March 11, 2026

Ken Nunley
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Evaluation of Amrize structural medium aggregate
ASTM C330 Testing
CTLGroup Project No. 201522

Dear Mr. Nunley:

As requested, CTLGroup has conducted ASTM C330 testing on the structural medium lightweight aggregate material provided by you.

The scope of work included testing aggregate samples and concrete specimens in accordance with ASTM C330, *Standard Specification for Lightweight Aggregates for Structural Concrete*. During the testing program, the following tests were conducted (with modifications as specified in ASTM C330, if applicable):

- ASTM C136, *Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates*
- ASTM C114, *Standard Test Methods for Chemical Analysis of Hydraulic Cement*
- ASTM C29, *Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate*
- ASTM C142, *Standard Test Method Clay Lumps and Friable Particles in Aggregates*
- ASTM C641, *Standard Test Method for Iron Staining Materials in Light-weight Concrete Aggregates*
- ASTM C127, *Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate*
- ASTM C151, *Standard Test Method for Autoclave Expansion of Hydraulic Cement*
- ASTM C39, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*
- ASTM C567, *Standard Test Method for Determining Density of Structural Lightweight Concrete*
- ASTM C496, *Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens*
- ASTM C157, *Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete*
- ASTM C666, *Standard Test Method for Resistance of Concrete to Standard Freezing and Thawing*

Concrete mixing and specimen fabrication were conducted in accordance with ASTM C192, *Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory*.

MATERIALS

The provided structural medium lightweight aggregate was used for chemical composition and physical property tests. In addition, this material was used for fabrication of concrete specimens to evaluate aggregate pop-outs, freeze-thaw resistance, drying shrinkage, equilibrium density, and compressive and tensile strengths. The gradation of as-received aggregate is presented in Table 1.

Table 1 - ASTM C136 gradation

Sieve No.	Cumulative % Retained on Individual Sieve	Cumulative % Passing on Individual Sieve	ASTM C330 Limits for 12.5 mm to 4.75 mm aggregate, % Cumulative Passing on Individual Sieve
1/2”	0.0	100.0	100
3/8"	6.8	93.2	80 – 100
#4	84.9	15.1	5 – 40
#8	98.9	1.1	0 – 20
#16	99.6	0.4	0 – 10
#200	100.0	0.0	0 – 10
Pan	100.0	0.0	--

For concrete batching, a CTLGroup lab stocked Type I/II portland cement, lab stocked fine aggregate, and lab stocked admixture were used in addition to the provided lightweight aggregate.

AGGREGATE TESTING

The results of aggregate specific tests are presented in Table 2.

Table 2 - Summary of Results for Aggregate Testing

Test	Description	Result	ASTM C330 Limit
ASTM C127	SSD Specific Gravity	1.85	--
ASTM C127	Absorption, %	16.1	--
ASTM C641	Staining Stain Index	0	60 Maximum
ASTM C114	Loss on Ignition, %	0.3	5 Maximum
ASTM C142	Clay Lumps and Friable Particles, %	0.1	2 Maximum
ASTM C29	Loose Dry Bulk Density, lb/ft^3	52	55 Maximum

CONCRETE BATCHING

The required quantity of structural medium aggregate was soaked in water for 72 hours prior to mixing to achieve a saturated condition. Following this, the additional water was allowed to drain from the aggregate container over a period of 24 hours. The wet aggregate was then thoroughly blended, and a test sample was procured and tested for determining the total moisture content. The purpose here was to determine the actual water content required for batching through appropriate moisture corrections. The total amount of potable water was adjusted during mixing to achieve the desired slump as required by ASTM C330 standard. The sequence of concrete mixing was as follows:

- Initial 3 minutes of mixing: lightweight and natural aggregate, cement, water, and admixtures
- 3 minutes of rest
- 2 minutes of mixing

One 2x2x11.25-in. nominal prisms and three 3x3x11.25-in. nominal prisms were fabricated for autoclave expansion and shrinkage tests, respectively. In addition, three 3x3x11.25-in. nominal prisms were fabricated for freeze-thaw testing per ASTM C666. Several 6x12-in. nominal concrete cylinders were fabricated to evaluate split tensile strength, and equilibrium density, and three 4x8-in. nominal concrete cylinders were fabricated to evaluate compressive strength. The quantities of different materials used to produce concrete mixture are presented in Table 3.

Table 3 - Mix Proportions (SSD Condition)

Ingredient	Quantity
Cement, lb/yd^3	564
Structural Mediums, lb/yd^3	1320
Natural Concrete Sand, lb/yd^3	1020
Water, lb/yd^3	300
Resulting w/cm ratio	0.53

FRESH CONCRETE PROPERTIES

After mixing, fresh concrete properties were measured as follows:

- Slump according to ASTM C143, *Standard Test Method for Slump of Hydraulic Cement Concrete*
- Unit weight (density) according to ASTM C138, *Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.*
- Plastic air content according to ASTM C173, *Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method*.

The measured fresh concrete properties are presented in Table 4.

Table 4 - Fresh Concrete Properties

Property	Test Value
Measured Slump, in.	3.00
Unit Weight (Density), lb/ft^3	121.0
Plastic Air, %	6.9

HARDENED CONCRETE PROPERTIES

A summary of the tests results conducted on hardened concrete are presented in Table 5. Note the test procedures adopted for evaluating different concrete properties were modified, if needed, per ASTM C330.

Table 5 - Hardened Concrete Properties

Property	Test Result	ASTM C330 Limits
ASTM C567 Equilibrium Density, lb/ft^3	110.0	105 - 110
ASTM C39 Compressive Strength, psi	4380	3000 Minimum
ASTM C496 Splitting Tensile Strength, psi	455	310 Minimum
ASTM C157 Shrinkage, %	0.03	0.07 Maximum
ASTM C151 Autoclave Expansion, %	No pop outs	No pop outs
ASTM C666 Freeze-thaw Resistance, DF	Pending	Satisfactory Performance

CONCLUSION

The results of the testing program indicate that structural medium lightweight aggregate material from Amrize – Utelite plant met all limit requirements specified for physical and chemical property tests listed in ASTM C330. An amended version of this letter will be issued once ASTM C666 freeze-thaw testing is complete.

Concrete specimens produced using structural medium aggregate material were evaluated for equilibrium density (ASTM C567), compressive strength (ASTM C39), splitting tensile strength (ASTM C496), pop outs (ASTM C151), freeze-thaw resistance (ASTM C666), and drying shrinkage (ASTM C157). Autoclave expansion of concrete prism specimens indicated no pop outs, indicating that concrete containing structural medium aggregate met the pop out requirement of ASTM C330. The calculated compressive and splitting tensile strength values were also higher than the minimum limit values imposed by ASTM C330. The calculated shrinkage at a drying age of 28 days was well below the maximum limit specified by ASTM C330.

DISCLAIMER

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CLOSING

Thank you for considering CTLGroup to assist you on this project. Should you have any questions, please don’t hesitate to call or email.

Sincerely,
CTLGroup

Pavan Vaddey, PhD, PE
Senior Engineer
Concrete and Cement-Based Materials
PVaddey@CTLGroup.com
Phone: (541) 602-5859

Attachments: ASTM C330 test reports (11 pages)

March 10, 2026

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CLOSING

Thank you for considering CTLGroup to assist you on this project. Should you have any questions, please don’t hesitate to call or email.

Sincerely,
CTLGroup

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Senior Engineer
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