODE

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# CONTENTS OF REPORTS FOR SUBMITTAL TO LADBS GRADING DIVISION

When geologic and/or soils reports are required, pursuant to Los Angeles Building Code Sections 7006.2 or 1803, the reports shall be submitted to the Grading Division of the Los Angeles Department of Building and Safety (LADBS) for review and approval.

These guidelines for submittal of geology and soils reports in the City of Los Angeles are developed from five sources:

1. The Los Angeles Building Code (LABC),
2. The Los Angeles Residential Code (LARC),
3. LADBS Information Bulletins, and
4. Publications of the California Geological Survey (CGS).
5. City of Los Angeles Preliminary Fault Rupture Study Areas (PFRSA).

The LABC and LARC provide regulations affecting design and construction of building and grading. Information Bulletins provide guidelines for specific topics in greater detail than the codes. The CGS Notes 42, 44, and 49 provide the general guidelines to geologic report format and content. The most recent version of CGS Special Publication 117 (SP 117) provides guidance for evaluation and mitigation of seismically induced ground failure.

The preparers of reports should first determine if the site is to be subdivided or if it is within an area of the City that requires special investigations or analysis. Those areas are as follows:

1. State Mapped Zones requiring Liquefaction and Landslide investigation/mitigation per the Seismic Hazard Mapping Act, State of California Public Resources Code, Section 2690 et seq.,
2. Alquist-Priolo Earthquake Fault Zones per the State of California Public Resources Code, Section 2620 et seq., and City of Los Angeles PFRSA.

All of the zones or areas listed above are viewable on the NavigateLA website.

Exemptions from these special investigations are defined in Information Bulletin P/BC 2017-044; EXEMPTIONS FROM LIQUEFACTION, EARTHQUAKE-INDUCED LANDSLIDE, AND FAULT-RUPTURE HAZARD ZONE INVESTIGATIONS. Information, analysis, and recommendations provided in the reports shall be developed and reported by the State registered professionals per the following matrix. The following matrix shows the common type of reports and the licensed professionals who typically prepare the reports.

Report Type	Licensed Engr. Geologist		Soils Engineer*		Other
Hillside Investigation	X	and	X		
Soils Investigation			X		
Earthquake Fault Rupture Hazard Zone	X				
Soils Compaction			X		
Final Geology AAs-Graded@	X				
Monthly Progress Report for Grading	X	and	X		
Liquefaction Report			X		
Private Sewage Disposal	X	and/or	X		
Mudflow Analysis	X	and/or	X	and/or	X (Civil Engineer)
Responsibility Letter	X	and/or	X		

\* Soils Engineer is a registered Civil Engineer practicing in the field of soils engineering.

Reports shall be submitted in duplicate, including one unbound original for archiving, at any of the four main offices located in downtown Los Angeles, West Los Angeles, Van Nuys or San Pedro. One copy of the report shall be submitted to the Department in digital form (Adobe PDF format) on a CD-ROM or Flash Drive. To ensure sufficient information and data are provided in these reports so that they can be reviewed in an expeditious manner, they should include, but not be limited to, the items listed below. The suggested formats and information required are intended to be relatively complete, and not all items would be applicable to small projects or low risk sites. In addition, some items would be covered in separate reports by geologists, soils engineers, seismologists, civil or structural engineers.

## **I. CONTENTS OF SOILS AND GEOLOGY REPORTS**

### **A. Site and Project Description**

Identify the address and legal description (Tract, Block, Lots, Arb=s) for the site. Discuss the type, size, and scope of the project, including a brief description of the buildings/structures including number of floor levels and maximum anticipated design loads, existing site topography, and the extent of grading work proposed. Specify the proximity of the proposed development to any relevant ascending and descending slopes and indicate slope heights and inclinations. Identify whether the site is located in a special studies zone designated by the State of California.

### **B. Geologic/Geotechnical Map and Cross Section**

All reports shall contain a scaled geotechnical map with topographic data of the site and a north arrow showing the location & extent of the project. Cross sections are usually required where a slope, basement, retaining wall, or temporary/permanent excavations are existing or proposed. The geotechnical map and cross sections shall clearly show the site boundaries, location and size of all existing and proposed buildings and structures, the location of all exploratory excavations, earth material contacts, and the extent of the proposed grading work. Cross sections shall also include: encountered groundwater, temporary excavations, existing and proposed grades, foundations, sub-drains, and slope setbacks. Topographic and cross section data shall extend beyond the site to demonstrate that adjacent or offsite slopes do not affect the stability of the site.

