



The COMBINO® three-section and five-section, low-floor articulated tramcar

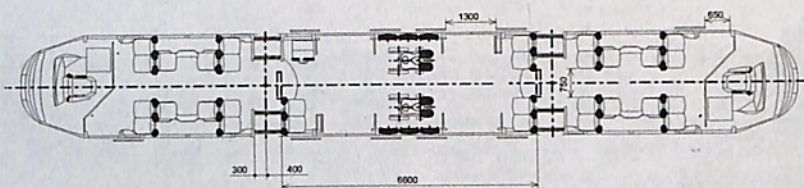
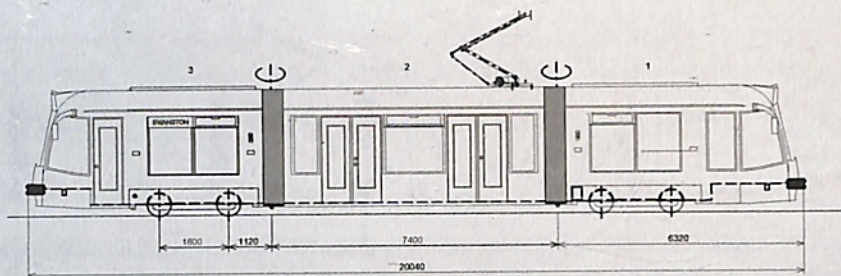
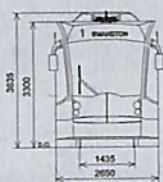
for the railway operator National Express Group (Australia)
M>Tram, Melbourne



Technical data		
Vehicle unit	Three-section, low-floor articulated power car for bi-directional operation	Five-section, low-floor articulated power car for bi-directional operation
Traction adhesion	100 %	100 %
Wheel arrangement	Bo Bo	Bo 2 Bo
Track gauge	1435 mm	1435 mm
Vehicle length over buffers	20040 mm	29850 mm
Vehicle width	2650 mm	2650 mm
Vehicle length	3635 mm over top of rail (pantograph lowered)	3535 mm over top of rail (pantograph lowered)
Weight empty	25.8 t	35.3 t
Weight loaded (at 4 pers./m ²)	9.1 t	21.3 t
Maximum axle load	<10 t	<10 t
Capacity (at 4 pers./m ²)	88, including 30 seats / 6 folding seats	190, including 58 seats / 6 folding seats
Maximum speed	70 kph	70 kph
Line voltage	(DC 600 V) +20% / -30% via overhead contact wire	(DC 600 V) +20% / -30% via overhead contact wire
Traction motors (nominal operating point)	4 x 100 kW	4 x 100 kW
Gear ratio	5.4444	5.4444
Wheel diameter (new/worn)	600 mm / 520 mm	600 mm / 520 mm
Traction-motor converter	2 IGBT PWM inverters	2 IGBT PWM inverters
On-board power supply	420 V – 1000 V DC	420 V – 1000 V DC
Low-floor component	100 %	100 %
Floor height	300 mm	300 mm
Useful life	min. 30 years	min. 30 years
Delivery	2002 – 2003	2003 – 2004

SIEMENS

efficient rail solutions



In April 2000, the operator, National Express Group (Australia), ordered 38 three-section and 21 five-section low-floor COMBINO tramcars from Siemens Transportation Systems. The first vehicle will be dispatched to the customer, M>Tram Melbourne, in November 2002.

A 15-year maintenance contract has also been signed for the vehicles.

The tramcar design is based on a welded aluminum underframe with a body framework of bolted aluminum sections. Aluminum sandwich panels are used for the roof. In running gear modules, the equipment container forms the roof of the tramcar.

