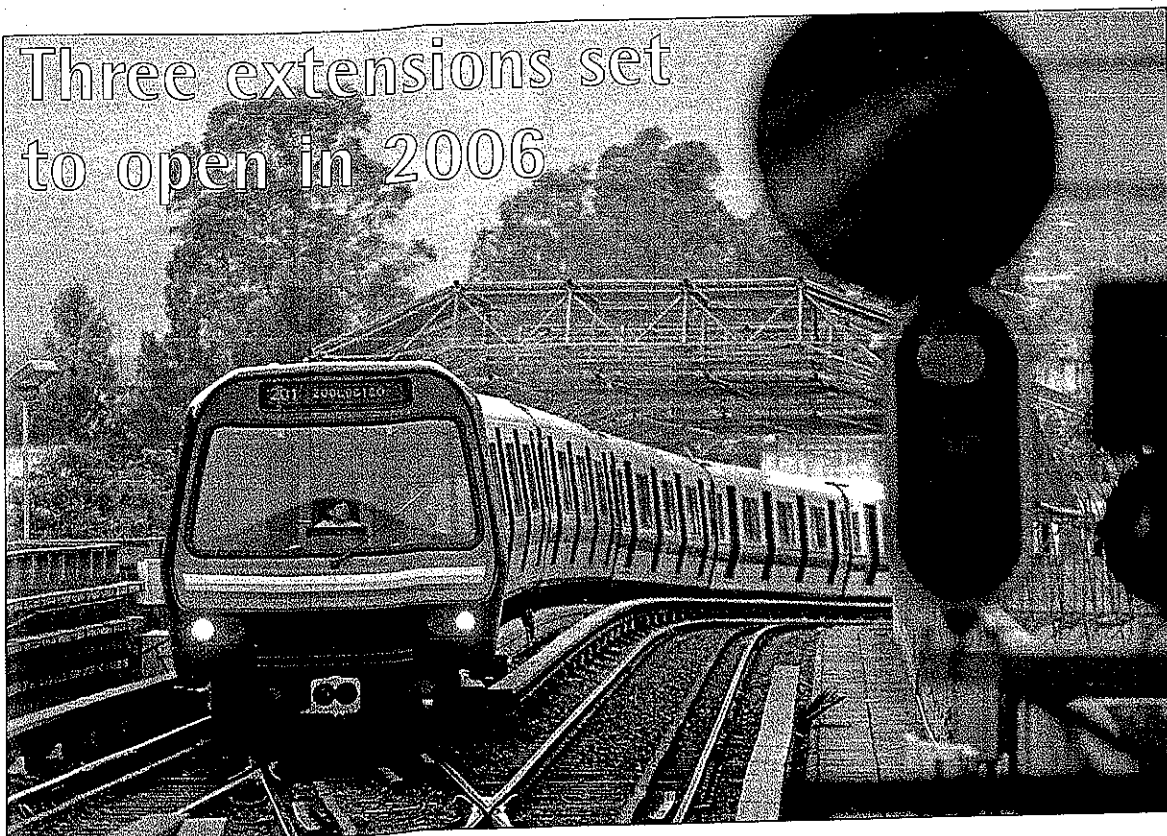


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Three extensions set to open in 2006



CONTRACTORS are poised to start installing electrical and mechanical equipment on the first section of Caracas metro Line 4 between Capuchinos and Plaza Venezuela. The work will get underway as soon as the civil engineering teams grant access for the E&M contractors.

If all goes well, the 5.8 km line could be ready for testing and commissioning by mid-2006, allowing Metro de Caracas to carry the first passengers by an autumn 2006 deadline – the aim is to have it in service ahead of the presidential election scheduled for December 2006.

Line 4 has been much delayed because of problems with funding the civil engineering work, which is being handled by Brazilian company

Odebrecht. Metro de Caracas insisted on some of the lost ground being made up. Odebrecht then brought in a new tunnel boring machine, and the current position is that access for E&M installation will be possible along the whole of the Line 4 alignment by the end of 2005.

