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Dresden, 7 August, 2018

Test Report

Order no. 2218002, Pos. 8-10

Client: Dasso Group
Zhejiang Xinhaiye Bamboo Technology Co., Ltd.
Xikou Industrial Zone, Longyou County
Zhejiang, CHINA

Date of order: 7 March, 2018

Order: Laboratory tests and analysis of wood decking: biological durability, anti-slip properties, mechanical properties and chemical analysis
Pos. 8-10: Mechanical properties

Contractor: EPH – Entwicklungs- und Prueflabor Holztechnologie GmbH
Laboratory Unit Material and Product Testing

Engineer in charge: Dipl.-Ing. J. Gecks

Dipl.-Ing. J. Gecks
Head of Laboratory Material and Product Testing

The test report contains 5 pages. Any duplication, even in part, requires written permission of EPH. These test results are exclusively related to the tested material.

1 Terms of Reference

The Entwicklungs- und Prueflabor Holztechnologie GmbH (EPH) was ordered by Dasso Group to carry out the tests below:

- Determination of resistance to indentation (Brinell hardness) acc. to DIN EN 1534
- Determination of modulus of elasticity (MOE) and of modulus of rupture (MOR) in bending acc. to DIN EN 408 in four-point bending test
- Determination of moisture resistance and of dimensional stability in water immersion test acc. to DIN EN 15534-1, § 8.3

2 Test Material

The test material was sent to the Contractor by the Client and got to the laboratory on 7 March, 2018.

Product name: DASSO CTech exterior strand woven bamboo decking

Cross-section: 100 mm x 20 mm

The test material was conditioned at a temperature of 23 °C and a relative humidity of 50 % after cutting of the test pieces.

3 Realisation of Tests

3.1 Resistance to indentation (Brinell hardness)

The test was carried out according to DIN EN 1534 at 50 measuring points.

A buffed steel sphere ($D = 10$ mm, diameter) was impressed into the surface of test specimens with a force F of 1000 N within 15 seconds. After 25 seconds of load holding, the sphere was got off. After 3 minutes waiting, the diameter (d) of impression was measured with a measuring magnifier (0.1 mm scale gradations).

The calculation of the resistance of indentation was carried out according to the following formula:

$$HB = \frac{2 F}{g \pi D (D - \sqrt{D^2 - d^2})} [\text{N/mm}^2]$$

The test was carried out on 27 June, 2018.

3.2 Bending Properties (MOE and MOR)

The bending properties were determined in accordance with EN 408 (four-point bending test) on 10 test specimens. The distance of the joists was chosen at 360 mm, the distance between the load application points was 120 mm. The modulus of elasticity in bending (MOE) and the bending strength (MOR) was calculated using the outer dimensions of the cross section.

The test was carried out on 26 June, 2018.

3.3 Moisture resistance and dimensional stability (water immersion test)

By analogy with EN 317, 3 test specimens were stored in water (temperature of 20 °C) during 28 days. Afterwards, the thickness, the width und the length was measured using a calliper gauge for the determination of swelling. The mass was measured before and after immersion test for the calculation of water absorption. The test pieces were stored at normal conditions (temperature of 23 °C and relative humidity of 50 %) before the test.

The test was carried out between 21 June and 19 July, 2018.

4 Results, Requirements

4.1 Resistance to indentation (Brinell hardness)

Table 1: Brinell hardness

No. of test specimen	Brinell hardness in N/mm ²
1	59.5
2	58.1
3	58.1
4	74.3
5	63.9
6	76.3
7	70.6
8	97.7
9	74.3
10	67.1
11	70.6
12	70.6
13	76.3
14	74.3
15	89.7
16	68.8
17	78.3
18	78.3
19	62.4
20	76.3
21	87.2
22	82.6
23	72.4
24	92.3
25	82.6
26	78.3
27	78.3
28	76.3
29	78.3
30	82.6
31	84.9
32	78.3
33	82.6
34	87.2
35	82.6
36	103.7
37	92.3
38	121.1
39	84.9
40	84.9

Table 1 (continued): Brinell hardness

No. of test specimen	Brinell hardness in N/mm ²
41	84.9
42	78.3
43	80.4
44	67.1
45	78.3
46	76.3
47	82.6
48	82.6
49	76.3
50	95.0
Mean value	79.2
Standard deviation	11.4
<i>Coefficient of variation (COV)</i>	<i>14 %</i>

4.2 Bending Properties (MOE and MOR)

Table 2: Modulus of elasticity (MOE) and bending strength (MOR)

No. of test piece	MOE in N/mm ²	MOR in N/mm ²
21-1	20400	66.8
21-2	17000	61.0
21-3	17900	51.3
21-4	16100	84.5
21-5	15800	63.7
21-6	16300	81.7
21-7	15500	84.3
21-8	15000	70.9
21-9	17000	81.6
21-10	16000	92.2
Mean value	16700	73.8
Standard deviation	1560	13.0
<i>Coefficient of variation (COV)</i>	<i>9 %</i>	<i>18 %</i>

4.3 Moisture resistance and dimensional stability (water immersion test)

Table 3: Swelling rate after immersion in water for 28 days (dimensional stability)

No. of test specimen	Dimension	Swelling rate in %
64-1	thickness	3.3
64-2		6.3
64-3		2.5
Mean value		4.0
64-1	width	0.6
64-2		0.8
64-3		0.5
Mean value		0.6
64-1	length	0.0
64-2		0.0
64-3		0.1
Mean value		0.0

Table 4: Water absorption after immersion in water for 28 days (water resistance)

No. of test specimen	Water absorption rate in %
64-1	8.6
64-2	4.1
64-3	9.5
Mean value	7.4

5 Summary of test results

Brinell hardness: 79.2 N/mm²
 Bending strength (MOR): 73.8 N/mm²
 Modulus of elasticity (MOE): 16700 N/mm²
 Swelling rate in thickness: 4.0 %
 Swelling rate in width: 0.6 %
 Swelling rate in length: 0.0 %
 Water absorption: 7.4 %

The values given above are mean values.

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