

Design of a long span Belfast truss using UK home-grown timber

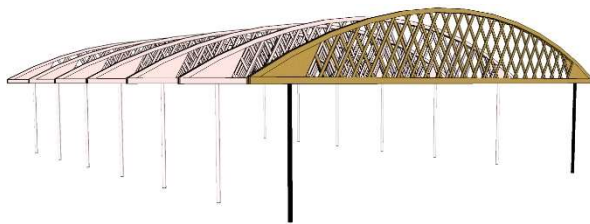
D. Johnstone¹, R. Hairstans² and *A. Livingstone³

¹ Edinburgh Napier University, 10 Colinton Rd, Edinburgh EH10 5DT, cocis@napier.ac.uk
www.napier.ac.uk

² Edinburgh Napier University, Unit 1, 7 Hills Business Park, Bankhead Crossway South, Edinburgh EH11 4EP, R.Hairstans@napier.ac.uk www.napier.ac.uk

³ Edinburgh Napier University, Unit 1, 7 Hills Business Park, Bankhead Crossway South, Edinburgh EH11 4EP, A.Livingstone@napier.ac.uk www.napier.ac.uk

Key Words: *Long span timber truss, Mass Customisation, Timber connection calculation software.*



The Belfast truss roof form, was first recorded in the 1860s, and was widely used for industrial buildings up to the first world war [1], with spans ranging from 6m to 20m [2]. From 1918 its use declined for the larger spans, but for the moderate spans continued throughout the 1930s [1]. This paper presents a long span UK home-grown timber Belfast truss roof system designed to Eurocode 5, and suitable for mass customisation with the capability of achieving a maximum clear span of 30m for industrial building use.

Although UK home-grown timber is often perceived as being inferior to imported timber, studies into it's mechanical properties have identified that, when graded to C16, it demonstrates a higher density and bending strength than imported timber of the same grade [3]. For this project, the connections rather than the bending stiffness are the limiting factor on member section sizes. Combined with the fact that density is the defining mechanical property of timber that effects the connection resistance.

This project was ideal for demonstrating a computational timber connection calculation software previously created within the research group. This software allowed for parametric optimisation of the Belfast truss design.

In conclusion, this example of a 30m clear span Belfast truss roof system using UK home-grown timber graded to C16+ as opposed to imported C16 grade timber generated savings of:

- Timber section dimensions savings of 34.4%
- Metal fixings (bolts) savings of 47.3%

This project was completed in conjunction with industry partners BSW timber and Carbon Dynamic.

REFERENCES

1. Gould, M., A. Jennings, and R. Montgomery, *Belfast roof truss*. Structural Engineer, 1992. **70**: p. 127-9.
2. Gilfillan, R. and S. Gilbert, *The 'Belfast' Roof Truss—Worth Conserving?* Journal of Architectural Conservation, 2003. **9**(1): p. 45-57.
3. Ridley-Ellis, D., *Derivation of GoldenEye-702 grading machine settings for British Spruce*. 2014, Report for CEN TC124/WG2/TG1: Edinburgh Napier University.