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PREFACE

On behalf of the Organising and Scientific committees, as well as the CIB W-14 Commission on Fire Safety it is our pleasure to welcome you to the International Fire Safety Symposium - IfireSS 2015, which is organised by the CIB’s Commission W14-Fire Safety, ALBRASCI and University of Coimbra. The Symposium aims to contribute to the exchange of ideas and knowledge in the area of Fire Safety and assist in planning future research activities in this area.

CIB W14-Fire Safety is a Working Commission of CIB (International Council for Research and Innovation in Building & Construction) and its main objectives are:

* To create an ongoing research and innovation focus for the development of a comprehensive, coherent, rational and empirical basis for a safe and sustainable built environment, which includes fire science and engineering practices and design methodologies;
* To promote the acceptance of Fire Science and Engineering Practices, Procedures and Design Methodologies worldwide, and to encourage their use in Building and Fire Safety Legislation, Codes, Regulations and Standards;
* To provide technical input, from a Fire Science and Engineering Perspective, to other relevant CIB Working Commissions and Task Groups;
* To facilitate the transfer of state-of-the-art Fire Science and Engineering Technology at international level;
* To encourage capacity building for Fire Science and Engineering worldwide.

The Luso-Brazilian Association for Fire Safety (ALBRASCI) was established recently by Portuguese and Brazilian specialists in the area of Fire Safety to create a platform for the development of Fire Safety in Portugal and Brazil.

The University of Coimbra (UC) is a reference in higher education and research in Portugal, due to the quality of the courses taught and to the advances achieved in pure and applied research in various areas of knowledge. UC is also well-known around the World due to the research and training in Fire Safety with an MSc and PhD in the area.

The Symposium has participants from researchers around the world and covers a wide variety of research areas including: Structural Fire Safety; Mechanical and Thermal Properties of Materials; Fire Chemistry, Physics and Combustion; Fire Reaction; Fire Safety in Vehicles and Tunnels; Fire Risk Assessment; Smoke Control Systems; Firefighting and Evacuation; and Fire Regulations, Standardization and Construction Trends.

João Paulo C Rodrigues
President of the Organizing Committee

George Hadjisophoces
President of the Scientific Committee
CONTENTS

FIRE SAFETY OF STRUCTURES

LOCALIZED FIRE TESTS ON THE STEEL COLUMNS FOR DIFFERENT CROSS SECTION AND CEILING CONDITIONS
Ali Nadjai, Sanghoon Han, Vassart Olivier and Obiala Renata ......................................................... 5

NUMERICAL MODELS OF COLD FORMED STEEL COLUMNS MADE OF SQUARE TUBULAR SECTIONS SUBJECT TO FIRE
Wagnher C. Rocha, Tiago A. Pires and José J.R. Silva .............................................................................. 7

SHEAR BUCKLING EVALUATION IN STEEL PLATE GIRDER WITH NON-RIGID END POSTS SUBJECTED TO ELEVATED TEMPERATURES
André Reis, Nuno Lopes and Paulo Vila Real .......................................................................................................................... 11

PARTIALLY ENCASED SECTION: STRENGTH AND STIFFNESS UNDER FIRE CONDITIONS
Paulo Piloto, David Almeida, A.B. Ramos-Gavilán and Luis M.R. Mesquita .............................................. 15

RECENT APPLICATION OF EN1993-1-2 IN GERMANY
Martin Mensinger, Florian M. Block, Christian Maiershofer, Rudolf O. Reisch and Walter Borgogno ...................................................................................................................... 19

TEMPERATURES IN BLIND-BOLTS CONNECTIONS TO HOLLOW AND CONCRETE FILLED TUBULAR COLUMNS
Ana M. Pascual and Manuel L. Romero ........................................................................................................... 23

EXPERIMENTAL INVESTIGATIONS ON THE THERMAL AND MECHANICAL BEHAVIOUR OF COMPOSITE COLUMNS WITH MASSIVE STEEL CORE IN FIRE
Peter Schaumann and Inka Kleiboomer ............................................................................................................. 27
ASSESSMENT OF THE SHEAR BEHAVIOUR OF T-SHAPED CONNECTORS AT ELEVATED TEMPERATURES
Luís Laím and João P. C. Rodrigues ................................................................. 95