As with all other E&M work on the Caracas metro, the Line 4 contract is in the hands of the Frameca consortium, with the deal inked in 1998. Frameca was established in 1986, with the work shared between the members as follows:

- Track: AMEC Spie, Vossloh and Alstom;
- Traction power supply and electrification: Alstom, AMEC Spie;
- Train control and communications: Thales, Siemens Transportation Systems, Alstom, CSEE Transport;
- Rolling stock: Alstom, Bombardier;

The citizens of Caracas are proud of their metro. Visitors are surprised at the cleanliness of the stations and trains, while there is a complete absence of graffiti. A Line 2 train arrives at Zoológico terminus

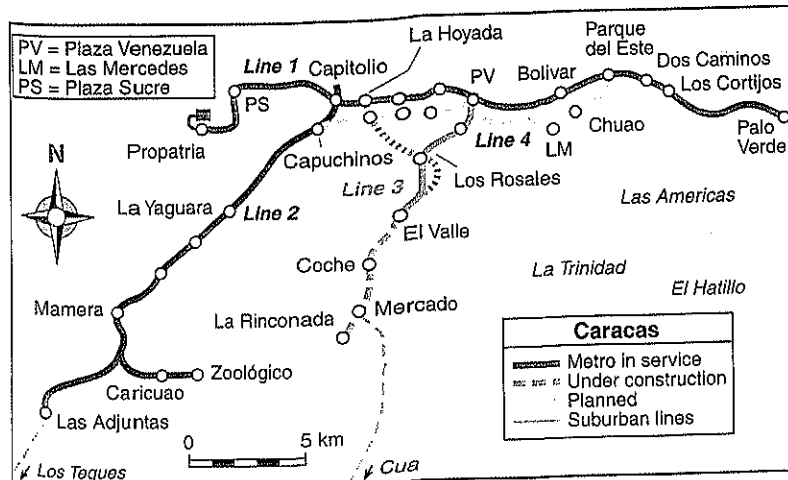
- Project co-ordination and engineering consultancy: SGTE (an AMEC Spie subsidiary), Alstom.

The first phase of line 4 will require 45 cars, and as with previous builds these are being assembled at Alstom's works at Valenciennes in northern France. Metro de Caracas asked for the cars to remain externally identical to its earlier fleet, but this masks important technical changes. For example, earlier cars had DC traction motors, but the Line 4 cars will use three-phase asynchronous motors and a modern traction control package with IGBT converters. Metro de Caracas has accepted this and a number of other technical changes where the supplier has been able to demonstrate savings in maintenance and other costs.

Relief for Line 1

Line 4 is of major significance for the Caracas metro as it parallels a section of Line 1, which suffers from severe overcrowding – more than one million passengers a day ride the trains on the 22.5 km route. The western terminus of Line 4 at Capuchinos will offer direct interchange with Line 2, while in the east it will connect with Line 1 at Plaza Venezuela.

This will have two advantages. Not only will Line 4 provide an alternative route for some Line 1 traffic, but it will



The most recent builds of car for the Caracas metro are visually identical to the earlier fleet, but numerous technical improvements have been made

also divert passengers who currently use Line 2 and then change to Line 1 at El Silencio-Capitolio. Estimates suggest that the new line will carry between 150 000 and 200 000 passengers a day.

The existing network handles around 1.4 million passengers every day, with traffic growing steadily as the network expands. The first 6.7 km section of Line 1 was opened between Propatria and La Hoyada in January 1983, and the next section running east from La Hoyada to Chacaíto followed in March that year.

The initial section of Line 2 from La Paz to Zoológico, with a branch to Las Adjuntas, was opened in October 1987, and this was extended north to meet Line 1 at El Silencio in November 1988. By that time Line 1 had been extended further east to Dos Caminos, and the final section of Line 1 to Palo Verde followed in November 1989.

