

Rail In Urban Freight

What Future, If Any?

by Mark Robinson and Phil Mortimer



Cargo Train in Zurich – a train with two trailers converted into a mobile rubbish collection station – a pilot project has been collecting rubbish in the city's peripheries

This paper follows on from the authors' article *Urban Freight and Rail – The State of the Art*, pp 46-51 in the January/February 2004 issue of *Focus*.

If rail is to break back into the urban freight and city markets it will have to achieve this despite distortions in the market place that have favoured road transport. Road freight transport enjoys the benefit of comparatively low infrastructure costs, and the external costs of road building and transport operations do not recognise the adverse environmental impacts they create.

Future of Heavy Rail Incorporating Intermodal Freight Transfer

In terms of train technologies, rail will have to incorporate JIT-type systems (Mortimer and Robinson 1999) into its own internal planning and operational processes, particularly in terms of the ability to respond to rapidly changing demands for freight train movements. It also suggests the need for smaller train sizes, operating at higher speeds and frequencies in terms of the number of departures and arrivals.

Containers are likely to remain the preferred option for longer-haul, deep-sea trade routes

with emphasis being increasingly placed on the abilities of ports to handle large blocks of traffic driven by ship imperatives. The use of even smaller modules (Collins 1991) requiring specific handling techniques suggests this might also be a case of the technology looking for a market rather than the alternative.

The use of small, self-propelled, bi-directional train formations operating without separate locomotives is attractive because it offers the potential to operate in and out of much simpler city terminals. For intermodal and direct load type traffic, the use of small, self-propelled trains capable of much higher performance and productivity levels on a lower cost base is a proposition already under development and has been the subject of demonstrator trials in the UK (Mortimer 2001).

Rail could begin to reclaim its share in the vital but demanding markets for retail food primary transport, large volume manufacturing and small-lot logistics traffic. To put this in context, a 1% share by value of the domestic freight market in the UK transferred to rail would be



CargoSpeed – demonstration technology designed to use tri-axle trailers for servicing urban freight activity



worth an estimated £450 million on an annual basis. It is not surprising that this market has been targeted by UK rail authorities.

For smaller and intermittent traffic flows, the combination of small trains operating in and out of simple terminals, using trailer-mounted cranes chartered in for the actual intermodal transfer and local delivery operations is an interesting prospect. It potentially brings rail back into cost and service contention to many smaller urban areas that are currently not well served by the network. The small train, in terms of addressing the reliability, speed and productivity issues at a fundamental level also applies to purpose-built train formations specifically tailored to logistics-type traffic flows such as parcels, small-lot logistics, inter-factory movements and retail food primary distribution or tanker options.

There have been repeated attempts to marry rail technologies and road transport with varying degrees of success. Piggyback, side-transfer, pivoting platforms, transverse loading arms and other mechanisms were tried as potential breakthroughs but few, if any, have been able to bring the two modes together. Bi-modal technology developed in North America is burdened with weight penalties on the specialist road transport trailers used in these types of service, largely as a function of the huge train sizes used by those rail operators deploying this type of technology and the need for enhanced strength in the road vehicle when used for the rail journey sector.

By reducing a bi-modal train formation to, perhaps, five to seven bogie-mounted tri-axle road trailers, capable of affecting the intermodal move by using their own air suspension, two major benefits are achieved: the need for complex and expensive terminal transfer equipment is removed; the tare weight penalty in terms of the required steelwork to reinforce a tri-axle road trailer is vastly reduced. The use of a small power car at each end of the trailer formation endows bi-directional capability and the required high-power to weight ratio for the envisaged high-speed main line train operations.

Such train formations – TracTruc® – could potentially operate into simple terminals very close to city centres or other urban demand centres, and allow large trailers to be delivered close to their ultimate destination without extensive road journeys within the city. By using the road tri-axle trailer as the cargo module and dispensing with complex and expensive lifting equipment, whilst simultaneously offering a tri-axle trailer as the cargo module, rail is able to offer current road-mandated flows a capability that is well beyond existing rail freight technologies. The use of existing brownfield sites, or sidings and pads embedded within urban zones, suggests that this type of train concept could operate without creating road traffic concerns that surround much larger and more orthodox intermodal terminal sites.

