BouwTechnologie

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REPORT 3244-2:
SHEAR STRENGTH AND SHEAR MODULUS OF MAGOXX®-BOARD

Project number:	3244
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1. PROJECT DATA

Commissioner	:	SINH Building Solutions B.V.
Address	:	Saturnusstraat 60, unit 67 NL - 2216 AH Den Haag
Contact person	:	Mr. J. Engels
Project	:	Shear strength and shear modulus of Magoxx®-Board
Project number	:	3244-2
Project manager	:	drs. H. Schinkel
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2. INTRODUCTION

BouwTechnologie RDA was commissioned by SINH Building Solutions BV to test Magoxx®-board as commercialized by SINH Building Solutions at Den Haag (NL). The shear properties shall be determined in accordance with EN 789 on five specimens, cut with it longest size parallel to the longest dimension of the board and five specimens, perpendicular to the longest dimension of the board.

The 29th of May 2020 SINH Building Solutions B.V. supplied five boards with a thickness of 9 mm. The width of all boards was 1200 mm and the length of the boards was 3000 mm. The sheets were marked on their surface:

MAGOXX-CE-ETA 15/0634 NLY01-9mm-09/03/20

BouwTechnologie cut the test pieces for the different tests in accordance to EN 326 and EN 12467, dimensions 900 x 450 mm.

3. DESCRIPTION

According to the cutting plan the samples were sawn by BouwTechnologie RDA BV. The samples were coded as follows:

Sheet number (1 trough 5)

Direction of cutting (P =parallel, L=perpendicular)

Sh (stands for shear)

3.1 Method

The tests were carried out in accordance with EN 789.

The deformation over 120 mm was measured using two Linear Variable Differential Transformers (LVDT's), mounted to two sides of the specimens. The characteristical value of the shear modulus ($G_{v,mean}$)was determined from the force and the dimension of the section.

The maximum force (F_{max}) and the dimensions were used for calculating the characteristical value of the shear strength ($f_{v,k}$).

In order to ensure a correct propagation of the force into the specimen both ends were packed between two pieces of wood, 35 mm thick fir.

Figure 1 shows the test set-up.

The deformation velocity was kept constant at 5 mm/min, at this loading rate the specimens yielded in 300 s ± 120 s.

