

# Victoria

*a world of experience*

# in light rail



State Government  
of Victoria  
Australia



Cover: A successful test run for the state-of-the-art vehicle developed in Victoria for the Sydney light-rail system.

# A message from the Minister

Victorian industry's success in designing and building light-rail systems for international markets hasn't happened overnight.

Victorian companies have been designing, building and operating light-rail systems for over a century. Victoria's capital, Melbourne, has one of the largest light-rail networks in the world.

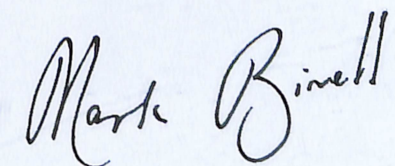
Underpinning the State's ability to design and produce world-class light-rail products is the fact that Victoria is Australia's manufacturing centre. Victoria is also Australia's leading location for industry-based research and development. This is why Victorian-based and -trained consulting engineers are already working throughout Asia on rail projects and why Victorian manufacturers are supplying trams for cities such as Hong Kong and Sydney.

Our capabilities are also reflected in other Victorian successes, including the export of railway engines to India, passenger carriages to America and signalling systems to Indonesia, Thailand and Taiwan. However, there is still enormous scope to gain further benefits from this important sector of manufacturing industry.

The Victorian Government, through its investment attraction and industry development agency, Business Victoria, is committed to helping to establish Victoria as the Australasian centre for excellence in light-rail technology, and the preferred source of light-rail solutions for modern cities throughout Asia.

The production of this capability guide, *Victoria—A World of Experience in Light Rail*, is one of the many initiatives we are supporting to promote the industry.

I recommend it to you as an excellent introduction to Victoria and our industry's ability to deliver the right solution for your light-rail requirements.



Hon. Mark Birrell, MP  
Minister for Industry, Science  
& Technology

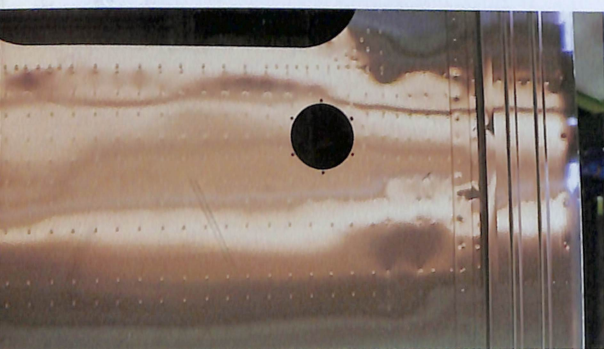






# A strong *industrial base*

Victoria is the logical first stop for light-rail authorities and operators looking for state-of-the-art technology, superb engineering, competitive prices and reliable delivery.



Victoria is the hub of Australia's transport, engineering and manufacturing sectors. It is also the country's primary centre for research and development. Its capital, Melbourne, has the largest light-rail system outside Europe. Put these ingredients together, and you have the most advanced light-rail industry capability in the Asia-Pacific.

The Victorian Government is committed to helping manu-

facturing industry grow and to establishing Victoria as the Australian centre for excellence in light-rail technology.

The Victorian Government is aware that transport infrastructure is being given a higher priority throughout Asia as economies mature and populations urbanise. This creates enormous scope for partnerships between Victorian firms and transport authorities and operators throughout the region.

The Victorian Government's export efforts are focused squarely on Asia, from the UAE to Korea (it has business offices in Dubai and Seoul, as well as in Hong Kong, Jakarta and Tokyo). Victorian light-rail companies have delivered systems and components to major cities like Hong Kong, Kuala Lumpur, Manila and Bangkok, as well as to centres in Sri Lanka, Indonesia, Thailand and Taiwan.

Victorian light-rail companies have had considerable success overseas, with significant sales to Canada, the USA and other countries. Some are even making an impression on the tough European market, as evidenced by the choice of Victorian track components for the London Underground.

