LBT POWER SA is a South African research-based, engineering and manufacturing company providing industry solutions and services based on Lightweight Concrete technologies to the wide range of industrial and environmental applications.

We specialize in Lightweight Concrete, which can either be Lightweight Aggregate concrete or Foamed concrete. LightBUILD™ concrete is approximately half the weight of conventional aggregate based concrete at similar strength ratings, which facilitates cost effective building designs and reduce transport and erection costs.

LightBUILD™ concrete also has five times the thermal resistance of conventional concrete which translates to high energy efficient buildings as well as reduce 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.

We offer our knowledge, specially designed equipment and on-site technical support to manufacture lightweight constructional materials as well as offer specialized services for various applications, in response to requests from developers, architects and engineers for a product which can provide the properties of concrete at a significantly reduced weight.

Through the collaborative scientific research and engineering we offer solutions and packages to all forms of business in South Africa who would like to use our techniques to manufacture products or offer services using Lightweight Cellular Concrete technology, providing them with all necessary equipment, expertise and extensive on-side technical support and after-sale service.

New technology for the Construction Industry
It is clear that the South African property market offers some exceptional opportunities, but with the growth of the South African construction industry it has been realised that alternatives to the tradition of brick and mortar are going to have to be used to enable the building demand to be met.

In order to meet the needs of Reconstruction and Development Program currently underway in South Africa and address the needs of the country, modern specialised technology should be used to improve the quality of building materials used in under-developed areas as well as to minimise the delivering costs.

LBT POWER SA was established to provide the expanding construction industry with the technology and engineering expertise for manufacturing energy efficient building materials with the unique properties.

By manufacturing lightweight building blocks, wall panels, roofing sheets, footings and roof slabs on the outskirts of undeveloped areas, the local communities could use their own transport to obtain these building materials, where the possible in-situ manufacturing of all necessary building materials can completely eliminate the needs for delivery in general.
Benefits of LightBUILD™ Cellular Concrete

- Fast construction speed, especially using precast panel technology – typically half, when compared with conventional construction methods.
- Additional, substantial savings are achieved due to a lower deadweight of the building. Significant reduction of overall weight results in savings in structural frames, footings or piles. Structural components and foundation cost are greatly reduced, in particular on high-rise projects.
- Good Thermal insulation properties give energy conservation advantages, which reduce operating costs (heating/air-conditioning)
- Low water absorption because of its closed cellular structure makes houses warm and pleasant for leaving.
- Lightweight concrete can be used for structural and non-structural applications and be manufactured to precise specifications of strength and densities
- Building materials can be produced on site, which makes it ideal for remote areas. If precast - handling & delivering costs greatly reduced
- 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 30 mm
- 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 obnoxious or toxic fume emission – no health hazards both in the manufacturing process and if product is subjected to heat (such as in case of fire).
- Acoustic properties are such that sound is being absorbed, not reflected as is the case with dense weight concrete or brick walls. Products can be used in construction of sound barriers or general construction when acoustic properties required (example: building complexes of townhouses close to the highways)
- Low cost of LightBUILD™ cellular concrete, in comparison to other methods producing lightweight concretes. The cost advantages is about 15% - 20%
- The production process is highly efficient, consuming less row materials and energy than other masonry production. All waste products can be collected and recycled back into manufacturing process.
- Quick turn-around in the manufacturing process (24 hours – or less)

Improved structural efficiency of materials in terms of strength/weight ratios resulting load reduction on the structure and substructure; fewer structural components resulting in more usable space in the structure, a reduction in the number and size of reinforcements, increased flexibility in absorbing strains; and improved thermal properties minimizing the effects of differential temperatures resulting in building energy conservation as well as improved fire/spalling mitigation.
Lightweight Concrete Applications

Density is the best characteristic feature of cellular concrete. The lowest densities can be used for fills and insulation and the higher densities should be used for structural applications, leading to a substantial reduction in the dead weight of a structure.

Density 300-500 kg/m³
This material is usually used in roof, walls and floor as insulation against heat and sound. For the floor levelling and thermal isolation applications it should be applied on rigid floors (i.e. in itself it is not a structural material) made of normal reinforced concrete or reinforced cellular concrete of high densities (not less than 1200 kg/m³). This material is also used for insulation in hollow blocks and any other filling situation where high insulating properties are required.

Density 600-800 kg/m³
Generally used for the manufacture of precast blocks and panels for curtain and partition walls, slabs for false ceilings, thermal insulation and soundproofing screeds in multi-level residential and commercial buildings. **LightBUILD™** aerated lightweight concrete of this density range is also ideal for bulk fill application.

Density 800-1200 kg/m³
This material is usually used for the manufacture of constructional blocks and panels for load bearing walls of buildings, architectural ornamentation as well as partition walls, concrete slabs for roofing and floor screeds.

