RILEM Proceedings Pro 118

Chennai, India 3-8 September 2017

Volume 1 of 4

Editors:

Manu Santhanam Ravindra Gettu Radhakrishna G. Pillai Sunitha K. Nayar

Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2017) by RILEM Publications All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact RILEM Publications at the address below.

RILEM Publications 4 avenue du Recteur Poincare 75016 Paris France

Phone: +33 1 42 24 64 46 Fax: +33 9 70 29 51 20

dg@rilem.net

Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA Phone: 845-758-0400

Fax: 845-758-2633

Email: curran@proceedings.com Web: www.proceedings.com

Optimizing Volumetric Properties and Performance of Asphalt Mixtures using Innovative Additives	
Hussain U. Bahia, Amir Arshadi and Erik Lyngdal	1
Sustainable HVAC Systems for Healthy Buildings Chandra Sekhar	17
Digital Concrete: Opportunities and Challenges Timothy Wangler, Ena Lloret, Lex Reiter, Norman Hack, Fabio Gramazio, Matthias Kohler, Mathias Bernhard, Benjamin Dillenburger, Jonas Buchli, Nicolas Roussel and Robert Flatt	25
Advanced Constitutive Modelling of Bituminous Materials Hervé Di Benedetto	39
Obtaining Durable Concrete Using Performance Specifications R. Douglas Hooton	45
Future cements and Durability Scrivener Karen	55
Structural Conservation of Heritage Buildings Paulo B. Lourenço	63
Constructing Alternative Futures for Sustainability – Interdisplinary Research for New Design Paradigms Forrest Meggers, Dorit Aviv, Eric Teitelbaum, James Coleman and Michael Bozlar	73
New Sustainable Concretes – Design Approach and Properties Harald S. Müller, Michael Haist, Jack S. Moffatt and Michael Vogel	81
Developing Innovations for Buildings with a Reduced Environmental Footprint: The Nest Project <i>P. Richner</i>	95
Key Metals and Alloys from Indian and South Indian Antiquity: An Archaeometallurgical Overview Sharada Srinivasan	99
Early Stage Hydration Studies of Tricalcium Silicate Using Silica Nanoparticles Lok P Singh, Dilshad Ali and Usha Sharma	113
The Need for Standardized Testing of Input Variables for Reliable Service Life Prediction of Reinforced Concrete Structures David Trejo, Mahmoud Shakouri, and Naga Pavan Vaddey	125

Conservation of Historical Constructions in Seismic Area: Experimental Research on Enhancement Techniques for Masonry Buildings <i>M. R. Valluzzi</i>	139
A Review of Recent Work on Deicing Salt Damage to Concrete Pavements and its Mitigation	
Prannoy Suraneni, Chunyu Qiao, Vahid Azad, Yaghoob Farnam, Jonathan Monical, Erol Unal, Chiara Villani, Burkan Isgor and Jason Weiss	155
Tracing Two Decades of Research at IIT Madras on Historical Structures Arun Menon	171
Author Index	191

RILEM Proceedings Pro 118

Chennai, India 3-8 September 2017

Volume 2 of 4

Editors:

Manu Santhanam Ravindra Gettu Radhakrishna G. Pillai Sunitha K. Nayar

Thixotropic Effects During Large-scale Concrete Pump Tests on Site Geert De Schutter	1
Modeling Fly Ash Based Geopolymer Flow for 3D Printing Applications Biranchi Panda, Li Mingyang, Yi Wei Daniel Tay, Suvash Chandra Paul and Ming Jen Tan	9
Understanding Ionic Dependence on the Water Absorption by Superabsorbent Polymer in Early Age Concrete Moon Juhyuk, Kang Sung-Hoon and Hong Sung-Gul	17
Parametric Study on the Influence of Cement Replacement Materials on the Rheology of Cement Paste using Brookfield Viscometer Kalyana Rama. J. S., Saikrishna Pallerla, Sivakumar M. V. N., Vasan, A. and Ramachandra Murthy A.	23
Factors Influencing the Interactions between PCE Superplasticizers and Portland Cement Pascal Boustingorry, Caroline Autier and Nathalie Azema	29
Evaluation of Delayed Addition of Superplasticizer in Standard Concrete <i>Mohit R., Sourabh T., Mohit K., Devender K., and Pardeep K.</i>	39
Comparison of Different Beneficiation Techniques to Improve Utilization Potential of Municipal Solid Waste Incineration Fly Ash Concrete Aneeta Mary Joseph, Philip Van den Heede, Ruben Snellings, Andres Van Brecht, Stijn Matthys and Nele De Belie	49
The Effect of Nanomagnetite on the Shielding Properties of Cementitious Composites	
Horszczaruk E., Brzozowski P., Sikora P., Cendrowski K. and Mijowska E. Characterization of Building Derived Materials for Ground Improvement of Contaminated Soils Stuti Mondal, Arkamitra Kar, Anasua Guharay and Naveen James	55 65
Nanosilica Coated Aggregates: Effects on Strength, Microstructure, and Transport Properties of Hydraulic Cement Mortars Parth Panchmatia, Jan Olek, Ehsan Ghafari, Seyedali Ghahari and Lu Na	73
Sensitivity of Reactivity Test Methods to the Fineness of Supplementary Cementitious Materials Anuj Parashar, Vineet Shah and Shashank Bishnoi	83
A Review on Biofortified Self-healing Concrete Sachin Tiwari, Shilpa Pal, Rekha Puria and Vikrant Nain	91

