

# Cellular Lightweight Concrete Technical Specifications



**Cellular Lightweight Concrete** building systems have been successfully developed and implemented for more than 85 years to create cost-effective, functional and safe buildings all over the world. Cellular Concrete is a product that is changing the future of industrial, commercial and residential development. It has proved its superior quality in virtually all climate conditions of the world.

**LightBUILD™** concrete is a non-autoclaved, cellular, lightweight concrete.

It is primarily a mixture of cement, sand/fly ash, water, additives and [pre-manufactured foam \(link\)](#) or air-entraining agent. It is generally air-cured. Curing might be accelerated by applying heat, steam or chemicals. A curing compound prevents excessive loss of water after casting and consequently increases strength.

Cellular concrete comprises myriads of tiny non-connecting air bubbles which give this material its incredibly diverse qualities that make it such an excellent insulator.

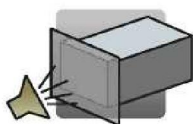
Cellular concrete is definitely one of the major achievements in the field of wall construction. It is a revolutionary material that offers a unique combination of strength, low weight, thermal insulation, sound absorption, unsurpassed fire resistance and unprecedented build-ability.

**LightBUILD™** concrete has up to 10 (ten) times the thermal resistance of conventional concrete which translates to high energy efficient buildings as well as reduced building and running costs. It can be used in external and internal applications and can be produced as either load bearing or non-load bearing elements.

Density and strengths can be controlled to meet specific structural and non-structural design requirements!

You can practically build the whole house structure with **LightBUILD™** concrete products. **LightBUILD™** concrete is designed to meet exacting quality standards as well as the requirements of the South African Building Regulations for internal partition walls, solid walls, cavity walls, separating walls, cavity and solid foundations as well as beam and block floors. For fast and easy building, excellent acoustic and thermal resistance and a tough, durable, lightweight design, you'll find **LightBUILD™** concrete is the answer.

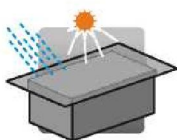
## Main properties



### Acoustic Insulation

**LightBUILD™** concrete has natural acoustic insulation due to their aerated structures and has superior sound absorption properties in comparison with other materials.

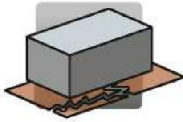
It reduces outdoor noise pollution and also saves costs by reducing costs of noise and echo proofing materials.



### Moisture, Pest and Mould Resistant

**LightBUILD™** concrete has much lower water retention or capillary action compared to conventional bricks. **LightBUILD™** blocks are also termite, pest, mould and fungus resistant and hence greatly improve the indoor air quality.

## Earthquake Resistance



**LightBUILD™** products have proven earthquake resistance due to its lightweight and porous structure. The structure has millions of tiny cells which cushions buildings from major forces, preventing progressive collapse. Thus it can save lives and response time for rescue operations during earthquakes.

## Design Flexibility



**LightBUILD™** products are easy to install with precision. Material can be sawn, drilled, nailed, and grooved etc. on site by artisans using simple working tools. Thus it saves on expensive labour cost as it does not require extra skilful and highly paid artisans or hi-tech tools.

## Environment Friendly



**LightBUILD™** concrete uses the least amount of energy to produce than any other masonry building material.

The manufacturing process is such that negligible gaseous, liquid or solid waste is released into the environment.

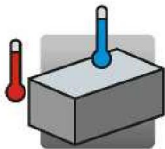
## Light Weight



**LightBUILD™** concrete can be up to 10 times lighter than conventional concrete and thus results in:

- Savings in foundation and structural costs due to decrease in overall dead load;
- Savings in handling and transportation costs;
- Better earthquake resistance;
- Possibility of additional floors on old structures.

## High Thermal Insulation



- Due to the numerous micro pores in concrete, it has a very low thermal conductivity and is an excellent thermal insulation material;
- It keeps interiors cooler in summer and warmer in winter;
- Due to reduced cooling/heating loads, it reduces air conditioning/heating loads by as much as 25-30%;
- Due to reduced operational loads, it saves on electricity bills and conserves the nation's fuel and environment.

## Fire Resistance



High Fire Rating – rated to a minimum 2 hours for 75 mm thick panel. Products can be used in construction of firewalls and buildings with the strict requirements to fire rating properties.

