The Institution of Railway Operators

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Light rail – tram, train or bus

Steve Hyde, S&T engineer with Serco Metrolink, explains how the signalling on Manchester's Metrolink differs from other light rail networks

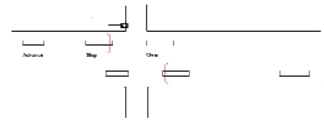
When Manchester's light rail network was being designed and built in 1990 and 1991, there were few established principles on which to base the design of the signalling and control systems. At the time, there were only two other second-generation light rail systems in the UK. Tyne and Wear Metro is a completely segregated railway operating on its own rights of way with conventionally-driven trains controlled by two aspect signals. The other, Docklands Light Railway, is an automatic driverless system with a transmission-based control system.

Although it was intended to be the first new street tramway, for much of its length Metrolink actually operates over existing heavy rail infrastructure at speeds of up to 80kph. A 3km stretch in central Manchester runs through streets at speeds of up to 50kph. Trams generally operate at short headways for up to 18 hours a day, requiring high levels of reliability. The system is divided into two distinct parts with control philosophies for each finally integrating them back at the Control Centre. Although specific technologies differ between the different LRT systems, the principles are very similar.

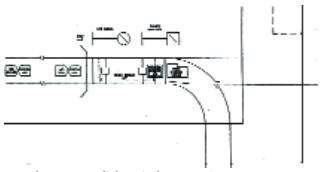
Trams running on former heavy rail track are controlled using a traditional track circuit block, two-aspect signalling system. This allows the trams to operate at speeds of up to 80kph where sight lines are restricted. The Tyne and Wear Metro uses similar technology, as its infrastructure is very similar. Both of these systems have an Automatic Train Stop system to apply emergency braking if a tram passes a stop signal at danger. In the case of Metrolink, most of the signalled route is fully automatic with track circuits controlling the signals. Only at junctions is manual operation provided, and even here they usually operate in automatic mode with the controller taking over for out-of-course working or to allow trams access to the depot. A tram's position is shown on a heavy rail-style train describer driven by track circuit inputs.

Where trams operate on street routes, new technologies come into play. Here they must operate as road vehicles and obey the rules of the road. Interfaces are needed between the trams and the road traffic signals to allow trams to pass through junctions and interact with normal traffic. The various systems currently in operation use different equipment to achieve the same result. In Manchester the trams are fitted with a bespoke tram-to-track data transmission system called the Vehicle Recognition System, that communicates with loops of cable cut into the road surface. These loops provide information about approaching trams to controllers, either in the form of a simple switch closure to indicate the approach or presence of a tram or through route information to request the appropriate direction at diverging junctions. The data telegrams actually contain the tram fleet number, the route code set by the driver and certain fault information.

The general layout of the loops



Manchester Metrolink Typical Traffic Light Controlled Junction.



Manchester Metrolink Typical Street Points Layout.

provides three functions. An advance function gives early warning of the tram's approach to enable priority to be given where required; a stop loop is used in situations where the tram arrives after the proceed aspect has finished; and a clear loop effectively hands the junction back to road traffic. In practice, the various functions become combined at consecutive junctions.

The form of traffic signal developed for light rail is different from the normal red, amber and green used by normal road users. It takes the form of a matrix of white lamps configured to display a horizontal bar for stop, diagonal bars to left or right for diverging routes or a vertical bar for straight ahead. The amber display seen when a normal signal reverts to red takes the form of a cluster of lamps. This helps minimise any confusion at junctions where tram movements may conflict with road traffic.

Points on the street sections of the tramways are called by the tram using the route data entered by the driver. The call is put in to the point controller from a loop or detector close to the points (in practice around 5m in Manchester) to minimise the risk of pedestrians crossing the points as they move. Once a call has been made to move the points they are locked and can only be released by the passage of a tram. This is achieved by the progressive occupation and clearance of a track circuit and mass detector system as the tram passes through the junction. At diverging junctions with point work, a separate indicator is provided to show that facing points are locked and detected. These are not interlocked with the traffic light controller although the call for the points comes from the same source as the traffic signal demand.

The control room has no facility to call facing points on the street sections, again to minimise risks to pedestrians. However, on Metrolink,

Diverging Junction showing LRT Signal and Point Position Indicator.

A Metrolink tram at Manchester Piccadilly with an LRT Signal.

Manchester Metrolink Control Room.

Road traffic signal with light rail signal alongside.

DIARY OF EVENTS

SCOTTISH AND IRISH AREA

London Underground vehicles were not what we expected to find when we accompanied the CILT on a visit to the Springburn works of Alstom in Glasgow. And it is doubtful if the Caledonian Railway could ever have envisaged, when it laid out its 45acre site, that it would repair a Eurostar coach damaged in a derailment in Belgium.

Greatly reduced in size, the remaining five acres of workshops attract an intriguing range of work. A staple product is wheelsets, machined to a surprising range of wheel profiles, and sometimes even varying between owning companies for similar vehicles. Springburn will also renovate whole locomotives.

There is an international flavour to much of the work carried out at Springburn. Indeed, staff were already in Spain to study stock being built there, so that they would be able to undertake repairs when the time came. So, although there is no new construction carried out there, it holds an important position as the most northerly facility for renovation and repair, backed by a sound tradition and adaptability.

