

Speakers and abstracts

Bio-based cement replacement potentials in Africa

Dr. Kolawole Adisa Olonade

Department of Civil & Environmental Engineering, University of Lagos, Nigeria

Agribusiness is the predominant occupation for about three-quarter of the population in Africa. Substantial agricultural wastes are thus generated during processing of the agri-products either for domestic or industrial utilization. Unfortunately, effective disposal of these “wastes” remains a major challenge. In this presentation, strategies to utilize bio-wastes for producing high-performance cement-based products are highlighted, which consequently guarantee sustainable construction. Challenges, prospects and expected action plans are equally presented.



Dr. Olonade is a Senior Lecturer in the Department of Civil and Environmental Engineering, University of Lagos, Nigeria and an expert in cement and concrete. His research focus is utilizing bio-wastes for production of high-performance cement-based products for affordable housing and sustainable construction in sub-Saharan Africa. He pioneers the use of cassava peel ash as supplementary cementitious materials through which he won the first German-African Innovation Incentive Award. Dr. Olonade is an initiator for the establishment of the Society of Cement and Concrete Researchers in Nigeria (SCCRIN). He is a member of many professional bodies such as NSE, COREN, ACI and RILEM. Currently, he is the Chairman Nigerian Society of Engineers, Abeokuta Branch.

“I foresee Africa to be self-sufficient in construction materials and driver for converting bio-wastes to bioresources, through cutting-edge research with firm regional integration.”

Future cement solutions for tropical climatic conditions

Prof. Manu Santhanam

Department of Civil Engineering, IIT Madras, Chennai, India

The talk will focus on 'global' and 'local' approaches to cement replacement in Africa, and draw upon the parallels with the existing situation in Asia. Particular emphasis will be given to the use of limestone, calcined clays, and agricultural ashes. Research results from IIT Madras involving these materials with respect to cement and concrete properties will be presented. Perspectives on sustainability will also be explored to provide a holistic view for the consideration of future use of these materials.



Manu Santhanam is a Professor and Head of the Department of Civil Engineering at IIT Madras in Chennai, India. He is a Senior Member and Fellow of RILEM, and has been an active researcher in concrete for nearly 20 years. His research focuses on supplementary cementing materials and their impact on special applications as well as durability of concrete. He is an Associate Editor for the ASCE Journal of Materials in Civil Engineering and Journal of Sustainable Cement Based Materials, as well as serves on the Editorial Board of Cement and Concrete Composites, and Advances in Cement Research.

"The projected growth in cement demand over the next several decades in Asia and Africa brings about a need for understanding the proper utilization of supplementary materials. A sound scientific approach is required to judiciously choose the right cement replacement material for durable concrete."

Specific African durability challenges

Prof. Mark Alexander

University of Cape Town, South Africa

Africa faces several challenges regarding durability of construction (concrete construction in particular). These include 'imported' solutions to technical problems, which traditionally have been from the west but increasingly now also from the east, and which are often not appropriate; lack of technical and scientific knowledge, expertise and facilities in some cases; and a highly differentiated construction sector. Much of the continent also lies in the tropical and sub-tropical belt with specific challenges for durability of construction materials. This presentation will explore some of these aspects and posit some possible solutions, specifically for concrete construction, which will form the bulk of future construction in Africa.



Mark Alexander is Emeritus Professor of Civil Engineering, and a Senior Research Scholar in the University of Cape Town. He has a PhD from the University of the Witwatersrand, Johannesburg, and is a Fellow of the University of Cape Town, RILEM, the South African Institution of Civil Engineering, and the South African Academy of Engineering. He teaches and researches in cement and concrete materials engineering relating to design and construction, with interests in concrete durability, service life prediction, concrete sustainability, and repair and rehabilitation of deteriorated concrete structures. He is a past President of RILEM and acts as a specialist consultant on concrete materials problems. He co-authored a vast number of books on durability issues and concrete performance.

"Africa is the continent of youth, who need to understand the need for science- and community-based solutions in order to progress. Africa's youth must shake off both colonial vestiges and unproductive approaches still extant in some parts of the continent, and emerge as a powerful lobby for sustainable approaches for the future."

Circular economic potentials in urban construction with bio-based concrete constituents

Dr. Dipl.-Ing. Wolfram Schmidt

Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany

The lecture introduces the unbalance between rural and urban development in many parts of the global South, and proposes materials technologies that can help enhancing livelihoods in rural areas in synergy with the rapid urban growth. Some technologies and value chains are introduced and critically discussed. Eventually, a case study of cassava waste usage in Nigeria is presented, followed by a conclusion on overcoming certain biases to replace old-fashioned techniques for future-oriented sustainable technologies.



