# SFU STADIUM PROJECT

Burnaby | BC | Canada

## Fast + Epp

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he new Simon Fraser University (SFU) stadium is a new addition to the SFU Campus in Burnaby, BC, being described by SFU leaders as "majestic". The primary goal of the SFU stadium is to provide a first ever outdoor home for SFU Athletics and a facility for student community events.





Photo Credit: Mathias Fast

### **INNOVATION**

The crowning piece of the building is the 900m<sup>2</sup> CLT canopy which cantilevers 16 metres, providing weather protection for the spectators below. The canopy strives to advance the use of wood in stadia type construction.

Early on in the design process, the design team developed the concept to drop CLT panels below cantilever steel girders which provided a 'wow' visual statement of continuous wood structure.

In order to achieve the vision of a seamless floating plane of CLT, innovation was required by the structural engineering team. The concept required the team to overcome two key technical uncertainties:

- 1. How to undertake the global design of a novel CLT canopy considering aerodynamic instabilities associated with a lightweight cantilever structure.
- How to connect the CLT to a steel beam using a robust hidden 'top hung' detail considering potential dimensional change of wood.

To overcome uncertainty of aerodynamic instabilities, the canopy was assessed using Finite Element dynamic analysis models and reviewed by a specialist wind consultant to determine that adverse wind effects were unlikely. However, as we knew this was a very theoretical approach, we also developed an in-situ dynamic testing plan using specialist equipment (accelerometers) to test the dynamic behaviour of the built canopy and validate our created finite element models. The testing occurred in Summer 2020 and validated our assumptions.

In order to develop a robust detail to 'hang' the CLT panels, we researched previously tested methods for CLT fixing systems and developed a series of concepts for the fixing detail, discussing ideas with fabricators to get industry feedback. The developed solution was a simple bearing hanger connection which is concealed by a timber 'plug'. We drew on capacity design approaches to ensure initial failure mechanisms of the connection are ductile and incorporated disc spring washers that could take up movement of the CLT panel in the extreme event there was a waterproof system failure. The resultant fixing method was simple and quick to install and is a robust fixing method to fix CLT to the underside of a steel beam.

## COMPLEXITY

The current building site is a grassy mound situated between the modernist Lorne Davies Complex (LDC) building by renowned local architect, Arthur Erickson and the SFU running track. The structural solutions had to ensure the LDC building and running track remain operational throughout the construction schedule. Being on top of Burnaby Mountain, high seismic and snow demands also added complexity to the design.

In order to meet the loading demands and facilitate efficient construction the project material choice follows the principles of the "right material for the right place". Concrete was chosen for the main primary framing as a durable material that can achieve the unusual stand geometry, and efficiently achieve gravity and seismic demands. In addition, the mass of the concrete structure provides a counterweight to the overturning forces associated with the canopy cantilever, which combined with ground anchors, provides global stability to the cantilever system.

Precast concrete structures were chosen for the seating to achieve quick installation times on a tight construction schedule and minimise impact on site adjacent'live'sites. Custom fabricated shaped steel box girders were used to facilitate the long cantilever canopy, tapered to match the structure demand and maximise material efficiency. High strength stainless steel rod, using a specific grade of rod commonly used on oil rigs, was used for the "tie back" to minimise spatial impact on the public concourse and provide high durability for this critical structural element. Prefabricated CLT panels facilitated a simple canopy surface construction.





Photo Credit: Fast + Epp







## SOCIAL + ECONOMIC BENEFITS

The long-awaited project has come to fruition thanks largely to funds raised by the students with funds matched by the university. The new Stadium is expected to reshape campus life and act as a new meeting place, connecting students, alumni and the community. Prior to building the stadium, spectators used to sit directly on the grass to take in a game. Here are a few benefits SFU students have already shared about the new stadium:

#### "It's huge to have a fanbase to come out and support you as you play."

#### *"It will bring more people, more excitement to any sport that is being played out there."*

## *"I think it will allow a lot more engagement from the student society, and students in general. It creates more excitement for all the sporting events and all the athletes that get to use it."*

The SFU Stadium construction, carefully integrated with the existing building, is much more than just a permanent seating facility. As well as providing 1,800-seats, the Stadium includes amenities such as an accessible concourse, concession area, washrooms and booths for coaches and VIPs.

The structural solution also drew on local expertise trade including specialist steel fabricators and CLT fabricators based in British Columbia, contributing to the local economy.

## **ENVIRONMENTAL BENEFITS**

As a community driven project, incorporation of sustainable materials and practices was paramount from the beginning. There was a strong desire to incorporate wood in to design as a low carbon material that could be sourced locally. During early review of the structural design the use of mass timber CLT panels was seen to have great potential benefits for the canopy surface provided robust weather proofing details were in place.

Every material has its place, but the best science seems to suggest that timber is hitting all the sustainability markers. It is a rapidly renewable resource with low-embodied energy and carbon sequestering capabilities. Over 152m<sup>3</sup> of timber was used in the canopy, replacing more carbon intensive alternatives as conventional steel framing and aluminum cladding.

In addition the prefabricated strategy resulted in fewer errors on site, less remedial work, and a shorter overall construction schedule. Prefabrication reduced the negative social impacts associated with construction such as noise, trucking, etc. It also meant less site-labour in the rain and more labour in a controlled shop environment.







## MEETING THE CLIENT'S NEEDS

The SFU Stadium project is a student-led initiative to the SFU Campus. Two key project goals were:

- 1. Value design to meet the clients budget
- 2. Minimal disruption to adjacent 'live' sites throughout the construction schedule

The structural engineering team considered the budget from the outset ensuring each structural element provides value by assuming more than just one role. A key example of this is the CLT panels which provide both a structural purpose, house mechanical and electrical fixings and are a statement architectural finish.

Ease of constructability was also considered by the design team. CLT Panel set out, including maximum possible panel lengths informed the canopy extent. Precast structure was clearly delineated from the main building in situ concrete structure providing simple trade integration. All steel connections were detailed with constructability in mind with the use of bolt fixings promoted where it was possible and careful detailing for the canopy ensured the CLT canopy was installed in less than two weeks.

Throughout construction, sports teams have been able to continue practicing on the SFU Terry Fox Field thanks to the implementation of just-in-time deliveries, which also helped resolve lack of lay down space.

Led by Chandos Construction, the project was achieved during extraordinary covid times. Despite some supplier delays resulting from Covid-19, the upgraded stadium met client expectations through efficiency of design, ease of constructability, and the ability of sports teams to continue practicing on the Terry Fox field.

For years to come, the SFU Terry Fox Field Stadium will enhance the student experience by providing a facility to host concerts, student orientation, accommodate largescale tournaments and recreational events, and serve as outdoor leisure seating for the campus community.









