



**CITY OF NEWPORT BEACH**  
**COMMUNITY DEVELOPMENT DEPARTMENT**  
**BUILDING DIVISION**  
**BUILDING CODE POLICY**

Effective Date	Subject	Policy No.
12/4/2000 Revised: 2/6/2001 Revised: 9/28/2001 Revised: 2/27/2006 Revised: 4/24/2012 Revised: 7/13/2014	Liquefaction Study Mitigation Measures	CBC 1803.5.11-12 <i>(supersedes CBC 1803.5.11)</i>

All structures in Seismic Design Category C, D, E or F are required to conduct geotechnical investigations to address the potential for liquefaction and differential settlement due to earthquake ground motions. California Building Code (CBC) Sections 1803.5.11 and 1803.5.12 require reporting and submittal of such investigations, including recommended liquefaction mitigation measures, to the Chief Building Official.<sup>1</sup>

**RESIDENTIAL STRUCTURES (1 or 2 family dwellings):**<sup>2</sup>

A. New Construction:

Provide a geotechnical investigation report with recommendations addressing liquefaction potential for new one or two family dwellings. The minimum requirements are:

- i) At a minimum, two borings or CPT's to a minimum depth of ten (10) feet below the lowest foundation level;
- ii) Obtain drive sample blow counts at two (2) feet intervals or less with hammer energy reported for each sample; and
- iii) Perform Liquefaction analysis and seismic settlement calculations for layers with a factor of safety  $\leq 1.3$ :
  - City's *Shallow Mitigation Methods* may be considered if seismic settlement is  $\leq 1$  inch or if seismic settlement is reduced to less than 1 inch by means of shallow ground modifications such as over excavation and recompaction, reinforced earth, etc.
  - City's *Deep Mitigation Methods* may be considered for cases with seismic settlement exceeding 1 inch.

B. Reconstruction or Remodel:

When the value of the proposed remodel alteration, or reconstruction work exceeds \$200,000 and 50% of the existing nondepreciated value of the building, all elements of the new and existing foundation system shall meet or exceed the *Residential Minimum Liquefaction Mitigation Methods* as outlined in this policy.

C. Additions (No Remodel or Alteration):

When the area of addition is greater than 500 square feet then foundation for additions shall meet or exceed the Residential Minimum Liquefaction Mitigation method.

D. New Foundations:

Whether a geotechnical investigation has been completed or not, all new foundations must meet the minimum design standards as indicated for Shallow Mitigation Methods.

**NON-RESIDENTIAL AND/OR MULTI-DWELLING STRUCTURES:**<sup>1</sup>

A complete site specific geotechnical investigation report is required. The report shall discuss and quantify the liquefaction and differential settlement potential for the site to a minimum of depth of 50 feet and provide design recommendations for mitigation. Please see Policy CBC 1803.5 for further information regarding geotechnical investigations.

## **RESIDENTIAL MINIMUM SHALLOW LIQUEFACTION MITIGATION METHODS:<sup>3</sup>**

### **1. *Strengthened slab on grade foundation system (minimum requirements).***

- a. Foundation slab:
  - i. Concrete slab shall be a minimum of 5 inch actual thickness;
  - ii. Reinforcement equivalent to #4 bars at 12 inches on center each way, equivalent bar spacing shall not exceed 18 inches on center, located at the center of the slab; and
  - iii. Doweled connections between the slab and footings with #4 bars at 24 inches on center maximum spacing.
- b. Footings:
  - i. Embedded 24 inches or more below the finish grade; and
  - ii. Reinforced with 2- #5 bars at top and bottom.
- c. All pad footings shall be tied by grade beams in not less than two directions.
  - i. Embedded 24 inches or more below finish grade.

### **2. *Structural Mat Foundation.***

- a. Minimum 12 inch thick engineered slab.

### **3. *Post-tension Slab Foundation System.***

### **4. *Modified Soil Mat.***

- a. The top 5 feet of soil shall be mixed with cement at a ratio of 2 sacks per cubic yard of soil;
- b. The soil-cement mix shall be recompactd in place; and
- c. All pad footings shall be tied by grade beams.

### **5. *Other Engineered Foundation System.***

A foundation system designed by a licensed civil engineer based on soils or geotechnical report recommendations, which meets or exceeds the mitigation measures above, and is approved by the Chief Building Official.

## **RESIDENTIAL MINIMUM DEEP LIQUEFACTION MITIGATION METHODS:<sup>3</sup>**

### **1. *Caisson or Pile Foundation System.***

- a. Minimum caisson/pile embedment depth into competent soil as determined by a geotechnical report;
- b. Caisson/pile design shall resist dragdown friction due to settlement of the liquefiable and other soil layers;
- c. Caisson/pile design and connections shall transmit the lateral loads of the structure to the bearing soil level;
- d. Caisson/pile shall be connected by a structural slab system; and
- e. Driven piles are not permitted.

### **2. *Ground Modifications***

- a. Stone Columns; and
- b. Grouting

Approved by:

  
Seimone Jurjjs, PE, Chief Building Official

#### Notes:

<sup>1</sup>Over the past decade, beginning with the publication of *Guidelines for Evaluating and Mitigating Seismic Hazards in California* Special Publication 117A in 2008, the California Geological Survey (CGS) has increased public awareness of potential property damage during liquefaction events through the media, and other resources. The increased public awareness may affect the value of properties where liquefaction has not been mitigated. The intent of these mitigation measures is to provide life safety in residential structures if a liquefaction event occurs. These measures will not fully eliminate the risk of damage to a structure if liquefaction or similar differential settlement occurs. Remedial work and repairs should be anticipated after any such event. If a greater level of risk protection is desired, additional mitigation measures based on a full geotechnical investigation and recommendations should be implemented.

<sup>2</sup>Depth of liquefiable material may be assumed as 30 feet unless borings indicate otherwise.

<sup>3</sup>New slab on grade shall install a Capillary Break in compliance with California Green Code 4.505.2.1.