# Fire Spalling Workshop 2019 Programme

## Day 1: 19 September 2019 (Thursday)

### Lecture Theatre 3, The Diamond

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Topic</th>
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<tr>
<td>08:00-09:00</td>
<td>Registration</td>
<td>Registration and Welcome Drink Reception at The Diamond</td>
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<tr>
<td>09:00-09:20</td>
<td>Opening Ceremony</td>
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</table>
| 09:20-09:40| Keynotes  | An update on the activities of the RILEM Technical Committee 256-SPF: Spalling of concrete due to fire: testing and modelling  
Pierre Pimienta  
CSTB, France  
Robert Jansson McNamee  
Brandskyddslaget, Sweden  
10:40-10:40 An update on the revisions of Eurocode 1992-1-2  
Jenny Burridge  
The Concrete Centre, UK |
| 10:40-11:00| Group Photo |                                    |
| 11:00-11:20| Coffee Break |                                    |
Kevin Mueller¹, Stephen Stacey², Anthony Bentivegna²  
¹ Thornton Tomasetti, USA  
² Jensen Hughes, USA |
| 11:35-11:50| Session 2: | Mitigation of fire-induced spalling of concrete using recycled tyre polymer fibre  
Yifan Li¹, Shan-Shan Huang¹, Kyros Pilakoutas¹, Harris Angelakopoulos², Ian Burgess¹  
¹ The University of Sheffield, UK  
² Twincon Ltd, UK |
| 11:50-12:05| | Experimental study of the spalling behaviour of ultra-high performance fibre reinforced concrete during fire  
Martin Schneider¹, Aljoša Šajna²  
¹ Carinthia University of Applied Sciences, Austria  
² Slovenian National Building and Civil Engineering Institute, Slovenia |
| 12:05-12:20| | Investigation of size effects in concrete spalling  
André Klimek, Sascha Hothan, Andreas Rogge  
Bundesanstalt für Materialforschung und -prüfung, Germany |
| 12:20-12:35| | Effect of geometry in concrete spalling risk subjected to high temperatures for thermal inertia studies  
Tamara Lucio-Martin, Javier Puentes, Maria Cruz Alonso  
Eduardo Torroja Institute for Construction Sciences (IETcc-CSIC), Spain |
| 12:35-12:50| | In situ concrete spalling risk assessment in tunnel by means of a mobile oil-fired furnace  
Dominique Pardon¹, Pierre Pimienta¹, Benoît-Louis Marie-Jeanne¹, Stéphane Hameury¹, Nicolas Pinoteau¹, Bérénice Moreau², Laetitia D'aloia Schwartzentruber³, Catherine Larive³, Pierre Peyrac¹, Xavier Thollard⁴  
¹ CSTB, France  
² CETU, France  
³ DRIEA-IF, France  
⁴ SETEC Bâtiment, France |
<p>| 12:50-13:50| Lunch |                                    |</p>
<table>
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<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Authors</th>
<th>Institutions</th>
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| 13:50-14:05  | Session 3:                                                                 | Spalling Tests                                                       | Investigation of the preventive effect on fire spalling of natural jute fibre in high performance concrete through ring-restrained specimen tests | Mitsuo Ozawa, Makiho Sukekawa, Haruka Akasaka  
Gunma University, Japan                                                      |
| 14:05-14:20  |                                                                                      | Fire-related spalling evaluation of ring-restrained polymer cement mortar | Yusuke Sugino, Mitsuo Ozawa, Toru Tanibe  
1 Taiheiyo Materials, Japan  
2 Gunma University, Japan                                                  |
| 14:20-14:35  |                                                                                      | Spalling behaviour of UHPC with modified microstructure due to fire load | Johannes Kirnbauer  
Vienna University of Technology, Austria                                               |
| 14:35-15:05  |                                                                                      | Australian large scale structural fire test facility for concrete tunnel linings | Maurice Guerrieri, Sam Fragomen, Carlos Sanabria, Wei Ming Lee, Esteban Pazmino  
1 Victoria University, Australia  
2 National University of Singapore, Singapore                                     |
| 15:05-15:20  |                                                                                      | Laboratory fire testing on tunnel segments : Suez canal tunnels case | Pierre Pimienta, Martin Doll, Dimitrios Rizos, Mahmoud Shamma, Benoît-Louis Marie-Jeanne, Philippe Rivillon, Ménad Chenaf, Mourad Bakhoun, Ahmed Fouda, Tarek Gewaily, Yehia Hussein, Tarik Youssef, Sameh Saad, Tarek Amin  
1 CSTB, France; 2 Arcadis ESG, France; 3 Orascom Constructions, Egypt  
4 The Petroleum Projects & Technical Consultations co., Egypt; 5 Cairo University, Egypt  
6 National Authority for Tunnels, Egypt  
7 Engineering Authority for the Egyptian Armed Force, Egypt  
8 National Research Center, Egypt; 9 L’Université Française d’Egypte, Egypt  
10 Arab Consulting Engineers, Egypt                                           |
| 15:20-15:45  |                                                                                      | Coffee Break                                                          |                                                                                                 |
| 15:45-16:00  | Session 4:                                                                                 | High Temperature Testing of Concrete                                  | Influence of the chemical and physical properties of hardened cement paste on the fire-induced spalling of concrete | Jochen Reiners, Christoph Müller  
Research Institute of the Cement Industry, Germany                             |
| 16:00-16:15  |                                                                                      | Heat-induced concrete spalling of new and aged concrete encased steel columns in hydrocarbon pool and jet fires | Holly Warren, David Wickham  
AkzoNobel, UK                                                                    |
| 16:15-16:30  |                                                                                      | Evolution of thermal conductivity on CAC concrete at high temperatures and during thermal fatigue tests | Tamara Lucio-Martin, Maria Cruz Alonso, Marta Roig-Flores, Luis Guerreiro  
1 Eduardo Torroja Institute for Construction Sciences (IETcc-CSIC), Spain  
2 Universitat Politècnica de València, Spain  
3 University of Evora, Portugal                                                |
| 16:30-16:45  |                                                                                      | Transport and reconfiguration of moisture in HPC due to unilateral heating | Ludwig Stelzner, Frank Weise, Tyler Oesch, Raphael Dlugosch, Bartosz Powierza  
1 Bundesanstalt für Materialforschung und -prüfung, Germany  
2 Leibniz Institute for Applied Geophysics, Germany                          |
| 18:00-21:00  |                                                                                      | Banquet Dinner at Kelham Island Museum                               |                                                                                                 |
### Day 2: 20 September 2019 (Friday)

