

MSE Retaining Wall Combines with Lightweight Aggregate

The tallest mechanically stabilized earth retaining wall ever built in Louisiana for a critical highway application takes innovation a step further with the use of a lightweight aggregate fill.

The Picardy Avenue interchange in Baton Rouge at Interstate 10 (I-10) is among the most ambitious roadway construction projects ever undertaken by the City of Baton Rouge, East Baton Rouge Parish, and the Louisiana Department of Transportation and Development (LaDOTD). The project's main goal is to reduce traffic congestion at I-10 and Bluebonnet Boulevard and Siegen Lane.

Construction for the intricate \$41-million interchange, which is being developed in six phases, began in April 2004 and should be completed by late fall of 2006. The project calls for the creation of two one-way frontage roads running eastbound and westbound along I-10, which will connect Siegen Lane and Bluebonnet Boulevard. One frontage road will run westbound along

I-10 and will connect the on- and off-ramps from I-10 westbound. The second frontage road will run eastbound along I-10, and will connect the on- and off-ramps from I-10 eastbound. The two frontage roads will also connect to a new overpass running over the interstate, which will be an extension of the existing Picardy Avenue. The project also calls for the widening and reconstruction of I-10 from Bluebonnet Boulevard to Siegen Lane as well as the design of four girder span bridges.

Periodic lane closures occur, but are limited to nighttime hours (8 p.m. to 6 a.m.) on Sundays through Thursdays. At all other times, two lanes of traffic will be maintained. No lane closures are permitted on weekends (between 6 a.m. Friday and 8 p.m. Sunday) or on holidays.

The consultant on the project is ABMB Engineers, Inc. (www.abmb.com). The consultant developed the concept for the project, performed feasibility studies, and requested access point approvals from the Federal Highway Administration. ABMB was also responsible for all traffic studies; surveys; right-of-way maps; public involvement; signalization;

coordination with city, state, and federal agencies; as well as the preliminary and final design and environmental studies.

As Anil Desa, ABMB's project manager for the structural components of the project points out, "The bridge elements of the design didn't pose any unusual challenges, but designing the retaining walls did." Cost considerations precluded creating conventional walls, while precast panels used along interstates in other parts of the country had not yet been approved by LaDOTD.

A mechanically stabilized earth (MSE) retaining wall, made from interlocking concrete blocks and tiebacks, seemed like a promising solution, but no one had built one along a Louisiana highway with the 30- to 40-ft heights required by the geometry of the site. However, the consultant pursued this alternative, meeting several times with the MSE retaining wall manufacturer (Keystone Retaining Wall Systems, Inc., www.keystonewalls.com) and running the numbers until it was sure it would work.

During the design development phase, Professional Services Industries, Inc. (PSI, www.psiusa.com), the project's geotechnical consultant, discovered low bearing capacity soils in the areas where retaining wall construction was necessary. PSI determined, through analysis of the existing soil conditions, that the critical wall height was about 22 ft. This finding meant that retaining walls taller than 22 ft and built using



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normal weight backfill (around 115 lb per cu ft) would produce excessive stress on the low bearing capacity soils, which would lead to unacceptable settlements. Since the proposed retaining walls approached heights of 40 ft in some locations, a cost-effective solution needed to be found that addressed these circumstances.

Remedying the Problem

PSI evaluated several options for remedying the problem. One option was to improve the existing foundation soils sufficiently enough to support the new retaining wall. Another was to use lightweight aggregate for fill behind the new retaining wall when the wall height exceeded 22 ft. This solution would reduce the structure's vertical pressure on the low bearing capacity soils. PSI determined that lightweight fill would be the most efficient and least expensive and recommended its use to ABMB, which in turn specified lightweight aggregate instead of the normal fill typically used in such projects to reduce the density behind the wall.


The project is now successfully making its way to completion in part because of the innovative use of the lightweight aggregate in the reinforced zones of the MSE retaining wall. Upon completion, the massive retaining wall will cover more than 214,000 sq ft,

reach heights close to 40 ft, and contain more than 120,000 cu yd of lightweight aggregate fill.

Big River Industries, a division of Oldcastle Architectural Product Group (www.oldcastle.com) was contacted during the preliminary design phase and provided the design team with the lightweight aggregate physical properties necessary to proceed with the final design. As a result there was a viable option for a cost-effective and timely method of building the complex interchange, which included several hundred ft of MSE retaining walls using the lightweight aggregate. The combination of the material's low bulk density (around 45 lb per cu ft) and high internal stability (phi angle of at least 40 degrees) made lightweight aggregate a good choice to use

behind the retaining wall without requiring ground improvements. The lightweight aggregate is distinctive because it is manufactured in a rotary kiln that produces ceramic aggregate particles filled with air voids, thus producing a strong, durable, and lightweight material.

"The product's availability, cost, and installation capabilities made it a natural, although unfamiliar choice, for the LaDOTD," said Jack Moore, director of engineered applications for Big River Industries. "The lightweight aggregate is a good option for weight-critical solutions to many geotechnical challenges where it is necessary to decrease the vertical or lateral earth pressure applied by the fill material."

The aggregate manufacturer provided the general contractor, James Construction; the retaining wall subcontractor, ABS Services, Inc.; along with the government agencies involved with inspection and testing services, educational sessions and extensive background information to ensure that everyone involved in handling and placing the lightweight aggregate was knowledgeable about the product and its installation process. 



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