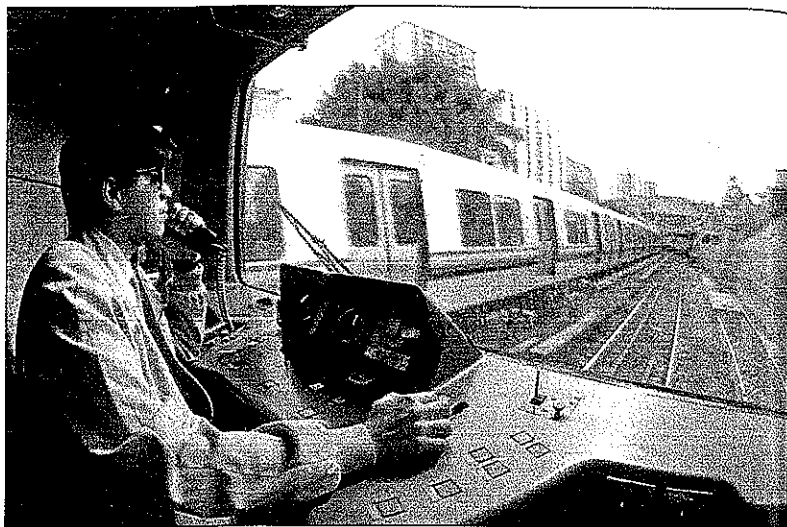
Line 3 progress

Construction is also in hand on an extension to Line 3. The first part of this route opened in 1994 over the 4.5 km from Plaza Venezuela to El Valle. A contract to build the 6.7 km south from El Valle to La Rinconada with intermediate stations at Los Jardines, Coche and Mercado was signed with Odebrecht as long ago as 2001, but funding delays also held up this project.

Not until 2002 was a contract for B&M equipment signed with Frameca (RG 11.02 p672). This covers 42 cars, which will also feature an up-to-date traction equipment package. Alstom and its partners have commenced production of the equipment, and the aim is to have the extension ready for inauguration in autumn 2006, although full commercial service may not be possible until a later date.

The Line 3 extension is expected to generate between 30 000 and 50 000 additional passengers a day, but many more are anticipated when the 43 km Tuy Medio suburban line (RG 9.04 p544) opens. This line will tap traffic in the development area between southern Caracas and Cua and feed it into Line 3 at Mercado; opening of the line is also expected during 2006.

All civil engineering on the Tuy Medio line has been finished, and B&M work is around 80% complete. The job includes electrification at 25 kV 50 Hz by Balfour Beatty Rail SpA of Italy; a fleet of 52 stainless steel EMU cars is being supplied by Nippon Sharyo of Japan, with fitting out by Costaferrroviaria of Italy.



Los Teques next

There is clearly a case to extend Line 4 eastward from Plaza Venezuela, but for the moment Metro de Caracas is heavily committed with the first part of Line 4 and the Line 3 extension. It is also awaiting completion of a third project.

This is the long-standing Los Teques scheme for an independent feeder line running 9.5 km from Las Adjuntas at the south end of Line 2 to El Tambor in the centre of Los Teques. Management of this scheme is in the hands of a separate organisation, CA Metro Los Teques, which was set up in October 1998. The company was charged with building along the San Pedro valley to serve the residential and dormitory zones in the Altos Miranda area. Some delay occurred while the company pondered how best to finance the US\$450m project, and a concession arrangement was rejected in favour of more conventional funding.

The civil engineering contract was awarded to a consortium of Brazilian and Italian companies led by Odebrecht, and about 75% of the work is finished.

Major tunnels are being built at La Linea and Rio Cristal.

All civil work is due to be

completed by September this year, although some delay is anticipated.

A tender for the B&M equipment, which includes the supply of 24 cars, is due to be issued shortly. The cars are likely to be the same as those supplied for Lines 3 and 4 as the line is being built to full metro standards. This will ensure standardisation and allow the Los Teques fleet to be maintained at the Line 2 workshop at Las Adjuntas.

However, there will be no through service, and passengers between Los Teques and Caracas will need to change at Las Adjuntas, where provision was made for interchange when the Line 2 station was built.

