Tuesday, September 15, 2015
EDC Exchange for Local and Tribal Agencies

National Usage of GRS-IBS

The majority of the bridges across the nation are small, single-span bridges commonly on rural and local roads. As the infrastructure ages, weight restrictions or bridge closures are becoming more frequent. With limited resources available, transportation agencies must find innovative, cost-effective solutions for bridge construction. The Geosynthetic Reinforced Soil–Integrated Bridge System (GRS–IBS) may be an excellent alternative to help reduce bridge construction time and cost!

Prior to the EDC initiative, implementation of the GRS-IBS was limited to two counties within Ohio and New York. Now there are more than 200 GRS-IBS structures across the country in 44 states and territories, and the number is growing. This EDC Exchange will present several case histories illustrating the range of diverse projects and design considerations to help others implement this type of construction. The webinar will also provide a brief overview of FHWA guidance on scour evaluation and countermeasure design as well as how scour can be successfully addressed when using GRS-IBS. This EDC Exchange will be of interest to local, tribal and state transportation agencies that are looking for a cost effective solution to replace deficient bridges.

Please join the Federal Highway Administration, the Oklahoma Local Technical Assistance Program and the Southern Plains Tribal Technical Assistance Program and the Oklahoma Department of Transportation for a presentation on the National Usage of GRS-IBS via a live webinar on Tuesday, September 15, 2015 from 11:00 am to 3:00 pm Central-Time. We’ll be starting at 11:00 am for a local presentation on Oklahoma’s usage of GRS-IBS followed by lunch and then the National webinar.

A Hideaway Pizza Lunch will be provided by Ads Pipe Company

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What is Geosynthetic Reinforced Soil (GRS)?
Geosynthetic Reinforced Soil (GRS) is an engineered fill consisting of alternating layers of compacted granular fill material and sheets of geosynthetic reinforcement (most commonly geotextile fabric). This technique can be applied to many facets of earthwork such as walls, abutments, culverts, slope stability, rock fall barriers, roadway support, and integrated bridge systems.

What is an Integrated Bridge System (IBS)?
An Integrated Bridge System (IBS) is a fast, cost-effective method of bridge support that blends the roadway into the superstructure using GRS technology. This creates a simple, joint-less interface between the bridge and the roadway. The IBS is typically built without many of the elements common to a conventional bridge abutment (e.g., the deep foundation, bridge seat, bridge bearings, deck joints, approach slab, end wall, and sleeper slab).

What are the benefits of an IBS?
The performance of GRS IBS bridges to date has been an improvement on similar bridges built with conventional construction techniques. The GRS IBS bridges have performed as well as the conventional bridges structurally and functionally in addition to eliminating the "bump at the end of the bridge" that often results from conventional construction. The suppression of the "bump at the end of the bridge" has been maintained to date for all the GRS IBS bridges in service. The first bridge constructed with this technology, the Bowman Road Bridge, has been in service for almost 5 years. In fact, this bridge has not even experienced cracking of the asphalt layer from the road to the bridge.

What is Accelerated Bridge Construction (ABC)?
Accelerated Bridge Construction (ABC) is the term given to technologies and methods that fast-track bridge construction. In addition to saving time, these methods typically save money. GRS IBS is a type of ABC.

What is the "Bridge of the Future" initiative?
FHWA launched the Bridge of the Future initiative to explore enhanced materials, structural systems, and technologies for building bridges with better structural performance. It emphasizes reliable and timely data and information, improved decision-support tools, and the development of quantitative measures of performance. It also stresses the safety, reliability, and security of bridge structures.

What is Mechanically Stabilized Earth (MSE)?
Mechanically Stabilized Earth (MSE) uses alternating layers of compacted soil and reinforcement. The reinforcement can be manufactured from steel or geogrid material and serves to provide tensile resistance to the soil. The reinforcement needs an outer facing element to mechanically connect it to resist lateral earth pressures.
How does GRS differ from MSE?
A primary difference is that the reinforcement layers are spaced differently. With MSE, layers of reinforcement are typically spaced 24 inches vertically while GRS layers are spaced 8 inches vertically. The reinforcement material is also different. With MSE, the reinforcement can be either steel or geogrid, while GRS reinforcement can be built any geosynthetic (most commonly with a geotextile fabric). Also, the connection between the reinforcement and the facing on GRS structures is frictional. The facing blocks sit directly on the reinforcing geosynthetic and are held in place purely by the friction between the reinforcement and concrete block. This is an adequate connection because the GRS is internally supported by the closely spaced reinforcement and does not need the facing block to resist lateral pressures. By contrast, with MSE structures, the face is providing external support (confinement) to the soil and must be mechanically connected to the reinforcement through devices such as shear pins, lips, or keys.

