

Preface

The 15th International Civil Engineering Conference (ICEC-2025), jointly organized by NED University of Engineering & Technology and The Institution of Engineers Pakistan, Karachi center was successfully held on November 7–8, 2025, in Karachi. This conference continued the long-standing tradition of bringing together researchers, academicians, industry professionals, and policymakers to exchange knowledge, share innovative ideas, and discuss emerging challenges in the diverse field of civil engineering.

The theme of this year's conference, "*Nano-Driven Material Innovation: Applications in Civil Engineering*," reflects the rapidly evolving landscape of construction materials and highlights the transformative role of nanotechnology in shaping modern infrastructure. Advances at the nanoscale have opened new avenues for enhancing the performance, durability, sustainability, and resilience of civil engineering materials. From high-performance concrete and smart composites to self-healing structures and environmentally sustainable solutions, nano-engineered materials are redefining traditional design and construction practices. The conference provided a dedicated platform to explore these cutting-edge developments and their practical implications for the future of infrastructure systems.

ICEC-2025 attracted an enthusiastic response from the academic and professional communities, with contributions from national and international researchers. While the central focus remained on the conference theme, the technical program also welcomed high-quality research papers covering a broad spectrum of civil engineering disciplines. These included structural engineering, geotechnical engineering, transportation systems, water resources, environmental engineering, construction management, and sustainable infrastructure. This diversity ensured a comprehensive exchange of knowledge and fostered interdisciplinary collaboration, recognizing that innovation in civil engineering often emerges at the intersection of multiple domains.

The conference featured keynote lectures by distinguished experts, technical sessions, and interactive discussions that encouraged meaningful engagement between researchers and practitioners. These sessions provided valuable insights into contemporary challenges, emerging technologies, and practical solutions aimed at addressing the demands of growing urbanization, climate change, and sustainable development.

The papers compiled in these proceedings represent the collective efforts of the authors and reviewers whose dedication and scholarly rigor have maintained the high standards of the conference. The organizing committee extends its sincere appreciation to all contributors, reviewers, session chairs, sponsors, and volunteers for their invaluable support and commitment to the success of ICEC-2025.

It is hoped that the knowledge shared through this conference and documented in these proceedings will inspire further research, innovation, and collaboration, ultimately contributing to the advancement of civil engineering practice and the development of resilient and sustainable infrastructure for society.



Engr. Dr. Sarosh Hashmat Lodi

Senior Vice-Chairman, Pakistan Engineering Council

It is a great honor and privilege to warmly welcome all participants to the 14th International Civil Engineering Conference (ICEC-2025), proudly organized by the Institution of Engineers Pakistan (IEP), Karachi Centre and NED University of Engineering and Technology and the NED International Alumni Network Association-Pakistan.

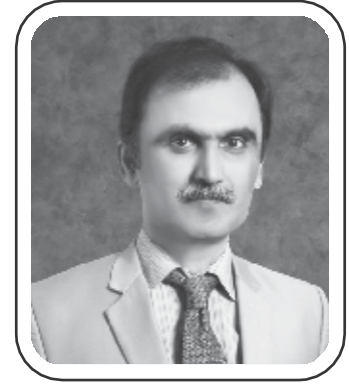
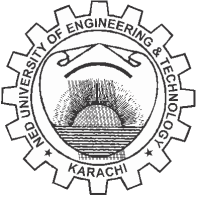
This esteemed event is further elevated by the valued partnerships with globally recognized engineering organizations, including the Asian Civil Engineering Coordinating Council (ACECC), The Federation of Engineering Institutions of South and Central Asia (FEISCA), and The Federation of Engineering Institutions of Islamic Countries (FEIIC) and the NED International Alumni Network Association-Pakistan

The theme of this year's conference, "Advancing Civil Engineering: Innovation for Achieving the UN Sustainable Development Goals (SDGs)," is both relevant and forward-looking. In today's rapidly evolving world, civil engineering plays a pivotal role in tackling some of the most pressing global issues ranging from climate change and urban sustainability to clean water availability and access to affordable energy. The SDGs set forth by the United Nations serve as a comprehensive framework for achieving equitable and sustainable progress. It is through innovative approaches, interdisciplinary collaboration, and a shared commitment to responsible development that the engineering profession can make a meaningful and lasting impact.

ICEC-2025 serves as a vital forum for academia, industry leaders, and public sector representatives to engage in meaningful discussions, present cutting-edge research, and explore innovative strategies for achieving sustainable development. This gathering of minds provides a unique opportunity to exchange knowledge, foster collaboration, and inspire creative solutions to the complex challenges facing our world today.

