



## UPGRADING BUSY SYDNEY STATION

North Sydney Railway Station was opened in 1932 to coincide with the opening of the Sydney Harbour Bridge and the North Shore Line and is now one of Sydney's busiest stations with an estimated 54,000 passengers using the station on weekdays.

The station has not undergone any significant upgrade since the original construction and with over 17,000 passengers using the station during peak hours, the amenities could not provide a high level of service to commuters.

The North Sydney Station Upgrade Project (NSSU) was undertaken by the Transport Infrastructure Development Corporation with Bovis Lend Lease as managing contractor, incorporating responsibility for design management. The aim was to provide a larger, open-plan facility to cater for increased passenger movements while also establishing the station as a landmark building in the North Sydney CBD.

The project was designed to meet forecasted patronage and provide equitable access to all passengers and to upgrade amenities to meet

contemporary statutory and regulatory requirements. The project includes improvements such as a spacious, expanded concourse; level access from the platforms; improved amenities; enhanced safety and security systems; new fire detection and protection safety systems; new lifts and escalators; increased natural light and ventilation and 16 additional ticket barriers.

Specifically, the upgrade involved raising the platform coping edges to provide level access to trains; providing platform operation facilities; providing additional emergency egress and improving existing egress routes; providing plant and equipment and upgrading power supplies; providing staff amenities; removing retail tenancies and upgrading the the station building; upgraded passive security by increasing the number of CCTV cameras and improved sight lines; and providing baby change facilities.

Work was completed to comply with the current Building Code of Australia, RailCorp Station Guidelines for Fire and Life Safety and aspects of the Disability Discrimination Act as well as smoke management capabilities, fire engineering measures and RailCorp standards for platform heights.

In regard to sustainability, environmental products were used including recycled aggregate. Fly-ash and silica-fume were also added to the concrete and recycled steel members were used. No new PVC was installed in the plumbing. In addition, specific design assumptions were incorporated including re-use of the maximum amount of the existing structure; natural ventilation/convection for air movement instead of mechanical AC; removal of skylights to reduce heat loading; natural

ventilation/convection for smoke extraction; natural lighting via vertical windows to the north or south sides (not the east and west); measured light levels at 'human level' and not average at lower concourse; measured light levels at RailCorp reference to include white edging and tactiles; the use of 'diaphragm action' for collision loads and widening the view of the project in regard to issues such as gravity drainage.

The Bovis Lend Lease project team faced a number of significant challenges in essentially rebuilding a station while it was fully operational.

All construction activities needed to accommodate station operations and consider the neighbouring residential areas to minimise impacts on passengers and the community. The project schedule also had to take into account major events such as New Years Eve, the Sydney Harbour Bridge 75th anniversary celebrations and World Youth Day, all of which placed heavier than usual demands on North Sydney Station. The project also had to carefully manage the risk of impact to nearby heritage-listed structures.

Work was scheduled to occur when the North Shore Line was closed for track maintenance work. Intensive work was carried out on a 24-hour basis during these periods to ensure time was maximised as productively as possible.

The resulting outcome is a significant new landmark for North Sydney, including a distinctive steel structure with a reconfigured roof structure to the entire building and impressive glass façades to the north and south elevations rising to 10 metres high.

Successful management of large infrastructure projects such as the North Sydney Station Upgrade requires the experience, specialist skills and corporate commitment of a company such as Bovis Lend Lease.

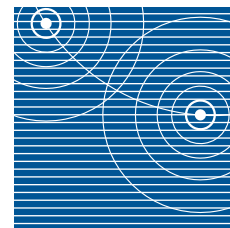
Bovis Lend Lease is one of the world's leading project management and construction companies, using industry best practices when working with clients to create high quality, sustainable property assets. It has a presence in over 30 countries, spearheaded by regional hubs in the UK, Australia and the US.

The organisation is at the forefront of project delivery with exceptional skills in construction management, project and program management, design management, design engineering, procurement and facilities management.

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## Creating a better world in which to work and live

Maunsell AECOM provided engineering and architectural design services for the upgrade of North Sydney Station, NSW.

In partnership with the Transport Infrastructure Development Corporation, the design and construction was developed to maintain daily station operations throughout the duration of the upgrade. The design solutions integrated existing station structures into the final design, and enhanced access and safety features to meet increased passenger movements.

Now providing a larger, open plan facility, the North Sydney Station Upgrade is another example of how Maunsell AECOM is creating a better world in which to work and live.

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## LAND & MARINE AT THE STATION

Land & Marine Ocean Engineering specialise in projects demanding engineering excellence, and it was their experience in detailed planning for offshore engineering works that was invaluable on the North Sydney Station Upgrade project.

For this project, Land & Marine project managed the construction of two flights of Emergency Egress Stairs, which were cut through the roof of the station.

