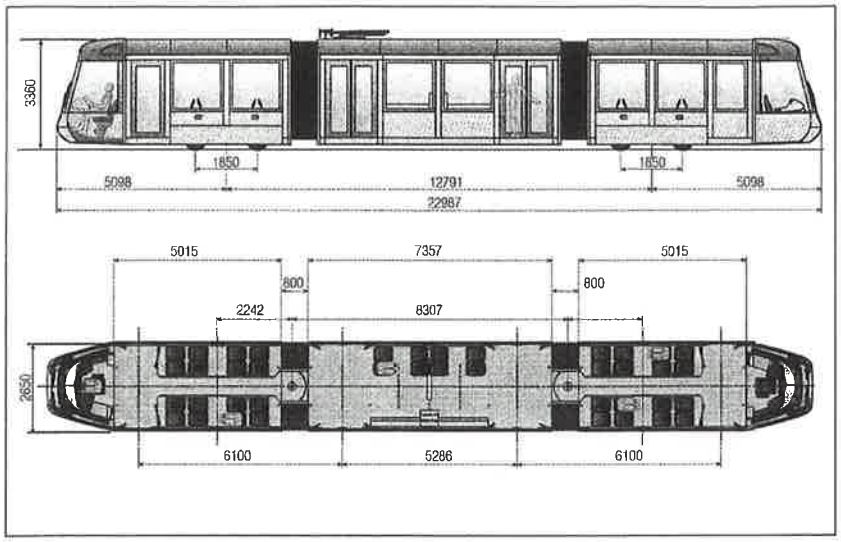


What you don't know about Melbourne's new lowfloors

How they meet *a cost-conscious market*

From factory to fare goers

How ALSTOM designed, manufactured and marketed the CITADIS (TM)

T&S Staff Writers

The CITADIS trams operated by Yarra Trams in Melbourne are a clever design and manufacturing response to the different requirements of a world market.

A design that evolved from research of the growing light rail market world-wide

They are built in modules and with different characteristics according to customer needs and the particular features which make one city different from another.

Melbourne's new trams - 36 of them to be on the rails before September 2002 - belong to Melbourne because they are designed to reflect the the traditions of one of the world's great tramcar cities.

They are the city's first lowfloors. They introduce to Australia a revolutionary light rail design process. The modular vehicles are the first developed using an ALSTOM patented process called OPTIONIC DESIGN(c).

Based on the premise that while different light rail operators have unique technical and aesthetic requirements, meeting those requirements in a cost-effective manner requires some standardisation. Historically, standardisation in light rail vehicle design has proved difficult.

Constraints have arisen due to the complexity and physical restrictions of the world's light rail networks in terms of differing gauges, supply voltage and platform heights.

Customers today, however, want better trams at lower costs. ALSTOM's response to this challenge is the development of a modular design system - a blend of custom-isation and standardisation that offers operators a range of specific dimensions, materials and technologies as well as significant cost savings.

Gliding past South Melbourne Town Hall with 'the lowest noise levels of any light rail vehicle.'

With this flexible approach, all necessary options are integrated in the design and development process from the outset.

All vehicle documentation takes into account the most severe constraints out of a range of options and adapts the design automatically to the chosen version with a minimum engineering cost. As the design is essentially generic, high reliability and low maintenance costs are guaranteed, and the delivery period is kept to a minimum, due to a shorter engineering period. More than 450 of the new vehicles, including options, have been ordered world-wide.

Each 23 metres long, 2.65 metre wide tram is bi-directional and has a capacity of 145 passengers - seated and standing, full air-conditioning, an exterior video system and facilities for disabled passengers. The trams step height is 33 centimetres.

Each tram has its own computer network connecting various control systems such as doors, PA system, automated ticketing, air conditioning and automated vehicle monitoring.

The trams evolved out of considerable analysis of the light rail market worldwide which included variables in gauge and performance including speed and different line capacities, personalised designs to reflect the unique nature of the city in which the vehicle operates and passenger options such as easy access and comfort features. The light rail vehicle market calls for short lead times coupled with reduced costs for everything from acquisition to maintenance.

The company's response to these market demands is to offer a completely modular vehicle in terms of length, width and performance, the choice of partial or full low floors, integrated proven components and the ability to easily upgrade the vehicles' capacity by adding car bodies, changing interior equipment or even the front end.

Standard safety features of the CITADIS(tm) include a reinforced cab structure for driver protection in case of a front impact and side wall structures with reinforcements running along the seat height to protect passengers against side impact.

