

CREATIVE CONCRETE CONSTRUCTION

Geosynthetic Reinforced Soil Bridge Abutments in Defiance County, Ohio

by Warren Schlatter, Defiance County



The Bowman Road Bridge was the first GRS bridge constructed by Defiance County in 2005. It uses an 80-ft-long beam. The bridge is 34 ft wide with a 24-degree skew and 7.6-degree superelevation. The abutments are 43.6 ft long and 15.25 ft tall.

Defiance County, Ohio, was introduced to geosynthetic reinforced soil (GRS) at a county engineers' conference in 2004. The presentation reported research conducted by the Federal Highway Administration (FHWA) on layers of aggregate reinforced with closely spaced sheets of geotextile using a concrete masonry block facing. The presentation advocated this technology for bridge abutments resulting in lower costs and possibly better performance than traditional methods.

The construction begins with the excavation to a competent soil layer. A GRS foundation is created by laying a large piece of geotextile on the bottom of the excavation, filling it with compacted aggregate approximately 8 to 10 in. thick, then folding the fabric over the top of the carefully leveled and compacted surface. The facing course is laid out on this foundation—in our case a row of split face, 8-in.-high concrete masonry blocks. Aggregate is placed, leveled, and compacted behind the facing in additional 8-in. lifts and the aggregate and facing covered with more layers of geotextile. This is repeated to achieve the desired wall height.

In 2005, Defiance County began using this technology to construct wingwalls on culverts followed by the first bridge abutments. In this initial installation, the vertical load-bearing abutments allowed the use of beam spans of about 80 ft instead of 110 ft, and perhaps eliminated an additional pier that traditional

spill-through slopes would have required. Even though it was a first project of sizeable scale, it went well, was installed as predicted, and at 6 years old, continues to demonstrate how well this type of bridge substructure performs. The adjacent, precast, prestressed concrete box beams sit directly on a layer of fabric on the GRS fill. The backfill at the ends of the beams is also GRS with no bearing slab or special approach slab. Despite, or perhaps because of this simple construction, there is no pavement crack or “bump at the end of the bridge.” All the materials are easy to obtain, handle, and store.

Defiance County has subsequently constructed over 20 more bridges using GRS abutments. Ranging from a 10 ft to a 130 ft span, they have all performed well. The small abutments can be substantially completed in a day as the crew gets more proficient with the method of construction. Several bridges have been built by contractors with similar results.

Defiance County encourages others to investigate how GRS may help save them money and build substantial bridges in these difficult economic times. The FHWA has chosen this technology to promote as part of its Every Day Counts initiative and has recently published new design and construction guidance that can help interested designers. Links to these documents and additional pictures of completed bridges can be found at www.defiance-county.com/engineer/GRS.htm.



A geosynthetic reinforced soil (GRS) abutment is constructed in 8-in.-high lifts with a layer of geotextile between each lift.



A close view of the 8-in. concrete masonry units forming the face of the abutment and the geotextile between layers.



Adjacent precast, prestressed concrete box beams are placed directly on the geotextile covering the compacted granular backfill.

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