Rail Research UK

Delivery of user needs: final report

Report: RRUK/C2/06

Prepared for Rail Research UK
by

John Preston, Graham Wall and Tony Whiteing
(Transportation Research Group, University of Southampton)

Project C2: Delivery of User Needs

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Executive summary

This paper summarises the work undertaken by Rail Research UK within project C2 to understand rail passenger and freight user needs and how new technologies can help deliver these needs. Preliminary work involved the determination of attributes of rail passenger user needs and how they may be met by various delivery mechanisms. Some 13 attributes of rail passenger user needs have been identified. These are: accessibility and inclusion; comfort; convenience; cost; customer service; effort; flexibility; information; psychological and attitudinal factors; reliability; safety; security; and time. In addition, some 20 delivery mechanisms were identified and briefly reviewed. These were: through ticketing; smart card technology; fine grain pricing; automatic ticket machines; standardised timetabling; real time information; public transport information data terminals; portable data terminals for staff; wireless technology; demand responsive transport; provision for cars; provision for bicycles; train-tram services; standardisation of station facilities; combined ticket office and retail facility; security provision; promotion of rail services; direct marketing; on-line trip planning and monitoring; and community rail partnership. Information technology was identified as being the most promising generic mechanism.

Subsequent work involved detailed reviews of the role of automatic ticket machines, real time information, public transport information data terminals, portable data terminals, on-line trip planning, on-line ticketing, personalised journey planning, wireless technology and smart cards. A distinction can be made between mass market and niche technologies. Case studies of Virgin Train's electronic retailing (mass market) and Great North Eastern Railway's WiFi services (niche) have been undertaken. An assessment has been made of the extent which new information technologies can contribute to the visions of intelligent rail systems and informed travellers

For freight, 14 delivery mechanisms were identified. These are: multimodal and intermodal freight distribution centres; innovative intermodal systems for smaller consignments; access to adequate network capacity; innovative approaches to meeting loading gauge constraints; innovation in provision of traction; lower cost local trip operation; provision of well-specified freight rolling stock; single point of contact for information and customer service; provision of one-stop-shop marketing systems; simplified freight reservation systems; consignment tracking in real time; contingency planning and recovery mechanisms; effective and reliable systems for temperature control; and financial grant-aid mechanisms. Four out of these 14 mechanisms identified information or customer information as a key user need

It was thought that the rail freight industry could learn a lot from the road freight industry, where substantially more progress had already been made in harnessing modern information systems for the benefit of both operators and users. Some developments in the rail industry were starting to emerge, but none of these has progressed to the stage whereby information could be obtained to undertake meaningful evaluation during the life of the project. An alternative approach was taken, therefore, to consider research findings and developments elsewhere in Europe and to consider their potential transferability to the rather different UK rail freight environment.

1. Introduction

This report summarises the work undertaken as part of project C2, Delivery of User Needs, for Rail Research UK (RRUK), a consortium of nine universities funded for six years by the Engineering and Physical Sciences Research Council. The work reported in this paper was undertaken by the Transportation Research Group, University of Southampton in conjunction with the Institute for Transport Studies, University of Leeds, as part of Phase One of RRUK and was completed in September 2006.

The background for this research was provided by the fact that between 1995 and 2000 national income (as measured by GDP) in Great Britain grew by 17%, the demand for passenger transport grew by 5% and the demand for passenger rail transport grew by 27%. The targets set by Government in the 10 Year Plan for Transport (DETR, 2000) envisaged further growth in passenger rail usage of 50% by 2010. With roads nearing capacity in many parts of the country, increasing affluence appears to have led to large increases in passenger rail usage. However, such growth has inevitably led to capacity constraints, with concomitant problems concerning overcrowding, punctuality, reliability and safety. It has become clear that delivery of the Ten Year Plan's targets will require substantial infrastructure improvements and service expansion. The aim of this project is to identify additional measures based on applications of new technology, particularly those developed in the area of telematics, which can assist in ensuring that user needs are met.

The original objectives of this project were:

1. To understand access to, and egress from, the rail system by users and the development of novel approaches to capacity and demand for travel.
2. To develop a fundamental understanding of how new technologies, particularly those related to location and communication/tracking and tracing can be best used to deliver user needs to make rail more attractive/accessible to existing and potential users.
3. To relate user needs and operating practices to the development of infrastructure priorities to best enhance user satisfaction for both passenger and goods movement.

This has been interpreted as consisting of the following aims:

1. To understand passenger and freight rail user needs and how technologies can help deliver these needs.
2. To test a range of suitable delivery mechanisms for UK railways.
3. To develop case studies centred on the delivery of information to support the whole journey by rail.
4. To examine delivery mechanisms for information provision.
5. To identify opportunities and barriers regarding implementation of such technologies.

