136 NEW TRAMWAYS IN THREE DECADES... and 50 more on the way

REPORT BY MICHAEL TAPLIN

Turkey's newest tramway is in Antalya, where visitors in September found the line about to open. CAF supplied the trams. Ch. Buisson

The Canadian city of Edmonton led the way with the first new light rail line of the modern era, and since the 1980s the pace of construction of new tramways and light rail around the world has increased at an incredible rate. There are already ten new systems since this list was last published in January 2008 and more than 50 are in the pipeline, with many more planned.

Of course there have been a few closures as well, some overtaken by events (like the Houten shuttle in the Netherlands, only intended to hold the fort until a heavy rail local service came along) and some like systems in the former Soviet Union and Romania, put out of business by the new economy and official indifference. However it is good to see that Kazakhstan at least recognises there is a case for new tramways in that part of the world, recently signing a EUR300m contract with Alstom for a brand new network for its capital, Astana (see *TAUT* 864, December 2009).

In addition to these approaching 150 tramways and LRT projects, another aspect is shown by the nearly 50 new heritage tramways, which may not provide full-time revenue earning service (although some do), but capture affection for the tramway as a fun way to travel. This can be just as vital a factor in city centre rejuvenation.

The worldwide trend to LRT

All these schemes have got where they are today by careful evaluation that has shown the tramway as the best value for money, taking into account its ability to attract passengers (particularly private car users) and the longevity of its assets. How many passengers riding a Brussels PCC today realise they are in a vehicle approaching 60 years old? They certainly would if they were in a 60-year old bus...

In pure number terms, France and the USA lead the way with 20 new systems and more to come in each country (by one count there are some 80 schemes at various stages of planning in the US); what a contrast with Britain's eight and just Edinburgh to come. A nation like Turkey (with its ten new systems and two more to come) puts the UK to shame.

Even 30 years ago, the previous editor of this magazine, W. J. Wyse, asserted that there was no clear dividing line between tramway, light rail and heavy rail, despite the efforts of semantic purists to prove otherwise. The rise of the tram-train only blurs the distinction more, while at the other end of the spectrum rail-guided rubber-tyred vehicles are a further challenge to definitions.

The lists that follow do not resort to categorisation therefore, but do include some notes to aid identification. Separated lines in cities such as in Paris and Los Angeles are counted individually.

TAUT has also identified 12 key milestones of the last three decades and examines their significance (all project costs are indicative of time of completion).

UNDER CONSTRUCTION

Abuja (NG) (d)
Algiers (DZ)
Angers (FR)
Austin (US) (d)
Bergen (NO)
Brasilia (BR)
Brest (FR)
Cadiz (ES) (tt)
Constantine (DZ)
Dijon (FR)
Dubai (AE)
Edinburgh (GB)
Firenze (IT)
Gazantiep (TR)
Gold Coast (AU)
Granada (ES)
Hanoi (VN)
Hasselt – Maastricht (BE/NL)(tt)
Jaen (ES)
Jerusalem (IL)
L'Aquila (IT)(r)
Le Havre (FR)
Los Angeles (3rd)
Manacor – Arta (ES)(tt)
Mendoza (AR)(tt)
Mulhouse (FR)(tt)
Nantes (FR)(tt)
Norfolk (US)
Oran (DZ)
Palermo (IT)
Rabat (MA)
Reims (FR)
Réunion (FR)
Samsun (TR)
Santiago (DO)
Sevilla (ES)(2nd)
Stockholm (SE)(2nd)
Toulouse (FR)
Tours (FR)
Tucson (US)
Vancouver (CA)
Venezia – Mestre (IT)(r)
Washington DC (US)
Zaragoza (ES)

Approved for construction

Aarhus (DK)(tt)
Astana (KZ)
Biel/Bienne (CH)
Groningen (NL)
Hamburg (DE)
Liege (BE)
Lens (FR)
København (DK)
Luxembourg (LU)
Tel Aviv (IL)

