



August 7, 2024

Mr. Michael Hammill
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Subject: **Final Report of ASTM C331
Carolina Stalite Fine Lightweight Aggregate (D-Tank)
SGS TEC Services Project No: 04-0514
SGS TEC Services Sample ID: 24-363-DT**

Dear Mr. Hammill:

SGS, Testing Engineering and Consulting Services (SGS, TEC Services) is an AASHTO R18, ANS/ISO/IEC 17025:2017, and an Army Corps of Engineers accredited laboratory. SGS TEC Services is pleased to present this report of our testing on the D-Tank fine lightweight aggregate submitted to our laboratory in February of 2024. The results of this testing pertain only to the samples tested. The aggregate was tested in accordance with ASTM C331-23 *Standard Specification for Lightweight Aggregates for Concrete Masonry Units* as authorized by the service agreement (TEC-PRO-04-0514) dated March 29, 2005.

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 C331 and are listed in Table 1. Based on the results, the D-Tank Fine lightweight aggregate (Gold Hill, NC) from Carolina Stalite submitted to our laboratory meet and/or exceeds the requirements of ASTM C331.



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Table 1: Summary of Test Results

Section 5 - Chemical Composition	Test Results	ASTM C331 Requirements
Organic Impurities (Color change)	<1	3 max
Staining (Stain index)	0	60 max
Loss on Ignition	0.14	5% max
Section 6 – Physical Properties		
Clay Lumps and Friable Particles (Dry mass)	0.8	2% max
Bulk Density, (Loose) lbs./ft ³	63	70
Relative Density (Specific Gravity) (Saturated Surface-dry)	1.986	
Relative Density (Specific Gravity) (Oven-Dry)	1.818	----
72-Hour Absorption	9.2	----
Drying Shrinkage at 100 Days	-0.031	-0.10% max
Popouts	No Popouts	0 max
Grading	See Table 3	

Test Results

Organic Impurities

The organic impurities were tested in accordance with ASTM C40-20 *Standard Test Method for Organic Impurities in Fine Aggregates for Concrete*.

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

Result – The lightweight aggregate **did not show any color change**.

Iron Staining

The staining testing was tested in accordance with ASTM C641-23 *Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates*.

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

Result – The lightweight aggregate showed no staining, which indicates an **index of 0**.

Loss on Ignition

The loss of ignition was tested in accordance with ASTM C114-23 *Standard Test Methods for Chemical Analysis of Hydraulic Cement*.

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

Result – The lightweight aggregate had a loss on ignition of **0.14 percent**.

Clay Lumps and Friable Particles

The clay lumps and friable particles was tested in accordance with ASTM C142-17 *Standard Test Method for Clay Lumps and Friable Particles in Aggregates*.

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

Results – The lightweight aggregate had **0.8 percent** clay lumps and friable aggregate.

Grading

The grading was tested in accordance with ASTM C136-19 *Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates*. The grading shall be by mutual agreement between interested parties. The Grading and the suggested grading are reported in Table 2.

Table 2: Grading and Suggested Range

Sieve Size	% Retained on Each Sieve	ASTM C331 Suggested Range
3/8 in	0	0-2
No. 4	1.5	0-10
No. 8	16.8	15-35
No. 16	28.1	15-35
No. 30	19.6	5-20
No. 50	11.8	5-15
No. 100	7.1	5-15
Pan	15.1	8-20

Bulk Density (Loose)

The oven dried loose bulk density was tested in accordance with Method C-Shoveling of ASTM C29-23 *Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate*.

Requirement – The maximum bulk density (loose) for fine aggregate is 70 lbs./ft³.

Result – The lightweight aggregate had an average bulk density (loose) of **63 lb/ft³**.

Specific Gravity & Absorption

The density factor was tested in accordance with ASTM C128-22 *Standard Test Method for Density, Relative Density (Specific Gravity) & Absorption of Fine Aggregate*. The sample was dried to a constant mass and soaked for 72 hours. The specific gravity and absorption are reported in Table 3.

Table 3: Specific Gravity & Absorption

Absorption after 72-hour Soak (percent)	Relative Density (Specific Gravity) (OD)	Relative Density (Specific Gravity) (SSD)
9.2	1.818	1.986

A concrete mixture containing the D-Tank Fine lightweight aggregate was batched in order to make test samples for drying shrinkage and popouts per ASTM C331. The material sources and amount of material used in the concrete mix are presented in Table 5.

Concrete Mix Proportions

Table 5: Mix Proportions

Material	Source	Batch Weights lbs.
Cement	Lehigh, Leeds	6.96
Fine Lightweight Aggregate	D-Tank, Carolina Stalite	26.39
Water	Lawrenceville City Water	8.40
Total		41.75

NOTE: Concrete had a slump of 2.25 inches

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%. Drying shrinkage shall not exceed 0.10 % at 100 days. The results are reported in Table 6.

Table 6: Drying Shrinkage at 28 days and 100 days.

Concrete Age	28 Days	100 Days
Curing Method	Air Cured	Air cured
Sample ID	Length Change (%)	Length Change (%)
1	-0.028	-0.032
2	-0.026	-0.030
3	-0.027	-0.031
Average	-0.027	-0.031

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 of providing our services to you. If you have any questions pertaining to this report or need any additional information, please do not hesitate to call us.

Sincerely,

SGS, TEC SERVICES, INC.



Caleb Howard
Project Manager



James G. McCants III
Laboratory Manager, Chemist