



## **4<sup>th</sup> ICTG Workshop on Intelligent Compaction Technologies in Earthworks**

The primary tool currently used for quality management of earthwork and unbound aggregates is a nuclear density gauge (NDG) to ensure appropriate density and moisture content. Significant research effort has been devoted to understanding and implementing stiffness-based quality control using the intelligent compaction (IC) concept, along with spot tests using modulus-based devices. When implemented properly, IC technology can provide QC over 100% of compacted geomaterials for assets such as roadways, railbeds, airfields, and other transportation infrastructure (major shortcoming of the spot testing) to assure the uniformity of the compaction process. This will lead to better performing transportation assets and lower maintenance costs. Even though the application of the IC technology in construction QC can be straight forward, several research efforts are on the way to address the gaps that prevent the IC technology from being used for the eventual construction acceptance of the geomaterials.

### **Program**

1. Introduction (Nazarian) 15 minutes
2. Fundamentals of Good Earthwork (Gomes Correia) (30 minutes)
- Break (10 minutes)
3. State of Practice
  - a. in US (Chang) (35 minutes)
  - b. in EU (Kloubert) (35 minutes)
- Break (10 minutes)
4. State of the Art
  - a. in US (Nazarian) (35 minutes)
  - b. in EU (Sangiorgi) (35 minutes)
5. QA and Discussions (15 minutes)



**Prof. Soheil Nazarian, Ph.D., P.E., DGE**  
**Director of Center for Transportation Infrastructure Systems**  
**The University of Texas at El Paso**  
**500 West University Ave, El Paso, TX 79968**  
**Phone: +1 915-747-6911**  
**Email: [nazarian@utep.edu](mailto:nazarian@utep.edu)**

Dr. Nazarian is the McIntosh Murchison Chair Professor of Civil Engineering at The University of Texas at El Paso (UTEP) where he has served as the Director of the Center for Transportation Infrastructure Systems and the Campus Director of the newly-established Engineering Research Center entitled “Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE)” funded by the National Science Foundation.

Dr. Nazarian has more than 40 years of experience in the areas of design, evaluation, and nondestructive testing of geotechnical and transportation infrastructure and lifeline. He has been one of the pioneers in the development and improvement of the nondestructive testing methods in infrastructure assessment, and he has significantly contributed to the body of knowledge in construction, quality management, and mechanistic characterization of earthwork using innovative technologies. He currently chairs the Geotechnical Instrumentation and Modeling Committee of the Transportation Research Board and is on the Executive Board of the International Society of Intelligent Construction.



**Dr. George K. Chang, P.E.**  
**Director of Research**  
**The Transtec Group**  
**Address: 6111 Balcones Drive, Austin, Texas USA**  
**Phone: +1-512-451-6233**  
**Email: [GKchang@TheTranstecGroup.com](mailto:GKchang@TheTranstecGroup.com)**

Dr. George Chang is an expert on pavement smoothness and intelligent compaction/construction technologies. Dr. Chang has founded the International Intelligent Construction Technologies Group (IICTG) in 2016, which is changed to the International Society for Intelligent Construction (ISIC) in 2019. His research, teaching, specification development, and software tools (such as ProVAL and Veta) have helped make significant technological advancements in the above fields. Dr. Chang has been the principal investigator for numerous projects that enhancing pavement materials/structures, pavement surface characteristics, etc. Recognized for his energetic, lively teaching style, Dr. Chang delivers smoothness and intelligent compaction/construction-related workshops worldwide.

Dr. Chang has been the chairman for ISIC, Road Profile Users’ Group (RPUG), TRB AFD90/AFP50 Pavement Surface Properties and Vehicle Interaction committee, etc. Dr. Chang received many awards, including Kummer Lecture Award, Meyer-Horne Award, and ASTM Billiard-Stubstad Award from the ASTM; NOVA award from Construction Innovation Forum, Founders’ Award from RPUG; Certificate of Appreciation from TRB; and Emeritus Member of TRB AFD90/AFP50 Committee. His research work has been featured in over 50 professional publications and 100+ reports.



**Prof. António Gomes Correia, PhD**  
**University of Minho/ School of Engineering**  
**Institute for Sustainability and Innovation in Structural Engineering**  
**(ISISE)**  
**Campus de Azurem**  
**4800-058 GUIMARAES, PORTUGAL**  
**Phone: +351 253510215**  
**Email: [agc@civil.uminho.pt](mailto:agc@civil.uminho.pt)**  
**<https://orcid.org/0000-0002-0103-2579>**

António Gomes Correia is professor and researcher at the Institute for Sustainability and Innovation in Structural Engineering (ISISE) of University of Minho and vice president of the International Society for Intelligent Construction (ISIC), former International Intelligent Construction Technologies Group (IICTG) from 2016. He received the diploma in Civil Engineering from the Technical University of Lisbon - IST in 1977, the degree of Doctor-Engineer Degree by “Ecole Nationale des Ponts et Chaussées”- Paris in 1985, the PhD degree in Civil Engineering by the Technical University of Lisbon – IST in 1987, and later in 1998 the title of “Habilitation” in Civil Engineering.

His activities involve research, teaching and consulting in the general field of geotechnical engineering for 42 years. António’s work has embraced transportation geotechnics, pavement, rail track, compaction, soil improvement, foundations, design, management, and more recently application of data mining, machine learning and artificial intelligence in transportation related problems. He has over 400 technical papers published on these subjects being 159 indexed in SCOPUS (February 2021). The research activities

Prof. Gomes Correia was from 1998 to 2001, Chairman of the ISSMGE - European Technical Committee - ETC 11 - Geotechnical aspects in design and construction of pavements and rail track and from 2001 Chairman of the International Technical Committee - TC 3 – Geotechnics for pavements of the ISSMGE, renamed from 2009 as TC 202 – Transportation Geotechnics. He is from 2013 member of the executive committee. He delivered the 2nd Proctor Lecture, TC202 honor lecture of ISSMGE, at the 19th ICSMGE, Seoul, 2017.

