Tenerife takes its tram to heart

The tram passes less than 5 m from historical buildings such as the theatre.

ISLAND Inaugurated only 18 months ago, Metrotenerife will soon complete its first extension and is already planning more. Jane Pearce has been to find out more about how the network is shaping up.

A trip on the tram in Santa Cruz de Tenerife is rather like riding a rollercoaster, as the brightly-coloured vehicle glides silently down the steep hills and around tight curves snaking its way towards the coast. However, the passengers who experience this sensation in ever-growing numbers are unperturbed, secure in the knowledge that the tram is controlled and constantly monitored from the state-of-the-art Central Command Post.

The CCP receives real-time information on the location of each tram, vehicle data such as the number of passengers, live CCTV images from cameras located on the vehicle and at tram stops, and the status of the overhead lines and power supply, thanks to the fully-integrated SAE operations management system. Metropolitana de Tenerife SA takes security very seriously. Controllers can respond quickly to incidents and anomalies, and keep passengers updated via the onboard public address.

Equipment suppliers from France, Spain and Portugal (Table I) rose to the challenge of providing software and equipment for the tram project in very tight timescales. These were then integrated by Transdev into the management information and operating system, which is linked to the Ikusi-Efacec domain responsible for electronic monitoring and control of all fixed and network installations.

As well as co-ordinating all tram operations, the management database generates the key performance indicators used by the government to supervise and measure MTSA's

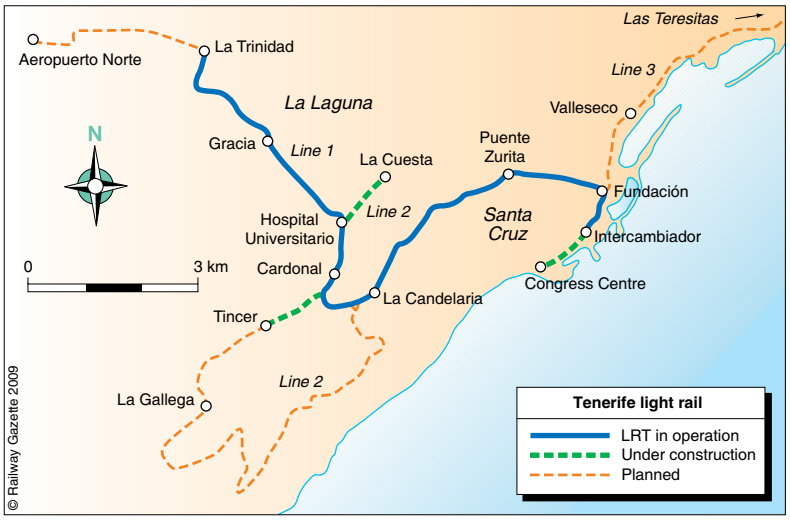


Table I. Metrotenerife Phase 1 equipment suppliers

Ikusi-Efacec JV	Vehicle scheduling and control system, signalling, fire detection, SCADA, communications, video surveillance, passenger information and ticketing
Efacec	1 primary and 7 traction substations, catenary and electrical installations
Lumiplan	Heurès route planning, scheduling and daily operations software
CARL Software	Asset management and maintenance management software
Atos Origin	Management information system
Transdata (subsidiary of Transdev)	Central management information and operating system; supervision and integration of subsystems
Transdev	Project management and operations
Alstom Transport	20 Citadis trams

performance. The government pays the operator an annual fee based on availability, which is determined by quality parameters such as reliability.

The CCP is located at MTSA's 22 420 m² headquarters together with the workshop and depot (known as Talleres y Cocheras), which can accommodate 35 vehicles. Any faults are immediately reported back to the control centre, where the CARL maintenance management programme generates work orders so that repairs can be processed ahead of the vehicle's return to the workshop. The depot is equipped to carry out all corrective and preventative maintenance activities in-house, which helps to minimise operational costs.

Energy costs are an important consideration. MTSA has invested €3·6m in a power plant comprising 3 680 solar panels, with a maximum output of 644 kW, which covers 4 660 m² of the roof surface at Talleres y Cocheras. Capable of generating 900 000 kWh per annum, the plant currently supplies 10·3% of MTSA's power requirements. Its capacity is being extended to 900 kW by the spring of 2009, providing around 16·5% of Metrotenerife's needs.

Outstanding ridership levels

Tenerife's tram has been a resounding success ever since its inauguration, with ridership far exceeding all forecasts. MTSA's financial results have been positive, not only covering operational costs but generating a surplus to start repaying the initial loans.

