Beneficial Use Case Study

Peña Boulevard Concrete Pavement Replacement

Coal Combustion Product Type
Class F Fly Ash

Project Name
Peña Boulevard Concrete Pavement Replacement

Project Location
Denver, Colorado

Project Participants
City and County of Denver, Headwaters Inc., Holcim (US) Inc., Plum Creek Structures, Aggregate Industries, Castle Rock Concrete Construction Company of Colorado, Euclid Chemical, and CESARE Inc.

Project Completion Date
2014

Project Summary
Peña Boulevard is a major thoroughfare connecting Denver via Interstate 70 with the city's international airport. Originally built in the early 1990s, the road's jointed plain concrete pavement (JPCP) two decades later had begun showing signs of severe alkali-silica reactivity (ASR) distress that required expensive repair. Initial plans for the road's overhaul called for placement of an 11-inch doweled JPCP atop a 12-inch Colorado Department of Transportation (CDOT) Class 6 aggregate base. Owing to concerns over the project's cost and potentially lengthy duration, airport authorities sought a different solution.

Project Description
Peña Boulevard is a heavily traveled road that carries up to 65,000 vehicles per day between the city of Denver and one of the country's busiest airports. As such, when it came time for resurfacing a three-mile stretch of the road near Denver International Airport, it was deemed imperative that construction work not unduly impede the flow of traffic. Combined with a recent Colorado state initiative to lower the environmental impact of construction, project designers were encouraged to seek out both innovative road repair materials and processes.

Since ASR had been the primary reason for Peña Boulevard requiring repair, the project team designed and tested the materials in the concrete mix to meet CDOT specifications for resistance to reactivity and sulfate attack. Ultimately, a mix incorporating Holcim's Envirocore® portland-limestone cement (PLC) together with 20 percent Class F fly ash was selected for the concrete binder. Rather than removing roadway segments, reconditioning the subgrade, and placing a CDOT Class 6 aggregate base, the team chose to rubblize the existing JPCP to serve as a foundation for the new pavement.

The project results were highly favorable across all economic and environmental criteria when judged against a business-as-usual approach to pavement reconstruction and include:

- Use of fly ash and PLC lowered the concrete's overall carbon footprint by reducing the amount of clinker used, as well as the energy associated with its production; and
- Crushing, recycling, and reusing roadway concrete in place saved the time, expense, and environmental impact of transporting old pavement and new base materials. This process saved an estimated several weeks of labor and $500,000 in associated costs, 1,250 gallons of diesel fuel, and 1.5 tons of avoided CO2 emissions.

For these achievements, the project received a number of industry accolades, including the 2015 Triad Award by *Public Works* magazine and the 2015 American Concrete Pavement Association's Paving Contractor Award for Excellence.

Photo: Colorado Department of Transportation