

# **Industrial approach to wood based multistory construction – case Stora Enso modular construction**

Industrielle Fertigung für den mehrgeschossigen Holzbau – Stora Enso Modulbau

Une approche industrielle de la construction bois à plusieurs étages à l'exemple d'une construction modulaire de Stora Enso

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## 1. Wood is gaining foothold in international urban building projects

Wood is increasing its popularity in urban construction. The hot spots of wooden urban construction are mainly outside the Central European markets, London, Stockholm, Helsinki and Melbourne to name a few. Global developers and investors are carefully studying the possibilities of urban wood construction. When some years back the main question was „Why should I use wood in this project?“ the question today is „How should I use wood in this project?“ The environmental benefits are known, maybe not yet fully utilized in the public tender processes. The technical development of wood products, their strength properties, span widths and dimensions are more and more understood in the construction segment. Solutions to manage fire, acoustic and structural behaviour are under continuous development. The main question still remains; *What is the best way to take the full advantage of the sustainable, lightweight, speedy and prefabricated product in urban construction?*

## 2. CLT and construction

CLT is a fairly young product, at least in the product life cycle of wood products. After some 20 years of trial and error CLT is today finding its way to more and more challenging projects. A 100 meter high wind mill tower or a 10 storey residential building are reality today – higher and more challenging projects are presently under construction or at least under project development.

Presently the most commonly used process, when using CLT, is to deliver the pre-cut panels to the building site, erect the superstructure and continue with other trades after the CLT-structure is in place. There are many attempts to add value on the CLT before it is taken to the building site, but these projects are not many – which might indicate that the process is not yet smooth enough or the added value is not paying off.

### **3. Stora Enso CLT and modular construction**

Year 2012 Stora Enso Building Solutions introduced the CLT based modular concept in Finland. The first two projects were low rise care homes. The Ikea based BoKlok apartment concept was the next step and by today over 100 apartments have been supplied to the BoKlok projects in Finland. However the focus was from the beginning in medium rise residential construction where the benefits of massive wood can fully be utilized. Early 2013 the first 4-storey building was delivered and by the end of 2013 the first 6-storey building was handed over to the customer. Presently we are finalizing the first 8-storey residential building and are in the middle of the delivery of 90 unit multi-storey residential project containing 4 separate buildings. Year 2015 the Wood City project in Helsinki will start with the 100 unit residential project containing two 8-storey buildings. The project continues with hotel and office buildings.

### **4. Benefits of modular construction**

Different stake holders have different target setting and goals for wood construction. Politicians look for energy efficient, sustainable and affordable housing. Building companies are after minimized risk and maximized profit but increasingly also after improved air tightness, less labour intensive processes, safe working methods and lightweight solutions. The investors are looking for increased speed as the method to be able to make the real estate development project calculations more lucrative.

Wood construction has something to offer for all the stakeholders: renewable material, speed, safe working methods and lightweight construction. Modular construction has without a question the speed as it's key benefit. Additionally the high share of industrial prefabrication takes the weather effect away as well as makes it possible to introduce the industrial quality control processes and dry working methods to the building and construction sector.

CLT based modular construction has additionally the massive and stiff structure as it's main advantage compared to light frame and steel construction. Lightweight but still massive and stiff module is clearly the combination which for example with concrete is simply impossible.

### **5. Challenges of modular construction**

CLT based modules are under continuous improvement process during and after each project. Repetition of projects is clearly the first condition to be fulfilled. Without repetition there is not a possibility for industrial production and without industrial production the cost efficiencies are not always reached or at least not fully utilized.

The question when introducing the modular concept to an architect is whether the modular system limits the design. Modular system sets certain base requirements for the design. The material as such has a range of optimal span width and the room size or number of walls is a result of the span width. The logistics, both within the industrial premises as well as the road transportation, sets the second requirement for the design. Mostly the requirement is about the width of the module, not so much about the length of the unit.

Particularly in Northern Europe the building services are requiring a lot of attention as the target is the plug-and-play solution for the modules at the building site in order to provide the promised increased speed of erecting the building. This in many cases leads to the so called wet (kitchen, bathroom) and dry (living room, bedroom) modules where the building services are all located in the wet modules.

The massive and stiff structure of the CLT based modules is a clear benefit. The impact sound insulation between the modules is done with the help of sound insulation elastomers which solves the acoustic questions but at the same time challenges the stability of the structure. Connection technique is key to provide both the acoustic solution and stiffness of the structure.

## **6. Future of urban construction**

The use of wood in urban projects will continue to increase. The main competitive edge of using massive wood is based both on the lightweight as well as the speedy building process. Modular solution is the fastest method for realizing residential projects. The solutions are developing now rapidly and the realized projects show already today that the small basic guidelines in design are not limiting the architectural outcome of the buildings.

The future success of urban wood construction will not be based only on technical solutions but on the further development of the total construction process. Here the traditional suppliers of wood products need to reconsider their position in the value chain. The future of urban construction can be based on wood only if wood as a solution is based on high quality and is having an efficient and integral part of the construction process.