

NATIONAL ARTS CENTRE ARCHITECTURAL REJUVENATION

Ottawa | ON | Canada



Fast + Epp

Exterior view from Elgin Street.
Credit: Double Space.
(Front: Credit: Double Space)



“The National Arts Centre in Ottawa underwent a significant rejuvenation for Canada’s 150th anniversary. A key feature in the project is a striking coffered ceiling, a unique piece of structural artistry visible from the street. The roof was formed of 28 hybrid wood-steel panels pre-fabricated off-site, with electrical, mechanical and acoustic integration. The ceiling promotes engineered wood products fabricated in Canada. The rejuvenated Centre is a new beacon for arts and culture in the nation’s capital.



Photo Credit: Double Space.



INNOVATION

The rejuvenation of the National Arts Centre in Ottawa transforms Canada's most prestigious performing arts institution from a Brutalist-era concrete monolith into a venue which opens itself up to the public through a 6,000 m² glass-clad extension. A coffered hybrid wood-steel roof is a piece of structural artistry, visible from the street, which draws inspiration from the ubiquitous triangular geometry of the existing building. The roof structure uses several hundred triangular glue-laminated wood coffers, all of the same unique shape but rotated differently and exposed to create a flowing artistic effect with no perceptible hierarchy between the three directions.

The extremely tight construction schedule drove a fully pre-assembled and panellized structure, able to be erected with temporary waterproofing and integrated services pre-installed off-site, while maintaining unaffected theatre operations in the existing venue. The rejuvenated venue was inaugurated by HRH Prince Charles during Canada's sesquicentennial celebrations on Canada Day, 1 July 2017.

Fast + Epp explored two-way-spanning structures which were well-suited to this multi-directional layout. However, the strategy of panellization, driven by the imperative of the schedule, demanded a structure which would not need complex connections in a secondary direction after erection.

Adopting a one-way, linear, structural system presented a structural conundrum: how could the architectural vision which emphasised a non-hierarchical tri-directional grid be realized structurally without over-designing, for the sake of uniformity, the two "non-structural" directions? How could such a system be adapted to four unique roof shapes?

Hybrid solution

Fast + Epp proposed a hybrid wood-steel solution to this design challenge. Slender steel plates up to 20mm thick and 750mm deep ($h/t = 37.5$) provided the sole bending capacity across the roofs. The triangular grid was put to structural effect by using triangular wood "coffers" made from 80mm wide pieces of glue-laminated timber (glulam) to provide continuous lateral support to the steel plates to prevent buckling.

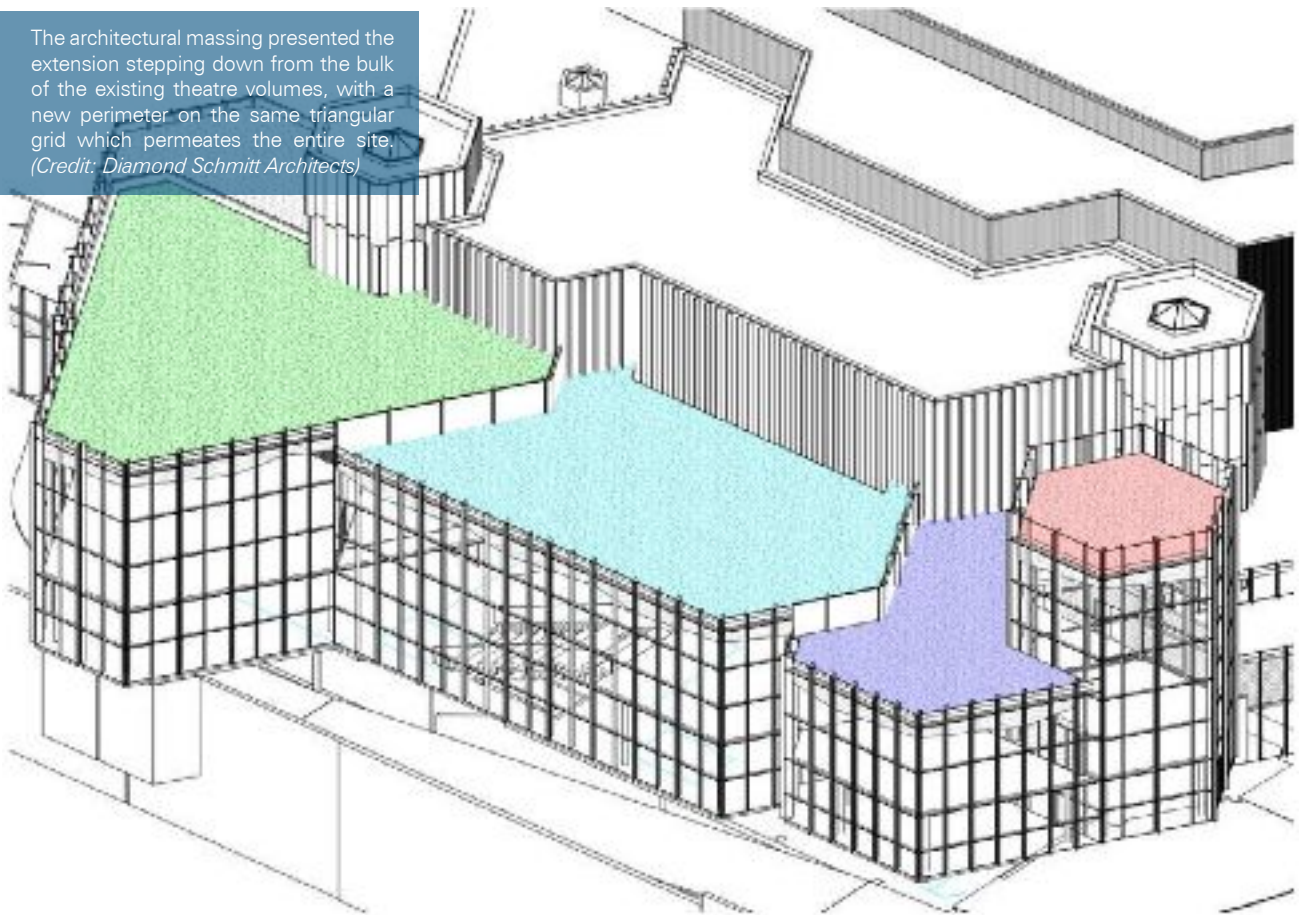
The symbiosis of this hybrid approach – the wood braces the steel while the steel holds up the wood – allowed the wood to express the three directions of the architecture while the steel, invisible by its slenderness, spanned the one direction of the structure.