He has been a member of the organizing/technical committee for many well-established international conferences. He has founded the conference series on Transportation Geotechnics and organized the 3rd ICTG in Guimarães in 2016. Associated with the 3rd ICTG he launched the First meeting/Forum of Young Transportation Geotechnics Engineers. He has also been one of founding editors for the international journal "Transportation Geotechnics" (from 2014), as well as of “Transportation Engineering” (from 2020), both published by Elsevier. He is also editor of the Journal "Geotecnia" (SPG (Portugal), ABMS (Brazil), SEMSIG (Spain)).



**Prof. Ing. Cesare Sangiorgi**  
**Alma Mater Studiorum – University of Bologna**  
**Department of Civil, Chemical, Environmental and Materials Engineering (DICAM)**  
**Road, railways and airports section**  
**Via U.Terracini 28, 40131 Bologna, Italy**  
**Email: [Cesare.sangiorgi4@unibo.it](mailto:Cesare.sangiorgi4@unibo.it)**  
**<https://orcid.org/0000-0003-1006-5935>**

He is a Civil Engineer in Transportation since year 2000, today he is Associate Professor at the Department of Civil, Chemical, Environmental and Materials Engineering of the University of Bologna, in Bologna. He works in the Transportation Infrastructures section of the Department and addresses research themes related to the pavement materials and innovative construction technologies. The use of recycled materials and low impact solutions are of primary importance in Dr. Sangiorgi's research and the collaboration with renowned research institutes are the basis for the research activities and the involvement of students at any level (PhD and MSc), as well as for the participation in various international research groups and associations, such as RILEM, APSE and iSMARTi.

In the area of pavement materials, the link with the Nottingham Transportation Engineering Centre is active since year 2001 after he spent part of his PhD at the former NCPE working on interlayer bonding. Then new links were established with other important research centers such as the TU Delft in The Netherlands, the Pavement Research Center (PRC) in Berkeley (today in Davis) (University of California, USA), the Centre for Pavement and Transportation Technology (CPATT) in Waterloo (University of Waterloo, Canada), the Centre of Subjects Allied to Built Environment Research (SABER) at Ulster University (UK), the C-MADE, Centre for Materials and Building Technology, in Beira Interior (Portugal), the Department of Mechanical, Aerospace and Civil Engineering of the London Brunel University, the Institute of Transportation of TU Wien and, more recently, the Research Institutes of Sweden (RISE), in Stockholm, Sweden.

Dr. Sangiorgi is a Marie Curie Fellow since 2015 as partner of the MSCA-RISE project REMINE on the *“Reuse of mining waste into innovative geopolymeric-based structural panels, precast, ready mixes and insitu applications”*. Moreover, Dr. Sangiorgi is Coordinator of the H2020 MSCA-ITN-ETN project SAFERUP! on Sustainable, Accessible, Safe, Resilient and Smart Urban Pavements that had its official Kick-off in March 2018 and will end in February 2022.

Dr. Sangiorgi is and has been Chief Investigator of several research projects in the private and public sectors dealing mainly with paving recycling materials and innovative construction solutions. He has lead researches for an overall amount of grants reaching over 5 million Euros in the last 10 years. Among the funding companies/institutions can be found: ENI SpA, Ecopneus, Scpa, Marini Spa and Iterchimica srl.

Dr. Sangiorgi has been invited to present the activities and researches of his research group at more than 50 national and international events such as Symposiums, Conferences, Workshops, Seminars and Summer Schools. He acted as Chairman and Keynote lecturer at international events in and out of Europe. He is reviewer for more than 50 scientific journals and acted as reviewer for many national and international Conferences and Congresses, among them the Transport Research Arena.



**Dipl.-Ing. Hans Kloubert**  
**BOMAG GmbH, Germany**  
**Application Engineering Hellerwald, 56154 BOPPARD, GERMANY**  
**Email: [hans-josef.kloubert@bomag.com](mailto:hans-josef.kloubert@bomag.com)**

Hans Kloubert, Head of Application Technology at BOMAG, is a Civil Engineer and received his diploma in Civil Engineering from RWTH Aachen University, Germany in 1985. Before joining BOMAG he served as a project engineer on a wide range of pavement and geotechnical projects.

For 30 years Hans has been BOMAG's application expert in soil and asphalt compaction, compaction quality control and soil stabilization. He has been involved in numerous compaction trials, the development of compaction concepts and the application of Continuous Compaction Control & Intelligent Compaction on international highway, railway and airport projects. Hans is also involved in BOMAG's ongoing development of new technologies in the field of compaction technology, roller integrated compaction measurement and recently digitalization. His publications on compaction, soil stabilization and mix-in-place recycling testify to his extensive global experience. Hans has been invited to many national and international workshops, seminars and conferences to present his experience on the application of modern compaction technology and Continuous Compaction Control.

Since 1995 Hans has been a member of German working committee of German regulations for Earthworks, Quality Control in Earthworks and Asphalt Technology. In 2010 he was appointed German delegate for CEN / TC 396 - the European standardization for quality control and CCC in earthworks - where he made a significant contribution to the conception of the European specification of Continuous Compaction Control (CCC).