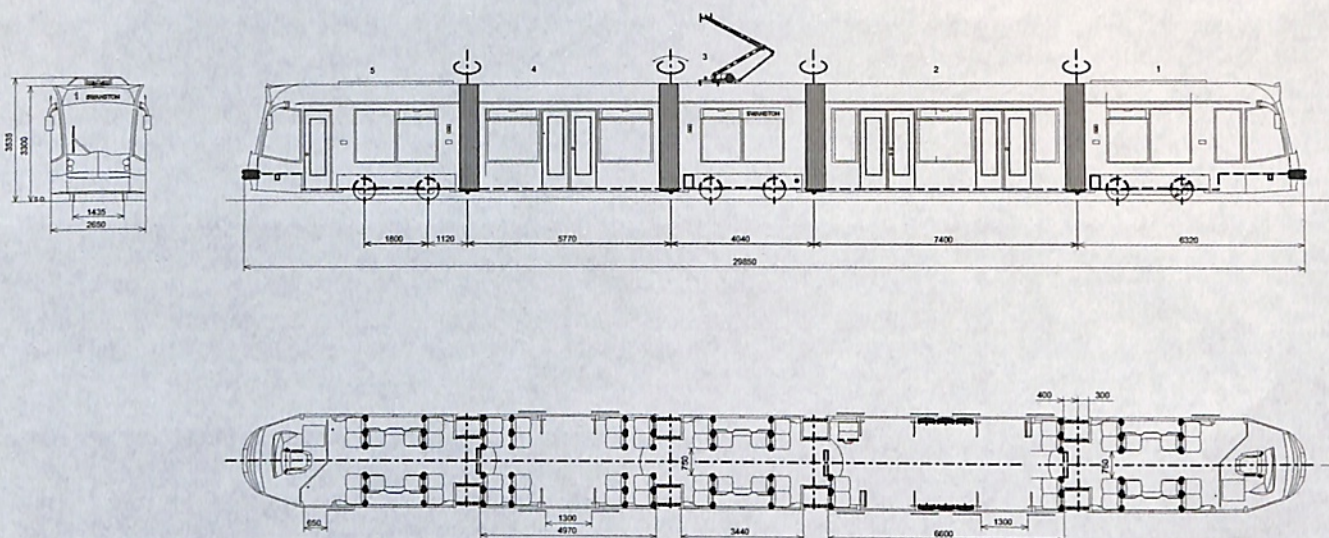
The powered bogie with its two outboard drives is characterized by its low center of gravity, minimized unsprung masses, and running characteristics which, due to mechanical coupling of the wheels in the longitudinal direction, have been improved over those of conventional 100% low-floor

running gear. Moreover, mechanical decoupling of the opposing wheel pairs rules out the inherent, additional longitudinal slip that causes wear when the vehicle travels through curves.

As traction equipment, two modern IGBT pulse-width-modulated inverters, low-wear three-phase induction motors and a 32-bit traction control unit (SIBAS® 32) are used. The traction system also allows power recovery.

The vehicle's control equipment is in the form of an MVB system with a lower-level, permanently wired fall-back level for the most important train-control functions. For the auxiliary and secondary equipment, low-wear and low-maintenance components are used throughout the vehicle.

Weight and the vehicle's low recovery of braking energy result in an improvement of the energy balance.



The latest COMBINO are characterized by the following features:

- **More space:** As a result of further development, it became possible to increase the space in the passenger areas, whereby the overall height of the vehicle remains unchanged
- **Easy to clean:** The seats in the intermediary modules have graffiti-resistant seat shells. In the bogie modules, there are integrated seating modules all of whose surfaces are at an angle so that objects placed on them fall on the floor. The interior paneling has a graffiti-resistant coating and the window panes are covered with anti-scratch foil
- **Easy to enter:** The door height is 2100 mm
- **Safety during vehicle movement:** All the seats are fitted with stanchions from where a stop request can be made
- **Unimpaired view:** Waist-high electronics cabinets enable an unimpaired view through the tramcar

- **Design:** As part of the modular COMBINO system, the end of the vehicle is designed according to specific customer wishes
- **Energy absorption (crumple) zone** provided by recessed underframe
- **Easy replaceability of the FRP paneling** at places which are susceptible to accident damage

The Melbourne COMBINO also has other special features such as the following:

