

G-BUBBLES

Widespread use of lightweight concrete aggregate from recycled glass



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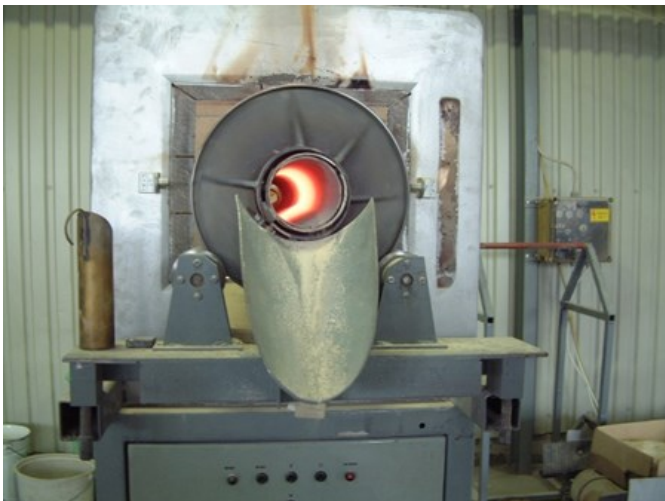


One of the greatest challenges and opportunities facing the industry is to reduce its burden on the environment while maintaining its profitability and growth. Gravel mining is damaging because it inflicts deep wounds on the surface of the Earth, therefore disrupting the harmony of the landscape.

The technology introduced by NISIO Group Hungary recycles waste of households and industry and substitutes gravel with its product. Usage of lightweight aggregates produced out of waste materials has a considerable environmental advantage.

PROCESS

Waste materials of high glass content are ground to an appropriate particle diameter. Homogenisation is carried out with a blowing agent dosed according to the amount of impurities in the raw materials. Granulation process is carried out by adding melting point reducer and viscosity modifying agents. The granulate is heat cured and coated to decrease water absorbing capability. Firing is carried out in a rotary furnace.



The product is a lightweight artificial foam gravel with a diameter of 2 to 25 mm having primarily heat and sound insulating properties. It can be embedded into various adhesive material and used as construction material.

TEST REPORTS

This product has three main types called A, B and C. Type A is used for thermal insulation, type B is used for structural lightweight concrete (LWAC) with thermal insulating property and type C is used for structural LWAC. The three types have different physical parameters determined by measurements of Budapest University of Technology.

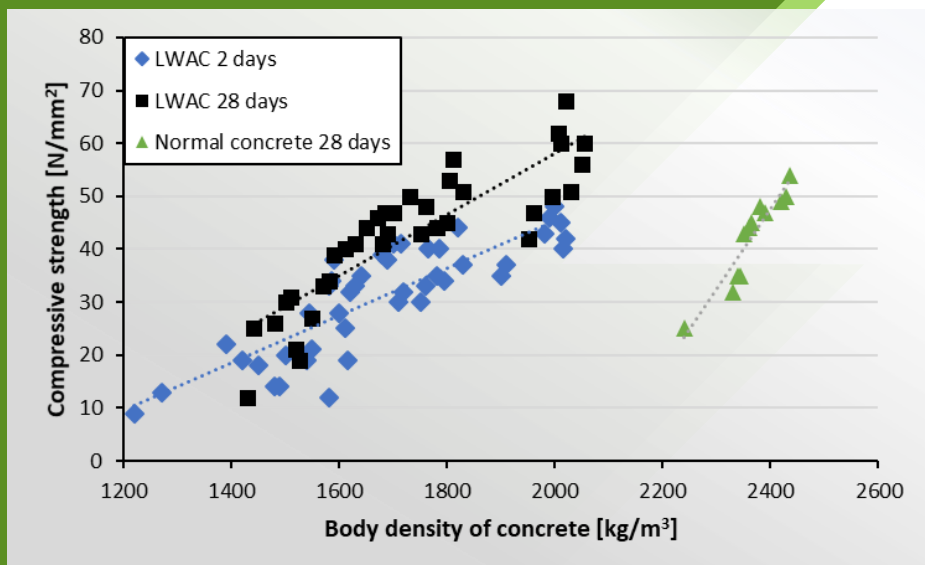
		Type A	Type B	Type C
Particle density	[kg/m ³]	260-1000	460-1200	1000-1850
Bulk density	[kg/m ³]	150-500	260-750	600-1100
Crushing test	[N/mm ²]	0.2-1	0.4-4.7	1-15
Water absorption capacity	[m/m%]	10-55	2-10	0.1-2



Products of the following characteristics can be produced by embedding foam gravels of the diameter of 2-25 mm into gypsum, cement or silicate resin matrix:

- ▶ Body density 350 - 2000 kg/m³
- ▶ Heat conductivity: 0.1 – 1.5 W/mK
- ▶ Compressive strength: 2.5 - 58 N/mm²
- ▶ Sound insulating capacity, RW: 42 dB
(thickness 12 cm, density 1100 kg/m³)

RESULTS OF DIFFERENT FOAM GRAVELS



AGGREGATE OF LIGHTWEIGHT CONCRETE



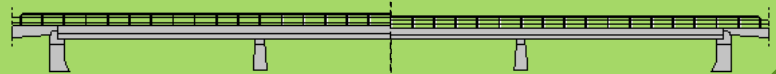
PUMPING EXPERIMENT



LAHN-BRIDGE STUDY

Existing concrete superstructure of the bridge

Possible G-bubbles lightweight concrete



Slab thickness:	110 cm	80 cm
Concrete:	810 t	590 t
Reinforcing steel:	98t	59 t

The most advantageous utilization form of G-Bubbles is embedding them into concrete as aggregate. Density of normal weight concrete is between 2200 and 2600 kg/m³ and influenced mainly by the density of the aggregate. Density of LWAC is between 1500 and 2100 kg/m³. Applying lightweight aggregates results in lower self-weight and requires smaller cross-section of the structure.

ADVANTAGES AGAINST NORMAL CONCRETE

- ▶ Higher crushing resistance of concrete (less reinforcement)
- ▶ Better data in thermal resistance
- ▶ Good data in acoustical behaviour
- ▶ Better fire protection
- ▶ Saving of natural raw material by using waste
- ▶ Environmental protection
- ▶ Saving of expenditures

ALTERNATIVE UTILIZATION



Apart from lightweight concrete there are several utilization forms of G-Bubbles depending on the applied matrix.

- ▶ sound barrier wall
- ▶ walling element
- ▶ heat insulation floor superstructure
- ▶ green roof topping
- ▶ heat insulating plaster



FLAT ROOF INSULATION

CLUBHOUSE SUPERSTRUCTURE

SOUND BARRIER WALL DESIGNS