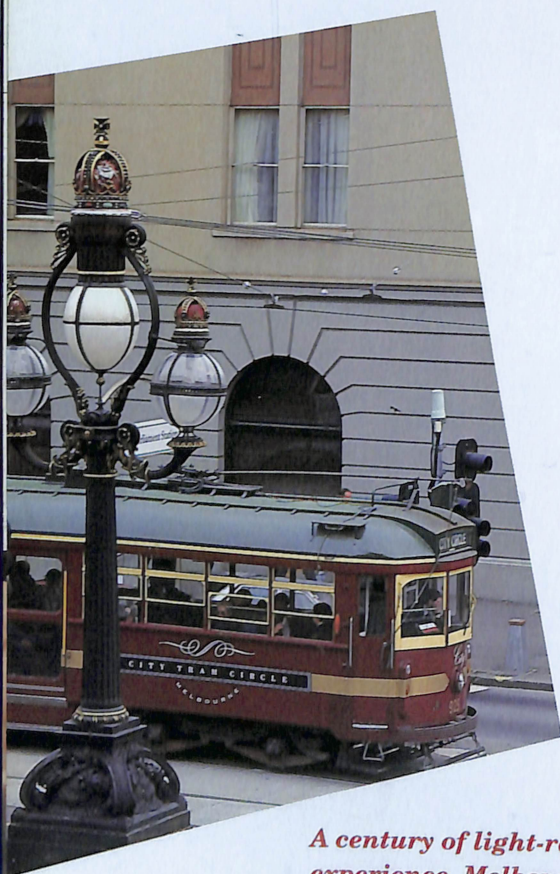




# Light-rail

## *solutions for modern cities*

Victoria and its light-rail industry are keen to share their experience and know-how. Victoria's commitment to light rail as a mass transit option has given rise to a strong and vibrant light-rail industry.



*A century of light-rail experience. Melbourne's historic W-Class trams are still used for tourist services on the City Circle and to inner suburban beaches.*

While the industry initially developed to support the vast Melbourne system, it now sells its products and services to light-rail operators around the world.

In the past, Australia's distance from European suppliers, and the relatively small size of the domestic market, meant that engineering firms had to be flexible, self-reliant and innovative to survive. Today, this has translated into a capacity to combine leading-edge technology and components from all over the world with local ingenuity to produce cost-competitive, tailored solutions.

The origins of the Melbourne system can be traced back to the nineteenth century, when cable cars and electric trams were introduced to keep the city's rapidly growing popula-

tion on the move. The system has come a long way since then. It now comprises 240 kilometres of track and 650 vehicles. They carry more than 100 million passengers and travel more than 24 million kilometres annually. The track network continues to expand, with radial extensions into new suburbs.

Victoria's light-rail industry currently consists of more than sixty local and international firms. Individually, they can be called on to handle almost any specialised task. Together, they command all the resources needed to plan, design, build, commission, operate, maintain and refurbish a complete light-rail system.

Many of the elements that go into a modern light-rail system are produced locally to the highest international



*Trams for Hong Kong.*

standards. More importantly, Victoria has the expertise to put solutions together based on the best the world has to offer. The reality is that no single source can supply every component of a light-rail system. The art is in knowing what to look for, where to look, and how to integrate what you find.

Victoria has mastered that art. Its light-rail industry is closely integrated and fully competitive with its counterparts around the globe. International firms work side-by-side with local companies to produce benchmark outcomes—whether they are creating a single component or a complete turnkey system. For example, a vehicle manufacturer may source bogies from one supplier, traction systems from another, body-work from a third.

### ON THE GROUND

#### **Hong Kong comes back for more**

Perhaps the best example of Victoria's capabilities is its successful delivery of the Tuen Mun light-rail system in Hong Kong. This was a turnkey project, complete and ready to operate at handover.

The system was developed by a Victorian consortium led by the vehicle manufacturer Comeng (now absorbed into ADtranz), the construction company Leighton Holdings, and the Melbourne and Metropolitan Tramways Board, which then operated Melbourne's light-rail system.

The Victorian consortium provided everything—track, electricals, vehicles and operating systems—for what has become one of the world's

busiest light-rail systems, with 30 vehicles carrying 2.5 million passengers each week on 70 kilometres of track.

Tuen Mun has been extended twice, most recently by another Victorian consortium, this time led by A. Goninan & Co Ltd. This again brought a range of Victorian firms together to meet Hong Kong's exacting requirements in relation to quality, fire resistance, passenger loads and reliability.