Acceleration of GGBS Cements by Chloride, New Insights on Early Hydration Steger L., Patapy C., Salesses B., Chaouche M. and Cyr M.	101
The Effect of Limestone on the Hydration and Workability of Ternary Blended Cement LC3: Limestone, Calcined Clays and Cement Aurélie R. Favier and Karen L. Scrivener	109
Micro-Physical Characterization of Buffalo Dung Ash Jagadesh P., Ramachandramurthy A. and Murugesan R.	117
Performance Evaluation of Concrete made of Recycled Fine Aggregates from Different Exposure Conditions Dhanya B. S., Anujith K. Babu, Jacob Sebastian, Varsha S. Kumar and Smruthi P. Nair	127
Feasible Use of Recycled Concrete Aggregates in Self-compacting Concrete: A Review Tung-Chai Ling, Yuxuan Liu and Senthil Kumar K.	137
Chloride Induced Corrosion of Steel in Alkali-activated Cements: A Review Shishir Mundra, Susan A. Bernal and John L. Provis	147
Reactivity and Performance of Limestone Calcined-Clay Cements (LC3) Cured at Low Temperature Franco Zunino and Karen Scrivener	155
Effects of Crystalline Admixtures on the Repeatability of Self Healing in Fiber Reinforced Concrete Estefanía Cuenca and Liberato Ferrara	163
Diffusion and Interactions of Chloride Ions with Ternary Blends of Portland cement-limestone-calcined clay Binders Hamed Maraghechi, Francois Avet and Karen Scrivener	173
Mix Proportioning for Structural Concrete Containing Recycled Concrete Aggregates Marco Pepe, Romildo Dias Toledo Filho, Eduardus A. B. Koenders and Enzo Martinelli	179
Compressive Strength and Surface Morphology of Hydrated Cement Paste Containing Micro- and Nano- Cement Additives Al-Bahar S., Chakkamalayath C. and Joseph A.	189
Effect of Hydraulic Retention Time on the Filtration Performance of Porous Concrete Murugan Muthu, Manu Santhanam and Mathava Kumar	195
Initial Study on Determining the Design Values of Macro Synthetic FRC for Floors-on-grade William P. Boshoff, Hermanus I. Bester and Celeste Vilioen	201

Research on the Chloride-free and Alkali-free Liquid Set Accelerator for	
Sprayed Concrete Ling WANG, Jiezhong GAN, Xia ZHAO, Ping ZHANG and Yading Xu	211
Enhancement of Mechanical Properties and Corrosion Behaviour of Concrete due to Addition of Ultrafine GGBS Pradeep Kumar M., Murali Rangarajan and Mini K. M.	221
Innovative Manufacturing Methods of Drapable Textile Reinforcements for Folded/Double Curved Concrete Facade Elements Gözdem Dittel, Andreas Koch and Thomas Gries	227
High Performance Concrete for Hydraulic Engineering Projects with Aggregates Presenting an AAR Hazard Falikman V. R, Safarov K. B. and Stepanova V. F.	233
Role of Reactive Alumina and Reactive Oxide Ratios on Strength Development in Alakaline Activation of Low-Calcium Fly Ash Bhagath Singh G. V. P. and Kolluru V. L. Subramaniam	243
Application of Waste-derived Lightweight Aggregates for Internal Curing of Concrete Pietro Lura, Mateusz Wyrzykowski, Sadegh Ghourchian, Sakprayut Sinthupinyo,	
Clarence Tang, Natechanok Chitvoranund, Tipwimol Chintana and Kritsada Sisomphon	251
Sustainability Study on Self-Compacting Concrete in-built with Raphanussativus as an Efficient Internal Curing Agent Rampradheep G. S., Sivaraja M., Geetha M., Raghupathy S. and Ragasudha P.	259
Latest Technologies for Industrial Concrete Floors; An International Overview Cortinovis C., Velikettil M. and Lee Brockway	269
Stress-crack Separation Relationship for Macrosynthetic, Steel and Hybrid Fiber Reinforced Concrete Chiranjeevi Reddy Kamasani, Jayakrishnan R. and Kolluru V. L. Subramaniam	279
Prestress Load Influence on Pull-out Behaviour of Post- installed Torque-controlled Expansion Anchors Rouane N., Salomon P., Pallud B. and Delhomme F.	287
Role of Steel Fibers in Shear Resistance of Beams in Arch Action Sahith Gali and Kolluru V. L. Subramaniam	297
An Analysis of Steel Fiber Efficiency on Reinforced Concrete Beams and Slabs Subjected to Static and Cyclic Loads	205
Buttigno T. E. T., Fernandes J. F., Sousa J. L. A. O. and Bittencourt T.	307

On the Tensile Characterization of Fiber Reinforced Concrete According to fib Model Code 2010	
Buttignol T. E. T., Fernandes J. F., Bittencourt T. and Sousa J. L. A. O.	317
Application of Digital Image Correlation (DIC) and Fracture Mechanics to Monitor and Measure Complex Mechanisms of Damage and Fracture in Reinforced Concrete Structures	
Luis Saucedo-Mora and Carmen Andrade Perdrix M.	327
Finite Element Analyses of Pinned Precast Beam Column Connections Jaya Prakash Vemuri, Sahith Gali and Subramaniam Kolluru	331
Investigation of Compression Failure in Brick Masonry Assemblies made with Soft Brick	
Mehar Babu Ravula and Kolluru V. L. Subramaniam	339
Longitudinal Reinforcement Limits in RC Vertical Elemets Based on Creep and Shrinkage Prediction Models Najeeb Shariff and Devdas Menon	349
Study on Concrete-Steel Sandwich Panel with Composite Skin Smriti Raj, Bharatkumar B. H. and Ramesh Kumar V.	357
Pull-out Phenomenon of Synthetic Macro Fibres from a Cementitious Matrix Adewumi J. Babafemi and William P. Boshoff	367
Impact of C₃A Content on the Chloride Diffusivity of Concrete <i>Vu Q. H., Pham G., Chonier A., Bauland A., Pommier G. and Moro F.</i>	377
Easy Evaluation of Air-void Systems in Concrete as Spatial Point Processes Tkakuma Murotani, Hidefumi Koto and Shin-ichi Igarashi	383
A Bayesian Approach to Assess the Influence of Coarse Aggregate on the Chloride Test Outcome	
Naga Pavan Vaddey, Mahmoud Shakouri and David Trejo	393
Relationship between Concrete Resistivity and the Indication of Chloride Penetration by ASTM C1202 in Concrete made with OPC, and Admixed with Slag and/or Limestone Powder	
Yury A. Villagrán Zaccardi, Natalia M. Alderete and Ángel A. Di Maio	403
Importance of the Curing Period Length on the Chloride Transport Through Concrete Containing SCMs	
Luna Molina F. J., Fernández Pérez A. and Alonso Alonso M. C.	413
Physical Model of the Capillary Absorption in Cementitious Materials, New Approach to Calculate Analytically the Pore Size Distribution from the Gravimetric Test	
Luis Saucedo-Mora, Carmen Andrade, Sandra Cabeza and Dietmar Meinel	423