In turn this has led to the development of four tasks: a review of user needs and delivery mechanisms; identification of suitable delivery mechanisms; development of application trials; and trial applications. The first two of these tasks will be detailed in section 2. In section 3, a rapid review of promising technologies will be detailed. Passenger field trials undertaken with the co-operation of two Train Operating Companies (TOCs), GNER and Virgin Trains is discussed in section 4. A discussion of European findings concerning freight applications that have potential application in the UK is contained in section 5. Section 6 outlines some conclusions and some implications for further work. The references and outputs of the project are detailed in sections 7 and 8. These are followed by a list of the industrial collaborators, the acknowledgements and the annex of tables and figures.

2. User needs and delivery mechanisms

The substantial existing literature and information on user needs was brought together (Crockett et al., 2005) in which 13 attributes were identified as being important: accessibility and inclusion; comfort; convenience; cost; customer service; effort; flexibility; information; psychological and attitudinal factors; reliability; safety; security; and time (see also Table 1). Existing evidence on the impact of these attributes on passenger rail use was examined based on consideration of the UK railway industry's "Passenger Demand Forecasting Handbook" (PDFH) (ATOC, 2002) as well as the wider literature on public transport demand (TRL, 2004, Faber Maunsell, 2004, TRB, 2004). The primary purpose of the review was to identify all the factors behind the modal choice decision, and the existing evidence relating to rail, with special attention given to the 'whole journey' concept – from origin to destination – where this is available.

It was found that time, cost – in the form of fares – and, to an extent, headway remain the dominant metrics in studies of modal choice and have seen the greatest attention with respect to rail travel, as can be seen in the PDFH. Interchange has also been the subject of a number of recent studies and it is apparent that it can be a strong deterrent to rail travel, particularly when the user is unsure of the environment in which it takes place. In part, at least, the focus upon these factors is a direct result of the relative ease with which they may be quantified and thus incorporated within generalised cost or time equations and subsequently demand forecasting models. Evidence for other passenger user needs is, in the main, less widespread and in some cases sparse and based on a limited number of studies. Aspects of these needs such as cleanliness of trains, CCTV at stations and real-time information can, when converted into a monetary cost, be considered in terms of an equivalent fare change. For example, early work for London Underground suggested that real time information could lead to patronage uplifts of 10% (Forsyth and Silcock, 1985, Sheldon et al., 1985), although subsequent work has suggested lower impacts. Elsewhere there are aspects of passenger user needs, such as convenience, effort, flexibility, information, reliability and especially psychological and attitudinal factors, which cannot be easily represented in such terms. When considered, they are often taken as an 'attribute specific constant' or 'modal penalty' generic across all modes of transport. The PDFH, for example, contains little direct evidence on the impact of access/egress improvements or information and marketing initiatives upon demand. This, though, does not mean that these factors provide minimal impact on the modal choice decision and, indeed, evidence shows that for some users they can be a more important consideration than the more readily quantifiable factors. In addition, it must be recognised that perceptions of all user needs may differ significantly from the reality 'on the ground'.

Empirical evidence on the quantifiable aspects of multi-modal travel, where rail is the main mode used, and the relative effects of improvements within the 'chain' – rather than specifically for rail – is also less widespread. This is especially true with regard to the planning stage and, to an extent, for the access/egress legs of the journey. The importance of this is highlighted by the fact that the National Travel Survey suggests almost 5% of walking is related to main line rail journeys (Evans and Addison, 2005). Difficulties, of course, arise when such aspects are outside the direct control of the operator or authority, but these can often be the 'weak links' which preclude the use of rail within an individual's modal choice decision.

Direct comparisons between the relative importance of each user need are difficult and will vary from user to user. However, using the available evidence, it is possible to produce the likely importance of each need in comparison to the three key journey purposes:

- Business travellers place a high value upon published travel times and variations around this mean value. In addition, information provision and comfort are also key factors, with users more willing to pay for improvements. Some qualitative factors such as convenience, customer service and flexibility are also likely to play a role in decision-making.

- Existing commuters value reliability above other factors; cost, time and flexibility are also important considerations. Other issues are of less importance, many as a result of the repetitive nature of, and thus familiarity with, the journeys involved.
- Cost and information are important needs for leisure travellers. In comparison to commute and business travellers, a wider range of factors come into play for leisure travellers, including those related to perceptions of the service - either from experience or secondary sources. Values of time are lower than for other journey purposes.

A preliminary analysis of existing, and potential, delivery mechanisms for rail passengers identified 20 mechanisms. These were: through ticketing; smart card technology; fine grain pricing; automatic ticket machines; standardised timetabling; real time information; public transport information data terminals; portable data terminals for staff; wireless technology; demand responsive transport; provision for cars; provision for bicycles; train-tram services; standardisation of station facilities; combined ticket office and retail facility; security provision; promotion of rail services; direct marketing; on-line trip planning and monitoring; and community rail partnerships. Particular focus was placed on Intelligent Transport System (ITS) concepts, and their role in supporting the whole journey and delivering cost-effective improvements to the industry and users alike.

