STEEL STANDS THE TEST OF TIME

The view that greets visitors arriving at Aotea Square is of a tall, slender building presiding over the public space – the Civic Administration Building (CAB). Built in 1966, the former Council building is an important piece of Auckland's architectural history.

As one of the first structural steel-framed buildings in New Zealand, it demonstrates numerous important technological feats in structural engineering and building design for its time and place. Designed in the 1950s, it is also a prime example of post-war 'international style' as applied to the New Zealand context.

Today, the category A heritage building is being awarded a new lease of life. The CAB is being restored, refurbished and transformed into high-end central city apartments.

The CAB itself is only a small part of the overall Civic Quarter development, which will go on to include development of the surrounding 5,300sqm of land with complementary buildings and infrastructure.

New steel is also being used in the CAB. The 4,600sqm steel-framed building includes a one-and-a-half level subterranean basement with large quantities of structural steel beams and circular hollow sections. But that's another story...

THE FACTS

- **1956, the year the building was designed**
- **1966, the year the CAB was completed**
- **4,600sqm building**
- **18-storeys**

DEVELOPER **LOVE & CO** ENGINEER **BECA** ARCHITECT **JASMAX** HERITAGE ARCHITECT **SALMOND REED ARCHITECTS** BUILDER **NAYLOR LOVE**

DEVELOPER

Developer Love & Co, owned by John and Josephine Love, has a solid track record of retaining and repurposing existing buildings but the CAB is its first foray into the adaptive reuse of a structural steel frame. Central to this project was the need to preserve the heritage qualities of the building.

Retention of the CAB's 18-storey steel frame was fundamental to its successful refurbishment. Indeed, analysis showed the structure had good 'bones' and was well suited to its change of use to residential. Notably, the steel was in excellent condition thanks to its protective fire- and corrosion-resistant coatings, and the seismic-resisting steel moment frame, which was leading edge in its day, ably meets today's seismic requirements.

Another driver to retain the steel frame was the heritage angle. While the steel frame itself isn't designated 'special character', it has the shape of some of the key heritage elements contained within it, such as the terrazzo-topped stairs and landings, the double-height mezzanine and the rooftop terrace.

An added appeal of reusing the structural steel frame is the environmental sustainability factor. Reusing such a large portion of the building vastly reduces its carbon footprint. The resilient structure, which has been there for 55 years, is good to go for another 50 years.

ARCHITECT

The goal was to retain the essence of one of Auckland's earliest high-rise steel structures, which had become outmoded as a council office building. A feature of the structure was the fluted aluminium cladding system, which was fixed to the steel frame. Internally, the steel was contained, boxed in or hidden in the ceiling cavities.

Under the Unitary Plan, a new build of this scale on the site wouldn't have been possible; it would have dictated a different shape with a lower overall height. Fortunately, as an existing structure, the CAB is exempt.

The proportions of the building's footprint and the frame, with its regular shape and grid spacings, lends itself well to residential. The intertenancy walls are positioned on the grid lines, avoiding unwanted columns in the middle of the floor. It offers a variety of apartment configurations, from the fabulous penthouse down to a range of three-, two- and one-bedroom spaces.

The imperial-sized steel sections start at about 600-wide at the base of the building and taper up. Less strength is required towards the top of the structure so the steel becomes more slender. Holding up the roof, for example, are 100x100 posts, considerably smaller relative to the ground components. That slenderness isn't possible with timber or concrete. And it enables excellent views. Steel's slender nature allows more outlook from the apartments, particularly at the upper levels. It also impinges very little on the space requirements.

When it comes to ticking the green building box, reusing or repurposing a steel building has advantages over a new build. While maintaining a link to the past, such buildings can be shaped for the current and future environment. The key is to identify new uses for old structures. Many older buildings have sufficient height and spacing of columns and beams to allow easy repurposing. Flexibility is pivotal and steel has the advantage over other materials.

The good condition of the steel throughout the project required very little remedial work to ensure it lasts for the next 50 years. While the team had little reason to modify the structural frame, some secondary steel was modified to suit new layouts. A real benefit of steel is the ease with which it can be altered – steel is readily adapted by welding, cutting or shaping.

BELOW: THE STEEL WAS IN EXCELLENT CONDITION THANKS TO ITS PROTECTIVE FIRE- AND CORROSION-RESISTANT COATINGS.

"STEEL IS INHERENTLY MORE SUSTAINABLE [THAN OTHER MATERIALS]. IT'S 100 PERCENT RECYCLABLE AND IT HAS AN ENDLESS LIFECYCLE. MY PERCEPTION OF STEEL HAS BEEN ENHANCED BY THIS EXPERIENCE OF REUSING THE EXISTING STEEL FRAME."