Total annual ridership exceeded 13 million in 2008, with a peak in October 2008 when monthly traffic reached 1·26 million passengers, 27% more than in 2007. This represents an average daily figure of 50 000 passengers, an increase of 8% on 2007 figures. Since the line opened on June 2 2007, a total of 19 million journeys had been completed.

The tram's success can be attributed to several factors. One is accessibility. Around 55% of the city's 339 000 inhabitants live within 500 m of a tram stop, with vehicles arriving every 5 min during peak hours. Trams operate between 06.00 and 24.00 from Monday to Friday, and a 24-hour service is provided during weekends and public holidays. Moreover, the route alignment was carefully planned to serve high-density residential areas, and key institutions, including two municipal hospitals and university campuses, as well as the main administrative centres on the coast and the historic city of La Laguna. Surveys show that 28% of users are under 25 years of age, and almost 50% of these are university students. According to Carlos Alonso, President of MTSA, 20% of trips are made for shopping and leisure.

Despite 50 road intersections, the tram takes only 37 min to cover the route from end to end, at an average speed of 20 km/h. The tracks are segregated from other traffic wherever possible and the tram has absolute priority over other traffic at all junctions. Although the tram competes with local buses or 'guaguas', figures show that 55% of all tram journeys would not have been made by bus, evidence that the tram has significantly increased Santa Cruz's public transport offering. Andrés Muñoz, Managing Director of MTSA, is proud of the fact that 25% of tram users formerly travelled by car but now choose to leave it at home.

Project background

Motivated by concerns about the high levels of car ownership in Tenerife, and the ensuing pollution and road congestion which often paralysed the north of the island, feasibility studies for Tenerife's first tramway began in January 2001. Metropolitana de Tenerife SA was created in September 2000 to draw up the project, which

A total of 3 680 solar panels have been installed on the roof of Talleres y Cocheras, which houses the CCP, workshop and depot. The modern control centre is the hub of Metrotenerife operations. Real-time information is displayed on the wall-mounted screen.

Photos: MTSA

Photo: MTSA

The tram runs through dense urban areas and along narrow streets, such as the Calle Imeldo.

was approved in November 2002. Tenders were subsequently launched in 2003 for civil works, rolling stock, depot and E&M contracts, and construction finally started in June 2004. In 2002 the Tenerife government awarded a 35-year build and operate concession to MTSA, which is now a public-private consortium comprising the government, which has an 80% share, Tenemetro (Transdev, Somague and Ineco) with 14%, and local bank CajaCanarias with a 6% share.

The 12·6 km line, which runs from Trinidad to Intercambiador and has 21 stops, cost €305·6m to build. The fleet of 20 articulated Alstom Citadis 302 trams which operate the route are a colourful sight. The 100% low-floor vehicles are 32·5 m in length and 2 400 mm wide with a capacity of 200 passengers, including 56 seated. The track is standard gauge and power at 750 V DC is supplied via overhead catenary. Maximum speed is 70 km/h.

Ticket machines are located at each stop with on-board validation machines located beside each of the 12 vehicle doors. Ticket inspectors are employed resulting in a low level of fraud, which stands at less than 3·5%.

The project posed several technical challenges due primarily to the steep gradients, which average 5% but reach 8·5% in places. To cope with the grades, the vehicles have all three bogies powered. Underpasses were constructed in several locations where the gradients were too steep to climb. Cars use regenerative braking, and power generated on the downhill trip is fed back to trams on the uphill track.

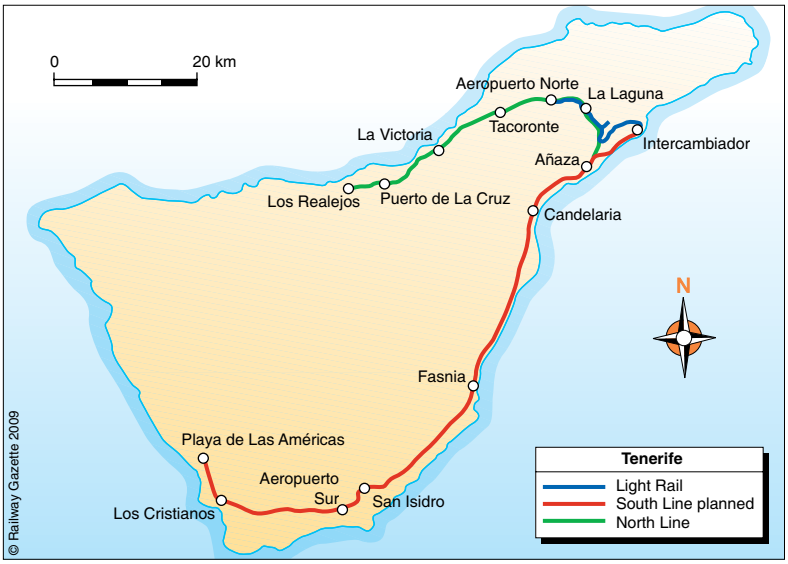
Expansion plans

Ricardo Melchior, president of Tenerife's government or Cabildo, is a staunch advocate of the tram and the driving force behind its implementation. Buoyed up by its success, he remains committed to increasing the provision of rail services in Tenerife

