Department	School of Engineering and the Built Environment
Supervisors	Dr Aamir Khokhar (Director of Studies) and Professor Robert Hairstans
Project Title	Vibrational Performance of timber floor - an Investigation of influence of construction parameters

PROJECT DESCRIPTION

Traditional timber floor systems are usually composed of a series of parallel timber joists (eg. solid and engineered I-joist or Laminated-Veneer-Lumber) which support wood-based sheathing. This produces a lightweight two-way rib-stiffened structural system. Due to this, timber floors have a tendency to produce high level of vibration when excited by human footfalls. When such high amplitude of vibration occur they can cause discomfort in the occupants. High level of vibration is strongly influenced by the across-joist (transverse) construction details. Enhancing stiffness in across joist (transverse) direction has been found to be an effective means, at some extent, of mitigating excessive vibration levels in wood floors [1]. Various construction methods have been introduced to increase the transverse stiffness. Examples of such are reducing the spacing of floor joists, adding extra layer of wood sheathing or concrete topping or adding additional partition walls. Moreover, investigators have reported that adding a row of between-joist bracing spin along the width of floor at mid-span is the most economical and effective approach [2]. However, despite their widespread application the mechanisms by which above construction parameters function has not been fully elucidated. Hence, their performances have not been optimized.

The overarching aim of the project is to investigate the influence of optimum effectiveness of construction parameters to obtain satisfactory vibrational performance timber floors. This will be delivered by experimental and numerical approaches. It is widely known that controlling static deflection under a point load at floor centre and increasing natural frequencies are a reliable indicators of vibrational serviceability of timber floors [3]. Therefore, a series of solid and engineered wood joisted floors will be tested under static and dynamic loads. Influence of geometric arrangements and rigidity of construction parameters and their connection stiffness to joists will be studied. These tests will assist in looking at how modification of construction parameters enhance the transverse stiffness and at what extent influence on static deflection and natural frequencies. Based on test results, analytical and numerical models will be developed to investigate further on the vibrational performance of timber floors. The results from experimental and numerical study will be used to develop a generalised approach that can be used in predictive models to calculate structural response of timber floors to static and dynamic loading conditions, and can be incorporated into a design procedure for controlling vibration in wood-based floors.

This research will provide an in-depth understanding of vibrational performance of timber. This could be a valuable contribution in timber structures, especially, for industry and for design codes. This research project is designed as accordance of Edinburgh Napier University (ENU) Strategy 2020, aiming to conduct prestigious research in area of timber engineering and produce high rated research publications and develop international collaboration. Furthermore, ENU is well renowned in area of research on timber and have been award the Queen's Anniversary Prize in recognition of internationally acclaimed work on timber engineering. This project is also designed to enhance ENU's international reputation in timber engineering.

Academic qualifications

A first degree (at least a 2.1) ideally in Civil Engineering with a good fundamental knowledge of timber

engineering.

English language requirement
IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental in conducting laboratory tests
- Competent in structural analysis, structural dynamics and structural mechanics
- Knowledge of timber as engineering material, design and test Standards (e.g. Eurocode)
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
Knowledge of timber floor construction, design and structural behaviour

Indicative Bibliography	[1] Onysko., DM. 1985. "Serviceability criteria for residential floos based on a field study of consumer response" Project 03-50-10-008, Forintek Canada Corporation, Ottawa, Canada. [2] Khokhar, A., Chui, Y., & Smith, I., 2019. "Influence of between-joists bridging elements on static and dynamic response of wood joisted floors". Engineering Structures, 188, 362-368 [3] Smith. I. & Chui. Y., 1992. "Construction methods for minimizing vibration levels in floors with lumber joists" Canadian Journal of Civil Engineering. 19,833-841.
Enquiries	For informal enquiries about this PhD project, please contact Dr. Aamir Khokhar, Email a.khokhar@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process