

FILLING IN THE GAPS

Expanded clay lightweight aggregate solves roadway-widening dilemma in Minneapolis suburb

By Don Eberly & Laura Drotleff

Rapid suburban development and growth combined with a two-lane highway is bound to result in traffic bottlenecks and safety issues. So when the opportunity to widen the road in Maple Grove, Minn., presented itself after years of waiting for funding, the local development planners took it without hesitation.

The problem: A 3-mile stretch of the road ran along a swampy area with unstable soils. The city engineers needed a cost-effective solution that not only was sustainable and

environmentally responsible, but also answered safety needs. They conceptualized a combination of expanded clay lightweight aggregate (LWA) and expanded polystyrene (EPS) blocks. The materials offered a timely and economical alternative to building a large, expensive bridge while providing an inert, free-draining substrate that helps manage storm water runoff.

Fast Development

Maple Grove is the fastest-growing community in the Minneapolis-St.

Paul metropolitan area. With roots as an old sawmill town in north-central Hennepin County, the city's development centers on a 2,000-acre gravel mining area. Active since the 1920s, the area is being developed into a residential and commercial downtown.

After three phases of development and with more building on the horizon, Maple Grove has more retail stores than any other town in the state after Bloomington, the home of the Mall of America. City planners anticipate the community will have nearly



A combination of expanded clay lightweight aggregate and expanded polystyrene blocks provided a way to manage storm water runoff and was an alternative to building a bridge.

6 million sq ft of commercial development at build-out, which may soon push Maple Grove into the No.1 spot for retail square footage.

Road to Retail

Such rapid growth in Maple Grove called for the widening of Bass Lake Road (County Road 10), a vital east-west roadway through the city and surrounding communities. Though development of the area has been underway for almost two decades, funding was not available to pay for road expansion until recently. When money did become available to improve the road from all three supporting government entities—county, state and federal—the city of Maple Grove hired Ames Construction to complete the project by 2012.

As a 100-year-old roadway, Bass Lake Road was originally a two-lane rural road running through rolling, hilly terrain. The project called for widening the road into a four-lane divided corridor with a median, while simultaneously reducing

vertical grade, decreasing linear slope and improving the road's safety and load-bearing capacity.

A 3-mile-long section of the road crossing Elm Creek offered a specific challenge. The geotechnical survey revealed unstable soils to depths of 75 to 150 ft due to glacial tills in the area. City engineers were unsure how to solve this problem and considered a number of options. "We questioned whether it was possible to 'clean out' inadequate soil at those depths within a drainage way, but it didn't seem possible," said Ken Ashfeld, a Maple Grove city engineer. "There was an existing drainage way with a flood plain we wanted to perpetuate." The need for a creative approach was evident.

A Sustainable Solution

The project team looked at fill options, including shredded tires and steel mill slag, which had been used in the past; however, the area to be filled was below the water table; due to

potential pollution and a state law making it illegal to place anything synthetic below the water table, those materials were out of the question.

Chris Ritter, project manager with Ames Construction, turned to John Hrkal, owner of independent light-weight aggregate distributor Hrkal Co., to source expanded clay LWA for the project. Hrkal suggested a company named Big River Industries, which is the leading producer of this type of LWA and is based in Alpharetta, Ga., with three manufacturing locations in the south. Hrkal contacted Jeff Speck, Big River's vice president of sales and marketing, to discuss the challenges of the project.

"I met with the project engineers to discuss environmentally friendly fill material that would do the job economically," Hrkal said. "We talked about cellular concrete, expanded clay LWA and EPS block. Because the fill was to be placed below the water table, the only solution was to use rotary kiln expanded



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clay LWA to avoid leaching, [to comply with] Minnesota state law.”

The team settled on a combination of expanded clay LWA and EPS block for the fill. “The embankment came up to 18 ft, which is a significant size on uncertain soils,” Ashfeld said. “It would have taken a significant amount of LWA to fill it, but the flexibility of the two materials combined gave us stability. We couldn’t use the EPS block below the water table because of its tendency to float, so it was not a complete solution. The two components together provided good options.”