A geologic map and cross sections shall be provided where bedrock formations are involved. The geologic map shall present all the features required on a geotechnical map and the distribution of geologic units, structural geology, faults, landslides, slumps, etc. Cross sections should be prepared along the steepest, highest, and geologically critical slopes. If apparent dip of the bedding is  $\Delta$ out of slope@, two cross sections shall be provided; one along bedding (true dip) and one along the slope direction (perpendicular to topographic contours). Cross section showing buildings should show the 1808.7.1 required slope setback.

### **C. Field Exploration**

Description of the method of exploration including sampling and testing of the soil and bedrock is required. Detailed logs of test pits and borings shall show the location of all samples and sampling resistance (blow counts, etc.). Ground water and seeps with possible fluctuation should be noted on the logs. If previous exploration data by others is relied upon in the investigation, then the soils engineer (and a geologist if applicable) shall provide a statement accepting professional responsibility for use of the data. For specific guidelines and requirements on hillside exploration and reporting of the results, refer to P/BC 2017-068.

## **D. Laboratory Testing**

All laboratory testing must be performed by a City of Los Angeles approved testing agency. Field density tests are considered to be laboratory tests. If data from previous reports are used, copies of the reports and any relevant LADBS review letters shall be included. If testing was done by others, provide a complete laboratory report signed and stamped by the engineer who supervised the laboratory testing, together with a responsibility statement by the project soils engineer who is using the laboratory data. The consulting soils engineer shall state that she/he has reviewed and concur with the data, and accepts responsibility for using the data.

Provide descriptions of all testing procedures and sample preparation. Graphical presentations are required for grain size analysis, maximum density, consolidation, and shear tests. The shear graphs shall include: the sample location, soil description, moisture content, dry density at the time of shearing, the shearing rate, type of test/sample preparation (undisturbed or remolded), and if the results are peak, ultimate, or residual. The graphs shall show all of the test points, the shear strength envelope, the resulting cohesion, and the friction angle. The approximate degree of saturation during testing shall be provided on the graph or an accompanying table. Material testing for slope stability analysis shall be in accordance with P/BC 2017-049.

## **E. Analysis**

Where more than three analysis cases are evaluated, a summary table shall be provided. Analysis and justifications are required for any recommendations less stringent than Code values and for the following:

### **1. Static Slope Stability Analysis**

For slopes steeper than 2:1 (horizontal : vertical) or where adverse geologic conditions are encountered, the soils report shall provide slope stability analysis in accordance with P/BC 2017-049 and P/BC 2017-050 where applicable. Provide cross sections with X & Y coordinates for all calculations, along with the input and output data from the computer analysis. When existing landslides are present nearby, back-calculation of shear strengths and evaluation of Atterberg Limits shall be provided to supplement laboratory shear testing. The analysis shall provide a complete search to demonstrate that the worst case condition has been determined. Temporary and permanent slopes require a minimum factor of safety of 1.25 and 1.5, respectively. Temporary excavations require a stability analysis for any of the following conditions: there is more than a 5-foot vertical; it is steeper than 1:1 when it is above 5-foot vertical; it is surcharged by off-site structures; slot cuts; and/or adverse geologic conditions. All analyses must use saturated shear test data.

2. Seismic Slope Stability Analysis

Seismic slope stability analysis shall be performed for new construction at sites having landslides, and those sites within a State of California Seismically Induced Landslide Seismic Hazard Zone. Exemptions from this requirement are defined in the Information Bulletin P/BC 2017-044. Seismic stability analysis shall be in accordance with P/BC 2017-049, P/BC 2017-050, and the most recent version of SP 117. A minimum factor of safety of 1.0 is required for seismic slope stability calculations.

3. Liquefaction Analysis

Liquefaction analysis shall be based on the maximum historic groundwater level in accordance with CGS Seismic Hazard Reports (available from the CGS website). Seismically induced settlement and surface rupture due to lateral spreading shall be evaluated. A minimum factor of safety of 1.1 is required.

4. Lateral Earth Pressure Analysis

Retaining structures up to 6 feet in height may be designed in accordance with Table No. 1610.1 of the building code and Table No. I-1 found in Information Bulletin P/BC 20147-083, provided that the wall supports either certified compacted fill or undisturbed native earth material with no adverse geologic conditions. Retaining structures over 6-foot high, or surcharged by structures, or subject to adverse geologic conditions, require a soil investigation report containing a lateral earth pressure analysis. Design lateral pressures shall be greater than or equal to those from limit equilibrium analysis (free-body diagram and vectors) with minimum safety factors on mobilized shear strength of: 1.5 for static lateral earth pressures. Additionally, retaining and basement walls exceeding a height of 6 feet require a soil investigation report containing a determination of lateral pressures due to earthquake motions. A minimum horizontal seismic coefficient corresponding to one-half of two-thirds of the  $PGA_M$  (Maximum Considered Earthquake-Geometric Mean,  $MCE_G$  adjusted for Site Class effects) shall be used. Sub-drains shall be provided to eliminate hydrostatic pressure, or walls shall be designed for hydrostatic pressure for their entire height. Walls founded in adverse geologic conditions, or on a descending slope will require a passive pressure analysis.