Effect of Calcium Nitrite Inhibitor on Mechanical and Durability Parameters of Concrete	
Bhaskar Sangoju, Bharatkumar B. H. and Ravindra Gettu	427
Durability Performance of Concretes Made with Different Cement Types <i>Fabrizio Moro and Roberto Torrent</i>	437
Prediction of Carbonation-induced Corrosion Initiation of Steel in RC Structures Exposed to Natural Inland Environment of South Africa Jacob O. Ikotun, Mike B. Otieno and Yunus Ballim	447
Suitability of Accelerated Test Methods as a Tool for Service Life Prediction for RC Structures Made of Ordinary Portland and Blended Cement Arora V. V. and Puneet Kaura	457
Comparative Study of Models for Porosity of Cement Paste Shatabdi Mallick, Anoop M. B. and Balaji Rao K.	467
Influence of 2D Chloride Ingress on Corrosion Initiation and Propagation in Cracked and Uncracked Concrete: A Critical Literature Review Ze G. Zakka and Mike B. Otieno	477
A Study of Concrete Deterioration Faced by Distillery Industry Ramaswamy K. P, Padmanabhan K and Manu Santhanam	485
Changes in Pore Structure Properties of Cement Paste and Concrete on Carbonation Vineet Shah, Anuj Parashar and Shashank Bishnoi	495
Bond Enhancement of Repair Mortar via Biodeposition Didier Snoeck, Jianyun Wang, Dale P. Bentz and Nele De Belie	501
Performance of RC Walls with Openings Strengthened by Fiber Reinforced Polymers: An Experimental and Theoretical Investigation Cosmin Popescu, Gabriel Sa, Thomas Blanksvärd and Björn Täljsten	509
Behavior of Hybrid NSM Reinforced and Externally Confined Reinforced Concrete Columns under Eccentric Compression – experimental and Numerical Studies Chellapandian M. and Suriya Prakash S.	519
Application of a Self-Healing Mechanism in Concrete to Reduce Chloride	
Ingress Through Cracks Bjorn Van Belleghem, Philip Van den Heede, Kim Van Tittelboom and Nele De Belie	529
GFRP Wrapped Concrete Filled Double Skin Tubular Beam-columns subjected to Reversed Lateral Loading	539

Elastomeric Polyurethane for Retrofitting Application of Concrete Structures under Dynamic Loadings	
Sudharshan N. Raman , H. M. Chandima C. Somarathna , Azrul A. Mutalib, and Khairiah H. Badri	549
Monitoring of Early-Age Characteristics of Concrete using EMI based Embedded PZT Transducers on Varying Plate Thickness Jothi Saravanan T, Gopalakrishnan N and Bharathi Priya C	557
Condition Assessment and Rehabilitation Measures for Fire Damaged Reinforced Concrete Supporting Structure of a Furnace Bhaskar Sangoju, Ramanjaneyulu K., Kanchanadevi A. and Saibabu S.	567
	307
Acoustic Emission Behavior of Synthetic Fiber Reinforced Concrete under Flexure Abdur Rasheed. M, Yuma Kawasaki, Suriya Prakash S. and Naoki Ogawa	577
Influence of Aggregate Modelling on Ultrasonic Wave Propagation in Concrete Anand Kumar R., Pardeep K., Moorthi P. V. P., Bahurudeen A., Subair M. and Nikhil S.	587
Temporal Evolution of Microstructure, Chemical and Mechanical Properties of Tricalcium Silicate Aleena Alex and Pijush Ghosh	597
Trainable WEKA Phase Segmentation on SEM/BSE Images of Slag Blended Cement Pastes	
Natalia M. Alderete, Yury A. Villagrán Zaccardi and De Belie Nele	603
Using the Pitzer Model to Predict Aqueous Solution Compositions of Portland Cements Blended with Supplementary Cementitious Materials Dale P. Prentice, Susan A. Bernal, Mark Bankhead, Martin Hayes and John L. Provis	613
Microstructural and Morphological Studies of Ordinary Portland Cement	
Paste and Fly Ash based Geopolymer in the presence of Chloride Ions Pavithra Parthasarathy, Asad Hanif, Hongyu Shao and Zongjin Li	623
	623633
Pavithra Parthasarathy, Asad Hanif, Hongyu Shao and Zongjin Li Reactivity of Slag-cement Blends by Thermogravimetric Analysis Kira Weise, Frank Roeser, Neven Ukrainczyk and Eduardus A. B. Koenders Modelling Early Age Hydration Kinetics of C ₃ S Blended with Different Particle Size Distributions	633
Pavithra Parthasarathy, Asad Hanif, Hongyu Shao and Zongjin Li Reactivity of Slag-cement Blends by Thermogravimetric Analysis Kira Weise, Frank Roeser, Neven Ukrainczyk and Eduardus A. B. Koenders Modelling Early Age Hydration Kinetics of C ₃ S Blended with Different Particle Size Distributions Shiju Joseph, Shashank Bishnoi, Koen Van Balen and Ozlem Cizer	
Pavithra Parthasarathy, Asad Hanif, Hongyu Shao and Zongjin Li Reactivity of Slag-cement Blends by Thermogravimetric Analysis Kira Weise, Frank Roeser, Neven Ukrainczyk and Eduardus A. B. Koenders Modelling Early Age Hydration Kinetics of C ₃ S Blended with Different Particle Size Distributions Shiju Joseph, Shashank Bishnoi, Koen Van Balen and Ozlem Cizer Micro-Analytical Characterisation of Concrete Deterioration due to Acid Attack in a Sewage Treatment Plant	633
Pavithra Parthasarathy, Asad Hanif, Hongyu Shao and Zongjin Li Reactivity of Slag-cement Blends by Thermogravimetric Analysis Kira Weise, Frank Roeser, Neven Ukrainczyk and Eduardus A. B. Koenders Modelling Early Age Hydration Kinetics of C ₃ S Blended with Different Particle Size Distributions Shiju Joseph, Shashank Bishnoi, Koen Van Balen and Ozlem Cizer Micro-Analytical Characterisation of Concrete Deterioration due to Acid Attack	633

