Data Article

Data collected from the experimental validation for the application of flat jack tests in cob walls

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**Abstract**

This paper accompanies the paper titled “Experimental validation for the application of the flat jack test in cob walls” presented by the same authors to the Construction and Building Materials Journal [1]. It contains data collected during the consolidation process of six cob wallets and data collected after single and double flat jack test were applied for the first time to a set of cob wallets at the laboratory facilities of the Department of Civil, Structural and Environmental Engineering at Trinity College Dublin. The data served to estimate the value of the dimensionless geometrical efficiency constant, $K_e$, and cob’s mechanical properties, namely, Young’s modulus, Poisson’s ratio and compressive strength. The detailed information presented here may be of interest for verification and replicability purposes.

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### Specifications Table

| Subject                        | Civil and Structural Engineering |
|-------------------------------|----------------------------------|
| Specific subject area         | Minor Destructive Tests (MDT)   |
| Type of data                  | Tables                           |
|                               | Figures                          |
|                               | Equations                        |
| **How data were acquired**    | Consolidation data was acquired from six cob wallottes in accordance with BS EN 1052 Part 1 [2]. Four Linear Variable Differential Transformers (LVDTs) RDP Electronics model ACT3000 with an accuracy of 0.01 mm +/- 0.5 % where attached to the front and rear faces' middle third of the wallottes to measure the deformation caused by the load transfer to it by the tensioning of four steel threaded bars. The load applied to the wallottes was measured with two load cells Tokyo Measuring Instruments Lab model KCM-300KNA, 300 kN capacity, 0.1 kN precision and two load cells Honeywell/Sensotec model TH, 890 kN capacity and 0.1 kN precision installed under every tensioning bar. Flat jack data was acquired from the application of single flat jack and double flat jack tests in the six cob wallottes. The slot cutting equipment used was a ring saw model Husqvarna K3600 with a blade diameter of 370 mm and a 6 mm thickness which allows for a maximum cut depth of 270 mm. The flat jacks used were eccentric flat jacks model SISGEO 0L103352600. Pressure increments were measured with a pressure transducer Wykeham Farrance model 28-WF6301 with a range capacity of 0-2000 kPa. Control points' displacements were manually measured with “Vernier” callipers equipped with a digital display. |
| **Data format**               | Raw                              |
|                               | Analysed                         |
| **Parameters for data collection** | The cob wallottes dried under natural conditions protected from rain and wind. They were subjected to a consolidation load of 84 kN +/- 1.0 kN. During the flat jack tests, the wallottes were subjected to a load of approximately 50 kN. |
| **Description of data collection** | Cob wallottes were initially loaded in increments of roughly 8 kN until a total load of approximately 84 kN was achieved. The load was kept quasi-constant for a period of five days and monitored. Deformation was measured by four LVDTs installed at the middle third of the wallotte (two in each of its faces). The procedures described in [3–8], were adopted and adapted to perform the flat jack test. |
| **Data source location**      | Institution: Trinity College Dublin |
|                               | City: Dublin                     |
|                               | Country: Ireland                 |
| **Data accessibility**        | With the article and in the following repository [9]: Repository name: Mendeley Data Data identification number: 10.17632/twbf86wxtx1 Direct URL to data: https://data.mendeley.com/datasets/twbf86wxtx/1 |
| **Related research article**  | Alejandro Jiménez Rios and Dermot O’Dwyer Experimental validation for the application of the flat jack test in cob walls Construction and Building Materials DOI: 10.1016/J.CONBUILDMAT.2020.119148 |

### Value of the Data

- This paper presents the first data ever published from the application of the flat jack test in cob walls.
- Conservation engineers working on the investigation of cob structures with the use of quantitative approaches can use this data as reference.
- The data was used to determine the values of the mechanical properties of the material, namely, Young’s modulus, Poisson’s ratio and compressive strength, and the dimensionless geometrical efficiency constant, $K_e$. Additionally, the data here presented contributes to the enrichment of the scarce information available in the literature concerned with the mechanical properties and the structural behaviour of cob.
1. Data

All raw data points collected during the wallettes consolidation can be freely accessed from the Mendeley repository [10]. The raw data is divided in three files. The first one contains all the data points collected during the first cycle loading for load (kN), and displacement (mm) for each wallette. The second file contains the same data collected during a second loading cycle (except for wallette W1). Finally, the third one contains data points collected during the consolidation period of five days for load (kN), displacement (mm) and time (min).

The analysed data obtained from the first and second load cycles applied to each one of the cob wallettes is presented from Tables 1–6 (wallette W1 was not reloaded). Total loads were obtained by adding the forces in each one of the four steel threaded bars whereas that average displacements were computed taking into account the displacements measured by the four LVDTs attached to the wallettes’ faces unless specified otherwise (the uneven surface of the wallettes hindered the proper installation of the LVDTs and some of them did not provided faithful measurements therefore were neglected to compute the average displacement value reported in these tables).

The analysed data points obtained during the consolidation period of five days are presented in Table 7 and Table 8 for wallettes W1, W2, W3 and W4, W5, W6 respectively. The average displacement–time curves plotted for each one of the wallettes are shown in Figure 1.

To transform loads and displacements into stresses and strains the wallettes dimensions and the LVDTs lengths were measured. Those dimensions were obtained with a metallic measuring tape with an accuracy of 5.0 mm and are reported in Table 9 and Table 10 respectively. The sketch in Figure 2 shows the location were every wallette’s dimension was taken.

Finally, the values reported in Table 11 represent the estimation of cob’s Young’s modulus based on the slope of linear regression lines fitted into the consolidation stress–strain curves. As wallette W1 was not subjected to a second load cycle no Young’s modulus values is reported for it. The mean value obtained (from wallettes, W2-W6) was 143.3 MPa with a SD of 32.6 MPa and a COV of 22.77 %.

The data collected from the measurements of the cuts in wallettes W1, W2 and W3 and the correspondent cut shapes are presented in Table 12 and Figure 3 respectively. Cuts’ measure-
### Table 1
First and second load cycle’s force-displacement and stress-strain data points for W1.

| 1st load cycle | Reloading |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total load (kN) | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) | Total load (kN) | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) |
| 0              | 0.00      | 0.00 | 0.0000 | -         | -                     | - | -   |
| 3.89           | 0.01      | 0.01 | 0.0001 | -         | -                     | - | -   |
| 8.24           | 0.03      | 0.02 | 0.0002 | -         | -                     | - | -   |
| 12.96          | 0.06      | 0.03 | 0.0005 | -         | -                     | - | -   |
| 20.49          | 0.10      | 0.05 | 0.0008 | -         | -                     | - | -   |
| 28.25          | 0.15      | 0.07 | 0.0011 | -         | -                     | - | -   |
| 35.8           | 0.22      | 0.09 | 0.0016 | -         | -                     | - | -   |
| 44.36          | 0.32      | 0.11 | 0.0024 | -         | -                     | - | -   |
| 51.97          | 0.43      | 0.13 | 0.0032 | -         | -                     | - | -   |
| 60.53          | 0.64      | 0.15 | 0.0048 | -         | -                     | - | -   |
| 67.85          | 0.87      | 0.17 | 0.0065 | -         | -                     | - | -   |
| 75.12          | 1.15      | 0.19 | 0.0087 | -         | -                     | - | -   |
| 84.76          | 1.67      | 0.21 | 0.0127 | -         | -                     | - | -   |

* LVDT 4 values discarded.
Table 2
First and second load cycle's force-displacement and stress-strain data points for W2.

| 1st load cycle | Average displacement (mm)* | Stress (MPa) | Average strain (mm/mm)* | Reloading | Total load (kN) | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) |
|----------------|---------------------------|--------------|-------------------------|-----------|----------------|--------------------------|--------------|---------------------|
| 0.00           | 0.00                      | 0.00         | 0.0000                  | 0.00      | 0.00          | 0.00                     | 0.00         | 0.0000              |
| 4.76           | 0.00                      | 0.01         | 0.0000                  | 8.48      | 0.00          | 0.00                     | 0.03         | 0.0001              |
| 12.79          | 0.03                      | 0.03         | 0.0001                  | 16.83     | 0.09          | 0.00                     | 0.04         | 0.0003              |
| 20.57          | 0.08                      | 0.05         | 0.0003                  | 24.47     | 0.15          | 0.00                     | 0.06         | 0.0005              |
| 28.27          | 0.16                      | 0.07         | 0.0005                  | 32.92     | 0.24          | 0.00                     | 0.08         | 0.0008              |
| 36.07          | 0.30                      | 0.09         | 0.0010                  | 40.77     | 0.29          | 0.00                     | 0.10         | 0.0010              |
| 44.05          | 0.49                      | 0.11         | 0.0016                  | 48.44     | 0.35          | 0.00                     | 0.12         | 0.0012              |
| 52.02          | 0.75                      | 0.12         | 0.0025                  | 57.25     | 0.44          | 0.00                     | 0.14         | 0.0015              |
| 59.56          | 1.08                      | 0.14         | 0.0036                  | 64.32     | 0.49          | 0.00                     | 0.15         | 0.0017              |
| 67.53          | 1.42                      | 0.16         | 0.0048                  | 72.11     | 0.55          | 0.00                     | 0.17         | 0.0018              |
| 75.71          | 1.99                      | 0.18         | 0.0067                  | 84.56     | 0.64          | 0.00                     | 0.20         | 0.0022              |
| 83.91          | 2.53                      | 0.20         | 0.0085                  | 90.56     | 0.68          | 0.00                     | 0.22         | 0.0025              |

* LVDT 2 values discarded.
Table 3
First and second load cycle's force-displacement and stress-strain data points for W3.

| 1st load cycle | Reloading | Total load (kN) | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) | Total load (kN) | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) |
|----------------|-----------|-----------------|---------------------------|--------------|------------------------|----------------|---------------------------|--------------|------------------------|
| 0.00           |           | 0.00            | 0.00                      | 0.00         | 0.0000                 | 0.00           | 0.00                      | 0.00         | 0.0000                 |
| 9.08           |           | 0.01            | 0.02                      | 0.04         | 0.0000                 | 8.13           | 0.02                      | 0.02         | 0.0001                 |
| 16.12          |           | 0.05            | 0.06                      | 0.06         | 0.0004                 | 16.60          | 0.02                      | 0.04         | 0.0001                 |
| 24.65          |           | 0.10            | 0.08                      | 0.08         | 0.0005                 | 24.95          | 0.11                      | 0.06         | 0.0004                 |
| 32.59          |           | 0.16            | 0.10                      | 0.10         | 0.0010                 | 32.69          | 0.14                      | 0.08         | 0.0005                 |
| 41.58          |           | 0.28            | 0.14                      | 0.14         | 0.0011                 | 40.50          | 0.18                      | 0.10         | 0.0006                 |
| 56.90          |           | 0.34            | 0.14                      | 0.14         | 0.0015                 | 48.40          | 0.23                      | 0.12         | 0.0008                 |
| 56.07          |           | 0.46            | 0.14                      | 0.14         | 0.0015                 | 57.14          | 0.29                      | 0.14         | 0.0010                 |
| 64.27          |           | 0.64            | 0.16                      | 0.16         | 0.0021                 | 64.29          | 0.31                      | 0.16         | 0.0011                 |
| 72.18          |           | 0.86            | 0.17                      | 0.17         | 0.0029                 | 72.22          | 0.35                      | 0.17         | 0.0012                 |
| 79.57          |           | 1.11            | 0.19                      | 0.19         | 0.0037                 | 80.13          | 0.37                      | 0.19         | 0.0013                 |
| 84.86          |           | 1.39            | 0.21                      | 0.21         | 0.0047                 | 84.14          | 0.43                      | 0.20         | 0.0014                 |
|                |           |                 |                           |              |                        | 0.13           | -0.02                     | 0.00         | -0.0001                |