The Material

Hrkal had recommended expanded clay LWA in the past and had seen it effectively used to solve geotechnical engineering problems and convert unstable soil into usable land in several instances. “Expanded clay LWA reduces the density of compacted geotechnical fills by up to one-half and provides significantly greater shear strength when

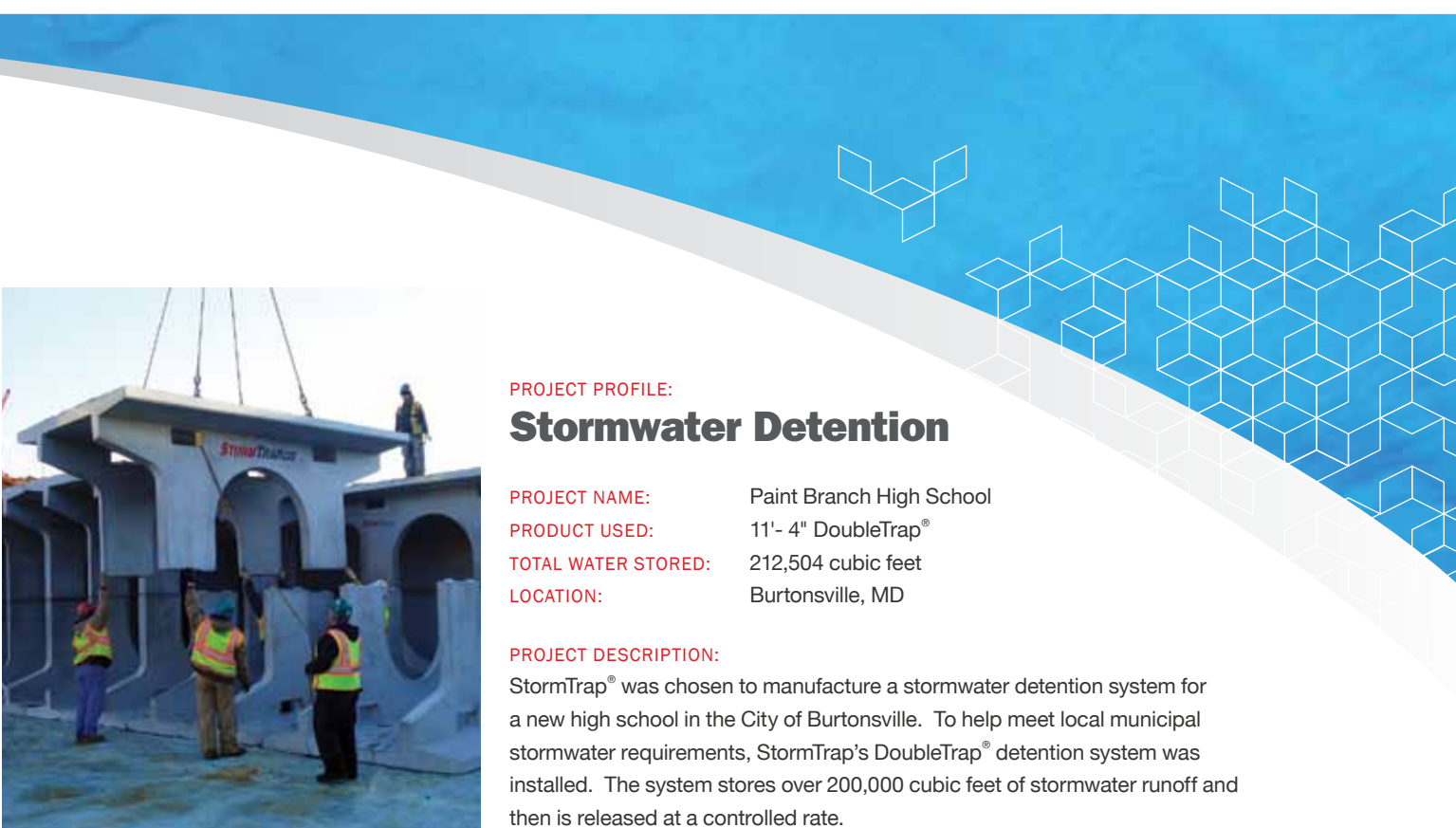
compared with ordinary soil, sand or gravel fill,” he said. Most appealing to the design and installation team, it offered an environmentally friendly material, was easy to handle, and supplied both competitive installation costs and comparable advantages over ordinary aggregates.

Before being shipped to the job site, the expanded clay LWA was produced to specification through a carefully controlled manufacturing process. In a rotary kiln, selectively mined clay was fired in excess of 2,000°F. The clay expanded, cooled and was then processed to specified grading. The result was a high-quality, lightweight aggregate that was inert, durable, insulative and free draining. The team agreed the LWA was ready to meet stringent structural specifications.

“The physical properties of this type of LWA vary according to gradation,” Speck said. “In general, it exhibits very low densities and very high angles of internal friction. As a result,

embankment fill using expanded clay LWA produces lower and more uniform settlement than ordinary fill materials, and lightweight aggregate backfills exert much lower lateral pressures against retaining walls and sheet pile structures.” In addition, because expanded clay LWA is used as a filter layer for pretreatment of non-point source water before entering streams, lakes and municipal sewer systems, it was the ideal fill material for the drainage way.

