

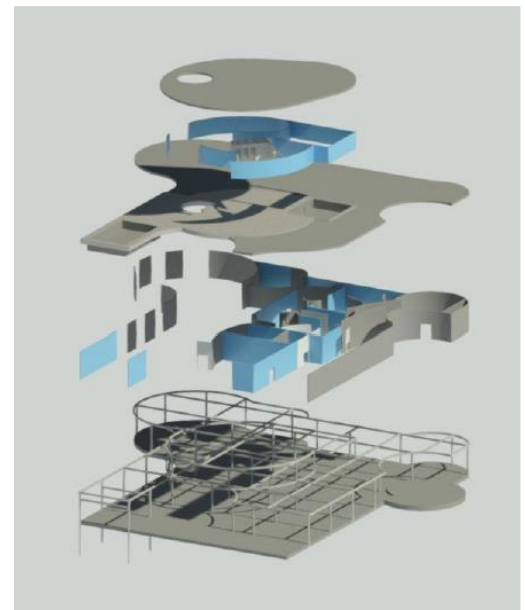
Teaching showcase



MArchEng thermal baths project
Integration of architectural, structural
and thermal design objectives
(ENAE602 Collaborative Design Studio)

“This structural design was developed to complement a fluid architectural philosophy. Reinforced concrete was selected for durability and strength. The exploded structural plan highlights two of the most important integrated design aspects. Firstly, shear walls in blue are distributed such that the centre of rigidity and mass are aligned to avoid torsional forces in seismic shaking. Secondly, while this building does not follow a standardised grid, the arrangement of beams and columns is such that a grid has been formed for optimal load transfer to the pad foundation to avoid differential settlement. Member sizings were based on calculation and buildings of similar size.”

MArchEng thermal baths project
Structural concept design
(ENAE602 Collaborative Design Studio)



MArchEng augmented reality project
Design communication using Trimble
Site Vision
(ENAE606 Building Modelling and
Integrated Design)

Message from Ada Rutherford Professor of Architectural Engineering



Prof Larry Bellamy

Welcome to the first annual report of Architectural Engineering at the University of Canterbury (UC). Architectural Engineering at UC is the only programme of its kind in New Zealand. While new in our country, it is well established and growing overseas. Its growth is driven by building designers seeking to improve their collaboration skills, to improve their technical mastery and to upskill in interdisciplinary areas such as low-carbon building design and digital design methods.

Our mission statement, *to lift the collaboration skills and technical mastery of building design professionals and improve communication between architects and engineers*, expresses why Architectural Engineering was established at UC. It also reflects the goals of the Ada Rutherford Trust when it gave a generous endowment to the University to establish the Ada Rutherford Professorship in Architectural Engineering.

I would like to highlight the Trust's support. The Trust's founder, the late Jim Rutherford, was a strong advocate of improving collaboration between architects and engineers. His determination and vision enabled Architectural Engineering to be established at UC. His story is included here to honour his legacy.

This report celebrates some successes of our Architectural Engineering programme, which were achieved despite COVID-19 striking soon after our flagship programme, the Master of Architectural Engineering, was launched. The pandemic continues to have a major impact on enrolments in the Master's, but on a positive note it has required greater use of remote learning and digital teaching methods, which has strengthened the programme.

The Master's is strongly supported by Holmes Consulting, a leading engineering consultancy, and the Warren Trust. Holmes' support enables Professor Didier Pettinga and other Holmes experts to teach two post-graduate structural engineering courses. The Warren Trust supports the International Architect-in-Residence position at the University, currently held by Professor Matthew Dudzik, which enables world-class teaching of architecture to be integrated into the Master's.

This report outlines plans to grow Architectural Engineering. These will be achieved only because a talented group of experts and industry leaders are committed to Architectural Engineering. I would like to thank everyone involved for your support.

Master of Architectural Engineering (MArchEng)

Courses and student numbers

Nine postgraduate Architectural Engineering courses were delivered in the year ending 30 June 2021. Five were offered twice over this period to enable August 2020 and February 2021 intakes into the MArchEng. Student numbers in these courses are shown in Table 1.

Table 1. Student numbers in postgraduate Architectural Engineering courses

COURSE#		2019		2020		2021	
		S2	S1	S2	S1	S2	S1
ENAE601	Whole Building Behaviour and Performance	13	9	6	7		
ENAE602	Collaborative Design Studio	9	5	4	4		
ENAE603	Structural Design Practice	14		6			
ENAE604	Structural Assessment and Retrofit	9		7			
ENAE605	Sustainable Building Design Practice	8	3	6	7		
ENAE606	Building Modelling and Integrated Design	11	7	26	7		
ENAE609	Building Envelope Design and Engineering	5	7		3		
ENAE610	Building Sustainability Assessment		9		6		
ENAE620	Integrated Building Design Project	4	7	2	4		

Each course has a point value of 15 (a full-time student workload is 120 points)

Student numbers in postgraduate Architectural Engineering courses in the year ending 30 June 2021 is equivalent to 11.9 EFTS (Equivalent Full-Time Students). This is approximately 50% less than the number expected before the emergence of COVID-19, and 20% less than the 15 EFTS achieved in the previous year. COVID-19 significantly reduced student numbers.

