Proceedings of the
17th SIIV International Summer School
and 5th International SIIV Arena

San Marino, Republic of San Marino
16-20 September 2019

Resilient road infrastructures

Climatic changes and perspective of
road infrastructures

Edited by:
Felice A. Santagata, Honorary President of SIIV, Italy
Antonio Montepara, University of Parma, Italy
Andrea Grilli, University of the Republic of San Marino, San Marino

San Marino University Press

SIIV SUMMER SCHOOL 2019

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Editors wish to thank the speakers and authors for their efforts in producing contributions of high scientific quality and in sharing concepts for the future development of research studies facilitating new international relationships.

Preface

SIIV (Società Italiana Infrastrutture Viarie) is an Italian scientific association that deals with road, railways and airport engineering.

In the field of transportation infrastructures, the aim of SIIV is mainly addressed to promote learning and technical-scientific knowledge, to encourage debates and to establish relationships and strategic experience exchanges with other institutions.

Working as a non-commercial association since 1990, SIIV organises technical committees, research groups, meetings and supports scientific and teaching initiatives, leading to the improvement of knowledge on transportation infrastructures.

The SIIV Summer School takes place every September as a specific event that involves and brings closely into contact the most representative leaders from the academic field and PhD students, research fellows and young researchers to facilitate exchange of skills, discussion and interaction.

The 17th SIIV Summer School was organised by University of Parma, University of the Republic of San Marino and the San Marino state-owned enterprise for public works (Azienda Autonoma di Stato per i Lavori Pubblici, AASLP). The Summer School was sponsored by AASLP, Ecopneus, MARINI-Fayat Group and TEMA experimental laboratory for building materials and organised under the patronage of three international scientific associations (EATA, ISAP TC APE and RILEM) and three government institutions bodies.

As a part of the SIIV Summer School, the SIIV Arena (PhD symposium) represents the platform in which PhD students, young researchers and scholars present their scientific research, inducing interaction and discussion inside the scientific community. The SIIV Arena offers a stage where young researchers paly a leading role promoting ideas and knocking down frontiers in order to exchange knowledge worldwide and extend scientific developments.

The 5th SIIV Arena consisted of selected extended abstracts and presentations on several topics such as life cycle assessment, recycling, crumb rubber modified asphalt binders, eco-friendly modified asphalt

mixture, “green” binder extenders, coloured pavements, information modelling and pavement management system.

The Proceedings of the 5th SIIV Arena intends to be a reference of the newest research topics in the field of transportation infrastructures and offers suggestions for future development of research studies and international relationships.

Contents

Investigation of thermal behaviour of coloured asphalt pavements

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Abstract

Coloured pavement techniques are more and more used in urban areas as traffic calming measures for the pedestrian areas and bike lanes but also as valuable mitigation strategy for the phenomenon of heating concentration through the cities. Along with the mechanical characterization, a consistent knowledge of the thermal behaviour of these materials is needed. The research project on thermal behaviour of coloured pavements undertakes an experimental investigation involving red, yellow, green and blue specimens utilizing mortars and resins for surface treatments, or tinted oxides for the colour modification of the asphalt mixes. The results highlight the contribution of colour in terms of heating processes.

Keywords

Coloured asphalt, thermal behaviour, oxides addition

Introduction

Coloured asphalt pavements could represent an innovative solution to the Urban Heat Island (UHI) phenomenon (i.e. temperature increases in cities) as well as for aesthetic preservation and traffic calming [1, 2]. Important benefits could be obtained with the use of suitable coloured or clear materials in terms of thermic and permeability properties [3]. Coloured or clear road pavements can be built using different materials and techniques such as synthetic transparent binders, modified decoloured bitumens, additives and pigments for mixtures, varnishes and paintings for wearing courses [4].

Experimental project

"Fully-coloured" asphalt concretes were achieved by adding coloured oxides (red or green pellets dosed at 5% by aggregate weight) during the preparation of a dense graded asphalt concrete (AC16) obtained using limestone aggregates and 50/70 penetration-grade bitumen. On the other hand, surface-coloured mixes were obtained by painting the black upper surface of "black" reference AC16 slabs using alternatively mortars or resins for surface treatment.

Thermal performance of studied materials was assessed analysing material responses in terms of simulated in-service temperatures, emissivity and albedo values. Thermic distributions on slabs were recorded by a thermal camera (Figure 1). Experimental setting up was organized to minimize the influence of boundary conditions [5].

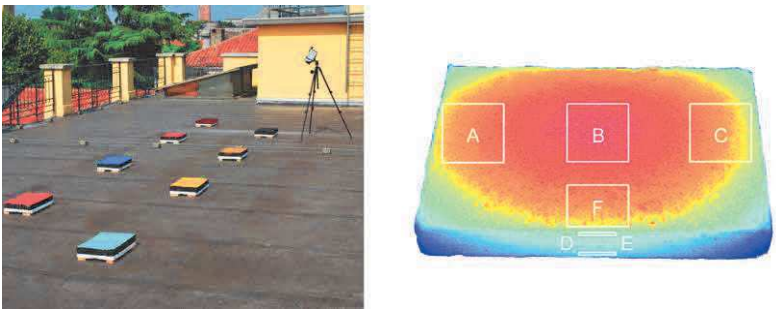

Figure 1. Set up (left), recorded temperature distribution (right) [5]

Findings

Emissivity calibration did not show significant information; inversely, albedo values indicate highest attitude to light rays' reflection for azure mortar slab and yellow resin slab. These findings were in accordance with average thermic trends deduced from in-service monitoring. In this case, highest heat mitigation was reached by azure mortar slab, with lower peak or medium temperatures. In general, results suggested that colour seems more effective with respect to material type in the case of surface treatment, as well as oxide pigments were not strongly able to mitigate heat concentration regardless the colour used (red or green). Thermal analysis suggested that surface colour (rather than material types) provided a sensible contribution to contain in-field surface temperatures. Along with a mechanical characterization, these preliminary findings seem to highlight suitable solutions to achieve thermal-optimized surfaces able to mitigate urban heat island phenomenon.

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