Work on the Tincer section of Line 2 is almost completed; the connection with Line 1, at the underground section near Taco, was made in early 2009.

Table II. Metrotenerife planned network

Line / Phase	Route	Length
Line 1 Phase 1	Intercambiador – La Trinidad	12·6 km
Line 1 Phase 2	La Trinidad – Los Rodeos/North Airport	3·2 km
Line 2 Phase 1	La Cuesta – Tincer (L1+L2)	3·6 km
Line 2 Phase 2	Tincer – La Gallega – La Candelaria	11·1 km
Line 3	Congress Centre – Intercambiador – Las Teresitas	9·4 km
Total length		**39·9 km**



in general, and tram services in Santa Cruz in particular.

Construction of the first phase of Line 2 started in March 2008 and is well advanced. Once the extension is completed, an additional 40 000 inhabitants will live within 500 m of a tram stop, creating an anticipated increase in demand of 17% or 6 500 passengers a day. The budget for the new line is €55m and includes the cost of six new vehicles to supplement the fleet.

The 3·6 km line from La Cuesta to Tincer shares its central section with Line 1, but two additional stretches of track totalling 2·3 km and four new stops — La Cuesta, Parque de Ofra, El Rosario and Tincer — have been built to the northeast and southwest of Line 1. The gradient averages 2% with a maximum of 8·5%. Trial running started in February and commercial service is now expected to start in June 2009.

Reflecting its satisfaction and excellent relationship with its existing suppliers, MTSA has retained their services for the new line. Civil works are being carried out by two consortia, with Sener Ingeniería y Sistemas and Teno Ingenieros y Consultores contracted to provide technical support and supervision. A park-and-ride facility with space for 65 cars will be located at Tincer near the TF-2 highway.

Future plans have yet to be finalised but include a 3·2 km extension of Line 1 from Trinidad to Tenerife North airport at Los Rodeos, several extensions to Line 2 to create a circular route via La Gallega and Santa María del Mar, and Line 3, which will run along the coast to San Andrés and Las Teresitas (Table II).

According to Carlos Alonso, detailed planning will start in early 2009 to determine the routes and estimate travel demand and costs; this work should be completed in six months. If all runs to plan, the project could be ready by 2010, with civil works starting simultaneously in 2011 on all approved extensions. There is also talk of a fourth line running from Districts 11 and 12 in Santa Cruz to Geneto and Casco de la Laguna. Finance is expected to come from the island's Cabildo, local municipalities, European funds and central government.

Interurban links

To improve mobility and reduce congestion on the main arterial roads, the government also plans to connect the north and south of the island via two interurban railways. The estimated cost is put at €2·8bn. Asesores de Infraestructuras SL was recently appointed to carry out a financial feasibility study for the 80 km southern route, which will have seven stations and connect Las Américas with Santa Cruz in 45 min. Preparation of the project plan will take approximately 18 months; construction work could start as early as 2011 with operation likely in 2017, but financing has yet to be agreed with the government. A fleet of eight four-car trains, 100 m long and with a capacity of 300 to 400 passengers will be required.

A further 38 km northern route from Santa Cruz via La Laguna to Los Realejos is also envisaged. However, work on this is unlikely to commence before 2013 and will last six years. Ricardo Melchior rejects suggestions that building rail and tram networks on an island only 100 km long is a whim. In his opinion, the rail network 'will be vital to drive balanced growth in our municipalities. In our island there are towns which are declining and others which are growing by up to 15% a year, which is ridiculous and puts unacceptable pressure on scarce land resources.'

In line with its green credentials, MTSA is hoping to become self-sufficient in energy. A nine-turbine wind farm is expected to be built at Arico in 2009 to generate power for tram lines 1 and 2. Any surplus power would later be used on the South Line, whose remaining energy requirements would be generated by another wind farm located at the proposed depot site in Fasnia.

Another concrete culvert, 711 m in length, is being installed in Barranco de Muerto to improve drainage; a drain has also been installed in Barranco de El Hierro.