- Standardized passenger information system
- Trip recorder with integrated accident-data memory
- Swing plug sliding doors (3-section vehicle: 4 two-leaf and 2 one-leaf; 5 section vehicle: 6 two-leaf and 2 one-leaf)
- Four electrically adjustable external mirrors
- Fully air-conditioned interior thanks to a powerful air-conditioning system; separate air-conditioning unit for the driver's cab and an air-conditioning unit for the interior in the 3-section vehicle and two

air-conditioning units in the 5-section vehicle

- Quick-release separation point in the articulation module
- No materials containing PVC or halogen in any parts of the vehicle
- Impact buffers with energy absorption device
- Vehicle front section and interior designed in accordance with customer's wishes
- Large workstation for the driver
- Open-loop and closed-loop control of the individual drives in a bogie (one converter per motor)
- Large, easy-to-read destination and station displays
- Comfortable aisle width in the passenger compartment (750 mm)

1.4 Vehicle overviews and equipment codes

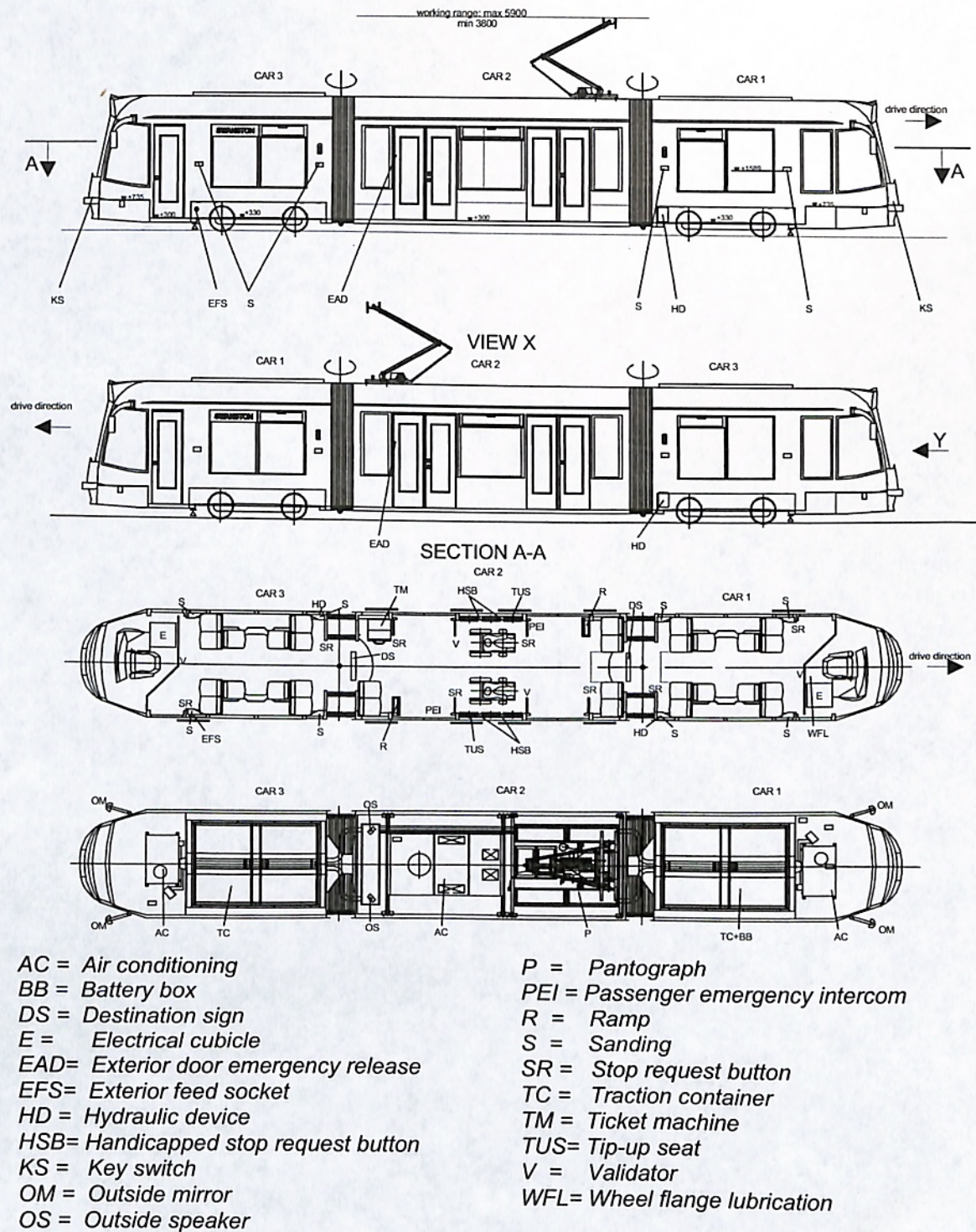
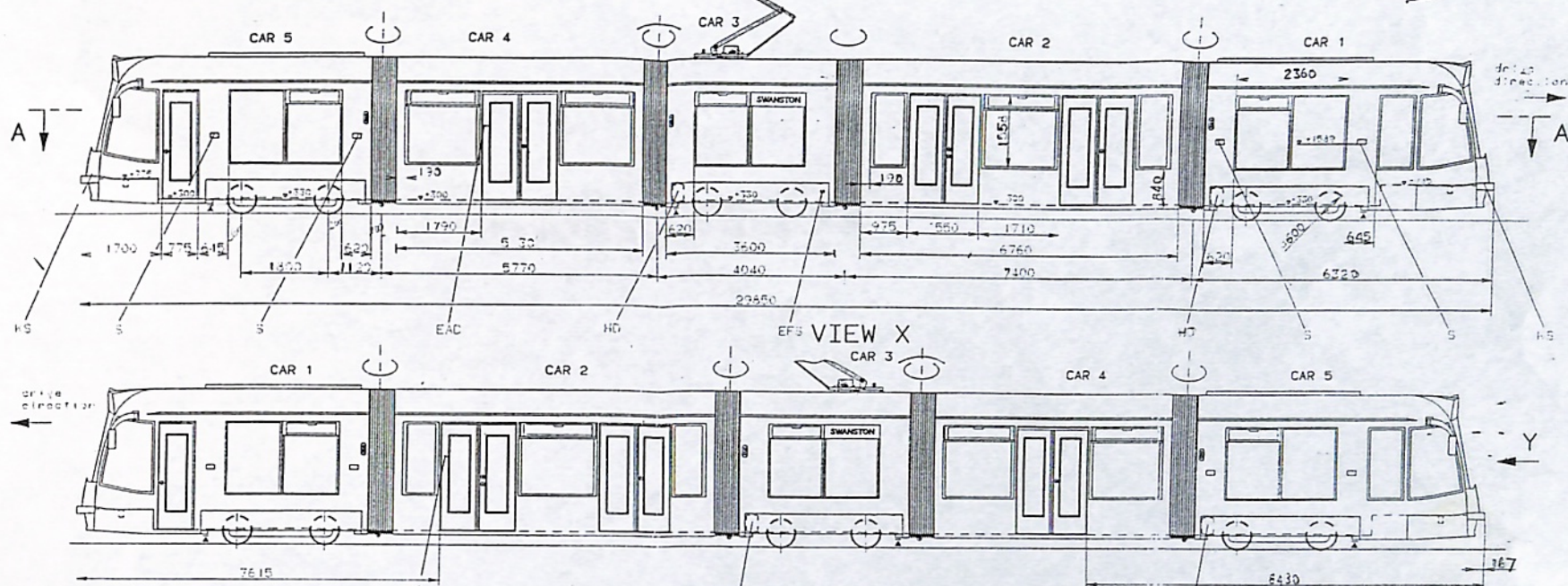
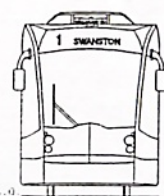


