LRT Is Changing The Face Of French Cities

The first modern French tramway opened in Nantes 20 years ago. Since then, about 20 more cities have either opened new light rail systems, or are building or planning them.

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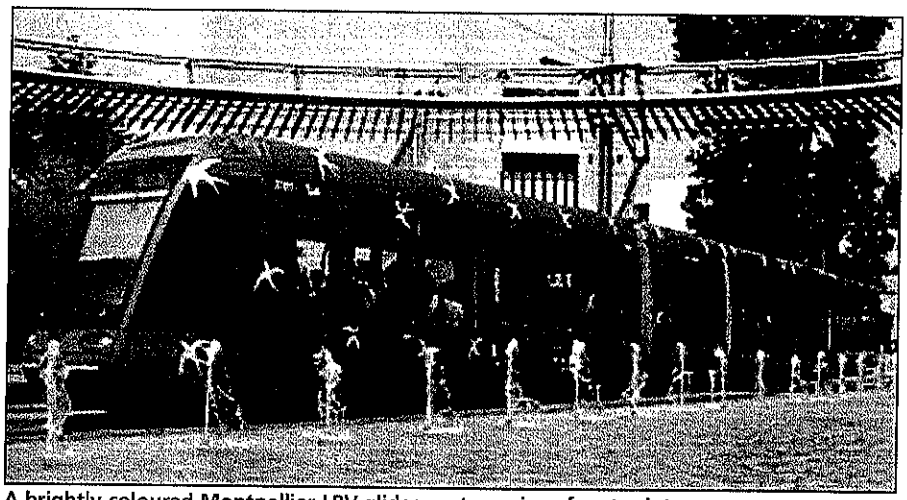


A brightly-coloured Montpellier LRV glides past a series of water jets.

AS one of the European countries that gradually abandoned many of its traditional tramways after the Second World War, France was able to start afresh when the new wave of light rail transit (LRT) began to be created in Europe through the introduction of segregated alignments and new rolling stock. At the same time, many other countries were embarking on reconstructing and modernising their existing networks.

The "fresh start" approach, coupled with some specifically French initiatives and conditions, such as a local transport tax on business (the *versement transport*), and the demographic fact that France has relatively few large cities for a country of its size, has arguably made the Gallic nation the most successful in Europe in terms of medium-capacity, rail-based public transport.

Part of the reason is that the French approach has endowed light rail with a role that goes well beyond that of simple public transport to encompass an integrated approach to transport, urban regeneration and generally returning the streets to the people instead of the motor car.

A report on French light rail produced by consultants Semaly and FaberMaunsell for a British public transport authority condensed the reasons for the undoubted success of French light rail as "money, commitment, and planning".

The report added: "French cities also combine the introduction of a tramline with the opportunity to pedestrianise their city centres, to reorganise the local road network and hierarchy and—some might say, most importantly—to restructure the underlying bus network to support, not compete with, the tramway."

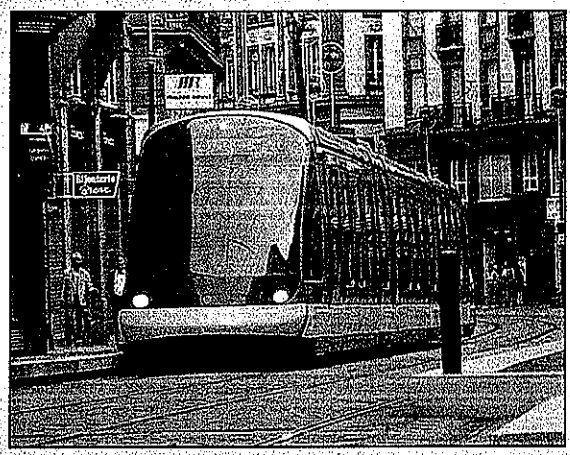
The local public transport tax, which can be up to 1.75% of the payroll of a public or private company employing more than nine people, has been levied since the early 1980s. It provides a constant and guaranteed flow of money that in a city like Lyon with a population of 1.4 million can reach €145 million each year.

