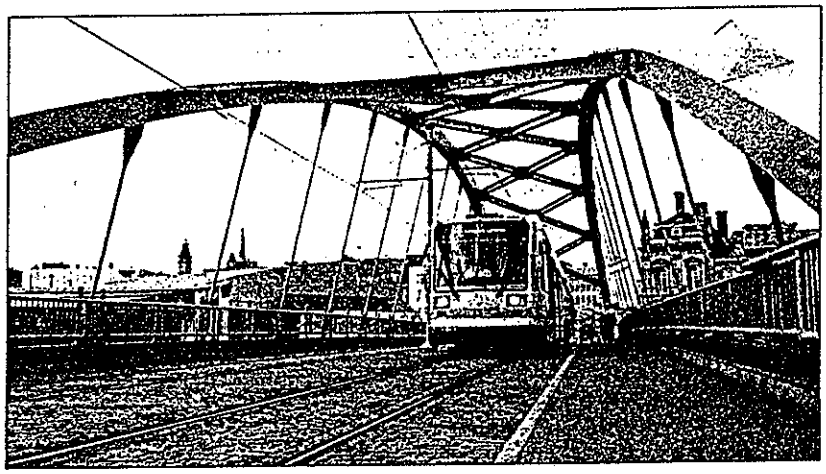
LIGHT RAIL SPECIAL



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Combining light rail transit and trains – a new approach to urban transport

TREVOR GRIFFIN, BRITISH RAIL RESEARCH

British Rail Research is playing a major role in the development of a new urban rail concept which may have a significant impact on how people choose to travel in future. It should go a long way towards solving the problem of attracting people back onto public transport, from the comfort and convenience of their cars.

Imagine that you live about 10 miles from the centre of the city and want to journey there. You go to your local railway station but, instead of catching a train, you wait a few minutes and board a tram. The tram operates on the ordinary railway, mixed in with InterCity and freight trains. It travels at high speed, taking advantage of the high quality alignment created during the Victorian era. You sit back in comfort, watching heavy traffic moving slowly on parallel roads. As you approach the city, the tram leaves the railway line and runs on its own track to the edge of the pedestrianised zone, where it continues on street tracks through traffic free streets. You step off the tram within metres of your destination.

In the past you might have gone by train but you would have needed to plan your trip to coincide with the infrequent timetable. The City station was far from your destination and, to complete your trip, you would have had the choice of an expensive taxi, waiting and paying again for a bus or an uncomfortably long walk. It would have been much quicker and more convenient to use a car, even allowing for the congestion and parking problems.

This is more than a pipe dream. It already happens in Germany, where Karlsruhe trams operate over regional routes of the Federal Railway. Passenger numbers are dramatically higher now that the trams have replaced local rail services. Karlsruhe is gradually implementing a plan which will create a regional network based on the concept. Two other German cities, Saarbrucken and Erlangen, have proposals for similar regional networks.

Why mix trains and trams? Surely, if the advantages are so great it would pay to convert existing railways to light rail operation, as happened in Manchester. The problem is that there are very few locations in urban areas where it is possible totally to segregate useful sections of the existing rail network.

The other option is to build entirely new light rail routes into the suburbs. This is feasible only if suitable alignments are available. In many cities, long sections of street operation may make light rail unattractive. Creating a route by demolishing property can be both very expensive and politically unacceptable. People also object to losing parks and attractive countryside.

Allowing trams to operate over conventional railway lines, a concept normally referred to as 'track sharing', is a means of creating high quality urban rail systems which can be applied when other methods prove not to be viable.

PROGRESS IN THE UK

British Rail Research has pioneered work to establish the requirements for shared track operation in Britain. It produced guidelines in 1993 which enable potential users of the concept to develop applications for approval by the Railway Inspectorate. These guidelines are to form the basis of acceptance standards which are to be created by Railtrack.

Greater Nottingham Rapid Transit has recently commissioned British Rail Research to undertake a study of the feasibility of building and operating its initial route as shared track. The route was authorised by parliament in July and would run from Nottingham Station, through the city centre to a junction with the Robin Hood line, which is operated by Regional Railways Central, at Wilkinson Street. The study is considering the option of track sharing with the Robin Hood trains between Wilkinson Street and the northern terminus at Hucknall. The Bill has also authorised a short light rail branch from this section to a park-and- ride car park on the old Babbington Colliery site.

Tyne and Wear Metro is also progressing its proposed Sunderland extension on the basis of shared track between Pelaw and Sunderland. Two other light rail applications for shared track are being considered, one in Hampshire and one in Bristol.

REQUIREMENTS

The features required of track, vehicles, stations, light rail stops and of control systems have all been established as part of the British Rail Research w

Sophisticated control systems are required to prevent trains colliding with trams. This is necessary because it is not practical to build street-running trams to the vehicle strength requirements which would normally apply. A form of Automatic Train Protection will need to be specially developed. It need not be identical with the system eventually introduced on main line railways but would probably use existing component designs.

Currently, British Rail Research are establishing the acceptance criteria for selecting a low cost ATP system suitable for the potential Nottingham application. Tyne and Wear would be operating its light metro cars to Sunderland. These are not trams but do not meet current end strength requirements. Tyne & Wear has commissioned a risk assessment exercise to determine if the current train stop system could be used in lieu of ATP.