I extend my sincere appreciation to the organizers, collaborators, and participants for their unwavering commitment to advancing excellence and innovation in the field of civil engineering. I am confident that the ideas, partnerships, and initiatives emerging from this conference will leave a lasting imprint on the engineering landscape both within Pakistan and on the global stage.

May ICEC-2025 be a resounding success in its vision of shaping a more resilient, inclusive, and sustainable future for all.



Engr. Prof. Dr. Muhammad Tufail

Vice-Chancellor

NED University of Engineering and Technology, Karachi

It is indeed a great honor for me, on behalf of NED University of Engineering and Technology, to extend a very warm welcome to all distinguished delegates, eminent researchers, practitioners, industry experts, and students who have gathered here to participate in the 15th International Civil Engineering Conference (ICEC-2025). This significant event, being held on the 7th and 8th of November 2025, is jointly organized by the Institution of Engineers Pakistan, Karachi Centre, and NED University of Engineering and Technology, in collaboration with esteemed international and national partners including the Asian Civil Engineering Coordinating Council (ACECC), Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), NED International Alumni Network (NEDIAN) Association–Pakistan, BUIITEMS–Quetta, Balochistan University of Engineering and Technology–Khuzdar, and Sir Syed University of Engineering and Technology–Karachi.

The theme of this year’s conference, “Nano-Driven Material Innovation: Applications in Civil Engineering,” underscores the pivotal role of cutting-edge material science in shaping the future of civil engineering practices. As the world grapples with the dual challenges of rapid urbanization and climate change, the pursuit of sustainable, resilient, and intelligent infrastructure has never been more critical. Nanotechnology offers transformative potential in developing advanced construction materials with superior durability, environmental performance, and cost efficiency ushering in a new era of civil engineering innovation.

ICEC-2025 will also provide an important platform to deliberate upon diverse and pressing areas of our discipline, including Environmental Engineering, Transportation Planning, Earthquake Engineering & Design, Water Resources, Disaster Management, Structural Engineering, Geotechnical Engineering, Traffic Simulation & Modeling, and Construction Project Management. Through this holistic approach, the conference not only strengthens technical knowledge but also encourages multi-disciplinary collaboration to address global and regional challenges.

I would like to acknowledge the tireless efforts of the organizing committee, partner institutions, and supporting organizations for making this event possible. Their dedication is a testament to the shared vision of advancing civil engineering knowledge and contributing meaningfully to societal development.

I sincerely hope that the deliberations of ICEC-2025 will inspire new ideas, foster meaningful collaborations, and contribute significantly to the body of knowledge that will guide the next generation of engineers, researchers, and policymakers. I encourage all participants to actively engage in discussions, share their experiences, and explore opportunities for future collaboration.

On behalf of NED University, I extend my best wishes for the successful proceedings of the 15th International Civil Engineering Conference and look forward to witnessing the groundbreaking contributions that will emerge from this esteemed gathering.



Engr. Sohail Bashir

Chairman

The Institution of Engineers Pakistan, Karachi Centre

As the Chairman of The Institution of Engineers Pakistan, (IEP) Karachi Center & host of ICEC-2025, it is with great pride and profound satisfaction that I extend a warm welcome to all distinguished authors, presenters, delegates, researchers, innovators, and participants to the 15th International Civil Engineering Conference (ICEC-2025), being jointly organized by IEP Karachi Center and our esteemed partner NED University of Engineering & Technology (NEDUET)-Karachi in collaboration with Balochistan University of Information Technology, Engineering & Management Sciences-Quetta, Balochistan University of Engineering & Technology-Khuzdar, Sir Syed University of Engineering & Technology-Karachi, NED International Alumni Network Association-Pakistan, Asian Civil Engineering Coordinating Council (ACECC), Federation of Engineering Institutions of Islamic Countries (FEIIC) and Federation of Engineering Institutions of South & Central Asia (FEISCA).

This prestigious gathering provides an invaluable platform for sharing knowledge, innovations, and visions that shape the future of civil engineering. This year, our themes focus on the forefront of technological advancements and sustainable development in Civil Engineering which includes but not limited to Nano-Driven Material Innovations: Applications in Civil Engineering - Exploring the transformative potential of nanotechnology to enhance construction materials, durability, and sustainability.