Wolfram Schmidt works at in the department “Safety of Structures” at BAM. He is responsible for the rheology and admixtures laboratory and his research focuses on innovative organic and inorganic cement and concrete constituents for high-performance and climate friendly concrete including alternative bio-based chemicals and binders. Furthermore, he is secretary of the German Rheological Society, co-founder of the Pan-African Cement Proficiency Testing Scheme (PACE-PTS) and co-initiator of the conference series “Advances in Cement and Concrete Technology in Africa” (ACCTA) and ISEE-Africa (Innovation, Science, Engineering, Education). In 2017 he received the German-African Innovation Incentive Award. He is member of RILEM and fib officer in the RILEM Development Advisory Committee and Board of Editors of the Technical Letters.

“I strongly believe that Africa’s next generation of decision makers and researchers can become worldwide pioneers in greener, environmentally and socio-economically more sustainable construction technologies. Awareness, education and unbiased science-based approaches are key.”

Transition to industrialized housing construction in developing economies

Firehiwot Kedir

ETH Zürich, Switzerland

The presentation discusses the results of a one-year research project in collaboration between Arup and the Chair of Innovative and Industrial Construction of ETH Zürich through the annual Global Research Challenge (2018). The report highlights the myriad of micro- and macro-level factors that contribute to the sustainable adoption of Industrialized Construction (IC) products and processes in developing economies. Data is drawn from field visits to three cities— Addis Ababa, Nairobi, and Cape Town – in sub-Saharan Africa. The report begins with a micro-level view of building elements. A life cycle analysis is conducted to compare the environmental impacts of different construction materials and methods. Next, a macro-level view focuses on the intricate ecosystem influencing IC adoption using a systems analysis approach. This report serves as an attempt to document the complex ecosystem and enable local stakeholders to make informed decisions about the optimal path to IC adoption in their respective contexts.



Firehiwot Kedir is doing her PhD at the chair of Innovative and Industrial Construction ETH Zürich. Her research focuses on evaluating resource efficiency performance and opportunities of industrialized construction materials and methods. Recently, she led a technical report together with ARUP and ETH Zurich titled 'Sustainable Transition to Industrialized Housing Construction in Developing Economies'.

"I am curious and driven about the path to the betterment of our built environment. At the moment, provision of sustainable urban infrastructures through Innovative and Industrial Construction is an increasingly important core research topic."

Importance of balance between urban growth and rural development

Nonkululeko Radebe

Karlsruhe Institute of Technology (KIT), Germany

Agribusiness is the predominant occupation for about three-quarter of the population in Africa. Substantial agricultural wastes are thus generated during processing of the agri-products either for domestic or industrial utilization. Unfortunately, effective disposal of these “wastes” remains a major challenge. In this presentation, strategies to utilize bio-wastes for producing high-performance cement-based products are highlighted, which consequently guarantee sustainable construction. Challenges, prospects and expected action plans are equally presented.



Nonkululeko Radebe is a 3rd year PhD student in the Institute for Technical Chemistry and Polymer Chemistry. Her research focuses on the early age hydration kinetics and mechanical behaviour of fresh cement paste using rheological and spectroscopic techniques. Outside of fundamental science she is passionate about the access to education and resources to the youth of the African continent. She has contributed to several conference series papers at the ISEE-Africa conference (<http://isee-africa.com/>) on these topics. Additionally, she is the elected representative of sub-Saharan Africa in the RILEM Youth Council (RYC), where she will work to attract and engage with young researchers to facilitate networking with top minds in scientific topics about the built environment. Lastly, she is a part of the Lindau Alumni Network, a volunteer for STEMi Makers Africa and founder of ArtScie, a youth development program based in South Africa.

“Access is everything! Without the tools and networks, progress is stagnant. I believe that the vast talent found on the African continent can and will only flourish through decolonized education, infrastructure and general resources needed to manifest the visions and ideas.”

Unformal African architectures

Kuukuwa Manful

SOAS University of London, UK

The vast majority of architecture and construction across the African continent takes place outside the realm of the formalised and state-controlled – that which I term the unformal. This presentation explores the goal of sustainable, inclusive, and resilient urbanisation in Africa through a centering of unformal realities.