* LVDT 2, 3 and 4 values discarded.
Table 4
First and second load cycle's force-displacement and stress-strain data points for W4.

| 1st load cycle | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) | Reloading | Average displacement (mm) | Stress (MPa) | Average strain (mm/mm) |
|----------------|---------------------------|--------------|------------------------|-----------|---------------------------|--------------|------------------------|
| Total load (kN) |                           |              |                        | Total load (kN) |                           |              |                        |
| 0.00           | 0.00                      | 0.00         | 0.0000                 | 0.00       | 0.00                      | 0.00         | 0.0000                 |
| 4.46           | 0.00                      | 0.01         | 0.0000                 | 4.43       | 0.01                      | 0.01         | 0.0000                 |
| 12.33          | 0.02                      | 0.03         | 0.0001                 | 12.40      | 0.22                      | 0.03         | 0.0008                 |
| 20.75          | 0.05                      | 0.05         | 0.0002                 | 20.77      | 0.06                      | 0.05         | 0.0002                 |
| 28.10          | 0.09                      | 0.07         | 0.0003                 | 28.30      | 0.10                      | 0.07         | 0.0004                 |
| 36.41          | 0.17                      | 0.09         | 0.0006                 | 36.71      | 0.13                      | 0.09         | 0.0005                 |
| 44.01          | 0.27                      | 0.11         | 0.0009                 | 44.24      | 0.17                      | 0.11         | 0.0006                 |
| 52.12          | 0.43                      | 0.13         | 0.0015                 | 52.18      | 0.20                      | 0.13         | 0.0007                 |
| 60.57          | 0.63                      | 0.15         | 0.0022                 | 60.01      | 0.23                      | 0.15         | 0.0008                 |
| 67.88          | 0.87                      | 0.17         | 0.0030                 | 68.15      | 0.28                      | 0.17         | 0.0010                 |
| 75.93          | 1.19                      | 0.19         | 0.0041                 | 76.34      | 0.32                      | 0.19         | 0.0011                 |
| 83.77          | 1.53                      | 0.21         | 0.0053                 | 84.52      | 0.40                      | 0.21         | 0.0014                 |

* LVDT 1 values discarded.
Table 5
First and second load cycle's force-displacement and stress-strain data points for W5.

| 1st load cycle | Reloading |
|----------------|-----------|
|                | Total load (kN) | Average displacement (mm)\(\ast\) | Stress (MPa) | Average strain (mm/mm)\(\ast\) | Total load (kN) | Average displacement (mm)\(\ast\) | Stress (MPa) | Average strain (mm/mm)\(\ast\) |
| 0.00           | 0.00       | 0.00       | 0.0000         | 0.00       | 0.00       | 0.0000         | 0.00       | 0.0000         |
| 4.45           | 0.00       | 0.01       | 0.0000         | 4.38       | -0.01      | 0.01           | 0.03       | 0.0000         |
| 12.43          | 0.01       | 0.03       | 0.0001         | 12.35      | 0.01       | 0.03           | 0.03       | 0.0000         |
| 21.31          | 0.02       | 0.05       | 0.0001         | 20.50      | 0.03       | 0.05           | 0.05       | 0.0001         |
| 28.54          | 0.05       | 0.07       | 0.0002         | 28.42      | 0.07       | 0.07           | 0.07       | 0.0002         |
| 36.65          | 0.12       | 0.09       | 0.0004         | 36.34      | 0.11       | 0.09           | 0.09       | 0.0004         |
| 44.22          | 0.19       | 0.11       | 0.0007         | 44.68      | 0.14       | 0.11           | 0.11       | 0.0005         |
| 52.27          | 0.31       | 0.13       | 0.0011         | 52.48      | 0.18       | 0.13           | 0.13       | 0.0006         |
| 60.28          | 0.43       | 0.15       | 0.0015         | 60.31      | 0.21       | 0.15           | 0.15       | 0.0007         |
| 68.16          | 0.60       | 0.17       | 0.0021         | 68.40      | 0.25       | 0.17           | 0.17       | 0.0009         |
| 76.00          | 0.81       | 0.19       | 0.0028         | 76.79      | 0.28       | 0.19           | 0.19       | 0.0010         |
| 84.13          | 1.01       | 0.21       | 0.0035         | 84.32      | 0.32       | 0.21           | 0.21       | 0.0011         |

\(\ast\) LVDT 4 values discarded.
Table 6
First and second load cycle's force-displacement and stress-strain data points for W6.

| 1st load cycle | Reloading |  |  |
|----------------|------------|----------------|----------------|
| Total load (kN) | Average displacement (mm)* | Stress (MPa) | Average strain (mm/mm)* |
| 0.00 | 0.00 | 0.00 | 0.00 |
| 5.05 | 0.01 | 0.01 | 0.000 |
| 12.82 | 0.02 | 0.03 | 0.0001 |
| 20.70 | 0.05 | 0.05 | 0.0002 |
| 28.96 | 0.09 | 0.07 | 0.0003 |
| 36.50 | 0.14 | 0.09 | 0.0005 |
| 44.03 | 0.21 | 0.11 | 0.0007 |
| 52.32 | 0.32 | 0.13 | 0.0011 |
| 59.41 | 0.44 | 0.15 | 0.0015 |
| 68.01 | 0.60 | 0.17 | 0.0020 |
| 75.36 | 0.77 | 0.19 | 0.0026 |
| 84.27 | 1.07 | 0.21 | 0.0036 |
| 0.00 | 0.00 | 0.00 | 0.00 |
| 4.71 | 0.00 | 0.00 | 0.00 |
| 12.67 | 0.01 | 0.01 | 0.03 |
| 20.99 | 0.05 | 0.05 | 0.05 |
| 28.87 | 0.09 | 0.07 | 0.0003 |
| 36.43 | 0.13 | 0.09 | 0.0005 |
| 44.67 | 0.17 | 0.11 | 0.0006 |
| 52.71 | 0.21 | 0.13 | 0.0007 |
| 60.79 | 0.25 | 0.15 | 0.0008 |
| 69.05 | 0.29 | 0.17 | 0.0010 |
| 76.70 | 0.32 | 0.19 | 0.0011 |
| 84.05 | 0.36 | 0.21 | 0.0012 |
| -0.90 | 0.00 | 0.00 | 0.00 |

* LVDT 1 values discarded.
** LVDT 1 and 3 values discarded.
| W1 | Average displacement (mm) | Time (min) | W2 | Average displacement (mm) | Time (min) | W3 | Average displacement (mm) | Time (min) |
|----|--------------------------|------------|----|--------------------------|------------|----|--------------------------|------------|
| 1.67 | 0 | 2.53 | 0 | 1.39 | 0 |
| 1.84 | 8 | 2.71 | 3 | 1.51 | 6 |
| 1.92 | 13 | 2.98 | 7 | 1.62 | 12 |
| 2.08 | 29 | 3.12 | 15 | 1.71 | 20 |
| 2.16 | 38 | 3.28 | 23 | 1.76 | 25 |
| 2.23 | 50 | 3.40 | 31 | 1.85 | 38 |
| 2.27 | 56 | 3.51 | 41 | 1.91 | 52 |
| 2.35 | 82 | 3.68 | 70 | 2.01 | 70 |
| 2.38 | 90 | 3.81 | 100 | 2.11 | 105 |
| 2.46 | 125 | 3.95 | 132 | 2.16 | 135 |
| 2.51 | 151 | 4.05 | 160 | 2.33 | 230 |
| 2.55 | 184 | 4.18 | 226 | 2.45 | 303 |
| 2.59 | 213 | 4.28 | 287 | 2.68 | 1245 |
| 2.63 | 244 | 4.36 | 340 | 2.75 | 1372 |
| 2.66 | 274 | 4.66 | 1315 | 2.82 | 1483 |
| 2.69 | 303 | 4.77 | 1422 | 2.89 | 1610 |
| 2.71 | 335 | 4.87 | 1563 | 2.95 | 1720 |
| 3.01 | 1297 | 4.94 | 1660 | 3.07 | 2695 |
| 3.06 | 1417 | 5.00 | 1780 | 3.12 | 2805 |
| 3.11 | 1532 | 5.20 | 2745 | 3.19 | 2955 |
| 3.16 | 1650 | 5.28 | 2885 | 3.22 | 3050 |
| 3.20 | 1770 | 5.33 | 3004 | 3.24 | 3180 |
| 3.38 | 2727 | 5.38 | 3124 | 3.35 | 4125 |
| 3.44 | 2850 | 5.43 | 3256 | 3.37 | 4245 |
| 3.47 | 2970 | 5.55 | 4185 | 3.40 | 4365 |
| 3.52 | 3095 | 5.60 | 4306 | 3.41 | 4485 |
| 3.55 | 3210 | 5.65 | 4428 | 3.46 | 4603 |
| 3.66 | 4170 | 5.69 | 4544 | 3.52 | 5565 |
| 3.70 | 4292 | 5.77 | 4640 | 3.55 | 5685 |
| 3.72 | 4410 | 5.85 | 5630 | 3.56 | 5807 |
| 3.75 | 4529 | 5.89 | 5744 | 3.59 | 5930 |
| 3.77 | 4650 | 5.93 | 5878 | 3.60 | 6050 |
| 3.85 | 5637 | 5.96 | 5980 | 3.67 | 7075 |
| 3.89 | 5752 | 6.02 | 6220 | 3.75 | 7075 |
| 3.90 | 5871 | 6.08 | 7060 | 3.80 | 7075 |

* LVDT 4 values discarded. **LVDT 2 values discarded.
Table 8
Consolidation time-displacement data for W4, W5 and W6.

