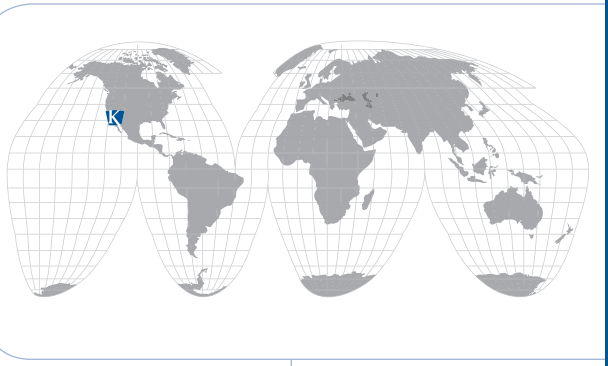
# Laguna Regional

## San Diego, California



Working around space constraints is a common challenge faced by retaining wall planners. Creative solutions are often required, and in the case of a Southern California project, a Keystone wall was the perfect solution for a sticky property line situation on a marginal building site.

Geogrid Retaining Wall Systems, Inc., the wall installer on the project, was faced with the prospects of building a wall bordering a state highway. On part of the 1,200 foot-long wall, normally positioned back cuts would have encroached onto the Cal Trans right-of-way. In order to allow construction on the site, part of the hillside needed to be temporarily supported with soil nails and shotcrete until a permanent Keystone wall could be assembled. In the area where the shotcrete was installed, the Keystone wall would act as a seamless wall facing, visually tying the two halves of the wall together.

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| **Project:** | *Laguna Regional* |
| **Location:** | *San Diego, California* |
| **Keystone Product:** | *Keystone Compac II Plantable Standard* |
| **Licensed Manufacturer:** | *RCP Block & Brick Lemon Grove, California* |
| **Total Wall Area:** | *16,058 square feet* |
| **Contractor/Installer:** | *Geogrid Retaining Wall Systems, Inc. Vista, California* |
| **Engineers:** | *Snipes-Dye Associates La Mesa, California* |
| **Soil Nailing Contractor:** | *Earth Support Systems Carlsbad, California* |

### *Making More Out of Tight Spaces*

"*This project had some very unique aspects which we had never faced before*," said Ed McCaffrey, Chief Operating Officer for Geogrid. "*The owner had requested that all three walls, consisting of over 16,000 square feet of Keystone units, be constructed in 61 days. The real problem was not so much the time constraints as the difficulty of accessing a 30-foot vertical cut to place the soil nails. The wall designed for the back of the property would not allow for the normal cutback required for the placement of the geogrid material used in segmental wall construction*."

To speed the process, it was determined that "sacrificial" nails be used for the soil nailing process. These nails were fitted with a sacrificial drill stem attached to the beginning of the nail. They were attached to a TEI rock drill that was mounted on a 55,000 pound-class excavator. The carbide tip on the nail was used to bore a hole slightly larger than the nail itself to a depth where pullout cannot be obtained. The whole assembly is then abandoned in the hole. In typical soil nailing, a drill stem is used to bore the hole and then removed. The completed soil nail is placed in the hole using centralizers. It was determined that this traditional method was going to take too much time. Also, it was suspected that traditional soil nailing would cause some caving when the drill rod was removed.

CASE STUDY

# CASE STUDY

### *Working Top to Bottom*

Due to poor slope stability, the soil nail and shotcrete wall was built from top down. Project contractors needed to construct a large ramp in front of the wall to access the upper 30 feet of the backcut.

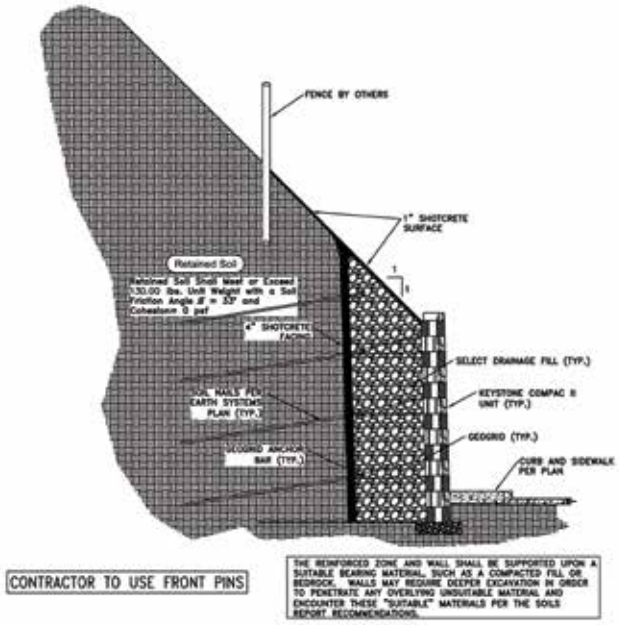
After those nails were placed, the sacrificial nail had to be sealed. Each boring was pressure grouted until all of the air was removed. This process ensured that the galvanized nail did not erode due to moisture contact. The slope face was then shotcreted to prevent erosion or slope failure. Next, the top half of the ramp was removed in order to access the middle portion of the slope and the soil nailing and shotcreting process was repeated.

After removing the last of the ramp, construction of the wall began. As the wall progressed, contractors followed a strict soil nail testing schedule. Using a 100-ton hydraulic jack, they tested every nail for a predetermined amount of design load (dtl) over a certain amount of time using a pressure gauge. For contractors, the danger of this testing is that if you have any nails that fail the pullout test, you must drill and sacrifice a new nail, grout it, and then let it set up before retesting. This delay shuts down wall construction while the new nail cures. Fortunately, this project experienced no failures.

### *Making the Connection*

Keystone segmental retaining walls are capable of making a very strong connection to soil or rock nails. Each nail had a threaded end that was wrapped to remain clean during the shotcreting process. That cover was then removed and a four-inch diameter galvanized hook was screwed on.

A four-inch galvanized pipe was then woven through the eyelets. After the eyelets were attached and the pipe woven through, it made a very uniform point of connection. The Keystone Compac wall was built using conventional methods with the exception of geogrid placement. The geogrid, was positioned over the fiberglass pins, then placed around the pipe and returned to the wall on the next course up. According to McCaffery, this process created a very structurally sound wall. In the end, Geogrid was able to beat the 61 days allowed to construct all three walls. "*I know the developer was blown away as we literally cut his construction time in half and we eliminated the excessive costs associated with excavation and crushing,*" said McCaffery.




"*In this case, the soil nailing was just a means to an end,*" said Daniel Bruffett of wall contractor Geogrid. "*The job called for a permanent solution that was also aesthetically pleasing – to me soil nails and shotcrete are neither. Keystone Compac units were perfect for the job, offering flexibility, strength and good looks.*"

Over 16,000 square feet of Keystone Compac II units, produced by Keystone supplier RCP Block & Brick, were used on the project. The wall reached 27 feet at its highest point.

Keystone Compac offers outstanding structural performance in a lightweight, space-saving design – perfect for tighter radius curves and corners.

For more information on Keystone Compac units, plantable Standard units or the other innovative Keystone products, please visit www.keystonewalls.com or call (800) 747-8971.



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