LCT ONE

It might look like any other tower on the block, but never judge a building by its cover. Underneath this aluminum is an innovative timber system which will make building up to 30 stories in wood a reality.

Michael Zangerl and Nabih Tahan
On November 18th, 2012, the world’s first eight-story timber hybrid building opened to the public in Dornbirn, Austria. Designed by the renowned Austrian architect Hermann Kaufmann, the LCT ONE is a flagship building for the Austrian tall wood building firm CREE GmbH, a division of the Rhomberg Group.

CREE’s success is derived not just from using glulam wood beams as the primary building material, but by combining them with a limited amount of concrete and a systemized, prefabricated approach called the LifeCycle Tower (LCT) system. This method enables the post and beam building envelope to be erected as quickly as a story a day, while still providing architectural flexibility in building designs.

Research shows the LCT system requires 50 per cent less construction time and 39 per cent fewer resources over the life of a building. The LCT system can also substantially reduce the amount of concrete used in construction, resulting in a lighter structure, with a smaller foundation and up to 90 per cent lower CO₂ emissions. While the LCT ONE is eight stories, research shows the building system has the ability to support as many as 30 stories.

Designing for the entire LifeCycle

The LCT ONE is a 17,222 sq.ft. (1,600 m²) pilot building for CREE’s LifeCycle Tower building method. Total construction time was one year, which is significantly faster than a comparable steel/concrete building. Additionally,
the airtight, watertight building envelope itself took only eight days to fully complete.

During the first six months of construction, while the foundation and central concrete core were being built on-site, CREE manufactured the wall and floor slab components off-site. Austrian-sourced glulam posts were used for the wall units while glulam beams and a limited amount of concrete were used for the hybrid floor slabs. Fabrication of the wall units included the windows and insulation needed for the building envelope. Costs, delays in schedule, material waste, and construction defects (common during on-site construction) were limited by prefabricating these identical components off-site.

Structurally, the LCT system revolves around the hybrid slabs, which can span up to 29.5 ft. (9 m.). On the exterior, the slabs bear on glulam posts. On the interior, they hang on a central stiffening core where the elevator, stairs and shafts are located. This long span allows for a wide variety of floor plans and layouts, since interior load bearing walls are not required.

Research shows the LCT system’s core can be designed out of wood, however, to expedite the permitting process, it can also be built out of steel or reinforced concrete. The core of the LCT ONE was built from concrete. When the foundation was complete, the building envelope was erected at a rate of one story a day. Each floor was assembled by interconnecting the slabs and wall units together with the preset pins and holes of the components.

The last six months of construction saw the completion of services and interior finishes. The glulam wall and ceiling beams were designed to remain exposed and reveal their natural finish, making the LCT ONE one of the tallest modern wood office buildings with exposed structural timber. This left most of the interior work to consist of installing mechanical, electrical, plumbing, floor coverings, doors and fixtures. The mechanical/electrical/plumbing services were integrated seamlessly into the available ceiling spaces between each glulam beam and covered with aluminium facing, eliminating the need for an additional dropped ceiling.

A smart building
Built to passive house standards, the LCT ONE is extremely energy-efficient. Lighting commonly accounts...
for up to 40 per cent of an office building’s energy needs, thus, the LCT ONE is optimized for general illumination based on the amount of daylight available to a room using smart lighting sensors, motorized window shutters and other controls. Additional energy costs for heating and cooling are also automatically optimized. Room temperatures and indoor air quality are maintained with a highly efficient heat recovery system and automatically controlled CO₂ measurement.

Fire safety
The fire protection strategy of the LifeCycle Tower system is twofold. First, all load bearing posts and beams are increased in size according to their charring rate. The rate allowed by code is 1.5 inches per hour, which results in a predictable burning rate for wood. Second, the CREE hybrid slabs were tested in a full-size fire chamber and passed a two-hour fire test. The design of the slabs provides a built-in fire separation between each floor because there is no wood-to-wood contact between the floors.

Ecological backpack
Starting with the design phase, all of the materials in the LCT ONE were chosen according to their ecological backpack, which measures the environmental impact of each material. This analysis includes its true weight, taking into consideration all the resources used to produce a product or material. Materials were also evaluated for their ability to be reused, recycled into new materials, or converted into bioenergy at the end of the building’s usable life, a concept known as urban mining.

The CREE LifeCycle Tower system and the LCT ONE building have won numerous awards, including the European Environmental Press Award (EEP), 2012 Innovation Prize of Vorarlberg, Solid Bautechpreis Award for Innovation 2012, the Energy Globe Award Vorarlberg 2011 and a nomination for the Austrian State Award for Innovation.

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