No noxious or toxic fume emission – no health hazards if the product is subjected to heat from fire.

## Compressive Strength

The compressive strengths of **LightBUILD™** cellular concrete is influenced by its density as well as age, moisture content, the physical and chemical characteristics of component materials and mix proportions.

It is desirable to keep the mix proportions, type of cement and sand or other fillers as well as the method of production constant to achieve the constant value of its compressive strength. A relationship exists between the density and the strength. Any change to the factors mentioned above could vary that relationship quite markedly.

The compressive strength can be significantly increased through effective and special curing methods. Moist curing has a profound effect on increasing compressive strength. For products such as foamed concrete building blocks, it is advisable to cling- or stretch-wrap the pallets, thus assisting in the moisture retention for longer. Steam curing is another option, if curing time is crucial.

Cellular concrete has a virtually linear increase in compressive strength over the first 12 months, unlike dense weight concrete which levels out much earlier. Table 1 indicates the most common compressive strength values and values of thermal conductivity (K) in relationship with the various dry densities for concrete produced by our turbulent TCM mixers. Table 2 is showing similar values for concrete produced by using our MFCP plants.

Table 1. Concrete produced by use of TCM mixers

Density Kg/m <sup>3</sup>	200	300	400	500	600	700	800	1000
Sand – Cement Ratio	0:1	0:1	0:1	0:1	1:1	1:1	1:1	2:1
28 days Strength, MPa	0.3	0.7	1.0	1.4	2.0	2.4	3.0	4.2
Thermal Conductivity, W/m°C	0.06	0.08	0.09	0.1	0.13	0.15	0.17	0.23

Table 2. Concrete produced by use of MFCP plants (continuous mode mixing technology)

Density Kg/m <sup>3</sup>	150	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
Sand – Cement Ratio	0:1	0:1	0:1	0:1	0:1	1:1	1:1	1:1	1:1	2:1	2:1	3:1	3:1	3:1
28 days Strength, MPa	0.4	0.6	1.2	1.6	2.0	2.8	3.2	3.8	6.5	7.2	8.4	10.6	11.8	14.0
Thermal Conductivity, W/m°C	0.05	0.06	0.08	0.09	0.1	0.13	0.15	0.17	0.2	0.23	0.26	0.29	0.34	0.38

Compressive strength will continue to increase indefinitely due to the reaction with CO<sub>2</sub> present in the surrounding air. Again, the significant difference is that cellular concrete has a higher rate of curing than dense weight concrete. Where the level of compressive strength is critical, methods of accelerating the natural CO<sub>2</sub> curing process are available as part of our **LightBUILD™** technology. There are various methods and it can be applied in particular with factory produced building elements such as blocks and panels.

**Note:**

Using specialized techniques, additives and supplementary cementitious materials in our production methods, we can achieve the substantial increase in compressive strength of **LightBUILD™** concrete products (up to 32 MPa at 1400 kg/m<sup>3</sup> density after 56 days and up to 26 MPa at 1250 kg/m<sup>3</sup> density after 7 days).

**Tensile Strength**

Depending on the method of curing, the tensile strength of foamed concrete can be as high as 0.25 of its compressive strength.

### Thermal Insulation

Thermal insulation is one of the outstanding characteristics of **LightBUILD™** cellular concrete. Due to its cellular structure, lightweight cellular concrete offers a very low transmission of heat. This means that in most cases the use of supplementary insulation in floors and walls is unnecessary.

The high insulating value of the material becomes important as energy is saved by cutting both heating and air conditioning requirements, giving greater comfort in a wide range of climatic conditions. **LightBUILD™** cellular concrete's thermal performance greatly reduces the occurrence of condensation from atmospheric humidity, arising as the result of changes in ambient temperature.

New homes are required to have insulated walls and ceilings in order to conserve energy. Table 3 indicates the superior economics of using cellular foamed concrete over other structural and insulating materials commonly used.

Table 3.