Operating low floor height trams introduces problems at light rail stops

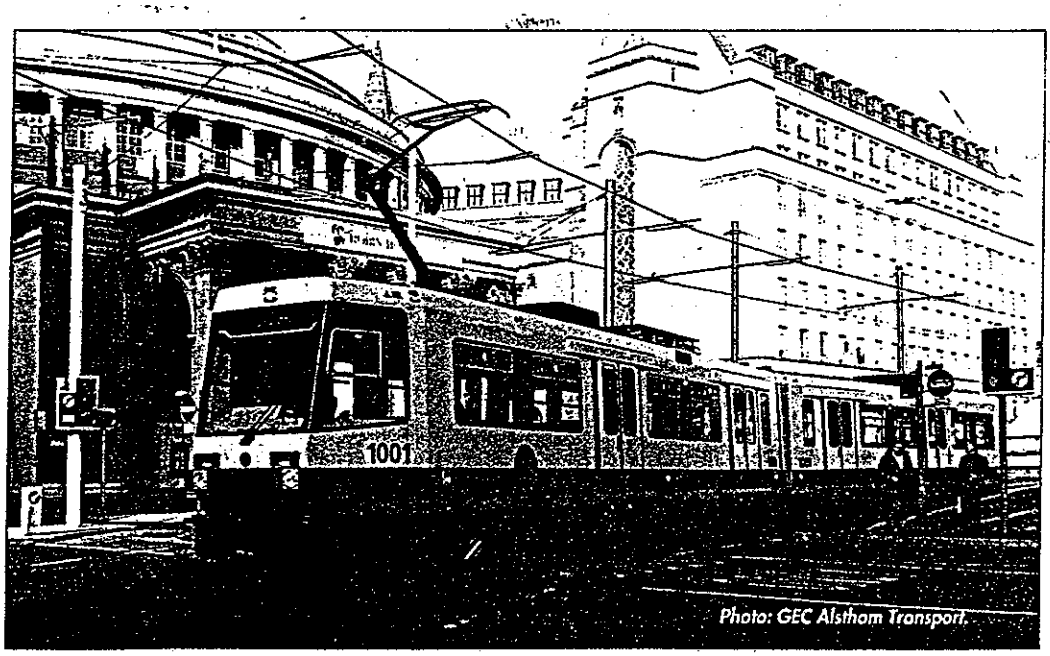


Photo: GEC Alsthom Transport.

Manchester Metrolink – the trams were carrying 47 per cent more passengers after one year than the two BR services they displaced.

(Continued from page 40)

on shared track. Methods of overcoming these have been identified. The method used at a particular location will depend on local circumstances.

Various options for electrification exist. If the line to be shared is already electrified at 25 kV dc overhead or 750 V dc third rail, this will clearly place constraints on the light rail system. However, Karlsruhe are operating trams which switch between 15 kV ac and 750 V dc overhead pickup, which shows what is possible. Railtrack will need to take a commercial view on whether or not allowing a specific route to have light rail electrification installed will be a barrier to entry to other potential operators. Duewag recently launched a scheme for a diesel tram, aimed at Karlsruhe-type regional networks.

OPERATION

The formation of Railtrack should facilitate track sharing since the infrastructure owner no longer runs trains and will not see a new entrant as a potential commercial threat. Railtrack can maximise its income and share its costs more widely, by encouraging use of its track, especially where the traffic is generating relatively high revenues.

New procedures for open access and licensing operators will overcome many of the difficulties which existed in the past.

COSTS AND BENEFITS

Shared track offers the possibility of avoiding most of the costs of constructing new light rail systems. For example, the 20 km Bretten route in Karlsruhe was only a third of the cost per km of the initial section of the Nantes Tramway.

To penetrate built up areas, it may be necessary to construct light rail as a street tramway. This is more expensive than a simple ballasted track railway, because of the costs of diverting underground utilities and of paved track construction. On the other hand, an off-street route will be considerably more expensive if earthworks, tunnels and bridges are required or if valuable property needs to be demolished.

Substantial capital savings may be made, even allowing for the additional safety features and requirements for shared track. Costs will increase if the heavy rail service is intensive. If empty trackbeds exist alongside the railway line, it may well be cheaper to build a parallel light rail line than share track, if the land can be acquired at low cost. There is a minimum route length at which shared track is likely to be a viable option because of the cost of the additional features required in order to implement it.

Operating costs will be reduced for light rail if infrastructure is shared with heavy rail operators, but this advantage will be offset, to some extent, by whatever track charges are paid to Railtrack.

The effect of replacing rail services terminating at the city centre edge by a through light rail service running in the street through the city centre can be seen in Manchester. The trams were carrying 47 per cent more passengers, after just one year operation, than the two British Rail services they had displaced.

Straight comparisons between shared track and non-shared track options are complicated by the fact that use of an existing route imposes a restriction. Another route might attract higher patronage. This is well illustrated by a study conducted for the Tyne & Wear Passenger Transport Authority in 1993. This compared:

- Building an extension of the existing light metro system from Newcastle to Sunderland via Washington New Town
- Metro sharing tracks with British Rail on the existing direct Sunderland-Newcastle line
- The latter option extended on a new route to serve part of the Sunderland urban area.

The route which would serve the new town would attract most passengers but, when all factors were taken into account, the third option proved to be the most attractive. It would gain most revenue (the mean journey length would be longer) and would cost only half as much as the entirely new route.

THE FUTURE

The principle can be applied either to allow light rail systems to expand into the suburbs, the countryside and to neighbouring towns, or to bring conventional railways into city and town centres. The second application is an exciting one which could have considerable impact.

Track sharing has not been widely applied as yet but we are at the birth of a significant change in our approach to rail transport. By putting the needs of the customer first, as a result of greater commercial awareness, railway operators can eliminate the artificial divisions between light and heavy rail. By exploiting the opportunities provided by 'open access' and advances in technology, they can combine the two to achieve high quality and cost effective transport systems which will play a major role in the 21st century.

ISRAEL LOOKS TO LIGHT RAIL

TONY YOUNG

As the first faltering footsteps towards lasting peace in Israel and the Middle East begin to gather pace, opportunities for major investment in the region's infrastructure become more exciting. The need in the transport field is evident – car ownership is rising rapidly and congestion is bringing life in the major cities to a standstill. There has already been considerable investment in new roads. Now, it is evident that something more than reliance on the private car will be needed.

