



# 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 masonry mortars' mixing was carried out by the client under the supervision of a technician from LNEC's Wall Coverings Unit (URPa) on 10 November 2025 at 2:00 pm. For this mixing following the provisions of Standard EN 1015-2: 1998 – Methods of test for mortar for masonry - Part 2: Bulk sampling of mortars and preparation of test mortars, a pre-measured mortar mix with 15% added sand was placed in the laboratory mixer's container. The mixer was then started in automatic mode at a relatively low speed. During the first 30 seconds, whilst the mixer was running, water was poured into the container. After two and a half minutes, the mixer was stopped and the material was mixed manually with a trowel, scraping the sides of the container to ensure a homogeneous mixture. The mixer was then switched on again at the same speed for an additional 30 seconds. The mortars' consistency 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 159.96 mm × 40.13 mm × 40.41 mm, intended for the tests 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
RE-M5-15%	6 kg	RE-M5-15%_1 to 6



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## 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 and 28 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.

After this period, the specimens were placed at a temperature of 20 °C (+3 / -2 °C) and a relative humidity of 65 ± 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 and 28 days.

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

Curing time	Specimens	Bulk Density (kg/m <sup>3</sup> )	US Velocity (m/s)	Dynamic Modulus of Elasticity (GPa)
7 days	RE-M5-15%_1	1851	1.416	3.3
	RE-M5-15%_2	1828	1.239	-
	RE-M5-15%_3	1849	1.667	4.6
	<b>Average</b>	<b>1843</b>	<b>1.441</b>	<b>4.0</b>
	<b>Standard deviation</b>	<b>± 13</b>	<b>± 0.215</b>	<b>± 0.9</b>
28 days	RE-M5-15%_4	1668	1.380	2.9
	RE-M5-15%_5	1669	1.178	2.1
	RE-M5-15%_6	1671	1.646	-
	<b>Average</b>	<b>1669</b>	<b>1.401</b>	<b>2.5</b>
	<b>Standard deviation</b>	<b>± 1</b>	<b>± 0.234</b>	<b>± 0.5</b>

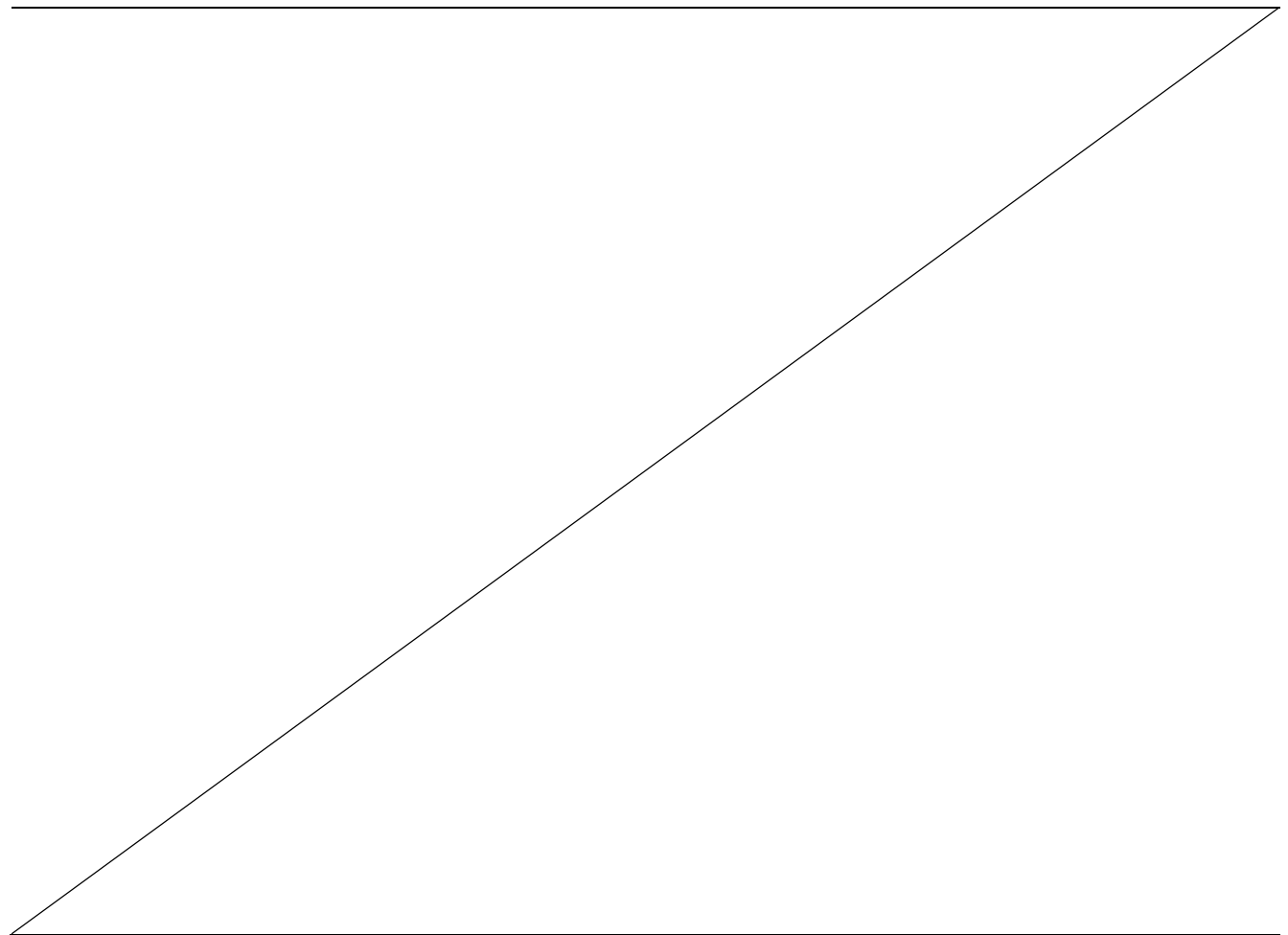


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## 5 | Comments

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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