

SHARING EXPERIENCE IN ZARAGOZA



Geoff Butler rounds up the highlights from this year's European Light Rail Congress in north-eastern Spain, a further return for face-to-face events for a mobility sector disrupted by the coronavirus pandemic.

With travel restrictions easing, the demand for in-person networking and sharing of experience is rising. Against this backdrop, figures from across the light rail sector gathered in Aragon's capital, Zaragoza, for the 2021 European Light Rail Congress – for many their first physical gathering in 18 months. Held over two days on 15-16 September, the event saw a focus on safety, innovation and sustainability, perhaps unsurprising as

the world has changed immeasurably since the last event in Brussels in 2019.

Mirrored across the globe, LRT systems have played a crucial role in keeping cities moving over the past 18 months. Nowhere is this more evident than in Zaragoza, where the tramway has once again proved its value as the backbone of the mobility network.

Organised by *TAUT* publisher Mainspring and supported by Mobility City, Fundacion Ibercaja and Tranvía de Zaragoza, over 100 participants heard first-hand case studies of



▲ ABOVE: In his opening address, Zaragoza Mayor Jorge Azcón outlined the city's ambitious plans to be carbon-neutral by 2030.

◀ LEFT: Zaragoza's 12.8km tramway has the highest ridership of any tramline in Spain.

▶ RIGHT: in Mainspring Managing Director and TAUT Publisher Matt Johnston joined city representatives Natalia Chueca and Jaime Armengol for a pre-event press conference.



some of the most exciting developments over the Congress' two days, also taking part in a technical visit and an interactive networking evening where delegates could explore some of the latest technologies first-hand.

A fine welcome

The Congress began with a warm welcome from the Mayor of Zaragoza, Jorge Azcón, who outlined the success of his city's tram network in driving modal shift away from car ownership. The city has an ambitious vision of sustainability and to drive its own carbon emissions down by 40% within the next decade. The tramway will play a key part in this plan. Although the effects of COVID-19 have been particularly felt in northern Spain, patronage is recovering well, he said.

Natalia Chueca, the City Council's Mobility Counselor, expanded on this vision for a cleaner, greener city, outlining the plan to reduce emissions by 2030. In 2020, bicycle use across the city grew by a remarkable 80% (helped by Aragon's climate with year-round sun and temperatures rarely below 10°C). Located between the major hubs of Barcelona, Madrid and Bilbao, Zaragoza was the host city for the 2008 Expo. It is also the home to a number of the country's leading rail and automotive manufacturers and suppliers.

In a relatively compact city with low population density – 724 people/km², far below Madrid (5335 people/km²) or Seville (4981 people/km²) – the tramway performs an important role, reflected in the statistic that only 24% of journeys are made by car. Zaragoza has one of Spain's lowest rates of car ownership, with fewer than 400 vehicles per 1000 residents.

Since the full extent of the city's first tramline opened in 2013, road traffic has been reduced by 15%. The figure is more than 40% in some areas of the centre, which has also seen improvements to the urban realm to make the city's historic core an attractive and vibrant place for work and leisure. The tramway holds a 23% market share for urban journeys overall (recording 29m passengers in 2019), Ms Chueca explained, an impressive figure for a city of around 700 000 residents. The 12.8km (eight-mile) line records the

highest passenger levels of Spain's second-generation tramways, by some margin.

The city is therefore very proud of its shift towards emissions-free travel and Jaime Armengol of Fundacion Ibercaja described how the Mobility City project forms an integral part of Zaragoza's landscape, with a variety of innovative projects across its 50-strong membership. Mobility City is a collaborative project led by Fundacion Ibercaja and supported by the Government of Aragon to reframe the debate around travel; it brings together industrial partners, academics and politicians to develop solutions to sustainable travel, again all positioned within the ambition of creating a carbon-free city by 2030.

“Figures from across the sector gathered for the European Light Rail Congress in Zaragoza – for many their first physical gathering in 18 months.”

Mobility City's projects highlight sustainability within transport, connectivity, autonomy, and customer service, all focused on environmental protection and the current and future needs of both the passenger and the city's spatial and economic development. Furthering these aims, a new regulatory framework has been developed to harmonise intelligent transport, autonomous vehicles and data systems.

The foundation also has a key outreach and education programme to engage local schools and education centres, with a weekly radio programme discussing its initiatives. Many of these are now reaching maturity, with the next two to three years seen as key to sharing learning and expertise with others.

The future of LRVs

From one of the largest partners in the region, CAF Tramway Product Manager José

Hernández showcased the manufacturer's current and future light rail programmes. Highlighting the importance of flexible, modular solutions, his presentation examined the popular move towards onboard energy storage for 'wire-free' operations as well as some of the enhanced technology available for communications and safety systems.

With its close links (CAF is a partner in the Traza consortium which delivered the city's tramway), Zaragoza is a testbed for much of the company's innovation, which delegates were able to see first-hand with a visit to the Valdespartera depot (see page 447).