FULL SERVICE TRAMWAYS OPENED	
Year	**Location**
1978	Edmonton (CA)
1980	Tyne & Wear (GB), Staryi Oskol (RU)
1981	Calgary (CA), Helwan (EG)*, San Diego (US)
1982	Rio de Janeiro (BR)
1983	Utrecht (NL)
1984	Buffalo (US), Constanta (RO)*, Manila (PH), Volgograd (RU)
1985	Nantes (FR), Tunis (TN)
1986	Kriviy Rih (UA), Portland (US)(1st)
1987	Brasov (RO)*, Buenos Aires (AR)(1st), Cluj - Napoca (RO), Craiova (RO), Grenoble (FR), London Docklands (GB), Ploesti (RO), Sacramento (US), San Jose (US), Sofia (BG)
1988	Masyr (BY), Resita (RO), Tuen - Mun (CN-HK), Ust - Ilimsk (RU), Valencia (ES)
1989	Guadalajara (MX), Istanbul (TR)(1st)
1990	Genova (IT), Los Angeles (US)(1st)
1991	Botosani (RO), Campinas (BR)*, Cheryomushki (RU), Karlsruhe (DE)(tt), Lausanne (CH), Monterrey (MX), Pyongyang (KP)(1st)
1992	Baltimore (US), Istanbul (TR)(2nd), Konya (TR), Manchester (GB), Paris (FR)(1st)
1993	St Louis (US)
1994	Denver (US), Geneva SBB(CH)(tt), Rouen (FR), South Yorkshire (GB), Strasbourg (FR)
1995	Buenos Aires (AR)(2nd)
1996	Ankara (TR), Dallas (US), Kuala Lumpur (MY), Oberhausen (DE), Pyongyang (KP)(2nd)
1997	Izmir (TR), Saarbrücken (DE)(tt), Sydney (AU)
1998	Paris (FR)(2nd)
1999	Alicante (ES), Chongjin (KP), Salt Lake City (US), West Midlands (GB)
2000	Hudson - Bergen (US), London Croydon (GB), Lyon (FR), Montpellier (FR), Orléans (FR), Stockholm (SE)
2001	Heilbronn (DE), Houten (NL)*, Ottawa (CA)(d), Portland (US)(2nd)
2002	Bilbao (ES), Bursa (TR), Porto (PT)
2003	Bordeaux (FR), Changchun (CN), Los Angeles (US)(2nd), Messina (IT), Rijn - Gouwe (NL)(tt), Tacoma (US)
2004	Athina (GR), Barcelona x 2 (ES), Caen (FR)(r), Camden – Trenton (US)(d), Dublin x 2 (IR), Eskisehir (TR), Heilbronn (DE)(tt), Houston (US), Minneapolis (US), Nordhausen (DE)(tt), Nottingham (GB)
2006	Aulnay – Bondy (FR)(tt), Clermont-Ferrand (FR)(r), Den Haag (NL)(tt), Zürich Glattal (CH), Kassel (DE)(tt), Mulhouse (FR), Paris (FR)(3rd), Sassari (IT), Toyama (JP)(tt), Valenciennes (FR), Vélez - Malaga (ES)
2007	Almada (PT), Buenos Aires (AR)(3rd), Cagliari (IT), Charlotte (US), Le Mans (FR), Madrid x 2 (ES), Marseille (FR), Murcia (ES), Nice (FR), Padova (IT)(r), Parla (ES), Santa Cruz de Tenerife (ES), Seattle (US), Sevilla (ES), Tjanjin (CN)(r)
2008	Cagliari (IT), Gasteiz-Vitoria (ES), Oceanside – Escondido (US)(d), Phoenix (US),
2009	Bergamo (IT), Adana (TR), Antalya (TR), Kayseri (TR), Stourbridge (GB), Seattle (US)(2nd)
Tram-train operations (included in above)	
1991	Karlsruhe
1994	Geneva – La Plaine (SBB)
2003	Rijn – Gouwe
2004	Heilbronn, Nordhausen
2006	Aulnay – Bondy (FR), Den Haag (RandstadRail), Kassel, Toyama

MODERN MILESTONE No. 1: 1978 - Edmonton

First light rail system of the modern era

In the 1970s the Canadian province of Alberta was wealthy with oil revenue, and a visit to Germany to see what light rail can do led to major investment.

Edmonton came first thanks to the Commonwealth Games, the drive of Bob Clark (an LRTA member and reader of *TAUT*'s previous evolution *Modern Tramway*). The available alignment was alongside the Canadian National Railway north-east from the city centre (accessed by subway).

Frankfurt technology, including 14 Siemens-Duewag U2 LRVs, worked 'out of the box'. The CAD65m, 7.2km line, opened on 23 April 1978, has been extended south from the city centre across the river to the University, with further construction in progress.

