ACSE AWARDS 2022

Matt Keen

Emerging Engineer of the Year

PROFILE

Matt is an integral member of Northrop's structural team. He enjoys working with builders, architects, and developers to formulate innovative structural solutions to complex problems and deliver beautiful buildings that meet the client's needs.

Matt has worked on a diverse range of projects across multiple sectors including residential, commercial, aged care, industrial, education, and student accommodation. These include projects in steel, concrete, and mass timber.

Career

Matt graduated from the University of Sydney in 2016 with a Bachelor of Engineering (Civil: Structures) (Hon I), a Bachelor of Science (Advanced) (Hon I) majoring in physics and chemistry, the University Medal and a number of awards including multiple Deans List awards, multiple Academic Merit awards, the A.S. MacDonald Prize of the Association of Consulting Structural Engineers, the Nicholas Snowden Trahair Prize, the Murray Rainsford Smith Prize, and the Astronomical Society of Australia's Bok Prize (for the best physics thesis in Australia).

After starting at Northrop through an undergraduate internship, Matt began his career as a graduate in 2017. In his first year of full-time employment, Matt was heavily involved in the design of large-scale, concrete-framed, residential developments including three 24 storey towers over a shared three storey basement.

Matt quickly progressed to client-facing roles and worked as the primary design engineer and construction phase job manager on some of Northrop's largest residential developments.

Matt then progressed to job management and now personally manages some of Northrop's largest concrete framed projects.

DEMONSTRATING CAREER EXCELLENCE

Key projects and delivery

Scape K2K – *under construction, expected completion 2023 - $300m construction value*

Matt is the project lead and job manager for four new purpose-built student accommodation buildings around UNSW. He is responsible for managing and leading the structural design team, consisting of over 15 engineers and drafters, internally to ensure that the projects are adequately resourced at all stages, are delivered on time and on budget, and the documentation meets Scape's requirements. A particular challenge on these projects has been the tanked basement design. As the sites sit over approximately 30-50 m of dense sand and are significantly below the water table (and in a flood zone), the basement structure is designed as fully tanked, and the foundations are designed as piled rafts supported by the dense sand. In addition, each building has been designed by a different architect. Matt has been instrumental in working closely with the respective architects and providing leadership on consistency and cost saving strategies across the precinct. On two of the projects Matt was able to work with the architect to replan the basement layout to eliminate the transfer structure, resulting in significant savings for Scape.

> *Matt has established himself as a technical go-to person both within our team and amongst the broader Northrop structural division. He has a thirst for knowledge and consistently goes above-and-beyond to find the best-for-project answer. Matt has the respect of his peers and also more senior staff who recognise his talent for structural design and consulting.*

Jonathan Low - Principal, Group Manager, Structural Engineer | Northrop Consulting Engineers

URBNSURF, Sydney Olympic Park, NSW – *under construction, expected completion 2023 - $50m construction value*

Matt is the project lead and job manager for URBNSURF - a new artificial surf lagoon. A highly complex project, technical challenges have included cyclic wave loading of the lagoon structure resulting in significant creep and cyclic degradation of the surrounding soils, resulting in the lateral movement of the pile, and hence the shear and moment induced in the pile, increasing significantly with time. The piles were also designed for fatigue of the reinforcement. This involved limiting stresses in the reinforcement.
Matt has worked closely with the geotechnical engineer to optimise the piling design and create efficiencies for the client. Another challenge was the control of shrinkage cracking in the 140 m long lagoon walls, which vary in thickness from 350 mm to 1100 mm. To solve this, Matt created a custom design tool to accurately model the differential and absolute temperature change in the concrete, calculate the restraint from the surrounding structure, and optimise the reinforcement to limit the resultant crack width. He also worked closely with a concrete technologist and concrete supplier to create a mix design that could meet these strict temperature and shrinkage requirements.
Finally, Matt was integral in communicating the complexities of the design solutions as well as the bespoke detailing, with URBNSURF and the contractor as it was important that the contractor understood the design methodology and the importance of quality control during such a complex construction process.

Zurich Tower, North Sydney, NSW – *completed 2020 - $159m construction value*

Zurich Tower is a 30-storey commercial tower with an eccentric side core and heavily loaded columns, making it particularly susceptible to drifting significantly under dead weight due to shortening of the building columns. Matt was responsible for developing a custom script to calculate the column shortening of the tower, account for the RL correction of the slab due to the construction staging of the building, and from this, determine the total drift of the building under gravity load.