FIRE TESTS ON SLENDER CONCRETE FILLED TUBULAR COLUMNS SUBJECTED TO LARGE ECCENTRICITIES
Ana Espinos, Manuel L. Romero, Enrique Serra and Vicente Ribero ............................ 99

THERMO-STRUCTURAL ANALYSES OF RC BEAMS IN FIRE
Gabrielis B. M. L. Albuquerque, Valdir Pignatta Silva and João Paulo C. Rodrigues ............. 103

PARAMETERS WITH INFLUENCE ON THE BEHAVIOR OF COMPOSITE TUBULAR COLUMNS SUBJECTED TO FIRE
Tiago A. C. Pires, João P. C. Rodrigues and José J. R. Silva ....................................... 107

FIRE BEHAVIOUR OF TABIQUE WALLS
Alexandre Araújo, Elza Fonseca, Débora Ferreira, Paulo Piloto and Jorge Pinto .................. 109

MECHANICAL RESPONSE OF TWO-LAYERED CURVED REINFORCED CONCRETE BEAM EXPOSED TO NATURAL FIRE CONDITIONS
Dusan Ruzič, Miran Saje, Igor Planinc, Robert Pecenko and Tomaz Hozjan ....................... 113

ASSESSMENT OF THE INFLUENCE OF THE VENTILATION IN ADVANCED FIRE MODELS
Izabela Hager and Tomasz Tracz ............................................................................. 117

MECHANICAL AND THERMAL PROPERTIES OF MATERIALS
STRESS REDISTRIBUTION ALONG POST-INSTALLED REBARS UNDER NON-UNIFORM TEMPERATURE LOADING
Nicolas Pinoteau, Sébastien Rémond, Pierre Pimienta and Thierry Guillet ................................ 123

COMPRESSIVE STRENGTH OF FIBRE CONCRETES WITH ENHANCED FIRE BEHAVIOR
Hugo Caetano, João P. C. Rodrigues and Armando M. Junior ......................................... 125

DETERMINATION OF WOOD THERMAL CONDUCTIVITY
Eduardo Schneid, Carolina de Rosa and Poliana D. Moraes ............................................. 127

ULTRASONOGRAPHY APPLIED TO DETERMINE THE CONCRETE RESISTANCE UNDER A FIRE CONDITION
Armando L. M. Junior, Nádia S. Veiga, Carolina A. N. Alvim, André A. Garcia, Maria C. D. Relvas and Rafaela Monteﬁsuo ................................................................. 131

FIRE BEHAVIOUR OF LIGHTWEIGHT CONCRETE UNITS BASED ON CORN COB AGGREGATE
Nuno Alves, Paulo Piloto, Elza Fonseca, Luisa Barreira, Débora Ferreira and Jorge Pinto ...... 133

THE RELATIONS BETWEEN THE ASSESSED DIAGNOSTIC PARAMETERS AND MECHANICAL PROPERTIES OF HEATED CONCRETES
Izabela Hager and Tomasz Tracz ............................................................................. 135

COMPRESSIVE BEHAVIOUR OF A TIRE RECYCLED STEEL AND TEXTILE FIBER CONCRETE SUBJECTED TO FIRE
Cristina C. Santos and João P. Rodrigues .................................................................. 137

EXPERIMENTAL RESEARCH ON THE RESIDUAL MECHANICAL PROPERTIES OF AN ORDINARY CONCRETES AFTER FIRE
Cristina C. Santos and João P. Rodrigues .................................................................. 141

EXPERIMENTAL ANALYSIS ON THE COMPRESSIVE STRENGTH AT HIGH TEMPERATURES OF A CONCRETE WITH PET CHIPS
Hugo Caetano, João P. Rodrigues and Pierre Pimienta .................................................. 145
ASSESSMENT OF THE SHEAR BEHAVIOUR OF T-SHAPED CONNECTORS AT ELEVATED TEMPERATURES
Luís Laím and João P.C. Rodrigues

FIRE TESTS ON SLENDER CONCRETE FILLED TUBULAR COLUMNS SUBJECTED TO LARGE ECCENTRICITIES
Ana Espíos, Manuel L. Romero, Enrique Serra and Vicente Ribero

