

application

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Subgrade Stabilization

Rice County, Minnesota

Geolon® HP770PET

THE CHALLENGE

The widening of C.S.A.H. 2 in Rice County, MN required the widening of a 7.32m (24ft) wide 2-lane paved road. The widening would take the road crest from 7.32m (24ft) to 12.8m (42 ft) in width and expand the side slopes from 2H:1V to 4H:1V. The roadway crosses 2 swamp areas, one being 213.4m (700ft) and the second being 182.9m (600ft). The present 2-lane road was constructed in 1966; at that time the swamp areas were only partially excavated to a depth of 3m (10ft) and then backfilled with clay.

A subsurface exploration in the two swamp areas identified the peat extended to depths of 13.7m (45ft) below the existing pavement surface.

THE DESIGN

Though the peat beneath the roadway core was compressed under

the weight of the clay fill, the peat that exists outside of the present roadway has a stable crust but is underlain by soft peat. A fill placement over this soil would cause mudwaving of the peat during construction. The engineer chose a high strength geotextile reinforcement plan that included seaming the panels together to maintain continuity, and then a stage loading and surcharge procedure. In order to achieve the necessary factor of safety for side slope stability, the designer specified Geolon® HP770PET.

CONSTRUCTION

The Geolon® HP770PET was cut to length in panels by ParTek Supply, delivered to the project site and then placed with the machine direction of the textile perpendicular to the centerline of the road. The high machine direction strength of the geotextile maintains the integrity of the embankment during construc-

tion. The panels needed to be sewn together to maintain continuity, which is one of the reasons that the engineer excluded geogrid from the specification. Overlapping would allow for the possibility for mud to move up between the panels of material. The engineer required 100% coverage be maintained during the filling operations; seaming was the only way to satisfy this requirement.

A bonded polyester thread (207 Denier) from Alliance Thread Supply was used. Trials were performed in order to determine what type of seam would result in what strengths. Two rows of stitching creating a Prayer seams with stitches installed

JOB OWNER:

Rice County, MNDOT

ENGINEER:

Gale-Tec, Engineering, Inc.

CONTRACTOR:

**ParTek Supply, Inc. &
Southern Minnesota
Contracting, Inc.**



Due to the soft, peat subsurface, Geolon® HP770PET was required to complete the road widening project.



Overlapping the fabric would allow the mud to move up between the panels. Seaming was required to maintain 100% coverage.

at a rate of 4.5 stitches per inch resulted in a seam strength of 24.96 kN/m (141 lbs/in) (ASTM D4884). A J-seam was also tested. Two rows of stitching with 5.5 stitches/in resulted in a seam strength of 28.9 kN/m (165 lbs/in). As a result of the testing, the Prayer seam, which is the simpler seam to create in the field, was selected. The geotextile was sewn with a 2-thread double locked stitch for security of the stitch and seam strength and quality. Two rows of stitching were created with the seams being 0.5 in apart. The stitches per inch setting on the machine was set at 4.5 stitches/inch based on the testing. Too few stitches per inch and the sewn seam may not be strong enough. Too many stitches per inch and the needle penetrations may weaken the fabric, resulting in a “zippering” or “tear along the dotted line” effect. Approximately 5.5 m (6 yds) of thread was used for each yard of geotextile sewn.

The roadway surface and aggregate base was removed. The geotextile was deployed and sewn as a continuous piece over the road and into the swamp areas on both sides of the road. Granular fill soils were then pushed in shallow lifts out over the geotextile.

PERFORMANCE

The raise in grade of 3 m (10 ft) was instituted over a 4-month time period, in order to allow excess pore pressures to dissipate within the peat. The high strength geotextile mobilized its strength while the seams maintained the integrity of the fill over the swamp soils.



A prayer seam was used to stitch the panels of Geolon® HP770PET.



After the Geolon® HP770PET panels were seamed together, 3m (10ft) of fill soil was installed and left for 4 months to compact the excess pore pressure of the peat.

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Sludge Lagoon Cover

Iron Mountain, Michigan

Geolon® HP665

THE CHALLENGE

Niagara Paper Company was required to close a series of 200 ft. wide by 1000 ft. long primary sludge lagoons by the local regulatory agency. The closure was required to comply with environmental regulations. The sludge derived from a pulp and paper mill operation, and was so soft that one could not walk over it. The closure was to consist of a high-strength geotextile or geogrid, granular fill, a 20-mil PVC liner and then a final cover.

THE DESIGN

A high-strength geotextile and a geogrid test fill, placed back to back, was ordered by the company. The company contacted Mirafi® Construction Products to implement the geotextile test fill cap. The purpose for the test fills was to visually identify which product would work

the best.

Mirafi® Construction Products chose a special "biaxial" geotextile developed for sludge caps, Geolon® HP 665. A "biaxial" geogrid commonly used for road base course reinforcement was also tested. *Biaxial* refers to near equal strength in both the machine and cross machine roll dimensions.

CONSTRUCTION

Geolon® HP665 was sewn together in a panel 45 ft. wide by the width of the sludge lagoon (approximately 200 ft.). The prayer seam consisted of two rows of stitching made with a Union Special 2200 B sewing machine. A Terrysyn bonded polyester thread was used in both the needle and the looper. The geogrid was overlapped 3 feet at each panel location.

