

Rail & Metro

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Transport advances pinned on technology

The biggest development banks are expected to spend \$175bn over the next 10 years on systems in emerging markets alone, writes *Mark Odell*

Congestion is costing the world's biggest cities billions of dollars a year and the problem will get worse with the percentage of the population living in urban areas set to jump from half to 70 per cent by 2050.

This trend means that public transport is in vogue like never before at a time when advances in mobile communications promise a fundamental shift in the way we manage our journeys.

The impact on the global economy of increasingly snarled-up cities is huge. A study by Roland Berger, the consultancy, estimates that in the world's 30 biggest conurbations the

economic and social cost of congestion is more than \$266bn a year. It forecasts the problems are only going to get worse, with 180,000 people a day moving to big cities.

More than half the planet's population lives in cities and over the next 40 years that number is likely to reach 6bn, with the largest cities in emerging markets growing the fastest.

In the developed world, the big difficulty for transport authorities in cities such as London and New York is how to modernise and expand ageing infrastructure in an urban environment where space is at a premium.

In the emerging nations, where mass migration to cities is putting an

increasing strain on the limited public transport networks (mostly buses, as more and more vehicles clog the roads) the focus is on embracing more efficient ways of moving millions of people. This has meant a proliferation of new metro and tram networks.

Putting numbers on the opportunities this creates for providers of mass transit systems and travel technology is difficult. The Roland Berger study points to data showing that the biggest development banks around the world are expected to spend \$175bn over the next 10 years on sustainable transport systems in emerging markets alone.

India is planning to spend about \$40bn on metro systems over the next

10 years, with 46 of its cities already boasting a population in excess of 1m. India's first metro began running services in Kolkata in the mid-1980s, with New Delhi's not becoming operational until 2002.

Five other Indian cities are in different stages of building their own networks – Mumbai, Bangalore, Hyderabad, Kochi and Chennai.

In China, 15 cities have mass transit systems, seven of which have become operational in the past five years. According to official statistics, 34 cities have received approval to build new metro lines with a total length of 4,300km, more than one-and-a-half times more track than is in service today.

Russia has ambitious plans to expand and modernise its ageing metro and tram networks as it prepares to host a series of large international events, including the football World Cup in 2018.

The plans for the metro in Moscow, one of the world's busiest systems, will see another 150km of new lines built, increasing the size of the network by half.

In other developed cities, the projects range from building new metro and commuter rail lines, such as London's £14.8bn Crossrail project, to squeezing out more capacity from existing infrastructure.

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Bridge the gap: China is pushing ahead with the huge investment needed to cope with rising demand for new rail lines *Reuters*

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London Crossrail

The £14.8bn project will give city its first new underground line for 30 years

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At the centre of attention

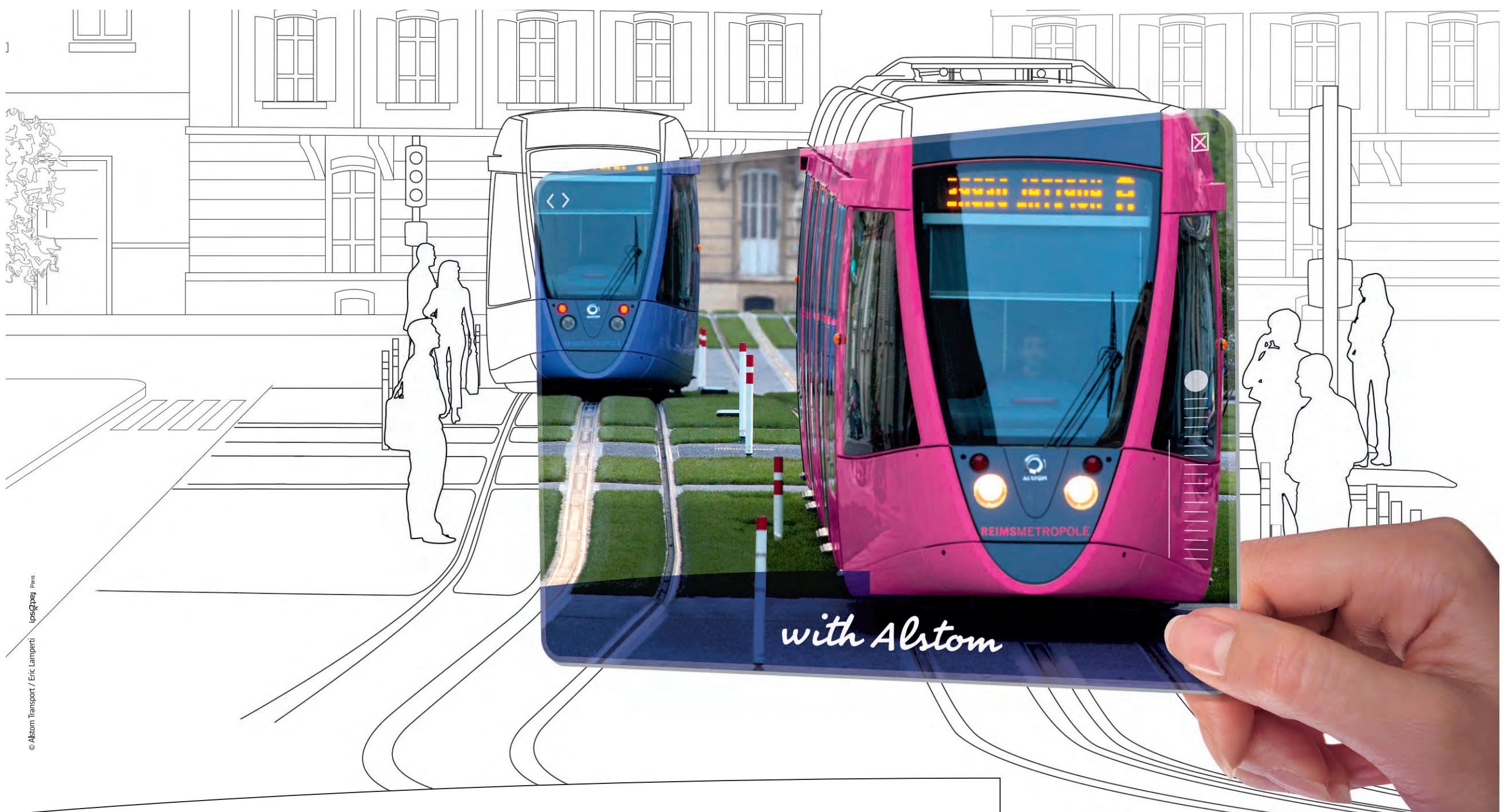
Infrastructure in India is ripe for investment