In order to identify delivery mechanisms worthy of detailed evaluation, a preliminary assessment was made against user needs (Table 2). It can be seen that the delivery mechanisms considered primarily impact upon some of the more qualitative, perceptual user needs: such as convenience, customer service, effort and, of course, information. A number also impact upon journey time and user valuations of time and, hence, the utility of rail travel. For each delivery mechanism connections are therefore made with user needs: in terms of its likely 'primary' impact and other 'secondary 'impacts'. Schemes were taken forward for further evaluation where information was the primary need being met. These mechanisms were:

1. Automatic Ticket Machines (ATMs). Examples include machines provided by South Eastern Trains (Scheidt and Bachmann), South West Trains (Avantix) and Virgin Trains (Fast Ticket).
2. Real-Time Information (RTI). Examples include Docklands Light Rail (Kizoom), South West Trains (Amey Datel), Transport Direct, National Rail Enquiries.
3. Public Transport Information Data Terminals and Assistants. Examples include GNER's customer information points, MIRACLES (Winchester) and VIVALDI (Bristol).
4. Portable Data Terminals for Staff. Examples include terminals used by National Express (Avantix) and London Underground Limited (PORTRAIT).
5. Direct Marketing. An example is InfoMotion (Hampshire County Council).
6. On line trip planning and monitoring. Examples include www.nationalrail.co.uk, www.thetrainline.com and www.raileurope.com, as well as Transport for London's Journey Planner.

An issue that was also considered was the way that these different delivery mechanisms can be integrated with each other and with other delivery mechanisms that were not designated as primarily meeting information needs (e.g. Smart Cards, Wireless Technology, on line ticketing such as megatrain.com).

The finding that information is important concurs with work undertaken by the Rail passengers (RPC, 2004). It was also confirmed by the Spring 2005 National Passenger Survey. Overall, 77% of rail users thought that the passenger rail industry's performance was good or satisfactory. For information about train times and platforms this was 75%. For ticket buying facilities this was only 65% and for how TOCs deal with delay this was 31%.

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A similar process for freight was also carried out and 14 mechanisms were identified. These were multimodal and intermodal freight distribution centres, innovative intermodal systems for smaller consignments, access to adequate network capacity, innovative approaches to meeting loading gauge constraints, innovation in provision of traction, lower cost local trip operation, provision of well-specified freight rolling stock, single point of contact for information and customer service, provision of one-stop-shop marketing systems, simplified freight reservation systems, consignment tracking in real time, contingency planning and recovery mechanisms, effective and reliable systems for temperature control, financial grant-aid mechanisms. Four out of these 14 mechanisms identified information or customer information as a key user need (see Table 3).

3. Rapid Review Case Studies

For nine passenger delivery mechanisms our rapid review examined exemplary schemes, mainly in the UK, but also worldwide and was based on a substantive literature/internet review (Wall and Preston, 2006a). Our review distinguished between mass market and niche market applications. On the freight side, none of the potential schemes thought likely to provide better information or customer service had progressed to the stage whereby information could be obtained to undertake meaningful evaluation (see section 3.3).

Mass market applications

Automatic and mobile ticket machines provide passengers with a quick convenient way of obtaining their tickets, particularly as most now accept credit/debit cards. The success of Virgin Trains FastTicket machines (FTMs) shows the potential in new innovative methods of zero-queue ticket purchase/collection methods for passengers. An increase in usage of FTMs of 68% during 2004 was recorded, although there is evidence in a subsequent decline in use for ticket purchase (but probably not ticket collection) due to the growth in web based bookings and the ability to buy advance fares on the web up to 6pm on the day before travel. Many train companies have invested heavily in such technology as it not only helps passengers but it can also reduce staff and administration costs as well as improving the journey data collection process.

Providing real-time information for passengers is an increasingly important service for passengers. The use of mobile phones in receiving text messages of latest departures and arrivals has been an important and successful development by Docklands Light Railway with 10,000 registered users (out of around 70,000 daily users) within the first six weeks of operation. This innovation will be copied by other TOCs in the future.

The use of on-line journey planning websites has grown significantly over the past few years and deals with some very large volumes. The Train Line website now has over 8 million registered users and deals with 150 million enquiries a year. The multimodal Transport Direct website was launched, without publicity in July 2004 and was formally launched in December. By early March 2005, it had recorded over half a million unique user sessions. Early monitoring suggests some evidence of modal shift away from the car/van/motorbike to public transport with the use 29% using a different mode to that anticipated as a result of the information provided. More conventional telephone based systems deal with large volumes. The National Rail Enquiry Service (NRES) was reputedly the busiest phone number in Britain, dealing with over 80 million enquiries in 2000/1 whilst the real time Train Tracker facility (that uses interactive voice recognition) has some 2.7 million enquiries per annum. However, recent evidence suggest that the popularity of telephone based information provision is beginning to decline, with NRES usage

down to around 35 million in 2005/6. In the first quarter of 2006/7, usage of the on-line journey planner was broadly that of the telephone enquiry service.