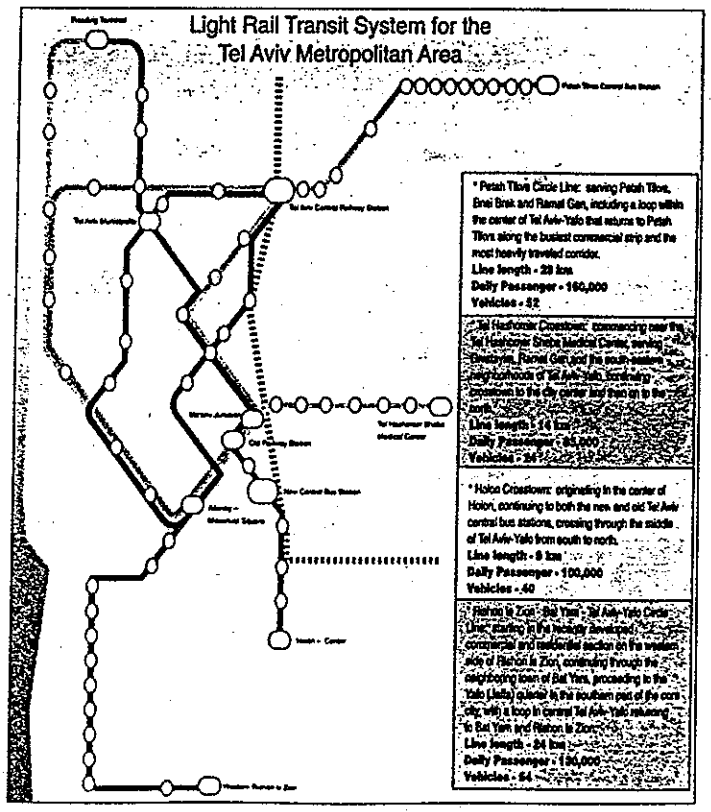
Four years ago, an ambitious master plan for the development of Israel's railways was prepared for the Port and Rail Authority by French consultants Sofretu and SNCF. It envisaged the development of suburban rail services in Tel Aviv and in Haifa, Israel's third largest city, some 60 miles north of Tel Aviv. New rolling stock and electrification throughout were planned, with intensive suburban services on existing lines and some newly constructed lines. No proposals were made for metros or light rail.

Progress with implementing the plan has been mixed. Early in 1994, British consultants Transrael were appointed by the Port and Rail Authority to update the Sofretu plan, working in conjunction with the Israeli Institute of Transportation Planning and Research. The key new link through the centre of Tel Aviv, between Arlozorov in the north and Ha Hagana in the south, was completed last year but has yet to be fully exploited for suburban trains. Even when completed, the network will leave many urban areas unserved. The plan did not include any local services for Jerusalem and its 400,000 inhabitants.

Israel's principal economic centre, Tel Aviv-Jafo, has a population of around 350,000 but the metropolitan area covers 1.8 million people, putting it well within the range of rail based rapid transit. Local public transport is currently provided almost entirely by buses, operated by two major cooperatives, Egged and Dan. They opened the world's largest bus station last year in Tel Aviv, overtaking the New York Port Authority Bus Terminal.

Realising that buses alone could not cope with future growth, Dan commissioned studies of light rail and

Proposed light rail development in Tel Aviv. This is taken from the brochure 'A Light Rail Transit System for the Tel Aviv Metropolitan Area' produced by Dan Dotan Transportation Planning and Development Ltd.



a four line network totalling 72km with 72 stations was proposed. A fleet of 170 LRVs would be needed. To gain a closer understanding of new light rail systems, the Israeli Minister of Transport, Mr Israel Kessar, visited a number of systems last year, including Manchester's Metrolink. He was accompanied by the General Manager of Israeli Railways, the General Manager of the Highways Company and the Managing Director of Dotan Transportation, who drew up the light rail plans.

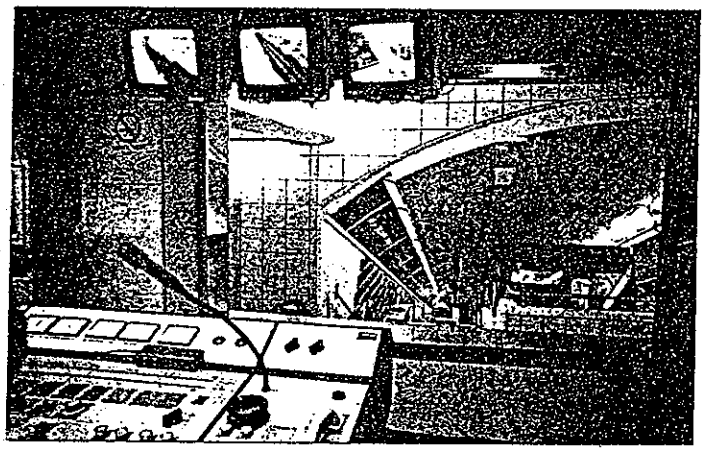
Political changes in Tel Aviv have brought renewed interest in the possibility of a metro system with substantial underground sections. However, the light rail options are being kept alive with the assistance of Dutch consultant, Holland Transport Advising who are progressing a scheme design for an initial system. HTA was recently formed by the light rail operators in Amsterdam, Rotterdam and The Hague.

