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Geogrids And Geosynthetics Help Construction Go Green

By: Roy R. Pedersen, P.E.

In the winter 2008 newsletter, I offered some definitions for our "green" vocabulary to help us understand the various discussions in the news currently on the subject of green living. In a still earlier edition, I wrote about how geosynthetics can help extend the life span of a pavement section. This is a way to be green in construction. Extending the life span of a roadway reduces the construction energy per year of life by extending the life span.

Geogrids can also make road construction "greener" by reducing the depth of subgrade necessary. This conserves raw materials as well as the fuel oil, manpower, and equipment required to mine, transport, and place the additional subgrade that would be required if geogrids were not used.

An article by Stephen Archer, PE in the October 2008 issue of CE News discusses the use of geogrids to improve a road subgrade. A geogrid is a mesh of plastic strips fused together at each junction point. These are laid onto the subgrade to strengthen the road bed and allow less granular base to be used.

The following photo from the Archer article shows a typical geogrid installation as well as a schematic diagram illustrating the effect on subgrade depth with or without geogrids.

Figure 2: Granular fill thickness reduction achieved through a biaxial geogrid layer

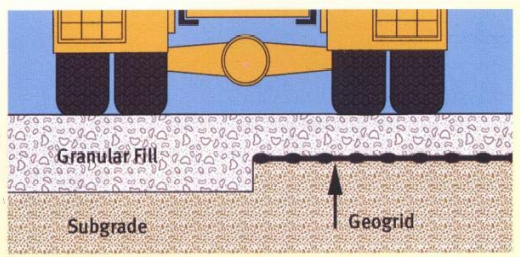
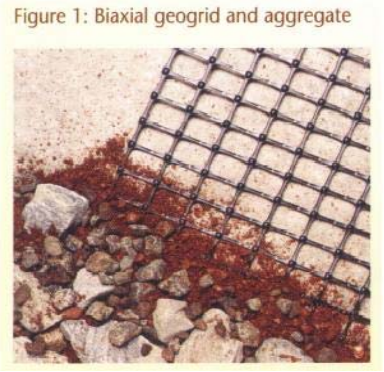


Figure 1: Biaxial geogrid and aggregate



Related to geogrids but performing a different function are geotextile membranes, or geomembranes. Geomembranes also allow road beds to be thinner by insuring that the granular subbase material stays separate from the native road bed.

While the use of geomembranes is still considered relatively new, it does have some history. An article by William Hawkins, in the June 2008 issue of Geosynthetics, reports on a experimental road built in Smyrna, Delaware in 1972 to determine the effectiveness of geomembranes under unpaved roads. Their findings were that after 35 years, the geofabric was essentially in good condition and still providing the separation function it had been installed to perform.

Veteran highway maintenance supervisors for municipalities used to say that unpaved roads needed to be "fed" annually. What they meant was they had to add gravel to the surface each year to replace the gravel that had "disappeared." What actually happened was the gravel at the bottom had mixed with the native soil and become uneffective as a road base. Geomembranes prevent this from happening, thus eliminating the need for annual "feeding" of roads.

Another use for geogrids is to reinforce soil behind retaining walls to allow less rigid retaining walls to be built than conventionally reinforced concrete walls. These newer style walls can be built more quickly, and at less material cost.

As we strive to be green in our designs, the use of geogrids and geomembrances will be considered. As with any engineering project, it is very important to apply the correct theory to the design and to assure that the correct product is used for the application. If this procedure is followed carefully, our designs can be green, and economically serve the public for many years with safe, strong roads and structures.

Infrastructure Again!

by Glenn D. Cooley, PE

By now everyone has heard of the Country's infrastructure problems. These are not new problems. The ugly truth is that in good economic times money for infrastructure is hard to come by, but in bad times infrastructure money is plentiful. There needs to be uniform spending for the repair and maintenance of our Nation's roads, bridges, water and sewer facilities, etc. That's probably not going to happen, so we have to rely on these sporadic "stimulus" packages that pour millions of dollars into construction projects over the course of only a few years. Then it is back to business as usual.

The American Society of Civil Engineers (ASCE) had been issuing "report cards" on American infrastructure every 4 years. The society gives letter grades to the various infrastructure categories such as: roads, bridges, drinking water, wastewater, aviation, schools and railroads. ASCE gave the Nation an overall "GPA" in 2001 was D+, in 2005 it was D and in 2009 it is a D again. Basically no improvement at all over this decade.

Between 2005 and 2009 the cost to bring all infrastructure up to acceptable conditions went from $1.6 trillion to $2.2 trillion. This is the cost to repair our aging infrastructure, not to expand services. This improvement cannot be completed over night, but will take years of dedicated funding.

