Basic Characteristics

COMPRESSIVE STRENGTH

- The strength shown was taken from laboratory cubes, and refers to oven-dry densities.
- High early strength can be achieved by rapid hardening cement.
- Increasing the quantities of sand and cement and decreasing the amount of foam yield higher densities and consequently higher strength.
- Different cualities of sand and cement influence the strength of cellular concrete.
- Combining expanded clay and other lightweight aggregates lead to an even better strength versus density ratio.

THERMAL CONDUCTIVITY (DIN 52612)

The thermal conductivity as shown by the diagram depends upon the density of the concrete. For structural elements we recommend a density between 1200–1600 kg/m³ (62–100 pcf).

CLC house cast in situ at the rate of one each day with every set of form work

WATER ABSORPTION AND FROST RESISTANCE

Tests were undertaken according to DIN 1048 (waterabsorption) and DIN 4226 (frost resistance). No visible damage was observed on the cubes after the tests, and the initial weight of the cubes was maintained throughout the test.

RESISTANCE TO CORROSION

Slabs were produced for tests in densities between 1200–1400 kg/m³. The non-protected reinforcement is to be covered with 25 mm of cellular concrete. After 4 months tests there was no corrosion on the 1200 kg/m³ specimen.

SAND GRADING (DIN 1045)

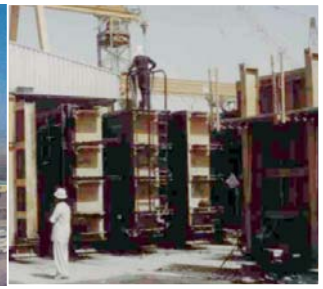
A minimum of 20–25 % fine sand (less than 0,25 mm) is recommended for better physical properties.

SHRINKAGE

A wall panel in density 1200 kg/m³ (75 pcf) for example, cured in open air, after 28 days showed a shrinkage of 0.215 mm/m (shrinkage of dense concrete, 250 kg/cm² = 0,145 mm). Between the 28th and 90th day the shrinkage was even less than with traditional concrete. Shrinkige can be further reduced when using fiber to replace steel mesh.

3.000 units in Tunis 1983

Agricultural schools in Iraq 1981 (Airial Photo)



Massiv vertical formwork

Recommended mix design for cellular concrete based on a mixing volume of 1 m³

Density in kg/m³ (pcf)		400 (25) weight (kg)		volume (ltr.)	800 (50) weight (kg)		volume (ltr.)	1200 (75) weight (kg)		volume (ltr.)	1600 (100) weight (kg)		volume (ltr.)
Sand	kg	-		-	420		160	780		297	1130		430
Cement	kg	30		97	320		103	360		116	400		129
Water	ltr.	11		110	120		120	120		140	160		160
Neopor foaming agent	kg		1,5			1,2			0,9			0,6	
Foam by volume	ltf.	-		800	-		630	-		460	-		290
Water in foam	ltr	60		-	46		-	46		-	21		-
Wet concrete		470 kg		1007 ltr.	906 kg		1013 ltr.	1315 kg		1013 ltr.	1711 kg		1009 ltr.

NEOPOR®
SYSTEM
CELLULAR LIGHTWEIGHT CONCRETE

bauma 2013

Demo House in CLC on the first anniversary of fateful hurricane Katrina on the site of HANSONS production site at New Orleans

Lightweight cellular concrete

- using sand, cement, water and foam only
- for structural (reinforced) and non-structural application
- produced as prefab or cast in-situ
- easily to be integrated into existing concrete and prefab plants at little investment and without major changes in production compared to traditional dense concrete
- tremendous weight reduction
- improved fire rating
- high thermal insulation
- easy application
- savings in rawmaterial, transport, crane-cost and assembly

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NEOPOR CLC · No.1 · THE GENUINE SYSTEM

Cellular concrete for structural application

Since the introduction of cellular concrete systems to the construction industry more than 50 years ago, it had been almost exclusively limited to non-structural void fillingjobs, roof insulation and at the best for blocks.

Insufficient physical properties caused by instable foams and lack of scientifically undertaken research work did not allow the use of such void-filling cellular concrete systems for structural application. In developing „neopor" foaming agent, equipment and concrete technology in joint-venture with a reknown manufacturer of chemicals, construction machinery builders and independent building research institutes, it was foclissed on a reliable system to enable the construction industry to produce cellular concrete for structural, reinforced application.

With the introduction of the „neopor" system more than 10 years ago it was for the first time possible to reproduce any desired density from 400–1800 kg/m³ with a high accuracy and at an optimum density versus strength ratio.

Foaming agent

Our protein-hydrolisation based foaming agent warrants high stability of the foam, successfully withstanding the mariifold forces occuring when mixing, conveying (pumpable), casting and during the hyclration process.

