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## A Dynamic Solution

Like the rest of Southern California, San Diego County has a number of active earthquake faults. In recent years there have been several earthquakes recorded within the Rose Canyon Fault Zone as it passes beneath the city. And when designing retaining walls in this seismic region, an additional dynamic load must be considered. Yet knowing this, it did not stop the construction of one of the tallest segmental retaining walls in the United States.

The San Diego Jewish Academy's Carmel Valley Campus was in need of new facilities with their current rented spaces overcrowded and outdated. The 40 acre site, adjacent to Interstate 5 in Northern San Diego County, was just what the Academy was looking for. This hillside lot could have easily been overlooked, but Allan Block retaining walls with heights reaching 50 ft (15.2 m) enabled a beautiful, functional, and fast paced project to be completed.

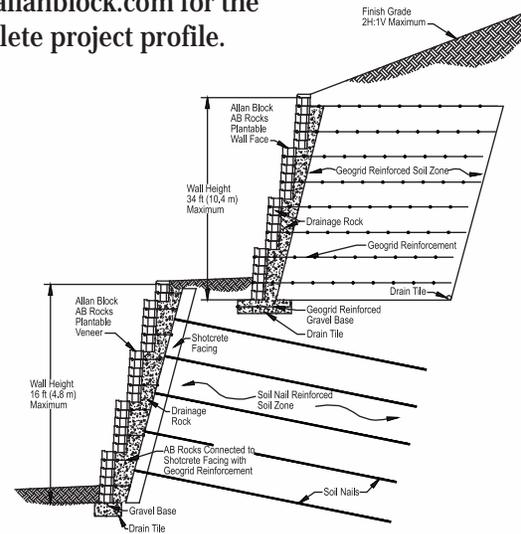


The south walls were cut walls with maximum heights of 50 ft (15.2 m) and the north walls were fill walls with maximum heights of 25 ft (7.6 m). Obviously, the design of the retaining walls required involvement from all engineering parties contracted for the project. There were many design factors that

were considered including height, soil conditions, slopes, surcharges and, of course, seismic loading.

With minor seismic events happening daily throughout Southern California and even a 5.2 magnitude on the Richter scale happening in June of 2004, the walls have stood these seismic tests for more than 10 years – once again proving that Allan Block is a viable site solution for your project.

Visit [allanblock.com](http://allanblock.com) for the complete project profile.



**Manufacturer:**

Orco Block, Riverside, CA

**Project Name and Location**

Jewish Academy, San Diego, CA

**Product Used and Size:**

AB Rocks from the AB® Collection

70,000 ft<sup>2</sup> with a maximum height of 50 ft (15.2 m)



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Allan Block has adopted similar methodology changes into our AB Walls 10 design software and the details of the methodology are clearly defined in our Allan Block Engineering Manual.

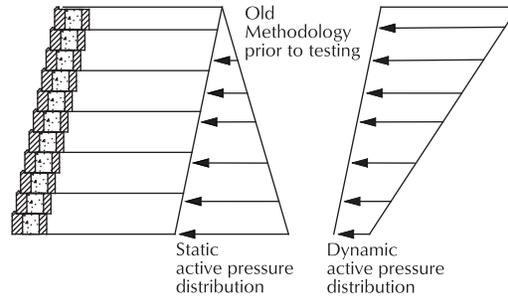
***Did you know?***

*Since 2000 there have been over 123,000 earthquakes over magnitude 4.0 throughout the world; over 4550 of these earthquakes were in the United States.*

\*For a more in depth discussion and copies of all references, see the "Seismic Loads and Segmental Retaining Walls" Tech sheet at allanblock.com

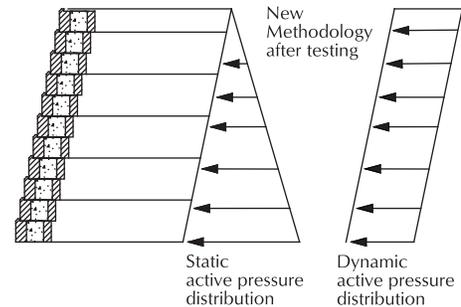
# Seismic Loads and SRW's

The Segmental Retaining Wall (SRW) industry has evolved significantly over the last three decades, which is a given considering the industry did not exist 30 years ago. The SRW design evolution has been most dramatic relative to the incorporation of loads from seismic events. These changes were not precipitated as a result of poor performance. On the contrary, design professionals saw exceptional performance on soil reinforced segmental retaining walls and reinforced slopes when they were exposed to seismic loading.\* The first published seismic design methodology came from the NCMA (SRW Seismic Design Manual, 1st Edition, 1998). It suggested that the seismic loading be applied to the wall in



the form of an inverted triangle, which focused most the load at the top of the wall. This greatly exaggerated the seismic forces when a slope was present above the wall. The Federal Highway Administration (FHWA) came along with a variation that also looked at the location of geogrid layers, which actually penalized the designer for concentrating grid layers near the top of the wall.

In 2004, a series of full-scale seismic tests were conducted by Prof. Hoe Ling (Columbia University) and Prof. Dov Leshchinsky (University of Delaware) as the principal investigators in cooperation with Columbia University, Allan Block Corp. and Huesker Inc.\* These full-scale tests not only demonstrate the superior performance of SRW's under dynamic loading of 0.80 g horizontal and simultaneously 0.40 g vertical, but also helped to lead the way to a series of methodology changes across the industry. During the full-scale testing, it was clear that actual load distribution was not focused at the top of the wall as defined in the NCMA design manual nor was it dependant on where the reinforcement was placed as presented by the FHWA. Rather in each of the test structures, the additional load manifested itself in the form of a rectangular pressure distribution similar to what is applied from surcharges above the structure. These findings triggered changes within the NCMA and FHWA methodologies resulting in new rectangular seismic pressure distributions for both, NCMA, 3rd Edition and the FHWA-NHI manual both published in the fall of 2009.



### Translating what was learned in the testing to practical uses in the field

It was determined that the optimum configuration for a reinforced soil structure included lighter weight geogrids combined with a maximum grid spacing of 16 inches (400 mm) as opposed to stronger grids at greater spacings. The tests also illustrated that minimum grid lengths of sixty percent (60%) of the height of the wall were adequate, but extending the top grid length to ninety percent (90%) of the height of the wall provided a bridge between the reinforced soil mass and the retained soil. This greatly reduced the soil cracking that occurred behind the reinforced mass when the grids were all truncated to the same length.

Visit allanblock.com for more information.



# Allan Block Technical Newsletter - 2nd Qtr 2010

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Jewish Academy, San Diego, CA

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Visit [allanblock.com](http://allanblock.com) for more information.

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