MODERN MILESTONE No. 2: 1980 - Tyne & Wear

First British and first new European light rail

Given subsequent progress, it is ironic that the first new light rail system in Europe was built in the UK, to serve Tyneside. However, in keeping with subsequent tradition, the gestation of the Tyne & Wear Metro was lengthy.

It revived moribund local rail services de-electrified by British Railways, in particular the North Tyne loop and South Shields line, with new subways under Newcastle and Gateshead.

As in Edmonton, a reader of this magazine (and subsequent LRTA President), Dr Tony Ridley was the driving force. Much technology came from Germany with 90 high-floor cars, essentially the *Stadtbahn-B* design, built by Metro-Cammell with dimensions not constrained by the need for street running. Opening date of the GBP278m, 56km system was 7 August 1980. Subsequent extensions see service to Newcastle Airport and to Sunderland.

ISO COUNTRY CODES

AE United Arab Emirates

AR Argentina

AU Australia

BG Bulgaria

BR Brazil

BY Belarus

CA Canada

CH Switzerland

CN China

CN-HK China-Hong Kong SAR

CL Chile

DE Germany

Do Dominican Republic

DZ Algeria

EG Egypt

ES Spain

MODERN MILESTONE No. 3: 1981 - San Diego

First new light rail in the USA

The coastal city in southern California achieved the construction of its first light rail line in 30 months, on-time to a budget of USD86m and without any federal funding. It also made a profit in terms of revenue covering running costs. Once again a rail corridor was available for the bulk of the line and the driving force was a reader of *Modern Tramway*, Senator James R. Mills, Chairman of the Metropolitan Transit Development Board.

Senator Mills had too seen how the Germans did things, and ordered 14 Siemens-Duewag U2 cars, and pavement ticket machines for an honour fare system, while to save costs on the 22.5km (14 mile) ex-railway section, single track with passing loops were laid to accommodate a 20-minute headway.

The line ran south from the city to the Mexican border at San Ysidro, just across from Tijuana, and was colloquially known as the Tijuana Trolley. There was 2.7km (1.7 mile) of new street track on 12th Ave and C Street to take the line to a terminus at the Santa Fe depot (railway station). Service on the no-frills line started on 26 July 1981. The success of the starter line ensured the construction of a three-line network in subsequent years.

Heritage tramways	
1981	Buenos Aires (AR)
1982	Seattle (US)*
1984	Fort Collins (US), Lowell (US), Rockford (US), Santos (BR)
1985	Kimberley (ZA)*
1986	Chisholm (US), Victor Harbor (AU)
1988	Galveston (US)(d)
1989	Dallas (US)
1990	Istanbul (TR)(1st), Molochne (UA)
1991	Fort Smith (US), Portland (US), Stockholm (SE)
1992	Nelson (CA)
1993	Memphis (US), Tucson (US)
1994	Birkenhead (GB), Christchurch (NZ), Edmonton (CA), Naumburg (DE)
1996	Arnhem (NL), Charlotte (US)
1997	A Coruña (ES), Lima (PE)
1998	Bergen (NO)
1999	Antalya (TR), Astoria (US), Vancouver (CA)
2000	Kenosha (US), Whitehorse (CA)
2001	Issaquah (US), Mar del Plata (AR)*
2002	El Reno (US)(d), Grove-Los Angeles (US), Tampa (US)
2003	Istanbul (TR)(2nd), San Pedro (US)
2004	Belém (BR), Iquique (CL), Little Rock (US)
2007	Döbeln (DE)
2008	Quilmes (AR), Beijing (CN), Glendale-Los Angeles (US), Savannah (US)

KEY	* since closed	(d) diesel light rail	(r) rubber-tyred system	(tt) tram-train

MODERN MILESTONE No. 4: 1980 - Buenos Aires

First heritage tramway in city streets

There is a distinction between a heritage tramway and a museum tramway. There are many of the latter, some over 50 years old that operate within enclosed museums. Heritage tramways operate in the public domain, in or beside city streets, and may be operated by public undertakings or volunteer groups, or the two working together.

Although there has been a raft of new schemes in recent years (mostly using public funding), the honour of leading the way belongs to a dedicated group (Association Amigos de Tranvia) in Buenos Aires, Argentina founded in 1976. Officially incorporated in 1977, the group saw the opportunity presented by the continued operation in the Caballito district of the surface depot of metro Line A. This was built in the 1920s when the metro was brought to the surface on a terminal loop around city streets.

