TENCATE Mirafi®

REINFORCEMENT

Case Study

application	Retaining Wall (Seismic Design w/ high liquefaction potential)	job owner	Washington DOT
location	Seattle, WA	engineer	Shannon ad Wilson / WSDOT
product	Miragrid® 5XT, 10XT, Mirafi® 140N	date of installation	2011 - 2012

TenCate develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

THE CHALLENGE

The State Route 99 Alaskan Way Viaduct carries thousands of automobiles and commercial vehicles to and from downtown Seattle, to two major stadiums and to the Port of Seattle each day. The viaduct's increasing age and vulnerability is apparent by crumbling concrete, exposed rebar, weakening column connections and deteriorating railings. In the Fall of 2011, the Washington Department of Transportation demolished the viaduct's south end section and replaced it with the first of two new side-by-side bridges.

The section of the viaduct between South Holgate and South King street was found to be built with columns founded on unstable soils that could liquefy during a seismic event. This south section of the viaduct was vulnerable to settlement that could occur during a seismic event and needed replacement. Replacing of the aging elevated freeway span required construction of several grade separation ramps at the south end of the project. The existing site soils are all fill materials and are affected by the daily flood tides of Puget Sound. Construction of typical MSE or Cast in Place (CIP) walls was not acceptable, because of their high surcharge to the underlying soils. Single stage MSE and the CIP walls would not be able to allow for the differential settlement that would occur as the soil load was placed on the subgrade.

THE DESIGN

WSDOT engineers designed ramp sections, called "SW-2", that incorporated MSE walls as high as 30'. These utilized a combination of wrapped geosynthetic and GeoFoam walls, to solve the problem of differential settlement and potential liquefaction of soils below the new ramps. The lower portions of the walls were designed with the typical WSDOT wrapped face wall design that incorporated geosynthetic reinforcement, while the upper portions of the walls needed to be designed with a lightweight fill alternative, called GeoFoam. The design utilized TenCate Miragrid® 3XT and 5XT for the lower 11-feet and GeoFoam for the upper portion of the walls.

This unique wall design allowed the contractor, Skanska U.S.A. , to stage their construction by building a temporary wall as shoring to hold the southbound detour, while the permanent southbound lanes were constructed immediately adjacent to it.

Beginning of wall construction using Miragrid® geogrid for reinforcement and face wrap.

Wood forms are used to achieve compaction at the face of the wrapped face wall.

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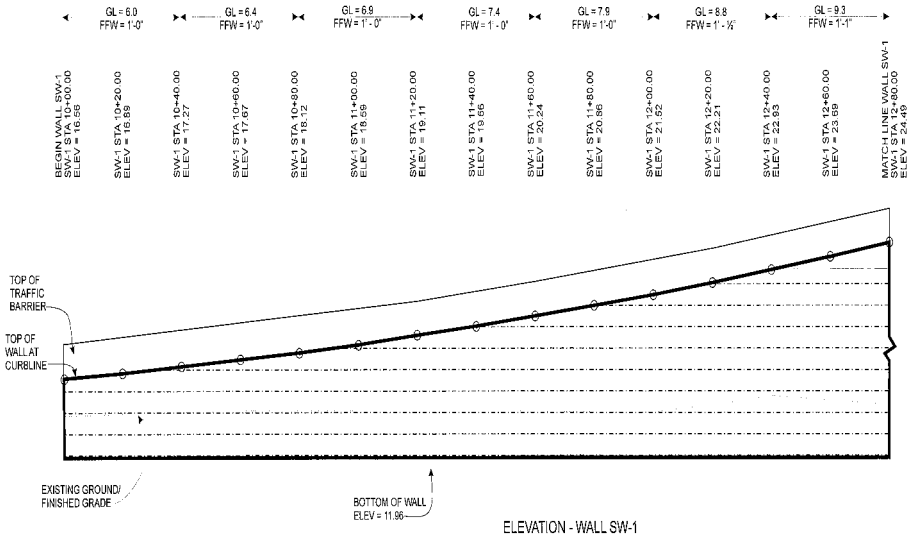
THE PERFORMANCE

In Fall 2012, construction crews completed the second bridge, finishing the project one year ahead of schedule. The east bridge carries northbound SR 99 traffic with southbound traffic remaining on the west bridge. The new bridges provide drivers with three lanes in each direction. A temporary construction bypass connects the new roadway to the remaining viaduct along the downtown waterfront. The bypass will remain in effect until the SR 99 tunnel opens in late 2015.

Skanska completed the permanent west wall SW-2 and the temporary shoring wall SW-2b in April of 2011. After analyzing the settlement and the costs of the walls, both WSDOT and Skanska chose to redesign the remaining permanent east wall SW-1. SW-1 had originally been designed as a 100% geofoam fill structure, but it was successfully converted into the same design as SW-2 that incorporated Miragrid® geogrid and GeoFoam. This design change replaced the expensive foam fill with Miragrid® geogrid in the lower 11' of the wall structure, saving a significant amount of money for an already cash strapped project. All of this was done while speeding up construction to achieve an earlier finish date.

Completed seismic wall prior to placement of the concrete panels.

Finished wall with concrete panels attached to the fence.



ELEVATION - WALL SW-1

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