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THE SINGAPORE ENGINEER

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SPECIAL FOCUS: ENGINEERING EDUCATION

SPECIAL FOCUS: ARTIFICIAL INTELLIGENCE

COVER STORY:

Restoration of masonry for national monument designed in English Neo-Gothic style

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MNG Solutions leverages Dynamics 365 to drive automation and AI-powered efficiency across customer operations, with four key features at the heart of this transformation:

Microsoft Dynamics 365 Finance
Microsoft Dynamics 365 Supply Chain Management

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The Agent enables a smarter, more proactive financial close by automating exception detection and suggesting actions. This reduces manual effort, improves accuracy, and empowers finance teams to reconcile more frequently and maintain real-time records. The result: faster closes, reduced risk, and better-informed decisions.

Supplier Communications Agent

By automating communication with vendors, the agent frees procurement teams from repetitive tasks, using AI to manage purchase order confirmations and follow-ups. Our clients will benefit by ensuring timely supplier responses, reducing procurement delays, and enabling their staff to focus on more strategic work.

Collections Coordinator Summary

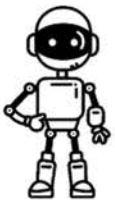
This feature helps collections agents manage overdue balances efficiently by consolidating relevant customer information on a single page. AI-generated summaries and reminder emails further streamline the collections process, enabling our clients to improve cash flow visibility and enhance collection efforts.

Invoice Capture

Utilizing advanced OCR technology, this solution automatically creates vendor invoices from digital images, minimizing human intervention. By automating invoice processing, we enable our clients to reallocate staff from routine tasks to strategic finance initiatives.

Copilot

Microsoft Copilot and AI Agents



are redefining ERP by turning routine tasks into intelligent, automated experiences.

From summarizing collections data and generating reminder emails, to capturing invoices, reconciling accounts, and drafting sales quotes — these tools reduce manual effort, boost accuracy, and empower users to focus on strategic work.

Microsoft Dynamics 365 Business Central

Analysis Assist with Copilot

Our client leverages this feature to interactively analyze data on list pages. With **Analysis Assist**, users can simply type requests like "sort by quantity" or "show average cost per category" and Copilot will generate a suggested analysis tab – making data exploration faster, more intuitive and user-friendly.

Payables Agent

The agent automates accounts payable by extracting vendor invoices from emails and SharePoint, processing them with Azure Document Intelligence, and creating purchase invoices in Business Central. This automation streamlines workflows, reduces manual effort, and allows AP teams to focus on higher-value tasks.

Sales Order Agent

The agent automates sales order capture from customer emails using AI to analyze requests and handle multi-turn conversations for clarification. It checks item availability, generates quotes, and creates sales orders – reducing errors and speeding up fulfillment.

Late Payment Predictions

With **Late Payment Predictions**, our client improves receivables management by forecasting potential late payments and enabling proactive adjustments. Predictions are easy to view, allowing quick action to reduce outstanding receivables.

Whether it's Microsoft Dynamics 365 Finance, Supply Chain Management, or Business Central, **MNG Solutions** empowers your business to harness AI as a true productivity partner.

Contact us now!

THE FUTURE OF ERP IS NOT ABOUT REPLACING PEOPLE–BUT EMPOWERING THEM

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IES and OT-ISAC strengthen collaboration with strategic dialogue and MoU signing

On Saturday, 5 July 2025, the Institution of Engineers, Singapore (IES) and the Operational Technology Information Sharing Analysis Center (OT-ISAC) co-hosted the 'IES x OT-ISAC Strategic Dialogue & MoU Signing'.

The event highlighted the growing importance of Operational Technology (OT) in industry and featured a keynote presentation by Mr Terence Tay, Head of Product at Rigorware, followed by an engaging panel discussion. Panelists Mr Steven Sim (Chair of OT-ISAC's Executive Committee) and Mr Lim Thian Chin (Senior Director, GovTech) shared insights on OT cybersecurity trends, moderated by Mr Kelvin Chin, Regional Director of Xage Security.

A key milestone was the signing of a Memorandum of Understanding (MoU) between IES and OT-ISAC, reinforcing their commitment to advancing OT integration through collaboration. The event also marked a first in Singapore, offering Professional Development Units (PDUs) for both engineers and cybersecurity professionals.

IES and the Operational Technology Information Sharing Analysis Center (OT-ISAC) co-hosted the 'IES x OT-ISAC Strategic Dialogue & MoU Signing'.

We extend our gratitude to Conny Tech Pte Ltd for their lunch sponsorship, as well as all speakers, panellists and attendees for contributing to a successful and insightful session.

Resounding success for the 'Engineering Resilient Structures Seminar'!

The 'Engineering Resilient Structures Seminar' concluded on a high note on 9 July 2025, drawing almost 160 participants from across the industry.

We extend our deepest gratitude to Er. Punithan Shanmugam for gracing the event as the Guest-of-Honour, and to our esteemed speakers, sponsors and attendees, for their insightful contributions.

The seminar delivered powerful insights on:

- Seismic design innovations
- Forensic investigations & failure analysis
- Façade diagnostics & durability
- Best practices in resilient engineering

These discussions underscored our shared mission: building a safer, more sustainable future for our built environment.

The seminar was organised by the IES Civil & Structural Engineering Technical Committee.

The 'Engineering Resilient Structures Seminar' concluded on a high note.

IES Charity Golf 2025 raises SGD 230,000 to empower future engineers and support the cerebral palsy community

On 23 July 2025, IES held its annual Charity Golf at Sentosa Golf Club, rallying our members, partners and supporters to raise funds in support of inclusive engineering education and social causes.

SGD 180,000 will go towards growing the IES Scholarship Fund which provides bond-free scholarships to deserving students from the Institute of Technical Education, polytechnics and universities. This support is aimed at helping aspiring engineers from lower-income families pursue their dreams.

SGD 50,000 has also been donated to Cerebral Palsy Alliance Singapore (CPAS), furthering their mission to uplift individuals with cerebral palsy and multiple disabilities.

At IES, we believe the future of engineering is built not just on talent, but on opportunity, compassion and community.

Thank you to everyone who has supported this meaningful cause, including our Guest-of-Honour, Mr Seah Kian Peng, Speaker of the Parliament of Singapore; all the sponsors; dedicated golfers; and a hardworking secretariat team.

Together, let us open doors for the next generation to build a better world!

IES held its annual Charity Golf at Sentosa Golf Club, to raise funds for empowering future engineers and uplift individuals with cerebral palsy and multiple disabilities.

IES-Huber & Ranner Joint Technical Talk 2025: A Full House!

The recent IES-Huber & Ranner Joint Technical Talk 2025 was a huge success.

The seminar on 'Clean Air, Cool Solutions: A Seminar on Hygienic AHUs and Hybrid Cooling', held on 21 July 2025 at e2i, Devan Nair Institute, welcomed over 150 participants from the Mechanical & Electrical Engineering community.

Our heartfelt thanks to Mr Udo Ranner, co-CEO of Huber & Ranner, for his keynote presentation on European hygiene standards for air handling units – including RLT Guideline 01, VDI 6022-1, and the new Eurovent certification standards. His deep dive into hygienic HVAC systems offered invaluable insights for high-stakes environments like healthcare and labs.

We also thank our esteemed speakers, Co-Convenors of TR 141 on hybrid cooling system for air-conditioning:

- Dr Adrian Chong (NUS) – for unpacking the science behind hybrid cooling and introducing the newly published TR 141:2025 by Enterprise Singapore, a key reference for enhancing energy efficiency in buildings.
- Er. Joseph Goh (DLM Pte Ltd) – for sharing practical, system-level strategies to achieve sustainable performance in real-world installations.

Moderated by the experienced Er. Ng Beow Suan, the session brought together theory, innovation and practical know-how, to advance sustainable, high-performance cooling in the tropics.

Special thanks to Huber & Ranner for their sponsorship and collaboration!

IES and Huber & Ranner recently organised the 'Clean Air, Cool Solutions: A Seminar on Hygienic AHUs and Hybrid Cooling'.

Huber & Ranner

Founded in 1974, Huber & Ranner has grown to become a global leader in the design and manufacturing of high-performance air handling units (AHUs) and advanced climate control solutions.

With deep-rooted German engineering expertise, the company specialises in delivering customised HVAC systems that meet the most demanding industrial, commercial and residential requirements. Huber & Ranner's commitment to quality, innovation and sustainability has driven its expansion across Europe, Asia-Pacific and beyond, with state-of-the-art production facilities in Germany and China.

Huber & Ranner is known for its precision-engineered products, tailored to meet the specific needs of each project. The company's flagship solutions embody its dedication to energy efficiency, reliability and cutting-edge technology.

Supported by the company's Eurovent-certified design software, Huber & Ranner ensures optimal performance and seamless integration with modern building HVAC systems, with a special capability in non-standard customised design solutions.

Huber & Ranner's global presence is reinforced by localised service networks, ensuring rapid response and expert support wherever they are needed.

Bentley Systems wins multiple 2025 Sustainability Delivery Awards

Bentley Systems, Incorporated, the infrastructure engineering software company, was recognised across multiple categories at Environment Analyst's 2025 Sustainability Delivery Awards, held in June this year, in Chicago.

Bentley received top honours in two award categories and was highly commended in a third, highlighting the company's continued leadership in driving innovation and measurable progress:

• Digital Innovation Award (Winner): Bentley's Carbon Analysis capabilities in iTwin Experience were recognised for their ability to enable infrastructure engineers to simplify and streamline data collection and carbon reporting, easily visualise and quantify embodied carbon, and rapidly explore alternatives for better designs, saving time and reducing risk on major infrastructure projects.

• Water Project of the Year (Winner): Together, Bentley and SABESP were recognised for the 'Integra 4.0 Cultural Transformation Through Digitalization' project, which is a landmark initiative accelerating sustainable water infrastructure modernisation in Brazil through digital twin technology.

• Energy Project of the Year (Highly Commended): Bentley and Exo were honoured for the 'Evergy Power Transmission Structure Stabilization' project, an effort that leveraged digital modelling and predictive analytics to enhance energy grid resilience.

These recognitions underscore Bentley's commitment and leadership position to advancing sustainability through digital engineering solutions that enable more resilient, efficient and low-carbon infrastructure.

The water and energy projects were previously honoured at Bentley's 2024 Year in Infrastructure conference. The SABESP Integra 4.0 program was recognised as a Going Digital Award winner in the Water and Wastewater category by a panel of independent jurors, while the Exo Evergy Power Transmission Structure Stabilization program received Bentley Founders Honors.

The Sustainability Delivery Awards, hosted by Environment Analyst, celebrate innovation, leadership, and tangible progress across global infrastructure. Judged by an independent panel of industry experts, this year's awards brought together leaders and changemakers committed to transforming the infrastructure sector.