French demography favours light rail as does the concomitant reduction in construction costs compared with heavy metros. This is reflected in the fact that France has but three heavy metros in Paris, Lyon, and Marseille, plus three light metros in Lille, Toulouse, and Rennes. Light rail operates in 11 cities, is under construction in three others, and planned or being considered in at least four more.

Light rail operates in Bordeaux, Greno-

The Rouen LRT network includes an underground section. Above right: Citadis LRV in operation on one of Paris' light rail lines.

Technolgy Cuts LRT Vibrations



PEOPLE living and working along the routes of new light rail lines do not want to suffer from increased noise and vibrations. Getzner, Austria, in cooperation with its French partners Angst & Pfister, Semaly, Sateba, and Systra, has been involved in providing solutions to reduce the damaging effects of vibrations on buildings in French cities for the last 10 years. Two systems have been employed using Sylomer (as in Strasbourg pictured) and Sylodyn materials.

The ASP system adds an elastic baseplate pad to traditional sleepers to reduce the amount of energy being transferred from a passing LRV. It also enables the maximum amount of track subsidence to be calculated exactly according to the mass-spring principle.

For particularly demanding situations, the slab is laid on an elastic support. The concrete is poured directly onto the Sylomer and Sylodyn. This also speeds up and simplifies track construction.

ble, Montpellier, Nantes, Orléans, Paris, Rouen, St Etienne, Strasbourg, and Valenciennes. Light rail lines are under construction in Le Mans, Lyon, Mulhouse, and Nice; and planned in Reims and Toulon. Other cities such as Brest and Tours are looking at light rail as a possible solution to their congestion problems and regeneration needs.

Capital investment costs for LRT schemes in France are generally in the range of €18 million to €20 million/km (2003 values). Outside the range at both ends, however, came Nantes Line 1 and Paris Line T2 at about €9 million/km each, and Rouen and Strasbourg Line A which cost about €30 million/km each due to some tunnelled sections.

While metros can handle up to 20,000 passengers per hour per direction (pphpd), the intermediate capacity of light rail between bus and metro finds strong appeal, including very small cities such as Orléans, which has a population of only 263,000. Even passenger demand below 3000pphpd can justify a light rail scheme, according to the Semaly/FaberMaunsell study. At the other end of the scale LRT is also applicable to cities of 2 million people.

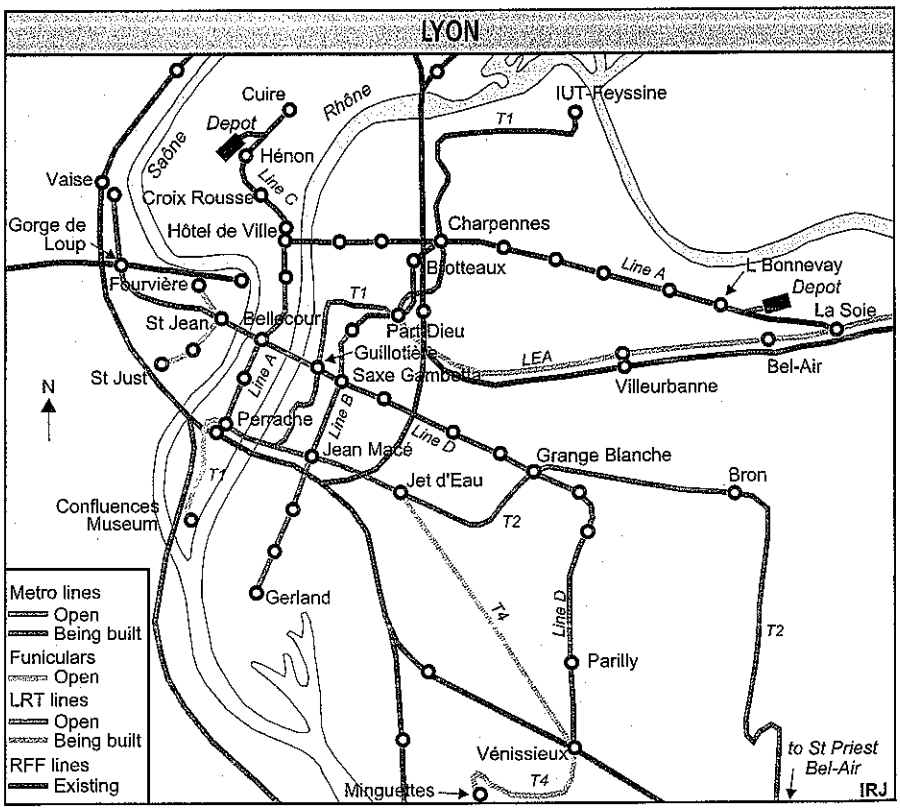
Dedicated rights of way provide some separation from normal road traffic to improve operational reliability and increase average speeds. Modern LRVs are a far cry from old-fashioned trams, with their up-to-date technology, exciting styling, high levels of comfort, and facilities including passenger information. The introduction of low-floor vehicles extended the appeal of LRVs to almost all sectors of the community.

