Retail renovations and expansions: The importance of a geotechnical engineering study

February 05, 2010 - Shopping Centers

Retail renovations and expansions introduce their own unique set of challenges. While most developers, property managers, and builders are familiar with working with architects and engineers, more often than not I find that they are unfamiliar with the importance of a geotechnical study and the value that a geotechnical engineer adds to a design team.

Working closely with the project design team, one of the primary roles of a geotechnical engineer is to determine and evaluate the subsurface soil, rock and groundwater conditions on the project site. This is accomplished by conducting a subsurface exploration, which typically involves performing a series of exploratory borings and/or excavations (test pits), evaluating the data and preparing a geotechnical report. In situations where the existing building foundation conditions and bearing materials are unknown, exploratory excavations are useful in providing information to the structural engineer and in evaluating the capacity of the bearing material. Studies for interior building modifications may require hand excavated test pits, small excavation equipment or low-headroom drilling equipment.

Renovations to retail space may involve: 1) adding a new floor or mezzanine level; 2) installing new equipment such as escalators or elevators; 3) creating new or lowering existing below grade levels; or 4) expanding out with a new addition. These changes result in new building loads which may require modifying or underpinning existing foundations or constructing new foundations. Larger retail expansion projects may also involve changes on the property such as new parking, roadways, parking structures, retaining walls, stormwater management systems and underground utilities. Geotechnical studies aid in the design and construction of these improvements.

Adding a new floor level, installing new mechanical equipment, or modifying a building for additional storage increases the loads on the existing building foundations. In these situations, the existing foundations and the underlying bearing materials must be evaluated to determine if the foundations and bearing materials can adequately support the new loads without detrimental settlements. In cases where the existing foundations are not adequately sized or the bearing materials are not suitable, underpinning techniques have been used to increase the foundation's size or to transfer the foundation loads to a stronger bearing material. Mezzanine additions commonly require new foundations.

Excavating inside an existing structure poses its own challenges. A geotechnical study with exploratory test borings and excavations can provide valuable information during the design and construction stages of a project. Carlin-Simpson & Associates was recently involved with two retail renovation projects that required new escalators to be installed for a two-level store. At one location, pits for the escalator equipment needed to be excavated adjacent to interior columns. Underpinning was used to lower the column foundations down to the escalator pit elevation. At another location,

soft soil conditions required the escalator pit to be supported on piles. Drilled-in concrete filled steel pipe piles were selected for the project. Test boring data was used to design the capacity, diameter and depth of the piles.

Deep excavations in limited spaces require an earth support (shoring or sheeting) system. These systems may be required to protect workers, adjacent properties, roadways or utilities. With knowledge of the subsurface conditions, the geotechnical engineer can develop the engineering design parameters and design the earth support system, including the ground anchors or tieback system if required. When a contractor's engineer designs the system, a design review by a qualified geotechnical engineer is recommended.

Shallow rock or groundwater conditions could be costly for a project. Rock removal inside buildings is often labor intensive and expensive. Knowledge of the subsurface conditions prior to construction permits an opportunity for design modifications that may reduce a project's cost by reducing the amount of rock removal. Shallow groundwater conditions may require permanent dewatering systems involving sump pits, pumps, subslab drainage and waterproofing. The geotechnical engineer can provide guidance in designing the dewatering, drainage and waterproofing systems.

Knowing what you're getting into before you start digging is crucial for a successful cost-effective project. Knowledge of the subsurface soil, rock, and groundwater conditions is not only important in the design phase of a project but is essential in preventing project delays and budget overruns. Insist that your design team includes a geotechnical engineer. A proper subsurface exploration and geotechnical report prepared by an experienced geotechnical engineer will give you an idea of what to expect before you start excavating. The critical areas to identify are groundwater conditions, extent of bedrock, unsuitable soil conditions, the need for a deep foundation system, underpinning, and temporary sheeting and shoring. Carlin-Simpson & Associates has been providing geotechnical services in the northeastern U.S. region for the past 37 years and is ready to assist you on your next project.

Robert Barnes, P.E., senior project engineer, Carlin-Simpson & Associates, Sayreville, N.J.