Bentley Systems and Enactus launch the 2025 iTwin4Good Challenge

As the global infrastructure sector faces a critical workforce shortage, Bentley Systems and Enactus, a global nonprofit advancing student innovation and entrepreneurship, have announced the start of the 2025 iTwin4Good Challenge. This international competition empowers university students to develop digital twin solutions to help address global infrastructure challenges.

The initiative comes at a pivotal time. In recent years, global infrastructure sectors have faced a critical workforce shortage, despite rising demand for better and more resilient infrastructure.

The iTwin4Good Challenge places students on a path to address workforce shortages by combining their passion for social and environmental impact with the power of digital technology. Through skills building and mentorship, it brings together global talent to grow a new and diverse pipeline of future infrastructure leaders and solution developers.

Students embark on a six-week programme featuring technical training, mentorship from across Bentley, and the opportunity to get certified as an iTwin Developer Associate. Participants, competing solo or in teams of up to three, will use Bentley's iTwin platform to create apps that could drive positive environmental or social impact in their communities.

Challenge overview

From June through October 2025, students from the US, Germany, Canada, the UK and Ireland (competing jointly), and Brazil will participate in national rounds. The top performers will present their solutions to a panel of industry experts, compete for cash prizes, and advance to a virtual 'Champions of Champions' showdown, with the global winner earning the opportunity to attend the Enactus World Cup 2025 in Bangkok.

This hands-on experience develops industry-ready professionals who can apply digital twin technology to solve real-world challenges, bridging the gap between academic learning and impactful infrastructure innovation.

Changi Airport Terminal 5 breaks ground

Aerial view of T5: Terminal 5 is an integral part of the Changi East development and will position Singapore to capture future growth opportunities in the region. Artist's impression.

The Prime Minister of Singapore and Minister of Finance, Mr Lawrence Wong, officiated at the groundbreaking ceremony, on 14 May 2025, for Changi Airport Terminal 5 (T5), a mega terminal which will strengthen Changi Airport's position as a leading air hub.

Powered by state-of-the-art airport systems and extensive automation, T5 will allow Changi Airport to significantly increase its handling capacity, optimise operations and leverage new opportunities as travel demand continues to increase in the decades ahead.

T5 will be linked to existing terminals at Changi Airport, so that the airport can operate as a single integrated air hub. It is designed to handle about 50 million passengers annually, in its first phase which is expected to open in the mid-2030s.

According to the Airports Council International, the Asia-Pacific is projected to be among the fastest growing air travel markets over the next two decades. The additional capacity at T5 will therefore enable Singapore to ride on the long-term growth of aviation in the region and beyond.

The Singapore Airlines Group, which currently operates across three terminals, will consolidate its operations under one roof at T5. There will also be room for other air carriers to expand their operations at T5 and Changi's other terminals.

Enhanced connectivity

For the first time, T5 will see Changi Airport house a ground transportation centre, bringing together train, bus, taxi and other transport services. It will enhance Changi's connectivity to the rest of Singapore, making the airport accessible not just for travel, but also as a destination for local residents to enjoy. Plans are in progress to extend both the Thomson-East Coast Line and the Cross Island Line to T5, to connect it to the city centre and other major hubs.

T5 also offers the possibility of enhanced air and sea connectivity – for more seamless passenger travel, including convenient connections to neighbouring destinations via ferry services.

A terminal of the future

T5 will see extensive automation of both passenger-facing processes and back-end functions, powered by innovative technologies that are being trialled today for wider implementation by the time T5 opens. This will enable the airport to operate technologies at scale in a sustainable manner, with reduced reliance on manpower.

In addition, T5 will be a Green

Mark Platinum Super Low Energy building which is more energy-efficient. It will be powered by more clean energy to reduce the carbon footprint of Changi Airport, and be equipped with building management systems that feature innovative and efficient systems design. The terminal's rooftop solar system, which would be one of the largest in Singapore, can potentially generate enough energy to power up about 20,000 4-room HDB flats for a year.

A mega yet cosy terminal

Inspired by Singapore's unique blend of nature and city, T5's design concept is characterised by a unique collection of overlapping curved roofs with varying heights. The 'roof leaves' break the mega terminal building into smaller spaces that are more human scale. Combined with natural light and landscaping at appropriate spaces, the terminal will have the familiar cosy, yet uplifting, feel that Changi is known for.

To make it easier for passengers to get around the terminal, travellators as well as an automated people mover (APM) system similar to the Skytrain will reduce walking distances. The walking distances in T5 will be comparable to Changi's current terminals. The APM network will also link T5 to Terminal 2, facilitating seamless transfers to the other terminals. T5 is also designed to be intuitive for wayfinding, with paths that lead passengers either to the boarding gates or the APM station, where trains will take them to their gates. Passengers will not need to rely heavily on signage to find their way around the terminal.

Mr Yam Kum Weng, Chief Executive Officer, Changi Airport Group, said, "Our vision is for T5 to be mega yet cosy, a terminal that embraces the Changi DNA – delivering a personalised, stress-free and positively surprising airport experience. As a new gateway to Singapore, T5 offers new possibilities and will bring new surprises. It will offer yet another vibrant space for families, friends and the airport community, to gather and bond."

Roof leaves: Terminal 5's roof design is an assembly of overlapping roof leaves with varying heights, creating a variety of spaces that are more human scale. This provides a cosy feel within the mega terminal. Artist's impression.

Intra-Terminal Train Station: All the buildings in Terminal 5 will be connected via an automated people mover system. There will also be an extension to Terminal 2, where passengers can connect to the rest of Changi Airport. Artist's impression.

The design of T5 was proposed by a consortium led by KPF, in partnership with Heatherwick Studio and architects61. The design work for T5 was paused in 2020 due to the Covid-19 pandemic and resumed in 2022.

Incorporating lessons learnt from the global pandemic, T5 will have the flexibility to operate as smaller sub-terminals, when needed, to facilitate the management of high-risk passengers. It will also feature systems such as contactless touchpoints that can help to reduce disease transmission.

T5 is located in Changi East, a 1,080 ha development which also includes the Changi East Industrial Zone (CEIZ) and the Changi East Urban District (CEUD). The aim of the CEIZ is to augment Singapore's position as a leading aircraft maintenance and integrated logistics and air cargo hub in the region, while the CEUD will serve as a vibrant business and lifestyle destination located at the doorstep of T5.

All images by Changi Airport Group

Connecting Changi Airport directly to the city centre and major hubs by rail

The Land Transport Authority (LTA) has announced a new Thomson-East Coast Line (TEL) – Cross Island Line (CRL) interchange station. The new TE32/CR1 Changi Terminal 5 station (working name) will connect the upcoming Changi Airport Terminal 5 directly to the city centre and other major hubs, through the Thomson-East Coast Line extension (TELe) and the CRL.

Enhanced connectivity for Changi Airport

Changi Airport Terminal 5, which broke ground earlier on 14 May 2025, will be a mega terminal that strengthens Changi Airport's position as a leading global air hub. Scheduled for completion in the mid-2030s, it will enable Changi Airport to serve about 50 million more passengers annually.

Terminal 5 will house a dedicated ground transportation centre, integrating train, bus, taxi, and other transport services in one location, enhancing Changi's connectivity with the rest of Singapore. This will make the airport a gateway for international travel, as well as a vibrant destination for Singaporeans to shop, dine and enjoy.

The new TEL – CRL interchange station at Terminal 5 will be part of the TELe, which will enable a direct rail connection between Changi Airport and the city centre. This new 14 km extension will extend the TEL from Sungei Bedok station to the new interchange station.

From there, the TEL will be further extended to connect to Tanah Merah station, with the existing East-West Line stretch between Changi Airport and Tanah Merah stations converted to TEL systems. Future passengers from the existing Changi Airport station and the new Changi Terminal 5 station will enjoy seamless and convenient access to the TEL network.

Alignment and location map.

When the TELe is completed, the TEL will span approximately 57 km, stretching from Tanah Merah through iconic destinations like Gardens by the Bay, Maxwell, and Orchard, and continuing north to Woodlands North station, where commuters can conveniently transfer to the upcoming Johor Bahru – Singapore Rapid Transit System Link.

The TELe will also reduce travel times for passengers travelling to and from Changi Airport. For instance, a trip from Changi Airport to Marina Bay via the TEL is expected to take approximately 40 minutes, compared to the current 50-minute journey.

Terminal 5 will also be connected to other parts of Singapore via the CRL. A 5.8 km extension from CR2 station will connect directly to Terminal 5, offering passengers fast and convenient access to key nodes such as the Punggol Digital District and Jurong Lake District, as well as residential areas including Ang Mo Kio, Clementi, Hougang, Pasir Ris and Punggol.

This will significantly improve travel convenience and shorten travel times. For example, a commuter travelling from Changi Airport to Ang Mo Kio via the CRL would take around 45 minutes, saving up to 15 minutes of travelling time compared to 60 minutes today.

Conversion of EWL stations to TEL systems

Converting existing rail stations from one line to another requires extensive modifications and careful planning to ensure compatibility with different train systems and operations. Since 2016, preparatory works to modify Tanah Merah station into an interchange station between the EWL and the TEL have been ongoing. These works include building new viaducts, adding a new platform, and expanding the concourse area. The modification works at Tanah Merah station will be completed by end-2025.

In the next stage of works, LTA will carry out systems integration works at the three EWL stations from Tanah Merah to Changi Airport station, to convert them to TEL stations. These works

include changes to the signalling, communications, controls, power supply systems, platform screen doors and tracks.

To facilitate these station modification and systems integration works, train service adjustments will be required along select stretches of the EWL near these stations. More details on these service adjustments will be shared when ready.

TEL

Singapore's sixth MRT line, the TEL spans more than 50 km, from Woodlands North to Bayshore. Since its initial opening in 2020 with three stations, the TEL has been progressively opened in stages with the fifth stage, TEL5, scheduled for opening in the second half of 2026. When fully completed, the line is expected to serve about 500,000 commuters daily in the initial years, increasing to about one million commuters in the longer term.

Commencement of passenger service on the new light rail vehicles

The entry into passenger service of the first two of 25 new, third-generation, two-car Light Rail Vehicles (LRVs) for the Sengkang-Punggol LRT (SPLRT) is a major milestone for the SPLRT fleet renewal programme which will see these third-generation LRVs progressively replace all the existing first-generation fleet of 25 one-car and eight two-car LRVs. Another eight second-generation two-car LRVs will remain in operation. The new LRVs are manufactured by Mitsubishi Heavy Industries (MHI) in Mihara, Japan.

The remaining 23 new third-generation LRVs will arrive progressively and enter passenger service from the third quarter of 2025 onwards, after completing comprehensive testing and commissioning. By end-2028, when all new LRVs are deployed, the SPLRT fleet will comprise 33 two-car LRVs. This will increase the overall passenger capacity of the SPLRT to meet ridership demand.