Tuen Mun confirmed the Victorian light-rail industry's reputation for delivering world-class systems at world-competitive prices—and for being able to work efficiently against the tightest of deadlines.





# Feasibility *planning and design*

Transport professionals play a vital role in planning, building and running light-rail systems, and Victoria's light-rail know-how and experience makes it the obvious place to come for professional services.

Victorian companies are highly qualified not only in engineering, but also in finance, law, marketing and all the other disciplines required for a significant light-rail undertaking.

These services cost significantly less in Melbourne than they do elsewhere. For exam-

ple, consultant engineering costs are lower in Melbourne than in Los Angeles, Shanghai and Singapore. Accounting advisory services cost around twice as much in Guangzhou, Hong Kong, Los Angeles and Osaka as they do in Melbourne. They also cost more in Jakarta, Shanghai, Singapore and Stuttgart.

Victoria's transport professionals can act as advisers, agents, supervisors, team leaders and project managers. They can undertake feasibility studies, transport and land-use planning, route surveys, detailed design, quantity surveys, financial analysis, computer simulations, signal planning and supervision, benchmark-

ing studies, maintenance reviews and operational monitoring. They can offer specialist advice on passenger reservation systems, information technology and more.

Victorian-based professionals are ideally placed to represent transport authorities and operators in their dealings with manufacturers and suppliers in Victoria and elsewhere in Australia.

## ON THE GROUND

### Good ideas and sound advice

Victorian transport professionals are increasingly in demand throughout Asia.

For example, Connell Wagner, one of Australia's largest engineering and management consultants, has its head office in Melbourne. The firm's recent overseas work includes the preliminary design for a triple-decker light-rail and freeway project in Jakarta and masterplanning and detailed design for a 15 kilometre elevated light-rail link feeding into the metro line at Xinzhuang in Shanghai. Connell Wagner has also been busy in Thailand, where its credits include the design and installation of railway signalling in Bangkok and route selection, operation planning and detailed design for a 25 kilometre freight and passenger railway between Map Ta Phut and Rayong.

Another example is the Melbourne-based rail specialist Asia Pacific Rail Pty Ltd. APR acted as technical adviser to Manila's Northrail on the proposed high-speed light-rail service from Manila to Clark Air Base, which is to be developed as Manila's new international airport. The firm set technical standards for the project and undertook the feasibility studies and economic appraisals Northrail needed to secure international finance. Asia Pacific Rail provided advice on everything from how best to relocate and rehouse 25,000 squatter families to the design of vehicles, stations and workshops. They dealt with route selection, infrastructure maintenance issues and the appointment of management support staff.





# Financing *and operating models*

Victorian firms recognise that the private sector's role in infrastructure provision is no longer simply to deliver the project, but to accept a share of the risk before it begins and a share of the management after it is complete.

They understand that new light-rail projects are no exception. Over the past five years, Victoria has led Australia—and sometimes the world—in developing innovative infrastructure provision based on private sector participation. For example, the Melbourne City Link—the largest infrastructure project currently under way in Australia—is being paid for in full by private investors under a build-own-operate-transfer agreement with the Victorian Government. City Link is being studied closely as a potential model for BOOT projects throughout the APEC region.

Victorian prisons, hospitals and the new Docklands Stadium are all being built and operated on a commercial basis by the private sector. The State Electricity Commission has been priva-

tised, and other utilities will follow. Several heavy-rail services have been taken over by private operators and the State's mass transit authority has been corporatised in preparation for its eventual privatisation.

Victoria's impressive professional and trade expertise in light-rail operations is already widely distributed across the public and private sectors. With privatisation of the Melbourne system imminent and export markets assuming ever greater importance, the light-rail industry has been quick to extend its focus from simply building systems to running them as well. Victorian firms can take hands-on responsibility for day-to-day operations. They can also train local personnel for key roles in conjunction with Victoria's industry-oriented training sector.

The larger Victorian light-rail firms have worldwide experience, and they are accustomed to dealing with international financial organisations. They have the financial backing to enter into large-scale joint ventures with other companies and public authorities here and overseas.

