Beneficial Use Case Study

Nice-Middleton Bridge

Coal Combustion Product Type
Fly Ash

Project Name
Nice-Middleton Bridge

Project Location
Newburg, Maryland/Dahlgren, Virginia

Project Participants
Maryland Transportation Authority, Skanska–Corman–McLean JV, AECOM, Coastal Precast Systems, Chaney Enterprises, Heidelberg Materials (formerly The SEFA Group), Siva Corrosion Services

Project Completion Date
October 2022

Project Summary
The Nice-Middleton Bridge replaced a congested, unsafe two-lane crossing that had carried U.S. Route 301 over the Potomac River between Maryland and Virginia since its construction in 1940. Designed as a 1.9-mile, four-lane structure with a 100-year service life, the new bridge prioritizes safety, durability, and sustainability. Recognizing that concrete would largely determine both long-term performance and embodied carbon, the design team incorporated high-volume fly ash mixes to enhance durability while reducing environmental impact in a demanding tidal river environment.

Project Description
Constructing a nearly two-mile bridge across a tidal waterway required the installation of extensive foundations, large structural components, and deck systems exposed to moisture, salt air, and deicing chemicals. Managing internal heat during curing and protecting reinforcing steel from corrosion were critical design and construction considerations.

To address these performance demands, 17 different concrete mixtures were developed and tested throughout the project. All mass concrete placements ultimately incorporated mixes containing 45 percent fly ash. Replacing nearly half of the cement with fly ash helped moderate internal temperatures during curing in large placements, while also enhancing long-term durability in the brackish river environment, where chloride-induced corrosion is a primary concern. Temperatures were monitored in real time using remote electronic sensors to track curing conditions and verify compliance with service-life and mix design requirements under varying ambient conditions.

To maintain quality and efficiency, an on-site concrete plant was constructed adjacent to the bridge. Concrete was transported to placement locations via a coordinated barge system, supporting more than 65,000 cubic yards of concrete installed in and over water. Real-time digital batching and monitoring systems tracked concrete properties during placement to ensure consistency from production through final placement.

The Nice-Middleton Bridge was completed ahead of schedule and within budget, and its structural design and construction have been formally recognized. The bridge received a 2024 Precast/Prestressed Concrete Institute Design Award in the Transportation category for bridges with main spans between 76 and 200 feet, reflecting excellence in structural design and construction. The project stands as a model of how fly ash can help deliver infrastructure that is safer, longer-lasting, and more sustainable.

Photo: Maryland Transportation Authority