

### Coal Combustion Product Type

Class F Fly Ash

### Project Name

Use of Green Concrete to Pave U.S. Route 287

### Project Location

Lamar, Colorado

### Project Participants

Castle Rock Concrete Construction Company, Holcim (US) Inc., Colorado Department of Transportation

### Project Completion Date

2008

### Project Summary

In 2007 Holcim (US) Inc. and Castle Rock Construction Company joined in a collaborative partnership to provide the Colorado Department of Transportation (CDOT) with a sustainable concrete pavement solution to help with the governor's initiative to lower the environmental impact of construction. An industry task force helped develop the "green concrete" specification allowing carbon-reducing alternatives to ordinary portland cement (OPC), such as portland-limestone cement (PLC) and fly ash, to be used in concrete paving projects. In 2008, CDOT became the first state department of transportation to approve the use of PLC containing up to 10 percent limestone and to allow blending with fly ash at the ready-mix plant.

### Project Description

An early usage and test of the lime/fly ash mix came in May 2008 with the replacement of a seven-mile segment, together with shoulder widening, of U.S. Highway 287. The road is a major U.S. - Mexico shipping highway that accommodates heavy truck traffic. When the time came to replace a section of this highway—a jointed plain concrete pavement near Lamar, Colorado—CDOT selected its Class P mixture, which is designed to have a 28-day flexural strength of at least 650 psi. Together with PLC sourced from Holcim (which replaced the more typical Type I/II portland cement), the concrete mix incorporated 20% Class F fly ash and a carefully selected blend of aggregate to facilitate the production of a consistent concrete batch and a solid platform for the concrete paver.



Colorado Department of Transportation

*Roughly 1.2 million square yards of fly ash-rich "green concrete" was placed during the construction of 12.5 miles of new express lanes on Colorado State Highway 470.*

Most of the paving work took place during the summer months, and contractor Castle Rock Construction dealt with frequent placement conditions of 100° Fahrenheit. Thus, the project provided a good opportunity to gauge the effect of hot weather on the PLC/fly ash mix. Site workers, however, reported no difference in performance or placement with the new mix. Ultimately, the green concrete satisfied all the requirements for batching, mixing, and placing—and the contractor earned a quality performance incentive by attaining a 28-day flexural strength of 695 psi.

Since this first project, Castle Rock Construction has used green concrete in most of its infrastructure paving work (over 600 lane miles). This includes the resurfacing of Pena Boulevard, the thoroughfare that leads to Denver International Airport, which was recognized with a Triad Award from *Public Works* magazine for outstanding innovation and sustainability in using PLC. Other notable projects include 1.5 million square yards of concrete for 12 miles of express lanes on U.S. Route 36 (which earned a National Award for Excellence from the American Concrete Pavement Association) and 1.2 million square yards of concrete for 12.5 miles of new express lanes on Colorado State Highway 470.