



TEST REPORT

TEST FOR THE DETERMINATION OF THE DYNAMIC MODULUS OF ELASTICITY BASED ON ULTRASONIC PULSE VELOCITY

1 | Identification

Name	LNEC/DE/NESDE
Address	Av. do Brasil, 101 1700-166 LISBON
Customer/applicant's order reference	DED/NCTC'S CONTRIBUTION TO THE "COLLECTION AND CONDUCT OF MECHANICAL CHARACTERISATION TESTS ON BEDDING MORTARS"

2 | Samples and sampling procedure

The sample of masonry mortar was taken on site by a technician from LNEC's Wall Coverings Unit (URPa) on 10 November 2025 at 09:30. The consistency of the sample was determined according to the standard EN 1015-3:1999 – Methods of test for mortar for masonry - Part 3: Determination of consistency of fresh mortar (by flow table) and the bulk density was assessed in accordance with standard EN 1015-6:1998 – Methods of test for mortar for masonry - Part 6: Determination of bulk density of fresh mortar. The sample was then cast into three metal moulds, each with three cavities measuring 160 mm × 40 mm × 40 mm, resulting in a total of nine test specimens. The average dimensions of the test specimens were 160.48 mm × 40.01 mm × 40.88 mm, intended for the test to determine the dynamic modulus of elasticity tests based on ultrasonic pulse velocity. The sample and specimens' identification is presented in Table 2.1.

Table 2.1 – Identification of the sample and test specimens

Sample description	Quantity	Test specimens
R1-M15	6 kg	R1-M15_1 to 9

3 | Tests carried out/Test conditions

3.1 Test Method

The dynamic modulus of elasticity determination test based on ultrasonic pulse velocity was carried out at 7, 28 and 60 days of curing time at the Wall Coverings Unit (URPa) of LNEC, in accordance with the specifications of the standard EN 12504-4:2021 – Testing concrete in structures - Part 4: Determination of ultrasonic pulse velocity. Before testing, the specimens were placed at a temperature of 20 °C (+3 / -2 °C) and a relative humidity of 95 ± 5% for 48 hours. They were then demoulded and kept in the same conditions for an additional period of five days.



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After this period, the specimens were placed at a temperature of 20 °C (+3 / -2 °C) and a relative humidity of $65 \pm 5\%$. They were then subjected to dynamic modulus of elasticity tests at the specified curing times.

For the determination of the dynamic modulus of elasticity based on ultrasonic pulse velocity, a STEINKAMP BP-7 ultrasonic equipment was utilized.

4 | Results

Table 4.1 shows the dynamic modulus of elasticity values determined based on ultrasonic pulse velocity, obtained at the curing times of 7, 28 and 60 days.

**Table 4.1 – Values obtained for the dynamic modulus of elasticity
based on ultrasonic pulse velocity**

Curing time	Specimens	Bulk Density (kg/m ³)	US Velocity (m/s)	Dynamic Modulus of Elasticity (GPa)
7 days	R1-M15_1	1840	2.683	11.9
	R1-M15_2	1846	2.543	10.7
	R1-M15_3	1821	2.629	11.3
	Average	1836	2.618	11.3
	Standard deviation	± 13	± 0.071	± 0.6
28 days	R1-M15_4	1713	1.972	-
	R1-M15_5	1706	2.965	13.5
	R1-M15_6	1725	2.838	12.5
	Average	1714	2.592	13.0
	Standard deviation	± 10	± 0.540	± 0.7
60 days	R1-M15_7	1694	1.627	4.0
	R1-M15_8	1703	1.407	3.0
	R1-M15_9	1710	1.349	2.8
	Average	1702	1.461	3.3
	Standard deviation	± 8	± 0.147	± 0.7