The high cost of physical gauge enhancements on key routes deterred this line of approach, with preference given to the accommodation of high-cube containers. This then led to the focusing of development on rail vehicle solutions – for example, Mega-3 and Piglet – able to accommodate trailers with varying degrees of technical success. Commercial interest in the ability to transport trailers by rail on purpose-built wagons for trunk haulage appears to have fallen away, particularly in the UK domestic traffic market. For international flows to and from Europe, the cargo potential is probably there to be tapped by piggyback derivatives but has not yet been deployed. The problem of promoting, funding and securing acceptance of new vehicle technology and innovation rail applications is significant, and potentially limits the capability of rail to re-enter competitive road-dominated markets.

A further example of innovative development (Palacin and Robinson, 2000) is a demonstration technology – CargoSpeed – being designed to use tri-axle trailers as the primary cargo module for servicing urban freight activity. CargoSpeed uses an innovative, simple and cost-effective floor-mounted pivot transfer to affect the intermodal movement between road and rail at a terminal. CargoSpeed wagons could be operated in



orthodox locomotive-hauled train formations or, potentially, in a small, self-propelled, bi-directional train formation. For urban freight, the ability to operate between and within urban areas by rail, minimising the impact of the road journey to and from the transfer point is a cardinal advantage to be exploited for sound commercial and environmental reasons.

Future of Heavy Rail – City Planning Aspects

A priority for Düsseldorf city authorities is encouraging direct trains to the sea ports of Rotterdam, Antwerp, Zeebrügge, Hamburg and Bremerhaven for international intermodal traffic as a means of constraining heavy road freight traffic. The authority's service template is similar in concept to that used in the UK by Freightliner for dedicated block trains. Following this, the next priority is providing direct trains to other regions with high cargo volumes. The new services are expected to provide a customer focus with earlier delivery and later collection times by development of city transport connections and improvement of added value services in the rail sector. It has been estimated that the maximum potential for modal shift is ~5.0 million tonnes/200,000 truck movements a year, potentially giving rail a healthy share of the freight market. Achieving this shift requires the provision of a routinely excellent quality of service at a competitive price.

Düsseldorf has demonstrated its commitment to completing an efficient central goods sorting point and increasing the number of connections between this and local shunting yards. In addition, bottlenecks on capacity-constrained routes will be eliminated to increase the number of train paths and make the freight route more independent of

the passenger network. These improvements should result in a 70% decrease in transport times, the creation of new connections and improve productivity of the freight locomotives by 75%. The emergence of new train operators, either as feeders or as trunk operators, is a possibility to engender real rail-on-rail competition. The value of the Düsseldorf initiative should not be played down. It does, however, raise the question as to what can be realistically achieved by the intervention of city authorities in mainland Europe and the UK. The difference in perspective between the commercial imperatives of the train service providers and the 'softer' planning perspectives of the city authorities may prove unbridgeable.

Enhanced organised co-operation in the Düsseldorf model between the regional rail freight traffic company – Deutsche Bahn – and any other new train service providers should create a stronger position for regional and urban rail freight transport. The new organisation should facilitate easier access to the rail freight sector by providing a 'one-stop shop' for service, schedule and pricing enquiries. The future model for rail freight services is shown in Figure 1 (Reusch, 2001). There remain some concerns over the continued use of techniques and technologies in terms of the implied time requirement and complexity of marshalling and shunting trains that need to be addressed to reinforce rail's competitive stance compared to road and waterborne transport.

Use of Underground and Metro Systems for Urban Freight Transfer

The potential use of the underground metro system in Amsterdam was an evolving process involving four factors:



Future Of Düsseldorf's Rail Freight Services

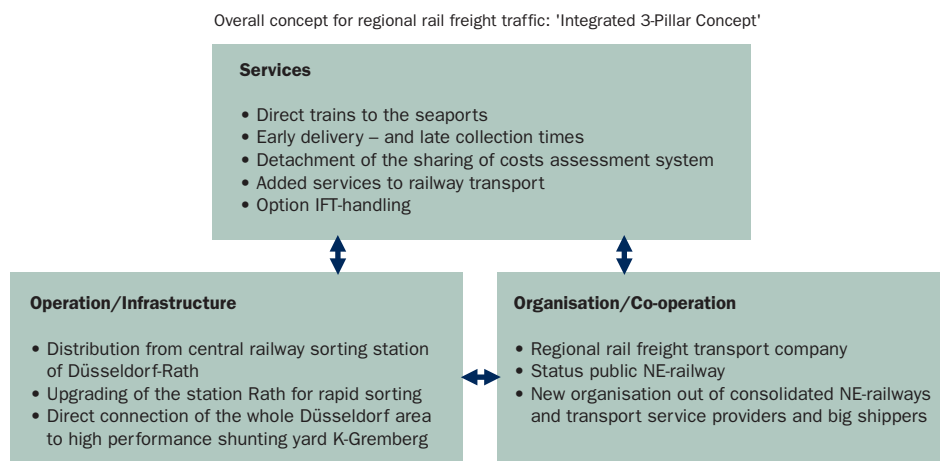


Figure 1

- Long-term logistics concepts
- Developing route possibilities
- Potential goods for distribution
- Environmental conditions and pressures

Various scenarios were assessed and some promising concepts identified to promote the initiative and to mobilise support from the private sector. This originally enthusiastic position has been diluted by the scaling back of support for the concept by the train operator in response to operational concerns and potential conflicts between the passenger and freight priorities.