Enhancements and improved features

With the new LRVs entering passenger service, commuters will enjoy smoother and more comfortable rides. To improve passenger experience, the new LRVs feature ergonomic seating, brighter and more energy-efficient LED lighting, clearer LCD passenger information displays, and new door-closing indicator light strips for more visible warnings of closing doors. The new LRVs will also come with an improved air-conditioning system for enhanced passenger comfort.

The new LRVs also feature operational enhancements. This includes an onboard touch-screen diagnosis panel for quicker fault detection during testing and maintenance, as well as more ergonomic access to onboard equipment by staff. Additionally, the LRVs are equipped with inter-car doors to facilitate safer and quicker passenger evacuation during emergencies.

SPLRT depot expansion

To support the operations and maintenance of the larger LRV fleet, the SPLRT depot is being expanded from 3.5 to 11.1 hectares, to provide additional stabling and maintenance facilities. The upgraded depot will include two new reception tracks to reduce LRV launch times, while three additional traction power substations will cater for the higher power demand of the new, two-car LRVs. These enhancements will improve the SPLRT's overall capacity and reliability, and are on track for completion by 2027.

To facilitate these depot expansion works, service adjustments will be required along select stretches of the SPLRT. More details on the service adjustments will be announced when ready.

Repurposing of first-generation LRVs

As the new LRVs are deployed for passenger service, the first-generation LRVs will be progressively decommissioned. As part of sustainability efforts, LTA is inviting community partners to repurpose the decommissioned LRVs either as full train cars or through reuse of individual parts.

LTA has previously worked with various organisations including City Developments Limited, ITE College West, SG Enable, the Singapore Armed Forces and Singapore University for Technology and Design, to upcycle decommissioned trains and train parts.

Interior of a new SPLRT vehicle.

Restoration of masonry for national monument designed in English Neo-Gothic style

A range of specialised chemical products and technical expertise were provided for the project.

The St Andrew's Cathedral in Singapore, reopened in January 2024 after restoration work was done over a two-year period.

Situated at the heart of Singapore's Civil District, it stands as the largest cathedral in Singapore and the oldest Anglican house of worship. Dedicated to the patron saint of Scotland, St Andrew's Cathedral was meticulously designed by Lieutenant-Colonel Ronald MacPherson in 1856, following the old English Neo-Gothic architectural style.

Designated as a national monument in 1973, St Andrew's Cathedral has since hosted numerous memorials and dedications on its grounds. It continues to be an active centre of worship for Anglican Christians in Singapore.

This cathedral has played a pivotal role in Singapore's history.

The St Andrew's Cathedral is a national monument.

Memorials

The cathedral and its surroundings feature numerous dedications and memorials. The stained-glass windows of the apse honour Sir Stamford Raffles (founder of Singapore as a British trading port), John Crawfurd (second Resident of Singapore), and Major-General William J Butterworth (Governor of the Straits Settlements from 1843 to 1855). Another window at the cathedral's entrance pays tribute to its designer and architect, Lieutenant-Colonel MacPherson, with a corresponding monument in the church grounds.

Tablets on the north wall and one of the pillars in the left aisle serve as memorials for the victims of the 1915 sepoy mutiny in Singapore. The War Memorial Wing, inaugurated in 1952 by General Sir Gerald Templer and Malcolm MacDonald, is dedicated to the servicemen who lost their lives in World War II. This wing also includes a plaque listing the names of fallen members of the Malayan Civil Service.

St Andrew's Cathedral today

St Andrew's Cathedral remains a significant place of worship for the Anglican Communion in Singapore.

History and architecture

The cathedral stands as one of the few surviving examples of English Neo-Gothic architecture. Resembling the iconic Salisbury Cathedral in England, its belfry boasts lancet-shaped windows and graceful spires.

Maria Balestier, wife of the then American Consul, Joseph Balestier and daughter of American Revolution patriot, Paul Revere, donated a half-tonne bell in 1843. Although replaced by a new peal of bells in 1889, the original bell now finds its home in the National Museum of Singapore.

Situated beneath the steeple, the porte-cochere, or carriage porch,

provides shelter to churchgoers and visitors, from the tropical heat.

The walls, originally adorned with Madras chunam – a plaster commonly used during that time on early colonial structures – exhibit a brilliant, polished appearance. The unique mixture involved shell lime, the white of eggs, coarse sugar (jaggery), and coconut husks steeped in water. Occasionally, fine soapstone powder was sprinkled on the walls, and rock crystals or rounded stones were employed to achieve a smooth, glossy finish.

The two-storey nave features aisle arcades topped by clerestory windows that naturally illuminate the interior. In the sanctuary, a high altar stands, adorned with an altarpiece depicting the Nativity of Jesus, flanked by images of Saint Peter and Saint Andrew.

Behind the altar, three grand, coloured and stained-glass windows pay homage to significant figures in Singapore's early colonial history – John Crawfurd, Sir Stamford Raffles and Major-General William J Butterworth, each accompanied by their respective coat-of-arms.

Intervention by Mapei

The MAPEI-ANTIQUE LINE of lime-based, cement-free products was used extensively in the restoration of the internal and external walls of St Andrew's Cathedral.

- MAPE-ANTIQUE ALLETTAMENTO was used to fill the gaps in the existing joints between the old bricks. As the building was constructed in 1861 and the plaster used during that era was different, various trials on plasters were conducted by the project contractor, with input from Mapei.
- MAPE-ANTIQUE INTONACO NHL and MAPE-ANTIQUE MC were used for plastering over the original bricks of the external wall.
- MAPE-ANTIQUE RINZAFFO was used as the salt-resistant base layer.
- MAPE-ANTIQUE F21 and MAPE-ANTIQUE I were applied using the injection method to fill the fine cracks on existing bricks and plaster.

Restoration work was carried out also on the interior walls of the cathedral.

- MAPESTOP was used to form a chemical barrier to prevent dampness rising in the original masonry walls, as a result of capillary action.

Mapei was able to contribute to this project due to its track record in the restoration of historic buildings in Singapore such as the Gallop Extension, Singapore Botanic Gardens, a UNESCO Heritage Site.

PROJECT DATA

Project
St Andrews Cathedral, Singapore

Architect
Lieutenant-Colonel Ronald MacPherson

Year of Construction
1856

Period of restoration
January 2022 - December 2023

Conservation Consultant
Dr Yeo Kang Shua, Associate Professor, Singapore University of Technology and Design

Architect
Seeds Architects

Civil & Structural Engineer
Longrove & Associates Pte Ltd

Mechanical & Electrical Engineer
M & P Consulting Engineers

Quantity Surveyor
BCM Consultants Pte Ltd

Main Contractor
Shanghai Chong Kee Furniture

The technical support offered by Mapei during the trial stages and while the project was ongoing, were also crucial factors in clinching the St Andrew's Cathedral project.

INTERVENTION BY MAPEI

Period of intervention
February 2022 - December 2023

Contribution by Mapei
Supplying products from the MAPE-ANTIQUE LINE for masonry restoration.

Application of Mapei products
Filling the gaps in the existing joints between the old bricks – MAPE-ANTIQUE ALLETTAMENTO

Plastering over the original bricks of the external wall – MAPE-ANTIQUE INTONACO NHL and MAPE-ANTIQUE MC

Forming a salt-resistant base layer – MAPE-ANTIQUE RINZAFFO

Filling the fine cracks on existing bricks and plaster – MAPE-ANTIQUE F21 and MAPE-ANTIQUE I

Forming a chemical barrier to prevent dampness rising – MAPESTOP

Website for further information
www.mapei.com
www.mapei.com/sg

Images by Mapei

Upcoming launch of Technical References for Railways

'The Singapore Engineer' finds out more about three new Technical References (TRs), related to service readiness for railways, from the Service Readiness Working Group (SRWG) under the IES-Standards Development Organisation (IES-SDO).

Mr Alvin Kek (co-convenor), SRWG

Mr Simon Yan (co-convenor), SRWG

Mr Lim Kim Chye (core member, working group), SRWG

The three TRs, which will be launched at a webinar on 15 September 2025, are:

- **TR 122:2024** - Mass rapid transit (MRT) and light rail transit (LRT) operations – Guide for the development and review of rulebooks.
- **TR 123:2024** - Mass rapid transit (MRT) and light rail transit (LRT) operations – Guide for operations control centre management.
- **TR 124:2024** - Mass rapid transit (MRT) operations – Guide for station management.

The Service Readiness Working Group (SRWG) is a working group formed under the purview of the Technical Committee for Railway Systems (TCRS). SRWG is led by Mr Alvin Kek (co-convenor) and Mr Simon Yan (co-convenor), with Mr Lim Kim Chye as one of the core members of the working group.

The Singapore Engineer (TSE): What is the motivation behind developing these three specific Technical References (TRs)?

Service Readiness Working Group (SRWG): We identified that there is a need for a platform for sharing / consolidating the best practices among local railway operators. These TRs can serve that purpose and also serve as a guide for existing and future railway operators, and potentially private lines, with the intent for continuous process improvement.

With the increased connectivity of the local railway network, it is beneficial to share our knowledge and lessons learned, with the goal of providing an excellent commuter experience and a reliable train service to passengers.

TSE: What are the objectives of the TRs and how do these three TRs complement each other?

SRWG: We want to create a holistic framework for railway operations, in terms of safety for railway staff and passengers, commuter experience and operational readiness. These TRs are interconnected.

Briefly, rule books (RBs) play an important role, as operating rules must be stringent to protect the safety of railway personnel when working on railway systems, e.g. while performing emergency fault rectification during passenger service hours or while maintaining railway systems / equipment during engineering hours, in order to ensure the safety of passengers commuting via the railway network.

The efficient functioning of the Operations Control Centre (OCC) and MRT Station requires clearly defined RBs to govern the operations, so that all personnel involved can carry out their work / duties safely.

By developing these three TRs concurrently, we can ensure the consistency of the contents developed and the important aspects that cut across these three areas.

TSE: What do TR 123:2024 and TR 124:2024 aim to address?

SRWG: The OCC serves as the nerve centre for railway operations, with its personnel manning the railway network 24 hours a day. OCC plays a crucial role and must respond promptly to any exceptional and security-related incidents and faults in the railway system.

During a train service disruption, OCC must also coordinate with relevant agencies and departments to ensure that the safety of passengers is not compromised. It must also ensure that the necessary information is disseminated, in a timely manner, to passengers and members of the public, so that they are aware of the situation and can seek alternative transport arrangements.

The MRT station is an important touchpoint between a railway operator and passengers, and is where passengers experience the benefits of key initiatives taken by a railway operator to enhance their travel.

Station personnel must be proficient in serving passengers and be able to respond to any abnormalities, to ensure the safety of passengers. They also play an important role in managing crowds (either during unforeseen railway incidents or special events), helping passengers in need, and coordinating with the OCC

and other relevant stakeholders to ensure the safety of passengers.

Taking into consideration the nature of operations for the OCC and the MRT station, both TRs provide frameworks which cover areas such as operations processes, operational authority, staffing level, span of control, contingency plans etc. We have also put emphasis on staff training and competency, to deliver excellent service and ensure operational readiness.

