



Beneficial Use Case Study

Capitol Tower/Bank of America Tower

Coal Combustion Product Type:

Fly ash

Project Location:

Houston, Texas

Project Participants:

Skanska USA Commercial Development,
Baker Concrete Construction, Gensler,
Walter P Moore, Wylie Consulting Engineers

Project Completion Date:

2019

Project Summary:

In 2015, Skanska USA Commercial Development placed the concrete foundation mat for a proposed 35-story tower in downtown Houston. In an unusual sequencing, Skanska held off on building the tower itself until it could pre-lease a significant portion of the 750,000 square feet of office space. However, that didn't preclude Skanska from having its building design pre-certified at the LEED Platinum v4 level—just the third building in the U.S. to receive such certification. Construction of the tower itself began in 2017 and was completed in 2019.

Project Description:

Shortly after the U.S. Green Building Council's beta launch of LEED v4, Skanska Commercial Development enrolled their planned office building, Capitol Tower (later to be renamed Bank of America Tower), in the program. To achieve Platinum pre-certification, the project would need to achieve most of the LEED "Materials and Resources" credits, including the "whole building life-cycle assessment," which is awarded based on a building's reduction in the impacts associated with the manufacturing and building materials.

Structural engineers Walter P Moore worked closely with concrete suppliers to assess the environmental impact of the project's concrete across six criteria: carbon dioxide emissions, depletion of stratospheric ozone, acidification, eutrophication, formation of tropospheric ozone, and depletion of non-renewable resources. A key strategy in achieving these included an aggressive program of cement minimization. Ultimately, 55% of the cement in the custom concrete mix was replaced with fly ash, which led to a 33% reduction in the production of ozone-depleting materials, a 19% decrease in global warming potential, and 12% less acidification. Use of fly ash in place of cement saved more than one million pounds of carbon dioxide, the equivalent emissions associated with driving a car 1.2 million miles.

The 20-hour continuous placement of 9020 cubic yards of concrete for the foundation carried with it some significant operational and logistical challenges. Among them were Houston's hot weather—temperatures remained in the 80s and 90s throughout placement—and a construction site with limited perimeter access. Overcoming the site constraints—which included an active light-rail line adjacent to one side of the foundation—meant the pour had to be carried out with only four mobile pumps. The placement's 902 concrete deliveries were executed at precise 10-minute intervals—the cycle time for trucks to discharge concrete at the pumps. To reduce the heat of hydration and minimize the risk of thermal cracking, engineers not only specified a high-percentage replacement of cement with fly ash, but also pre-cooled aggregates with water spray. Concrete placement temperatures ranged from 88° F to 92° F—well below the 98° F limit.

To minimize the risk of logistical mishaps preventing completion of the foundation in the allotted time, the team built redundancies into the plan. A backup pumper was stationed on site, and a tow truck was on standby to tow away any concrete pumps were they to have failed. Additional batch plants were used to maintain concrete production.



Source: Skanska USA.