The French LRV market is dominated by Alstom and its Citadis range of vehicles, though Bombardier has supplied LRVs to Strasbourg and Nantes, and has an order for Marseille. Worldwide, Alstom has orders for a total of just over 700 Citadis vehicles with options for 113 vehicles and 30 vehicle extensions for Montpellier LRVs to cope with increased passenger demand. Sales and orders within France total more than 400 vehicles.

In addition to Montpellier, Alstom has also supplied or has orders from Orléans, Lyon, Valenciennes, Bordeaux, Paris, Grenoble, Mulhouse, Strasbourg, Nice, and Le Mans. Citadis was developed from the generic train design methodology called Optionic Design. This modular approach allows proven technological solutions to be matched with local aspirations and requirements so far as, for example, front-end styling, interiors, seating arrangements, onboard facilities, and driver's cab and control panel. In addition, Citadis vehicles may be between 2.3m and 2.65m wide and between 20m and 50m long.

One unusual application was in Montpellier where the operator needed to increase the capacity of the vehicles ordered because of the popularity of the system. The city ordered 30, 10m-long extensions to the 30m-long vehicles. The transition started in the summer of 2002 without interruption to commercial service and was completed in April 2003. All of Alstom's new-generation LRVs are equipped with Onix IGBT asynchronous traction systems. Onix has a standard, modular design aimed at ensuring cost-effectiveness while maintaining safety, reliability, high availability, and flexibility.

New French LRT systems due to open in the next few years include Le Mans, Mulhouse, Nice, and a peri-urban line in Lyon. Unlike the famous race in Le Mans, the tramway will take a little longer than 24

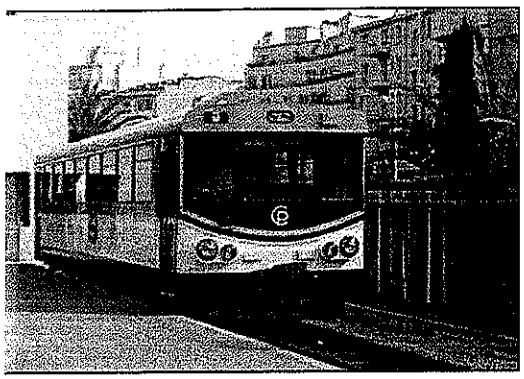


Lyon is expanding its light rail network to complement the metro.

hours to complete but the benefits to the town will be much longer lasting.

The plan for a 15.4km north-south line, on which work started last year, is due for completion in 2006-07. The €290 million project is being delivered by a joint venture of Semaly, Thales EC, Ouest-Infra, Dubus-Richez, and Attica, while Alstom has a €55 million order from Le Mans Metropole for 23 bi-directional, 100% low-floor Citadis LRVs, each 2.4m wide and 32m long.

