JORDANS BASEBED

This technical data sheet was initially 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 1,311 tests have been carried out from 2006 in accordance with current European standards by the BRE and Sandbergs 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. Section 5.6 in the BS8298 part 2 & 4 set out the calculation for the factor of safety. Table 4 shows the components for this calculation and Albion Stone are happy to assist with interpretation of our data.

Breaking load at Dowl was historically tested in the Type 0 orientation. Testing demonstrated that results in this configuration are consistent with those obtained in the Type IIb orientation. As a result, testing is now carried out in the Type IIb orientation in accordance with BS EN 13364 Part 1, as this more closely reflects the typical orientation of Portland Stone in use.

Petrography

Greyish cream when dry and beige to greyish pale brown when wet, medium to fine grained oolitic/peloidal LIMESTONE, well to moderately compacted. Occasional unevenly distributed, relict bioclasts, up to 1mm across and 3mm long and commonly less than 0.3mm across and 0.7mm long. Also, sporadic sparry calcite crystals or crystal aggregations less than 0.5mm across were unevenly distributed. The stone was hard to moderately hard and robust (subjective estimate), generally porous exhibiting irregular voids, up to 1.5mm and commonly less than 0.5mm across.

Strength

Compression - BS EN 1926

Lowest Expected Value 33.89 MPa
Highest Expected Value 77.85 MPa
Average: 52.93 MPa from 66 tests

Flexural Strength - BS EN 13161

Lowest Expected Value 4.76 MPa
Highest Expected Value 9.30 MPa
Average: 6.78 MPa from 126 tests

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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	4329	3530 / 5254
50	2766	1321 / 5147
40	1757	758 / 3521
30	618	496 / 762

Durability

Water Absorption - BS EN 13755
Lowest Expected Value 5.02%
Highest Expected Value 7.26%
Average: 6.07% from 133 tests

Density - BS EN 1936
Lowest Expected Value 2167 kg/m^3
Highest Expected Value 2322kg/m^3
Average: 2243 kg/m^3 from 144 tests

Porosity - BS EN 1936
Lowest Expected Value 13.32%
Highest Expected Value 19.20%
Average: 16.09% from 245 tests

Saturation Coefficient - BS EN 1936
Lowest Expected Value 0.74
Highest Expected Value 0.91
Average: 0.82 from 106 tests

Salt Crystallisation - BS EN 12370
Lowest Expected Value 15.34%
Highest Expected Value 70.82%
Average: 34.63% from 6 tests

Thermal Shock Resistance - BS EN 14066
Lowest Expected Value 0.12%
Highest Expected Value 12.84%
Average: 1.94% from 10 tests

Water Absorption by Capillarity - BS EN 1925
42.66 $g/m^2.sec^{-2}$

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Flooring / Paving

Abrasion Resistance - EN 14157
Lowest Expected Value 22
Highest Expected Value 28
Average 25 from 12 tests

Slip Resistance - BS EN 1341 TRRL Pendulum Test: Grit 120 (Flooring)
Lowest Expected Value 65
Highest Expected Value 87
Wet Average value 75 from 30 tests
Lowest Expected Value 73
Highest Expected Value 87
Dry Average value 79 from 30 tests

Freeze/Thaw—Flexural Strength - BS EN 12371 & 12372 (Pre-thermal testing)
Lowest Expected Value 5.82 MPa
Highest Expected Value 12.38 MPa
Average: 8.64 MPa from 30 tests

Freeze/Thaw—Flexural Strength BS EN 12371 & 12372 (Average figure 14-168 cycles)
Lowest Expected Value 9.10 MPa
Highest Expected Value 11.29 MPa
Average: 10.15 MPa from 49 tests

Freeze/Thaw — Flexural Strength - BS EN 12371 & 12372 (After 14 (20) cycles) For cladding in accordance with EN 1469
Lowest Expected Value 8.90 MPa
Highest Expected Value 11.53 MPa
Average: 10.15 MPa from 20 tests

Freeze/Thaw — Flexural Strength - BS EN 12371 & 12372 (After 56 cycles) For paving in accordance with EN 1341
Lowest Expected Value 9.50 MPa
Highest Expected Value 11.25 MPa
Average: 10.34 MPa from 9 tests

Freeze/Thaw — Flexural Strength - BS EN 12371 & 12372 (after 168 cycles) in accordance with EN 771-6
Lowest Expected Value 9.10 MPa
Highest Expected Value 10.75 MPa
Average: 9.90 MPa from 10 tests

Determination of Load Capacity of FZP-Anchors (Fischer under cut Anchors) - pull out testing on 50mm thick
Lowest Expected Value 3824 N
Highest Expected Value 5132 N
Average: 4440 N from 10 tests

Light Reflectance - tested using NCL Colour Scan instrument - Grit 60
Mean Value 62.20

Internal Flooring
Jordans Basebed 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 Basebed is traditionally acknowledged as being less durable than Whitbed but it has been used extensively where a faster rate of weathering is acceptable or where its working qualities were required. It is possible to compare the results for the Basebed Stone from Jordans Mine to those collected from buildings, exposure trials and tests on quarry samples collected by BRE during the last 70 years. This shows that the stone compares well with the traditional view of Portland Basebed. Previous research at BRE has shown that Portland limestone which has a low saturation coefficient (>0.72), a high microporosity (>11.0 of the stone by volume) and an increased amount of micritic matrix will weather more rapidly than Whitbed when used on buildings. The results summarised on these sheets show that most of the samples tested are of this type.

The crystallisation test results show the stone to be Class D -E which BRE Report 141 suggests that it is suitable for plain walling and cladding. The results from the other tests suggest that soundest stone may well perform better than this class in the current environment. Where more severe exposure conditions are expected, for example high concentrations of sulphur dioxide or severe frosts, or where a long life is required (for example >50 years) then it may be desirable to use a more durable stone (e.g. Jordans Whitbed). When using Jordans Basebed it is especially important that the detailing of the stonework is designed to offer the maximum protection to rainwater and rainwater runoff.

Based on current research it seems likely that the stone would weather at a rate of between 3 and 4 mm per 100 years but it could be greater in severe exposures or on the edges of stonework.

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

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