BRINGING STRUCTURAL STEEL SOLU

Mixed-use development

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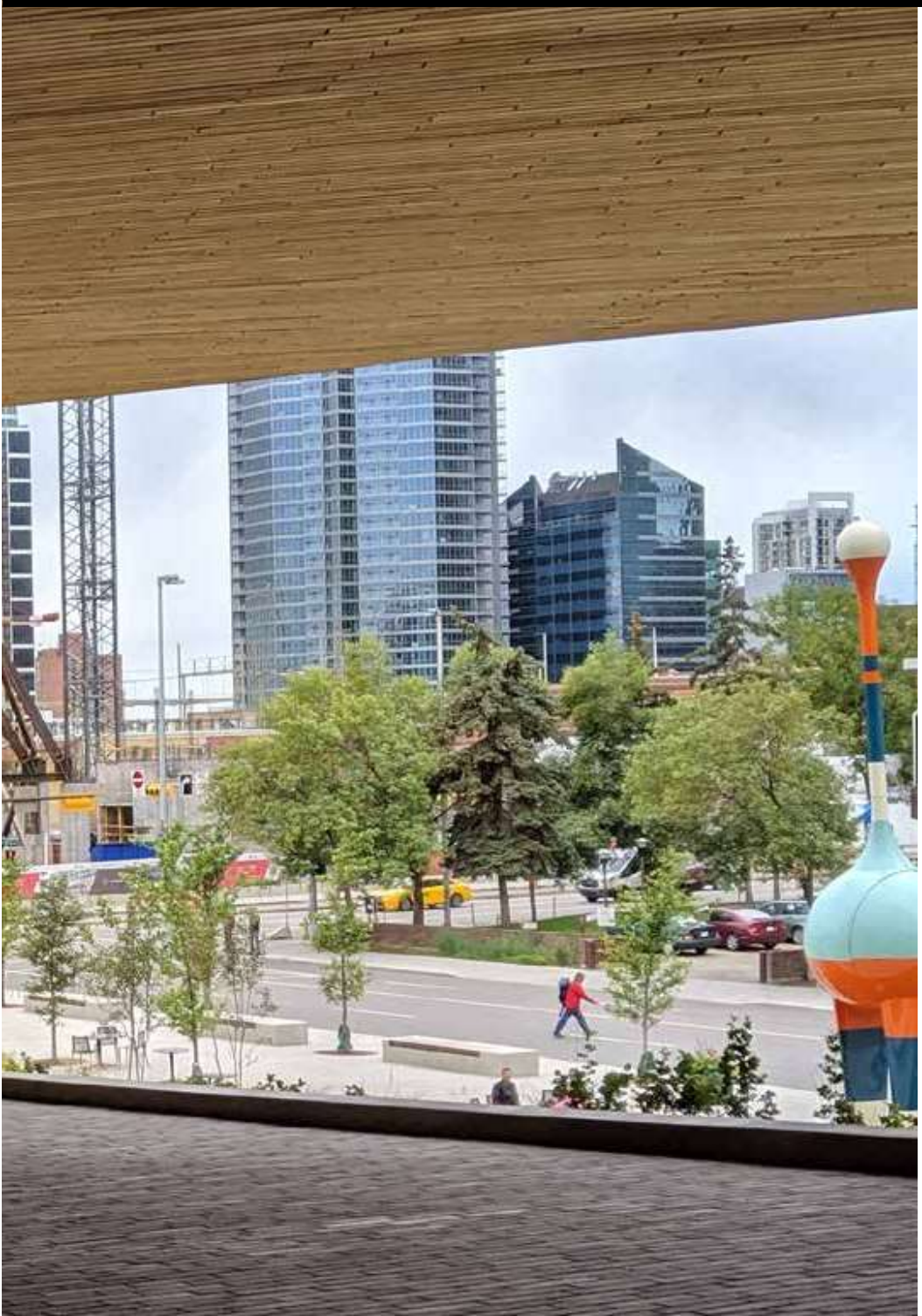
TIONS TO A CALGARY PARKADE



THE 9TH AVENUE PARKADE in Calgary's East Village neighbourhood is by no means your average parkade.

