Expanded Shale, Clay, and Slate Institute

The Expanded Shale, Clay & Slate Institute (ESCSI) is the international trade association for manufacturers of expanded shale, clay, and slate (ESCS) aggregates produced using a rotary kiln. The institute is proud to sponsor *ASPIRE*™ magazine.

For nearly a century, lightweight aggregate concrete has been used successfully around the world in a wide range of applications where reduced density and its other unique properties are beneficial. Structural lightweight concrete gives bridge designers greater flexibility in creating solutions to meet the design challenges of longer spans, accelerated construction schedules, more stringent durability requirements, limited budgets, increasing seismic design requirements, and restricted site access while building, repairing, and rehabilitating bridges. Research and numerous bridge projects provide ample evidence that lightweight concrete has the same or even better durability than normal weight concrete.

For more information on lightweight concrete, including a listing of ESCSI members and available publications, please visit www.escsi.org. The members of ESCSI look forward to assisting owners, designers, and concrete producers in using lightweight concrete for bridges.

Officials in Prince Georges County, Maryland, shifted to concrete bridges after a variety of factors made it apparent the benefits will pay off.

Thinking Long TERM

By Edward J. Binseel

The new concrete Race Track Road bridge, so named because it leads to a racing track, features the decorative touch of the straining head of a racehorse on the railings.

For many years, designers in Prince Georges County, Maryland, built bridges using steel components. But about 12 years ago, we re-evaluated the long-term costs, taking into account maintenance and other factors that were not always being considered during the initial design stages. As a result, we went entirely in the opposite direction and now specify precast, prestressed concrete beams for the superstructure of almost all of our bridges.

Over the past 12 years, we have standardized the design of our bridges, allowing us to pursue a cookie-cutter approach when replacing old, obsolete structures (although we do sometimes dress them up for special occasions). The bridges typically span streams rather than roadways and average 60 to 80 ft in length. Today, the majority of those bridges are built with precast, prestressed concrete box beams with a composite concrete deck. They typically include massive foundations, with the goal of making the bridges as permanent and as maintenance-free as possible.

The desire to obtain a minimum life span of 75 to 100 years for our bridges while minimizing their maintenance was the driving force behind our switch to concrete bridges. This change began in 1994, when we designed a standard steel bridge and advertised the bridge for construction. We were surprised when the bids received far exceeded the engineer's estimate due to a recent spike in the cost of steel beams. We immediately redesigned the bridge using precast, prestressed concrete box beams. We never looked back.

At the same time, I had been reading about the European approach to bridge design, which focused on making the structures long-term, permanent parts of the environment. That philosophy not only helped the bridges become

Most of the county's bridges, like the MB Road Bridge, use adjacent box beams with composite concrete deck.

area landmarks, but it minimized maintenance costs and extended the life of the bridges. Those attributes allowed the County to begin to manage the life-cycle costs of its bridges and to more effectively use the limited funds available. It also eliminated the problems arising with detours and high user costs during the performance of future bridge repairs or maintenance.

At the same time as these philosophies and steel prices were directing us toward concrete, other factors began to become apparent, too. We realized that trucks were likely to continue to become heavier, resulting in the need to load post bridges that had once carried full legal loads. Designing for HS20 loads wasn't feasible any more—and the use of the HS25 or HS27 design vehicles was now necessary. We realized that we were also retrofitting bridges that were functionally obsolete and were not capable of bearing full legal loads, even after updating.

Maintenance Budget Cut

Meanwhile, the budget for bridge maintenance continued to be cut, making us realize that we needed to create more durable designs within the original construction budget. This was brought home when the repainting of a large steel beam bridge superstructure required us to clean the lead painted steel beams down to bare metal before they could be re-coated. That wake-up call to our limited maintenance budget then resulted in still further changes in the way we design our bridges.

