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MIKE HADDON.

Welcome

The UK's eight existing light rail and tram systems are currently in rude health, as confirmed by the latest figures from the Department of Transport.

These reveal that the highest ever number of annual passenger journeys (252 million) and vehicle miles (21 million) were recorded in the year ending March 2016 (records began in 1983).

And these numbers are only set to increase, as light rail transit's modal share of public transport journeys continues to rise from 2.7%, and ever more route miles are required to meet growing demand on many regional systems.

Our 16-page special celebrates the success of light rail transit (LRT) in the UK.

This is perhaps most apparent on the UK's largest LRT system, Manchester Metrolink, which, 25 years after first opening, completed its 'Big Bang' expansion in February following the opening of its Second City Crossing.

On page 54, Richard Clinnick looks back at the impressive achievements of the past two and a half decades, but also at the northern city's ambitious plans to grow its 57-mile network further still, and press ahead with new technological developments including tram-trains.

Hot on the heels of Manchester Metrolink is Birmingham's Midland Metro, also undergoing rapid expansion at a cost of £1.2 billion over the next ten years, as it gears up to build lines from the city centre out to Wolverhampton, Edgbaston, Brierley Hill,

Birmingham Airport and the city's planned HS2 station at Curzon Street.

RAIL asks Transport for West Midlands Midland Metro Programme Director Phil Hewitt what benefits this will bring for the West Midlands region, and how it will be delivered by a fully integrated alliance of contractors, known as the Midland Metro Alliance.

Another system that has undergone significant expansion in recent years is Nottingham Express Transit (NET), now 20 miles long after a second phase more than doubled the size of the system when it opened in August 2015. Alstom formed a key part of the consortium that built Phase 2, and now operates the entire system, while the global supplier also bolstered NET's fleet of trams by supplying 22 of its Citadis light rail vehicles.

On pages 44-47, Alstom explains to RAIL why it considers NET and Dublin's Luas tram systems to be examples of the company's finest works to date, and shining examples of how light rail can transform the urban environments of the cities it serves.

Last but not least, Systra outlines its four-pronged approach to reducing the cost of LRT, helping to make it a more attractive option to cities wary of the financial impact.

Using its wide-ranging global experience, the international consultancy offers sage advice on the cost-effective construction and operation of LRT.

PAUL STEPHEN
Assistant Features Editor, RAIL

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LIGHT RAIL HEAVYWEIGHT

SUSAN EVANS and NICK PHILLIPS of Alstom explain to PAUL STEPHEN why Nottingham's and Dublin's light rail systems are held up as examples of the firm's finest works to date

Alstom is an undisputed global market leader when it comes to providing metro and light rail solutions, having developed projects in some of the world's most populous cities.

Having supplied more than 50 clients, Alstom has made its mark from Sydney to Sao Paulo, Milan to Manila and Athens to Algiers, deploying its full portfolio of turnkey solutions, including the design and building of infrastructure, through to the supply and ongoing maintenance of rolling stock.

But the two projects that Alstom considers to be its most emblematic are much closer to home. They act as international showcases for the company's ability to exceed customer expectations, and bring continuous improvement to the cities these systems serve.

These exemplars for best practice in light rail are in Nottingham and Dublin, which Alstom describes to *RAIL* as 'jewels in the crown' for demonstrating excellence and acting as test beds for many of the company's latest innovations.

Beginning with the East Midlands, it was in Nottingham that Alstom played a central part in facilitating a £570 million extension to Nottingham Express Transit (NET), adding two new lines measuring a combined 17.5km, that more than doubled the size of the network once they opened in August 2015.

Alstom formed part of the consortium



that was awarded a 22-year contract in 2011 to design and build the extension (known as NET Phase Two) and then to take over the operation of all three NET lines upon completion. It also supplied 22 of its Citadis trams to bolster the existing

fleet of 15 Bombardier-built Incentros, and now maintains all 37 vehicles at the newly expanded Wilkinson Street depot.

As well as demonstrating Alstom's ability to maintain a mixed fleet, NET Phase Two features a number of unique design features, where Alstom engineers were challenged to develop innovative and bespoke solutions.

This included mitigating the effects of noise and vibration with floating slab track where NET passes Nottingham University's main campus and research areas, and addressing the issue of electromagnetic compatibility, where overhead wires and communications systems had the potential

to affect sensitive scientific and electrical equipment at the Queen's Medical Centre (QMC) hospital.

"The NET line to Beeston and Chilwell is the first operational tram line in the UK to run past a hospital," says Susan Evans, Managing Director, Urban & Services, Alstom UK & Ireland. "And at the tram stop for the QMC you'll see that each of the OLE [overhead line equipment] masts are individually fed. That's designed to limit any potential impact from any electromagnetic compatibility issues which, of course, we wouldn't want in the vicinity of a hospital.

"Hopefully we might now see other lines

get to run past hospitals because, certainly in my experience, trying to park at hospitals is horrendous and often very expensive, so if public transport connections can be improved, then everyone benefits."

Nottingham is also the only place in the UK where Alstom has used its automated track laying solution Appitrack.

Appitrack consists of a convoy of machines synchronised using a 3D guidance system to lay concrete track slabs and the baseplates which hold the rails in place.