RILEM Proceedings Pro 118

Chennai, India 3-8 September 2017

Volume 3 of 4

Editors:

Manu Santhanam Ravindra Gettu Radhakrishna G. Pillai Sunitha K. Nayar

Effect of Molecular and Chemical Composition on Lignosulfonates Performance in Concrete Anatoly I. Vovk	1
Measuring Behavior of Fresh Cement Paste Parth K. Thaker and Narendra K. Arora	11
Effect of Slag Addition and Rate of Loading on Fibre Pullout in Alkali- Activated Fly Ash-Based Materials Mohammed Farooq, Aamer Bhutta and Nemkumar Banthia	19
Fresh and Hardened Properties of Alkali-Activated Mortar with Class F-Fly Ash, GGBS Combinations Mahipal Kasaniya and Prakash Nanthagopalan	29
The Influence of Curing Temperature and Curing Period on Strength Development in High Volume Fly Ash Concrete. G. V. P. Bhagath Singh and Kolluru V.L. Subramaniam	39
Utilization of Steel Slag in Concrete as Coarse and Fine Aggregate Arhab Elahi, Muntasir Ahmed and Majedul H. Mazumder	47
Nano-Reinforcement in Cement Composites: Tubes and Platelets Roey Nadiv, Matan Birenboim, Oren Regev and Alva Peled	55
Shrinkage of Fly Ash Concrete for Different Replacement Levels and Under Different Curing Conditions Mude Hanumananaik and Kolluru V.L. Subramaniam	61
Experimental Studies on the Properties of Metakaolin Blended Self-Compacting Coconut Shell Lightweight Concrete Idowu H. Adebakin, Gunasekaran Kandaswamy and Annadurai Ramasamy	71
Early-Age Properties of Flash-Calcined Dredging Sediment Blended Cements C. Van Bunderen, R. Snellings, L. Horckmans, L. Vandewalle and Ö. Cizer	81
Influence of Treated Recycled Concrete Aggregate on Concrete Properties Anna Galindo and Miren Etxeberria	89
Characterisation and Pozzolanic Reactivity of Incineration Ashes Size - Separated by a Novel, Closed Circuit Classification Technology Peter Nielsen, Ruben Snellings, Sumit Srivastava and Michel Loots	97
Influence of Calcination Conditions on the Properties of MgO C. Unluer and J. Liu	101
Effects of C-S-H Nano-Crystals on Early Strength Development in Concrete S. Das. S. Ray and S. Sarkar	111

The Influence of Calcined Clay Substitution on the Properties of Limestone Calcined Clay Cement (LC3)	
Wilasinee Hanpongpun and Karen Scrivener	119
Environmental and Durablility Assessment of Cements with Addition of Coal Bottom Ash	125
E. Menéndez, S.E. Ruiz, and J. de Frutos	12.
Effect of Type of Binder on the Behavior of High Strength Lightweight Aggregate	135
Manu S Nadesan and Dinakar Pasla	130
A Study on the Effect of Sodium Silicate Modulus on the Mechanical Properties and Microstructure of Fly Ash Based Geopolymers M. Srinivasula Reddy, Dinakar Pasla and B. H. Rao	143
Use of Various Grades of Calcined Kaolinitic Clays in Limestone Calcined Clay Cement (LC3) F. Avet and K. Scrivener	151
A Study on Producing Self-Compacting Concrete Mixtures using Different Waste Materials as Mineral Fillers Shamsad Ahmad and Saheed Kolawole Adekunle	155
High Temperature Effects of Self Compacted Concrete: Experimental and Numerical Study of Ash, GGBS Combinations D Harinadha Reddy and Ananth Ramaswamy	165
Low Carbon Cement LC3 in Cuba- The Process of Development and Interaction with the Industry for Full Introduction as a Mainstream Product Fernando Martirena and Karen Scrivener	175
Influence of Lime Stabilized Lake Sediments as Fine Aggregates in Cement	
Mortar P. Priyadharshini, K. Ramamurthy and R.G. Robinson	183
Glass Powder based Geopolymer Binder for Precast Concrete Dipten M, Bharath M. S, Deepika S and Manu Santhanam	193
Properties of Geopolymer Concrete with OPC as a Curing Agent Bhushan H. Shinde and Kshitija N. Kadam	203
Design of Geopolymers with Reduced Content of Metakaolin and Silicate	
Solution Christian A. Herget, Oliver Vogt, Adrian Zimmermann, Neven Ukrainczyk and Eduardus A. B. Koenders	
Edwar and II. D. Hoermers	209