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Taking charge

Wireless systems provide opportunity for electric urban transport

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Rail & Metro

East-west scheme set to lift capacity

Line viability draws scrutiny

Crossrail Projected line deemed vital to relieve London's ageing Tube network congestion, writes *Mark Odell*

Deep below the streets of London, five giant machines are excavating the tunnels for the city's newest underground railway, which promises to transform one of the world's most congested metro systems

Three more tunnelling machines are set to head underground by the middle of next year to complete the twin-bore 21km tunnels that will form part of the £14.8bn Crossrail project. The latter promises to deliver a 10 per cent increase in the city's rail capacity when it opens in 2018.

From Paddington railway station in the west of the city to Canary Wharf in the east, more than 40 work sites have sprung up to produce the capital's first new underground line in 30 years.

London Underground already carries more than 1.1bn passengers a year and the scheme – the first full-sized rail route to cross the capital from east to west – is desperately needed with most metro and commuter routes already heavily congested during peak hours.

Crossrail has been designed to complement the 11 lines that make up the London Underground – the world's oldest metro system, which celebrates its 150th anniversary this year.

As most of the so-called Tube network dates from the turn of the 20th century, the lines run through smaller tunnels than more modern metros. Ironically, as the capital city of the country that brought railways to the world, London has suffered in many ways from the success of the early innovators.

Compounding the limitations of early technology, public transport infrastructure was starved of investment for more than 40 years from the end of the second world war when the motor vehicle came of age and roads were the focus of government spending.

The impact of Crossrail cannot be overstated. Each 200 metres-long train will be able to carry 1,500 passengers, almost twice the capacity of a Tube train, with an estimated 200m passengers set to use Crossrail each year.

The project is moving into its peak construction phase. This will see nine new stations built, including four in some of the city's busiest areas – Paddington, Bond Street, Tottenham Court Road and Liverpool Street – to accommodate up to 78,000 passengers an hour who are expected to use the service at peak times. Trains will con-



Eastern approach: the Crossrail construction site at Canning Town

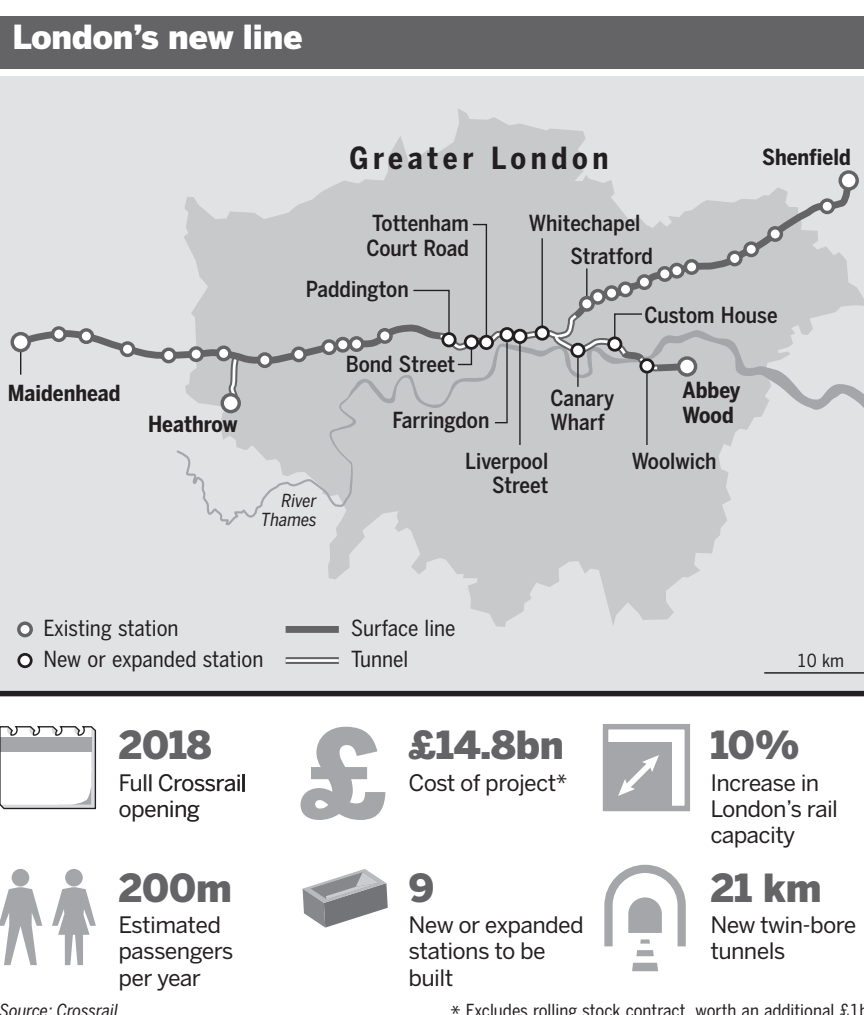
Each Crossrail train will carry 1,500 people, almost twice the capacity of a Tube