It is said to be three to four times quicker than traditional manual methods, while increasing safety, site cleanliness and

Alstom designed a bespoke OLE system at Nottingham Express Transit's Queen's Medical Centre stop, to limit electromagnetic compatibility issues with sensitive equipment in the adjacent hospital. ALSTOM.

accuracy by being less labour-intensive, as well as generating less noise and dust.

It can lay 80 metres of track per day on average, which increases to between 300-400 metres per day in favourable conditions, for example dry weather and a straight alignment.

During construction of NET Phase Two in 2014, several of Alstom's other clients

“It would be good to get cities such as Leeds and Liverpool to think more about tramways.”

Susan Evans, Managing Director, Urban & Services, Alstom UK & Ireland



► from across the globe were invited to visit worksites in Nottingham to see Appitrack in action, before being deployed in their own cities.

Evans adds: "Appitrack has been used to build tramways at other locations across the world, but its use on NET is certainly unique in the UK. We made the best use of it we could and I think the best we achieved was 220 metres one summer's day, on Queen's Walk, heading down from the city centre to the River Trent.

"Appitrack is a cleaner and more efficient process because you don't need jigs, and workers to come along and pour the concrete, the machine lays a slab of concrete that supports its own shape, then a GPS-controlled machine places the plates directly into the wet concrete.

"You generally avoid any rework that way because you've got the plates exactly where you want them, while not having any jigs makes everything look like a much tidier and modern, more efficient worksite.

"We had visitors from a number of different cities from around the world, including Rio de Janeiro, whose tramway was obviously part of the city's key



“ Dublin’s Citadis trams move about 32-35 million passengers a year - the whole of Irish Rail moves about 42 million.”

Nick Phillips, Project Manager Dublin, Alstom

infrastructure for the 2016 Olympics. But also many other nationalities came to see Appitrack at work and the unique technology. During the peak construction phase we had people coming nearly every week to see it in action, including from Dublin."

Evans says that Alstom is hopeful of other opportunities to deploy Appitrack in the UK, either in the increasingly likely event that NET is extended further, or in other cities building new or extending existing systems. NET's line to Toton is expected to be extended a short distance to the proposed site of the East Midlands station on High Speed 2, should it be built by 2033, as is

currently scheduled. But it could also be extended to Derby, in order to improve links between the two neighbouring cities and HS2.

"We know some of the other cities that already have tramways might start to talk about extensions," explains Evans. "Edinburgh has recently revealed plans to extend its line, and we'll be assessing that. A colleague of mine recently went there and said it looked extremely suitable for Appitrack, as the planned route is nice and straight and clear.

"Obviously, we hope Nottingham continues to grow, and we will be keeping an eye on what's going to happen with Toton.

As well as forming a better link between HS2 and Nottingham, it would also be great to get a tram route to Derby. That's certainly something we'd encourage. The other obvious location to link to HS2 would be East Midlands Airport (ten miles to the south of Toton, near Castle Donington).

"Thinking about other cities, and Northern Powerhouse and the opportunities there, it would be quite good to get cities such as Leeds and Liverpool to think more about tramways. Cities of the same size in France or Germany usually have a tram system already."

Meanwhile, more than 200 miles to the west and across the Irish Sea, Alstom continues to play a pivotal part in the development of Dublin's Luas tram system.

Opened in 2004, Alstom was chosen to supply the rolling stock, and received an order for an initial batch of 40 Citadis trams, which subsequently grew to a total of 66. These trams were originally 30 metres in length, but have since been extended to 40 metres by Alstom, as patronage continues to rise and Ireland's economy continues to recover from the financial crisis that hit the country particularly hard in 2008.



Nottingham Express Transit is where Alstom's Appitrack automated track laying system made its UK debut, in 2014, accelerating the laying of track by three to four times the normal rate. ALSTOM.

Dublin is already home to 66 Alstom Citadis trams, but is set to receive seven more 50-metre variants in October. These will be the longest trams ever supplied by Alstom worldwide. ALSTOM.



In December 2015, Transport Infrastructure Ireland (TII) gave off another sign of economic recovery, by placing a 36 million euro (£31m) order for seven 50-metre Citadis trams - they'll be the longest single-unit Citadis trams in the world, once they enter traffic later this year.

In 2014, Alstom's contract to maintain and periodically overhaul the Citadis fleet was renewed for a further five years to 2019, and a second contract to maintain the entire Luas system infrastructure was also extended. Together, these contracts were worth 53 million euros (£45.5m), and reflect the level of service offered to both the customer (TII) and the travelling public by Alstom.

Nick Phillips, Alstom Ireland's operation director, says: "The 66 Citadis trams in Dublin have been extended from 30 metres to 40, which ably demonstrates the modular design. And they're well used - we move about 32-35 million passengers a year, which you can compare to the whole of Irish Rail, which moves about 42 million.

"We're now seeing growth, after the problems in 2008, and that has brought higher passenger volumes. To meet that we will provide seven new 50-metre Citadis trams, which are the longest trams Alstom provides globally, so it is a first for Dublin and a first for Alstom. We are retrospectively applying these larger vehicles to existing infrastructure, so there's a lot of other work to do, for example increasing traction current, extending platforms and readjusting signalling, to accommodate the extra length.

