

International Conference on Concrete Repair, Rehabilitation and Retrofitting (ICCRRR 2018)

MATEC Web of Conferences Volume 199 (2018)

Cape Town, South Africa
19 - 21 November 2018

Part 1 of 2

Editors:

M.G. Alexander
H. Beushausen

F. Dehn
P. Moyo

ISBN: 978-1-5108-7403-9

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.

This work is licensed under a Creative Commons Attribution 4.0 International Licence. Licence details:
<http://creativecommons.org/licenses/by/4.0/>.

Printed by Curran Associates, Inc. (2018)

For additional information, please contact EDP Sciences – Web of Conferences
at the address below.

EDP Sciences – Web of Conferences
17, Avenue du Hoggar
Parc d'Activité de Courtabœuf
BP 112
F-91944 Les Ulis Cedex A
France

Phone: +33 (0) 1 69 18 75 75

Fax: +33 (0) 1 69 28 84 91

contact-edps@webofconferences.org

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

TABLE OF CONTENTS

PART 1

FORENSIC ENGINEERING - FIB MC 2020 AND EXISTING STRUCTURES	1
<i>Matthews Stuart, Mancini Giuseppe</i>	
CATHODIC PROTECTION OF STEEL IN CONCRETE – EXPERIENCE AND OVERVIEW OF 30 YEARS APPLICATION	15
<i>Polder Rob, Peelen Willy</i>	
FRP STRENGTHENING OF STRUCTURES – BRIDGING GAPS IN ACADEMIC RESEARCH AND INDUSTRY - 25-YEARS’ EXPERIENCE CREATING INNOVATION	21
<i>Täljsten Björn</i>	
FIBER REINFORCED CONCRETE FOR REPAIRING AND STRENGTHENING RC STRUCTURES: SOME RECENT ADVANCEMENTS	31
<i>Plizzari Giovanni A.</i>	
MODELLING OF CHLORIDE INGRESS IN CONCRETE BASED ON BENCHMARKING FIELD RESULTS	42
<i>Koenders E.A.B.</i>	
POLYMER-CONCRETE COMPOSITES FOR THE REPAIR OF CONCRETE STRUCTURES	49
<i>Czarnecki Lech</i>	
SUSTAINABLE, DURABLE CONCRETE – ARE SPECIFICATIONS ALWAYS FIT FOR PURPOSE – A CASE STUDY	58
<i>Grantham Michael G</i>	
CONDITION ASSESSMENT: FROM GOOD CHOICE OF METHODS TO RELIABLE RESULTS THAT MEET THE CUSTOMER DEMAND	65
<i>Taffe Alexander</i>	
OPTIMIZING THE ACID RESISTANCE OF CONCRETE WITH GRANULATED BLAST-FURNACE SLAG	71
<i>Breitenbücher Rolf, Bäcker Jan, Kunz Sebastian, Ehrenberg Andreas, Gerten Christian</i>	
MICROBIAL INDUCED ACID CORROSION FROM A FIELD PERSPECTIVE - ADVANCES IN PROCESS UNDERSTANDING AND CONSTRUCTION MATERIAL DEVELOPMENT	78
<i>Grengg Cyrill, Mittermayr Florian, Ukrainczyk Neven, Koenders Eddie, Koraimann Günther, Kienesberger Sabine, Dietzel Martin</i>	
BIODETERIORATION MECHANISMS AND KINETICS OF SCM AND ALUMINATE BASED CEMENTS AND AAM IN THE LIQUID PHASE OF AN ANAEROBIC DIGESTION	84
<i>Giroudon Marie, Peyre Lavigne Matthieu, Patapy Cédric, Bertron Alexandra</i>	
EVALUATION OF THE RESISTANCE OF CAC AND BFSC MORTARS TO BIODEGRADATION: LABORATORY TEST APPROACH	92
<i>Aboulela Amr, Peyre-Lavigne Matthieu, Patapy Cédric, Bertron Alexandra</i>	
A NEW TEST FOR COMBINED CA-LEACHING AND SULPHATE RESISTANCE OF CEMENTITIOUS MATERIALS	98
<i>Steindl Florian R., Baldermann Andre, Galan Isabel, Sakoparnig Marlene, Dietzel Martin, Mittermayr Florian</i>	
SULFATE RESISTANCE OF RICE HUSK ASH CONCRETE	105
<i>Kamau John, Ahmed Ash, Ngong Killian</i>	
OPTICAL PH IMAGING OF CONCRETE EXPOSED TO CHEMICALLY CORROSIVE ENVIRONMENTS	111
<i>Grengg Cyrill, Mueller Bernhard, Mittermayr Florian, Mayr Torsten, Borisov Sergey, Dietzel Martin</i>	
EFFECTS OF CONCRETE QUALITY AND NATURAL JOHANNESBURG ENVIRONMENT ON CONCRETE CARBONATION RATE	115
<i>Ikotun Jacob Olumuyiwa</i>	
CHANGES OF MICROSTRUCTURE AND DIFFUSIVITY IN BLENDED CEMENT PASTES EXPOSED TO NATURAL CARBONATION	121
<i>Soja Wioletta, Maraghechi Hamed, Georget Fabien, Scrivener Karen</i>	
INTEREST OF USING A MODEL COMBINING CARBONATION/CHLORIDE INGRESS AND DEPASSIVATION TO BETTER ANTICIPATE THE REHABILITATION OF CONCRETE STRUCTURES	126
<i>Schmitt Lucie, Mai-Nhu Jonathan, Duprat Frédéric, De Larrard Thomas, Rougeau Patrick</i>	