Long-term plans

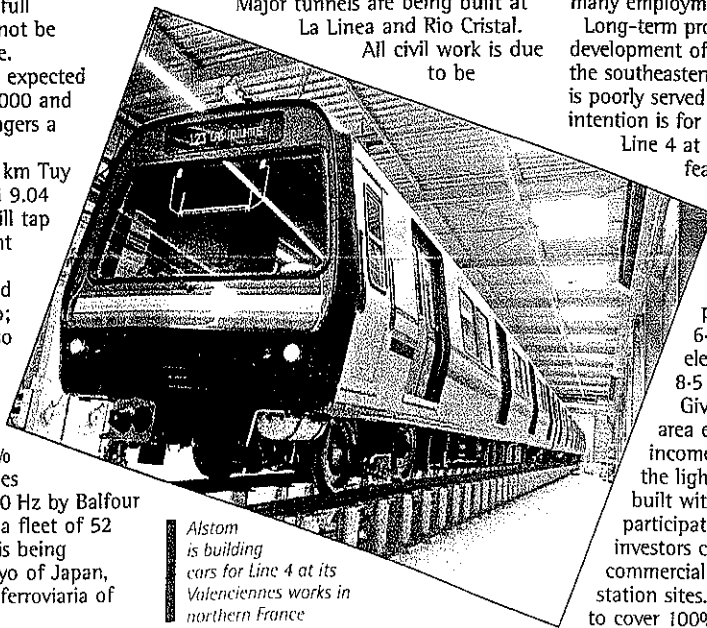
In the long term Line 4 is likely to be extended from Plaza Venezuela to Parque del Este, taking the length of the line to 12.3 km with 10 stations. This extension would run entirely in tunnel, with two crossings of the River Guaire. It would serve a large part of the city's central area with a dense population and many employment opportunities.

Long-term proposals also envisage the development of a light rail network in the southeastern sector of the city, which is poorly served by public transport. The intention is for this to feed into metro

Line 4 at Chuao or Tamanaco. Pre-feasibility studies suggest

that the light rail service could be carrying 340 000 passengers a day by 2010. A 15 km route is proposed, of which 6.7 km would run on elevated alignment and 8.5 km in tunnel.

Given that people in this area enjoy relatively high income, proposals envisage that the light rail project could be built with private-sector participation; one idea is that investors could be attracted to commercial property development at station sites. Fares would be pitched to cover 100% of operating costs. ■



Alstom is building cars for Line 4 at its Valenciennes works in northern France

Luas sceptics climb on board



Michael Sheedy
Director, Light Rail
Railway Procurement Agency

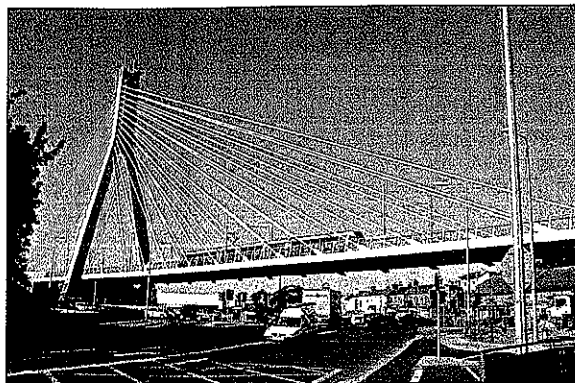
OVER 1.8 million passengers rode the two light rail lines in Dublin during March, bringing the total ridership since the first section of line was opened in June 2004 to more than 11 million.

Our target patronage for the first year of full operation is 20 million. In fact, the build-up is running well ahead of projections, confirming our long-held belief that light rail has a valuable role to play in Dublin's transport mix. Thanks to strong economic growth over the past decade, the Irish capital has expanded rapidly, and housing developments are continuing to spring up on both sides of the new orbital motorway.

When the idea of light rail for Dublin was first floated in 1984, there were many sceptics who doubted the viability of the concept. Criticism continued as successive plans were unveiled and the route network kept changing, even after the Dublin Light Rail Act was passed in 1996. Throughout the planning and construction process, the protests grew louder with every minor problem. But within a couple of months of the first trams running, doubt turned to

TOP: The Red Line makes use of the historic 1821 bridge across the Liffey at Heuston station

RIGHT: Replacing a demolished bridge on the old Harcourt Street alignment, this dramatic cable-stayed viaduct at Dundrum on the Green Line is one of the architectural signatures of the Luas project



acceptance and then delight.

Today Dubliners have taken Luas to their hearts. The trams are seen as a symbol of modernity and renewal, of vision for the future. It is notable how many advertisements for a whole range of products are already featuring Luas in some way or another. And it is clear from the growing ridership that this support is not just being expressed in words.