Figure 2 shows the long-term logistics scope and the potential to develop into a Dutch (Bous 2001) national network.

The metro effectively would have become another optional modal link between an urban logistic park and the shipper/receiver, based reasonably close to the metro station offering this type of service/facility. If the cargo concept is to be used in conjunction with the current operating passenger system – COMBI – it is imperative that this activity is concurrent and does not result in any delay. This implies that freight handling time at each station is limited to an absolute maximum of 20 seconds. To achieve this, freight handling equipment must be assessed and modified for direct application in this system. Routine achievement of this degree of precision and accuracy whilst operating in a high intensity passenger environment is a challenging target

and appears to have been the main focus of the potential operators' concerns that have, as a consequence, slowed the overall programme.

Three possible scenarios were considered:

Dedicated night deliveries, which would obviously offer potentially high capacity. A large buffer stock would be needed and utilised for all shipment types. However, it may not be possible to deliver to the final distribution centre outside working hours. The availability of the metro lines may also be restricted by nocturnal track and system maintenance and cleaning priorities.

Dedicated day deliveries where capacity is potentially high, but not as high as in the dedicated night deliveries. Deliveries would be infrequent due to the imperatives and priority of the passenger network. A dedicated secure unloading space would be needed that did not conflict with passenger flows in the stations.

Combi day deliveries would have a limited capacity and therefore would only be appropriate for relatively high-value cargo packets.

Research undertaken (Bous 2001) into the future pattern of demand for metro-fed urban freight identified some anomalies in the market's likely requirements. A large proportion of the estimated demand – around 40% – would be funnelled through only 5% of the station transfer points and would have little potential for combination with other traffic because of this narrow geographic



Potential Dutch Freight Network

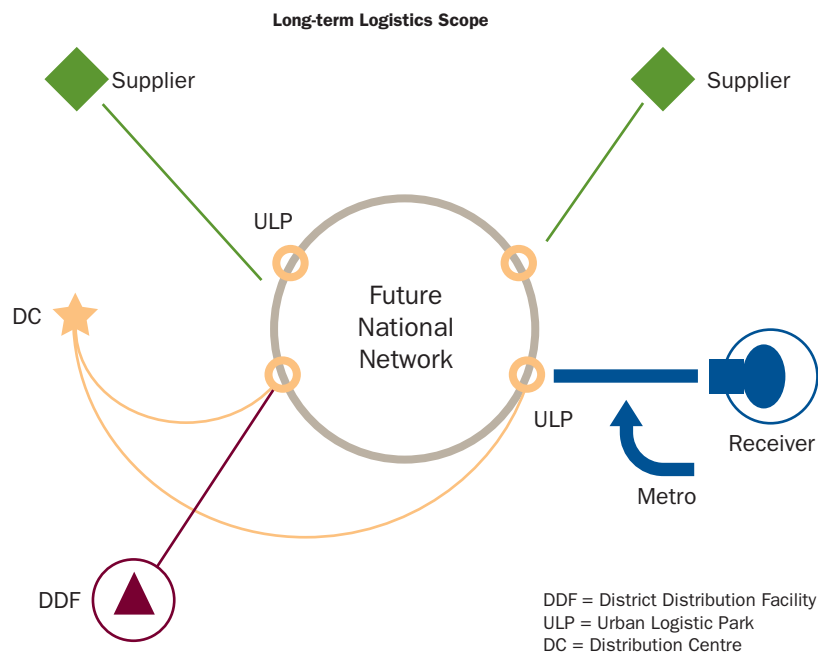


Figure 2

focus. This traffic, effectively the equivalent of full trailer load (FTL), may be beyond the capability of the metro concept to service adequately within the confines and constraints of the proposed concept. Less than trailer load (LTL) traffic – also at 40% of the estimated demand – would appear to have more potential to combine into useful lot sizes and would be taken by ~20% of the proposed station stops. The balance of traffic in individual packets would be spread over 75% of all station stops and would need to be combined into useful blocks.

