

## Foundation and Building Impacts

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### Know Before You Begin

Some projects require large foundation costs due to the underlying soil conditions. Sometimes moving the building location on a site can save on these costs. Talk to your GE!

# 4 Considerations that Affect the Geotechnical Design and Impact Your Construction Costs

## I. Soil and Geologic Conditions

The underlying soil dictates how your structure will be supported. Here is a general list of conditions that could define how your foundation is designed and constructed.

**Fill Materials** – Fill soil is either properly compacted (tested and observed during placement) or undocumented. If the fill is undocumented, increased costs will be incurred to remove and recompact the fill materials. If removal and recompaction is not possible, deep foundations may be required.



*Placing fill for the Portola Center project in Lake Forest, California*

**Unconsolidated Soil** – Relatively loose, dry native soil, such as alluvium (stream deposits), colluvium (gravity deposits), loess (wind deposits) and bay deposits may experience settlement from hydrocollapse (settlement due to water intrusion). If these deposits are saturated and groundwater is near the surface, liquefaction (loss in strength where soil behaves as a liquid) may occur during a seismic event and settlement may occur.

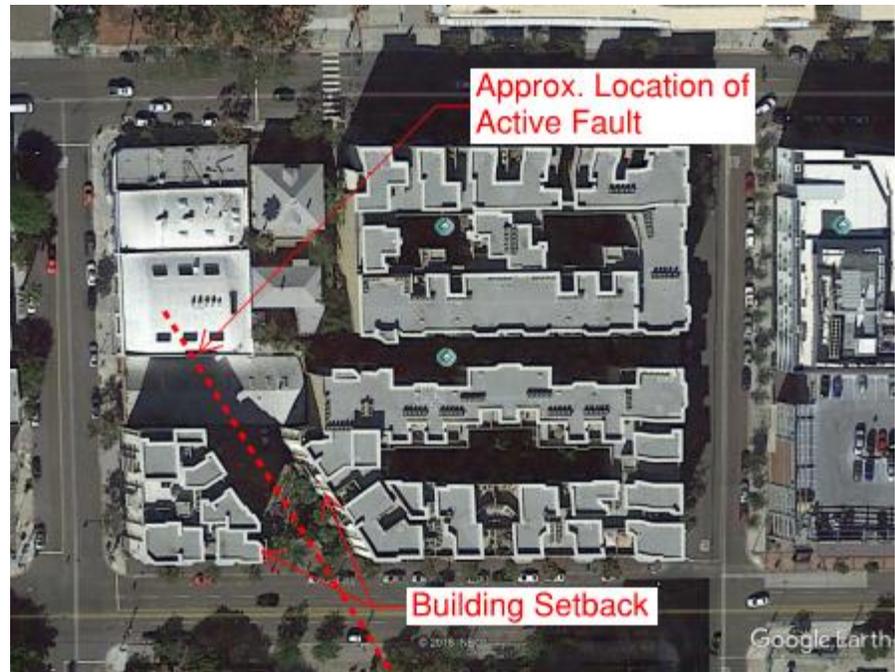
**Strong Rock** – Excavations into strong rock are very difficult and require specialized equipment or blasting. The cost to grade on sites with strong,

non-rippable rock can be about 10 times more than conventional grading operations. The evaluation of the volume and location of strong, non-rippable rock will have a significant cost impact to a project.

## 2. Geologic Hazards

There are several geologic hazards that exist in California that can impact building design and construction costs.

**Faulting** – The State of California does not allow structures for human occupancy to be constructed on active earthquake faults (movement in the last 11,000 years). Structural setbacks are required where an active fault is located on the property.



*Building Setback in Downtown Area of San Diego, California*

**Liquefaction** – Liquefaction (and related phenomena) occurs in relatively loose material where groundwater and seismic activity are possible. If liquefaction is a concern for the structure, ground modification or deep foundations may be required. Ground modification such as stone columns, soil mixing, deep dynamic compaction or others can be used. We can help begin conversations with specialty contractors if ground modification will be required.



*Stone Columns Being Installed in San Diego, California*

**Landslides/Slope Stability** – Projects that are located adjacent to slopes may require a landslide or slope stability analysis. If the analyses indicate slope stability concerns, the grading and construction costs can significantly increase due to slope stability requirements. Grading solutions such as stability fills or buttresses are normally less expensive than installing structural components such as shear pins and tieback anchors. Working with a good geologist will help reduce your risk for slope instability.



*Grading Temporary Backcut Failure in Lake Forest, California*

### 3. Soil Properties

The physical and chemical properties of the underlying soil can have an effect on the foundation and site design recommendations for your project.

**Expansive Soil** – Soil expansion can increase the amount of concrete and steel required for your foundations. Expansive soil also can also increase your maintenance costs on the project long after the project is complete (e.g. repairing lifting flatwork). Expansive soil typically possess poor pavement support characteristics and results in thicker pavement sections to be required.

**Hydrocompression** – Properly compacted fill may experience significant settlement (due to hydrocompression) over the lifetime of the improvements that it supports. The ultimate settlement potential of fill is a function of the soil type, placement relative compaction, placement moisture content and subsequent increases in the soil moisture content.

**Water-Soluble Sulfate Content** – The California Building Code and American Concrete Institute require concrete to have specific cement types, concrete strengths and concrete water-cement ratios depending on the water-soluble sulfate content of the soil that is in contact with the concrete. Soil that possess an “S1” to “S3” will likely have increased concrete costs due to increased strength and cement content requirements.

**Corrosive Soil** – The soil may possess pH, resistivity and chloride ion contents that require utilities and other improvements to be protected. A project corrosion engineer may be required to help design your project.

## 4. Proposed Project

The building type, location and project layout all have an effect on the geotechnical recommendations for your project. For example, buildings that are located adjacent to slopes may require deepened foundations. Project that possess subterranean garages on property lines would require temporary shoring. Some structures may be able to tolerate more settlement than others. Heavy structures (such as high-rises) may exceed the capacity of shallow foundations and require deep foundations. Subterranean garages may also require special waterproofing and considerations of buoyancy.



*Sheet Piles and Auger Piles for Pacific Gateway in San Diego, California.*

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*Feel free to contact us so we can help your project. We strive on service and helping our client economize their project with appropriate engineering solutions. Geocon Incorporated has helped public and private clients since 1971.*

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