Melbourne is a major financial centre, and Melbourne-based banks account for 33 per cent of Australia's savings and trading operations. Altogether, 16 Australian and 18 foreign-owned banks operate in Melbourne. They handle commercial loans and leasing, corporate and property finance, money market dealings and foreign exchange. Melbourne stockbrokers account for more than half of all capital raisings on the Australian Stock Exchange.





# Vehicle manufacturing

Vehicle manufacture is the cornerstone of the Victorian light-rail industry.



*Victoria's light-rail sector has also proven itself in heavy-rail, supplying locomotives to Indian Railways and passenger carriages to the South Eastern Pennsylvania Transit Authority.*

Victorian firms are not only building trams for Sydney and Hong Kong, but also railway engines for India and passenger carriages for America.

A major player like ADtranz—a new group uniting the rail transport arms of ASEA Brown Boveri and Daimler-Benz—can draw on years of experience in Victoria as well as the global resources of its parent companies. ADtranz inherits the expertise of Comeng, which built most of Melbourne's modern light-rail fleet (Comeng was acquired by ABB before the inception of ADtranz in 1996).

Other important manufacturers include A. Goninan & Co Ltd. Long considered one of Australia's leading manufacturers of heavy-rail locomotives and rolling stock, Goninan & Co has more

recently turned its attention to diesel passenger rail cars, developing a significant light-rail manufacturing capability. It built the latest additions to Hong Kong's vehicle fleet.

Victoria's light-rail vehicle makers are particularly strong in two areas:

- ▶ **Quality components.** Many smaller Victorian firms specialise in applying advanced technologies to the production of specific components, from brake linings to fibreglass mouldings to pantographs.
- ▶ **Tailored engineering.** Australia is a country of vast distances and small markets. This has made our manufacturers extremely adaptable and cost-conscious. The Victoria light-rail industry's flexible manufacturing capacity has made it just as adept at designing and constructing complete light-rail systems as at handling small, specialised tasks.



## ON THE GROUND 1

### Leading-edge vehicle design

Two recent vehicle design and construction projects demonstrate Victoria's capabilities in this exacting field.

The state-of-the-art vehicles used in Sydney's new light-rail system were developed in Victoria by ADtranz using a mixture of locally and globally sourced components. The company's brief was to produce a vehicle that was fast, reliable, energy-efficient, quiet and attractive to users. They achieved all that and more.

The final design is wide and low for maximum passenger comfort. Wider seats and aisles eliminate push and shove, while the low floor makes the vehicles more accessible—not least to people with disabilities, the elderly, and passengers with luggage, parcels, prams and bicycles.

Greater accessibility means that people can get on and off the vehicle quicker, making for shorter stops, faster journeys and lower operating costs.

The low floor is made possible by mounting each of the vehicle's three-phase AC traction motors directly inside the wheel it drives. The high-tech drive system used in the Sydney light-rail vehicle consumes less energy and requires less maintenance than conventional alternatives.

The drive system, and all of the vehicle's other systems, are controlled by an onboard computer which constantly analyses their operating status and provides feedback to the driver in real time.

While the Sydney light-rail system is brand-new, parts of Hong Kong's Tuen Mun light rail date back to 1988. When A. Goninan & Co were asked to produce 20 new vehicles for Tuen Mun, their challenge was to come up with a design that incorporated the latest technologies while remaining fully interoperable with the existing system. Goninan's ability to get the balance right has allowed the Hong Kong authorities to upgrade their system while retaining total operational flexibility.

The Victorian firm looked at all of the existing conditions

in Tuen Mun and developed a response to each one. For example, while today's most advanced drive systems use AC, Tuen Mun's overhead lines carry DC. Goninan's solution was to employ a system that drew DC from the existing power supply and converted it to AC onboard.

Tuen Mun is a platform-loading system in which the vehicles run in a continuous loop. Given these parameters, Goninan was able to reduce costs by developing a design with a driver's cabin at only one end of the vehicle and doors on only one side. The same responsiveness can be seen in even the smallest details. Thus, the vehicle's exterior colours are applied using long-lasting, easy-to-replace plastic decals, which are much better suited to Hong Kong's climate than paint.

Victoria's latest Tuen Mun light-rail vehicle takes the best solutions available and adapts them to a specific operating environment. It is a perfect example of appropriate technology.