JOHN LOVE, MANAGING DIRECTOR, LOVE & CO.

“ADAPTIVE REUSE IS GOOD FOR THE PLANET. INSTEAD OF TAKING A KNOCK-IT-DOWN AND BUILD-A-NEW-ONE APPROACH, REPURPOSING BUILDINGS IS IMPORTANT FOR THE FUTURE. THE BEAUTY OF STEEL IS THAT IT IS READILY ADAPTABLE.”

ANDY ANDERSON, PRINCIPAL, JASMAX

RIGHT: REUSING SUCH A LARGE PORTION OF THE BUILDING VASTLY REDUCES ITS CARBON FOOTPRINT.

BOTTOM RIGHT: MINOR RETROFITS WERE REQUIRED TO THE STAIRCASES, WHICH ARE A HERITAGE FEATURE, TO ENSURE THEY WOULDN’T IMPACT THE BUILDING’S SEISMIC PERFORMANCE.

ENGINEER

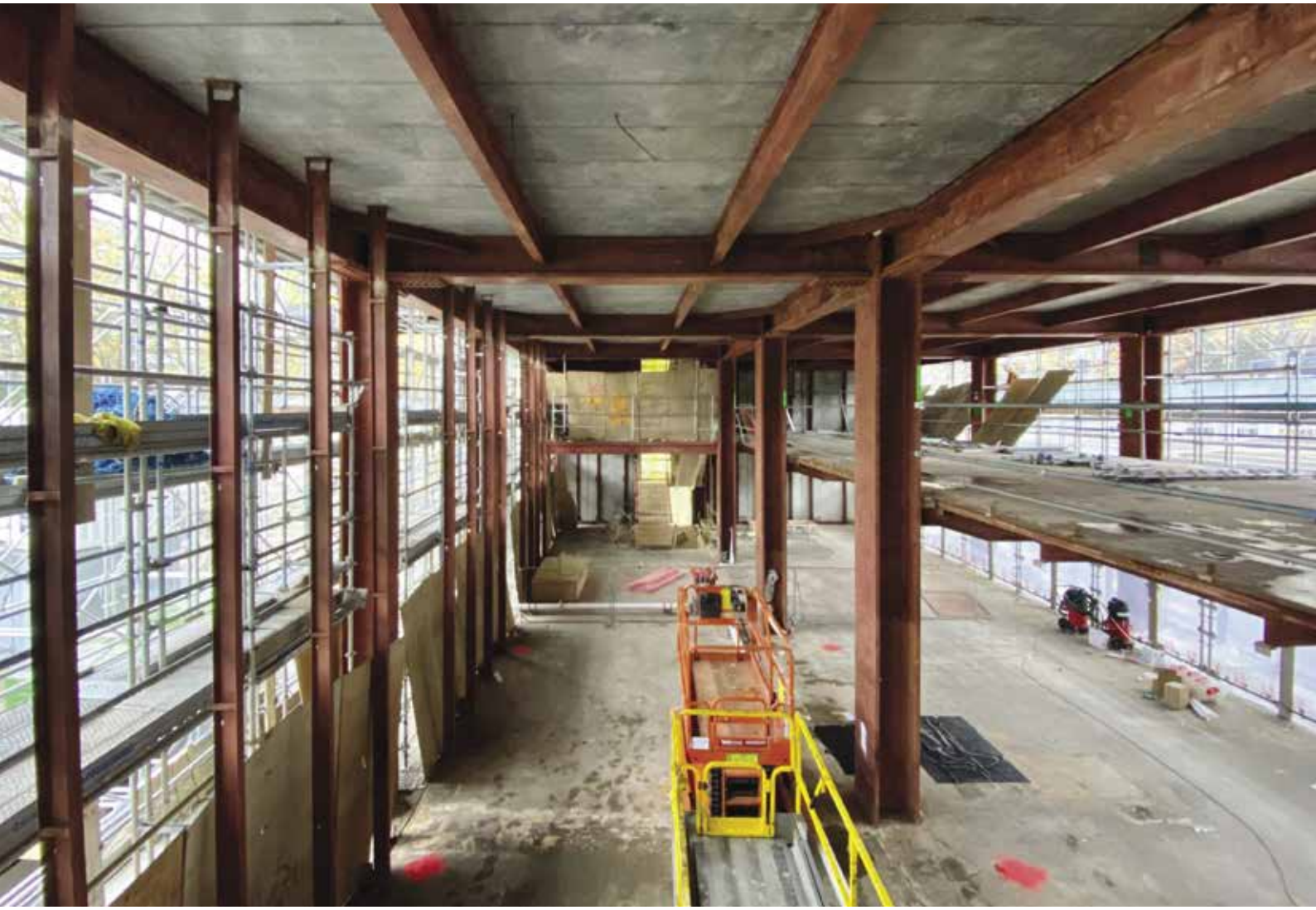
An engineering survey coupled with comprehensive records from the original construction, which included welding reports and construction photos, showed that the structure was built to a high level of dimensional accuracy. It instilled the team with confidence that the original design was undertaken competently.