Density 1200-1400 kg/m³
This material is usually used in precast panels of any dimension for commercial and industrial use, in-situ casting of walls, garden ornaments and other uses where structural concrete of light weight is an advantage.

There is variety of applications for lightweight concrete technology. We can divide them into Architectural Applications and Flowable Fill.

Architectural Applications

Lightweight Cellular Concrete is ideally suited for precast concrete products as larger units can be handled with the same handling equipment or manually for same size units, resulting in speed and economy in construction.

These materials can be lifted or managed by down-sizing machinery resulting in reducing site cranage requirements and maximizing the number of concrete elements on trucks without exceeding highway load limits reducing transportation delivery cost.

The main Architectural Applications for **LightBUILD™** cellular concrete would be the following:

- **Lightweight Constructional Blocks**
  This block is the standard product which can be produced in various sizes, formats and densities. Close-toleranced dimensions of blocks will help to lay them more ergonomically, as well as quickly and easily on a thin mortar or glue layer. Blocks can easily be cut to the required size with a saw. Further advantage: blocks provide an ideal base for attachment without cavities, permit optimum surface treatment through homogeneous, level wall surfaces and good noise protection.

  It's also possible to manufacture the special reinforced blocks with the special robust supporting frame to meet the special load bearing requirements.

- **Flat Building Boards for Partition Walls**
  Solid partition walls with little own weight can be erected quickly and easily using pre-manufactured flat building boards. The flat building board is similarly characterised by outstanding protection against fire and also by good noise protection due to the advantageous pore structure. Handy large formats are easily processed using thin mortar beds.
- **Wall Elements**
  Wall elements can be produced with lengths of more than 7 metres. Their width and height depend on the purpose for which the wall elements are used. These wall elements allow the building work to proceed very rapidly with little personnel required. Planning of the buildings is based on optimised parts using the planning grid for System wall elements, thus reducing the risk of potential building errors. The physical building properties of the wall elements correspond with those of constructional block.

- **Ceiling Boards**
  Reinforced ceiling boards could be ideal for basement ceilings and intermediate ceilings in single-family, duplex and terraced houses. They are laid quickly and simply with the aid of a crane. With no complex or time-consuming formwork required, the boards can immediately be subjected to loads and walked over, thus guaranteeing rapid progress in building work.

  The ceiling boards are non-flammable and suitable for all types of flooring. Even solid roofs can be produced with these ceiling boards. We can manufacture ceiling board in standard lengths of 6 metres, but lengths of up to 8 metres are also possible. The ceiling boards are normally available in widths of 62.3 cm and more, as well as in a thickness of 20 cm or more.

- **Roof Boards**
  If the roof space is to be used for living purposes, the solid roof is of decisive advantage by ensuring a balanced room climate. Particularly the statutory requirement for wind-tightness can easily be met with this material. Roof and ceiling boards can be laid directly from the truck on the prepared masonry. This is possible up to a roof angle of < 15°. The roof boards for roofs sloping at an angle of more than 15° will be fitted with transport anchors. The roof boards of reinforced foamed concrete usually come in lengths and sizes similar to the ceiling boards.

- **Lintels**
  Reinforced lintels can be manufactured for span openings in load-bearing and non-load-bearing walls. Formwork is not needed. The lintel is laid quickly and easily in a thin mortar bed and can immediately be subjected to loads. Supports are not required. There is no need to change materials when finishing the surface, since the same plaster base is involved.

- **Heat Insulating Ceiling Sheets and Panels**
  Precast heat insulating ceiling products can be the modern approach to increase energy efficiency of the building. Using lightweight cellular concrete techniques we can design and manufacture roof sheets and panels with unique heat insulating properties, which will replace the traditional gypsum based sheets and improve the existing suspended ceiling systems.

- **Binary Density Insulating Panels**
  One example of areas to which High Performance Cellular Concrete can be applied is in the development of a lightweight binary density insulating concrete panel system.

  This product could be a consideration for future applications in a new generation of buildings. These elements can be used for the construction in all types of building or structures worldwide.

  For instance affordable housing, schools, senior citizen’s centres, industrial, military and municipal facilities, and structures requiring service life in severe or hostile environments.

  Another precast application would be for new or replacing metal sheeting on the exterior skins on metal buildings.

  The thinner layer could be manufactured down to 8mm in width with use of coloured finish and would contain density between 1400 and
1600 kg/m³. And the second layer following the first would be between 600 and 1000 kg/m³ thermal density.

Two main advantages with system is [1] savings on colouring, since it only is encapsulated in the thing area and not the entire mix, and [2] thermal conductivity through both members lowering the costs to heat or cool inside the structure.

The binary system reduces the weight of both members lowering costs to heat or cool inside the structure. The binary system reduces the weight of the material in addition decreasing structural weight yet maintaining medium or high MPa.

