CoMSIRU

Concrete Materials and Structural Integrity Research Unit

ANNUAL REPORT 2017

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UNIVERSITY OF CAPE TOWN
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Message from the director

Digital Technologies have been successfully implemented in various sectors including manufacturing, mining and construction. In the construction industry, changes are happening on many fronts such as construction methods, new materials, and digital technologies. Building Information Modelling (BIM) is now commonly used by consultants and contractors. If fully exploited, BIM can play a critical role in infrastructure management. 3D Printing technologies have now moved out of laboratory environments to construction sites. Sensing technologies and the ability of such smart structures to communicate with each other are now available, thus providing a range of opportunities for real-time performance monitoring.

If appropriately implemented, these "Industry 4.0" technologies can drastically improve operational efficiencies, productivity and safety. It is increasingly clear that this new paradigm requires skills different from the traditional engineering skill sets. In keeping with the motto, 'developing high level manpower for the construction industry', CoMSIRU continuously reviews its training and research agenda in order to remain technically sound and relevant. We believe it is now an opportune time to reflect on our long-term research and training program with input from our Industry Partners and Advisory Board.

We look forward to a productive 2018!

Prof Pilate Moyo

May 2018

Introduction

CoMSIRU is an active research unit in the Department of Civil Engineering at the University of Cape Town. The unit's research is focused on durability of concrete structures, structural health monitoring, structural integrity assessment, and repair and rehabilitation strategies for concrete structures.

The guiding principle for CoMSIRU is developing high-level manpower for industry, research and academia, while engaging in innovative and impactful research. This is reflected in the strong integration between the unit's research, education and technology transfer activities. The unit maintains healthy and active, linking with industry through an advisory board, involvement in professional bodies and continuing professional development courses, as well as postgraduate training. CoMSIRU's well-established international links provide opportunities for collaborative research and benchmarking, which enables the research unit to continuously evolve and strengthen its niche research focus. CoMSIRU recognises the impact of the emergence of "Industry 4.0" and its impact on both research and training needs.

CoMSIRU's research enjoys high impact as measured by scholarly productivity, inclusion in local standards, local and international awards and the demand for its graduates in industry.

Objectives of the research unit

- Expand and improve the pool of high-level skills in concrete materials and structural engineering, in South Africa;
- Influence the culture and practice of engineering design of concrete structures;
- Improve management of the infrastructure;
- Embed durability and sustainability in all aspects of concrete structural/civil engineering;
- Promote structural health monitoring as a key tool for structural performance assessment;
- Embrace the opportunities and challenges of Industry 4.0

Staffing

Director

Prof Pilate Moyo

Co-director

Prof Hans Beushausen

Senior Research Scholar

Emer. Prof Mark Alexander

Honorary Research Associates

Prof Manu Santhanam

In 2010, Prof Santhanam joined COMSIRU where he has been providing expertise to the unit from the viewpoint of microanalytical characterization of cementitious materials, and participated in the adaptation of the EN concrete standards in South Africa. Prof Santhanam's research interest lies in cement chemistry, materials characterization and non-destructive evaluation.

Dr Sifiso Nhleko

A former student of UCT's civil engineering department, where he obtained both his BSc and MSc degrees, Dr Nhleko completed his PhD at the University of Oxford. In 2013 Dr Nhleko joined CoMSIRU, and presents lectures to postgraduates on a yearly basis, along with various other activities within the research unit and department. With his main research interest in structural dynamics, he is involved in a wide variety of civil and structural engineering due to his current position in the nuclear industry.

Mr Vernon Collis

Mr Collis has been co supervising some of our post-grad students with Professor Alexander since 2007 and officially joined the CoMSIRU team four years ago, with research interests in the sustainability arena.

Postdoctoral research fellows

Dr Fulvio Busatta

Joining the CoMSIRU family in 2014 from Italy, Dr Busatta received an MSc (Eng) from University of Padova and a PhD in Structural, Earthquake and Geotechnical Engineering from Politecnico di Milano. Since his arrival Dr Busatta has been working closely with Professor Moyo, and his research interests cover operational modal analysis, structural health monitoring and railway bridge dynamics.