To make the bridges more durable, the decision was made to use epoxy-coated reinforcement throughout the bridge's substructure and superstructure. We increased the minimum concrete cover usually specified over reinforcement by 1 in. for both cast-in-place and prestressed concrete components. And we incorporated the use of silane-penetrant sealers (rather than linseed oil), and we restricted the water-cementitious materials ratio of the concrete to 0.40 for all superstructure concrete and substructure beam seats. These changes are all intended to make the bridges less permeable to salt intrusion.

While we initially received criticism for "wasting" concrete as a consequence of the thicker cover over the reinforcing steel, we calculated that our approach added only $3,000 to $5,000 to the typical bridge budget of $1.5 to $2 million. We saw we could get a lot of protection for a tiny incremental cost. We can't mobilize a contractor to fix even minor concrete spalls on a bridge for that much!

The upshot of our switch to concrete bridges is that we have not been back to repair any of the 20 concrete bridges that we've built in the past dozen years, a testament to this approach. The designs also have allowed us to incorporate interesting aesthetic touches, adding the icing to this concrete cake.

Edward J. Binseel is Associate Director, Office of Project Management, Department of Public Works & Transportation, Prince Georges County, Maryland.

National Ready Mixed Concrete Association

Founded in 1930, the National Ready Mixed Concrete Association (NRMCA) is the leading advocate for the industry. Our mission is to provide exceptional value for our members by responsibly representing and serving the entire ready mixed concrete industry through leadership, promotion, education, and partnering.

NRMCA works in conjunction with state associations on issues such as quality, business excellence, promotion, and regulatory concerns. We strive for constant communication on the latest information, products, services, and programs to help our members expand their markets, improve their operations, and be their voice in Washington, D.C.

NRMCA offers certifications for both ready mixed concrete production facilities and personnel. Certified producers strive to provide the highest quality ready mixed concrete in the safest and most efficient ways possible.

NRMCA is a principal sponsor of CONEXPO-CON/AGG. This show features over 1.5 million square feet of exhibits including an information technology pavilion and an emphasis on live demonstrations throughout the exhibit areas. The show brings together contractors, producers, and equipment manufacturers at the largest exposition in the Western Hemisphere for the construction industry.

NRMCA is also the principal sponsor of the Concrete Technology Forum, an annual symposium on state-of-the-art concrete technologies. The Forum brings researchers and practitioners together to discuss the latest advances, technical knowledge, continuing research, tools, and solutions for ready mixed concrete.

For more infornmation, contact the National Ready Mixed Concrete Association, 900 Spring Street, Silver Spring, MD 20910 888-84NRMCA (888) 846-7622; www.nrmca.org.

Silica Fume Association

The Silica Fume Association (SFA), a not-for-profit corporation based in Delaware, with offices in Virginia and Ohio, was formed in 1998 to assist the producers of silica fume in promoting its usage in concrete. Silica fume, a by-product of silicon and ferro-silicon metal production, is a highly-reactive pozzolan and a key ingredient in high performance concrete, dramatically increasing the service-life of structures.

The SFA advances the use of silica fume in the nation's concrete infrastructure and works to increase the awareness and understanding of silica fume concrete in the private civil engineering sector, among state transportation officials and in the academic community. The SFA's goals are two-fold: to provide a legacy of durable concrete structures and to decrease silica fume volume in the national waste stream.

Some of the recent projects completed by the SFA, under a cooperative agreement with the Federal Highway Administration (FHWA), include:

- The publication of a *Silica Fume User's Manual*—the manual is a comprehensive guide for specifiers, ready mixed and precast concrete producers, and contractors that describes the best practice for the successful use of silica fume in the production of high performance concrete (HPC).
- The introduction of a Standard Reference Material (SRM)® 2696 Silica Fume for checking the accuracy of existing laboratory practices and to provide a tool for instrument calibration. This SRM is available from the National Institute of Standards and Technology (NIST).

A much anticipated research program nearing completion by the SFA is the testing of in-place silica fume concrete under service conditions. At the conclusion of this research the results will demonstrate the benefit of silica fume concrete's unparalleled long-term performance. For more information about SFA, visit www.silicafume.org.