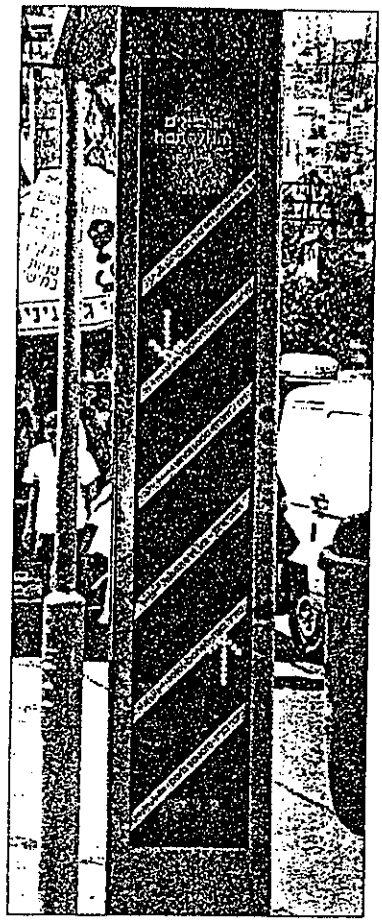
Last year, Transrael were enlisted to undertake studies in Haifa including a possible light rail line serving the northern suburbs of the Kryot, the city centre and the rapidly developing coastal strip to the south west. The light rail line would complement the Israeli Rail line and substantially improve distribution from the main stations, which are not ideally located. It would also provide interchange with the Carmelit, Israel's only existing rapid transit system. The Carmelit is an underground funicular running 1.8 km from Mount Carmel to Downtown with six stations. Two two-car trains provide a six minute headway. Modernised and re-equipped in 1992 at a cost of £18million, it is highly automated and employs some novel features, including street level indicators showing the precise location of each train on the system.

The proposed light rail system for Haifa would total around 24 km, partly on existing railway formations, partly on street and partly on new alignment. A fleet of 28 LRVs would provide a basic 10 minute headway, reducing to five minutes over the central sections. Total cost was estimated at about £200million but an initial phase could be built for £90million. Some 33,000 passenger trips per day were forecast.

The latest city to consider light rail is Jerusalem. Transrael, who have undertaken a number of passenger and freight studies in Israel, have now been appointed as general advisors to the Jerusalem Transportation Masterplan Team. Light rail is to be studied as an option for getting to grips with the pressing traffic problems of this busy metropolis. Proposals for a feasibility study were invited in May 1994 and five submissions were considered, two from the USA and one each from Belgium, France and Holland. The British consultants, Colin Buchanan and Partners, who have previously worked in Israel, were supporting the French bid by Semaly. A decision on the selected consultant is expected in the autumn and the study recommendations should be made available to the city authorities in summer 1995.

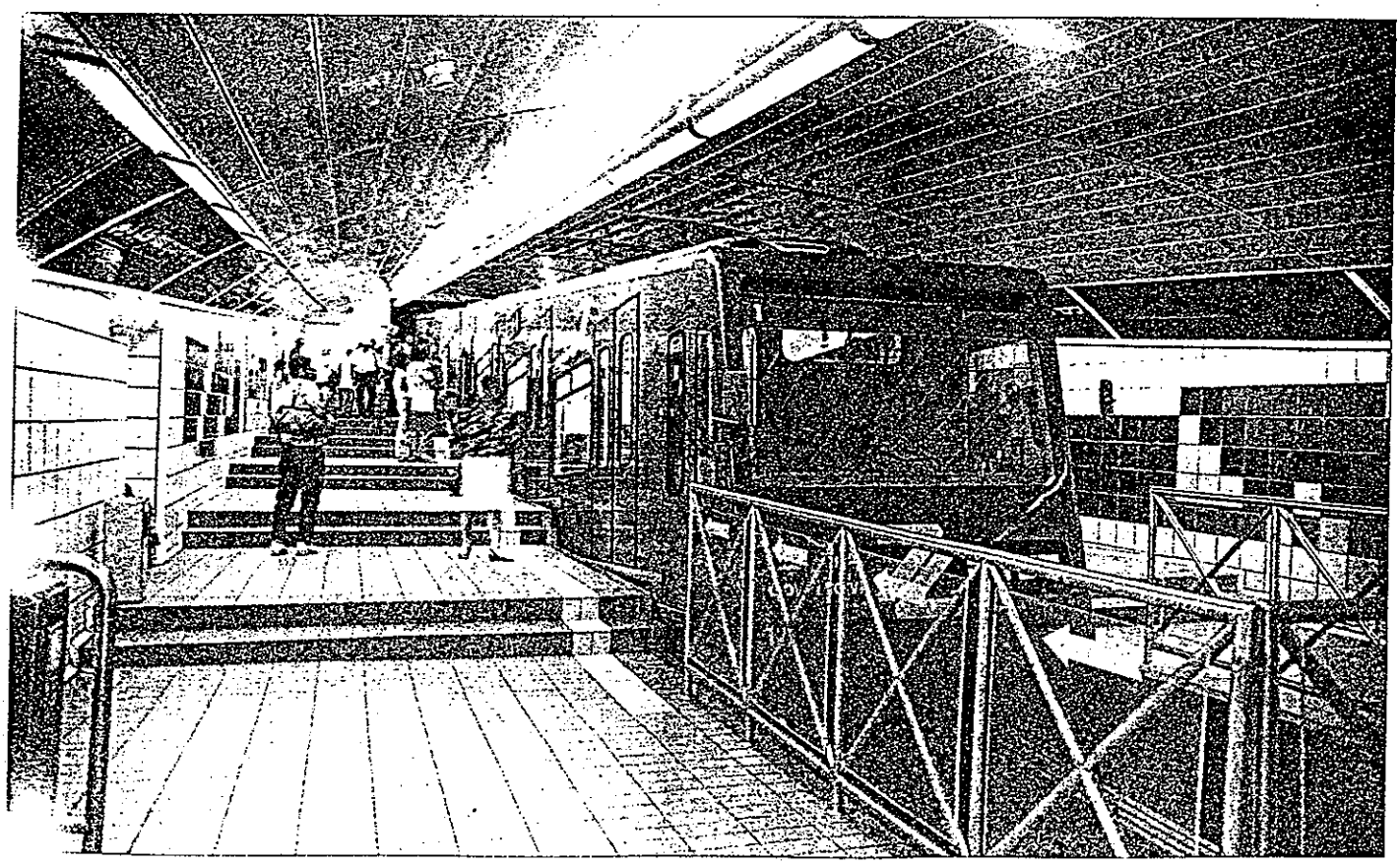
It may be some time before any firm decisions are taken to invite tenders for light rail system construction but the prospects for light rail in at least one of Israel's three major cities over the next few years are good.