| W4 Average displacement (mm) | Time (min) | W5 *Average displacement (mm) | Time (min) | W6 **Average displacement (mm) | Time (min) |
|------------------------------|------------|--------------------------------|------------|--------------------------------|------------|
| 1.53                         | 0          | 1.01                           | 0          | 1.07                           | 0          |
| 1.69                         | 5          | 1.12                           | 5          | 1.24                           | 5          |
| 1.80                         | 15         | 1.20                           | 11         | 1.35                           | 15         |
| 1.90                         | 25         | 1.26                           | 17         | 1.44                           | 35         |
| 1.96                         | 35         | 1.32                           | 28         | 1.55                           | 72         |
| 2.13                         | 51         | 1.38                           | 43         | 1.62                           | 102        |
| 2.22                         | 92         | 1.43                           | 56         | 1.69                           | 132        |
| 2.36                         | 130        | 1.50                           | 88         | 1.78                           | 180        |
| 2.43                         | 180        | 1.57                           | 120        | 1.86                           | 275        |
| 2.50                         | 225        | 1.65                           | 182        | 1.94                           | 335        |
| 2.57                         | 295        | 1.72                           | 240        | 2.14                           | 1475       |
| 2.71                         | 370        | 1.77                           | 300        | 2.21                           | 1605       |
| 2.93                         | 1330       | 1.82                           | 356        | 2.28                           | 1740       |
| 3.01                         | 1445       | 1.99                           | 1320       | 2.33                           | 1860       |
| 3.04                         | 1520       | 2.06                           | 1458       | 2.36                           | 1980       |
| 3.12                         | 1685       | 2.10                           | 1550       | 2.47                           | 2790       |
| 3.18                         | 1794       | 2.15                           | 1685       | 2.51                           | 2915       |
| 3.43                         | 2810       | 2.21                           | 1820       | 2.55                           | 3035       |
| 3.47                         | 2942       | 2.35                           | 2880       | 2.57                           | 3155       |
| 3.51                         | 3060       | 2.40                           | 3000       | 2.60                           | 3275       |
| 3.53                         | 3185       | 2.44                           | 3120       | 2.69                           | 4230       |
| 3.57                         | 3305       | 2.48                           | 3254       | 2.72                           | 4350       |
| 3.67                         | 4195       | 2.51                           | 3360       | 2.76                           | 4477       |
| 3.69                         | 4315       | 2.60                           | 4200       | 2.79                           | 4590       |
| 3.73                         | 4440       | 2.63                           | 4320       | 2.81                           | 4710       |
| 3.77                         | 4795       | 2.66                           | 4450       | 2.87                           | 5735       |
| 3.86                         | 5700       | 2.69                           | 4556       | 2.90                           | 5850       |
| 3.88                         | 5820       | 2.72                           | 4680       | 2.92                           | 5975       |
| 3.91                         | 5940       | 2.78                           | 5640       | 2.94                           | 6095       |
| 3.92                         | 6055       | 2.81                           | 5760       | 2.95                           | 6230       |
| 3.94                         | 6180       | 2.83                           | 5900       | 3.01                           | 7105       |
| 4.17                         | 7085       | 2.85                           | 6000       | 2.92                           | 7090       |

* LVDT 4 values discarded. **LVDT 1 values discarded.
Table 9
Cob wallettes' measured dimensions (mm).

| Location | W1 | W2 | W3 | W4 | W5 | W6 |
|----------|----|----|----|----|----|----|
| H1       | 1010 | 980 | 1020 | 1035 | 1020 | 990 |
| H2       | 1010 | 990 | 1020 | 1010 | 1010 | 990 |
| H3       | 410  | 425 | 420  | 400  | 405  | 410 |
| H4       | 405  | 430 | 400  | 395  | 395  | 405 |
| H5       | 985  | 980 | 1000 | 1020 | 1020 | 1010 |
| H6       | 1000 | 1005| 1010 | 1020 | 1015 | 1000 |
| H7       | 400  | 410 | 405  | 405  | 410  | 410 |
| H8       | 400  | 425 | 410  | 400  | 405  | 390 |
| V1       | 950  | 955 | 970  | 950  | 950  | 950 |
| V2       | 960  | 950 | 970  | 960  | 945  | 955 |
| V3       | 955  | 950 | 965  | 960  | 950  | 950 |
| V4       | 955  | 950 | 985  | 950  | 950  | 950 |

Table 10
LVDT’s distances between points of attachment to the wallettes’ faces.

| W1 LVDT Length (mm) | W2 LVDT Length (mm) | W3 LVDT Length (mm) | W4 LVDT Length (mm) | W5 LVDT Length (mm) | W6 LVDT Length (mm) |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 1 110               | 1 287               | 1 295               | 1 290               | 1 300               | 1 300               |
| 2 170               | 2 286               | 2 300               | 2 287               | 2 285               | 2 290               |
| 3 135               | 3 300               | 3 295               | 3 289               | 3 290               | 3 290               |
| 4 129               | 4 309               | 4 300               | 4 287               | 4 295               | 4 300               |

Figure 2. Sketch showing the locations were the wallettes measurements were taken.

ments and the correspondent cut shapes of wallettes W4, W5 and W6 are presented in Table 13 and Figure 4 respectively. As the depth of the cuts was measured using a template fabricated with a piece of timber with a thickness of 1.23 cm, the measured depth was corrected by subtracting this value and is presented as the Corrected depth in Table 12 and Table 13.

The data collected at every pressure increment for the distances between control points is presented from Tables 14–19 for each one of the wallettes. Furthermore, Figure 5 shows the distances between control points for every pressure increment, Figure 6 illustrates the correspondent deformations and, finally, Figure 7 displays the deformation recovery plots for every wallette.

The over imposed load was monitored at different stages of the single flat jack test. The data collected is presented in Table 20. Finally, data concerned with the wallettes’ geometry and other loads acting in the wallettes during the test is presented in Table 21.
Figure 3. Slot cut shape of wallets (a) W1 (ASLOT=79921.50 mm²), (b) W2 (ASLOT=85277.75 mm²) and (c) W3 (ASLOT=84428.60 mm²).
Figure 4. Slot cut shape of wallets (a) W4 (ASLOT=79921.50 mm²), (b) W5 (ASLOT=83249.75 mm²) and (c) W6 (ASLOT=82627.75 mm²).
Figure 5. Control points’ distances for (a) W1, (b) W2, (c) W3, (d) W4, (e) W5 and (f) W6.
Figure 6. Control points’ deformations for (a) W1, (b) W2, (c) W3, (d) W4, (e) W5 and (f) W6.
Figure 7. Deformation recovery plots for (a) W1, (b) W2, (c) W3, (d) W4, (e) W5 and (f) W6.
Table 11
Estimated values of cob’s Young’s modulus.

| Wallette | Young’s modulus (MPa) |
|----------|-----------------------|
| W1       | -                     |
| W2       | 92.05                 |
| W3       | 135.89                |
| W4       | 148.45                |
| W5       | 162.41                |
| W6       | 177.70                |

The data collected from the measurements of the upper cuts in wallets W1, W2 and W3 and the corresponding cut shapes are presented in Table 22 and Figure 8 respectively. Cuts’ measurements and the corresponding cut shapes of wallets W4, W5 and W6 are presented in Table 23 and Figure 9 respectively. As the depth of the cuts was measured using a template fabricated with a piece of timber 1.23 cm thick, the measured depth was corrected by subtracting this value and is presented as the Corrected depth in Table 22 and Table 23.

Table 24 presents important data used to perform intermediate calculations before estimating the material’s mechanical properties. \( A_{ij} \) represents the area of the eccentric flat jack used, \( A_{EJSLAT} \) and \( K_{adj} \) represent respectively the measured area of the lower cut and the corresponding value for the dimensionless geometrical coefficient. \( A_{EJSLAT} \) and \( K_{adj} \) represent the values of the upper cut and the corresponding value for the dimensionless geometrical coefficient respectively. \( K_{ave} \) is the average of both geometrical dimensionless coefficients, \( K_{adj} \) and \( K_{adj} \). Finally, \( K_m \), is the dimensionless coefficient provided by the manufacturer of the flat jacks.

The data collected at every pressure increment for the distances between vertical (VCP) and horizontal (HCP) control points is presented from Tables 25–30 for each one of the wallets.

The stresses in the cob wallets, \( f_m \), caused by the increment of the pressure, \( p \), in the flat jacks were computed using Eq. 1 whereas that strain values were computed by dividing the changes of the distances between control points by the initial distance recorded. Stress-strain values computed from all cob wallets are presented from Tables 31–36. Furthermore, Figure 10 shows the stress-strain curves obtained for each one of the control points and Figure 11 displays the average stress-strain curves for every cob wallette.

\[
f_m = K_m K_0 p
\]

Both ASTM C 1197 and RILEM LUM D3 advise to compute the Secant Young’s modulus of the material, \( E_{si} \), using Eq. 2. On the other hand, RILEM MDT. D5 advises that the values estimated for the Secant Young’s modulus of the material should be corrected by implementing the dimensionless geometrical efficiency constant, \( K_e \), thus obtaining a corrected Secant Young’s modulus \( E_{si corrected} \) (see Eq. 3). A value for \( K_e = 0.51 \) is advised to be used when the flat jack test is applied in cob walls. Moreover, values for the Young’s modulus of the material were as well estimated by taking into account the slope of a linear regression curve fitted to the points of the linear region of the average stress-strain curves presented in Figure 11. The selected stress-strain points and the correspondent linear regression curves fitted are shown in Figure 12. The estimated values using Eq. 2 for the Secant Young’s modulus of wallets W1, W2 and W3 are presented in Table 37 whereas those for wallets W4, W5 and W6 are presented in Table 38.

\[
E_{si} = \frac{f_{mi}}{\varepsilon_{mi}}
\]

\[
E_{si corrected} = K_e \frac{f_{mi}}{\varepsilon_{mi}}
\]

The material Poisson’s ratio was estimated as the average value obtained using Eq. 4 for different pressure levels within the elastic range of the stress-strain curves. The estimated values using Eq. 4 for the Poisson’s ratio of wallets W1, W2 and W3 are presented in Table 39.
Table 12
Cut measurements of wallettes W1, W2 and W3.