Photo credit: Double Space.

National Arts Centre in 2012, with the extension shown in pink.
(Credit: Joel Bedard)



The architectural massing presented the extension stepping down from the bulk of the existing theatre volumes, with a new perimeter on the same triangular grid which permeates the entire site.
(Credit: Diamond Schmitt Architects)



COMPLEXITY

Questioning how the structure would be assembled and erected drove the design process. Fast + Epp faced an extremely tight timeline which demanded a construction process which would allow pre-fabricated panels to be fully integrated with services and temporary waterproofing in advance of erection. Fast + Epp created small physical models to explore the construction of individual coffers, their assembly into a panel and the panel's erection onto columns.

The requirement for sound-absorbent panels in the coffers presented a concealed zone which could be used for distribution of services. A single notch size was created in the walls of every coffer, located away from the line of the effective bracing strut in the wood. The complete service distribution was then finalized by connecting to a single feeder route at one end of the panels after installation.

The coffer

The design team needed to find a way of creating an extraordinary roof with a minimum number of different components. A single triangular coffer design with slender 80mm thick Douglas Fir glulam sides was developed as the structural unit, which is repeated across the entire roof. The unit has three different depths at its vertices, of 900mm, 1100mm and 1300mm. When this single design is repeated across the roof, it presents a beautiful and varied texture for the roof which belies the simplicity of the single unit composing it.

Fast + Epp studied the optimal gap between adjacent coffers – to be large enough for the connections at the ends of the panels and small enough for the steel plates to be concealed effectively from view from below – and recommended to the architect a gap of 150mm. We sensed a harmony in these proportions and found delight in the dark accent lines that this depth of shadow gave to the architectural expression.



ENVIRONMENTAL BENEFITS

The NAC project is defined by its investment in extending the life of this existing institution, guaranteeing its continued social function and economic viability for at least another 50 years. This was enabled by careful structural assessment and designing strengthening to maximize the re-use of existing spaces.

The design heavily promotes engineered wood products fabricated in Canada, using the most sustainable of structural materials and promoting the social and economic benefits of local industry.

SOCIAL + ECONOMIC BENEFITS

The new wood roof is a structure which is also a piece of art. But it is not a mere exhibit for only those who care to seek it out – it is a central experience of every patron who visits the NAC. The simplicity and elegance of the structure make it a feature to be expressed, rather than concealed.

The geometry of the roof draws from the all-pervasive triangular forms of the existing building. Whereas the existing building expresses this geometry in its finishing and cladding, the new roof boldly places it at the heart of the structural design. The tapering profiles of the 247 coffers assemble into a uniquely undulating roof with a fluidity that contrasts with – and brings to life – the flatness of the triangular geometry inherited from the existing building.

In addition, the ceiling promotes engineered wood products fabricated in Canada, thereby contributing to the Canadian timber manufacturing economy. Unveiled by HRH Prince Charles on July 1, 2017, the rejuvenated Centre is a new beacon for arts and culture in the nation's capital.





MEETING THE CLIENT'S NEEDS

As the sesquicentennial year of 2017 approached, the Canadian government allocated C\$110m (£61m) for an architectural rejuvenation of the building.

The project goals included:

1. to create a new, visible entrance and attract a new generation of patrons,
2. to provide new space for flexible programming and revenue generation, and
3. to respect the character-defining heritage elements of the original building.

The symbolic value of opening the arts centre on Canada's 150 year anniversary was immense. Meeting this opening date was only possible using pre-fabricated panels with an integrated systems approach.

The light-weight hybrid roof design minimized the impact on supporting structures. Where strengthening was unavoidable, Fast + Epp promoted an extensive use of fibre-reinforced polymer wrapping of existing beams and columns, ensuring the continued viability of revenue-generating spaces and not sacrificing parking spaces in the three levels of underground parking.

The roof created by the design team delivered to the client an exceptional structure which is an attraction in itself.

Photo credit: Double Space.



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