

March 31, 2023 by Matias Bessai

## Building A Landmark: Structural Ingenuity Supports Calgary's BMO Centre Expansion

Calgary's premier convention venue, the 500,000 ft<sup>2</sup> [BMO Centre](#), is in the midst of a transformational expansion. In [the first part](#) of our look at the project, we examined how the plans evolved to create a visually distinct and structurally complex landmark for Alberta's largest city. The \$500 million project, now well into construction with the main steel frame completed in November last year, was developed around the push to deliver an internationally competitive facility for conventions and events, and to expand upon the offerings of the existing building.

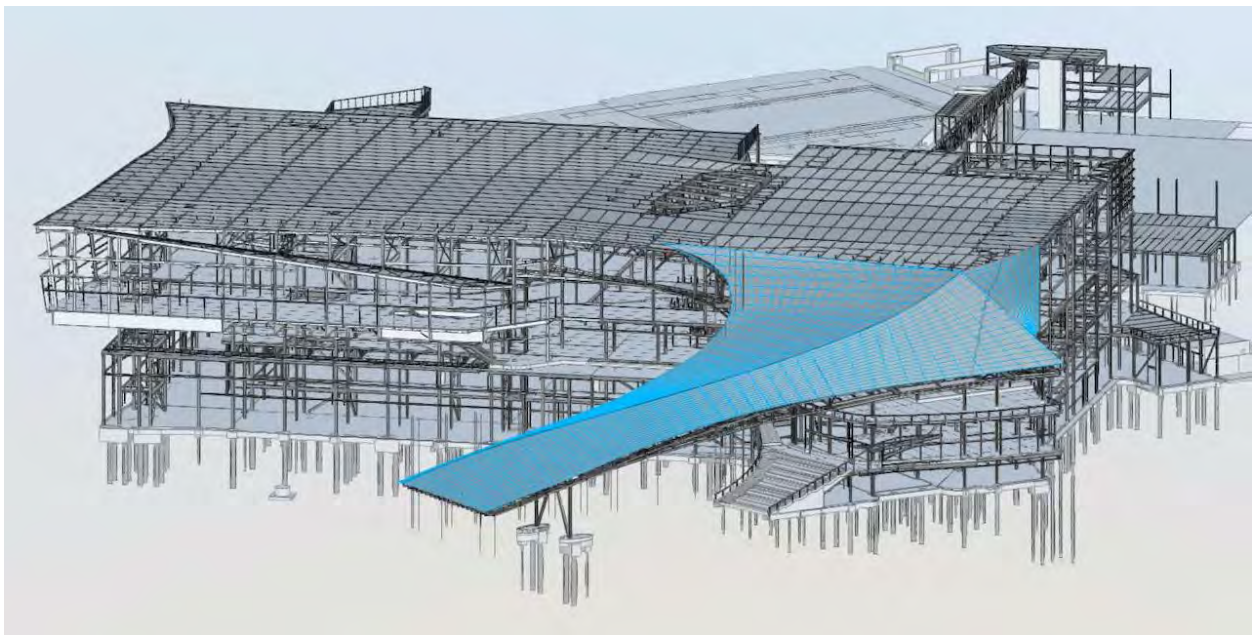
Led by development manager, the Calgary Municipal Land Corporation (CMLC) on behalf of their partners, the Calgary Stampede, the design that emerged from the team of [Stantec](#), [Populous](#), and [S2](#) contemplated a three-storey structure with a minimal number of columns on the main level and fully column-less ballrooms on the top level. This design allows the venue to accommodate the largest conventions and events with spaces that are capable of exceptionally diverse programming, and is also visually dramatic.



Interior view of the ballroom space, enjoying a columnless floorplan, image courtesy of CMLC and Calgary Stampede

Given the task of developing the structural systems required to create the building in physical space, the engineering team of [RJC Engineers](#) and [Magnusson Klemencic Associates](#), working with steel subcontractors [Walters Group](#), had a challenging assignment that was central to the success of the project. How they developed these systems was a process of working around the architects' vision, requiring complex modelling, crafty workarounds, and most importantly, applying their experience to make the right choices early on.