A further vote of confidence has come from the many development projects taking shape along the routes, some of which started before the lines were ready to open. Particularly worthy of note are the new Jervis shopping complex on the Red Line near Abbey Street and a luxury residential block over the park-and-ride car park at Balally, where the flats are attracting premium prices because of the good transport links.

Phased opening

The background to Luas and details of the construction were explained in a previous article (MR 01 p31). At that time we were still in the early days of civil engineering on the Red Line, and the Green Line had only just been authorised. Over the next two years civil works

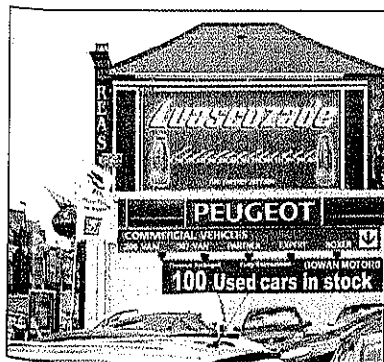
pushed ahead, followed by tracklaying and electrification, and the construction of the depots for the two independent lines. The Red Cow depot on the Red Line is the larger, housing the control centre and offices for the operating concessionaire, but Sandyford is fully equipped for servicing and maintenance.

A major advance came in May 2002, when after competitive tendering the operating franchise was awarded to Connex Transport Ireland. The contract runs for five years, with an option to extend for a further five years. Ridership risk remains with RPA, but the payment structure means that Connex is incentivised to increase ridership where possible.

Apart from ridership, the performance-related contract gives Connex total responsibility for all aspects of the operation. RPA had already awarded maintenance contracts to Alstom, Dalkia and Scheidt & Bachmann, but these were subsequently novated to Connex so that the concessionaire has single-point responsibility (RG 3.05 p158).

Awarding the operating concession before the line was completed, and giving the rolling stock maintenance contract to the supplier, meant that both parties were on board during the final commissioning process, and they provided valuable input in the run-up to opening.

Because the 9 km Green Line is shorter,



Luas imagery is already being used for a wide range of unrelated advertising, symbolising the modern face of today's Dublin

and mostly follows the alignment of the former Harcourt Street railway closed in 1958, construction was much simpler and quicker. Despite the later start, this route was ready to open first.

After a simple ceremony on June 30 2004, we threw the line open for five days of free travel, which attracted over 350 000 people – more than a third of the city's entire population! There were long queues snaking around St Stephen's Green as people waited happily to sample the new trams.

This burst of enthusiasm was repeated when the 15 km Red Line was formally inaugurated by the Taoiseach, Bertie Ahern on September 28. Again Dubliners turned out in their hundreds of thousands, with 225 000 sampling the line in the six days before the start of revenue operation on October 4.

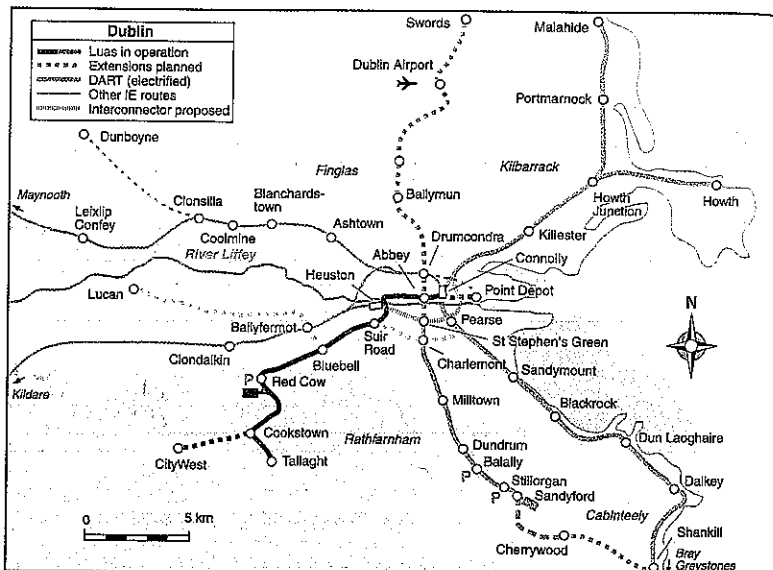
Within two months of opening, average daily ridership on the Red Line reached 23 250, overtaking the 21 350 being recorded on the Green Line. By the end of 2004 Luas had carried over 6 million passengers – 4 million on the Green Line in six months and 2 million on the Red Line in three.