The continuing evolution of Greentech technology, which stores a vehicle's braking energy, advances in overspeed control, fatigue and risk detection plus virus and bacterial protection systems were some of the many developments covered by Mr Hernández.

In a similar presentation from Stadler, Mar Rivas gave an overview of the company's tram-train activities. A modular platform, the *Citylink* offers all the benefits of the company's tram and LRV platforms with the customisability for operation on a diverse range of heavy and light rail infrastructure. Offering a variety of traction power systems, the *Citylink* units employed in the UK have both 25kv ac and 750V dc power (South Yorkshire) and 25kv ac/battery hybrids (South Wales). There are also electric/diesel options, as supplied to Alicante (Spain), Chemnitz (Germany) and Szeged (Hungary).

As a market-leader in tram-train, the *Citylink* is both lightweight and high-strength, with improved interior passenger space while maintaining level-boarding for both traditional tramway and light rail infrastructure and heavy rail platforms.

With ever-increasing demands on reliable two-way communications between vehicles, wayside systems and control centres, Sonia Miguel from Teltronic presented her company's work in delivering critical voice and real-time data, signalling, CCTV and passenger information systems.

The use of multi-channel transmission was highlighted with the RTP-800 unit, a next-generation onboard radio that uses



communications are lost, the onboard system activates an audible/visual warning. If the driver does not respond to an alert in a given period, the emergency brake is activated.

On the event's second day, Dr Ruprecht Anz from Bosch Engineering presented another solution for driver and vehicle safety – and one that has already been applied to over 1100 trams and LRVs around the world.

Deriving technology from decades of experience in the automotive and rail sectors, Bosch's TFCW (Tram Forward Collision Warning) system focuses on four main tenets: driver alerts; automated braking; obstacle and pedestrian detection; and future developments towards automated driving. First delivered into passenger service in 2017, the system is fully compliant and certified to standards in Europe and the US and consists of multi-purpose cameras, mid-range radar and a rail control unit.

Incorporating AI technology, the system's sensors and monitoring units continually scan the track ahead; if they determine possibility of an upcoming collision, an alert is raised for the driver. If the driver does not react, the system can initiate the brakes. Designed as a non-intrusive system, the driver remains in full control, with the ability to override the system at any time.

Digitisation system assets

Eduard Cabrera from Barcelona's Autoritat del Transport Metropolitana (ATM) offered detail on the project to unify Barcelona's physically separate Trambaix and Trambesòs networks (see *TAUT* 1003), framing it within the context of one of the Europe's 'smartest cities'.

As well as its ongoing programme to connect the two networks, ATM has undertaken a project to digitise its assets to ease and improve maintenance and reduce lifecycle costs. These digitised assets allow for real-time interrogation, better management of third party works and interventions, the sharing of system information, and enhancing the process of public consultation procedures through more transparent and more interactive demonstrations.

The application of BIM and GIS modelling should also inform and improve the accuracy of tendering processes, future network improvement studies and final acceptance, as well as ongoing operations and maintenance efficiencies for the expanded network.

Following Eduard, Elli Kartsakli from the Barcelona Supercomputing Centre explained its advanced software architecture for advanced mobility systems and autonomous transport networks – ELASTIC. The ambition of this EU-funded project is to look at the challenges in the cloud computing ecosystem with solutions to facilitate complex data analytics and exploit the advanced parallel and energy-efficient embedded platforms.

ELASTIC is currently being used in the Italian city of Firenze (Florence). As the city investigates the potential of autonomous vehicles, enhanced maintenance services and smart mobility, ELASTIC is looking at Next Generation Autonomous Positioning (NGAP) and Advanced Driving Assistance Systems (ADAS), predictive maintenance and energy efficient driving to make tram travel more efficient, smarter and safer, moving towards autonomous transportation.

one compact rack with both narrow- and broadband radio technology with LTE and Wi-Fi technologies for an 'all in one' solution.

A new dimension of safety

Tranvía de Zaragoza CEO Ana Moreno shared the recently-implemented programmes to boost passenger comfort and confidence.

This includes a world-first with the fitment of bipolar ionising filters to the tramway's *Urbos* trams. These not only reduce the amount of bacteria and potentially harmful micro-organisms (up to 80% in initial trials), but also up to 75% of the damaging PM2.5 microparticulates and other airborne contaminants which have been proven to be a longer-term hazard to public health.

A first of its kind in a public transport application, bipolar ionisation is already installed in the buildings at Los Angeles International Airport and the Spanish Constitutional Court.

With initial trials complete, Zaragoza's 21 trams should have the new filters fitted by the end of the year, and the operator is keen to publicise its efforts to passengers, further

restoring confidence in public transport as the city moves into its next phase of dealing with the coronavirus pandemic.

Taking an alternative approach to LRT signalling, José Yera of Electrans offered an insight into how beacon-based ATP (Automatic Train Protection) and tram detection systems are playing a role in the safe and efficient operation of modern networks.