- **Precast Wall Panels**
  Precast wall panels can substitute for conventional in-situ and pre-cast concrete, bricks, blocks, and other lightweight building products in a range of building applications including multi storey buildings and is an effective building system for external walls and for internal walls requiring high sound reduction ratings.

- **Sandwich panels with various surface materials**, using Aerated Lightweight Concrete as filler will gain acceptance for partition walls in office complexes, commercial walling, shopping centres and internal walls of residential houses and flats. The combination of different techniques can be incorporated in sandwich panel manufacturing process. For example, use of lightweight cellular concrete of different densities, binary density panels, lightweight concrete using Expanded Polystyrene beds as lightweight aggregates, with various facing skin such as clay, ceramic, brick face, stone or marble.

- **Precast or Cast-in-Place Sound Barriers**

- **Columns, Beams, Decorative Concrete**

**Flowable Fill**

Primary application of Low Strength Lightweight Cellular Concrete is as Flowable fill in lieu of compacted fill. In many cases the compaction is not required and it is ideal for use in tight or restricted-access areas where placing and compacting fill is difficult.

Low density Flowable fill is especially advantageous where weak soil conditions are encountered and the weight of the fill must be minimized. It provides superior thermal insulation and shock mitigation properties.

Flowable fill is an engineered backfill material used as an alternative to compacted fill that can make backfill faster, is self leveling, and can obtain total compaction within a few hours of placement.

Compressive strengths can be adjusted according to the project requirements. Flowability can be varied from very stiff to very fluid depending upon requirements.

The relatively small sized mixer enables to use lightweight material at any constructional project.

The effectiveness of cast in-situ Lightweight Cellular Concrete is stipulated by:

- Simplicity of equipment for foamed concrete mix making;
- Mobility of assemblies;
- Possibility to vary foamed concrete properties from heat-insulating with density grade D300 to constructive with density grade D1400;
- Minimal energy consumption; installed capacity of mobile assemblies is from 3.2 to 10 KW;
- Low materials consumption as an aggregate is the air;
- Economical efficiency.

Cast in-situ LightBUILD™ cellular concrete is the most effective advanced building material and it has a wide range of applications:

- **Wall Sound and Thermal insulation**
  By grouting of foam concrete into permanent or removable formwork, moulds or between masonry leaves in cavity walls.

- **Roof Sound and Thermal Insulation**
  The ideal density for this purpose is 500 kg/m³. The heat transmission in this case would be 0.08 Kcal/m²h°C. The minimum thickness must never be less than 40 mm.

- **Rigid Pavement Floor Screeds**
  A layer of foam concrete under ceramic tiles, marble paving, cement tiles etc. Generally a 500 kg/m³ density is used, in order to gain thermal and acoustic insulating properties and at the same time, to load the structure as little as possible. The minimum recommended thickness for such a screed is 40 mm.

- **Elastic Pavement Floor Screeds**
  This application is for floors covered with carpet, timber parquetry, vinyl tiles etc. As the paving material is directly glued onto the floor screed in many instances, the most suitable density is 1100 kg/m³. The pavement is laid as described for rigid pavements, excepting that particular care is taken to trowel off the surface by hand or by mechanical trowel in 24 hours after pouring.

- **Void filling**
  of tanks, sewers, cellars, culverts, tunnels etc.
  The market for void filling is diverse. Lightweight Cellular Concrete can be used for applications in sewage lining grouting, this market has enormous potential.

  Typical applications are void filling in mines, after excavation work or disused trenches and shafts. This is just one example of how this market can be developed.

  Any industry that requires grouts for void filling can benefit from the utilization of Lightweight Cellular Concrete. For instance, in Oil Drilling, they pump massive quantities of grout around the shaft they place in the newly drilled hole. This market is currently untapped.

- **Utility Trench Fill**
  The flowable backfill [soil cement pipe bedding] is designed to completely surround the pipe and extend a minimum of 152.40 mm above the top of the pipe as shown in the following illustrations for a common street and sidewalk application.

  In the placement area of the foamed concrete fill is easily accommodated by setting the drainage [concrete, clay or polyethylene plastic pipe] on supports [Figure A]. These can be plastic chairs or to economize, used/broken concrete, bricks, stones, or recycled material.

  Once the fill has been placed to just below the utility elevation, temporary blocking or bracing could be used to hold the utility pipe in place as the lightweight foamed concrete fill is placed around it. Additional utility [electric or gas] can then be placed at this time [Figure B]. The last rise/lift fill is poured to the level that will receive the top surface.