Dr Ines Tchetgnia Ngassam

Joining the CoMSIRU family in 2015 from Cameroon, Dr Ngassam completed her PhD at University of Paris East in France on the durability of reparations made with polymer-modified mortars. Since her arrival Dr Ngassam has been working closely with Professor Beushausen, with her focus now on alternative formulations of repair mortars.

Teaching activities and postgraduate training

CoMSIRU is integrally involved in two postgraduate programmes within the Department of Civil Engineering namely, the Structural Engineering and Materials (SEM) Programme and the Civil Infrastructure Management and Maintenance (CIMM) Programme. CIMM was developed by the research unit to offer a broad range of knowledge and skills including asset management, maintenance, repair and rehabilitation of civil infrastructure in line with South African Government's Immovable Asset Management Act of 2007. Courses offered in these programmes are also open to industry for continuing professional development (CPD)

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Postgraduate courses

STRUCTURAL CONCRETE PROPERTIES AND PRACTICE

The aims of the course are to provide structural engineers with fundamental and practical knowledge in concrete materials technology, to establish an understanding on modelling and designing concrete properties relevant to structural design and to create awareness of chemical and physical material characteristics of cementitious construction materials.

STRUCTURAL DYNAMICS WITH APPLICATIONS

This course aims to introduce the concepts of structural dynamics and its applications in structural engineering. Specifically applications considered include applications to seismic design of structures, blast and impact effects on structures and wind engineering.

BRIDGE MANAGEMENT AND MAINTENANCE

This course aims to introduce the principles of bridge management and maintenance, with a focus on both highway and railway bridges. The course expands on the basic philosophies behind bridge management systems, the structure of a bridge management system and the implementation of bridge management system. Key to this course is practical bridge inspections and case studies.

DURABILITY AND CONDITION ASSESSMENT OF CONCRETE STRUCTURES

This advanced course aims to develop an understanding of durability aspects, service life design and non-destructive testing of concrete structures.

STRUCTURAL PERFORMANCE ASSESSMENT AND MONITORING

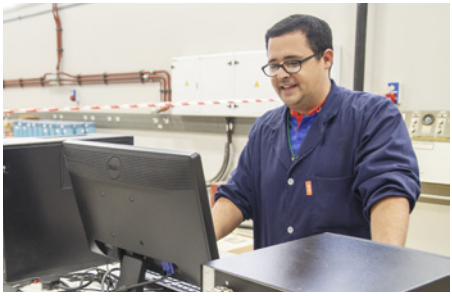
This aims to introduce concepts of structural health monitoring of civil infrastructure through static and dynamic field measurements as well as finite element modelling.

REPAIR AND REHABILITATION OF CONCRETE STRUCTURES

This course deals with the repair and rehabilitation of concrete structures. Strengthening systems, using fibre-reinforced composites are also covered.

ADVANCED INFRASTRUCTURE MANAGEMENT

This course provides the principles and the practice of infrastructure management.



Continuing professional development courses

BRIDGE DESIGN, ANALYSIS AND CONSTRUCTION

This course covers various practical aspects of bridge design, analysis and construction, including bridge loads, conceptual design, and structural design and construction technologies. Emphasis is on highway and railway bridges in reinforced and restressed concrete.

BRIDGE MANAGEMENT AND MAINTENANCE

The course provides guidance on the development and implementation of bridge management systems to facilitate effective maintenance and rehabilitation of bridge structures.

CONDITION ASSESSMENT AND REPAIR CONCRETE STRUCTURES

The purpose of the workshop is to provide participants with a fundamental and practical understanding of condition assessment of concrete structures, and concrete repair and strengthening methods.

STRUCTURAL CONCRETE PROPERTIES AND PRACTICE

The underlying aims of the workshop are to highlight the importance of materials in the design and performance of concrete structures and to facilitate a good understanding of modern concrete technology in order to promote economic and sustainable design of reinforced concrete structures.