Alkali-Activated Cements and Concretes – Where are We, and Where do We Go Next?	
John L. Provis	219
Design Procedures for Cement-Reduced Concrete Jack S. Moffatt, Michael Haist and Harald S. Müller	223
Experimental Investigations on Fracture Parameters of Recycled Aggregate Concrete	222
Bhashya V and Bharatkumar B. H	233
Experimental Study on Drying Shrinkage of Fibre Reinforced Concrete Srinivasa Rao Naraganti , Rama Mohan Rao Pannem and Jagadeesh Putta	241
Effect of Internal Curing on Concrete Properties Fahim Ahmed, Munaz Ahmed Noor, Muhammad Nazmul Huda, Fazle Rabbi and Md. Rashedul hasan	249
Concrete under High Dynamic Loads for Mechanical Engineering Christian Neunzig, Simo Schmidt, David Jasper, Wolfgang Brameshuber, Christian Brecher, Michael Raupach and Thomas Heiermann	259
Reinforced Lightweight Foamed Concrete for Seismically Resistant Low-rise Residential Buildings Trevor P.A. Dunn, Algurnon S. van Rooyen and Gideon P. A. G. van Zijl	269
Regulative Background and Latest Developments of Post-Installed Reinforcing Bars	270
P. Mahrenholtz	279
The Decisive Role of Acidophilic Bacteria on Biogenic Acid Corrosion in Sewers: A Novel Model Approach	
Cyrill Grengg, Florian Mittermayr, Guenther Koraimann, Florian Konrad, Mate Szabó, Attila Demeny and Martin Dietzel	287
Torsional Behaviour of Steel Fiber Reinforced Concrete Beam under Various Fiber Orientations	
Sumant Nivarutti Shinde and Mrudula Sanjay Kulkarni	297
Experimental Characterization of the Post-cracking Response in Hybrid Recycled/Industrial Steel Fiber-reinforced Concrete	
Antonio Caggiano, Marco Pepe, Carmine Lima, Paula Folino and Enzo Martinelli	305
Comparison of Load-displacement Relationship and Crack Development Mechanism in Reinforced Geopolymer Concrete Beams with that of Regular	
Reinforced Concrete Beams. Agnal Shah and C.R. Shah	315

The Importance of C-A-S-H Surface Chemistry on Chloride Resistance of Slag-Blended Cement	
Elakneswaran Yogarajah and Toyoharu Nawa	323
Are Prescribed Mixes in BS 8500-1:2015 Containing GGBS Suitable for the Marine Environment?	
E. Tzoura, T. Howarth, P.A.M. Basheer	333
The Effect of Metakaolin on Delayed Ettringite Formation of the Heat-Cured Mortars	
Van-Huong Nguyen, Nordine Leklou and Pierre Mounanga2	343
The Origin of Anomalous Thermal Expansion Behavior in Calcium-Silicate- Hydrates	
N M Anoop Krishnan, Bu Wang, Gabriel Falzone, Yann Le Pape, Narayanan Neithalath, Laurent Pilon, Mathieu Bauchy and Gaurav Sant	353
The Effect of Granulated Blast Furnace Slag on Chloride Diffusivity of	
Concrete Takashi Fujii, Hitoshi Fujiwara and Toshiki Ayano	361
Time Development of Chloride Diffusion Coefficients for Concrete Exposed to	
the Marine Environment Rukshani Heiyantuduwa and Mark Alexander	369
Chloride Thresholds for Stainless Steel Rebars J. Sanchez, A. Pachon, C. Andrade, J. Fullea and V. Matres	375
A Study on Sodium Nitrite, Zinc Oxide and Di-sodium Hydrogen Phosphate as Corrosion Inhibitors in Reinforced Concrete Rozampuia, Jyotish Kumar Das and Bulu Pradhan	385
Investigation of Mixture Factors Influencing Alkali-silica Reaction in Fly Ash-	
Based Geopolymer Mortars Abdolhossein Naghizadeh and Stephen O. Ekolu	395
Autogenous Shrinkage and Creep of Limestone and Calcined Clay Based Binders	
Julien Ston, Adrien Hilaire and Karen Scrivener	401
Effect of Air Entrainment on the Resistance of Mortars to Physical Sulfate Salt Attack	
Semion Zhutovsky and R. Douglas Hooton	409
Experimental Study of Chloride Diffusivity in Unsaturated Ordinary Portland Cement Mortar	
Yong Zhang and Guang Ye	417

