

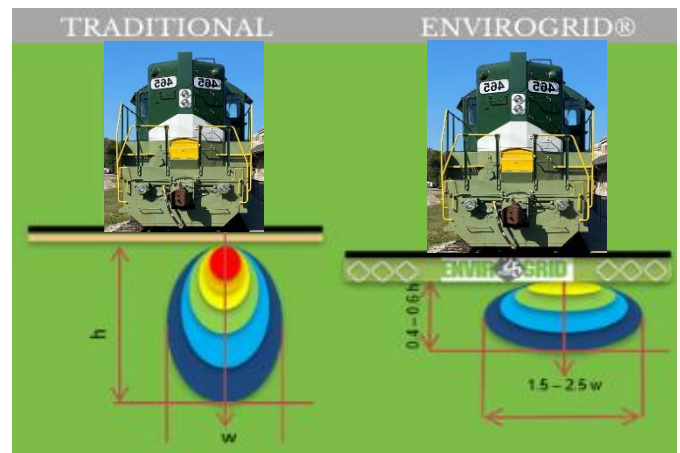


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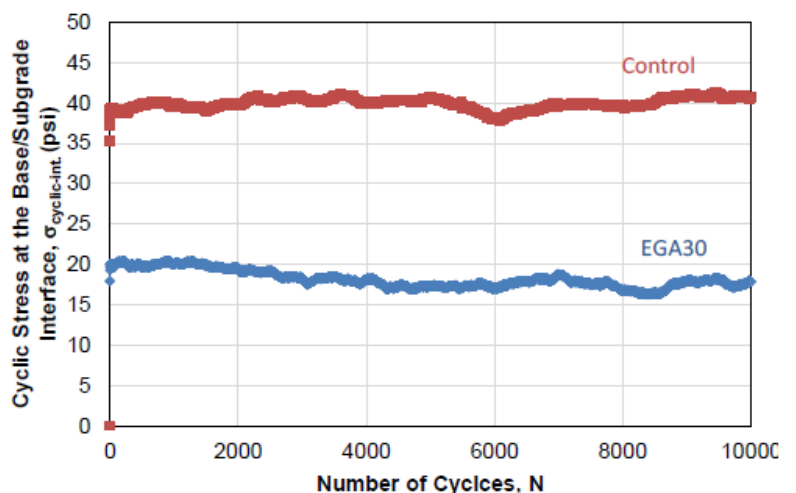
GEOCELL FOR RAILWAY APPLICATIONS:

The world's railway network spans over 800,000 miles, and much of the world's economy relies on the movement of goods that these rail lines carry. The United States operates most of the world's railways, closely followed by Russia, China, India, Canada, Germany, and France. When designing these systems, one needs to consider the traffic effect on the rail system and the environment they will be constructed in to ensure these systems can run uninterrupted. The ballast and sub-ballast layer must be designed so the stresses from the loading and environment is reduced when transferred to the subgrade. Because of this, the required thickness of the track bed layer can be very large depending on these conditions. As high-quality building resources are becoming scarcer and more expensive, it is imperative that state-of-the-art technologies are used to maintain and build these systems not only for cost savings, but also to reduce the footprint left on the earth.

Geocell provides an opportunity to meet these requirements by reinforcing the foundations to accomplish greater strength by minimizing the material needed and allowing for local, marginal-quality material to be used instead of using additional resources to haul in material. Many of the issues poor subgrades cause such as ballast pockets, unsymmetrical subgrade strength and subgrade pumping can be addressed with EnviroGrid® Geocell. EnviroGrid® will improve the properties of the existing subgrade, which will provide adequate and uniform support for the rail system. EnviroGrid® does this by providing a large increase in the bearing capacity of the infill material. Based on empirical research and bearing capacity calculations by Dr. Robert Koerner, it was found that geocell can increase the bearing capacity of soil by over 13 times. Not only does EnviroGrid® increase the bearing capacity of infill material, but it spreads the load laterally, known as a mattress effect. The mattress effect occurs when lateral earth pressures are mobilized and transferred across the three-dimensional network of interconnected cells. In this regard, the properties of the infill material act in conjunction with the characteristics of the EnviroGrid® to facilitate the desired ground improvement effect, which is to reduce the stress on the subgrade. In recent testing, it was shown that EnviroGrid® reduces the stress on the subgrade by over 50% compared to a section with equal height of compacted stone. (See chart).