PERPENDICULAR-TO-CRACK CHLORIDE INGRESS IN CRACKED AND AUTONOMOUSLY HEALED CONCRETE	134
<i>Van Belleghem Bjorn, Van den Heede Philip, Van Tittelboom Kim, De Belie Nele</i>	
DETERIORATION MODEL OF RC BEAMS UNDER MARINE ATMOSPHERIC ENVIRONMENT	139
<i>Guo Hongyuan, Li Guobing, Gu Xianglin</i>	
INVESTIGATION ON THE TRANSPORT PROPERTIES OF CHLORIDES IN CONCRETE (I) IDENTIFICATION OF ITZ	146
<i>Ye Tian, Xianyu Jin, Nanguo Jin</i>	
INVESTIGATION ON THE TRANSPORT PROPERTIES OF CHLORIDES IN CONCRETE II NUMERICAL SIMULATION	149
<i>Ye Tian, Xianyu Jin, Nanguo Jin</i>	
ASSESSING THE INFLUENCE OF SELF-HEALING CAPACITY OF LIME-BASED MORTARS ON BRICK-MORTAR INTERFACE STRENGTH IN MASONRY UNITS	154
<i>De Nardi Cristina, Cecchi Antonella, Ferrara Liberato</i>	
PERFORMANCE OF CONCRETE WITH AND WITHOUT CRYSTALLINE ADMIXTURES UNDER REPEATED CRACKING/HEALING CYCLES	159
<i>Ferrara Liberato, Cuenca Estefania, Tejedor Antonio, Gastaldo Brac Enricomaria</i>	
DEVELOPMENT OF AN IMPROVED CRACKING METHOD TO REDUCE THE VARIABILITY IN TESTING THE HEALING EFFICIENCY OF SELF-HEALING MORTAR CONTAINING ENCAPSULATED POLYMERS	165
<i>Van Mullem Tim, Van Tittelboom Kim, Gruyaert Elke, Caspeele Robby, De Belie Nele</i>	
ASSESSMENT OF THE EFFECT OF NANOSILICA ON THE MECHANICAL PERFORMANCE AND DURABILITY OF CEMENTITIOUS MATERIALS	170
<i>Lefever Gerlinde, Aggelis Dimitrios G., De Belie Nele, Snoeck Didier, Van Hemelrijck Danny</i>	
LUCAS-WASHBURN VS RICHARDS EQUATION FOR THE MODELLING OF WATER ABSORPTION IN CEMENTITIOUS MATERIALS	175
<i>Villagrán Zaccardi Yury, Alderete Natalia, De Belie Nele</i>	
PORE STRUCTURE OF MORTARS CONTAINING LIMESTONE POWDER AND NATURAL POZZOLAN ASSESSED THROUGH MERCURY INTRUSION POROSIMETRY AND DYNAMIC VAPOUR SORPTION	179
<i>Alderete Natalia, Villagrán Yury, Mignon Arn, Snoeck Didier, De Belie Nele</i>	
COAL GASIFICATION ASH AND WEATHERED FLY ASH, AS PARTIAL REPLACEMENT OF PORTLAND CEMENT – EFFECT ON SELECTED DURABILITY PROPERTIES OF CONCRETE	186
<i>Maboea Dikeledi, Otieno Mike</i>	
CONCRETE QUALITY ON-SITE VS SEPARATELY MANUFACTURED SPECIMENS	191
<i>Jacobs Frank</i>	
CHARACTERIZATION OF POLYACRYLAMIDE BASED SUPERABSORBENT POLYMERS FOR POTENTIAL USE IN PC MATRICES WITH SUPPLEMENTARY CEMENTITIOUS MATERIALS	197
<i>Almeida Fernando C.R., Rostami Rohollah, Klemm Agnieszka J</i>	
OUTCOMES OF THE ROUND ROBIN TESTS OF RILEM TC 247-DTA ON THE DURABILITY OF ALKALI-ACTIVATED CONCRETE	206
<i>Provis John L., Winnefeld Frank</i>	
LEACHING, CARBONATION AND CHLORIDE INGRESS IN REINFORCED ALKALI-ACTIVATED FLY ASH MORTARS	213
<i>Gluth Gregor J. G., Hlaváček Petr, Reinemann Steffi, Ebell Gino, Mietz Jürgen</i>	
THREE DECADES OF INTERNATIONAL RILEM ACTIVITIES TO COMBAT DELETERIOUS ALKALI-SILICA REACTIONS (ASR) IN CONCRETE	220
<i>Wigum Børge Johannes, Lindgård Jan</i>	
OUTDOOR EXPOSURE SITE TESTING FOR PREVENTING ALKALI-AGGREGATE REACTIVITY IN CONCRETE – A REVIEW	225
<i>Fournier Benoit, Lindgård Jan, Wigum Børge J., Borchers Ingmar</i>	
LIVING WITH AAR: AN ENGINEER’S PERSPECTIVE	234
<i>Wood Jonathan G M</i>	
DETERMINING ALKALI LEACHING DURING ACCELERATED ASR PERFORMANCE TESTING AND IN FIELD EXPOSED CUBES USING COLD WATER EXTRACTION (CWE) AND μXRF	242
<i>Lindgård Jan, Østnor Tone, Fournier Benoit, Lindgård Øyvind, Danner Tobias, Plusquellec Gilles, De Weerd Klaartje</i>	

