Earth Systems group of companies
ENGINEERING FOR THE FUTURE
Fall 2010

Consultant's Corner

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Low Impact Development

Geotechnical Considerations that May Affect Your Project

In geotechnical engineering, conveyance of site drainage away from improvements as rapidly and completely as possible has always been a basic principle. With the advent of Low Impact Development (LID) practices, the opposite philosophy prevails as project designers are encouraged to retain storm water on site. Many far-reaching environmental benefits can be derived from storm water infiltration, such as restoration of historic hydrologic cycles, mitigation of degraded creek environments, better management of water resources, and comprehensive, watershed-wide water quality improvement.

Although the benefits of on-site storm water infiltration are great, caution must be exercised in implementation due to the potential for unintended and potentially disastrous geotechnical consequences.

Features such as underground infiltration systems, above-grade basins, bioswales, and permeable pavement that involve infiltration of storm water into the soil can lead to saturation of subgrade soils below or adjacent to improvements. When soils become saturated near foundations, a number of problems can occur, such as softening of foundation support soils, hydrocollapse, or soil expansion. Foundation settlement, heaving of the foundation, or differential movement

Foundation damage due to soil expansion

between different parts of the foundation can be unfortunate consequences. Sloping floors, cracked slabs, broken floor tiles, cracks in foundations or walls, or difficulty in opening doors and windows can be indications of foundation problems related to saturated soils. Musty odors, mildew or mold can develop when soils beneath a building become saturated or where there is standing water.

In paved areas, saturated soils can lead to uneven surfaces, depressions, cracks, subsurface erosion, and accelerated deterioration of asphalt concrete. Where improvements are located on or near slopes, increased soil moisture can lead to soil creep, separation of curbs and gutters from pavement and, in extreme cases, can even affect slope stability. Sand-filled trenches for utility lines create an ideal pathway for water to migrate. Water can also migrate through permeable retaining wall or other backfill material and reach areas where it was never intended to be conveyed.

The keys to avoiding unintended geotechnical consequences are identification of

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Consultant's Corner
Published quarterly by Earth Systems Inc.
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Earth Systems Global, Inc. Opens Beijing Office

Earth Systems Global, Inc. (ESGI) recently opened a new office in Beijing, China. Located in the heart of Beijing's eastern business district, ESGI's new location will advance their operations in China as they support the country's renewable energy goals. Focusing on wind and solar energy development, ESGI offers unique and innovative foundation designs for support of wind turbines, thermal concentrators, and power distribution infrastructure.

Our Man In China: Dr. Hongbin Huo

Geotechnical engineer Dr. Hongbin Huo is "Our Man in China" where he heads up operations at ESGI's new office in downtown Beijing. Dr. Huo joined Earth Systems in 2005 to support Earth Systems' growing international presence in the wind energy industry. Currently he is working on the Cao Shan Liang project in Shannxi Province in northwest China, a 33-1.5 MW wind turbine facility that is currently under construction.

Dr. Huo was born in Ning An, an historic town in Hei Long Jiang Province in northeast China. After graduating from the prestigious Tong Ji University in Shanghai in 1996, Dr. Huo was involved in the geotechnical engineering aspects of the design of several large petroleum plants throughout China. In 2000, he moved to the United States to pursue higher education; he earned an M.S. and a Ph.D. in civil engineering, with a geotechnical engineering specialty, from Purdue University in Indiana. His interest in wind energy was sparked after meeting Earth Systems' geotechnical engineer and wind turbine foundation expert, Shelton Stringer. While employed with Earth Systems, Dr. Huo has worked on wind energy projects throughout the United States and in the Inner Mongolia province of China.

Hongbin at Inner Mongolia job site in China.

There are challenges to working in China, Dr. Huo says, particularly in familiarizing the Chinese with American technology, such as the Earth Systems' proprietary Patrick and Henderson wind turbine foundation. "Chinese developers are reluctant to use our P&H foundations before they see real projects constructed. I believe with the Shannxi project being constructed successfully, more clients and developers will feel comfortable employing our design for their future projects." The P&H foundation is experiencing growing popularity in the United States and other Western countries.

Dr. Huo splits his time between his Beijing apartment and his permanent home in Rancho Cucamonga, California where his wife and young children live. As they enjoy aspects of both cultures, Dr. Huo and his family frequently travel between the United States and China. Dr. Huo particularly enjoys the Beijing opera, Chinese traditional poetry, and hiking during his spare time. He also visits with his parents and brother who still live in his home town of Ning An.

Rock of the Season

Chondrite

When the European Space Agency's Rosetta spacecraft took a detour on July 10, 2010 to fly by the mysterious asteroid Lutetia, scientists at ESA were ecstatic over the images (as shown below) and data they received. The multi-cratered Lutetia shows the marks of its 4.5 billion years of existence. What scientists are hoping to discover as they analyze data from Rosetta's sensors is the composition of Lutetia. It may be that Lutetia is composed of chondrite, the oldest known rock in our solar system. Chondrites are stony meteorites; over 27,000 have fallen to Earth and are in collections worldwide. Olivine and pyroxene are the usual minerals found in chondrites, while in some, feldspar, magnetite, calcite, and troilite are found. There are chondrites that even contain grains of dust that originated before the formation of our solar system from somewhere else in the galaxy. Meanwhile, closer to home, the Rosetta spacecraft continues its journey toward the comet Churyumov-Gerasimenko. When it reaches it in 2014, Rosetta will go into orbit around the comet and release an exploratory lander on its surface. Perhaps chondrite will be amongst its finds.


