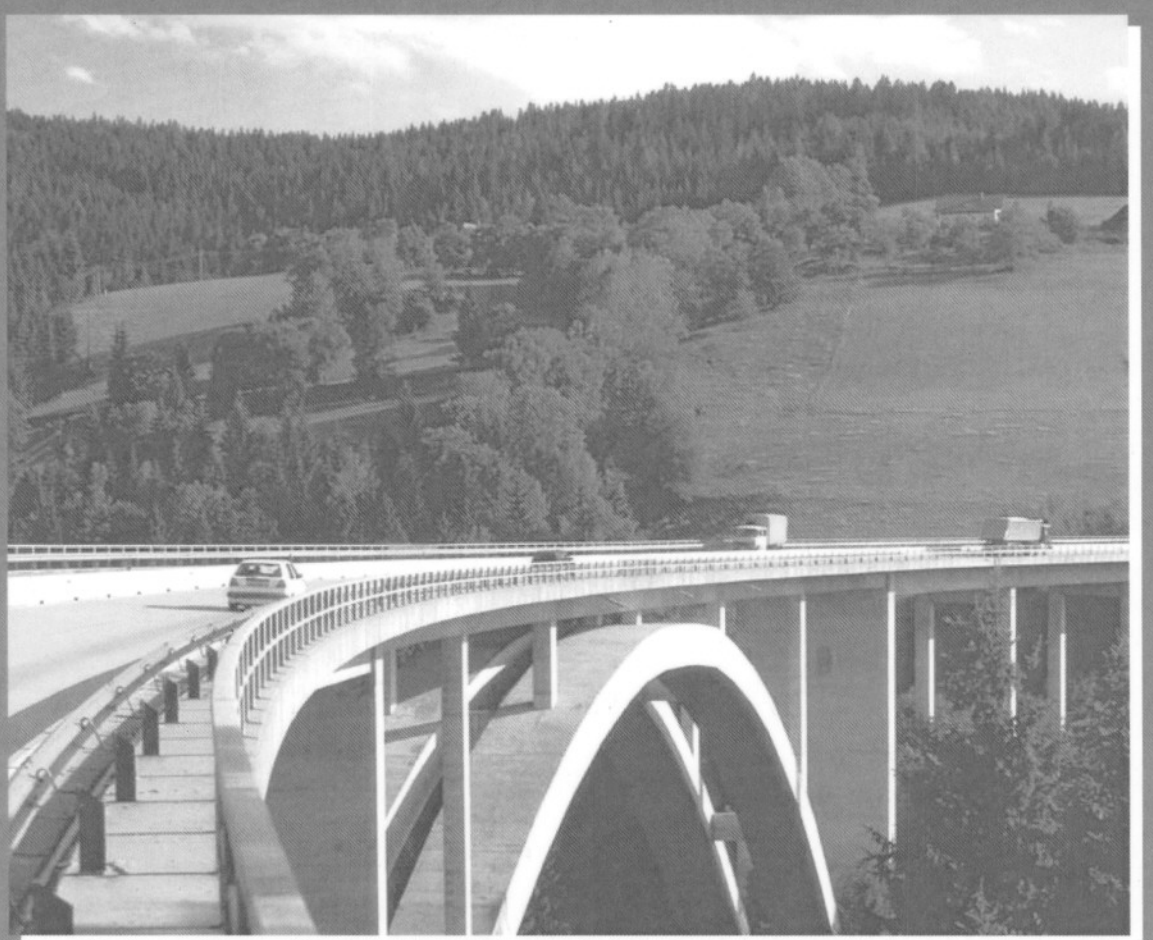
Federal Highway Administration

EPA
United States Environmental Protection Agency

Using Coal Ash in Highway Construction: A Guide to Benefits and Impacts



ACAA INTERNATIONAL

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EPA-530-K-05-002
April 2005

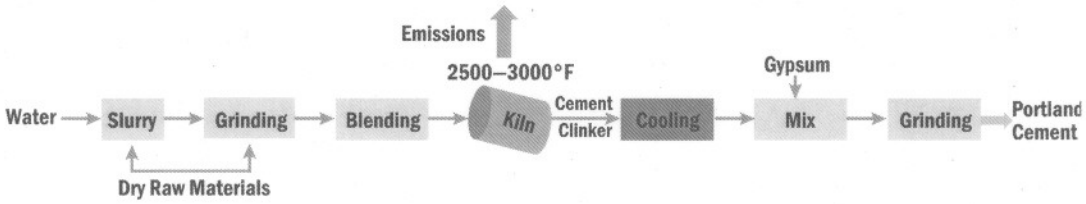
Environmental Benefits

The use of coal combustion products in highway construction provides significant short- and long-term environmental benefits. Specifically, using coal combustion products in lieu of other materials, such as Portland cement, reduces energy use and greenhouse gas emissions and conserves natural resources. In addition, it prevents the disposal of a valuable resource, reducing the need for landfills and surface impoundments. Finally, the inherent performance benefits of concrete made from coal ash actually leads to additional environmental benefits. Highways and bridges made with coal ash concrete are more durable than those made without it and, therefore, do not need to be repaired and replaced as often.