"We're also doing day-to-day maintenance of the existing fleet right up to vehicle overhaul and bogie overhaul. The 300,000km overhaul was completed in 2015, and we've just started the 900,000km overhaul on some

of the first trams we delivered to the system's Red Line."

As has been the case for Nottingham, Dublin has also been chosen to showcase some of Alstom's new and innovative solutions: equipping two trams with smart meters to analyse energy use, for instance. This was conducted as part of a joint research programme with the Irish Railway Procurement Agency to test optimisation solutions such as regenerative braking, energy storage and an enhanced air conditioning control system.

Explains Phillips: "On the back of that we also trialled a supercapacitor in Dublin as a way of putting regenerative energy back into the system. Although it wasn't for a client specifically, it proved the technology does work. We've also been trying out various GIS (geographic information systems) on infrastructure and track so we can better plan the maintenance.

"We have often highlighted Dublin as a good platform to trial new technologies, as we were one of the first projects to receive Citadis trams, and so we can provide a higher level of feedback on the product which is now in its fifth generation worldwide."

As with Nottingham, Dublin's tram system also turned heads internationally, and multiple foreign delegations have been hosted by Transport Infrastructure Ireland to experience the transformative effect of light rail in the urban environment.

Phillips concludes: "When you get light rail systems that work, and are cost effective, reliable and safe, like here in Dublin, then a lot of people are quite happy to copy that."

And so it would seem where Alstom leads, others will follow. ■

Metro in the pink



The Midland Metro Alliance is taking a new approach to the Birmingham conurbation's tram network, and setting some laudable long-term goals, writes **RICHARD CLINNICK**

Midland Metro's fleet of 21 CAF Urbos 3 trams entered traffic in 2014/15, and are to be retrofitted with batteries to enable catenary free running on planned extensions to the network towards Wolverhampton and Centenary Square. CENTRO.

While Manchester grabs all the headlines for tram expansions, Midland Metro is quietly growing under the media's radar which, perhaps, explains why many people are unaware of it. Surprisingly, some of those 'unaware' people live in the very areas it serves.

But much like Manchester, the Midland Metro is soon to have its own 'Big Bang' expansion, including playing a crucial role in the development of Birmingham, Solihull and Dudley. It will also connect to HS2 when the £55.7 billion railway arrives in the city, in 2026.

Growth and expansion, says Transport for West Midlands Midland Metro Programme Director Phil Hewitt, has already started. And it will continue for the next seven years as the network undergoes massive growth. "The city centre extension to Edgbaston

was approved in 2005. We opened part of it in May last year, and it links from Snow Hill. "We have planned a series of extensions to be delivered over time. There are also some small but complicated improvements to be made."

The size of the contracts, coupled with the complex nature of the work required, is the reason for the creation of the Midland Metro Alliance, which brings all the contractors and the owner of the Midland Metro line into a single team. Under this approach, the system will expand using one standardised set of processes led by the same managers.

Says Hewitt: "Every major project spends time and resources trying to reinvent the wheel. This approach changes all that. We want to develop and maintain a consistent system of project management. And with a consistent approach, people get used to it and can develop their skills. So while the costs

associated with projects may be high in the early days, as the team practises and refines standardised practices, so the cost can be reduced."

There are several projects planned, including new routes, fleet expansion and the introduction of the UK's first catenary-free tram routes. Hewitt explains how these schemes will work.

Starting at the north of the network, in Wolverhampton, the plans are to extend from the existing St Georges stop to serve Wolverhampton's national network station. Hewitt says: "We'll introduce the tram from right outside the station entrance. Accessibility will be hugely improved."

In charge of delivering this project is Alejandro Moreno. Previously Managing Director in Scandinavia for Colas Rail, he will head up the Alliance. His previous roles also include MD for Central Europe for

Colas Rail and General Manager of Tranvia de Zaragoza in Spain; there he gained experience in delivering a tram network free from overhead catenary, something that will be introduced on two sections of the Midland Metro system.

The Alliance changed the plans at Wolverhampton, says Hewitt. Moreno explains: "The idea is the Alliance brings international experience. All nine companies in the Alliance have experience from France, Singapore and Malaysia. They have LRT market understanding and know what is needed."

The partners making up the Midland Metro Alliance are: the West Midlands Combined Authority, the design consortium of Egis, Tony Gee and Pell Frischmann and contractor Colas Rail, (supported by their sub-alliance partners Colas Limited, Barhale, Bouygues UK and Auctus Management

Group).

Hewitt says: "The original plan was a for a single-track line and stop - basically a headshunt. The Alliance respecified that. It is now more robust and features improvements to the location. Passengers will not have to

“ We want to build a Midland Metro academy. We want to improve training by bringing people in and nurturing local skills.”

Alejandro Moreno, Director, Midland Metro Alliance

go hunting for the stop. And the new plan saves money."

The first major project for the Alliance is actually a renewal scheme further south, at Bilston Road. The track there is 20 years old and is on an 'A' road. Replacement is needed as the track is life-expired. Explains Hewitt: "This is big. The original design is also hard to replace due to the way it was built. We're putting in a lot of effort to ensure that one lane of road traffic can still use the road."