Above: Street level indicators for the Carmelit system show the precise location of each train.

Left and below: The Carmelit underground.



SOUTH YORKSHIRE SUPERTRAM PHASE 2 OPENS

JOHN SULLY

South Yorkshire Supertram Phase 2 from Fitzalan Square to Spring Lane (a distance of four kilometres), opened on 22 August. The first phase of the South Yorkshire Supertram system, from Fitzalan Square to Meadowhall Interchange, began commercial operation on 21 March 1994. Meadowhall Interchange, incorporating a rail station used by an average of two to three thousand passengers per day and a bus station, is adjacent to the Meadowhall Shopping Centre, opened in 1990 and attracting over 20 million shoppers a year. Unlike Manchester Metrolink, which connects two former rail routes, to Bury and Altrincham, with a short section of street-running in the centre city, Supertram is a purpose built system with 55 per cent on non-segregated track, the first light rail scheme to have such extensive street-running.

The Meadowhall section was completed first because it used the least street running along its 8 km of track and contains the tramway depot and control centre on an old British Rail marshalling yard at Nunnery.

DEVELOPMENT

Sheffield was the last city in England to dispense with trams, in October 1960. Discussions about the return of trams have continued since 1974, when a network of modern tram routes was one of the options considered by the Sheffield and Rotherham land-use transportation study. The present scheme originated in 1985. It was hoped to start on the Meadowhall route in 1990, so that a section would be ready for the World Student Games in July 1991 but Government funding was held back until 11 December 1990, when Roger Freeman, then Minister for Public Transport, confirmed that the Government had made resources available to fund the £240 million project. The approval was on the basis of work undertaken by the PTE, the City Council and MVA consultants, which established that when non-user benefit was taken into account, there would be a return of eight per cent over 30 years.

