Leading Sustainability through Innovation

How Graham Construction Is Building the Trinity College Lawson Centre for Sustainability at the University of Toronto

Produced By: Build Canada | Photos provided by Graham Construction

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Currently pursuing LEED Platinum and Zero Carbon Building certification, The Lawson Centre for Sustainability at Trinity College at the University of Toronto emphasizes the integration of advanced ecological design principles and cutting-edge technologies to reduce the building's carbon footprint and optimize energy efficiency.

Sean Carroll, Site Superintendent with Graham Construction joins us to explore the key sustainable features, materials, and products incorporated into the design and construction of The Lawson Centre for Sustainability.

Build Canada: With the Lawson Centre targeting LEED Platinum and Zero Carbon Building certification, what are some of the key sustainable features, materials, and products being used in its design and construction?

Sean Carroll: The Lawson Centre for Sustainability has strived for the highest ratings achievable in new green building technologies, by targeting both LEED platinum, and Carbon Zero certification through building design, green friendly materials and construction methodology. The project used thermal models and research analysis to facilitate in testing the high energy saving systems prior to construction, with the building envelope design targeting a thermal resistance value of R-37-38 effective for the façade and R-40 for the standard roofs, and up to R-50 on the Green Roofs, to minimize energy use for space conditioning.

The building utilizes enhanced insulation and airtightness to minimize heating and cooling needs that has over 200mm of insulation and 40mm air gap on the walls, a higher R value on the roof, combined with a vapour permeable envelope system which allows the building to breathe naturally to provide longevity for the mass timber structure.

A continuous AVB system from base of footing wraps completely around to the buildings opposite side creating a continuous AVB for maximum air tightness. Features include triple-glazed windows with bird-friendly fritting and a strategic window-to-wall ratio to minimize heat loss and still maintain natural light in the building.

The concrete used, was a modern Green friendly concrete called EcoCrete. This EcoCrete had to meet a certain standard and minimize the GWP (global warming potential) number, which was quite a a challenge as it uses low cement content in its design, but still had to meet a high compressive strength criteria. In close collaboration with a local concrete supplier and some reiterations with our structural engineering team, we successfully achieved multiple concrete designs that met the low GWP criteria, and maintained the high strength structurally, and still met the many different types of concrete that was required for different applications throughout the building. One of the sacrifices to achieve these criteria, was for the concrete to reach its design compressive strength at 56 days

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instead of the typical 28 days. Our schedule needed to be broken down and sequenced in a certain rhythm to allow for the longer curing time. Innovative digital cloud based thermal couplers were used to track and monitor concrete curing patterns along with the traditional testing methods of cylinder collections and breaking at pre-established time periods following the pours. 1 qty 3-day break, 1 qty 7-day break, 1 qty 28-day break, and 2 qty 56-day breaks. The building's facade is clad in locally supplied limestone bricks and limestone slabs, which reduces embodied carbon associated with transportation and supports the regional economy.

BC: What are the key Geothermal Heating and cooling enhancements being implement at The Lawson Centre that have significant potential to reduce the footprint and impact compared to traditional heating and cooling systems?

SC: The Lawson Centre has a designated geothermal field situated in the southeast corner of the project site, the field is approximately 40m latitudinal x 25m longitudinal and has 57 geothermal holes at 650’ deep which houses a single loop geothermal heat recovery system.The loop and heat pump system houses a combined 32,500 liters of heating fluid. Of this, building side holds 4500 liters of which 1125 liters is pure Glycol. Field side has 28,000 liters of which 7000 liters is pure Glycol.

This was the first activity completed on the project. The geothermal field loops are capped, and the horizontal loops are approximately 5’ below final grade, which is designated for only green field space with just grass SOD and perinatal plantation on top of the field. The average temperature of the earth at this depth in this region is approx. consistent 10°c all year round, using cutting edge thermal recovery and heat pump systems, this constant 10°c is used for heating in the wintertime, and cooling in the summertime. This eliminates entirely the need for fossil fuels directly for heating and cooling systems of the building. The only gas lines that are used in the building is for the emergency generator, and the 2 functional fireplaces in the common areas which were added as an architectural feature.

The Lawson Centre for Sustainability

Trinity College, University of Toronto

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The **Lawson Centre for Sustainability** will serve as the heart of Trinity College, connecting people and uniting existing buildings. This four-storey hybrid mass timber facility places sustainability at its core, featuring rooftop community gardens that support a sustainable food program along with numerous other environmentally conscious design and construction elements.