Moreno chips in: "The whole plan is to keep the road open. It is an industrial area and it needs good access."

The Alliance studied various construction solutions, and settled on a plan which will allow for three or four basic track renewals before the slab that supports the track will need replacing again. "It's a sound life cycle prediction as it's based on what Alliance partners have observed in numerous other



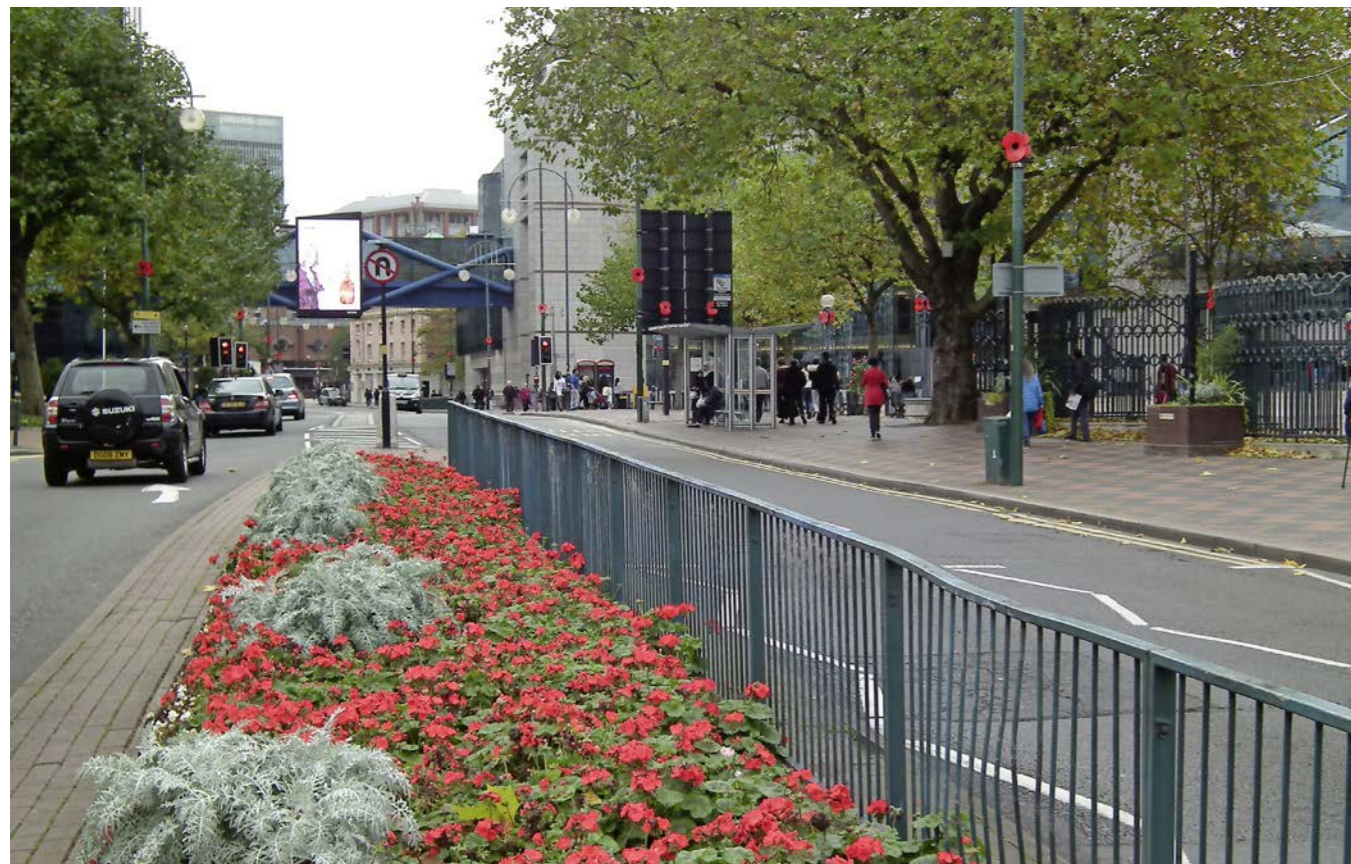
► tramways abroad," says Hewitt. "The design we have currently is a result of the UK rediscovering how to build tramways, and it uses principles from that early knowledge. Experience and knowhow acquired in other countries means we know a lot more now."

He says that this particular project is essential. "We will bring in catenary-less trams for the new section at Wolverhampton so this has to be ready. Wolverhampton might be the first to get catenary-free running, but it's a toss-up between there and Centenary Square."

The Centenary Square work involves building an 840-metre section of twin-track tramway from Birmingham Grand Central at Stephenson Street, up Pinfold Street and ending up at Centenary Square. An intermediate stop is being built outside the Town Hall in Victoria Square, where it will meet the Navigation Street link.