With increased access and usage of the internet (see section 4), there has been a shift from purchasing tickets/making journey enquiries at the station or by telephone to finding the information themselves (in real-time) on the website. However, many passengers still have security concerns about providing their credit/debit card details to make purchases over the internet. There have been important trials of e-ticketing (such as those undertaken by Chiltern and the Print@Home scheme tested by Midland Mainline, One and Virgin) and of mobile phone based M-tickets (Deutsche Bahn, National Express Coaches, Eurostar). The mobile phone payment system (TELEPAY), tested in Berlin, Paris and Rome, has led to the need for 50% less ticket machines.

The use of smartcards have grown in usage and scope over the last 5 years. There are now 13 million Octopus cards in circulation in Hong Kong for public transport and retail purposes, whilst by 2006 there were some 5 million Oyster cards in circulation in London, less than three years after introduction. They provide passengers with flexible cheaper ticketing, reduced queuing (passing through fare collection points 15%-20% faster in Hong Kong) and no longer a requirement to carry cash. They can be used to integrate various forms of public transport more effectively, harmonise ticketing structures, reduce administrative and staff costs, reduce fraud (down 20% in Moscow Metro), provide better management information (Bagchi and White, 2005) and help with journey planning purposes. There are concerns, however, regarding the reliability of the system, the longevity of the card, interoperability between cards and issues regarding civil liberties. The UK has developed its own interoperability standard (ITSO) which has been adopted by the new South West Trains franchise, to be fully operational by 2009.

Niche market applications

Information kiosks have not yet been fully utilised by the public. Research in Bristol and Winchester suggests only around 30 users per day per kiosk. However, if such kiosks were provided at all 2,500 or so rail stations in Britain this could lead 27 million enquiries per year. Research suggests kiosks need to be located in strategic places (e.g. city centre precinct or travel interchange) and branded in a bright colour for their presence to be noticed.

Railway staff are very important in the delivery of information (especially real-time) to passengers as they provide a friendly visible presence and complement the introduction of the new technologies. Portable Data Terminals such as Avantix and PORTRAIT assist this process.

Direct marketing has had some success, with a review of five studies suggesting reductions in single occupancy car travel of between 6% and 10% and increases in the use of public transport of between 10% and 41%, particularly in areas where it can be accessed easily (Roth, 2003). Without longer-term incentives, it is unclear what proportion of these single occupancy car drivers would stay with public transport. This is considered a niche market because to date individualized marketing has involved small samples. However, there are those that advocate a wider role out of these measures under the banner of smart choices (Cairns et al., 2004).

The introduction of discounted rail tickets to make better use of spare seats during the off-peak periods has been popular with the public (30% increase in advanced tickets being purchased on Midland Mainline during first 3 months of operation). Similarly, megatrain.com, launched in October 2005, with around 3,300 seats available a week, had 280,000 hits and 26,000 bookings in the first five months (Stagecoach, 2006). The success of the scheme is reflected by the fact that it has expanded from the original London to Southampton and Portsmouth routes to wide range of flows across the South West Trains and Virgin Cross Country networks.

Wi-Fi on-board services have been popular with passengers, with early trials by GNER reporting growth rates of 77% per week. They could encourage modal shift away from single occupancy car driving and air travel, as 72% reported they would be more likely to travel by train with Wi-Fi than by car or plane. Other TOCs, led by Southern, are following suit although there are still some concerns about how secure the network is.

3.3 Freight applications

For freight, the standpoint at the start of the research was that the rail industry could learn a lot from the road freight industry, where substantially more progress had already been made in harnessing modern information systems for the benefit of both operators and users. Some developments in the rail industry were starting to emerge, including

1. Single points of contact as provided by Customer Service Delivery Centres.
2. One stop marketing systems, such as provided by www.railfreightonline.co.uk.
3. Consignment tracking in real time, as provided by Isotrak.
4. Freight reservation systems, as provided by the major railfreight operators EWS and Freightliner, the latter under the banner of Logico (www.logicotransport.co.uk).

Over the life of the project, however, none of these has progressed to the stage whereby information could be obtained to undertake meaningful evaluation. Indeed, none of the first three have even survived. Consignment tracking on rail did not progress beyond the life of the Freight Multiple Unit experiment sponsored by the SRA. More recently, the abolition of the SRA has led to the demise of the railfreightonline website. Even more recently, EWS has announced the abandonment of its Customer Service Delivery Centre, which serviced all its customers from one location, in favour of a return to a more commodity based, sectoral approach to management.