Windows and paneling can be replaced within 20 minutes. The trams have the lowest noise levels in light rail today due to special noise insulation in the under frame above the bogie areas. The plug-in, pull-out layout of equipment interfaces allows the quickest possible exchange and maximum availability of vehicles.

Using standard products in order to be economical but remaining flexible enough to meet the different requirements of individual contracts resulted in a technical challenge for ALSTOM. The company found the solution by standardising the sub-components that are designed to match the complete range specification, by taking a modular and variable parameter approach for mechanical design and by using advanced design methodologies such as "Digital Mockup".

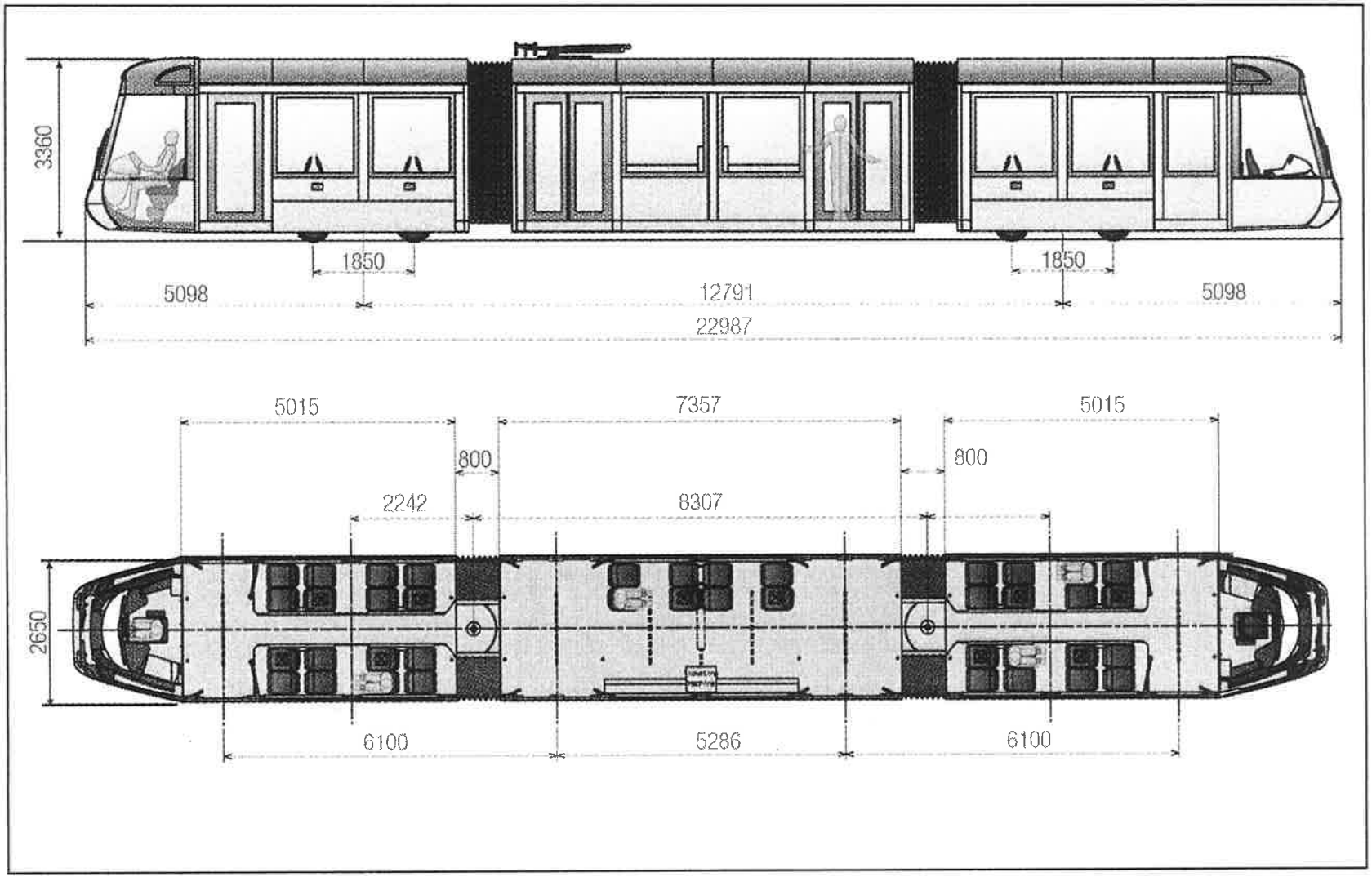
A car body shell went through a stringent fatigue test equal to a thirty-year lifetime

ALSTOM approached the adaptation of the technical car body by using a linear under frame and roof structures which are fully variable in width and vertical frames (representing door openings) that can be positioned wherever necessary along the side of the car.