There will be no overhead wires, but a charging point will be required. Says Hewitt: "The reality is the tram is a selling point. It does attract people and business." He says of the wire-free plans: "Battery technology has moved on. CAF [Construcciones de Auxilliar Ferrocarriles - the builder of Midland Metro's new trams, and which is converting the first tram in Zaragoza right now] is more than

The view at the future site of the Centenary Square tram stop, looking west along Broad Street on October 28 2014. From this location the tracks will eventually be extended to Five Ways and Edgbaston. MIKE HADDON.



“ All nine companies in the Alliance have experience from France, Singapore and Malaysia. They have LRT market understanding and know what is needed.”

Alejandro Moreno, Director, Midland Metro Alliance

confident it will work."

Centenary Square is not planned to be the final stop on this route. "The next bit is the extension to Edgbaston. The final business case is going through and we will submit it to the combined board on March 17. It will go forward to the Department for Transport for their contribution. We then submit an application for a Transport and Works Act Order (TWAO). The majority of the powers are still there."

This work is over around 1.35km (just over 0.8 miles), and runs from the Centenary Square stop on Broad Street before running through Five Ways, before terminating outside 54 Hagley Road. It will be an entirely on-street section. Two tram stops are planned at Brindleyplace and Five Ways. Catenary-free running is planned from Centenary Square and Brindleyplace, and between Five Ways and Hagley Road.

But if, as Hewitt says, the powers are still in place, why go through this process? "As with so many tram schemes, the money dried up in 2005-2007," he says. But there has been a new wave of projects, and Hewitt advises:

"You cannot underestimate the impact of HS2 and devolution on schemes.

"When you look at rising congestion and deteriorating air quality, light rail may be a good business to be in."

Passenger figures suggest people are making use of the system more, now that it serves key areas like Grand Central. Hewitt says that since the extension opened, patronage has risen by 40% in the first calendar year "...and 25-30% year-on-year on top of the growth we had last year already. We opened the new section and introduced the new CAF trams. That makes a better service. We run ten trams per hour - it's a better offering that maximises use of what we have now."

Another planned extension with huge potential is the 1.7km twin-track section from the current line at Bull Street/ Corporation Street to a new terminus at High Street Deritend. This will serve the planned Curzon Street HS2 station, the Eastside regeneration area and the major railway stations.

A TWAO was submitted in October 2016.

The site of the future junction of the Wolverhampton Station extension with the existing line to the St George's terminus, as seen looking south east from the junction of Pipers Row and Bilston Street on May 30 2016, with the distinctive Bilston Street Island tramway bridge in left background. MIKE HADDON.



Says Hewitt: "We are negotiating with objectors and an inquiry into the TWAO will take place this summer. We have an application for powers and the funding for the scheme is in place.

"The scheme is relatively short but it's a game-changer. It will allow cross-city links. We will have created a delta junction.

"If all goes well, we'll get approval in the next year. Building will begin in 2019 and it will open in 2023."

The Alliance has begun route clearance for the Wednesbury to Brierley Hill extension, which will use a disused railway. The twin-track 11km route will access Dudley town centre and branches off the existing Midland Metro line east of the current depot at Wednesbury. Again, a TWAO exists, but money curtailed the original plans. "It is included in the devolution deal, so we are refreshing the business case," explains Hewitt.

Moreno explains: "It's really an abandoned railway and it has been so for 20 years. We are doing clearance of the whole area. There's a lot of knotweed in there! Also, we are talking to Network Rail about removal of some infrastructure. Surveying starts soon and that is a key task, particularly in areas such as Parkway Viaduct."

Hewitt says the bottom line is "putting transport where the people need it." It will

cost £300 million, and the plan is for it to be operational in 2023. He chuckles: "We have certainly given Alejandro a challenge."

Moreno accepts the challenge and talks of the bigger picture: "It is going to make a huge change. It will transform the economy." Hewitt agrees: "It is a game-changer for the West Midlands, it opens up the Black Country. I have no doubt this will be a success story. It will create job opportunities and it will be more attractive. There are lots of buses now, but they are on increasingly busy roads. Trams have real potential."

The final big project is the 17km airport line. "This is very much about the regeneration and growth of Solihull, and improving access to job opportunities," says Hewitt. "It is providing the link to the rest of the UK, central Birmingham and interchanges with the airport.

"There are already good train links, but this is about local transport. This is about the tram scheme, not rapid links.

"2026 is the planned opening. It's subject to obtaining a TWAO, and business cases being successful, but it is part of the devolution deal. We are working on the TWAO application and we aim to submit it in 2020."

The Alliance uses a standardised methodology to predict and meet future targets. Hewitt explains: "To deliver on all these plans, we have tasked Alejandro's

team with predicting what will be needed for success in 2030. We need to think ahead to that. Do we increase the number of trams, and by how much? Will we need new depots? We think it will result in some interesting proposals."

Moreno is ready for the task, and aims to use experience gained elsewhere. "The key point is that if we don't have set new targets then we won't deliver. We want to work out what the ideal scenario will be in 2030. Those were the plans.

"We have a roadmap of the project on the wall. We know where we'll need to be in ten years' time, and we are hitting our targets along the way."

Finally, Moreno insists the Alliance is not just creating infrastructure, but improving the skillsets in the area. "We want to build a Midland Metro academy. We want to improve training by bringing people in and nurturing local skills. This move is about demonstrating our loyalty to the project and the area, and about giving people professional skills as a result."