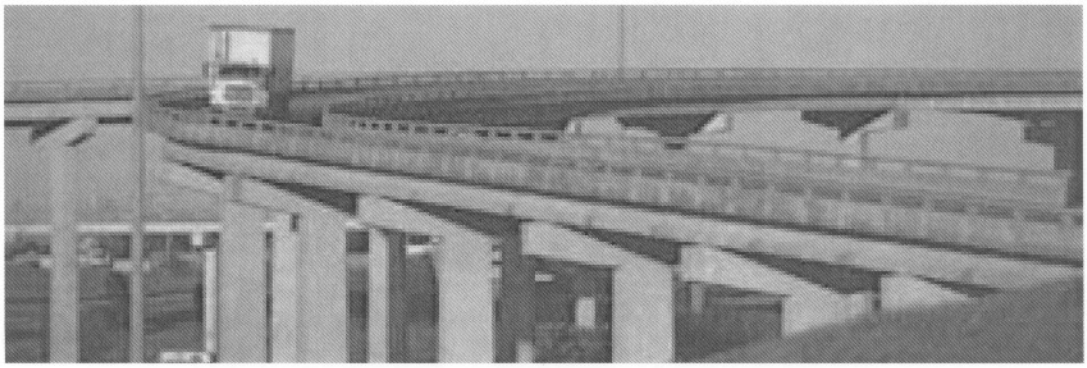
Greenhouse Gas Emissions and Energy Reductions

Producing cement involves many steps, including grinding and blending raw ingredients (such as limestone, shells or chalk, and shale, clay, sand, or iron ore), heating those ingredients to very high temperatures in a kiln, cooling and mixing those ingredients with gypsum, then grinding down the mixture to form cement powder.

Figure 7: Generic Cement Production Process



This energy-intensive process typically emits nearly one ton of greenhouse gases for each ton of cement created and requires the equivalent of a barrel of oil per



ton. Using fly ash—which would otherwise be disposed of—in concrete has the potential to significantly reduce the quantity of greenhouse gases emitted and the amount of fuel used. Typically, between 15 to 30 percent of Portland cement in concrete can be replaced with fly ash.

The Federal Highway Administration reports that roads and bridges made with high-performance coal ash concrete can last years longer than those made with Portland cement as the only binding agent. Thus, using coal ash concrete reduces the need to produce new concrete, which consequently means further reductions in future greenhouse gas emissions, energy use, and natural resources. For some locations, coal combustion products are a locally available construction material that requires less transportation costs and fuel usage for trucking the material to the construction site.

In 2002, the American Coal Ash Association estimated that 12.6 million tons of fly ash were used as a substitute for Portland cement in the United States. The industry set a goal to increase its use to 20 million tons by 2010. EPA estimates that this would reduce the future generation of greenhouse gasses by more than 6.5 million tons a year.[2]

What Are Greenhouse Gas Emissions?

The Earth's atmosphere acts like an immense greenhouse, trapping heat from the sun to warm the planet to create habitable conditions. This "greenhouse effect" occurs when solar radiation is absorbed by greenhouse gases in the atmosphere. Most greenhouse gases, such as carbon dioxide, nitrous oxide, and other trace gases like methane, occur naturally. Human activities may intensify this natural phenomenon. Burning fossil fuels to power cars, homes, and industry releases carbon dioxide and increases concentrations of other greenhouse gases in the atmosphere.

One ton of fly ash used as a replacement for cement:

- Conserves enough landfill space to hold about 1,200 pounds of waste, or the amount of solid waste produced by one American over 270 days.
- Reduces the equivalent of two months of an automobile's carbon dioxide emissions.
- Saves enough energy to provide electricity to an average American home for 19 days.

[2] *Estimated using EPA's Waste Reduction Model, Solid Waste Management and Greenhouse Gases, Second Edition, EPA 530-R-02-006, Office of Solid Waste, June 2002.*