Considerable testing of materials was carried out to confirm the structure’s properties: steel of various thicknesses was extracted to test things like yield strength; bolts were removed and tested for chemical composition; some weld testing was completed. And during the removal of existing finishes, the team did spot checks on the dimensions of existing elements, compared them to the original plans and confirmed they were good.

The painted steel frame’s condition was of particular importance, specifically any sign of corrosion. Calculated corrosion rates showed that the existing paint system didn’t require any upgrade although some additional corrosion protection was undertaken for elements at the perimeter.

Beca undertook a seismic assessment of the building’s primary structural system to determine if its likely performance in an earthquake stacks up with today’s standards – it passed with flying colours.

But the staircases, which are connected to the floors, required some modifications. The staircases are a heritage feature – the stairs, stringers and handrails were carefully designed and detailed by the architect of the day. As a building rocks during an



A SEISMIC ASSESSMENT OF THE BUILDING'S PRIMARY STRUCTURAL SYSTEM SHOWED THAT ITS LIKELY PERFORMANCE IN AN EARTHQUAKE STACKS UP WELL WITH TODAY'S STANDARDS.

"REUSING THE STEEL AND NOT HAVING TO INCORPORATE ANY MORE ENERGY, THAT'S REWARDING. AND THERE IS NO CARBON TO ACCOUNT FOR WITH THE STEEL FRAME, IT'S ALREADY BEEN ACCOUNTED FOR."

NEIL HORSFIELD, GENERAL MANAGER – STRUCTURES, BECA

earthquake the floors slide relative to one another and it was important that the stairs didn't attract load as a result. So, the team recommended relatively minor retrofits to ensure the staircases wouldn't impact the building's seismic performance.

Preserving the heritage qualities was a challenge for some elements, for example, the façade. The building boasted one of the first uses of an aluminium curtain wall as a façade system but it wasn't in a condition to be reused so it has been recreated.

A real benefit of the steel moment frame is that it's inherently more stable. It meant that the floors could be pulled out and replaced without affecting the stability of the primary steel structure.

An advantage of replacing the floors was that the slab panel method could be used to demonstrate that fire protection wasn't required for the entire steel frame, just the primary structure of columns and beams.