RESEARCH METHODOLOGY AND TECHNICAL WRITING

This course aims to equip engineering professionals with the transferable skills of technical investigation, technical writing and presentation.

STRUCTURAL HEALTH MONITORING & NON-DESTRUCTIVE TESTING OF STRUCTURES

These techniques are increasingly used for structural performance assessment of structures both during construction and operational phases. The course covers instrumentation, data management and analysis and integration of measurement with computational modelling.

PRACTICAL DESIGN OF FLOORS AND FOOTBRIDGES FOR VIBRATION SERVICEABILITY

The course is designed to equip engineers with the state of the art on practical design and assessment of floors and footbridges for vibration serviceability.

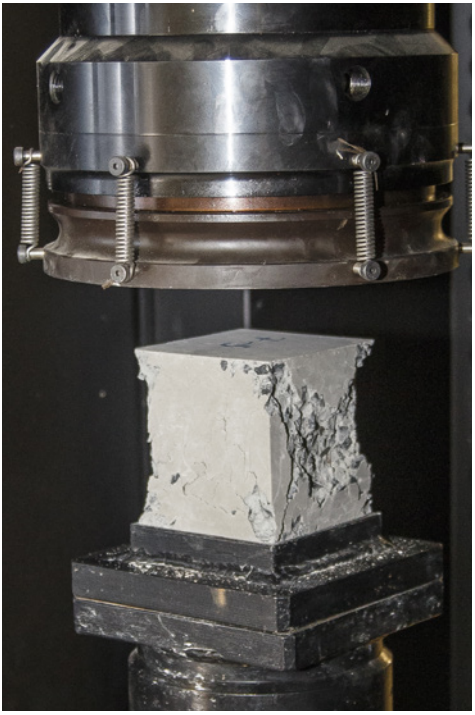
CONDITION ASSESSMENT OF STEEL STRUCTURES

This course cover approaches for the inspection of steel structures as well as methodologies for structural performance assessment and remedial actions.

Current students

In 2017, CoMSIRU 44 registered postgraduate students: (6 PhD, 17 MSc (Eng) and 21 MEng students). 10 Masters students graduated in 2017. Details are given in the tables below.

	TOTAL	FEMALE	MALE	BLACK/ INDIAN	WHITE	FOREIGN	SOUTH AFRICAN
PhD	6	1	5	6	0	6	0
MSc (Eng)	17	4	13	13	4	7	10
MEng	21	2	19	18	3	7	14
Grand Total	**44**	**7**	**37**	**37**	**7**	**20**	**24**




OPEN

2017 PhD students

NAME	SUPERVISOR	TITLE
R Gopinath	MG Alexander H Beushausen	A service life prediction model based on carbonation induced corrosion for South African conditions
M Kabani	P Moyo MG Alexander	Time-dependent bridge network reliability assessment with health monitoring
P Bukenya	P Moyo H Beushausen	Dynamic characterisation of concrete dams using operational modal analysis
P Arito	H Beushausen MG Alexander	The optimisation of mix design parameters and constituents to minimise cracking in patch repair mortars
R Heiyantuduwa	MG Alexande	Chloride prediction model for concrete durability.
S Surana	H Beushausen MG Alexander	Use of chloride conductivity parameter in chloride prediction models

2017 MSc (Eng) students

NAME	SUPERVISOR	TITLE
A Moore	H Beushausen	Critique of environmental exposure classification for tidal zone
H Sohawon	H Beushausen	Service life extension of reinforced concrete structures using silane impregnation.
N Omar	H Beushausen	Carbonation Predictions for Modern South African Concretes
M Holmes	MG Alexander	The optimisation of the packing of powder materials for the reduction of clinker content in concrete
S Ross	MG Alexander V Collis	Bamboo construction as a sustainable building technology from a structural and materials engineering perspective
S Balendra	H Beushausen	Performance approaches for concrete durability – developing a new framework for application
D Govender	MG Alexander	DI database and integration with SANRAL Management Systems