Contrasting lines

The Red Line provides the long-awaited cross-city link between Iarnród Éireann's principal stations at Connolly and Heuston, continuing through the south-west suburbs to Red Cow and Tallaght. The line is operated by a fleet of 26 Citadis 301 cars, 30 m long, running typically at 5 to 6 min intervals. The scheduled service requires 24 cars, giving a typical capacity of 2 800 passengers/h in each direction.

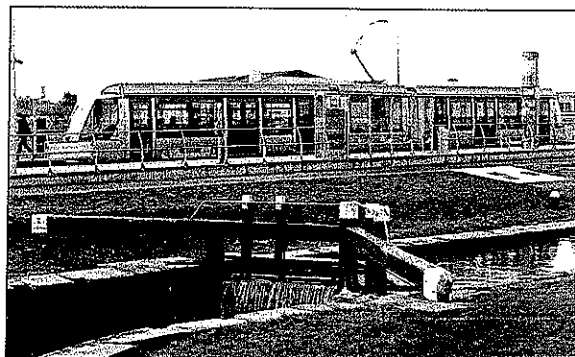
By contrast, the shorter Green Line to the southeast has a smaller fleet of 14 cars, but these are the 40 m long Citadis 401 version, so the capacity with 13 cars in service is higher at 3 650 passengers/h despite a less frequent off-peak service running at 10 or 11 min intervals.

Both Luas routes serve park-and-ride interchanges, with four sites offering 2 200 spaces. The biggest of these is at Red Cow, with others at Stillorgan and Balally on the Green Line. Red Cow lies close to a key junction on the orbital motorway, and is proving popular with commuters from the western suburbs. Next year we expect to complete a flyover



ABOVE: The Dublin Transport Strategy published in 2002 envisages the addition of several extensions to the light rail network by 2014

RIGHT: A 30 m Red Line car runs alongside the Grand Canal through Dublin's southwest suburbs inbound from Tallaght



allowing cars to reach the park-and-ride without getting caught in the traffic jams that build up around the junction, which should boost usage even further.

In the months following the opening of the Red Line, various improvements have been instituted to cut the running time and increase the service frequency. At the start the end-to-end journey time was 48 min and the basic headway 10 min. By the end of 2004 these had been cut to 45 and 7½ min respectively, and in April they were reduced further to 43 and 5 min.

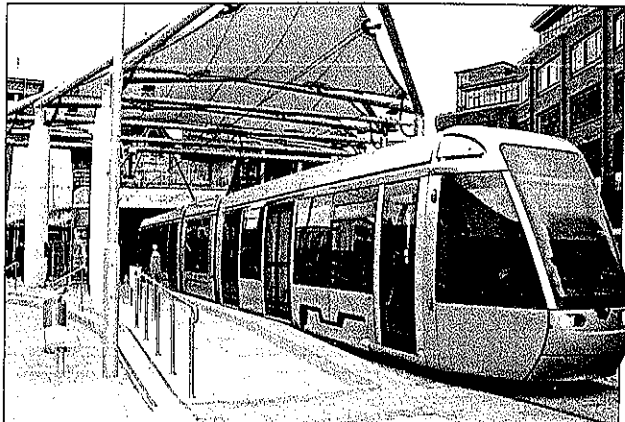
If the Red Line patronage continues to rise at current rates, we are looking to cut the peak headways to 4 min by the

end of 2006, and we may also be looking at lengthening the trams to 40 m by inserting an extra section. This is one of the advantages of

Alstom's modular Citadis design – cars have already been lengthened in this way for Montpellier. Some interesting ridership trends have started to emerge over the first six months, with clear weekday daily and hourly patterns emerging. The morning peak has been very steady since the start of service, followed by a mid-morning slump and stronger ridership around lunchtime. The afternoon dip is less noticeable, with the afternoon peak spread well into the evening by late-night shopping traffic.