4. Passenger field trials

Two trial applications were undertaken. The first was undertaken in conjunction with Great North Eastern Railways (GNER), which operates intercity services principally between London and Edinburgh/Leeds and examined the impact of the provision of on-board WiFi services (Wall and Preston, 2006b). Initial trials were undertaken in December 2003, with roll out to 10 Mallard trains in December 2004 and roll out to the rest of the GNER fleet between February and June 2006. Access was given to GNER data and five surveys undertaken by Accent Marketing Research. Most of our findings relate to the period when WiFi services were available in around one-third of GNER's trains. The provision of these services did not have a detectable impact on demand, but did have a measurable impact on revenue, largely as a result of Standard Class passengers migrating to First Class, where the WiFi service was provided free of charge. Revenue from the usage of WiFi services by Standard Class passengers was negligible in comparison to GNER's total revenue. The roll out of WiFi services was forecast by market research to have an impact on overall demand. However, a feature of such research was the prevalence of non commitment bias. Respondents' stated intentions of using WiFi services were considerably higher than their actual usage - by a factor of three in one survey. Hence, although there was strong evidence of the existence of a product take-off curve (with the number of passengers using Wi-Fi increasing four fold in the first half of 2006 and usage times also increasing), it remains very much a niche market. Only a minority of passengers thought that it represented value for money and hence there has been much work on alternative payment methods. Overall, our estimate is that such services can only increase patronage by one or two percentage points, at best, but can have a slightly higher impact on revenue due to passenger upgrades. These results are consistent with the findings on the impacts of improvements in station facilities and rolling stock upgrades in the PDFH (ATOC, 2002.), such as the 1.5% average revenue uplift detected by Wardman and Whelan (2001).

The second trial was undertaken in conjunction with GNER and Virgin Trains (Wall and Preston, 2006c, d) and considered the issue of distribution channel migration. Virgin Trains consists of two TOCs, Virgin West Coast, that operates intercity services between London and cities such as Birmingham, Manchester and Glasgow, and Virgin Cross Country, that operates a network of services with a hub at Birmingham. As of 2005, at the three TOCs studied, between 43% and 69% of tickets were sold at booking offices, with between 18% and 53% being sold at the booking offices of other TOCs (see Table 3). It is estimated that this manual form of distribution can account for up to 15% of revenue (Barjansky, 2006). Migration to more automated services could reduce this to 5%. This cost saving is likely to exceed any revenue growth that new forms of distribution might bring. Although, we detected trends away from sales at booking offices, the rates of transfer were relatively modest (between 1 and 3 percentage points per annum), suggesting that it would be over 30 years before ticket distribution was fully automated. A detailed study of Virgin Trains Fast Ticket Machines (85 installed between 1999 and 2006) indicated that there was considerable resistance from several market segments.

Indeed, a feature overall is the fragmented nature of the ticket buying market (see Figure 1), with around one third of rail users resistant to any form of technology. Furthermore, of those using technology around one half use it for information only. In other words only one third of rail users are currently prepared to use technology for ticket purchases with a roughly even split between internet and call centres.

Another feature of the work summarized in Table 4 is the growth in web-based ticket sales, accounting for between 10 and 22% of sales, and growing in one case by as much as 13 percentage points in one year. This is being encouraged by TOCs as part of a drive towards more airline style fares and information provision (with an increased emphasis on single leg fares) and the associated revenue yield management techniques. This also seems to have resulted in the use of Fast Ticket Machines for ticket collection rather than purchase and also seems to have led to strong reductions in the use of Travel Agents and more modest reductions in the use of Call Centres for ticket purchases. The overall conclusions was that the internet offered a vehicle for effecting distribution channel migration, with scope for both growing the market and reducing distribution costs. With appropriate design of web sites this could also be combined with improved information provision concerning train time/fare combinations. There is also great scope for mobile telephones to act as a delivery platform for tickets and this could be combined with real time information provision.

5. Freight – European research findings and their potential for UK application

Despite such disappointing progress in bringing concepts to successful application, it is still felt that there is potential for information system applications aiming to improve user benefit. An alternative approach was taken, therefore, to consider research findings and developments elsewhere in Europe and to consider their potential transferability to the rather different UK rail freight environment.

Various EU research programmes have examined the development of improved rail freight information systems (Whiteing, 2006). The most notable are FIRE and F-MAN. FIRE was concerned with the development of an information system relating to freight train scheduling (including wagon provision and positioning), with benefits of information provision on current status and delays. Benefits would mainly be to operators but there would be spin-off benefits to customers in terms of better information on service availability and tariffs. The F-MAN project developed various prototype systems including systems for freight wagon tracking across Europe, systems that predicted estimated arrival times on the basis of current progress along the route, and on-board sensing systems covering both the condition of the wagon and of the load.

In terms of potential UK application, it is concluded that such systems would represent a significant step forward, but are far from ideally configured for the UK environment, reducing their

potential benefits. In particular, the benefits relate mainly to wagon-load services, whereas UK rail freight is dominated at present by trainloads for particular customers. In addition, the systems are envisaged as part of the solution to Europe-wide rail inter-operability, whereas in the UK 99% of all rail freight is purely domestic, and moreover it is extremely rare for wagons to be moved by more than one rail freight operator. As currently configured, European systems are clearly focused on improving the very poor utilisation of rail freight assets (particularly) wagons, rather than focused on delivering benefits to users more directly.