Gaussian Trends in Corrosion Morphologies of Reinforcing Bar in Concrete under Marine Environment	
S. Muthulingam	425
Experimental Investigation on Behavior of Concrete Exposed to ISO Rate of Heating	
Daniel T. Paul, Anand. N and Prince G. Arulraj	435
	443
Perfdub: A Four-year Research Project to Make a Performance-based Approach Operational in France	451
Fabrizio Moro, Bruno Godart and Xavier Guillot	451
Bond Strength of SRG Composite Systems Applied to Concrete <i>Elena Stievanin, Enrico Garbin, Matteo Panizza and Francesca da Porto</i>	459
Assessment of the Behavior at High Temperature of Polymer Cement Mortars for Repair	
E. Menéndez, E. Puerto, R. Gettu, Mª Eugenia Maciá and A. Castillo	469
New Silicone-resin-based Integral Water Repellent for Cementitious Materials Nenad Milenković, Lecomte Jean-Paul, Basab Saha, Marie-Jo Sarrazin, Leon Marteaux, Marie-Paule Delplancke and Christian Pierre	479
Effect of the Type of Cement on the Performance of Repair Mortars Inès L. Tchetgnia Ngassam and Hans Beushausen	489
Development of an Embedded PZT Sensor for Monitoring Mechanical Impedance of a Cementitious Material through Setting and Early Strength Gain	
Arun Narayanan, Amarteja Kocherla and K. V. L. Subramaniam	497
Monitoring Acoustic Emission of Fresh Cement Paste Evin Dildar Dzaye, Geert De Schutter and Dimitrios Aggelis	507
How to Control the Quality of Concrete Strength Estimates Derived from NDT Measurements and Conversion Models	
Denys Breysse, Maitham Alwash and Zoubir Mehdi Sbartai	517
Microstructure Guided Simulations to Predict the Effective Mechanical Properties of Cementitious Materials	
Sumanta Das, Gaurav Sant, Nikhilesh Chawla and Narayanan Neithalath	527
Study of the Effect of MgO on Alite Polymorphism and Its Subsequent Effect on the Hydration Properties	
Nikhila Balasubramanya, Nibedita Dutta, and Amit Chatterjee	537

U-Phase[(CaO)x (Al ₂ O ₃) (SO ₃)y(Na ₂ O)z:nH ₂ O] in Hydrating Cement with Sodium Sulfate	
Yuka Morinaga, Tomohiro Kajio, Elakneswaran Yogarajah, Toyoharu Nawa and Eiji Owaki	547
Micro- and Macroscopic Investigations on the Interface Between Layers of 3D- Printed Cementitious Elements	
Venkatesh N. Nerella, Simone Hempel and Viktor Mechtcherine	557
Durability Assessment of Reinforced Concrete Structures Assisted by Numerical Simulation	
Jan Cervenka, Karolina Hajkova, Libor Jendele, Tereza Sajdlova and Vit Smilauer	567
Behaviour of Clay Brick Masonry with Soft Brick Under Uniaxial Compression G. Pruthvi Raj and Kolluru V. L. Subramaniam	577
Early Reinforced Concrete Structures, a Methodological Approach from	
Materials and Details to Structural Assessments Elena Stievanin, Enrico Garbin, Michele Secco, Francesca da Porto and Gilberto Artioli	587
Natural Hydraulic Lime Based Composites for Strengthening of Historical Structures	
Bekir Y. Pekmezci	597
Retrofitting of a Historical Masonry Building Using RC Shear Wall and Externally Bonded FRP System	
Padalu Pravin Kumar Venkat Rao, Yogendra Singh, Umesh Sharma, Sreekanta Das and Devavrata Singh	607
Numerical Modelling of Fastnet Lighthouse Based on Experimental Dynamic Identification	
A. Pappas, D. D'Ayala, A. Antonini, J. Brownjohn and A. Raby	617
Natural Air Cooling System in 16 th Century Mughal's India: Architechtural Technology and Characterization	
Manager Singh and Selvam Vinodh Kumar	629
Author Index	639

RILEM Proceedings Pro 118

Chennai, India 3-8 September 2017

Volume 4 of 4

Editors:

Manu Santhanam Ravindra Gettu Radhakrishna G. Pillai Sunitha K. Nayar

Study on Physical and Microstructural Properties of Light Weight Aerated Fly Ash Based Geopolymer. T. Revathi, R. Jeyalakshmi and N. P. Rajamane	1
· · · · · · · · · · · · · · · · · · ·	
Chloride Profiling of Integral and Non-Integral Surface Treated Foamed Concrete Algurnon S. van Rooyen and Gideon P.A.G. van Zijl	11
Artificial Neural Network for Evaluating the Strength of Self Compacting Self-Curing Concrete A. Mohanraj, V. Senthilkumar and N. Karthiga Shenbagam	17
Hydration of Cement Blended with Flash-calcined Dredging Sediments Ruben Snellings, Liesbeth Horckmans, Céline Van Bunderen, Lucie Vandewalle, Koenraad Van Balen, Joris Dockx, Jonas Marlijn, Jos Vandekeybus and Özlem Cizer	27
Behaviour of M 50 Grade Self-compacting Concrete Developed Using Indian Metakaolin Kruthi Kiran Ramagiri, Janardhana Maganti and Dinakar Pasala	35
Effect of Molarity of Sodium Hydroxide and Curing Temperature on the Strength of Geopolymer Concrete Containing Recycled Concrete Aggregate Thulasirajan Krishnan and Revathi Purushothaman	45
Post-Processing Methods for Improving Strength of Geopolymer Produced Using 3d Printing Ming Xia and Jay Sanjayan	55
Making and using Self-compacting Concrete with Locally Available Materials for Various Applications in Indian Scenario L. S. Kannan, V. Umamaheshwaran and K. Sivakumar	63
Repair and Retrofitting of Structural Components Using Textile Reinforced Concrete Smitha Gopinath, Nagesh R. Iyer and Ravindra Gettu	73
Early Hydration and Autogenous Shrinkage of UHPC Jianhui Liu, Caijun Shi and Zeimei Wu	81
Characterization of Separability of Carbon Textile Reinforced Concrete for Increased Material Sustainability Magdalena K. Kimm, Nils Gerstein, Lia Weiler, Anya Vollpracht and Thomas Gries	93
A Crack-Width Design Approach for Seamless Jointless Steel Fibre Reinforced Concrete Grade Slabs Hendrik Thooft, H. E. Sriprakash Shastry and Navneet T. Narayan	101
Effect of Addition of Nucleation Seeds in Alkali Activated Binders Sravanthi Puligilla, Dipobrato Sarbapalli and Paramita Mondal	111
Ductility of Concrete Confined with FRP under Cyclic Loading G. Ramesh, Rayindra Getty and R. H. Rharatkumar	119