Material	Density Kg/m <sup>3</sup>	Thermal Conductivity, W/m°C	Relative Cost per m <sup>3</sup> Placed
Marble	2700	2.9	-
Concrete	2400	1.3	2.85
Clay Brick	1800	0.8	3.4
LightBUILD Cellular Concrete	1200	0.29	2.46
	1000	0.23	2.2
	800	0.17	1.9
	600	0.13	1.65
	500	0.1	1.35
Pine Wood	500	0.1 – 0.18	4.8
LightBUILD Cellular Concrete	400	0.09	1
	200	0.06	0.65
Expanded Cork	100	0.03	8.76
Rock Wool	100	0.032	5.8
Expanded Polystyrene	25	0.04	3.64
Expanded Polyurethane	35	0.03 – 0.04	12.72

### Shrinkage

Lightweight cellular concrete, like all cement based materials has a shrinkage phenomenon during the setting stage. The amount of shrinkage is dependent upon various factors e.g. type of cement, type of curing, size, quality of sand, amount of cement in the mix, density of foamed concrete, as well as the water : cement ratio.

The greater extent of shrinkage occurs during the first 28 days, after which time it is negligible.

During the first 28 days, if the conditions of manufacture of the foamed concrete are well controlled, shrinkage can be kept under 0.1%. This fact is of particular importance since cracks in walls – often caused by foundation movements – are regularly blamed on concrete shrinkage. If a crack occurs beyond the initial 28 days after the concrete was poured, it is virtually impossible that this is due to shrinkage.

### Expansion

The coefficient of linear expansion for cellular concrete is of the same order as that of normal concrete, i.e. 0.000009 per degree centigrade (0.000005 per degree F). This factor becomes important when using **LightBUILD™** lightweight concrete on large areas of roof slabs, which are exposed to heat and cold.

### **Acoustic Isolation**

Lightweight cellular concrete has a high sound absorption capacity. In general, dense weight concrete tends to deflect sound whereas cellular concrete absorbs sound. Sound transmission, however, on conventional walls, over most of the audible frequency range may be higher by 2-3% when compared to dense weight concrete. This slight disadvantage is in most cases academic, since most walls are either rendered, painted or both. This in turn will make a wall deflect the sound as the dense weight concrete does.

Low frequency noise on the other hand is being greatly absorbed by lightweight concrete, thus it is often used as an insulating layer on structural concrete slabs to restrict noise transmission from floor to floor in multi-level residential or office buildings.

### **Fire Resistance**

Cellular lightweight concrete is extremely fire resistant and thus well suited to fire rated applications. Furthermore, the application of intense heat, such as an oxyacetylene torch held close to the surface, does not cause the concrete to spall or explode as is the case with normal dense weight concrete.

The result of this is that the reinforcing steel remains cool and protected for a much longer period. Tests and certificates from various authorities indicate that 150 mm of lightweight concrete achieves in excess of a four hour fire rating.

Even at reduced thicknesses aerated lightweight concrete will not burn, spall or give off toxic gases, fumes or smoke.

### **Production benefits**

- Low production costs of **LightBUILD™** cellular concrete, in comparison to other methods producing lightweight concretes such as polystyrene concrete or autoclaved cellular concrete. The cost advantage is greater than 20%
- The production process is highly efficient, consuming less raw materials and energy than other masonry productions. All waste products can be collected and recycled back into the manufacturing process.
- Quick turn-around in the manufacturing process (24 hours – or less, if accelerators or steam curing methods are employed).

### **Benefits of using **LightBUILD™** cellular concrete**

- Lightweight cellular concrete can be used for structural and non-structural applications and be manufactured to precise specifications of strength and densities;
- Fast construction speed, especially using precast panel technology – typically half, when compared with conventional construction methods. Construction speed leads to substantial labour savings and bottom line profits;
- Good Thermal insulation properties give energy conservation advantages, which reduce operating costs (heating/air-conditioning);
- Handling & delivery costs greatly reduced due to materials lower weight;
- Building materials can be produced on site, which makes it ideal for remote areas;
- The use of **LightBUILD™** cellular concrete in pre-cast or tilt-up construction enables a reduction in crane size and requires minimum labour for erection;
- **LightBUILD™** cellular concrete can be sawn by hand, sculptured and penetrated by nails and screws;
- **LightBUILD™** cellular concrete is extremely easy to screed, and may be placed on site at thicknesses down to 40 mm