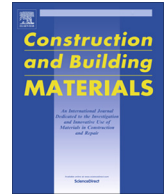




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Complex modulus and fatigue resistance of bituminous mixtures containing hydrated lime



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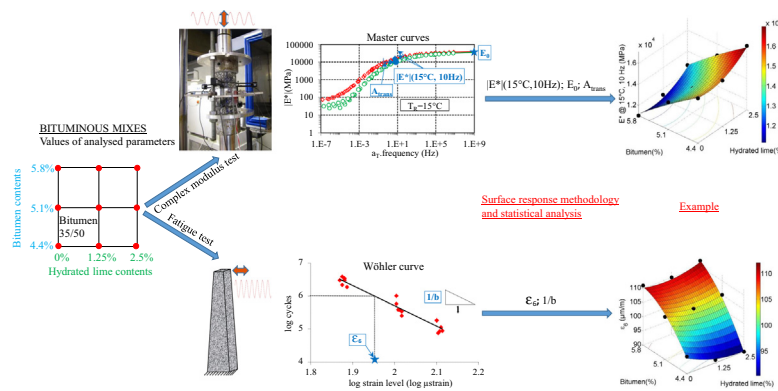
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HIGHLIGHTS

- Effect of hydrated lime on stiffness and fatigue of bituminous mixtures is analyzed.
- Statistical analysis is applied on experimental results.
- Hydrated lime does not influence fatigue parameter ϵ_6 of mixtures.
- Use of hydrated lime filler causes an increase of complex modulus.

GRAPHICAL ABSTRACT



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ABSTRACT

An ongoing study on influence of hydrated lime on mechanical properties of bituminous mixtures is carried out. In this paper we focus on Linear ViscoElastic (LVE) properties and fatigue behavior.

Nine mixtures were produced with the same 35/50 penetration grade bitumen, three different bitumen contents (4.4%, 5.1%, 5.8%) and three different hydrated lime contents (0%, 1.25%, 2.5%). Hydrated lime replaces a part of limestone filler (the mass of removed filler for the same mass of added hydrated lime). LVE properties of mixtures (complex Young's modulus) were determined using a tension/compression test developed at University of Lyon/ENTPE. In the same time, two points bending tests were used to evaluate fatigue resistance.

Surface response methodology and ANOVA (ANalysis Of VAriance) were carried out on experimental data obtained for different responses in order to evaluate the influence of bitumen content and hydrated lime content on linear viscoelastic properties and fatigue resistance.

Time-Temperature Superposition Principle (TTSP) was verified with good approximation using very close shift factors for all tested materials. The use of hydrated lime filler (instead of limestone filler) induces an increase of complex modulus. Its effect increases with hydrated lime content. Hydrated lime does not change fatigue resistance of mixtures.

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1. Introduction

Hydrated lime has been used in bituminous mixtures for a long time in order to increase resistance to moisture damage and frost. However, its effect on complex modulus and fatigue resistance is

still an active research field as demonstrated by the high number of recent publications. Several studies [1–7] researched on the effect of hydrated lime on linear viscoelastic properties of bituminous mixtures. These works showed that the complex modulus of mixtures does not always increase with hydrated lime content

