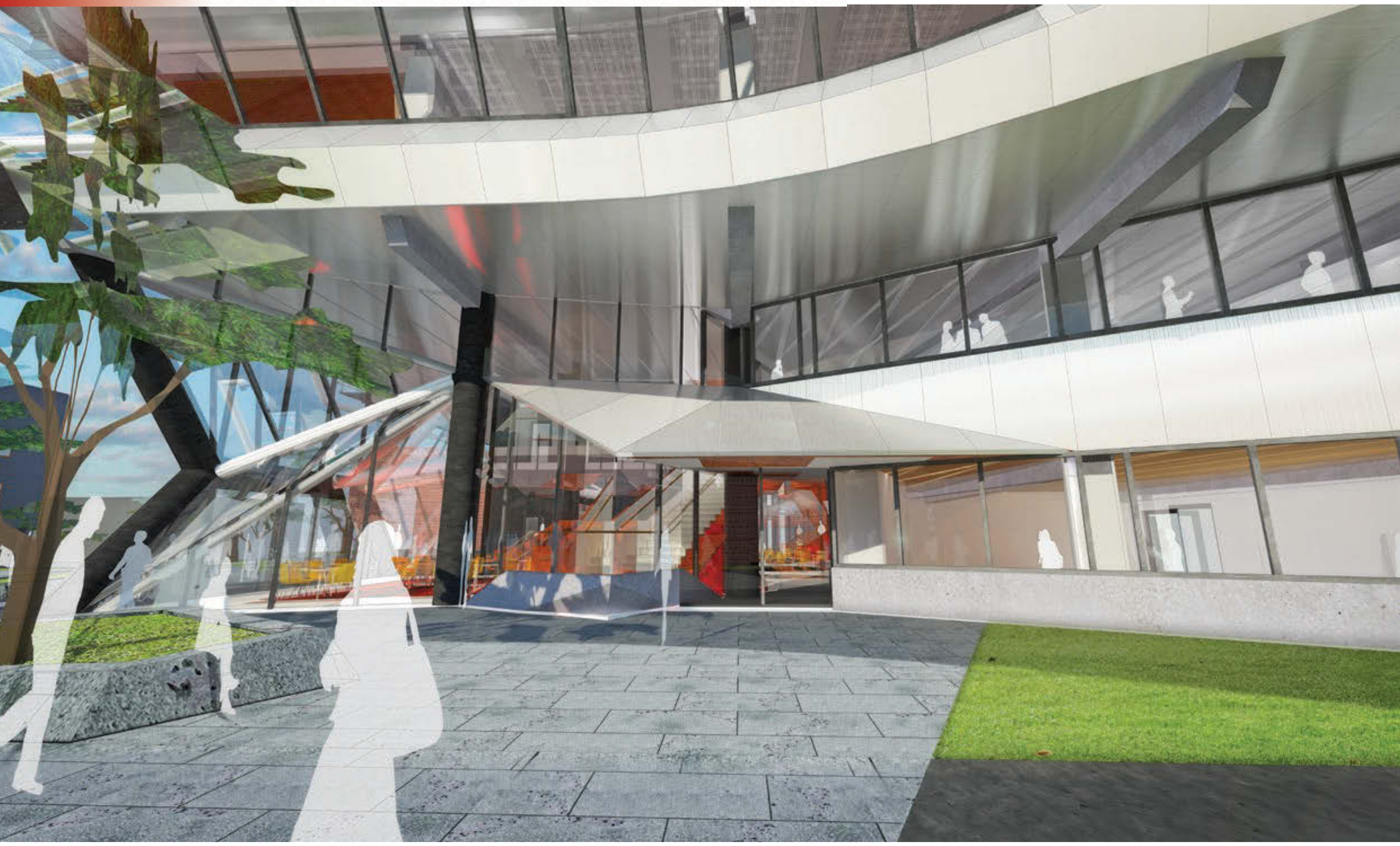


Right formula for services-intensive lab building

Monash Green Chemical Futures, Melbourne

A landmark institutional building in Melbourne originally envisaged as a largely concrete supported structure was reconceptualised during tender with steel as the primary structural material.