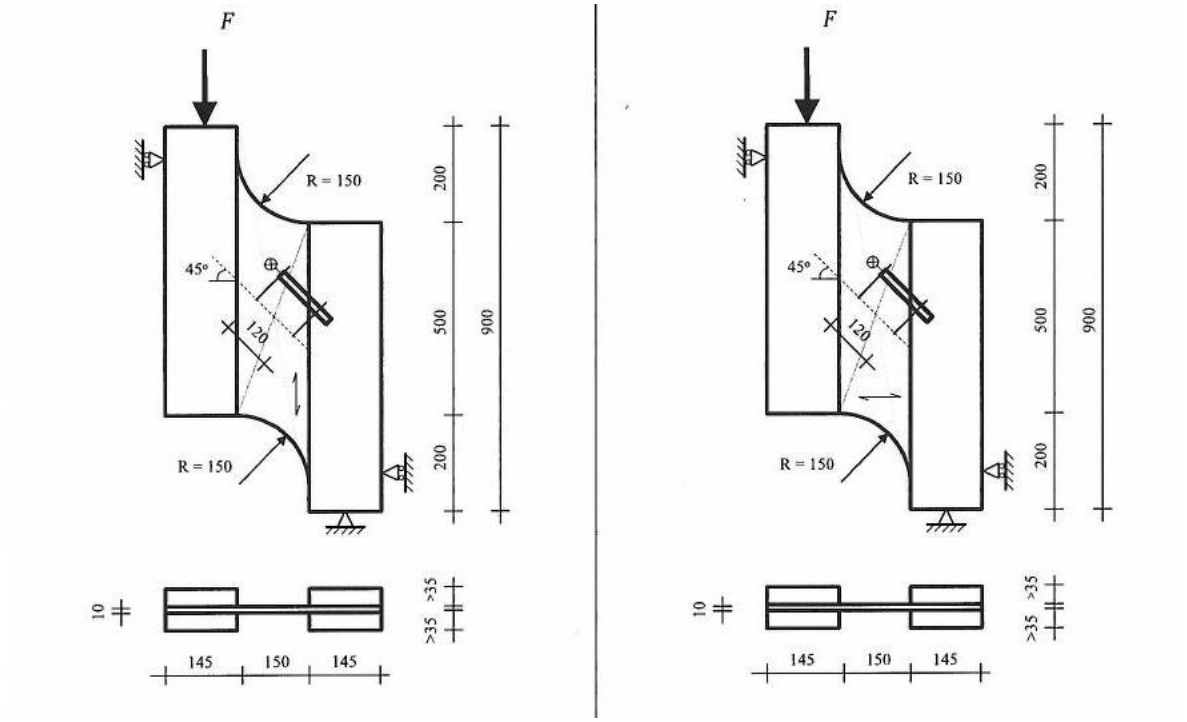

Figure 1. Dimensions and arrangement of the specimens and sensors

3.2 Calculations

Shear strength f_v was calculated using the formula:

$$f_v = \frac{F_{max}}{A}$$

where:

fv	shear strength	[N/mm²]
F_{max}	maximum load at yield	[N]
A	surface of the section (height x thickness)	[mm²]

Shear modulus G_v was calculated between 0,1 F_{max} and 0,4 F_{max} using:

$$Gv = \frac{0{,}5 \,.\, l1.\,(f40 - f10)}{A.\,(u40 - u10)}$$

where:

G_v	shear modulus	[N/mm^2]
l_1	distance between the measuring points (120 mm)	[mm]
A	surface of the section (height x thickness)	[mm²]
F_{40}-F_{10}	increment of force between 10% and 40% of yield load	[N]
u_{40}-u_{10}	increment of deformation 10% and 40% of yield load	[mm]

The characteristic values are calculated according with EN 14358, under the assumption that the test values have a log normal spread.

3.3 Apparatus used

Universal test bank Schenk (calibrated)

Digital (calibrated)

3.4 Time frame of tests

The tests were done July 24, 2020

3.5 Deviations from standard

The surface of the fixings of the LVDT's was superior to 5 mm².

4. RESULTS

The individual test results of the different tests are given in table 2. The average values are the arithmetic means by calculation.
The results didn't show a difference in the two directions of cutting. Table 1 summarizes therefor all results without the distinction of direction.

Table 1. Characteristic values of shear strength and shear modulus

MAGOXX®-board 9 mm	Shear strength ($f_{v,k}$) [N/mm²]	Shear modulus (G_{mean}) [N/mm²]
Independent of board direction	5,61	2497

Table 2. Individual results.

Sample	t_{up} [mm]	t_{down} [mm]	t_{mean} [mm]	F_{max} [kN]	f_v [N/mm²]	ln mi [N/mm²]	$(\ln mi-y)^2$ [N/mm²]	F_{10} [kN]	F_{40}]kN]	U10 [mm]	U40 [mm]	G_v [N/mm²]
1LSh	9,56	9,38	9,47	30,37	5,88	1,77	0,0060	3,02	12,10	0,013	0,055	2511
1PSh	9,08	9,28	9,18	33,14	6,62	1,89	0,0017	3,29	13,21	0,009	0,055	2559
2LSh	9,58	9,58	9,58	33,56	6,43	1,86	0,0001	3,34	13,32	0,016	0,059	2657
2PSh	9,67	9,50	9,59	35,37	6,77	1,91	0,0040	3,51	14,07	0,012	0,056	2742
3LSh	9,37	9,28	9,33	34,63	6,81	1,92	0,0048	3,42	13,84	0,012	0,057	2751
3PSh	9,30	9,25	9,28	34,51	6,83	1,92	0,0051	3,41	13,70	0,014	0,060	2666
4LSh	9,54	9,50	9,52	30,18	5,82	1,76	0,0079	2,96	11,97	0,010	0,060	2057
4PSh	9,65	9,67	9,66	32,34	6,14	1,82	0,0012	3,20	12,92	0,014	0,060	2401
5LSh	9,54	9,38	9,46	32,06	6,22	1,83	0,0005	3,13	12,72	0,012	0,061	2267
5PSh	9,55	9,54	9,55	31,99	6,15	1,82	0,0011	3,18	12,68	0,019	0,065	2361
Average			9,46	32,82	6,37							2497
St.Dev			0,15	1,76	0.38							225
VC (%)			2	5	6							9

Characteristic values EN 14358:2016

y	mean	1,85
s_y	st,dev	0,060
n		10
k_s (n)		2,10

$f_{v,k}$ [N/mm²] 5,61

$G_{v,mean}$ [N/mm²] 2497