proceedings of the international workshop

from materials modelling to structural performance

edited by

Jorge De Bel Esprit
Mauro Carreia Rodrigues
Algerian Application and Analysis Center
M. J. F. F. de A. Ribeiro
International Workshop

“Fire Design of Concrete Structures – From Materials Modelling to Structural Performance”

Coimbra - Portugal 2007
Proceedings of the International Workshop

“Fire Design of Concrete Structures – From Materials Modelling to Structural Performance”

Copyright © 2008 João Paulo Correia Rodrigues, Gabriel Alexander Khoury and Niels Peter Høj

Edited by:
João Paulo Correia Rodrigues
Gabriel Alexander Khoury
Niels Peter Høj

1st edition
May, 2008

No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work.

ISBN: 978-972-96524-2-4

Published by:
Department of Civil Engineering,
Faculty of Sciences and Technology,
Universidade de Coimbra – Polo II,
Rua Luís Reis Santos,
3030-788 Coimbra,
Portugal.
EXPLOSIVE SPALLING OF CONCRETE UNDER FIRE CONDITIONS

Ulrich Schneider
Professor
Vienna University of Technology

Johannes Horvath
A. PORR AG,
Absberggasse 47,
A-1100 Vienna

Keywords: Tunnel Fire Curve, Impact Resistance, Polypropylene Fibres, Special aggregates, Real scale Tunnel-fire Test

ABSTRACT

During the last decade a series of fire disasters especially in tunnels has shown, that this type of fires is a tremendous risk for users and constructions. On the basis of the increasing public road- and railway traffic and the increase of risks interconnected with it, the importance of constructive structural fire protection in tunnel constructions is a main objective in many countries. Fires in traffic tunnels admittedly are rare, but if fire occurs it causes high damages and in last consequence also life. The lining system of tunnels must be planned in a way that sufficient protection of life safety is guaranteed in the case of a fire on the one hand, and on the other hand the repair measures must be economically justified and the reconstruction of the tunnel must be performed as quickly as possible. Modern lining systems ensure life protection and the application of economical restoration measures. Due to these facts many scientists and institutes are working to find models for the prediction of spalling.

The present paper comprises a small state of the art report only of the thermo-hydraulic process explosive spalling, describes the behaviour of steel- and polypropylene fibre concrete under fire exposure and discusses latest experiences from fire tests in Austria.

*Institut für Hochbau und Technologie, Technische Universität Wien, Karlplatz 13/206, A-1040 Wien, e-mail: ulrich.schneider@tuwien.ac.at
4. CONCLUSIONS

Effect of polypropylene fiber geometry on HSC behaviour under elevated temperature was confirmed through the measurement of pore pressure (P), temperature (T), and mass (M). Maximum pore pressure of 3.82 and 3.66 MPa was observed on Plain and PP-A, while 1.04 MPa at depth of 50 mm was found on PP-B. This concludes that addition of 0.1% by volume of fine polypropylene fiber (d$_f$= 18 mm) was found to be effective in reducing pore pressure, mechanism that mitigate explosive spalling on HSC under elevated temperature condition. Another important finding is difference of maximum temperature between Plain and PP-A, B. This phenomenon could be explained by the result of the endothermic reaction of polypropylene fiber at high temperature. This endothermic reaction of polypropylene fiber also mitigates the explosive spalling. The heating scenario is less severe than the ISO curve which is itself less severe than the hydrocarbon curve found in tunnels and that in these fires the pore pressures may be significantly higher than given in this paper.

REFERENCES


