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Perspective

Geotechnical Engineering and its Structures and Footings

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DESCRIPTION

The division of civil engineering that deals with the engineering behavior of ground materials is called geotechnical engineering. In order to solve each of its individual engineering issues, it applies the principles of rock mechanics and soil mechanics. Geology, hydrology, geophysics, and other relevant sciences are also necessary for it to function. Among the many subfields of geological engineering is geotechnical engineering.

Geotechnical engineering is used in a variety of fields besides civil engineering, including the military, mining, petroleum, coastal engineering, and offshore building. There are areas of knowledge that cross over between engineering geology and geotechnical engineering. While engineering geology is a subfield of geology, geotechnical engineering is a specialist of civil engineering. Both soil mechanics and rock mechanics are based on the same principles, but their applications are different.

Structures

Transmission of loads from the buildings to the earth occurs through the foundation of a building or a piece of transportation infrastructure. The features of the soils and/or bedrock at the site, along with the load characteristics of the structure, are used by geotechnical engineers to build foundations.

Bearing capacity, settlement, and earth movement beneath the foundations are the main factors to take into account for foundation support. The ability of the site soils to support the loads imposed by buildings or structures is known as bearing capacity.

In all soil types and loads, settling happens beneath the foundations; however it may be minimal for lightly loaded buildings or rock sites. Both general settlements relative to undeveloped regions or nearby buildings, as well as differential settlement under a particular structure, can be issues for heavier structures and/or softer soils.

A settlement that develops gradually is of special concern because an immediate settlement can typically be made up for during construction. Low bearing capacity soils, volumetric changes in expansive soils brought on by moisture, freeze-thaw cycles, or the melting of permafrost, or inadequate fill materials with low strength, high compressibility, and high water content can all cause ground movement beneath the foundations of buildings. The design of foundations must take into account each of these components.

Footings

Footings are structural components that directly areal contact the ground to transfer structure loads. For point or column loads, footings can be isolated; for walls or other long loads, they can be strip footings. Footings are often made of reinforced concrete that is cast directly into the soil and driven into the ground in order to pass through the frost movement zone and/or to acquire more bearing capacity.

An alternative to spread footings is to have a single concrete slab support the full area of the structure, bearing the weight of the entire structure. In order to disperse the bearing loads reasonably evenly and reduce differential settling over the foundation, slabs must be thick enough to give adequate stiffness.

Flexure is sometimes permitted, and buildings are designed to accommodate slight foundation movement instead. The foundation slab's thickness can range from less than 300 mm for small structures like single-family homes to several metres for bigger projects.

Slab foundations, which are frequently used in structures with basements, can either be slab-on-grade foundations or embedded foundations. The potential for ground movement brought on by shifting soil conditions must be accommodated in the design of slab-on-grade foundations.

A retaining wall is a construction that retains soil. Retaining walls maintain vertical or almost vertical grade changes and stabilize soil and rock against downslope movement or erosion. Retaining walls can also refer to water-retention structures like cofferdams and bulkheads.

The weight of the retained material is causing lateral ground pressure behind the wall, which may cause the wall to deform or

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fail, and this is the main geotechnical problem in the design and installation of retaining walls. The lateral earth pressure is determined by the height of the wall, the soil's strength, density, and the amount of permissible wall movement. Similar to hydraulic pressure, this pressure is lowest at the top and rises toward the bottom, tending to push the wall away from the backfill. A drainage system-ineffective groundwater behind the wall puts additional horizontal hydraulic strain on it.