For information on all Scottish events, contact Scottish@railwayoperators.org or phone Jim Summers, Acting Chairman, on 01324 625284.

SOUTH WEST AREA

For information on all South West events and matters, contact Lawrie Hall on 01453 822150 or email us at Southwest@railwayoperators.org

NORTH WEST AREA

Future meeting dates: **21 September, 23 November, 25 January, 22 March** and **24 May.**

To contact the North West area on any matter, please contact Clive Evans on 01270-629009 or email us at: Northwest@railwayoperators.org

MIDLANDS AREA

On **Monday 23 May** the Midlands Section of the IRO was the guest of EWS during a tour of the Wolverhampton Steel Terminal. Chris Swan, the Terminal Manager, explained the role of the terminal in the chain of transportation of steel coil and other base products from producer to end user. EWS is well placed in this important market in the West Midlands as the terminal affords customers a facility to store steel until it is needed as well as a direct rail-road interface for just-in-time products. Services run direct to the terminal from the east coast ports for imported steel and from South Yorkshire for Corus. Members viewed unloading areas, the coil storage shed, the rail sidings and the listed Victorian canal/rail freight transport interchange at Monmore Green. Thanks are due to Chris Swan and to Don Rajpa, Chief Clerk at Wolverhampton, for their hospitality during the visit. Please note the Midlands Area does not run any events over the summer period. The next provisional date after the summer break is **Monday 19 September**. To contact the Midlands Area on any subject, please call Julia Stanyard on 0121 345 5030 or email: Midlands@railwayoperators.org

SOUTH EAST AREA

Monday 25 July, London: Ann Bates, member of the DfT's Disabled Persons Transport Advisory Committee and the Rail Passenger Council

Monday 26 September: London David Franks, National Express Group

Monday 21 November, London

All South East Area meetings take place at the Union Jack Club, Sandell Street, Waterloo. Doors open at 18:00 and the talks commence at 18:30. To contact the South East area on any subject please email: Southeast@railwayoperators.org

NORTH EAST AREA

Tuesday 12 July, Horbury: An opportunity to see the conversion work being undertaken to create GNER's 'Mallard' sets from the original BR 225s. Transport will be provided from Wakefield Westgate and numbers will be have to be limited; to reserve a place email liz.kent@gner.co.uk. Final details will be published nearer the date.

The programme for meetings in September and November is still being finalised but is intended to include items on the Rail Accident Investigation Board and engineering planning processes.

All North East Area meetings normally take place at 17:30 for 18:00, at York. For further news on the IRO in the North East contact us by email at: Northeast@railwayoperators.org

the lie of most street points is displayed in the control room.

An integrated control room conrols and minotrs the system. Again the various light rail systems have differing needs and levels of control. At Manchester the supervisory system provides control and monitoring of the heavy rail style signalling along with tram position monitoring, traction power control and plant monitoring on the stops. A separate voice system provides telephone and public address facilities. In addition, each tram cab can communicate with Control using a trunked radio system.

Effective maintenance regimes are required to ensure reliability. These have to be shoehorned into the very short 'white periods' of around four hours each night. Points are a particular focus, especially on the street sections. Cleaning and vacuuming of street points along with frequent jetting of point drains are all very necessary; a typical day's service will see a set of facing points on Metrolink's Delta Junction called almost 300 times a day, and at Piccadilly the facing points are moved around 500 times a day. Service exchanges of equipment are designed around shortened life cycles compared with similar equipment on conventional railways. On street, external agencies often need possessions or isolations. Even a simple task like cleaning office block windows may require the power to be isolated.

Performance penalties, designed to achieve at least 98 per cent of timetabled mileage, concentrate the mind when planning closures. The focus is on planning and maximisation of the resources available. Although relatively small in comparison to the heavy rail network, the maintenance of services on these light rail networks can require just as much detailed effort and keeps the maintenance engineer on his toes.

NEWS FOR IRO MEMBERS

The following employers operate a corporate membership scheme, by paying a one-off annual fee which covers all their employees' affiliate or associate membership subscriptions: Network Rail, Eurostar UK, First ScotRail, First Great Western, First Great Western Link, Railnews, Iarnród Éireann (Irish Rail), EWS Railway, Northern Ireland Railways, Freightliner, Virgin Trains, Arriva Trains Wales, Thameslink, Southern, London Lines, South Eastern Trains, Corus Rail Consultancy, Transport for London, London Underground Ltd, Docklands Light Railway, Sheffield Supertram, Stagecoach Rail, South West Trains and Island Line.

Those with full membership will continue to pay their subscription personally, irrespective of whether they can subsequently claim it back. As the IROs subscriptions are tax-deductible, a receipt will be issued for all payments, whether by cheque, standing order or via online internet payment.

If your company would like to explore the benefits of corporate membership of the Institution, please contact us. We welcome applications from all industry companies, suppliers and associations – please contact Chris Daughton on 01444 248931 or email admin@railwayoperators.org

IF YOU ARE NOT ALREADY ENROLLED...

Have you got experience of operating the railway? Would you like professional recognition, development and work-based academic qualifications?

The Institution of Railway Operators exists to provide a professional structure and qualifications for people with knowledge and experience of operating the railway, at all levels. An information pack is available for anyone interested in finding out more. Contact Claire Wickes at the above address if you would like a pack for yourself or colleagues.