TSE: With regard to TR 122:2024, how can this TR help existing and future railway operations, in terms of RB management?

SRWG: Railway operations is a very complex area which involves many systems and multiple stakeholders, to ensure the railway is safe for passengers and railway staff. To manage it effectively, RBs must be easy to understand, and must not have ambiguity and inconsistency. They must also clearly define the parties executing the actions.

We wanted to create a framework to highlight the importance of simple, clear, concise and consistent language, RB documentation structure, RB development and review processes, approving authority and the dissemination of any new or revised RB. We hope that the TR can be a useful guide for railway operators and ensure that the RBs are always a clear and reliable source of knowledge for safe and efficient railway operations.

TSE: What impact do you hope these TRs will have on the local railway industry?

SRWG: We hope that these TRs can set the common baseline and enhance the local railway industry in terms of safety, competency, operational efficiency and readiness, incident management and commuter experience. Furthermore, we also hope that the TRs can serve as a collaborative platform for railway industry players to contribute their expertise for continuous improvement of the industry.

TSE: For organisations who are interested in adopting these TRs, what would your advice be for better utilisation of the TRs?

SRWG: For organisations interested in adopting these TRs, our advice is to view them as a flexible framework rather than as a rigid framework.

We recognise that every railway system and operating environment is unique, and thus the TRs are developed to serve as a guide. This approach is to offer organisations the flexibility to adapt and further develop their own internal operating rules to best suit their specific needs, operational context and railway system.

Railway operations is a very complex area which involves many systems and multiple stakeholders.

Webinar on and Launch of Technical References related to Service Readiness for Railways

Monday, 15 September 2025 (1 pm – 3 pm)

This webinar will introduce three new Technical References related to Service Readiness for Railways. The aim is to create a special platform for sharing and consolidating best practices among railway operators, and also to serve as a guide for future railway operators.

- **TR 122:2024** - Mass rapid transit (MRT) and light rail transit (LRT) operations – Guide for the development and review of rulebooks.
- **TR 123:2024** - Mass rapid transit (MRT) and light rail transit (LRT) operations – Guide for operations control centre management.
- **TR 124:2024** - Mass rapid transit (MRT) operations – Guide for station management.

The webinar is complimentary upon purchase of the TR(s).

To purchase the standards, scan the QR code.

Construction begins on Cross Island Line Phase 2

This phase will comprise six stations underground, two of which will be interchange stations.

Exterior view of CR15 King Albert Park interchange station. Artist's impression.

The Land Transport Authority (LTA) has commenced civil construction works for Phase 2 of the Cross Island Line (CRL).

Acting Minister for Transport, Jeffrey Siow, officiated the ground-breaking ceremony at the site of the future CRL Clementi station.

Phase 2 of the CRL (CRL2), targeted for completion by 2032, will extend the 29 km long Phase 1 of the CRL by another 15 km westwards. CRL2 will comprise six underground stations. Two of the six stations will be interchange stations. The CRL King Albert Park interchange station and the CRL Clementi interchange station will connect commuters to the Downtown Line (DTL) and East-West Line (EWL), respectively.

CRL2 will improve public transport connectivity for residents living in the west and shorten travel times for commuters travelling to and from the western parts of Singapore. For example, a West Coast resident travelling to work at Ang Mo Kio Industrial Park can save up to 40 minutes on their commute – from more than an hour by train and bus today, to 30 minutes on the CRL.

Exterior view of CR17 Clementi interchange station. Artist's impression.

When completed, the CRL will significantly enhance the resilience of Singapore's MRT network. As Singapore's second orbital line connecting to all the radial MRT lines, it will greatly improve rail connectivity and expand the network's overall capacity. Almost half of the CRL stations will be interchanges, which will open up many new travel routes in the network and provide commuters with more alternative ways of getting around, particularly during scheduled maintenance works or unexpected service disruptions.

Deepest station in Singapore

At 50 m deep (equivalent to 16-storeys) and extending to five basement levels, CRL King Albert Park interchange station will be Singapore's deepest station, when completed. It will surpass the

CRL Pasir Ris station which, when completed, will be 47 m deep and Bencoolen station on the DTL, currently the deepest underground station at 43 m.

Construction methods

Addition and alteration works will be carried out at the EWL Clementi station and the DTL King Albert Park station to provide commuters with seamless transfers to the CRL. Construction works for these transfer links will be implemented, in phases, and will be monitored closely to minimise any disruptions to existing train services.

A 5 km bored tunnel between CRL Bright Hill and CR14 stations through the Central Catchment Nature Reserve (CCNR) will be constructed using a Large-Diameter Tunnel Boring Machine (LDTBM). Measuring 12.8 m in diameter, the LDTBM will bore through the ground only once for the construction of the tunnel which houses two tracks, improving productivity and construction efficiency. The tunnelling works towards the CCNR commenced in May this year, along with ongoing ground improvement works.

To enhance environmental sustainability, the CRL2 stations' permanent structures will be built using greener steel and concrete with less embodied carbon. Complementing these green building materials, the projects will also explore the use of electric machinery such as excavators, tipper trucks and cranes, to reduce construction-related emissions and noise.

The CRL Changi East Depot, which houses the CRL's Operations Control Centre as well as maintenance facilities for up to 70 CRL trains, will also be fitted with solar panels to generate renewable energy for depot operations.

Biodiversity measures

CRL2 spans a number of biodiversity areas including Eng Neo Avenue Forest, Maju Forest and Clementi Forest. Since 2013, LTA has worked closely with nature group members to discuss the various alignment options, optimise the worksites, and co-create mitigation measures arising from the environmental impact assessment.

Interior view of CR18 station. Artist's impression.

This partnership has yielded significant improvements, including reducing the size of worksite A1W1 at Windsor Nature Park, from 15,000 m² to 7,000 m², and installing aerial rope bridges and underground culverts to facilitate the safe movement of animals across roads (e.g. Island Club Road and Fairways Drive).

Before works commenced, comprehensive Environmental Impact Assessments (EIA) were carried out to assess any potential impact of the construction and operations on the nearby environment.

A robust Environmental Monitoring and Management Plan (EMMP) has been implemented at the sites, including measures such as installing opaque screens and windows at the site offices, to prevent bird collisions, creation of fauna barriers and box culvert crossings to prevent traffic collisions with animals, as well as wildlife proofing of food waste bins.

A new freshwater marsh has also been constructed at the CRL King Albert Park site to serve as a habitat for the fauna and flora from the existing marsh.

In addition, a Biodiversity Training Centre has been set up at the Fairways Drive site office to provide mandatory wildlife awareness training for site workers and promote an environmentally responsible culture on site.

LTA will continue to engage with nature groups throughout the construction and operation of the CRL.

The CRL

The CRL will be Singapore's eighth and longest, fully underground MRT line, at more than 50 km in length, when fully completed. It will serve the existing and future developments in the eastern, western and north-eastern corridors, linking major hubs such as the Jurong Lake District, Punggol Digital District and Changi.

When fully completed, the CRL is expected to have a daily ridership of at least 600,000 in the initial years, growing to one million in the longer term. It will be constructed and opened in three phases.

Phase 1 of the CRL is 29 km long and comprises 12 stations. Construction works are well in progress and are expected to be completed by 2030. The 7.3 km CRL-Punggol Extension comprising four stations is targeted for completion 2032. Engineering studies for CRL Phase 3, which will serve the Jurong Industrial Estate, are currently ongoing, and more details will be announced after these studies are completed.

Syed Alwi Pumping Station strengthens flood protection in Jalan Besar and Little India

An unconventional solution.

PUB, Singapore's National Water Agency, has completed the Syed Alwi Pumping Station (SAPS), enhancing flood protection for the low-lying Jalan Besar area and parts of Little India.

Located next to Rochor Canal along Syed Alwi Road, the fully automated SAPS is designed to divert stormwater that falls over the area into an underground tank, from where it is then pumped into Rochor Canal during and after storms.

The SAPS, which serves a catchment area of about 30 hectares, forms part of PUB's diverse stormwater management infrastructure to strengthen Singapore's flood resilience, as climate change brings about more frequent and intense rainfall.

Jalan Besar is a low-lying area that faced challenges with flooding from the 2000s to 2010s. In 2014, PUB upgraded drains along Syed Alwi Road and raised the road level to mitigate flooding in the area. This was followed by the widening and deepening of Rochor Canal in 2015 to increase its drainage capacity. These measures also enhanced flood protection in nearby areas such as Veerasamy Road, Hindoo Road and Desker Road.

In consideration of the many heritage buildings in the area, SAPS was conceptualised as an alternative solution to enhance flood resilience, without the need for redevelopment works to raise ground levels. The SAPS takes up about 1,190 m² of space, equivalent to one-sixth of a football field. During a storm, the infrastructure diverts stormwater from the upstream of Rochor Canal into an underground tank before pumping it to the downstream section of the canal.

The Syed Alwi Pumping Station forms part of the stormwater management infrastructure in Singapore.

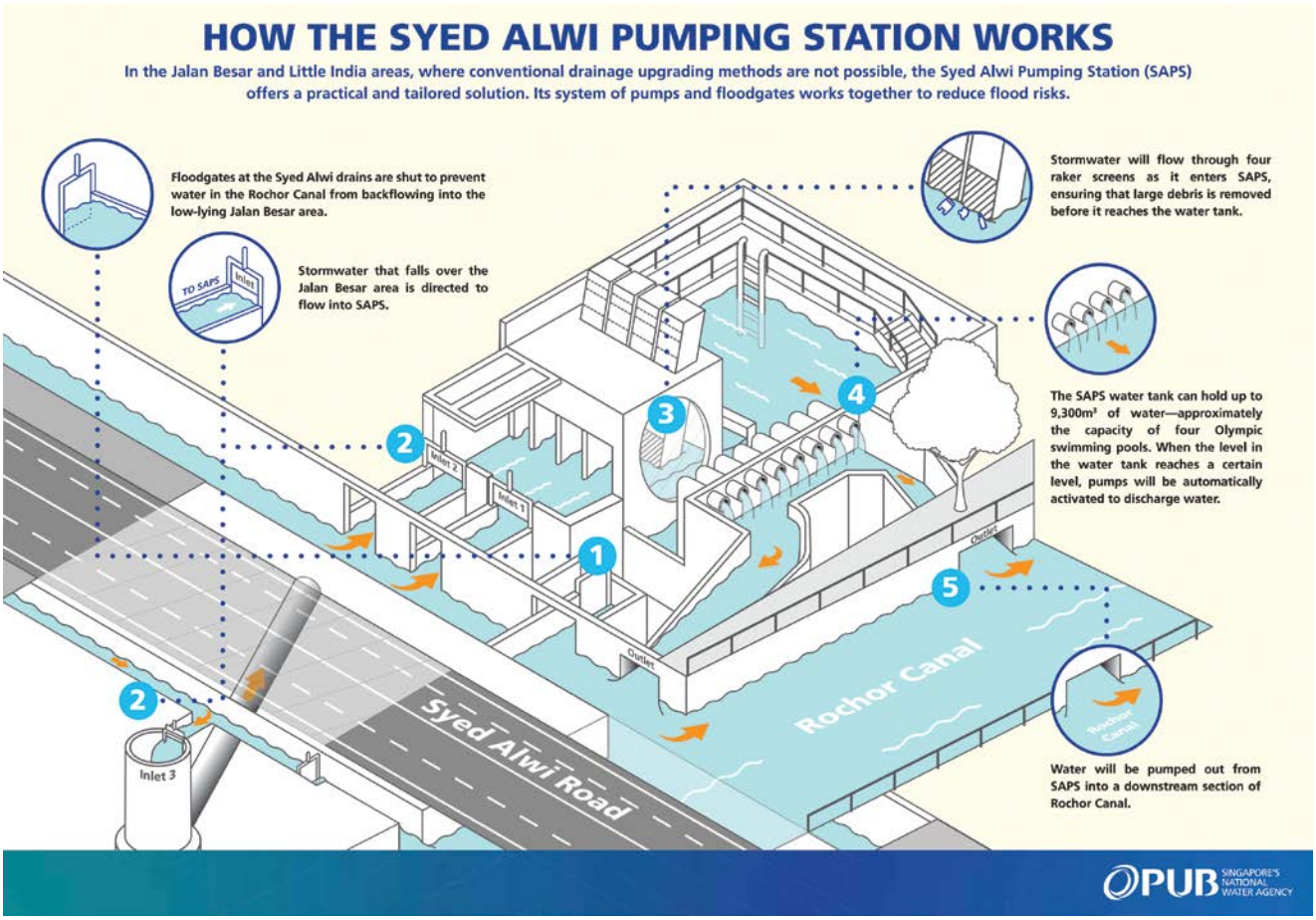
Green wall (left) and green roof (right), at the SAPS facility.