This was to be a limited pilot project, scheduled to be operational in 2003 (Bous 2001), with one station in the city centre – the outlet – and one in the south-east suburbs – inlet. The venture on the Oostline required minimal investment as cargo handling would use manual labour and existing elevators. This was obviously not the optimal solution for a new high quality logistics solution, but it would demonstrate feasibility for small quantities and the high-value, time-sensitive packet market. It was proposed that combi trains would be used in the day outside the peak hours and the use of one or two dedicated trains at night would be investigated. These scenarios would require limited storage facilities on the existing station platforms and would utilise small vans for the short journey to and from the customer/receiver. The project management team believed that this initial demonstration must receive financial support as it was unlikely to operate at a profit.

If this pilot proved successful, it was proposed to develop Oostline with investment in two central stations, and a further input station in the suburbs. The development was to be accompanied by improvements to provide buffer-stock storage capacity, automatic handling, efficient links to end distribution and general improvement in the quality of the logistics product. It was anticipated that these improvements would lead to a growing market share and long-term relationships with bulk retailers. It was believed that this system could compete in terms of service. However, finance would be necessary to fund the infrastructure investments needed.

The original concept has been scaled back following reservations from the metro operator relating to possible conflicts with passenger priorities and the need for night time engineering line possessions for track and tunnel maintenance. Again, this suggests that this whole initiative was more a technical solution looking for a market rather than being

market-driven, and that some of the fundamentals of operating the metro in a dual role were overlooked, or not recognised, with sufficient clarity at the outset.

Incorporating Tram and Light Rail Systems in Intermodal City Freight Distribution

The Vienna concept (Dorner 2001) was conceived to be truly intermodal. It was anticipated that heavy rail would provide long-distance freight transport into one of three city terminals. The plan was to link these city terminals by a cargo tram circle line, and final delivery into the centre was to be from the most convenient transfer point by a small environmentally friendly truck. The cargo unit was to be a specialist 'logistic box', enabling rapid transshipment.

Implementation of this concept in Vienna has, however, proved difficult and the reasons are:

- Perceived systems and level of service disadvantages
- Concept still required a road sector for final local collections and deliveries using specialist road transport equipment
- Implementation required co-operation between parties who could also be competitors
- Claimed environmental benefits did not materially influence commercial decisions
- Cost premium and complexity compared to the alternative of road transport

In the future, Cargo Tram in Zurich may operate where the city's waste disposal and recycling department wants to move household waste. A tram with two trailers will be converted into a mobile rubbish collection station. The pilot project started at the end of April 2003 collecting rubbish in the city's peripheries. The city's authorities have adopted this innovative tram solution because the usual waste collection lorries need about three times longer to move across the heavily congested city during peak hours. This gives Cargo Tram the benefits of being cheaper, faster and producing fewer pollutants. It is a technology moving a commodity of low intrinsic value and which is largely indifferent to time sensitivities.

Infrastructure – The Future

In France, where commercial interests and companies still retain a significant presence in central urban areas, there is evidence that they are already using rail. The catering supply





Scale model of the TracTruc® bi-modal train

industry, for example, serving hotels and the catering trade in Paris alone transports ~200,000 tonnes of related products and materials a year by rail into the city. Rail also serves the construction and energy sectors, which receive building materials and fuel products by rail in bulk deep into the urban areas for final local distribution by road. The strategy for freight could provide facilities for the transhipment of bulk goods and intermodal transfer. In addition, value added services could be provided, such as secure storage, warehousing and order preparation. Rail would need to match, as a minimum, the logistics capabilities of the road-based operators in terms of unit cost and the range of products and services already routinely deployed by the competing mode. The involvement of an incumbent national monopoly rail service provider in this general development has proved difficult for new potential users who are concerned about possible service level erosion and cost inflation. The freedoms opened up by liberalisation of the rail freight market in Europe should act as a catalyst to change this. Much will depend on the receptivity, or otherwise, of the present national rail service provider to respond to EU directives in relation to new market entrants and their service offers aimed at urban areas.

Exploitation Of Rail For Urban Freight

Rail services into urban areas, particularly those moving high-value, time-sensitive commodities, will have to break from the orthodox train operating patterns. Until there is a sustained and widespread acceptance of the external costs that road transport generates, and has largely been able to ignore, rail will have to fight for market presence on an unfair playing field. It will have to develop its markets

on the merits of its product and services and any innovation it elects to deploy. This suggests that rail has to develop away from the existing conventional train technologies.

