



August 8, 2012

Mr. Jeff Speck  
Big River Industries, Inc  
3600 Mansell Road, Suite 575  
Alpharetta, GA 30022

Phone: 678-461-2830  
Fax: 678-461-2845  
E-mail: jeff.speck@oldcastleapg.com

Subject: **Final Report of ASTM C 331 *Standard Specification for Lightweight Aggregates for Concrete Masonry Units* on Livlite Fine/Intermediate Blend Lightweight Aggregate**  
**TEC Services Project No.: 10-0825**  
**TEC Services Sample ID: 12-103-B**

Dear Mr. Speck:

Testing, Engineering & Consulting Services, Inc. (TEC Services) is a AASHTO R18 and International Accreditation Services (IAS) (TL-458) accredited laboratory in compliance with ANS/ISO/IEC Standard 17025:2005 and a Army Corps of Engineering approved laboratory. TEC Services is pleased to present this report of our testing on the Livlite Fine/Intermediate Blend lightweight aggregate submitted to our laboratory on April 9, 2012. The results of this testing pertain only to the samples tested. The aggregate was tested in accordance to ASTM C331-10 *Standard Specification for Lightweight Aggregates for Concrete Masonry Units* as authorized by the service agreement (TEC-PRO-10-0825) dated August 2010.

This specification covers lightweight aggregates intended for use in concrete masonry units when a prime consideration is to reduce the density of the units. The maximum and minimum requirements for this specification are presented in Section 4 *Chemical Composition* and Section 5 *Physical Properties* of ASTM C 331 and are listed in Table 1. Based on the results, the Livlite Fine/Intermediate Blend lightweight aggregate submitted to our laboratory meets and/or exceeds the requirements of ASTM C 331-10.

**Table 1: Summary of Test Results**

<b>Section 4 - Chemical Composition</b>	<b>Test Results</b>	<b>ASTM C 331-10 Requirements</b>
Organic Impurities (Color change )	1	3 max
Staining (Stain index)	0	60 max
Loss on Ignition	0.75	5% max
<b>Section 5 – Physical Properties</b>		
Clay Lumps and Friable Particles (Dry mass)	0.25	2% max
Bulk Density (Loose)	38 lbs/ft <sup>3</sup>	70 lbs/ft <sup>3</sup>
Drying Shrinkage at 100 Days	-0.073	0.10% max
Popouts	0	0 max
Grading	See Section 5.1.2 Below	

A concrete mixture containing the Livlite Fine/Intermediate Blend lightweight aggregate was batched in order to make test samples for drying shrinkage per ASTM C 331 testing. The material sources and amount of material used in the concrete mix are presented in Table 2. Fresh properties are presented in Table 3.

## Concrete Mix Proportions

**Table 2: Mix Proportions**

<b>Material</b>	<b>Source</b>	<b>Batch Weights (lbs.)</b>
Cement	Lafarge, Calera	8.70
Lightweight - Fine/Intermediate Blend	Big River, Livlite	21.11
Water	Lawrenceville City Water	11.91
Total		41.72

*NOTE: Concrete had a slump of 2.25 inches*

## Test Results

### Section 4.1.1 Organic Impurities

Requirement – Lightweight aggregate subjected to the test for organic impurities shall not produce darker color than standard.

Result – The Livlite Fine/Intermediate Blend lightweight aggregate did not produce any color change.

### **Section 4.1.2 Staining**

Requirement – Lightweight aggregate shall have a stain index of less than sixty.

Result – The Livlite Fine/Intermediate Blend lightweight aggregate showed no staining, which indicates an index of zero.

### **Section 4.1.3 Loss on Ignition**

Requirement – Lightweight aggregate shall have a loss of ignition not more than 5 percent.

Result – The Livlite Fine/Intermediate Blend lightweight aggregate had a loss on ignition of 0.75 percent.

### **Section 5.1.1 Clay Lumps and Friable Particles**

Requirement – The amount of clay lumps and friable particles shall not exceed two percent by dry mass.

Results – The Livlite Fine/Intermediate Blend lightweight aggregate had 0.25 percent clay lumps and friable aggregate.

### **Section 5.1.2 Grading**

The grading shall be by mutual agreement between interested parties. The Grading and the suggested range are reported in Table 4.

**Table 3: Grading and Suggested Range**

Sieve Size	% Retained Each Sieve	% Range Suggested
3/8 in	0	0-2
No. 4	5.3	0-10
No. 8	16.2	15-35
No. 16	27.1	15-35
No. 30	20.5	5-20
No. 50	11.9	5-15
No. 100	7.4	5-15
Pan	11.6	8-20

**Section 5.1.4 Bulk Density (Loose)**

Requirement – The maximum bulk density (loose) for fine aggregate is 70 lbs/ft<sup>3</sup>.

Result – The Livlite Fine/Intermediate Blend lightweight aggregate had an average bulk density (loose) of 38 lbs/ft<sup>3</sup>.

**Section 5.1.6 Density Factor**

The sample was dried to a constant mass, soaked for 72 hours, and allowed to drain for 10 minutes. The sample was towel dried to an approximated SSD condition before recording a specific gravity of 1.25.

**Section 5.2.3 Drying Shrinkage**

Three length change beams (2" x 2" x 11¼") were moist cured for seven days. Upon the completion of the moist curing, an initial reading was obtained, and was used as the base length for the drying shrinkage calculations. The samples were then placed in a curing cabinet maintained at 73.5 ± 3.5°F with a relative humidity of 50 ± 5%.

Requirement- Drying shrinkage shall not exceed 0.10 % at 100 days. The results are reported in Table 5.

Table 5: Drying Shrinkage at 28 days and 100 days.

<b>Concrete Age</b>	<b>28 Days</b>	<b>100 Days</b>
Curing Method	Air Cured	Air cured
Date	5/28/2012	8/8/2012
Sample ID	Length Change (%)	Length Change (%)
12-103-B1	-0.062	-0.075
12-103-B2	-0.062	-0.072
12-103-B3	-0.063	-0.072
<b>Average</b>	<b>-0.062</b>	<b>-0.073</b>

**Section 5.2.4 Popouts**

Requirement – There shall be no popouts observed after test concrete made with the tested lightweight aggregate is subjected to an autoclave in accordance with ASTM C151-09 *Standard Test Method for Autoclave Expansion of Hydraulic Cement*.

Result – No popouts were observed.

We appreciate the opportunity to provide our services to you on this project. Should you have any questions or comments regarding this report, please feel free to contact us at your convenience

Sincerely,

Testing, Engineering & Consulting Services, Inc.



Steven Maloof  
Project Manager



Trey McCants  
Laboratory Manager