NAME	SUPERVISOR	TITLE
M Mwatile	MG Alexander	Topic to be decided
J Ndawula	S Skatulla H Beushausen	Multiphase modelling of deterioration of reinforced concrete structures
A Titus	MG Alexander	Properties of Western Cape concrete with metakaolin
C Ludwig	P Moyo	The influence of the structure-ballast rail interaction on the dynamic properties of railway bridges
Z Mahomed	MG Alexander	Alkali aggregate reaction - current Western Cape mixes
B Nyoni	P Moyo	Numerical modelling of concrete hydropower dams exposed to ASR: long-term environmental effects of climate change
A Goodhead	P Moyo	Fatigue life of prestressed concrete sleepers on an open decked bridge
P Jassa	H Beushausen	Alternative patch repair materials for rebar corrosion damage
A Ragoleka	P Moyo	Vibration serviceability of footbridges in SA: An investigation of the crowd capacity of The Boomslang Footbridge.
L Thako	P Moyo	Railway tunnels management system in South Africa

2017 MEng students

NAME	SUPERVISOR	TITLE
G Abed	MG Alexander	Rebar corrosion of RC structures in the Cape Peninsula
A Allison	P Moyo	Determining the dynamic responses of the non-overspill bridge decks of the Van Der Kloof dam
K Chiremboa	H Beushausen	Thesis to be decided
C Dankers	P Moyo	The evaluation of the structural safety of concrete gravity dams

NAME	SUPERVISOR	TITLE
O Davis	MG Alexander	Heat transfer through anaerobic digester concrete tank walls
W Delport	P Moyo	Methodgy to model dam foundations
I Hartley	MG Alexander	Integration of IDMS & SIPDM at local municipalities
G Hove	H Beushausen	Concrete crack repair
B Isaacs	P Moyo	A review of the TNPA 7 TFR infrastructure & asset maintenance manuals
C Koen	P Moyo	Statistical modelling of water pipeline failure
W Macua	H Beushausen	Thesis to be decided
A Marais	H Beushausen	Repair and strengthening of masonary structures
D Mashanda	H Beushausen	Concrete deterioration – trends and problems
M Mulaudzi	H Beushausen	Quality assurance for the construction of concrete slabs placed on the ground
T Namalima	P Moyo	System analysis of railway bridges with concrete sleepers
D Ngwenya	P Moyo	Collapse of Tongaat mall
E Nyambalo	H Beushausen	Thesis to be decided
E Rugemalira	H Beushausen	Thesis to be decided
M Salie	P Moyo	Thesis to be decided
H Stehle	P Moyo	A comparative study on the structural behaviour of concrete arch dams subjected to swelling due to chemical reaction
H Van Wijk	P Moyo	Thesis to be decided

Graduated master's degree students (2017)

NAME	SUPERVISOR	TITLE
M Poyo	H Beushausen	Abrassion resistanceof Immersion – Vibrated roller compacted concrete of the spillway steps
W Smith	H Beushausen	Reinforced Concrete Durability: The effective use of cover level with the application of surface treatments on reinforced concrete
G Abed	MG Alexander	Rebar corrosion of RC structures in the Cape Peninsula
Z Prins	P Moyo	Investigating the operational behaviour of a double curvature arch dam
M Mothetho	P Moyo	Assessing local water distribution infrastructure management and maintenance challenges
K Mmekwa	P Moyo	The impact of aging infrastructure on South Africa's economy
B Gombele	P Moyo	Implementation of the DER system within power generated plant environment
S D Paulse	P Moyo	Analysis and comparison of the South African and Eurocode live load models for railway bridges
P Habimana	P Moyo	Behaviour of FRP Strengthened RC Beams with Concrete Patch Repairs Subjected to Impact Loading
S Hendricks	P Moyo	Vibration Based Assessment of Kalbaskraal Rail Bridge
L Thako	P Moyo	Railway tunnels management system in South Africa

Research activities

CoMSIRU's research work is focused on developing a deep understanding of both the short-term and long-term behaviour of concrete and developing methodologies for producing durable and structurally sound concrete that minimises maintenance costs. Thus, there is a strong emphasis on understanding the deterioration mechanisms of concrete structures, development of technologies for assessment of concrete structures as well as development of life extension of deteriorated concrete structures. This is achieved through two broad research thrusts; concrete materials and construction and structural integrity and monitoring.