FIELD EVALUATION OF CONCRETE USING HAWAIIAN AGGREGATES FOR ALKALI SILICA REACTION	250
<i>Robertson Ian, Shen Lin</i>	
INCIDENCE OF ALKALI RELEASE IN CONCRETE DAMS. EVALUATION OF ALKALIS RELEASABLE BY FELDSPARS	256
<i>Menéndez E., García-Rovés R., Aldea B.</i>	
MODELLING OF ALKALI SILICA REACTION IN CONCRETE STRUCTURES FOR REHABILITATION INTERVENTION.....	265
<i>Pourbehi Mohammad S., van Zijl G.P.A.G., Strasheim J.A.v.B.</i>	
EFFECTS OF ALKALI-SILICA REACTION ON A HYDROPOWER STRUCTURE AFTER 50 YEARS OF ONGOING DETERIORATION	276
<i>Brueckner Rene, Ndugga Noah, Meri Tony C.</i>	
EFFECTIVENESS OF SILANE TO MITIGATE ALKALI-SILICA REACTION IN A HISTORICAL BRIDGE	285
<i>Schindler Anton, Johnson Darren, Warnock Robert, Barnes Robert</i>	
TOWARDS UNDERSTANDING CORROSION INITIATION IN CONCRETE – INFLUENCE OF LOCAL ELECTROCHEMICAL PROPERTIES OF REINFORCING STEEL	292
<i>Michel Lucas, Angst Ueli</i>	
TOWARDS UNDERSTANDING CORROSION INITIATION IN CONCRETE – INFLUENCE OF LOCAL CONCRETE PROPERTIES IN THE STEEL-CONCRETE INTERFACIAL ZONE	300
<i>Boschmann Kähler Carolina, Angst Ueli M., Elsener Bernhard</i>	
A NEW APPROACH TO DETERMINE THE CHLORIDE THRESHOLD INITIATING CORROSION: PRELIMINARY RESULTS	306
<i>Chalhoub Chantal, François Raoul, Carcassés Myriam</i>	
CORROSION OF STEEL IN CONCRETE DUE TO ONE AND TWO DIMENSIONAL CHLORIDE INGRESS	312
<i>Zakka Ze Gyang, Otieno Mike</i>	
MACROCELL CORROSION BETWEEN CROSSED STEEL REBARS EMBEDDED IN CONCRETE UNDER CHLORIDE ENVIRONMENTS	318
<i>Gu Xianglin, Dong Zheng, Jin Zhihao</i>	
CORROSION BEHAVIOUR OF REBARS 1.4003 IN CRACKS OF RC STRUCTURES CONTAINING CHLORIDES	325
<i>Dauberschmidt Christoph, Fraundorfer Andreas</i>	
MONITORING DIAMOND DEVICE FOR CORROSION STATE EVALUATION OF REINFORCED CONCRETE STRUCTURES	334
<i>Samson Gabriel, Deby Fabrice, Garciaz Jean-Luc, Perrin Jean-Louis</i>	
PROBABILITY DISTRIBUTION OF CROSS-SECTIONAL RADIUS OF CORRODED STEEL BARS IN CONCRETE AND ITS APPLICATION	340
<i>Chongkai LI, Weiping ZHANG, Xianglin GU, Qinghua HUANG</i>	
CORRELATION BETWEEN SURFACE CRACK WIDTH AND STEEL CORROSION IN REINFORCED CONCRETE.....	347
<i>Mak Michele Win Tai, Desnerck Pieter, Lees Janet M.</i>	
EFFECT OF THE DEGREE OF CORROSION ON BOND PERFORMANCE OF CEMENT POLYMER COMPOSITE (CPC) COATED STEEL REBARS	355
<i>Kamde Deepak K., Pillai Radhakrishna G.</i>	
TOWARDS ARRESTING REINFORCED CONCRETE CORROSION – A REVIEW.....	360
<i>Christodoulou Christian, Goodier Chris, Glass Gareth</i>	
SERVICE LIFE EXTENSION OF STATE HIGHWAY 16 BRIDGES – NEW ZEALAND’S FIRST HYBRID CORROSION PROTECTION APPLICATION.....	365
<i>Christodoulou Christian, Cobbs Ryan, Corbett Paul, Elliot Mike</i>	
LONG-TERM PERFORMANCE OF HYBRID ANODES FOR CATHODIC PROTECTION OF REINFORCED CONCRETE	372
<i>Dodds Wayne, Christodoulou Christian, Goodier Chris Ian</i>	
A 5 YEAR TRACK RECORD ON A GALVANIC CP SYSTEM APPLIED ON A LIGHT WEIGHT CONCRETE BRIDGE WITH PRESTRESSED STEEL – DEVELOPMENTS IN TIME OF THE EFFECTIVENESS AS DETERMINED BY DEPOLARISATION VALUES AND CURRENT DENSITIES.....	379
<i>van den Hondel A.J. (Hans), Gulikers Joost, Giorgini Roberto, van den Hondel Anthony (W.M.)</i>	
MAINTENANCE AND REPAIR OF STEEL REINFORCED CONCRETE STRUCTURES BY GALVANIC CORROSION PROTECTION – FIELD EXPERIENCES OVER 10 YEARS	387
<i>Schwarz Wolfgang, Pichlhöfer Alexander, van den Hondel Anthony, Esteves Hernani</i>	