  Additional various densities concrete can be specified for sidewalk, sub-base, road surface, pavers or precast panels. [Figure C].
This allows the use of a flowable fill to minimize the excavation required for the pipeline. And the use of elaborate sheeting and shoring [top inset photo] is not necessary because workmen do not have to enter the trench to compact the bedding material in lifts. Polyethylene plastic pipe has the economic advantage over conventional clay, concrete or metal pipe placement.

- **Drainage Trench Construction**
  Common drainage trench construction with stone and mortar is slow and labour intense. A simpler, accelerated and economical approach would be to use the technique below.

  Rigid pre-sloped expanded polystyrene forms 3 meters in length are placed in excavated channel. Lightweight Cellular Concrete with a specified strength and density is poured around the forms and allowed to harden. Form is removed and additional site completion either as an open or closed system.

- **Structural Fill**
  Pictures below show application where substandard soil under a structure has failed and now replaced with a fill. Structure is supported by material with density and compressive strength specified by a structural engineer.
- **Reduction in lateral load** If foamed concrete is used in place of conventional backfill material, such as behind a bridge abutment, the lateral load is reduced and there is less settlement.

- **Soil Stabilisation**
  The stability of embankment slopes can be improved if part of the soil is replaced with foamed concrete, thus reducing the weight which contributes to slope instability.

- **Conduit / Pipe Bedding**

- **Use of Lightweight Cellular Concrete with the Modern Building Techniques**
  With ever increasing building costs, the requirement for rapid building, rising energy costs and greater awareness of global warming and energy conservation as an important aspect of building design, expanded polystyrene (EPS) is becoming increasingly used in modern day construction.

  In South Africa alternatives to the tradition of brick and mortar are going to have to be used to enable the building demand to be met.
  Automa Building Products (Pty) Ltd. has designed Expanded Polystyrene Building Systems and offer the range of products manufactured from expanded polystyrene (EPS) for use in the construction industry.

  Expanded polystyrene (EPS) building systems are commonplace in the rest of the world primarily because of EPS's thermal insulation properties and light weight.

  Automa VARIBLOCK is made up of high density, expanded polystyrene panels that lock together vertically to act as formwork allowing concrete to be poured between the panels creating a reinforced concrete wall.

  The side panels are held together by a series of internal expanded polystyrene cross braces which are slotted into position between the vertical rebar to hold the side walls in position and maintain a flat and perpendicular wall.

  Automa POLYBLOCK is a hollow EPS building block which acts as a permanent formwork for a reinforced concrete infill and is used for building houses, perimeter and retaining walls, infill panels for steel frame construction, agricultural buildings and high rise developments.

  ![AUTOMAPOLYBLOCK BUILDING PROCESS](image1)

  ![3D VIEW OF AN AUTOMAPOLYBLOCK](image2)
After the formwork in place it should be filled by reinforced 15MPa concrete. **LightBUILD™** high density Lightweight Cellular Concrete (D1200 kg/m³) can be used as retaining walls fill and the low density cellular concrete (D600-800 kg/m³) can be used in partition walls.

**Benefits of using EPS blocks with LightCrete Cellular Infill:**

- **Permanent thermal insulation**
  EPC with Lightweight infill will keep homes warm in winter and cool in summer saving energy costs involved in heating and cooling.

- **Lightweight**
  EPC blocks are easy to carry and position.
  EPC frameworks filled with **LightBUILD™** are up to 70% lighter than equivalent sized brick walls.

- **Quick to build**
  Automa modular blocks are dimensionally accurate, equivalent in size to 36 bricks and the patented locating mechanism locks the blocks together easily and tightly.

- **No need for skilled labour**
  Due to the simplicity of fitting the Automa blocks and the requirement simply to fill with concrete, skilled bricklayers are not required.

- **Structurally sound**
  The structure of the Automa block system is reinforced cellular concrete which is as strong as brick but with the unique properties of cellular concrete.

- **Speed of construction**
  Walls can be built up to 5 times as fast as brick with building rates of 50m² per day per building team readily achievable.

- **Moisture resistant**
  Both EPS and Cellular Concrete is water impermeable and therefore create a moisture barrier.

- **Cost competitive**
  Considering material cost and speed of building constructing with the Automa blocks system is chipper comparing to the traditional building techniques.

- **Long life**
  EPS with **LightBUILD™** infill is resistant to rot, bacterial and termite attack and degradation over time and will retain its thermal insulating and moisture barrier properties for the life of the building.

**Conclusion**

**LBT Power SA** was established in 2005 as a research-based, engineering and manufacturing company providing industry solutions and services based on Lightweight Concrete technologies to the wide range of industrial and environmental applications.

Through the collaborative scientific research and engineering we offer solutions and packages to all forms of business in South Africa who would like to use our techniques to manufacture lightweight constructional materials or offer services using Lightweight Cellular Concrete technology, providing them with all necessary equipment, expertise, extensive on-side technical support and after-sale service.

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