Lawson Centre

The geothermal system works in collaboration with mainly chilled beams systems, which eliminates the need for conventional forced air systems for heating and cooling, air handling units are still used for air balancing of the building, but unlike the majority of AHU, these do not have a gas requirement, as the chilled beams are the main thermal control inside the building. This same system supports a strategic snow melt system that surrounds the exterior of the building.

PHOTO CREDIT
Mecanoo Architecten

BC: Could you provide further insights into the double wall foundation system? Additionally, what are the best practices and advantages for this system that contribute to the building's thermal envelope?

SC: The double foundation wall acts as a twin support for 2 adjacent loads being projected on to the footing below grade and allows for a continuous insulation layer from the top of the building footing all the way up to the roof parapet. The inner wall is a 200mm thick foundation wall that supports the exterior structure of the building, which in most buildings is a metal or wood stud system. With the Lawson Centre for Sustainability, it is a CLIPS wall system, which stands for (Cross Laminated Insulated Panel System). This load of the CLIPS wall

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system, which stands for (Cross Laminated Insulated Panel System). This load of the CLIPS wall system transfers on to the footing below on the Interior Structural wall. Between the inner and outer wall is a 100mm rigid insulation that is continuous from footing to roof. The outer wall is also a 200mm wall which transfer the Façade limestone load to the foundation. This outer wall is the infrastructure for the continuous AVB that wraps the entire building from footing and tying into the roofing system and back down the building on the other side to the adjacent footing.

BC: How does the Centre's green roofs, interior green walls, and rooftop Urban Farm add to – not only energy savings – but the importance of integrating urban farming with research, education, and community engagement?

SC: As all inner cities want to protect as many green spaces as possible. The design intent for The Lawson Centre was to return as much green space as possible, and a great way is to introduce green roofs. Not only does the green roof

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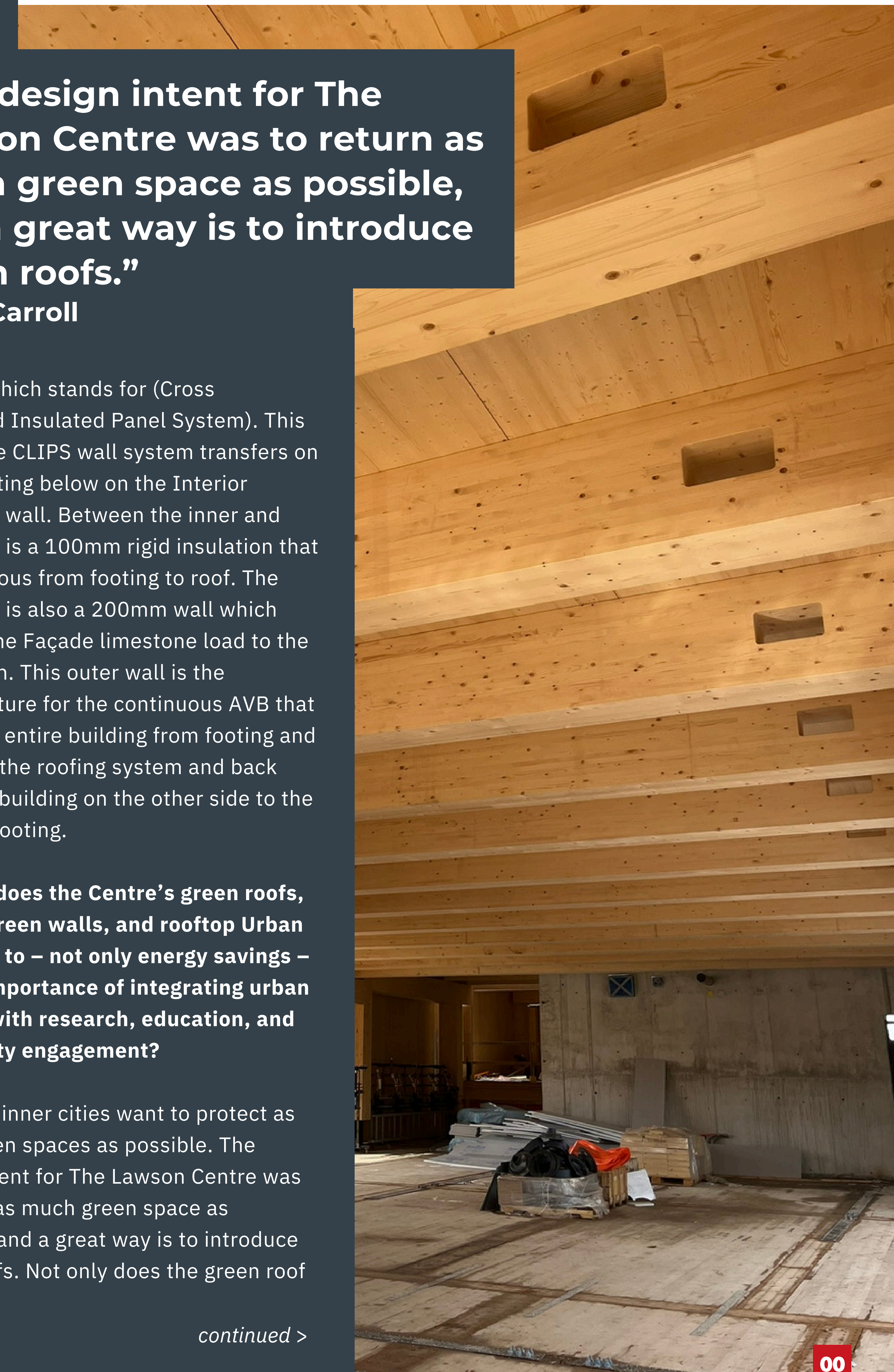