GALVANIC CATHODIC PROTECTION OF CORRODED REINFORCED CONCRETE STRUCTURES	394
<i>Whitmore David</i>	
CORROSION PROTECTION OF EMBEDDED STEEL BARS IN CONCRETE	400
<i>Pistolesi L., Zaffaroni C.</i>	
IMPREGNATION TECHNIQUE PROVIDES CORROSION PROTECTION TO GROUTED POST-TENSIONING TENDONS	408
<i>Whitmore David, Lasa Ivan</i>	
CATHODIC PROTECTION OF CONCRETE WITH CONDUCTIVE COATING ANODES: 25 YEARS OF EXPERIENCE WITH PROJECTS AND MONITORING RESULTS	414
<i>van den Hondel Anthony, van den Hondel Hans</i>	
RELIABILITY ASSESSMENT OF EXISTING BRIDGE CONSTRUCTIONS BASED ON RESULTS OF NON-DESTRUCTIVE TESTING	420
<i>Küttenbaum Stefan, Taffe Alexander, Braml Thomas, Maack Stefan</i>	
DEMOLITION OF OLD OAK BRIDGE B4113: CONDITION OF A 54-YEAR OLD PRESTRESSED CONCRETE BRIDGE	429
<i>Kramer Wandie, Martin William, Viljoen Harry</i>	
NEW ASHTON ARCH – FUNCTIONAL ASSESSMENT OF DIRECT AND INDIRECT CONSTRUCTION COSTS AND EVALUATION OF SERVICE LIFE WITH RESPECT TO FLOODING RISK	438
<i>Ronné Philip, Newmark Abe, du Toit Nadri, van Wijk Heinrich</i>	
SUGGESTIONS FOR IMPROVED REINFORCED CONCRETE HALF-JOINT BRIDGE INSPECTION IN ENGLAND	444
<i>Desnerck Pieter, Valerio Pierfrancesco, Lees Janet M, Loudon Neil</i>	
INVESTIGATIONS ON THE DETECTABILITY OF WATER INTRUDING INTO BRIDGE DECK SEALINGS BY ELECTRICAL RESISTIVITY MEASUREMENTS	450
<i>Driessen Carla, Raupach Michael</i>	

