Soft Soils Meet their Match

Structurally-stable, light-weight wall structure separates a development area from an extremely soft-soil environment.

by Greg Northcutt & Patricia Stelter

A 660-ft. long retaining wall separating the site of an experimental urban housing development 40 km east of Tokyo from adjacent rice fields lying below the town typifies the meticulous techniques used on construction projects throughout Japan.

This project highlights the advantages of a light-weight, flexible, and high-strength geocellular earth retention system compared to conventional concrete and steel retaining structures in meeting the challenges of this particular site: 1) soft, unstable soils, 2) high water table, and 3) limited access for construction equipment and materials. An added benefit of the geocell system is the outer facia of the wall system supports vegetation, offering the aesthetics of a living wall structure and natural blending with its environment.

The area above the wall is a community park where the Urban and Housing Technology Research Institute conducts state of the art housing design, life style, energy conservation and environmental studies.

Bordering working rice fields, a narrow paved road along the bottom of the walls allows farmers access to the fields. In these irrigated terraced fields, young rice plants are transplanted with machines in about six inches of water. During the growing season, the water level is gradually lowered so that the fields are dry when the crop matures, about six months after planting, and farmers harvest the rice using small combines.

Prior to the project, there was not a wall separating the rice fields from the development area. There was only a dirt path at the bottom of the slope used by farmers for access to the rice fields. Erosion was occurring from the development area with sediment entering the rice fields during rains. There was a need to separate the Development Agency Project from the agricultural area, so the project was conceived to provide a barrier between the development area and the rice fields, and also to upgrade the dirt path into an asphalt lane for easier access to the rice fields.

Urban Renaissance Agency, the site administering organization, planned to build the wall using pre-cast interlocking concrete blocks. However, that option was rejected due to concerns with the ability of the inherent moist, peaty soils to support the weight of a concrete wall.

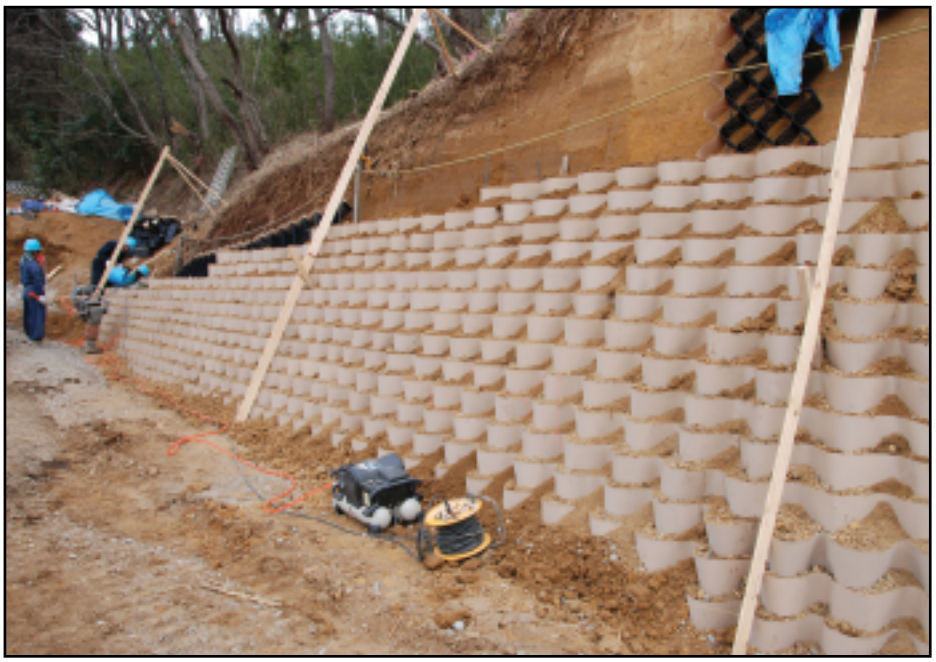
The Presto Geoweb® earth retention system was proposed by distributor, Wescot Corp., Tokyo, as a viable option to meet all of the design criteria at this site. In soft soil environments, the system can tolerate differential settlement without losing its integrity even when exposed to compressible subgrade soils. In addition, the Geoweb sections can be used to provide a stable foundation for the footing of the wall.

Low-Impact Development

A key factor for selecting this system was its long history as an environmental-

ly-friendly construction material and proven record of low environmental impact during construction. Each layer of geocell sections is installed with a set-back from the layer beneath, creating horizontal terraces with exposed outer facia cells. These open outer facia cells are typically vegetated to produce a living green structure. Rainfall collects in the exposed cells, supporting plant growth and minimizing runoff.

The system's flexibility and ability to maintain structural integrity was proven in an actual 8.6 magnitude earthquake, an important consideration in this earthquake-prone part of the world. Other benefits of this wall system: 1) it allows contractors to use native soils as infill, reducing the time and expense of importing fill to the site, 2) it maintains structural stability against known externally imposed loads, 3) it will not corrode or degrade like many hard-surface wall systems, and 4) it conforms easily to landscape contours.



Precision Japanese construction ensures exacting wall alignment and setback. Native infill soil eliminates the expense of importing soil.

Tiered Installation

The earth retention walls were constructed of a series of 6-inch high layers of geocell sections measuring 8 cells wide and 3 cells long. The original design using interlocking concrete blocks called for vertical cuts as high as about 26 feet. However, use of the earth retention system allowed the designers to reduce vertical cuts to no higher than 16 feet.

The retaining wall base varied in thickness from one to three geocell section

Volunteer vegetation consisting of native grasses, wildflowers and ferns develops naturally.

layers, depending on the strength of the subsoils in varying areas of the project.

Precision Quality

Japanese construction companies take tremendous pride in their work, giving meticulous attention to every construction detail. In the U.S., construction projects are driven by profit and work is typically awarded to the lowest bidder. By contrast, in Japan quality is first and foremost. After establishing the cost to achieve the desired quality, various contractors and subcontractors then negotiate their share of the costs and profit.

In this project, the construction crew carefully sculpted the curves and angles in excavating the site for the base and wall. To achieve precise alignment and setback of the wall facia's slope angle, wooden templates were used for controlling the setback.

Common with Japanese construction, the retaining walls were left to re-seed naturally and quickly supported growth of native grasses, wildflowers and ferns. When fully vegetated, the wall facia will have minimal visibility. The 2:1 slopes above the retaining wall were protected with erosion control blankets made from polypropylene fibers with tubes of fertilizer sewn into them and allowed to reseed naturally with local fauna and grasses.

The total cost of the retaining wall and base was less than the cost of a concrete block wall, due in part to the much simpler construction methods. The project was completed in eight weeks with a six-person crew. The project owner was pleased with the ability to economically construct natural wall structures that support local species of vegetation at this challenging site. **L&W**

For more information, contact Patricia Stelter, Presto Geosystems at patricia.stelter@prestogeo.com or (920)738-1336.