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Combating the Railroad's Soil Stabilisation Challenges

When railroads encounter soft or unstable soils, operations can come to a halt, leading to costly downtime.

Soft, saturated subgrade under the track causes speed reduction and,

in severe cases, even derailment. Right-of-way embankment soils that become saturated after storm events often cause washouts or slides, impacting safety and operations. In this article, the GEOWEB® 3D Soil Confinement System is presented as an effective and reliable solution for addressing

some of the common geotechnical challenges faced by the rail industry.

Soil Stabilisation for Soft Soils & High-Impact Areas

The GEOWEB® 3D Soil Confinement System (Geocells) has been

successfully used by the railroad industry for over 40 years, helping to solve challenging soil stabilisation problems for both new construction as well as railroad repair work. It is a proven and versatile ground improvement solution that is beneficial in soft soil environments and high-impact areas subjected to heavy stresses such as bridge approaches and crossings.

In load support applications, whereas conventional rolled geosynthetic products provide reinforcement only along a two-dimensional plane, the GEOWEB system is a three-dimensional geosynthetic that allows for the effective transfer of lateral earth pressures developed beneath applied loads to an interconnected network of honeycomb-like cells. As a result, stresses are reduced and distributed over a wider area through a phenomenon known as the mattress effect. The mattress effect reduces stress reaching the sub-grade, and therefore can mitigate the negative effects of deflection and settlement. For railroad applications, some of the key benefits of the GEOWEB 3D system are identified below.

Key Benefits:

- The 3D soil confinement technology creates a high-stiffness foundation under the track that reduces vertical stresses, allowing for a reduction of the sub-ballast section of up to 50%
- The GEOWEB System’s confinement reduces ballast compression and displacement leading to a more stable track surface requiring less maintenance
- The GEOWEB System limits upward movement of ballast particles and significantly increases the stability of the track
- The system is quick to deploy and install, limiting track downtime

Table 1: GEOWEB Geocell Advantages for High-Impact Areas

High-Impact Area	Challenge	GEOWEB Geocell Advantage
At-Grade Crossings	Prone to stresses from aggressive rail loads and high-volume traffic	Dissipates stresses to control settlement and reduce maintenance/repair costs
Road Crossings	Excessive braking and acceleration forces transferred through the crossing to the subgrade	Dissipates forces from traffic and rail while delivering a floating platform that absorbs the braking and acceleration forces
Bridge Abutments	High-impact loadings and settlement	Dissipates stresses to control settlement and reduce maintenance/repair costs
Railroad Scales	Scales require a very stable subgrade for accurate measurement	Strengthens scale areas with the GEOWEB 3D system for extra stability and accuracy, especially over soft subgrades

Moreover, as summarised in Table 1, the GEOWEB 3D Soil Confinement System can be used to improve high-impact areas that may be susceptible to settlement and long-term stability issues.

Project Highlight: Florida East Coast Railroad, Subgrade Reinforcement for High-Impact Bridge Abutment

On a Florida East Coast project, the GEOWEB 3D system was applied at a bridge abutment and through the grade crossing – both high-

maintenance areas due to soft soils and frequent, heavy truck loadings.

The end result is a more durable subgrade that increases railway life by preventing long-term settlement and consolidation. The ability to quickly install the GEOWEB panels and limit the track downtime was critical in maintaining operations.

Project Manager’s View:

“Estimated time to install the GEOWEB system was minimal. Since the location was pumping, we had to excavate and grade the subbase lower than normal. For this particular location, we completed the subbase preparation and installation of the GEOWEB material in approximately three hours. If hot mix asphalt had been used for the subbase, in proper lifts and thicknesses, it would have been an all-day process and at least twice as expensive. We would have required pavers, and additional compaction equipment.”

Houston Spears, P.E., Project Mgr, Gonzales & Sons Equipment, Inc

Railroad Embankment Repair

The GEOWEB 3D Soil Confinement System has also been successfully used for slope protection and emergency railroad embankment repair. The cells can be infilled with soil to support development of a vegetated slope, or the cells can be infilled with aggregate for non-vegetated slopes. For hard-armoured protection, concrete infill is also an option.

In Burlington Northern Santa Fe's track in the U.S. Pacific Northwest, for example, a failure on a 1:1 railroad embankment caused by record rainfalls and saturated soils led to a slide that caused interruptions in service. An immediate repair was critical to restoring service and mitigating track closure costs.

The GEOWEB geocell solution was designed with aggregate infill over a geomembrane liner to create a permeable, weatherproof slope cover.

The liner was integrated into the final design as an additional

protective measure to prevent subgrade soils from becoming saturated and sliding down the steep embankment. In conjunction with the aggregate-filled permeable aggregate it facilitates drainage and minimises sheet flow.



Secret Weapon for Emergency Repairs



Offering the ability to repair washouts and address localised track issues quickly and economically with a single solution, the GEOWEB geocells have gained acceptance by the rail industry as

a powerful tool in emergency repair situations.

The GEOWEB system is easy to deploy and install, even in areas with limited site access.

Railroads can inventory a few pallets to quickly repair problem areas. The GEOWEB sections are packaged in bundles and expand to cover 230 sq. ft—each section is 8.5ft wide by 27ft long. One pallet covers 2800 sq ft and one truckload covers 120,000 sq ft.

Low-cost, locally available materials can often be used as infill. Another benefit is that ease of installation allows railroad maintenance crews to do their own installations.

Presto Geosystems offers a free project evaluation service to evaluate the unique needs of each project. Our recommendations will deliver a structurally sound, cost-effective solution based on four decades of accredited research and testing data.



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