CoMSIRU's research work is supported by state-of-the-art laboratories for concrete technology and structural concrete. The research unit integrates laboratory work, field measurements and computational modelling of materials and structures, which places the research unit in a good position to develop realistic and practical engineering solutions.

An important consideration in deterioration science and renewal engineering is sustainability of materials and construction. To this end, the research unit has embarked on developing knowledge and technologies that may be used by structural engineers to ensure their designs are sustainable.

Current research projects

SERVICE LIFE PREDICTION MODELS FOR REINFORCED CONCRETE IN THE SA CONTEXT

Service life prediction models exist at an international level, but it is essential that locality-specific models also be developed and calibrated, in view of the specificity of local environmental exposure conditions. Two such models are under development: one for chloride ingress into a wide variety of different concrete types, and the second a carbonation-corrosion model that couples CO_2 ingress with a tendency for subsequent corrosion.

LOW-CLINKER CEMENTS

It is imperative that modern concretes be formulated with as low a clinker factor as possible in the binder component, to minimise the carbon footprint of such concretes. This project considers practical ways of reducing the clinker factor of concrete using a combination of improved packing and reactivity of the fine filler materials, based largely on finely ground limestone and potentially reactive fly ash.

DURABILITY AND DETERIORATION STUDIES

This research has been a consistent theme in CoMSIRU for many years. Currently, these studies relate to deterioration of concrete sewer pipes, for which PhD work is being done in order to better understand the deterioration processes in such sewers, and characterisation of the inter-tidal zone for chloride ingress into concrete. Work on deterioration of continuously reinforced concrete pavements has also been undertaken.

SUSTAINABILITY AND RESOURCE MINIMISATION STUDIES

A PhD study was recently concluded that laid out a novel framework to assist structural concrete engineers to design for more sustainable concrete structures. Work is also on going on understanding how to minimise resource usage of concrete materials, and a study on local bamboo in construction is being completed.

FATIGUE RELIABILITY AND LONG-TERM MONITORING OF RAILWAY BRIDGES

Developments in structural health monitoring of bridge structures are enabling the capture of information on as-built structural behaviour of these structures. Such information is useful for the assessment of the condition and reliability of bridges. This project is focused on the fatigue behaviour of concrete railway bridges. In particular, box-type sections will be considered. A monitoring system has been developed for the Olifants River Bridge, located in Vredendal.

BRIDGE MANAGEMENT SYSTEMS

Visual inspection is the predominant bridge assessment technique employed by most current BMS. In South Africa, substantial visual inspection data has been collect in the last decade. However, these data have not been analysed to determine predominant deterioration mechanisms. This project seeks to gain deeper understanding of deterioration mechanisms in bridges located in the Western Cape.

LONG-TERM PERFORMANCE OF REPAIRED REINFORCED CONCRETE STRUCTURES

There is a dearth of information on the long-term performance of repaired reinforced concrete structures. Quite often, infrastructure owners have no idea about the effectiveness of repair and strengthening interventions and their long-term performance. In particular, the long-term behaviour of new cementitious grouts for structural repairs as well as fibre-reinforced polymers (FRP) for structural strengthening is not well understood.

AMBIENT VIBRATION MONITORING OF CONCRETE DAMS

Finite element modelling is a powerful tool for simulating structural system behaviour. In this body of work, updated finite element models will be used to predict the future behaviour of dams. Updating of the FEM models will be based on ambient vibration testing.