|   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|
| W1 | Horizontaldistance(cm) | Meas.Depth(cm) | Correcteddepth (cm) | W2 | Horizontaldistance (cm) | Meas.Depth(cm) | Correcteddepth (cm) | W3 | Horizontaldistance (cm) | Meas.Depth(cm) | Correcteddepth (cm) |
|---|------------------------|----------------|---------------------|---|------------------------|----------------|---------------------|---|------------------------|----------------|---------------------|
| 0.0 | 0.0                     | 0.0             | 0.0                 | 0.0 | 0.0                    | 0.0            | 0.0                 | 0.0 | 0.0                    | 0.0            | 0.0                 |
| 2.0 | 17.1                    | 15.9            | 0.0                 | 2.0 | 17.7                    | 16.5            | 2.0                 | 17.1 | 15.9                    | 0.0            | 0.0                 |
| 4.0 | 19.8                    | 18.6            | 4.0                 | 4.0 | 20.4                    | 19.2            | 4.0                 | 19.8 | 18.6                    | 4.0            | 4.0                 |
| 6.0 | 22.1                    | 20.9            | 6.0                 | 6.0 | 23.3                    | 22.1            | 6.0                 | 22.1 | 20.9                    | 6.0            | 6.0                 |
| 8.0 | 23.7                    | 22.5            | 8.0                 | 8.0 | 25.0                    | 23.8            | 8.0                 | 23.7 | 22.5                    | 8.0            | 8.0                 |
| 10.0| 25.4                    | 24.2            | 10.0                | 10.0| 25.8                    | 24.6            | 10.0                | 25.4 | 24.2                    | 10.0           | 10.0                |
| 12.0| 26.0                    | 24.8            | 12.0                | 12.0| 30.4                    | 29.2            | 12.0                | 26.0 | 24.8                    | 12.0           | 12.0                |
| 14.0| 28.2                    | 27.0            | 14.0                | 14.0| 30.4                    | 29.2            | 14.0                | 28.2 | 27.0                    | 14.0           | 14.0                |
| 16.0| 27.5                    | 26.3            | 16.0                | 16.0| 29.3                    | 28.1            | 16.0                | 27.5 | 26.3                    | 16.0           | 16.0                |
| 18.0| 27.5                    | 26.3            | 18.0                | 18.0| 28.6                    | 27.4            | 18.0                | 27.5 | 26.3                    | 18.0           | 18.0                |
| 20.0| 27.6                    | 26.4            | 20.0                | 20.0| 27.7                    | 26.5            | 20.0                | 27.6 | 26.4                    | 20.0           | 20.0                |
| 22.0| 27.4                    | 26.2            | 22.0                | 22.0| 27.3                    | 26.1            | 22.0                | 27.4 | 26.2                    | 22.0           | 22.0                |
| 24.0| 26.8                    | 25.6            | 24.0                | 24.0| 27.5                    | 26.3            | 24.0                | 26.8 | 25.6                    | 24.0           | 24.0                |
| 26.0| 26.3                    | 25.1            | 26.0                | 26.0| 30.4                    | 29.2            | 26.0                | 26.3 | 25.1                    | 26.0           | 26.0                |
| 28.0| 25.1                    | 23.9            | 28.0                | 28.0| 25.6                    | 24.4            | 28.0                | 25.1 | 23.9                    | 28.0           | 28.0                |
| 30.0| 24.2                    | 23.0            | 30.0                | 30.0| 23.5                    | 22.3            | 30.0                | 24.2 | 23.0                    | 30.0           | 30.0                |
| 32.0| 22.0                    | 20.8            | 32.0                | 32.0| 22.8                    | 21.6            | 32.0                | 22.0 | 20.8                    | 32.0           | 32.0                |
| 34.0| 19.3                    | 18.1            | 34.0                | 34.0| 20.6                    | 19.4            | 34.0                | 19.3 | 18.1                    | 34.0           | 34.0                |
| 37.0| 0.0                     | 0.0             | 36.0                | 37.5| 13.8                    | 12.6            | 37.0                | 0.0  | 0.0                     | 37.5           | 0.0                 |
Table 13
Cut measurements of wallettes W4, W5 and W6.

| W4 | W5 | W6 |
|----|----|----|
| Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) | Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) | Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.0 | 21.0 | 19.8 | 2.0 | 17.4 | 16.2 | 3.5 | 16.6 | 15.4 |
| 4.0 | 23.2 | 22.0 | 4.0 | 20.6 | 19.4 | 5.5 | 21.6 | 20.4 |
| 6.0 | 25.2 | 24.0 | 6.0 | 22.8 | 21.6 | 7.5 | 22.4 | 21.2 |
| 8.0 | 26.4 | 25.2 | 8.0 | 24.0 | 22.8 | 9.5 | 24.8 | 23.6 |
| 10.0 | 27.4 | 26.2 | 10.0 | 27.2 | 26.0 | 11.5 | 25.1 | 23.9 |
| 12.0 | 27.7 | 26.5 | 12.0 | 27.5 | 26.3 | 13.5 | 26.0 | 24.8 |
| 14.0 | 28.4 | 27.2 | 14.0 | 28.0 | 26.8 | 15.5 | 27.3 | 26.1 |
| 16.0 | 28.5 | 27.3 | 16.0 | 28.2 | 27.0 | 17.5 | 27.4 | 26.2 |
| 18.0 | 28.4 | 27.2 | 18.0 | 28.5 | 27.3 | 19.5 | 27.5 | 26.3 |
| 20.0 | 28.2 | 27.0 | 20.0 | 28.2 | 27.0 | 21.5 | 27.5 | 26.3 |
| 22.0 | 27.9 | 26.7 | 22.0 | 27.8 | 26.6 | 23.5 | 27.3 | 26.1 |
| 24.0 | 27.1 | 25.9 | 24.0 | 27.4 | 26.2 | 25.5 | 26.9 | 25.7 |
| 26.0 | 26.4 | 25.2 | 26.0 | 27.0 | 25.8 | 27.5 | 26.3 | 25.1 |
| 28.0 | 25.1 | 23.9 | 28.0 | 25.7 | 24.5 | 29.5 | 25.5 | 24.3 |
| 30.0 | 23.4 | 22.2 | 30.0 | 22.8 | 21.6 | 31.5 | 24.0 | 22.8 |
| 32.0 | 22.2 | 21.0 | 32.0 | 21.6 | 20.4 | 33.5 | 22.1 | 20.9 |
| 34.0 | 18.5 | 17.3 | 34.0 | 20.5 | 19.3 | 35.5 | 20.4 | 19.2 |
| 36.5 | 0.0 | 0.0 | 36.0 | 15.7 | 14.5 | 39.5 | 0.0 | 0.0 |
| 37.0 | 0.0 | 0.0 | 37.0 | 0.0 | 0.0 | 37.0 | 0.0 | 0.0 |
| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|----------------|----------------|-------------------|-------------------------|
|                | CP1 | CP2 | CP3 | CP4 | CP1 | CP2 | CP3 | CP4 |                      |
| Initial        | 120.69 | 121.45 | 120.65 | 121.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00           | 120.11 | 120.09 | 119.63 | 121.50 | 0.58 | 1.36 | 1.02 | 0.49 | 0.86 |
| 0.00*          | 119.73 | 120.18 | 119.36 | 121.35 | 0.96 | 1.27 | 1.29 | 0.64 | 1.04 |
| 0.73           | 119.88 | 120.08 | 119.46 | 121.15 | 0.81 | 1.37 | 1.19 | 0.84 | 1.05 |
| 1.04           | 119.77 | 120.07 | 119.56 | 121.30 | 0.92 | 1.38 | 1.09 | 0.69 | 1.02 |
| 1.53           | 119.71 | 120.16 | 119.64 | 121.27 | 0.98 | 1.29 | 1.01 | 0.72 | 1.00 |
| 2.01           | 119.76 | 120.45 | 119.79 | 121.41 | 0.93 | 1.00 | 0.86 | 0.58 | 0.84 |
| 2.50           | 119.88 | 120.64 | 119.87 | 121.46 | 0.81 | 0.81 | 0.78 | 0.53 | 0.73 |
| 3.05           | 120.23 | 121.05 | 120.48 | 121.91 | 0.46 | 0.40 | 0.17 | 0.08 | 0.28 |
| 3.54           | 120.72 | 121.43 | 120.79 | 122.08 | -0.03 | 0.02 | -0.14 | -0.09 | -0.06 |
| 4.03           | 120.86 | 121.84 | 121.27 | 122.25 | -0.17 | -0.39 | -0.62 | -0.26 | -0.36 |

* After a second slot cut.
Figure 8. Slot cut shape of wallets (a) W1, (b) W2 and (c) W3.
Figure 9. Slot cut shape of wallets (a) W4, (b) W5 and (c) W6.
Figure 10. Stress-strain curves obtained from the double flat jack test for (a) W1, (b) W2, (c) W3, (d) W4, (e) W5 and (f) W6.
Figure 11. Average stress-strain curves obtained from the double flat jack test for (a) W1, (b) W2, (c) W3, (d) W4, (e) W5 and (f) W6.
Figure 12. Linear regression curves fitted to the selected stress-strain points of the elastic range of the material for (a) W1, (b) W2, (c) W3, (d) W4 and (e) W5 (as the test for W6 was unsuccessful no regression line is reported for that wallette).
Table 15
Control points' distances and deformation data of W2.

| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|-----------------|----------------|-------------------|--------------------------|
|                 | CP1       | CP2       | CP3       | CP4       | CP1       | CP2       | CP3       | CP4       |
| Initial         | 121.95   | 165.18   | 140.51   | 127.61   | 0.00      | 0.00      | 0.00      | 0.00      |
| 0.00            | 121.35   | 163.48   | 139.35   | 126.36   | 0.60      | 1.70      | 1.16      | 1.25      |
| 0.55            | 121.21   | 164.12   | 139.42   | 126.25   | 0.74      | 1.06      | 1.09      | 1.36      |
| 1.04            | 121.55   | 164.14   | 139.71   | 126.52   | 0.40      | 1.04      | 0.80      | 1.09      |
| 1.53            | 121.63   | 164.9    | 139.89   | 126.56   | 0.32      | 0.28      | 0.62      | 1.05      |
| 2.01            | 121.62   | 164.74   | 140.23   | 126.88   | 0.33      | 0.44      | 0.28      | 0.73      |
| 2.50            | 121.94   | 165.14   | 140.48   | 126.97   | 0.01      | 0.04      | 0.03      | 0.04      |
| 3.05            | 121.95   | 165.46   | 141.12   | 127.25   | 0.00      | -0.28     | -0.61     | 0.36      |
| 3.48            | 122.22   | 165.78   | 141.53   | 127.48   | -0.27     | -0.60     | -1.02     | 0.13      |
|                 |           |           |           |           |           |           |           | -0.44     |

Table 16
Control points' distances and deformation data of W3.

| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|-----------------|----------------|-------------------|--------------------------|
|                 | CP1       | CP2       | CP3       | CP4       | CP1       | CP2       | CP3       | CP4       |
| Initial         | 118.46   | 122.76   | 122.72   | 119.53   | 0.00      | 0.00      | 0.00      | 0.00      |
| 0.00            | 117.79   | 121.84   | 121.89   | 118.90   | 0.67      | 0.92      | 0.83      | 0.63      |
| 0.55            | 117.92   | 121.79   | 121.74   | 118.73   | 0.54      | 0.97      | 0.98      | 0.80      |
| 1.04            | 117.97   | 121.87   | 122.01   | 118.91   | 0.49      | 0.89      | 0.71      | 0.62      |
| 1.53            | 118.07   | 122.02   | 122.12   | 119.02   | 0.39      | 0.74      | 0.60      | 0.51      |
| 2.01            | 118.16   | 122.29   | 122.15   | 119.03   | 0.30      | 0.47      | 0.57      | 0.50      |
| 2.50            | 118.26   | 122.31   | 122.26   | 119.20   | 0.20      | 0.45      | 0.46      | 0.33      |
| 3.05            | 118.40   | 122.49   | 122.55   | 119.16   | 0.06      | 0.27      | 0.17      | 0.37      |
| 3.54            | 118.41   | 122.63   | 122.76   | 119.44   | 0.05      | 0.13      | -0.04     | 0.09      |
| 4.03            | 118.58   | 122.90   | 122.94   | 119.46   | -0.12     | -0.14     | -0.22     | 0.07      |
| 4.52            | 118.49   | 123.15   | 123.23   | 119.61   | -0.03     | -0.39     | -0.51     | -0.08     |
|                 |           |           |           |           |           |           |           | -0.25     |

Table 17
Control points' distances and deformation data of W4.

| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|-----------------|----------------|-------------------|--------------------------|
|                 | CP1       | CP2       | CP3       | CP4       | CP1       | CP2       | CP3       | CP4       |
| Initial         | 121.70   | 119.93   | 119.62   | 121.37   | 0.00      | 0.00      | 0.00      | 0.00      |
| 0.00            | 120.75   | 118.66   | 118.41   | 120.39   | 0.95      | 1.27      | 1.21      | 0.98      |
| 0.00*           | 120.59   | 118.63   | 118.37   | 120.62   | 1.11      | 1.30      | 1.25      | 0.75      |
| 0.61            | 120.75   | 118.55   | 118.62   | 120.70   | 0.95      | 1.38      | 1.00      | 0.67      |
| 1.04            | 120.90   | 118.84   | 118.32   | 120.48   | 0.80      | 1.09      | 1.30      | 0.89      |
| 1.53            | 120.83   | 119.08   | 118.83   | 120.75   | 0.87      | 0.85      | 0.79      | 0.62      |
| 2.01            | 120.89   | 119.14   | 118.89   | 120.83   | 0.81      | 0.79      | 0.73      | 0.54      |
| 2.44            | 121.21   | 119.37   | 119.35   | 120.99   | 0.49      | 0.56      | 0.27      | 0.38      |
| 3.05            | 121.32   | 119.71   | 119.70   | 120.91   | 0.38      | 0.22      | -0.08     | 0.46      |
| 3.54            | 121.38   | 119.94   | 119.77   | 121.37   | 0.32      | -0.01     | -0.15     | 0.00      |
| 4.03            | 121.52   | 120.76   | 120.84   | 121.84   | 0.18      | -0.83     | -1.22     | -0.47     |
|                 |           |           |           |           |           |           |           | -0.58     |

* After a second slot cut.

whereas that those for wallets W4, W5 and W6 are presented in Table 40.

\[
\epsilon_i = \frac{\epsilon_{hi}}{\epsilon_{vi}}
\] (4)

To estimate cob's compressive strength a logarithmic regression curve was fitted to the average stress-strain curves as done by Lombillo [11] and the corresponding equation was then extrapolated for a strain value of 2% which was observed from the stress-strain curves reported by Miccoli et al. [12] as the strain value at which cob attained its peak strength. The fitted logarithmic curves and their correspondent equations are shown in Figure 13. The fitted curve's
Figure 13. Logarithmic regression curves fitted to the average stress-strain curves (a) W1, (b) W2, (c) W3, (d) W4 and (e) W5 (as the test for W6 was unsuccessful no regression line is reported for that wallette).
Table 18
Control points’ distances and deformation data of W5.

| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|-----------------|-----------------|------------------|--------------------------|
|                 | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  |
| Initial         | 120.33 | 121.04 | 118.58 | 123.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00            | 119.46 | 119.72 | 116.83 | 122.32 | 0.87 | 1.32 | 1.75 | 0.86 | 1.20 |
| 0.55            | 120.00 | 119.70 | 116.75 | 122.19 | 0.33 | 1.34 | 1.83 | 0.99 | 1.12 |
| 1.04            | 119.88 | 119.98 | 117.10 | 122.02 | 0.45 | 1.06 | 1.48 | 1.16 | 1.04 |
| 1.53            | 119.88 | 120.33 | 117.79 | 122.51 | 0.45 | 0.71 | 0.79 | 0.67 | 0.66 |
| 2.01            | 120.11 | 120.49 | 117.83 | 122.37 | 0.22 | 0.55 | 0.75 | 0.81 | 0.58 |
| 2.50            | 120.15 | 120.52 | 117.89 | 122.26 | 0.18 | 0.52 | 0.69 | 0.92 | 0.58 |
| 3.00            | 120.19 | 120.57 | 117.96 | 122.75 | 0.14 | 0.47 | 0.69 | 0.43 | 0.43 |
| 3.54            | 120.37 | 121.09 | 118.39 | 122.73 | -0.04 | -0.05 | 0.19 | 0.45 | 0.14 |
| 4.03            | 120.78 | 121.65 | 118.78 | 122.89 | -0.45 | -0.61 | -0.20 | 0.29 | -0.24 |
| 4.52            | 120.94 | 121.72 | 119.58 | 122.86 | -0.61 | -0.68 | -1.00 | 0.32 | -0.49 |

Table 19
Control points’ distances and deformation data of W6.

| Pressure (bars) | Distances (mm) | Deformations (mm) | Average deformation (mm) |
|-----------------|-----------------|------------------|--------------------------|
|                 | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  | CP1  | CP2  | CP3  | CP4  |
| Initial         | 102.96 | 99.08 | 103.14 | 102.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00            | 102.86 | 98.14 | 102.20 | 101.54 | 0.10 | 0.94 | 0.94 | 1.28 | 0.81 |
| 0.37            | 102.98 | 98.14 | 102.16 | 101.62 | -0.02 | 0.94 | 0.98 | 1.20 | 0.77 |
| 0.61            | 102.99 | 97.90 | 102.28 | 101.92 | -0.03 | 1.18 | 0.86 | 0.90 | 0.73 |
| 0.86            | 103.12 | 97.94 | 101.98 | 101.88 | -0.16 | 1.14 | 1.16 | 0.94 | 0.77 |
| 1.16            | 102.94 | 98.22 | 102.26 | 101.88 | 0.02 | 0.86 | 0.88 | 0.94 | 0.67 |
| 1.34            | 103.00 | 98.42 | 102.36 | 101.92 | -0.04 | 0.66 | 0.78 | 0.90 | 0.57 |
| 1.64            | 103.14 | 98.16 | 102.32 | 101.82 | -0.18 | 0.92 | 0.82 | 1.00 | 0.64 |
| 1.83            | 103.22 | 98.60 | 102.34 | 101.98 | -0.26 | 0.48 | 0.80 | 0.84 | 0.46 |
| 2.14            | 103.24 | 98.34 | 102.58 | 102.04 | -0.28 | 0.74 | 0.56 | 0.78 | 0.45 |
| 2.32            | 103.12 | 98.42 | 102.62 | 102.20 | -0.16 | 0.66 | 0.52 | 0.62 | 0.41 |
| 2.62            | 103.14 | 98.70 | 102.68 | 102.02 | -0.18 | 0.38 | 0.46 | 0.80 | 0.36 |
| 2.81            | 103.12 | 98.68 | 102.66 | 102.06 | -0.16 | 0.40 | 0.48 | 0.76 | 0.37 |
| 3.11            | 103.20 | 98.94 | 102.72 | 102.16 | -0.24 | 0.14 | 0.42 | 0.66 | 0.24 |
| 3.24            | 103.12 | 98.88 | 102.72 | 102.12 | -0.16 | 0.20 | 0.42 | 0.70 | 0.29 |
| 3.60            | 103.24 | 99.28 | 103.24 | 102.22 | -0.28 | -0.20 | -0.10 | 0.60 | 0.33 |
| 4.00            | 103.32 | 99.22 | 103.28 | 102.34 | -0.36 | -0.14 | -0.14 | 0.48 | -0.04 |
| 4.27            | 103.44 | 99.12 | 103.34 | 102.42 | -0.48 | -0.04 | -0.20 | 0.40 | -0.08 |

equations used to estimate the Young’s modulus and compressive strength are summarized in Table 41.

2. Experimental Design, Materials, and Methods

The consolidation loading setup of the wallettes consisted in four treaded bars fixed at the bottom and top steel pallets which were tensioned by tightening the nuts at the top. The tightening of the nuts was performed manually, in increments of approximately 2 kN per bar, and the initial loading process, going from 0 up to 85 kN took approximately 15 to 20 min for each wallette. The tension forces thus applied caused the shortening of the bars, deformation that subsequently was transformed into a compressive force applied to the cob wallettes. Therefore, loads were applied slightly eccentrically but in a symmetric way as the points of anchorage of the bars were located at the external faces of the steel pallets flanges. A load cell was installed between each point of support at the top steel pallet and the nut to measure the load transferred from the bars to the wallette. The total load transferred to the wallette was calculated as the sum of the four bars’ forces.
### Table 20

Dataset of monitored load values.

| Wallette | F1 (kN) | F2 (kN) | F3 (kN) | F4 (kN) | Total (kN) | Time  | Situation          |
|----------|---------|---------|---------|---------|------------|-------|--------------------|
| W1       | 12.59   | 12.76   | 12.46   | 12.49   | 50.30      | 11:14 | Initial load       |
| W2       | 12.38   | 12.33   | 12.04   | 11.85   | 48.60      | 11:44 | Load before cut    |
|          | 12.24   | 12.05   | 11.27   | 10.98   | 46.54      | 11:54 | Load after cut     |
|          | 11.95   | 11.66   | 10.87   | 10.60   | 45.08      | 12:37 | Load before pumping|
|          | 12.03   | 11.76   | 11.39   | 11.28   | 46.45      | 13:06 | Load at recovery   |
| W3       | 12.54   | 12.42   | 12.50   | 12.50   | 49.96      | 10:01 | Initial load       |
|          | 12.11   | 11.67   | 11.90   | 11.71   | 47.39      | 10:17 | Load before cut    |
|          | 11.05   | 10.64   | 11.70   | 11.30   | 44.69      | 10:23 | Load after cut     |
|          | 10.84   | 10.34   | 11.40   | 11.00   | 43.58      | 10:42 | Load before pumping|
|          | 11.13   | 11.21   | 11.40   | 11.00   | 44.74      | 11:02 | Load at recovery   |
| W4       | 12.57   | 12.42   | 12.50   | 12.47   | 49.96      | 12:23 | Initial load       |
|          | 11.58   | 11.44   | 10.10   | 10.35   | 43.47      | 12:50 | Load after cut     |
|          | 11.46   | 11.24   | 9.90    | 10.25   | 42.84      | 13:12 | Load before pumping|
|          | 11.45   | 11.35   | 10.80   | 11.33   | 44.93      | 13:29 | Load at recovery   |
| W5       | 12.55   | 12.48   | 12.50   | 12.47   | 50.00      | 10:37 | Initial load       |
|          | 12.30   | 11.80   | 11.60   | 11.30   | 47.00      | 10:45 | Load before cut    |
|          | 11.95   | 11.66   | 10.70   | 10.90   | 45.21      | 10:52 | Load after cut     |
|          | 11.58   | 11.38   | 10.30   | 10.50   | 43.76      | 11:17 | Load before pumping|
|          | 11.57   | 11.33   | 11.20   | 11.00   | 45.10      | 11:38 | Load at recovery   |
| W6       | 12.55   | 12.61   | 12.60   | 12.40   | 50.16      | 10:47 | Initial load       |
|          | 11.66   | 11.86   | 10.90   | 10.60   | 45.02      | 11:20 | Load after cut     |
|          | 11.50   | 11.75   | 10.60   | 10.40   | 44.25      | 11:32 | Load before pumping|
|          | 11.61   | 11.75   | 11.80   | 11.40   | 46.56      | 11:49 | Load at recovery   |
|          | 12.54   | 12.57   | 12.44   | 12.50   | 50.04      | 10:44 | Initial load       |
|          | 11.72   | 11.67   | 11.66   | 11.95   | 46.99      | 11:09 | Load before cut    |
|          | 10.40   | 10.42   | 11.41   | 11.76   | 44.00      | 11:19 | Load after cut     |
|          | 10.34   | 10.12   | 11.22   | 11.47   | 43.14      | 12:01 | Load before pumping|
|          | 11.21   | 11.08   | 11.17   | 11.47   | 44.92      | 13:17 | Load at recovery   |

Four LVDTs were placed in the.wallettes' faces, two in the front and two in the back, to measure the vertical deformation caused by the compressive forces. The LVDT’s were pinned through the material using stainless steel pins of roughly 5 to 6 cm length by 2 mm diameter. The points of support were held in place at an initial distance of roughly 30 cm (except for W1) at the middle third of the specimens. This arrangement is in accordance with BS EN 1052 Part 1 [2]. The full consolidation setup is shown in Figure 14.

