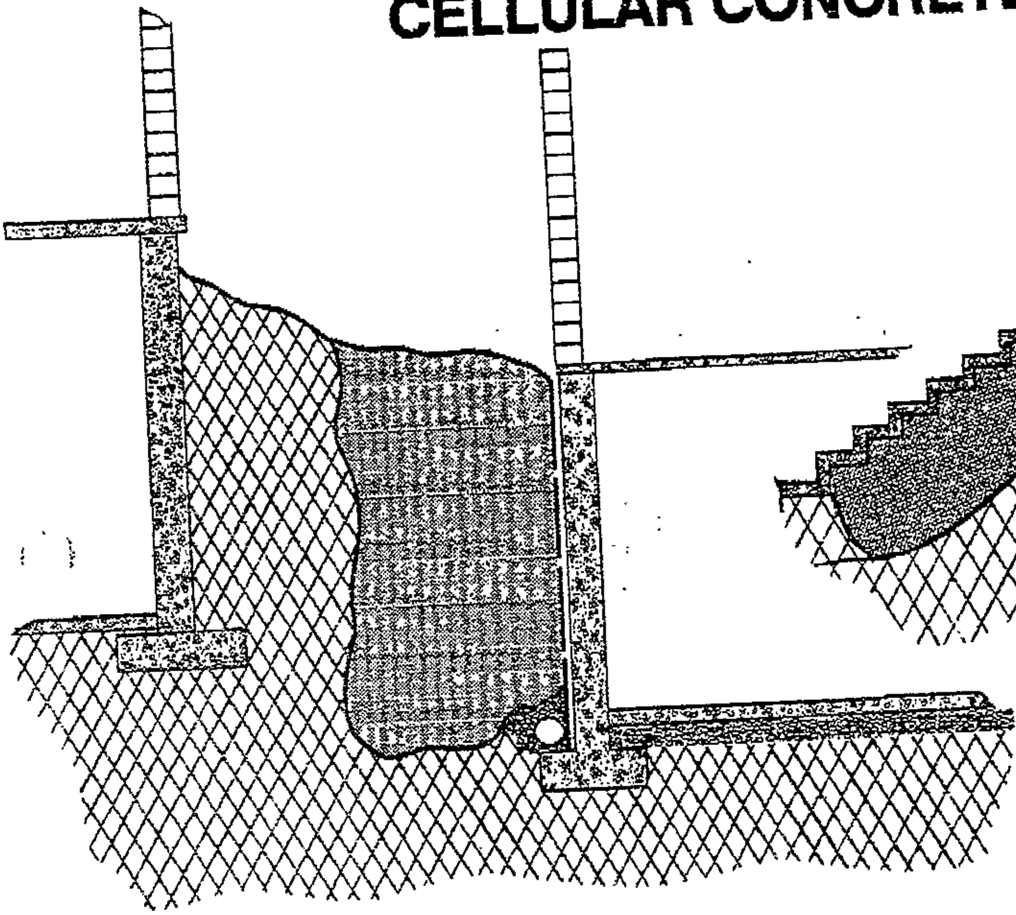
CELLUFOAM
CONCRETE
SYSTEMS

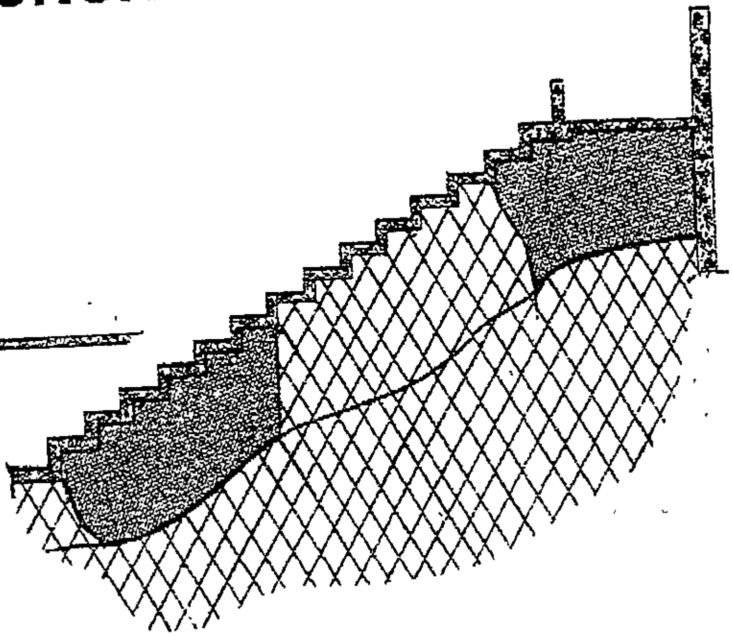
A DIVISION OF PATRICK CHADWICK INCORPORATED

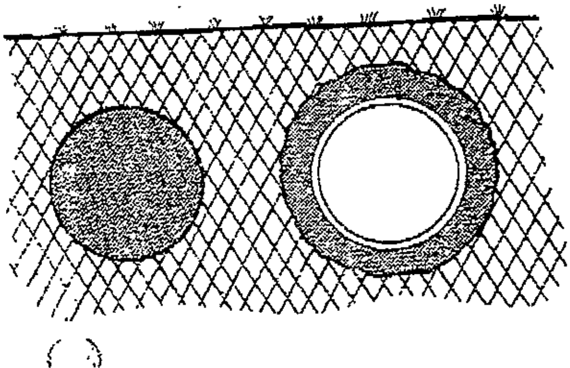
CELLUFOAM brand

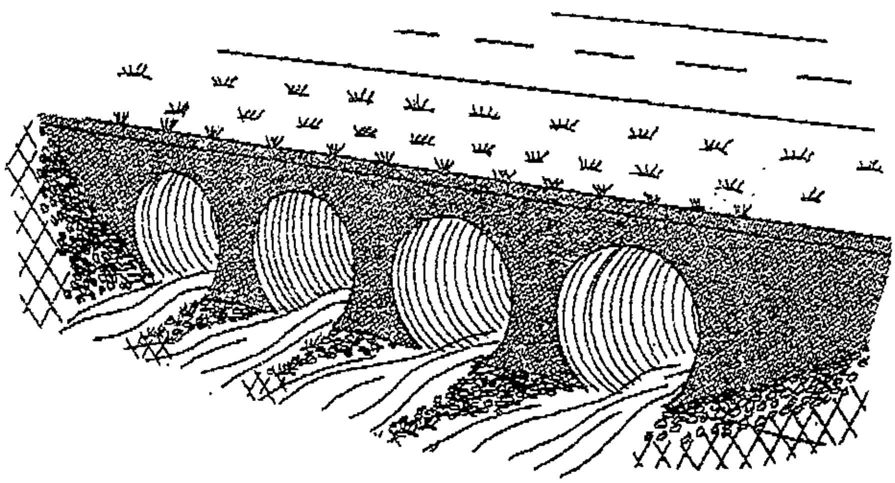
ULTRA-LITE AND TERRA-FILL

GEOTECHNICAL CELLULAR CONCRETES









Cellufoam Concrete 6/87 Systems

03362 SPECIALLY PLACED CONCRETE
low density/insulating

GENERAL INFORMATION

EXPLANATION

This brochure provides a broad overview of the properties of cellular concrete, its potential geo-technical uses and examples of how Cellufoam brand Ultra-Lite and Terra-Fill cellular concrete licensed contractors have used this unique product and their expertise to meet the challenges imposed by nature and the need to protect our environment.

Cellular concrete with a density spectrum of 14-120 PCF (224-1920 kg/m^3) is the most versatile of all concrete products.

For over twenty years geo-technical engineers and contractors have found cellular concrete to be a cost effective solution to many of their design and construction challenges.