Above ground, the pumping station's management facility, including the control room, is housed in a compact building. An area next to the above-ground facility is being developed into an open plaza and will provide a community space that is integrated with the nearby Build-To-Order development, King George's Heights, currently under construction. The SAPS is designed to integrate greenery where possible, such as a green roof and green wall.

Even as PUB continues to invest in enhancing the drainage infrastructure to strengthen Singapore's flood resilience, absolute protection is not possible and building community resilience is key.

Stakeholders like building owners and contractors can ensure proper maintenance of internal drainage systems and implement flood protection measures according to stipulated guidelines, to better protect their properties.

The public can stay updated about flood warnings and occurrences through PUB's Telegram Channel or the myENV app.



The Syed Alwi Pumping Station was conceptualised as a solution to enhance flood resilience, without the need for redevelopment works to raise ground levels.

Functioning of the Syed Alwi Pumping Station

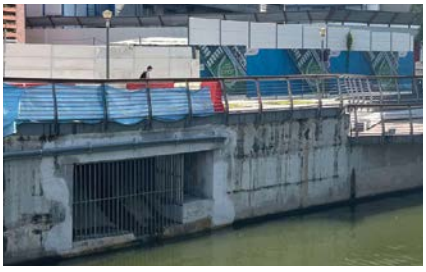
The SAPS operates with two floodgates – one at the outlet drain in front of the SAPS and the other at the roadside drain along Syed Alwi Road.

The floodgate at the roadside drain along Syed Alwi Road is kept shut to prevent stormwater in the Rochor Canal from backflowing into the low-lying Jalan Besar area. Stormwater that falls over the Jalan Besar area is then directed to flow through three water inlets into the SAPS.

Before entering the main underground storage tank, stormwater passes through raker screens that remove debris. The tank can hold 9,300 m^3 of stormwater, equivalent to approximately four Olympic swimming pools.

Once the water level in the tank reaches 4.5 m, the main pumps are activated to pump the water back into the downstream section of Rochor Canal. The SAPS thus controls the water levels upstream of Rochor Canal and reduces flood risk in the low-lying area.

Stormwater passes through raker screens at the inlet (left), that removes debris, before entering the main underground storage tank (right). The tank can hold 9,300 m^3 of stormwater.



Once the water level in the tank reaches 4.5 m, the main pumps (left) are activated to pump the water, through the outlet (right), back into the downstream section of Rochor Canal.

All images by PUB, Singapore's National Water Agency

Rethinking water for the future

Mr Robert Chan, Vice President of Water in Asia, AECOM, explains some of the strategies for creating infrastructure that sustains generations.

AECOM is a multinational, infrastructure consulting firm, headquartered in the US.

Mr Robert Chan

The Keppel Marina East Desalination Plant boasts of a first-of-its-kind, dual-mode design.

The Singapore Engineer (TSE): Singapore is running out of land for traditional water catchment and treatment expansion. How does integrated, smart and adaptive infrastructure come help to address this challenge?

Robert Chan (RC): Singapore's land constraints necessitate a highly integrated, smart and adaptive approach to water infrastructure. A prime example of this approach is the Keppel Marina East Desalination Plant (KMEDP) which boasts of a first-of-its-kind, dual-mode design, allowing it to treat either seawater or freshwater from the Marina Reservoir. This adaptability reduces energy use when freshwater is available, enhancing energy efficiency and supply resilience.

The plant is strategically built underground, while above ground it is crowned with a 20,000 m² green roof for public recreation, maximising land utilisation by co-locating essential infrastructure with public amenities. Through KMEDP, we place emphasis on resilience dividends, ensuring that infrastructure brings about co-benefits to communities and is designed with flexibility and robustness for long-term adaptability.

Furthermore, Singapore's holistic integrated approach extends beyond water to include food security, coastal resiliency, transportation and urban planning.

By leveraging technologies like digital twins, real-time monitoring and predictive analytics, we can optimise existing assets, rather than relying solely on physical expansion.

These smart systems enable adaptive responses to shifting demand platforms, climate variability and urban growth, ensuring that the water supply remains resilient and efficient.

TSE: In a space-constrained city, what are some of the water collection and flood prevention methods that can be adopted?

RC: In a space-constrained city like Singapore, alternative water collection and flood prevention

methods are paramount. Singapore's proactive approach to water security, recognised as a global best practice, stems from a clear understanding of the challenges posed by a growing global population and limited freshwater resources.

The World Wide Fund for Nature (WWF) estimates that, by 2025, two-thirds of the world's population may face water shortages – making Singapore's strategy even more critical. Given its small land mass and limited capacity to capture and store rainfall, Singapore understands the urgent need to expand its sources of water supply beyond climate-based rainfall.

The 'Four National Taps' strategy was built on foresight, creating a sustainable, long-term and reliable water source that is less vulnerable to climate change.

This strategic blend of the four taps contributes unparalleled reliability and resiliency to Singapore's long-term water supply. It allows for an adaptive response to urban growth and peak demand surges, while maintaining system reliability and redundancy, thereby setting a global benchmark for water resource management.

It is important for a shift to 'blue-green infrastructure' which integrates wetlands, mangroves and other green solutions into urban landscapes, to protect water, support biodiversity and enhance climate resilience.

For instance, the ABC Waters programme, a strategic initiative, in which AECOM has long been participating, transforms drains and canals into attractive waterways, incorporating water-sensitive urban design elements like rain gardens and cleansing biotopes to filter stormwater runoff, improve aesthetics and create a family-friendly environment that encourages community engagement.

For flood prevention, a multi-faceted approach, centred on hybrid infrastructure and nature-based solutions, can be adopted. Singapore articulates a flexible approach for coastal protection, combining engineered solutions, like sea walls, with nature-based elements such as mangroves and vegetation, to dissipate wave energy.

By consistently innovating and implementing these strategies, Singapore seeks to achieve a robust and sustainable water supply system, and a resilient coastal infrastructure.

TSE: Coral bleaching is caused by rising temperatures in the ocean. Are there measures that Singapore can implement, to protect underwater habitats amidst the land reclamation and coastal resilience efforts?

RC: Singapore can implement strategies to protect underwater habitats like coral reefs amidst land reclamation and coastal resilience efforts, even though coral bleaching is largely driven by global ocean temperature rises. The most important thing is that nature-based solutions are built into reclamation projects to create natural resilience shorelines that can combat the impacts of reclamation and, also, the ill effects of climate change.

Nature, unlike hard engineering, is naturally adaptive and whilst it can be affected by climate change, it can also help mitigate the impacts that climate change brings. For example, restoring mangrove forests and creating intertidal habitats, not only protect shorelines from erosion and rising sea levels, but also enhance biodiversity.

With the incorporation of various morphologies and topographies into project design, different habitat types can be supported, promoting biodiversity. This includes designing eco-shorelines with enhanced surface complexity, in intertidal zones, to boost biodiversity by including different marine life-forms, from algae to fish. In the case of coral bleaching, research institutes are pioneering the use of coral nurseries and 'coral gardening' techniques, where fragments from resilient coral species are propagated and transplanted onto degraded reefs.

Coupled with research into heat-tolerant coral genotypes, this helps bolster the reefs' resilience to future bleaching.

By applying science, and collaborating with government and academia, AECOM is developing a strong focus on science-driven approaches to nature-based solutions that provide coastal resilience whilst simultaneously restoring nature and providing benefits to human beings.

We do see Singapore actively exploring ways to protect the country's coastline, not just with 'grey infrastructure', like seawalls, but also through green infrastructure, in order to provide natural biodiversity, recovering mangroves and maintaining mudflats.

AECOM is committed to embedding biodiversity action across all projects, on the basis of our 'Sustainable Legacies' strategy. We also have a 'Resilient Reefs' initiative which has a methodology for resilience-based management and focuses on local actions to build reef resilience.

When planning coastal expansion and land reclamation, Singapore adopts strategies designed to minimise impacts on vulnerable marine ecosystems.

TSE: In order to promote sustainability in the built environment, how can the community spark behavioural and social change?

RC: We are building for the betterment of our society and promoting sustainability in the built environment. This is vital, as design choices and operational phases directly impact long-term carbon and water footprints. With emphasis on embedding climate

resilience and decarbonisation strategies into projects, from the start, assets will become more sustainable and resilient. An example would be the efforts to reduce 'embodied carbon', using computational design technologies which can significantly lower carbon designs and reduce design production time.

Community engagement is crucial for sparking behavioural and social change. Public engagement is critical in the transition to blue-green infrastructure for water management. When communities see the tangible benefits of blue-green spaces, they become advocates for further investment in sustainable infrastructure.

Singapore's ABC Waters programme actively involves the community in transforming waterways into vibrant spaces, fostering a sense of ownership and promoting water-wise behaviours.

This co-creation of public spaces and integration of nature into urban planning, as seen in projects, like Jinji Lake in Suzhou Industrial Park, China, encourages long-term behavioural shifts by empowering people to adapt and build resilience through direct experience which can then translate into social norms.

TSE: What role can Singapore play as a regional and global leader in water security and in coastline protection and flood resilience?