Park Sydney, Erskineville – *completed 2020 - $166m construction value*

Matt was the design engineer and construction phase job manager for Park Sydney, Erskineville. This project consists of eight residential towers over a combined basement and retail podium. Key design features were the precast façade, consisting of both load-bearing and non-load-bearing elements, the tanked basement over a borrow pit of contaminated material, large cantilevers over the retail and public domain and a complex array of walking columns, which were introduced to eliminate transfers, maximise floor-to-floors and suit the changing apartment layouts up the buildings. These walking columns resulted in a complex strut-and-tie design in the building diaphragms. During this project Matt created a tool to automate the design and documentation of concrete columns from ETABS. This resulted in material reduction as well as increased efficiency in design and documentation. Matt's ingenuity in creating this tool has revolutionised the way concrete columns are now designed at Northrop.

Estella Public School, Denham Court Public School & Barramurra Public School - *completed 2021 - $115 construction value*

Matt was the design engineer and job manager responsible for three new DfMA schools. Key design challenges included the three-storey modular classroom buildings, in particular the lateral design and connection detailing of the modular buildings, as well as the interfacing between modular and in-situ structures. Matt worked closely with the modular contractor and builder to deliver a structurally robust, cost effective and practical modular solution for the schools.






Technical Leadership

Matt is especially passionate about seismic detailing and lateral design. After being thrown in the deep end as a fresh graduate with the lateral design of three 24 storey residential buildings over a three-storey combined basement, Matt has quickly become the 'go-to' person at Northrop for any lateral design or ETABS-related question. He shares this knowledge through company-wide presentations, technical talks and coordinated training. Through his passionate technical leadership, the number of active ETABS users has grown from five to twenty-seven!

Matt has written an ETABS user guide and created an ETABS model QA process and checklist to help standardise modelling across the structural section. Matt is also responsible for maintaining and updating Northrop's ETABS template and acting as an independent verifier for models and lateral designs across the structural section. Matt is currently working on a general lateral design guide to help upskill his fellow engineers.

Matt is also particularly passionate about design optimisation and automation, with the aim to increase efficiency and improve quality within the structural section. As one of Northrop's structural section technical leaders Matt is part of the Northrop structural technical group. In this role Matt is responsible for reviewing new software packages to determine their viability for the structural section, organising and facilitating the creation of new design tools, reviewing design tools before they are released across the company and updating and maintaining Northrop's standard notes and details.

Matt has also strongly advocated for improved consistency and quality control in the Northrop structural section, resulting in Matt publishing dozens of custom design tools and specialist spreadsheets for use across the business. These tools are now used widely across the business and have greatly assisted in improving efficiency and consistency across projects. Matt has also recently undertaken a detailed review of Northrop's typical reinforced concrete wall details and updated them in line with the requirements of AS3600-2018. These details have since been released across the company.

Matt continues to excel technically far beyond his years and staff, across all Northrop offices, will often look to consult Matt about various technical problems. Whether it be calculating the bursting reinforcement for your latest strut & tie design or resolving an intricate connection detail, Matt has an answer for almost everything. Matt naturally leads and mentors all of those around him, both formally and informally.

Mentorship

Matt loves to teach. Running through complex structural concepts, whether it be with a junior engineer, architect or builder, helps to get everyone on-board and enthused with the structural solution. His commitment has been demonstrated through the formal mentorship of two engineers at Northrop.

Recently, Matt has also been involved in the undergraduate and graduate recruitment process at Northrop by attending university careers fairs, reviewing applications, and conducting interviews.

Uni & Community Engagement

Throughout his university studies, Matt tutored several key structural courses. In 2020, Matt returned to uni to tutor the concrete structures course. He introduced real-world examples to demonstrate how concepts learned at university are used in the everyday life of a structural engineer.

He has been an active member of the Young Engineers Australia Sydney division committee (YEAS). Through this role, Matt has organised events and encouraged cross-discipline collaboration across the industry.

Matt has also applied to be a part of the ACSE Associates Network and is excited about his future contributions.

What does the future hold?

Matt is currently on track to become chartered by the end of the 2022. He looks forward to continuing to mentor young engineers, being more active in the wider industry through organisations such as the ACSE, and Matt also has a medium-term ambition of joining the AS3600 code committee.

Matt also intends to devote more time to developing computational design tools and design optimisation workflows to optimise material usage, minimise construction costs and create more sustainable buildings. To further this endeavour Matt is looking to return to university in the coming years to pursue a computer science degree, as he can see real opportunities for the industry to optimise designs, save time, reduce material usage, create more sustainable solutions, and improve quality using computational design. Watch this space!

Matt's goal as a structural engineer is to make a real contribution to the Sydney skyline and create value through innovative structural engineering solutions and clever construction methodologies.