Originally, specifications for the Maple Grove project were written for ¾-in. course LWA material, but Hrkal knew that would be too difficult to install. Instead, he worked with Big River to manufacture a lighter, ⅜-in.-by-0 gradation. This gradation measurement was necessary because “trucks can’t back over the larger size, because it’s like marbles and equipment would slip and get stuck in it,” Hrkal said. “The ⅜-in.-by-0 size achieved what we wanted as far as weight is concerned. It’s easier for the contractor




PROJECT PROFILE:

Stormwater Detention

PROJECT NAME:	Paint Branch High School
PRODUCT USED:	11'- 4" DoubleTrap®
TOTAL WATER STORED:	212,504 cubic feet
LOCATION:	Burtonsville, MD

PROJECT DESCRIPTION:

StormTrap® was chosen to manufacture a stormwater detention system for a new high school in the City of Burtonsville. To help meet local municipal stormwater requirements, StormTrap’s DoubleTrap® detention system was installed. The system stores over 200,000 cubic feet of stormwater runoff and then is released at a controlled rate.



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to put in and easier for trucks to dump and drive over.”

The Project

When building the road expansion, Ames Construction removed 6 ft of existing organic material with backhoes and trucks and backfilled the excavated area with 10,000 cu yd of expanded clay LWA. “The goal for the LWA was to perpetuate the existing 100-year flood plain, which was at a 9- to 11-ft elevation, [and] bring the elevation to 9 to 14 ft so the EPS blocks placed on top of the LWA would not lift up and impact the road,” Ritter said.

An independent trucking company brought the LWA to the job, and Ames Construction used bulldozers and Bobcats to place it. The job specified using only machines with tracks of a certain width to avoid compaction with too much weight; however, it turned out that using equipment to minimize pressure and compaction was unnecessary due to the gradation used in the project.

“One of the benefits of using this gradation is that we did not have to worry about the pressure on it to break it down,” Speck said. “The material had already been through crushers and couldn’t break down any more. We had the lab at the South Carolina Department of Transportation in Columbia, S.C., confirm this through scores of testing.”

Once the LWA material was in place, Ames Construction used a 10-hp walk-behind plate compactor to level it out. It topped the LWA with seven layers of EPS blocks, with each block measuring 8 ft long by 4 ft wide by 4 ft tall. “With each layer resting perpendicular to the one before it, the blocks offered great strength and rested tightly together,” Ritter said.

Next, 4 ft of soil went on top of the blocks and the roadway section was built over that to include 27 in. of sand, 14 in. of Class 6 aggregate and 7 in. of bituminous pavement.

In all of the layers of construction, the weight distribution of the LWA

and blocks was equal to the weight of the 6 ft of organic material taken out of the ground. “The net load on the soils was zero,” Ritter said. “There was no potential for settlement in our calculations, because we didn’t add any [more] weight to the area than was already there with the non-supporting soils.”

Speck concluded, “Not only was the net load zero, but the environmental impact is a net positive, as the LWA serves to filter contaminants from the storm water runoff.” **[SWS]**

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GRAVITY CHANNEL INSTALLS IN JUST 10 DAYS



The City’s project manager said: It’s a home run when you can put up an aesthetic channel like this instead of the usual concrete channel or gabion baskets—and economically too.

When a sharp turn in a stream began eroding homeowners’ yards, this northern Kentucky city needed a solution, and fast.

“The ability to construct the wall without geogrid reinforcement was critically important to this project,” explained the P.E. The city manager added, “We chose Redi-Rock because we had more finish options, including the new Ledgestone face. Plus, it was very economical.”



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46" x 41" x 18" High
5.75 sq. ft. of face
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Redi-Rock’s massive, one-ton blocks stacked like giant Legos to harness the power of gravity in this project. The 13.5 ft. high walls required no reinforcement, which cut down on excavation time and costs considerably. In total, the 4,800 sq. ft. wall was installed in less than two weeks!

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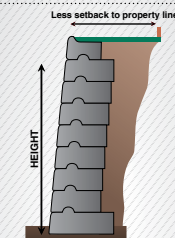
- Hear why engineers chose Redi-Rock
- Learn how Redi-Rock fit the city’s budget
- See what homeowners think of the channel

Or view the video on www.redi-rock.com!

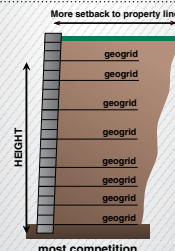


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