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BELGIAN BUILDING RESEARCH INSTITUTE

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VAT n° : BE 407.695.057

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LABORATORY : Materials	TEST REPORT	N° DE, DAT. RE : 621xA491 N° Labo : 3963 N° Sample : 21 / 68 / 7
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REQUESTED BY : CRAFTSTONE INTERNATIONAL PTE LTD
65 SUNGEI KADUT DRIVE
SINGAPORE 729564
ATTN: MR. BENJAMIN CHNG

Contact persons :	- Demander - Mr. Šu, Chien Chou	- BBRI - Mr. F. de Barquin
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Test carried out : Apparent density, open porosity and frost resistance on agglomerated stone, called "Lava Stone" by the demander.

References : NBN B27-009 (1983), NIT 205 (1997) § 3.12 and 4§ .1, NBN EN 1936 (1999).

Date and reference of the request	: 17.04.2001
Date of receipt of the sample(s)	: 06.06.2001
Test date	: July - August 2001
Drafting date of the report	: 22.08.2001

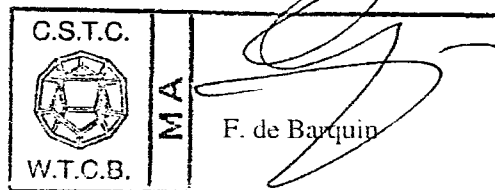
This report contains 3 pages, numbered from 1/3 to 3/3 ; it may only be reproduced in its entirety. Each page of the original report has been stamped (in red) by the laboratory and initialled by the head of laboratory. The results and findings are only valid for the tested samples.

- No sample
- Sample(s) submitted to a destructive test
- Sample(s) to be removed from our laboratories 60 calendar days after sending of the report, unless a written request is received by the demander of the test

In charge of the test

P. Vanherck

The Assistant Head of Division



Technical assistance :

F:B/SDE



1. TEST SPECIMENS

The following samples of an agglomerated stone called "Lava Stone" by the demander were delivered in the test center of the BBRI in Limelette on 6 June 2001:

- samples 1 to 6: cubic samples of 70 mm x 70 mm x 70 mm
- samples 7 to 16: prismatic samples of 190 mm x 90 mm x 35 mm
- samples 17 to 22: cubic samples of 70 mm x 70 mm x 70 mm
- samples 23 to 28: slabs of 200 mm x 200 mm x 35 mm

2. TEST RESULTS

2.1 Open porosity and apparent density (NBN EN 1936 - 1999)

The 6 cubic samples numbered from 17 to 22 were dried at 75 °C until constant mass has been reached. They were weighed (md) and water impregnated under vacuum with a barometric depression of 740 mmHg. After 24 h, they were weighed in water (mh) and in the air (ms).

The open porosity P_o is given by:

$$P_o = \frac{ms - md}{ms - mh} \cdot 100 \text{ (vol \%)}$$

The apparent density is expressed by:

$$\rho_b = \frac{md}{ms - mh} \cdot \rho_m$$

where ρ_m is the density of water at 20°C (998 kg/m³)

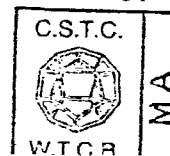
Specimen nb	md (g)	ms (g)	mh (g)	P _o (vol %)	ρ _b (kg/m ³)
17	540.47	655.87	315.62	34	1585,3
18	540.46	657.23	315.15	34.1	1576,8
19	539.8	657.31	314.78	34.3	1572,8
20	533.82	649.87	312.24	34.4	1578
21	528.98	647.85	309.59	35.1	1561
22	535.18	650.38	314.35	34.3	1589,5
average				34.4	1577,1

2.2 Frost resistance (NBN B27-009 - 1983) (BELTEST)

The 5 slabs numbered from 23 to 27 were dried at 75°C until constant mass is reached.

After cooling, the slabs were weighed and water impregnated under vacuum with a barometric depression of 650 mm Hg.

So impregnated, the slabs were submitted to the direct frost test according to the standard NBN B27-009, i.e. 25 cycles of free-thaw, comprising 10 cycles with a freezing phase at -15°C and 15 cycles with a freezing phase at -5°C.





At the end of each freezing phase, the samples were thawed under water at + 15°C.

Before and after the cycles, measurements of the dynamic elasticity modulus were made in accordance with the standard NBN B15-230.

Slab nr.	Water content (mass %) before the cycles	Water content (mass %) after the cycles	Variation in dynamic elasticity modulus after the cycles (%)
23	18,72	19,03	+ 12,26
24	19,11	19,54	+ 8,81
25	18,03	17,86	+ 13,35
26	18,97	18,98	+ 12,80
27	18,46	18,72	+ 12,91
average	18,66	18,83	+ 12,03

Visual description of alterations

- No visual alterations on the slabs 23 to 26.
- On the slab 27, the detachment of a small fragment ($\leq 10 \text{ mm}^2$) has been observed on one of the corner (minor damage which does not compromise the integrity of the specimen).

2.3 *Compressive strength (NBN EN 1926 – 1999) and flexural strength (NBN EN 12372 – 1999)*

See enclosed report 621 x A491 of laboratory Structures (SC).