nect Heathrow airport and the town of Maidenhead, to the west of the city, to Shenfield, a commuter town, east of London, and Abbey Wood to the south of the Thames.

The project is being overseen by London Underground's parent, Transport for London (TfL). But when it comes to running Crossrail services later this decade, TfL is looking to replicate the success of the London Overground, the newly refurbished orbital railway, which is run under a management contract by a third party.

A fierce battle to run the trains is likely, with six bidders submitting initial expressions of interest in an attempt to make the shortlist for the tender.

The UK-listed transport groups, including FirstGroup and National Express, have been joined by Hong Kong-listed MTR and France's RATP, as well as Arriva, a subsidiary of Deutsche Bahn. Go-Ahead of the UK



is expected to team up with Keolis, a subsidiary of French SNCF and its traditional partner in the UK rail market. Stagecoach is also thought to have entered the fray.

TfL is expected to produce a short list of three to five bidders by the end of June and issue tender documents in September, with final bids due in by mid-January 2014.

A winner is expected to be announced in September 2014. Full services are not due to start until 2018 but the winning operator will take over existing mainline rail services between London Liverpool Street and Shenfield in Essex from mid-2015. This line will then become part of Crossrail when it is linked in to the central tunnel section of the project due to open three years later.

Mike Brown, managing director of London Underground, says Crossrail is just the beginning. TfL and Boris Johnson, the mayor, are already lobbying central government to fund a

second railway line, running from the north to the south of the capital, and dubbed Crossrail 2. Mr Brown says that, without this new line, the terminus for the so-called High Speed 2 line (HS2), to connect London to the north of England, would be swamped by additional passengers. TfL forecasts that the number of people arriving at London's Euston station in peak hours would jump from 23,500 in 2009 to 57,000 in 2033, when HS2 is due to be fully open.

TfL says it has started public consultations on two possible routes for a new north-south rail link for London, that Mr Brown says is "imperative" if HS2 is to become a reality.

The projected growth in London's population by 1.5m over the next 20 years is another reason Crossrail 2 is crucial, says Mr Brown. It would come on top of the 30 per cent planned rise in capacity of London's underground and rail network, which includes the Crossrail project already under way.

Agencies seek watertight storm solutions

Flooding

New York's subway has yet to be properly repaired, says *Robert Wright*

On the night of October 29 last year, Joe Leader climbed over one of the hoardings protecting the New York City subway's South Ferry station from floodwater and headed downstairs to the ticket hall. But as he inspected the steps leading down to the station's platforms, Mr Leader, then the subway's head of maintenance, noticed floodwater slowly creeping up the stairs towards him.

"There was no real rush of water at that time," Mr Leader says. "I thought the water had stopped. Then I looked down and said, 'I have to leave'."

The damage to South Ferry station, where water eventually rose all the way into the ticket hall, was some of the most concentrated anywhere in New York on the night that Superstorm Sandy rolled into the city, pushing a wall of seawater 13ft higher than normal levels.

The storm sent water pouring into parts of the region's mass transit systems that few had ever anticipated, including nine of the tunnels carrying subway tracks between the boroughs of Manhattan, Brooklyn and Queens.

The system's quick response to the catastrophe – many parts of it were working almost as normal within a week – won worldwide admiration for the Metropolitan Transportation Authority's handling of the crisis.

"We were astonished at just how quickly the agen-

cies in New York were able to restore service," says Andrew Love, professional head of technology for metro signalling at Atkins, the consulting engineers. "They were an inspiration. They have set the bar as to how people should recover from an extreme weather event."

Yet, more than six months on, recovery work continues on the \$5bn of damage that the MTA suffered. South Ferry, which only opened in 2009, remains closed. Direct service to areas of the city's Rockaway shoreline remains suspended because a causeway across Jamaica Bay was swept away. Engineers are also regularly discovering new damage to signalling cables and metal plates lining tunnels.

Reliability in some areas has been badly affected, says Mr Leader, who was appointed acting vice-president of the MTA's subways division this month. He points to the Montague Street tube, which carries the R train service from lower Manhattan to Brooklyn, as one of the worst-hit places.

The extent and severity of the damage have prompted transport agencies across the world, as well as the MTA itself, to re-examine their systems' ability to cope with severe weather. Mr Leader has been in touch with transit agencies in Hong Kong, London and several other big cities keen to learn Sandy's lessons, he says.

The event has shown that transit agencies need to take "low-probability high-impact" events such as hurricanes into account in their planning, Mr Love says. "It's important not simply to assume that such events never happen," he explains.

The core of the efforts to



After the deluge: South Ferry station remains closed Reuters

rebuild a more robust New York subway will be to try to keep it drier, according to Mr Leader. How to do that remains unclear.