**Lecture Theatre 3, The Diamond**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 5: Effect of Spalling on Fire Resistance (10:00-10:15)</th>
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<tbody>
<tr>
<td>10:00-10:15</td>
<td>Effect of loss of concrete cover on the fire resistance of reinforced concrete (RC) beams: Numerical study using fiber beam-column element</td>
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</tbody>
</table>
|               | *Hitesh Lakhani, Jan Hofmann*  
|               | *University of Stuttgart, Germany* |

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<tr>
<th>Time</th>
<th>Session 6: Modelling (11:30-12:30)</th>
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<tbody>
<tr>
<td>11:30-11:45</td>
<td>Concrete spalling failure: a coupled buckling instability and crack failure analytical model</td>
</tr>
</tbody>
</table>
|               | *Matteo De Poli*, *Kees Blom*, *Bas Lottman*  
|               | *Flour Infrastructure, Netherlands*  
|               | *Delft University of Technology, Netherlands*  
|               | *Municipality of Rotterdam, Netherlands*  
|               | *Witteveen+Bos, Netherlands* |
| 11:45-12:00   | Open issues in modelling concrete at high temperature |
|               | *Benedikt Weber*  
|               | *Empa, Switzerland* |
| 12:00-12:15   | The effect of micro-structural mechanisms on the macro-level behaviour of cementitious materials at elevated temperatures |
|               | *Jiayi Wang, Colin T Davie, Enrico Masoero*  
|               | *Newcastle University, UK* |
| 12:15-12:30   | Flash vaporization next to an opening crack: a possible explanation of the explosive nature of concrete spalling |
|               | *Roberto Felicetti*, *Ramin Yarmohammadian*, *Stefano Dal Pont*, *Alessandro Tengattini*  
|               | *Politecnico di Milano, Italy*  
|               | *Université Grenoble Alpes, France*  
|               | *Institut Laue-Langevin, France* |