*The Sydney light-rail vehicle in operation and under construction.*





*Light-rail door systems. Assembling the control mechanism (top), pressing the panels (above), and testing the system to the limit (below)—this door has been opened and closed 3,000,000 times and it's still going strong.*

## ON THE GROUND 2

### Opening doors all over the world

Sab Wabco Pty Ltd does one thing, and does it better than just about anyone else in the world, and that's make door and window systems for mass transit vehicles.

Sab Wabco's door systems are pneumatically or electrically operated and computer-controlled. They use a fully programmable microprocessor designed and built by the company itself. This allows both integration with train management systems and millimetre-accurate control. Aluminium honeycomb door panels are constructed to complex specifications and

exacting tolerances using techniques developed for the aerospace industry.

Sab Wabco's systems are used by rail operators in Ireland and Denmark, in European cities like Zurich and Lille, Asian cities like Hong Kong, Jakarta and Kuala Lumpur, and North American cities like Portland and San Francisco. The company's products have also found their way into Korean vehicles destined for the Philippines and Turkey, French vehicles destined for Eire, Chinese vehicles destined for Afghanistan and Japanese vehicles destined for China. It shows what a small company with a commitment to quality and a global outlook can achieve.



# Track infrastructure

Victorian firms manufacture high-quality track systems for all forms of rail transport. They also design, supply, construct and maintain all of the ancillary infrastructure needed to support a light-rail service—from electrification systems to passenger amenities.

Victoria's rail and track production infrastructure includes world-class casting and engineering capabilities. Victoria can supply track assemblies (welded or bolted); rail fastening systems; vibration damping systems; complex switches, points, crossings, turnouts and

crossovers—even plate-laying and rail-handling tools. Tracks can be supplied in standard rail steel or specially hardened grades for extra load-bearing and durability. Victoria has also developed ground-breaking manganese casting techniques to produce long-lasting, easy-to-install and cost-effective manganese-

steel light-rail fittings. Other leading-edge technologies pioneered by the Victorian industry include computer modelling to assess the effect of different track configurations on bogies, and ultrasonic stress testing.

International customers include Canada, Indonesia and Thailand.



# Electrical and electronic systems

Light-rail depends on reliable, high-performance electrical systems.



*Trackwork being manufactured in Melbourne and (previous page) installed on the corner of College and Bathurst Streets in Toronto.*

## ON THE GROUND

### Melbourne puts Toronto on the right track

The Toronto Transit Commission has a lot to think about when it plans light-rail track maintenance and construction—how to minimise disruption, how to fit in with what other agencies are doing and how to get everything finished between March and November—before the city's sub-zero winter sets in. The job isn't made any easier when suppliers fail to meet delivery deadlines—something that happened all too often before 1992.

That was the year the TTC first turned to Melbourne's TKL Rail, an international pacesetter in trackwork engineering. The initial order was small, but the Canadians were impressed with TKL's quality and reliability. Over the next three years, the Victorian firm picked up an impressive amount of work through the TTC's annual tender process.

However, not all of the TTC's contractors were as conscientious as TKL, and in 1996 the commission decided that what it really wanted was a long-term relationship with one proven supplier. It invited tenders for the supply of almost 1,000 manganese-steel

switches, mates and frogs (points and crossings) between 1997 and 2001. There were four bids—two from North America, one from the United Kingdom and one from TKL Rail in Victoria. The Toronto Transit Commission had worked with all of the bidders before. It chose TKL.

The secret of TKL's success? Value for money. That doesn't necessarily mean TKL Rail submitted the lowest bid. Just a bid that promised a quality product, technical proficiency, a history of on-time delivery, a commitment to customer service, experienced personnel, financial stability, flexible plant capacity—and a competitive bottom line.

That dependence now extends to sophisticated electronic systems, which are used to automate operations and contain costs.

Victorian firms have supplied transmission equipment and related electrical components to Malaysia, the Philippines and other markets in Asia and beyond.

The Victorian light-rail sector has proven equally adept in designing systems and fabricating equipment.