Hewitt agrees: "Our ten-year programme means that if we train now they will be working on the Metro in ten years' time. We aim to give people a long-term plan and a future."

The Alliance is building the West Midlands' future in more ways than one. ■



THE FOUR PILLARS OF AFFORDABLE LRT

PAUL STEPHEN speaks to Systra's UK Metro & LRT Programme Director **NICOLAS PERROT**, on the company's four-pronged approach to cost-effective delivery of tramways in the UK

Systra is an international transport planning, consultancy and engineering provider, and needs little introduction. Having operated in over 150 countries across the globe, it already has a substantial presence in the UK and Ireland, with more than 400 staff working from 17 offices.

It is also a growing company. Systra has completed the acquisition of two UK-based consultancies: JMP in 2015, followed by SIAS in 2016.

It has also played a key part in leading the delivery of several of the UK's most high-profile rail projects, including managing the development of the design, procurement, construction and commissioning of Crossrail, EGIP (Edinburgh-Glasgow Improvement Programme) and High Speed 1.

But one area in which the company would like to demonstrate more of its expertise is light rail, by importing the lessons learned from its vast portfolio of overseas clients.

"We want to grow considerably in the UK and Ireland. It's important for us to have our staff close to our clients," says Systra's UK Metro & LRT Programme Director Nicolas Perrot.

"We have led the design and construction of 500km of light rail systems across the world. Modern tramways are already working well around the world, and in some UK cities. And there are certainly more opportunities for light rail systems elsewhere in this country."

It's easy to see the potential for light rail in the UK when only seven of its cities can

boast modern tramways compared with 29 in France, despite both nations having broadly similar populations.

This can be attributed to the significant variance in cost that has been experienced constructing UK tramways, which has subsequently made it an unattractive option to local councils.

Many studies have found the expense of diverting utilities such as gas and water mains as the primary driver of increased costs. But Perrot argues that you cannot apply the same model to each tramway, given the diverse range of factors that can affect cost, for instance running through city centre streets versus utilising a disused railway alignment. Instead, Systra uses the breadth of its global experience to mitigate risk, and control capital and operating expenditure, which it has split into four distinct areas.

"Cost seems to be a big factor in discouraging many cities from progressing in this direction. Market conditions in France are comparable to the UK, but people here seem more afraid. That's why we are keen to bring our experience of cost control to this country, and also highlight all the ways we can tailor things for each UK city."

"We have a thorough understanding of the problems a light rail project can raise, which is how we came to the conclusion that there is no set formula for making savings."

"You cannot just say 'beware of track works costs or building stations' because there is no fixed rule, which makes the cost issue a difficult one to solve. What you do need here is a very broad experience of working in different global cities, and we



have that in abundance. The fact that our skilled people have worked on so many projects around the world is what makes us different.

"We work on the principle of four pillars in making tramways affordable. They will never be cheap, but they can be financially viable. Cost is a big turn-off at the moment, but somewhere between £15 million and £20m per km is very feasible."

"I understand why cities balk at the idea, but when you look at the cities that have built a light rail system, such as Manchester, Birmingham or Edinburgh, they now want to extend those systems, because the benefits have made it worth the cost."

Perrot explains that these four pillars are concept and design, contractual engineering, managing cost control, and project organisation.

Starting with the first, Systra has a lot of sensible advice for clients in the initial stages of planning, in which costly mistakes are frequently made. This includes intensively supervising utility diversion work to avoid unnecessary delays, and designing these diversions to avoid utility maintenance disrupting the tramway once

The French city of Besançon's tram system is nine miles long and serves 31 stops. It opened in 2014 and cost less than £14 million per km to construct. Systra consulted on the project including the procurement of rolling stock and power supply. P. JOURDAIN/SYSTRA.

it is operational. Systra will also advise on the use of cost-effective materials, such as deactivated concrete, which can be ten times cheaper for ground surfacing than pavements.

Perrot says that decisions about alignment are equally important: "We have seen lots of projects where technicians encounter problems trying to build a tramway where the alignment has already been fixed, for political or traffic management purposes. Our advice there is to involve technical people in your feasibility study and you'll save money down the line."

"You can also do things like place substations every 2km instead of every 1.5km, using optimisation techniques, which could save more than £2m in a 15km tramway project. It's not about having one big cost-saving idea, it's about saving £1-2m here and there - and wherever possible - to bring down the total cost."

More cost-effective decisions can also be made with rolling stock procurement, and

Perrot points to the French cities of Dijon and Brest, which bundled together their procurement of 32 and 20 trams respectively, sharing the same specification, which cut costs by almost 10% compared with the average for projects that procured the same rolling stock. He says that in the UK, transport authorities such as Transport for the North could help facilitate this as a broker between two cities for procurement, but also sharing maintenance and depot facilities in some instances.

The second pillar is collaborative engineering and awarding contracts to those suppliers that share risk and reward for construction - this will ultimately incentivise more efficient delivery.

"The tender phase is key to the project: do it wrong and you'll never recover," adds Perrot. "So it is about clear definition of the requirements, and people understanding their responsibilities from early on."