THERMO-STRUCTURAL ANALYSES OF RC BEAMS IN FIRE
Gabriela B.M.L. Albuquerque, Valdir Pignatta Silva and João Paulo C. Rodrigues

PARAMETERS WITH INFLUENCE ON THE BEHAVIOR OF COMPOSITE TUBULAR COLUMNS SUBJECTED TO FIRE
Tiago A.C. Pires, João P.C. Rodrigues and José J.R. Silva

FIRE BEHAVIOUR OF TABIQUE WALLS
Alexandre Araújo, Elza Fonseca, Débora Ferreira, Paulo Piloto and Jorge Pinto

MECHANICAL RESPONSE OF TWO-LAYERED CURVED REINFORCED CONCRETE BEAM EXPOSED TO NATURAL FIRE CONDITIONS
Dusan Ruzio, Miran Saje, Igor Planinc, Robert Pederson and Tomaz Hozjan

ASSESSMENT OF THE INFLUENCE OF THE VENTILATION IN ADVANCED FIRE MODELS
Izabela Hager and Tomasz Tracz

RESCAN AND THERMAL PROPERTIES OF MATERIALS
Stress Redistribution Along Post-Installed Rebars Under Non-Uniform Temperature Loading
Nicolas Pinoteau, Sébastien Rémond, Pierre Pimienta and Thierry Guillet

COMPRESSIVE STRENGTH OF FIBRE CONCRETES WITH ENHANCED FIRE BEHAVIOR
Hugo Caetano, João P.C. Rodrigues and Armando M. Junior

DETERMINATION OF WOOD THERMAL CONDUCTIVITY
Eduardo Schneid, Carolina da Rosa and Poliana D. Moraes

ULTRASONOGRAPHY APPLIED TO DETERMINE THE CONCRETE RESISTANCE UNDER A FIRE CONDITION
Armando L.M. Junior, Nádia S. Veiga, Carolina A.N. Alvim, André A. Garcia, Maria C.D. Relvas and Rafaela Montefusco

FIRE BEHAVIOUR OF LIGHTWEIGHT CONCRETE UNITS BASED ON CORN COB AGGREGATE
Nuno Alves, Paulo Piloto, Elza Fonseca, Luísa Barreira, Débora Ferreira and Jorge Pinto

THE RELATIONS BETWEEN THE ASSESSED DIAGNOSTIC PARAMETERS AND MECHANICAL PROPERTIES OF HEATED CONCRETES
Izabela Hager and Tomasz Tracz

COMPRESSIVE BEHAVIOUR OF A TIRE RECYCLED STEEL AND TEXTILE FIBER CONCRETE SUBJECTED TO FIRE
Cristina C. Santos and João P. Rodrigues

EXPERIMENTAL RESEARCH ON THE RESIDUAL MECHANICAL PROPERTIES OF AN ORDINARY CONCRETES AFTER FIRE
Cristina C. Santos and João P. Rodrigues

EXPERIMENTAL ANALYSIS ON THE COMPRESSIVE STRENGTH AT HIGH TEMPERATURES OF A CONCRETE WITH PET CHIPS
Hugo Caetano, João P. Rodrigues and Pierre Pimienta
FIRE CHEMISTRY, PHYSICS AND COMBUSTION

A DESIGN FIRE MODEL FOR THE FULL PROCESS OF FIRE
Xia Zhang, Xiao Li and George Hadjisophocleous
................................................................................................................. 149

TOXIC GAS ANALYSIS FROM COMPARTMENT FIRES USING HEATED RAW GAS
SAMPLING WITH HEATED FTIR 50+ SPECIES GAS ANALYSIS
Abdulaziz A. Alarj, Herodotos N. Phylaktou and Gordon E. Andrews
................................................................................................................. 153

NUMERICAL SIMULATION OF VAPOUR CLOUD FIRES USING FLACS-FIRE
Deiveegan Muthusamy and Kees van Wingerden
................................................................................................................. 157

IMPACT OF WOOD FIRE LOAD ON TOXIC EMISSIONS IN VENTILATION CONTROLLED
COMPARTMENT FIRES
Bintu G. Mustafa, Gordon E. Andrews, Herodotos N. Phylaktou, Ayesh AlShammi, Vishal Shah
and Omar A.O. Aljumaiah
................................................................................................................. 159

