EMC – Energetically Modified Cement

The following is a summary from a paper by Professor V Ronin of the Lurea University of Technology in Sweden: “An Industrially Proven Solution for Sustainable Pavements of High Volume Pozzolan Concrete – Using Energetically Modified Cement (EMC)”, that was presented at the International Conference on Sustainable Concrete Pavements in Sacramento, California in September 2010.

Some five years ago the use of EMC and Supplementary Cementitious Materials (EMC – SCM) entered the concrete market in Texas. The commercial product is called “CemPozz”. It is a binder where 50 – 80% of the Portland Cement (PC) is replaced by natural pozzolans or flyash (FA). Depending on the requirements, the CemPozz concrete could be 5% PC and 95% FA. Such mixes are called high volume pozzolan concretes (HVPC).

These mixes are applicable for paving and structural concretes. This significant increase in FA reduces the “carbon footprint” by over 50% of the industrially produced conventional concrete.

The EMC – SCM technology comprises of mechanical processing of blends of pozzolan with small volumes of PC, using a special milling system. This process creates increased surface activation of the pozzolan and PC particles. It is suggested that the starting trials with HVPC should be 30% PC and 70% CemPozz (FA).

The following are pertinent test results from trials at Pennsylvania DoT with various proportions of CemPozz FA:

- The CemPozz concrete had significantly less cracking and drying shrinkage;
- The 50/50 (PC/FA) mixes perform in line with the normal 80/20 mix concretes;
- A 30/70 mix can reach 34 MPa in 28 days, but will continue to gain significant strength to 56 days;
- The 50/50 mix shrinks only about ¼ of the normally permitted strain level;
- The w/c, initial set and final set are virtually identical to the normal concrete mixes for the same strength;
The actual compressive strengths (MPa) were:

<table>
<thead>
<tr>
<th>Cement type</th>
<th>w/c</th>
<th>1</th>
<th>3</th>
<th>7</th>
<th>28</th>
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<tbody>
<tr>
<td>PC</td>
<td>0.48</td>
<td>10.3</td>
<td>26.6</td>
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<tr>
<td>50% CemPozz</td>
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<td>21.9</td>
<td>27.2</td>
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<tr>
<td>80% PC/20% FA</td>
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<td>6.5</td>
<td>20.4</td>
<td>23.6</td>
<td>35.8</td>
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<tr>
<td>60% PC/40% FA</td>
<td>0.44</td>
<td>3.8</td>
<td>15.1</td>
<td>17.7</td>
<td>29.6</td>
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