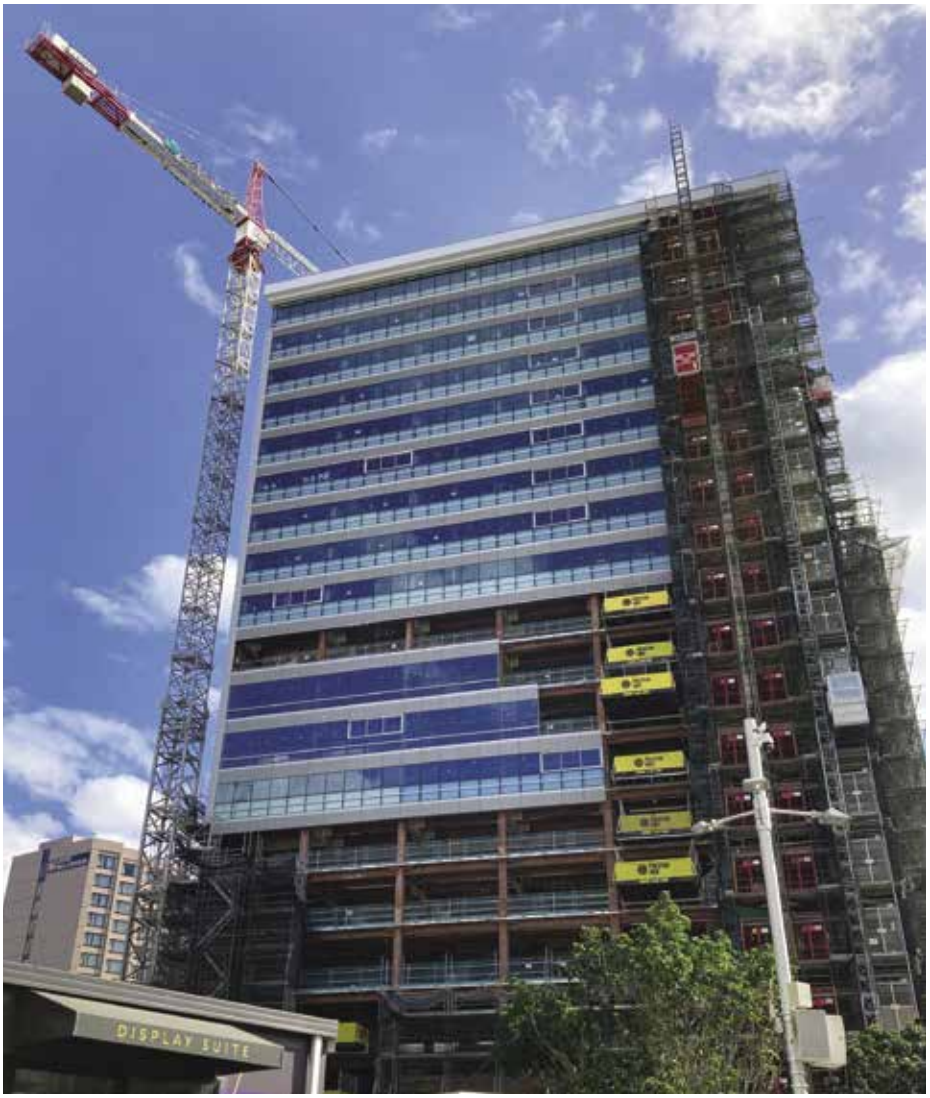
BUILDER

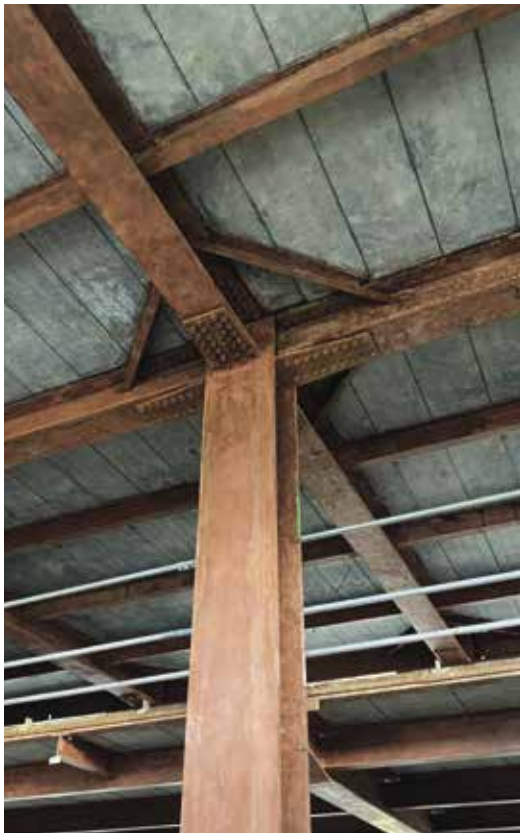
When Naylor Love approached the CAB project it was prepared for the unexpected – as with any refurbishment work there is always an element of the unknown.

Any issues with a new build can be dealt with on the drawing board before getting to site. But, with an existing building, some issues only become apparent on site and the team has to adapt.

For example, the CAB's ceiling spaces were tighter than anticipated and the steel that the team assumed would be common all the way down isn't. Some areas required plans to be adjusted on the fly to accommodate the building services, which wasn't easy when working to a floor-by-floor programme.

All of the building is effectively bolted together, as opposed to being a welded structure. The team found that the





ABOVE: THE STRUCTURAL STEEL ELEMENTS OF THE CAB WERE FOUND TO BE VERY SOUND.

LEFT: THE BUILDING WAS STRIPPED BACK TO BARE STEEL AND THE TEAM WORKED IN BLOCKS OF FOUR FLOORS FROM THE TOP DOWN, REMOVING THE OLD FLOORS AND REPLACING WITH A STEEL COMPOSITE FLOORING SYSTEM.

structural steel elements of the CAB are very sound; however, the same couldn't be said for the concrete floors, which weren't fit for purpose in a residential setting because the acoustic rating between apartments was poor. The team considered various techniques to try to compensate for the lack of acoustic performance but, ultimately, it came down to time and cost, and it was better to take out the floors and start again.