Cost control is the third pillar, which must come a close second to safety as the main

priority when making decisions for new tramways, says Perrot. Focusing on cost is essential, even if it means incurring a delay in the construction sequence, he adds.

"Safety is the first priority, then you must factor in the cost element as the main driver of the project, as focusing on cost is what will enable you to control it. From our own experience, we know that if you focus on cost, you must then allow flexibility in time. If you allow a margin into project schedules you will put fewer constraints on engineers and they will be less likely to make costly decisions."

Finally, the fourth pillar is project organisation, and while it's last on Perrot's list, it certainly isn't least in Systra's light rail recipe.

"For a tram project to be a success, you need to maintain a clear, overall vision of its finished state. Tram systems are very complex and if you lack experience or the necessary background then you will overlook important things."

"You must build a multi-disciplinary team who, collectively, understand every aspect of what it takes to build a cost-effective, financially sustainable tramway." ■



“The fact that our skilled people have worked on so many projects around the world is what makes us different.”

Nicolas Perrot,
UK Metro & LRT Programme Director, Systra



An even greater Manchester

Britain's largest and most successful Light Rail network, Manchester Metrolink, celebrated the successful completion of its 'Big Bang' expansion on February 26, when the Second City Crossing (2CC) opened.

Next on the agenda is the construction of the route to the Trafford Centre, due to open in 2020, and which will finally provide a rail link from the city centre to the major out-of-town retail and leisure complex.

But Transport for Greater Manchester (TfGM) is already looking far beyond that; it's looking more than 20 years down the line to meet the demands of a growing city in the UK's Northern Powerhouse.

In its 2040 *Strategy Document*, TfGM has looked to address the issues facing its transport systems (not just Metrolink, but road and rail transport, as well as the local bus network) and tried to find solutions to the looming capacity and connectivity issue.

TfGM says in its report that: "While the concept of integration is not new, the delivery of a truly integrated transport system has, in the last 30 years, been beyond our reach due to a range of regulatory and institutional barriers."

It says it will now stop treating the different modes of transport as separate entities, and instead plan its system as a single, integrated network. This, it says, will enable TfGM to prioritise investment in improvements where they are needed.

"We will enhance our public transport so that bus, rail and tram services and facilities are planned and delivered in a much more integrated way to minimise the time and cost penalties of changing between services," it says.

In the next 22 years, TfGM says it will take a much broader view of rapid transit, and will focus on building the most appropriate,

“ Tram-trains offer the potential to deliver metro services to more areas without laying new track.”

Tram-trains seem to be the perfect fit for Manchester's new, unified approach to public transport, reports **RICHARD CLINNICK**

integrated public transport network for meeting the needs of different parts of the city and its surrounding areas.

It has already identified the changes needed and devised various new operating practices. This means that "traditional boundaries" between heavy and light rail and bus networks will become increasingly blurred. "We will now be able to focus on providing the right rapid transit system to meet the existing and future travel markets in Greater Manchester, and to support the significant population and economic growth."

To meet these goals, TfGM is examining the possibility of using tram-trains. They are nothing new in Europe, but the first UK trial, planned for Sheffield, has been delayed. Proposed in 2009, there are now seven tram-trains in the UK, but the infrastructure is not ready, and so is not yet in place for their introduction onto the national rail network.

Nevertheless, TfGM discusses tram-trains in its strategy. It reasons: "in the medium term, tram-trains (vehicles which can travel on both street tramway and all-purpose

railway lines) offer the potential to deliver metro services to more areas without laying new track.

"The tram-train approach can help to improve access to the city centre at peak and off-peak times, while also releasing valuable capacity on the heavy rail network."

It also states that: "Where demand is not sufficiently high for rail-based rapid transit, other types of rapid transit, such as busways, segregated bus lanes and express bus services can offer many of the same benefits with much lower infrastructure costs. They may also serve to build up demand for rapid transit to a point where a Metrolink extension can be justified in the future."

The regional centre for the area will continue to be Manchester city centre. This will continue because of the high concentration of what TfGM calls "trip attractors" and also the role it plays as the key interchange node in the Greater Manchester public transport network. The strategy highlights new inter-city rail services being created by HS2 and trans-Pennine Northern Powerhouse rail services.

WHAT NEXT?

With Transport for Greater Manchester laying out its plans, the key question is what happens next?

TfGM says its strategy "sets out how investment in new transport infrastructure, delivery of services and maintenance of existing assets will be focused to support growth in the widest sense. It recognises that improving access to jobs and training, and improving the health of the population, are essential aspects of improving productivity, while improving the quality of many of our urban areas will be a pre-requisite for attracting investment."

It claims that the focus on

requirements of different journey types is "innovative" and it has been able to take: "a holistic view of the investment needed: to improve connectivity to global markets; transform journey times to other major cities; capitalise on the potential of a rapidly growing Regional Centre; create better transport links between jobs and homes across the metropolitan area and, finally, provide 'first and last mile' connections within neighbourhoods that will make sustainable travel an attractive option."

Over the next five years, it says, various schemes will be delivered, and paid for out of the Local Growth Fund.