Performance Study of Steel Fibre Reinforced Concrete Slabs-on Ground in Industries	129
M. Murugesan, Dashrath Rajpurohit and Kishor Kumar M	
Compressive Strength Modelling Using Artificial Neural Network (ANN) for Concrete with Waste Foundry Sand as Partial Fine Aggregate R. Muthukumaran, M. Nithya, A. K. Priya, V. Aparna and D. Vivek	137
Comparison of Flexural Toughness Parameters from Notched and Unnotched Beam Tests for Fibre Reinforced Concrete Sujatha Jose and Ravindra Gettu	143
Effect of Prestress on the Bond Strength of Pretensioned Concrete Systems Prabha Mohandoss and Radhakrishna G. Pillai	153
Effects of Span to Bonded Length of CFRP on Flexural Performance of CFRP/Concrete Composites	161
P. M. Ekanayake, J. C. P. H. Gamage and U. N. D. Perera	
Progress on Testing of Mechanical Properties of Cement Based Materials - Extended Round Robin Test of Cost Action TU 1404 Bokan Bosiljkov V, Serdar M, Staquet S and Azenha M	171
Effect of Surface Protection on Carbonation Induced Corrosion in Reinforced Foamed Concrete	179
Marlin S. Mubatapasango and Algurnon S. van Rooyen	
Experimental Study on Effect of Polypropylene Fibers on Durability Properties of High Volume Fly Ash Concrete Karthikeyan R. M, Venkatesh Babu D.L and Prince Arulraj G	189
Effect of the Pore Size of Cement Based Materials on Migration Tests Quang Hung Nguyen, Sylvie Lorente and Anne Duhart-Barone	199
Grouted Post-Tensioning Evaluation and Corrosion Mitigation <i>Liao Haixue</i>	207
A Study on Deterioration of Flexural Behaviour of Corroded Pre-tensioned Beams G. Resmi, Amlan K. Sengupta and Radhakrishna G. Pillai	213
Concrete with Fly Ash – Highest Quality for Durability Ever Achieved in Mozambique for a Bridge D. Swanepoel, J. Seitz and B. Pengyu	223
Aging Factors in 100 Years Old Concrete of Panamá Canal C. Andrade, N. Rebolledo, R. Perez, M. Baz	233
Durability of Bagasse Ash Based Cementitious Systems in Acidic Environment Ramaswamy K. P, Satyanarayana Rao N and Manu Santhanam	243
Modelling Carbonation Rates in Concretes with Similar Strength and With and Without slag Sundar Rathnarajan, Naga Pavan Vaddey, Radhakrishna G. Pillai, Ravindra Gettu, and Manu Santhanam	253

Comparison of Corrosion of Damaged Fusion-Bonded-Epoxy-Coated (FBEC) and Uncoated Steel Rebars Deepak K. Kamde and Radhakrishna G. Pillai	261
Deterioration of Concrete under Combined Freeze-thaw Cycles, Chloride Attack and Flexural Load Yin CAO, Ling WANG and Yan YAO	269
Additional Insights on the Influencing Factors and Mechanism of Degradation Due to Acid Attack: Special Case of Acids Forming Soluble Salts Ramaswamy K. P., Alexandra Bertron and Manu Santhanam	279
Challenges in Determining the Chloride Threshold of Steel Embedded in Cementitious Systems Sripriya Rengaraju and Radhakrishna G.Pillai	291
Influence of the Incorporation of Fly Ash and Slag on the Shrinkage Response of Common Concretes Sakthivel T., Ravindra Gettu and Radhakrishna G. Pillai	299
The Full Utilization of Recycled Concrete Aggregates Produced Using the Microwave Beneficiation Technique in Combination with Carbon Sequestration Ashokreddy Annapareddy, Lin Jie and K. C. Gary Ong	305
Water Content Effect on Concrete Response in UPV Tests Biondi S, Valente C and Zuccarino L	313
Service Life Modeling of Biogenic Sulphuric Acid Attack on Sewage Structure: A State-of-the-art Review Ankur Bansal and Shashank Bishnoi	319
Molecular Dynamics Based Mechanical Characterization of Cement Constituents at Elevated Temperatures Harsha Praneeth and Tezeswi Tadepalli	329
Microstructural and Phase Assemblage Changes in Naturally Carbonated Cement Paste with Supplementary Cementitious Materials (SCMS) W. Soja, H. Maraghechi and K. Scrivener	337
The Hydration and Microstructural Development of Limestone Calcined Clay Cement Shashank Bishnoi and Sreejith Krishnan	343
Temperature Effects on Performance of Cementitious Systems: Microstructure and Transport Properties Yuvaraj Dhandapani, Karen L. Scrivener and Manu Santhanam	351
High Stable Asphalt Wearing Course Mix (DAsphalt® D HS) - for Bus Lane, Roundabout and Industrial Areas Pahirangan Sivapatham and Norbert Simmleit	361
Fatigue Evaluation Tests for Asphalt Binders and Instabilities in Torsional Flows Abhijith B. S. and Atul Narayan S. P.	371