It meant the building had to be stripped back to bare steel. It's not ideal to be 18 storeys in the air, demolishing floors. To maintain stability, the team worked in blocks of four floors, removing the old flooring and replacing with Tray-dec, a steel composite flooring system. But first, the entire building was scaffolded. It was a top-down programme because the roof and the parapet had to be redone before the team could progress.

A large part of the project was bringing the steel's corrosion- and fire-protection coatings up to today's standards. The modern passive fire techniques now used vary throughout the building from applying intumescent paint and cementitious coatings to boxing in the steel.

The existing corrosion protection was left intact except for sections the team needed to work on. Here, the steel first had to be 'cleaned' locally. A paint removal system called Peel Away was used. The adhesive product is applied to the structural steel, left for a time then removed along with the coating.

The process doesn't produce dust so avoided the need for isolation zones around the steel. For example, a 250x250mm hole through a beam required cleaning on just one metre either side of the penetration. It's not significant compared to the overall size of the building, but it's slow work and a process that can't be hurried.

"IT'S A SERIOUSLY STRONG EXISTING STRUCTURE, WELL CAPABLE OF WHAT IT WAS INTENDED TO DO AND MORE; IT'S ABLE TO ACCOMMODATE THE CHANGE OF USE AND, AS A RESULT, IS A MUCH MORE SUSTAINABLE METHOD OF CONSTRUCTION."

PATRICK KAVANAGH, PROJECT MANAGER, NAYLOR LOVE

HERITAGE

The former Council building is an important piece of Auckland's architectural history and it has polarised Aucklanders since it was built in 1966. Love it or hate it, the building is significant for several reasons: its central role in the governance of Auckland in the second half of the twentieth century; its use of cutting-edge 1950's technology in the building's design; and it's a major example of the 'international style' as applied in New Zealand at that time.

Tibor Donner, chief architect for the Auckland City Council (ACC) from 1947-1967, led the design of the building in the '50s. He avoided the status quo in terms of buildability and materials, instead drawing his influence primarily from the USA and Central America, and a little bit from Europe.

The fact that the structure stacks up from an engineering angle even today isn't surprising. In 1956 Donner and ACC engineer Vern Coleman set out on an overseas fact-finding tour. Together they attended the inaugural World Conference on Earthquake Engineering where they met Californian structural consultant John Blume.

Blume recommended using a steel frame with bolted moment connectors to transfer earthquake loading to the foundation. It ensured that the building was not just an aesthetic reflection of the international style but that it also captured structural advances of the day. And it is the moment connectors that make the design seismically so relevant today.

The steel frame consists of columns and principal beams secured with high-tensile bolts. The column sections were welded together at every third floor level. Smaller secondary beams were bolted between the principal beams to support the concrete floors.

This steel frame and the development of local technologies – including aluminium extrusions, neoprene window seals and ceramic acoustic tiles – were innovative and broadened the array of building technologies available in New Zealand in the 1960s.

The focus of a building conservation project is to retain as many heritage elements as possible. But, if retaining or reusing isn't possible, the focus shifts to fixing; if it can't be fixed it's replaced sympathetically.

The steel frame has stood the test of time remarkably well. While steel wasn't identified as a heritage element of the project, it's certainly part of the heritage value. Architecturally, it was the steel that enabled the 1950's design to proceed. And it is the steel structure that has allowed the multiple heritage elements to be preserved or replicated.

THIS STORY HAS BEEN TOLD WITH THANKS TO JOHN LOVE AND JOSEPHINE LOVE.

ABOVE: THE BUILDING IS A STEEL FRAME WITH BOLTED MOMENT CONNECTORS TO TRANSFER EARTHQUAKE LOADING TO THE FOUNDATION – IT IS THE MOMENT CONNECTORS THAT MAKE THE DESIGN SEISMICALLY SO RELEVANT TODAY.

BOTTOM: ALL OF THE BUILDING IS EFFECTIVELY BOLTED TOGETHER, AS OPPOSED TO BEING A WELDED STRUCTURE.

"FROM A HERITAGE PERSPECTIVE MANY OF THE BUILDING ELEMENTS HAVE POSED CHALLENGES, BUT THE STEEL HASN'T BEEN AN ISSUE. IT HAS REMAINED STRUCTURALLY SOUND, IT HAS SUITABLE SEISMIC STRENGTH PROPERTIES, AND IT'S IN GOOD CONDITION."

LLOYD MACOMBER, DIRECTOR, SALMOND REED ARCHITECTS