EE 24
REDUCE CO2 EMISSIONS FROM SPECIALIZED CONCRETE

New York City Building Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:
The NYC Building Codes currently limits the amount of recycled material that can be used in concrete exposed to de-icing chemicals.

Recommendation:
Increase the maximum percentage of recycled material that can be used in concrete.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:
1. Amend Table 1904.2.3 as follows:

<table>
<thead>
<tr>
<th>CEMENTITIOUS MATERIALS</th>
<th>MAXIMUM PERCENT OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT&lt;sup&gt;a,b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fly ash or other pozzolans conforming to ASTM C 618</td>
<td>30</td>
</tr>
<tr>
<td>Slag conforming to ASTM C 989</td>
<td>50</td>
</tr>
<tr>
<td>Silica fume conforming to ASTM C 1240</td>
<td>10</td>
</tr>
<tr>
<td>Total of fly ash or other pozzolans, slag and silica fume</td>
<td>50&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total of fly ash or other pozzolans and silica fume</td>
<td>35&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Supporting Information

Issue – Expanded
Cement manufacturing is responsible for 3.4%-5% of global carbon emissions and is the largest source of U.S. emissions after fossil fuel consumption. The primary source of carbon emissions from cement production is the use of coal and petroleum to fuel kilns. The production of one ton of Portland cement results in the emission of approximately one ton of CO<sub>2</sub>.

All concrete, including simple flat work and concrete with high compressive strengths, can be made with reduced amounts of Portland cement by using supplementary cementitious materials. These materials are typically fly ash, ground granulated blast-furnace slag (GGBFS) and silica fume, all of which are by-products of industrial processes that are typically placed in landfills. Since they are waste products, the use of supplementary cementitious materials directly offsets the CO<sub>2</sub> that would otherwise be released in cement production.

Fly ash can replace up to 50% of Portland cement in concrete mixtures, and the use of 25% fly ash is already common. GGBFS commonly replaces up to 40% of cement, and has replaced up to 80%; silica fume can replace 5% to 7% of cement. In addition to reducing CO<sub>2</sub> emissions, fly ash and blast furnace slag increases the workability of concrete, which aids finishing operations, and reduces water demand. Supplementary cementitious materials also reduce the permeability of concrete, making them a necessary ingredient in concrete that has reinforcing steel or is subjected to...
chlorides, such parking structures, bridge decks, road pavements and marine structures.

**Environmental & Health Benefits**
As previously discussed, replacing Portland cement with fly ash reduces greenhouse gas emissions.

NYC uses over 50,000 cubic yards of concrete exposed to chloride based de-icer per year. This proposal would lead to an average reduction of 25 lbs of cement per yard, reducing CO₂ emissions in NYC by over 50 tons per year.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

**Cost & Savings**
This proposal is not expected to have any significant impact on capital costs.

**Precedents**
Many other municipalities across the country allow for the substitution of supplementary cementitious materials for Portland cement. However, the levels proposed here would become the highest known allowed.

The Port Authority of NY &NJ has been replacing 30% of Portland cement with fly ash in concrete mix proportions used on its bridge decks, parking structures and marine facilities. These structures have been subjected to chloride ions for about ten years and the Port Authority reports that the concrete produced is of high strength and durable.

**LEED**
LEED credits are available for the use of supplementary cementitious materials that are derived from industrial by-products.

These credits include: LEED NC- MR cr.4.1 & 4.2 Recycled Content; LEED CI-MR cr. 4.1 & 4.2 Recycled content; LEED EB-MR cr.2 Optimize use of Alternative Materials; LEED for Schools MR cr.4.1 & 4.2 Recycled Content; LEED for Homes MR cr. 2 Environmentally Preferable Products; and credits under the various pilot programs.

**Implementation & Market Availability**
There are no known implementation issues for this proposal. Alternative cementitious materials are readily available. There are enormous qualities of fly ash available and presently ample quantities of GGBFS.

It may be necessary to bring some concrete suppliers and engineers up to date with the current concrete technology in the use of supplementary cementitious materials. The Concrete Industry Board of NYC is capable and willing to perform this task.

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**ENDNOTES:**
