

Potential of Irish Orientated Strand Board in Bending Active Structures

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Abstract : To determine the potential of a low cost Irish engineered timber product to replace high cost solid timber for use in bending active structures such as gridshells a single Irish engineered timber product in the form of orientated strand board (OSB) was selected. A comparative study of OSB and solid timber was carried out to determine the optimum properties that make a material suitable for use in gridshells. Three parameters were identified to be relevant in the selection of a material for gridshells. These three parameters are the strength to stiffness ratio, the flexural stiffness of commercially available sections, and the variability of material and section properties. It is shown that when comparing OSB against solid timber, OSB is a more suitable material for use in gridshells that are at the smaller end of the scale and that have tight radii of curvature. Typically, for solid timber materials, stiffness is used as an indicator for strength and engineered timber is no different. Thus, low flexural stiffness would mean low flexural strength. However, when it comes to bending active gridshells, OSB offers a significant advantage. By the addition of multiple layers, an increased section size is created, thus endowing the structure with higher stiffness and higher strength from initial low stiffness and low strength materials while still maintaining tight radii of curvature. This allows OSB to compete with solid timber on large scale gridshells. Additionally, a preliminary sustainability study using a set of sustainability indicators was carried out to determine the relative sustainability of building a large-scale gridshell in Ireland with a primary focus on economic viability but a mention is also given to social and environmental aspects. For this, the Savill garden gridshell in the UK was used as the functional unit with the sustainability of the structural roof skeleton constructed from UK larch solid timber being compared with the same structure using Irish OSB. Albeit that the advantages of using commercially available OSB in a bending active gridshell are marginal and limited to specific gridshell applications, further study into an optimised engineered timber product is merited.

Keywords : bending active gridshells, high end timber structures, low cost material, sustainability

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