

Sustainability in Geotechnical Engineering and Related Urban Issues – Editors’ Note

Deepankar Choudhury^{1,2} · G. L. Sivakumar Babu³ · Ikuo Towhata^{4,5}

Published online: 13 July 2018
© Indian Geotechnical Society 2018

This special issue is aimed to show the importance of sustainable development of the human community from the view point of geotechnical engineering and construction business. In this message, we would like to stress that quality control and maintenance effort are meaningful for the future economic success (sustainability) of nations.

Infrastructures have typically a long life time. During their life, social situation changes and often quality has to be improved (under revised design codes) or even the function may be changed. Moreover, environmental and geo-hazards deteriorate the infrastructures and “restoration, maintenance and retrofitting” become required. Thus, the life of an infrastructure is similar to the life of a human being in that continuous care is needed and the body grows up with time. This is the essential difference between infrastructures and household properties.

There are several hazards underlying the accelerated infrastructure construction, unless thoughtfully scheduled. First, the quantity of constructed infrastructure is considered to be more important than quality. Often quality of materials is sacrificed and deterioration starts soon. After a short time, structural damage becomes evident and the infrastructure becomes useless. This is evidently wasting of money and time. Second, most of available financial resources are spent on new construction in order to demonstrate the “achievement” clearly. As a consequence, supports for maintenance of existing built structures decrease and the abovementioned deterioration is made worse. Third, infrastructures are planned by smart people whose minds are oriented towards infrastructural and financial “planning”. In their financial mind, investment on new infrastructures draws more attention than the investment required for maintenance in later years.

Another noteworthy situation is the underestimation of the importance of geotechnical investigation prior to design and construction. It is not uncommon that insufficient soil investigation results in accidents and unexpected expenses later on. People believe that subsoil is rigid and stable. They stand on soil every day and for many decades they have not felt it unstable. This empiricism is not right at all as evidenced by many slope disasters, collapse accidents of excavations and settlement of soft clay ground. Unfortunately, people do not imagine that the same disaster would happen to themselves. Due to this optimistic attitude, spending money on investigation of “supposed-to-be” rigid and stable ground is not respected. There are examples, however, where ample expenditure on geotechnical investigation resulted in reduction of construction cost. Such an overall viewpoint is frequently missed in our community.

Achievement of good quality in new infrastructures is obviously important. Good quality of materials will reduce

✉ Deepankar Choudhury
dc@civil.iitb.ac.in

G. L. Sivakumar Babu
gls@iisc.ac.in

Ikuo Towhata
towhata.ikuo.ikuo@gmail.com

¹ Department of Civil Engineering, Indian Institute of Technology Bombay, IIT Bombay, Powai, Mumbai 400076, India

² Academy of Scientific and Innovative Research (AcSIR), CSIR Campus, Chennai 600113, India

³ Department of Civil Engineering, Indian Institute of Science, Bengaluru 560012, India

⁴ Kanto Gakuin University, Yokohama, Japan

⁵ Department of Civil Engineering, University of Tokyo, Tokyo, Japan

the deterioration in later years and increase the life time of the structure, thus, the total cost (life cycle cost) of the structure is reduced. Good maintenance (good asset management) further improves the life-cycle performance. The roles of good initial quality and good maintenance efforts are discussed by using a simple mathematical model. The short-term view of infrastructure planning, which unduly focuses on the number of new construction, increases the total cost. The decayed shape of an infrastructure affects the fame of the public sector.

Many nations experienced construction booming in the past. They made the same mistake then by spending a huge amount of fund on new construction of infrastructures. Afterwards, little attention was paid on good maintenance for elongation of the service time. Those infrastructures, that have similar quality and age, faced deterioration problem at the same time and made a huge burden on the budget of nations. Today, those who are engaged in new infrastructure development are asked to study the mistakes in the past and develop a new scheme for their communities.