Each vehicle can accommodate 209 passengers, 64 of them seated. The air-conditioned LRVs are equipped with rear-view cameras, CCTV, and a disabled persons' area.



Nice plans to incorporate the under-used CP line to Lingostière into the light rail network.

The line will run via the city centre and the mainline railway station with a branch to a residential and leisure area. The alignment follows several bus routes. Displaced buses will be re-deployed to improve the service on other routes and to act as feeder services for LRT—a common practice in France which sets it apart from other countries in the bus/LRT context.

Road traffic routes will also be reorganised to improve traffic flows in the central area, making more use of the Le Mans by-pass, and improving inter-district connections avoiding the central area. Park-and-ride facilities will be provided at the ends of the line and branch—at University, Antarès, and Espal. Car parks will be free for LRV users.

In Lyon, the local engineering consultancy, Semaly, is involved in creation of the peri-urban LEA line, which will run 15km from the mainline Part-Dieu station and metro interchange, east to the Meyzieu industrial estate. The line will have 10 stations and is due to open next year. Alstom has contracts worth a total of €54 million for 17km of track, 10 Citadis LRVs, and signalling.

The Paris-based consultancy, Systra, has a project management contract for the first two sections (9.5km) of Line T4 in Lyon, which will cost nearly €180 million to build. Construction is due to start in mid-2006 for completion at the beginning of 2009. The first phase will run from an interchange with Line T2 at Jet d'Eau to Vénissieux station on metro Line D, where a new interchange is planned. The second phase will extend the line via the Vénissieux terminal station of metro Line D to Minguettes by 2009. The line will have a total of 18 stations and two park-and-ride facilities. It will later be extended northwards from Jet d'Eau to Part-Dieu

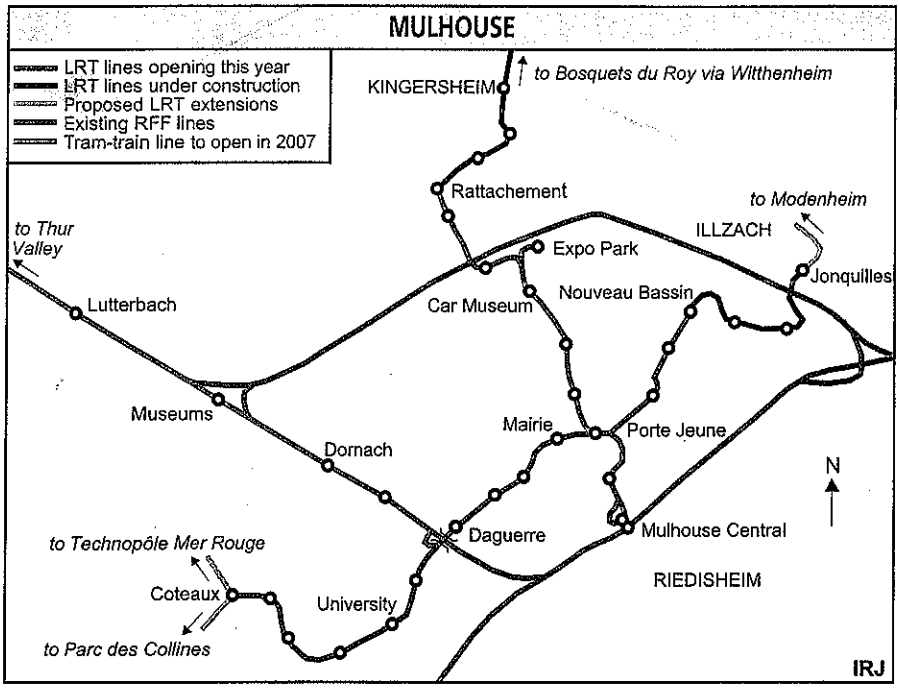
In December 2004, Alstom won an order for 10 bi-directional, low-floor Citadis LRVs, each 2.4m wide and 32.4m long with accommodation for 201 passengers, 56 of them seated.