In the late 1950's the U.S. Corp. of Engineers was using cellular concrete as a tunnel lining and annular fill. They also utilized its unique shock (energy) absorption qualities in other specialized types of geo-technical and building construction.

Many State highway departments have found that cellular concrete in the 18-50 PCF (288-800 kg/m^3) density range resolves the cost and technical difficulties attributable to poor load bearing or unstable soils.

Cellular concrete with specified densities ranging from 20-105 PCF have been used to secure abandoned in-ground structures and to fill voids created by soil subsidence and wash outs.

Voids beneath the stadium, resulting from subsidence of the original (1920) earth form were filled with Ultra-Lite 220. To ensure continued spectator safety and add years to the life expectancy of the structure. — Cincinnati, Ohio

DESCRIPTION

Cellufoam brand Ultra-Lite cellular concrete consists of a cement, water and pre-generated aqueous foam. The density range is 14-50 PCF (224-800 kg/m^3). A density selected from this spectrum, to provide the required properties, can be maintained to within ±5%.

Cellufoam brand Terra-Fill cellular concrete consists of a cement, aggregate, water and pre-generated aqueous foam. The density range is 40-120 PCF (640-1920 kg/m^3). A density selected from this spectrum, to provide the required properties, can be maintained to within ±5%.

The late L. M. Legatski, professor emeritus, University of Michigan, best described cellular concrete as a product which, "owes its distinctive properties to a multitude of macroscopic, non-inter connecting air cells uniformly distributed throughout its mass." "These cells may account for up to (94%) of the total volume." "Density, thermal resistance and strength can be adjusted to meet specific design requirements by varying the amount of foam, cement and water." "By introducing an aggregate and adjusting the mix design, compressive strengths of up to 300 p.s.i. (20 MPa) are attainable."

Cellufoam brand products represent a total engineering approach to the production of cellular concrete.

The Cellufoam brand foam generator is a precision built, cavitating, centrifugal pump, factory calibrated to produce an exact liquid to foam expansion ratio. It is designed to eliminate the variables associated with compressed air foam generation and requires no operator adjustment to achieve the specified foam out-put and foam density.

The cellufoam Brand foam concentrate is synthetic. The formulation is a stablized blend of hydrocarbon ionic surfactants, aliphatic alcohol and selected wetting agents. Specifically blended for cellular concretes the liquid to foam expansion ratio is designed to compliment the Cellufoam brand foam generating equipment. The Concentrate to water ratio is constant and exact. It does not require operator adjustment to accommodate production variations.

The Cellufoam brand Ultra-Lite and Terra-Fill mix designs provided to our licensed contractors are laboratory tested to verify the ascribed properties.

Cellufoam brand Ultra-Lite and Terra-Fill cellular concretes are available only through factory trained, licensed contractors, who are independant contractors with a proven capability in the production and placement of cellular concretes.

USE

- ☐ Shock (energy) absorption
- ☐ Lightweight structural highway base
- ☐ Raising highway grades
- ☐ Perma frost protection
- ☐ Insulating frost susceptible soils
- ☐ High temperature pipe insulation
- ☐ Stress relief of retaining walls
- ☐ Land slip correction and repair
- ☐ Load reduction for culvert structures
- ☐ Weight reducing landscaping fill
- ☐ Mat foundations
- ☐ Pipeline fill
- ☐ Pipe bedding
- ☐ Annular fill
- ☐ Silo void fill
- ☐ Self supporting structural fill
- ☐ Granular fill consolidation
- ☐ Non settling utility trench cover

CELLUFOAM BRAND

ULTRA-LITE

PHYSICAL PROPERTIES

CELLUFOAM brand Ultra-Lite Concretes (ASTM C495-77a)

Oven Dry Unit Wght. PCF (kg/m³)	Typical Compressive Strength Range at 28 Days PSI (KPa)
*18-25 (288-400)	20-125 (138-862)
*25-30 (400-480)	60-225 (414-1552)
*30-40 (480-640)	125-450 (862-3105)
*40-50 (640-800)	280-750 (1932-5175)

*The compressive strength of a given density within the above range can be engineered by Cellufoam to optimize physical properties or cost efficiency.

