



Wisdom Stockholm

Stockholm, Sweden

Wisdom Stockholm is a spectacular wooden building design of 1 325 square meters with a unique vaulted roof. Inside the building, there is a globe-shaped dome theatre of 21.6 meters in diameter hosting a 3D cinema with a spherical screen.

Museum buildings are a centrepiece for architects to show their talents and provide a venue for civic pride. Stockholm's Wisdom is the latest example. Sweden is known for design, innovation and sustainability and the world is waiting to see the opening of a new building at the Swedish National Museum of Science and Technology in 2023. The arena has the hallmarks of a low-carbon wonder: a sustainable wood building of 1,325 square meters with a spectacular vaulted free-form roof and a dome-shaped theatre that is 21.6 meters in diameter hosting a 3D cinema with a spherical screen.

The low-carbon masterpiece designed by Elding Oscarson is already capturing international media attention, and much has been reported about it and its spectacular cross-laminated timber dome. To celebrate World Green Building Week, we take a deep dive into the significance of the ceiling made from laminated veneer lumber (LVL) and the incredible collaborative model it is taking to construct it.

LVL was selected for this project because of its unique properties. LVL continues to steadily increase in popularity in mass timber construction. 'Over the next few years, LVL demand in Europe is forecast to have a projected average annual growth rate of 6+%' (Structural Timber Magazine).

Although LVL is industrial in strength and can be produced in long sheets as well as beam and column form, it can also be curved and twisted in various directions at the same time, opening a world of design options. Wisdom, while breathtaking, is just one example of what can be conceived and constructed with wood that was never imagined before.

LVL can also span long distances without the need for supporting columns while taking very high weight loads. Often used for building large storage facilities and warehouses, LVL is twice as strong as steel in proportion to weight and five-times lighter than concrete, providing the perfect solution of strength, dimensional stability, and high load-bearing capacity with a small carbon footprint (a mere 155 kg CO₂ / m³ embodied carbon emissions (A1-A3)). Coupled with the fast construction times building with wood (around one week per storey) and the very low or zero construction waste on-site, LVL also delivers a sound environmental construction solution.

Any defects in the wood are removed and spread throughout the five layers, resulting in a highly strong, straight, uniform, and modern material. Any issues with shrinking and swelling are greatly reduced, and architects and designers can plan with precision and accuracy. Due to LVL's composite nature and stiff pre-graded veneers*, LVL does not warp or twist over time. In short, LVL is an incredibly strong material that makes one of the most efficient uses of raw timber.

Continuous product innovation

The specific LVL used in the Wisdom ceiling is made from multiple veneers of strength-graded* dried spruce bonded together in Stora Enso's production unit in Varkaus, Finland.

For this project, Stora Enso arranged for the mill to produce 850 m³ of LVL in rectangular panels of 13.5 m x 2.4 m at varying thicknesses.

*Strength graded means wood that has been pre-sorted based on the veneer's strength, stiffness, density, and appearance to optimise its use.



The LVL panels were further processed into approximately 2 730 unique pieces by award-winning timber construction company Blumer Lehmann AG. They used computer numerical control (CNC) machining to cut, block glue, pre-assemble and then transport the ceiling components to the site. Once on-site, pigmentation and fire resistance coating are added. In the summer of 2022, installation started at the museum site under a weather-protected tent covering the entire site. Inside the tent, an overhead crane unloads and lifts the wood elements into place.

The roof shell structure consists of five layers sanded to 31 mm to 33 mm LVL S beams which are connected by a dowel system together to create one long continuous span.



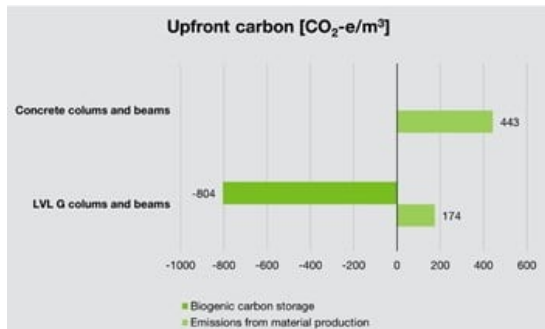
Because LVL can create extremely long uninterrupted spans without any need for internal supporting columns, transportation can be a complication for such vast lengths. Anything longer than 13.5 meters requires additional logistical assistance and increased costs.

An additional benefit of cutting the pieces into smaller parts other than easing transportation is that it makes the wood much easier to bend and twist to the exact shape required. One beam package comprises five individual lamellas cut to 31 mm. Installed together with a dowel system of connections in place, they create one long continuous span.

