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GRS-IBS offers unique advantages in the construction of small bridges

Instead of conventional bridge support technology, Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS) technology uses alternating layers of compacted granular fill material and fabric sheets of geotextile reinforcement to provide support for the bridge. GRS also provides a smooth transition from the bridge onto the roadway, and alleviates the "bump at the bridge" problem caused by uneven settlement between the bridge and approaching roadway. The technology offers unique advantages in the construction of small bridges, including:

- Reduced construction time and cost, with costs reduced 25 to 60 percent from conventional construction methods.
- Easy to build with common equipment and materials; easy to maintain because of fewer parts.
- Flexible design that's easily modified in the field for unforeseen site conditions, including unfavorable weather conditions.

Ancient Secrets, Modern Science: Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS)

The Federal Highway Administration's "Bridge of the Future" initiative took a wise look at the past before soaring ahead to the future. The result was the Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS), which combined cutting-edge geosynthetics with ancient building secrets. This radically simple construction method can lower costs, slash construction time, improve durability, and increase worker safety.

Modern Twist on an Old Idea

Some ancient buildings remain standing because their builders understood an important concept: reinforcing mud building blocks with woven reeds greatly increases a structure's strength and durability. When the Federal Highway Administration (FHWA) launched its "Bridge of the Future" initiative, its forward-thinking engineers applied modern technologies to this old concept for a radical result: the Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS).

By using Geosynthetic Reinforced Soil (GRS) to create an Integrated Bridge System (IBS), FHWA managed to solve a problem that plagued those ancient architects. By using geosynthetic materials,

FHWA researchers were able to create durable structures that can withstand the elements more effectively.

Geosynthetic materials offer a major advantage over the woven reeds used by the ancients. When the reeds were exposed to water and weather, which happened when the blocks were broken, they decayed. This weakened the structures. By contrast, synthetics remain strong, and the structures remain strong.

Bridges built with this GRS IBS are not only stronger and more durable than bridges built by traditional methods; they are also less expensive to build.

Low Tech, Low Time

GRS IBS is a form of accelerated bridge construction (ABC) that lowers cost, slashes construction time, improves durability, and increases safety—all at the same time. For budget-challenged State Transportation Agencies (STAs), that is a life-saver.

Rather than drilling a deep foundation, the reinforced soil method builds up the substructure in a faster, simpler way. One engineer described it as similar to building a layer cake. First, builders lay a row of facing blocks. Second, they add a layer of compacted fill (soil, etc.) to the height of the facing blocks (8 in.) Next, they add a layer of geosynthetic fabric. The process is repeated over and over until the desired height is achieved.

This low-tech approach continues as the bridge is placed directly on the GRS abutment mass. A GRS approach way is then built behind the bridge beams to transition the bridge to the approaching roadway. No joint or cast-in-place concrete is needed. The bridge extends naturally out of the roadway.

This simplified process radically reduces construction time. A GRS IBS is built in days or weeks, not months. There is no need to wait for cast-in-place concrete to dry; the substructure is immediately ready for the bridge.

On-site changes are easy to accommodate. As one engineer commented, "If I want to make it one foot wider, I put one more block in and take more fabric off the roll."

Weather is rarely a problem, since this type of construction can occur in variable conditions. And fewer delays mean faster completion.

Reduced Costs to Budget

Shortened construction time means fewer labor hours. In Defiance County, Ohio, one bridge abutment was built in just 3 days. Using traditional techniques such as cast-in-place construction, that same abutment would have required 2 to 3 weeks.

This lower-tech option also reduces materials costs. Inexpensive, common materials and equipment are used. There is no need for highly skilled labor. And simpler construction also means simpler maintenance.

In all, GRS IBS costs 25 to 30 percent less than standard pile capped abutments on deep foundations. Compared to a standard Department of Transportation (DOT) bridge, there is a potential for even more significant savings. In fact a savings up to 60 percent was achieved.

Reduced Cost to the Environment and to Workers

The environment also benefits with GRS IBS. The technology is environmentally sensitive and results in minimal environmental impacts. The construction footprint is reduced since no deep foundation is needed. Moreover, construction can be adapted to fit the environmental needs of a variety of applications.

Workers also benefit. Because the abutments are built from the inside out, personnel are less exposed to potential roadside hazards. And simpler construction generally means fewer accidents.

Other Benefits

Shorter construction time also means shorter travel disruptions. Travel lanes are closed for much shorter periods of time. Typically, fewer lanes need to be closed. The joint less construction is also a noticeable side benefit to travelers because of the smooth transition on and off the bridge.

GRS IBS is strong and durable. A recent full scale shake table experiment showed that a GRS abutment structure can withstand a 1.0 g earthquake acceleration.

The clean, simple design of GRS IBS is modern and attractive. The realization of GRS technology will ultimately lead to widespread use and expanded applications in building better roads and bridges.

Demands on the bridge and highway system continue to grow dramatically, and budgets rarely keep pace. Many bridges are either functionally or structurally deficient; there is an increasing need for new bridges. In combining insights from the past with cutting-edge modern technologies, GRS IBS offers an effective and economical solution.

Reference (http://www.fhwa.dot.gov/everydaycounts/technology/grs_ibs/)

Does this all sound almost too good to be true?

We were wondering that too, so the staff at LHTAC took a trip to see one of these projects with our own eyes. In September 2013 we went to Dupuyer, Montana to see up close a FHWA sponsored GRS-IBS bridge construction site on US-89. The north abutment was nearing completion at the time of our visit. It consisted of 8-inch blocks with fabric between the lifts of backfill. On this project, the blocks were red in color towards the bottom of the reinforced fill and then gray towards the top. The color variation was meant for a quick glance inspection if the stream was scouring under the bridge. The construction used very simple, yet effective, techniques. Once completed, the girders were to be placed on a Styrofoam pad located approximately 2.5 feet behind the reinforced fill block wall.

LHTAC staff was impressed and is currently discussing with FHWA funding for a demonstration project here in Idaho. ITD District 6 has constructed this type of bridge near Ririe at the entrance to a new maintenance yard. As more information and/or demonstrations of this construction techniques advance, we will keep you posted.