Real estate development is often a challenging business—even more so in areas containing poor subgrade soils. The vicinity of Austin-Bergstrom International Airport in Texas is one such area. In early 2002, the construction schedule for a 680 home subdivision just east of the airport was at risk. The developer and his engineer needed a quick, reliable method for subgrade stabilization. The solution came in the form of stiff, biaxial geogrids.

Given the geology of the Austin area and information from the site geotechnical report, the developer and contractor anticipated the presence of soft, highly-plastic subgrade soils at the proposed development site. It is well known that roadway and infrastructure performance is highly dependent on support provided by the subgrade. Consequently, the developer’s engineer specified chemical (lime) stabilization of all pavement subgrade soils to mitigate the risk of poor support and the potential for heaving. This recommendation was in accordance with the local standard of practice and is often considered the “default” solution for soft and/or expansive subgrade soils across Texas. The specified pavement cross section was comprised of 1.5 in. of Texas DOT Type D Hot Mix Asphalt Concrete (HMAC), over 8 in. of crushed limestone flexible base, and over 6 in. of lime treated subgrade soil. The section was designed to provide 20 years of service to the subdivision at loading rates designated by local code. The design was reviewed and approved by the local municipality. None of the parties involved had considered alternatives to this typical solution.

During the time between design and construction of the subdivision, the developer’s engineer learned of the potential benefits of mechanical (geogrid) stabilization as opposed to traditional chemical methods through a local geogrid distributor’s educational presentation. The local distributor demonstrated these benefits using new road design software that incorporates the Giroud-Han method for subgrade stabilization and an adaptation of the American Association of State Highway and Transportation Officials (AASHTO) 1993 flexible pavement design methodology. In addition, several successful mechanical stabilization case histories were presented and discussed.

As it turned out, the developer and engineer had not always been completely satisfied with construction rates and performance of lime stabilization. However, until the geogrid distributor’s presentation, they were not aware of any acceptable alternatives. In addition, construction of the new 680 home subdivision was due to begin in a few short months. Spring weather in Texas can often be unpredictable. Given the uncertainty and installation sensitivity associated with lime treatment, they were concerned that the project might be delayed during periods of wet or freezing weather. The construction schedule was already tight, and such delays early in the project would have severe financial implications. Consequently, the developer and his engineer decided to work with the contractor to propose an alternate pavement section to the local municipality for approval. This section would include mechanical stabilization using stiff, biaxial geogrid rather than lime stabilization.

Working with the local geogrid distributor, the developer’s engineer designed an equivalent performance pavement section replacing the 6-in. lime stabilized subgrade layer with a single layer of stiff, biaxial geogrid over 6 in. of moisture-conditioned subgrade. Through mechanical interlock with the flexible base aggregate, the specified stiff geogrid was capable of providing equivalent performance to 6 in. of lime stabilized subgrade. For the project partners, this option revealed multiple advantages to mechanical subgrade stabilization versus traditional chemical methods. For example, geogrids are supplied in roll form and are easily handled and
installed by one to two general laborers. Lime and other chemical agents require specialized equipment, trained crews, and, in some areas, environmental monitoring and controls. If not adequately dispersed in the soil, lime stabilization will not work. Superior quality control is necessary during the lime stabilization process. Moreover, geogrids may be installed in almost any weather and perform as intended immediately, with no curing period. Lime stabilization requires very specific moisture and temperature conditions to be effective. In fact, once applied, lime must be kept moist and cured for three to seven days. During this period, the ambient temperature must stay above 40°F or the curing process may not be effective. Furthermore, stiff biaxial geogrids are manufactured from durable polypropylene. Thus, they are inert to almost any soil chemistry and will not significantly degrade or lose effectiveness over the design life. On the other hand, lime is very sensitive to soil chemistry and may actually leach from the soil matrix when subjected to wetting. Worse yet, lime has the potential to react adversely with soils containing sulfates or excessive organic material. If the sulfate content of the soil is too high, severe, non-reversible swelling can occur upon addition of lime. If the organic content is too high, the lime may not react enough to effectively stabilize the soil.

The local municipality's geotechnical engineer reviewed the proposal to employ an alternate pavement section and approved it, citing many of the advantages listed above. Construction of the subdivision roads, including stiff geogrids in lieu of lime, began in April 2002. All parties were very pleased with construction rates and performance of the geogrid. The contractor was able to construct the roads without delay due to weather, equipment or environmental problems. This allowed the project to stay on schedule in the most critical early phases. It is estimated that the use of geogrid stabilization saved two weeks to one month of time over what would have been required with lime.

More importantly, the roads built over a geogrid stabilized subgrade are performing better than expected. The repeated, heavy loads (material and equipment delivery trucks, concrete trucks, etc.) associated with high-volume residential construction have not disturbed the pavement.

Based on this success, the developer's engineer has specified geogrid stabilization rather than lime in three other Austin subdivisions. At the same time, the local municipality has specified stiff, biaxial geogrids for use in several public works projects since being introduced to the concept through this project.

In summary, this project case history demonstrates the numerous advantageous of mechanical stabilization with geogrid over a more traditional chemical method. With each application, the acceptance of geosynthetics as a replacement for—or enhancement of—traditional construction methods and materials grows.

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Stephen N. Valero, P.E., is vice president of technology at Tensar Earth Technologies Inc., Atlanta.

Project information
Owner/Developer: KB Homes, Austin, Texas
Contractor: Austin Engineering, Austin, Texas
Design software: SpectraPave2 from Tensar Earth Technologies Inc., Atlanta
Engineer: Carlson, Brigance & Doering Inc., Austin, Texas
Geogrid distributor: Geo-Solutions Inc., Austin, Texas
Geogrid manufacturer: Tensar Earth Technologies Inc., Atlanta

By Stephen N. Valero, P.E.