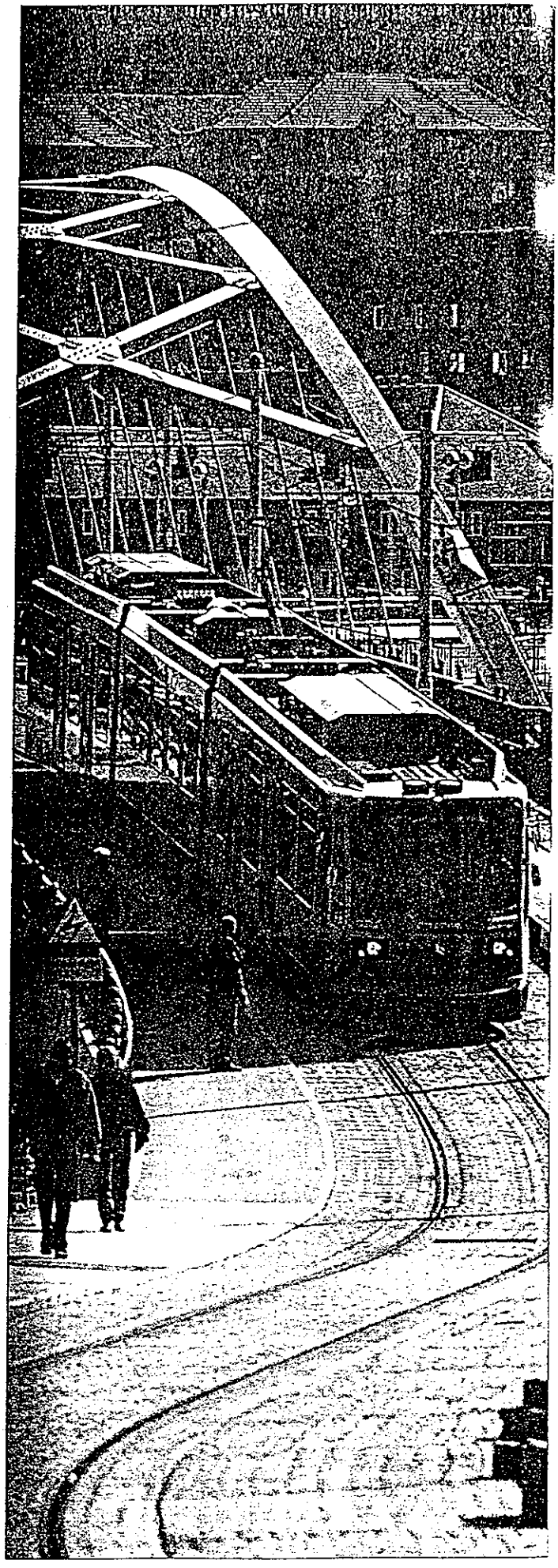
THE DESIGN AND CONSTRUCTION PROCESS

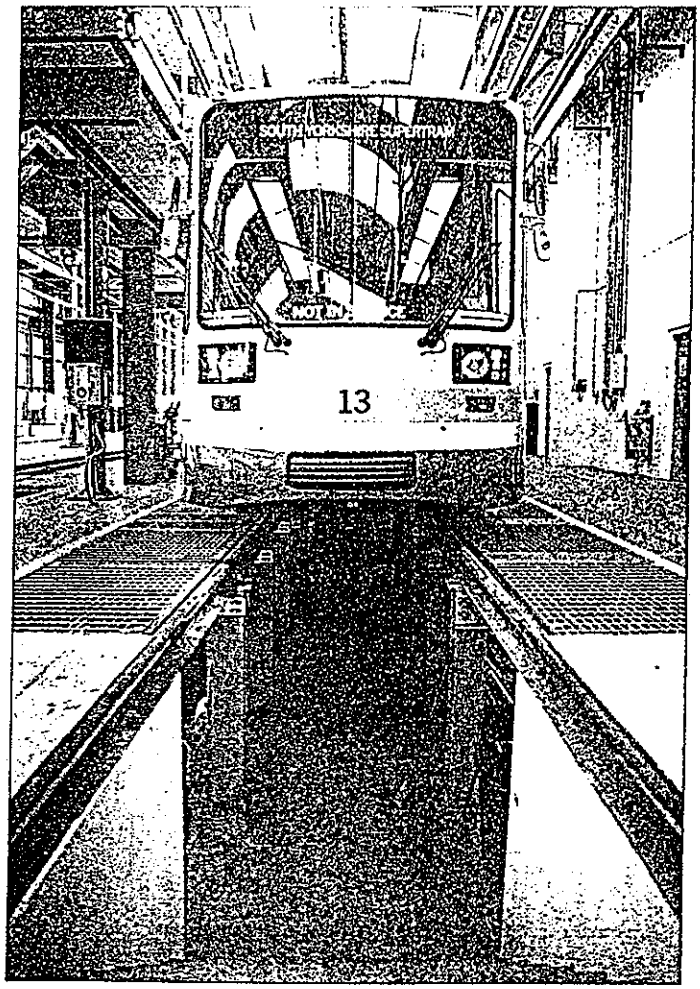
The Passenger Transport Executive established a wholly owned subsidiary, South Yorkshire Supertram Ltd, to manage and operate the system. Balfour Beatty is the contractor for constructing the complete light rail network including the civil engineering, signalling and power supply. Siemens has designed and is manufacturing the 25 Supertrams. The project is different from that of Manchester Metrolink, where the company is owned by a number of different public companies as well as the PTE and GM Buses. The Board of Supertram consists of is three executive directors appointed by the PTE, four non-executive directors, who are businessmen from South Yorkshire and one chief executive.

Major construction work for Phase 1 included a three span bridge over the River Don near the Tinsley viaduct, a steel arched bridge, which is skewed, over the Sheffield canal, a bridge over the Sheffield Parkway, Sheffield's main link to the M1 and a bridge over the British Rail main line north of Sheffield Midland station.

MAINTENANCE AND OPERATION OF THE SYSTEM

The Supertrams, designed to carry 250 people, are each 35 metres long with a





width of 2.65 m, articulated in three sections to allow them to go round sharp corners on street operation and give a very smooth ride. They have off-vehicle fare collection. The door widths and the relative levels of the station platforms and the vehicle floors are designed to provide convenient access for wheelchairs. Tram stops are designed with gently sloping ramps. All PTE concessionary fares are available. At junctions, the tram signals are within the Urban Traffic Control system and designed to give the trams priority.

PHASE 2

Phases 1 and 2 are running initially as two services: Fitzalan Square to Meadowhall and Fitzalan Square to Spring Lane (City Road).

Passengers are able to travel the full extent of the two phases on one valid ticket. Peak and daytime off-peak services on Phase 1 have an eight minute frequency and on Phase 2 a 10 minute frequency.

The key innovation with Phase 2 is the fact that Supertram is running on-street with the traffic for the first time.

Peter Gross, Marketing Manager for South Yorkshire Supertram Limited explained, "The opening of Phase 2 sees the first on-street operation of a modern tram system in the United Kingdom, where the tram vehicle is not totally segregated from the rest of the traffic. Supertram Phase 2 runs with normal road traffic.

The tram commences on street from Park Grange Road near Queen's Tower, up through the Norfolk Park Estate and to Spring Lane, adjacent to the C Road junction, where there is a temporary Phase 2 terminus with turn back facilities controlled by traffic lights." There is also a short on-street section on Granville Street.

Mr Jack Meredith, Chairman of the South Yorkshire Transport Authority stated that the new phase would be of major benefit to people close to the new route. "We are all aware of the inconvenience that the construction works have caused a number of people travelling or working in the City. When completed, the Supertram project will be the pride of South Yorkshire. Our main urban centre will be more accessible and people will be able to experience modern, trouble free journeys. Other major European cities have benefitted from their tram systems and Sheffield, which is itself in the class, will benefit also. People living close to the Phase 2 route can travel to the city and back in comfort, with the knowledge that they do not have to find a parking space. By changing trams in Fitzalan Square, they can travel