Victoria is the centre of Australia's IT&T industry, and the light-rail industry has been one of the first to recognise the potential of the new digital technologies. Simoco Pacific Pty Ltd is one example. The company has moved far beyond its original focus on radio, and now produces global positioning systems that enable operators to track their vehicle fleet in real time. Victorian firms also provide software solutions for system control and integration, asset management and communications.

From a single telemetry module to a complete, ready-to-run control-room environment, Victorian firms have the solution. Products include distributed and cen-

tralised control systems, signalling equipment, mimic panels, test equipment, power supplies and power management systems, distribution panels and surge protection equipment. They can be seen in action everywhere from Indonesia, Sri Lanka, Thailand and Taiwan to New Zealand, the United Kingdom and the USA.





A complete  
overhaul for  
Melbourne's  
Z-Class fleet.



# Asset *management*

Melbourne's light-rail system has been in continuous operation for more than a century.

This has given Victorian firms plenty of time to study vehicle and infrastructure lifecycles and develop long-term asset management, maintenance and replacement strategies. These strategies can be applied to the refurbishment of legacy systems and the upkeep of new ones. The aim in both cases is to ensure that the operator gets the maximum return on its investment.

One innovative maintenance option is full service leasing, under which vehicles are

leased to the operator, but the manufacturer remains responsible for keeping them on the rails. This usually means looking after scheduled maintenance and inspections, repairs, part replacements, overhauls and any modifications required. The manufacturer may also provide back-up rolling stock to ensure that an agreed number of vehicles is always available and ready for use, even when some of the fleet is undergoing periodic maintenance. Although the full service

leasing model was first applied to vehicles, it can be adapted readily to other systems as well.

As well as providing maintenance services, Victorian firms can build specialised maintenance facilities. The stabling yard and workshop complex recently completed by Leighton Contractors in Melbourne's Southbank is one example. The PTC Trainwash Plant built by Clyde Carruthers in North Melbourne is another.

# Talk to us *about your light-rail needs*

Business Victoria is the Victorian Government agency responsible for recruiting investment and boosting exports. It can help international customers make the most of Victoria's outstanding light-rail industry capabilities by:

- ▶ providing strategic information, contacts and introductions
- ▶ coordinating government inputs

- ▶ sponsoring networks
- ▶ supporting trade fairs and trade missions (inbound and outbound).

The Victorian Government invites transport authorities and light-rail operators in the market for quality products and services to contact Business Victoria, the Australian Rail Industry Corporation, or the companies listed at the end of this booklet.





# Contacts

## Business Victoria

### Head Office

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Internet: [www.business.vic.gov.au](http://www.business.vic.gov.au)

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<i>Hong Kong, China</i> (852) 2587 1133	<i>Tokyo, Japan</i> (813) 5210 5041
<i>Jakarta, Indonesia</i> (6221) 570 7209	