„neopor" foam causes no chemical reaction in the concrete but merely serves as wrapping material for the air entrapped. Store-life of „neopor" ist guaranteed to be at least 24 months when adhered to

Facades in CLC cast on site in battery molds at Ankara, Turkey

instructions. Qualified as concrete additive under the strict regulations prevailing in Germany, „neopor" foaming agent is constantly subject to unannounced quality control by officials, ensuring that no cornponents are used that might be harmful to concrete or reinforcement. (Chloride content of „neopor" less thar, the allowed 0,002 %).

Note:

1 kg of „neopor-600" foaming agent, diluted in 40 ltrs. of water yields approx. 510 ltrs. of foam.

Equipment

A full range of stationary and mobile equipment to produce and precisely dose the foam, a conveying system to feed sand and cement, and a mixer with highly effective horizontally operating screw and integrated concrete pump, all produced for „neopor" by PUTZMEISTER, is available with either electric motor or diesel drive. However, most traditional mixers and very successfull truck mixers may be utilized to produce cellular concrete. By installing a foam generator the „neopor" system can readily be intergated into existing concrete or prefab plants, with little investment and maintaining production procedures used to.

Handling of cellular concrete

The total absence of gravel and the ball-bearing effect of the foam are responsible forthe high consistency of cellular concrete. Thus vibration for compacting reasoris is totally unnecessary, as the moulds, vertical or horizontal, are completely filled.

Releasing agent

Proper releasing agents have a substantial influence on the surface of cellular concrete.

Curing of cellular concrete

Cellular concrete is generally air-cured. Curing might be accelerated by either applying heat, steam or chemicals. A curing compound prevents excessive loss of water after casting and consequently increases strength.

Demoulding of cast elements

Depending upon the outside temperature and upon the cement quality used, building elements of cellular concrete may be stripped 6–10 hours after casting. As with tradtional dense concrete curing on the yard or on the site should be facilitated by keeping the demoulded elements under moisture for a few days.

Ageing of cellular concrete

Using the same basic components as for dense concrete, namely sand, cement and water, and considering that „neopor" foam has no chemical reaction in concrete besides serving as wrapping material for the air-bubbles embecided, ageinc of cellular concrete virtually carries on infinitely and as long as the cement used draws humidity from the air.

Foam and trials on CLC in China

High payload in prefab CLC at Singapore

Multi-Applications

for structural and non-structural cellular concrete

Semi attached houses in prefab in Switzerland

Bazar at Istanbul of blocks as fill in on 13 floors, 6 million blocks

Sound and impact panels along railroads/highways in US

Feeding CLC from ready-mix truck on to flat-bed mold

Some physical properties of cellular concrete

Range of densities:
400–1800 kg/m³

Achievable strength
1,0–25 N/mm2 (10–250 kg/cm²)

Shrinkage behaviour:
1200 kg/m³ – 0,215 mm/m
dense concrete – 0,145 mm/m

Thermal conductivity:
0,042–0,555 (W/m K)
dense concrete - 2,1 (W/m K)

Fire rating:
non combustible DIN 4164

Water absorption:
approx. 5 % at a density of 1200 kg/m³ no condensation closed cellular structure

Detailed diagrams based on comprehensive tests and research work undertaken by independent building institutes are available.

Major references of projects undertaken worldwide

Tens of thousands of houses and apartments, but also schools, hospitals, industrial and commercial buildings have been constructed all over the world or are under progress using „neopor" products and technology.

Services offered by „neopor" by „neopor" customers

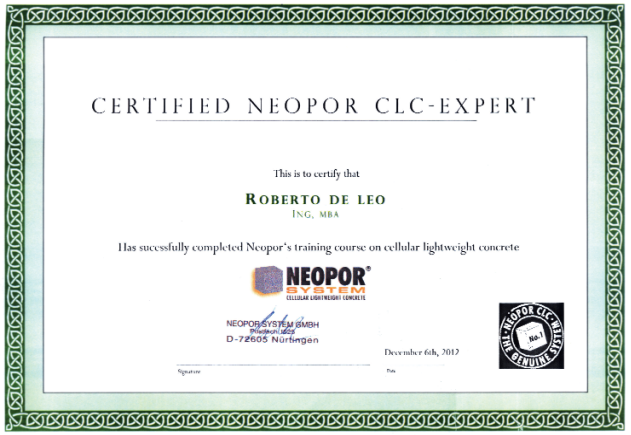
Supply of equipment and chemicals
Provision of concrete- and civil engineers to teach local labour
Supply of compiete mobile or stationary prefab plants solely based on cellular concrete.

Some outstanding projects are:

200.000 buildings produced in 50 countries in 40 years such as towns in Algeria and Cairo.

apartments in Cairo/Egypt
apartments in Singapore
roofs in Libya
houses in Brasil
villas in Medina
houses in Tunisia
houses in Botswana
low cost houses in Nigeria
agricultural schools in Iraq
sewerage relining system in Kuwait
technical application in mining
industrial and commercial buildings

Hollow core wall CLC panels in 1.200 kg/m3 density in Thailand



Certificate after taking 4 days Crash Course at Neopor lab