THE EFFECT OF USING LIDS IN DIFFERENTIAL SCANNING CALORIMETER
EXPERIMENTS FOR DETERMINING THE HEAT OF REACTION OF WOOD
Xiaoyun Wang, Charles Fleishmann and Michael Spearpoint
................................................................................................................. 161

INVERSE MODEL FOR DETERMINING HEAT RELEASE RATES
Qianru Guo, Alvaro Salinas and Ann E. Jeffers
................................................................................................................. 165

TOXIC GASES FROM COMPARTMENT FIRES WITH HANGING COTTON TOWELS AND
LOW VENTILATION
Gordon E. Andrews, Paul Yeomans and Herodotos N. Phylaktou and Omar A. Aljumaiah
................................................................................................................. 169

ANALYSIS OF A NEW PLATE THERMOMETER - THE COPPER DISC PLATE
THERMOMETER
Alexandra Byström, Oskar Lind, Erika Palmkvist, Peter Jönsson and Ulf Wickström
................................................................................................................. 171

XIV

FIRE REACTION

NUMERICAL INVESTIGATION ON THE EFFECT OF SIDEWALLS AND OPENING
GEOMETRY ON WINDOW EJECTED FACADE FLAMES
M. Duny, D. Dhima, J.P. Garo, H.Y. Wang and B. Martinez-Ramirez
................................................................................................................. 177

BURNING OF POLYURETHANE FOAM CLOSE TO A WALL AND A CORNER DEPENDING
ON SEPARATION DISTANCE
Junghoon Ji, Kazunori Harada, Yoshifumi Ohmiya, Masaki Noaki and Yichul Shin
................................................................................................................. 181

THE APPLICATION OF DIFFERENT COMPONENT SCHEMES TO PREDICT WOOD
PYROLYSIS AND FIRE BEHAVIOUR
Xiaoyun Wang, Charles Fleishmann and Michael Spearpoint
................................................................................................................. 185

BURNING OF POLYURETHANE FOAM BLOCK IN ISO ROOM COMPARTMENT
Kazunori Harada, Ken Matsuyama, Kazuhiro Ido, Masaaki Noski, Sungchan Lee and
Jaeyoung Lee
................................................................................................................. 189

NUMERICAL MODELING OF A VERTICAL WALL FIRE
M. Duny, D. Dhima, J.P. Garo, H.Y. Wang, and B. Martinez-Ramirez
................................................................................................................. 193

FIRE SPREAD RESULTED FROM BURNING A DOUBLE-SKIN FACADE DEMONSTRATION
RIG
Nadia C.L. Chow
................................................................................................................. 195

TESTS ON INTUMESCENT PAINTS FOR FIRE PROTECTION OF EXISTING STEEL
STRUCTURES
Antonio Bilotta, Donatella de Silvia, Emidio Nigro and Luca Ponticelli
................................................................................................................. 199

