



The Crystal Cove project involved moving 6 million cubic yards of dirt and the installation of a 1,000-foot long soil cement wall, 23,000 feet of reinforced concrete pipe, 60,000 feet of retaining walls, and 800,000 square yards of geogrids. The grading contract alone approached \$20 million. *Photo courtesy of Sukut Construction.*

Crystal Cove: A Case Study For The Better Grade

BY CHRISTINE ROMBOUS

After much delay and anticipation, the model homes at Crystal Cove, located on the Newport Coast in California, will finally open to the public this month. Local topography, soil conditions and population density are leading to more hillside development projects, like Crystal Cove, especially near the metropolitan areas in northern and southern California, where these factors are more prevalent. Some of the innovative techniques used in the land planning and grading stages of the Crystal Cove project are allowing builders to develop what

was once unbuildable land. New techniques to develop natural-looking steep earth slopes helped address the engineering and aesthetic challenges of the seaside development, where every piece of buildable land was precious and geotechnical problems abounded. The new technology can mitigate several engineering and geotechnical problems such as adverse bedding and active and prehistoric landslides.

Crystal Cove is part of the Newport Coast Planned Community being developed by the Irvine Community Development Company, a subsidiary of The Irvine Company. Four home builders are building a variety of product type within Crystal Cove from attached luxury villas to classic estate homes. Home prices

start just below \$1 million. Upon completion, the Newport Coast Planned Community will include 2,600 homes and 2,150 resort units. There are also several custom lots available, ranging in size between 19,645 square feet to more than 12 acres and ranging in price between \$2,415,000 to \$4,620,000. Of the 10,000 acres encompassing the project, nearly 80 percent is dedicated to open space. The project is located near Irvine and Newport Beach business, schools, shopping, beaches, marinas, entertainment and recreation.

Sukut Construction performed all the mass grading and storm drain construction on the Crystal Cove project, and just a few of the obstacles the earth moving



A new method of grading hillsides, developed by Soil Retention Systems, was used to install the 60,000 feet of retaining walls on the Crystal Cove project. Soil Retention Systems has mechanized the installation of modular block walls with a grapple machine designed specifically for the company. Photo courtesy of Sukut Construction.

company had to overcome were: extreme topography, ancient landslides, sensitive habitat areas, and public and private agencies' scrutiny, according to Matt Holley, estimator/project manager, Sukut Construction. Other major consultants on the job included Soil Retention Systems, Leighton & Associates, TRG Land, Inc., Hunsaker & Associates Irvine, Inc., and Goffman, McCormick & Urban, Inc.

The project involved moving 6 million cubic yards of dirt and the installation of a 1,000-foot long soil cement wall, 23,000 feet of reinforced concrete pipe, 60,000 feet of retaining walls, and 800,000 square yards of geogrids. The grading contract alone approached \$20 million as Holley put it, "The Irvine Company spared no expense to make this a premium piece," including \$160 million in public improvements.

Holley said one difficulty was coordinating all the tasks being performed simultaneously on the project against tight schedules. "Logistically it was a challenge because of all the activities that were being done at the same time, between the

mass grading, laying the pipeline and building the walls, staying on schedule was difficult. We worked six days a week, 12 hours a day in order to meet schedules," said Holley, although he added that it is more cost effective to install drainage during grading. "This is definitely a cost-saving device builders should consider. It just makes sense," said Holley.

He said that builders considering developing hillside properties also need to realize that the amount of remedial grading can often be "substantial, almost as much as the mass excavation."

Utilizing design software also allowed developers to build more efficiently on the available land of the Newport Coast. Proprietary software developed by TRG Land, Inc. was used extensively in planning the Newport Coast community. This software used for the planned community helped align lots to major views, vantage points and other foci on the site analysis map to ensure the project took optimum advantage of each. This allowed the builders to maximize the number of premi-

um lots that could be sold at higher prices.