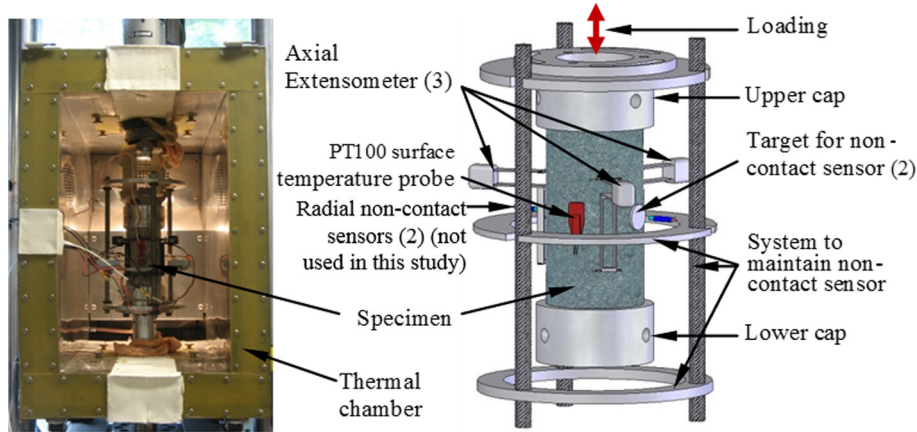


Fig. 1. General view of the experiment (left) and strain measurement system (right) developed at University of Lyon/ENTPE to obtain the axial strain.

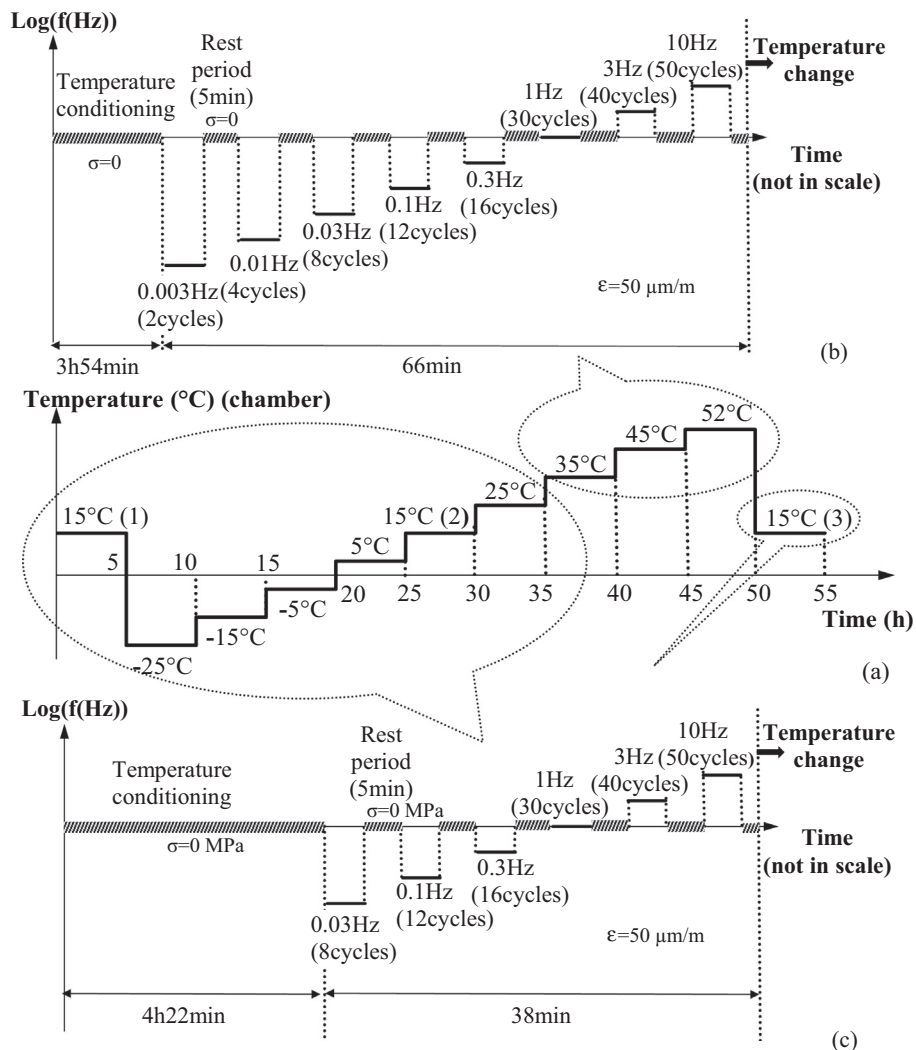


Fig. 2. Temperature chronology of each test (a) and chronology of applied frequencies at each temperature: 35 °C, 45 °C, 52 °C (b) and from 10 °C to 25 °C (c). All cyclic loadings at fixed strain amplitude of 50 μm/m.

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