Although the metro had later become a wholly underground line, the ramp from Primera Junta station to the surface remained for irregular workshop access, as did the street loop. The group was given access to restore museum trams to operating condition at the depot and on 15 November 1980 inaugurated public service on the street loop. Old trams and metro cars continue to be restored and in 2008 the group also ran a second service on the streets of outer suburb Quilmes.

MODERN MILESTONE No. 5: 1985 - Nantes

First new French tramway

In 1975 the French government launched a competition inviting cities to submit plans for new fixed track surface public transport lines, for which the state would contribute to the capital cost. Nantes' politicians at that time really wanted a metro, but the cost proved prohibitive and those arguing for a modern tramway persuaded the majority to vote for trams in December 1978.

The project manager appointed was Christian Buisson (another LRTA member) and under his guidance final legal approval came in March 1981; 50 000 passengers were able to sample the new system in December 1984 and commercial services started on 7 January 1985, soon carrying 42 000 passengers per day.

The 10.4km (6.5 mile) line cost the equivalent of EUR93.3m (1985 prices) and was all on surface reserved track. The 20 trams were the first (and last) *Tramway Français Standard* built by Alsthom - 30m six-axle high floor cars (all since fitted with low-floor centres sections). By the time the new Grenoble tramway became the second in France to open, the design had been replaced by the low-floor *TFS-II*. The Nantes system has since expanded to three lines.

MODERN MILESTONE No. 6: 1987 - London Docklands

First automated light rail

The Docklands Light Railway was conceived as an instrument of regeneration for London's Docklands area that had lost □
Dogs, a site for new employment. After some debate about possible street running, the London Docklands Development Corporation voted for an automated mostly-elevated system, using in part abandoned freight railway alignments.

Construction started in 1984 and initially 12km (7.4 mile) linked Tower Gateway in the city, and Stratford, with Island Gardens. Built to a fixed price of GBP77m, it was intended to carry 1500 passengers/hour/direction. German firm LHB supplied 11 six-axle cars, again based on the *Stadtbahn-B* design, but fitted with automatic train control. A Royal opening by Queen Elizabeth II took place on 30 July 1987. Plans to upgrade the capacity of the system were being made even before the opening, and extensions have since been built to Bank, Beckton, Woolwich via London City Airport and Lewisham, with a new link from Canning Town to Stratford International for Eurostar and the 2012 Olympics.

MODERN MILESTONE No. 7: 1991 - Karlsruhe

First tram-train project

Karlsruhe in south-western Germany has operated trams since 1877, but in 1913 the main railway station was moved to a new site 2km (1.2 mile) south of the city centre. Main line trains provided a selection of rail services, but commuters mostly had to change from train to tram to complete their journeys.

In the 1980s plans were developed to integrate the two systems by designing a tram that could operate on railway tracks and building links between the railway tracks and the tramway system. Supported by funds from the Federal Department of Research and Technology, Siemens-Duewag developed a dual-voltage (750 V dc and 15 kV ac) car of the *Stadtbahn* type with a suitable wheel profile and railway safety equipment.

Ten were ordered (for the equivalent of EUR18m) and on 2 June 1991 they took over the stopping train service between Karlsruhe and Pforzheim. On 1 September 1991 the ramp linking Verkehrsbetriebe Karlsruhe and state railway tracks was opened at Durlach and through service from the railway to the city centre could start. The initial project cost the equivalent of EUR41m. The Karlsruhe system was so successful (300% passenger increases) that it has been extended to eight lines, with more planned.

MODERN MILESTONE No. 8: 2000 - Montpellier

First Alstom *Citadis* tram

With new tramways springing up all around France, Alstom wanted to offer its customers an alternative to the rather heavy *TFS-II* with its 70% low-floor capacity. It developed a modular design that could be built to various lengths and widths, with 100% low-floor or partly low-floor, and with a variety of front-end designs that could be tailored to reflect the individuality of the cities where they would operate.

Renowned industrial designer Philippe Neerman was brought in to 'clothe' the new technical innovations and orders were received from Montpellier, Orléans and Lyon. It was Montpellier's 28 type 301 (partial low-floor) 30m trams that were the first *Citadis*, serving its new 15.2km tramway built at a cost of EUR349m from 3 July 2000.