Due to open later this year, Green Chemical Futures (GCF) is a 9300sqm multilevel facility under construction in the North West Precinct at Monash University's Clayton Campus to support research within Australia's chemicals sector and training to bolster Australia's 'green workforce'. The building is designed to house over 100 chemists and engineers and new laboratory spaces available for over 1000 students and 100 industry partners.

The Green Chemical Futures project was funded by the Australian Government through the Education Investment Fund. During the tender phase the builder, Lend Lease reviewed the construction methodology and planning requirements of the superstructure.

According to the responsible Lend Lease Project Manager **Dim Jancev**, with a planned mix of steel, precast concrete and in-situ concrete, Lend Lease saw opportunities to save on cost and program by substituting precast with steel.

"We thought that by changing the design to a lighter construction frame we could improve the efficiencies of construction onsite, prefabricate the majority of the elements and most importantly, offer to the client a cost saving by changing to steel," he said.

Project architect, **Paul Dash** from Lyons said that apart from its striking architectural form inspired by molecular structures, a key aspect of the design was providing flexible laboratory environments.

This was achieved through the use of Vierendeel trusses creating a deep interstitial services zone above the laboratories and allowing them to be column-free to accommodate high flexibility in adapting laboratory facilities to the evolving demands of chemistry tuition and research.

He said that the deep Vierendeel truss structure allows for services (mainly fume cupboard flues) to run above the laboratories as much as possible so the floors can be kept clear of riser shafts, columns and other elements that would obstruct flexibility to adapt the labs in the future.

"The Salk Institute in La Jolla, California by **Louis Kahn** was an exemplar for the project with a structure that provides room for services while allowing the laboratory space to change and evolve," he said.

"For the GCF we wanted the laboratories to be open and connected to facilitate research and collaboration, and the structural solution we developed with Arup allows it to happen."

A series of projecting meeting rooms, decks and collaboration lounges with expressed steel structure and glazed foyers at ground level, taking their form from characteristic chemical bonds, bring the activity of the building out to engage with the campus.

He said that challenges were posed by the site being located in the middle of Monash campus with limited access next to the Monash Centre for Electron Microscopy (MCEM) facility with its high electromagnetic sensitivity and its tight 18-month development period for such a large building.

"We have a very close collaboration with both Arup and the services engineers SKM, through a shared project BIM model, using the Revit platform, and frequent coordination meetings," he said.

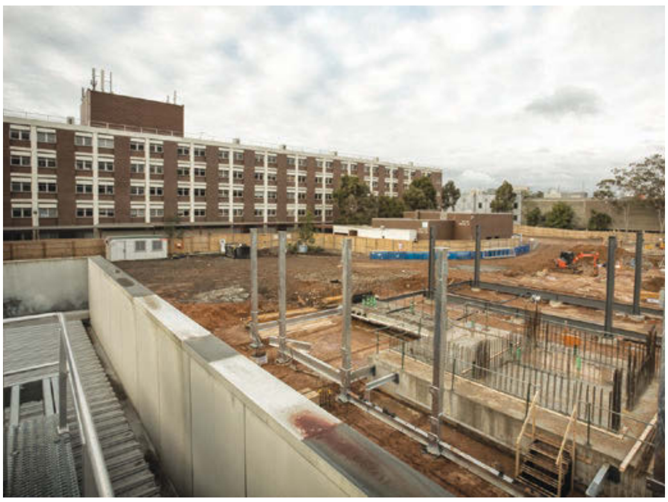
"The 3D tools allow very precise spatial coordination between all disciplines in the design phases and fed into the shop-drawing and fabrication process."

Principal at Arup in charge of building structures, **Brendon McNiven** said his office worked extremely closely with both the architect and the building services engineer on the basic building concept.

"Consisting (largely) of research and teaching laboratories, the building is to be highly serviced and intensive coordination was required to integrate services, structure and architecture," he said.

