Concrete PCR and EPDs

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Sr. VP, Sustainable Development
Brief History

Nov 2012

2011-2013

Feb 2011

Feb 2013

Oct 2014
Product Category Rules (PCR)

- Carbon Leadership Forum
  - CLF PCR v1 Nov 2012
  - CLF PCR v1.1 Dec 2013

**CONCRETE**

Meeting the requirements of one of the following:
- ASTM C94
- ASTM C90
- CSA A23.1/A23.2
- UNSPSC code 30111500

EPDs created by this PCR are appropriate to be used to evaluate the environmental impact of the material concrete (does not include reinforcement, curing or formwork) for products manufactured in North America (United States and Canada) and other countries who use the standards listed above.

ADOPTED NOVEMBER 30, 2012  Revised Version 1.1 December 4, 2013
NRMCA EPD Program

- Verify (certify) EPDs
- Reviews LCAs
- Develops PCRs
- Encourage members to publish EPDs
- Third party verifiers
NRMCA Verified EPDs

- 4 companies
- 2000 products
- 4 EPDs verified in other programs
## Table 1: Declared Product Range Classification

<table>
<thead>
<tr>
<th>Specified Compressive Strength range (Column 1)</th>
<th>SCM range (%) (Column 2)</th>
<th>Product Name (Column 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2500 psi (0-17.24 MPa)</td>
<td>0-19% Fly Ash and/or Slag</td>
<td>2500-00-FA/SL</td>
</tr>
<tr>
<td></td>
<td>20-29% Fly Ash</td>
<td>2500-20-FA</td>
</tr>
<tr>
<td></td>
<td>30-39% Fly Ash</td>
<td>2500-30-FA</td>
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<tr>
<td></td>
<td>40-49% Fly Ash</td>
<td>2500-40-FA</td>
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<tr>
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<td>30-39% Slag</td>
<td>2500-30-SL</td>
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<tr>
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<td>40-49% Slag</td>
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<td>≥ 50% Slag</td>
<td>2500-50-SL</td>
</tr>
<tr>
<td></td>
<td>≥ 20% Fly Ash and ≥ 30% Slag</td>
<td>2500-50-FA/SL</td>
</tr>
<tr>
<td>2501-3000 psi (17.25-20.68 MPa)</td>
<td>0-19% Fly Ash and/or Slag</td>
<td>3000-00-FA/SL</td>
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<tr>
<td></td>
<td>20-29% Fly Ash</td>
<td>3000-20-FA</td>
</tr>
<tr>
<td></td>
<td>30-39% Fly Ash</td>
<td>3000-30-FA</td>
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<tr>
<td></td>
<td>40-49% Fly Ash</td>
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<td>30-39% Slag</td>
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<td>≥ 50% Slag</td>
<td>3000-50-SL</td>
</tr>
<tr>
<td></td>
<td>≥ 20% Fly Ash and ≥ 30% Slag</td>
<td>3000-50-FA/SL</td>
</tr>
<tr>
<td>3001-4000 psi (20.69-27.58 MPa)</td>
<td>0-19% Fly Ash and/or Slag</td>
<td>4000-00-FA/SL</td>
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<tr>
<td></td>
<td>20-29% Fly Ash</td>
<td>4000-20-FA</td>
</tr>
<tr>
<td></td>
<td>30-39% Fly Ash</td>
<td>4000-30-FA</td>
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<tr>
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<td>40-49% Fly Ash</td>
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<td>≥ 50% Slag</td>
<td>4000-50-SL</td>
</tr>
<tr>
<td></td>
<td>≥ 20% Fly Ash and ≥ 30% Slag</td>
<td>4000-50-FA/SL</td>
</tr>
</tbody>
</table>

| 4001-5000 psi (27.59-34.47 MPa)               | 0-19% Fly Ash and/or Slag | 5000-00-FA/SL          |
|                                               | 20-29% Fly Ash            | 5000-20-FA             |
|                                               | 30-39% Fly Ash            | 5000-30-FA             |
|                                               | 40-49% Fly Ash            | 5000-40-FA             |
|                                               | 30-39% Slag               | 5000-30-SL             |
|                                               | 40-49% Slag               | 5000-40-SL             |
|                                               | 50% Slag                  | 5000-50-SL             |
|                                               | ≥ 20% Fly Ash and ≥ 30% Slag | 5000-50-FA/SL       |

| 5001-6000 psi (34.48-41.37 MPa)               | 0-19% Fly Ash and/or Slag | 6000-00-FA/SL          |
|                                               | 20-29% Fly Ash            | 6000-20-FA             |
|                                               | 30-39% Fly Ash            | 6000-30-FA             |
|                                               | 40-49% Fly Ash            | 6000-40-FA             |
|                                               | 30-39% Slag               | 6000-30-SL             |
|                                               | 40-49% Slag               | 6000-40-SL             |
|                                               | ≥ 50% Slag                | 6000-50-SL             |
|                                               | ≥ 20% Fly Ash and ≥ 30% Slag | 6000-50-FA/SL       |