Enrolments in postgraduate Architectural Engineering courses comprised:

- 51 students who took at least one postgraduate Architectural Engineering course.
- 13 students enrolled in the MArchEng – 5 part-time domestic students, 2 full-time domestic students and 6 full-time international students.
- 2 students enrolled in the Structural Engineering endorsement of the MArchEng.
- 4 / 7 students with an engineering / architecture background enrolled in the Integrated Building Design endorsement of the MArchEng.
- Students enrolled in the MArchEng came from France, USA, Indonesia, Tonga, China and New Zealand.

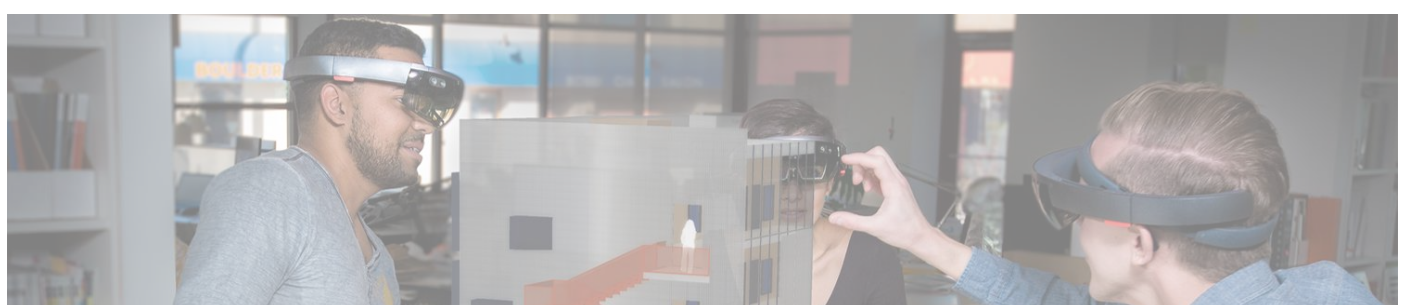
Teachers and teaching quality

The Master’s was established to be a practice-focused programme taught primarily by leading practitioners and academics with industry experience. This teaching philosophy is reflected in the programme’s teachers listed in Table 2. This list does not include a number of leading practitioners who contributed to the programme through giving guest lectures.

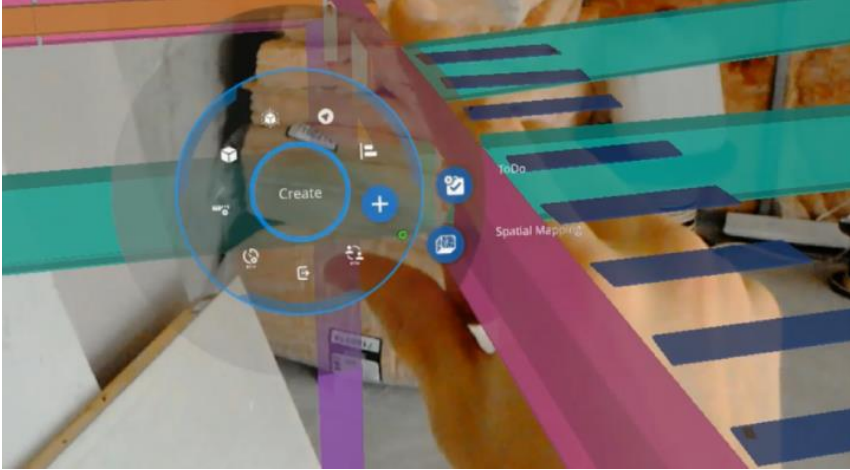
The quality of teaching in the postgraduate courses ENAE601, ENAE603 and ENAE605 was evaluated by the University over the last year. Their scores were 4.3, 4.2 and 4.6 respectively, out of a maximum of 5 marks, which are deemed high quality.

