



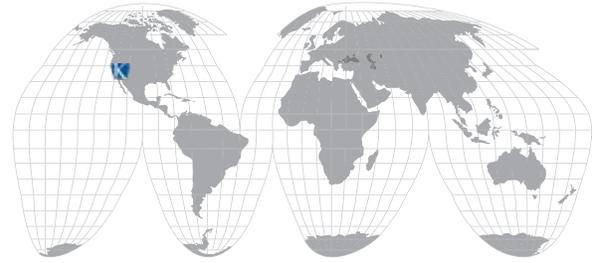
Auto Park Way Escondido, California

When the new regional medical center was built, and traffic increased along Auto Park Way, the city of Escondido, CA knew it was time to widen the road. As a major arterial street connecting State Highway 78 to Interstate 15, the heavily travelled road needed to remain open during construction. Associate Civil Engineer for the City of Escondido, Samuel Cottrell, P.E., took on the challenge of designing the project. In the end, not only would Cottrell's design dramatically widen the road, but a 20 foot tall, 600 foot long Keystone retaining wall would be built to hold back the area's rocky soil.

City engineers met with local businesses and property owners before construction began. These meetings and conversations shaped the project parameters that would allow traffic to flow and businesses to remain open during eight months of construction.

Nailing Down the Solution

Cottrell knew the soil conditions in the area would make the retaining wall construction a challenge. As a result, his design would call for the wall to be built from the ground up, but the excavation and embankment stabilization would take place from the top down. *"That was probably the biggest challenge we faced in the wall construction. It's different. The superintendent had never built a wall that way,"* said Cottrell.



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| Project: | <i>Auto Park Way</i> |
| Location: | <i>Escondido, California</i> |
| Owner: | <i>City of Escondido</i> |
| Keystone Product: | <i>Keystone Standard</i> |
| Licensed Manufacturer: | <i>RCP Block & Brick, Lemon Grove, CA</i> |
| Total Wall Area: | <i>17,840 square feet</i> |
| Wall Contractor: | <i>Southland Paving, Inc.</i> |
| Soil Nail Contractor: | <i>Edick & Watt</i> |
| Civil Engineers: | <i>City of Escondido</i> |
| Geotechnical Engineer: | <i>Ninyo & Moore</i> |



CASE STUDY



CASE STUDY

Before excavation began, Cottrell called in Ninyo & Moore, a southern California geotechnical engineering firm to evaluate the soil conditions. "I was dealing with soil material that was rock," said Cottrell. "Ninyo & Moore confirmed that we'd need to use soil nails to stabilize the embankment and support the retaining wall units." Edick and Watt, a general engineering contractor specializing in drilling and blasting rock for construction projects, installed and grouted soil nails into the 20-foot high embankment at 4-foot on center horizontally and vertically. The soil nails were put through rigorous testing to ensure their stability, and the future stability of the wall. Creep tests and pull tests were performed on ten percent of all installed nails. Cottrell set the specifications for each test. For creep tests, the total movement was not to exceed 1mm between one and ten minutes. Movements more than 1 mm were deemed unacceptable. The pull tests required the same load used in the creep tests to be held for an additional 50 minutes. If the soil nail moved less than 2mm between six and 60 minutes, the soil nail passed.

Finally, filter fabric was placed over the exposed soil before 1-foot steel plates (designed by Cottrell) and 3-inch galvanized pipes were bolted to the soil nails. As excavation began, the combination of the plates, fabric and pipe held the vertical soil embankment in place.

Pins Make the Difference

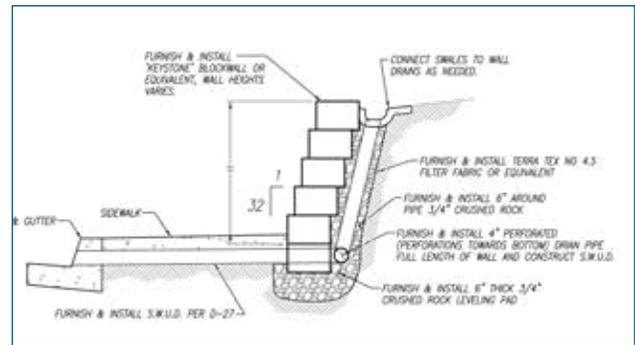
Keystone Standard retaining wall units were specifically selected by Cottrell for the wall. Supplied by Keystone producer RCP Block & Brick, the Standard unit offered many structural and aesthetic advantages that made it ideal for the project.

Structurally, Keystone's patented fiberglass pin technology aided wall construction in two ways. Firstly, because space constraints were critical to the project, the ability to have the wall in a near vertical condition allowed Cottrell to save horizontal distance for other project aspects. With a near vertical wall, less excavation was needed, thus reducing construction time and the overall impact felt to nearby property owners and businesses. Secondly, the pins allowed for a quick and easy, yet structurally sound connection, between the Standard units and the soil nail anchor system. According to Cottrell, the pins differentiated the Keystone Standard units from other wall systems by their ability to secure the geogrid. "The combination of the Keystone Standard units and the soil nails was very important to the integrity of the wall."

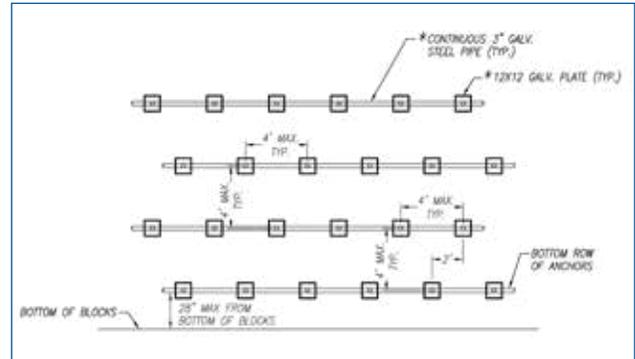
Along with structural durability, Keystone Standard units provided the aesthetic appeal Cottrell was looking for at a price that, ultimately, helped the job come in under budget. Escondido based Southland Paving, Inc. installed roughly 17,840 total square feet of natural grey



Installing Keystone retaining wall in front of soil nail wall.



Retaining Wall Section



Typical Anchor Pattern - Scale = 1" to 5'

and sandstone colored, which complemented the surrounding area and prevented the wall from becoming an eyesore. "I really considered how the wall would contrast with the area around it," said Cottrell. "It turned out really well!"

The Open Road

As construction neared completion, Cottrell heeded recommendations from the State of California when it came time to backfill the wall. While it is the nature of segmental retaining walls to help control and prevent erosion, within the last five years, California has asked that the amount of water runoff from new projects either be reduced, or retained on site, in an effort to address erosion. Cottrell's plans called for the wall to be backfilled with gravel as a way to increase water mitigation for runoff. Vegetation was also planted along the wall and roadway to help filter water and reduce runoff into nearby creeks.

When the project was completed, Auto Park Way was widened to support four traffic lanes, a bike lane and on-street parking on both sides of the road. An additional driveway was built to add access to an adjacent commercial property. "I never expected it to look so nice. I've used Keystone products on other projects; it adds a nice, finished touch," said Cottrell.

Keystone's Standard unit started the segmental retaining wall industry and it remains the industry's product of choice for tall walls and critical structures. Keystone Standard unit provides outstanding product integrity and ease of installation; proven performance for long lasting structures.

For more information on the Keystone Standard unit or other innovative Keystone products, please visit www.keystonewalls.com or call 800-747-8971.