PART 2

VALIDATION OF ARTIFICIAL DEFECTS FOR NON-DESTRUCTIVE TESTING MEASUREMENTS ON A REFERENCE STRUCTURE	455
<i>Stefan Maack, Salvador Villalobos, David Scott</i>	
DETECTION OF NEAR-SURFACE REINFORCEMENT IN CONCRETE COMPONENTS WITH ULTRASOUND	464
<i>Vonk Sarah, Taffe Alexander</i>	
CORROSION ON PRESTRESSING WIRES DUE TO SEGREGATION OF THE INJECTION MORTAR – DETECTION OF INJECTION DEFECTS WITH ULTRASONIC-ECHO TECHNIQUE	471
<i>Sodeikat Christian, Mayer Klaus, Obermeier Philipp</i>	
ALTERNATIVE METHODOLOGY FOR LINEAR POLARIZATION RESISTANCE ASSESSMENT OF REINFORCED CONCRETE STRUCTURE	478
<i>Samson Gabriel, Deby Fabrice, Garciaz Jean-Luc, Perrin Jean-Louis</i>	
A PRACTICAL METHODOLOGY TO ASSESS CORROSION IN CONCRETE SEWER PIPES	483
<i>Taheri Shima, Ams Martin, Bustamante Heriberto, Vorreiter Louisa, Withford Michael, Martin Clark Simon</i>	
CONDITION ASSESSMENT OF REINFORCED CONCRETE BEAMS – COMPARING DIGITAL IMAGE ANALYSIS WITH OPTIC FIBRE BRAGG GRATINGS	487
<i>Kearsley Elsabe, Jacobsz SW</i>	
HEALTH MONITORING AND REPAIR OF A CONCRETE SHELL ROOF STRUCTURE	494
<i>Pazhanivel K., Arunachalam S., Meenakshisundaram S.</i>	
THE MFL TECHNIQUE – BASIC APPLICATION FOR PT CABLE BREAK DETECTION IN CONCRETE STRUCTURES	497
<i>Wilcke Martin, Walther Andrei, Szielasko Klaus, Youssef Sargon</i>	
ASSESSMENT OF THE IN SITU COMPRESSIVE AND TENSILE STRENGTH OF EXISTING MASSIVE HYDRAULIC STRUCTURES	508
<i>Spörel Frank</i>	
DESIGN AND DEVELOPMENT OF CONCRETES FOR SPECIAL REHABILITATION TASKS	516
<i>Flohr Alexander, Osburg Andrea</i>	
CHARACTERIZATION TOOLS FOR SHRINKAGE-COMPENSATING REPAIR MATERIALS	522
<i>Bissonnette Benoît, Essalik Samy-Joseph, Lamothe Charles, Jolin Marc, Courard Luc, Gagné Richard, Morin Richard</i>	