"The question is what technologies are out there that would prevent water from coming into the system," he observes.

Water exclusion could prove still more important in future as more sophisticated communications-based train control (CBTC) technology spreads, according to Peter Torrellas, chief

Transit agencies need to take 'low-probability, high-impact events' into account in their planning

technology officer in the US for the infrastructure and cities division of Germany's Siemens group.

Mr Torrellas points out that it proved relatively simple after Sandy to clean out the electro-mechanical switches that control most New York subway equipment, including the clusters of switches for signals known as interlockings.

Although the MTA says it would be simpler to move modern, solid-state electronics out of the path of a future catastrophe, Mr Torrellas fears the outcome if

water were to penetrate the equipment.

"There's just no way you can open up a solid-state interlocking and clean it off with a water hose," Mr Torrellas says. "But you can do that with older equipment."

The MTA is seeking to put more critical components, such as signalling rooms, in higher parts of stations and other facilities, in the hope that will keep them above floodwater. That may prove difficult in parts of the network built by the now defunct Brooklyn-Manhattan Transit Corporation, mainly the lines identified by letters, which tend to have little spare space, Mr Leader says.

Sections put in place by another original subway builder, the Interborough Rapid Transit company – mostly the numbered lines – often have more space. The most spacious are the parts of the lettered lines built later by the Independent Subway (IND). "In the IND station complexes, on some of the mezzanines, you could almost have a football game," Mr Leader says. "In some other places, you have very tight situations."

South Ferry station, meanwhile, has some way to go before reopening. The station's entrances remain surrounded by plywood hoardings, partly because the MTA has yet to work out how to carry out repairs while making the restored station watertight.

Cultural complexities play role in International Express upgrade

Signalling

Robert Wright takes the 7 train through the New York borough of Queens

Even by the multicultural standards of suburban New York City, the route of New York subway's 7 train through Queens is extraordinarily diverse. Chinese or Korean grocers dominate one block along Roosevelt Avenue, then Indian restaurants, then Dominican stores follows.

But the International Express, as the route is known, should soon enjoy another distinction. Within a few years, the trains that sway along the elevated tracks on the 7 – or Flushing – Line will be guided by complex electronics that let them run faster and more regularly. The line will be only the second on New York's subway system, one of the world's largest and busiest, to use the electronic control system, known CBTC, or communications-based train control.

CBTC systems track trains' locations and speeds much more closely than traditional signalling systems. While conventional systems split track up into fixed blocks and hold one block empty behind each train, CBTC systems constantly work out how much space each train needs to stop safely.

The 7 Line's resignalling looks set to grapple with daunting technical and logistical difficulties, to judge by the long and problematic experience of the L Train, the only New York subway line equipped with CBTC, and similar projects worldwide.

The modern signalling system will have to integrate with existing equipment that, in the 7 train's case, dates back as far as

the first world war. Not least of the problems will be that New York, uniquely among big world cities, runs its metro 24 hours a day.

"It's kind of like performing open-heart surgery while someone's jogging," says Peter Torrellas, chief technology officer in the US for the infrastructure and cities division at Germany's Siemens, on the question of performing the work on a running railway. Siemens designed and installed the CBTC system on the L Train. France's Thales will work on the 7 Train.

Yet, perhaps appropriately given how many cultures co-exist along its line, the biggest difficulties on the 7 project may lie in managing the contrasting approaches of contractors, train operators and different parts of the train operating organisation.

Ken Mooney, chief engineering officer in the Maintenance of Way department of the New York subway, says much of the L Train project's first two years was spent working out how to make its contractor's system work according to the subway's operating rules. The L Train's system was

originally developed to control trains on the Paris metro's driverless Line 14, which opened in 1998.

A rush-hour trip on the 7 illustrates why the subway feels the need for the new system. The 7, like most other lines on most mornings, crams its passengers together on what are quite often long journeys.

The overcrowding is a result of the relatively modest train frequency that the

'You have a whole generation of an organisation that's used to doing things certain ways'

system can support while it relies on traditional operating methods, where drivers control trains' speed and braking, and obey colour light signals by the track-side.

It is seldom possible to run more than 24 trains an hour with traditional signals.

By contrast, the uniformly efficient automati-

the end of the year that would allow detailed planning and preparation work for the first phase of the line to begin, with a view to starting construction in 2017.

The project is under constant scrutiny and has already survived a legal challenge by opponents. The legal battles could continue for years, depending on the outcome of an appeal that is due to be heard in June.

The latest setback came this month when the first detailed analysis of the project by the National Audit Office, the state spending watchdog, found there was "little" evidence to support the government's claim that the line would bring more growth to the regions.

The findings undermined comments by David Cameron, the UK prime minister, who said this year that no amount of opposition would turn him against the project because it "would spread wealth and prosperity" across the country.

The NAO found that much of the data on which many of the main assumptions were based were out of date. Amyas Morse, head of the NAO, says the main concern is the "lack of clarity" around the strategic case for the line.

The findings were rejected by the government, with ministers and officials accusing the watchdog of ignoring progress in the last 12 months that has seen the government unveil its plans for the full route between London, Manchester and Leeds.

Patrick McLoughlin, the UK's transport secretary, rejects the focus on economic modelling and says big infrastructure projects do not always stand up to that kind of scrutiny.

"We are not building HS2 simply because the computer says 'yes'," he says.

