Project Showcase

From the 2006 International Achievement Awards for Geosynthetic Projects

All photos courtesy of TenCate Geosynthetics

| The lower one-third portion of the massive retaining wall for the Interstate 5/805 bypass lanes is seen here. The wall was built last fall.

Five-year CalTrans freeway project is nearing completion in San Diego

Introduction

In an effort to reduce traffic congestion and improve safety conditions in northern San Diego, the California Department of Transportation (CalTrans) is adding lanes and creating a truck bypass at the Interstate 5/805 junction. A unique portion of this project is the construction of a plantable, geosynthetic-reinforced retaining wall that transforms a simple slope into a vertical face that supports additional lanes of the reconstructed freeway.

A two-phased building system allows the attachment of a massive retaining wall, with layers of engineered fill wrapped with high-strength, woven geogrid, to a concrete facing system that protects the exposed geosynthetic while a polypropylene geotextile holds loose plantable topsoil to facilitate vegetative growth.

| Information provided from the IAA competition entry forms; Ron Bygness, editor of *Geosynthetics*, also contributed to this article.

| A quarter-mile stretch of geogrid reinforcement awaits final inspection from CalTrans officials before it is covered with compacted fill.

'The Merge'

There were days when traffic on the Interstate 5/805 junction in Sorrento Valley north of San Diego was backed up for literally hours. CalTrans estimated that more than 261,000 vehicles passed through this mother of all bottlenecks—known locally as "The Merge"—every weekday.

That is why a $190 million road-improvement project—the most expensive ever in San Diego County—has been in progress for five years and will be completed this year. At it widest point, the reconfigured freeway will consist of an unheard-of, football field-wide 23 lanes: seven conventional lanes and four bypass lanes in each direction, plus a northbound carpool lane.

The Merge is one of the busiest Interstate segments in the country, and it serves as the major entryway into San Diego from the northern part of the county as well as Orange County and Los Angeles. Reconstruction on the roadway began in 2002. By 2005, new northbound lanes opened. The new southbound lanes will open this year.

Traffic on The Merge doubled in the past 15 years. And CalTrans estimates say it will double again in about another 10 years—a total of more than half a million vehicles on average each weekday.

Building the wall

To support these new lanes of traffic, CalTrans engineers designed a huge geosynthetic-wrapped retaining wall with a massive concrete basket system at its face. This two-part method allows the construction of a retaining wall, with layers of engineered fill and high-strength, woven geogrid attached to a concrete facing system that protects the geosynthetic exposed at the face and holds loose plantable topsoil to facilitate vegetative growth.

The concrete facing portion of the wall has tiers of headers that extend into the geosynthetically reinforced backfill and stretchers that extend between headers to form the front face of the wall. These stretchers, with the help of nonwoven geotextile-bridged gaps between the stretchers, hold in loose topsoil so that vegetation will grow easily at the face of the wall.

The tremendous soil forces generated behind the concrete tiers are sustained by layers of geogrids that extend up behind the stretchers and then back into the backfill. The end result is a massive, near-vertical retaining wall more than 65 ft. high that will be completely vegetated.

Geosynthetics

CalTrans required extensive laboratory testing of the geosynthetic materials before they could be approved for use in this project. Aggressive installation damage testing was performed to demonstrate their resistance to damage when exposed to sharp angular rock under heavy loads.

Creep testing (how much a geosynthetic will stretch under a century of sustained loading) was also performed on all the geosynthetic materials required to hold soil loads in the foundation and the retaining wall. The geosynthetics chosen for use on this project were manufactured out of high-tenacity polyester that demonstrated high creep resistance and long-term durability.

The construction of this 65-ft.-high structure proved problematic from several sources. CalTrans set stringent requirements for the geosynthetic-wrapped facing of the wall. It also required high compaction of the fill, even adjacent to the geosynthetic-wrapped face, to limit any differential settlement that may point load sections of the concrete stretchers.

Further, the geogrid was cut to fit around each concrete header. The contractor had to develop a system to keep the geosynthetic-wrapped face square, achieve proper compaction adjacent to the geosynthetic face, and keep the geosynthetic extremely tight and in place during the entire process.

Maintaining high soil compaction within the geosynthetic-wrapped sections proved particularly challenging on this project. The contractor developed a set of wood forms that held the geosynthetic square and in place while compacting the fill adjacent to the geosynthetic face. Only hand-held compaction equipment would fit between the headers, which slowed production significantly and made achieving compaction even more difficult.

| Fill is placed over the geogrid reinforcement.

Once the compaction was completed, the wood forms were removed to reveal a densely compacted geosynthetic-lined face that was completely square and almost hard as stone that was then subject to approval by on-site CalTrans personnel. This tedious process of wrapping fabric between the headers was repeated in 5-in.(0.13m) vertical increments in the lower section of the wall and increased to as much as 19-in.(0.5m) vertical increments at the top of the wall.

CalTrans officials approved each compacted, geogrid-wrapped section.

Completion

The foundation of the plantable geosynthetics-reinforced retaining wall also used geosynthetic reinforcement. Two layers of geogrid were placed within a gravel blanket to form a reinforced foundation mattress (geosynthetics helped keep the gravel from spreading laterally while under load) to support the retaining wall structure with minimal differential settlement. The entire blanket was wrapped in geotextile.

When all the dust settled, approximately 1 million yds.^{2} of geosynthetics were used to construct this project. The total wall face is more than 200,000 ft.^{2} (18,581m^2) with heights of up to more than 65 ft. (21m) and a length of more than 3,000 ft. (938m). The project consumed a total of more than 815,000 yds.^{2} (681,422m^2) of geogrid products.

Project Highlights

Owner: California Department of Transportation
Location: Interstates 5/805 junction, San Diego County, Calif.
Project duration: 2002–2007
Manufacturing: TenCate Geosynthetics
Geogrid: Mirafi Miragrid 10XT, 7XT, 5XT, 3XT
Nonwoven geotextile: Mirafi 140NC

Editor's Note:
The Industrial Fabrics Association International (IFAI) invites entries for its 2007 International Achievement Awards competition. For more information about the IAAs, contact Christine Malmgren, +1 651 225 6926, cmmalmgren@ifai.com.

| Concrete stretchers, lined with filter geofabric, contain loose topsoil for growth of vegetation at the face of the retaining wall.

Copyright © 2007 *Geosynthetics* Magazine. Reprinted with permission of IFAI.