

## Engineering Standards for Sustainable Infrastructure

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### Introduction

The Asian Civil Engineering Coordinating Council (ACECC) is an organization of 17 national civil engineering societies established in 1999 "...to promote collaborative work towards sustainable development of infrastructure within the Asian regions."<sup>[1]</sup> The ACECC does its work mainly through its technical committees. A committee on sustainable infrastructure (TC14) was established in 2011 led by the American Society of Civil Engineers (ASCE). The three-year (2019-2022) objective of TC 14 "...is to develop a sustainable infrastructure roadmap tailored to the Asian region and supportive of the UN SDGs." The TC 14 roadmap is adapting the priorities in the ASCE Five-Year Roadmap to Sustainable Development - Do the Right Project; Do the Project Right; Expand Technical Capacity; and Advocate.<sup>[2]</sup> An important if not the key to "Doing the Project Right" is having the right codes and standards and using them to drive and transform engineering practice. TC 14 is also integrating the SDGs into its Roadmap.

### Background

The ACECC members represent some of the least developed and some of the most developed economies. Infrastructure needs vary from ensuring basic services to expanding high speed rail. The physical obstacles to infrastructure development in the ACECC countries are some of the most challenging in the world from the mountains of Nepal to the delta region of Bangladesh. UNOPS has demonstrated that infrastructure underpins all 17 of the Sustainable Development Goals (SDGs).<sup>[3]</sup> One of the first demands of any infrastructure system is to support the provision of basic services. The UN defines the basic infrastructure-related services necessary to eliminate extreme poverty (SDG1) as: water & sanitation (SDG6), electricity (SDG 7); mobility (SDG 9 & 11), waste management (SDG 11), and ICT (SDG 5 & 9).<sup>[4]</sup> A first priority for any infrastructure system should therefore be to support these basic services.

Hallegatte et al review in detail the impacts of disasters on the poor.<sup>[5]</sup> They note the importance of robust building standards and the relatively low cost of improving resilience in new buildings versus retrofitting existing buildings. With the volume of new affordable housing needed in developing countries by 2030 it is imperative that all construction be to the

highest standards. Buildings in most countries are covered by building codes that can and should incorporate up-to-date standards. For example, the National Building Code of Bangladesh incorporates by reference ASCE 24 "Flood Resistant Design and Construction. For the U.S., ASCE 24 is referenced in the International Code Council Model Building Code the basis of many local codes in the U.S.. ASCE 24 and ASCE 7 Minimum Design Loads And Associated Criteria For Buildings And Other Structures apply to buildings as well as more generally to any structure.

Basic services such as water and sanitation, electricity, mobility, waste management, and ICT are generally considered to be part of public infrastructure. In the United States, there is a model building code but no analogous code for infrastructure. Infrastructure design and construction are addressed in various design guidelines typically sector specific although general infrastructure guidelines are evolving.

Examples of sector specific guidelines are the Chicago Department of Aviation "Sustainable Airport Manual" and the U.S. Federal Highway Administration (FHWA) "An Integrated Approach to Sustainable Roadside Design and Restoration for Roads."<sup>[6,7]</sup> Examples of the latter are the Port Authority of New York and New Jersey (PANYNJ) and the Los Angeles County sustainable infrastructure guidelines.<sup>[8,9]</sup>

Good progress is being made on incorporating sustainable practices into building and infrastructure design and construction. See e.g. UNEP's Sustainable Infrastructure Partnership (SIP).<sup>[10]</sup> The SIP Tool Navigator includes a search for standards and although several infrastructure standards are identified, none of them can be considered engineering standards.<sup>[11]</sup>

ASCE is in the process of creating ASCE/COS 73-XX Standard Requirements for Sustainable Infrastructure. The proposed standard will be applicable across all infrastructure sectors, providing coherent and consistent performance-based objectives that can be included in procurement documents by owners, regulators, stakeholders, and policymakers.

The standard addresses the entire life cycle of a project, with an emphasis on the operations-and-maintenance phase and the establishment of baselines and reduction targets over the infrastructure's lifetime.<sup>[12]</sup> In addition to being used in procurement, the standard could be used as a design guide or provide the basis for a local

design guide. An advantage of using the ASCE standard is that it will be updated on a regular basis and draws on the expertise available to ASCE that is often not available locally. The standard is expected to be available by summer 2022.

Many existing codes and standards are not adequate to address a changing climate. The World Federation of Engineering Organizations (WFEO) Code of Practice on Principles of Climate Change Adaptation for Engineers Model Code Principle #2 calls for engineers to review the adequacy of current standards.<sup>[13]</sup> ASCE recognized the importance of climate change in its report "Adapting Infrastructure and Civil Engineering Practice to a Changing Climate" and the ASCE Committee on Adaptation to Climate Change is currently reviewing all ASCE standards for adequacy with respect to climate change.<sup>[14]</sup> This includes ASCE 24 that is widely referenced for its relatively high protection against coastal and river flooding.

Standards and codes are tools for good governance. One of the most important contributions the engineering profession can make to sustainable development is to provide good engineering standards. Good engineering standards are an imperfect public good and one of the dangers is that good engineering standards can be underproduced. To be effective, governments at all levels must also require the use of up-to-date engineering standards and ensure they are enforced.

## Recommendations

- The UN should formally recognize the important role that engineering standards play and can play in achieving the SDGs specifically as they contribute to supporting basic services.
- The UN should encourage countries to adopt the WFEO Model Code of Practice on Principles of Climate Change Adaptation for Engineers
- The UN should call on the engineering profession globally to review existing standards and update them for climate change focusing first on those that support basic services.
- The UN should endorse engineering standards as an important governance tool and call on governments to incorporate the latest engineering standards in building codes and infrastructure guidelines.

## References

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