RC: Singapore plays a significant role via its sharing of expertise and integrated approaches. Its multi-tap water strategy, a robust and sustainable water supply system, provides a valuable model for other water-stressed cities. Singapore's experience in developing climate-resilient coastal designs, which include hybrid infrastructure and nature-based solutions, is highly relevant for other vulnerable coastal cities.

Engaging with institutions such as Singapore Water Association for capacity building, further strengthens regional capabilities. Alongside demonstration of how a clear vision, integrated planning and investment in innovative technologies can drive success, Singapore is ready to share its expertise with other nations, leading to enhanced water security and resilient coastal infrastructure.

Investigation study for wetland conservation park

Early this year, AECOM announced that it has been selected by the Civil Engineering and Development Department (CEDD) and Agriculture, Fisheries and Conservation Department (AFCD) of the Hong Kong Special Administrative Region (HKSAR) Government, to deliver the Investigation Study for Sam Po Shue Wetland Conservation Park (SPS WCP).

Spanning 348 hectares, the SPS WCP is the first WCP to be established under the WCPs System proposed under the Northern Metropolis Development Strategy released in 2021, with the WCPs System aiming to conserve the wetlands with ecological values in the Deep Bay, increase environmental capacity for the Northern Metropolis, and achieve co-existence of conservation and development.

AECOM will provide comprehensive services for the investigation stage of the SPS WCP, including preliminary design, engineering infrastructure works, wetland enhancement, landscaping, environmental sustainability integration, digital monitoring, and park management. The establishment of the SPS WCP is expected to enhance the ecological quality and biodiversity of the Northern Metropolis, provide high-quality outdoor eco-education and eco-recreational facilities to the public, as well as introduce modernised and sustainable aquaculture into the WCP.

A view of the proposed area for the future Sam Po Shue Wetland Conservation Park.

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Design·AI Edge: The Future of Innovation and Resilience

by Poon King Wang, Chief Strategy and Design AI Officer and Director, Lee Kuan Yew Centre for Innovative Cities, Singapore University of Technology and Design

BIG TOPIC: How might we strengthen resilience against disruption, dislocation, and deskilling? And also nurture innovators as AI advances accelerate in weeks and months instead of years?

The house view of the Singapore University of Technology and Design (SUTD) is to give innovators the Design·AI Edge. Here is why and how.

AI disrupts all jobs, skills and tasks. From a simple prompt, AI now generates instant answers.

Humans can lose their jobs as a result. Even if they do not, frequent use of such AI can cause cognitive deskilling (see References).

Design·AI can counter these fears and risks. Based on SUTD's first 15 years since its establishment, and the decade-long research into the future of work and innovation by the Lee Kuan Yew Centre for Innovative Cities (see References), we can say that the Design·AI Edge does so, in three ways:

01. Learn to Ask - Asking good questions

02. Human-Centred Design - Crafting a deep care for human values

03. Design Innovators - Making an impact on economy and society

Learn to Ask – Asking good questions

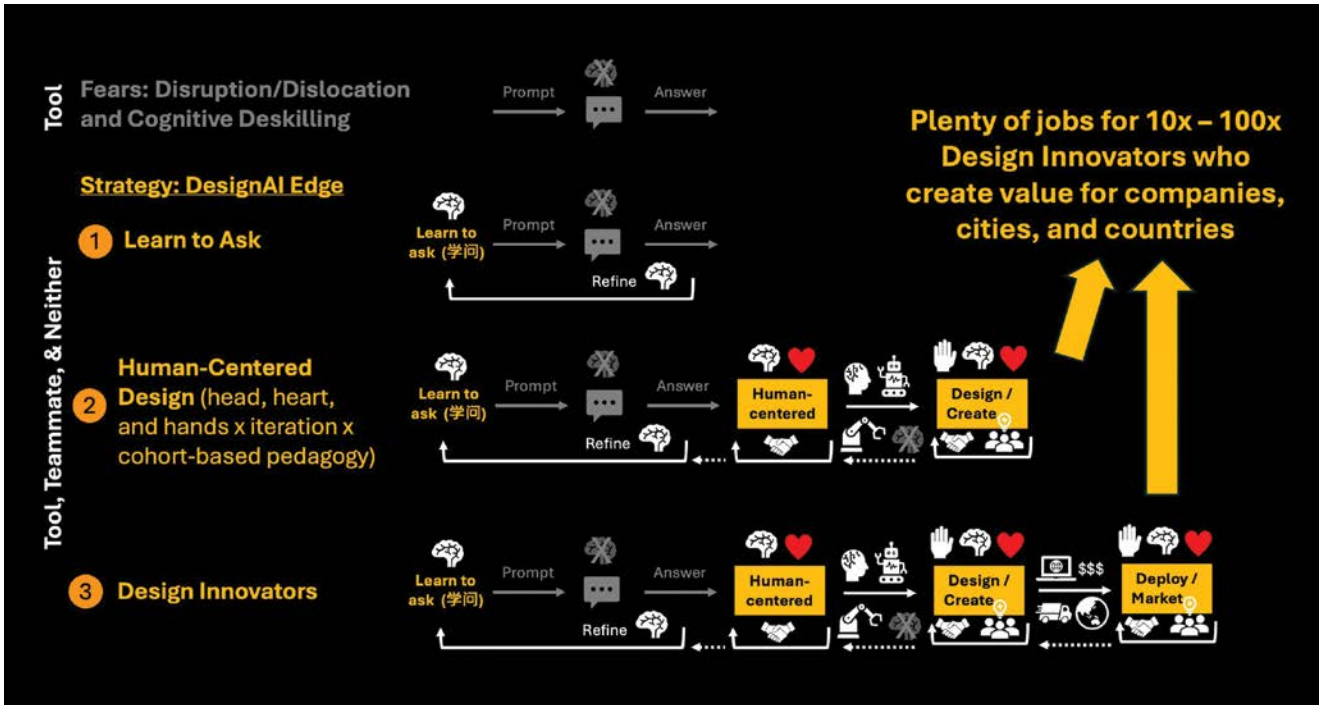
Innovators with the Design·AI Edge learn to ask good questions. Asking good questions engages the mind. Instead of mindless prompting and generation, where nothing is learned, taking time to formulate a good question and refining it iteratively, to arrive at high quality answers stretches the brain.

The risks of cognitive deskilling through mindless use of AI are thus reduced. The odds of cognitive strengthening through thoughtfulness are raised. (The Chinese word for 'knowledge' is '学问' i.e. learn to ask, emphasising lifelong dedication to wisdom and self-improvement).

Human-Centred Design – Crafting a deep care for human values

Innovators with the Design·AI Edge have a deep capacity for Human-Centred Design. This capacity is built from two interlocking human endeavours.

The first is that innovators must be human-centred. They interact with humans and use their hearts and



Design·AI can counter the fears and risks created by the rapid advancement of AI.

heads to empathise, understand and translate human values into designs that humans value.

The Humanities, Arts and Social Sciences are allies and assets in this. These disciplines help uncover the 'sources of truth' regarding why humans live their lives the way they do, and when and how they change.

All these – interacting, empathising, understanding, having heart and head, and sensing change – must be lived. They cannot be AI-generated. They are what give such innovators an edge.

The second human endeavour is Design. Design is a human endeavour, too, because like in the first endeavour, innovators must use both head and heart, as they interact with users, ignite ideas with teammates and iterate with both.

Moreover, through Design, innovators often make with their hands. Doing so is cognitive strengthening, because the "hand is the cutting edge of the mind" (Bronowski, 1973).

This is the case even when some of the AI is deskilling – any loss is more than offset by the depth and breadth of how innovators create, design and make, with a range of AI.

There is more. Recent research indicates integrating Gen AI into design thinking strengthens higher order learning outcomes, through complex problem-solving, critical thinking and iterative innovation (see References). Design is empowered by AI, instead of being disrupted by it.

Design Innovators – Making an impact on the economy and society

Innovators with the Design·AI Edge make an impact on the economy and society. They make an impact by marshalling networks and resources to market, fundraise and distribute locally, regionally and globally.

Like in Human-Centred Design, they must work with head and heart, as they interact with users, ignite ideas with teammates and iterate with both.

All these strengthen skills and resilience.

Moreover, when innovators make an impact on people's lives, they will always be relevant and in demand. That strengthens them further.

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How Infineon is turning Singapore into a global AI innovation hub

R&D, AI and Machine Learning are enabling the company to be a leader in digital transformation.

Over the past five years, Infineon's ARISE programme has redefined the company's path towards innovation and digital transformation. Anchored in Singapore, 'ARISE: Augment, Reskill, Implement, Share, and Expand' has been the driving force behind Infineon's ambition to become a global AI innovation hub. The innovative programme fosters a collaborative environment where AI enthusiasts across the company can come together to accelerate their learning and innovation.

To date, ARISE has upskilled over 1,000 employees and launched more than 25 AI-enabled projects across the value chain. This has allowed Infineon to embed AI into every facet of its operations, from smart manufacturing to advanced product development. ARISE has enabled Infineon not only to adapt but to lead in a rapidly changing digital landscape.

For example, Infineon's Singapore Backend team has been harnessing domain expert knowledge and incorporating it into a Large Language Model (LLM) knowledge base. This initiative aims to provide technicians with 24/7 access to data-driven insights and direct guidance, facilitating quicker resolutions to equipment problems.

Additionally, the project encourages technicians to engage in self-learning, by posing interactive questions. By implementing this application, the project team has been able to enhance the Overall Equipment Efficiency (OEE) of test equipment, by minimising downtime and allowing technicians to focus on more value-added tasks.

An R&D project team within Infineon has also built an advanced AI and Machine Learning recommendation and prediction model, to streamline the referencing process through a single tool, which significantly improves R&D efficiency. The model not only allows for rapid identification of comparable products and package attributes but also broadens coverage across various products, thereby enhancing the overall development process.

Infineon's ARISE programme fosters a collaborative environment where AI enthusiasts across the company can come together to accelerate their learning and innovation.

The model supports a wide range of package platforms and variants, yielding a 20% to 40% reduction in project validation time. Ultimately, it has helped to accelerate development timelines, reduce costs and improve product alignment with market needs.

Beyond manufacturing and R&D, AI and Machine Learning is also making an impact in non-engineering areas such as Finance. Infineon's Asia Pacific Finance Team recently partnered with academia to develop a hybrid approach that combines the speed and analytical capabilities of ML with human expertise, enabling faster, more accurate forecasts.

The ML solution focuses on aggregated-level forecasting, allowing predictions for total cluster costs and key business units, without needing detailed data. The team now has the capability to generate forecasts in minutes, empowering controllers to simulate changes in cost drivers and quickly assess impacts, thus facilitating informed decision-making.

Through ARISE, Infineon has fostered a culture of continuous learning and digital growth, collaborating with leading institutions and start-ups to strengthen the AI ecosystem. Strategic investments in infrastructure and partnerships have also accelerated the adoption of cutting-edge technologies, enabling solutions that make life easier, safer and greener.

