Editorial

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Since their origin in the 70's, reinforced soil walls have been adapted to multiple construction needs, improving and optimizing the performance of their components, growing in their applicability, functionality, cost savings, and reducing their environmental impacts compared to other structural options. Reinforced fill is understood as a system made up of the association combination of a compacted soil used as fill (material with adequate, or at least, previously well-known properties) and a passive reinforcement placed inside. Simply explained, the construction procedure of a reinforced earth structure is developed with the progressive placement of the facing components, located and assembled one on top of the other as the extension and compaction of the fill material progresses by layers, and the reinforcements installed at different heights connected or attached to the facing. In this way, in the reinforced fill technique, part of the material to be contained becomes structural component of the solution. There is a significant variety of systems and combinations within the reinforced fill structures, both in the nature of reinforcement (steel and polymeric, with a multiplicity of geometric configurations -sheets, meshes, ladders, strips, bars, cells, etc.- and even second order variations using the same component types and materials), as well as in the facing options (concrete, steel, masonry blocks, etc.) and reinforcement-to-facing connection methods. In civil engineering, reinforced fill applications are diverse and with versatile configurations, including bridge abutments, road and railway embankments, retaining walls, slopes, silos, dikes, riverbanks, among others.

Technical Committee 218 on Reinforced Fill Structures is pleased to present the first Special Issue on Reinforced Fill Structures of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) International Journal of Geoengineering Case Histories. This special issue presents six well-documented case studies combining different reinforced fill structures in terms of application (simple walls, slopes, railway and highway embankments, bridge abutments, back-to-back walls, and arch bridges), environment (including urban), backfill (including marginal soils), facing type (masonry blocks, wrapped, welded wire mesh, and precast concrete panels), and reinforcement material (geogrids, polymeric straps, steel ladders and meshes). Different design method approaches and a wide range of wall heights appear in the case studies presented. Thus, most reinforced fill structure types are well-represented in this Special Issue, covering many companies and systems, both well-established and newer, providing a good representation of the market.

The case studies are summarized below:

Trovato et al. present a reinforced fill case study where the Building Information Modeling (BIM) is used as an effective and innovative design methodology for geotechnical engineering structures. The study is based on a ramp and abutment project in Poland, with precast facing panels and geostrap reinforcements. This study shows how the BIM method is rapid, more precise, and cost-effective than traditional design tools, easing the collaboration of the stakeholders, granting a higher efficiency in the project management and reducing the loss of information. Through the case study analysed, the benefits and potential of adapting BIM methodology in reinforced fill structure projects are detailed and highlighted.

Reference: Damians, I. P. and Lugli, G. (2022). Editorial. International Journal of Geoengineering Case Histories, https://www.geocasehistoriesjournal.org/, Vol.7, Issue 2, p. i - iii. doi: 10.4417/IJGCH-07-02-00.

Gil et al. presents the extensive use of reinforced soil retaining walls in a single project in Slovakia, where about 60 different reinforced soil structures were involved. The project comprises both steel (ladders) and polymeric (strap) reinforcement types, retained earth solutions as simple walls (with or without back-slopes on top of the structure), true and false (piled) bridge abutments, back-to-back wall cases, as well as different facing solutions with precast concrete panel and welded wire mesh stone facing systems installed. The study provides a general presentation and specific data resulting from the design calculations, materials, production and construction of the walls, specifically focusing on the true bridge abutments and stone facing alternatives installed. This study includes mechanical performance verification sensitivity analyses for both ultimate and serviceability limit states through 2D FEM modeling calculations assuming both polymeric strips and steel ladders reinforcement types. The study demonstrates the suitability of polymeric strap reinforcement for reinforced fill bridge abutment applications.

Brusa et al. present experience in the UK where marginal and recycled fill types from colliery spoil to made ground to high plasticity clays were considered for reinforced fill railway and highway embankment applications by using a geocomposite that combines a drainage material with a geogrid to reduce pore water pressure development in the structural backfill. The study demonstrates the effectiveness of the system and provides confidence to engineers in the use of marginal/recycled fills in reinforced soil systems, being this also a cost-effective and environmentally-friendly alternative.

Conesa and González present a case in Spain where reinforced fill walls were used to extend a large area of land for housing in a residential area with natural abrupt changes in grade where conventional retaining systems were not an option due to cost overruns. The constructed reinforced fill solutions provided a flexible, green, and sustainable solution with minimum environmental impact and only slight disturbance to the neighborhood. Details of the implementation of the full system resulting from the combination of polyester geogrids, drainage geocomposites and steel mesh are given along with analysis methods and construction details for welded wire mesh and wrap-around facing types.

Rodriguez and Amo present another case in Spain, where the construction of a hospital required new road accesses, connecting down to a river level through already existing urban services, rainwater chambers, and on floodable low bearing capacity foundations. Due to these construction constrains, preliminary alternative in situ foundation and concrete wall options were discarded, and geogrid reinforced walls with segmental block facing were used. The study presents details of the design process including project-specific geotechnical tests and analyses using analytical and finite element methods.

Jones and Doulala-Rigby present two interesting case studies of masonry arch bridge walls in the UK where reinforced fill was placed over the arch and between back-to-back spandrel walls. Polymeric geogrid reinforcement was used for repair of a masonry arch bridge built in the 18th century and another constructed in 2000.

TC-218 is the global learned technical committee of the ISSMGE dedicated to the scientific and engineering development of reinforced fill structures. TC-218 is comprised of members from around world including engineers, researchers, academics and industry, with a mission to provide a forum for all the ISSMGE members who are interested in reinforced fill systems to exchange ideas, solve issues, improve understanding, propose developments and report advances in reinforced fill techniques.

We would like to acknowledge all the authors who made this 1st Special Issue on Reinforced Fill Structures of the International Journal of Geoengineering Case Histories possible.

Table of Contents

Brusa, N., Naughton, P., and Rimoldi, P. (2022). Drainage Reinforced Geocomposite for Marginal and Cohesive Slopes and Walls. International Journal of Geoengineering Case Histories, Volume 7, Issue 2, pp.34-48, doi: 10.4417/IJGCH-07-02-03

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