CEMATRIX™
Cellular Concrete Solutions

Example Specifications for CEMATRIX Cellular Concrete

Enclosed are example specifications for CEMATRIX Cellular Concrete with cast densities of 400 kg/m^3 (Pages 2 to 5) and 475 kg/m^3 (Pages 6 to 9).

CEMATRIX sales staff are available to customize these specifications based on site-specific requirements. Please contact us at either (888) 876-0484 or sales@cematrix.com.

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1.01 Lightweight Closed Cell Cellular Concrete 400 kg/m³ Specification

(a) References:

- ACI 523.1, Guide for Cast-in-Place Low Density Cellular Concrete
- ASTM C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
- ASTM C869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete
- ASTM C796, Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
- CAN/CSA A3001, Cementitious Materials for Use in Concrete
- CSA A23.1, Concrete Materials and Methods of Concrete Construction
- ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars
- ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- OSHA 29 CFR 1926 and 1910, Permissible Exposure Limit of crystalline silica and Portland Cement for the construction and general industry
- ASTM C666 / C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

(b) Qualifications:

The approved Subcontractor producing and placing cellular concrete shall have a record of experience in excess of 10 similar applications with engineered stamped compressive strength reports that prove the quality of work has been achieved in these applications. The subcontractor must be capable of developing a mix design, batching, mixing, handling, and placing cellular concrete. The Subcontractor shall be certified by the manufacturer of the foaming agent and regularly engaged in the production and placement of cellular concrete. The Subcontractor shall have fully qualified workers who are thoroughly trained and experienced in the production, placement and quality control of cellular concrete. Certificates verifying their qualifications and training will be required as part of the submittal for approval.

(c) Conformance:

Cellular concrete supplier must provide independent, third-party testing that confirms the proposed cellular concrete meets:

1. ASTM C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete - Minimum compressive strength of 0.4 MPa at 28 days.
2. ASTM C666, modified Procedure B as per ACI 523.1 - Standard for freeze thaw cycles with relative dynamic modulus of elasticity (E) not less than 70% of its original value after 120 cycles.

(d) Equipment

The specialized batching, mixing, and placing equipment shall be automated and certified for the purpose by the manufacturer of the cellular concrete material.

Dry-mix equipment must be able to receive bulk cement installed with a dust suppression system to conform to OSHA 29 CFR 1926 and 1910. The dry-mix unit must be capable of producing over 100 cubic metres per hour on-site, continuously, from one piece of equipment, and pump through hoses or pipes up to a flat lineal distance of 1000 meters. Bulk cement weight measurements shall be determined by onboard instrumentation that operates within a tolerance of one and one-half percent (1.5%) per batch.

Wet-mix production units manufacture cellular concrete utilizing slurry supplied from a ready-mix plant that has the required dust suppression system to create the slurry. Wet-mix equipment must be able to receive slurry on-site into the equipment and process it continuously during ready-mix supply, and pump through hoses or pipes up to a flat lineal distance of 200 meters. Each unit must be capable of producing 75 cubic metres per hour.

Cellular concrete must be pumped by a positive displacement pump (Peristaltic or similar). A foam generator shall be used to continuously produce pre-formed foam, which shall be injected and mixed with the cementitious slurry downstream of the positive displacement slurry pump. The equipment shall be calibrated to produce a precise and predictable volumetric rate of foam with stable uniform microbubbles.

Ready-mix drum-delivered cellular concrete, or mixing using bagged cement is not permitted.

(e) Materials and Testing

A slurry of Portland Cement, supplementary cementing materials, and water is introduced with a foaming agent and air to create closed cell cellular concrete.

Cellular concrete shall be CEMATRIX CMEF-400 lightweight engineered fill with a minimum unconfined compressive strength at 28 days of 0.4 MPa and wet cast density of 400 kg/m³ (+/-10%).