The decision to move from a primarily precast concrete structure to a steel one varied the vibration criteria slightly but provided benefits in craneage and simplicity of detailing.

"Essentially it was a straight material substitution between concrete and steel. Obviously the structural detailing was different, but the basic form of the building was maintained and functionality and architecture was not compromised in any way."



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Mr McNiven said that three dimensional modelling of the building between the architect, structural engineer and building services engineer was the key to producing an integrated coordinated design to ensure adequate space for services fit.

He said that being a laboratory building, control of vibration was one of the main drivers influencing structure satisfying dynamics and the engineering approach.

"The solution developed by the design team (called for) relatively large clear spans to provide maximum flexibility in how the laboratories were organised, requiring a deep structure to achieve the vibration limits agreed to with the University.

"The Vierendeel truss solution adopted was able to meet the required vibration requirements whilst still allowing room for the intensive mechanical duct penetrations servicing the fume cupboard exhausts. The narrow form of the 'Vierendeels' (also) allowed the fume cupboards to exhaust vertically along laboratory party walls minimising overall floor to floor depths.

"The floor plates are offset in plan in places to suit the ground level circulation and architectural form of the building which responds to site constraints. This gives rise to a number of areas of transfer including cantilevers to the north side of the building. A deep steel girder beam solution with penetrations akin to the Vierendeel trusses was developed to deal with these transfers."

Senior Structural Engineer, Buildings in Melbourne, **Mark Ayers** said that Arup's in-house floor vibration software made the lightweight steel truss and precast plank solution possible.

"Being a laboratory, the stringent criteria for footfall induced floor vibrations would have been difficult to satisfy by other means," he said.

"Our staff recently authored an international technical paper on best practice guidance for assessing footfall induced vibration and this leading edge thinking was incorporated into our analysis software."

According to the Director of the project's prime steel contractor and ASI fabricator Structural Challenge, **Maria Mavrikos** they worked closely and confidentially with the builder and design team during the tender process on various steel design options until the one which offered the most significant cost and onsite savings was adopted.

"The main challenges for us were working on a design which was not finalised so the lead times for each stage were quite short and also tight coordination was required particularly for the 'H' columns which had to be made onsite and then lifted in one piece to avoid welding at height," she said.

"Our project team worked closely with the builder, architects and structural engineers and our own steel detailers to finalise the design by providing models of each area prior to detailing to ensure issues were sorted out early. We also provided our model to other trades to further assist coordination.

"Our shop worked two shifts throughout parts of the project to maintain lead times and all 350 Grade Z plate and high grade structural members were ordered at the beginning at the project to avoid delays.

"The main steelwork was supplied with a zinc phosphate primer as it had to be fireproofed to meet stringent laboratory standard requirements."

The western plant room and roof plant platform are galvanized. The eastern end and entry are finished with Zinc Anode 402 and a top coat of Weathermax.®

"That wasn't originally in our scope but we did it to meet timing and to avoid it having to be applied onsite which would have affected the Green Star rating, for which they needed two points to achieve," she said.

"Two points were required for the steel package to achieve the Green Star Rating. One was for the fabricator to be part of the ASI Environmental Sustainability Charter which we are a part of and the second was for the use of higher grade material for at least 25 percent of the project.

"We have managed to achieve this in part by also pre-ordering Grade 400 welded beams and columns."

Project Team

Principal: Monash University

Architecture: Lyons

Quantity Surveyors: WT Partnership

Project Management: DCWC

Builder: Lend Lease Building

Alternative Preliminary Design Contractors: Irwinconsult

Structural, Civil and Façade Engineering: Arup

Building Services Engineering: Sinclair Knight Merz

ASI Steel Fabricator: Structural Challenge

Steel Detailing: Steel One

Galvanizing: Kingfield Galvanizing

Coatings Supply: Dulux Protective Systems

ASI Steel Distributor: Surdex Steel

ASI Steel Manufacturers: Australian Tube Mills (tube), BlueScope Steel (plate), OneSteel (structural)