This year we are proud to have Dr. K.N. Gunalan, President Elect. of World Federation of Engineering Organizations (WFEO) and Dr. Sarosh H. Lodi, Senior Vice-Chairman, Pakistan Engineering Council as Keynote speakers in the Inaugural session of this conference, whereas, Dr. Marsha Anderson Bomar, President, American Society of Civil Engineers (ASCE) and Prof. Dr. Md. Sirajul Islam, North South University, Dhaka, Bangladesh will deliver Keynote address in the closing session of this conference. During the technical sessions, Paul L. Mitchell, Center for Pavement Excellence from Engineers Australia, April J. Landers from Engineers New Zealand and Shalendra Ram from Engineers Australia will give their presentations in the recent development in the field of Civil Engineering. Our National Experts, Engr. Arif Kasam, Dr. Bashir Lakhani, Engr. Al-Kazim Mansoor, Engr. Ashar Lodi, Engr. Mujtaba Shaikh and Engr. Moonis Soori, will also share their presentations on pressing subjects of Civil Engineering during the technical sessions.

The conference beside other topics will also dwell on subjects like Artificial Intelligence Accelerating Transition to Embodied Autonomous Robots in Construction – Highlighting the role of AI in revolutionizing construction processes, increasing safety, and improving efficiency and on Need to Develop and Adopt Green Building Code in Construction – Emphasizing the importance of environmentally sustainable practices and regulatory frameworks in shaping green infrastructure.

This conference marks a significant milestone in our collective journey toward academic and technological excellence jointly organized with our esteemed partner engineering universities and in collaboration with several renowned national and international institutions and organizations. ICEC 2025 serves as a dynamic platform for knowledge exchange, innovation, and global networking.

I extend my heartfelt appreciation to all the Faculty members and staff of Department of Civil Engineering-NEDUET specially Engr. Prof. Dr. Abdul Jabbar Sangi, Convener ICEC-2025, Engr.

Prof. Dr. Shamsoon Fareed - Conference Secretary ICEC-2025 and his team, to all organizing partners, keynote speakers, researchers, authors, presenters, industry invited speakers, organizing committee members and student volunteers who have worked tirelessly to make this event possible. Your commitment to academic excellence and innovation has been instrumental in bringing this international conference to life. Special thanks to our Diamond Sponsors AI Engineers for their generous support.

I am confident that this conference will serve as a catalyst for transformative ideas, enduring partnerships and a shared vision for a smarter, more sustainable future. I extend my best wishes for a successful & enriching discussions, insights, and connections forged here which will spark transformative solutions that serve humanity and sustainable civil engineering solutions for a better future.

Wishing you all a productive, successful, enriching and inspiring ICEC-2025 experience.



Engr. M. Farooq Arbi

Secretary

The Institution of Engineers Pakistan, Karachi Centre



It is indeed a matter of great honor and privilege for the Institution of Engineers Pakistan, Karachi Centre, to host the 15th International Civil Engineering Conference (ICEC-2025), being held on 7th and 8th November 2025. This prestigious conference, organized jointly with the NED University of Engineering and Technology, in collaboration with esteemed national and international partners, provides a significant platform for engineers, researchers, academicians, and industry leaders to share knowledge, explore innovations, and build stronger professional linkages.

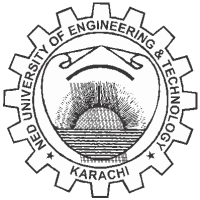
The theme of this year's conference, "Nano-Driven Material Innovation: Applications in Civil Engineering", reflects the emerging frontier of technology that is revolutionizing how we design, construct, and sustain our built-up environment. The integration of nanotechnology into civil engineering promises unprecedented advancements in durability, sustainability, and efficiency of materials and infrastructure. It opens new horizons to address global challenges such as climate resilience, sustainable urban development, and disaster preparedness.

This year's technical program is enriched with diverse topics, covering Environmental Engineering, Transportation Planning, Earthquake Engineering & Design, Water Resources, Disaster Management, Structural Engineering, Geotechnical Engineering, Traffic Simulation & Modeling, and Construction Project Management. Such breadth of focus ensures that the conference will foster meaningful dialogues and outcomes beneficial to both academia and industry.

On behalf of the Institution of Engineers Pakistan, Karachi Centre, I extend my deepest gratitude to our partners Asian Civil Engineering Coordinating Council (ACECC), Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), NED International Alumni Network (NEDIAN) Association-Pakistan, Balochistan University of Information Technology Engineering and Management Sciences (BUITEMS), Balochistan University of Engineering and Technology-Khuzdar, and Sir Syed University of Engineering and Technology-Karachi for their invaluable collaboration and support.

I am confident that ICEC-2025 will be a landmark event, bringing forth impactful research, practical solutions, and strong professional networking opportunities. Together, let us continue our collective mission of advancing civil engineering knowledge and contributing to a sustainable and resilient future.