For rail to win back markets in the urban freight area means a radical rethinking of the technology of the trains, the methods governing their operation, and the cost profile under which they will operate. For the rail infrastructure operator this means changing the approach to the planning and setting of timetables and train paths to a much more responsive position.

For the rail infrastructure operator this poses a dilemma in that freight services could generate more revenue than subsidised passenger services around large metropolitan centres with significant train activity. The ability to generate income from terminal sites, previously considered to be inappropriate for orthodox train operations, by using simple configurations with minimal facilities could also be an attractive option. Their limited road traffic generation propensities could allay wider traffic and city planning concerns on this score. The long period of decline could be halted by adopting innovative and radical measures.

Summary

Rail freight has potential for exploitation in urban areas beyond the confines of the present product and service structures. Rail freight can contribute to a reduction in urban traffic congestion by providing a welcome alternative to the present dominance of road-based logistics systems. This could contribute to reducing the increasing environmental burden in cities. It is vital to note that rail freight facilities are an increasing generator of road traffic in their own right for deliveries and collections. In this regard rail does not have a monopoly of virtue. To achieve

greater commercial impact and acceptance rail services need to improve in a number of areas such as operational integrity, frequency of services, infrastructure, organisation and co-operation with terminals and local road operations to provide a level of service as attractive as the 'all road' model without sacrifice of the intrinsic environmental benefits rail possesses.

For a credible and sustained improvement in the rail freight share, operational costs need to be fully competitive with the road-based alternatives. Conflicts between passenger and

freight trains need to be minimised and, in some cases, freight train priority may need to be re-evaluated.

The preservation of railway infrastructure is essential, with open access to this infrastructure to provide higher levels of service and choice particularly for new market entrants serving niche commodity or traffic markets. The rail freight infrastructure needs investment and protection measures to make this possible and to avoid the possible loss of long-term solutions to city logistics issues.

In Conclusion

Rail has been ousted from its position as a key player in the servicing of urban freight by developments in transport technology, industrial location patterns, changing commercial and industrial technologies, and the demand by cargo shippers/receivers for unfailingly reliable levels of quality service that the orthodox rail model has been unable to fulfil.

If rail is to break back into markets governed by these considerations, then the implications in terms of a wholesale repositioning of the rail product and service profile are profound. 

References

- BOUS, D, 'Feasibility study on the use of the Amsterdam metro system for distribution of goods', *BESTUFS Workshop 5 – Rail Based Transport: A Disappearing Opportunity or a Challenge for Urban Areas?*, 30th-31st August 2001, DVB-Dresden, Germany
- COLLINS, M J, *Freightliner*, Oxford Publishing Company, UK, 1991
- DORNER, R, 'Concepts for rail based city distribution, requirements and case studies', *BESTUFS Workshop 5*, *ibid*
- FOYER, P, 'Just-In-Time by Rail: Enabling Railfreight to Return to the City', *BESTUFS Workshop 5*, *ibid*
- MORTIMER, P N and ROBINSON, A M, 'The need for innovation in rail freight vehicles and operations', *European Rail Freight What Future?*, Stakis Hotel, Sheffield, 1999
- MORTIMER, P N, 'The mighty atom', *Railway Strategies*, Autumn 2001, pp 48-50
- PALACIN, R and ROBINSON, M, 'Intermodalism: faster, better, cheaper', *Container Management*, 187, Nov/Dec 2000, pp 76-77
- ROBINSON A M and MORTIMER, P N, 'Urban Freight And Rail – The State Of The Art', *Logistics & Transport Focus*, January/February 2003, pp 46-51
- RUESCH, M, 'How to improve rail freight in urban areas: an example', *BESTUFS Workshop 5*, *ibid*

About the Authors



Dr Mark Robinson is the Director of the Advanced Railway Research Centre (ARRC) at the University of Sheffield. He has a specific interest in city logistic issues, intermodal rail freight, freight transfer equipment and innovative rail freight vehicle concepts.

Contact: Tel: +44 (0)114 222 0150. Fax: +44 (0)114 222 0155.

Email: a.m.robinson@sheffield.ac.uk



Phil Mortimer is a Research Fellow at the Advanced Railway Research Centre (ARRC), University of Sheffield. He has extensive experience in rail, maritime and aviation transport operations, product and service development, project planning and marketing in the UK, Europe and North America. He is also involved in city planning in relation to freight operations and access planning in the UK.

Contact: Tel: +44 (0)1243 869118. Fax +44 (0)1243 868370.

Email: phil@trucktrain.demon.co.uk

First printed in *Logistics & Transport Focus*, the journal of The Chartered Institute of Logistics and Transport (UK).