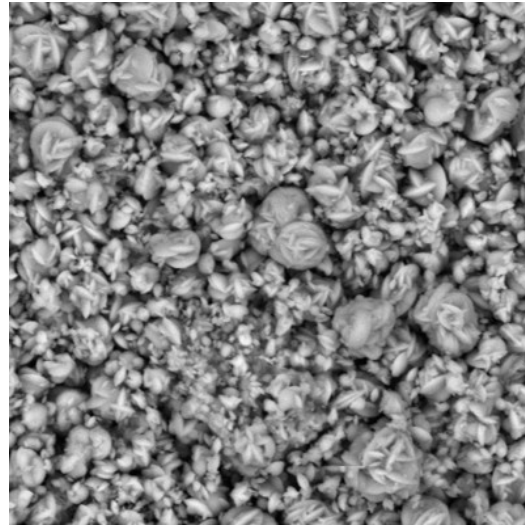




ReAct® Blend

3RD PARTY REPORT INTRODUCTION

Fortera is in the process of commercially manufacturing a cementitious and proprietary form of calcium carbonate, ReAct Blend. ReAct Blend's unique properties optimize blended cements. ReAct Blend's spherical shape enhances cements' workability and increases flow, while its ample surface area nucleates the growth of calcium silicate hydrate, thereby accelerating cement hydration and early property development and increasing the cement paste pore tortuosity. ReAct Blend's main mineral, vaterite, reacts to form monocarboaluminate, a stiff and stable AFm mineral that helps to stabilize ettringite.



This report is a compilation of testing reports detailing the properties of blended cements produced with ReAct Blend made from two different limestones sourced from a major international cement producer, a high-grade limestone (HLS) and a low-grade limestone (LLS). Cements from two different plants were utilized. For a cement producer, high-grade limestone refers to limestone with a high calcium carbonate content and low-grade limestone refers to a limestone with a significant impurity. In this case, the low-grade limestone was an argillaceous limestone that contained a clay impurity. During the calcination of the limestone to produce the ReAct Blend, Fortera was able to activate the clay impurity, similar to how calcined clay pozzolan is activated during calcination. This resulted in a ReAct Blend from the low-grade limestone that also had pozzolanic properties. The portland limestone cement labelled Type IL(15)-HLS was made with 15% ReAct Blend from the high-grade limestone, and the portland limestone cement labelled Type IL(15)-LLS was made with 15% ReAct Blend from the low-grade limestone.

Prepared by:

A handwritten signature in black ink, appearing to read "Craig Hargis".

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Client: **Fortera**
 Project: **Innovandi**
 Contact: **Mike Cohn**
 Submitter: **Jorge Duque**
 Date Received: **29-Aug-22**

CTL Project No.: **382948**
 CTL Proj. Mgr.: **P. Kenealy**
 Analyst: **MB, PS, WD, SD, BS**
 Approved: **P. Kenealy**
 Date Analyzed: **31- Aug Through 13-Sept-22**
 Date Reported: **13-Oct-22**

ASTM C595-20 : TABLE 2 PHYSICAL REQUIREMENTS

	IL, IP IS(<70) IT(S<70)	Test Results 5512901 Type IL(15)-HLS
Fineness, specific surface ^A :		
No. 325 sieve, % retained	---	6.7
Air permeability test, min. m ² /kg:	---	411
Density, g/cm ³ :	---	2.97
Autoclave expansion, max. % ^B :	0.80	0.12
Autoclave contraction, max. % ^B :	0.20	---
Time of Setting, Vicat test: ^C		
Initial, not less than, min.	45	170
Initial, not more than, hours	7	
Final, min.	---	238
Normal Consistency (wt%)	---	30.0
Air content of mortar, max volume %:	12	8
Strength, compression, min., MPa (psi)		
Mortar flow (%)	---	106
1 day	---	--
3 days	13.0 (1890)	28.3 (4110)
7 days	20.0 (2900)	32.1 (4650)
28 days	25.0 (3620)	38.8 (5630)
Water Requirement, max wt% cement:	---	49

General Notes:

- A: Both amount retained on a 45 micron sieve and the (blaine) air permeability fineness are to be reported on all certificates requested from the manufacturer.
- B: The specimens shall remain firm and hard and show no signs of distortion, cracking, checking, pitting, or disintegration when subjected to the autoclave expansion test.
- C: Time of setting refers to initial setting time in Test Method C191. Test conducted using method B of ASTM C191-19.
 The time of setting of cements containing a user-requested accelerating or retarding functional addition need not meet the limits of this table, but shall be stated by the manufacturer.
- D: This report may not be reproduced except in its entirety.

Client: **Fortera**
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 Date Received: **29-Aug-22**

CTL Project No.: **382948**
 CTL Proj. Mgr.: **P. Kenealy**
 Analyst: **MB, PS, WD, SD, BS**
 Approved: **P. Kenealy**
 Date Analyzed: **31- Aug Through 11-Nov-22**
 Date Reported: **15-Nov-22**

ASTM C595-20 : TABLE 2 PHYSICAL REQUIREMENTS

	IL, IP IS(<70) IT(S<70)	Test Results 5512903 Type IL(15)-LLS
Fineness, specific surface ^A :		
No. 325 sieve, % retained	---	4.8
Air permeability test, min. m ² /kg:	---	455
Density, g/cm ³ :	---	2.99
Autoclave expansion, max. % ^B :	0.80	0.12
Autoclave contraction, max. % ^B :	0.20	---
Time of Setting, Vicat test: ^C		
Initial, not less than, min.	45	172
Initial, not more than, hours	7	
Final, min.	---	246
Normal Consistency (wt%)	---	31.7
Air content of mortar, max volume %:	12	9
Strength, compression, min., MPa (psi)		
Mortar flow (%)	---	88
1 day	---	--
3 days	13.0 (1890)	31.9 (4630)
7 days	20.0 (2900)	35.2 (5110)
28 days	25.0 (3620)	37.0 (5370)
Water Requirement, max wt% cement:	---	49

General Notes:

- A: Both amount retained on a 45 micron sieve and the (blaine) air permeability fineness are to be reported on all certificates requested from the manufacturer.
- B: The specimens shall remain firm and hard and show no signs of distortion, cracking, checking, pitting, or disintegration when subjected to the autoclave expansion test.
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