Viscoelastic Characterization of Bitumen and Bitumen-filler Mastics with Indentation Tests	381
Hassan Fadil, Denis Jelagin and Per-Lennart Larsson	
Assessment of Laboratory Oven-Aging of Asphalt Concrete Mixtures Via the Impact Resonance Test Ilker Boz, Xuan Chen and Mansour Solaimanian	391
Hollow Cylinder Apparatus to Characterize Interfaces between Pavement Layers Thomas Attia, Hervé Di Benedetto, Cédric Sauzéat, François Olard and Simon Pouget	401
Development of Response Surface Model for Mechanical Properties of Foamed Bitumen Mixtures Siksha S. Kar, Devesh Tiwari, Aravind K. Swamy and Pramod K. Jain	411
Effect of Natural Rubber and Zycotherm on Moisture Performance of Asphalt Mixtures P Saha Chowdhury, Sonu Kumar and D Sarkar	421
Effect of Aggregate Gradation on Rutting Performance of Asphalt-Rubber Gap Graded (AR-GAP) Mixtures Veena Venudharan and Krishna Prapoorna Biligiri	429
Characterization of Uncertainty in Asphalt Mixture Complex Modulus Data Aswathy Rema and Aravind K. Swamy	439
Influence of Aging and Moisture Conditioning on the Tensile Strength Characteristics of Bituminous Mixtures Bhaskar P Das, Nishant Bhargava and Anjan Kumar S	449
A New Test Method to Study the Healing Behaviour of Asphaltic Materials Containing Encapsulated rejuvenators Tariq Al-Mansoori, Rui Micaelo, Ignacio Artamendi and Alvaro Garcia	459
Induction Heatable Asphalt Tiles and Pellets: New Approaches in Road Maintenance Breixo Gomez-Meijide, Hadel Obaidi, and Alvaro Garcia	467
Water Evaporation from Asphalt Porous Media Mustafa Aboufoul and Alvaro Garcia	477
Use of WLF Equation to Capture Short Term Aging Characteristics of Asphalt Binder Priyansh Singh and Aravind K. Swamy	487
Development of Probabilistic Rutting Curve from Wheel Tracking Device Data <i>Priyansh Singh and Aravind K. Swamy</i>	495
Influence of Evotherm® on Moisture Resistance of Dense Bituminous Mixtures Subjected to Varied Temperatures and Pressures in a Moisture Induced Sensitivity Tester Utsav Vishal, Sandel Prashant Shyam, Venkaiah Chowdary and K. Ahmed Asif	503

Influence of Static and Vibratory Compaction on the Flow Behaviour of Asphalt Surface Courses Ehsan Ghafoori Roozbahany, Alvaro Guarin and Manfred N. Partl	511
Exploration of Temperature and Loading Rate Interdependency for Fracture Properties of Asphalt Mixtures Katie E. Haslett, Eshan V. Dave and Jo S. Daniel	521
Using the Hamburg Wheel Tracking Test to Characterize Asphalt Mixture Rutting and Moisture Damage Resistance in Cold Regions Hussain Bahia, Cheng Ling and Daniel Swiertz	531
Evaluating the Effect of Mix Design Variables on Flexibility Index from Semicircular Bend Test at Intermediate Temperature Hussain Bahia, Cheng Ling, Remya Varma, Daniel Swiertz and Pouya Teymourpour	541
Evaluation of Low Temperature Cracking Tests and Their Sensitivty to Asphalt Mixture Design Factors Hussain U. Bahia, Andrew Hanz, Tirupan Mandal and Remya Varma	551
Effect of Dynamic Vehicle Loading on the Rutting Behavior of Bituminous Pavements Kavinmathi K, Atul Narayan S. P	563
Evaluation of Tack Coat Materials and Application Rates for Asphalt Interlayer Bond Strength Vinayak Malaghan and Amit Goel	573
Effect of Fibres Addition on the Electrical and Thermal Properties of Recycled Rubber Membranes J. Norambuena-Contreras, J. L. Concha, R. Muñoz and E. Baradit	579
Study on Feasibility and Effect of Adding PCM (Phase Changing Material) in Wearing Course using Cold Mix Technology Piyush Sharma and Amit Goel	589
Effect of Natural Polymers from Aegle Marmelos on the Characteristics of Hydraulic Lime Mortar R. Ravi, S. Thirumalini and Khalid Ahmed Gour	599
Historic Mortar Production in the First Millennium A. D. New Results from Archaeology and Scientific Dating Sophie Hueglin	609
Effect of Aging on the Microstructural Characteristics of Lime Putty Divya Rani and Manu Santhanam	615
Finite Element Modelling of a Three-Storey Cross Laminated Timber Structure Chrysl A. Aranha, Jorge M. Branco and Paulo B. Lourenço	621
Effect of Transportation of Fly Ash: An LCA and LCCA Analysis of Concrete Daman Panesar and Deepak Kanraj	631
Environmental Assessment of Disruptive Innovation in Concrete Structures G. Habert, S. Zingg, I. Agusti Juan	641

Sustainable Building Systems- Features and Benefits Seema A. Nihalani, Jayesh Juremalani, and Nazimali Chinwala	651
Low Energy Bio-aggregate-clay-lime Concrete Rotem Haik, Isaac A. Meir and Alva Peled	657
Assessment of Carbon Sequestration of Hemp Concrete Tarun Jami and Sumit Kumar	665
Identification of Suitable Ready Mix Concrete Suppliers Using Geographic Information System Nivedha P., Athira G., Bahurudeen A. and Prasanta K. S.	675
Validation of Cooling Load Calculation of a Building using Transmission Matrix Method Nabeel Khan and B. Bhattacharjee	683
Factors Influencing Sustainable Construction in India: Evidences from Case Studies Aneetha Vilventhan and Sivaramakrishnan	689
PCM in Cement Based Materials for Green Construction: A Review Suresh Kumar Padala, Shraddha J. Deshpande, B. Bhattacharjee	699
Retrofitting Building Roof for Energy Efficiency Bandana Jha and B. Bhattacharjee	709
Thermal Comfort and Energy Savings Through Cool Elastomeric Roof Coatings Gulab N. Malunjkar and Jouko Vyörykkä	719
Study of Eco-Efficiency of Ready-Mixed Concrete Production Processes Anna George Nellickal and Sivakumar Palaniappan	729
Author index	739