Kuukuwa Manful is a trained architect and researcher who creates, studies, and documents architecture in Africa. She is the cofounder of sociarchi, an organisation that advocates for and provides architectural services to people who ordinarily cannot afford architects. She also runs Accra Archive - which digitises endangered historical architectural material in Ghana; and curates adansisem - an architecture collective that documents and showcases stories of Ghanaian architecture.

Her current research - towards a PhD at SOAS, University of London - examines the sociopolitics of West African nation-building and citizenship through a study of the architecture of educational institutions. Some of her past research has been on the use of sustainable building materials and technologies; the social acceptance of earth building in urban areas in Ghana; and the history of the architecture profession in Ghana. She holds Masters and BSc Architecture degrees from the Kwame Nkrumah University of Science and Technology (KNUST), and an MSc in African Studies from The University of Oxford.

"It is important to use research-based, community-participation approaches to design to help solve environmental and social problems."

An eight year old's perspective of an urbanised Africa

Ester Kamaara

Star Kids Initiative, Kenya

Children are the future. The next generations will live longer in the world that we are currently creating - so why not integrate their perspectives in the design of the future? Factually, through education and exposure, teaching is of best practices can be imparted on them. However, on the same breath, children can innovatively question the status quo and dream up solutions with minimal inhibitions, therefore contributing to resolutions. This presentation elaborates on the construction challenges that children from Mukuru Kayaba Informal Settlement in Nairobi, Kenya identify around them, the immediate solutions they believe can be implemented and their dreams on sustainable urbanisation.



Esther Kamaara is the Founder and Executive Director of Star Kids Initiative, a community-based organization in Nairobi, Kenya that empowers children to reach their full potential by providing access to quality education to underprivileged children living in urban slums. Through several education programs, the initiative aims to develop the mindsets of the next generation into one that is morally upright, self-aware, socially responsible and environmentally cautious. Kamaara has 7 years of experience in 'Education for Development' sector and is currently a Masters candidate in Development Studies at Erasmus University Rotterdam, Netherlands.

"I believe that through multi-directional learning the development of a sustainable and resilient urbanisation of Africa is only a grasp away."

Conservation of cultural heritage, of traditions and the environment for prosperity

Prof. Eduardo Pereira and Prof. Tiago Miranda

University of Minho, Portugal

This talk focuses on the great challenges that African urbanized areas face in the near future. A holistic and integrated vision is required to find a clear path that guides African communities to human safety and prosperity. Although the construction industry is indisputably linked to the prosperous future of Africa, it cannot be separated from other key factors such as heritage and cultural roots, environmental sustainability and access to essential goods, as well as its relation to the Oceans. Therefore, the discussion will be triggered by different aspects such as how to take advantage of local materials and construction systems, sustainable ways to exploit resources and provide subsistence to all, and forms of regenerating old skills and occupations to generate new economical and socially responsible activities.



Eduardo Pereira is Assistant Professor at the University of Minho and a member of IB-S (Institute for Bio-sustainability) and ISISE (Institute for Sustainability and Innovation in Structural Engineering). His research focus on the creation of new value chains for waste materials and circular economy in the construction sector. He is also involved in projects dealing with the sustainable conservation of cultural heritage, as well as the sustainable relation with oceans and natural capital.

Tiago Miranda is Professor in the Civil Engineering Department at University of Minho in Portugal. From 2015 he was the Executive Director of the Institute for Science and Innovation for Bio-Sustainability (IB-S). Tiago's research focus on environmental geotechnics, circular economy in the construction sector, sustainable and advanced materials for construction and coastal engineering. Member of the UN Global Ocean Accounts Partnership.



"While searching for its deserved prosperity and human safety, the African continent is rapidly heading to an uncertain future. The challenges are enormous, but unprecedented solutions will emerge from the hearts and minds of young generations. The hope is that these eventually enlighten the world, in its own quest."

Global GHG from construction materials and the role of life cycle engineering to mitigate impacts

Prof. Sabbie A. Miller

University of California, Davis

Currently, the high production, and consequent environmental impacts, of cement and cement-based materials has sparked global concern. Cement and cement-based materials are responsible for 7-8% of global anthropogenic greenhouse gas emissions. These high impacts are a function of the great quantities of cement-based materials that are demanded annually rather than the degree of impacts of the materials themselves. With growing demand for infrastructure systems and a need to reduce material consumption, a complex challenge presents itself for how we can tackle known environmental impacts. This lecture will explore the reasons why reducing greenhouse gas emissions from some construction materials has been difficult and will present several mitigation strategies controlled at different stages of the material's life cycle.