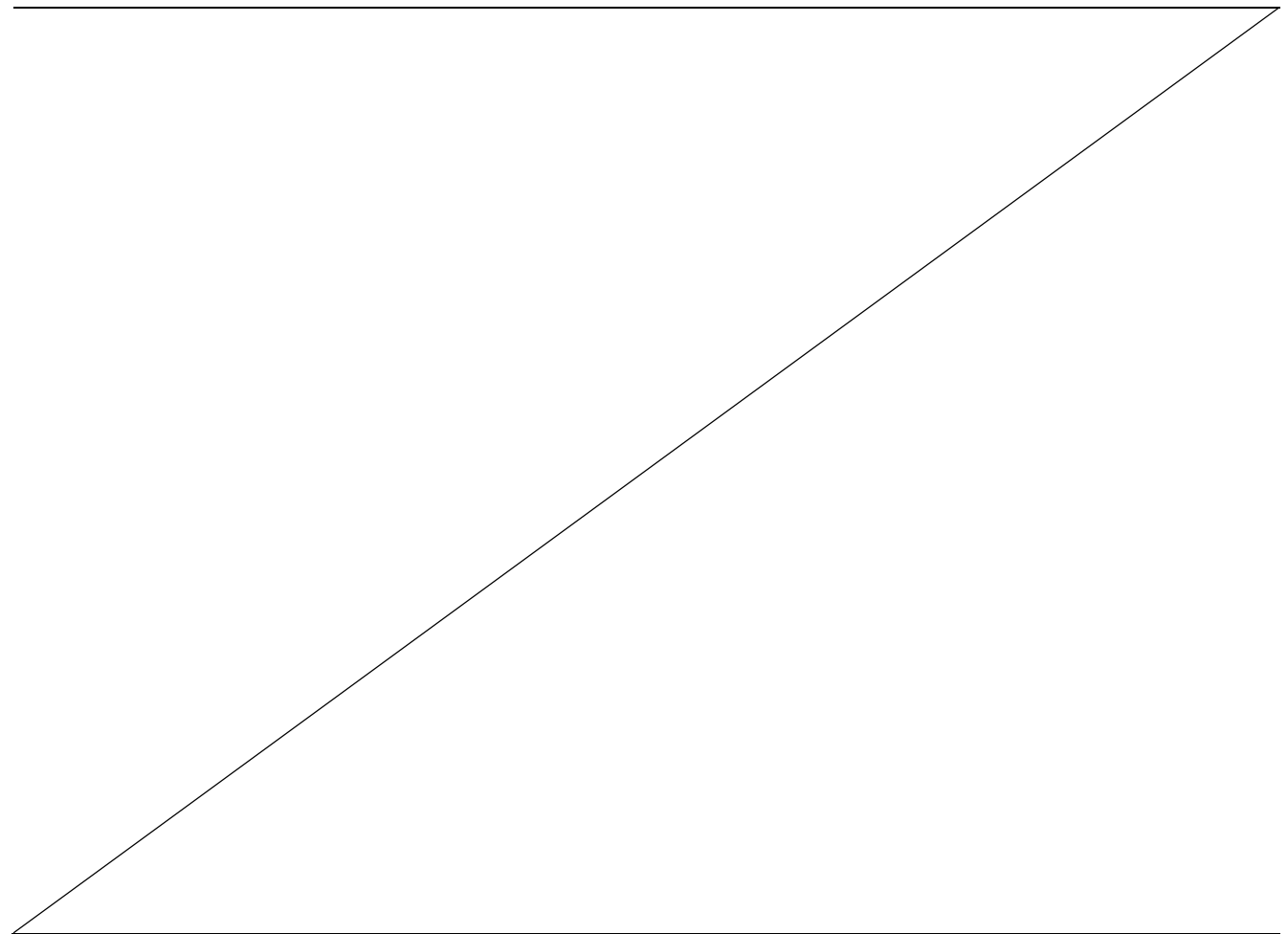


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5 | Comments

The results obtained in this test are part of the study on the mechanical characterisation of mortars conducted for LNEC/DE/NESDE.



Lisbon, LNEC, 27 March 2026

TESTED BY

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