The result is maximum flexibility in the vehicle length. The car body is closed at both ends by aluminium rings; a complete cab assembly is mounted on to the front aluminium ring and the total car body is bolted and riveted together enabling simple accident repairs or upgrading such as adding doors to a given car body.

To guarantee durability, a prototype car body shell was put through a stringent fatigue test of up to ten million cycles - equivalent to a 30-year lifetime. The assembly passed the test without any cracks or play between the bolted elements.

The Melbourne trams, are an example of the fusion of customisation and standardisation in a modular approach that will revolutionise light rail design. ❖



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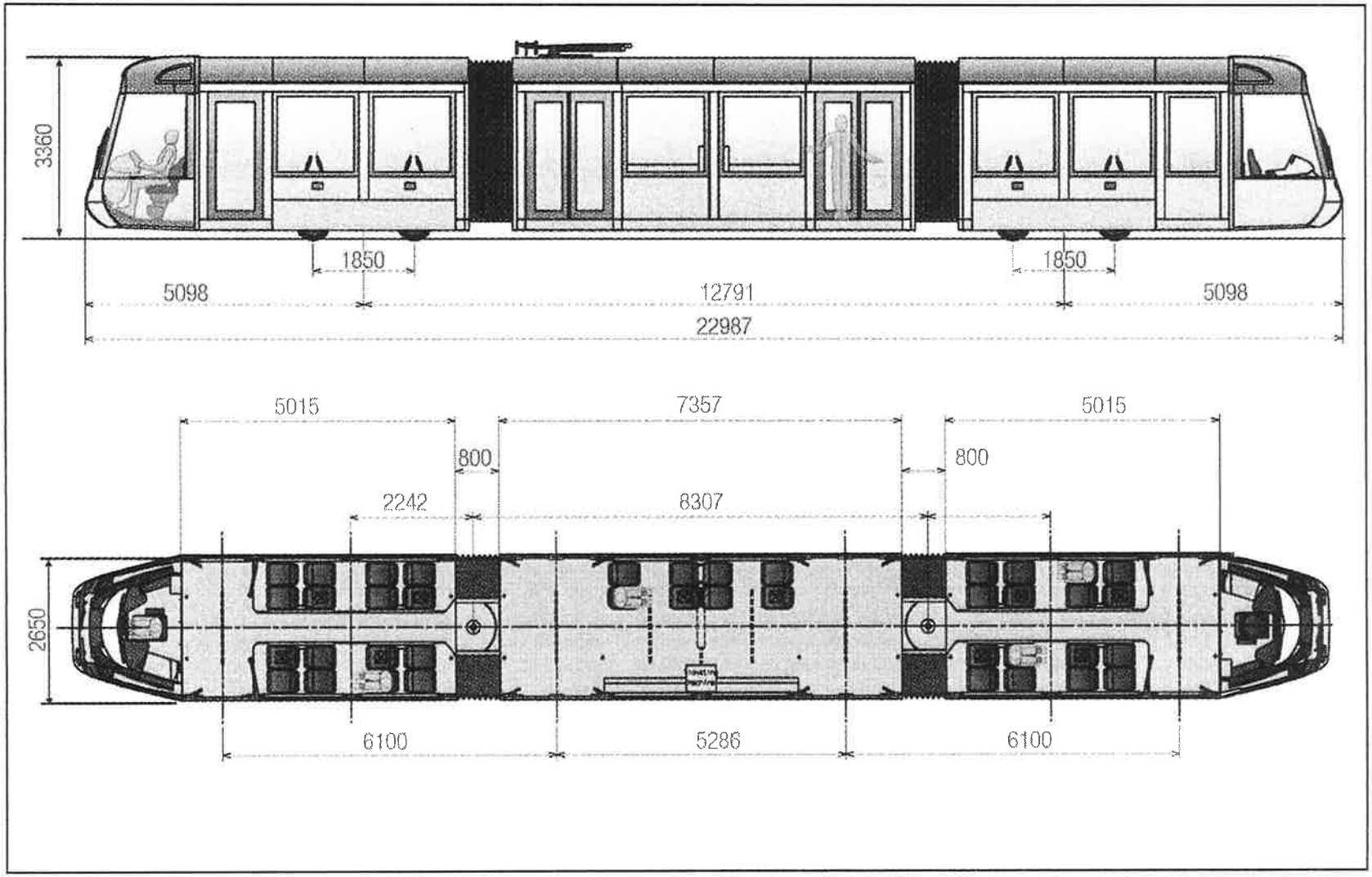

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