

Unusual design drivers for membrane structures and details

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ABSTRACT

Carpatec is a company dedicated to Textile Architecture, Mobile Structures and Canopies with design, structural calculation, manufacturing and installation under one roof. Typically, the design of membrane structures and their details are governed by a design brief, the project location, the installation process, and in practice often by economic constraints. Compared to what architecture schools and other project designs usually teach, many of our designs are governed by rather unusual parameters. This paper presents 3 categories of case studies (i) cover roof for children's playgrounds, (ii) energy saving membranes on facades of existing buildings and (iii) textile covers for outdoor gyms and sports courts, all of them significantly influenced by these unusual design drivers. (fig. 1) **Playgrounds** provide safe and accessible places for physical activity, cognitive development, socialization and more, but have certain risks. Safety standards and guidelines, such as EN 1176, are in place in Spain, with requirements for playground covers to provide shade and protection from weather. The designs presented in this document are the result of a thorough analysis of relevant architectural and technical design parameters, with a focus on safety, such as clearances, UV-blocking membrane materials. One of these design parameters is informed by a fatal injury incident that led to the omission of inclined cables and pin-jointed masts, and has consequences on the installation processes and costs of the structures. **Energy-saving membranes on building facades** can convert existing structures into more sustainable ones while also adapting to modern architecture. The implementation of such designs is driven by the economic pressure to save money and comply with laws and regulations. Flat surfaces of membranes or meshes are preferred for their optical advantage, as they do not introduce distortion of the view and ease of installation, overruling the structural advantages of spatially curved surfaces. The new application of these materials in architecture, the limitations of their attachment to existing buildings, and the goal to convert aged buildings into modern and sustainable structures, while also complying with national and European regulations will be demonstrated through real-world examples and numerical data on the energy savings achieved, both in winter and in summer. **Outdoor sports courts** are becoming increasingly popular as people prioritize their health and fitness. With the Covid-19 pandemic, the need for outdoor gyms has risen. Covering sports tracks to protect from weather is becoming more necessary. When designing the roofs for sports facilities, factors such as size and height, width, and length in accordance with sport regulations, as well as urban regulations, access difficulties, and safety need to be considered simultaneously. A balance between architectural design, sports regulations, economic profitability and safety must be achieved and result in sports courts that can be used year-round and comply with national and European regulations. So, the design of membrane structures and their details



Figure 1: 3 categories of case studies (i) cover roof for children's playgrounds, (ii) energy saving membranes on facades of existing buildings and (iii) textile covers for outdoor gyms and sports courts

are often governed by unusual parameters and have a significant impact on the architectural and technical design. The examples presented introduce projects between technical requirements, standards and special conditions and open the discussion about constraints, conflicts and creative solutions.