DESIGN CONSIDERATIONS AND INNOVATIVE APPROACH FOR RESTORATION OF HISTORIC LANDMARKS IN OLD MONTREAL	529
<i>Morin Richard, Al Chami Ghfran, Gagné Richard, Bissonnette Benoit</i>	
INTRINSIC MODIFICATION OF REPAIR MORTARS MADE WITH EVA AND CAO, IMPACTS AT THE EARLIER AGES	534
<i>Ngassam Inès L. Tchegnina, Schmidt Wolfram, Beushausen Hans, Kühne Hans-Carsten</i>	
USING GLP AS PARTIAL REPLACEMENT IN CEMENT MORTARS	539
<i>El-Tair Ahmed, Youssef Passant, El-Nemr Amr</i>	
WORKABILITY AND MECHANICAL PROPERTIES OF ULTRAFINE CEMENT BASED GROUT FOR STRUCTURAL REHABILITATION: A PARAMETRIC STUDY ON THE PARTIAL REPLACEMENT WITH SCMS	545
<i>Shamsuddoha Md, Hüskén Götz, Schmidt Wolfram, Kühne Hans-Carsten, Baeßler Matthias</i>	
UHPFRC FOR CONCRETE REPAIR.....	552
<i>Maltais Alexandrine, Petrov Nikola, Thibault Michel, Bissonnette Benoit</i>	
USE OF POLYPROPYLENE FIBER AND SILICA FUME MODIFIED CONCRETE AS A REPAIR MATERIAL	560
<i>Liu Jing, Liu Wen, Guan Shugang, Guo Chao, Zheng and Xinguo</i>	
REHABILITATION OF MARINE CONCRETE STRUCTURE WITH UNDER-WATER HYDRODEMOLITION AND SPRAYED CONCRETE	564
<i>Yun Kyong-Ku, Lee Kyeo-Re, Han Seung-Yeon, Kim Yong-Gon, Kwon Soo-Ahn</i>	
NON-DESTRUCTIVE TESTING OF CONCRETE TREATED WITH PENETRATING SURFACE SEALANT USING A KARSTEN-TUBE.....	568
<i>Nwaubani Sunday O.</i>	
UNDERWATER ABRASION RESISTANCE OF CEMENTITIOUS ACRYLIC COATING ON REPAIRED SURFACE OF CONCRETE DAM AND STILLING BASIN.....	576
<i>Šušteršič Jakob, Kryžanowski Andrej, Brodnik Aleš, Zajc Andrej</i>	
INVESTIGATION IN REMEDIATION OF WIND TURBINE GENERATOR (WTG) FOUNDATIONS WITH EPOXY RESIN.....	585
<i>Bode Kay A.</i>	
POLYMER INJECTION REHABILITATION TECHNOLOGY FOR LIFTING DIFFERENTIAL SETTLEMENT OF TURNOUT BALLASTLESS TRACK	592
<i>Liu Jing, He Yuanqing, Zhang Jiahai, Hong Jian, Wen Xihua, Xiao Jianhong, Wang Feng, Zheng Xinguo</i>	
DURABILITY OF FLAX/BIO-BASED EPOXY COMPOSITES INTENDED FOR STRUCTURAL STRENGTHENING	596
<i>Benzarti Karim, Chlela Robert, Zombré Wendlamita, Quiertant Marc, Curtil Laurence</i>	
THE EFFECT OF HYDROPHOBIC (SILANE) TREATMENT ON CONCRETE DURABILITY CHARACTERISTICS	603
<i>Sohawon Haris, Beushausen Hans</i>	
THE INFLUENCE OF CONCRETE SUBSTRATE MOISTURE CONDITION ON THE TENSILE PULL-OFF STRENGTH OF PROTECTIVE COATINGS.....	610
<i>Kay Sean, Beushausen Hans</i>	
ALTERNATIVE PATCH REPAIR MATERIALS FOR REBAR CORROSION DAMAGE.....	615
<i>Jassa Primesh, Beushausen Hans, Tchegnina Ngassam Ines</i>	
PERFORMANCE OF CONCRETE OVERLAYS IN IOWA	623
<i>Taylor Peter, Gross Jerod, King Dan, Chen Yu-An, Ceylan Halil</i>	
DESIGN AND CONSTRUCTION OF ULTRA-THIN CONTINUOUSLY REINFORCED CONCRETE (UTCRC) ON N1 NEAR HUGENOTE TUNNELL.....	627
<i>Bredenhann Steph, van Heerden Johan, Strauss Pieter, Joubert Phillip</i>	
DEVELOPMENT OF SAFE CONSTRUCTION TEMPERATURE RANGES TO AVOID BLOW-UPS IN ULTRA-THIN CONCRETE PAVEMENTS.....	635
<i>Mentz Johannes, Hartman Anton</i>	
GUIDELINES FOR CONCRETE SURFACE PREPARATION: 10 YEARS RESEARCH AND EXPERIENCE.....	642
<i>Courard Luc, Bissonnette Benoît, Garbacz Andrzej, Vaysburd Alex M., von Fay Kurt F.</i>	
BOND BEHAVIOUR OF THIN CONCRETE OVERLAYS FOR MAINTENANCE OF CONCRETE PAVEMENTS	648
<i>Breitenbücher Rolf, Schulte-Schrepping Christoph, Kunz Sebastian</i>	
A STUDY ON THE NUMERICAL MODELLING OF UHPFRC-STRENGTHENED MEMBERS	655
<i>Franssen Renaud, Guner Serhan, Courard Luc, Mihaylov Boyan</i>	
BEHAVIOR OF RC BEAMS STRENGTHENED IN SHEAR WITH ULTRA-HIGH PERFORMANCE FIBER REINFORCED CONCRETE (UHPFRC).....	665
<i>Sakr Mohammed A., Sleemah Ayman A., Khalifa Tarek M., Mansour Walid N.</i>	

