

Coal Combustion Product Type

Class C Fly Ash

Project Name

Batson Children's Hospital

Project Location

Jackson, Mississippi

Project Participants

Holcim US, MMC Materials

Project Completion Date

October 2020

Project Summary

Batson Children's Hospital is the only hospital in Mississippi dedicated to providing children with medical care in more than 30 specialty areas. The facility averages 10,000 patients annually from throughout the state and around the country. Opened in 1997, Batson Children's Hospital was in dire need of additional space to allow hundreds of additional children to be cared for every year. In response, the hospital developed plans for a 370,000-square-foot addition—including intensive care rooms, surgical suites, a state-of-the-art imaging center, and a children's heart center—as well as a 193,000-square-foot parking garage.

Project Description

The plan called for placing 26,600 cubic yards of concrete for the hospital addition and 8,000 cubic yards of concrete for the parking garage. With concrete a significant portion of the expansion project, the use of sustainable materials in the high-performance mixes was paramount.

Mixes also needed to meet specified durability requirements for moderate sulfate resistance and chloride exposure, as well as achieve compressive strengths of 4,500 psi for the foundations, 5,000 psi for the elevated decks, and 6,000 psi for the structural columns. Achieving a 75 percent early strength gain of 3,750 psi within three days for the elevated decks, especially the post-tensioned slabs of the parking garage, was also important to keep the project on schedule.

With sustainability a high priority, the project offered an ideal opportunity for using concrete mix designs incorporating Portland Limestone Cement (PLC) and Class C fly ash. Used seamlessly as a direct substitution for ordinary portland cements, PLC (Type IL) provides performance that is equivalent to or better than Type I/II cements. Because Holcim's OneCem® PLC uses less clinker than traditional portland cement, CO2 emissions are reduced by 5 to 10 percent per ton of cement. Reducing clinker content even more with fly ash further lowers a project's carbon footprint.

According to Taylor Wilson, sales and service coordinator at MMC Materials, PLC interacts with fly ash extremely well and allows higher amounts of Class C fly ash to be used in concrete mixes. "Type IL cement not only enables the use of



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more recycled materials to reduce clinker content, but also helps achieve better early strength gain and improved set time for concrete placement," he explained.

To develop cost-effective mix designs for various structural concrete applications on the project, the quality control team at MMC Materials evaluated 25 different recipes of OneCem PLC, Class C fly ash, various admixtures, and different aggregates. Laboratory analysis included tests on early strength, maturity of the concrete, slump, workability, set time, permeability, and durability.

Upon completion of the performance assessments, the team settled on six mixes incorporating OneCem PLC, 20 to 30 percent Class C fly ash, and various performance-enhancement admixtures. Throughout the construction process, MMC Materials supplied the sustainable concrete mixes from two of its batch plants located 15 minutes from the job site and conducted quality control tests in the laboratory and in the field during every placement. Cylinders were cast and tested every 150 yards.

The hospital expansion was completed on schedule and within budget, with a ribbon-cutting ceremony held in October 2020. The use of OneCem PLC combined with fly ash replacement levels of 20 to 30 percent reduced the embodied carbon of the concrete by as much as 35 percent. The custom-designed PLC/fly ash mixes also achieved all application-specific performance targets for durability, permeability, workability, ultimate strength, and finishing qualities.

Information adapted from materials supplied by Holcim US.