



**MATERIAL CERTIFICATION REPORT**

**Plant:** Rapid City  
**Address:** 501 N. St Onge Street  
 Rapid City, South Dakota  
**Contact:** Gail B. Arnicucci  
**Phone:** (605) 721-7100

**Cement Type:** I/II, Low Alkali, GU  
**Date Issued:** 01-Jun-18  
**Production Period:** 1-May-18  
**To:** 31-May-18

**STANDARD REQUIREMENTS ASTM C150/AASHTO M85/ASTM C1157**

| CHEMICAL                                    |                       |             |
|---|-----------------------|-------------|
| Item  | ASTM C150 Spec. Limit | Test Result |
| SiO <sub>2</sub> (%)                        | A                     | 20.2        |
| Al <sub>2</sub> O <sub>3</sub> (%)          | 6.0 max               | 4.6         |
| Fe <sub>2</sub> O <sub>3</sub> (%)          | 6.0 max               | 3.3         |
| CaO (%)                                     | A                     | 64.2        |
| MgO (%)                                     | 6.0 max               | 1.2         |
| SO <sub>3</sub> (%)                         | 3.5 max <sup>B</sup>  | 3.0         |
| Loss on Ignition (%)                        | 3.5 max               | 2.3         |
| Na <sub>2</sub> O (%)                       | A                     | 0.11        |
| K <sub>2</sub> O (%)                        | A                     | 0.69        |
| Insoluble Residue (%)                       | 1.5 max               | 0.44        |
| CO <sub>2</sub> (%)                         | A                     | 1.2         |
| Limestone (%)                               | 5.0 max               | 3.0         |
| CaCO <sub>3</sub> in Limestone (%)          | 70 min                | 94          |
| Potential Phase Composition <sup>C</sup>    |                       |             |
| C <sub>3</sub> S (%)                        | A                     | 58          |
| C <sub>2</sub> S (%)                        | A                     | 14          |
| C <sub>3</sub> A (%)                        | 8 max                 | 7           |
| C <sub>4</sub> AF (%)                       | A                     | 10          |
| C <sub>3</sub> S + 4.75C <sub>3</sub> A (%) | 100 max               | 89          |

| PHYSICAL                                 |                       |                        |             |
|--|-----------------------|------------------------|-------------|
| Item                                     | ASTM C150 Spec. Limit | ASTM C1157 Spec. Limit | Test Result |
| Air Content (volume %)                   | 12 max                | 12 max                 | 9           |
| Blaine Fineness (cm <sup>2</sup> /g)     | 2600-4300             | A                      | 4029        |
| Residue 45 μm (No. 325) Sieve (%)        | A                     | D                      | 3.5         |
| Autoclave Expansion (%)                  | 0.80 max              | 0.80 max               | -0.03       |
| Compressive Strength                     |                       |                        |             |
| 1 day, MPa (psi)                         | A                     | A                      | 13.9 (2020) |
| 3 days, MPa (psi)                        | 12.0 (1741) min       | 13 (1890) min          | 25.4 (3690) |
| 7 days, MPa (psi)                        | 19.0 (2760) Min       | 20.0 (2900) min        | 33.9 (4920) |
| 28 days, MPa (psi) <sup>E</sup>          | A                     | 28.0 (4160) min        | 45.8 (6640) |
| Time of Setting, Initial Vicat (minutes) | 45-375                | 45-420                 | 124         |
| Heat of Hydration, 7 days, kJ/kg (cal/g) | F                     | A                      | 350         |
| Mortar Bar Expansion C-1038 (%)          | B                     | 0.020 max              | 0.004       |

| INORGANIC PROCESSING ADDITION (If Applicable) |      |                               |    |
|---|------|-------------------------------|----|
| Type  | None | Base Phase Cement Composition |    |
| SiO <sub>2</sub> (%)                          | NA   | C <sub>3</sub> S (%)          | 59 |
| Al <sub>2</sub> O <sub>3</sub> (%)            | NA   | C <sub>2</sub> S (%)          | 15 |
| Fe <sub>2</sub> O <sub>3</sub> (%)            | NA   | C <sub>3</sub> A (%)          | 7  |
| CaO (%)                                       | NA   | C <sub>4</sub> AF (%)         | 10 |
| SO <sub>3</sub> (%)                           | NA   |                               |    |

**OPTIONAL REQUIREMENTS ASTM C150/AASHTO M85/ASTM C1157**

| CHEMICAL                |                       |             |
|-------------------------|-----------------------|-------------|
| Item                    | ASTM C150 Spec. Limit | Test Result |
| Equivalent Alkalies (%) | 0.60 max              | 0.56        |

| PHYSICAL      |                       |                        |             |
|---------------|-----------------------|------------------------|-------------|
| Item          | ASTM C150 Spec. Limit | ASTM C1157 Spec. Limit | Test Result |
| False Set (%) | 50 min                | 50 min                 | 67          |

<sup>A</sup> Not applicable  
<sup>B</sup> It is permissible to exceed the specification limit provided that ASTM C1038 Mortar Bar Expansion does not exceed 0.020 % at 14 days.  
<sup>C</sup> Adjusted per Annex A1.6  
<sup>D</sup> No limit specified, data reported for information purpose only  
<sup>E</sup> Test result of prior month  
<sup>F</sup> Test result represents most recent value. Heat of hydration test has been carried out by American Engineering Testing, Saint Paul, MN.

GCC of America Cement is warranted to conform at the time of shipment with current ASTM C150/AASHTO M85/ASTM C1157. No other warranty is made or implied. Having no control over the use of its cements, GCC of America does not guarantee finished work. GCC is not responsible for any additives not stated in the Certificate of Compliance. GCC of America certifies that the data described above under "Processing Addition" represents the materials in the cement manufactured during the production period indicated.