NUMERICAL MODELLING OF THE SWELLING EFFECT OF CONCRETE STRUCTURES

The chemical reactions involving aggregates, cement paste and water may lead to the swelling of concrete. Such volume changes lead to premature deterioration and, in some cases, structural failure. The problem of concrete swelling has been widely reported, especially in concrete dams. A number of numerical models have been proposed to simulate the swelling action and compute the structural response to this internal loading. This project is focussed on developing computational models for implementation in standard finite element analysis codes.

Impact of research

The unit's research in concrete durability has been on-going for more than two decades and has led to a better understanding of the deterioration mechanisms of concrete. Test methods for the durability of concrete developed by CoMSIRU researchers have now been refined to a point where they are now within the SABS system for acceptance as national standards. In addition, the revision of SANS10100-2 will incorporate research outputs in terms of concrete durability clauses.

CoMSIRU's research has instilled a comprehensive approach to condition assessment and strengthening of concrete structures, which may be noted by the input into national codes and standards, where research findings are being reflected. The unit's publications, specifically the series of monographs that are produced and regularly supplemented by new material. As far as scientific papers are concerned, the output of CoMSIRU is substantial, and the vast majority appear in internationally respected journals and conferences.

New approaches from this research continue to be applied in major national construction projects.

Publications

Books

Alexander, M.G., Bentur, A. & Mindess, S. 2017. Durability of concrete: design and construction. CRC Press (Taylor & Francis Group). 323 pp.

Alexander, M.G. & Blight, G.E. 2017. Southern and central Africa. (Chapter 12) Alkali-aggregate reaction in concrete: a world review. Eds Sims, I. & Poole, A. CRC Press (Taylor & Francis Group). 509-538.

Refereed/peer reviewed journals

Angelucci, M., Beushausen, H., Alexander, M.G. & Mackechnie, J.R. 2017. Specifying cement content for concrete durability: why less is more. Concrete Beton. 150:12-17.

Beushausen, H., Hoehlig, B. & Talotti, M. 2017. The influence of substrate moisture preparation on bond strength of concrete overlays and the microstructure of the OTZ. Cement and Concrete Research. 92:84-91.

Nganga, G., Alexander, M.G. & Beushausen, H. 2017. Practical implementation of durability index performance-based specifications: current experience. Concrete Beton. 150:18-22.

Otieno, M., Alexander, M.G. & Du Plessis, J. 2017. Soft water attack on concrete tunnel linings in the Ingula pumped storage hydro-power scheme: assessment of concrete resistance and protection. Journal of South African Institution of Civil Engineering. 59(3):57-67.

Starck, S., Beushausen, H., Alexander, M.G. & Torrent, R. 2017. Complementarity of in-situ and laboratory-based concrete permeability measurements. Materials and Structures. 50:177.

Proceedings of refereed international conferences

Alexander, M.G. 2017. Durability and service life prediction for concrete structures - developments and challenges. Proceedings of the 2nd International Congress on Materials & Structural Stability (CMSS2017). 22-25 November 2017. Rabat, Morocco. Available: www.matec-conferences.org/articles/matecconf/abs/2018/08/matecconf_cmss2018_01006/matecconf_cmss2018_01006.html

Alexander, M.G. & Nganga, G. 2017. Developments in the performance approach for durability and service life prediction for concrete structures. Proceedings of the 1st International Conference on Construction Materials for Sustainable Future (CoMS2017). 19-21 April 2017. University of Zagreb, Zagreb, Croatia. 56-63.

Alexander, M.G. & Nganga, G. 2017. Transport properties of concrete - improving concrete durability. Proceedings of the symposium "The future of cement, 200 years after Louis Vicat". 6-8 June 2017. UNESCO, Paris, France.

Beushausen, H. 2017. Performance-based specifications and control of concrete durability. Proceedings of the 3rd Corvallis Workshop on Service-Life Prediction of Concrete. 16-19 July 2017. Oregon State University, Corvallis, United States of America. 4-28.