"It all revolves around creating those really long spans at the bottom level," said [Geoff Kallweit](#), RJC's Project Engineer for the Expansion. A column-less level at the very top of the structure alone would have been a rather standard design according to Kallweit, similar to the design of an arena or auditorium; but incorporating a ground floor layout that also features as few columns as possible columns is where the challenges come into play. With two additional floors of building resting directly above it, a plan had to be devised to support and redistribute that load in creative ways. "We had to do some really interesting structural gymnastics to be able to open it all up," he said, "and we ended up with this stacked system that required these heavy structural truss configurations."



Structural model shows the configuration of the steel frame of the expansion building, image courtesy of RJC Engineers

Design Engineer at RJC, Annelise Loczy, offered additional insights to make clear how this structural truss configuration works to distribute the load of the building onto the few structural columns of the open-concept main level. On the second floor, directly above the main level event space, the steel configuration employs two key components that work in concert; the primary and secondary trusses. The primary trusses are comprised of large, heavy steel sections, and cover the 27.5 metre east-west span between the closest columns on the main level. The secondary trusses, meanwhile, span north-south, and collect load from the floors above. When the

secondary trusses intersect with the primary ones at a perpendicular angle, their load is transferred to the primary trusses, which then distribute that load out to the main level columns.



Looking up at the primary/secondary truss configuration from the exhibition level, image courtesy of RJC Engineers

“A lot of people go to buildings and think, ‘what’s that column doing there’, or ‘why is that wall here’,” said Loczy. “The goal for us ultimately was to make the structure seamless and complimentary to the building, not a hindrance to it.” With this complimentary approach in mind, the meeting level above the event space presented some interesting opportunities for the engineers to refine the structure with fewer visual concerns. With 38 meeting rooms occupying the second floor, the segmented programming allowed them to conceal several transfer columns within dividing walls that support the ballroom level above.

Interestingly, with the ballroom programming occupying the top floor, another structural challenge emerged related to the rigidity of the building frame. The live load created by people dancing at the ballroom level had the potential to cause vibrations throughout the structure, but with meeting rooms located directly below, the building had to be designed to minimize the amount of movement and vibrations. Commenting on how this was achieved, Loczy explained how “in our design, it’s the acceleration of the beams that we are limiting.”

The process of limiting those accelerations involved modelling how the floor system would respond to the different frequencies of vibration created by dancing and motion, and then determining how the structure would accelerate or vibrate as a result. With such a low tolerance for vibration on the floor below, the acceleration had to be brought down almost to zero, Loczy said, detailing how “we actually limited it to less than what you would see on a highway structure, so it’s quite stringent and tight criteria.”



Looking northwest to the building’s steel frame, image courtesy of CMLC and Calgary Stampede

Reflecting on the project overall, now that construction of the steel frame has been completed, Kallweit commented that beyond the structural solutions that were developed for this challenging build, the greatest accomplishment was in the turnaround. The complete structural package, he explained, was required before the architectural plans were completed.

“It’s not the conventional way to do things, to have decided exactly what structure you’re building before you have determined what’s in it,” Kallweit said. But even under the demands of time, and some uncertainty of how the final product would actually look, Kallweit expressed a sense of pride for what the engineers were able to deliver. “The amount of pre-planning that went into this, the coordination in the 3D models, and all of our experience meant that we were able to pull this off.”



Looking northwest to the BMO Centre Expansion, image courtesy of CMLC and Calgary Stampede

For the people of Calgary, the project delivers a new feature building worthy of international attention, but beyond that, the BMO Centre Expansion is a catalyst for further investment from the private sector. "When you showcase this level of public investment, people start to take notice," said Kate Thompson, President and CEO of the CMLC. "It's no longer a plan, it's a reality, and that's really got the development industry talking."

"The fundamental goal of CMLC is to invest public dollars to attract private dollars," Thompson continued. "In the last 15 years we've invested over \$400 million in Calgary's East Village and attracted over \$3 billion in private investment. So that's when you can take stock and say, it is working, because those investments wouldn't have come without us removing the barriers and creating the opportunity. Now we're doing the same thing in the Culture and Entertainment District."

With the focus of construction now transitioning to the cladding and the interiors, Calgary's expanded BMO Centre is set to open in 2024.