5. Settlement Analysis

Settlement analysis is required where the differential settlement of foundations will exceed 1/4 inch. Estimated differential settlement between an existing structure and a proposed addition should also be reported. Settlement of on-site and adjacent structures due to dewatering shall also be included.

6. Mudflow and/or Debris Flow Analysis

Where the site is located in the path of concentrated drainage or is in an area with a

history of debris flows, recommendations should conform with the minimum guidelines of section 7014.3 of the LABC and P/BC 2017-064. Additionally, where specific unstable conditions have been identified, recommendations for mitigation shall be based upon the amount of potentially unstable material as identified by the geologist and soils engineer. In addition to the minimum design criteria specified in code section 7014.3(1) for channel flow, a diversion/impact wall shall be provided along the downslope side of the channel. Where the channel is directed at a property line shared with other private property, a diversion/impact wall shall be provided along the property line to prevent mud or debris from crossing the property line. Diversion/impact walls shall always be a minimum of three feet in height, or higher, as determined by the project consultants and approved by the Grading Division. As a minimum, where the wall is potentially subject to impact, it shall be designed for a lateral load equal to an equivalent fluid pressure of 125 psf per foot of depth.

7. Surface Fault-Rupture Investigation

See Information Bulletin P/BC 2017-129 for guidelines to perform fault rupture investigations.

8. Bulking and Swelling Factor

“Bulking” and “Shrinkage” percentage values shall be included in geology and soils reports submitted to the LADBS Grading Division for projects in hillside grading areas. Bulking is the increase of volume of the earth material when it is excavated. Shrinkage is the decrease in volume of the earth material when it is compacted. These parameters will aid in the determination of the actual volume of material to be exported from a grading site or imported to a grading site. In addition, please note that brush or similar material will be considered in the export/import volume calculations during plan check review (see 2017 LABC Section 7006.7.1).

Bulking and Shrinkage are defined as follows:

$$Bulking \text{ (\%)} = \left( \frac{In - Situ \text{ Density}}{Loose \text{ Density}} - 1 \right) \times 100;$$

$$Shrinkage \text{ (\%)} = \left( 1 - \frac{In - Situ \text{ Density}}{Compacted \text{ Density}} \right) \times 100;$$

where: the In-Situ Density is the density of the material in its natural state, the Loose Density is the density of the material after it is excavated, and the Compacted Density is the density of the material after compaction.

The reports shall provide an average Bulking and an average Shrinkage of the earth materials intended to be excavated and compacted at the site.

## F. Recommendations

The recommendations should cover mitigation of the effects of liquefaction and adverse geologic conditions; address the temporary and permanent cut, fill, and natural slopes; provide design parameters for shoring, foundations, retaining walls, pavement, setbacks from ascending and descending slopes; stipulate measures to handle expansive soil conditions; and specify any inspection requirements to be performed by the consulting engineer. Recommendations concerning sub-drains, lateral deflection, and the order of construction/backfill shall be provided for retaining structures, as appropriate. Recommended site classification for seismic design (LABC section 1613.3.2) shall be provided.

## II. CONTENTS OF COMPACTION REPORTS

Pursuant to LABC Section 7011.3, which stipulates that all fills shall be compacted to a minimum of 90% of relative compaction as determined by ASTM D-1557, compaction reports are required to be submitted to this Department for review and approval. The report shall include, but not limited to, the following:

### A. Address and Legal Description

The address and legal description of the site under which the work is authorized shall be the same as the address and legal description on the report, Certificate of Compliance, and the grading permit.

### B. Plot Plan

A drawn-to-scale plot plan, with a north arrow, showing the location and depth of the fill, location and depth of compaction tests, location and height of retaining walls, location of sub-drains, toe and top of slopes, property boundaries, and any adjacent structures and streets. Note: Subsurface cross sections may be required if deemed necessary.

### C. Purpose and Use of Fill

The purpose and use of fill shall be described including **Primary Structural Fill** for supporting footings, **Secondary Structural Fill** for supporting hardscape, **Non-Structural Fill** for landscaping.