"It provided us with the ability to gain better overviews. There were a number of paradigms about what an adequate overview was. Historically at lower elevations, we felt a 30-foot split would be sufficient, but in this case, by making the slopes steeper, we determined we needed a 35-foot split to optimize the views and we discovered this through the computer model. It was very important to understand this. By optimizing views, location premiums of up to \$500,000 were realized. This technology also allowed for better planning and it's actually caused us to rethink other projects," said Norm Witt, vice president of land development for The Irvine Company.

Mark Rogers, principal with TRG Land, Inc., which specializes in hillside developments, explained the concept behind the technology. "Through computer simulation and program analysis, we can understand the relationship between the land's shape, foci and the product type. It's a process to determine how to



Great measures were taken to ensure some of the natural features on the Crystal Cove site were preserved like the Pelican Hill Golf Course and the natural slopes. The soil cement wall separating the golf course from the project is 55 feet tall, 8 feet wide and 1,000 feet long. *Photo courtesy of Sukut Construction.*

accomplish views, lot sizes and orientation," said Rogers. He added that the technology has wide-spread applications. "Expect to see it used on all types of projects, not just the ones that command the kind of property values coastal properties do," said Rogers. This technology can also help overcome severe engineering and geotechnical constraints such as steep topography and landslide terrain.

Roz Munroe, principal geologist with Leighton & Associates, added that great measures were taken to ensure some of the natural features on the Crystal Cove site were preserved.

"It was a difficult project, especially since we were trying to retain some of the existing features like the natural slopes and

the golf course (the Newport Coast community is located right next to the world renowned Pelican Hill Golf Course). We had to design the stability of the slopes and remedial grading work around these. And providing the support from the top, or higher than the bottom, requires an extreme amount of design analysis and careful planning," said Munroe.

Contour grading with topographic contours and re-vegetation was used to create natural looking slopes throughout Newport Coast, which Witt said was very important with this project.

"The home sites were carved out of the hillsides as opposed to a mass grading operation that would have created linear tiers," said Witt.

This helps decrease the impacts that are often a result of traditional grading and construction. This technique is usually more cost effective because it reduces the amount of site development needed, including clearing and installing drains, landscaping and embankment. There were two types of geogrids used for the Crystal Cove project, provided by Tensar and T.C. Mirafi. Both were made from the high-strength materials needed to provide long-term durability and protection against landslides. According to a report from *Civil Engineering*, "The internally reinforced slopes also perform more reliably than natural slopes of equivalent or flatter inclination. Properly secured geogrids provide long-term durability even if the slopes are neglected or abused."

A new method of grading hillsides, developed by Soil Retention Systems, was used to install the 60,000 feet of retaining walls on the Crystal Cove project. Soil Retention Systems has mechanized the installation of modular block walls with a grapple machine designed specifically for the company. The modular walls are used for inclinations up and over 45 degrees, providing greater access to build on, according to Bob Edwards, sales engineer, Soil Retention Systems. He said the system is four times faster than conventional methods and allows up to 800 to 2,000 square feet of construction per day.

"When special reinforced slopes are utilized on slope gradients greater than 1H:1V, a concrete modular facade must be used to protect the reinforced buttress fill from erosion. The system we use increases production rates since it is so much faster than other methods," said Edwards.

In addition to state-of-the-art technology, preliminary research and analysis is one of the reasons Holley believes the project was so successful, despite its challenges.

"The Irvine Company did their homework. They defined problems and developed solutions before any of the work was performed," said Holley. Especially with projects like Crystal Cove it's critical to determine the basic characteristics of drainage patterns, slope, soil conditions and any floodplains or wetlands to determine what is buildable and unbuildable, said Munroe. **BAD**

Christine Rombouts is the senior editor of Builder and Developer magazine. A former employee with the Los Angeles Times, she has nearly 10 years of experience in writing, editing, graphic design, photography and public relations.