Land & Marine utilised a number of innovative techniques to overcome the challenges on this project created by the intermittent access, close proximity of high powered electrical cabling, working with the existing structure and the limited access for heavy lifting equipment.

Fabricated steel sections were used to underpin the concrete structure of the entire span of the station and large areas of scaffolding erected extensively to enable access to the roof structure. To speed demolition works, minimise vibration and provide a precise finish, concrete wire sawing methods were used.

Scaffolding, which had to span across the railway tracks in order to allow vehicle access for other works, was constructed from the rail level to the ceiling structure to safely remove the existing concrete with the main penetration demolition carried out from above the station.

The installation of the supporting steel structure was a highly precise and complicated task. Steel beams had to be accurately measured and fabricated in a short period of time and lifting of the steelwork around the overhead power cables required specialised techniques, including cutting through the slab above.

The flights of stairs project out over the railway tracks and up through the original roof structure so precast panels for the stairs and enclosures, demanding accurate 3D modelling, were used to prevent encroachment into the rail corridor.

The Land & Marine Group provides innovative solutions to clients in a range of fields including Marine and Civil Construction, Ocean and Maritime Engineering, Research and Construction Vessel Operation and Hydrographic Surveying.

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## AQUAS MONITOR NORTH SYDNEY ENVIRONMENT

Implementing a successful Environmental Management System for a major project requires a thorough understanding of the impacts, aspects and risks that the construction activities will have on the environment then identifying and assessing control measures based on compliance with legislation, standards, codes of practice, best practice and other requirements.

Australian Quality Assurance & Superintendence Pty Limited (AQUAS) was the first quality consultant certified to ISO9001 in Australia and has extensive experience in the development and implementation of systems addressing Environmental, Quality and Safety as well as conducting compliance audits against recognised criteria.

AQUAS was engaged as the Environmental Management Representative (EMR) for the North Sydney Station Upgrade project, which was the fourth such project undertaken by the company having been involved in the Parramatta Interchange, Chatswood Interchange and the Homebush-Lidcombe Turnback projects.

As defined in the Conditions of Planning Approval (CoA), the North Sydney project required AQUAS to consider and advise TIDC on matters relevant to the environmental management of the project, review, approve and monitor the site induction and training program,

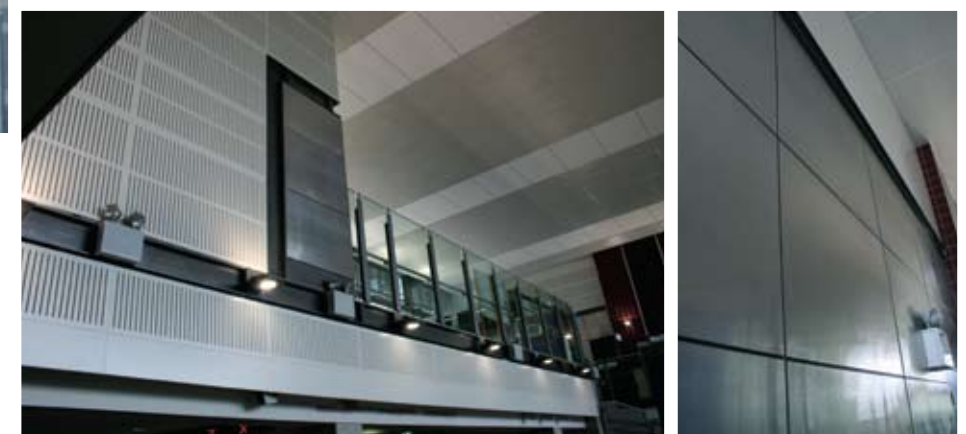
conduct periodic inspections, endorse the Contractors' Environmental Management Plan and Environmental Control Maps, and Provide TIDC with the relevant reports and recommendations.

The major challenge was to strike a balance between the project needs and the compliance requirements of the CoA. Adopting a cooperative approach, AQUAS worked closely with the Contractor to ensure that they acknowledged the need for environmental controls and developed suitable processes to comply with the contract requirements especially in regard to nominated work hours which was a major issue on this project, with much of the work having to be carried out on weekends and evenings.

From their initial involvement in the construction of Sydney's Parallel Runway Project, AQUAS has grown in size and capability and now provides a range of consulting services to property developers, contractors, architects and engineers, project managers, manufacturers, telecommunication firms, defence organisations, state government agencies, and local governments on a national basis.

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## CLASSY CLADDING



North Sydney railway station has undergone a major revamp resulting in a more contemporary feel, much better ventilation and natural lighting and a larger upper and lower concourse to ease crowding. All this was achieved on a site where more than 17,000 people stream through within each two hour peak period. Not all of the works could be carried out safely until after hours, and space restrictions mean that most components were prefabricated off-site.