What makes GRS strong?
GRS utilizes the compressive strength of soil and the tensile strength of the reinforcement to create a composite material. GRS is an internally supported system, which means that it stabilizes the soil mass simply by including reinforcement sheets. The tightly spaced reinforcement and granular soil create an internally stabilized composite material.

What other advantages does GRS have for bridge construction?
Due to the flexibility of GRS structures, they are more tolerant to settlement. They are easy to construct, require less excavation, and are economical.

Does GRS have other uses?
The composite behavior modeled for the GRS structure is applicable to many other applications where geosynthetics and soil are tightly layered. GRS can be used for retaining walls, slopes, embankments, roadways, and load-bearing foundations. Over the past 2 decades, generic GRS structures have increased in popularity worldwide.

How is a GRS mass created with a modular block facing system?
Building a GRS mass involves three simple steps. First, lay a row of facing blocks. Second, add a layer of compacted fill to the height of the facing blocks (8 in.) Next, add a layer of geosynthetic fabric. Each layer of geosynthetic is extended between the rows of blocks to frictionally connect the block to the GRS mass. This 1-2-3 process is repeated until the desired wall height is reached. The construction of the GRS mass should then follow two simple rules. First, thin layers of granular fill materials should be well compacted. Second, the reinforcement should be placed in closely spaced layers.

What makes GRS-IBS unique?
GRS IBS uses alternating layers of compacted granular fill and sheets of geotextile fabric reinforcement to create a seamless connection between a bridge and the approaching roadway without using joints or cast-in-place concrete. It is intended that the riding road surface of the IBS can be maintained in the future just like it was part of the roadway pavement. No special attention to joints or the bridge deck is required. The GRS IBS is also capable of withstanding considerable loads. It is a simple, fast, and cost-effective method of bridge support.

Are facing systems used?
GRS facing blocks are primarily used as a construction aid. They provide a form for each lift of compacted fill. They also serve as a protective barrier. Facing blocks can also serve as a façade for aesthetic purposes, but they do not carry any appreciable load. Because GRS is generic, other facing types can be used provided they follow the two rules of construction. First, thin layers of granular fill materials should be well compacted. Second, the reinforcement should be placed in closely spaced layers.
Is GRS-IBS significantly less expensive than traditional methods?
Building a bridge with GRS IBS is potentially 25 to 60 percent less than traditional methods, depending on the standard of construction and the method of contracting (local forces versus a private contractor). Maintenance costs will likely also be reduced since the GRS IBS has fewer parts and is joint-less than a conventional bridge system. Since GRS IBS can be built in variable weather conditions, labor costs can also be reduced: few stoppages for weather are needed. Material costs are also reduced. The system is built with common materials and readily available equipment.

How much time is saved?
A GRS IBS can be built in substantially less time —weeks versus months. This translates into less congestion and disruption around work zones.

On what kind of roadways can GRS-IBS be used?
GRS IBS can be used to build bridges on all types of roads, whether they are in the National Highway System or the local system. The system is not intended for scour-critical crossings.

Who developed GRS-IBS?
GRS IBS was developed by FHWA during the "Bridge of the Future" initiative and built off of previous research conducted by the U.S. Forest Service and the Colorado Department of Transportation. It was designed to help meet the demand for the next generation of small, single span bridges in the United States.

What are some examples of GRS and GRS-IBS construction?
About 44 bridges have been built on GRS abutments in the United States. Approximately 27 of those were built with the GRS IBS. Other GRS bridges can be found in Defiance County, OH; Saint Lawrence County, NY; Warren County, OH; King County, WA; Inyo National Forest, CA; Mammoth Lakes, CA; Ouchita Wildlife Refuge, LA; and in several locations in Colorado.

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