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Physical Testing and Modelling – Masonry Structures

ERRATA TO TESTS FOR THE CHARACTERIZATION OF REPLICATED MASONRY AND WALL TIES

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This document is to be considered an amendment to the report Esposito, R., Messali, F., Rots, J.G. Tests for the characterization of replicated masonry and wall ties. Delft University of Technology, Final version, 18 April 2018.

The following corrections are reported with respect to the **Section 5 "Flexural strength of masonry"**:

- The distances d_1 and d_2 were incorrectly reported for the out-of-plane bending tests. An amendment of Table 12 in the original document is given in Table 1 below.
- The bending tests were performed in horizontal configuration, but the effect of self-weight was not considered in the estimation of the stress (see Eq. 7 in the original document). The flexural strength values have been recalculated as following:

$$f_{x1} = \frac{3F_{\max}\left(d_1 - d_2\right)}{2l_s t_s^2} + \frac{3m}{l_s t_s^2}\left(x - \frac{\left(\left(h_s - d_1\right)/2 + x\right)^2}{h_s}\right) \quad (1)$$

$$f_{x2} = \frac{3F_{\max}\left(d_1 - d_2\right)}{2h_s t_s^2} + \frac{3m}{h_s t_s^2}\left(x - \frac{\left(\left(l_s - d_1\right)/2 + x\right)^2}{l_s}\right) \quad (2)$$

$$f_{x3} = \frac{3F_{\max}\left(d_1 - d_2\right)}{2t_s h_s^2} + \frac{3m}{t_s h_s^2}\left(x - \frac{\left(\left(l_s - d_1\right)/2 + x\right)^2}{l_s}\right) \quad (3)$$

where f_{x1}, f_{x2} and f_{x3} are the flexural strength values of masonry tested respectively with the moment vector parallel to the bed joints and in the plane of the wall (OOP1), with moment vector orthogonal to the bed joints and in the plane of the wall (OOP2), and with moment vector orthogonal to the bed joints and in the plane of the wall (IP); F_{max} is the maximum force reached in the test; l_s, h_s and t_s are, respectively, the length height and thickness of the specimens considering its construction position; m is the mass of the specimen; x is the distance between the cracked cross-section and the nearest support.
The mass m of the specimens has been calculated by considering a density of 1805 and 1769 kg/m^3 for calcium silicate brick masonry and perforated clay brick masonry.
In the case of OOP1 tests, the distance x is determined on the basis of pictures of the crack pattern. In the case of OOP2 ad IP tests, it is assumed that the crack occurs at the centre of the specimen; this assumption is made because usually a stepwise crack pattern is observed.

Table 2 and Table 3 list the flexural strength values of calcium silicate and perforated clay brick masonry considering the aforementioned modifications.

Table 1 – Overview of specimens for bending tests (replaces Table 12 of original document). In red the values that have been modified.

Test type	Specimen name	Masonry type	l_s (bricks)	h_s (bricks)	d_1 (mm)	d_2 (mm)	d_3 (mm)
Bending test with moment vector parallel to the bed joints and in the plane of the wall (OOP1)	TUD_MAT-12a-f	Calcium silicate	2	10	700	360	170
	TUD_MAT-22a-f	Clay	2	10	420	220	110
Bending test with moment vector orthogonal to the bed joints and in the plane of the wall (OOP2)	TUD_MAT-13a-f	Calcium silicate	4	4	700	360	170
	TUD_MAT-23a-f	Clay	4	5	720	360	180
	TUD_MAT-23a4-f4	Clay	4	4	720	360	180
Bending test with moment vector orthogonal to the bed joints and in the plane of the wall (IP)	TUD_MAT-14a-f	Calcium silicate	4	4	700	360	170
	TUD_MAT-24a-f	Clay	4	5	720	360	180
	TUD_MAT-24a4-f4	Clay	4	4	720	360	180

Table 2 – Flexural strength values of calcium silicate masonry (replaces Table 14 in original document).

Specimen name	**f_{x1}**	**Specimen name**	**f_{x2}**	**Specimen name**	**f_{x3}**
	MPa		MPa		MPa
TUD_MAT-12a	0.33	TUD_MAT-13a	0.24	TUD_MAT-14a	0.27
TUD_MAT-12b	0.23	TUD_MAT-13b	0.77	TUD_MAT-14b	0.48
TUD_MAT-12c	0.20	TUD_MAT-13c	0.29	TUD_MAT-14c	0.42
TUD_MAT-12d	0.29	TUD_MAT-13d	0.77	TUD_MAT-14d	0.47
TUD_MAT-12e	0.26	TUD_MAT-13e	0.56	TUD_MAT-14e	0.31
TUD_MAT-12f	0.23	TUD_MAT-13f	0.67	TUD_MAT-14f	0.40
Average	**0.26**		**0.55**		**0.39**
Standard deviation	**0.05**		**0.22**		**0.08**
Coefficient of variation	**0.18**		**0.39**		**0.21**
		f_{x2} / f_{x1}	**2.1**	f_{x3} / f_{x1}	**1.5**

Table 3 – Flexural strength values of clay masonry (replaces Table 15 in original document).

Specimen name	f_{x1}	Specimen name	f_{x2}	Specimen name	f_{x3}
	MPa		MPa		MPa
TUD_MAT-22a	0,38	TUD_MAT-23a	1,32	TUD_MAT-24a	0,57
TUD_MAT-22b	0,26	TUD_MAT-23b	1,82	TUD_MAT-24b	0,63
TUD_MAT-22c	0,36	TUD_MAT-23c	1,24	TUD_MAT-24c	0,77
TUD_MAT-22d	0,54	TUD_MAT-23d	0,81	TUD_MAT-24d	0,80
TUD_MAT-22e	0,43	TUD_MAT-23e	1,26	TUD_MAT-24e	0,70
TUD_MAT-22f	0,32	TUD_MAT-23f	0,85	TUD_MAT-24f	0,58
		TUD_MAT-23a4	0,95	TUD_MAT-24a4	0,67
		TUD_MAT-23b4	1,16	TUD_MAT-24b4	0,70
		TUD_MAT-23c4	1,20	TUD_MAT-24c4	0,53
		TUD_MAT-23d4	0,95	TUD_MAT-24d4	0,42
		TUD_MAT-23e4	1,43	TUD_MAT-24e4	0,67
		TUD_MAT-23f4	1,12	TUD_MAT-24f4	0,59
Average	**0,38**		**1,18**		**0,64**
Standard deviation	**0,10**		**0,28**		**0,11**
Coefficient of variation	**0,26**		**0,24**		**0,17**
		f_{x2} / f_{x1}	**3,10**	f_{x3} / f_{x1}	**1,68**