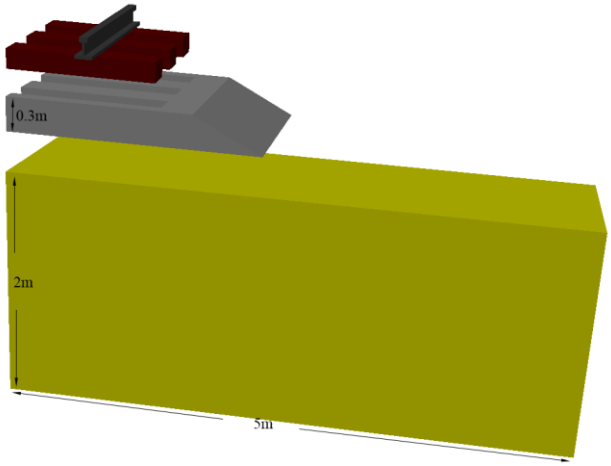
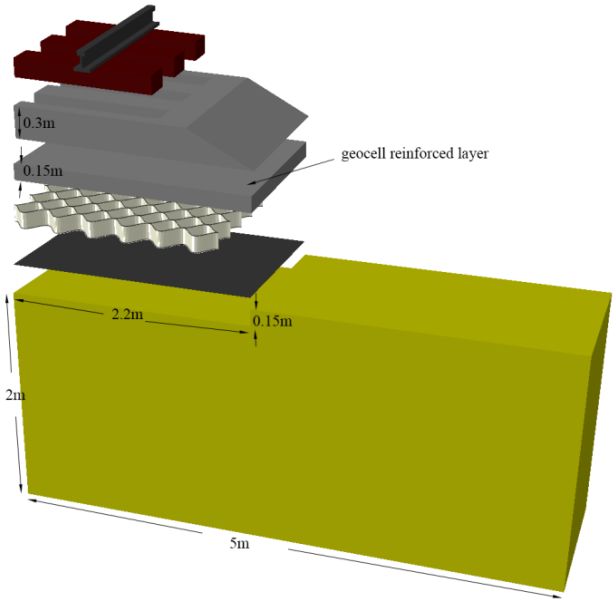
GEOWEB® GEOCELL SYSTEM
PRESTO PRODUCTS GEOSYSTEMS®
PERFORMANCE TESTING-REINFORCED RAIL BALLAST

Summary of Oregon State University Research:

GEOWEB® geocell confinement is commonly used in a variety of geotechnical applications, including erosion protection, earth retention, pavement design, and increasingly, railway applications. Of particular promise is the use of GEOWEB confinement of railway ballast over soft subgrades, where the confining behavior of the three-dimensional reinforcing structure can decrease settlement, reduce lateral heave, decrease subgrade stress and extend the service life. A testing program of geocell-reinforced ballast placed on weak subgrade material was performed at University of Kansas. In addition to University of Kansas research, Oregon State University performed state-of-the-art, three-dimensional dynamic Finite Element modelling to analyze the reinforcing benefit of GW30V GEOWEB® geocells in railway applications.

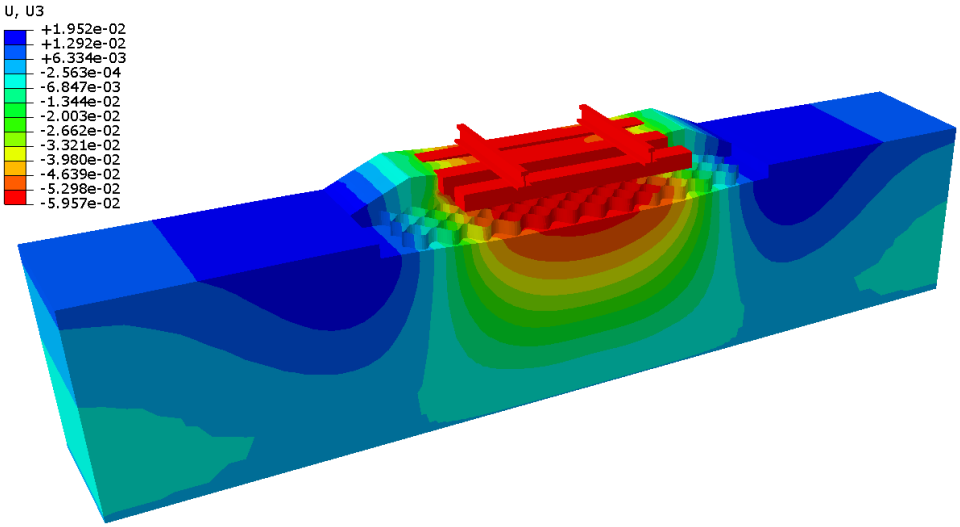


Exploded view of half of unreinforced cross-section.



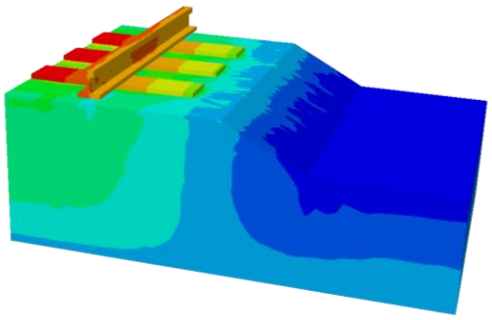
Exploded view of half of GEOWEB-reinforced cross-section.

