Innovation in Irish Timber Usage
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Introduction: Due to the increasing focus on the use of sustainable construction materials to meet environmental targets, related to efficient energy use and emissions, a significant opportunity exists for the Irish wood products sector. In order to increase the utilisation of Irish timber in construction, the mechanical and physical properties of the material must be established. The study intends to collate all the available historical data of the properties of Irish Sitka spruce [1-4]. Moreover, testing of a large number of samples will be undertaken to establish the properties of the current resource.

A significant opportunity exists in the Irish timber market to increase the use of Irish-grown engineered timber products. In this project, the performance reinforced timber elements and joints made from Irish timber is investigated. In addition, the suitability of Irish-grown Sitka Spruce for the manufacture of cross-laminated timber (CLT) panels, and the necessary engineering data to support the commercialisation of Irish-made CLT will be developed.

This project outcomes will be disseminated to National and European standards committees, the timber processing and wood products industry, Enterprise Ireland, Enterprise Northern Ireland, Intertrade Ireland, and engineering designers and architects.

Figure 1: Flow diagram of research tasks

Reinforcement of Timber Joints:
The jointing of timber is a critical aspect of timber design. Joints will be manufactured and tested using internal dowel connections comprised of bonded-in Basalt Fibre Reinforced Polymer (BFRP) rods. BFRP is lightweight, strong and sustainable, making it an excellent alternative to traditional steel plate connections. This project develops further work conducted utilising steel dowels [6-8]. Pull-out tests will be carried out to determine the optimum configuration of bars in the connection which will then be modelled numerically and tested at full scale.

Figure 3: Pull-out testing of bonded-in BFRP bars

Long-term behaviour of reinforced timber:
Engineered timber products such as FRP (Fibre-Reinforced Polymer) reinforced timber have huge potential for commercialisation and will be highly valuable to the timber products industry. The objective of this project is to determine the long-term behaviour of reinforced timber beams. The effects of load duration and varying climate will be monitored for a period of two years with the aim of determining appropriate strength modification factors for design and as a result increase the demand for such engineered products. In parallel with the physical experiments, models will be developed to predict the effects of load duration on the beams and calibrated using the test data (Fig. 2).

Figure 2: Outline of the investigation on long-term performance of reinforced timber beams

Cross-Laminated Timber (CLT):
Cross-laminated timber is a prefabricated multi-layer engineered wood product made of at least three orthogonally bonded layers of timber. In order to increase rigidity and stability, successive layers of boards are placed cross-wise to form a solid timber panel (Fig. 4). Load-bearing CLT wall and floor panels are easily assembled on site to form multi-storey buildings. This improves construction and project delivery time, reduces costs, and maximises efficiency on all levels [9-10]. In this project, the feasibility of using Irish Sitka spruce to produce commercial CLT panels is investigated.

Figure 4: CLT panel schema [5]