add back the green space to the project area, but it also helps reduce the energy consumption and manage climate effects in a dense urban environment. The vegetation and planting medium provides an extra layer of natural insulation keeping the building cool in the summer and warm in the winter. The addition of the Green roof increases the R-Value to approximately R-50. This also helps combat a phenomenon called Urban Heat Island effect, which is raised temperature in cities in comparison to the surrounding areas. It does this through a process called evapotranspiration; the plants release water in warmer days which uses up the heat energy naturally cooling the air around the building.

The interior green wall, as well as being a beautiful vertical garden inside the building, it also has many health and wellness benefits and works towards the LEED platinum certification of the building. Studies have shown that interior green walls improve indoor air quality, by being natural air purifiers by absorbing carbon dioxide and releasing oxygen, they also help regulate air humidity and reduce sickness and fatigue. There are also studies that show green walls boosts mental well-being and increase productivity and creativity.

BC: What are some of the environmental benefits of the Centre's rain harvesting and recycling systems that protect natural resources and ecosystems?

SC: The rainwater harvesting system greatly reduces the amount of city supplied incoming water used to operate the building. One of the biggest usages of water in our modern buildings is toilets flushing. The Lawson Centre for Sustainability has

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wisely designed a system that vastly reduces that amount of water usage, especially as it accommodates and houses approximately 346 students and approx. 50 additional staff. The system captures rainwater, and some of that rainwater is diverted into city storm system, and a calculated, metered amount of that rainwater is diverted into a combination of internal sump pit tanks inside the building and fed into an external box culvert situated below the landscaping in the common areas around the building.

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This water is then pumped into the building and is processed through a rainwater harvesting system, which is then stored in tanks and used to flush toilets and used to irrigate the landscaping plantation and grass around the building during drier spells in the summertime.

BC: Since mass timber components can absorb water quickly if exposed to standing water - what were the moisture management or protection measures for recognizing and mitigating risk through the design and building process?

SC: Controlling the moisture content of the mass timber during the construction process, and after construction is the most important aspect when considering using mass timber products for a building. This contributes directly to the building's performance and longevity. There is a lot of research gone into how timber performs with different moisture content and what effect it has on the timber as time passes. It has been proven that the timber must meet a strict criterion to maximise the lifespan of the product.

Prior to construction commencing our team in conjunction with the leading consultant in mass timber in North America, RDH Building Science, developed a detailed moisture management plan which adapted the industries tried and tested best practices. As our construction went through the wintertime, we had to get creative and come up with innovative solutions to keep progress moving through the cold and snow.

The mass timber is most vulnerable in covered areas, when it loses the ability to dry and breathe naturally, such as installing floor topping, which typically consists of a layer of rigid insulation, or acoustical mat, with a 3" concrete topping installed on top. Or when we encapsulate the mass timber on the underside of the CLT flooring, or walls that are cladded in drywall. It is essential that measures be taken to ensure that the wood flooring is at a moisture content that meets the design specifications and kept at the moisture content before and after the pour. There are a few steadfast rules in making sure this is achieved.

First rule – Never pour a topping on a floor unless the roof is completely sealed and is going to stay sealed. Windows and openings must also be sealed from any incoming rain or moisture that could get under the topping when completed.

Second rule – The substrate must be tested to ensure all areas are at or under the desired moisture content, which is typically 16% - 17% internal moisture content at all depths of the wood, prior to enclosing. At this point we need to freeze a moment in time and document this data prior to proceeding. We documented this by creating what we called a pre-enclosure report, that showed all the information with photos and moisture content readings data for each separate area that was to be poured, and the same for every area that was enclosed with any cladding that prevented the wood from breathing.