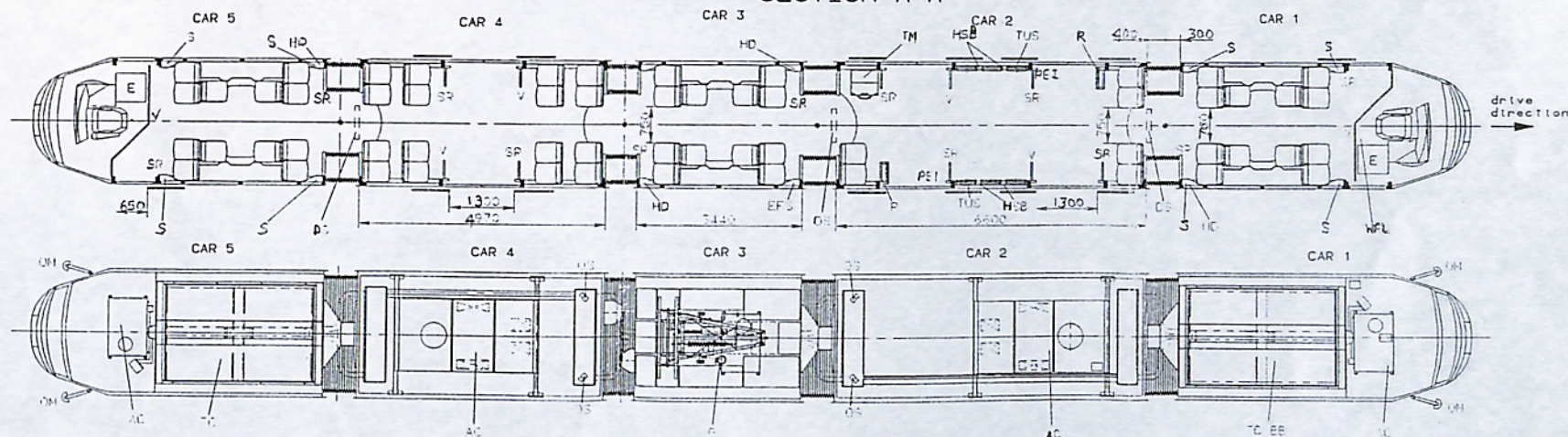
Figure 1: COMBINO Melbourne

14	Driver's Manual	TS IS DT	Melbourne Swanston
of			Mel Swa=R&BDC0022/00071
139	Commercial in Confidence	Rev.: B	

Attachment 2



SECTION A-A



- AC = Air conditioning ✓
- BB = Batterie box ✓
- DS = Destination sign ✓
- EAD = External access device ✓
- EFS = Exterior feed socket ✓
- H = Heating device ✓
- HD = Hydraulic device ✓
- HSB = Handicapped stop request button ✓
- KS = Key switch ✓
- OM = Outside mirror ✓
- OS = Outside speaker ✓
- P = Pantograph ✓
- PEI = Passenger emergency intercom ✓
- R = Ramp ✓
- S = Sanding ✓
- SR = Stop request button ✓
- TC = Traction container ✓
- TM = Ticket machine ✓
- TUS = Tip-up seat ✓
- V = Validator ✓
- WFL = Wheel flange lubrication ✓

Car 1	Car A
Car 2	Car B
Car 3	Car C
Car 4	Car D
Car 5	Car E

Seats	:	58 + 6 Tip-up seats + 2 driverseats
Standing room:		49 (1.5 Per./m ²)
Total	:	107

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SIEMENS



CASE STUDY

Low-Floor Combino Trams



"... Melbourne's largest fleet of low-floor trams"

World-class trams for a world-class city

Delivering on a vision to improve customer comfort, accessibility and safety

With 59 Siemens world-class Combino low-floor trams in operation on Melbourne's tram network, travelling around one of the world's most liveable city by public transport is safe, comfortable and stylish.

The decision by the Victorian Government's Department of Infrastructure to award a major contract to Siemens for the supply and maintenance of 59 new Combino trams supports operator Yarra Trams' vision to improve customer comfort, accessibility and safety.

The Melbourne tram network is the third largest in the world – it has 245 kilometres of double track, and recorded 145 million passenger trips in the 12 months to July 2005.

