Data Article

Experimental data on the compressive and flexural strength of lateritic paving tiles compounded with pulverized cow bone

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\textbf{A B S T R A C T}

This article presents the data of the bulk density, compressive strength and flexural strength of lateritic paving tiles compounded with pulverized cow bones (PCB) as reinforcement, the data set are presented in three categories. Category A involves the mixture of laterite and PCB, category B involves the mixture of sharp sand and PCB, lastly, category C involves the mixture of laterite, sharp sand and PCB. The paving tiles were made using the casting method in a 200 × 100 × 60 mm mould, using 20, 15, 10% wt. Portland cement as a binder and cured for 28 days in a curing tank. The data provided will give useful information for predicting the mechanical properties of paving tiles at different PCB constituent percentage.

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Specifications Table

| Subject | Mechanical Engineering, Civil and Structural Engineering |
|---------|----------------------------------------------------------|
| Specific subject area | Waste Management, recycling, Construction Materials |
| Type of data | Table, Figure, Chart |
| How data were acquired | Casting of paving tiles compounded with pulverized cow bones in the laboratory and carrying out bulk density test, compressive test and flexural strength tests |
| Data format | Raw |
| Parameters for data collection | Samples produced were cured in curing tank at room temperature for 28 days. |
| Description of data collection | Data were collected from the readings of the universal testing machine (UTM) FS50AT |
| Data source location | Institution: University of Ilorin, City/Town/Region: Ilorin, Country: Nigeria |
| Data accessibility | Latitude and longitude (and GPS coordinates, if possible) for collected samples/data: 8.4928°N, 4.5962°E |
| Related research article | Data are as presented in this article. |
| J. O. Aweda, P. O. Omoniyi, I. O. Ohijeagbon, Suitability of Pulverized Cow Bones as a Paving Tile Constituent, Int. Conf. Eng. Sustainable World 2018. [https://doi:10.1088/1757-899X/413/1/012046](https://doi:10.1088/1757-899X/413/1/012046) |

Value of the Data

- The data set gives an opportunity for further improvement in the knowledge base and applications of the suitability of PCB as a paving tile constituent.
- The building and road sector will hugely benefit from the data.
- The data set will be helpful in building an empirical model for the prediction of the mechanical properties of lateritic paving tiles.
- The test data will also allow further investigation into the mechanical behaviour of the lateritic paving tiles.
- The data will provide requisite information and guide in the planning and designing of sustainable and affordable paving tiles in the construction sectors.

1. Data description

The data provided contains the information on the bulk density, compressive strength and flexural strength of PCB reinforced lateritic tiles, with 20, 15 and 10% Portland cement addition as a binder.

| Pulverized Cow Bones (%) | Laterite (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------------|--------------|------------|----------------------|---------------------------|------------------------|
| 30                       | 50           | 20         | 1.72                 | 4.56                      | 1.23                   |
| 20                       | 60           | 20         | 1.74                 | 4.05                      | 0.53                   |
| 10                       | 70           | 20         | 1.75                 | 4.03                      | 0.36                   |
| 5                        | 75           | 20         | 1.77                 | 3.44                      | 0.20                   |
| 0                        | 80           | 20         | 1.80                 | 3.50                      | 0.50                   |
Table 2
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 15% Cement Content and Laterite.

| Sample Composition | Pulverized Cow Bones (%) | Laterite (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------|--------------------------|--------------|------------|----------------------|--------------------------|------------------------|
| 30                 | 55                       | 15           |            | 1.70                 | 3.03                     | 0.84                   |
| 20                 | 65                       | 15           |            | 1.73                 | 3.86                     | 0.54                   |
| 10                 | 75                       | 15           |            | 1.74                 | 3.68                     | 0.21                   |
| 5                  | 80                       | 15           |            | 1.76                 | 3.09                     | 0.18                   |
| 0                  | 85                       | 15           |            | 1.82                 | 3.25                     | 0.40                   |

Table 3
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 10% Cement Content and Laterite.

| Sample Composition | Pulverized Cow Bones (%) | Laterite (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------|--------------------------|--------------|------------|----------------------|--------------------------|------------------------|
| 30                 | 60                       | 10           |            | 1.68                 | 1.53                     | 0.57                   |
| 20                 | 70                       | 10           |            | 1.72                 | 2.61                     | 0.56                   |
| 10                 | 80                       | 10           |            | 1.73                 | 3.23                     | 0.12                   |
| 5                  | 85                       | 10           |            | 1.75                 | 3.04                     | 0.09                   |
| 0                  | 90                       | 10           |            | 1.85                 | 3.05                     | 0.30                   |

Table 4
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 20% Cement Content and Sharp Sand.

| Sample Composition | Pulverized Cow Bones (%) | Sharp Sand (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------|--------------------------|----------------|------------|----------------------|--------------------------|------------------------|
| 30                 | 50                       | 20             |            | 1.77                 | 4.16                     | 0.95                   |
| 20                 | 60                       | 20             |            | 1.83                 | 3.01                     | 0.91                   |
| 10                 | 70                       | 20             |            | 1.95                 | 2.26                     | 0.84                   |
| 5                  | 75                       | 20             |            | 2.04                 | 1.30                     | 0.78                   |
| 0                  | 80                       | 20             |            | 2.10                 | 1.50                     | 0.80                   |

Table 5
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 15% Cement Content and Sharp Sand.

| Sample Composition | Pulverized Cow Bones (%) | Sharp Sand (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------|--------------------------|----------------|------------|----------------------|--------------------------|------------------------|
| 30                 | 55                       | 15             |            | 1.85                 | 3.93                     | 0.89                   |
| 20                 | 65                       | 15             |            | 1.86                 | 2.68                     | 0.85                   |
| 10                 | 75                       | 15             |            | 1.92                 | 1.89                     | 0.73                   |
| 5                  | 80                       | 15             |            | 2.08                 | 1.09                     | 0.65                   |
| 0                  | 85                       | 15             |            | 2.12                 | 1.40                     | 0.60                   |