Looking ahead, Infineon's commitment to ecosystem collaboration and talent development ensures it remains at the forefront of technological transformation, shaping a sustainable and innovative future. This dynamic evolution positions Infineon to stay updated and thrive in the era of AI transformation.

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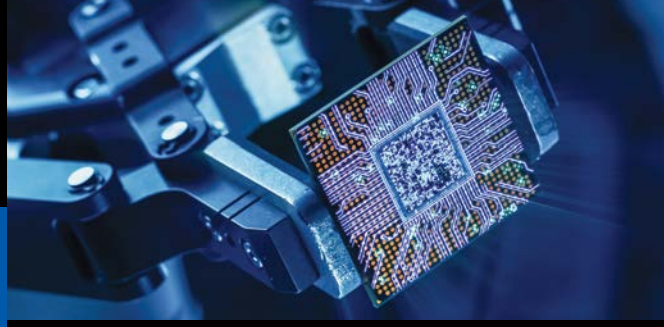

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As semiconductor demand soars, SIT's Applied Learning closes the talent gap

SIT's 'Machine Learning and AI Data Analytics for the Semiconductor Industry' course is helping professionals like Cecilia Lim drive innovation in the manufacturing process.

When Ms Cecilia Lim used AI-powered tools in her engineering role, she could operate them effectively but felt like she was only seeing half the picture.

"I often found myself wanting to understand how the tools worked, what algorithms powered them, how models were trained, and how to interpret their output more critically," said the 32-year-old Process Support Engineer at Applied Materials (Applied), which makes the equipment used to manufacture computer chips.

In 2024, she enrolled in SIT's 'Machine Learning and AI Data Analytics for the Semiconductor Industry' course through her employer, to become more adept at using AI to predict production yields and assess anomalies.

Applied Materials engineers from SIT's 'Machine Learning and AI Data Analytics for the Semiconductor Industry' course with A/Prof Zhou Junhong from SIT (first row, second from right). Image: SIT.

SIT's 'Machine Learning and AI Data Analytics for the Semiconductor Industry' course Graduation Ceremony for the inaugural batch of Applied Materials learners in 2025. Image: SIT.

Real problems, real solutions

With the dramatic rise in the number of connected devices in semiconductor manufacturing, engineers are expected not only to operate AI-driven systems but to understand and improve them. SIT's course was launched in 2024 to meet this critical need, targeting semiconductor professionals such as engineers, process managers and equipment designers.

Spanning 13 sessions over 11 weeks, the course blends fundamental data science concepts with hands-on application using Python – all contextualised within the semiconductor industry. Learners tackle actual problems their companies face, using real production data and presenting solutions to management.

"The course was thoughtfully designed. It offered a flexible pace, modular content and practical assignments that aligned well with real-world applications. It gave me the confidence to contribute more proactively to data-driven projects. I now approach problems with a more structured, analytical mindset," said Ms Lim, who completed eight hours of coursework a week on top of her full-time job.

In the semiconductor industry, where precision, speed and complexity converge, skilled talent like Ms Lim is increasingly in demand. With the sector projected to reach USD 1 trillion in sales by 2030 [1], pressure is mounting to produce next-generation, energy-efficient chips that power technologies like electric vehicles, AI and clean energy systems. However, a gap in talent adept in skills like AI and data analytics poses a significant challenge to sustaining this momentum.

"To stay ahead, we need to adopt new technologies faster than our competitors, and that requires engineers who are not only technically competent, but also digitally savvy," said Mr Tan Way Tat, Ms Lim's supervisor at Applied Materials.

"While we can hire externally, developing our existing talent ensures quicker integration, stronger engagement and long-term continuity," he added.

Ready to drive change

Ms Lim, who has a Bachelor's degree in Materials Engineering, said SIT's course gave her a solid grounding in methods such as regression models and decision

trees. This helped her use data to make the manufacturing process, from process optimisation to defect classification and yield prediction, more efficient.

Since completing the course in July 2024, she has been involved in predictive modelling and data visualisation projects, at Applied. She also helped drive digital transformation through its AIx initiative that uses AI to accelerate manufacturing insights and decision-making.

"Cecilia now contributes beyond her original role – she brings a data-driven lens to problem solving and confidently applies machine learning models to real-world challenges," observed Mr Tan.

Ms Lim's success story is not unique. She is one of 40 Applied Materials engineers who have benefitted from SIT's course, which has spawned 11 innovative projects across five business units in the company so far.

Encouraged by the tangible outcomes, Applied has enrolled a third cohort of 23 engineers for training, while chipmaker STMicroelectronics has also partnered with SIT to train 18 members of its quality control department.

"Upskilling is not just important, it is essential. Our engineers already possess deep process knowledge, and when combined with AI and machine learning capabilities, they become powerful drivers of innovation," said Mr Tan.

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'Machine Learning and AI Data Analytics for the Semiconductor Industry' course

ABOUT THE COURSE

Semiconductor manufacturing poses intricate challenges stemming from its complex processes, machinery and parameters.

Manufacturing companies often struggle with the early detection of anomalies and optimising process parameters due to the high costs associated with traditional methods like Design of Experiment (DOE).

Additionally, inadequate machine maintenance can lead to quality issues and financial losses, exacerbated by existing maintenance routines that may not effectively prevent breakdowns. To address these challenges, the semiconductor manufacturing sector requires Artificial Intelligence (AI) driven solutions.

This course is designed to empower industry professionals with advanced data analytics methodologies in AI and Machine Learning (ML). Through a combination of theoretical exploration, relevant case studies, and hands-on Python programming sessions, learners will develop a deep understanding of AI technologies and their application in semiconductor manufacturing.

By delving into real semiconductor data examples and utilising sample code, learners will gain practical experience in AI data analytics, enabling them to identify and address areas for improvement within their industries. Whether it is enhancing defect detection, optimising process parameters, or implementing predictive maintenance systems, this course equips learners with the tools and knowledge needed to drive meaningful change.

WHO SHOULD ATTEND

Professionals in the semiconductor manufacturing industry, including:

- Engineers
- Process, maintenance, and project managers
- Equipment designers and builders
- Professionals involved in the manufacturing process, quality control, and equipment maintenance

PREREQUISITES

- Learners must have basic Python programming skills and statistical knowledge

LEARNING OUTCOMES

Understanding, processing, and cleaning the data

- Performing data cleaning and manipulation
- Understanding data using plotting tools

Compressing and selecting the data dimensions

- Analysing the correlation and identifying the major factors
- Compressing and reducing the data dimensions

Building and evaluating supervised learning models

- Using the classification models method

Building and evaluating unsupervised learning models

- Using the clustering models method

Building and evaluating neutral network models

- Using neutral network models

Applying machine learning to the applications

- Understanding machine learning and its application
- Applying the methods learned to the application and evaluating the model's performance

Empowering businesses with AI and robotics

Transformation through innovation.

Ngee Ann Polytechnic's (NP) Robotics Research & Innovation Centre (RRIC) is integrating Artificial Intelligence (AI) to assist Singapore organisations in improving operational efficiency and safety standards, in a range of environments, from construction sites to medical facilities.

Edge AI vision system for Autonomous Front-Wheel Loaders

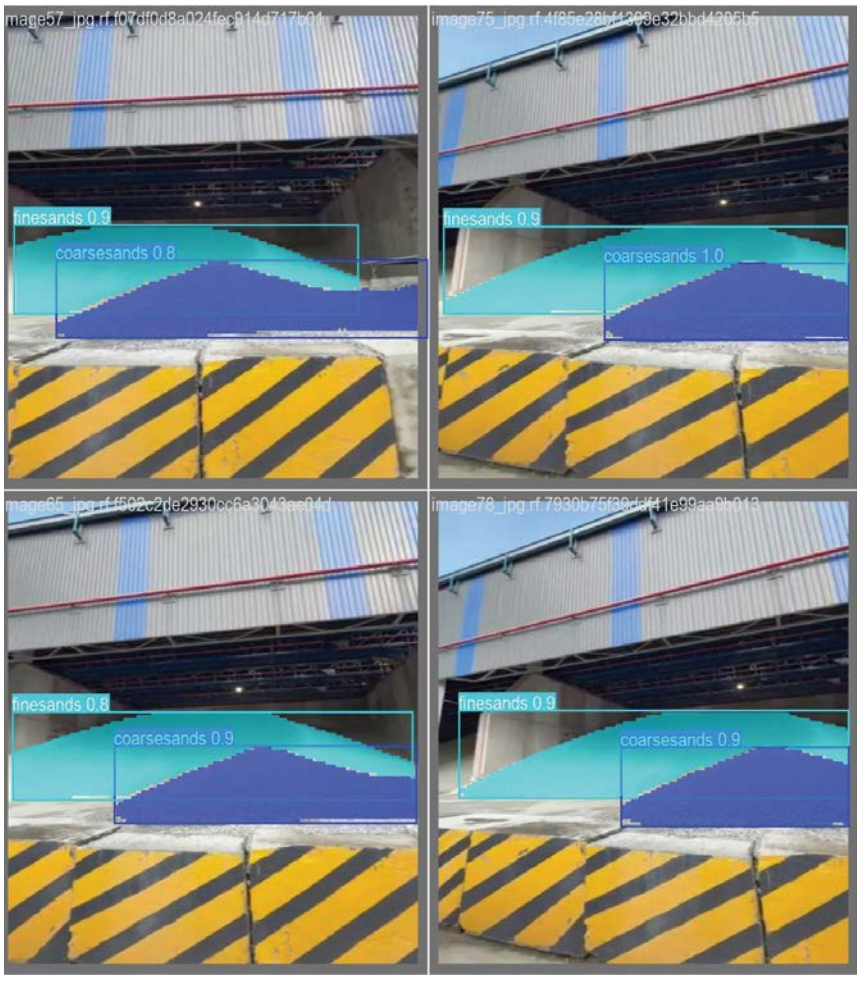
As a key member of the Centre of Innovation for Built Environment – Robotics and Automation (COI-BERA), NP is committed to promoting robotics and AI adoption in the built environment. A standout project under this initiative is the development of an Autonomous Front-Wheel Loader (AFWL) with E&T Intelligence Singapore Pte Ltd.

Designed for Island Concrete Pte Ltd, a leading building materials solutions provider, the AFWL uses an Edge AI vision system to identify coarse and fine material zones within a stockyard. By leveraging AI technologies, the vision system accurately detects these zones and guides the AFWL to load materials systematically. This ensures optimal blending, resulting in greater consistency and improved quality in concrete production.

The project, formalised in November 2024, is expected to reduce manpower needs, from multiple drivers to a single operations supervisor – enhancing both efficiency and workplace safety.

Following successful testing, the AFWL solution will be deployed at Island Concrete's latest batching plant within the Ready-Mixed Concrete (RMC) Ecosystem, a SGD 200 million shared-services hub, at Jurong Port. This marks a significant step towards autonomous construction operations.