On-line freight reservation systems, as operated in the UK by both EWS and Freightliner (Logico), are also directed towards relatively ad-hoc rail freight movements, in that they basically aim to sell spare space on scheduled services (especially intermodal services). As such, they offer benefits primarily to the operators, in terms of marginal revenues and better utilisation of train space. There may well be the potential to link such systems to the load sharing and spare capacity auctioning systems already available for road freight (e.g. “Freight Traders”), but this would depend on mutually acceptable commercial terms being agreed. Optimum system configuration would also need to be determined, e.g. would the rail freight providers routinely place their spare capacity on such systems, or would such systems interrogate the rail freight operators’ systems when relevant requests are received? The need to cover container lifting between modes and road collection and delivery would be an added complexity if such systems were to be interfaced. Hence this development is regarded as some way off at present.

6. Conclusions and further work

A wide range of passenger rail user needs and possible delivery mechanisms have been identified by this research. Developments associated with the information technology revolution seem particularly promising, particularly in the areas of information provision, ticket purchase and ticket distribution. One of the key challenges is the wide range of new communication channels available, in addition to traditional methods such as direct personal contact, paper, electronic display boards, teletext and call centres. Examples include PC web browsers, Mobile phone web browsers, Mobile phone Short Message Services, Personal Digital Assistants, Smartcards, Public-access kiosks, Fast Ticket Machines and Interactive TV (Digital and Cable). Our research identified a number of technologies as promising. It is suggested that a possible way forward may be to examine the extent to which different delivery mechanisms improve the convenience of different types of rail journey using a similar combination of cluster analysis and categorization methodologies used by Crockett and Hounsell (2005) to determine the appropriate provision of facilities at stations. This would require major new market research. We suspect that for local rail trips, Smartcards will promote the convenience of rail travel as well permit finer grain pricing, in particular with respect to shoulder peaks. For longer distance trips, we suspect that mobile telephony will play a much greater role in information and ticketing, in conjunction with the internet. New WAP 2.0 mobile smartphones could carry ticketing information (including seat reservations), provide real-time information (including information about alternatives in cases of delay) and provide navigational capabilities (to assist in locating station platforms and train carriages). Hybrid technologies may be expected to develop that fuse some characteristics of Smartcards and mobile phones. It is likely that not all of the facilities would be used by all passengers, with the likelihood that a greater range of services (such as WiFi or WiMax services) would be supplied to business travellers, whilst certain offers (e.g. megatrain.com) will be limited to leisure travellers. An important issue will be the extent to which there will be a full migration to new technologies. Given the segmented nature of the passenger market, it is likely that traditional methods will also need to be provided. Our research suggests that each of the information delivery mechanisms we have identified will only have a small impact on demand and revenue in isolation but packages of measures could have a synergy effect. Retail and information distribution cost savings could be more important, but will be limited if there is only partial migration. One likelihood of more widespread mobile technologies would be a move away from a turn up and go system, particularly for long distance travel, to an advanced booking system, albeit one in which advance bookings could be made up to a few minutes for departure. This would

greatly assist with capacity management which is likely to be the key issue for Britain's railways in the medium term (see Whelan et al., 2006)

It is intended that Southampton Railway Systems Research (SR2) will continue this work through an application to the European Commission's Seventh Framework programme. It is understood that the First Call (to be issued late 2006/ early 2007) will include a work task on meeting rail customers' expectations. The way that information packages may be combined in concepts such as the Informed Traveller and the Intelligent Interactive Train could be considered in such a task. Similarly, the theoretical risk of too much information (or technology) being provided ('information (technology) overload') could be considered. Emphasis should be placed on the concept of intelligence rather than information per se. It is also hoped that issues of integrating ticket sales and information provision using mobile telephony can be further investigated in EPSRC/DTI/DfT Future Intelligent Transport Initiative, with the co-operation of the Association of Train Operating Companies.

For freight, opportunities for modal shift and greater intermodality form one theme of the work already under way on the EPSRC Green Logistics programme. IT providers and load sharing system providers are contributing in kind to this programme, giving the opportunity to take forward research into the scope for harnessing such information systems to encourage greater use of rail (and hence greater sustainability), through meeting user needs more effectively.