Tables 1–3 shows the mechanical properties of category A paving tiles with 20, 15 and 10% cement addition respectively and mixture of PCB with laterite. Tables 4–6 shows the mechanical properties of category B paving tiles, with 20, 15 and 10% cement addition respectively and mixture of PCB with sharp sand. Tables 7–9 shows the mechanical properties of category C paving tiles with 20, 15, 10% cement addition respectively and mixture of PCB, sharp sand and laterite.
Table 6
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 10% Cement Content and Sharp Sand.

| Sample Composition | Physical and Mechanical Properties |
|-------------------|------------------------------------|
| Pulverized Cow Bones (%) | Sharp Sand (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
| 30 | 60 | 10 | 1.65 | 1.24 | 0.12 |
| 20 | 70 | 10 | 1.72 | 0.92 | 0.12 |
| 10 | 80 | 10 | 1.82 | 0.53 | 0.09 |
| 5 | 85 | 10 | 1.92 | 0.23 | 0.09 |
| 0 | 90 | 10 | 2.01 | 0.22 | 0.10 |

Table 7
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 20% Cement Content, Sharp Sand and Laterite.

| Sample Composition | Physical and Mechanical Properties |
|-------------------|------------------------------------|
| Pulverized Cow Bones (%) | Sharp Sand (%) | Laterite (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
| 30 | 10 | 40 | 20 | 2.45 | 5.05 | 1.83 |
| 20 | 35 | 25 | 20 | 2.54 | 5.05 | 1.79 |
| 10 | 50 | 20 | 20 | 2.62 | 3.41 | 1.75 |
| 5 | 55 | 20 | 20 | 2.65 | 2.42 | 1.70 |
| 0 | 40 | 40 | 20 | 2.60 | 4.68 | 1.80 |

Table 8
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 15% Cement Content, Sharp Sand and Laterite.

| Sample Composition | Physical and Mechanical Properties |
|-------------------|------------------------------------|
| Pulverized Cow Bones (%) | Sharp Sand (%) | Laterite (%) | Cement (%) | Bulk density (g/cm³) | Compressive Strength (MPa) | Flexural Strength (MPa) |
| 30 | 20 | 35 | 15 | 2.42 | 5.05 | 1.21 |
| 20 | 30 | 35 | 15 | 2.50 | 5.04 | 1.09 |
| 10 | 40 | 35 | 15 | 2.57 | 3.04 | 0.90 |
| 5 | 50 | 30 | 15 | 2.62 | 2.40 | 0.86 |
| 0 | 50 | 35 | 15 | 2.68 | 2.84 | 1.05 |

Fig. 1 shows a typical lateritic paving tile produced. Finally, Figs. 2–4 shows the performance of the paving tiles at different cement composition.

2. Experimental Design, Materials and Methods

The pulverized cow bones (PCB) used in this research study consist of waste femurs, scapulurs and ribs of cow procured from an abattoir in Ilorin, Nigeria. They were washed and sun-dried for 4 weeks, to reduce the moisture content and eliminate the organic matter in the marrows of the bones. Thereafter, they were crushed and pulverized using a laboratory ball mill. The properties of other materials such as lateritic soil and sharp sand used are same as used in [1] and were carried out in accordance with the appropriate standards of American society for test and materials standard (ASTM). The pulverized cow bones were mixed with the lateritic soil and sharp sand. Cement satisfying the requirements of ASTM C150/C150M [2] was used as binder in various proportions.
Table 9
Physical and Mechanical Properties of Experimental Lateritic Paving Tiles with 10% Cement Content, Sharp Sand and Laterite.

| Sample Composition | Bulk density (g/cm$^3$) | Compressive Strength (MPa) | Flexural Strength (MPa) |
|--------------------|-------------------------|-----------------------------|-------------------------|
| Pulverized Cow Bones (%) | Sharp Sand (%) | Laterite (%) | Cement (%) | | |
| 30 | 30 | 30 | 10 | 2.40 | 3.08 | 0.26 |
| 20 | 25 | 45 | 10 | 2.46 | 3.05 | 0.12 |
| 10 | 30 | 50 | 10 | 2.53 | 3.36 | 0.05 |
| 5  | 45 | 40 | 10 | 2.58 | 2.38 | 0.08 |
| 0  | 45 | 45 | 10 | 2.50 | 2.34 | 0.10 |

Fig 1. Paving tiles samples.

Percentage composition of cement was chosen, based on literature review, where researchers [3,4] have observed that percentage addition of cement above 20%, will not further improve the mechanical properties of tiles and will be of less economic importance. Therefore, the mixing ratios are indicated in Tables 1–9.

Each paving tile was produced by adopting the method used by Aweda et al., [1] and ASTM C685/C685M [5]. universal tensile machine FS50AT was used in carrying out the compressive and flexural strength of the paving tiles, following ASTM standards [6,7] respectively. Bulk density was carried out in accordance with ASTM C948 [8]. The paving tiles were cured in a curing tank for 28 days.
Fig 2. Engineering properties of paving tiles made with laterite and PCB.

Fig 3. Engineering properties of paving tiles made with sharp sand and PCB.
Fig. 4. Engineering properties of paving tiles made with laterite, sharp sand and PCB.

Ethics Statement

All experiments complied with the ARRIVE guidelines and were carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, EU Directive 2010/63/EU for animal experiments.

Declaration of Competing Interest

None declared.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2020.106511.
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