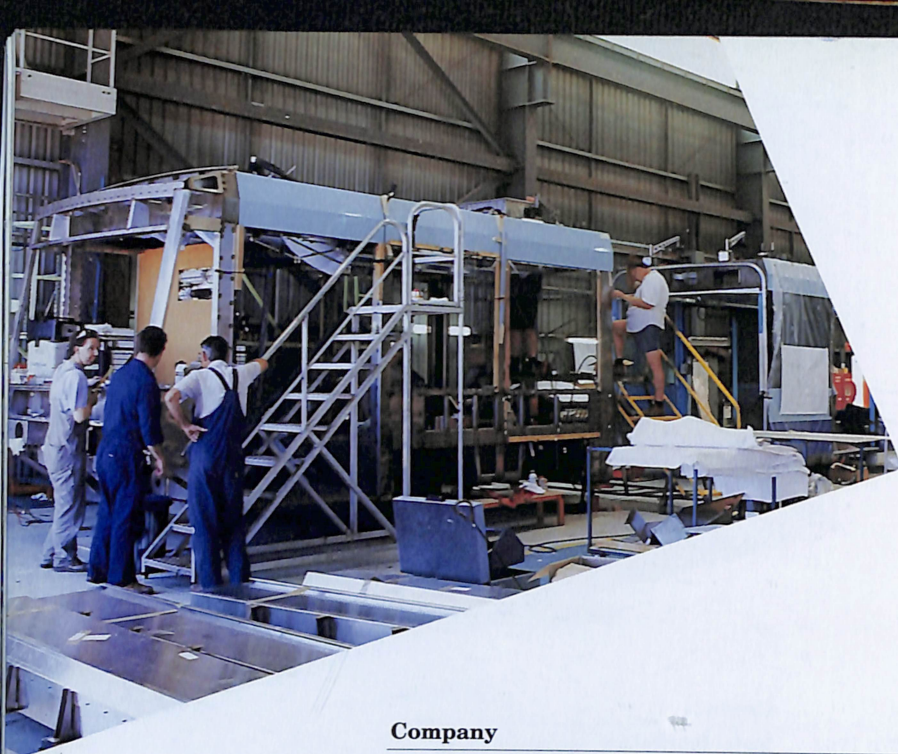
## Companies

Company	Phone	Product
3M Australia Pty Ltd	613 9265 4333	Decals
A. Goninan & Co Limited	613 9613 1343	Rail vehicles and systems
ADtranz ABB Daimler-Benz Transportation	613 9794 2111	Rail vehicles and systems
ABB Engineering Construction Pty Ltd	613 9615 6600	Metal fabrication
ACTCO Sheetmetal	613 9775 0677	Metal fabrication
Adaptaflex Pty Ltd	613 9544 4300	Conduit systems
Air International Transit Pty Ltd	613 9364 8433	Air conditioning equipment
Allied Friction Australia Pty Ltd	613 9314 4600	Vehicle brake components
Ampere Electrical Manufacturing Co Pty Ltd	613 9510 4333	Electrical components
ANI Bradken Wodonga	612 6024 2022	Iron, steel and alloys
Apollo General Engineering (Aust) Pty Ltd	613 9459 4611	Metal fabrication
Asia Pacific Rail Pty Ltd	613 9650 1444	Consulting engineers
Austbreck Pty Ltd	613 9768 2299	Pantographs
Australian Calibrating Services (Aust) Pty Ltd	613 9417 5688	Equipment calibration
Australian Timken Pty Ltd	613 5320 2700	Roller bearings and alloy steels
Bell Powder Coatings	613 9484 6007	Powder coating
Bendix Mintex Pty Ltd	613 5327 0211	Brake and suspension components
Bolwell Corporation Pty Ltd	613 9580 2500	Seats
BTR Aerospace Australia	613 9720 6166	Vehicle components
Burn Brite Lights (Vic) Pty Ltd	613 9729 6255	Electrical engineering
Charles Marshall Pty Ltd	613 9429 9044	Metal fabrication
Clyde Engineering Motive Power Division	613 9305 4146	Rail vehicles
Connell Wagner	613 9697 8333	Consulting engineers
Consolidated Bearing Company (Vic) Pty Ltd	613 9314 4311	Bearings
Courtaulds (Aust) Pty Ltd	613 9313 4555	Protective coatings