After the load of 84 kN +/- 1 kN was imposed to the wallettes it was kept quasi-constant for a period of five days and displacements increments were monitored. After this consolidation period loads were completely removed manually by untightening the nuts in decrements of roughly 2 kN per bar. A second load cycle was applied (except for W1), as described for the first cycle, and loads and displacements were recorded.

The procedure followed for the application of the flat jack tests is briefly described here. Full details about its implementation have been reported in a co-submitted MethodsX article [13].

1. Single flat jack:
   a. Wallette setting up and application of load (50 kN) (load recorded).
   b. Control points fixing.
   c. Initial distance between control points measured.
   d. Slot cutting (load recorded immediately before and after making the cut).
   e. Cleaning of the slot and cut depth measurement every 2 cm.
   f. Initial displacements measurement.
   g. Flat jack connection, insertion and system purging.
   h. Pressure applied at 50 % (between 1.0 and 2.0 bars) to allow seating of the flat jack.
   i. Removal of pressure.
Table 21
Wallettes' geometries and other over imposed loads.

| Wallette | Height (m) | Density (kg/m³) | Weight above cut (N) | Other loads (N-) | Cross section at cut (m²) | Average monitored load (N) |
|----------|------------|-----------------|----------------------|------------------|--------------------------|---------------------------|
| W1       | 0.96       | 1476.44         | 9631.79              | 1471.50          | 0.405                    | 47521.50                  |
| W2       | 0.95       | 1434.39         | 9304.68              | 1471.50          | 0.426                    | 46065.00                  |
| W3       | 0.97       | 1523.44         | 10125.22             | 1471.50          | 0.411                    | 47443.50                  |
| W4       | 0.96       | 1563.63         | 10200.58             | 1471.50          | 0.403                    | 46050.00                  |
| W5       | 0.95       | 1541.30         | 9960.38              | 1471.50          | 0.405                    | 48360.50                  |
| W6       | 0.95       | 1540.04         | 9990.03              | 1471.50          | 0.396                    | 45957.45                  |
Table 22
Cut measurements of wallettes W1, W2 and W3.

| W1 | Meas.Depth (cm) | Correcteddepth (cm) | Horizontaldistance (cm) |
|----|-----------------|----------------------|--------------------------|
| 0.0| 0.0             | 0.0                  | 0.0                      |
| 2.0| 19.0            | 17.8                 | 2.0                      |
| 4.0| 20.8            | 19.6                 | 4.0                      |
| 6.0| 23.9            | 22.7                 | 6.0                      |
| 8.0| 24.4            | 23.2                 | 8.0                      |
|10.0| 26.6            | 25.4                 | 10.0                     |
|12.0| 27.5            | 26.3                 | 12.0                     |
|14.0| 28.0            | 26.8                 | 14.0                     |
|16.0| 28.4            | 27.2                 | 16.0                     |
|18.0| 28.4            | 27.2                 | 18.0                     |
|20.0| 28.4            | 27.2                 | 20.0                     |
|22.0| 27.9            | 26.7                 | 22.0                     |
|24.0| 27.6            | 26.4                 | 24.0                     |
|26.0| 26.9            | 25.7                 | 26.0                     |
|28.0| 25.8            | 24.6                 | 28.0                     |
|30.0| 24.4            | 23.2                 | 30.0                     |
|32.0| 21.8            | 20.6                 | 32.0                     |
|34.0| 20.0            | 18.8                 | 34.0                     |
|37.0| 0.0             | 0.0                  | 37.0                     |

| W2 | Meas.Depth (cm) | Correcteddepth (cm) | Horizontaldistance (cm) |
|----|-----------------|----------------------|--------------------------|
| 0.0| 0.0             | 0.0                  | 0.0                      |
| 2.0| 19.1            | 17.9                 | 2.0                      |
| 4.0| 20.7            | 19.5                 | 4.0                      |
| 6.0| 23.6            | 22.4                 | 6.0                      |
| 8.0| 25.4            | 24.2                 | 8.0                      |
|10.0| 26.1            | 24.9                 | 10.0                     |
|12.0| 26.9            | 25.7                 | 12.0                     |
|14.0| 28.4            | 27.2                 | 14.0                     |
|16.0| 28.7            | 27.5                 | 16.0                     |
|18.0| 28.9            | 27.7                 | 18.0                     |
|20.0| 28.6            | 27.4                 | 20.0                     |
|22.0| 27.6            | 26.4                 | 22.0                     |
|24.0| 27.2            | 26.0                 | 24.0                     |
|26.0| 26.8            | 25.6                 | 26.0                     |
|28.0| 25.8            | 24.6                 | 28.0                     |
|30.0| 24.1            | 22.9                 | 30.0                     |
|32.0| 22.3            | 21.1                 | 32.0                     |
|34.0| 19.8            | 18.6                 | 34.0                     |
|37.0| 15.7            | 14.5                 | 37.0                     |

| W3 | Meas.Depth (cm) | Correcteddepth (cm) | Horizontaldistance (cm) |
|----|-----------------|----------------------|--------------------------|
| 0.0| 0.0             | 0.0                  | 0.0                      |
| 2.0| 18.4            | 17.2                 | 2.0                      |
| 4.0| 18.9            | 17.7                 | 4.0                      |
| 6.0| 23.4            | 22.2                 | 6.0                      |
| 8.0| 22.9            | 21.7                 | 8.0                      |
|10.0| 26.6            | 25.4                 | 10.0                     |
|12.0| 26.7            | 25.5                 | 12.0                     |
|14.0| 27.1            | 25.9                 | 14.0                     |
|16.0| 27.5            | 26.3                 | 16.0                     |
|18.0| 28.3            | 27.1                 | 18.0                     |
|20.0| 28.3            | 27.1                 | 20.0                     |
|22.0| 27.3            | 26.1                 | 22.0                     |
|24.0| 26.8            | 25.6                 | 24.0                     |
|26.0| 26.0            | 25.0                 | 26.0                     |
|28.0| 24.9            | 23.7                 | 28.0                     |
|30.0| 24.1            | 22.9                 | 30.0                     |
|32.0| 21.4            | 20.2                 | 32.0                     |
|34.0| 19.8            | 18.6                 | 34.0                     |
|37.0| 15.2            | 14.0                 | 37.0                     |
Table 23
Cut measurements of wallettes W4, W5 and W6.

| W4 Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) | W5 Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) | W6 Horizontal distance (cm) | Meas. Depth (cm) | Corrected depth (cm) |
|-----------------------------|------------------|----------------------|-----------------------------|------------------|----------------------|-----------------------------|------------------|----------------------|
| 0.0                         | 0.0              | 0.0                  | 0.0                         | 0.0              | 0.0                  | 0.0                         | 0.0              | 0.0                  |
| 2.0                         | 19.4             | 18.2                 | 2.0                         | 19.9             | 18.7                 | 2.0                         | 12.5             | 11.3                 |
| 4.0                         | 21.0             | 19.8                 | 4.0                         | 22.4             | 21.2                 | 4.0                         | 16.4             | 15.2                 |
| 6.0                         | 23.5             | 22.3                 | 6.0                         | 24.5             | 23.3                 | 6.0                         | 20.3             | 19.1                 |
| 8.0                         | 25.5             | 24.3                 | 8.0                         | 25.7             | 24.5                 | 8.0                         | 24.5             | 23.3                 |
| 10.0                        | 26.6             | 25.4                 | 10.0                        | 26.5             | 25.3                 | 10.0                        | 25.1             | 23.9                 |
| 12.0                        | 27.7             | 26.5                 | 12.0                        | 26.9             | 25.7                 | 12.0                        | 25.4             | 24.2                 |
| 14.0                        | 28.2             | 27.0                 | 14.0                        | 28.4             | 27.2                 | 14.0                        | 26.2             | 25.0                 |
| 16.0                        | 28.6             | 27.4                 | 16.0                        | 28.5             | 27.3                 | 16.0                        | 26.7             | 25.5                 |
| 18.0                        | 28.5             | 27.3                 | 18.0                        | 28.8             | 27.6                 | 18.0                        | 27.0             | 25.8                 |
| 20.0                        | 28.5             | 27.3                 | 20.0                        | 28.7             | 27.5                 | 20.0                        | 27.0             | 25.8                 |
| 22.0                        | 28.4             | 27.2                 | 22.0                        | 28.1             | 26.9                 | 22.0                        | 27.0             | 25.8                 |
| 24.0                        | 28.1             | 26.9                 | 24.0                        | 27.7             | 26.5                 | 24.0                        | 26.6             | 25.4                 |
| 26.0                        | 27.6             | 26.4                 | 26.0                        | 26.9             | 25.7                 | 26.0                        | 26.0             | 24.8                 |
| 28.0                        | 26.3             | 25.1                 | 28.0                        | 26.3             | 25.1                 | 28.0                        | 25.6             | 24.4                 |
| 30.0                        | 24.7             | 23.5                 | 30.0                        | 25.6             | 24.4                 | 30.0                        | 23.8             | 22.6                 |
| 32.0                        | 24.5             | 23.3                 | 32.0                        | 23.8             | 22.6                 | 32.0                        | 22.7             | 21.5                 |
| 34.0                        | 20.5             | 19.3                 | 34.0                        | 21.9             | 20.7                 | 35.0                        | 20.0             | 18.8                 |
| 36.0                        | 17.8             | 16.6                 | 36.0                        | 17.1             | 15.9                 | 37.0                        | 16.9             | 15.7                 |
| 37.0                        | 0.0              | 0.0                  | 37.0                        | 0.0              | 0.0                  | 39.0                        | 7.3              | 6.1                  |
|                            |                  |                      |                            |                  |                      |                            | 41.0             | 4.2                  |
|                            |                  |                      |                            |                  |                      |                            | 43.0             | 0.0                  |
Table 24
Coefficients determined for every wallette.

| Property | W1       | W2       | W3       | W4       | W5       | W6       |
|----------|----------|----------|----------|----------|----------|----------|
| A₀j (mm²)  | 77855.64 | 77855.64 | 77855.64 | 77855.64 | 77855.64 | 77855.64 |
| A₀j SLOT (mm²) * | 79921.50 | 85277.75 | 84428.6  | 83249.75 | 83028.50 | 82627.75 |
| A₀j SLOT (mm²)  | 82716.50 | 84422.60 | 82142.15 | 85823.50 | 86318.50 | 83332.00 |
| K₀ dfj (-) * | 0.97     | 0.91     | 0.92     | 0.94     | 0.94     | 0.94     |
| K₀ dfj (-)  | 0.94     | 0.92     | 0.95     | 0.91     | 0.90     | 0.93     |
| K₀ ave (-)  | 0.96     | 0.92     | 0.93     | 0.92     | 0.92     | 0.94     |
| K₀ lm (-)   | 0.92     | 0.92     | 0.92     | 0.92     | 0.92     | 0.92     |

* Values obtained from the single flat jack test performed in the same cob wallettes.

