CASE STUDY NO 9

WELLINGTON COLLEGE MEMORIAL HALL – ALAN GIBBS CENTRE

STEEL CONSTRUCTION NEW ZEALAND

AUGUST 2020

Andy Spain Photography

STRUCTURAL STEEL: RHYTHM, SCALE AND RESILIENCE FOR WELLINGTON COLLEGE

A cornerstone of Wellington College and the community, the newly rebuilt Wellington College Memorial Hall and Performing Arts Centre is a grand and welcoming structure that conveys the spirit of the old hall before it.

Wellington College needed a larger hall to accommodate its increasing school roll. The initial brief aimed to largely retain the old school hall and simply lift the roof to add a second tier of seating. However, following structural analysis, and weathertightness and construction cost considerations, a complete rebuild became a real option. With the added advantage of a new build designed to a modern code, the 'raise the roof' proposal was abandoned and the decision was made to demolish the old hall and build a new one, avoiding the complexities inherent in reusing an existing structure. Architecture + and engineer Clendon Burns & Park went back to the drawing board to develop a new solution.

THE FACTS

- 102 tonnes of structural steel
- $1m of structural steelwork
- 1,036 assemblies
- 2,539 sqm of painted steel
- 3,850 bolts

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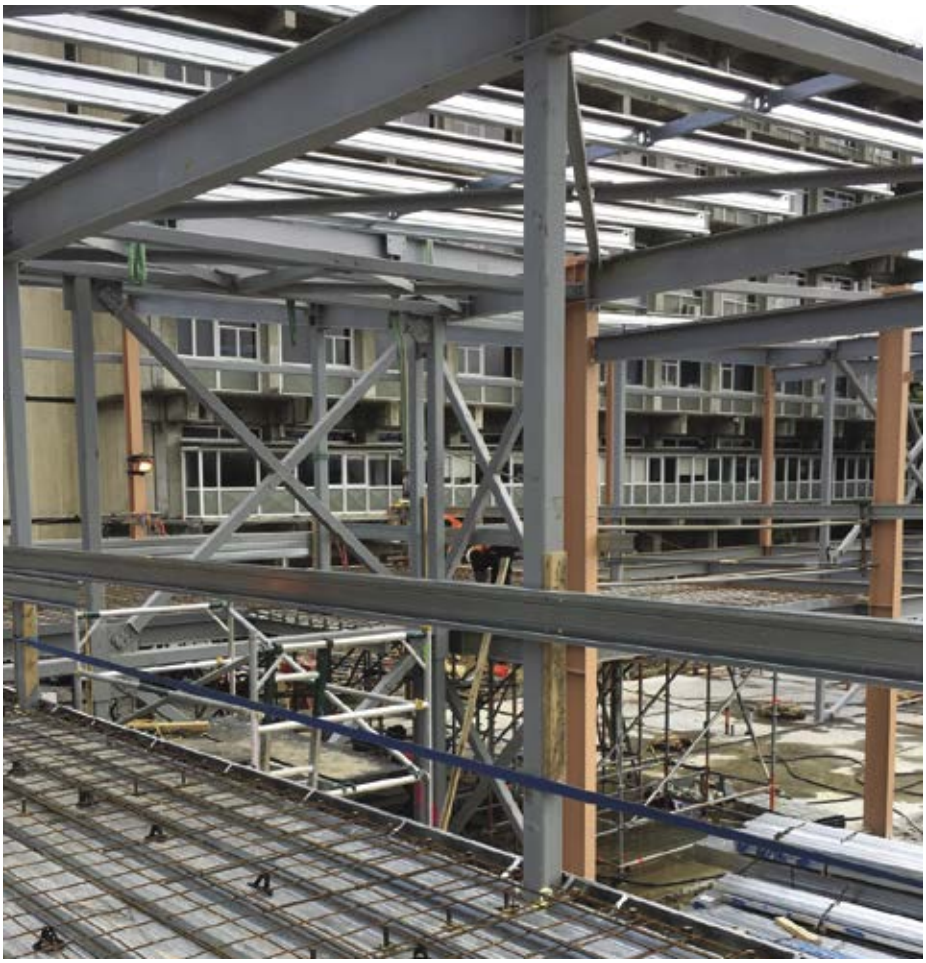
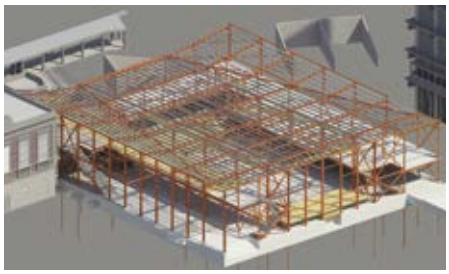
ENGINEER CLENDON BURNS & PARK **ARCHITECT** ARCHITECTURE + **STEEL CONTRACTOR** STEVENSONS **BUILDER** MAYCROFT





To satisfy the structural, aesthetic and functional requirements of the project, structural steel was chosen for the superstructure.

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"THE SUCCESS OF THE PROJECT RELIED ON GOOD COLLABORATION. WE ARE PROUD TO HAVE BEEN PART OF THE TEAM THAT DELIVERED AN ARCHITECTURALLY STUNNING BUILDING, DESIGNED FOR SUPERB SEISMIC PERFORMANCE USING STEEL AS THE PRINCIPAL ENGINEERING MATERIAL."