Sabbie Miller's research focuses on lowering the environmental impacts of the built environment. She is developing methods for improving materials design procedures to concurrently assess environmental impact and material performance by linking concepts from structural engineering, materials engineering, and life-cycle assessment. Application of these methods allows strategic execution of composite design measures and constituent selection techniques in the design of infrastructure materials. She is a member of several national and international technical committees pertaining to environmental sustainability of construction materials.

"We are faced with a myriad of global challenges, and by coming together, we have the potential to meet all of our societal needs without causing further harm to the environment. The only way to meet these challenges is through global engagement, continuous sharing of information and knowledge, and the active support of our current and future scientists."

Urban metabolism to demonstrate material and energy flows in cities

Dr. Nadine Ibrahim

Civil & Environmental Engineering, University of Waterloo, Canada

As it applies to cities, urban metabolism is a description of activities that make the city function, and therefore includes the sum total of the technical and economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste. This presentation introduces urban metabolism, and demonstrates some historical examples in literature, and more recent examples of global cities developed by students, including African cities. A deeper dive into the construction material stocks in roads and buildings in two Canadian cities is also presented, showing that the results help cities take effective steps toward achieving a circular economy and implementing urban mining strategies. It concludes with a call to urban policy makers to make sense of the urban metabolism of their cities, which is a practical approach to know if they are using water, energy, materials, and nutrients efficiently, and to consider to what extent their local resources are being exhausted and, if necessary, the appropriate strategies to slow or avoid exploitation of resources.



Nadine Ibrahim is the Turkstra Chair in Urban Engineering, and a Lecturer in the Department of Civil and Environmental Engineering at the University of Waterloo. She holds a BSc, MSc, and PhD in Civil Engineering, and a Certificate of Preventive Engineering and Social Development from the University of Toronto (UofT). She worked on Engineering Education for Sustainable Cities in Africa, launching a “Sustainable Cities” course online, and piloted a Global Classroom. She leads new educational attitudes and advocates for civil engineers as municipal leaders, where she leverages her industry experience in Canada and abroad, to expand her inquiry into cities through urban and environmental projects. She worked on multiple international, interdisciplinary development, educational and engineering projects.

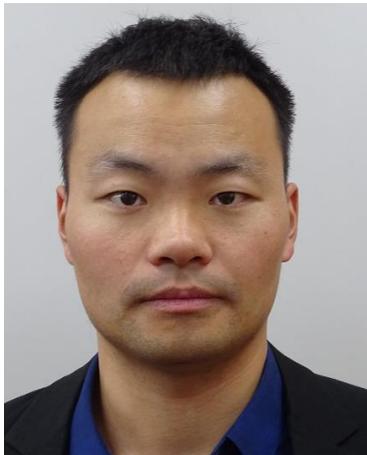
“The adage “what gets measured, gets managed” is one that guides meaningful action. Data-driven decision-making is key to supporting climate action to achieve more sustainable cities, but we must first ensure that we start with a good baseline to build upon.”

A methodological framework for adopting digitalisation in deconstruction management

Dr. Ruoyu Jin

School of Built Environm. and Architecture, London South Bank University, UK

Construction and demolition (C&D) waste diversion has not progressed much. There is also a lack of data on C&D waste categories. Sorting wastes is time and labour-intensive. Aiming to address the gap between circular economy (CE) ambition and existing practices, there is a need to engage various stakeholders and multi-disciplinary expertise, such as digital twin in deconstruction planning. A review of existing studies in applying latest digital technologies leads to the initiated methodological framework for applying digitalisation in deconstruction planning. More future work is recommended not only for new construction, but also how the aging and existing built assets can be properly planned for enhancing circular economy practice.



Dr Ruoyu Jin specialises in Building Information Modelling (BIM), construction waste management especially recycled aggregate concrete, and off-site manufacturing for construction. With professional experience in both civil engineering technologies and construction management, Dr Jin is highly motivated to link technological development in built environment (e.g., digitalisation in construction) into the managerial aspect, such as multi-stakeholder perceptions towards digitalisation in a socio-technical approach. Dr Jin has the established track record of adopting digitalisation in construction & demolition waste demolition. He has authored over 70 peer reviewed journal articles, and one patented innovation in reusing construction wastes as sustainable materials.

"I believe the urbanisation trend in Africa could bring the joint opportunities for inter-disciplinary research and practices in enhancing Circular Economy, by integrating the knowledge, experience, and technologies from scholars, policy makers, and local stakeholders. Sustainability amid the urbanisation needs a cross-disciplinary approach integrating social, economic, technical, and environmental aspects."