I warmly welcome all distinguished delegates, speakers, and participants to Karachi and wish everyone a fruitful and inspiring conference.



Engr. Prof. Dr. Abdul Jabbar Sangi

Chairman, Department of Civil Engineering
NED University of Engineering and Technology
& Conference Convener, 15th ICEC-2025

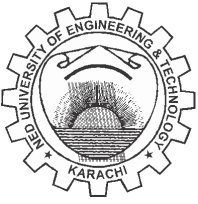
It gives me immense pride and pleasure to extend my heartfelt felicitations on the successful organization of the 15th International Civil Engineering Conference (ICEC-2025), being held on 7th and 8th November 2025 at Karachi. This prestigious event, jointly organized by the Institution of Engineers Pakistan, Karachi Centre and NED University of Engineering and Technology, in collaboration with leading national and international partners including Asian Civil Engineering Coordinating Council (ACECC), Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), NED International Alumni Network (NEDIAN) Association-Pakistan, BUITEMS Quetta, BUET Khuzdar and Sir Syed University of Engineering and Technology Karachi, is a true testament to our collective commitment to advancing the frontiers of Civil Engineering.

This year's theme, "Nano-Driven Material Innovation: Applications in Civil Engineering", highlights the groundbreaking role of nanotechnology in shaping sustainable, resilient, and smart infrastructure. The adoption of nano-driven materials is opening new horizons in durability, efficiency, and environmental responsibility aspects that are critically important in addressing the pressing global challenges of urbanization, climate change, and disaster resilience.

In addition, the conference's focus on Environmental Engineering, Transportation Planning, Earthquake Engineering & Design, Water Resources, Disaster Management, Structural Engineering, Geotechnical Engineering, Traffic Simulation & Modeling, and Construction Project Management ensures a comprehensive platform for meaningful discourse, research dissemination, and knowledge-sharing. I am confident that the valuable contributions from distinguished academics, seasoned professionals, and emerging researchers will enrich the scientific dialogue and inspire innovative solutions for the future.

On behalf of the Department of Civil Engineering, NED University of Engineering and Technology, I express my deepest gratitude to all collaborators, partners, and contributors whose tireless efforts have made ICEC-2025 possible. May this conference serve as a beacon of excellence, collaboration, and innovation in Civil Engineering, both in Pakistan and across the global community.

I wish the conference great success and hope that the deliberations and outcomes of ICEC-2025 will contribute significantly towards building a sustainable and technologically advanced future.



Engr. Prof. Dr. Shamsoon Fareed

Secretary, 15th ICEC-2025

The International Civil Engineering Conference has always served as a distinguished platform for researchers, academicians, and industry professionals to engage in meaningful dialogue, exchange innovative ideas, and foster collaborations that contribute to the advancement of civil engineering knowledge and practice. This year's theme "Nano-Driven Material Innovation: Applications in Civil Engineering." of the 15th International Civil Engineering Conference (ICEC-2025) is especially significant, as the integration of nanotechnology into material science is reshaping the future of civil engineering by enabling sustainable, resilient, and efficient infrastructure solutions.

I also commend the invaluable support of our esteemed collaborators: Asian Civil Engineering Coordinating Council (ACECC), Federation of Engineering Institutions of South and Central Asia (FEISCA), Federation of Engineering Institutions of Islamic Countries (FEIIC), NED International Alumni Network (NEDIAN) Association–Pakistan, Balochistan University of Information Technology, Engineering and Management Sciences (BUIITEMS)–Quetta, Balochistan University of Engineering and Technology–Khuzdar, and Sir Syed University of Engineering and Technology–Karachi. Their contributions have strengthened the academic and professional fabric of this conference, ensuring it remains inclusive, diverse, and impactful.

This year's conference promises to bring thought-provoking discussions and cutting-edge research across a broad spectrum of civil engineering domains, including Environmental Engineering, Transportation Planning, Earthquake Engineering & Design, Water Resources, Disaster Management, Structural Engineering, Geotechnical Engineering, Traffic Simulation & Modeling, and Construction Project Management. Each of these areas is vital to addressing the pressing challenges of urbanization, climate change, and sustainable development that the world faces today.

As Secretary of ICEC-2025, I look forward to witnessing fruitful interactions that will inspire new directions in research and practice, while strengthening the global civil engineering community. I am confident that the outcomes of this conference will not only enrich the academic discourse but also provide innovative solutions to real-world engineering problems.

I once again congratulate the organizers, collaborators, participants, and all contributors to ICEC-2025 for their unwavering commitment and dedication. May this conference mark yet another milestone in advancing civil engineering knowledge and innovation for the betterment of society.

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