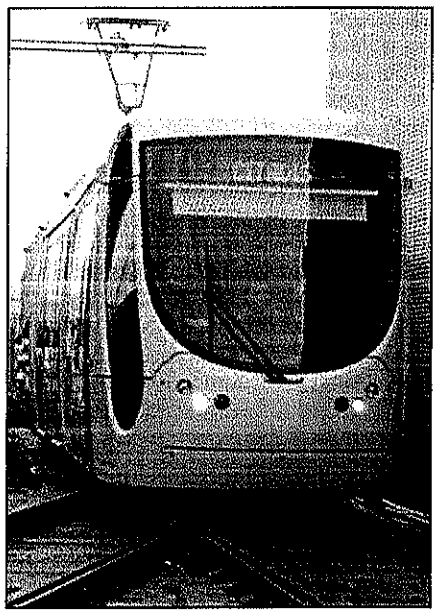
A consortium led by Alstom has a €198 million contract to build the first part of a light rail network for Valenciennes and supply 21 Citadis vehicles with options for up to seven more. The scheme is supported by Japanese car builder, Toyota, which is hoping to take on 3000 employees at a new assembly plant. Part of the objective of the scheme is to revitalise an area that has suffered badly from the effects of the decline of traditional heavy industries such as coal mining and steel making.

Bordeaux has pioneered a ground power supply system to avoid catenary in the historic city centre.

The 21km Transvilles network will link a string of towns and villages that are currently suffering from severe road congestion. The 9.5km first line connects the northwestern suburb of Dutemple with the University of Mount Houy.

There will be 19 stations in all, eight of





The first Alstom Citadis arrived in Mulhouse last year with much fanfare.

them connecting with at least one bus line and one providing interchange at the main-line railway station. It will open in 2005-06. A number of peripheral park-and-ride facilities will also be created. A later stage will involve an 8.5km line between Denain and Valenciennes that is due to open in 2007.

The Mediterranean resort of Nice gained the declaration of public utility in 2003 for a 12-year plan to reorganise public transport, including the creation of a 40km LRT network. First part of the plan is actually related to the creation of a 9.9km reserved-lane busway between Cadam and Place Ile-de-Beauté. Cadam is about 1km from the city airport's two terminals. In 2010 it is planned to convert the busway to light rail but, as it is not possible to extend the line to serve the airport, feeder buses or another solution will be adopted to get passengers to the airport.

Innovations In Bordeaux

BORDEAUX's three-line light rail network, which was completed last year, had several innovations. Ineo Systrans, France, was responsible for some of them.

The innovations designed and supplied by Ineo Systrans included an automatic vehicle location (AVL) and a real-time passenger information system. This makes use of the digital Tetra radio network installed in Bordeaux to provide voice and secure data communication. Ineo Systrans also designed and supplied the signalling system using computer-based interlockings.

LRT Line 1 is due to be inaugurated next year. It runs 8.6km between Comte de Falicon and Pont Michel. The line is due to be extended by 4.5km from Pont Michel to L'Ariane and La Trinité in the northeast in 2010. In this same busy light rail year for Nice, the converted busway will be extended by 6km to the coastal resorts of Saint-Laurent-du-Var and Cagnes-sur-Mer-Centre, both of which are west of Nice.

The next milestones occur in 2015 with a 4.5km extension of Line 2 from Cagnes-sur-Mer-Centre to Villeneuve-Loubet, and the inauguration of the 6km Line 3 between St Augustin and Plaine du Var via Lingostière. This will be a north-south route following the Var river from Cadam. It will connect with the Provence Railways (CP) metre-gauge railway at its northern end.

Further developments beyond 2015 could include a line from Lingostière to the city centre over under-utilised CP tracks; an extension of Line 1 beyond L'Ariane to the northeast; and extensions westwards of Cagnes-sur-Mer-Centre with as many park-and-ride facilities as possible to counter the near-saturation of the entire coastal road network.

