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Data Article

Ultrasound data for laboratory calibration of an analytical model to calculate crack depth on asphalt pavements

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ABSTRACT

This article outlines the ultrasound data employed to calibrate in the laboratory an analytical model that permits the calculation of the depth of partial-depth surface-initiated cracks on bituminous pavements using this non-destructive technique. This initial calibration is required so that the model provides sufficient precision during practical application. The ultrasonic pulse transit times were measured on beam samples of different asphalt mixtures (semi-dense asphalt concrete AC-S; asphalt concrete for very thin layers BBTM; and porous asphalt PA). The cracks on the laboratory samples were simulated by means of notches of variable depths. With the data of ultrasound transmission time ratios, curve-fittings were carried out on the analytical model, thus determining the regression parameters and their statistical dispersion. The calibrated models obtained from laboratory datasets were subsequently applied to auscultate the evolution of the crack depth after microwaves exposure in the research article entitled "Top-down cracking self-healing of asphalt pavements with steel filler from industrial waste applying microwaves" (Franesqui et al., 2017) [1].

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Specifications Table

Subject area	*Civil Engineering*
More specific subject area	*Pavement Engineering and Maintenance*
Type of data	*Text file, Tables, Figures*
How data was acquired	*Ultrasonic Pulse Velocity (UPV) measurements based on time-of-flight diffraction (TOFD). Ultrasound device: CSI type CCT-4 "concrete tester", cylindrical couplant plate contact (CPC) transducers, 26 mm diameter, 54 kHz. T=20 °C.*
Data format	*Averaged experimental measurements*
Experimental factors	*3 types of hot mix asphalt (HMA): AC-S, BBTM, PA. Crack depths: 10 to 50 mm. Temperature: 20 °C. Ultrasound frequency: 54 kHz.*
Experimental features	*Slab specimens cut in prismatic beam samples. Cracks simulated by means of notches (4–5 mm slot). Samples previously conditioned at 20 °C (4 hours). 10 repeated ultrasonic measurements on each sample under the same experimental conditions (material, sample, crack depth).*
Data source location	*Laboratory of Highway Engineering, Department of Civil Engineering, University of Las Palmas de Gran Canaria (ULPGC), 35017 Las Palmas de Gran Canaria, Canary Islands, Spain, 28°4'11.669"N; 15°27'19.843"W*
Data accessibility	*Data is with this article*

Value of the data

- The data allows verification of the model´s precision and the statistical dispersion of the ultrasound measurements on 3 types of asphalt mixes (AC-S, BBTM and PA). It also becomes a starting point for future research regarding other types of mixtures. Up until now ultrasound transmission time ratios on different types of bituminous mixtures have not been systematically reported.
- It will enable the comparison with data obtained in future research using other ultrasonic transducers (dry point contact [DPC] sensors, different pulse frequencies and baselines).
- The data has facilitated to obtain empirical recommendations for the practical implementation of this non-destructive technique using ultrasounds on asphalt mixtures: pulse frequency and baseline selection, and minimum measurement requirements.

1. Data

The dataset within this article provides averaged values of ultrasonic pulse transit time and velocity measurements (Table 3) and transmission ratios (Table 4) on prismatic laboratory samples of different bituminous mixtures: semi-dense asphalt concrete (AC-S), gap-graded asphalt concrete for very thin layers (AC-TL, also known in Europe as BBTM) and porous asphalt (PA). All of these materials are commonly used in surface layers of asphalt pavements. By means of regression analysis, the aforementioned data was used to calibrate an analytical model in order to determine the depth of a surface-breaking crack on asphalt pavements using ultrasounds (Eq. 6).

2. Materials

Slab specimens ($300 \times 300 \times 60$ mm) of 3 different types of hot mix asphalt (HMA) were prepared: a) semi-dense asphalt concrete (AC 16 surf 50/70 S); b) gap-graded asphalt concrete for very thin layers (BBTM 11B PMB 25/55–65); c) porous asphalt mixture (PA 11 PMB 25/55–65). Given that ultrasonic techniques are non-destructive, these specimens were subsequently used to monitor the self-healing and the evolution of the crack depth after repeated heating cycles