### D. Descriptions

The following descriptions shall be included in the report:

1. Materials encountered at the bottom of the excavation.

2. Preparation of the bottom prior to placement of fill.
3. Fill/backfill placement, preparation, and compaction.
4. Identification of fill material used with the Unified Soil Classification System, maximum dry density, and optimum moisture.
5. Moisture content control method and results.
6. Thickness of the uncompacted fill lifts (typically 6-8 inches).

#### **E. Results of Density Tests**

Results of all density tests with applicable ASTM or UBC standard designation numbers shall be submitted with the report. All soil testing shall be performed by a laboratory licensed by the Department's Materials Control Division. Engineers may employ an approved laboratory to perform the testing provided they furnish the Department with a letter of responsibility stating that they have reviewed and concur with the test data and results and accept responsibility for using it. A copy of the laboratory report signed and stamped by the laboratory engineer shall also be provided.

#### **F. Field Testing Results**

Field tests shall be taken at every two vertical feet or for every 500 cubic yards of fill placed, whichever is more restrictive. Test results showing less than required relative compaction are not acceptable. Description of removal and recompaction of the unacceptable fill and its retesting shall be included.

#### **G. Nuclear Testing Results**

Nuclear testing results, if used, shall be performed in conformance with P/BC 20147-068:

1. At least one sand cone test (ASTM 1556) shall be taken for every ten nuclear tests (ASTM D6938).
3. The sand cone test shall be taken at the same general location and elevation as one of the ten nuclear tests so it can be correlated with the nuclear test.

#### **H. Recommended Bearing Capacities and Minimum Footing Embedment**

In accordance with LABC Section 1803.5.3 and LARC R403.1.8, either expansion index testing or recommendations for design for highly expansive soil shall be provided. Where design



values exceed those shown in either LABC Table 1806.2 or LARC Table R401.4.1, or where footing or slab support may be provided by import materials, additional tests for maximum dry density, moisture content, direct shear tests, and consolidation will be required.

### **I. Shear Testing Results**

As-built subsurface cross-sections and shear test results conducted on undisturbed samples taken during grading for buttress fills and slopes steeper than 2:1 (horizontal : vertical) are required.

### **J. Certificate of Compliance**

A Certificate of Compliance shall be completed, signed, and stamped by the soils engineer.

## **III. CONTENTS OF SPECIAL REPORTS**

### **A. SUBDIVISION OF LAND**

1. The reports shall conform with the general guidelines in this bulletin.
2. The geologic/geotechnical map shall be based upon the proposed subdivision map and show all proposed property lines.

### **B. FINAL REPORT AND PROGRESS REPORTS FOR TRACT GRADING**

1. The final geology map must be based upon the  $\Delta$ As-Graded@ plan prepared and certified by the design engineer or land surveyor. Sub-drain locations shall be depicted on the plan.

### **C. PRIVATE SEWAGE DISPOSAL SYSTEMS**

1. The report shall conform with the guidelines of P/BC 20147-027.
2. The report shall contain a geologic map and cross-section showing the seepage pit, topographic conditions, the distance to any streams and the setbacks required in Table H 1.7 of the plumbing code.
3. Recommendations for depth of sealing to prevent effluent from affecting any adverse geologic conditions.

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**IV. RELATED DEPARTMENT INFORMATION BULLETINS**

- P/BC 2017-001 FOOTINGS ON OR ADJACENT TO SLOPES
- P/BC 2017-027 ONSITE WASTEWATER TREATMENT SYSTEM - RESIDENTIAL
- P/BC 2017-028 NUCLEAR DEVICES - SOIL DENSITY AND MOISTURE DETERMINATION
- P/BC 2017-044 EXEMPTIONS FROM LIQUEFACTION, EARTHQUAKE-INDUCED LANDSLIDE, AND FAULT-RUPTURE HAZARD ZONE INVESTIGATIONS
- P/BC 2017-049 SLOPE STABILITY EVALUATION AND ACCEPTANCE STANDARDS
- P/BC 2017-050 CONSTRUCTION UPON SLOPES STEEPER THAN TWO HORIZONTAL TO ONE VERTICAL
- P/BC 2017-064 FLOOD HAZARD MANAGEMENT SPECIFIC PLAN GUIDELINES
- P/BC 2017-068 RULES AND REGULATIONS FOR HILLSIDE EXPLORATORY WORK
- P/BC 2017-083 RETAINING WALL DESIGN
- P/BC 2017-118 GUIDELINES FOR STORMWATER INFILTRATION
- P/BC 2017-121 CONTROLLED LOW STRENGTH MATERIAL (CLSM)
- P/BC 2017-129 SURFACE RUPTURE HAZARD INVESTIGATION