XV
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE CHEMISTRY, PHYSICS AND COMBUSTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A DESIGN FIRE MODEL FOR THE FULL PROCESS OF FIRE</td>
<td>Xia Zhang, Xiao Li and George Hadjipanayotou</td>
<td>149</td>
</tr>
<tr>
<td>TOXIC GAS ANALYSIS FROM COMPARTMENT FIRES USING HEATED RAW GAS</td>
<td>Abdulsalit Alarif, Herodotos N. Phylaktou and Gordon E. Andrews</td>
<td>153</td>
</tr>
<tr>
<td>SAMPLING WITH HEATED FTIR 50+ SPECIES GAS ANALYSIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMPACT OF WOOD FIRE LOAD ON TOXIC EMISSIONS IN VENTILATION CONTROLLED</td>
<td>Deiveegan Muthusamy and Kees van Wingerden</td>
<td>157</td>
</tr>
<tr>
<td>COMPARTMENT FIRES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE EFFECT OF USING LIDS IN DIFFERENTIAL SCANNING CALORIMETER</td>
<td>Xiaoyun Wang, Charles Fleishmann and Michael Spearpoint</td>
<td>161</td>
</tr>
<tr>
<td>EXPERIMENTS FOR DETERMINING THE HEAT OF REACTION OF WOOD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INVERSE MODEL FOR DETERMINING HEAT RELEASE RATES</td>
<td>Quanru Guo, Alvaro Salinas and Ann E. Jeffers</td>
<td>165</td>
</tr>
<tr>
<td>TOXIC GASES FROM COMPARTMENT FIRES WITH HANGING COTTON TOWELS AND</td>
<td>Gordon E. Andrews, Paul Yeomans and Herodotos N. Phylaktou and Omar A.</td>
<td>169</td>
</tr>
<tr>
<td>LOW VENTILATION</td>
<td>Aljumahial</td>
<td></td>
</tr>
<tr>
<td>ANALYSIS OF A NEW PLATE THERMOMETER - THE COPPER DISC PLATE</td>
<td>Alexandra Byström, Oskar Lind, Erika Palmkvist, Petter Jönsson and Ulf</td>
<td>171</td>
</tr>
<tr>
<td>THERMOMETER</td>
<td>Wickström</td>
<td></td>
</tr>
<tr>
<td>FIRE REACTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMERICAL INVESTIGATION ON THE EFFECT OF SIDEWALLS AND OPENING</td>
<td>M. Duny, D. Dhima, J.P. Garo, H.Y. Wang and B. Martinez-Ramirez</td>
<td>177</td>
</tr>
<tr>
<td>GEOMETRY ON WINDOW EJECTED FACADE FLAMES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BURNING OF POLYURETHANE FOAM CLOSE TO A WALL AND A CORNER DEPENDING</td>
<td>Junghoon Je, Kazunori Harada, Yoshihiro Ohmiya, Masaki Noaki and Yichul</td>
<td>181</td>
</tr>
<tr>
<td>ON SEPARATION DISTANCE</td>
<td>Shin</td>
<td></td>
</tr>
<tr>
<td>THE APPLICATION OF DIFFERENT COMPONENT SCHEMES TO PREDICT WOOD</td>
<td>Xiaoyun Wang, Charles Fleishmann and Michael Spearpoint</td>
<td>185</td>
</tr>
<tr>
<td>PYROLYSIS AND FIRE BEHAVIOUR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BURNING OF POLYURETHANE FOAM BLOCK IN ISO ROOM COMPARTMENT</td>
<td>Kazunori Harada, Ken Matsuyama, Kazuhiko Ido, Masaki Noaki, Sungchan</td>
<td>189</td>
</tr>
<tr>
<td>Lee and Jeeyoung Lee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMERICAL MODELING OF A VERTICAL WALL FIRE</td>
<td>M. Duny, D. Dhima, J.P. Garo, H.Y. Wang, and B. Martinez-Ramirez</td>
<td>193</td>
</tr>
<tr>
<td>FIRE SPREAD RESULTED FROM BURNING A DOUBLE-SKIN FACADE DEMONSTRATION</td>
<td>Nadia C.L. Chow</td>
<td>195</td>
</tr>
<tr>
<td>RIG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TESTS ON INTUMESCENT PAINTS FOR FIRE PROTECTION OF EXISTING STEEL</td>
<td>Antonio Bilotta, Donatella de Silva, Emidio Nigro and Luca Ponticelli</td>
<td>199</td>
</tr>
<tr>
<td>STRUCTURES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SMOKE CONTROL

ROAD TUNNEL - FIRE AND EVACUATION SCENARIO CASE STUDY
Dirceu Santos, João P. Rodrigues and Jorge Saraiva

SCALE MODEL EXPERIMENTS ON SMOKE MOVEMENT IN A TILTED TUNNEL
S.I. Tsang, W.K. Chow and Gigi C.H. Lui

FULL-SCALE TESTS AND CFD MODELLING TO INVESTIGATE THE EFFECT OF DIFFERENT MAKE-UP AIR VELOCITIES ON SMOKE LAYER HEIGHT IN ATRIUM FIRES
Amir Rafinazarí and George Hadjisophocleous

FULL-SIZE EXPERIMENTS OF AIR CURTAINS FOR SMOKE CONTROL IN CASE OF FIRE
João Carlos Viegas and Hildebrando Cruz