In fact, the busiest single day of the week is Saturday, as Luas has proved particularly attractive for shopping and leisure travel in and out of the city centre. The busiest periods on Saturday see more transactions at the ticket vending machines than the weekday morning peaks. Sunday is the quietest day, but nevertheless there has been a noticeable impact from 'Luas Tourists' taking family days out.

Because leisure and off-peak occasional riders are the dominant sectors, basic singles and returns represent around 80% of all ticket purchases, and season ticket sales have not been as high as we expected. In conjunction with IE and Dublin Bus, we have launched combined bus/tram and rail/tram passes, and on March 21 we introduced smart cards on the trams. RPA is currently leading the procurement process for an integrated



The Red Line terminus at Connolly lies adjacent to the station entrance

smart card ticketing system that will be introduced across all three modes over the next 18 months or so.

Future expansion

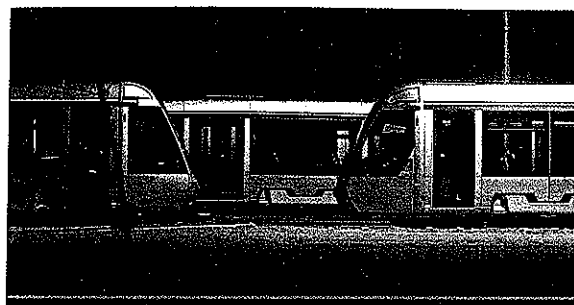
The Dublin Transport Strategy published in 2002 sets out a number of rail expansion projects to be carried forward over the next decade. This includes the first stage of the capital's planned Metro network, improvements to IE suburban services (RG 5.05 p275) and extensions to the Luas light rail network.

At the southern end of the Green Line, planning is well advanced for a 7.5 km extension from Sandyford to Cherrywood, which would diverge from the old railway alignment to serve new suburbs further west. RPA is about to lodge a formal application for powers to build this line. A subsequent extension would rejoin the old trackbed and follow it to Shankill, where the trams would interchange with the electrified DART suburban railway to Bray and Greystones.

A 1.8 km eastern extension of the Red Line from Connolly to Point Depot is at an advanced planning stage; with four stops this would serve the docklands development zone on the north bank of the River Liffey. We hope to start work in 2006 for opening in 2008. Still under discussion is the possibility of raising finance from the private sector, perhaps through some sort of property development levy.

Another challenge will be to close the

The distinctive metallic lilac and purple livery adopted for the Luas cars has proved very popular



gap between the two lines, eliminating the 10 min walk from St Stephen's Green to Abbey Street. With Grafton Street now pedestrianised, we

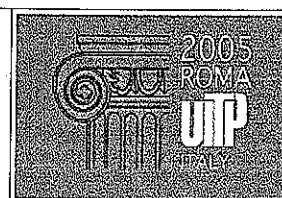
have commissioned studies into alternative surface routes. Achieving a surface connection would require surrendering some road space now used by buses and cars, so getting public opinion behind Luas will be essential.

An underground extension of the Green Line northwards from St Stephens Green is envisaged by the government as the first stage of the Metro network, and the line has been designed for upgrading to metro standards if required. After connecting with the Red Line near Abbey Street, the route would continue north through Ballymun to the airport and the growing suburbs around Swords.

Two further lines to serve the western suburbs are currently being examined. The first is a 4.0 km branch off the Red Line, which would diverge at Cookstown and run to CityWest, adding four stops. The Yellow Line would start from

Lucan and run eastwards to Ballyfermot, where there would be an interchange with IE's Heuston - Kildare line, and then turn south to join the Red Line at Bluebell. Yellow Line services would share the existing track towards the city centre as far as Suir Road, after which the Yellow Line would continue alongside the Grand Canal around the south side of the city centre to meet DART in the southeast of the city, interchanging with the Green Line at Charlemont en route.

Further interchanges between Luas and the suburban network would be provided if IE's proposals for its Interconnector cross-city rail tunnel go ahead (RG 5.04 p276). This would run east from Heuston to a station at St Stephen's Green and then loop northwards under the Liffey to a Docklands station near Point Depot. After this the route would surface again and connect with the routes leading north and west from Connolly. ■



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