The geogrid and geotextile preformed "equally" as long as the ground was

stable and no deformation occurred during granular soil filling. When ground deformation did occur, two performance differences were observed:

1. The geotextile, as a result of its ability to be sewn together, acted more like a snowshoe, spreading the load out, while the geogrid simply sunk into the sludge.
2. The geotextile prevented sludge from flowing up and, contaminating the fill while the geogrid allowed the contaminated mud to come up through the geogrid into the overlying fill.

When ground displacement did occur (approximately 2 ft. mud wave) the geotextile's modulus (stress-strain

JOB OWNER:

Niagara Paper Company

ENGINEER:

**Gale-Tec Engineering, Inc
RMT, Inc**

CONTRACTOR:

Bacco Construction



Geolon® HP665 prevented sludge from flowing up through the geotextile, the geogrid did allow the contaminated mud to soak through into the overlying fill.



When ground displacement did occur, the geotextile stretched with the deformation of the sludge and split apart.

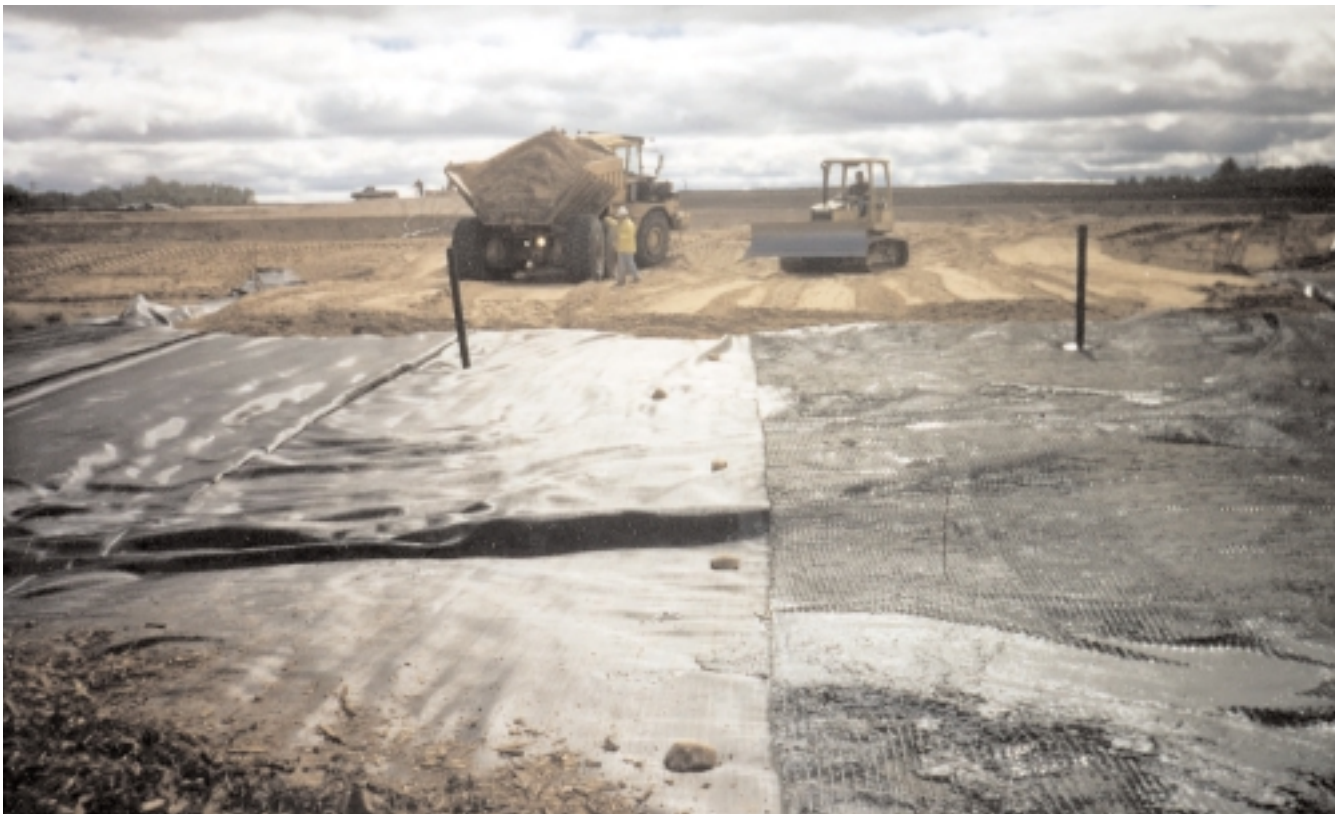
property) was such that the geotextile stretched with the deformation of the sludge resulting in a tensioned membrane effect. The stiffness of the geogrid caused it to kink and split apart, an unacceptable performance result.

PERFORMANCE

The conclusion of the test fill study was that the Geolon® HP665 developed working loads at a more appropriate strain for this sludge cap than the geogrid. Geolon® HP665 provided uniform load distribution while the grid kinked and split apart. Geolon® HP665 prevented the movement of the contaminated sludge up into the free-draining granular fill which was to serve as a gas venting layer while the geogrid could not stop mud flow.



When ground displacement did occur, the geotextile stretched with the deformation of the sludge in a tensioned membrane effect.



The Geolon® HP665 provides for uniform load distribution, prevents movement of the contaminated sludge into the granular fill, and has more appropriate strain for this sludge cap than the geogrid. The geogrid could not stop mud flow.

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