

# LESSONS LEARNED:

GEOTECHNICAL ENGINEERING

## OBSERVATIONS AND LESSONS FROM THE SCHOOL OF EXPERIENCE

### BIAXIAL/TRIAXIAL GEOGRIDS FOR PAVEMENTS

Geogrids are a class of geosynthetic materials used to enhance the performance of soils by creating a composite soil/geogrid structure. Selection of the appropriate geogrid is based on the desired mechanical properties of the soil/geogrid composite and the type of structure in which the composite will operate (e.g., retaining wall, roadways, etc.). There are two basic types of geogrids; uniaxial geogrids for retaining walls (i.e., strength in one direction), and multi-axial (biaxial and triaxial) geogrids for subgrades/pavements (i.e., strength in 2 or 3 directions). This **Lessons Learned** will focus on the applications and benefits of biaxial/triaxial geogrids.

#### BRIEF HISTORY OF GEOGRIDS:

The concept of soil reinforcement to achieve improved mechanical properties is not new. In fact, the first known application of soil reinforcement dates back to the 6<sup>th</sup> century BC when the ancient Mesopotamians used woven reed mats to reinforce clay in order to construction their Ziggurat structures. These structures currently stand at more than 150 feet in height, with some thought to have originally been as much as 250 feet in height, the Ziggurat structures are still some of the world's tallest earthen structures nearly 8,000 years after their construction.

#### BIAXIAL/TRIAXIAL GEOGRID APPLICATIONS:

- **SUBGRADE STABILIZATION:** Use of geogrid reinforcement for subgrade stabilization refers to the placement of a geogrid immediately over a soft subgrade soil to improve the bearing capacity and mitigate differential deformation of the subgrade soil. The goal of this application is to reduce undercut requirements, improve construction efficiency, reduce the thickness of aggregate subbase/base material required, provide a stiff working platform for pavement construction, or a combination of these goals.
- **PAVEMENT ENHANCEMENT:** Use of geogrid reinforcement for pavement enhancement refers to the placement of a geogrid beneath or within the aggregate base course of a flexible pavement system to improve the stiffness of the system. The goal of this application is to reduce the amount of aggregate base material or asphaltic concrete required (reducing initial cost), increase the life of the pavement (reduce life-cycle cost), or a combination of the two. The diagram on the front of this **Lessons Learned** depicts geogrids used to reduce the thickness of the aggregate base.

Another application of geogrids for pavement enhancement is when the pavement thickness, or depth of undercut, is limited by the presence of shallow existing utility lines. By incorporating geogrids into the pavement design, a thinner pavement thickness can be used while still supporting the required traffic volume.

#### GEOGRID SELECTION:

As you might suspect, not all geogrids are the same. The main factors in selection of a geogrid are the strength and deformation characteristics of the geogrid. With many geogrid manufacturers, there are many geogrids that have similar properties, and alternative geogrids are often proposed. Since the use of geogrids is a soil/structure interaction issue, the selection of the appropriate geogrid is best performed by the project geotechnical engineer. When used for enhancement in the design of a pavement, the selection is relatively straight forward. However, when it comes to stabilization of a soft or very soft pavement subgrade, considerable judgment and experience is employed by the geotechnical engineer in the selection of an appropriate geogrid and the materials placed on top of the geogrid.

Unfortunately, there is not enough space on this page to fully explore the finer details of this subject. Should you have questions regarding biaxial/triaxial geogrid utilization, please contact the geotechnical engineering staff at your nearest ECS office. We hope this **Lessons Learned** will be helpful to you on future pavement projects.

Respectfully,

**ECS Corporate Services, LLC**

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