An Autonomous Front Wheel Loader to be deployed at Island Concrete's latest batching plant within the RMC Ecosystem at Jurong Port.



AI model for detecting the zones for coarse and fine sand.

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Assisting healthcare with AI-powered slide quality checks

Beyond construction, NP's RRIC is also making waves in healthcare. In partnership with Singapore General Hospital (SGH) and Techfox Pte Ltd, NP is developing a customised AI solution to check the quality of tissue slides used in medical labs.

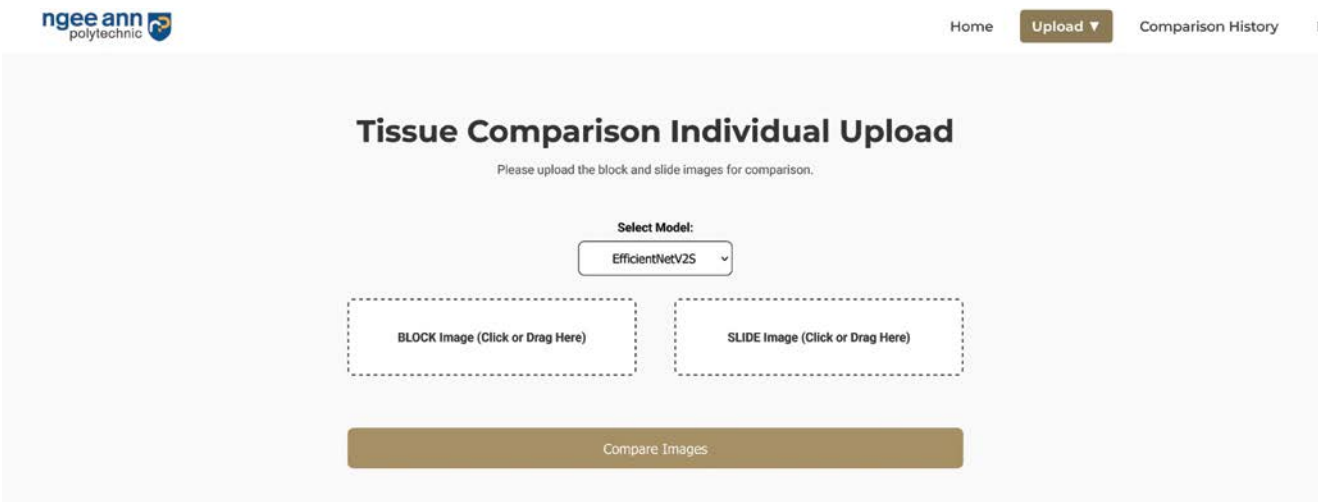
SGH's histopathology lab processes the largest volume of formalin-fixed paraffin embedded (FFPE) tissue blocks and slides in Singapore, for medical diagnosis.

Each technologist manually checks 350 to 600 block-slide pairs daily, a labour-intensive task that is prone to human error. To address this, NP has created an AI-powered software tool for reducing incomplete detection of tissue defects from slides, with promising results from the collected data.

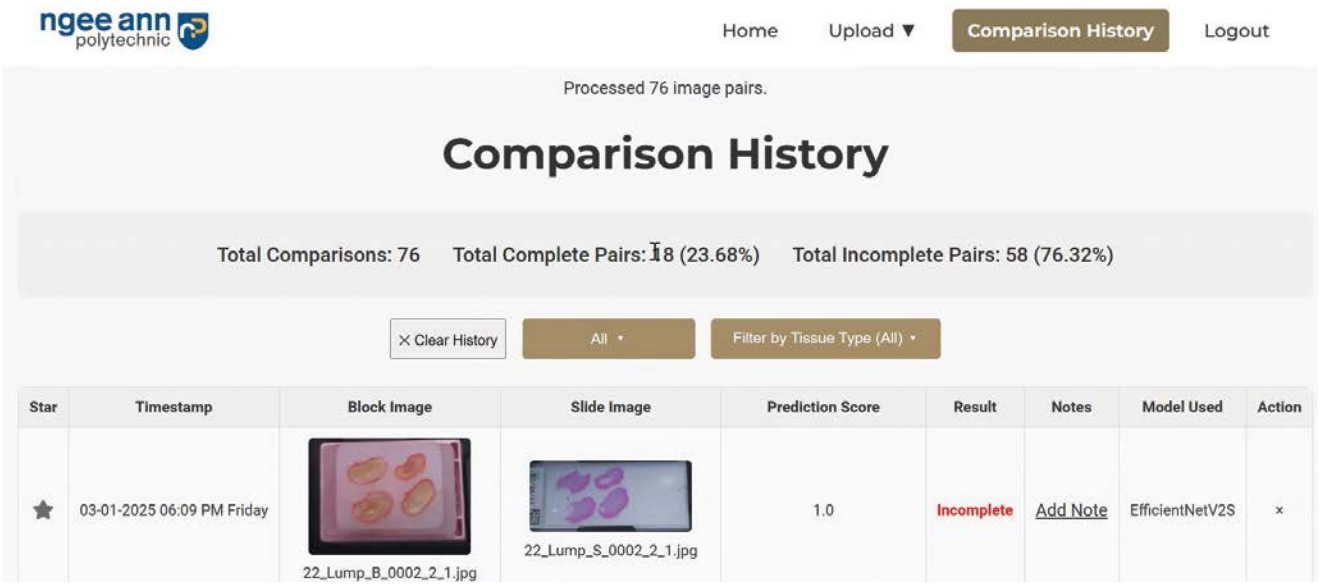
Trained and deployed on a secure web server, the AI model offers a user-friendly interface where SGH technologists can upload images for AI-assisted quality checks. The results are stored and visually presented side-by-side for quick review by doctors, streamlining diagnostics and improving reliability.

This project exemplifies RRIC's end-to-end AI capabilities – from data collection and annotation to model design, training and deployment. It also highlights the potential of embodied AI in future robotics applications, paving the way for new business opportunities in healthcare automation.

NP's RRIC is committed to forging stronger partnerships with industry through innovation and applied research. Whether it is using AI to guide heavy machinery or assist medical workflow, NP is proud to develop smarter, safer and more efficient systems to drive business transformation.



User interface for tissue comparison.



An AI-powered software tool reduces incomplete detection of tissue defects from slides.

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Formwork and scaffolding solutions for high-rise building in Vienna

Ensuring safety and efficiency on the construction site.

DC Tower 2 is growing upwards at a rapid pace, in Vienna, Austria. Having already contributed with its proven formwork and scaffolding solutions during the construction of DC Tower 1, PERI is also playing a key role in the execution of this project. With a planned total height of 174 m, DC Tower 2 will have a lasting impact on the cityscape.

Above a base section comprising catering and co-working areas, modern, flexibly configurable office space of around 980 m² per floor is being developed across 30 floors. Starting at a height of 102 m, 314 rental flats with wraparound loggias will be built, thereby adding to the high quality of life in the urban area.

A notable highlight is the sustainable facade design with integrated photovoltaic elements – a first in European high-rise construction, that will make an important contribution to the building's energy efficiency.

PERI is supporting the construction of DC Tower 2, with formwork and scaffolding solutions. Image: PERI.

PERI Systems for bespoke requirements

Proven PERI Systems were in use as early as the initial phase of the high-rise construction project. Up to the sixth floor, the building was constructed in the conventional manner, due to the solid steel components in the wing walls.

The MAXIMO Panel Formwork, the SKYDECK Panel Slab Formwork and the SRU Shaft Platform were all used.

Thanks to the easy-to-handle, lightweight system components, the walls and slabs could be formed in a straightforward, energy-saving manner, with minimal manpower requirements.

Application of PERI Climbing Systems

The RCS Rail Climbing System was installed in the core of the building for the remainder of the construction process. This facilitated an efficient 5-day cycle per floor – a decisive factor in the team's ability to meet the ambitious schedule. A concrete distributor with a radius of 36 m assisted with the continuous supply of concrete to the core, slabs and columns.

To optimise processes, the building core was divided into four work areas. The climbing formwork with enclosed concreting platform that was deployed made it possible to work safely even with reinforcement heights of over two and a half storeys.

The MAXIMO Panel Formwork, which was precisely adjusted with the aid of a carriage, ensured fast shuttering times. In addition, the RCS P Climbing Protection Panel offered comprehensive protection against fall hazards, wind and falling objects.

All climbing platforms and enclosure elements were delivered pre-assembled, in order to minimise the final assembly time on the construction site. A passenger and material lift with a load capacity of 2 tonnes was successfully deployed and enabled the transport of materials and personnel to up to six storeys.

The process of moving resources hydraulically to the next construction section went smoothly. The combined passenger and material lift is equipped with safety features such as automatic locks and ergonomic operating elements and can be easily integrated on the construction site.

Project support during construction

The modular PERI UP Scaffolding System proved to be a success. It was used for daily activities such as reinforcement, shuttering and concreting, and also impressed with its high level of safety. The seamless decking surfaces enabled work on the formwork to be carried out safely. In addition, the fall edges were safeguarded with the quick-fit PROKIT Safety System.

PROJECT CREDITS: Contractor – Porr AG Vienna, Austria. **Field Service** – PERI Austria, Nußdorf ob der Traisen.

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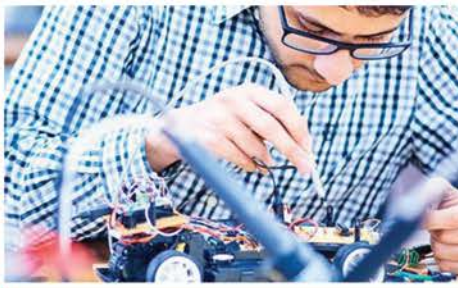

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New formwork product line launched

Doka has launched DokaFit, a new product line engineered at its Asia Innovation Hub to deliver scalable time- and cost-savings for construction projects of any size.

Designed to be truly 'fit for purpose', the DokaFit product line offers a blend of durability, cost-efficiency and multipurpose functionalities.

Manufactured in Doka's facilities in Asia, DokaFit is tailored to meet the evolving challenges of both emerging and mature markets. DokaFit products are readily available, cost-effective, and feature lightweight handling for quick assembly and disassembly.

These benefits translate to tangible results on construction sites, in terms of productivity, speed and overall project efficiency.

The DokaFit Handset offers high efficiency and is suitable for a wide range of applications, including walls, columns and foundations. The DokaFit Handset also allows for fast, crane-independent forming, reducing material requirements and leading to time- and cost-savings.

Optimised for durability, the DokaFit Prop offers easy handling and ergonomic fastening, while its price makes it suitable for small and large projects.

With the debut of the DokaFit Handset and DokaFit Prop, the DokaFit product line is now available in Asia Pacific.

The DokaFit Handset is a lightweight system with integrated ergonomic handles, designed for efficient forming. Image: Doka.

The DokaFit Prop provides a safe and cost-effective solution for durable slab formation. Image: Doka.

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