

2011 MSc Research Grant Scheme

Project title: In-service monitoring of a sustainable house made of Structural Insulated Panels (SIPs)

University: Birmingham University

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Aims of research: The aim of the research is to devise and implement a real-time monitoring system measuring in-service performances of a SIP-made house under both environmental and mechanical actions. The monitoring system can measure the vibration of floor slabs under normal use of the building, the sway of building under wind load, the creep of wall panels under temperature and humidity variation. Results will be used to interpret the vibration performance for this type of light weight floor construction and the long-term performance of SIP buildings in the service life.

Description of method: SIP-made houses are a novel sustainable home system, offering a number of favourable features towards carbon neutral/zero home solutions. SIP is a composite material, consisting of sheath (e.g. OSB) and core (e.g. PUR or EPS). With the support of a previous EPSRC CASE award and the industrial partner ErgoHomes, a demonstration SIP home (rated as level 4 based on Codes for Sustainable Homes) has recently constructed in Birmingham campus, which offers further opportunities to monitor in-service performances and other long-term behaviours, such as creep experienced by SIP materials and the effect of humidity and temperature variation. To this end, a set of non-destructive monitoring system will be devised and installed in the house during the project. The monitoring devices include the accelerometers attached to the floor, LVDTs fixed to the gable wall, temperature and humidity sensors and creep measurement apparatus attached to the wall panel. The data will be collected by an integral data logging unit and recorded continuously throughout the project duration. It is anticipated that the monitoring may be continued after this project by other researchers. The collected data will be analyzed and interpreted to evaluate performances of the SIP building, i.e., the vibration of the SIP floor construction, the creep of the SIP wall under the variation of temperature and humidity and the racking stiffness of the SIP structures under normal service conditions.

Benefits to structural engineering: Structural Insulated Panel (SIP) is a new emerging material, and has the potential to benefit housing industry in sustainability and affordability. Current SIPs market in UK is around £20M a year. However, the understanding of SIPs by most engineers is very limited and there is no design guides available. These two facts have significantly hindered the SIP use and both of them are related to the lack of the first-hand research data. The research findings from this project will provide complementary information to the in-depth research work we have already completed on SIPs under controlled laboratory conditions. It will further inform SIPs engineers with prudent information on performances of SIP buildings under real service conditions, which will lead to an improved practice in design and maintenance.

Proposed finish date: 09/2011