Ultra-Lite insulates steam duct to conserve energy. — Scarborough, Ontario

Examples (commonly used mix designs)

Product	Density Wet (kg/m³)	Density Oven Dry (kg/m³)	Comprehensive Strength (KPa)
Ultra-Lite 125	30 PCF (480)	21 PCF (336)	85 PSI (586)
Ultra-Lite 220	38 PCF (608)	30 PCF (480)	225 PSI (1552)
Ultra-Lite 400	43 PCF (688)	35 PCF (560)	350 PSI (2415)

Other Properties (Typical)

Flexural Strength:
25% of compressive strength

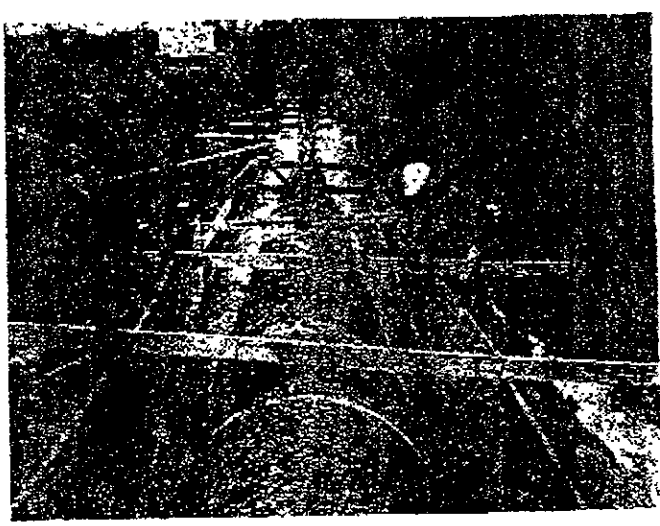
Tensile Strength:
12% of compressive strength

Coefficient of Thermal Expansion:
5.0 to 7.0 x 10^{-6}/°F (9.0 to 12.6 x 10^{-6}/°C)

Modulus of Elasticity (Static):
$E = 33w^{1.5} f'c^{0.5}$
W = density (dry)
f'c = compressive strength

Water Absorption (ASTM C796-74T):
3.5 to 19% by Volume depending upon density and additive:

Ultra-Lite 400 was used as a shock absorbing annular fill to protect a water transmission line from damage from future rock blasting. — Austin, Texas



Ultra-Lite 280 pumped 3700 feet from one location as a pipe beading in unstable soil.

CELLUFOAM BRAND
TERRA-FILL

PHYSICAL PROPERTIES

CELLUFOAM brand Terra-Fill Concretes (ASTM C495-83)

Oven Dry Unit Wght. PCF (kg/m³)	Typical Compressive Strength Range at 28 Days PSI (KPa)
*40-50 (640-800)	20-750 (138-5175)
*60-70 (960-1120)	200-960 (1380-6624)
*100-120 (1600-1920)	1000-3400 (6900-23460)

*The compressive strength of a given density within the above range can be engineered by Cellufoam to optimize physical properties or cost efficiency.

Terra-Fill 80, a unique cellular flyash structural back fill 4' wide 50' deep was used for a downtown project. Its use minimized traffic congestion, sped up the construction schedule and eliminated concern about proper compaction. — Kansas City, Kansas

Examples (commonly used mix designs)

Product	Density Wet (kg/m³)	Density Oven Dry (kg/m³)	Comprehensive Strength (KPa)
Terra-Fill 20	49 PCF (784)	41 PCF (656)	40 PSI (276)
Terra-Fill 100	72 PCF (1152)	63 PCF (1008)	250 PSI (1725)
Terra-Fill 1200	94 PCF (1504)	85 PCF (1360)	1350 PSI (9315)