"We are building it because it is the right thing to do to make Britain a stronger and more prosperous place."



New York's 7 line: the second to use CBTC system Getty

Rail & Metro

Demise of a colossus clears the way ahead

China Beijing's restructuring of railway ministry should assist the switch towards a market economy, writes *Simon Rabinovitch*

The demotion of the Chinese railway ministry two years ago was a precipitous fall from grace. Previously, the ministry had been a colossus bestriding China, with more than 2m employees, its own police force and court system and nearly as much debt as the government of Russia.

Corruption charges against Liu Zhi-jun, the then railway minister, in early 2011 signalled that Beijing was ready to reduce the power of the ministry. A fatal high-speed train crash in July 2011 expedited the process.

In March, after careful planning, the government did the deed, reclassifying the railway ministry as a bureau under the transport ministry.

The extent of the downsizing became clear a few months later when it was announced that the newly formed state railway administration would be home to 130 employees, fewer than 0.01 per cent of the ministry's original headcount.

Does the drastic cut mean that China's railway ambitions have also been ratcheted down? The simple answer is no.

The restructuring should instead be a boon, ensuring that those ambitions can be fulfilled more effectively and with less corruption than in the past.

The objective is "to change China's rail industry from a planned economy

to a market economy", says Patrick Xu, an analyst with Barclays Capital. "The end result will be a greater focus on safety, efficiency and profitability."

Before taking a closer look at what the restructuring actually entails, it is important to recall the bigger picture: China's need for more – lots more – railway lines.

Despite vast amounts of investment over the past decade, China's rail network remains overburdened. It carries 24 per cent of global freight volumes with just 6 per cent of global capacity, according to HSBC. The US rail network, hardly a paragon of efficiency, is twice as big.

As for passengers, China's railways transported an average of 11m people per kilometre in 2012, more than five times the developed world average and just slightly lower than India's rate.

The shortage of subways and commuter rail is even more severe. The OECD estimates that average rail density in big urban centres is about a quarter of the global standard.

For China's 10 biggest cities to reach world averages, the OECD believes another 5,000km of subway lines would be needed – and that is before considering the other 100 or so cities with populations of more than 1m.

"A considerable deficit in provision



Capacity: China's trains transported 11m people per km last year Getty

needs to be overcome," the OECD wrote in its 2013 survey of the Chinese economy.

Odd as it may seem, eliminating the railway ministry is a crucial step to plugging that deficit. The state railway administration may be much smaller but it is far from the only entity charged with replacing the ministry.

Much more important is the China railway corporation, a newly established company that will be the main national rail operator. This separation of powers – with the state railway administration largely responsible for project approvals and safety standards – will free the China railway corporation to focus on planning and financing lines.

Over time, the corporation will be joined by other rail operators, injecting more market forces into the industry. "The government will not allow there to be disorderly competition right away, but it will gradually develop an orderly, market-oriented competitive framework," according to Sun Ning, deputy general manager of an advisory firm managed by the China academy of railway sciences.

Confining the state railway administration to a supervisory role has helped alleviate safety concerns. The tragedy of the 2011 bullet train crash, which killed 40 people, exposed the

problems in China's railway push of the past decade. Mr Liu, the former minister, had advocated "leapfrog development", ordering bullet trains to run at unsafe speeds. China's trains are now running a little more slowly.

As for the ministry's legacy of debt and questions about how the China railway corporation would manage the Rmb2.8tn (\$456bn) in liabilities have been put to rest. Officials have declared that railway debts are fully backed by the government, making them as reliable as sovereign bonds.

This has cleared the way for the China railway corporation to issue new bonds and increase spending. In the first quarter of 2013, investment in railway infrastructure reached Rmb54.5bn, up 28 per cent year-on-year.

The corporation's spending power has also been given a boost by the government's willingness to move to a more market-based system for pricing, especially for freight. This year, Beijing approved a 13 per cent increase in freight charges.

When the railway ministry was closed, people rushed to its former headquarters to take photographs as mementoes of the ministry that had loomed so large in Chinese life. But if the restructuring is successful, rail will play an even bigger role in the China of the future.

Transport hopes rely on technology

Continued from Page 1

In London, planning has already started for a second new underground commuter line similar to the east-west Crossrail link, this time from north to south.

Mike Brown, managing director of London Underground and London Rail, says despite existing plans that include upgrading the signalling and rolling stock across the network, which will help boost capacity by 30 per cent, the new north-south line is "imperative".

Whether it be London, Paris, New York or elsewhere, the proliferation of upgrades to existing networks offers plenty of business for suppliers. The biggest, such as Germany's Siemens, are increasingly looking at tapping technology to link urban transport systems across all modes – from road traffic management systems to bicycle schemes and passenger information systems on commuter rail and metro lines.

"We think there is huge potential," says Roland Busch, chief executive of Siemens' infrastructure and cities department.

Mr Busch highlights how Siemens technology used in London's congestion charging scheme and also in the GPS tracking on the buses, has helped cut traffic by 37 per cent.

But it is not always easy to change the thinking of city planners, says Marc Winterhoff, a consultant at Roland Berger. "In cities, everything is done in silos and some interests are working against each other."

"There is no silver bullet. We first of all have to raise the issue and then make the point that it [congestion] is not going to go away and it is only going to get worse."

The rapid spread of 3G and 4G high-speed broad-

band networks is seen as critical to ensuring the efficiency of transport systems, not least by giving commuters all the information they need via their smartphones to make their travel choices.

