

## Case Study

application	Subgrade Improvement
location	Mason County, WA
product	Miragrid® 24XT

job owner	State of Washington
engineer	WSDOT
contractor	Quigg Brothers Construction

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 Purdy Creek Bridge is located in Mason County, WA and is used to allow traffic along the US 101 to cross over the Skokomish River Valley. Unfortunately, the bridge span elevation was built too low and flood waters easily crest over the bridge during large storm events. The flood waters overtopping the bridge create dangerous conditions for drivers and have forced frequent closures of the US 101.

The lower Skokomish River basin has been the subject of numerous studies undertaken by Mason County, Tacoma City Light, Federal Emergency Management Agency (FEMA), United States Geologic Survey, the Skokomish Indian Tribe, and the US Army Corps of Engineers. These studies recommend several improvements throughout the Skokomish River Valley. One of the most important recommended improvements was reconstructing Purdy Creek Bridge with a higher elevation span that allows water to pass under the bridge even during the highest flood water levels.

The 2004 State Legislature tasked WSDOT to construct a raised US 101 roadway and replacement bridge that would allow floodwaters to freely pass under the bridge and allow the highway to remain open to traffic during these severe flood events.

### THE DESIGN

Design and public involvement began in early 2005. Constructing a new bridge in this area was no small task. The soils in the area of the Purdy Creek Bridge were very saturated and susceptible to liquefaction. Engineers had to

find a way to support the new approaches, while controlling possible differential settlement, and liquefaction of the underlying subgrade soils.

The design engineers had to consider extremely high soil loading conditions combined with very high factors of safety that result from a bridge design of this nature. Design engineers began to look at ways to reinforce the subgrade soils using high strength geosynthetics. Eventually, design engineers chose Miragrid® 24XT (one of the strongest geogrids made in the US) to reinforce the subgrade. Miragrid® 24XT has an Ultimate Tensile Strength of 370.3-KN/M with a Long-Term Design load of 202.9-

KN/M and was more than enough strength to build a stable platform for the bridge approaches. The engineers decided to use a multi-layer approach placing Miragrid® 24XT approximately every 0.5-meters until the subgrade was stable. It took 4 layers to complete this task. The geogrid was placed parallel with the roadway to a length of 30.48-meters.

### THE CONSTRUCTION

Construction started in July of 2008 and bridge construction is on schedule to be complete in late 2009. This project replaces the existing timber-trestle bridge with a new concrete structure supported on a geogrid mattress.



Crushed rock placed directly on Miragrid® 24XT over saturated finegrained soils.



Placement of Miragrid® 24XT with 0.3-meter overlap and zip ties every 1-meter.

The new bridge will have a higher and longer span than the existing bridge, greatly limiting the risk of closure due to flooding or high water. The contractor began placing Miragrid® 24XT in the early spring of 2009. The contractor cut the Miragrid® 24XT into 30.5-meter long segments and placed each layer perpendicular to the bridge abutment wall. Crushed rock was then placed directly on the Miragrid® 24XT and compacted to create a stable platform for bridge load support. The contractor decided to use zip-ties and a 0.3 meter overlap to hold the grid together during crushed rock placement. The contractor completed the geogrid placement on the south approach and then repeated the same procedure of geogrid placement on the northern approach.

#### THE PERFORMANCE

The portion of US 101 over Purdy Creek has had numerous closures due to floodwaters flowing over the roadway and subsequent repairs due to pavement washouts and bridge scour related damages when creek flows wash away the soil around the bridge footings. The new bridge and roadway are designed to stop flooding of US 101, improving safety for the traveling public while eliminating traffic delays during storm surges. The new bridge is designed to provide more than 50 years of service, unlike the previous timber trestle bridge that needed to be repaired/maintained regularly. More than \$15,000,000 was spent on construction and design of this project.

The largest concern was to reduce the risk of catastrophic bridge failure during high water flooding events. Miragrid® 24XT played a crucial role in strengthening the subgrade and creating the stable platform for the bridge approaches.



Fourth lift of Miragrid® 24XT, which provided a stable platform for constructing the southern bridge approach.



Completed bridge approach from the south.



Completed bridge approach from the north.

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