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Other:

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9. Industrial collaborators

The industrial collaborators involved in the project were as follows:

Surname of Contact:	**Marsden, Dinah**
Name of partner organisation:	GNER
Division/Department:	Marketing
Address:	M90 Main HQ Station Rd York YO16HT
Tel:	01904 523142 Mobile: 07920 276552
Fax:	01904 524404
Email:	Dinah.Marsden@gner.co.uk

Surname of Contact:	**Rivet, Stephanie**
Name of partner organisation:	Virgin Trains
Division/Department:	Revenue Management
Address:	Hardwick House, North Wing Offices, Platform 1, Euston Station, London
Tel:	020 7983 8094
Fax:	020 7922 9253
Email:	Petra.Mendes@virgintrains.co.uk (PA)

Surname of Contact:	**Deas, Sarah**
Name of partner organisation:	Virgin Trains
Division/Department:	Market Research
Address:	Hardwick House, North Wing Offices, Platform 1, Euston Station, London
Tel:	0207 9838052
Email:	Sarah.Deas@virgintrains.co.uk

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Annex

Table 1: Rail passenger user needs and definitions

User Need	Constituent Elements	Definition
Accessibility & Inclusion	Physical barriers to usage Informational barriers Social exclusion	Extent to which the whole journey is physically and financially accessible
Comfort	In-station In-vehicle Cleanliness Crowding	Compatibility of rail (and other modes to support the whole journey) with comfort requirements and expectations
Convenience	Access/egress Station facilities/environment Interchange	Convenience of undertaking the whole journey
Cost	Fares Terminal cost/access fare	Monetary cost of planning and undertaking the whole journey
Customer Service	Staffing Service provision Facilities	Support for the user from staff and facilities in order to enhance delivery of the whole journey
Effort	Physical Cognitive Affective	The amount and nature of effort and the consequences of that effort needed to plan and undertake the whole journey
Flexibility	Departure times Frequencies of service Destinations	Ability of the service to adapt to changing user requirements when planning and undertaking the whole journey
Information	Planning Undertaking Journey support	Knowledge of and access to information to support preparation and undertaking of the whole journey
Psychological and Attitudinal Factors	Image Lifestyles Autonomy and privacy Familiarity Awareness Society and the environment	Compatibility of rail use (and other modes to support the whole journey) with social and cultural considerations and expectations
Reliability	Punctuality Risk of delay/journey failure Non-time journey elements	Confidence in the delivery of the whole journey
Safety	Risk of accidents	The degree to which undertaking the whole journey is seen to be safe
Security	Fear of crime Graffiti/vandalism Anti-social behaviour	Implications for personal security of undertaking the whole journey
Time	Access Waiting In-vehicle	Time required to plan and undertake the whole journey

Table 2: Intuitive assessment of likely progress towards meeting passenger user needs

Passenger User Need	Likely Importance			Passenger Delivery Mechanism (PDM)																		
	Commute	Business	Leisure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Accessibility and Inclusion	Medium	Low	Medium				S		S		S		S			S	S				S		
Comfort	Medium	Very High	High			S							S				S						
Convenience	Medium	High	High	S				S		S			S	**P**	**P**	**P**	S	**P**				S	
Cost	High	Medium	Very High	**P**	**P**	**P**								S									S
Customer Service	Low	High	High	S	S		S		S	S	S	**P**	S	S			S	S			S	S	S4
Effort	Low	Medium	High	S				S	S	S	S										S	S	
Flexibility	High	High	Medium	S	S			**P**					**P**	S	S	S							
Information	Medium	Very High	Very High		S		**P**	S	**P**	**P**	**P**	S					S	S		S	**P**	**P**	S
Psychological & Attitudinal Factors	Low	Medium	Medium		S				S	S		S					**P**		S	**P**	S	S	**P**
Reliability	Very High	Very High	High						S	S	S	S		S									
Safety	Low	Low	Medium												S								
Security	Low	Medium	Medium		S				S						S		S	S	**P**				
Time	High	Very High	High	S	S		S	S					S	S	S	S	S					S	

P refers to 'Primary' User Need; S refers to 'Secondary' User Need.
PDMs: 1. Through ticketing; 2. smart card technology; 3. fine grain pricing; 4. automatic ticket machines; 5. standardised timetabling; 6. real time information; 7. public transport information data terminals; 8. portable data terminals for staff; 9. wireless technology; 10. demand responsive transport; 11. provision for cars; 12. provision for bicycles; 13. train-tram services; 14. standardisation of station facilities; 15. combined ticket office and retail facility; 16. security provision; 17. promotion of rail services; 18. direct marketing; 19 on-line trip planning and monitoring; 20. community rail partnerships.

Table 2: Tentative assessment of likely progress towards meeting freight user needs

Freight User Need	Likely importance (Bulk)	Likely importance (Unit load)	Freight Delivery Mechanism													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
A: Cost performance of each mode	very high	very high			S	S	S	**P**	**P**							**P**
B: Physical performance of each mode																
B1 Door to door transit time	low	high			S			S	S							
B2 Reliability	very high	very high			S				S					**P**		
B3 Security	low	medium											S			
B4 Safety	medium/low	low?														
C: Perceived convenience of each mode and effort required by the user																
C1 Ease of physical accessibility to modal network	medium/high	medium/low	**P**	S	**P**	**P**	**P**	S	S							
C2 Flexibility	high	medium?		S		S	S	S				S			S	
C3 Intermodality	medium	medium/low	S	**P**		S	S								**P**	
C4 Interoperability	low	low				S										
C5 Managerial / behavioural modal choice biases	medium/low	medium/low														
D: Perceived level of customer service																
D1 Customer Service	medium/high	medium/high								**P**	**P**	**P**	S	S	S	
D2 Information	medium	medium								S	S	S	**P**			
E: Good environmental performance	medium/low	low?														S