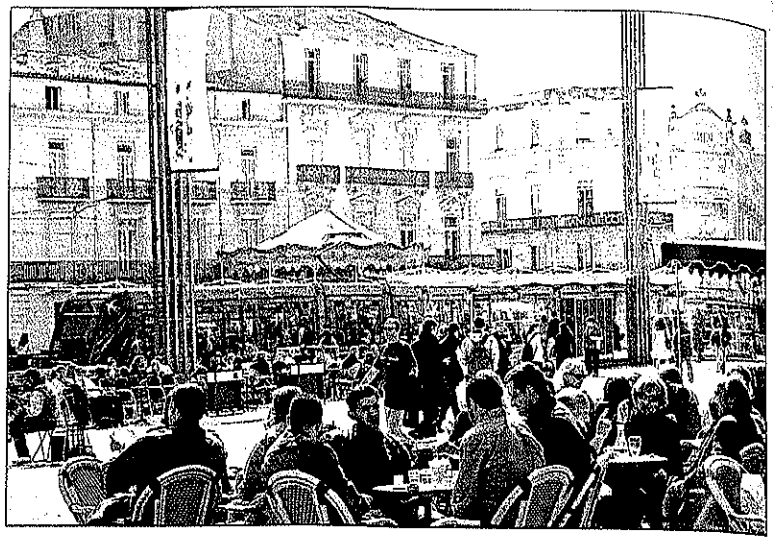
A tram-train system in Mulhouse will consist of two urban light rail lines, the first part of which is due to open this year, and a suburban section that will also use French Rail Network (RFF) tracks. The urban sections, operated by Citadis LRVs, will serve five areas—Mulhouse, Illzach, Riedisheim, Kingersheim, and Wittenheim. The two lines, totalling 19.7km, will cross at Porte Jeune, and the first 12km of these will open this year. The 8.75km east-west line will have 21 stops and will run from the Modenheim area of Illzach via Porte Jeune to the Côteaux area of Mulhouse. The 10.97km north-south line will run from the Bosquets du Roy area of Wittenheim, via Porte Jeune, to Mulhouse Central railway station with 17 stops.

Alstom has a €48 million contract for 20 Citadis LRVs for the urban section. The 37km suburban line, which will link Mulhouse with the Thur valley using RFF tracks, is expected to open in 2007.

Other ongoing light rail projects in France include:

- Toulon: a 17.7km double-track system with 37 stations connecting La Seyne station in the west with La Garde station in the east via the city centre
- Reims: Systra is offering technical and financial assistance for a plan for a 10km line between Croix-Rouge and Orgeval via the city centre, due to open in 2010 with daily ridership averaging 35,000
- Marseille: a 16.4km LRT network is being created through the modernisation of the old Line 68 and construction of two new lines. Bombardier has an order for 26 low-floor Flexity Outlook LRVs due in service at the beginning of 2007, and
- Montpellier: the initial 12km route opened (two months early) in 2000 and the 19km Line 2 is due to open next year. **IRJ**

Good penetration of the city centre, together with convenient park-and-ride facilities and easy interchange with local bus routes, has helped Montpellier's first light rail line beat all its patronage projections



2001, and endorsed by the Ministry of Transport in April 2002. Following a lengthy public consultation process, Line 2 finally received its Declaration of Public Utility on May 11 2004, enabling construction work to get underway.

Earlier this year the main road between Montpellier and Castelnau-le-Lez was closed for 17 months to permit the reconstruction of the bridge over the River Lez. The old bridge, known locally as the 'Pont Submersible' for its propensity to flood, will be replaced by a new structure, 6 m higher above the water, carrying two road lanes, two tram tracks and a segregated cycleway.

