

## GROVE WHITBED

This technical data sheet was compiled by the Building Research Establishment (BRE) at the request of Albion Stone and is updated by Albion Stone to incorporate current test results. The 866 tests have been carried out in accordance with current European standards by the BRE on Albion Stone's behalf, or by other accredited testing houses. The early test data that pre-dates the introduction of Euro-codes has been included providing the test methods were very similar. The work carried out by the BRE on this technical data sheet has been undertaken as a paid commission and does not represent an endorsement of the stone by the BRE.

This data includes the Lowest and Highest Expected Values (LEV & HEV) using the statistical calculations from the Euro-codes. We are confident that these results give a good indication of the stones value, but as it is a natural material we, like other stone producers, are unable to guarantee individual results for specific stones. Instead, we recommend that an appropriate factor of safety is used to ensure satisfactory performance, Cladding Annex 1 of the Technical Manual provides further information, but we suggest that a suitably qualified stone consultant with geological and testing experience is employed to provide further information.

### Petrography

#### Macro Examination

This appeared to be a fine-grained sedimentary limestone. Light creamy-white coloured matrix containing an abundance (>10%) of highly elongate light-grey (brownish-grey when weathered) coloured fossiliferous material. This material was orientated primarily in one direction which probably represented bedding. These fossiliferous clasts were observed up to 3µm in length.

Voidage appeared modest and the fluorescent resin take up appeared high. This sample appeared to be a fairly uniform fine-grained material in which no bedding or linear features other than the fossiliferous material was apparent.

(For a full Petrographic description of this stone, please contact us on 01737 771772 or email [enquiries@albionstone.com](mailto:enquiries@albionstone.com))

### Strength

#### Compression - BS EN 1926

Lowest Expected Value 35.53 MPa

Highest Expected Value 61.06 MPa

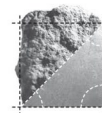
**Average: 47.04 MPa from 26 tests**

#### Flexural Strength - BS EN 13161

Lowest Expected Value 2.47 MPa

Highest Expected Value 8.13 MPa

**Average: 6.03 MPa from 82 tests**



**Flexural Strength - BS EN 12372 (Pre-thermal testing)**

Lowest Expected Value 3.83 MPa

Highest Expected Value 6.15 MPa

**Average: 4.88 MPa from 10 tests**

**Breaking Load at Dowel Hole - BS EN 13364:2002**

Specimen Thickness (mm)	Mean Breaking Load (N)	Lowest Expected Value (N) / Highest Expected Value (N)
75	4667	3749 / 5668
60	2249	1777 / 2816
50	1860	1460 / 2342
40	1191	922 / 1519
30	667	539 / 817

**Durability**

**Water Absorption - BS EN 13755**

Lowest Expected Value 3.54%

Highest Expected Value 10.30%

**Average: 6.29% from 49 tests**

**Density - BS EN 1936**

Lowest Expected Value 2,002 kg/m<sup>3</sup>

Highest Expected Value 2,315 kg/m<sup>3</sup>

**Average: 2,155 kg/m<sup>3</sup> from 60 tests**

**Porosity - BS EN 1936**

Lowest Expected Value 13.88%

Highest Expected Value 25.79%

**Average: 19.24% from 83 tests**

**Saturation Coefficient - BS EN 1936**

Lowest Expected Value 0.56

Highest Expected Value 0.92

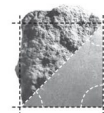
**Average: 0.73 from 22 tests**

**Salt Crystallisation – BS EN 12370**

Lowest Expected Value 0.00%

Highest Expected Value 6.14%

**Average: 2.05% from 6 tests**



ALBION STONE

### **Thermal Shock Resistance—BS EN 14066**

#### **% change in elastic modulus**

Lowest Expected Value 0%

Highest Expected Value 32%

**Average: 4.51% from 10 tests**

### **Water Absorption by Capillarity - BS EN 1925**

59.41g/m<sup>2</sup>.sec<sup>2</sup>

### **Flooring/Paving**

#### **Abrasion Resistance - EN14157**

Lowest Expected Value 20.55

Highest Expected Value 28.99

**Average: 24.48 from 9 tests**

#### **Slip Resistance - TRRL Pendulum Test: Grit 120 (Flooring)**

Lowest Expected Value 68

Highest Expected Value 84

**Wet Average value 76 from 24 tests**

Lowest Expected Value 79

Highest Expected Value 97

**Dry Average value 88 from 24 tests**

#### **Freeze/Thaw – BS EN 12371 & 12372**

168 Freeze/Thaw Cycles

Mean Value 3.5 MPa

38% reduction in strength

**Pass**

#### **Light Reflectance - tested using NCL Colour Scan instrument - Grit 60**

Mean Value 57

### **Internal Flooring**

Grove Whitbed is suitable for all flooring applications up to semi-intensive use such as shops and offices with estimated visitor numbers of 5,000,000 with a service life without significant wear of 20 years. The slip resistance results of over 40 demonstrate that the stone will be safe in all applications.

### **Technical Summary**

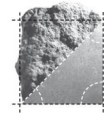
**Prepared by: Dr T Yates, BRE (Building Research Establishment)**

### **Durability and Weathering**

It is important that the results from the sodium sulphate crystallisation tests are not viewed in isolation. They should be considered with the results from the porosity and water absorption tests and the performance of the stone in existing buildings. Stone from the Portland Whitbed is

[www.albionstone.com](http://www.albionstone.com)

t 01737 771772 e [enquiries@albionstone.com](mailto:enquiries@albionstone.com)



ALBION STONE

traditionally acknowledged as generally being a very durable building stone and it has been used extensively in many towns and cities in the UK. Comparing the results for the Whitbed Stone from Jordans Quarry to those collected from buildings, exposure trials and tests on quarry samples collected by BRE during the last 70 years shows that this stone compares very well with the traditional view of Portland Whitbed. Previous research at BRE has shown that Portland limestone which has a low saturation coefficient ( $<0.72$ ), a low microporosity ( $<11.0$  of the stone by volume) and an open oolitic structure generally performs well over long periods when used on buildings. The results summarised on these sheets show that the limited number of samples tested meet these criteria. The average crystallisation test results show the stone to be Class C which BRE Report 141 suggests is suitable for most uses including where exposure conditions are to be more severe, for example high concentrations of sulphur dioxide or severe frosts, or where a long life is required (for example  $>50$  years). In all cases it is important that the detailing of the stonework is designed to offer the maximum protection from rainwater and rainwater runoff.

**Based on current research it seems likely that the stone would weather at a rate of between 1 and 2 mm per 100 years but it could be greater in severe exposures.**

(Weathering rates are based on the BRE interpretation of historical data dating from 1932).