A STUDY ON THE BOND BEHAVIOR OF DIFFERENT FRCM SYSTEMS	671
<i>Younis Adel, Ebead Usama</i>	
CHARACTERIZATION AND APPLICATION OF FRCM AS A STRENGTHENING MATERIAL FOR SHEAR-CRITICAL RC BEAMS	676
<i>Younis Adel, Ebead Usama</i>	
PERFORMANCE OF STRAIN HARDENING CEMENTITIOUS COMPOSITE AS STRENGTHENING AND PROTECTIVE OVERLAY IN FLEXURAL MEMBERS	682
<i>Umer Sial Sardar, Iqbal Khan M.</i>	
USE OF STRAIN-HARDENING CEMENT-BASED COMPOSITES (SHCC) FOR RETROFITTING	690
<i>Müller Steffen, Mechtcherine Viktor</i>	
REHABILITATION OF A VEHICLE IMPACT DAMAGED CONCRETE BRIDGE GIRDER WITH GFRP REBARS	696
<i>Yazdani Nur, Montero Maria</i>	
CHARACTERIZATION OF SHEAR STRENGTH OF FRP ANCHORS	705
<i>Mahrenholtz Philipp, Cho Jae-Yeol, Park Ja-Min, Eligehausen Rolf</i>	
DURABILITY OF CONCRETE WITH CFRP WRAPPING	710
<i>Yu Qian-Qian, Li Xiang, Gu Xiang-Lin</i>	
RETROFIT AND RENOVATION OF CONCRETE BRIDGES WITH FIBRE REINFORCED POLYMER (FRP): THE THIRD ALTERNATIVE	715
<i>Visser Gerrit, Ijselmuijden Kees Van, Klamer Ernst, Zijl Gideon Van</i>	
AXIAL STRESS-STRAIN BEHAVIOUR OF PRE-DAMAGED SQUARE CONCRETE COLUMN REPAIRED WITH FRP JACKETS	722
<i>Li Pengda, Zhou Yingwu, Han Ningxu, Xing Feng</i>	
CONCRETE COLUMNS CONFINED WITH DIFFERENT COMPOSITE MATERIALS	729
<i>Donnini Jacopo, Corinaldesi Valeria</i>	
ACOUSTIC MONITORING OF A PRESTRESSED CONCRETE BEAM REINFORCED BY ADHESIVELY BONDED COMPOSITE	734
<i>Chataigner Sylvain, Gaillet Laurent, Falaise Yannick, David Jean-François, Michel Richard, Aubagnac Christophe, Houel Adrien, Germain Didier, Maherault Jean-Philippe</i>	
BASALT REINFORCED CONCRETE STRUCTURES FOR RETROFITTING CONCRETE SURFACES	742
<i>Wolf Benjamin, Kustermann Andrea, Schuler Christian, Dauberschmidt Christoph, Bucak Ömer</i>	
SEISMIC RETROFITTING OF A BRIDGE PIER WITH ULTRA HIGH PERFORMANCE FIBRE REINFORCED CONCRETE	750
<i>Adriano Reggia, Morbi Alessandro, Plizzari Giovanni A.</i>	
CASE STUDY OF CONCRETE REPAIRS ON JETTY IN PORT NOLLOTH, NORTHERN CAPE	758
<i>Schrecker Malan, Viljoen Duan, van der Spuy Pierre</i>	
THE WIDENING OF STRUCTURES OVER THE ORANGE RIVER ON NATIONAL ROUTE 12 SECTION 9 NEAR HOPETOWN, THE NORTHERN CAPE	767
<i>Massingue Tiago, Lourens Chris</i>	
THE REHABILITATION OF STRUCTURES ON THE NATIONAL ROUTE 10 SECTION 12 BETWEEN UPINGTON KM 0.0 AND NAKOP KM134.17	774
<i>Massingue Tiago, Zietsman Bennie</i>	
STRENGTHENING OF A RAILWAY ARCH BRIDGE FROM 1854	782
<i>Andersen Ole Viggo</i>	
REHABILITATION OF THE KOMATI RIVER BRIDGE B1604	786
<i>Strydom Johnnie, du Plessis Etienne, Pieters Lourens</i>	
A CASE STUDY OF THE RETROFITTING OF THE GREAT FISH RIVER BRIDGE	795
<i>Moodley Nerave, Moore Graham, Wylie David</i>	
OLIFANTS RIVER BRIDGE WIDENING	802
<i>Rowan Andrew, Thomson Les</i>	
STRENGTHENING, REHABILITATION AND WIDENING OF THE EXISTING ARCH BRIDGE ON NATIONAL ROUTE 7 OVER THE OLIFANTS RIVER, SOUTH AFRICA	806
<i>van der Spuy Pierre, Niehaus Hennie</i>	
STRUCTURAL REPAIR TO CONSERVE LANGKAWI'S MAIN TOURIST ATTRACTION: PRACTICAL APPROACH	813
<i>Mohammad Maziah, Zahari Ros Asmah</i>	
ON THE EFFECT OF THE PHYSICAL STRUCTURE OF CEMENT ON SHRINKAGE OF CEMENTITIOUS MATERIALS	819
<i>Karimi Hossein, Yu Qingliang, Brouwers H.J.H.</i>	