– PHILIP YONG, DIRECTOR, CLENDON BURNS & PARK

The project still offered its own unique challenges – construction in a confined space, the need for the school to remain operational during construction and a tight delivery timeframe. To meet these requirements, the team selected structural steel for the superstructure. The new structure was designed to ensure superb seismic performance and was informed by learnings gained in the wake of the Canterbury and Seddon earthquakes.

Ultimately, the success of the project relied on the strong collaboration between the design team and the contractor, whose teamwork was integral to delivering this great building for Wellington College.

The final result is a fantastic cultural focal point and ceremonial space for generations of Wellington College students and the local community to enjoy. The building provides a new focus for the College and a clear point of engagement with the community.

ENGINEERING

To satisfy the structural, aesthetic and functional requirements of the project, Clendon Burns & Park selected structural steel for the superstructure. Designed to Importance Level 3, steel offered a lightweight and high stiffness solution to match the strength requirements and to ensure good seismic performance.

The objectives of the seismic designwere twofold: to both fulfil life safety requirements and offer a low-damage solution to allow a quick recovery following a major earthquake.

The building features a gravity system (to bear the 'dead' weight and any imposed load on the building), which is comprised of steel portals and mullions to support the stunning architectural metal skin. Cross-braced frames with tension anchors also feature as the lateral bracing system to control drift.

Bolted connections allowed for easy and quick assembly on site while fully braced steel roof diaphragms were designed to deal with the complicated roof profile. The composite flooring for the mezzainine – structural steel with a shallow reinforced concrete foundation with tension anchors

Steel lent itself nicely to the building's internal design and aesthetics. The exposed structural steel inside the Hall provides a sense of rhythm and scale.

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"STRUCTURAL STEEL IS HONEST AND TRUE, AND CLEARLY EXPRESSES WHAT THE STRUCTURAL FUNCTION IS. USING STEEL SECTIONS, AS WE'VE DONE, ENABLES US TO CREATE FORMAL RHYTHM AND SCALE."

– DAMON PEACHEY, REGISTERED ARCHITECT, ARCHITECTURE +

for the bracing elements – was designed with careful consideration of the vibration performance for the various live loading conditions.

The structural detailing was developed using 3D Revit software, which allowed for both efficiency in design and detailing, and easy transfer of data from design drawings to fabrication.

ARCHITECTURE

Wellington College ran a design competition to choose the architect and Architecture + came out on top. Its challenge was to design a hall to serve multiple purposes: a space where the entire school could come together; a focal point for visitors to the school, including the school and principal's offices; and a top-tier, non-specialist venue for use by the community.

The existing, large stained-glass window – a memorial to former students who fought in the wars – was an important feature of the original building and was preserved and reinstated in the new building.

The spacious, multipurpose interior boasts two stages: to the north, the memorial window is a backdrop to a formal stage, which is used for school assemblies and presentations; to the south, a second stage accommodates drama productions and is complemented by a backstage area. A mezzanine level was built along each side with tiered seating to allow for an increased number of students at the school.

The Hall's entry and outside gathering space is marked by a high external colonnade. The otherwise simple external profiled metal cladding is enhanced with aluminium angles set in a roimata pattern – a sombre reference to albatross tears to represent grief and loss. The bronze-coloured aluminium in the colonnade has joints set in a poutama, a stepped pattern of tukutuku panels. The 'stairway to heaven' effect symoblises a student's progress, learning and planning for their future.

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"TEAMWORK – FROM THE FIRST TEAM THAT STARTED CUTTING ALL THE PLATES, TO THE FABRICATORS, PAINTERS, TRANSPORTERS AND ERECTORS – ALLOWED THE ENTIRE FABRICATION PROCESS TO FLOW SEAMLESSLY AND SUCCEED."

– EVAN KROLL, MANAGING DIRECTOR, STEVENSONS

One of the main challenges was ensuring the new structure would fit in the space so the steel constructor team carried out preassemblies in the workshop to test buildability.

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simple addition of aluminium angles in a decorative pattern on the main structural frame lifts the material above the ordinary and creates a dramatic and intimate effect. The clever use of simple materials has created a spectacular yet restrained and dignified building.

FABRICATION & ERECTION

For Stevensons, one of the main challenges was ensuring the new structure would fit in the space so the team carried out preassemblies in the workshop to test buildability.

Building a large structure within a confined space meant that the construction methodology had to allow for as much off-site work as possible to minimise on-site activity. So the superstructure features extensive use of bolted connections to allow for quick on-site assembly.

Working collaboratively - engineer, head contractor and steel constructor - fabrication of the entire superstructure was planned off site. Templates were used to set out the bolts in the foundations, with on-site measurements taken of these as-cast bolts prior to fabrication of column base plates to ensure fit.

The use of steel made the construction relatively simple due to its lightweight frame, which enabled the structures to be brought in as modules without large lifting equipment and quickly assembled on an active school site. Any other material would have required a procession of trucks on site, which would have disrupted the building process and everyday school life.

The type of steel was selected based on the stiffness or strength requirements. For example, high-strength grade steel box sections were chosen as braces for structural efficiency; for sections where stiffness governs rather than strength, rolled sections of mild steel grades were used. All bolt fixings are high-strength to minimise the impact on the size of connections and sections.

SCNZ STEEL CONSTRUCTION NEW ZEALAND

Steel Construction New Zealand Inc.
L2, 17-19 Gladding Place, P.O. Box 76403, Manukau City 2241, New Zealand
Phone: +64 9 263 5635, Fax: +64 9 263 5638, Email: info@scnz.org
www.scnz.org