Beushausen, H. 2017. The influence of mix composition and curing conditions on shrinkage cracking of cementitious materials. Proceedings of the 2nd RILEM/ COST Conference on Early Age Cracking and Serviceability in Cement-based Materials and Structures.12-14 September 2017. Brussels, Belgium. 39-50.

Beushausen, H. & Nanukuttan, S. V. 2017. Performance-based specifications and control of concrete durability. Proceedings of the 8th International Conference on Structural Engineering and Construction Management (ICSECM 2017). 7-9 December 2017. Kandy, Sri Lanka.

Bukenya, P. & Moyo, P. 2017. Monitoring the structural behaviour of concrete arch dams: the case of Roode Elsberg dam. Proceedings of SANCOLD Conference 2017. 15-17 November 2017. Centurion, Tshwane, South Africa. 429-438. ISBN 978-0-620-76981-5

Busatta, F. & Moyo, P. 2017. How testing and monitoring can support heavy haul railway bridge management: the experience gained in South Africa. Proceedings of the 11th International Heavy Haul Association Conference (IHHA 2017). 2-6 September 2017. Cape Town, South Africa. 599-606. ISBN: 978-0-911-382-66-2

Busatta, F. & Moyo, P. 2017. Assessing the performance of a heavy haul railway viaduct through monitoring traffic loads and dynamic effects. Proceedings of Experimental Vibration Analysis for Civil Structures Testing, Sensing, Monitoring, and Control Conference (EVACES 2017). 12-14 July 2017. San Diego, United States of America. 770-780. ISBN 978-3-319-67442-1

Gopinath, R., Alexander, M.G. & Beushausen, H. 2017. Predicting depth of carbonation of concrete for varying climatic conditions. Proceedings of the 2nd International RILEM/COST Conference on Early Age Cracking and Serviceability in Cement-Based Materials and Structures - EAC2. 12-14 September 2017. ULB-VUB, Brussels, Belgium.

Govender, D. 2017. Structural restoration of fractured concrete specimens using pressured crack injection technology

and micro-silica epoxy resin compounds. Proceedings of the 17th fib Symposium on High Tech Concrete: Where Technology and Engineering Meet. 12-14 June 2017. Maastricht, Netherlands. 273-283.

Heiyantuduwa, R. & Alexander, M.G. 2017. Time development of chloride diffusion coefficients for concrete exposed to the marine environment. Proceedings of the International Conference on Advances in Construction Materials and Systems (ICACMS-2017), RILEM PRO 118. 3-8 September 2017. Chennai, India. 369-34.

Holmes, M.S. & Alexander, M.G. 2017. The optimisation of the packing of powder materials for the reduction of clinker content in concrete. Proceedings of 3rd KEYS Symposium on Sustainable Building in Africa. 26-30 June 2017. University of the Witwatersrand, Johannesburg, South Africa. 111-115.

Mahomed, Z.M., Alexander, M.G. & Beushausen, H. 2017. Alkali aggregate reaction: current Western Cape concrete mixes. Proceedings of 3rd KEYS Symposium on Sustainable Building in Africa. 26-30 June 2017. University of the Witwatersrand, Johannesburg, South Africa. 187-191.

Moyo, P. & Bukenya, P. 2017. Experiences with continuous monitoring of deformation and modal properties of an arch dam. Proceedings of SHMII-8; Structural Health Monitoring of Intelligent Infrastructure Conference 2017. 5-8 December 2017. Queensland University of Technology, Brisbane, Australia.

Moyo, P. & Nordengen, P. 2017. Experiences with management and structural performance assessment of highway bridges in South Africa. COST Action TU1406 Workshop on Sustainable Bridge Management. 23-24 November 2017. Riga Technical University, Riga, Latvia.

Nanukuttan, S. V. & Beushausen, H. 2017. The effect of cracking on concrete durability. Proceedings of the 8th International Conference on Structural Engineering and Construction Management (ICSECM 2017). 7-9 December 2017. Kandy, Sri Lanka.

Papers in non-peer reviewed journals; un-refereed articles

Alexander, M.G. 2017. Durability index testing - update on test methods. Concrete Beton. 48:44-45.