Photo by ESA


A sample of chondrite

Rising Sea Level Settles Decades-Old Territorial Dispute

For the past 30 years, India and Bangladesh have argued over control of New Moore Island, a tiny rock island in the Bay of Bengal. The uninhabited island, 1.5 miles wide and 2 miles long, was located in the Sunderbans mangrove delta in the mouth of the Hariabhanga River, which divides India and Bangladesh. The two nations, although friendly, have never established a maritime boundary, and each claimed rights to New Moore and several other islands in the area. New Moore Island, referred to by Bangladesh as South Talpatti Island, was first discovered in satellite images in the mid 1970's and was thought to have emerged in the aftermath of the 1970 Bhola Cyclone. In March 2010, as the result of rising sea levels in the Bay of Bengal, it finally became completely submerged. Until about 2000, sea levels in the bay rose about 0.12 inches per year, but over the last decade the rate increased to about 0.2 inches annually. Oceanographers say that at least ten other islands in the vicinity are at risk of submergence in the coming years.

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potential site constraints and proper siting of infiltration features. Natural site constraints can include slopes, potentially unstable areas, and soils that are not conducive to infiltration. Man-made features can also act as constraints. For example, caution should be exercised near existing or proposed improvements such as foundations, basements, retaining walls, or utility trenches.

Often site constraints can be mitigated simply by siting the infiltration system a sufficient distance away to avoid impacts. As what constitutes "sufficient distance" will vary depending upon a number of factors (such as the type of constraint, the site topography, and the soil characteristics), involving a geotechnical professional early in the design process can be beneficial. Generally, avoiding constraints via selective siting is easier for projects involving new construction (rather than redevelopment, remodels or additions) as there is greater flexibility in the design process.

Soil properties such as permeability and/or percolation potential can greatly affect the movement of water through soil. Percolation or permeability testing may be included as part of the design process to assess the site's suitability for the type of infiltration system planned. The information developed from such testing can assist the designer in the selection and design of the most effective system for storm water infiltration.

When avoiding constraints through selective siting of infiltration features is not feasible, various accommodation measures can be used. Barriers of impermeable material can be placed in utility trench backfill to mitigate water from easily migrating through trenches. Where permeable pavers are used for driveways, impermeable surfaces or subdrains may be recommended where the pavement is in close proximity to foundations. Deeper foundations or cut-off walls can be used to mitigate moisture from gaining access to subfloor areas. Geotechnical professionals are well-versed in many different types of accommodation measures, and are available to assist designers in development of appropriate solutions for their projects.

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Consultant's Corner • *Fall 2010*

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Fact or Fiction

On April 18, 1906, a massive earthquake estimated at a Richter magnitude of 7.8 shook the San Francisco Bay area. The shaking lasted less than a minute, but the temblor, followed by several days of fires, resulted in a loss of life estimated at as many as 3,000 people. In areas north of San Francisco, the San Andreas fault moved up to 20 feet.

Cow art by Jen Barnes

(Re-enactment of cow event)

One of the pervasive stories that arose following the big quake was that of Matilda the Cow. Matilda lived on a ranch near Tomales Bay, California, which is within the rift zone of the San Andreas fault. According to the story, a fissure opened up during the earthquake, and the unlucky cow fell in. Subsequent tremors closed the crevice, leaving only the cow's tail sticking out as mute evidence of Matilda's fate. There were many accounts of the incident, which lent credence to the story and led to its inclusion in an official report by the U.S. Geologic Survey prepared in 1908. But did it really happen, or is the story just an urban (or in this case, rural) legend?

Upon closer examination of contemporary and historical accounts, both written and oral, it has been found that what people actually witnessed was the aftermath of the incident, not the incident itself. The common theme in all of the accounts was that while numerous people saw the tail of the dead cow protruding from the fissure, none claimed to have witnessed the actual event.

In a letter written in 1966, H.H. Howard, whose family owned an adjacent ranch, described a conversation that he overheard as a boy in 1912. "I can remember my father asking [our cousin] why did you tell those reporters that your cow was swallowed up by the crack in the earth?" To which the cousin replied "Look, the cow had died, and we had to bury her. That night along came the earthquake which opened up a big crack in the ground. We just dragged Matilda over to the crack and tipped her in with her feet sticking out. Then along came those newspaper reporters and when they got the idea that the cow had fallen in, we weren't about to spoil a good story!"

Kudos

Jeff Rocca Earns Another ICC Certification

The International Code Council has recently certified Mr. Jeff Rocca as a Structural Steel and Bolting Special Inspector. Mr. Rocca has been employed with Earth Systems Southern California out of their Palmdale office since 2004. About two years ago, he took a one-month leave of absence to drive a "big rig" across the country. When he returned, he shifted his training into high gear and has since earned four ICC Special Inspector certifications: fireproofing, reinforced concrete, and masonry, in addition to the most recent. As Jeff is also certified by NICET to test asphalt, concrete, and soils, he not only drives the open road, he makes sure it's a smooth ride.