Reduction in Stresses on Subgrade



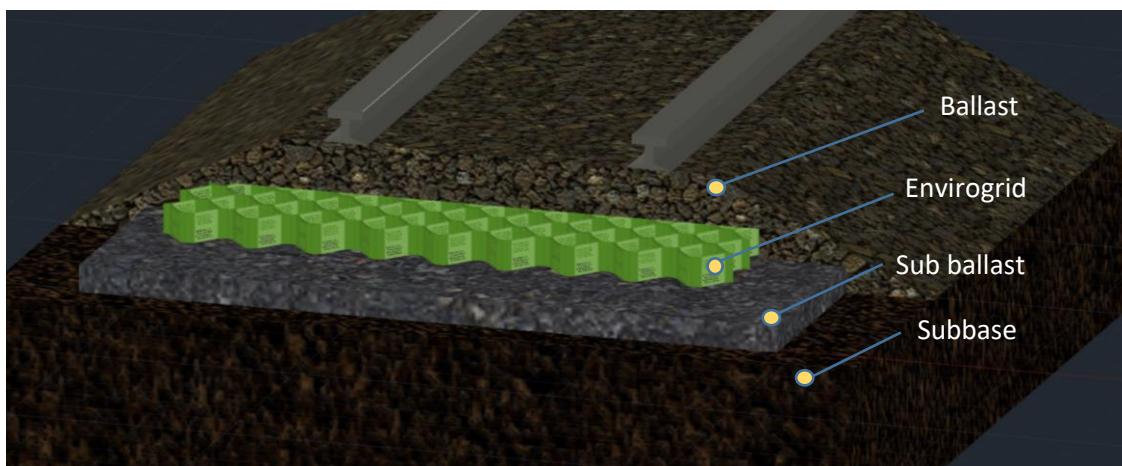
Stress Difference between Reinforced Section and Non-Reinforced Section



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In comparison, a similar test ran with geogrid found that a standard BX geogrid was only able to reduce the stress on the subgrade by approximately 20%.

In other recent research as well as field case studies, it has been found that geocell can reduce the depth of constructing or granular fill material needed by 40 – 50%. This reduction is due to the geocell's ability to eliminate most of these problems. EnviroGrid® extends the life of the track and minimizes maintenance, which overall reduces the amount of track downtime.



The geocell layer acts as a stiff mat and distributes the footing load over a larger area, reducing the vertical stresses directly beneath the load. The geocell layer is placed at the ballast/sub-ballast layer.

EnviroGrid® will keep the track in place when there is shrinkage and swelling of a clay subgrade, as it provides tensile strength and shear strength to contour the soil movement. Because EnviroGrid® provides a bearing strength improvement to the infill material, less material is needed to achieve the needed strength to support the rail system. In addition, unlike geogrid, any drained material can be used. Geogrid can only be used with a well graded high-quality stone which usually has to be manufactured and hauled in, whereas local, onsite material is able to be used with EnviroGrid®.

The American Railway Engineering and Maintenance of Way Association (AREMA) manual includes geocell as an approved method of construction. The Federal Railroad Administration has also carried out field test on geocell and has shown that they do in fact increase the performance of rail systems.



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A recent project was completed in west Texas to address poor subgrade soil. The project consisted of improving the subgrade of the track for 10,000 linear feet. A 6inch EnviroGrid® was placed at the ballast / sub-ballast layer, then filled and compacted with drained infill material.



EnviroGrid® is a state-of-the-art solution for railroads in both new construction and repair work. It can be used for yard stabilization, ballast reinforcement, quick response to emergency repairs, and embankments or drainage channels along railways. EnviroGrid® offers superior performance and is more economical than alternative erosion and stabilization methods such as geogrids and other two-dimensional solutions. Contact Geo Products to find out more about the solutions they will provide to your railways. Geo Products offers full technical and field support along with design resources at www.geoproducts.org.