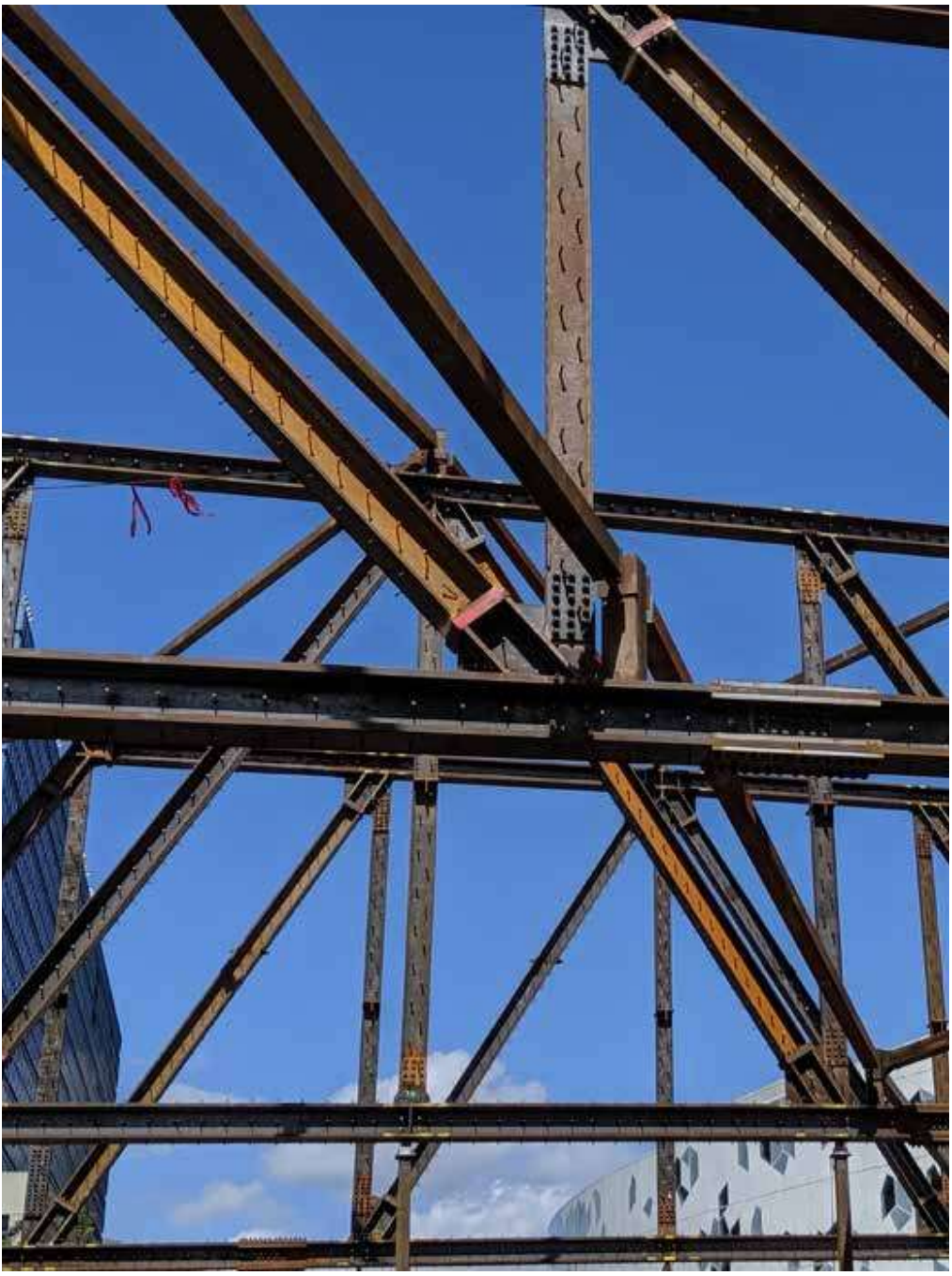
In fact, this 510-stall parkade structure, in addition to serving the cultural landscape that surrounds it, also serves as an innovation incubator space and is truly an interesting mixed-use development.

There were also specific requirements toward ensuring flexibility so that amenity spaces and future occupancy changes could be facilitated. If parking garages slowly phase out, this resilient structure can easily adapt to other types of occupancy with additional superimposed dead loads.

The site presents a number of challenges, including the fact that it's relatively narrow and bounded by Calgary's CP Rail corridor to the south, 9th Avenue SW to the North, utility buildings on both the west and east sides, and Calgary Transit's Red Line tunnel and major utility corridor bisecting the site.