| 6001-8000 psi (41.38-55.16 MPa)               | 0-19% Fly Ash and/or Slag | 8000-00-FA/SL          |
|                                               | 20-29% Fly Ash            | 8000-20-FA             |
|                                               | 30-39% Fly Ash            | 8000-30-FA             |
|                                               | 40-49% Fly Ash            | 8000-40-FA             |
|                                               | 30-49% Slag               | 8000-30-SL             |
|                                               | 40-49% Slag               | 8000-40-SL             |
|                                               | ≥ 50% Slag                | 8000-50-SL             |
|                                               | ≥ 20% Fly Ash and ≥ 30% Slag | 8000-50-FA/SL       |
## Impacts

### Table 8a. Summary Results (A1-A3): 3001-4000 psi (20.69-27.58 MPa) RMC product, per cubic yard

<table>
<thead>
<tr>
<th>Indicator/LCI Metric</th>
<th>GWP</th>
<th>ODP</th>
<th>AP</th>
<th>EP</th>
<th>POCP</th>
<th>PEC</th>
<th>NRE</th>
<th>RE</th>
<th>NRM</th>
<th>RM</th>
<th>CBW</th>
<th>CWW</th>
<th>TW</th>
<th>CHW</th>
<th>CNHW</th>
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<tbody>
<tr>
<td>Unit (equivalent)</td>
<td>kg CO2</td>
<td>kg CFC-11</td>
<td>kg SO2</td>
<td>kg N</td>
<td>kg O3</td>
<td>MJ</td>
<td>MJ</td>
<td>MJ</td>
<td>kg</td>
<td>kg</td>
<td>m3</td>
<td>m3</td>
<td>m3</td>
<td>kg</td>
<td>kg</td>
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<td>Minimum Indicator/</td>
<td>191.4</td>
<td>3.49E-6</td>
<td>1.01</td>
<td>0.11</td>
<td>13.40</td>
<td>1690</td>
<td>1676</td>
<td>13</td>
<td>1545</td>
<td>0.41</td>
<td>0.10</td>
<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
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<td>Metric Value</td>
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<tr>
<td>Maximum Indicator/</td>
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<td>5.44E-6</td>
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<td>2439</td>
<td>2421</td>
<td>17</td>
<td>1795</td>
<td>0.53</td>
<td>0.10</td>
<td>0.09</td>
<td>0.19</td>
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<td>2.04</td>
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<td>Metric Value</td>
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<tr>
<td>4000-00-FA/SL</td>
<td>318.1</td>
<td>5.44E-6</td>
<td>1.39</td>
<td>0.15</td>
<td>16.91</td>
<td>2439</td>
<td>2421</td>
<td>17</td>
<td>1795</td>
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<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
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<tr>
<td>4000-20-FA</td>
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<td>2127</td>
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<td>4000-30-FA</td>
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<td>14.35</td>
<td>1959</td>
<td>1945</td>
<td>14</td>
<td>1620</td>
<td>0.44</td>
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<td>0.09</td>
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<td>4000-40-FA</td>
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<td>1555</td>
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<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
</tr>
<tr>
<td>4000-30-SL</td>
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<td>15.83</td>
<td>2021</td>
<td>2006</td>
<td>15</td>
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<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
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<tr>
<td>4000-40-SL</td>
<td>216.8</td>
<td>3.93E-6</td>
<td>1.17</td>
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<td>1883</td>
<td>1868</td>
<td>15</td>
<td>1622</td>
<td>0.47</td>
<td>0.10</td>
<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
</tr>
<tr>
<td>4000-50-SL</td>
<td>191.4</td>
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<td>15.11</td>
<td>1745</td>
<td>1730</td>
<td>14</td>
<td>1578</td>
<td>0.46</td>
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<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
</tr>
<tr>
<td>4000-50-FA/SL</td>
<td>193.0</td>
<td>3.49E-6</td>
<td>1.04</td>
<td>0.12</td>
<td>14.11</td>
<td>1690</td>
<td>1676</td>
<td>13</td>
<td>1545</td>
<td>0.43</td>
<td>0.10</td>
<td>0.09</td>
<td>0.19</td>
<td>0.31</td>
<td>2.04</td>
</tr>
</tbody>
</table>
Industry Baselines/Averages

Average Impacts
- 2500 psi
- 3000 psi
- 4000 psi
- 5000 psi
- 6000 psi
- 8000 psi

Masses of Materials, per Cubic Yard of Concrete
www.nrmca.org/sustainability