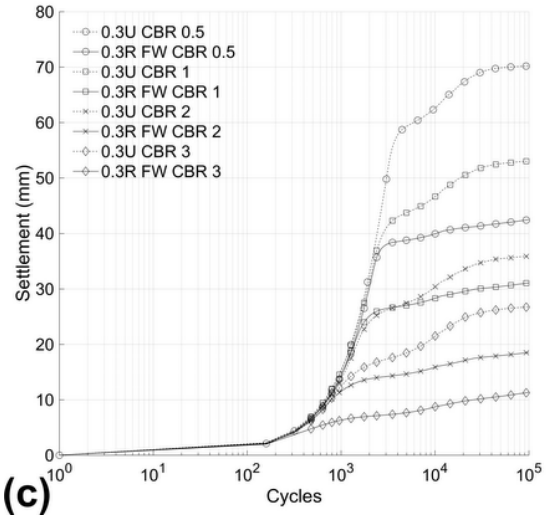
PRESTO GEOSYSTEMS
670 N PERKINS STREET, APPLETON, WISCONSIN, USA 54914
Ph: 920-738-1328 or 800-548-3424 ■ Fax: 920-738-1222
e-mail: INFO@PRESTOGEO.COM WWW.PRESTOGEO.COM



Settlement profile of GEOWEB geocell-reinforced cross-section. GEOWEB geocell reduced settlements by up to 50% versus unreinforced cross section of similar geometry.

The GEOWEB geocell confinement decreased the settlement of the railway ballast significantly. Performance of the GEOWEB geocell increased at lower subgrade strengths as confinement and mattress effect were highly mobilized. For weaker subgrades, the influence of the confinement provided reduced settlement equivalent of more than 8 inches (20 cm) of ballast, depending on the scenario.





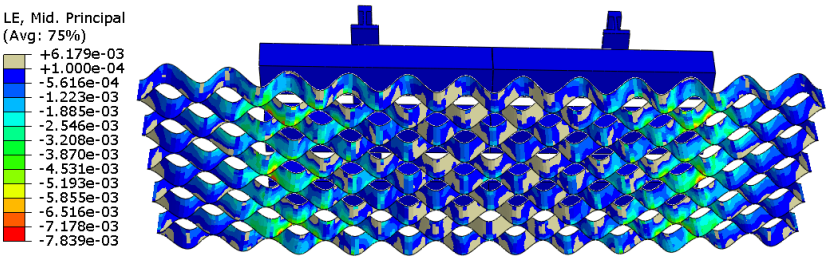
GEOWEB geocell confinement increased the resilience of the sub grade after many cycles representative of loaded freight wheels. The rate of cyclic settlement was decreased by confining the ballast and distributing the load to a larger area in the subgrade.

GEOWEB geocell reinforcement also decreased the observed lateral heave of the ballast. The confinement offered by the cellular geometry of the GEOWEB geocell likely prevents the lateral heave of the material along with the mattress, slab-like effect stemming from the confinement of the granular ballast.

The use of the GEOWEB geocell confinement was effective in redistributing the vertical stresses on the subgrade, resulting in larger areas of subgrade mobilizing shear strength and reduction of plastic deformations. GEOWEB geocell reinforcement decreased the pressure at the ballast subgrade interface by nearly 50% for weak subgrades. GEOWEB geocell reinforcement also increased the load bearing area of the subgrade and resulted in the decreased interface pressure. The decreased pressure in subgrade results in lower subgrade settlements.

Subgrade pressure concentrations without GEOWEB geocell.

Reduced subgrade pressures with GEOWEB geocell.



For the loading conditions used in the analyses, the strains in geocell were low (less than 1%) and within the elastic range for typical geosynthetic materials. The maximum tensile strains were localized at the bottom corners of the cells, showing the importance of adequately durable seams.

Summary Results

The benefits of applying GEOWEB geocell confinement for reinforcement of rail ballast over weak subgrades, as acknowledged by this research summary, are summarized below:

- Significant decrease in settlement of the railway ballast. Geoweb confinement influence reduced settlement by to up 50% under heavy freight loadings over weak sub grades.
- Increase in ballast resiliency after many cycles--resulting in decreased rate of cyclic settlement.
- Decrease in lateral heave of the ballast--resulting from ballast confinement.
- Redistribution of vertical stresses on the subgrade--resulting in higher shear strength and reduction in plastic deformation.
- Decrease in subgrade interface pressure by nearly 50% for weak subgrades. The decreased pressure in subgrade results in lower subgrade settlements.
- For the largest loading conditions used in the analysis, the strains in the geocell were low (less than 1%) and within the elastic range for typical geosynthetic materials. The maximum tensile

strains were localized at the bottom corners of the Geoweb, showing the importance of adequately durable seams.

- Strains in the Geoweb were low (less than 1%) even under heavy, freight loadings over very soft sub grades. As these are small strains, most polymeric materials will sufficiently confine infill material and better distribute loading to weak sub grades. Stress concentrations were found at the seams, highlighting the importance of Geoweb seam strength during loading condition.