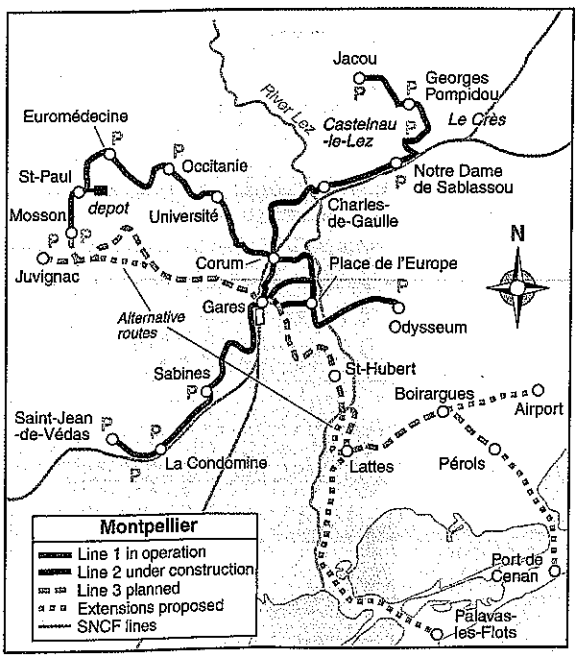
Total cost of the project is put at €424m (at 2000 prices). Of this the government agreed to contribute €100m, and the *région* and *département* would each provide €23m, leaving CAM to raise the balance of €278m. In practice the government cancelled part of its support, so that CAM and the region had to make up the difference.

Connecting five outlying towns and suburbs with the city centre, Line 2 is forecast to carry around 52 000 passengers/day. Services will operate from 05.00 to 01.00 each day, with headways of 5 to 7 min on the central section between Sabines and Sablassou and 10 to 15 min on the extremities. The route will serve nine park-and-ride facilities: four in the south and five in the northeast. Initially there will be 1 930 parking spaces, with provision to increase this to 3 980 in the long term.

To operate the new line, TaM has ordered a further 24 Citadis cars from Alstom at a cost of €54m. Unlike the original vehicles, they will be all-low-floor, but they will share many common parts and will also be designed for subsequent extension from 30 to 40 m if required. Both fleets will be able to operate on either line if necessary, but they will normally keep to their own tracks.

Alstom engineers have been working with the city's interior and external design consultants Garouste and Bonetti and with local passenger representatives to develop the new vehicles. The designers have given the Line 2 cars their own identity, with more rounded car ends, ergonomic improvements to the cabs, and modified headlight clusters. The cars will carry a green livery featuring flowers instead of the blue livery and seagulls used on the Line 1 vehicles.

Capacity of the Line 2 cars will be 64 seated and 146 standing passengers, compared to the 76 seated and 213 standing on the lengthened Line 1 vehicles. Maximum speed in service will remain 70 km/h, and the target is to offer an end-to-end commercial speed of 20 km/h including 32 intermediate stops.



The Line 2 Citadis cars will carry a floral motif to differentiate them from the blue Line 1 fleet sporting their distinctive seagull symbols

Line 3 to follow

Planning for a third route has been underway for almost five years, and in April 2002 CAM voted to adopt a preferred route with one or two alternatives for further study. In May 2005 a consortium led by Semaly was appointed to manage the €450m project, with the target of putting the line into operation in 2010.

Line 3 is intended to serve four park-and-ride sites. It will start from Juvignac, to where Line 1 will also be extended from Mosson. Line 3 will run to the south of the existing route to reach the city centre, and then continue southeast to Pérols. The preferred route is 21 km long, and it is forecast to carry around 55 000 passengers/h when it opens.

When all three lines are operational, they will form the main axes of a complete public transport 'grid' across the entire TaM service area, offering high-quality interchange between train, tram, bus and interurban bus services. There will also be improved facilities for pedestrians and cyclists, offering every resident of Montpellier and the surrounding communities an effective alternative to using their cars.

Reflecting this ambition and anchoring the network will be a transport hub in the city centre. A new interchange to be served by all three tram routes is taking shape in front of the railway station, at the heart of a truly integrated, high-quality public transport network. ■