Other Properties (Typical)

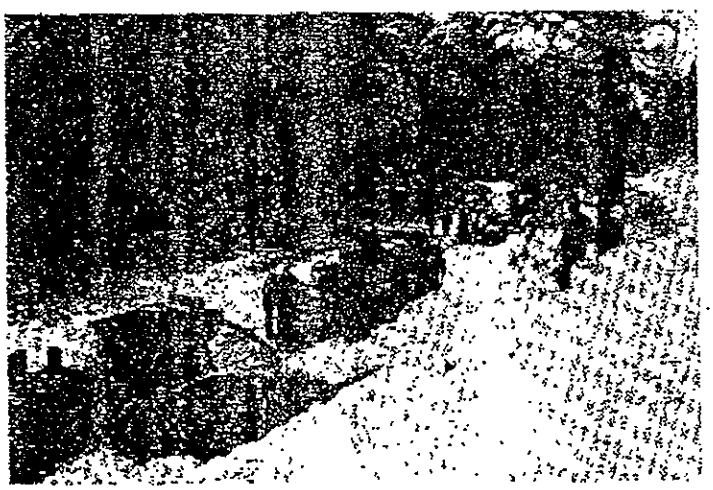
Flexural Strength:
25% of compressive strength

Tensile Strength:
12% of compressive strength

Coefficient of Thermal Expansion:
5.0 to 7.0 x 10^{-6}/°F (9.0 to 12.6 x 10^{-6}/°C)

Modulus of Elasticity (Static):
$E = 33w^{1.5} f'c^{0.5}$
W = density (dry)
f'c = compressive strength

Water Absorption (ASTM C796-74T):
3.5 to 19% by Volume depending upon density and additives



Grout delivered by transit truck is surcharged with cellufoam and discharged by pumping into an abandoned water transmission line. — Walla Walla, Washington

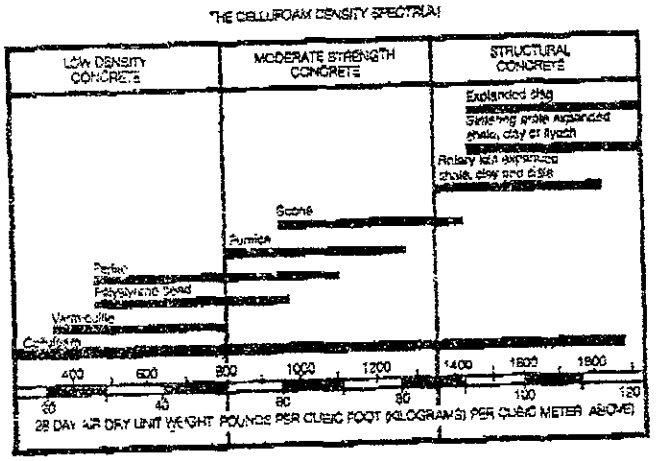
The structural capacity of Terra-Fill was utilized in this culvert fill to overcome heavy traffic loading on a roadway with minimal top cover over the culvert. — La Cygne, Kansas

PRODUCT DATA

FEATURES

PUMPABILITY can be pumped further and higher than conventional fills under low pump pressures.
GRAVITY FLOWS 300-500 linear feet (some mix designs).
FLUIDITY ensures elimination of voids, conforms to irregular surfaces.
NO COMPACTION REQUIRED does not shrink or settle.
LOW HYDRAULIC HEAD PRESSURE minimizes the structural requirements of bulkheads and form work.
REDUCED FLOTATION in trench fills and pipe bedding.
COMPRESSIVE STRENGTH exceeds that of compacted earth fills.
FAST SETTING TIME minimizes down time, speeds construction schedules.
LOAD REDUCTION eliminates continual settlement by predictably distributing weight and traffic loads.
REDUCES LATERAL LOADING significant savings in original footing and wall design, stress relieves load on existing structures.
THERMAL EFFICIENCY Thermal resistance of R 1.9 to R 0.4 depending upon density.
QUALITY CONTROL density and compressive strengths are maintained from start to finish by qualified on-site personnel.
ON SITE BATCHING reduces construction traffic.