PROJECT SUMMARY

This project, in part due to its unconventional nature and requirements, has brought our team a myriad of technical challenges, many of which could only be solved by implementing structural steel as a framing material.



PROJECT:

STRUCTURAL ENGINEER: ENTUITIVE **DEVELOPMENT MANAGER:** CMLC
OPERATOR: CALGARY PARKING AUTHORITY **TENANT:** PLATFORM CALGARY
EXECUTIVE ARCHITECT: KASIAN ARCHITECTURE **DESIGN ARCHITECT:** 5468796
CONSTRUCTION MANAGER: ELLISDON **STEEL FABRICATOR & ERECTOR:** SUPERMÉTAL
PROJECT MANAGERS: COLLIERS PROJECT LEADERS

Technical Challenge #1

MEGA TRUSSES.

Much like the adjacent New Central Library, the site is bisected by the LRT tunnel roughly 2m below grade. Spanning the building 33m over the tunnel was a considerable constraint of the site which was really only feasible with the use of mega steel trusses. A total of five trusses were needed to span over the LRT tunnel and utility right-of-way, which are skewed in plan, and vehicle drive aisles. Two of these trusses are two storeys tall and the four main trusses weigh roughly 59,000 kg each.

An unconditioned open parking structure exposed to extreme temperature changes, de-icing salts and potential vehicle impacts is not the most forgiving environment for a steel structure. Considering also that the steel would need to be fire protected and support and connect with a primarily concrete building, meant that concrete encasement was essential. To retain a consistent look for the building, the truss members were kept compact so that even the 6.7m-tall column supporting an 18,400 kN (1,900 metric tonnes) design load was no wider than the typical parking column.

While much of the truss framing will be exposed to temperatures below -30°C and necessitated the appropriate Charpy V-notch requirements; large portions of the trusses are also within the conditioned level 2 office space. This temperature gradient added additional complexity to the design and significant additional forces to be resisted, including bending of the web members.

Technical Challenge #2

CONSTRUCTION CONSTRAINTS.

One of the site constraints was that construction loading over the LRT tunnel was not to exceed a uniform factored pressure of 14 kPa. This meant that just the self weight of the trusses alone along with temporary construction loading was close to this maximum threshold. Therefore, the trusses had to be erected and be temporarily stabilized on their own without the concrete slabs in place. Additionally, since the weight of no more than one floor of concrete could be shored at grade over the tunnel, the trusses needed to be sequentially loaded and concrete construction progressed while maintaining the required temporary

bracing of the trusses. A carefully planned out schedule was devised that included erecting and removing bracing between the four main trusses with minimal impacts to the concrete formwork, reinforcement and finishing. This required bracing the truss nodes up to a vertical offset of 1m above their work points and a total of 35,040 kg of temporary erection steel.

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Technical Challenge #3

FLYING RAMP.

Another challenge involved the fact that level 2 of the parkade is a conditioned innovation space with nearly all parking stalls situated on the floors above. More challenging still was that the innovation space tenant became part of this unique building halfway through the detailed design phase. We had to find a way for vehicles to reach the third level.

The solution was to design a long "flying" vehicle ramp through the atrium of the parkade to allow cars to bypass level 2 from the ground floor. The ramp is supported on 14 girders that crank up and down at different angles and provide a uniquely articulated look. The girders are supported on what was essentially designed as four separate structures with differential relative movements that had to be considered. To allow for this movement, unique large sliding pin details were used at one end of the girders along with a movement joint halfway up the ramp. This one vehicle ramp is made up of 67,443 kg of steel.

Since the site is bisected by a significant water main, the ramp also needed to be framed relatively thin and with a slope profile to allow emergency crews and equipment enough vertical clearance to maintain or repair the pipe.

The flying steel ramp also has steel vehicle barriers encased in concrete for durability and enhanced resiliency designed significantly beyond code minimum vehicle code impact loads.

FINAL THOUGHTS

Overall, it's extremely exciting to see the transformation and to help shape Calgary's East Village neighbourhood. Entuitive has had the opportunity to work on the New Central Library and the St. Louis Hotel Restoration, both requiring significant amounts of steel, and now we're part of the team that's helping to design the new Calgary Event Centre. AS

https://www.youtube.com/watch?v=btA4arMiJUQ