Table 25
Distances between control points at every pressure increment for wallette W1 (mm).

| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
|----------------|------|------|------|------|------|------|------|
| Initial        | 288.64 | 288.00 | 286.58 | 288.28 | 270.58 | 272.88 | 271.90 |
| 0.00           | 288.64 | 288.00 | 286.58 | 288.28 | 270.58 | 272.88 | 271.90 |
| 1.04           | 288.48 | 287.50 | 286.48 | 287.96 | 271.70 | 272.96 | 272.06 |
| 2.08           | 288.48 | 287.40 | 286.58 | 287.90 | 270.72 | 273.18 | 272.20 |
| 3.05           | 288.28 | 287.70 | 286.38 | 287.62 | 270.98 | 273.38 | 272.46 |
| 4.03           | 288.38 | 287.18 | 286.08 | 287.78 | 271.38 | 272.96 | 272.98 |
| 5.01           | 288.36 | 287.56 | 285.98 | 287.80 | 272.26 | 274.82 | 274.12 |
| 6.10           | 288.36 | 287.20 | 285.46 | 287.58 | 273.72 | 276.22 | 275.54 |
| 7.00           | 288.34 | 287.52 | 284.96 | 287.28 | 274.68 | 277.68 | 277.48 |

Table 26
Distances between control points at every pressure increment for wallette W2 (mm).

| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
|----------------|------|------|------|------|------|------|------|
| Initial        | 285.30 | 284.76 | 286.86 | 286.64 | 273.80 | 270.52 | 270.56 |
| 0.00           | 285.30 | 284.76 | 286.86 | 286.64 | 273.80 | 270.52 | 270.56 |
| 1.04           | 285.40 | 284.46 | 286.42 | 286.38 | 273.84 | 270.68 | 270.70 |
| 2.01           | 285.26 | 284.36 | 286.18 | 286.38 | 273.74 | 270.72 | 270.76 |
| 3.05           | 284.86 | 283.74 | 286.80 | 286.08 | 274.18 | 271.12 | 271.14 |
| 4.03           | 284.64 | 283.54 | 285.50 | 285.96 | 275.44 | 272.58 | 272.64 |
| 5.01           | 284.96 | 283.32 | 285.58 | 285.80 | 277.00 | 274.48 | 274.54 |

Table 27
Distances between control points at every pressure increment for wallette W3 (mm).

| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
|----------------|------|------|------|------|------|------|------|
| Initial        | 285.18 | 284.88 | 289.28 | 286.56 | 273.44 | 271.72 | 270.66 |
| 0.00           | 285.18 | 284.88 | 289.28 | 286.56 | 273.44 | 271.72 | 270.66 |
| 1.04           | 285.40 | 284.92 | 289.08 | 286.28 | 273.40 | 271.78 | 270.58 |
| 2.01           | 286.58 | 284.52 | 289.34 | 286.28 | 273.46 | 271.85 | 270.76 |
| 3.05           | 284.98 | 284.30 | 288.66 | 286.08 | 273.48 | 272.08 | 270.90 |
| 4.03           | 284.82 | 284.18 | 288.64 | 285.82 | 273.82 | 272.50 | 271.12 |
| 4.75           | 284.68 | 284.00 | 288.30 | 285.88 | 275.00 | 274.16 | 272.96 |
| 5.75           | 284.53 | 283.60 | 287.86 | 285.90 | 277.98 | 276.80 | 275.48 |
| 6.75           | 284.68 | 282.92 | 287.18 | 285.80 | 280.00 | 279.48 | 278.14 |

j Pressure increments of about 0.5 bars (increments in the first wallette tested, W6, were of only 0.25 bars) until initial distance is recovered (load recorded before start pumping, distance between control points measured at every increment and load recorded again at recovery of initial distance between control points).

k System depressurisation and removal of flat jack.

2 Double flat jack:
| Table 28 | Distances between control points at every pressure increment for wallette W4 (mm). |
|----------|--------------------------------------------------------------------------------|
| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
| Initial | 286.00 | 286.62 | 283.98 | 285.64 | 280.86 | 281.88 | 281.58 |
| 0.00 | 286.00 | 286.62 | 283.98 | 285.64 | 280.86 | 281.88 | 281.58 |
| 1.04 | 285.82 | 287.46 | 284.56 | 285.08 | 280.60 | 281.98 | 281.48 |
| 2.01 | 286.22 | 286.10 | 283.44 | 284.42 | 280.76 | 282.14 | 281.58 |
| 3.05 | 285.64 | 286.08 | 283.24 | 284.88 | 281.88 | 282.20 | 281.74 |
| 3.97 | 285.40 | 285.60 | 282.76 | 284.96 | 281.14 | 282.50 | 281.98 |
| 4.75 | 285.30 | 286.48 | 282.48 | 284.72 | 281.88 | 283.54 | 282.86 |
| 6.00 | 285.16 | 285.18 | 281.76 | 283.86 | 283.92 | 285.30 | 284.54 |
| 6.75 | 284.68 | 285.00 | 280.82 | 283.58 | 284.98 | 286.50 | 285.58 |

| Table 29 | Distances between control points at every pressure increment for wallette W5 (mm). |
|----------|--------------------------------------------------------------------------------|
| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
| Initial | 284.68 | 285.76 | 285.18 | 289.28 | 270.96 | 272.38 | 270.54 |
| 0.00 | 284.68 | 285.76 | 285.18 | 289.28 | 270.96 | 272.38 | 270.54 |
| 1.04 | 285.08 | 286.28 | 284.66 | 289.52 | 271.04 | 272.44 | 270.34 |
| 2.01 | 284.44 | 285.90 | 284.78 | 289.20 | 270.94 | 272.50 | 270.48 |
| 3.05 | 284.38 | 285.78 | 284.68 | 289.14 | 271.16 | 272.66 | 270.80 |
| 4.03 | 284.34 | 285.58 | 284.58 | 289.88 | 271.66 | 273.22 | 271.38 |
| 4.75 | 284.28 | 284.74 | 284.60 | 288.96 | 272.64 | 274.32 | 272.50 |
| 5.75 | 284.28 | 285.35 | 284.56 | 288.74 | 273.70 | 275.42 | 273.42 |
| 6.75 | 284.26 | 285.50 | 285.06 | 288.94 | 275.58 | 277.40 | 275.72 |

| Table 30 | Distances between control points at every pressure increment for wallette W6 (mm). |
|----------|--------------------------------------------------------------------------------|
| Pressure (bars) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC |
| Initial | 287.14 | 284.58 | 286.52 | 287.38 | 270.02 | 273.60 | 272.10 |
| 0.00 | 287.14 | 284.58 | 286.52 | 287.38 | 270.02 | 273.60 | 272.10 |
| 0.55 | 287.38 | 284.76 | 286.88 | 287.66 | 270.00 | 273.50 | 272.16 |
| 1.04 | 287.30 | 284.80 | 286.82 | 287.40 | 270.00 | 273.48 | 272.68 |
| 1.59 | 286.82 | 284.70 | 286.92 | 287.40 | 270.08 | 273.50 | 272.54 |
| 2.08 | 287.22 | 284.98 | 286.76 | 287.56 | 270.00 | 273.60 | 272.46 |
| 2.63 | 287.44 | 284.62 | 286.72 | 287.66 | 270.20 | 273.52 | 272.34 |
| 3.05 | 287.24 | 284.74 | 286.88 | 287.50 | 270.10 | 273.52 | 272.20 |
| 3.54 | 286.92 | 284.40 | 286.40 | 287.58 | 270.12 | 273.80 | 272.78 |
| 4.03 | 286.68 | 284.30 | 286.38 | 287.52 | 270.18 | 273.98 | 272.94 |
| 5.01 | 286.72 | 284.36 | 286.66 | 287.46 | 270.84 | 274.44 | 273.40 |
| 6.04 | 286.70 | 284.66 | 286.46 | 287.50 | 271.88 | 275.50 | 274.28 |
| 7.02 | 286.98 | 284.62 | 286.66 | 287.72 | 273.04 | 276.98 | 275.80 |

| Table 31 | Computed stresses and strains for wallette W1 (mm/mm). |
|----------|------------------------------------------------|
| Stress $f_{m}$ (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC | Average vertical strain | Average horizontal strain |
| 0.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 0.09 | 0.0006 | 0.0017 | 0.0003 | 0.0011 | -0.0041 | -0.0003 | -0.0066 | 0.0009 | -0.0017 |
| 0.18 | 0.0006 | 0.0021 | 0.0000 | 0.0013 | -0.0005 | -0.0011 | -0.0010 | -0.0000 | -0.0090 |
| 0.27 | 0.0012 | 0.0010 | 0.0007 | 0.0023 | -0.0015 | -0.0018 | -0.0021 | 0.0013 | -0.0018 |
| 0.35 | 0.0009 | 0.0028 | 0.0017 | 0.0017 | -0.0030 | -0.0003 | -0.0040 | 0.0018 | -0.0024 |
| 0.44 | 0.0010 | 0.0015 | 0.0021 | 0.0017 | -0.0062 | -0.0071 | -0.0082 | 0.0016 | -0.0072 |
| 0.54 | 0.0010 | 0.0028 | 0.0039 | 0.0024 | -0.0016 | -0.0122 | -0.0134 | 0.0025 | -0.0124 |
| 0.61 | 0.0010 | 0.0017 | 0.0057 | 0.0035 | -0.0152 | -0.0176 | -0.0205 | 0.0030 | -0.0178 |
Table 32
Computed stresses and strains for wallette W2 (mm/mm).

| Stress f_m (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC | Average vertical strain | Average horizontal strain |
|-----------------|------|------|------|------|------|------|------|------------------------|--------------------------|
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.09            | -0.00040 | 0.0011 | 0.0015 | 0.0009 | -0.0001 | -0.0006 | -0.0005 | 0.0008                  | -0.0004                  |
| 0.17            | 0.0001 | 0.0014 | 0.0024 | 0.0009 | 0.0002 | -0.0007 | -0.0007 | 0.0012                  | -0.0004                  |
| 0.26            | 0.0015 | 0.0036 | 0.0022 | 0.0020 | -0.0014 | -0.0022 | -0.0021 | 0.0018                  | -0.0019                  |
| 0.34            | 0.0023 | 0.0043 | 0.0047 | 0.0024 | -0.0060 | -0.0076 | -0.0077 | 0.0034                  | -0.0071                  |
| 0.42            | 0.0012 | 0.0051 | 0.0045 | 0.0029 | -0.0017 | -0.0146 | -0.0147 | 0.0034                  | -0.0137                  |

Table 33
Computed stresses and strains for wallette W3 (mm/mm).

| Stress f_m (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC | Average vertical strain | Average horizontal strain |
|-----------------|------|------|------|------|------|------|------|------------------------|--------------------------|
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.09            | -0.00080 | -0.00030 | 0.00010 | 0.0007 | 0.0010 | 0.0001 | -0.0001 | -0.00020 | 0.0003 | 0.0002                |
| 0.17*           | -0.00490 | 0.0013 | -0.00002 | 0.0010 | -0.0001 | -0.0006 | -0.0004 | -0.0007               | -0.0003                  |
| 0.26            | 0.0007 | 0.0020 | 0.0021 | 0.0017 | -0.0001 | -0.0013 | -0.0009 | 0.0016                | -0.0008                  |
| 0.34            | 0.0013 | 0.0025 | 0.0022 | 0.0026 | -0.0014 | -0.0029 | -0.0017 | 0.0021               | -0.0020                  |
| 0.41            | 0.0018 | 0.0031 | 0.0034 | 0.0024 | -0.0057 | -0.0090 | -0.0085 | 0.0027               | -0.0077                  |
| 0.49            | 0.0023 | 0.0045 | 0.0049 | 0.0023 | -0.0166 | -0.0187 | -0.0178 | 0.0035               | -0.0177                  |
| 0.58            | 0.0018 | 0.0069 | 0.0073 | 0.0027 | -0.0240 | -0.0286 | -0.0276 | 0.0046               | -0.0267                  |

* Neglected data point for linear regression fitting.