Kessy, J., Alexander, M.G. & Beushausen, H. 2016. Concrete durability design in North America, Australia and Europe. CPI International. 6:62-71.

Awards, prizes and appointments

Matongo Kabani, was awarded "Outstanding Student Engineering Award", by the International Heavy Haul Association (IHHA), for his work on live loading for assessment of railway bridges in heavy haul lines. His work provides new insights into deterioration assessment, structural health monitoring and service life prediction for a range of bridge spans subjected to very long heavy haul trains.

Prof Pilate Moyo was appointed Head of Civil Engineering Department, University of Cape Town for the period 2018-2022.

Organisational arrangements

Governance

CoMSIRU is overseen by its two directors, Prof Pilate Moyo and Prof Hans Beushausen. Emeritus Prof Mark Alexander now plays role of senior advisor to CoMSIRU. Regular meetings are held by these three directors to discuss teaching, research, administration and budget issues. CoMSIRU is serviced administratively and financially by a research administrative finance officer, Mr Werner van der Ross.

CoMSIRU Advisory Panel

NAME	COMPANY/ INSTITUTION	E-MAIL
Pilate Moyo	UCT	pilate.moyo@uct.ac.za
Hans Beushausen	UCT	hans.beushausen@uct.ac.za
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Manu Santhanam	Indian Institute of Technology, Madras	manusanthanam@gmail.com

Highlights

Prof Alexander undertook a collaborative visit to IITM (Indian Institute of Technology, Madras) in September-October 2017, to share research ideas, to participate in postgraduate research seminars, and to advise selected postgraduate students. He was also invited to participate and present a paper at the French Cement Industry '200-year Vicat' Conference in Paris in June 2018.

CoMSIRU participated in the 11th International Heavy Haul Association (IHHA) Conference, held at the Cape Town International Convention Centre (CTICC) on 2-6 September 2017. This five-day event was attended by about one thousand delegates from more than 25 countries. CoMSIRU, organised the participation of 20 Grade 10 & 11 learners from Masiphumelele High and Ocean View High School to expose learners to the various sectors in the heavy haul railway industry.

They had full access to the conference including strategic sessions one of which was chaired by Prof. Mamokgethi Phakeng, UCT Deputy Vice-Chancellor Research and Internationalisation.

The theme of the conference was "Advancing Heavy Haul Technologies and Operations in a Changing World." The IHHA 2017 Conference is hosted by Transnet and the South African Heavy Haul Association (SAHHA), the South African chapter of the IHHA, of which CoMSIRU is an active member. Prof Moyo was a member of the organising committee for the conference.

Financial statement

		2016	2017
TOTAL INCOME	Industry income	R 4 366 245,66	R 4 129 210,53
	Grants/Contracts	R 867 829,70	R 616 816,00
	Investment Fund	R 694 908,38	R 712 680,68
	Carry over	R 591 536,30	R 1 614 191,62
	Total	**R 7 193 989.16**	**R 7 072 898,83**
TOTAL EXPENDITURE	STAFFING COSTS	R 1 340 281,82	R 908 528,80
	BURSARIES	R 1 292 797,90	R 1 558 893,55
	ADMIN AND OPERATING EXPENSES	R 306 448,82	R 265 825,91
	CONFERENCE AND REGISTRATION EXPENSES	R 29 188,61	R 43 574,26
	LOCAL TRAVEL	R 171 550,44	R 121 807,58
	FOREIGN TRAVEL	R 320 825,11	R 410 638,38
	EQUIPMENT	R 573 513,57	R 474 658,19
	OTHER COSTS	R 289,38	R 17 388,53
	COST RECOVERY	R 337 083,08	R 294 537,38
	LAB EXPENSES	R 534 349,69	R 435 636,04
	Total	**R 4 906 328,42**	**R 4 531 488,62**
	Balance	**R 1 614 191,62**	**R 2 541 410,21**

Funders

Collaborations and linkages