THE CHALLENGE FOR YARRA TRAMS

Over the next five years Yarra Trams plans to attract an additional 22 million passenger trips across the tram network in Melbourne.

The Yarra Trams vision is to:

- provide improved access for the elderly, people with disability and people with mobility difficulties
- deliver high frequency and high capacity of service
- provide a level of service to ensure safe, comfortable and reliable travel for passengers
- reduce reliance on car transport and position tram travel as an appealing mode of transport
- reliable maintenance services.

Yarra Trams required a replacement solution for ageing rolling stock that is highly reliable, with proven performance and smooth integration into existing infrastructure and operations.

Power

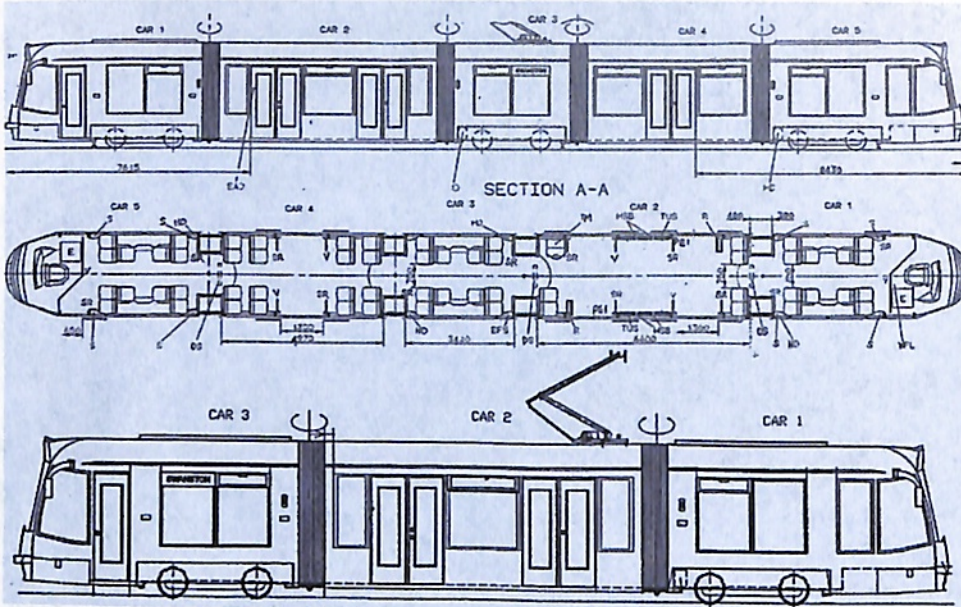
Transportation

Automation

Communications

Healthcare

Buildings



THE SIEMENS SOLUTION

In total, Siemens supplied and now maintains 38 three-module trams and 21 larger capacity five-module trams, which comprise Melbourne's largest fleet of low-floor trams. Having a mixture of three and five module trams assists Yarra to cater its transportation services to high-volume, high-peak routes and special events.

Features of the Siemens Combino trams include:

- low-floor access and wider aisles for people with wheelchairs, the elderly, and the mobility impaired
- closed circuit television (CCTV) systems for passenger security
- improved lighting for a bright and welcoming ambience
- emergency stations to contact the driver
- electronic passenger information systems with voice announcements
- improved destination signage and public address system
- comfortable seats with vandalism proof upholstery
- fully air conditioned with individual systems for passengers and driver's cab
- Modular design allows for easy component change-outs.

The contract was awarded in March 2001 with the final tram delivered into service in December 2004, on time and on budget.

KEEPING ROLLING STOCK ROLLING

All maintenance is carried out at the Malvern depot, including recovery services 7 days a week. The Siemens maintenance management system implemented for this project enables better planning of services to achieve outcomes such as optimised whole of life costs, assess fault trends, and spare parts management.

A Local Industry Participation Plan (LIPP) was established by Siemens to maximise local content for the supply and maintenance of the trams.

Siemens' dedicated and experienced maintenance team works closely with Yarra Trams to achieve operational and service charter objectives, and takes a proactive approach in continuously improving the level of service and reliability of the Combino fleet.

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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

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