THE CELLUFOAM DENSITY SPECTRUM



LIMITATIONS

The properties of a specific mix design will depend upon the type of cement, and or aggregate used. The type of cement and or aggregate used may require adjustment to the water cement ratio. Curing conditions and other job site variables may also affect the given properties. Cellufoam Concrete Systems is available to advise and assist in the evaluation of these variables.

RELATED REFERENCES

ACI 64-44 (Guide for Cast-in-Place Low Density Concretes)
ACI SP29 (Lightweight Aggregate, Insulating & Cellular Concretes)
ACI P29-10 (Fire Resistance of Lightweight Insulating Concretes)

TEST METHODS

Compressive Strength	– ASTM C495-63
	– ASTM C495-77a
Foaming Agents	– ASTM C869-80
	– ASTM C796-80
Thermal Conductivity	– ASTM C177-63

PRODUCT HANDLING

The pre-generated aqueous foam used in Cellufoam brand Ultra-Lite and Terra-Fill cellular concretes is non-toxic and non-flammable. Tests conducted by an independant agency confirm that it is not harmful to human skin or the environment. The safe handling instruction labels on each container should be read and complied with. Our licensed contractors have the pertinent M.S.D.S. on hand.

Cellufoam brand Ultra-Lite and Terra-Fill cellular concrete may contain cement in higher than normal levels. Direct contact with any part of the body should be avoided. Flush any part of the body so exposed with water immediately upon contact. In case of large exposure or exposure to sensitive organs, consult a physician immediately.

Licenced contractor checking density to verify conformance to specification.

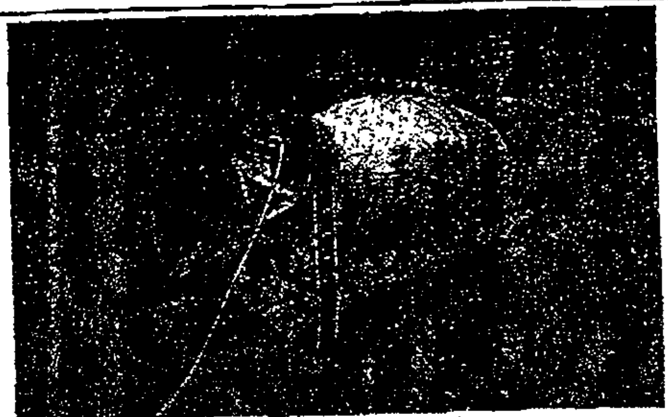
EQUIPMENT AND QUALITY CONTROL

QUALITY ASSURANCE

Through its licensed contractor programme Cellufoam and the contractor provide a joint commitment to quality control.

Cellufoam equipment, chemicals and mix designs represent a total engineering approach to cellular concrete and provides the predictability and consistancy engineers and contractors can rely on.

Licenced contractors are factory trained and fully equipped to continuously monitor product quality.



Terra-Fill contractor surcharging a transit.
Truck grout mix with Cellofoam*.

Ultra-Lite, bulk cement and continuous batch mixing and pumping equipment maximizes production capacity

Ultra-Lite equipment set up for small volume project — use of bag cement limits production capacity

OTHER USES

- ☐ Fireproof roof fill
- ☐ Encapsulated insulation roofing system
- ☐ Sound attenuating floor underlayment
- ☐ Residential housing systems — precast, tilt-up and
- ☐ poured in-place
- ☐ Explosion attenuation panels
- ☐ Fragmentation shielding

CELLUFOAM CONCRETE SYSTEMS
A DIVISION OF PATRICK CHADWICK INCORPORATED

MANUFACTURERS, FORMULATORS & DISTRIBUTORS OF SPECIALTY CONCRETE PRODUCTS

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