This special issue consists of 13 papers including one article of professional interest on the topic of sustainability in Geotechnical Engineering and related urban issues. In “An Integrated Approach for Resilience and Sustainability in Geotechnical Engineering”, authors proposed an integrated framework for assessing sustainability and resilience of geotechnical infrastructures. The results of this assessment framework can be used in building a robust geotechnical infrastructure that can withstand extreme events and climate change, and contribute towards sustainable development. “Stability Analysis of Underground Tunnel for 2nd Perimeter Highway Construction Work in Incheon” presented a case study on stability analysis of an underground tunnel for construction work of a highway in Incheon, South Korea. The paper also discussed about other aspects like reduction of ground vibration and noise using controlled rock blasting, prediction and prevention of disaster using field monitoring data.

In “Sustainable Utilization of Scrap Tire Derived Geomaterials for Geotechnical Applications”, authors addressed the sustainable utilization of scrap tire derived (STD) geomaterials for various geotechnical applications. Two case studies on enhanced utilization of limited land area were discussed in “Sustainability of Landfills in Urban Areas—Two Case Studies for Enhanced Utilization of Limited Land Area”. Enhancement of capacities of Hazardous Waste (HW) landfills by 35–50% on the existing land area are discussed in detail. In “Use of Mixed Construction and Demolition Recycled Materials in Geosynthetic Reinforced Embankments”, authors depicted the use of fine mixed construction and demolition (C&D) recycled materials in the geosynthetic reinforced embankments to represent a more sustainable future. “Studies on Characterization of Mechanically Biologically Treated Waste from Bangalore

City” presented a comprehensive study on characterization of mechanically biologically treated (MBT) waste generated in Bangalore, India. Based on the characterization, a suitable treatment scheme was recommended for Bangalore.

In “Numerical studies on the effectiveness of dynamic compaction in loose granular deposits using shear wave velocity profiling”, authors presented results of a numerical model study for predicting the degree and depth of improvement in the field due to dynamic compaction on soil by means of shear wave profiling. In other ways, the above mentioned concept highlighted the sustainability in engineering practice by enabling land reclamation and utilization of sites with locally available compressible soils. In “Effect of Geocomposite Layers on Slope Stability Under Rainfall Condition”, authors investigated the effect of inclusion of geocomposite layers within slopes subjected to rainfall and suggested the use of locally found low-permeable soils in the construction of reinforced soil slopes by economizing the project. “Influence of Confining Pressure on Water Retention Characteristics of Compacted Soil” depicted the influence of confining pressure on water retention characteristics of compacted soil by performing both experimental and analytical studies. Dual functionality of embedded geotextiles (both as barrier and drainage) is presented in “Combined Functioning of Geotextile as Barrier and Drainage Material in Unsaturated Earth Retaining Structures “. In this study, the use of multiple layers of geotextiles as drainage materials was found to enhance the sustainability of reinforced soil walls with unsaturated backfills. “Challenges to Quality Control in Bored Cast-In-Situ Piling in Growing Urban Environment” addressed the challenges to quality control in bored cast-in situ piling in the growing urban environment and simultaneously discussed probable guidelines for adequately meeting those challenges. In “Sustainable Foundation Remediation for Reservoir on Anomalous Ground”, authors presented a case study on identification of hazard zones beneath a reservoir foundation in Abu Dhabi, UAE and highlighted the necessity of proper geotechnical and geophysical investigation in the initial stages of an engineering project for avoiding serious financial implications and delays to operations/projects. Authors of “Experimental Study on the Influence of Supercritical Carbon Dioxide Soaking Pressure on the Mechanical Properties of Shale” discussed the influence of supercritical carbon dioxide (SC-CO₂) soaking pressure on the mechanical properties of shale to provide a theoretical basis of the for the extraction technology of shale gas.

As can be seen from the published papers in this special issue of Indian Geotechnical Journal, it is evident that “Sustainability in Geotechnical Engineering Practices” to handle “Urban Issues” are extremely important in present day of world infrastructural projects. More detailed research works are needed for various sectors of geotechnical engineering related to various urban issues to make the civil geotechnical constructions more sustainable.