The proliferation of myriad mobile phone applications around the world in recent years, aimed at providing users with live travel information, demonstrates the potential. But the difficulty is in the creation of a coherent offering from multiple sources.

Matthew Cole, senior vice-president for strategy and business development at Cubic Transportation Systems, a US-based supplier of mass transit ticketing systems and revenue management technology, is one of those trying to bind

\$40bn

Amount India will spend on metro rail in next 10 years

70%

Proportion of people living in urban areas by 2050

the disparate strands together.

"If we are going to undergo a next paradigm shift in the technology then rather just looking at how people pay their fares, we should go broader than that," Mr Cole says.

"We can be part of solving the problem of how we get a person from point A to point B in the most efficient way."

"The trends that are going to impact on that are population growth and density," he adds.

"There are going to be more people with less space looking to move around, so it is going to become more congested and harder to travel."

Despite vast amounts of investment, the rail network remains under stress

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Rail & Metro

Big population propels India to the centre of attention

Investment Demography explains the buzz over infrastructure potential, writes *Rose Jacobs*

In February, India's second annual metro rail conference started with a visit to the Chennai metro system, currently under construction. The southern city is only the country's sixth biggest, but with about 5m inhabitants, it demonstrates why people in the business of building and running metro systems are excited about India.

The rule of thumb is that, for a metro system to offer value for money, in terms of benefit to the wider economy rather than narrower measures of investors' returns, it needs to serve an urban area of at least 1m people. The UK has two such cities, Germany four, the US 10. But, according to 2011 census data, India boasted 46.

That number is set to increase, thanks to population growth and urbanisation. Analysts at McKinsey Global Institute expect India's population to rise from about 1.2bn to 1.4bn by 2025. They forecast that 40 per cent of those people will live in cities by 2030 – with 68 urban conurbations having a population of 1m or more.

Transport investment will therefore be necessary to prevent a parallel rise in gridlock. Neil Ridley, director at the Transport Knowledge Transfer Network, believes providing extra transport capacity is just one of many reasons for the managers of growing cities to consider building a metro. "Metros bring urban regeneration, urban redevelopment. And they can help direct where urban growth actually happens," he says.

He points to the London Underground's early expansionary phases when lines were built out into the suburbs well before people had moved there. A new subway station, he

argues, can do much more than a new road to attract development.

Urban planners and politicians on the sub-continent do not need much convincing. Nor will they be flying blind. Construction on India's first metro system, for Kolkata, started in the early 1970s and finished a decade later. When the service began in 1984, it became Asia's fifth metro system, today boasting two lines with 21 stops.

Meanwhile, the New Delhi metro, which opened in 2002 and has revenues of more than \$100m a year, has been hailed as a symbol of how infrastructure projects can work in India – on budget and on time – compared with past embarrassments. But Abhinav Bhandari, senior infrastructure analyst at Elara Capital in Mumbai, says it may not be the perfect example when it comes to attracting investors.

While the Indian government is hoping that 60 per cent of the costs of future metro projects will be funded by private investors, New Delhi's system was almost entirely publicly funded, even if some stretches are now being privatised.

Nor is it turning a profit, making it a difficult draw for investors who can earn relatively safe returns on investments such as toll roads. These offer yields of between 8 and 15 per cent, depending on the level of risk involved. "Metros are an area that are still not proven to be successful [in investment terms]," Mr Bhandari says.

Still, the construction of five big systems for Indian cities is already under way – in Mumbai, Bangalore, Hyderabad, Kochi and Chennai – and they have attracted private backers.



Investment: New Delhi metro is hailed as a symbol of how big projects can work in India

AFP

As for smaller cities' future projects, they may boast some advantages over the likes of New Delhi when it comes to speed of delivery and return on investment.

Planners might learn from their predecessors the importance of developing revenue streams above and beyond ticket sales, for example, from selling advertising space to developing stations into retail centres and office locations.

Moreover, they have greater opportunity to build underground, given a relative lack of underground electricity and water systems in newer cities. That might reduce the biggest challenge that metro systems face, in Mr Bhandari's view – land acquisition battles.

These are one reason, he argues, why a number of projects are stalled. Landowners and residents are waiting to see whether parliament will approve a bill that would increase the payouts and resettlement packages

that they might demand when land is seized for infrastructure projects. If the bill passes – most observers expect it to eventually – those buyout costs could well exceed the extra construction costs associated with tunnelling underground rather than laying above-ground lines.

Colin Stewart, global rail business leader at Arup, the engineering consultancy that has worked on rail and airport projects in India (though not on metro systems), agrees that the difficulties deserve serious consideration. While "everyone aspires to a metro", that does not always translate into profits. "It's quite difficult to make a rail system stand on its own financially," he says. "Most rail projects are a public service. You have to have a government with the confidence to do it."

With about \$40bn set to be spent on urban metro systems over the next 10 years, India might well be that government.

Partnerships make tracks to reform

Russia

Considerable strides are being taken to improve decaying infrastructure, writes *Isabel Gorst*

When Vladimir Putin recently toured the Hanoi industrial fair with Angela Merkel, the German chancellor, he stopped off for a chat at the stand of Uralvagonzavod, the Russian machine building company.

UVZ is the world's biggest tank maker but, for once, Mr Putin was not out to flaunt his country's military might. The Russian president was signalling Kremlin approval for UVZ's latest departure – a partnership with Bombardier of Canada to design and build modern metros and trams.