FIRE RISK ASSESSMENT

THE EFFECTS OF CONSTRUCTION TYPE AND ACTIVE FIRE PROTECTION OPTION ON THE OVERALL BUILDING FIRE RISK
Xiao Li, Xia Zhang and George Hadjisophocleous

SENSITIVITY ANALYSIS OF SIMULATION PARAMETERS FOR FIRE RISK ASSESSMENT
Damien Lamalle, Pierre Carlotti, Richard Perkins and Pietro Salizzoni

FIRE RISK OF HORIZONTAL WOODEN STRUCTURES FULL SCALE VERIFICATION
Petr Hejtmanek, Luciano M. Bezzerra and George C. B. Braga

FIRE RISK ASSESSMENT OF INDUSTRIAL BUILDINGS - PARAMETERS THAT MAY HAVE INFLUENCE
Cecília Barra, João P. Rodrigues and Robert Fitzgerald

EVACUATION AND FIREFIGHTING

THE EFFECTIVENESS OF FIRE EXITS IN COMPLEX BUILDINGS - A WAYFINDING EXPERIMENT
Rosana Ono, Katia B.R. Moreira, Tomaz P. Leiras and Gilberto L. Camanho

METHODOLOGY TO VALIDATE THE 'FASTER IS SLOOWER' CONCEPT
César Martín-Gómez, Iker Zuriguel, Natalia Mambrilla, Ángel García-Martín and Martín Pastor

PARAMETERS FOR BREATHING PROTECTION EQUIPMENT CONSUMPTION: CONTRIBUTION FROM AN EXPERIMENTAL PROTOCOL
Cristiano Corrêa, Anderson S. Castro, Aline Talcido, George C. Braga, José J.R. Silva and Tiago A.C. Pires

MULTICRITERIA EVALUATION OF EFFICIENCY IN THE URBAN FIREFIGHTING
José P. Lopes, Carlos H. Antunes and João P. Rodrigues

FIRE REGULATIONS, STANDARDIZATION AND CONSTRUCTION TRENDS

A FRAMEWORK FOR SYSTEMATIC DEVELOPMENT OF FIRE SCENARIOS AND QUANTIFIED DESIGN BASIS FIRES
Ian Jutras, Brian Meacham and Beth Tubbs

EXPERIMENTAL PLAN FOR ASSESSING FIRE PERFORMANCE OF SELECT ‘GREEN’ BUILDING FEATURES AND TECHNOLOGIES
Drew Martin, Brian Meacham and Nicholas Dembsey

RELIABILITY-BASED EQUIVALENT FIRE DURATION FOR CONCRETE ELEMENTS EXPOSED TO NATURAL FIRES
Ruben Van Cred, Robby Caspeele and Luc Taerwe
IMPORTANCE OF ACCOUNTABILITY IN BUILDING CONTROL: A CASE STUDY
Amaya Osacar and Juan Echeverria

RELIABILITY CENTERED MAINTENANCE APPROACH TO INSPECTION, TESTING, AND MAINTENANCE OF FIRE PROTECTION SYSTEMS AND EQUIPMENT
Lonny Simonian

COMMENTS TO EUROPEAN CODE PROVISIONS FOR CONCRETE MODULUS OF ELASTICITY AT ELEVATED TEMPERATURES
Izabela Hager and Katarzyna Krzemień

Hot Disk AB develops and provides scientific instruments for measuring and testing thermal conductivity, thermal diffusivity and specific heat capacity. Solids and liquids, including powders, pastes, foams and laminates can readily be analysed. With any of the flexible and robust Hot Disk systems, testing thermal properties is accurate, fast and non-destructive. All Hot Disk instruments utilize the Transient Plane Source (TPS) technique, described in ISO 22007-2, and they all test small samples from the single millimetre scale and up.

The instruments are tailored to application specifications, temperature ranges etc. Currently up to nine measurement modules are available, including: Isotropic Standard, One-Dimensional, Anisotropic, Slab, Thin Film, Specific Heat Capacity, Structural Probe, Low-Density/Highly-Insulating and Automation modules.