To enable such a complex project, several digital tools are used to control and share the engineering, logistics and installation of the wood components including Stora Enso's CLT360+, Calculatis and Track and Trace.

Turning urban spaces from carbon sources into carbon sinks

LVL is not only strong but also a very low-carbon emission construction material. The wood used in Stora Enso's LVL originates from sustainably managed slow-grown, Finnish forests and is third-party certified by traceability and chain of custody systems, FSC® and PEFC. The energy used to manufacture LVL in the mill is also extremely low. Compared to other construction materials, the carbon stored in LVL is high and the energy required for its manufacture is low. One m³ of LVL stores around 804 kg CO₂ all of which lines up neatly with the Museum's own sustainability goals.



In addition to being sustainable, wood is a health-promoting material. Wood brings the feeling of the forest into the urban city. Sharing this natural ambience together with the spectacular design in a public space will be extremely enjoyable. The workers and visitors enjoy an enhanced indoor air climate that is demonstrated to have a positive impact on health and human performance.

Innovation through collaboration

From a business model perspective, the Wisdome building process is also taking ceilings to new heights. The innovative approach of cooperation has accelerated the multi-team process so holistically that the model has the potential to change how business is done in the construction industry long term. A recent report by global industry leaders confirms that taking a collaborative approach across the value chain significantly accelerates low-carbon building. You can learn more about this in an upcoming live webinar as a part of the 2022 World Green Building Week.

Working collaboratively is not new to Stora Enso. They have built a reputation for sharing their body of knowledge to help their customers work with wood. A 2022 insight study by Conor Wilcock, Ian Marshall, Lorna Finlay & Georgina Stone at B2B International found that of the major timber companies, Stora Enso stands out as the most reliable experts in this area. But, when the Wisdome project presented itself, those underlying principles were tested.

Wisdome brings together a complex web of stakeholders with drastically different skill types, for example, the building owner, in this case, is a museum. Not only is construction with wood new to the museum management team, but also construction, in general, is outside the scope of their regular museum activities. Coupled with this project being an incredible investment with multiple revenue streams and donors in kind, the extent of the undertaking for them is enormous.

Similarly, Stora Enso is first and foremost a renewable materials company that develops and produces solutions based on wood and biomass materials. When they stepped into their new role of Wisdome's head sponsor, they were learning from some of the most cutting-edge experts in the field while striving to share their expertise and positively influence the overall success of the project.

The collaboration has not only resulted in what is sure to be an architectural wonder of our time but also instilled more understanding about what is possible to construct with wood while forging lasting partnerships. We hope Wisdome has inspired you, too and you will continue to watch this space and share the developments as the project unfolds into the site of lifelong learning and civic engagement.

Key Facts

Official start of construction: 2022

Estimated opening: 2023

Location: Sweden's National Museum of Science and Technology, Stockholm

Building size: 1,325 m²

Dome size: 21.6 m in diameter, 12.2 m high

Number of seats in dome theatre: 100

Main partner and supplier of wood materials: Stora Enso AB

Architect: Elding Oscarson

Specialist Timber contractor: Blumer Lehmann AG

Construction contractor: Oljibe

Partners: Ericsson, Vectura, NIBE

Financiers: Wallenberg Foundations, Erling-Perssons Foundation, Stora Foundation, Fritz Öst Foundation

Collaborations: Wisdome is a national initiative where Sweden's five leading science centres collaborate—Malmö Museums, Universeum in Gothenburg, Curiosum in Umeå, Tekniska Museet in Stockholm with Visualization Center C in Norrköping as the hub of



the collaboration.

Wisdom Sustainability Facts

132 tonnes of greenhouse gas emissions were emitted during the manufacturing of the LVL
 683 tonnes of carbon dioxide was removed from the atmosphere when the trees were growing and stored in the wood over the lifetime of Wisdom. And then hopefully the wood will be reused or repurposed to store the carbon even longer.
 And only a couple of minutes for the same amount of wood to grow back in the Finnish forests on a summer day.

Production stage CO₂ emissions (A1-A3) 155 kg CO₂/m³
<https://www.environdec.com/library/epd1730>

General

Delivery year
 Under Construction

Building type
 Others

Area (m²)
 1325

Storeys
 1



Photo credit: Elding Oscarson

Products

Products
 CLT, LVL

Product volume (m³)
 1 500



Team

Developer

Sweden's National Museum of Science
and Technology

Architect

Elding Oscarson

Structural Engineer

Blumer Lehmann

Main contractor

Oljibe

Specialist Timber

Contractor

Blumer Lehmann