Cellular concrete supplier must be capable of incorporating supplementary cementing materials into their mix designs. Blast furnace slag shall conform to ASTM C 989 and/or CAN/CSA A3001 Standard Specification. The percentage of blast furnace slag, if used, shall range from 20% to 30% depending on application.

Fly ash, if utilized, must conform to ASTM C618 and/or CAN/CSA A3001 Standard Specification.

Portland cement shall conform to the requirements of CSA Standard CAN/CSA A3001, Type GU, GUL, HS or HE. Supplementary cementing materials shall conform to the requirements of CSA Standard CAN/CSA A3001.

Mixing water shall conform to the requirements of CSA Standard A23.1. Water of questionable quality shall not be used unless proven to produce specimens whose 28-day compressive strength is at least 90 % of those made with known acceptable water and an identical material mix.

Foaming agents shall conform to the requirements of ASTM C 869 when tested in accordance with the provisions of ASTM C 796. Only CEMATRIX approved foaming agents shall be used. The Subcontractor shall be pre-qualified and approved in writing by the foaming agent manufacturer, referencing this Project.

The fresh cellular concrete density shall be measured and recorded once per production run, or once for every 50 m^3 (dry mix), or once for every ready-mix truck (wet mix), whichever is more frequent. The density shall be maintained within +/-10% of the design density. All measuring and testing equipment will be certified and calibration records will be available for confirmation.

Cellular concrete samples must be captured, cured, and tested to verify the compressive strength requirement is satisfied. An engineered stamped record of the results is required for confirmation and payment. One sample is comprised of one set of three cellular concrete cylinders. One sample should be taken for each placement, or every 100m^3, whichever is more frequent. Cylinders are cast in 3 inch by 6 inch cylindrical plastic molds. The sample mold must be lined with “freezer paper” with the plastic side against the cellular concrete. Cellular concrete cylinders shall be cured and tested as per ASTM C495, modified to represent the field curing conditions for geotechnical applications.

(f) Quality Control and Reporting

The cellular concrete supplier must have documented quality control (QC) procedures that include processes for training and certification of QC personnel. The cellular concrete supplier must provide a dedicated onsite QC representative that is certified according to the above-noted process.

A turnover package must be provided within 60 days of project completion. The information in the turnover package must include, at a minimum, the measured cast densities of cylinders, cast dates, location of samples, cylinder dimensions and mass, and compressive strengths at 28 days. The turnover package must be stamped by a Professional Engineer.

(g) Subgrade Conditions and Site Preparation

The subgrade shall be cleared of vegetation, soft, wet, muddy, loose soil and other deleterious material, and graded and compacted to the lines and grades shown on the relevant drawings. The prepared subgrade shall be good competent level ground with nominal compaction to provide a firm base. The placement area shall be free of standing water during placement of cellular concrete and until backfill is placed on top of the cellular concrete. Snow and ice must be removed from the area prior to placement.

(h) Installation

Any items to be fully or partially encased in the cellular concrete shall be properly set and stable prior to the installation of the cellular concrete.

Where required, formwork should be designed and installed to withhold cellular concrete, and may require lining with poly sheeting or similar impermeable membrane to prevent leakage.

Cellular concrete may be placed during freezing conditions, provided measures are taken to prevent damage to the cellular concrete until sufficient strength has been attained. Care should be taken to avoid freezing before initial set. Cellular concrete must not be placed during heavy or prolonged precipitation.

Once mixed, the cellular concrete shall be conveyed promptly to the location of placement without excessive handling.

The Constructor shall determine the maximum lift thickness based on density and any other considerations that may impact placement. Cellular concrete shall be cast in a formed area within 1 to 2 hours, to permit an undisturbed setting.

Finished surface elevation shall be within ±25 mm of the design grades shown on the drawings. Cellular Concrete can be placed with a maximum slope of 1%. Slopes greater than 1% will require profiling by creating steps for the Cellular Concrete with formwork or can be mechanically graded to slopes in excess of 1% by means of grader, bull dozer or milling machine.

