Geogrids vs Geocell

Two of the most popular materials employed for mechanical stabilization are geogrids and geocells. However, there is some misunderstanding on how these two materials differ and which ones should be used in differing applications. This document's purpose is to clarify the practical differences between the use of geocell and geogrid.

Geogrids are 2-dimensional planar reinforcement. They provide confinement for the aggregate; usually the first or second layer of stone in contact with the geogrid. The granular materials usually have an average size greater than ¾'s of an inch. As a result, only well graded processed stone can be used to realize the full benefit of the geogrid. Geogrids rely on the stone interlocking with the grid. As it moves or ruts, it will push against the grid, activating the tensile strength of the grid. If the grid is not pre-stretched, it will display unwelcomed movement before the geogrid starts to add performance to the system. Additionally, the aggregate that is in contact with the geogrid will only lock the stone that is a layer or 2 above or below the geogrid system. As a result, stone that is a few layers above the geogrid can move laterally, thereby increasing potential rutting. To overcome this limitation multiple layers of geogrid need be used. This will add more material and labor costs, and still require well graded material to be used in all layers.

Geocells are 3-dimensional, not 2-dimensional. Geocells are honeycomb structures that are typically welded together to form an interconnected system. Geocell will confine almost all drained material. The cell walls completely encase the infill material. The confinement effect is composed of three main mechanisms; 1) active earth pressure; 2) passive earth pressure; and 3) and hoop strength. When a geocell is loaded, the infill material is confined by the cell wall and/or the hoop strength. Active pressure is created, pushing out against the walls, but countered by the passive forces the surrounding cells provide. This, in turn, produces what is called the slab/ mattress effect. The American Society for Testing and Materials has described the mattress effect as, the Individual cells limit lateral movement of the infill, which reduces vertical settlement and increases stiffness within the reinforced layer. As these individual cells work in concert with other adjacent cells (, i.e., the mattress effect), applied loads are more widely spread. This results in a more uniform distribution of applied

	GEOCELL	GEOGRID
Infill Material	Any drained material such as sand, fine aggregate, gravel, recycled concrete or recycled asphalt	Requires well-graded processed infill (usually size - 3/4inch minimum)
Confinement	All infill material is confined in the cell as well as some above and below	only confines 1 to 2 layers of aggregate in contact with grid
Environmental	Reduces quarrying, hauling, fuel, pollution, carbon footprint;	Limited reduction in quarrying, hauling, fuel, pollution, carbon footprint over just using aggregate
Installation	Easy to install on soft soil, effective immediately	First layer can be fast but may times require multiple layers to be equivalent to geocell, hard to stretch on soft ground
Layer reduction thickness over just using stone	Greatest reduction in thickness	Marginal reduction in thickness

stresses as well as a reduction in the magnitude of these stresses to underlying layers. Consequently, there is a decrease in the overall settlement and a reduction in differential settlement.

Recent field tests performed by a third-party lab show that a 6 inch geocells can reduce the stress on the subgrade by over 50% compared to a control section of just 6inch of stone. The load was reduced from the driving surface to the subbase interface by 75% (the 80 PSI load only applied 20 PSI to the subbase interface). Conversely, in a very similar test performed by the University of Kansas showed a high strength triangle grid and 9 inch of stone only reduces the stress on the subgrade by approximately 30%. Additionally, a standard geogrid with 9 inch of stone only reduce the stress at the subgrade interface by approximately 13%. Unlike geogrids, geocells do not need to be pre-tensioned to maximize performance. Geocells can be filled with drained material, including but not limited to, sand, fine aggregate, gravel, recycled concrete and recycled asphalt. These materials are usually more available, and much less expensive than the high-quality aggregate that is usually necessary for use with a geogrid.

Testing performed by the same third-party lab mentioned above utilized a 12-inch plate that applied 80psi to the test site for a given number of cycles on 2 sections both filled with the same infill stone. One section was a 6-inch geocell and the other was 8 inches of infill over a biaxial geogrid. The data was then used to forecast the number of cycles to achieve a given rut depth within the infill material. It was found that the geocell controls deformation of the infill material substantially better than the geogrid section. The testing lab data concluded that over 2 million passes would be needed to see 1 inch of rutting within the infill material in the geocell section, whereas the geogrid section would see a 1-inch rut at just 24,500 passes.

CONCLUSION

The Federal Highway Administration reports that geocells have the ability to confine granular base materials in place, and increase soil stiffness and strength properties. This allows for reduction in required base thickness and increased pavement service life. Certain Federal, State and Local agencies have employed geocells for decades. Consider choosing geocell as it is often less expensive and performs better than geogrid. Geocells also provide environmental benefits by reducing the amount of earthwork that is required for an engineered project. Additionally, geocell will reduce time of construction and reduce the amount of maintenance and repair needed. Perhaps the greatest environmental and cost benefit of choosing geocell over geogrid is geocell's unmatched ability to utilize most locally-sourced drained material as its infill.

2D Geogrid

3D Geocell