As traffic jams clog Russia's big cities thanks to soaring car ownership after the collapse of communism, the authorities are taking steps to upgrade the neglected public transport system.

International engineering groups are offering high-tech solutions that will change the downbeat image of the country's trams, metros and commuter trains and persuade inner-city travellers to leave their cars in the garage.

In Moscow, where problems are the most acute, the city government plans to build an extra 150km of underground train lines that will increase by half the size of the sprawling metro system by 2020. Plans are afoot to patch up the 416km of tramways that criss cross the city and to replace the aged tram fleet with more comfortable models that do not rattle and shake.

Plans to reform public transport stretch far beyond the capital. Russia is preparing to host a series of prestigious international events, including the Sochi Winter Olympics next year and the football World Cup in 2018. Hundreds of thousands of supporters are expected to descend on the 13 cities where the championships will be staged.

Bombardier's partnership with UVZ, formed last year, recently won a contract to develop 120 trams for the city of Moscow.

After chasing transport contracts for several years, other big international engineering groups have concluded that the Russian market is best approached with local partners.

France's Alstom invested \$425m to acquire a 25 per cent plus one share in Transmashholding (TMH), Russia's largest railway engineering group, in 2009.

TMH was founded in the 1990s by a group of Russian coal and metals business leaders to solve the transport needs of natural resource producers. It controls 14 rail car plants that Alstom sees as the key to the Russian and former

Soviet transport markets. Alstom and TMH's first joint project was to design a freight locomotive but the partners are expanding into passenger transport.

Traffic congestion is forcing Russian cities to redesign public transport systems and provide travellers with an efficient and comfortable alternative to the motor car, says Bernard Gonnet, senior vice-president of Alstom Transport CIS.

"People in Russia prefer to travel by car than train. It's exactly what transport was like in western Europe 20 years ago."

TMH's Mytishi plant near Moscow has been turning out metros since Soviet times and is well placed to compete as cities renew their underground train fleets. Alstom is helping refit the Mytishi facility to produce a new generation of trains based on its Metropolis technology.

In a separate venture with TMH, Alstom recently launched a €120m project to convert a railcar plant in St Petersburg to design and manufacture trams.

Most of Russia's fleet of 13,000 trams need to be replaced but, although potential demand is there, finance is a problem, says Mr Gonnet. Alstom is helping to promote the so-called life-cycle infrastructure scheme, including finance and maintenance, to facilitate sales.

Although public transport

New high-speed trains between Moscow and St Petersburg are almost always full

is heavily subsidised, passengers will have to come to terms with higher travel costs if foreign companies are to make headway selling expensive, high-technology products.

There are positive signs. Russian Railways was pleased by the success of the Sapsan, a high-speed train built by Siemens of Germany for the Moscow to St Petersburg rail line. Although ticket prices are as high as three times higher than on ordinary trains, the four Sapsan departures a day are almost always full.

Siemens has since established a local railcar manufacturing base to bolster its position.

As in the case of the Alstom-TMH partnership, Siemens' joint venture with Sinara, the Russian railcar maker, began with a project to build freight locomotives. Some of the 38 electric trains Siemens is supplying for the Winter Olympics will be assembled at a Sinara plant near Ekaterinburg in the Urals.

More orders are flowing in for trains that promise to raise transport to standards that Russians can now only dream of.

Wireless systems lead charge of electric brigade

Urban transport

Loop technology can replenish batteries as vehicles move over a grid, writes *Mark Odell*

The days of the diesel-powered urban bus and those of its "greener" hybrid successors appear numbered. Advances in wireless charging technology hold out the prospect that, over the next 10 years, many cities could switch to all-electric powered fleets.

The biggest obstacle to operators running all-electric buses to a busy urban timetable is ensuring each vehicle carries enough charge to make it through the day.

A standard plug-in charging system would either require buses to carry enough batteries to maintain a charge – adding too

much weight to the vehicle – or force the operator into a financially unsound position of building enough contingency into the fleet to allow buses to return to the depot for lengthy recharging.

Recent advances in battery and charging technologies have seen two rival suppliers emerge in Europe offering a wireless charging system that would allow electric buses to top up their batteries when in service.

The system is based on inductive loop technology – the same principle that charges modern electric tooth brushes – which manipulates powerful magnetic fields to recharge batteries without any contact.

The charging grids can be buried under the road at depots and stops. The number of sites depends on the topography of the route, which dictates power consumption, and are only activated when a vehicle comes to a stop over the grid. This

year, a number of commercial test schemes are due to start as more and more local authorities explore the benefits of zero-emission bus fleets combined with the prospect of potentially large savings in operating costs.

Bombardier is one of two companies at the forefront of promoting the system. The Canadian-based maker of aircraft and rail equipment has developed its own inductive loop system that it hopes will allow it to break into the bus market for the first time.

MBK Arup Sustainable Projects Limited (Masp), a joint venture between Mitsui, the Japanese trading house, and Arup, the engineering consultancy, has linked up with Conductix-Wampfler, a subsidiary of Delachaux, the French engineering and metals group, which supplies the inductive technology.

The system used by Masp is already tested, with a fleet of 30 electric buses in



Grid locked: battery charger

the Italian cities of Turin and Genoa having run on Conductix-Wampfler technology for the past 10 years. It is only now starting to move beyond those trials owing to the constraints on the amount of charge the original system could deliver, limiting the buses to short city-centre routes.