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<tr>
<th>Time</th>
<th>Session 7: Other Research Topics (13:40-14:40)</th>
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<tr>
<td>13:40-13:55</td>
<td>Correlation between concrete tensile strength and intrinsic permeability towards the evaluation of spalling susceptibility</td>
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|               | *Johann van der Merwe*, *Fangxia Lu*, *Mario Fontana*  
|               | *ETH Zürich, Switzerland*  
| 13:55-14:10   | Assessing spalling risk in buildings: Considering spalling in probabilistic fire safety design |
|               | *Ieuan Rickard*, *Ian Fu*, *Danny Hopkin*, *Luke Bisby*  
|               | *OFR Consultants, UK*  
|               | *The University of Edinburgh, UK*
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<tr>
<th>Time</th>
<th>Session 8: Protective Measures</th>
<th>Presentation</th>
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</table>
| 14:10-14:25  | 14:10-14:15                      | Thermal and mechanical response of reinforced concrete slabs under natural and standard fires  
|              |                                  | *Siyimane Mohaine*\(^1\), *Nataša Kalaba*\(^1\), *Jean-Marc Franssen*\(^2\), *Luke Bisby*\(^3\), *Alastair Bartlett*\(^4\), *Jean-Christophe Mindeguia*\(^5\), *Robert McNamee*\(^6\), *Jochen Zehfuss*\(^7\), *Fabienne Robert*\(^8\)  
|              |                                  | \(^1\)Université de Pau et des Pays de l’Adour, France  
|              |                                  | \(^2\)Lège University, Belgium  
|              |                                  | \(^3\)The University of Edinburgh, UK  
|              |                                  | \(^4\)University of Bordeaux, France  
|              |                                  | \(^5\)Brandskyddslaget, Sweden  
|              |                                  | \(^6\)IBMB, Germany  
|              | 14:25-14:40                      | Atomic structural evolution of calcium-containing alkali-activated metakaolin exposed to fire conditions  
|              |                                  | *Karina Alventosa*, *Claire E. White*  
|              |                                  | *Princeton University, USA*  
| 14:40-15:00  | Coffee Break                     |                                                                                |
| 15:00-15:15  | 15:00-15:15                      | Application of laminated ferrocement, high tensile laminated ferrocement and cellular concrete to fire prevention and fire restoration of concrete structures  
|              |                                  | *Michael Pemberton*\(^1\), *Alasdair Beal*\(^2\), *Anthony Tucker*\(^1\), *Paul Nedwell*\(^1\), *Martin Pullan*\(^1\)  
|              |                                  | \(^1\)Trafalgar Marine Technology Ltd, UK  
|              |                                  | \(^2\)Thomasons Ltd, UK  
|              |                                  | \(^1\)Manchester University (Retired), UK  
| 15:15-15:30  | 15:15-15:30                      | Experimental and numerical study of the influence of the PP fiber diameter on spalling behaviour of concrete  
|              |                                  | *Fariza Sultangaliyeva*\(^1\), *Chhainan Leang*\(^2\), *Hélène Carré*\(^1\), *Christian La Borderie*\(^1\), *Nicolas Roussel*\(^1\)  
|              |                                  | \(^1\)Université de Pau et des Pays de l’Adour, France  
|              |                                  | \(^2\)INSA Rennes, France  
|              |                                  | \(^1\)IFSTTAR, France  
| 15:30-15:45  | 15:30-15:45                      | Experimental contribution to the optimization of the choice of polypropylene fibers in concrete for its thermal stability  
|              |                                  | *Fariza Sultangaliyeva*\(^1\), *Bruno Fernandes*\(^1\), *Hélène Carré*\(^1\), *Pierre Pimienta*\(^2\), *Christian La Borderie*\(^1\), *Nicolas Roussel*\(^1\)  
|              |                                  | \(^1\)Université de Pau et des Pays de l’Adour, France  
|              |                                  | \(^2\)CSTB, France  
|              |                                  | \(^1\)IFSTTAR, France  
| 15:45-16:15  | Closing Ceremony                 |                                                                                |