



Seismic Design and Off-Site Construction of College Buildings for 500 Students with Timber Frame 3D Modules in Clisson (near Nantes, France)

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Abstract

Clisson public college of 5 767 m² consists of a two storey building, a restaurant, as well as four staff dwellings. The classrooms are grouped on two floors organised around two patios. Designed to accommodate about 500 students, the college is designed in functional and modular blocks and might be easily extended if necessary.

Building work lasted 12 months including prefabrication work. Ninety eight timber modules, up to 16 meters long, were prefabricated and pre-equipped in a workshop located less than 2kms away from the construction site. This off-site building technique takes a very specific, challenging and controlled industrial process. Similar in appearance, each module actually has its own specificities (size, openings, equipments, finishing...).

Modules are designed to earthquake construction detailing and structural calculations were carried out according to Eurocode 8: seismic joints; load paths, connections and anchors resistance; ballast foundations. 3D spectral modal analysis resulted in long and complex iterative calculations due to timber frame walls stiffness settings. Nevertheless structural optimisation was achieved.

The paper intends to present different aspects of the design and construction of this off-site building process with a strong focus on structural design of multi-material frames (concrete, steel, timber) of the main entrance hall.

Keywords: timber frame; modules; off-site; earthquake ; structural design.

1 Introduction

Clisson public college of 5 767 m² consists of a two storey building, a restaurant, as well as four staff dwellings (Figure 1). The classrooms are grouped on two floors organised around two patios. Designed to accommodate about 500 students, the college is designed in functional and modular blocks and might be easily extended if necessary.

Modularity is perceptible in the buildings' aesthetics because they are constructed from timber frame 3D modules. However the external architecture is designed in order to hide regular joints and prefabricated modules.

Building work lasted 12 months including off-site prefabrication work with Bouygues Bâtiment Grand Ouest acting as General contractor. Off-site