Company	Phone	Product
Crib Point Engineering Pty Ltd	613 5979 1703	Metal fabrication
DVR Engineering	613 9309 2266	Metal fabrication
Electronic Ballasts	613 9720 6322	Electronic lighting controls
Elliott Engineering Pty Ltd	613 9728 5500	Metal fabrication
Embleton Industries Pty Ltd	613 9350 2811	Metal fabrication
Fastron Technologies Pty Ltd	613 9794 5566	Electrical equipment
First Lighting	613 9574 1744	Lighting and pressed metal
Flexible Drive Agencies	613 9376 5644	Vehicle components
Fluor Daniel Pty Limited	613 9268 6000	Engineering and procurement
Fortress Security Pty Ltd	613 9587 4099	Power resistors
Galvanizing Industries	613 9480 2866	Galvanizing and safety equipment
GEC Alsthom	613 9263 6500	Signalling systems
GEC Lighting & Wholesale	613 9558 2644	Electrical and telecommunications
GNB Australia Industrial Battery Division	613 9270 0100	Batteries
Granor Rubber & Engineering Pty Ltd	613 9720 6606	Rubber products
Hagglunds Drives Pty Ltd	613 9753 4111	Pumps and drives
Hella Asia Pacific Pty Ltd	613 9581 9333	Automotive components
Henderson's Industries Pty Ltd	613 5279 7491	Automotive components
Henkes & Harmon Industries Pty Ltd	613 9729 9966	Signalling and security
Huber & Suhner (Aust) Pty Ltd	613 9706 9872	Radox cables
Indec Consulting	613 9899 2111	Management consultants
John Holland Group	613 9934 5209	Construction and engineering
KAB Seating Systems	613 9790 6222	Drivers' seats
Leighton Contractors Pty Ltd	613 9228 7700	Construction and engineering
Lock Focus Pty Ltd	613 9798 1322	Locks
Loctite Australia Pty Ltd	613 9763 1533	Adhesives and sealants
Menvier Electronics International Pty Ltd	613 9469 2888	Emergency lighting and control gear
MFB Products	613 9801 1044	Internal lining panels
MGP Electrical	613 9890 6808	Relay panels and drivers' consoles
Miller Bros Industries Ballarat Pty Ltd	613 5332 7368	Metal fabrication
MIT'S Limited	613 9613 9000	Rail control systems
Mitsubishi Electric-Westinghouse Electric	613 9262 9800	Electrical and electronics
Monroe Australia Pty Ltd	613 9569 8933	Shock absorbers
Morgan Carbon Brush	613 9544 2477	Carbon brushes
Multi-Contact Australia Pty Ltd	613 9383 3733	Electrical components
Nilsen Electric (Vic) Pty Ltd	613 9450 1300	Electrical panels
Northern Glass	613 9416 8111	Glass
O'Donnell Griffin	613 9646 0000	Cables and signals
Olex Cables	613 9281 4444	Cables
Peaston (Vic) Pty Ltd	613 9762 3544	Wire, cables and mouldings
Pierlite Lighting Pty Ltd	613 9207 3277	Lighting
Powder Coaters Pty Ltd	613 5222 1466	Powder coating





Company	Phone	Product
Preston General Engineering & Structural Steel	613 9357 0011	Metal fabrication
Public Transport Corporation	613 9619 4907	Rail operations
Sab Wabco Pty Ltd	613 9794 6611	Door systems, glazing and composites
Sheedy Bearings Australia Pty Ltd	613 9432 2977	Bearings
Siemens Ltd	613 9420 7254	Electric traction equipment
Silentbloc & Ainsby Rubber	613 9555 2999	Rubber suspension components
Simoco Pacific Pty Ltd	613 9574 3600	Communications and electronics
SKF Australia Pty Ltd	613 9567 2800	Roller bearings and ball bearings
SMC Pneumatics (Aust) Pty Ltd	613 9558 9980	Doors systems and pantographs
Southport Engineering	613 9793 3663	Metal fabrication
Stone McColl Pty Limited	613 9546 8622	Tread mats
TED Engineering Australia Limited	613 9584 9876	Toolmaking
Techniplan International Pty Ltd	613 9899 7977	Telephonic public address systems
The Torrington Bearing Company	613 9554 1700	Bearings
Thermal Bay Composites Pty Ltd	613 9318 0033	Fibreglass and plastic assemblies
Thompsons, Kelly & Lewis Pty Ltd	613 9562 0744	Railtrack products
Trico Pty Ltd	613 9546 8799	Windscreen-wipers
U-Neek Bending Co	613 9791 2288	Stanchions and handrails
Universal Engineers' Supplies (Aust) Pty Ltd	613 9763 4400	Vehicle components
Variflow Melbourne Pty Ltd	613 9583 4815	Metal fabrication
Westinghouse Brake & Signal Co (Aust) Limited	613 9676 8888	Signalling and electronic equipment

#### Production

Brouhaha Design & Copywriting

#### Photography

Cover and pages 6, 11 (middle), 11 (bottom) and 20 – Motive Audio Visual/ADtranz. Pages 1 and 17 – DSD Marketing. Pages 2, 3, 4 (top), 5, 10 (bottom), 11 (top), 12, 14 and 16 – Martin Saunders/DSD Marketing. Pages 4 (bottom), 9 and 15 – Andrew Chapman. Page 7 – Asia Pacific Rail. Pages 10 (top) and 19 – ADtranz. Page 13 – Ian Carr/TKL Rail.



