

Life-Cycle-Based Considerations in Design of Driven Piles

Geotechnical infrastructure projects must be designed to satisfy safety and serviceability requirements, and design solutions that meet these criteria while minimizing cost are often selected. In recent years, there has been a growing initiative to evaluate and consider environmental impacts associated with the possible design options. Environmental accounting methodologies, such as life cycle assessment (LCA), have increasingly been employed to quantify the environmental consequence of geotechnical systems.

The presentation will first provide an overview of sustainability principles, calculation methods relevant to geotechnical engineering, and advancements across the discipline to date. This will be followed by a detailed examination of piled foundations. Even though several studies have examined the environmental impacts of deep foundations, none to date have examined documented field case histories. To address this knowledge gap, twelve case studies of driven piles constructed in sand deposits were analyzed using LCA and design principles from the Unified CPT-Based Method (Lehane et al. 2017). The study identifies common trends across the case histories, provides further insights through examination of additional idealized cases, and finally incorporates uncertainties in pile demand and capacity to extend the findings from factor of safety to probability of failure. The presentation will conclude with generalized guidelines that may be considered to encourage more sustainable deep foundation practices.