In combination with the unique Hot Disk sensors, the TPS instruments constitute the most robust and flexible systems for analysing thermal properties currently available on the market.
IMPORTANCE OF ACCOUNTABILITY IN BUILDING CONTROL: A CASE STUDY.
Amaya Osácar and Juan Echeverria
261

RELIABILITY CENTERED MAINTENANCE APPROACH TO INSPECTION, TESTING, AND MAINTENANCE OF FIRE PROTECTION SYSTEMS AND EQUIPMENT
Lonny Simonian
265

COMMENTS TO EUROPEAN CODE PROVISIONS FOR CONCRETE MODULUS OF ELASTICITY AT ELEVATED TEMPERATURES
Izabela Hager and Katarzyna Krzemień
267

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In combination with the unique Hot Disk sensors, the TPS instruments constitute the most robust and flexible systems for analysing thermal properties currently available on the market.
The elevation of the external temperature of a concrete structure, for example as in a fire situation, results in a resistance reduction of the material and makes it subject to chipping. This shows the importance of a structural evaluation after a fire, and based on this problem a hypothesis is formed for obtaining a module of elasticity by non-destructive methods. An evaluation of the dynamic module of the concrete was obtained using the non-destructive method of ultrasonography (Figure 1) and compared to the module of static elasticity obtained by normal compression.

Figure 1, Ultrasonography test.

PREPARATION

To simulate a fire, 24 cylindrical test samples of 15cm X 30cm were used. These were separated in groups of 4 test samples, one group was tested under no heat and the others were tested in an oven under distinct temperatures: 150 degrees C, 300C, 500C, 700C and 900C. After heating the samples passed for the tests of ultrasonography and compression for obtaining the elastic modulus.

CONCLUSIONS

The correlation between the modules of dynamic elasticity and static obtained for the various groups, presented correlation coefficient of 0.99. The results showed that the temperature above 500C reduced more than 90% of concrete’s resistance. It also concludes that through the elasticity module obtained by ultrasonography it is possible to estimate the temperature reached during the fire.
On the other hand, corn cob has also been proposed as an alternative aggregate for the manufacturing of lightweight concrete for non-structural applications. In these cases, there is an additional advantage because these organic products are treated as agricultural waste.

In this research work, lightweight concrete unit based on granulate of corn cob (LWCUGC) is proposed as an alternative building material. Granulate of corn cob works as a substitute of the current applied aggregates such as expanded clay. The adopted geometrical and size typologies, composition and manufacturing technology are similar to the ones currently applied in lightweight concrete unit based on expanded clay (LWCUEC). Therefore, this type of unit is used as reference in this study. Taking into account that partition walls are a potential building scenario in terms of the application of the LWCUGC the respective fire behaviour is fundamental to know. The main goal of this research work consists on giving a contribution in this context by performing an experimental and a numerical analysis of the proposed building material under specific fire conditions. Thus, samples of LWCUGC and LWCUEC were tested under fire conditions related to the standard fire curve indicated in ISO 834. The obtained experimental results allow understanding the behaviour of the units under severe fire conditions and also comparing the two types of solutions. In addition, these results are also used to validate the proposed numerical model of the fire behaviour of the units. Figure 1 shows the experimental test set-up and the numerical results at the end of the fire exposure.

Figure 1: Experimental test: thermocouples, oven fire resistance and numerical results.

2. CONCLUSIONS

According to [1], both LWCUGC and LWCUEC have shown adequate fire behaviour because the fire failure criterion was verified in both cases. In fact, the outer face of the wall (which was not exposed to fire) showed adequate performance and fire resistance. The integrity at 180°C limit temperature was verified under a fire exposure during 4330s and 5004s.

3. REFERENCES


Keywords: NDT, rebound hammer, UPV, concrete assessment, high temperature.

1. INTRODUCTION

The research was concerned with determination of concrete damage caused by the action of fire using selected diagnostic methods. High temperature results in gradual dehydration of cement paste and its cracking, which contributes to deterioration of mechanical properties [1, 2]. The extent of damage as well as the thickness of the damaged layer is assessed using in situ and laboratory methods [3, 4, 5]. This paper presents an evaluation of the suitability of the rebound hammer and ultrasonic pulse velocity method used to ascertain the condition of concrete subjected to the temperature characteristic of fire. The research aimed at determining the changes of some selected properties (density, compressive strength, splitting tensile