

Coal Combustion Product Type

Fly Ash

Project Name

London Power Tunnels

Project Location

London, England

Project Participants

National Grid, Hochtief-Murphy Joint Venture, Wagners, AECOM, Mott MacDonald, WSP, Tarmac, Capital Concrete

Project Completion Date

2026

Project Summary

London Power Tunnels is a project to reinforce London's electricity transmission network by building over 60 km of deep-level tunnels carrying high-voltage cables. Phase two of the project involves constructing 20.2 miles of tunnels, 10 feet in diameter and up to 200 feet below street level, from Wimbledon to Crayford in southeast London. Part of the project involved infilling the base of the 180-foot-deep tunnel shaft at the Hurst Substation in South London—a job that National Grid chose to complete with cement-free concrete.

Project Description

In 2020, National Grid Electricity Transmission, which owns and maintains the high-voltage electricity transmission network in England and Wales, committed to achieving carbon-neutral construction emissions by 2026. "National Grid Infrastructure projects are responsible for half the UK's carbon emissions," the company wrote in its report *Our Route to Net Zero Emissions*. "Building new assets such as substations is a big part of our job. We therefore need to find ways to make our construction work less carbon intensive, which goes hand-in-hand with reducing costs for the business."

Capital Concrete had previously supplied "Earth Friendly Concrete" (EFC)—which substitutes ordinary portland cement with chemically activated fly ash and slag in a geopolymer binder—for use in other London-based projects where the material's low levels of embodied carbon, high tensile strength, and low shrinkage helped meet project requirements. After extensive trialing of the cement-free concrete at various other London Power Tunnels sites, the green light was given to use EFC in the infilling of the Hurst Substation tunnel shaft.

Appropriately, on April 22, 2023—Earth Day—a record EFC placement of 25,992 cubic feet was carried out over an 11-hour period. The concrete mix incorporated 55.2 metric tons of fly ash—sourced from Tarmac in Tudela, Spain—at a substitution rate of 25 percent. Use of the cement-free concrete reduced carbon emissions by an estimated 72 metric tons—or 64 percent—the equivalent emissions of driving a car around the world 18 times. In addition to the environmental advantages of the mix, the use of supplementary cementitious materials, particularly fly ash, helped reduce the heat of hydration associated with the placement.

Additional actions carried out to help achieve the project's environmental goals included diverting 99.98 percent of project waste from landfill—representing a 21 percent reduction against the carbon reduction pre-project baseline—for shafts, tunnels, and headhouses. This equated to a savings of 25,250 metric tons of CO₂.



Photo courtesy of Capital Concrete