Table 34
Computed stresses and strains for wallette W4 (mm/mm).

| Stress f_m (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPC | Average vertical strain | Average horizontal strain |
|-----------------|------|------|------|------|------|------|------|------------------------|--------------------------|
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.00            | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000                  | 0.000                    |
| 0.09*           | 0.0006 | -0.0029 | -0.00200 | 0.00200 | 0.009 | -0.00040 | 0.00040 | 0.0006                | 0.0003                   |
| 0.17            | -0.00080 | 0.0018 | 0.0019 | 0.00800 | 0.0004 | -0.00090 | 0.00000 | 0.0009               | -0.0002                  |
| 0.26            | 0.0013 | 0.0019 | 0.0026 | 0.0027 | -0.0036 | -0.0011 | -0.0006 | 0.0021              | -0.0018                  |
| 0.33            | 0.0021 | 0.0036 | 0.0043 | 0.0024 | -0.0010 | -0.0022 | -0.0014 | 0.0031             | -0.0015                  |
| 0.40            | 0.0024 | 0.0005 | 0.0053 | 0.0032 | -0.0036 | -0.0059 | -0.0045 | 0.0029            | -0.0047                  |
| 0.51            | 0.0029 | 0.0050 | 0.0078 | 0.0062 | -0.0109 | -0.0121 | -0.0105 | 0.0055        | -0.0112                  |
| 0.57            | 0.0046 | 0.0057 | 0.0111 | 0.0072 | -0.0147 | -0.0164 | -0.0142 | 0.0072         | -0.0151                  |

*Neglected data point for linear regression fitting.

- a Wallette setting up.
- b Second slot cut.
- c Cleaning of the slot.
- d Second cut depth measurement every 2 cm.
- e Control points fixing.
- f Flat jacks insertion.
- g Flat jack connection and system purging.
- h Pressure applied at 50 % (between 1.0 and 2.0 bars) to allow seating of the flat jacks.
- i Removal of pressure.
- j Initial distance between control points measured.
- k Pressure increments of about 0.5 bars (increments in the first wallette tested, W6, were of only 0.25 bars) until material started to fail (distances between vertical and horizontal control points recorded at every increment).
- l Removal of pressure.
- m Removal of flat jacks.
### Table 35
Computed stresses and strains for wallette W5 (mm/mm).

| Stress $f_m$ (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPA | Average vertical strain | Average horizontal strain |
|--------------------|------|------|------|------|------|------|------|-------------------------|---------------------------|
| 0.00               | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000                   |                           |
| 0.00               | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000                   |                           |
| 0.09*              | -0.0014-0.0018 | 0.0018 | -0.0008-0.0003 | -0.0020-0.0007 | -0.0006 | 0.0001 | 0.0000 | -0.0002-0.0009 |                           |
| 0.17               | 0.0008 | -0.0050-0.014 | 0.0003 | 0.0001 | -0.0040-0.0002 | 0.0005 | 0.0000 |                           |                           |
| 0.34               | 0.0011 | -0.0001-0.0018 | 0.0005 | -0.0007-0.0010 | -0.0006-0.0008 | -0.0009 |                           |                           |
| 0.34               | 0.0012 | 0.0006 | 0.0021 | 0.0010 | -0.0026-0.0031 | -0.0031-0.0012 | -0.0029 |                           |                           |
| 0.40               | 0.0014 | 0.0036 | 0.0020 | 0.0011 | -0.0062-0.0071 | -0.00720-0.0020 | -0.0069 |                           |                           |
| 0.48               | 0.0014 | 0.0014 | 0.0022 | 0.0019 | -0.0101-0.0112 | -0.0106-0.0017 | -0.0106 |                           |                           |
| 0.57               | 0.0015 | 0.0009 | 0.0040 | 0.0012 | -0.0171-0.0184 | -0.0191-0.0010 | -0.0182 |                           |                           |

* Neglected data point for linear regression fitting.

### Table 36
Computed stresses and strains for wallette W6 (mm/mm).

| Stress $f_m$ (MPa) | VCP1 | VCP2 | VCP3 | VCP4 | HCPA | HCPB | HCPA | Average vertical strain | Average horizontal strain |
|--------------------|------|------|------|------|------|------|------|-------------------------|---------------------------|
| 0.00               | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000                   |                           |
| 0.00               | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000                   |                           |
| 0.05*              | -0.0008-0.0006-0.0013 | -0.0010-0.0001 | 0.0004 | -0.0002-0.0009 | 0.0000 | 0.0001 |                           |                           |
| 0.09*              | -0.0006-0.0008-0.0010 | -0.0001-0.0001 | 0.0004 | -0.0021-0.0006 | -0.0005 |                           |                           |
| 0.14*              | 0.0011 | -0.0004-0.0014 | -0.0001-0.0002 | -0.0008-0.0002 | -0.0006 |                           | -0.0005 |                           |
| 0.18*              | -0.0003-0.0014-0.0008 | -0.0006-0.0001 | -0.0000 | -0.0013-0.0008 | -0.0004 |                           | -0.0004 |                           |
| 0.23*              | -0.0010-0.0001-0.0007 | -0.0010-0.0001 | -0.0007-0.0003 | -0.0009-0.0007 | -0.0004 |                           | -0.0004 |                           |
| 0.26*              | -0.0003-0.0006-0.0013 | -0.0004-0.0030-0.0003 | -0.0004-0.0006 | -0.00250-0.0003 | -0.0012 |                           | -0.0001 |                           |
| 0.30               | 0.0008 | 0.0006 | 0.0004 | -0.0007-0.0004 | -0.0007 | -0.00250-0.0003 | -0.0012 |                           | -0.0004 |                           |
| 0.35               | 0.0016 | 0.0010 | 0.0005 | -0.0005-0.0006 | -0.0014-0.00310-0.0006 |                           | -0.0017 |                           |
| 0.43               | 0.0015 | 0.0008 | -0.0005-0.0003 | -0.0030-0.0031 | -0.00480-0.0004 |                           | -0.0036 |                           |
| 0.52               | 0.0015 | -0.00030-0.0002 | -0.0004-0.0069 | -0.0069-0.00800-0.0003 | -0.0073 |                           | -0.0036 |                           |
| 0.60               | 0.0006 | -0.0001-0.0005 | -0.0012 | -0.0112 | -0.0124-0.0136-0.0003 | -0.0124 |                           | -0.0036 |                           |

* Neglected data point for linear regression fitting.

**Figure 14.** Cob wallets’ consolidation setup.
Table 37
Young’s modulus estimation values computed for wallets W1, W2 and W3.

| W1 Pressure (bars) | Young’s modulus (MPa) | W2 Pressure (bars) | Young’s modulus (MPa) | W3 Pressure (bars) | Young’s modulus (MPa) |
|-------------------|-----------------------|-------------------|-----------------------|-------------------|-----------------------|
| 1.04              | 97.09                 | 1.04              | 110.94                | 1.04              | 469.72                |
| 2.08              | 183.96                | 2.01              | 140.33                | 2.01∗              | -239.79               |
| 3.05              | 202.86                | 3.05              | 159.40                | 4.03              | 162.02                |

∗ Neglected data point.
Table 38
Young’s modulus estimation values computed for wallettes W4, W5 and W6.

| W4 | Pressure (bars) | Young’s modulus (MPa) | W5 | Pressure (bars) | Young’s modulus (MPa) | W6 | Pressure (bars) | Young’s modulus (MPa) |
|----|----------------|-----------------------|----|----------------|-----------------------|----|----------------|-----------------------|
| 1.04* | 150.00 | -150.00 | 1.04* | 156.72 | - | - |
| 2.01 | 182.79 | 2.01 | 2.01 | 333.81 | - | - |
| 3.05 | 122.43 | 3.05 | 3.05 | 319.16 | - | - |
| 3.97 | 108.53 | - | - | - | - |

* Neglected data point.

Table 39
Poisson’s ratio estimation values computed for wallettes W1, W2 and W3.

| W1 | Pressure (bars) | Poisson’s ratio (-) | W2 | Pressure (bars) | Poisson’s ratio (-) | W3 | Pressure (bars) | Poisson’s ratio (-) |
|----|----------------|-------------------|----|----------------|-------------------|----|----------------|-------------------|
| 1.04* | 1.79 | 1.04 | 0.53 | 1.04* | -0.39 | - |
| 2.08* | 0.92 | 2.01 | 0.35 | 2.01* | -0.48 | - |
| 3.05* | 1.36 | 3.05* | 1.05 | 3.05 | 0.48 | - |
| 4.03* | 1.33 | - | - | 4.03* | 0.93 | - |

* Neglected data point.

Table 40
Poisson’s ratio estimation values computed for wallettes W4, W5 and W6.

| W4 | Pressure (bars) | Poisson’s ratio (-) | W5 | Pressure (bars) | Poisson’s ratio (-) | W6 | Pressure (bars) | Poisson’s ratio (-) |
|----|----------------|-------------------|----|----------------|-------------------|----|----------------|-------------------|
| 1.04* | 0.52 | 1.04* | 0.13 | - | - |
| 2.01 | 0.20 | 2.01 | 0.10 | - | - |
| 3.05* | 0.85 | 3.05* | 1.13 | - | - |
| 3.97* | 0.50 | - | - | - | - |

* Neglected data point.

Table 41
Linear and logarithmic regression equations obtained for each wallette.

| Wallette | Linear regression equation | Logarithmic regression equation |
|----------|-----------------------------|---------------------------------|
| W1 | $y = 186.45x - 0.0161$ | $y = 0.4161 \ln(x) + 3.0356$ |
| W2 | $y = 136.57x - 0.0052$ | $y = 0.1994 \ln(x) + 1.512$ |
| W3 | $y = 129.94x - 0.0607$ | $y = 0.141 \ln(x) + 1.2575$ |
| W4 | $y = 103.86x - 0.0314$ | $y = 0.2009 \ln(x) + 1.5416$ |
| W5 | $y = 321.21x - 0.0018$ | $y = 0.1827 \ln(x) + 1.6151$ |
| W6 | - | - |

Declaration of Competing Interest

None.

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