Table 2. MArchEng principal teachers

	POSITION	EXPERTISE	COURSES
Larry Bellamy	Ada Rutherford Professor of Architectural Engineering	Energy and buildings	ENAE601 / 602 / 605 / 609 / 610 / 620
Matthew Dudzik	Professor; UC International Architect in Residence	Architecture Integrated building design	ENAE601 / 602
Didier Pettinga	Holmes Professor of Structural Design; Technical Director, Holmes Consulting	Structural engineering	ENAE603 / 604
Giuseppe Loporcaro	Lecturer in Architectural Engineering	Materials and structure Digital building design	ENAE 606
Enda Crossin	Associate Professor; UC Director of Engineering Management	Life cycle assessment	ENAE610
Aisling O’Sullivan	Associate Professor	Environmental impact assessment	ENAE610
John Hawkins	Technical Director (Facades), Mott Macdonald	Façade engineering	ENAE609
Robert Lane	Associate Director, Lewis Bradford Consulting Engineers	Structural engineering Integrated building design	ENAE620



Research showcase



Augmented Reality (AR) in Construction

Dr Giuseppe Loporcaro is working with Trimble Ltd to test and help develop their AR system, based on HoloLens glasses and Trimble Connect technology, for clash detection during design and accuracy checking during construction.

Building Innovation Partnership (BIP)

(<https://bipnz.org.nz/>)

Prof Larry Bellamy has served as Science Leader of the \$12.5M BIP research and innovation programme, co-funded by MBIE and industry.

BIP has three research themes:

- 1) Better investment decisions
- 2) Enabling integrated design, construction and operation
- 3) Fit-for-purpose building components

The BIP report on Digitalisation of the NZ building industry, shown opposite, is an example of the outputs from the BIP programme.

Larry is planning to relinquish the BIP Science Leader role so he can lead the development of a new theme of research in the BIP programme, on

Low carbon buildings and infrastructure, to support the transition of New Zealand to a net-zero carbon economy.



Digitalisation of the New Zealand Building Industry

Capturing the Benefits of Digital Technologies on the Planning, Design, Construction and Management of Buildings.

International Architect-in-Residence

Prof Matthew Dudzik has a chapter, *Intentional Viewing: Decoding, Learning, and Creating Culturally Relevant Architecture* being published in the book *Visual futures through international perspectives: a dialogic compendium on visibility and visual practice*.

Matthew has given public and conference presentations in Oxford (UK), Toronto (Canada), Christchurch and Auckland.

In addition to his scholarly work, Matthew is a practicing architect and artist. Matthew's Barragan and Teotihuacan collage, exploring cultural narratives in architecture, is shown opposite.



Looking ahead

Increase enrolments in MArchEng

With international travel continuing to be restricted by COVID-19, an increase in domestic students is needed to grow the MArchEng.

Our intent is to increase enrolments by:

- Offering a new 400-level elective course in Architectural Engineering for Bachelor of Engineering with Honours students interested in building design, architecture and engineering. This course will lift awareness of Architectural Engineering and the MArchEng. The intention is to offer this course in Semester One 2022, subject to gaining required approvals.
- Offering professional development courses in Structural Engineering to practicing engineers, based on material taught in ENAE603 Structural Design Practice and ENAE604 Structural Assessment and Retrofit. Initial discussions regarding this initiative have been had with the University of Auckland and the Structural Engineering Society of NZ (SESOC).
- Continuing to advertise and promote postgraduate study and professional development opportunities within the professional engineering and architecture communities.
- Giving guest lectures on Architectural Engineering at other universities to promote transdisciplinary collaboration.

Strengthen the Architectural Engineering team

There are three core members in the Architectural Engineering team – Professors Bellamy and Dudzik, and Dr Loporcaro. We have plans in place to strengthen the team by adding staff with expertise in digital building design methods and low carbon building design. These areas are interdisciplinary by nature and major issues for industry, which makes them ideal focus areas for the Architectural Engineering team.

Our intent is to strengthen the Architectural Engineering team by:

- Hiring a fixed-term (5 years) Lecturer / Senior Lecturer in Architectural Engineering with expertise in digital design methods. This new position is being advertised July – August 2021.
- Hiring a Postdoctoral Fellow to work on the *BIM (Building Information Modelling) for Health and Safety in Buildings* programme, which is part of the Building Innovation Partnership research programme. This new position is expected to be filled in the second half of 2021.
- Hiring a Postdoctoral Fellow and a PhD student to work on the *Low Carbon Buildings and Infrastructure* programme, a new theme of research being developed in the Building Innovation Partnership by Professor Bellamy in collaboration with industry and the Ministry of Business, Innovation and Employment (MBIE). Funding for these new positions is expected to be secured in the second half of 2021.

Establish an Industry Advisory Group

An Industry Advisory Group for the MArchEng will be established in the second half of 2021. Insights provided by this group will help to grow the programme and improve the usefulness and impact of graduates.

Jim Rutherford graduated from Canterbury University College in 1955 with a bachelor's degree in Civil Engineering. Interested in the interrelationship between architecture and engineering, he studied architecture at night school while working for consulting engineers in Christchurch. He went on to study at the prestigious Architectural Association School of Architecture in London. Jim rose to partner at the largest of Arup's practices in West Africa, where he managed over 450 staff and projects worth more than \$1 billion. His success was founded on having a deep knowledge of both engineering and architecture.