FDMs: 1. Multimodal and Intermodal freight distribution centres; 2. Innovative intermodal systems for smaller consignments; 3. Access to adequate network capacity; 4. Innovative approaches to meeting loading gauge constraints; 5. Innovation in provision of traction; 6. Lower cost local trip operation; 7. Provision of well-specified freight rolling stock; 8. Single point of contact for information and customer service; 9. Provision of one-stop-shop marketing systems; 10. Simplified freight reservation systems; 11. Consignment tracking in real time; 12. Contingency planning and recovery mechanisms; 13. Effective and reliable systems for temperature control; 14. Financial grant-aid mechanisms.

Table 4: Current Use of Distribution Channels at Three TOCs and Rates of Migration (2005)

	TOC 1		TOC 2		TOC 3	
	Use (%)	Migration (% pa)	Use (%)	Migration (% pa)	Use (%)	Migration (% pa)
Own Ticket Office	25	-4	12	-1	34	-1.5
Other Ticket Office	18	+1	53	0	25	0
Call Centre	7	-1	6	-1	8	-1.5
Own Website	4	+7	3	+3	10	+1.5
Other Website	5	+6	5	+5		
Fast Ticket Machines	14	-6	3	-2	13	+2.5
Other	27	-4	18	-5	10	-1

Note: Other includes on-train, travel agents and miscellaneous.

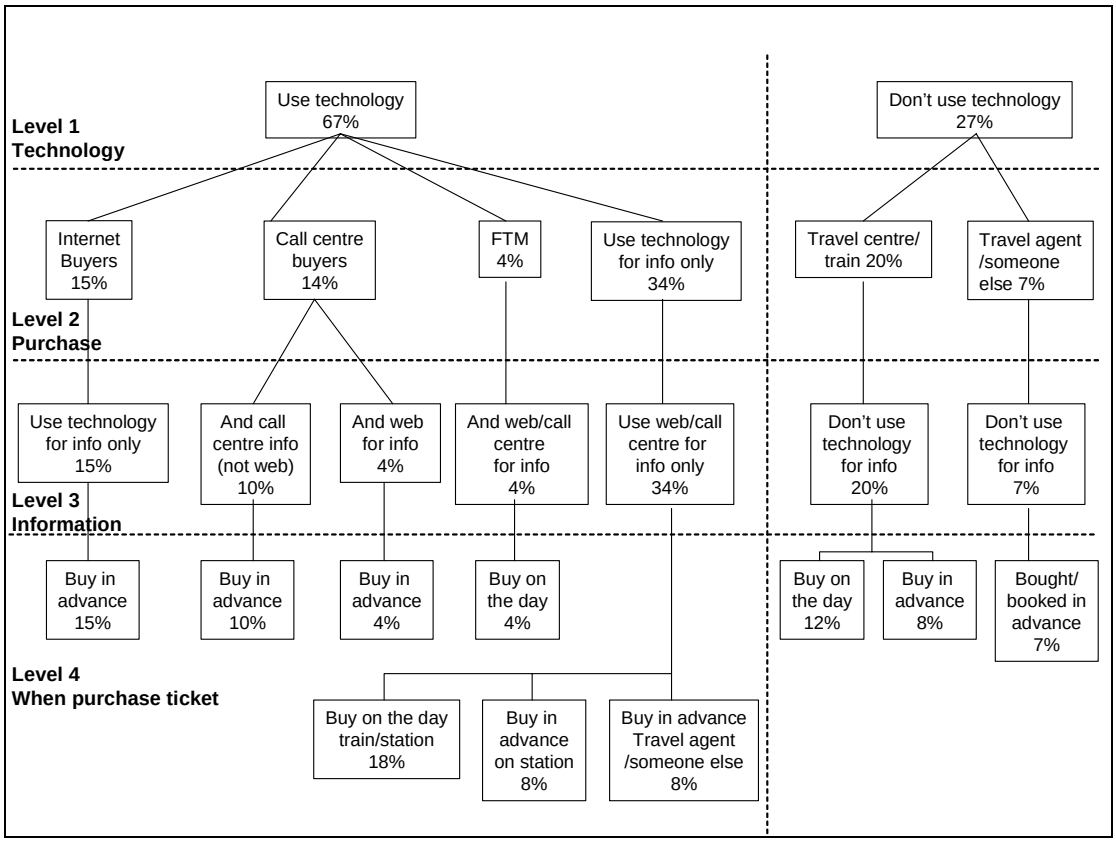

Figure 1: Ticket buying behaviour