Dunrite Linings won the sub-contract for the internal and external linings on this project. A variety of materials were specified, including perforated min-orb (Colorbond steel); timber (Superwood); aluminium composite (Alpollic) and stainless steel cladding; compressed fibre cement and fire-rated plasterboard; each one requiring a different skill-set for design, fabrication and installation.

Dunrite's work started with a three week burst in November 2007, followed by a six week burst starting mid January 2008, and has continued to ramp upwards ever since. The complex reached its final configuration only in October 2008, with the successful installation and commissioning of ticket gates to the lower and upper concourse levels, and Dunrite's installation of cladding to the main ceiling structure. Slava Sokolov of Dunrite Linings said that the design, manufacture and installation of the main concourse ceiling were typical of the "design

and construct" process that characterised their involvement in the whole job.

"It's a big area. It was designed, specified and measured, several months in advance for our manufacturer overseas, but once the southern glass wall had been completed, allowing us to start the ceiling structure, we found that the as-built dimensions had changed," said Slava.

"That's where our decade of practical experience really counted. It required close coordination with the site foreman and the other trades, but only if you really knew what you were doing, could you do what it takes to make it all work out in the end."



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## SAFETY IN THE STATION

With their extensive experience in government and private projects, Swetha International was contracted to provide safety staff for the North Sydney Station upgrade project.

Swetha International provided safety staff for the project to ensure that safe working procedures were in place to safeguard workers and visitors to the site.

Formed in 1997, Swetha quickly established itself as a market leader in rail work site protection and has broadened its operations to include supply of staff to a range of both public and private infrastructure projects.

Swetha ensure the best and most economical practices are implemented and in addition to supply of staff, the company provide all safe working equipment including radios, Dets, flags and motor vehicles.

In addition to providing safety personnel, Swetha also provides administration and technical services and engineering expertise to clients with both long and short term demands.

Swetha operates under an approved quality management system, paying particular attention to safety, quality and the environment and has developed binding policies to ensure workplace safety and best work practices are implemented at all times.

As proof of the company's increasing reputation for excellent service, Swetha has an outstanding list of clients which includes Abigroup, Australand, Boulderstone Hornibrook, Bovis Lend Lease, Downer, Leightons, Ansaldo, ARTC, City Rail, the Department of Commerce, Energy Australia, Kell & Rugby, Queensland Rail, RailCorp, RTA, Thiess, Transfield and Ward Civil Engineering.

Recent projects include Liverpool to Ashfield Pipeline, Parramatta Rail Link, K2RQ Alliance, SIA Alliance, Sydney Harbour Bridge Fencing, Albury-Wodonga Road Link.

Swetha operates a fair and equitable recruitment policy and ensure all employees are fully trained to carry out the required duties.

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## NEPEAN TO NORTH SYDNEY ON TRACK

The "can do" approach of a highly skilled team, combined with the commitment to engineering excellence proven by Nepean Engineering on complex and challenging projects, were crucial in keeping the North Sydney Station Upgrade (NSSU) project on track to its successful completion.

A founding member of Nepean Group, Australia's leading privately owned, specialised engineering and industrial manufacturing group, Nepean Engineering is one of Australia's largest full service engineering businesses, providing sophisticated custom design, fabrication and erection services and all facets of machining and tool making.

Nepean Engineering was contracted by Bovis Lend Lease for fabrication and installation of 220 tonnes of structural steel on the landmark NSSU project. The scope of the works involved the new roof, two new lift shafts, mezzanine floors, awnings on Blue Street and Platform No. 4.

The new structural steel roof was designed over the existing concourse with 4 main portal frames of 37.5m. Nepean Engineering supplied all the rafters, 37.5 m long and approximately 8 tonne each, assembling them on site on Blue Street, before they were lifted into position by crane. The roof steelworks of approximately 70 tonnes were installed over two weekends.

The station remained operational throughout the project, creating major challenges for contractors and its successful completion is further proof that Nepean Engineering has the skills, equipment, people and experience to successfully complete large scale construction projects. Recent major fabrication and erection projects also include Deutsche Bank Place Sydney and Goro Nickel-Vale Inco's thickeners for the new US\$3.2b Nickel mine in New Caledonia.

Nepean's 40,000 m<sup>2</sup> manufacturing facility on the south-west fringe of Sydney, includes large fabrication workshops enabling them to provide a range of services including construction and design engineering, structural steel, plate and sheet metal fabrication, laser cutting, painting and blasting surface treatment, structural rigging services, site erection and labour, crane and boom lift hire as well as service and maintenance. Soon to be installed is a state of the art Daito Seiki beam profiling line.

The Nepean Group operates in a diverse range of international markets in the USA, Canada, Europe, Middle East, Africa, Asia and Australia manufacturing and marketing products to customers in the mining, manufacturing, transport, aviation, agriculture, residential, commercial and industrial construction, and food production sectors.

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