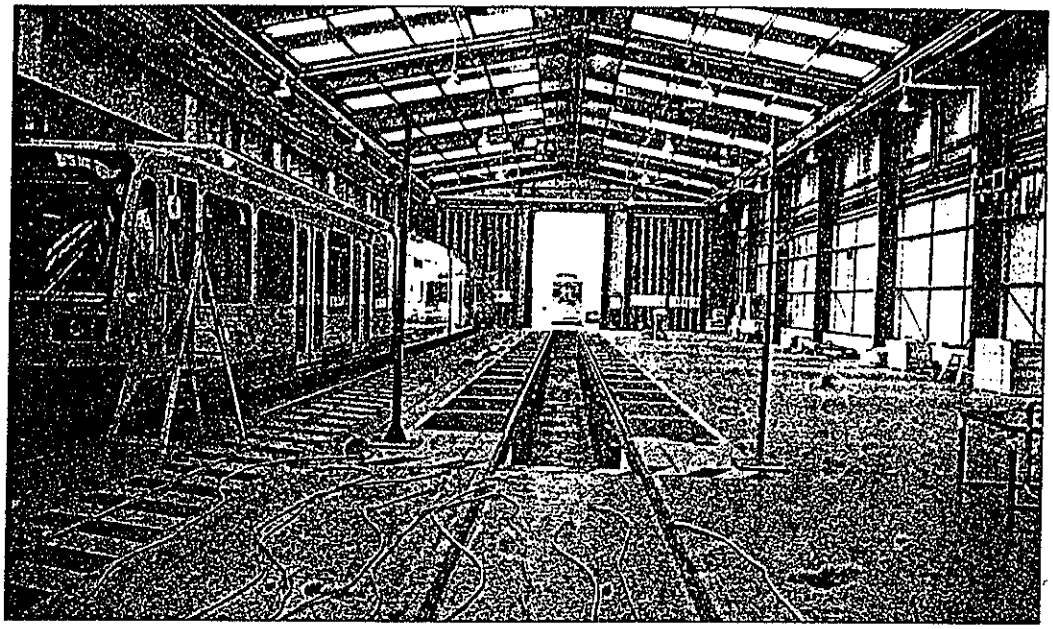
Left: Inspection pit for supertram.

anywhere along the already popular Phase 1 route.

The only stop not fully operational for passengers on Phase 2 is the Sheffield Station/Hallam University stop, where a temporary pedestrian access will be constructed shortly, to link to the station and should be open later this autumn. However, access can be gained to the Hyde Park Flats."

Students studying at The Sheffield College opposite the Granville Road stop should find that the tram gives them better public transport access to the college. One tram platform is adjacent to their main entrance.

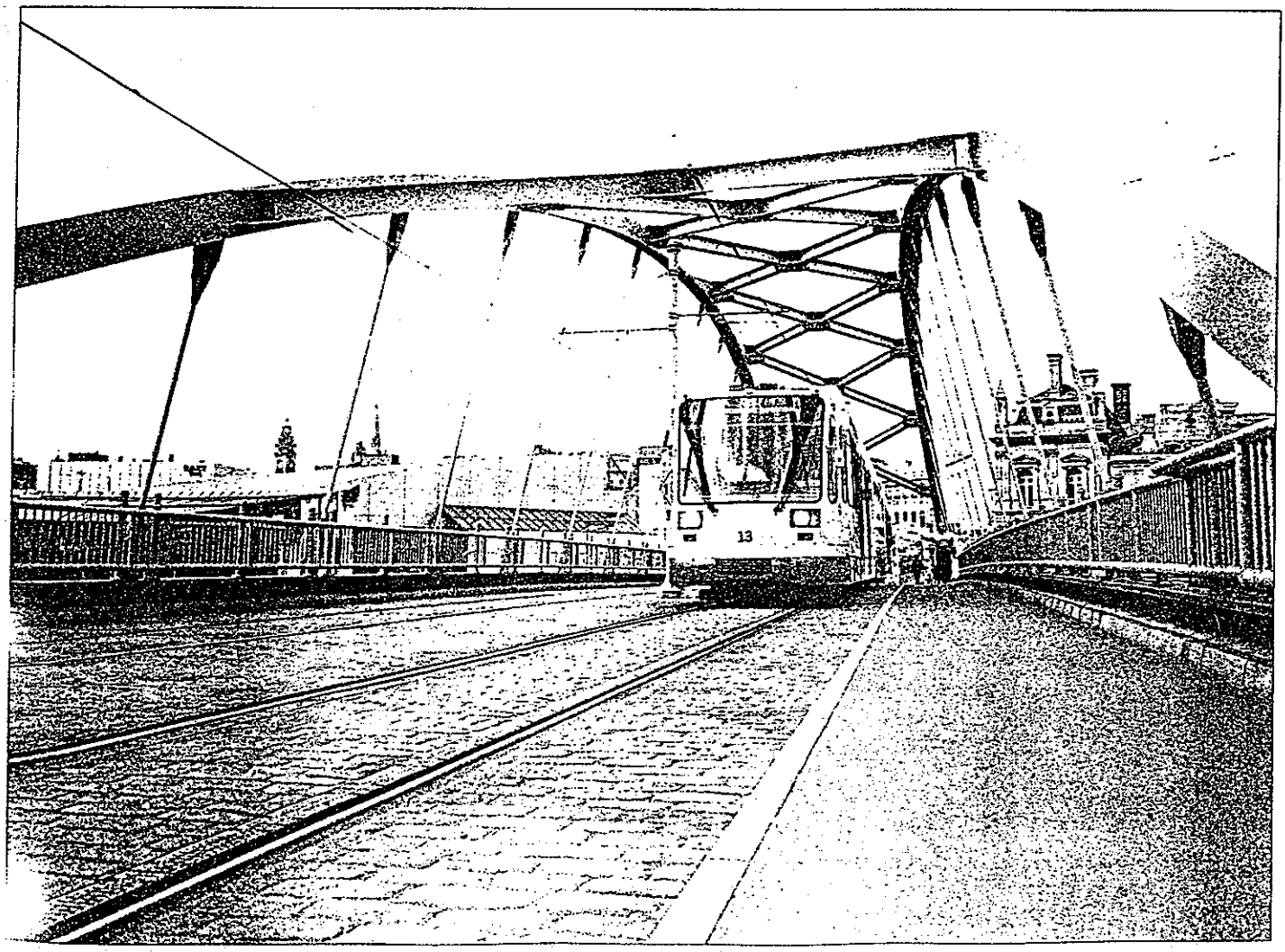
Another first for Sheffield and South Yorkshire Supertram Limited is the fact that the Phase 2 route contains the steepest, normal-adhesion tram section in the country. To cope with the gradients, all eight axles of the tram are powered and there are three separate, sophisticated braking systems.