These, it says, will mean the city centre will become even more important and that the rapid transit strategy will seek to maximise the benefits of strategic rail services to the region. It does hint that in the future a second rapid transit hub could be created at Manchester Airport, but this proposal will remain on paper for the foreseeable future.

The immediate priorities highlighted in the 2040 *Strategy Document* include providing additional cross-city capacity in the Regional Centre for existing and future rail-based rapid transit services, and this features the potential for tunnelling beneath the city. This was first mooted in the 1970s, to link Piccadilly and Victoria stations.

Other priorities include converting suburban rail services that have a relatively poor financial performance to metro-style services, where there is a good financial case and the potential to attract both peak and off-peak passengers. This, states TfGM, would be achieved by track-sharing between light and heavy rail services.

TfGM wants to provide additional capacity to accommodate predicted growth on other suburban heavy rail services to the Regional Centre, while ensuring excellent local rapid transit connections with the Northern Powerhouse and HS2. As part of that, it also proposes the creation of a network hub at Piccadilly.

New sections of a rapid transit route will be built, says TfGM, but only where there are opportunities to provide substantially faster

FUNDING

The main funding source is Central Government. In 2014, Greater Manchester was awarded money from the Local Growth Fund (LGF) of £314 million for major schemes (costing more than £5m) and £15.2m for small schemes (costing less than £5m) for the period 2015-16 to 2020-21.

As part of the Greater Manchester Devolution Deal, TfGM secured Government commitment to establishing a multi-year transport settlement for the medium term. This, says TfGM: "reflects the growth potential of the conurbation."

Securing these funds, it says, will enable TfGM to "plan ahead and use resources more effectively than

is possible with short-term funding streams."

Another income source is via funding competitions targeted at specific policy objectives. TfGM has been successful with these before, and it says it will continue to present the case for investment.

Brexit is a concern. TfGM adds: "The decision for the UK to leave the European Union will clearly impact on funding, given that Greater Manchester has previously benefited from a number of European programmes. We will work with the Government to identify alternative means of funding for strategically significant projects."

journeys than with a stopping bus service. According to TfGM, developing new bus-based rapid transit routes to the Regional Centre from areas poorly served by heavy rail could, in time, create opportunities for future Metrolink routes.

So that's 'how'. What about 'when'?

TfGM suggests that in the short-term (until the early 2020s), capacity demands will be met by the new 2CC, along with the Northern Hub works and the introduction of enhanced, higher capacity heavy rail services. And then there's the delivery of the Trafford Park link, and the chance to increase capacity on the busiest Metrolink lines by

running more four-car trams.

In the medium-term (to 2030), TfGM adds that it is seeking to develop and deliver tram-trains as it looks to "improve rapid transit connectivity into and across the Regional Centre and develop potential cross-city metro proposals to complement the Northern Powerhouse Rail network."

Long-term (from the mid-2030s), TfGM seeks to implement cross-city rapid transit capacity enhancements (potentially through tunnelled metro services) and deliver suburban rail enhancements to complement Northern Powerhouse rail.

Manchester has led the way in the UK for light rail, and it now wants to transform the way the system serves the city, while embracing up-to-date technology. Following the success of Metrolink, you would not bet against it working again. ■

On February 26, the opening day of Manchester's Second City Crossing (2CC), Trams 3083 and 3108 pass along Cross Street. This project marks the completion of the £1.5 billion 'Big Bang' expansion of the Manchester Metrolink system that started in 2009. By 2040, TfGM wants to introduce tram-trains as part of a major shake-up in connectivity across the city. RUSSELL WYKES.



The **RAIL** 100 Breakfast Club

Announcing the speakers for the next two meetings

The RAIL 100 Breakfast Club, organised by RAIL magazine, is a business networking club for the industry's senior managers. At each meeting members are kept abreast of current topics in the industry and can discuss these with their peers.

We have great pleasure in announcing the speakers for the next two meetings.



April 6

**Rob Brighthouse, Non-executive Director,
Network Rail and Chairman, East West Rail**

Rob has 40 years' rail experience in the UK, Australia and Hong Kong.

Before joining Network Rail he was Managing Director of Chiltern Railways, where he was responsible for the introduction of the new Chiltern service to Oxford Parkway. Rob joined Chiltern in 2000, and as Projects Director he led the delivery of the earlier Evergreen route upgrades before leading the MTRC/Chiltern bid to operate London Overground.

He is a Fellow of both the Institution of Civil Engineers and Institute of Directors, and chairs the Advisory Board at Aston Business School.



July 6

Chris Grayling, Secretary of State for Transport

Chris Grayling was appointed as Secretary of State for Transport on July 14 2016. He was elected Conservative MP for Epsom and Ewell in 2001. He served as Minister of State at the Department for Work and Pensions from May 2010 until September 2012, and was Lord Chancellor and Secretary of State for Justice from September 2012 until May 2015 and Lord President of the Council and Leader of the House of Commons from May 2015 until July 14 2016. He also held a number of shadow front bench posts, including Shadow Home Secretary and Shadow Transport Secretary.



If you are interested in joining the RAIL 100 Breakfast Club, please contact Cristina Melenchon, cristina.melenchon@bauermedia.co.uk or call 01733 395094

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