Loading of, or traffic on the cellular concrete shall be prevented until the material has attained sufficient strength to withstand the loads with no damage. Backfill can commence with cellular concrete supports foot traffic without leaving an indentation.

(i) Measurement and Payment

Measurement and payment shall be on a unit rate basis for the number of cubic metres placed. The unit rate shall include materials, production, placement, and testing of cellular concrete materials.

Placed volumes shall be determined by multiplying the known volume of slurry by the ratio of slurry density to average cellular concrete density (expansion ratio).

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1.01 Lightweight Closed Cell Cellular Concrete Specification - 475 kg/m³

(j) References:

- ACI 523.1, Guide for Cast-in-Place Low Density Cellular Concrete
- ASTM C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
- ASTM C869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete
- ASTM C796, Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
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- ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- OSHA 29 CFR 1926 and 1910, Permissible Exposure Limit of crystalline silica and Portland Cement for the construction and general industry
- ASTM C666 / C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- ASTM D5084, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

(k) Qualifications:

The approved Subcontractor producing and placing cellular concrete shall have a record of experience in excess of 10 similar applications with engineered stamped compressive strength reports that prove the quality of work has been achieved in these applications. The subcontractor must be capable of developing a mix design, batching, mixing, handling, and placing cellular concrete. The Subcontractor shall be certified by the manufacturer of the foaming agent and regularly engaged in the production and placement of cellular concrete. The Subcontractor shall have fully qualified workers who are thoroughly trained and experienced in the production, placement and quality control of cellular concrete. Certificates verifying their qualifications and training will be required as part of the submittal for approval.

(l) Conformance:

Cellular concrete supplier must provide independent, third-party testing that confirms the proposed cellular concrete meets:

3. ASTM C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete - Minimum compressive strength of 0.4 MPa to 0.5 MPa (foaming agent dependent) at 28 days.
4. ASTM C666, modified Procedure B as per ACI 523.1 - Standard for freeze thaw cycles with relative dynamic modulus of elasticity (E) not less than 70% of its original value after 120 cycles.

5. ASTM D5084, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter - Maximum hydraulic conductivity (k) coefficient of 1 x 10^{-5} cm/sec at 125 kPa effective stress.

(m) Equipment

The specialized batching, mixing, and placing equipment shall be automated and certified for the purpose by the manufacturer of the cellular concrete material.

Dry-mix equipment must be able to receive bulk cement installed with a dust suppression system to conform to OSHA 29 CFR 1926 and 1910. The dry-mix unit must be capable of producing over 100 cubic metres per hour on-site, continuously, from one piece of equipment, and pump through hoses or pipes up to a flat lineal distance of 1000 meters. Bulk cement weight measurements shall be determined by onboard instrumentation that operates within a tolerance of one and one-half percent (1.5%) per batch.

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Ready-mix drum-delivered cellular concrete, or mixing using bagged cement is not permitted.

(n) Materials and Testing

A slurry of Portland Cement, supplementary cementing materials, and water is introduced with a foaming agent and air to create closed cell cellular concrete with minimal shrinkage.

Cellular concrete shall be CEMATRIX CMEF-475 lightweight engineered fill with a minimum unconfined compressive strength at 28 days of 0.4 MPa to 0.5 MPa (foaming agent dependent) and wet cast density of 475 kg/m³ (+/-10%).

Cellular concrete supplier must be capable of incorporating supplementary cementing materials into their mix designs. Blast furnace slag, if utilized, shall conform to ASTM C 989 and/or CAN/CSA A3001 Standard Specification. Fly ash, if utilized, must conform to ASTM C618 and/or CAN/CSA A3001 Standard Specification.

Portland cement shall conform to the requirements of CSA Standard CAN/CSA A3001, Type GU, GUL, HS or HE. Supplementary cementing materials shall conform to the requirements of CSA Standard CAN/CSA A3001.

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