Supertram workshop.

Phase 1 has involved the construction of many major engineering structures, the most prominent being the bowstring arch steel bridge that carries the system into Commercial Street and the cantilevered viaduct that brings Supertram onto Park Square from the north. Phase 2 also contains major modern structures. The main structural feature is the 1000ft steel viaduct spanning from Granville Road to Park Grange Road.

Peter Gross says, "Supertram is on programme. All stages are scheduled to be completed by the Autumn of 1995. Each Phase represents a learning curve for us and for the people of Sheffield. We are committed to keeping the public well informed. Before Phase 2 went live, every household in the immediate area received a leaflet explaining the various operational and safety aspects of Supertram. In addition, we visited local schools to advise children on the principle functions of Supertram. Again, we included safety education. Before we open the next phase, local residents will receive a comprehensive guide to provide them with all they need to know about using the tramway."



Light Rail 94 - Sheffield

8–10 NOVEMBER, THE 8TH INTERNATIONAL EXHIBITION AND CONFERENCE

A diverse range of exhibitors can be seen at the Light Rail 94 Exhibition which will be held at Ponds Forge International Centre in the heart of Sheffield, between the 8 and 10 November 1994. Not surprisingly, many of the companies who have been involved in the construction of the infrastructure and vehicles for the South Yorkshire Supertram System have a high presence. Many other manufacturing, consulting and operational organisations are eager to demonstrate their contribution to the light rail transit scene. Helped by the fact that Phase 2 of the Supertram System is now operational, the exhibition is bound to draw visitors from far afield. Being in the heart of the City of Sheffield, Ponds Forge International Centre is an ideal venue for the LRT experts to meet. It is just across the street from the Supertram (Fitzalan Square/Ponds Forge Tramstop is two minutes from the exhibition).

What of the exhibition itself? The Balfour Beatty Group (Power Construction, Civil and Railway Engineering) are on Stand 50 displaying the expertise behind the infrastructure of the Supertram Project. Balfour Beatty are well positioned to take advantage of other major transportation projects. Traction for the Supertram Cars is provided by Siemens Transportation Systems (Stand 40) who are supported by Duewag (the Supertram Car manufacturers).

Other Supertram exhibitors are Edilon BV (Stand 70) and Turner & Townsend Project Management (Stand 65).

Babcock Rail Projects (Stand 35) will be showing its latest design in tramways on its impressive stand. While the debate on LRT v GLT continues, Bombardier Eurorail will be showing its GLT in the outside exhibition area.

Many other companies with interests in rail and urban mass transit are exhibiting, with operational companies and PTEs. They are anxious to demonstrate that they have the skills and much of the essential resources to ensure viable planning of their future schemes. This will serve as a reminder to the government that there is a great demand for LRTs across the country and that assistance is vital with the financial aspects.

The Conference at Light Rail 94 is drawing many speakers and delegates who will discuss not only the Sheffield Supertram System but much broader topics, from 'Street Tramways for Central London' to 'Comparison of Light Rail and Guided Buses'. New product developments will be presented. The final day is devoted to technical visits, including several locations on the Supertram System and a major track manufacturing company.

The Light Rail 94 Exhibition is open Tuesday 8 November to Thursday 10 November 1994 (1000-1800 hrs daily). For exhibitor, visitor or delegate information please contact Transport Science Ltd, 17 Hope Street, Liverpool L1 9BQ. Tel: 051-707 0100 Fax: 051-707 0001

PRELIMINARY PROGRAMME

Tuesday 8th November 1994:

SOUTH YORKSHIRE SUPERTRAM SYSTEM

9.30 am	**Official Opening** *Jack Meredith, Chairman Passenger Transport Authority*
9.40 am	**Keynote Speech** Speaker to be announced
10.00 am	**Session 1:** *Chairman: Jim Russell, Director General - SYPTE*
	The SYPTE Strategy for improving public transport as an attractive alternative to the private car. *Phil Haywood, Director of Planning - SYPTE*
	Planning the System. *Peter Haigh - MVA*
	Detailed design of the Supertramway. *Peter Gross, South Yorkshire Supertram Ltd*
1.00 pm	Lunch
2.15 pm	**Session 2: Realising the Supertramway.** *Chairman: John Davies, Chief Executive, South Yorkshire Supertram Ltd*
	Managing the Project. *Neil French, Turner & Townsend Project Management*
	Building the Infrastructure. *Geof Boak, Balfour Beatty*
	Designing and Building the Supertram Cars. *David Wilson, Siemens UK Ltd*
	Operating the Supertram System: Initial Experience. *Wilfred Lau, General Manager, Supertram Operating Co*

Wednesday 9th November 1994

OTHER DEVELOPMENTS

9.30am	**Session 1:** *Chairman:*
	Deciding on the best public transport system. *Roger Mackett University College London*
	Street Tramway for Central London. *Chris Wood - Centre for Transport Studies*
	Refurbishing a railway system using an Integraied Team Approach. *John Hoy - John Brown Engineering*
1.00pm	Lunch
2.15pm	**Session 4:** *Chairman:*
	LRT & GLT compared. *Colin Walton - Bombardier UK*
	Tramways - do clients get what they want? *Ian Johnson - ABB*
	Progress with the new Tram LRV.
	Technical Specification of the LR55 track system. *Roger Sawyers - Travers Morgan*
	Commercial Aspects of privately funded Light Rail Schemes. *Scott Hellewell, Consultant*

Thursday 10th November 1994

TECHNICAL VISITS

1	Supertram System - Depot - First Line - Second Line - Construction in street towards Hillsborough
2	The Meadowhill Public Transport Interchange
3	Edgar Allen Track Factory, Sheffield