PARTIAL REPLACEMENT OF CONVENTIONAL FINE AGGREGATE WITH CRUMB TYRE RUBBER IN STRUCTURAL CONCRETE – EFFECT OF PARTICLE SIZE ON COMPRESSIVE STRENGTH AND TIME DEPENDENT DEFORMATIONS	824
<i>Mushunje Kudzai, Otieno Mike, Ballim Yunus</i>	
A REVIEW OF WASTE TYRE RUBBER AS AN ALTERNATIVE CONCRETE CONSITUENT MATERIAL	829
<i>Mushunje Kudzai, Otieno Mike, Ballim Yunus</i>	
INFLUENCE OF SUPERABSORBENT POLYMER ON THE SPLITTING TENSILE STRENGTH AND FRACTURE ENERGY OF HIGH-PERFORMANCE CONCRETE	837
<i>Olawuyi Babatunde James, Boshoff William Peter</i>	
MECHANICAL PROPERTIES OF HYBRID STEEL/PVA FIBERS REINFORCED HIGH STRENGTH CONCRETE.....	844
<i>Abbass Wasim, Khan M. Iqbal</i>	
EFFECT OF HYBRIDIZATION OF STEEL FIBERS ON THE MECHANICAL PROPERTIES OF HIGH STRENGTH CONCRETE	849
<i>Khan M. Iqbal, Abbass Wasim</i>	
PULLOUT SIMULATION OF POST INSTALLED CHEMICALLY BONDED ANCHORS IN UHPFRC	853
<i>Delhomme Fabien, Brun Michael</i>	
DESIGN AND CHARACTERIZATION OF SELF-SENSING STEEL FIBER REINFORCED CONCRETE	860
<i>Ferdiansyah Teuku, Turatsinze Anaclet, Balayssac Jean-Paul</i>	
STEEL FIBRE-REINFORCED CONCRETE: MULTI-SCALE CHARACTERISATION TOWARDS NUMERICAL MODELLING	865
<i>Zeranka Stephan, van Zijl Gideon</i>	
A NEW TESTING METHOD FOR TEXTILE REINFORCED CONCRETE UNDER IMPACT LOAD	874
<i>Hering Marcus, Curbach Manfred</i>	
PROPERTIES OF WESTERN CAPE CONCRETES WITH METAKAOLIN	882
<i>Bakera Alice T., Alexander Mark G.</i>	
STUDY ON CHARACTERISTICS OF TENSILE STRENGTH OF CONCRETE CONSIDERING TEMPERATURE DEPENDENCE IN MASS CONCRETE STRUCTURES.....	896
<i>Izumi Hiroki, Arai Juniti, Mizobuchi Toshiaki</i>	
MEASURED TEMPERATURE EFFECTS DURING THE CONSTRUCTION OF A PRESTRESSED PRECAST CONCRETE BRIDGE BEAM.....	903
<i>Küsel Frank, Kearsley Elsabe, Butler Liam J., Skorpén Sarah A., Elshafie M.Z.E.B.</i>	
CONCRETE HYDRATION TEMPERATURES FOR THE DESIGN OF CRACK-WIDTH REINFORCEMENT IN CONCRETE WATER-RETAINING STRUCTURES – DESIGN VALUES VERSUS IN-SITU VALUES	910
<i>Angelucci Matteo</i>	
TENSILE STRENGTH OF CARBON ROVINGS IMPREGNATED WITH DIFFERENT MATERIALS UNDER ANODIC POLARIZATION	919
<i>Asgharzadeh Amir, Raupach Michael</i>	
ELECTRICAL RESISTANCE TOMOGRAPHY FOR ASSESSING WATER MOVEMENT IN CRACKED CEMENTITIOUS MIXTURES	925
<i>Kawaai Keiyu, Ujike Isao</i>	
Author Index	