The original trams have been extended to 41m, while Alstom has gone on to sell around 1500 *Citadis* units around the world.

Rubber-tyred trams have achieved limited sales, with the Lohr system proving particularly successful. This Translohr car runs in the Shanghai suburbs. Lohr

COUNTRY CODES

FR France
GB Great Britain
GR Greece
IL Israel
IR Ireland
IT Italy
KP North Korea
KZ Kazakhstan
MA Morocco
MX Mexico
MY Malaysia
NG Nigeria
NL Netherlands
NO Norway
NZ New Zealand
PE Peru
PT Portugal

MODERN MILESTONE No. 9: 2003 - Bordeaux

First tramway with surface current collection

For a century almost all electric tramways have been powered by a current collector on the top of the vehicle collecting power from an overhead wire. Modern overhead systems can be designed to elegant and minimalist standards, though left to their own devices engineers are inclined to want to make them hurricane-proof with unsightly over-heavy equipment. This so-called clutter can make the concept difficult to sell to politicians, particularly those with historic city centres to preserve.

Alstom recognised this and introduced a system of alimentation par le sol (surface current collection - APS). A collector under the tram picks up current from a central rail, but to make it street-safe, the rail is energised only when the current collector is present, using magnets to lift the feeder. Extensive tests were carried out on private right-of-way in Marseille and when Bordeaux decided to build a new tramway in 1998, it was also willing to pay the price to be first to try APS.

A total of 44 APS-equipped *Citadis* were ordered in 2000 and on 21 December 2003 entered service on the 12.5km Line A. Teething problems ensued, but eventually Alstom was able to achieve 99% reliability, and the APS system has been sold to several other new systems.

MODERN MILESTONE No. 10: 2004 - Ekisehir

First metre-gauge and first new system with Bombardier *Cityrunner/Flexity*

Bombardier's modular tram was launched as the *Cityrunner*, but laster renamed as part of the *Flexity* family in 2005. In 2002 Bombardier and Yapi Merkezi (a Turkish infrastructure company) were awarded a turnkey contract by the municipality of Ekisehir (a city of 600 000, 230km west of Ankara) to design and build a 15.7km two-route metre-gauge tramway system. Work started in July 2002.

Rolling stock was finalised as 18 100% low-floor, 29.5m *Cityrunner* five-section articulated trams, based on the design produced for the Austrian city of Linz (but with one less body section). The project was built to time, with the trams delivered fully-tested from Germany, and opened for service on 24 December 2004. In the first full month (January 2005) 2.3 million passengers were carried and operator Estram soon had to order four more cars to meet demand.

MODERN MILESTONE No. 11: 2004 - Camden–Trenton

First diesel light rail

Here we see differences between the North American and European views of transit. Diesel trams are nothing new (Karachi and Sapporo, for example) and lightweight diesel units running on railways, sometimes on street for short distances, can be found across Europe. The Americans however discovered those European-built units as an option for providing light rail commuter service without the expense of electrification.

In 2001 Ottawa shipped over some Bombardier Talent diesel trains (diverted from a DB order for quick delivery) to run a demonstration project on a suburban line, but the first planned diesel light rail involving new construction (including street track) was the 54km Camden–Trenton line in New Jersey (the River Line, or Southern New Jersey Light Rail Transit). It comprised mostly former Conrail railway (still with time-shared freight service), but with new track for better city access. Since 14 March 2004 service is provided by 20 30.6m Stadler GTW2/6 units imported from Switzerland with 65% low floors carrying 9000 passengers/week. The project cost was USD604m under a design/build/operate/maintain contract.

COUNTRY CODES

RO Romania, RU Russia, TN Tunisia

TR Turkey

UA Ukraine

US United States of America

VE Venezuela

VN Vietnam

ZA South Africa

MODERN MILESTONE No. 12: 2007 - Almeda–Seixal

First system to use Siemens' *Combino Plus*

In 1985 an integrated transport plan for the Sul do Tejo (south of the river Tagus) region opposite Lisboa identified what was called a metro as needed to match the future travel needs of the population (1.9 million). Further studies published in 1995 showed light rail to be the best solution as a 13km system with three branches from a central point.

An international competition for a design/build/operate/maintain contract saw the MTS consortium (led by Siemens with Portuguese partners) start work on the EUR320m project in December 2002. Progress was slowed by several disputes over land acquisition, but 24 five-section steel-bodied *Combino Plus* trams from Siemens were delivered from May 2005, the first of this type since problems with earlier aluminium-bodied cars had led production to be suspended.