The ASCE recommends five tasks that must be pursued to get the Country's infrastructure back on track. First, leadership on the federal level must concentrate on the needed progress. Second, infrastructure improvements must be sustainable and durable. Next, infrastructure improvements must flow from federal level to region to state levels in an integrated way. Fourth, once an infrastructure item is constructed, its life cycle costs must be included so that it remains fully functional. And finally, infrastructure costs need to be financed by all levels of government, owners and users.

You can see more details, on line, at:
www.asce.org/reportcard2009/solutions.html

In closing, we have recommended for several months that our municipal clients "dust off" their project plans that are on the shelf and be sure they are properly updated. Additionally, if they do not have ready plans, they may consider getting design work completed or at least initiated. The new federal stimulus bill is already passed. Regulations and requirements for the money are being prepared now. Speed will be necessary if your infrastructure improvements are to become reality.

Going 3D in the Construction World

By: Frederick J. Moricca III, P.L.S.

Land surveyors have been going 3D ever since the first land developer asked that one, important question. What does the land do?

With that one question the topographic survey, or topo survey for short, entered the scene for land developers, architects, engineers and anyone else that needs to know what the ground does so that the land can be developed or improved into what ever that person or persons want.

What is a topographic map? It's an accurate three-dimensional (3D) Digital Terrain Model (DTM) of the project site. It's this DTM that developers, architects and engineers cherish for implementing the best design for their projects, but this is where the 3D world ends. Most developers, architects and engineers still design in a two-dimensional (2D) setting.

Forward-looking developers, and designers looking to get an edge on the competition, are

transitioning to the use of DTMs for design. This comes in two stages. The first stage of this design process is the proposed DTM. These design surfaces are created as a result of the engineering design process. These surfaces are created and used to quickly create proposed contours, label proposed slopes and spot elevations, and calculate earthwork volume. These design surfaces are not survey accurate and are not used beyond the purposes for which they were intended. They are usually less detailed than a construction surface. However, these surfaces serve as the starting point in creating construction surfaces. After creating a proposed design DTM, analysis and design tasks are much easier to accomplish. Spot elevations at points of interest on the surface can be extracted directly from the DTM, eliminating the time and inaccuracies of manual interpolation. Drafting tasks are also simplified with the creation of a proposed design DTM. Proposed contours are drafted in seconds and labeling of contours can be completed in minutes.

The second stage of the design process is the proposed DTMs for construction. Creating of proposed DTMs for the use in construction operations such as stakeout or GPS-guided machine control is the final step in the DTM design process. The main difference between design and construction DTMs is the level of detail in the creating of the proposed design features.

After the construction DTM has been created, the data then returns to the field for use in grading operations. Traditional site grading has been in the form of grading stakes that are used to determine cut and fill at specific locations and then interpolated between those grade stakes. Now with GPS and the use of these construction DTMs, a new trend that has been gathering considerable momentum is stake-less grading by GPS or guided machine control. This procedure provides the ultimate in timesaving because the grading operations are performed without the need for traditional grade stakes. On site survey control is still needed, but most of the operation is handled in an automated fashion. Earthmoving machines are equipped with GPS antennas and a computer interface for the equipment operator inside the cab. This interface can have the operator manually raise or lower the blade or the interface can operate the operation of the blade by the use of hydraulics.

Digital Terrain Models (DTMs) form the backbone for almost all development projects. The existing condition DTM (the topographic survey) provides the developers, architects and engineers with knowledge of current site conditions. The proposed design DTMs allow the developers, architects and engineers to increase precision and quality while keeping costs and time spent on the project down. Construction DTMs used by contractors will allow for stake-less grading and high quality construction in less time.

The future of land development and construction is to go 3D (DTMs). Individual firms at each step of the process can realize productivity and performance gains. The firms that learn to master the skills needed to create and utilize this data will be the ones that succeed.

Newsletter - email version

We are currently considering the use of email for the delivery of our newsletter to our clients and friends who would like to receive it that way. If you are interested in getting the newsletter by email send an email to: newsletter@emengineers.com. In the email please give your name, affiliation (town, village, company, etc.) and your email address.

If we get a good response to this question, we will begin the email edition with our summer issue. This would be occurring in July.

We are happy to announce the recent promotions of Christopher M. Ernst, P.E. and Frederick J. Moricca III, PLS to partners in E & M Engineers and Surveyors, P.C.

Mr. Ernst is a Penn State graduate and has worked for E & M since 1998. He is the lead engineer for bridge design and many storm water management projects. He lives in Port Allegany with his wife Abbey.

Christopher M. Ernst, PE

Mr. Moricca is a graduate of the SUNY College of Technology at Alfred and has worked for E & M since 1990. He is the chief surveyor for the Firm and does all types of surveying including boundary, topographic, construction layout, Global Positioning Surveying, and oil and gas work. He lives in Olean, NY with his wife, Susan and their daughter.

Frederick J. Moricca, III, PLS

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