Technical standard CEN/TS 19101: Publications & presentations

CICE 2023: 11th International Conference on Fiber-Reinforced Polymer (FRP) Composites in Civil Engineering, 23-26 July 2023, Rio de Janeiro, Brazil

Special Session: Design of All FRP Structures Using CEN/TS 19101

Design of Fibre-Polymer Composite Structures (CEN/TS 19101): Overview, Commentary and Worked Examples

Authors: Ascione, L.; Correia, J.R.; Keller, T.; Knippers, J.; Mottram, J.T.; Paulotto, C.; Sena-Cruz, J.

Abstract: During the current revision of the first generation of Eurocodes, which started in 2016 and will end in 2025, the European Community decided to start to develop a Eurocode for fibre-polymer composite structures. According to the CEN procedure, a Eurocode has to be preceded by a Technical Specification (TS) and, after a period of trial use, the TS can then be converted into a Eurocode. This paper gives an overview of the European TS CEN/TS 19101: 2022, published in November 2022, and of two of its complementary documents, respectively a commentary, of about 1000 pages, and a collection of fifteen worked examples.

Access the complete article: https://zenodo.org/record/8066346

Design of Fibre-Polymer Composite Structures (CEN/TS 19101): Serviceability Limit States and Creep Rupture

Authors: Sena-Cruz, J.; Sa, M.; Correia, J.R.; Mottram, J.T.; Keller, T.; Gil Pérez, M.; Ascione, L.; Tromp, L.; Russo, S.

Abstract: In November 2022, the European Committee for Standardization (CEN) published the Technical Specification CEN/TS 19101:2022, "Design of Fibre-Polymer Composite Structures", which is a milestone towards the widespread application of composite materials in civil engineering structures. This paper gives an overview of the clauses about serviceability limit states (SLS) and the creep rupture verification at ultimate limit state (ULS). The SLS criteria include deflections, vibrations and matrix cracking verifications, which should consider the effects of environmental conditions and creep effects. The creep rupture of composite members and components is prevented by limiting the magnitudes of sustained stresses, using relevant quasi-permanent combinations of actions.

Access the complete article: https://zenodo.org/record/8066441

Design of Fibre-Polymer Composite Structures (CEN/TS 19101): Basis of Design and Effects of Temperature and Moisture

Authors: Correia, J.R.; Pacheco, J.; Sørensen, J.D.; Garrido, M.; Firmo, J.P.; Keller, T.; Sena-Cruz, J.; Mottram, J.T.; Ascione, L.; Tromp, L.

Abstract: In November 2022, the European Committee for Standardization (CEN) published the Technical Specification CEN/TS 19101:2022, "Design of Fibre-Polymer Composite Structures", which is a milestone towards the widespread application of composite materials in civil engineering structures. This paper presents the basis of design of CEN/TS 19101:2022, which follows the philosophy and partial factor format of the Eurocodes, and describes how the effects of temperature and moisture are considered, namely through the use of conversion factors.

Access the complete article: https://zenodo.org/record/8066317

Design of Fibre-Polymer Composite Structures (CEN/TS 19101): ULS Analysis of a Spatial Reticular Structure

Authors: Russo, S.; Mottram, J.T.; Talledo, D.A.; Tondi, M.

Abstract: Presented in this paper is a worked example to demonstrate the practical application of the CEN European Technical Specification CEN/TS 19101:2022 when designing a spatial reticular structure that has been constructed inside the Santa Maria Paganica church, Italy, following severe damaged by the 2009 L'Aquila earthquake. The example showcases the use of fibre-polymer composites to create a lightweight, resilient shelter that ensures the structural integrity and seismic safety over the time interval necessary for restoration of the damaged church. This worked example summarizes the structural analysis and ULS verification checks carried out to meet the requirements of CEN/TS 19101, thereby emphasizing its effectiveness in facilitating the design process to safeguard historic sites during restoration projects.

Access the complete article: https://zenodo.org/record/8066513

Design of Fibre-Polymer Composite Structures (CEN/TS 19101): Design Example of a Composite Road Bridge

Authors: Tromp, L.; Veltkamp, M.; de Boer, A.; de Boon, J.; Koetsier, M.; Pavlovic, M.

Abstract: Fibre-reinforced polymer composite is a competitive material for traffic bridges and decks due to low self-weight, significant fatigue life and corrosion resistance compared to steel and reinforced concrete. Composite decks are commercially available as stand-alone short-span bridges or as decks on primary girders, with or without composite action. The Technical Specification for Design of fibre-polymer composite structures (CEN/TS19101: 2022; TS) provides holistic design guidance for composite bridges. This paper presents the application of the design rules and verification analysis according to TS on a 7,35 m single span stand-alone regional road bridge, with load models according to prEN1991-2. The bridge section is vacuum infused web-core sandwich with multi-directional glass fibre laminates.

ULS, SLS, fatigue and creep deformation are verified with partial factors for material, resistance models and conversion factors according to TS. A FE model of the whole bridge deck is built using shell elements for facings and webs to account for their interaction in global and local (wheel load) analysis, multi-axial stress states and local buckling. The study demonstrates the simple and more advanced analysis in line with the Eurocode and TS and highlights areas where optimizations are needed.

Access the complete article: https://zenodo.org/record/8066412