The technology is being tried in s'Hertogenbosch in the Netherlands on one bus operated by Arriva, the

international bus and train subsidiary of Deutsche Bahn.

Masp's first venture will see it use the same technology on eight buses, also operated by Arriva, in Milton Keynes in the UK, which are due to enter commercial service in September. Jamie Talbot, Masp's project manager on the Milton Keynes trials, says it was the experience that Conductix-Wampfler has gained from the Italian operations that made the company an attractive partner.

"Their system is proven and we believe it will offer a reduction in operating costs of between £12,000 and £15,000 per bus per year," he says.

David Martin, chief executive of Arriva, believes the technology could change the face of urban bus operations. "I'm sure this will be the future for electric buses in five to 10 years' time," he says.

Jérémie Desjardins, the head of Primove, a new

business unit at Bombardier, is equally optimistic. "We are claiming that we can be competitive against diesel-powered buses. But now we have to demonstrate we can do it and, once we do, the accessible market could be between 70,000 and 100,000 buses per year," he says.

Bombardier has agreements to run three commercial trials. The first will start in Brunswick in northern Germany with six buses in June, followed by smaller schemes in Mannheim further south and Bruges in Belgium.

Mr Desjardins says Bombardier has been working on the technology since 2007 when he was looking for ways to remove catenaries, which pick up electricity from overhead lines, from its trams.

He says it soon became apparent that a slightly scaled down version of the charging system for trams could be used to recharge electric buses.

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Land of the freeway starts to steer clear of the car

US commuters

Texas is displaying a more accepting attitude towards public transport, says *Robert Wright*

The commuter trains that serve some of the biggest cities in Texas illustrate how even the US's most car-dependent areas are trying to provide alternatives to the automobile.

The Trinity Railway Express, inaugurated in 1996, carries about 8,000 commuters a day along a route linking Dallas and Fort Worth, the two main cities in central Texas. Around Austin, a newer service, the Capital Metro-Rail, inaugurated in 2010, carries about 2,800 people a day into and out of the

state capital. The services' existence, says Jon McDonald, vice-president transit and rail of Atkins, the consulting engineer, reflects the gradual decline in driving in the US. "People generally are starting to become more familiar with public transit, more accepting of it," he says.

Despite the relatively modest passenger numbers, the two Texan services also represent visions for how US commuter rail services might develop in future. Each TRE service towers over the platform, hauled by a vast, powerful diesel locomotive. The passengers ride behind in big, sturdy double-deck cars.

Capital Rail Express's customers, meanwhile, travel in lighter, airier carriages powered by diesel engines hidden under the floor. The trains, built by Switzerland's Stadler, are among the few such Euro-

pean-style diesel trains – known as multiple units – permitted to run on mixed-traffic rail lines in the US.

European manufacturers say European-style multiple units would offer US transit agencies cost and capacity advantages compared with running heavy, locomotive-hauled trains.

However, the Federal Railroad Administration's safety rules mean, for the moment, most operators continue to buy locomotives manufactured by GE Transportation, part of General Electric, and Caterpillar, manufacturers of nearly all US diesel locomotives.

Henri Poupart-Lafarge, president of the transport sector of France's Alstom, one of the world's biggest trainmakers, says it wants to bring more of its global products to North America. The company has previously built cars for both the New York City subway and

Washington metro and won a contract in February to supply its first trams to North America – to Ottawa. The company is also supplying six diesel multiple units to operate around the Canadian capital.

Alstom would like to expand beyond metros, into the US commuter rail market, Mr Poupart-Lafarge says. "There are more and more talks about accepting European standards on these lines," he says.

The central consideration for the FRA is it considers

'If you start looking at approaches such as crumple zones, you can demonstrate the same safety'

which trains to allow is that many current or potential commuter train routes carry the freight trains that handle 40 per cent of the US's inter-urban freight. The FRA's safety standards have long been based on ensuring passenger trains would withstand intact a head-on collision with such a train, some of which can be two miles long. The agency also considered the potential for a level-crossing crash between a passenger train and a US large truck.

The result, according to Mr McDonald, has been that, with a few exceptions, only big locomotives and sturdy coaches like those running on TRE had been considered safe enough.

But European manufacturers point out that, while European safety rules are different, most of their products are built to withstand head-on impacts at

the 200kph or higher speeds of many European rail systems, often by absorbing the energy through crumpling of components at the front of a train. Guillaume Mehlman, president of Alstom Transport North America, says the FRA is starting to consider more European approaches – known as "crash energy management".

"If you start looking at approaches like crumple zones, you can demonstrate the same safety, but with a lot less steel and structural parts," Mr Mehlman says.

The FRA confirms that its railroad safety advisory committee, Amtrak, the federal government's passenger rail operator and others are working on safety design standards that would allow multiple units to operate in the US market. "There is broad consensus on the path forward," it says. "We are collaborating

with Amtrak, railcar manufacturers and other partners to establish and implement safety standards that will ensure safe operation of these trains for passengers, employees and communities around the United States."

Mr McDonald says many commuter rail operators, such as Caltrain in the San Francisco area, are considering investing in electrification. Although this involves significant capital costs, it would allow them to buy cheaper, more reliable electric multiple units. "Caltrain believe they're going to pay [the capital cost] back in a fairly short amount of time – about 30 years," Mr McDonald says.

Such projects would need long-term finance. But they could suit European manufacturers still better than a move to diesel multiple units. "Over the longer term, the best solution is electric," Mr Mehlman says.