The 36.4m low-floor trams carry 232 passengers (74 seated) and run up to 70 km/h. The line connects wit the Lisboa ferries at Cacilhas and the Fertagus rail service at Pragal and Corroios. Opening day was 30 April 2007.

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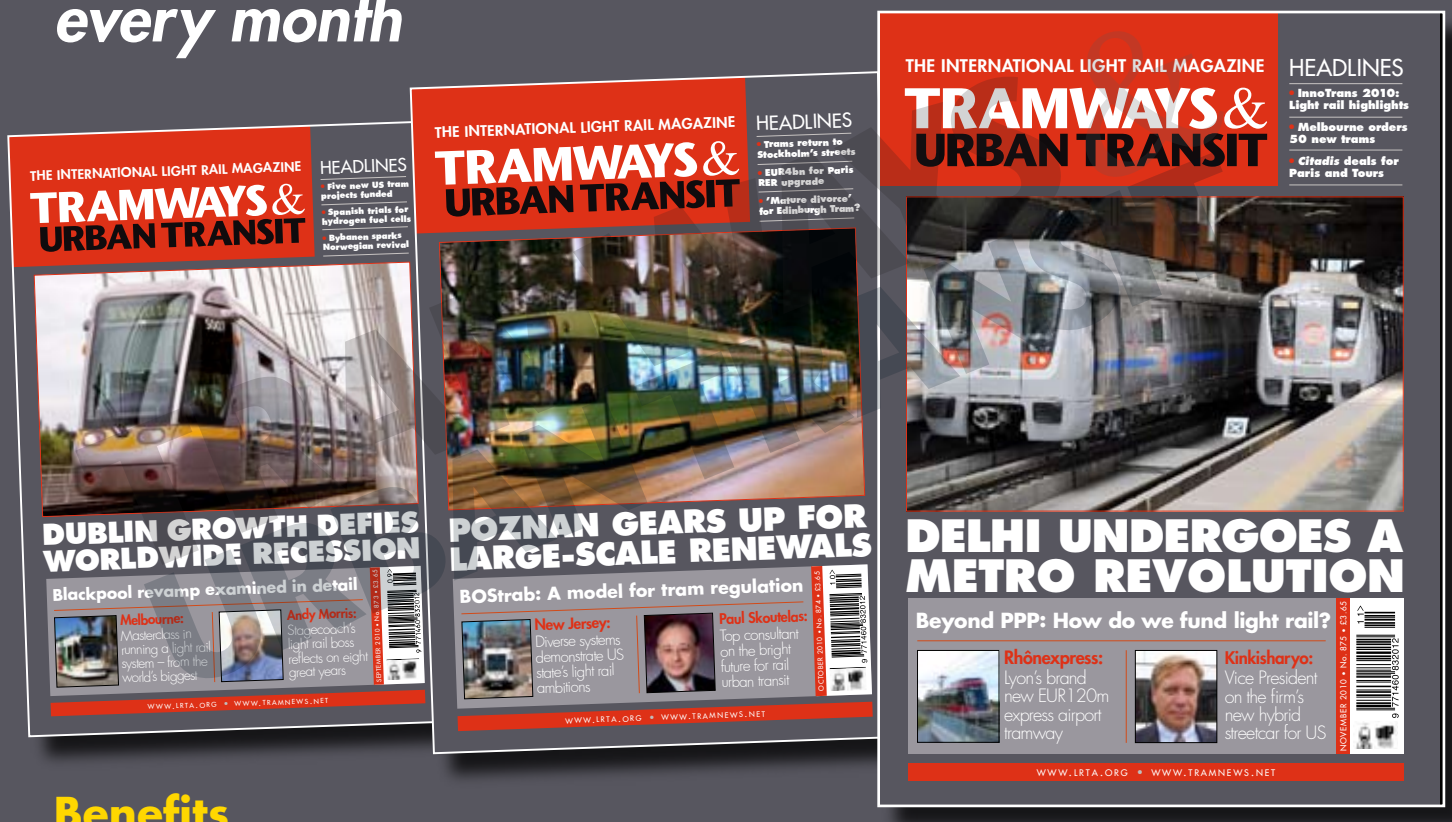

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