Electrans is the largest signalling supplier in Spain, also supplying products to more than 30 countries. The company says its driver assistance system to avoid tram overspeed and signals passed at danger is a more suitable solution than CBTC, which is more suited to heavy rail applications.

Tramways built before the year 2000 are not usually equipped with such equipment, Mr Yera explained; therefore it is important to have a technical solution which can be installed cost-effectively without having to renovate the entire signalling system.

A beacon-based solution relies on the simple premise of transmissions between the vehicle and wayside equipment to determine a vehicle's location. In the event that



▲ Metrotenerife's novel solution to the challenge of embedded track renewal has found a commercial partner and will soon be available to tramway operators and maintainers around the world. Courtesy of Metrotenerife

◀ **LEFT: Dr Ruprecht Anz of Bosch explained how the popularity of driver assistance systems is increasing worldwide.**

▶ **RIGHT: Senior industry figures discussed the changing demographics of the Spanish rail sector in a panel debate on the event's second day.**

ELASTIC proposes a novel architecture for the distribution of complex analytics to infrastructure while guaranteeing non-functional requirements, supporting the reallocation of resources to enhance the overall programmability, portability and performance.

A new way forward for track renewals?

Day two began with Metrotenerife's Pablo Oromí talking about embedded rail replacement – another complex issue that can lead to extended periods of disruption for passengers and lost revenue for operators.

Common encapsulation techniques found on many second-generation networks are great at insulating against stray currents, noise and vibration, but can be problematic when it comes to maintenance, removal and necessary replacement works.

With rails wearing and maintenance required over time, including grinding and welding, eventually replacement is required. To reduce both the time and cost associated with this process for embedded rail, Metrotenerife has developed its 'removable insulating chamber for grooved rail'.

Offering excellent electrical and acoustic insulation, it is made from recycled materials (used car tyres in this instance) which



gives the benefits of lower manufacturing costs, fewer components, environmental improvements and time, and disturbance reductions to the urban environment.

For LRT track, the removable insulating chamber is compatible with different track coverings (for example grass, asphalt or paving) and with the most common types of rail fasteners. It's a benefit for travellers as disruption is reduced. It's a benefit for operators due to ease of installation and less time spent without revenue operations. It's a benefit for construction staff with a reduced

workload due to the easier replacement. It's a benefit for residents and businesses due to the reduced inconvenience during the works.

With trial installations completed, Metrotenerife has shown cost reductions of up to 42% compared with traditional solutions. The operator has also partnered with a commercial supplier to make the system available to other operators. **TAUT**

▶ All images by Tranvía de Zaragoza and Geoff Butler unless stated. The European Light Rail Congress is organised by Mainspring – www.mainspring.co.uk

GETTING HANDS ON

In the afternoon of the first day of the congress, delegates were given a first-hand view of the tramway depot at Valdespartera. One of the most advanced facilities in Europe, CAF's 'Digital Workshop' is responsible for the maintenance of the Zaragoza tram fleet.

Visitors were able to see the digital transformation processes implemented so far and the technologies applied to optimise the maintenance and energy efficiency strategy. Amongst the most important is LeadMind, a digital platform for operation and maintenance. The workshop team at Valdespartera shared case studies of real-time detections that have prevented service incidents, the application of CAF's advanced analytics for predictive maintenance and the value of CBM (Condition Based Maintenance) for safe and efficient planning even before the Urbos units arrive at the workshop.

One of the initiatives that has attracted most attention has been the implementation of the traceability system which employs radio-frequency identification (RFID) technology. Allowing the depot to track tagged items, workshop staff have total control over the traceability of selected assets such as the bogies.

In an effort to improve efficiency and remove time-consuming paperwork from the facility, the Maintenance Execution System

(MES) sees personalised tablet computers that allow employees to register all the vehicle maintenance and preparation works. Before the maintenance teams start a new task, they are given a simple overview of works already assigned, pending and completed. The system is able to process all the related documents for the given job, which are generated automatically in PDF format and stored in a secure server.

Likewise, CAF Turnkey & Engineering is currently developing a new system which involves the installation of data acquisition systems on its energy infrastructure. In this way, information gathered and processed using Big Data analytics with the aim of compiling information that is useful for CBM (Condition Based Maintenance) and thus improving the energy efficiency of the system.

Upon their return to the city centre, delegates were welcomed to an evening networking event at the Aura Restaurant, with its views across the city and the River Ebro.

A selection of the latest cutting-edge products included a tram depot console from local company Hubtech and a demonstration of the CAF Lead Mind software tool.

Zaragoza-based HMY brought along its charging products for e-scooters, allowing for rapid charging at travel hubs. The company also demonstrated its latest range of smart parcel storage



lockers, plus the fun element of a digital 'mirror' where people stand in front of a large screen and find themselves represented virtually in all manner of alternative outfits!

Micromobility firm Bird showed off its latest e-scooters, with delegates able to trial one for themselves.

As public art is a key part of the Zaragoza system, there was also a display from several local artists who take part in the Festival Asalto. This annual event sees modern art displayed on tramstops around the city, and the artists demonstrated their skills on the night.